Consiglio Nazionale delle Ricerche

Istituto di Ricerca Sulle Acque

chi siamo ◆ le pubblicazioni scientifiche ◆ i progetti di ricerca ◆ la terza missione

# Annuario dell'attività scientifica dell'Istituto

2019 – 2020

Bari
Brugherio
Roma
Taranto
Verbania

# L'Istituto in sintesi

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|---|---|---|
| 5 sedi | 552 pubblicazioni | 131 progetti |
| 149 dipendenti | 86 collaboratori | 272 terza missione |

## Contatti:


CNR IRSA
Via Salaria km 29,300 - C.P. 10, 00015 Monterotondo St. (RM)

Tel.: +39 06 90672 850
Fax: +39 06 90672 787

Email: direzione@irsa.cnr.it
Web: www.irsa.cnr.it


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Bari
Brugherio
Roma
Taranto
Verbania

Acquisizione, impaginazione e revisione grafica: Massimo Ianigro – CNR IRSA

# ANNUARIO IRSA 2019-2020

## Premessa

Le annualità 2019 e 2020 hanno consentito di consolidare il nuovo assetto dell'Istituto di Ricerca Sulle Acque (IRSA) del CNR dopo l'acquisizione di ulteriori due sedi, quella di Verbania proveniente dell'ex Istituto per lo Studio degli Ecosistemi e quella di Taranto proveniente dall'Istituto per l'Ambiente Marino Costiero. Tale consolidamento si è poi sovrapposto con il cambio della direzione dell'IRSA, a partire da ottobre 2019 a seguito dell'espletamento del concorso pubblico per la posizione di direttore, ed è stato poi penalizzato dall'evento pandemico del Covid-19 che ha costretto le varie sedi dell'IRSA, per la maggior parte dell'annualità 2020, a ridurre le varie attività sperimentali in presenza e praticamente ad azzerare sia le varie visite presso le altre sedi che le riunioni in presenza.

Le attività di ricerca sono comunque proseguite coerentemente con i temi scientifici riportati nelle cinque aree tematiche (1. gestione integrata e sostenibile della risorsa acqua e delle risorse biologiche e comprensione dei fenomeni per la definizione di metodi e modelli di valutazione degli effetti sull'ambiente; 2. biodiversità e funzionalità degli ecosistemi acquatici attraverso l'analisi delle interazioni ecologiche e biochimiche tra componenti biotiche ed abiotiche; 3. tecnologie per la depurazione delle acque, anche ai fini del riutilizzo di reflui civili ed industriali; gestione e valorizzazione dei fanghi; 4. processi avanzati di recupero di risorse ed energia dal trattamento di reflui, rifiuti, biomasse nel segno dell'economia circolare; 5. tecnologie innovative per la caratterizzazione, messa in sicurezza e bonifica dei siti ed ambienti contaminati), i cui dettagli sono riportati in una sezione successiva del presente Annuario. Questo ha consentito alle ricercatrici/tecnologhe e ricercatori/tecnologi dell'IRSA di proseguire i progetti di ricerca in corso e anche di avviarne dei nuovi, con il prezioso contributo dei vari giovani dottorandi, borsisti ed assegnisti di ricerca, che hanno reso possibile il conseguimento dei vari risultati riportati nelle sezioni successive in termini di pubblicazioni scientifiche, contributi a congressi internazionali e nazionali, brevetti e risultati inerenti alla terza missione.

Roma, dicembre 2020

Il Direttore

dott. Giuseppe Mascolo

# L'Istituto

L'Istituto IRSA si articola su cinque sedi: Roma Montelibretti è la sede principale e Bari, Brugherio, Taranto, Verbania sono le sedi secondarie.

## Sede Istituzionale di Roma Montelibretti

Strada Provinciale 35d, km 0,700 – 00010, Montelibretti (RM)

Indirizzo postale: Via Salaria km 29,300 - C.P. 10, 00015 Monterotondo St. (RM)

Tel.: +39 06 90672 850

Fax: +39 06 90672 787

### Personale di Ricerca

| Nominativo | Qualifica |
|---|---|
| **Ademollo Nicoletta** | Ricercatore |
| **Amalfitano Stefano** | I° Ricercatore |
| **Aulenta Federico** | I° Ricercatore |
| **Barra Caracciolo Anna** | Dirigente di ricerca |
| **Braguglia Camilla Maria** | I° Ricercatore |
| **Casentini Barbara** | Ricercatore |
| **Crognale Simona** | Ricercatore |
| **Cruz Viggi Carolina** | Ricercatore |
| **Denaro Renata** | Ricercatore |
| **Di Pippo Francesca** | Ricercatore |
| **Falconi Francesca** | Collaboratore tecnico enti di ricerca |
| **Fazi Stefano** | I° Ricercatore |
| **Gallipoli Agata** | Tecnologo |
| **Ghergo Stefano** | I° Tecnologo |
| **Gianico Andrea** | Ricercatore |
| **Grenni Paola** | I° Ricercatore |
| **Guyennon Nicolas Dominique** | Ricercatore |
| **Levantesi Caterina** | Ricercatore |
| **Mastroianni Domenico** | Collaboratore tecnico enti di ricerca |
| **Matturro Bruna** | Ricercatore |
| **Montecchio Daniele** | Ricercatore |
| **Moretti Roberta** | Collaboratore tecnico enti di ricerca |
| **Mosca Angelucci Domenica** | Ricercatore |
| **Patrolecco Luisa** | Ricercatore |
| **Petrangeli Anna Bruna** | Tecnologo |

## Personale amministrativo e di supporto

| Nominativo | Qualifica |
|---|---|
| **Amato Roberto** | Operatore tecnico |
| **Benedetti Bruno** | Collaboratore tecnico enti di ricerca |
| **D'amico Patrizia** | Collaboratore di amministrazione |
| **Di Blasi Veronica** | Operatore tecnico |
| **Manca Riccardo** | Collaboratore di amministrazione |
| **Moretti Roberta** | Collaboratore tecnico enti di ricerca |
| **Pennazza Marco** | Collaboratore di amministrazione |
| **Vescera Christiana** | Collaboratore tecnico enti di ricerca |

## Personale non strutturato

| Nominativo | Qualifica |
|---|---|
| **Cuomo Giuseppe** | Borsista |
| **Del Gaizo Gabriele** | Borsista |
| **Di Lenola Martina** | Assegnista |
| **Di Palma Paolo Roberto** | Assegnista |
| **Frollini Eleonora** | Assegnista |
| **Garbini Gianluigi** | Borsista |
| **Gazzola Giulio** | Assegnista |
| **Luprano Maria Laura** | Borsista |
| **Mancini Alessio** | Borsista |
| **Manetti Marco** | Borsista |
| **Mazzurco Valentina** | Assegnista |
| **Melita Marco** | Assegnista |
| **Pagliaccia Pamela** | Assegnista |
| **Palma Enza** | Assegnista |
| **Parrone Daniele** | Assegnista |
| **Piscitelli Daniela** | Borsista |
| **Rauseo Jasmin** | Borsista |
| **Resitano Marco** | Borsista |
| **Tucci Matteo** | Assegnista |
| **Venezia Cristina** | Borsista |
| **Visca Andrea** | Assegnista |

## Sede Secondaria di Brugherio (MB)

Via del Mulino, 19 - 20861 Brugherio (MB)

Tel.: +39 039 216941

Fax: +39 039 2004692

### Personale di Ricerca

| Nominativo | Qualifica |
|---|---|
| **Balestrini Raffaella** | I° Ricercatore |
| **Buffagni Andrea Stefano** | Dirigente di ricerca |
| **Cazzola Marcello** | Collaboratore tecnico enti di ricerca |
| **Copetti Diego** | Ricercatore |
| **Delconte Carlo Andrea** | Collaboratore tecnico enti di ricerca |
| **Erba Stefania** | Ricercatore |
| **Guzzella Licia Maria** | Dirigente di ricerca |
| **Marziali Laura** | Ricercatore |
| **Morganti Michelangelo** | Ricercatore |
| **Palumbo Maria Teresa** | Collaboratore tecnico enti di ricerca |
| **Polesello Stefano** | Dirigente di ricerca |
| **Roscioli Claudio Giovanni** | Collaboratore tecnico enti di ricerca |
| **Salerno Franco** | I° Ricercatore |
| **Stefani Fabrizio** | Ricercatore |
| **Valsecchi Sara Maria** | I° Ricercatore |
| **Vigano' Luigi** | I° Ricercatore |

### Personale amministrativo e di supporto

| Nominativo | Qualifica |
|---|---|
| **Arena Francesco** | Collaboratore di amministrazione |
| **Frana Cristina** | Operatore tecnico |
| **Guercio Salvatore** | Collaboratore di amministrazione |
| **Talarico Francesco** | Operatore tecnico |

### Personale non strutturato

| Nominativo | Qualifica |
|---|---|
| **Ferrario Claudia** | Assegnista |

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| **Pascariello Simona** | Borsista |
| **Porro Zeno** | Collaboratore |
| **Schiavon Alfredo** | Borsista |
| **Valenti Erica** | Borsista |

## Sede Secondaria di Bari

Via F. De Blasio,5 - 70132 Bari (Italy)

Tel.: +39 080 5820511

Fax: +39 080 5313365

## Personale di Ricerca

| Nominativo | Qualifica |
|---|---|
| **Ancona Valeria** | Ricercatore |
| **Bagnuolo Giuseppe** | Collaboratore tecnico enti di ricerca |
| **Barca Emanuele** | Ricercatore |
| **Bellifemine Domenico** | Collaboratore tecnico enti di ricerca |
| **Berardi Giovanni** | Operatore tecnico |
| **Berardi Marco** | Ricercatore |
| **Blonda Massimo** | Ricercatore |
| **Calabrese Angelantonio** | Tecnologo |
| **Caputo Maria Clementina** | Ricercatore |
| **Ciannarella Ruggiero** | Collaboratore tecnico enti di ricerca |
| **De Carlo Lorenzo** | Ricercatore |
| **De Girolamo Anna Maria** | Ricercatore |
| **De Sanctis Marco** | Ricercatore |
| **Di Iaconi Claudio** | Dirigente di ricerca |
| **Garnier Monica** | Ricercatore |
| **Giordano Raffaele** | Ricercatore |
| **Ianigro Massimo** | I° Tecnologo |
| **Laera Giuseppe** | Ricercatore |
| **Lo Porto Antonio** | I° Ricercatore |
| **Locaputo Vito** | Collaboratore tecnico enti di ricerca |
| **Masciale Rita** | Ricercatore |
| **Masciopinto Costantino** | I° Ricercatore |
| **Mascolo Giuseppe** | Dirigente di ricerca |
| **Massarelli Carmine** | Tecnologo |
| **Matarrese Raffaella** | Tecnologo |
| **Pagano Alessandro** | Ricercatore |
| **Palmisano Vito Nicola** | Collaboratore tecnico enti di ricerca |
| **Pappagallo Giuseppe** | Collaboratore tecnico enti di ricerca |
| **Passarella Giuseppe** | Ricercatore |
| **Pastore Carlo** | I° Ricercatore |
| **Pollice Alfieri** | Dirigente di ricerca |
| **Portoghese Ivan** | Ricercatore |
| **Salerno Carlo** | Tecnologo |
| **Uricchio Vito Felice** | Dirigente tecnologo |

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| **Vergine Pompilio** | Ricercatore |
| **Volpe Angela** | Ricercatore |
| **Vurro Michele** | Dirigente di ricerca |

## Personale amministrativo e di supporto

| Nominativo | Qualifica |
|---|---|
| **De Benedictis Francesco** | Collaboratore tecnico enti di ricerca |
| **Decembrino Andrea** | Operatore tecnico |
| **Dell'Olio Gina** | Collaboratore tecnico enti di ricerca |
| **Leone Giuseppe** | Operatore tecnico |
| **Leuzzi Anna** | Collaboratore di amministrazione |
| **Livorti Domenica** | Operatore tecnico |
| **Piscitelli Vincenzo** | Collaboratore di amministrazione |
| **Sgaramella Giuseppe** | Collaboratore tecnico enti di ricerca |
| **Tullo Giuseppe** | Tecnologo |
| **Vulpis Vito** | Operatore tecnico |

## Personale non strutturato

| Nominativo | Qualifica |
|---|---|
| **Aimola Giorgia** | Borsista |
| **Altieri Valerio Guido** | Assegnista |
| **Angelini Antonella** | Assegnista |
| **Basile Annamaria** | Collaboratrice |
| **Bisaccia Donatella** | Borsista |
| **Brigida Silvia** | Assegnista |
| **Casale Barbara** | Assegnista |
| **Cassetta Noadia** | Borsista |
| **Di Bitonto Luigi** | Assegnista |
| **Ferrari Giuseppe** | Collaboratore |
| **Frisari Elisabetta Maria** | Collaboratrice |
| **Galeone Ciro** | Assegnista |
| **Giannantonio Roberto** | Assegnista |
| **Girardi Giovanni** | Assegnista |
| **Glaciale Marco** | Borsista |
| **Lamaddalena Roberta** | Assegnista |
| **Loi Erika** | Borsista |
| **Lopez Nicola** | Collaboratore |
| **Lorusso Nicola** | Borsista |

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|---|---|
| **Losacco Daniela** | Borsista |
| **Mandrelli Laura** | Borsista |
| **Mauro Roberto** | Borsista |
| **Murgolo Sapia** | Ricercatrice Tempo Determinato |
| **Pentassuglia Simona** | Assegnista |
| **Pulchinotta Irene** | Assegnista |
| **Salvadori Matteo** | Borsista |
| **Savino Ilaria** | Borsista |
| **Scelsi Enrico** | Borsista |
| **Sgherza Damiano** | Borsista |
| **Tumolo Marina** | Borsista |
| **Turturro Antonietta C.** | Assegnista |

## Sede Secondaria di Taranto

Via Roma, 3 - 74123 Taranto

Tel.: +39 099 4542 202

Fax: +39 099 4542 215

### Personale di Ricerca

| Nominativo | Qualifica |
|---|---|
| **Biandolino Francesca** | Ricercatore |
| **Caroppo Carmela** | Ricercatore |
| **Cavallo Rosa Anna** | Tecnologo |
| **Cecere Ester** | I° Ricercatore |
| **Di Leo Antonella** | I° Ricercatore |
| **Fanelli Giovanni** | Ricercatore |
| **Giandomenico Santina** | Ricercatore |
| **Milillo Matteo** | Collaboratore tecnico enti di ricerca |
| **Narracci Marcella** | Ricercatore |
| **Pacifico Pasquale** | Collaboratore tecnico enti di ricerca |
| **Parlapiano Isabella** | Ricercatore |
| **Petrocelli Antonella** | Ricercatore |
| **Portacci Giuseppe** | Collaboratore tecnico enti di ricerca |
| **Prato Ermelinda** | Ricercatore |
| **Rubino Fernando** | Ricercatore |
| **Spada Lucia** | Collaboratore tecnico enti di ricerca |
| **Stabili Loredana** | I° Ricercatore |

### Personale amministrativo e di supporto

| Nominativo | Qualifica |
|---|---|
| **D'Amato Marianna** | Collaboratore di amministrazione |
| **De Palmis Vincenzo** | Operatore tecnico |
| **Giacovazzo Giuseppe** | Collaboratore tecnico enti di ricerca |

### Personale non strutturato

| Nominativo | Qualifica |
|---|---|
| **Calò Maria** | Assegnista |

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|---|---|
| **Denti Giuseppe** | Assegnista |
| **Papa Loredana** | Assegnista |
| **Ricci Patrizia** | Assegnista |

## Sede Secondaria di Verbania-Pallanza

Largo Tonolli 50 - 28922 - Verbania Pallanza (VB)

Tel.: +39 0323 518300

Fax: +39 0323 556513

### Personale di Ricerca

| Nominativo | Qualifica |
|---|---|
| **Boggero Angela** | Ricercatore |
| **Callieri Cristiana** | I° Ricercatore |
| **Ciampittiello Marzia** | Ricercatore |
| **Corno Gianluca** | I° Ricercatore |
| **Dresti Claudia** | Ricercatore |
| **Eckert Ester Maria** | Ricercatore |
| **Fantozzi Laura** | Ricercatore |
| **Fontaneto Diego** | Dirigente di Ricerca |
| **Galafassi Silvia** | Ricercatore |
| **Garzoli Laura** | Ricercatore |
| **Guerrieri Nicoletta** | Tecnologo |
| **Kamburska Lyudmila Todorova** | Ricercatore |
| **Lami Andrea** | I° Ricercatore |
| **Lauceri Rosaria** | Ricercatore |
| **Mammola Stefano** | Ricercatore |
| **Riccardi Nicoletta** | Ricercatore |
| **Saidi Helmi** | Ricercatore |
| **Tartari Gabriele** | Collaboratore Tecnico Enti di Ricerca |
| **Volta Pietro** | Ricercatore |

### Personale amministrativo e di supporto

| Nominativo | Qualifica |
|---|---|
| **Beltrami Monica** | Collaboratore Tecnico Enti di Ricerca |
| **Crippa Evelina** | Operatore Tecnico |
| **Di Chiano Nicola** | Operatore Tecnico |
| **Ferrara Marina** | Collaboratore di Amministrazione |
| **Giacomotti Paola** | Collaboratore Tecnico Enti di Ricerca |
| **Manca Dario** | Collaboratore Tecnico Enti di Ricerca |
| **Orru Arianna** | Collaboratore Tecnico Enti di Ricerca |
| **Piscia Roberta** | Collaboratore Tecnico Enti di Ricerca |
| **Salanitro Agatina** | Collaboratore di Amministrazione |

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|---|---|
| **Tonsi Tiziana** | Collaboratore di Amministrazione |

## Personale non strutturato

| Nominativo | Qualifica |
|---|---|
| **Arpaia Alessia** | Collaboratore |
| **Benelli Sara** | Assegnista |
| **Brambilla Diego** | Assegnista |
| **Canale Martina** | Collaboratore |
| **Caroni Rossana** | Assegnista |
| **Cicala Davide** | Assegnista |
| **Cremona Massimiliano** | Collaboratore |
| **Doneda Maura** | Assegnista |
| **Fornaroli Riccardo** | Assegnista |
| **Martinez Alejandro** | Assegnista |
| **Modesto Vanessa** | Assegnista |
| **Mor Roy Jordi Rene** | Assegnista |
| **Musazzi Simona** | Assegnista |
| **Paganelli Daniele** | Assegnista |
| **Polgar Gianluca** | Assegnista |
| **Puppieni Laura** | Collaboratrice |
| **Sabatino Raffaella** | Assegnista |
| **Sala Paolo** | Assegnista |
| **Sathicq Maria Belen** | Assegnista |
| **Sbaffi Tomasa** | Assegnista |
| **Senczuk Gabriele** | Assegnista |
| **Sforzi Tommaso** | Collaboratore |
| **Solano Emanuela** | Assegnista |
| **Tiberti Rocco** | Assegnista |
| **Zaupa Silvia** | Assegnista |

# Aree Tematiche

L'attività dell'Istituto si articola su cinque aree tematiche fondamentali, di seguito descritte in dettaglio.

## Gestione integrata e sostenibile della risorsa acqua e delle risorse biologiche e comprensione dei fenomeni per la definizione di metodi e modelli di valutazione degli effetti delle pressioni antropiche sull'ambiente

### Descrizione

La Gestione Sostenibile delle Risorse Idriche (SWRM) è un processo che promuove l'utilizzo responsabile della risorsa acqua e la conservazione delle risorse ambientali ad essa correlate, al fine di raggiungere e sostenere il benessere economico e sociale, senza compromettere la sostenibilità nel tempo degli ecosistemi dipendenti dal ciclo dell'acqua. La SWRM si esplica a livello di acque interne e marino-costiere perseguendo i seguenti obiettivi: promuovere un approccio trans-disciplinare e multisettoriale nella gestione della risorsa integrando gli aspetti scientifici, tecnologici, socio-economici, ambientali e sanitari; pianificare l'utilizzazione sostenibile del territorio e delle risorse idriche sulla base delle necessità delle comunità, delle strategie di sviluppo nazionale e dei possibili scenari di cambiamento climatico; predisporre, valutare ed implementare progetti e programmi economicamente e socialmente sostenibili sulla base di un'ampia partecipazione pubblica; identificare, implementare e rafforzare appropriati meccanismi socio-istituzionali, normativi e finanziari per assicurare che le politiche dell'acqua e la loro attuazione siano un punto focale per il progresso sociale e la crescita economica.

### Contenuti scientifici tecnologici

L'IRSA in questa area tematica si occupa dei seguenti contenuti scientifici tecnologici: - Sviluppo di conoscenze teoriche e applicative nel campo della criosfera, dell'idrologia delle acque superficiali, sotterranee e marino-costiere finalizzate a valutare le disponibilità idriche, il destino di sostanze inquinanti e la diffusione di patogeni. - Sviluppo di modelli concettuali, numerici e matematici per la valutazione delle disponibilità idriche, dell'impatto antropico, delle concentrazioni di inquinanti e per il bilancio tra disponibilità e domanda idrica anche in relazione ai cambiamenti climatici. – Predisposizione di strumenti tecnici ed approcci organizzativi per la pianificazione territoriale a livello di bacino idrologico e per la applicazione della WFD - Individuazione di tecnologie, elaborazione di liste di misure gestionali ed organizzative adeguate all'ambiente mediterraneo finalizzate al contenimento dei consumi idrici, in particolar modo in agricoltura, e dell'inquinamento diffuso, alla rinaturalizzazione dei corpi idrici, al miglioramento della ritenzione idrica nei suoli. - Sviluppo di sistemi integrati ed interoperabili per il monitoraggio in continuo quali-quantitativo della risorsa idrica anche utilizzando dati provenienti da piattaforme remote. - Integrazione di soft-data all'interno di sistemi di monitoraggio tradizionali mediante l'utilizzo di metodi partecipativi e

metodologie di *collective decision making*. - Metodi per il trattamento, la stima e la riduzione dell'incertezza associata a dati ambientali. – Individuazione delle migliori strategie per la realizzazione di azioni di "*water diplomacy*" in aree sensibili del pianeta.

**Description**

Sustainable Water Resources Management is a process promoting the responsible use of water as a resource, as well as the conservation of the water related ecosystems, aiming at fostering and sustaining the social and economic well-being without compromising over time the ecosystems depending on the water cycle. The SWRM concerns inland and marine-coastal water pursuing the following goals: to promote a trans-disciplinary and multi-sectorial approach to the resource management, integrating scientific, technological, socio-economic, environmental and health aspects; to plan the sustainable land use and water resources exploitation based on community's needs, national development strategies and expected scenarios of climate change; to develop, evaluate and implement sustainable projects and programs from both a social and economic perspective, based on a wide public participation; to identify, implement and strengthen social, institutional, regulatory and financial mechanisms fostering water policies focused on social progress and economic growth.

**Scientific and technological contents**

IRSA in this thematic area deals with the following technological-scientific contents: Development of theoretical and applied knowledge in the fields of cryosphere, surface, marine-coastal and groundwater hydrology aiming at assessing water resources availability, fate of pollutant and diffusion of pathogens. - Development of conceptual, numerical and mathematical models aimed at the assessment of water availability, anthropic impact, pollutants concentrations and to evaluate the water balance between water availability and needs, also in relation to climate change. - Provision of technical tools and management approaches for land use planning at the river basin level and for the implementation of the WFD. - Identification of technologies, drawing up lists of management and organizational measures appropriate to the Mediterranean environment aimed at reducing water consumption, especially in agriculture, and diffuse pollution, at the re-naturalisation of water bodies, at the improvement of soil water retention. - Development of integrated and interoperable systems for continuous monitoring of water resources also using data from remote platforms. - Integration of soft-data within traditional monitoring systems through the use of participatory methods and collective decision making methodologies. - Methods for processing, estimating and reducing uncertainty associated with environmental data. - Identification of the best strategies for the implementation of "water diplomacy" actions in sensitive areas of the planet.

## Biodiversità e funzionalità degli ecosistemi acquatici attraverso l'analisi delle interazioni ecologiche e biochimiche tra componenti biotiche ed abiotiche

### Descrizione

Si conducono ricerche teoriche ed applicate sulla struttura e funzionalità degli ecosistemi strettamente acquatici (acque interne e marino costiere), così come su quelli indirettamente dipendenti dalla risorsa acqua, con particolare attenzione alle interazioni tra comparto abiotico e biotico ed ai processi eco-evolutivi a diverse scale spaziali e temporali.
L'approccio di ricerca è finalizzato alla conservazione e gestione degli habitat e delle risorse biologiche, della biodiversità, dei servizi ecosistemici ad essa associati, al monitoraggio e riqualificazione ambientale di un'ampia gamma di ecosistemi. L'approccio multidisciplinare include la valutazione degli effetti dei cambiamenti globali sulla funzionalità ecosistemica anche in ambienti remoti. Il mantenimento di serie storiche di dati costituisce un elemento chiave per l'area tematica. In questo ambito, è contemplato l'utilizzo di specie modello animali e vegetali anche non direttamente legate all'ambiente acquatico.
Sono inoltre sviluppate le discipline relative all'ecotossicologia, alla microbiologia e allo studio della distribuzione e degli effetti degli inquinanti emergenti e prioritari. Infine, altri ambiti di ricerca sono la pesca in acqua interne e l'acquacoltura, biologica ed ecocompatibile, rivolta ad individuare nuove specie e tecnologie innovative di allevamento in grado al contempo di mitigare gli impatti negativi sull'ecosistema marino.
La promozione e partecipazione a progetti di conservazione e ricerca nazionali ed internazionali è parte integrante della realizzazione di questa area tematica.

### Contenuti scientifici tecnologici

I contenuti scientifici tecnologici si differenziano per il target specifico delle ricerche condotte e si possono ricondurre a: - studio delle relazioni strutturali e funzionali tra comunità acquatiche e terrestri, habitat e stressor ambientali ed antropici; - evoluzione, autoecologia e tassonomia di alcuni taxa di particolare importanza e individuazione di specifici indicatori ambientali; - studio della funzionalità degli ecosistemi e della biodiversità sia in senso classico che genetico, anche in ambienti estremi mediante un approccio di ecologia e filogenesi molecolare; - valutazione degli impatti sulla biodiversità, tramite l'analisi delle comunità zoo- e fitobentoniche, delle specie aliene e di specie algali potenzialmente tossiche; - risposta dei parametri strutturali e funzionali delle comunità microbiche alle variazioni ambientali e agli inquinanti; biodiversità e funzionalità del comparto microbico lungo il continuum tra ecosistemi di acqua dolce e ambienti marino-costieri ed in ambienti estremi (sorgenti di $CO_2$);-ottimizzazione dei protocolli di classificazione dello stato ecologico di tutte le tipologie di acque (interne e marino costiere) secondo le normative nazionale e le direttive comunitarie;- studio dei processi di accumulo, trasformazione e rimozione dei nutrienti negli ecosistemi ; - studi di dinamica ambientale di contaminanti prioritari e emergenti e interazione con gli organismi in ecosistemi acquatici temperati e polari; - studio degli effetti tossici di contaminanti chimici sugli organismi acquatici e ricerca di marker di esposizione e di danno applicati a più livelli di complessità biologica; studio delle risposte biochimiche degli organismi

acquatici agli impatti ambientali e antropici; bioaccumulo, metabolizzazione e ripartizioni di inquinanti in corpi idrici superficiali (fiumi e laghi) e valutazione del rischio ecologico associato a sedimenti contaminanti; trasporto e caratterizzazione della sostanza organica in relazione allo studio di processi biologici e suo ruolo nella mobilità e trasformazione di inquinanti organici ed inorganici; - studio di inquinanti e microinquinanti inorganici in acqua e suolo: sorgenti, diffusione ed impatti includendo la predisposizione di test ecotossicologici dedicati; - valutazione degli effetti dei cambiamenti climatici e degli apporti atmosferici di inquinanti sui cicli biogeochimici in ambienti di alta quota - biologia e gestione della pesca nelle acque interne;-sperimentazione in laboratorio e in campo di metodologie di allevamento e nutrizione di nuove specie di interesse commerciale con tecniche indirizzate alla gestione sostenibile dell'ecosistema, alla mitigazione degli impatti negativi sull'ambiente di allevamento e alla valutazione e contenimento di eventuali patogeni emergenti; - ecologia, comportamento e conservazione di vertebrati (i.e. uccelli, chirotteri) selvatici in relazione a fattori ecologici a diverse scale spaziali e temporali, anche in ambienti acquatici.

**Description**

Theoretical and applied researches are carried out on the structure and functioning of both strictly aquatic ecosystems (inland and coastal waters) and on those indirectly dependent on water, with an emphasis on the interactions between abiotic and biotic compartments and on eco-evolutionary processes at multiple spatial and temporal scales.
Researches aim at the conservation and management of habitats and biological resources, biodiversity and associated ecosystem services as well as the monitoring and restoration of a wide range of ecosystems. The multidisciplinary approach also includes the assessment of the global change effects on ecosystem functionality even in remote environments. The maintenance of of long-term data series is a key prerogative for this topic.
In addition, ecotoxicology, microbiology and the effects of emerging contaminants and priority substances are investigated. In these research lines, it is included the use of animal and plant model species not necessarily strictly related to water ecosystems.
Further topics under investigation relate to inland water fishery and eco-friendly and sustainable aquaculture aimed at identifying new reared species and the development of innovative farming techniques able to mitigate the negative impacts on the marine ecosystem.
The proposal and contribution to national and international projects either focused on conservation and/or research, is a key aspect of this branch of the institute's activities.

**Scientific and technological contents**

Different scientific and technological contents follow the variety of the research topics and are summarized as follows.
- Study of functional and structural relationship between water and terrestrial communities, habitat, environmental and anthropogenic stressors; - evolution, taxonomy and autoecology of key taxa and identification of environmental indicators based on key species/taxa; - study of biodiversity and ecosystems functionality through an ecological approach and molecular phylogeny also in extreme

environments; - assessment of the impacts on biodiversity, through the analysis of the zoo- and phytobenthic communities, alien species and potentially toxic algal species; - response of the microbial structural and functional parameters to environmental changes and pollutants; - biodiversity of microbial communities along the continuum between inland and coastal waters, including extreme environments (e.g. $CO_2$ sources); - development and optimization of protocols for ecological status classification according to national regulations and community directives; - nutrient dynamics, transformation and removal; - dynamics and distribution of emerging and priority contaminants and their interaction with biota in temperate and polar aquatic ecosystems; - ecotoxicology and multilevel markers development, including biochemical answers of aquatic organisms;- trophic magnification, bioaccumulation, risk assessment analysis; - assessment of the hazard potential of contaminated sediments; - characterization and transport of organic and inorganic compounds; - evaluation of climate change effects on nutrient and pollutants dynamics in high mountains; - biology and management of inland fisheries; - laboratory and field experimentation on breeding and nutrition of new species of commercial interest with techniques aimed at the sustainable management of the ecosystem, the mitigation of negative impacts on the rearing environment and the evaluation and reduction of any emerging pathogens;- Ecology, behaviour and conservation of wild verterbrates (i.e. birds, bats) in relation to ecological factors considered at different spatial and temporal scales, also with reference to aquatic environments.

## Tecnologie per la depurazione delle acque, anche ai fini del riutilizzo di reflui civili ed industriali; gestione e valorizzazione dei fanghi

### Descrizione

L'obiettivo generale del trattamento delle acque consiste nel rendere la qualità delle stesse consona all'utilizzo cui sono destinate, garantendo la salvaguardia della salute umana e dell'ambiente ed un corretto funzionamento dei processi nei quali sono impiegate.
La ricerca in questo campo deve rispondere a sfide sempre nuove, legate essenzialmente a tre fattori: (i) aumento dei consumi idrici, (ii) riduzione della disponibilità idrica causata dai cambiamenti climatici e (iii) crescente attenzione alla salvaguardia dell'ambiente. Quest'ultima, insieme ad una crescente capacità analitica che mette in luce nuovi fattori di rischio, si traduce in limiti normativi progressivamente più stringenti.
Attualmente, i principali obiettivi di ricerca nel campo delle tecnologie per il trattamento delle acque sono: la riduzione dei consumi energetici e degli spazi occupati dagli impianti di trattamento, il riuso delle acque depurate, la minimizzazione dei residui solidi (fanghi), la rimozione spinta di nutrienti, il trattamento di composti persistenti e dei contaminanti emergenti (composti solitamente non normati, ma con potenziali effetti negativi sull'uomo o sull'ambiente) e il contenimento dell'antibiotico-resistenza.

### Contenuti scientifici tecnologici

Le attività di ricerca in questo campo comprendono: (i) lo sviluppo di tecnologie innovative, testate in impianti di trattamento appositamente realizzati, dalla scala da banco sino alla piena scala, (ii) la caratterizzazione di comunità microbiche, (iii) l'identificazione di percorsi degradativi e di sottoprodotti, (iv) lo sviluppo di tecniche avanzate di monitoraggio e (v) la modellizzazione dei processi di depurazione. Queste attività multidisciplinari forniscono una caratterizzazione completa dei processi di trattamento, utile per migliorare le prestazioni dei processi durante il loro sviluppo sperimentale e per valutarne le potenzialità applicative.

Tra le tecnologie oggetto di studio: - sistemi innovativi di bioreattori a membrana per il trattamento e il riuso di acque reflue municipali; sistemi a biomassa granulare aerobica ed anaerobica per il trattamento di reflui urbani ed industriali; - processi biologici per il recupero delle acque nei sistemi di acquacoltura integrata multitrofica; - per il trattamento di reflui industriali, processi biologici combinati con ossidazione chimica e reattori biologici ibridi a doppia fase specifici per la rimozione dei contaminanti xenobiotici; - tecnologie basate sull'integrazione di processi biologici ed elettrochimici per il trattamento di idrocarburi e di altri composti recalcitranti; - tecnologie basate su processi di ossidazione avanzata e/o catalizzatori per la rimozione dei contaminanti emergenti; - per il trattamento e la minimizzazione dei fanghi derivanti dalla depurazione delle acque, processi innovativi di digestione anaerobica e pre-trattamenti che favoriscono la lisi cellulare.

### Description

The general aim of water treatment is to make the water suitable for its intended use, in order to protect human health and the environment and to ensure the proper functioning of the processes in which the water is used.
Research in this field must face ever new challenges, which are mainly linked to three factors: (i) the increase in water consumption, (ii) the water availability reduction caused by climate change and (iii) the increasing environmental awareness. The latter, together with the development of advanced analytical techniques that allows to uncover new risk factors, results in increasingly stricter regulations.
Currently, the main research targets in the field of water treatment technologies are: energy consumption and foot-print minimization in water treatment plants, water reuse, solid waste (sludge) minimization, enhanced nutrient removal, effective treatment of recalcitrant compounds and emerging pollutants (compounds that are not commonly regulated, but with suspected adverse ecological or human health effects) and containment of antibiotic resistance.

**Scientific and technological contents**

Research activities in this field include: (i) the development of innovative technologies, tested in specifically built water treatment plant, from the bench scale up to the full scale, (ii) the characterization microbial communities, (iii) the identification of degradation pathways, (iv) the development of advanced monitoring systems and (v) the modeling of treatment processes. These multidisciplinary activities provide a complete characterization of the treatment processes under study, which allows to improve the performance of the technologies during their experimental development and also to evaluate their application potential.
Among the technologies under study: - innovative membrane bioreactor systems for municipal wastewater treatment and reuse; aerobic and anaerobic granular bioreactor systems for the treatment of urban and industrial wastewater; - biological processes for water reclamation in integrated multi-trophic aquaculture systems; - for industrial streams, technologies that combine biological and chemical oxidation processes and two-phase partitioning bioreactors specific for xenobiotics' removal; - systems based on the integration of biological and electrochemical processes for the treatment of hydrocarbons; - technologies based on advanced oxidation processes and/or catalysts for the removal of emerging pollutants; - for sewage sludge treatment and minimization, innovative anaerobic digestion processes and pre-treatments that promote cell lysis.

# Processi avanzati di recupero di risorse ed energia dal trattamento di reflui, fanghi, rifiuti, biomasse nel segno dell'economia circolare

## Descrizione

Le attività di ricerca sono finalizzate a contribuire all'implementazione dell'Economia Circolare attraverso lo sviluppo di processi e tecnologie ambientalmente sostenibili volte a valorizzare reflui, rifiuti e biomasse mediante il riutilizzo, il riciclo ed il recupero sia in forma di energia, sia in forma di prodotti ad alto valore aggiunto. Tale approccio si integra perfettamente nel concetto di "Bio-raffineria" intesa come piattaforma tecnico-scientifica che opera la trasformazione di scarti, rifiuti e reflui in componenti quali biometano, prodotti chimici e biomolecole, mediante una serie di processi e tecnologie sostenibili.
Le attività sono finalizzate a:
- Incrementare trattamenti anaerobici di biomasse, reflui e fanghi tramite la messa a punto e lo sviluppo di tecnologie innovative per massimizzare il recupero di biometano e/o bioidrogeno, nutrienti e composti ad alto valore aggiunto;
- Caratterizzare e selezionare le comunità microbiche al fine di ottimizzare le prestazioni di bioprocessi (ad es. *dark fermentation, chain elongation*, digestione anaerobica).
- Sviluppare sistemi bioelettrochimici per il recupero di energia da reflui e minimizzazione di fanghi.
- Valorizzare sia la componente lipidica (dove significativamente presente) che la componente ligneo-cellulosica di biomasse e rifiuti tramite l'ottimizzazione di trattamenti chimici per la produzione di prodotti ad elevato valore aggiunto, con potenziale applicativo in molti settori.
- Sviluppare modelli di simulazione per la valutazione dei potenziali recuperi in termini di energia e/o risorse dal trattamento di fanghi, reflui e rifiuti.
- Minimizzare il rischio per la salute umana in processi di riuso di acque reflue e/o fanghi trattati attraverso un'attenta valutazione del destino dell'antibiotico resistenza e della carica patogena.

## Contenuti scientifici tecnologici

I contenuti scientifici affrontano tematiche orientate a:
- Caratterizzazione chimica di biomasse organiche di scarto (fanghi di depurazione, rifiuti organici municipali, scarti agricoli, alghe, ecc.) e loro valorizzazione sostenibile per via termochimica in platform-molecules e prodotti ad alto valore (HMF, FDCA, acido levulinico e derivati, *biobased solvents*, biodiesel, *renewable diesel*, biolubrificanti di nuova generazione).
- Sviluppare processi avanzati di digestione anaerobica per la valorizzazione di biomasse e rifiuti in termini di idrogeno, metano, biocombustibili, composti a valore aggiunto e digestato di qualità.
- Aumentare il potenziale inespresso derivante da bioprocessi anaerobici di scarti organici producendo, con soluzioni green, prodotti chimici di rilevanza economica.
- Sviluppare sistemi innovativi per il recupero energetico da biomasse e acque reflue.
- Realizzare il recupero di energia dai reflui municipali mediante impiego di sistemi anaerobici avanzati operanti a temperatura ambiente e di reattori anaerobici high rate, seguiti da post trattamento aerobico di rimozione dell'azoto.
- Realizzare il recupero di nutrienti dalle acque reflue da utilizzare in agricoltura.

- Promuovere il recupero termico da processi di trattamento aerobico di acque reflue a bassa produzione di fango.
- Ottimizzare le prestazioni di recupero di fosforo dai reflui urbani attraverso modellizzazione e analisi del ciclo di vita (LCA).
- Recuperare carbonato di calcio delle conchiglie dei molluschi eduli lamellibranchi (per scopi edili, industriali ed agricoli) e valorizzare le biomasse prodotte dalla molluschicoltura (conchiglie, polpa, bisso).
- Effettuare valutazioni riferite ai carichi energetici ed ai potenziali impatti ambientali relativi a processi di recupero di energia e risorse.
- Promuovere lo sviluppo di innovazioni di processo per limitare l'uso delle materie plastiche nelle pratiche molluschicole.

**Description**

Research activities in this field are aimed at contributing to Circular Economy implementation through the development of environmentally sustainable technologies to increase reuse, recycling, and recovery of biowaste (wastewater, waste and other biomass), with particular regard to energy and added-value products recovery. This approach is perfectly integrated in the concept of "Bio-refinery", as sustainable technical-scientific platform converting waste into valuable components such as biomethane, fine chemicals, and biomolecules.
The activities are aimed at:
- Enhancing the anaerobic treatments of biowaste through the development of innovative technologies to maximize bio-methane and/or bio-hydrogen production, nutrients recovery and fine chemicals recovery.
- Characterizing and select microbial communities in order to optimize the performance of bioprocesses (e.g. dark fermentation, chain elongation, anaerobic digestion).
- Development of bio-electrochemical systems for energy recovery from wastewater and for sludge minimization.
- Valorizing both the lipid and the lignocellulosic fraction (where significantly present) of biomass and waste, through the optimization of chemical treatments for the production of added value compounds, with wide application potential in many sectors.
- Development of simulation models to evaluate the recovery potential in terms of energy and/or resources from organic waste treatment.
- Minimizing the risk for human health associated with wastewater or sludge reuse through a careful assessment of the presence of pathogens and the fate of the antibiotic resistance genes.

**Scientific and technological contents**

The scientific contents are oriented to:
- Chemical characterization of biological resources (as sewage sludge, municipal organic waste, agro industrial waste, algae, etc.) and their sustainable thermochemical valorization in platform-molecules and value-added products (HMF, FDCA, levulinic acid and derivatives, *biobased solvents*, biodiesel, *renewable diesel*, biolubricants of new generation).

- Sustainable biological valorization of biowaste through innovative advanced anaerobic digestion processes to produce biofuels (hydrogen, methane) and value-added products together with a recyclable digestate and phosphorus recovery.
- Increase the unexpressed potential deriving from bioprocesses treating biowaste to produce, with sustainable and green solutions, chemicals with industrial and economic value.
- Develop innovative systems aimed to recover energy from wastewater and biomass.
- Recovery energy from municipal wastewater through advanced anaerobic systems at ambient temperature and high rate anaerobic reactors, followed by an aerobic post-treatment for nitrogen removal.
- Recovery nutrients from wastewater for agricultural use.
- Promote thermal recovery from the aerobic treatment of wastewater with low sludge production.
- Optimize phosphorus recovery from wastewater through modelization and life cycle assessment.
- Recover bio-calcium carbonate from seashells, as filler for polymer matrix composite materials (for construction, industry, agriculture) and valorize the shellfish farming biomass.
- Evaluate energy requirements and environmental impacts of the processes used to recovery energy and resources.
- Promote the development of process innovations in order to limit plastic use in shellfish practices.

## Tecnologie innovative per la caratterizzazione, messa in sicurezza e bonifica dei siti ed ambienti contaminati

### Descrizione

Le attività di ricerca svolte nell'ambito di questa area tematica sono finalizzate allo sviluppo di tecnologie innovative per la caratterizzazione, messa in sicurezza e bonifica di matrici ambientali contaminate.
IRSA svolge attività di ricerca per *i)* sviluppare processi e tecnologie di bonifica innovative e sostenibili per il risanamento di siti contaminati; *ii)* studiare le potenzialità metaboliche di microorganismi capaci di biodegradare/trasformare gli inquinanti*; iii)* ottimizzare metodologie biomolecolari innovative per la caratterizzazione ed il monitoraggio delle matrici ambientali contaminate; *iv)* sviluppare database ambientali per la caratterizzazione integrata dei siti contaminati; *v)* caratterizzare siti contaminati o potenzialmente tali con tecniche indirette al fine di garantire il minimo disturbo delle matrici investigate; *vi)* caratterizzazione idraulica delle matrici contaminate finalizzata alla verifica della presenza di vie preferenziali di flusso e dei tempi di transito dei contaminanti nella zona non satura.
Lo sviluppo di tecnologie di bonifica innovative e sostenibili si basa sullo studio di processi di risanamento *ex situ o in situ*, che prevedono sia trattamenti chimici che biologici, questi ultimi basati sulla capacità dei microorganismi ambientali (biorisanamento) o delle piante (fitorimedio) di degradare e/o trasformare specifici composti tossici. In questo contesto, investigare le potenzialità metaboliche di microorganismi coinvolti nei processi di biodegradazione/trasformazione degli inquinanti consente di ottimizzare l'efficacia delle tecnologie di bonifica biologica. Lo studio di tali microorganismi di interesse biotecnologico avviene sia attraverso metodi di microbiologia ambientale coltura dipendente che attraverso metodologie biomolecolari coltura indipendente. Queste ultime trovano inoltre largo impiego per la caratterizzazione di matrici ambientali contaminate: in particolare, il monitoraggio delle comunità microbiche e di specifici biomarcatori coinvolti nella biodegradazione/trasformazione di contaminanti sono essenziali per la valutazione predittiva del potenziale di recupero dei siti contaminati, nonché per supportare la valutazione dell'efficacia di una determinata tecnologia di bonifica biologica. Gli studi di caratterizzazione comprendono inoltre lo sviluppo di database per la raccolta di dati ambientali utilizzabili nelle fasi di valutazione degli interventi di bonifica dei siti contaminati.

### Contenuti scientifici tecnologici

Nell'ambito di questa area tematica, i contenuti scientifici tecnologici affrontanti dall'IRSA hanno carattere multidisciplinare e sono finalizzati a:
i) sviluppare trattamenti di bonifica e relativo *scale-up* dal laboratorio alle applicazioni di campo, che includono:
- studi di processo per la degradazione e/o trasformazione di contaminanti ambientali quali composti alogenati aromatici e alifatici (VOC, PCBs, PFAS), idrocarburi aromatici e alifatici, contaminanti emergenti (farmaci, pesticidi, microplastiche);

- trattamenti biologici per il biorisanamento *ex situ* di suoli contaminati basati sull'impiego di polimeri assorbenti mediante processi doppio stadio di estrazione via polimero e successiva biorigenerazione in reattori biologici ibridi a doppia fase;
- trattamenti di fitorimedio e bioelettrochimici per il biorisanamento *in situ* di acque, suoli e sedimenti contaminati;
- trattamenti chimici di ossidazione avanzata (AOP) basati su processi di ozonizzazione ed impiego di UV per la bonifica di acque contaminate;
- trattamenti meccanochimici per la degradazione di xenobiotici organici con substrati catalitici quali minerali argillosi.

ii) studiare le potenzialità di risanamento biologico di siti contaminati attraverso:
- caratterizzazione del microbioma di matrici contaminate mediante tecniche biomolecolari avanzate, incluse quelle omiche;
- studio di biomarcatori di interesse biotecnologico (microorganismi, geni funzionali) coinvolti nei processi di degradazione/trasformazione di contaminanti ambientali.

iiI) creare *geo-database* sito-specifici per la raccolta e gestione dei dati ambientali finalizzati alla definizione di un quadro conoscitivo territoriale integrato utilizzabile per l'identificazione delle più opportune strategie di mitigazione/bonifica delle aree investigate.

iv) caratterizzazione geofisica di siti contaminati o potenzialmente tali (discariche abbandonate e/o in esercizio) per la verifica della tenuta del telo di impermeabilizzazione posto sul fondo, valutazione dell'estensione del plume di contaminazione organica e stima dei tempi di propagazione di tali contaminanti.

**Description**

Research activities carried out within this thematic area focus on the development of innovative technologies for the characterization and remediation of contaminated environmental matrices.
IRSA activities aim at the *i)* development of innovative and sustainable processes and technologies for the remediation of contaminated sites; *ii)* study the metabolic potential of microorganisms capable of biodegrading/transforming pollutants; *iii)* optimization of innovative biomolecular methodologies for the characterization and monitoring of contaminated environmental matrices; *iv)* development of environmental databases for the integrated characterization of contaminated sites ; *v)* characterization of contaminated or potential contaminated sites and evaluation of travel times in the vadose zone.
The development of innovative and sustainable remediation technologies is based on the study of *ex situ* or *in situ* remediation processes, which involve both chemical and biological treatments, the latter based on the ability of environmental microorganisms (bioremediation) or plants (phytoremediation) to degrade and / or transform specific toxic compounds.
In this context, investigating the metabolic potential of microorganisms involved in the processes of biodegradation / transformation of pollutants allows to optimize the effectiveness of biological remediation technologies.
The microorganisms of biotechnological interest are studied through cultivation-based approaches and through biomolecular methodologies. The latter are also widely used for the characterization of contaminated environmental matrices allowing the monitoring of microbial communities and specific biomarkers involved in the biodegradation / transformation of contaminants for the

predictive assessment of the recovery potential of contaminated sites, as well as to support the evaluation of the effectiveness of biological remediation technologies.
The characterization of contaminated matrixes also includes the development of databases for the collection of environmental data that can be used in the evaluation phases of the remediation of contaminated sites.

**Scientific and technological contents**

Within this thematic area, multidisciplinary contents are faced including:
*i)* development of remediation treatments and related scale-up from laboratory to field applications, which include:
- process studies for the degradation and/or transformation of environmental pollutants such as aromatic and aliphatic halogenated compounds (VOC, PCBs, PFAS), aromatic and aliphatic hydrocarbons, emerging contaminants (drugs, pesticides, microplastics);
- biological treatments for *ex situ* bioremediation of contaminated soils based on the use of absorbent polymers through two-step process with extraction via polymer and subsequent bio-regeneration in two-phase partitioning bioreactors;
- phytoremediation and bioelectrochemical treatments for the *in situ* bioremediation of contaminated waters, soils and sediments;
- advanced oxidation chemical treatments (AOP) based on ozonation processes and the use of UV for the remediation of contaminated water;
- mechanochemical treatments for the degradation of organic xenobiotics with catalytic substrates such as clay minerals.
*ii)* study the biological remediation potential of contaminated sites through:
- characterization of the microbiome of contaminated matrices by advanced biomolecular techniques, including omics;
- study of biomarkers of biotechnological interest (microorganisms, functional genes) involved in the degradation / transformation processes of environmental contaminants.
*iii)* create site-specific geo-database for the collection and management of environmental data aimed at defining an integrated territorial cognitive framework that can be used for the identification of the most appropriate mitigation/remediation strategies of the investigated areas.
iv) geophysical characterization of contaminated or potentially contaminated sites (dismissed or operating landfills) in order to verify the status of the HDPE liner placed on the bottom of the waste body, to assess the extension of the organic contamination plume and to estimate the travel time of these contaminants into the vadose zone.

# Pubblicazioni scientifiche

## Articoli in riviste

### Seasonal changes of commercial traits, proximate and fatty acid compositions of the scallop Flexopecten glaber from the Mediterranean Sea (Southern Italy)

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** PeerJ, 2019, 7, e5810, DOI: 10.7717/peerj.5810

**Autori:** Ermelinda Prato, Francesca Biandolino, Isabella Parlapiano, Loredana Papa, Giuseppe Denti and Giovanni Fanelli

**Abstract ITA:** Questo studio fornisce informazioni sugli aspetti biologici (indice gonadosomatico), qualità commerciale (indice di condizione e resa di carne) e biochimici (composizione prossima, acidi grassi) dei tessuti molli di *Flexopecten glaber* allevati in gabbie sospese nel Mar Ionio. I risultati hanno mostrato che l'indice di condizione (CI) e la resa di carne (MY) hanno raggiunto il picco a dicembre (60 e 30%, rispettivamente) e in aprile, maggio e giugno (dal 53 al 60% per CI e dal 34 al 36% per MY). L'indice gonadosomatico è risultato elevato nei mesi invernali, primaverili ed estivi. Il contenuto di proteine (8,18-11,9 g / 100 g), dei lipidi (0, 78-1,18 g / 100 g) e dei carboidrati (1,19-3,30 g / 100 g) è variato in modo significativo durante il periodo di studio. Gli acidi grassi saturi sono risultati dominanti, ad eccezione nel mese di dicembre quando gli acidi grassi polinsaturi hanno mostrato la percentuale più alta (43% degli AF totali). docosaesaenoico ed eicosapentaenoico sono stati gli acidi grassi del gruppo n-3, maggiormente rappresentati. I rapporti n3 / n6 più elevati sono stati registrati nei campioni primavera-estate, con valori> di 5. I risultati hanno mostrato una migliore qualità nutrizionale delle capesante a maggio, luglio e dicembre.

**Abstract ENG:** This study provides information on biological (gonadosomatic index), commercial quality (condition index and meat yield) and biochemical aspects (proximate composi- tion, fatty acids) of the soft tissues of Flexopecten glaber reared in suspended cages in the Ionian Sea. The results showed that condition index (CI) and meat yield (MY) peaked in December (60 and 30%, respectively) and in April, May and June (from 53 to 60% for CI and from 34 to 36% for MY). Gonadosomatic index showed three main peaks in winter, spring and summer months. Contents of protein 8.18–11.9 g/100 g), lipid (0,.78–1.18 g/100 g) and carbohydrate (1.19–3.30 g/100 g) varied significantly during the study period. Saturated fatty acids was the dominant group, except in December when polyunsaturated fatty acids showed the highest proportion (43% of total FAs). Fatty acids of the n3 group were dominant with docosahexaenoic and eicosapentaenoic acids. Highest n3/n6 ratios were recorded in spring-summer specimens, with values > of 5. The results showed a better nutritional quality of scallops in May, July and December.

## Dissipation of the antibiotic sulfamethoxazole in a soil amended with anaerobically digested cattle manure.

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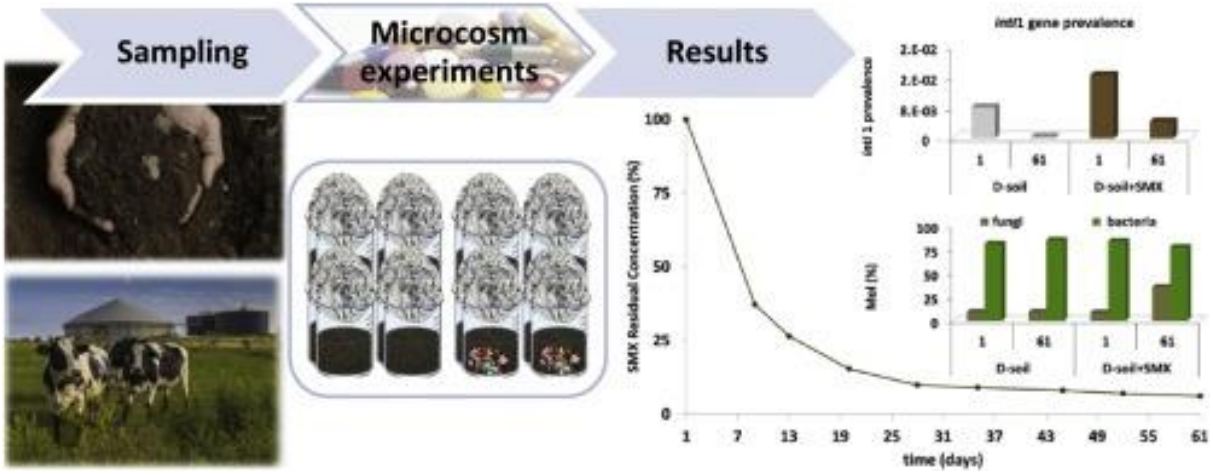
**Riferimento rivista con DOI:** Journal of Hazardous Materials, 378:120769 DOI: 10.1016/j.jhazmat.2019.120769

**Autori:** Jasmin Rauseo J, Anna Barra Caracciolo, Nicoletta Ademollo, Martina Cardoni, Martina Di Lenola, William Hugo Gaze, Isobel C. Stanton, Paola Grenni, Tanita Pescatore, Francesca Spataro, Luisa Patrolecco

**Abstract ENG:** The application of anaerobically digested cattle manure on agricultural land for both improving its quality and recycling a farm waste is an increasingly frequent practice in line with the circular economy. However, knowledge on the potential risk of spreading antibiotic resistance through this specific practice is quite scarce. The antibiotic sulfamethoxazole (SMX) is one of the most heavily prescribed in veterinary medicine. In this study, SMX dissipation and the possible effects on natural microorganisms were investigated in a soil amended with an anaerobically digested cattle manure produced from a biogas plant inside a livestock farm. Microcosm experiments were performed using amended soil treated with SMX (20 mg/kg soil). During the experimental time (61 days), soil samples were analysed for SMX and N4-acetylsulfamethoxazole, microbial abundance, activity and structure. Furthermore, the prevalence of the intI1 gene was also determined. The overall results showed that, although there was an initial negative effect on microbial abundance, SMX halved in about 7 days in the digestate-amended soil. The intI1 gene found in both the digestate and amended soil suggested that the use of anaerobically digested cattle manure as fertilizer can be a source of antibiotic resistant bacteria (ARBs) and genes (ARGs) in agroecosystems.



## A new fluorescent oligonucleotide probe for in-situ identification of Microcystis aeruginosa in freshwater

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Microchemical Journal 148: 503-513 DOI: 10.1016/j.microc.2019.05.017.

**Autori:** Anna Barra Caracciolo, Laura Dejana, Carmen Fajardo, Paola Grenni, Margarita López Martín, Gerardo Mengs, Sebastián Sánchez-Fortún, Teresa Lettieri, Maria Ludovica Saccà, Linda K Medlin

**Abstract ENG:** Cyanobacteria colonize different environments and blooms can occur in both contaminated and non-contaminated water bodies (freshwater, brackish and marine areas). Among 150 known cyanobacteria genera, >40 species are able to produce toxins, which are natural compounds that differ from both a chemical and toxicological point of view and are responsible for acute and chronic poisoning in animals and humans. Among the main classes of cyanotoxins, microcystins are frequently found in the environment. Fast and accurate methods for unequivocally identifying microcystin-producing cyanobacteria, such as *Microcystis aeruginosa* in water bodies, are necessary to distinguish them from other non-toxic cyanobacteria and to manage and monitor algal blooms. For this purpose, we designed, developed and validated an oligonucleotide probe for FISH (Fluorescence *In Situ* Hybridization) analysis to detect *Microcystis aeruginosa* at the species level even at relatively low concentrations in freshwater. The FISH probe, MicAerD03, was designed using the ARB software with the Silva database within the framework of the MicroCoKit project, also with the intention of adding it to the microarray from the EU project, µAQUA, for freshwater pathogens, which had only genus level probes for Microcystis.

We tested various fixative methods to minimize the natural autofluorescence from chlorophyll-a and certain accessory pigments (viz., phycobilins and carotenoids). The FISH probe was tested on pure cultures of *Microcystis aeruginosa*, and then successfully applied to water samples collected from different sampling points of the Tiber River (Italy), using a laser confocal microscope. Subsequently, the probe was also conjugated at the 5′ end with horse-radish peroxidase (HRP-MicAerD03) to apply the CAtalysed Reported Deposition-FISH (CARD-FISH) for increasing the fluorescence signal of the mono-fluorescently labelled probe and make it possible to detect *M. aeruginosa* using an epifluorescence microscope. Samples taken within the EU MicroCokit project indicated that microarray signals for *Microcystis* were coming from single cells and not colonial cells. We confirmed this with the CARD-FISH protocol used here to validate the microarray signals for Microcystis detected at the genus level in MicroCokit.

This paper provides a new early warning tool for investigating *M. aeruginosa* at the species level even at low cell concentrations in surface water, which can be added to the µAqua microarray for all freshwater pathogens to complete the probe hierarchy for *Microcystis aeruginosa*.

## Nutritional Quality of Edible Marine Bivalves from the Southern Coast of Italy, Mediterranean Sea

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Pol. J. Food Nutr. Sci., 2019, 69 (1), 71–81, DOI: 10.31883/pjfns-2019-0001

**Autori:** Francesca Biandolino, Antonella Di Leo, Isabella Parlapiano, Loredana Papa, Santina Giandomenico, Lucia Spada, Ermelinda Prato

**Abstract ITA:** Sono stati determinati i parametri di qualità nutrizionale di otto specie di bivalvi commercialmente importanti (*Arca noae, Flexopecten glaber, Limaria tuberculata, Mimachlamys varia, Modiolus barbatus, Mytilus galloprovincialis, Ostrea edulis* e *Solen marginatus*) del Mar Ionio (Italia meridionale, Mar Mediterraneo). Sono stati valutati anche gli indici di resa in carne e di qualità nutrizionale dei lipidi (indice aterogenico, indice di trombogenicità e rapporto acidi grassi ipocolesterolemici / ipercolesterolemici). I valori di resa della carne variavano dal 31,4% in F. glaber al 44,5% in M. varia. I risultati hanno mostrato che tutte le specie possono essere considerate come prodotti alimentari con proprietà dietetiche interessanti a causa dell'alto contenuto di proteine, minerali (Ca, K, Na, Fe, Zn, Cu), acidi grassi polinsaturi essenziali (PUFA) e basso contenuto di colesterolo. Tra i PUFA, gli acidi eicosapentaenoico (EPA) e docosaesaenoico (DHA) hanno mostrato i livelli più alti rispettivamente in M. galloprovincialis (11,74%) e in M. varia (14,41%). Un elevato rapporto n-3 / n-6 ha caratterizzato il profilo degli acidi grassi di tutte le specie con valori compresi in un range di 2,65 in F. glaber a 7,19 in M. galloprovincialis. Gli indici di qualità nutrizionale dei lipidi hanno mostrato che M. varia, M. galloprovincialis, O. edulis, S. marginatus e L. tuberculata potrebbero avere effetti benefici sulla salute del consumatore. Questo documento sarà di valore pratico dal punto di vista della salute per le popolazioni che consumano molluschi e un potente strumento di marketing per gli allevatori di bivalvi.

**Abstract ENG:** Nutritional quality parameters of eight commercially important bivalve species (Arca noae, Flexopecten glaber, Limaria tuberculata, Mimachlamys varia, Modiolus barbatus, Mytilus galloprovincialis, Ostrea edulis and Solen marginatus) from the Ionian Sea (Southern Italy, Mediterranean Sea), were determined. The meat yield and lipid nutritional quality indices (atherogenic index, thrombogenicity index and hypocholesterolaemic/hypercholester- olaemic fatty acid ratio) have been also evaluated. Meat yield values ranged from 31.4% in F. glaber to 44.5% in M. varia. The results showed that all species might be considered as food items with interesting dietetic properties due to high contents of proteins, minerals (Ca, K, Na, Fe, Zn, Cu), essential polyunsaturated fatty acids (PUFAs), and to low cholesterol content. Among PUFAs, eicosapentaenoic (EPA) and docosahexaenoic acids (DHA) exhibited the highest levels in M. galloprovincialis (11.74%) and in M. varia (14.41%), respectively. Elevated n-3/n-6 ratio characterized the fatty acids profile of all species ranging from 2.65 in F. glaber to 7.19 in M. galloprovincialis. The lipid nutritional quality indices showed that M. varia, M. galloprovincialis, O. edulis, S. marginatus, and L. tuberculata might have beneficial effects on the consumer's health. This paper will be of practical value from a health perspective for populations who consume shellfish and a powerful marketing tool for farmers of the bivalves.

## New Mediterranean Biodiversity Records (April, 2019)

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Medit. Mar. Sci., 2019, 20/1, 230-247, DOI: 10.12681/mms.19609

**Autori:** Vasiliki KOUSTENI, Rigers Agron BAKIU,, Ahmed BENHMIDA, Fabio CROCETTA, Vincenzo Di MARTINO, Aikaterini DOGRAMMATZI, Nikolaos DOUMPAS, Sherif DURMISHAJ, Ioannis GIOVOS, Mehmet GÖKOĞLU, Mehmet Fatih HUSEYINOGLU, Carlos JIMENEZ, Stefanos KALOGIROU,, Periklis KLEITOU, Lovrenc LIPEJ, Armando MACALI, Alen PETANI, Slavica PETOVIĆ, Ermelinda PRATO, Fernando RUBINO, Yassine Ramzi SGHAIER, Bessy STANCANELLI, Serkan TEKER, Francesco TIRALONGO and Domen TRKOV

**Abstract ITA:** L'attuale articolo presenta nuove informazioni sui dati di biodiversità su 18 taxa (14 specie aliene, 3 native e 1 criptogeniche) appartenenti a 5 Phyla segnalati per 11 diversi paesi elencati in base alla loro posizione geografica dal Mediterraneo occidentale a quello orientale. Algeria: l'alga verde aliena *Caulerpa taxifolia var. distichophylla* e gli eterobranchi *Aplysia dactylomeda* e *Aplysia punctata* vengono segnalati per la prima volta in tutto il paese. Francia: viene segnalato un nuovo ritrovamento dell'idroide alieno Porpita porpita dal Mar Corso, che rappresenta il secondo record della specie nel Mar Mediterraneo occidentale. Tunisia: il pesce alieno *Scatophagus argus* è segnalato dal Golfo di Gabès, probabilmente rappresenta una liberazione dell'acquario. Italia: il noto bivalve alieno mediterraneo Malleus regula viene segnalato per la prima volta in Italia. Slovenia: il bivalve marino alieno Xenostrobus securis viene segnalato per la prima volta da tutto il Paese. Croazia: il gasteropode alieno Biuve fulvipunctata viene segnalato per la prima volta dal Paese ma anche dall'intero mare Adriatico. Montenegro: la bivalve aliena Rapana venosa viene segnalata per la prima volta dalle acque montenegrine. Albania: il noto pesce alieno Lagocephalus sceleratus e il raro squalo nativo Rhizoprionodon acutus sono segnalati per primi dall'intero paese. Grecia: la rara razza autoctona Leucoraja circularis viene segnalata per la prima volta dal Golfo di Argolikos e per la prima volta per l'intero Paese viene confermata la sua identificazione morfologicamente e molecolarmente; registrazioni aggiuntive della medusa nomade aliena Rhopilema nomade documentano la sua distribuzione in espansione, mentre la presenza e i pesci alieni Sillago suezensis e Pomadasys stridens sono segnalati per la prima volta dalle acque elleniche. Turchia: sono riportate ulteriori registrazioni del gambero egiziano Metapenaeopsis aegyptia con alcune informazioni biologiche. Cipro: viene segnalato per la prima volta in tutto il Mar Mediterraneo il pesce alieno Variola louti, uscito probabilmente da un acquario, mentre viene segnalato per la prima volta da tutto il Paese il granchio alieno della luna Matuta victor.

**Abstract ENG:** The Collective Article on “New Mediterranean Biodiversity Records” offers the means to publish biodiversity records in the Med- iterranean Sea. The current article presents new biodiversity data information on 18 taxa (14 alien, 3 native and 1 cryptogenic species) belonging to 5 Phyla that are reported for 11 different countries listed according to their geographic position from the western to the eastern Mediterranean Sea. Algeria: the alien green alga Caulerpa taxifolia var. distichophylla and the heterobranchs Aplysia dacty- lomeda and Aplysia punctata are first reported from the entire country. France: a new record of the alien hydroid Porpita porpita is reported from the Corsican Sea, representing the second record of the species in the western Mediterranean Sea. Tunisia: the alien fish Scatophagus argus is reported from the Gulf of Gabès, probably representing an aquarium release. Italy: the well-established Mediterranean alien bivalve

Malleus regula is first reported from the entire country. Slovenia: the alien marine bivalve Xenostrobus securis is reported for the first time from the entire country. Croatia: the alien gastropod Biuve fulvipunctata is reported for the first time from the country but also from the entire Adriatic Sea. Montenegro: the alien bivalve Rapana venosa is reported for the first time from the Montenegrin waters. Albania: the well-established alien fish Lagocephalus sceleratus and the rare native shark Rhizoprionodon acutus are reported for the first from the entire country. Greece: the rare native ray Leucoraja circularis is reported for the first time from the Argolikos Gulf and for the first time for the entire country its identification is confirmed morphologically and molecularly; additional records of the alien nomad jellyfish Rhopilema nomadic document its expanding distribution, while the occurrence and the alien fishes Sillago suezensis and Pomadasys stridens are reported for the first time from Hellenic waters. Turkey: additional records of the Egyptian Prawn Metapenaeopsis aegyptia are reported with some biological information. Cyprus: the alien fish Variola louti is reported for the first time for the entire Mediterranean Sea, probably released from an aquarium, while the alien moon crab Matuta victor is reported for the first time from the entire country.

## Can Different Body Tissues of Two Sea Cucumbers Supply a Fair Amount of Omega 3 for Health Benefit?

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Journal of Aquatic Food Product Technology, 2019, 28 (8), 821-836 , doi: 10.1080/10498850.2019.1652217

**Autori:** Francesca Biandolino, Isabella Parlapiano, Giuseppe Denti, Giovanni Fanelli, and Ermelinda Prato

**Abstract ITA:** Il contenuto lipidico e il profilo degli acidi grassi di diversi tessuti di Holothuria tubulosa e H. polii sono stati analizzati per valutare l'idoneità delle specie del Mediterraneo centrale come potenziale risorsa marina per gli acidi grassi, in particolare acidi grassi polinsaturi omega-3 (n- 3 PUFA). Contemporaneamente sono stati valutati i loro importanti indici per la salute umana. La gonade e l'albero respiratorio avevano il più alto contenuto di lipidi, mentre il corpo aveva i valori più bassi. I risultati hanno mostrato differenze significative tra le specie e tra le diverse porzioni analizzate. La tunica interna e il muscolo longitudinale di H. tubulosa hanno mostrato la più alta proporzione di PUFA (rispettivamente 55,3 e 46,4%). L'acido eicosapentaenoico (EPA, C20: 5n-3) e l'acido arachidonico (ARA, C20: 4n-6) erano i PUFA più abbondanti in entrambe le specie, con un rapporto n-3 / n-6 favorevole in tutti i tessuti. Gli indici di aterogenicità e trombogenicità e il rapporto tra acidi grassi ipocolesterolemici / ipercolesterolemici hanno suggerito l'alta qualità di questo alimento, simile ai valori nutrizionali dei pesci più diffusi.

**Abstract ENG:** The lipid content and fatty acids profile of different tissues of Holothuria tubulosa and H. polii were analyzed to assess the suitability of the central Mediterranean species as a potential marine resource for fatty acids, in parti- cular omega-3 polyunsaturated fatty acids (n-3 PUFAs). Simultaneously, their important indices for human health were evaluated. Gonad and respiratory tree had the highest lipid content, while the body had the lowest values. The results showed significant differences between species and among the differ- ent portions analyzed. Internal tunic and longitudinal muscle of H. tubulosa exhibited the highest PUFA proportion (55.3 and 46.4%, respectively). Eicosapentaenoic acid (EPA, C20:5n-3) and arachidonic acid (ARA, C20:4n-6) were the most abundant PUFAs in both species, with a favorable n-3/n-6 ratio in all tissues. The atherogenic and thrombogenicity indices and hypocholes- terolaemic/hypercholesterolaemic fatty acid ratio suggested the high-quality of this food, similar to the nutritional values of most popular fish.

## Effects of a Simulated Acute Oil Spillage on Bacterial Communities from Arctic and Antarctic Marine Sediments

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Microorganisms, 2019, 7, 632, doi: 10.3390/microorganisms7120632

**Autori:** Rizzo, C.; Malavenda, R.; Gerçe, B.; Papale, M.; Syldatk, C.; Hausmann, R.; Bruni, V.; Michaud, L.; Lo Giudice, A.; Amalfitano, S.

**Abstract ENG:** Background: The bacterial community responses to oil spill events are key elements to predict the fate of hydrocarbon pollution in receiving aquatic environments. In polar systems, cold temperatures and low irradiance levels can limit the effectiveness of contamination removal processes. In this study, the effects of a simulated acute oil spillage on bacterial communities from polar sediments were investigated, by assessing the role of hydrocarbon mixture, incubation time and source bacterial community in selecting oil-degrading bacterial phylotypes. Methods: The bacterial hydrocarbon degradation was evaluated by gas chromatography. Flow cytometric and fingerprinting profiles were used to assess the bacterial community dynamics over the experimental incubation time. Results: Direct responses to the simulated oil spill event were found from both Arctic and Antarctic settings, with recurrent bacterial community traits and diversity profiles, especially in crude oil enrichment. Along with the dominance of Pseudomonas spp., members of the well-known hydrocarbon degraders Granulosicoccus spp. and Cycloclasticus spp. were retrieved from both sediments. Conclusions: Our findings indicated that polar bacterial populations are able to respond to the detrimental effects of simulated hydrocarbon pollution, by developing into a more specialized active oil degrading community.

## Role of depositional dynamics and riverine input in shaping microbial benthic community structure of Po prodelta system (NW Adriatic, Italy)

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Estuarine Coastal and Shelf Science, 2019, 227, 106305, DOI: 10.1016/j.ecss.2019.106305

**Autori:** Alvisi, Francesca; Cibic, Tamara; Fazi, Stefano; Bongiorni, Lucia; Relitti, Federica; Del Negro, Paola

**Abstract ENG:** To understand to what extent depositional dynamics and riverine input contribute to shape the microbial benthic community structure in coastal systems, surface sediments were collected along one nearshore and two land-sea transects in the Po River prodelta, and analyzed for lithology, sediment structures, grain-size, short-lived radioisotopes (7Be and 137Cs) and organic matter (OM) quantity and origin (C, N, stable isotopes). The most recent surface supply (i.e. 5–6 mo = SUP layer) and the underneath, older sub-surface deposits (i.e. >6 mo = SUB layer) were analyzed at six selected sampling sites and checked for possible differences in the microbial community abundance and structure. According to different depositional dynamics, three distinct groups of sites were detected: nearshore muddy and sandy sites, and offshore sites. Sedimentary records reflected the interplay of different elements and/or processes acting in this complex and highly dynamic system. River-derived sediments, as depicted by high contribution of silty particles and recent riverine OM inputs, were confined to nearshore locations in front of the main river mouth. They resulted highly correlated to bacterial distribution and prokaryotic abundances in SUP layer. Nevertheless, in subsurface sediments affected by the delivery of high amount of mud, potential burial phenomena and/or the development of anoxic conditions occurred, leading to a change in the bacterial community structure. We speculated that the decrease of Gamma- and increase of Delta-Proteobacteria in the SUB layer could be related to their sulfur-oxidizing and sulfate-reducing activities, respectively. On the other hand, at offshore sites, the presence of a low, and regular sedimentary input and less intense hydrodynamic conditions favored a more stable microbial structure across surface and subsurface sediments. Four discriminating proxies, such as grain-size representing the system energy, Total N as an indicator of land-derived nutrient inputs, 7Be as a tracer of the freshness of riverine discharge, and stable C isotope as an indicator of the type and age of OM, mainly summarize the complex relationships between sedimentary dynamics and bacterial community structure in the Po River prodelta area.

## Microbiomes in Soils Exposed to Naturally High Concentrations of CO2 (Bossoleto Mofette Tuscany, Italy)

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Frontiers in Microbiology, 2019, 10, 2238, DOI: 10.3389/fmicb.2019.02238

**Autori:** Fazi, Stefano; Ungaro, Fabrizio; Venturi, Stefania; Vimercati, Lara; Viggi, Carolina Cruz; Baronti, Silvia; Ugolini, Francesca; Calzolari, Costanza; Tassi, Franco; Vaselli, Orlando; Raschi, Antonio; Aulenta, Federico

**Abstract ENG:** Direct and indirect effects of extremely high geogenic CO2 levels, commonly occurring in volcanic and hydrothermal environments, on biogeochemical processes in soil are poorly understood. This study investigated a sinkhole in Italy where long-term emissions of thermometamorphic-derived CO2 are associated with accumulation of carbon in the topsoil and removal of inorganic carbon in low pH environments at the bottom of the sinkhole. The comparison between interstitial soil gasses and those collected in an adjacent bubbling pool and the analysis of the carbon isotopic composition of CO2 and CH4 clearly indicated the occurrence of CH4 oxidation and negligible methanogenesis in soils at the bottom of the sinkhole. Extremely high CO2 concentrations resulted in higher microbial abundance (up to 4 × 109 cell g–1 DW) and a lower microbial diversity by favoring bacteria already reported to be involved in acetogenesis in mofette soils (i.e., Firmicutes, Chloroflexi, and Acidobacteria). Laboratory incubations to test the acetogenic and methanogenic potential clearly showed that all the mofette soil supplied with hydrogen gas displayed a remarkable CO2 fixation potential, primarily due to the activity of acetogenic microorganisms. By contrast, negligible production of acetate occurred in control tests incubated with the same soils, under identical conditions, without the addition of hydrogen. In this study, we report how changes in diversity and functions of the soil microbial community – induced by high CO2 concentration – create peculiar biogeochemical profile. CO2 emission affects carbon cycling through: (i) inhibition of the decomposition of the organic carbon and (ii) promotion of CO2-fixation via the acetyl-CoA pathway. Sites naturally exposed to extremely high CO2 levels could potentially represent an untapped source of microorganisms with unique capabilities to catalytically convert CO2 into valuable organic chemicals and fuels.

## Resistance to degradation and impact of the herbicide glyphosate on the bacterioplankton community of a large river system dominated by agricultural activities

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Marine and Freshwater Research, 2019, 71(8) 1026-1032, DOI:10.1071/MF19079

**Autori:** Piccini C., S. Fazi, G. Pérez, G. Batani, G. Martínez de la Escalera, J.R. Sotelo,

**Abstract ENG:** Glyphosate-based herbicides are widely used for several crops, such as transgenic soybean and forestry. The aim of this study was to determine the effect of glyphosate on the community structure of riverine bacterioplankton and to evaluate the potential of bacterioplankton to degrade the herbicide. River water to which 13C-labelled glyphosate (10, 100 μg L–1) was added or not (control) was incubated for 6 days at the temperature measured in situ (20°C). Significant differences in bacterioplankton community composition, as assessed by microfluidics-based automated ribosomal intergenic spacer analysis, were found among treatments, with differences in the presence of 100 μg L–1 of glyphosate being more pronounced, namely significant decreases in bacterial richness and diversity. The glyphosate degradation product aminomethylphosphonic acid (AMPA) was detected, accounting for 1.2% of glyphosate conversion in water with 100 μg L–1 of 13C-labelled glyphosate, together with a significant enrichment of 13C in the bacterial biomass. These findings suggest that glyphosate had a direct detrimental effect on most bacterioplankton taxa, but enriched those that were able to degrade the herbicide. Together, the results indicate that glyphosate degradation in the river assessed would be a slow process (months–years), taking place through the AMPA degradation pathway and meaning glyphosate accumulate in the ecosystem.

## Natural and anthropogenic disturbances shape benthic phototrophic and heterotrophic microbial communities in the Po River Delta system

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Estuarine Coastal and Shelf Science, 2019, 222:168-182, DOI: 10.1016/j.ecss.2019.04.009

**Autori:** Cibic, Tamara; Fazi, Stefano; Nasi, Federica; Pin, Lorenzo; Alvisi, Francesca; Berto, Daniela; Viganò, Luigi; Zoppini, Annamaria; Del Negro, Paola

**Abstract ENG:** This study represents the first example in which benthic heterotrophic and photoautotrophic microbial communities (prokaryotes and microphytobenthos-MPB, respectively) were simultaneously investigated. To explore how they synergistically respond to multiple natural and anthropogenic stressors, in the framework of the Project RITMARE four lagoons of the Po River Delta were sampled in May 2016: two with more marine features, i.e. Scardovari (SC) and Caleri (CL), and two more directly affected by the Po River flow, i.e. Canarin (CN) and Vallona-Marinetta (MV). The abundance and structure of benthic communities were related to physical-chemical parameters i.e. grain-size, total N, total organic C, stable C and N isotopes, and synthetic organic contaminants. Stations were gathered into three distinct groups (Ransosim = 0.540 $p < 0.001$) according to their different physical-chemical features: outer, inner-freshwater and inner-marine sites. Contamination levels did not seem to severely affect the microbial abundances that were overall stimulated by the combined effect of high organic and nutrient loads: prokaryotes up to +42% and MPB up to +93%. Bacteria and Archaea displayed high densities at sites directly influenced by the freshwater input and anthropogenically derived nitrogen. Delta- (30.8%), Alpha- (12.8%), Gamma- (11.8%) and Beta-Proteobacteria (7.1%) were the dominant classes at all sites. For both communities, a significant inter-lagoonal (among different lagoons) and intra-lagoonal (among stations within the same lagoon) pattern was highlighted by PERMANOVA. nMDS and SIMPER analyses revealed distinct assemblages in the inner and outer parts of the lagoons. We applied a novel functional approach based on diatom life modes. At inner and outer sites, different diatom living forms developed: epipsammic (on sand) nearby the lagoonal mouths, epipelic (on mud) at the innermost sites and non-benthic forms (planktonic, tychopelagic and epiphytic) at sites directly influenced by freshwater. Distance-based Linear Models further indicated that salinity, clay and temperature were the significant drivers of the prokaryotic spatial distribution whereas clay, PAHs, PCBs and salinity best explained the MPB structure. The dominance of non-benthic diatom life modes in the more polluted lagoon (CN) suggests a negative influence of contamination on the MPB structure. Two diatom keystone species likely contribute to restore the oxic gradient in sediments frequently exposed to anoxia, allowing the subsequent microbial aerobic degradation and the recolonization of higher trophic organisms. The capacity of re-oxygenation after anoxia has important ecological and economic implications in lagoons exploited for aquaculture.

## Human health risk assessment for the occurrence of enteric viruses in drinking water supplied from wells: Role of flood runoff injections

**Anno di pubblicazione:** 2019

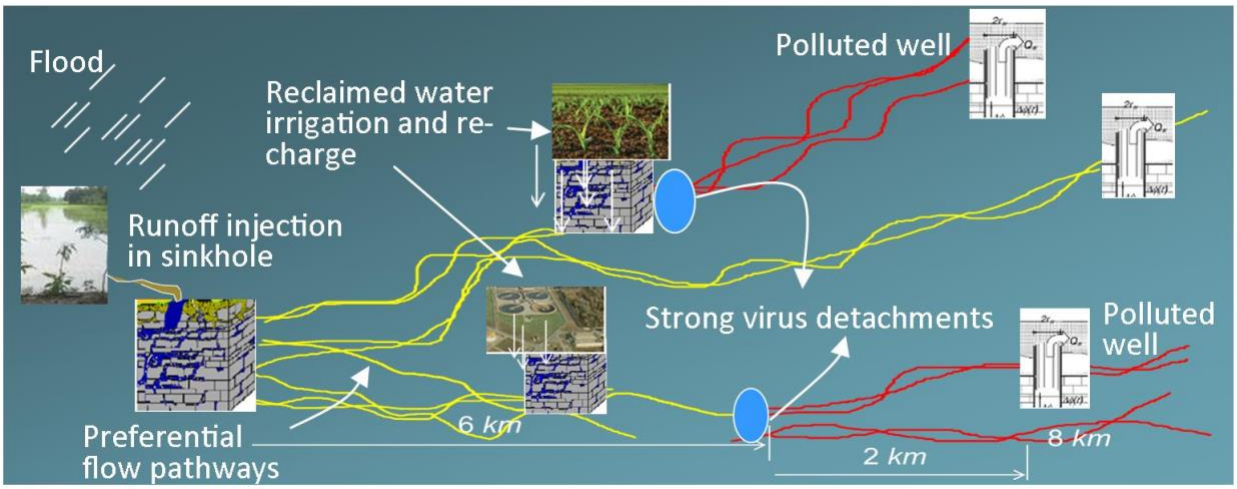
**Riferimento rivista con DOI:** Science of the Total Environment, 2019, 666, 559-571, doi: 10.1016/j.scitotenv.2019.02.107

**Autori:** Masciopinto, C., De Giglio, O., Scrascia, M., Fortunato, F., La Rosa, G., Suffredini, E., Pazzani, C., Prato, R, Montagna, M.T.

**Abstract ITA:** Abbiamo dimostrato che le inondazioni possono indurre una grave contaminazione microbiologica dell'acqua potabile proveniente dai pozzi e abbiamo suggerito strategie per affrontare meglio i piani di sicurezza idrica per l'approvvigionamento idrico sotterraneo. Dal 2002 l'Istituto Italiano di Ricerca sull'Acqua (IRSA) ha rilevato virus dell'epatite A, adenovirus, rotavirus, norovirus ed enterovirus in campioni di acqua provenienti da pozzi della penisola salentina, nel sud Italia. Le perturbazioni nella forza ionica nel flusso d'acqua possono avviare forti distacchi di virus dai sedimenti di terra rossa nelle fratture carsiche. Questo studio ha quindi esplorato i potenziali impatti sulla salute delle iniezioni prolungate di deflusso nelle acque sotterranee salentine causate da forti inondazioni durante l'ottobre 2018. Per determinare il rischio è stato applicato un modello matematico per il destino del virus e il suo trasporto nelle fratture che stima l'impatto dell'iniezione di acqua di piena sulla qualità delle acque sotterranee, incorporando meccanismi che influiscono attaccamento / distacco del virus e sopravvivenza in acqua corrente alla microscala. Questo modello ha previsto concentrazioni target di virus enterici che possono verificarsi inaspettatamente nei pozzi a distanze considerevoli (5-8 km) dal sito di iniezione del deflusso superficiale (vora o foiba). Successivamente l'impatto sulla salute dei virus nell'acqua potabile fornita da pozzi contaminati è stato stimato durante l'estate 2019 sulla costa salentina. Sono stati proposti coefficienti specifici del modello dose-risposta non pubblicati per determinare le probabilità di infezione per enterovirus Echo-11 e Polio 1 attraverso l'ingestione. Il rischio mediano (50%) di infezione è stato stimato a 6,3 · 10−3 con un'incertezza del 23%. Il carico di malattia previsto è stato di 4,89 anni di vita aggiustati per la disabilità all'anno (DALYs), cioè il doppio del carico di malattia massimo tollerabile. I risultati evidenziano la necessità di ulteriori trattamenti di disinfezione dell'acqua nel Salento prima della distribuzione dell'acqua potabile. Inoltre, una nuova direttiva quadro sulle acque dovrebbe imporre controlli mensili della presenza di virus enterici nelle acque dei pozzi nelle regioni semiaride a causa della vulnerabilità delle falde acquifere carbonatiche carsiche a iniezioni prolungate di acqua alluvionale e alla contaminazione da virus enterico.

**Abstract ENG:** Wedemonstrated that floods can induce severemicrobiological contamination of drinkingwater fromwells and suggest strategies to better address water safety plans for groundwater drinking supplies. Since 2002, the Italian Water Research Institute (IRSA) has detected hepatitis A virus, adenovirus, rotavirus, norovirus, and enterovirus in water samples fromwells in the Salento peninsula, southern Italy. Perturbations in the ionic strength inwater flow can initiate strong virus detachments from terra rossa sediments in karst fractures. This study therefore explored the potential health impacts of prolonged runoff injections in Salento groundwater caused by severe flooding during October 2018. A mathematicalmodel for virus fate and transport in fractures was applied to determine the impact of floodwater injection on groundwater quality by

incorporating mechanisms that affect virus attachment/detachment and survival in flowing water at microscale. This model predicted target concentrations of enteric viruses that can occur unexpectedly inwells at considerable distances (5–8 km) from the runoff injection site (sinkhole). Subsequently, the health impact of viruses in drinking water supplied from contaminated wells was estimated during the summer on the Salento coast. Specific unpublished doseresponse model coefficients were proposed to determine the infection probabilities for Echo-11 and Polio 1 enteroviruses through ingestion. Themedian (50%) risk of infectionwas estimated at 6.3 · 10−3with an uncertainty of 23%. The predicted burden of diseases was 4.89 disability adjusted life years per year, i.e., twice the maximum tolerable disease burden. The results highlight the requirement for additional water disinfection treatments in Salento prior to the distribution of drinking water. Moreover, monthly controls of enteric virus occurrence in water fromwells should be imposed by a newwater framework directive in semiarid regions because of the vulnerability of karst carbonate aquifers to prolonged floodwater injections and enteric virus contamination.



## Combining electrokinetic transport and bioremediation for enhanced removal of crude oil from contaminated marine sediments: Results of a long-term, mesocosm-scale experiment

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Water Research, 2019, 157, 381-395, 10.1016/j.watres.2019.03.094

**Autori:** Simone Cappello, Carolina Cruz Viggi, Michail Yakimov, Simona Rossetti, Bruna Matturro, Lazaro Molina, Ana Segura, Silvia Marqués, Luis Yuste, Emma Sevilla, Fernando Rojo, Angela Sherry, Obioma K. Mejeha, Ian M. Head, Linus Malmquist, Jan H. Christensen, Nicolas Kalogerakis, Federico Aulenta

**Abstract ENG:** Marine sediments represent an important sink of harmful petroleum hydrocarbons after an accidental oil spill. Electrobioremediation techniques, which combine electrokinetic transport and biodegradation processes, represent an emerging technological platform for a sustainable remediation of contaminated sediments. Here, we describe the results of a long-term mesocosm-scale electrobioremediation experiment for the treatment of marine sediments contaminated by crude oil. A dimensionally stable anode and a stainless-steel mesh cathode were employed to drive seawater electrolysis at a fixed current density of 11 A/m2. This approach allowed establishing conditions conducive to contaminants biodegradation, as confirmed by the enrichment of Alcanivorax borkumensis cells harboring the alkB-gene and other aerobic hydrocarbonoclastic bacteria. Oil chemistry analyses indicated that aromatic hydrocarbons were primarily removed from the sediment via electroosmosis and low molecular weight alkanes (nC6 to nC10) via biodegradation.

## Magnetite nanoparticles enhance the bioelectrochemical treatment of municipal sewage by facilitating the syntrophic oxidation of volatile fatty acids

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**Riferimento rivista con DOI:** Journal of Chemical Technology and Biotechnology, 2019, 94 (10), 3134-3146, DOI: 10.1002/jctb.6120

**Autori:** Carolina Cruz Viggi, Stefania Casale, Habib Chouchane, Refka Askri, Stefano Fazi, Ameur Cherif, Marco Zeppilli, Federico Aulenta

**Abstract ENG:** BACKGROUND: Microbial electrochemical technologies (METs) represent a novel platform to harvest the energy trapped in municipal wastewater. At the anode of METs, electro-active bacteria (EAB) anaerobically oxidize wastewater constituents using the electrode as the terminal electron acceptor and, by so doing, generate an electric current. To convert complex wastewater constituents into electricity, EAB must not only establish syntrophic relationships with other members of the microbial community, but also compete with methanogens for consumption of hydrogen and acetate. Here, we examined the addition of magnetite nanoparticles (NPs) (250 mg Fe L−1) as a novel strategy to manipulate such metabolic interactions and in turn maximize the efficiency of wastewater treatment and the yield of electric current generation. RESULTS: Batch experiments carried out either in the presence of a mixture of volatile fatty acids or of a synthetic sewage demonstrated that magnetite addition accelerate the rate of electrogenic oxidation of specific compounds, particularly propionate (up to 120%), an intermediate which frequently accumulates during anaerobic treatment processes, while correspondingly enhancing electric current generation (up to 90%), and diminishing the rate of competing methane generation (up to 50%). Notably, the composition of the microbial community was not substantially affected by the presence of magnetite nanoparticles, possibly suggesting that these latter facilitated extracellular electron transfer mechanisms (among microbes and with the electrode), rather than enriching conditions for specific microorganisms. CONCLUSION: The addition of magnetite NPs may represent a practical strategy to kick-start a bioelectrochemical system designed for wastewater treatment and improve the effectiveness of electrogenic substrate oxidation processes.

## Bioelectrochemical treatment of groundwater containing BTEX in a continuous-flow system: Substrate interactions, microbial community analysis, and impact of sulfate as a co-contaminant

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**Riferimento rivista con DOI:** New Biotechnology, 2019, 53, 41-48, DOI: 10.1016/j.nbt.2019.06.004

**Autori:** Enza Palma, Anna Espinoza Tofalos, Matteo Daghio, Andrea Franzetti, Panagiota Tsiota, Carolina Cruz Viggi, Marco Petrangeli Papini, Federico Aulenta

**Abstract ENG:** Microbial electrochemical technologies (MET) are increasingly being considered for in situ remediation of contaminated groundwater. However, their application potential for the simultaneous treatment of complex mixtures of organic and inorganic contaminants, has been only marginally explored. Here we have analyzed the performance of the 'bioelectric well', a previously developed bioelectrochemical reactor configuration, in the treatment of benzene, toluene, ethyl-benzene and xylenes (BTEX) mixtures. Although to different extents, all BTEX were found to be degraded in the bioelectrochemical system, operated using a continuous-flow of groundwater at a hydraulic retention time of 8.8 h, with the graphite anode potentiostatically controlled at +0.200 V vs. the standard hydrogen electrode. In the case of toluene and ethyl-benzene, biodegradation was further confirmed by the GC–MS identification of fumarate-addition metabolites, previously shown to be involved in the activation of these contaminants under anaerobic conditions. Degradation rates were higher for toluene (31.3 ± 1.5 mg/L d) and lower for benzene (6.1 ± 0.3 mg/L d), ethyl-benzene (3.3 ± 0.1 mg/L d), and xylenes (4.5 ± 0.2 mg/L d). BTEX degradation was linked to electric current generation, with coulombic efficiencies falling in the range 53–69%, although methanogenesis also contributed to contaminant degradation. Remarkably, the system also allowed removal of sulfate simultaneously with toluene. Sulfate removal was likely driven by the hydrogen abiotically generated at the cathode. Taken as a whole, these findings highlight the remarkable potential of this innovative reactor configuration for application in a variety of contamination scenarios

## Physiological profiling and functional diversity of groundwater microbial communities in a municipal solid waste landfill area.

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**Autori:** Melita M, Amalfitano S, Preziosi E, Ghergo S, Frollini E, Parrone D, Zoppini A.

**Abstract ITA:** Le discariche dei rifiuti solidi urbani rappresentano a scala mondiale la maggiore minaccia per l'ambiente degli acquiferi. Lo scopo di questo studio è esplorare come le caratteristiche geochimiche delle acque sotterranee possono influenzare a funzionalità delle comunità microbiche e potenzialmente i modelli di degradazione di sostanze organiche selezionate in risposta a diversi livelli di alterazione indotti dalla discarica. Le acque sotterranee raccolte da una discarica sono state monitorate valutando i principali parametri fisico-chimici e i livelli di contaminazione microbiologica (coliformi totali e indicatori fecali - Colilert-18). La comunità microbica acquatica è stata ulteriormente caratterizzata dalla citometria a flusso e dal dosaggio Biolog EcoPlates TM. Tre condizioni delle acque sotterranee (cioè, incontaminate, miste e alterate) sono state identificate in base ai loro distinti profili geochimici. Le acque sotterranee alterate hanno mostrato valori relativamente più alti di concentrazione di materia organica e conta cellulare totale, insieme alla presenza di batteri indicatori fecali, rispetto ai campioni da condizioni incontaminate e miste. I profili cinetici della degradazione del substrato Biolog hanno mostrato che la comunità microbica che prospera in condizioni alterate era relativamente più efficiente nel metabolizzare un numero maggiore di substrati organici, compresi quelli con strutture molecolari complesse. Abbiamo concluso che la valutazione del profilo fisiologico e della diversità funzionale a livello di comunità microbica potrebbe rappresentare uno strumento di supporto per comprendere le potenziali conseguenze della contaminazione organica delle falde acquifere colpite, integrando così le attuali strategie per la gestione delle acque sotterranee.

**Abstract ENG:** The disposal of municipal solid wastes in landfills represents a major threat for aquifer environments at the global scale. The aim of this study was to explore how groundwater geochemical characteristics can influence the microbial community functioning and the potential degradation patterns of selected organic substrates in response to different levels of landfill-induced alterations. Groundwaters collected from a landfill area were monitored by assessing major physical-chemical parameters and the microbiological contamination levels (total coliforms and fecal indicators—Colilert-18). The aquatic microbial community was further characterized by flow cytometry and Biolog EcoPlates TM assay. Three groundwater conditions (ie, pristine, mixed, and altered) were identified according to their distinct geochemical profiles. The altered groundwaters showed relatively higher values of organic matter concentration and total cell counts, along with the presence of fecal indicator bacteria, in comparison to samples from pristine and mixed conditions. The kinetic profiles of the Biolog substrate degradation showed that the microbial community thriving in altered conditions was relatively more efficient in metabolizing a larger number of organic substrates, including those with complex molecular structures. We concluded that the assessment of physiological profiling and functional diversity at the microbial community level could represent a supportive tool to understand the potential consequences of the organic

contamination of impacted aquifers, thus complementing the current strategies for groundwater management.

## Impact of a river flood on marine water quality and planktonic microbial communities

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**Autori:** Zoppini A., Ademollo N., Bensi M., Berto D., Bongiorni L., Campanelli A., Casentini B., Patrolecco L., Amalfitano S.

**Abstract ITA:** I sistemi costieri rappresentano i recettori primari dei nutrienti e degli inquinanti derivati dalla terra, svolgendo così un ruolo cruciale nei processi di sepoltura del carbonio e di produttività marina. Uno sguardo più da vicino ai potenziali effetti delle inondazioni dei fiumi e alle successive modifiche della qualità dell'acqua di mare è fondamentale per esplorare in modo specifico i collegamenti tra i modelli di contaminazione marina ei processi microbici planctonici coinvolti nei flussi di carbonio. Qui abbiamo studiato gli effetti di un evento di inondazione estrema (8603m3s-1) da un grande fiume (fiume Po, Italia) sulle proprietà fisiche e chimiche dell'acqua di mare, insieme alle risposte delle comunità microbiche fitoplanctoniche ed eterotrofe agli input fluviali. A seguito di un'indagine oceanografica multidisciplinare condotta su tre transetti di campionamento perpendicolari alla costa italiana, le acque marine influenzate in modo diverso dall'alluvione del fiume potrebbero essere discriminate in base ai modelli di variazione delle proprietà dell'acqua di mare rilevanti (ad esempio, temperatura, salinità, ossigeno disciolto, materia sospesa totale) . Le concentrazioni dei principali nutrienti e la composizione della materia organica (cioè particolato e carbonio organico disciolto, composizione isotopica del carbonio stabile, materia organica disciolta cromoforica) erano significativamente più alte nelle acque ad alti livelli di impatto delle piene del fiume. Il carbonio organico totale disciolto e le concentrazioni di inquinanti organici e inorganici selezionati (cioè metalli pesanti e idrocarburi policiclici aromatici) sono stati inalterati dagli input fluviali, mostrando valori simili o inferiori a quelli riportati in condizioni di flusso regolare. Inoltre, le comunità microbiche fitoplanctoniche ed eterotrofe hanno mostrato cambiamenti significativi legati alle piene fluviali, come rivelato da un netto aumento delle concentrazioni di clorofilla-b (correlato alla presenza di taxa algali d'acqua dolce), tassi di produzione di C procarioti più elevati e tempi di turnover delle cellule procariotiche più brevi in acque fortemente colpite. In conclusione, i nostri risultati hanno mostrato che un evento di inondazione fluviale estrema potrebbe rappresentare una fonte di energia per il metabolismo microbico coinvolto nei processi di trasformazione dell'OM, con conseguenze sul flusso C microbicamente guidato e sulla produttività complessiva dei sistemi marini costieri.

**Abstract ENG:** Coastal systems represent primary receptors of land-derived nutrients and pollutants, thus playing a crucial role in carbon burial and marine productivity processes. A closer look into potential effects of river floods and following seawater quality modifications is fundamental to specifically explore the links between the marine contamination patterns and the planktonic microbial processes involved in carbon fluxes. Here we investigated the effects of an extreme flood event (8603 m3 s−1) from a large river (Po River, Italy) on the physical and chemical seawater properties, along with the responses of phytoplanktonic and heterotrophic microbial communities to riverine inputs. Following a multidisciplinary oceanographic survey conducted across three sampling transects perpendicular to the Italian coastline, marine waters differently impacted by the river flood could be discriminated according to the variation patterns of relevant

seawater properties (i.e., temperature, salinity, dissolved oxygen, total suspended matter). The concentrations of major nutrients and the organic matter composition (i.e., particulate and dissolved organic carbon, stable carbon isotopic composition, chromophoric dissolved organic matter) were significantly higher in waters at high river flood impact levels. The total dissolved organic carbon and the concentrations of selected inorganic and organic pollutants (i.e., heavy metals and polycyclic aromatic hydrocarbons) were unaltered by riverine inputs, showing values similar or lower than those reported at regular flow conditions. Moreover, the phytoplanktonic and heterotrophic microbial communities showed significant changes linked to river flood, as revealed by a net increase of Chlorophyll-b concentrations (related to the occurrence of freshwater algal taxa), higher prokaryotic C production rates, and shorter prokaryotic cell turnover times in highly impacted waters. In conclusion, our results showed that an extreme river flood event could represent a source of energy for the microbial metabolism involved in OM transformation processes, with consequences on the microbially-driven C-flux and to the overall productivity of coastal marine systems.

## Sediment Respiration Pulses in Intermittent Rivers and Ephemeral Streams

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**Autori:** von Schiller D., T. Datry ,R. Corti,A. Foulquier,K. Tockner ,R. Marcé G. García-Baquero ,I. Odriozola,B. Obrador,A. Elosegi ,C. Mendoza-Lera,M.O. Gessner,R. Stubbington,R. Albariño,D.C. Allen,F. Altermatt,M.I. Arce,S. Arnon ,D. Banas, A. Banegas-Medina,E. Beller,M.L. Blanchette,J.F. Blanco-Libreros,J. Blessing,I.G. Boëchat,K.S. Boersma,M.T. Bogan ,N. Bonada,N.R. Bond,K. Brintrup,A. Bruder,R.M. Burrows,T. Cancellario ,S.M. Carlson,S. Cauvy-Fraunié ,N. Cid ,M. Danger,B. de Freitas Terra,A. Dehedin,A.M. De Girolamo,R. del Campo,V. Díaz-Villanueva,C.P. Duerdoth,F. Dyer,E. Faye, C. Febria,R. Figueroa,B. Four,S. Gafny,R. Gómez,Ll. Gómez-Gener,M.A.S. Graça,S. Guareschi ,B. Gücker,F. Hoppeler,J.L. Hwan,S. Kubheka,A. Laini,S.D. Langhans,C. Leigh,C.J. Little,S. Lorenz,J. Marshall,E.J. Martín, A. McIntosh, E.I. Meyer ,M. Miliša,M.C. Mlambo,M. Moleón, M. Morais,P. Negus , D. Niyogi,A. Papatheodoulou, I. Pardo, P. Pařil ,V. Pešić ,C. Piscart ,M. Polášek ,P. Rodríguez-Lozano,R.J. Rolls, M.M. Sánchez-Montoya, A. Savić, O. Shumilova,A. Steward , A. Taleb,A. Uzan , R. Vander Vorste, N. Waltham, C. Woelfle-Erskine, D. Zak,C. Zarfl, A. Zoppini.

**Abstract ITA:** I fiumi intermittenti ed effimeri (IRES) possono rappresentare oltre la metà della rete di flussi globali, ma il loro contributo alla respirazione e alle emissioni di anidride carbonica (CO2) è in gran parte indeterminato. In particolare, si sa poco della variabilità e dei fattori di respirazione nei sedimenti IRES al momento della reumidificazione, che potrebbero provocare grandi impulsi di CO2. Presentiamo uno studio globale che esamina i sedimenti da 200 raggi IRES secchi che abbracciano più biomi. I risultati dei test standardizzati mostrano che la respirazione media è aumentata da 32 a 66 volte dopo la reidratazione dei sedimenti. La modellizzazione dell'equazione strutturale indica che questa risposta è stata determinata dalla consistenza dei sedimenti e dalla quantità e qualità della materia organica, che, a loro volta, sono state influenzate dal clima, dall'uso del suolo e dalla copertura vegetale ripariale. Le nostre stime suggeriscono che gli impulsi respiratori risultanti dalla bagnatura dei sedimenti IRES potrebbero contribuire in modo significativo alle emissioni annuali di CO2 dalla rete di flussi globali, con un singolo impulso respiratorio che potenzialmente aumenta l'emissione dello 0,2-0,7%. Poiché l'estensione spaziale e temporale dell'IRES aumenta a livello globale, i nostri risultati evidenziano l'importanza di riconoscere l'influenza dei cicli di bagnatura-asciugatura sulla respirazione e sulle emissioni di CO2 nelle reti di flussi.

**Abstract ENG:** Intermittent rivers and ephemeral streams (IRES) may represent over half the global stream network, but their contribution to respiration and carbon dioxide (CO2) emissions is largely undetermined. In particular, little is known about the variability and drivers of respiration in IRES sediments upon rewetting, which could result in large pulses of CO2. We present a global study examining sediments from 200 dry IRES reaches spanning multiple biomes. Results from standardized assays show that mean respiration increased 32-fold to 66-fold upon sediment rewetting. Structural equation modeling indicates that this response was driven by sediment texture and organic matter quantity and quality, which, in turn, were influenced by climate, land use, and riparian plant cover. Our estimates suggest that respiration pulses resulting from rewetting of IRES sediments could contribute significantly to annual CO2 emissions from the global stream

network, with a single respiration pulse potentially increasing emission by 0.2–0.7%. As the spatial and temporal extent of IRES increases globally, our results highlight the importance of recognizing the influence of wetting-drying cycles on respiration and CO2 emissions in stream networks.

## Simulating rewetting events in intermittent rivers and ephemeral streams: a global analysis of leached nutrients and organic matter

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**Autori:** Shumilova O, Zak D, Datry T, von Schiller D, Corti R, Foulquier A, Obrador B, Tockner K, Altermatt F, Arce MI, Arnon S, Banas D, Banegas-Medina A, Beller E, Blanchette M, Blanco-Libreros J F, Blessing J, Gonçalves Boëchat I, Boersma K, Bogan M T , Bonada N, Bond N, Brintrup K, Bruder A, Burrows R, Cancellario T, Carlson SM , Cauvy-Fraunié S, Cid N, Danger M, de Freitas Terra F, De Girolamo AM, del Campo R, Dyer F, Elosegi A, Emile F, Febria C, Figueroa R, Four B, Gessner M O, Gnohossou P, Gómez Cerezo R, Gómez-Gener L, Graça M A S, Guareschi S, Gücker B, Hwan J L, Kubheka S, Langhans S D, Leigh C, Little C, Lorenz S, Marshall J, McIntosh A, Mendoza-Lera6 C, Irmgard Meyer E, Miliša M, Mlambo M C, Moleón M, Negus P, Niyogi D, Papatheodoulou A, Pardo I, Paril P, Pešić V, Rodríguez-Lozano P, Rolls R R, Sánchez-Montoya M M, Savić A, Steward A, Stubbington R, Taleb A, Vander Vorste R, Waltham N, Zoppini A, Zarfl C.

**Abstract ITA:** Il cambiamento climatico e le pressioni antropiche stanno modificando la distribuzione globale e l'estensione dei fiumi intermittenti ed effimeri (IRES), che costituiscono metà dell'area della rete fluviale globale. Gli IRES sono caratterizzati da periodi di interruzione del flusso, durante i quali i substrati del canale si accumulano e subiscono cambiamenti fisico-chimici (precondizionamento), e periodi di ripresa del flusso, quando questi substrati vengono reumidificati e rilasciano impulsi di nutrienti disciolti e materia organica (OM). Tuttavia, non ci sono stime della quantità e della qualità delle sostanze lisciviate, né ci sono informazioni sui vincoli ambientali sottostanti che operano su scala globale. Abbiamo simulato sperimentalmente, in condizioni di laboratorio standard, la bagnatura di foglie, sedimenti del letto di fiume e biofilm epilitici raccolti durante la fase secca attraverso 205 IRES da cinque zone climatiche principali. Abbiamo determinato le quantità e le caratteristiche qualitative dei nutrienti lisciviati e dell'OM e abbiamo stimato i loro flussi areali dai letti dei fiumi. Inoltre, abbiamo valutato la varianza delle caratteristiche del percolato in relazione alle variabili ambientali selezionate e alle caratteristiche del substrato. Abbiamo scoperto che i sedimenti, a causa delle loro grandi quantità all'interno dei letti dei fiumi, contribuiscono maggiormente al flusso complessivo di sostanze disciolte durante gli eventi di bagnatura (56% –98%) e che i tassi di flusso differiscono nettamente tra le zone climatiche. Il carbonio organico disciolto, i fenoli e il nitrato hanno contribuito maggiormente ai flussi areali. Le quantità maggiori di sostanze lisciviate sono state trovate nella zona climatica continentale, coincidente con la più bassa biodisponibilità potenziale dell'OM lisciviato. Il modello opposto è stato trovato nella zona arida. Le variabili ambientali che si prevede sarebbero state modificate in base ai cambiamenti climatici (es. Potenziale evapotraspirazione, aridità, durata del periodo di siccità, uso del suolo) erano correlate alla quantità di sostanze lisciviate, con la relazione più forte trovata per i sedimenti. Questi risultati mostrano che il ruolo dell'IRES dovrebbe essere tenuto in considerazione nei cicli biogeochimici globali, soprattutto perché la prevalenza dell'IRES aumenterà a causa della crescente gravità degli eventi di essiccazione.

**Abstract ENG:** Climate change and human pressures are changing the global distribution and the extent of intermittent rivers and ephemeral streams (IRES), which comprise half of the global river network area. IRES are characterized by periods of flow cessation, during which channel substrates accumulate and undergo physico-chemical changes (preconditioning), and periods of flow resumption, when these substrates are rewetted and release pulses of dissolved nutrients and organic matter (OM). However, there are no estimates of the amounts and quality of leached substances, nor is there information on the underlying environmental constraints operating at the global scale. We experimentally simulated, under standard laboratory conditions, rewetting of leaves, riverbed sediments, and epilithic biofilms collected during the dry phase across 205 IRES from five major climate zones. We determined the amounts and qualitative characteristics of the leached nutrients and OM, and estimated their areal fluxes from riverbeds. In addition, we evaluated the variance in leachate characteristics in relation to selected environmental variables and substrate characteristics. We found that sediments, due to their large quantities within riverbeds, contribute most to the overall flux of dissolved substances during rewetting events (56%–98%), and that flux rates distinctly differ among climate zones. Dissolved organic carbon, phenolics, and nitrate contributed most to the areal fluxes. The largest amounts of leached substances were found in the continental climate zone, coinciding with the lowest potential bioavailability of the leached OM. The opposite pattern was found in the arid zone. Environmental variables expected to be modified under climate change (i.e. potential evapotranspiration, aridity, dry period duration, land use) were correlated with the amount of leached substances, with the strongest relationship found for sediments. These results show that the role of IRES should be accounted for in global biogeochemical cycles, especially because prevalence of IRES will increase due to increasing severity of drying events.

## A conceptual framework for understanding the biogeochemistry of dry riverbeds through the lens of soil science

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**Autori:** Arce MI, C Mendoza-Lera C, Almagro M, Catalan N, Romani AM, Martí E, Gomez R, Bernal S, Foulquier A, Mutz M, Marcé R, Zoppini A, Gionchetta G, Weigelhofer G, Del Campo R, Robinson CT, Gilmer A, Rulik M, Obrador B, Shumilova O, Zlatanović S, Arnon S, Baldrian P, Singer G, Datry T, Skoulikidis N, Tietjen B, Von Schiller D .

**Abstract ITA:** I fiumi intermittenti ed effimeri (IRES) comprendono ecosistemi fluviali che smettono di scorrere e si prosciugano ad un certo punto nello spazio e nel tempo. Durante la fase secca, i corsi d'acqua IRES sono costituiti principalmente da alvei fluviali asciutti (DRB), ecotoni prevalenti ma ampiamente inesplorati tra la fase secca e quella umida che possono influenzare fortemente la biogeochimica delle reti fluviali. I DRB sono spesso trascurati perché non appartengono strettamente né al dominio della scienza del suolo né a quello dell'acqua dolce. A causa di questo duplice carattere dei DRB, suggeriamo che i concetti e le conoscenze della scienza del suolo possano essere utilizzati per espandere la comprensione della biogeochimica IRES. Sulla base di questa idea, proponiamo che i DRB possano essere intesi concettualmente come suoli in fase iniziale che mostrano molte somiglianze con i suoli attraverso due forze principali: i) tempo trascorso dall'ultimo evento di trasporto di sedimenti e ii) lo stato di sviluppo delle strutture stabilizzanti (es. / o piante vascolari). La nostra analisi suggerisce che mentre i DRB e i suoli possono differire negli attributi fisici principali (ad esempio gli orizzonti del suolo rispetto alla facies sedimentaria fluviale), diventano rapidamente confrontabili in termini di comunità microbiche e processi biogeochimici. Proponiamo inoltre che i driver della biogeochimica dei DRB siano simili a quelli dei suoli e, quindi, i concetti e i metodi utilizzati nella scienza del suolo siano trasferibili alla ricerca sui DRB. Infine, il nostro articolo presenta le future direzioni di ricerca per far progredire la conoscenza dei DRB e per comprendere il loro ruolo nella biogeochimica delle reti fluviali intermittenti.

**Abstract ENG:** Intermittent rivers and ephemeral streams (IRES) encompass fluvial ecosystems that eventually stop flowing and run dry at some point in space and time. During the dry phase, channels of IRES consist mainly of dry riverbeds (DRBs), prevalent yet widely unexplored ecotones between dry and wet phases that can strongly influence the biogeochemistry of fluvial networks. DRBs are often overlooked because they do not strictly belong to either domain of soil or freshwater science. Due to this dual character of DRBs, we suggest that concepts and knowledge from soil science can be used to expand the understanding of IRES biogeochemistry. Based on this idea, we propose that DRBs can be conceptually understood as early stage soils exhibiting many similarities with soils through two main forces: i) time since last sediment transport event, and ii) the development status of stabilizing structures (e.g. soil crusts and/or vascular plants). Our analysis suggests that while DRBs and soils may differ in master physical attributes (e.g. soil horizons vs fluvial sedimentary facies), they become rapidly comparable in terms of microbial communities and biogeochemical processes. We further propose that drivers of DRBs biogeochemistry are similar to

those of soils and, hence, concepts and methods used in soil science are transferable to DRBs research. Finally, our paper presents future research directions to advance the knowledge of DRBs and to understand their role in the biogeochemistry of intermittent fluvial networks.

## Brachionus rotundiformis Tschugunoff, 1921 from the Brachionus plicatilis species complex (Rotifera. Monogononta): New record from a remote and isolated lake in Galápagos Archipelago, Ecuador.

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Pap. Avulsos Zool., 2019, 59, e20195921, DOI: 10.11606/1807-0205/2019.59.21

**Autori:** López C., Steintz-Kannan M., Stamou G., Michaloudi E., Papakostas S., Fontaneto D. & Segers H.

**Abstract ITA:** The presence of the rotifer species Brachionus rotundiformis from the B. plicatilis species complex in Lake Arcturo, a saline lake in the Genovesa Island of the Galápagos Islands, is here reported. This is the first record of the species for the rotifer fauna of Ecuador as well as of the species complex to the Galápagos Islands. This finding is consistent with the idea of high dispersion capacity, and of cosmopolitan distribution of this species complex. Because Genovesa Island is uninhabited, passive transport by wind currents and zoochory by migrant birds seem to emerge as the most plausible factors in this process of colonization. Integrative studies on the morphological variations, genetic, molecular, and ecological aspects are still required to further understand the process of dispersion and the ecology of this member of the B. plicatilis species complex in this remote and isolated locality, and the exact taxonomical position of the island's population to the other members of the complex.

**Abstract ENG:** The presence of the rotifer species Brachionus rotundiformis from the B. plicatilis species complex in Lake Arcturo, a saline lake in the Genovesa Island of the Galápagos Islands, is here reported. This is the first record of the species for the rotifer fauna of Ecuador as well as of the species complex to the Galápagos Islands. This finding is consistent with the idea of high dispersion capacity, and of cosmopolitan distribution of this species complex. Because Genovesa Island is uninhabited, passive transport by wind currents and zoochory by migrant birds seem to emerge as the most plausible factors in this process of colonization. Integrative studies on the morphological variations, genetic, molecular, and ecological aspects are still required to further understand the process of dispersion and the ecology of this member of the B. plicatilis species complex in this remote and isolated locality, and the exact taxonomical position of the island's population to the other members of the complex.

## Anaerobic-aerobic sequential treatment: Temperature optimization and cost implications

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Journal of the Air & Waste Management Association 69(10), 1170-1181 (2019) http://dx.doi.org/10.1080/10962247.2019.1629361

**Autori:** Ghanimeh S.; Abou Khalil C.; Mosca Angelucci D.; Tomei M.C.

**Abstract ENG:** Traditionally, aeration units, used as a polishing stage after anaerobic digestion (AD) of wastes, are operated at ambient temperature. Yet, when effluent quality is the main design criterion, raising the temperature of the aeration stage can be justified by improved removal efficiencies. In this study, an anaerobic-aerobic sequential system (AASS) was operated to co-digest raw wastewater and food waste. The aerobic compartment was tested under psychrophilic and mesophilic temperatures. At the design loading rate of 2 g L d, the anaerobic digester achieved removal efficiencies of 85 ± 2% of volatile solids (VS), 84 ± 3% of total chemical oxygen demand (COD) and a biogas yield of 1,035 ± 30 mL g (50% methane). The aerobic reactor achieved additional removal of 8% COD and 7 % VS. By raising the temperature of the aerobic reactor to the mesophilic range, COD and solids concentrations of the effluent dropped to approximately half their values. This was accompanied by an increase in nitrification (from 68% to 91%) and denitrification (from 10% to 16%). The energy analysis showed that total energy consumption slightly increases (from 0.45 to 0.49 kWh kg) by raising the temperature of the aerobic reactor to mesophilic range. A preliminary evaluation of the sludge disposal cost, revealed a saving increase of 5-6% under mesophilic operation with respect to psychrophilic conditions. Implications: In order to cope with the globally increasing constraints on the disposal of urban wastes, efficient post-processing of effluents becomes a crucial requirement for the anaerobic digestion industry. In this context, the submitted manuscript shows that the quality of the effluent, of an anaerobic digester, treating food waste with raw wastewater, can be substantially improved by optimizing the aerobic polishing stage. Raising the temperature of the aerobic reactor to the mesophilic range resulted in a drop of solids and COD concentrations to approximately half their values. Equally important, the implications on operational costs were found to be favorable, compared to traditional psychrophilic aerobic post-treatment, when taking into consideration indirect sludge treatment costs and energy selling revenues.

## Enhancing biodegradation of toxic industrial wastewaters in a continuous two-phase partitioning bioreactor operated with effluent recycle

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Process Safety and Environmental Protection 124, 172-180 (2019) http://dx.doi.org/10.1016/j.psep.2019.02.011

**Autori:** Tomei M.C.; Mosca Angelucci D.

**Abstract ENG:** In this study, we propose the application of a Continuous Two-Phase Partitioning Bioreactor (C-TPPB) operated with the tubing effluent recycle to enhance the biodegradation of toxic substrates in industrial wastewaters under severe loading conditions. Stepwise increasing influent concentrations (from 200 to 900 mg L) of 2,4-dichlorophenol (2,4-DCP) were fed to a C-TPPB operated with Hytrel G3548 tubing to simulate phenolic wastewater. Practically complete 2,4-DCP removal has been achieved during the entire experimental period, but the increased load reduced biodegradation efficiency. At influent concentration of 700 mg L, the first effluent recycle (recycle /influent flow rate ratio = 0.3) was applied: biodegradation efficiency doubled from 40 to 80% and was maintained until influent concentrations of 800 mg L. Higher influent concentrations caused a decrease in 2,4-DCP biodegradation, so the effluent recycle ratio was increased to 0.5 at 900 mg L and, also in this case, the bioreactor showed a fast recovery (~ 24 h) of the biodegradation efficiency at 80%. Mass transfer data analysis showed that the effluent recycle resulted in an increase of the mass transfer coefficient. This positive effect, joined with the reduction of the influent concentrations, demonstrated the feasibility of recycle application in enhancing the C-TPPB performance.

## Pentachlorophenol biodegradation in a two-phase system operated with absorptive polymer: Box-Behnken experimental design and optimization by response surface methodology

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Process Safety and Environmental Protection 131, 105-115 (2019) http://dx.doi.org/10.1016/j.psep.2019.09.005

**Autori:** Mosca Angelucci D., Piscitelli D., Tomei M.C.

**Abstract ENG:** The biodegradation of pentachlorophenol (PCP), the most toxic among chlorophenols, was extensivelyinvestigated in solid-liquid two-phase bioreactors (according to Box-Behnken experimental design) todemonstrate the feasibility of this technological platform. Process performance optimization for the sub-sequent scale up was also performed. The process was catalysed by an acclimated microbial consortiumand the partitioning phase consisted of Hytrel 8206 polymer. The virtuous combination of polymeruptake/release and microbial biodegradation allowed achieving practically complete biodegradationefficiencies and rates in the range of 4.0-7.8 mg/(L h) for PCP concentrations up to 100 mg/L far abovethose previously tested. Detected biodegradation rates are one order of magnitude higher than the onesreported for suspended biomass reactors. A regression model based on 3 independent variables (initialPCP and biomass concentration and polymer-to-water ratio) was formulated to predict the volumetricbiodegradation rate. The significance of independent variables and their interactions was tested by theanalysis of variance (ANOVA) with 95% confidence limit. The model resulted adequate and the polymer-to-water ratio was identified as the most significant factor affecting the system response. Maximizationof the biodegradation rate has been achieved for PCP concentration of 100 mg/L, biomass concentrationof 1 gVSS/L and polymer-to-water ratio of 9%.

## Polymer extraction and ex situ biodegradation of xenobiotic contaminated soil: Modelling of the process concept

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Journal of Environmental Management 230, 63-74 (2019) http://dx.doi.org/10.1016/j.jenvman.2018.09.045

**Autori:** Mosca Angelucci D.; Annesini M.C.; Daugulis A.J.; Tomei M.C.

**Abstract ENG:** An integrated model of a two-step process for the ex situ bioremediation of xenobiotic contaminated soil has been formulated. The process is characterized by an initial extraction step of the organic contaminants from the polluted soil by contact with inexpensive and commercially-available polymer beads, followed by release and biodegradation of the xenobiotics, with parallel polymer bioregeneration, in a Two-Phase Partitioning Bioreactor (TPPB). The regenerated polymer is cyclically reused in the extraction step, so reflecting the robust and otherwise-inert properties of such polymers. The model was calibrated and validated for a soil contaminated with 4-nitrophenol (4NP) and treated with the DuPont polymer Hytrel 8206. In the model calibration, the partition coefficient polymer-soil, Pps, and the mass transfer coefficient, K, were evaluated, as 105.3 and 0.24 h-1 respectively. A diffusion coefficient within the polymer of 6.3 10-8 cm2 s-1 was determined from the fitting of sorption/desorption data. The model was then tested for two alternative process configurations consisting of either one or two soil extraction units, followed by the biodegradation/bioregeneration step. The latter configuration resulted in more effective polymer utilization and is suitable if each extraction step requires a shorter time than the regeneration step. The model predicted that an extraction time of 12 h was sufficient to reach removal efficiencies >=90% while the biodegradation/bioregeneration step required 24 h to reach efficiencies >=93%, with a good agreement with experimental data (R2 > 0.98 for both cases). The simulation of the process operated with two extraction units showed a better performance with a final concentration ~0.2 g4NP kgds-1 vs. 1.69 g4NP kgds-1 obtained with single extraction unit, for a soil contaminated with 10 g4NP kgds-1. Corresponding extraction efficiencies were 96 and 83%, respectively.

## Post-aerobic treatment to enhance the removal of conventional and emerging micropollutants in the digestion of waste sludge

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Waste Management 96, 36-46 (2019) http://dx.doi.org/10.1016/j.wasman.2019.07.013

**Autori:** Tomei M.C.; Mosca Angelucci D.; Mascolo G.; Kunkel U.

**Abstract ENG:** Low content of micropollutants in sewage sludge, essential to allow its safe re-use in agriculture, requires effective removals during the digestion phase. To this purpose, we investigated the performance of the anaerobic-aerobic sequential digestion process applied to real waste sludge in the removal of several classes of standard pollutants, i.e. extractable organic halogens (EOXs), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), di(2-ethylhexyl)phthalate and alkylphenolethoxylates. In addition, emerging pollutants were also investigated based on their widespread occurrence and on their physicochemical characteristics and eco-toxicological relevance: quaternary ammonium compounds, a number of pharmaceuticals and selected biocides. The anaerobic step was conducted at mesophilic conditions, while two operating temperatures were tested for the post-aerobic treatment, i.e. 20 and 37 °C, respectively. Results showed that the post-aerobic digestion step enhanced the removal of all investigated standard and emerging micropollutants, even in presence of high accumulation in the anaerobic digestate (occurred for some PAHs and PCB congeners). Increased removals (up to 30%) have been generally observed at 37 °C aerobic temperature in comparison with tests at T = 20 °C for all investigated organic micropollutants, with the only exception of halogenated compounds (i.e. EOXs and PCBs). Low biodegradability and high bioaccumulation of the investigated pollutants were successfully faced by the sequential process, which has been demonstrated as an effective alternative solution to produce digested sludge for safe agricultural re-use.

## Energy efficiency improvement of thermal hydrolysis and anaerobic digestion of Posidonia oceanica residues

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Applied Energy, 2019, 252, 113457, DOI: 10.1016/j.apenergy.2019.113457

**Autori:** De Sanctis, M., Chimienti, S., Pastore, C., Piergrossi, V., Di Iaconi, C.

**Abstract ENG:** Posidonia oceanica is the most abundant aquatic plant of the Mediterranean Sea where it plays great ecological importance. The accumulation of residues along the shore, however, creates a littering hardship for the territory due to their bad rotting smell and introduces an obstacle to the enjoyment of the beaches and tourist swimming. Posidonia oceanica residues may be valorized producing bioenergy by anaerobic digestion. Due to its high lignin content, however, a pretreatment step is required for enhance energy recovery. In the present study the effects of acid addition in the thermal hydrolysis step were evaluated in terms of energy balance, biogas production and solids reduction. The results obtained have shown that when thermal pretreatment was enhanced by adding hydrochloric acid (0.4% w/w), an improvement in methane production of 575% was obtained compared to thermal pretreatment only with specific biogas production as high as 0.241 ± 0.065 Nm3 per kgVS of wet Posidonia or 0.138 ± 0.056 Nm3 CH4/kgVS. This result was ascribed to the defibration of lignocellulosic components operated by acidic thermal pretreatment which allowed the removal of 74%, 70% and 24% of cellulose, hemicellulose and lignin, respectively, during anaerobic digestion. The energy analysis carried out for treatment plants with capacity of 10 and 50 m3/d has shown that acid addition in the thermal hydrolysis step allows the energy balance to turn from extremely negative (energy demand is 8 to 10 times greater than the one produced) to positive values, with process energy efficiencies ranging from 22 to 35% with regards to the size of the plant.

## Evaluation of Posidonia oceanica residues as feedstock for anaerobic digestion

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Bioresource Technology Reports, 2019, 8,100317, DOI: 10.1016/j.biteb.2019.100317

**Autori:** De Sanctis, M., Di Iaconi, C.

**Abstract ENG:** The suitability of Posidonia oceanica as feedstock for anaerobic digestion process was evaluated carrying out several biochemical methane potential tests. No clear evidence of process inhibition were observed during tests. Nevertheless, the very high lignin content of Posidonia did not allow the organic matter solubilization by microbial lithic enzymes, thus limiting the effectiveness of the anaerobic digestion process. Therefore, Posidonia was subjected to thermal (132 °C) and thermo-chemical pre-treatment in order to increase its anaerobic digestibility. The opportunity of reducing biomass stress due to the high salinity of Posidonia suspension (performing a washing operation before anaerobic digestion) was also evaluated. Thermal treatment and salt removal allowed only a limited increase in anaerobic digestion process efficiency. Whilst thermo-chemical pre-treatment at 132 °C in presence of HCl 0.40% resulted in a relevant increase of Posidonia biodegradability leading to a specific methane production higher than 90 mL/gVS and a VS removal efficiency of about 50%

## Prospective environmental and economic assessment of solar-assisted thermal energy recovery from wastewater through a sequencing batch biofilter granular reactor

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Journal of Cleaner Production, 2019, 212, 1300-1309, DOI: 10.1016/j.jclepro.2018.12.074

**Autori:** Muñoz, I., Portillo, F., Rosiek, S., Batlles, F.J., Martínez-Del-Río, J., Acasuso, I., Piergrossi, V., De Sanctis, M., Chimienti, S., Di Iaconi, C.

**Abstract ENG:** The integration of an off-grid solar-assisted heat pump (SHP) and a sequencing batch biofilter granular reactor (SBBGR) for thermal energy recovery from wastewater was assessed by means of a prospective life cycle assessment (LCA) and life cycle costing (LCC), by theoretically scaling up a pilot installation in Bari, Italy, to a full-scale unit designed for 5000 person-equivalents. The LCA and LCC included all activities in the life cycle of the SHP and wastewater treatment plant (WWTP), namely construction, operation and end-of-life. The thermal energy produced by the SHP was assessed as supplying heating and cooling for an air-conditioning system, displacing a conventional air-source heat pump powered by electricity from the grid. This integrated system was compared to a reference situation where wastewater is treated in a conventional WWTP applying activated sludge with no thermal energy recovery system, showing clear environmental benefits in all impact indicators, such as a 42% reduction in greenhouse-gas emissions and a cost reduction of 53%. Several sensitivity analyses confirmed these findings, with the exception of the price rebound effect, which showed that the lower cost of the integrated system could lead to overturning the environmental benefits. As a limitation of the study, the distribution of the supplied air-conditioning to meet a demand off-site the WWTP premises, such as in residential buildings or hotels, was not included. Therefore, our results constitute only a preliminary positive outcome that should be validated in a real-life application.

## Contribution of EMI and GPR proximal sensing data in soil water content assessment by using linear mixed effects models and geostatistical approaches

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Geoderma, 2019, 343, 280-293, doi 10.1016/j.geoderma.2019.01.030

**Autori:** Emanuele Barca Daniela De Benedetto Anna Maria Stellacci

**Abstract ITA:** La stima del contenuto di acqua del suolo superficiale è di primario interesse nel quadro dell'agricoltura di precisione, ma, in In generale, tale valutazione è costosa e complicata da diversi fattori di interferenza che non consentono una precisa predizione. Il rilevamento prossimale può fornire strutture tecnologiche adeguate per supportare ricercatori e tecnici in questo compito. I sensori GPR ed EMI sono strumenti preziosi in quanto possono fornire covariate molto informative utilizzato per migliorare la stima del contenuto di acqua del suolo. Nel presente lavoro è stato esplorato il singolo (EMI o GPR) e il contributo combinato (EMI + GPR) di queste sorgenti di dati prossimali. Inoltre, geostatistica (Kriging ordinario e Kriging con deriva esterna) e modelli lineari a effetti misti sono stati applicati per confrontarli rispettive capacità predittive. Di conseguenza, il GPR ha dimostrato di essere più efficace nella stima dell'acqua del suolo superficiale contenuto rispetto a EMI ma, combinando entrambe le informazioni, un miglioramento nell'accuratezza della previsione è stato osservato. Inoltre, è consentito aggiungere più covariate nei modelli (risultati GPR o risultati GPR + EMI) filtrando la componente spaziale strutturata del contenuto idrico del suolo. Infine, gli approcci statistici ha dimostrato di comportarsi in modo molto simile, con una performance leggermente migliore del Kriging con deriva esterna.

**Abstract ENG:** The estimation of topsoil water content is of primary interest in the framework of precision farming, but, in general, such assessment is costly and complicated by several interfering factors which do not allow an accurate prediction. Proximal sensing can provide suitable technological facilities to support researchers and technicians in this task. GPR and EMI sensors are valuable instruments as they can provide very informative covariates to be used for improving soil water content estimation. In the present work, it was explored the single (EMI or GPR) and the combined (EMI+GPR) contribution of these proximal data sources. Furthermore, geostatistical (Ordinary Kriging and Kriging with external drift) and linear mixed effects models were applied to compare their respective predictive capabilities. As a result, GPR demonstrated to be more effective in estimating topsoil water content with respect to EMI but, combining both the information, an improvement in the prediction accuracy was observed. Moreover, adding more covariates in the models (GPR outcomes or GPR+EMI outcomes) allowed filtering out the structured spatial component of soil water content. Finally, the statistical approaches proved to behave very similarly, with a slight better performance of Kriging with external drift.

**Soil Science Society of America JournalApplication of Multivariate Analysis Techniques for Selecting Soil Physical Quality Indicators: A Case Study in Long-Term Field Experiments in Apulia (Southern Italy)**

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Soil & Water Management & Conservation, 2019, 83 (3), 707-720, doi: 10.2136/sssaj2018.06.0223

**Autori:** Mirko Castellini Anna Maria Stellacci Emanuele Barca Massimo Iovino

**Abstract ITA:** Esperimenti sul campo a lungo termine e tecniche di analisi multivariata rappresentano strumenti di ricerca che possono migliorare la nostra conoscenza sulla valutazione della qualità fisica del suolo (spq). Queste tecniche ci consentono di misurare condizioni del suolo relativamente stabili e di migliorare il giudizio sulla qualità del suolo, riducendo così le incertezze. Durante la stagione di crescita del grano duro è stato stabilito un monitoraggio della spq in esperimenti a lungo termine, finalizzato a confrontare le strategie di gestione dei residui colturali (combustione vs. incorporazione di paglia, Fe1) e la gestione del suolo (minima lavorazione vs. nessuna lavorazione, Fe2), . Sono state valutate le relazioni tra cinque spqindicators (densità apparente [BD], macroporosità [pMAC], capacità d'aria [AC], capacità idrica disponibile dell'impianto [pAWC] e capacità di campo relativa [rFC]) e due tecniche di analisi multivariata (analisi delle componenti principali e analisi discriminante graduale) sono state applicate per selezionare gli indicatori chiave per la valutazione della spq. Secondo gli indicatori utilizzati, una spq da ottimale a intermedia (cioè non decisamente scarsa) è stata rilevata nel 65% delle osservazioni in Fe1 e nel 54% in Fe2. I risultati principali hanno mostrato una significativa relazione negativa tra rFC e AC, e l'analisi multivariata ha identificato rFC come un indicatore chiave di spq, principalmente in Fe2. la capacità idrica disponibile dell'impianto e BD hanno mostrato la più alta capacità discriminante nel set di dati Fe1. I punteggi più alti della valutazione rFC sono stati evidenziati per i trattamenti di bruciatura e minima lavorazione (+1 e +2). È stato ottenuto un intervallo AC ottimale, derivato dai limiti ottimali di rFC, che è stato suggerito per valutare meglio l'AC dei terreni agricoli (0,10 £ AC £ 0,26 cm3 cm-3).

**Abstract ENG:** Long-term field experiments and multivariate analysis techniques represent research tools that may improve our knowledge on soil physical quality (spq)assessment. These techniques allow us to measure relatively stable soil condi-tions and to improve soil quality judgment, thereby reducing uncertainties. A monitoring of spq under long-term experiments, aimed at comparing crop residue management strategies (burning vs. incorporation of straw, Fe1) andsoil management (minimum tillage vs. no tillage, Fe2), was established during the crop growing season of durum wheat. The relationships between five spqindicators (bulk density [BD], macroporosity [pMAC], air capacity [AC], plant available water capacity [pAWC], and relative field capacity [rFC]) were evalu-ated, and two techniques of multivariate analysis (principal component analysis and stepwise discriminant analysis) were applied to select key indicators for spq assessment. According to the used indicators, an spq from optimal to intermediate (i.e., not definitely poor) was detected in 65% of the observations in Fe1 and in 54% in Fe2. The main results showed a significant negative rela-tionship between rFC and AC, and multivariate analysis identified rFC as a key spq indicator, mainly in Fe2. plant available water capacity and BD showed the highest discriminating capability in the Fe1

dataset. The highest scores of rFC assessment were highlighted for burning and minimum tillage treat-ments (+1 and +2). An optimal AC range, derived from optimal rFC limits, was obtained and was suggested to better assess the AC of agricultural soils (0.10 £AC £ 0.26 cm3 cm–3).

## Spatial Variability of Soil Physical and Hydraulic Properties in a Durum Wheat Field: An Assessment by the BEST-Procedure

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** water, 2019, 11, 1434, doi: 10.3390/w11071434

**Autori:** Mirko Castellini Anna Maria Stellacci Matteo Tomaiuolo Emanuele Barca

**Abstract ITA:** La variabilità spaziale delle proprietà del suolo su scala di campo può determinare l'estensione dell'agricoltura sono necessarie rese e ricerche specifiche in questo settore. L'obiettivo generale di questo studio era indagare le relazioni tra le proprietà fisiche e idrauliche del suolo e la resa del grano su scala di campo e testare la procedura BEST per la spazializzazione delle proprietà idrauliche del suolo. Una versione semplificata della procedura BEST, per stimare alcuni indicatori capacitivi dalla curva di ritenzione idrica del suolo (aria capacità, ACe, capacità di campo relativa, RFCe, capacità idrica disponibile impianto, PAWCe), è stata applicata e accoppiato a stime dell'indice di stabilità della struttura (SSI), determinazioni della tessitura del suolo e misurazioni di densità apparente (BD), carbonio organico del suolo (TOC) e conducibilità idraulica satura (Ks). Variabili oggetto di studio sono stati spazializzati per indagare le correlazioni con i livelli medio-alti osservati di grano rendimenti. La valutazione della qualità fisica del suolo e l'analisi delle correlazioni hanno evidenziato alcune incongruenze (cioè, una correlazione negativa tra PAWCe e resa del raccolto), e solo cinque variabili (cioè, argilla + limo frazione, BD, TOC, SSI e PAWCe) erano strutturati spazialmente. Pertanto, per il sistema suolo-coltura studiato, l'applicazione della procedura BEST semplificata non ha restituito risultati completamente affidabili. I risultati hanno evidenziato che (i) BD era l'unica variabile selezionata dall'analisi graduale in funzione di resa del raccolto, (ii) BD ha mostrato una distribuzione spaziale in accordo con quella rilevata per la resa del raccolto, e (iii) l'analisi di correlazione incrociata ha mostrato una significativa relazione positiva tra BD e grano resa fino ad una distanza di circa 25 m. Tali risultati hanno implicazioni per il Mediterraneo gestione degli agroambienti. In ogni caso, l'affidabilità di metodi di misurazione semplificati per la stima delle proprietà idrauliche del suolo deve essere ulteriormente verificata adottando misurazioni più dense griglie per catturare meglio la variabilità spaziale del suolo. Inoltre, la stabilità temporale di osservato le relazioni spaziali, cioè tra BD o tessitura del suolo e rese delle colture, devono essere studiate lungo a intervallo di tempo più ampio al fine di utilizzare correttamente queste informazioni per migliorare la gestione agronomica.

**Abstract ENG:** Spatial variability of soil properties at the field scale can determine the extent of agricultural yields and specific research in this area is needed. The general objective of this study was to investigate the relationships between soil physical and hydraulic properties and wheat yield at the field scale and test the BEST-procedure for the spatialization of soil hydraulic properties. A simplified version of the BEST-procedure, to estimate some capacitive indicators from the soil water retention curve (air capacity, ACe, relative field capacity, RFCe, plant available water capacity, PAWCe), was applied and coupled to estimates of structure stability index (SSI), determinations of soil texture and measurements of bulk density (BD), soil organic carbon (TOC) and saturated hydraulic conductivity (Ks). Variables under study were spatialized to investigate correlations with observed medium-high levels of wheat yields. Soil physical quality assessment and correlations analysis highlighted some inconsistencies (i.e., a negative correlation between

PAWCe and crop yield), and only five variables (i.e., clay + silt fraction, BD, TOC, SSI and PAWCe) were spatially structured. Therefore, for the soil–crop system studied, application of the simplified BEST-procedure did not return completely reliable results. Results highlighted that (i) BD was the only variable selected by stepwise analysis as a function of crop yield, (ii) BD showed a spatial distribution in agreement with that detected for crop yield, and (iii) the cross-correlation analysis showed a significant positive relationship between BD and wheat yield up to a distance of approximately 25 m. Such results have implications for Mediterranean agro-environments management. In any case, the reliability of simplified measurement methods for estimating soil hydraulic properties needs to be further verified by adopting denser measurements grids in order to better capture the soil spatial variability. In addition, the temporal stability of observed spatial relationships, i.e., between BD or soil texture and crop yields, needs to be investigated along a larger time interval in order to properly use this information for improving agronomic management.

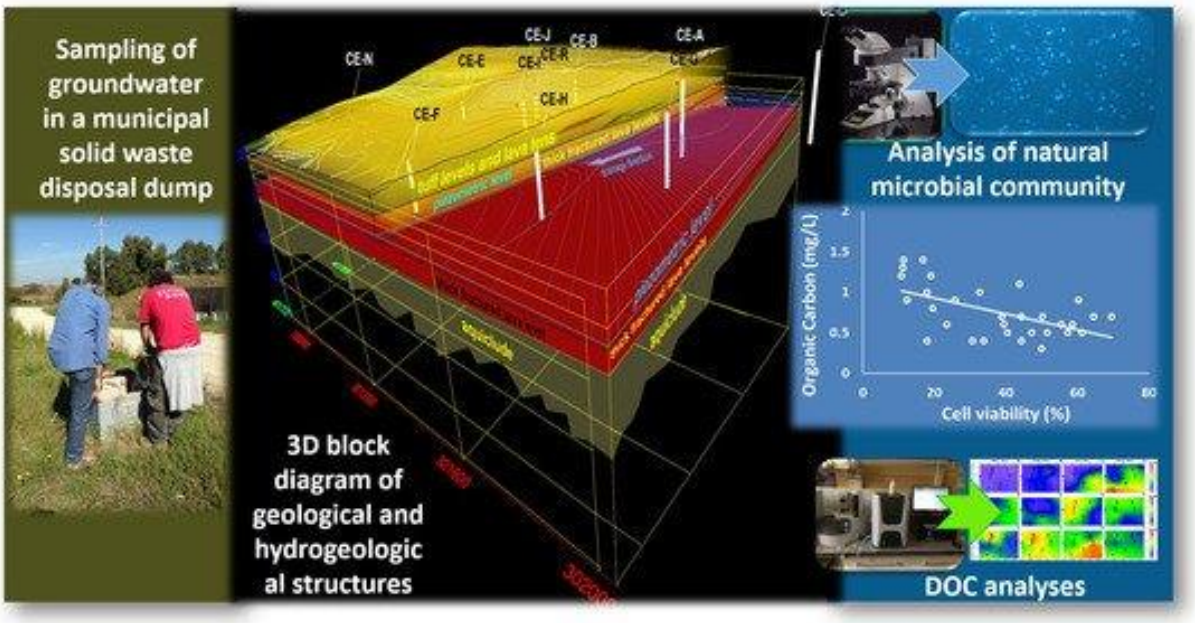
## Groundwater Autochthonous Microbial Communities as Tracers of Anthropogenic Pressure Impacts: Example from a Municipal Waste Treatment Plant (Latium, Italy).

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Water, 2019, 11(9), 1933; doi:10.3390/w11091933

**Autori:** Rossi D, Barra Caracciolo A, Grenni P, Cattena F, Di Lenola M, Patrolecco L, Ademollo N, Ciannarella R, Mascolo G, Ghergo S, 2019

**Abstract ENG:** The groundwater behavior at a municipal solid waste disposal dump, located in Central Italy, was studied using a multi-parameter monitoring over 1 year consisting of 4 seasonal samples. The hydrological and hydrogeological dynamics of water circulation, microbiological parameters (microbial abundance and cell viability of the autochthonous microbial community), dissolved organic carbon, and several contaminants were evaluated and related to the geological structures in both two and three dimensions and used for geostatistical analysis in order to obtain 3D maps. Close relationships between geological heterogeneity, water circulation, pollutant diffusion, dissolved organic carbon, and cell viability were revealed. The highest cell viability values were found with dissolved organic carbon (DOC) values 0.5 mg/L; above this value, DOC negatively affected the microbial community. The highestDOCvalues were detected in groundwater at some sampling points within the site indicating its probable origin from the waste disposal dump. Although legislation limits for the parameters measured were not exceeded (except for a contaminant in one piezometer), the 1-year multi-parameter monitoring approach made it possible to depict both the dynamics and the complexity of the groundwater flux and, with “non-legislative parameters” such as microbial cell viability and DOC, identify the points with the highest vulnerability and their origin. This approach is useful for identifying the most vulnerable sites in a groundwater body.



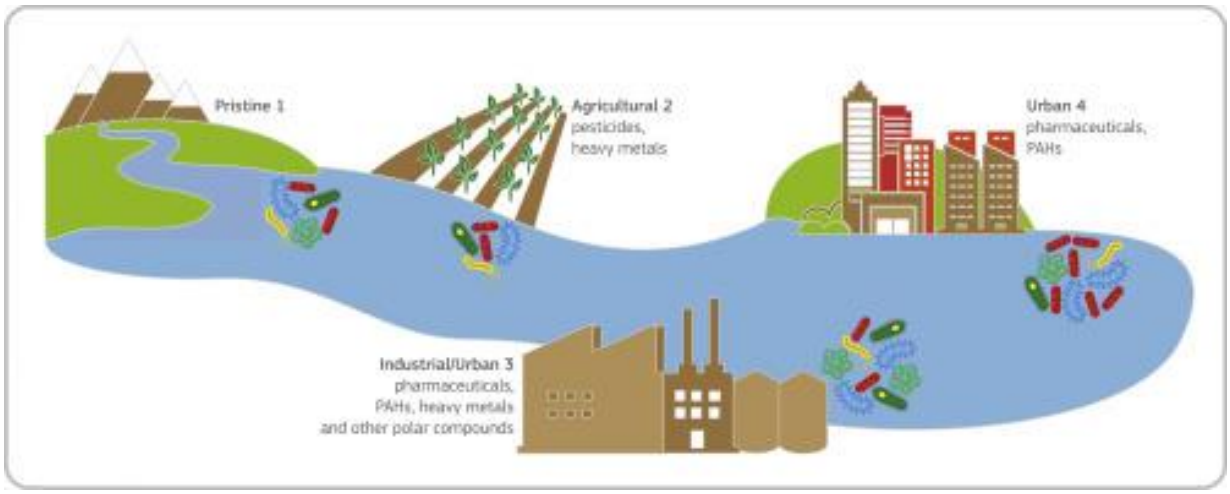
## Chemical mixtures and natural microbial community in an urbanized stretch of the River Danube.

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Microchemical Journal, 2019, 147, 14, 985-994. doi: 10.1016/j.microc.2019.04.021

**Autori:** Barra Caracciolo A, Patrolecco L, Grenni P, Di Lenola M, Ademollo N, Rauseo J, Rolando L, Spataro F, Plutzer J, Monostory K, Sperlagh B, 2019

**Abstract ENG:** River pollution from different sources can affect ecosystems in different ways with consequences on water quality for both biota and human health. The River Danube was selected to perform chemical and biological analyses. The river was sampled at three different points, one inside Budapest and two just outside. Water samples were collected twice in the same year (April and November 2017) in order to determine metal concentrations, occurrence of ubiquitous contaminants such as Polycyclic Aromatic Hydrocarbons (PAHs) and some not-yet-regulated pharmaceuticals (17β-estradiol, 17α-ethinylestradiol, estrone, fenoprofen, naproxen, ibuprofen, gemfibrozil, sulfamethoxazole and ciprofloxacin). Moreover, the structure of the natural microbial community was also analysed in terms of total microbial abundance and identification of the main bacterial groups by the Fluorescence In Situ method. Finally, the same water samples were tested to assess their possible estrogenic effects using the yeast estrogenic screen (YES). The results show diffuse residual concentrations of both PAHs and pharmaceuticals in the river stretch investigated, with the highest values in April (in line with a lower rainfall input) and at the sampling site inside the city of Budapest. At this latter point, the natural microbial community was less abundant than in the other sites, suggesting detrimental effects of the overall contaminants on its structure. Finally, an estrogenic activity was found in all water samples analysed with higher average values in line with higher amounts of contaminants in the April sampling.



## Chemical mixtures and fluorescence in situ hybridization analysis of natural microbial community in the Tiber River

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Science of the Total Environment, 2019, 673, 7-19. doi: 10.1016/j.scitotenv.2019.04.011.

**Autori:** Saccà ML, Ferrero VEV, Loos R, Di Lenola M, Tavazzi S, Grenni P, Ademollo N, Patrolecco L, Huggett J, Barra Caracciolo A, Lettieri T.

**Abstract ENG:** The Water Framework Directive (WFD) regulates freshwater and coastal water quality assessment in Europe. Chemical and ecological water quality status is based on measurements of chemical pollutants in water and biota together with other indicators such as temperature, nutrients, species compositions (phytoplankton, microalgae, benthos and fish) and hydromorphological conditions. However, in the current strategy a link between the chemical and the ecological status is missing. In the present WFD, no microbiological indicators are foreseen for integrating the different anthropogenic pressures, including mixtures of chemicals, nutrients and temperature changes, to provide a holistic view of the freshwater ecosystem water quality. The main aim of this work was to evaluate if natural microbial populations can be valuable indicators of multiple stressors (e.g. chemical pollutants, temperature, nutrients etc.) to guide preventive and remediation actions by water authorities. A preliminary survey was conducted to identify four sites reflecting a contamination gradient from the source to the mouth of a river suitable to the objectives of the European Marie Curie project, MicroCoKit. The River Tiber (Italy) was selected as a pilot case study to investigate the correlation between bacteria taxa and the chemical status of the river. The main physicochemical parameters, inorganic elements, organic pollutants and naturalmicrobial community compositionwere assessed at four selected sites corresponding to pristine, agricultural, industrial and urban areas for three consecutive years. The overall chemical results indicated a correspondence between different groups of contaminants and the main contamination sources at the selected sampling points. Phylogenetic analysis of the microbial community analyzed by Fluorescence In Situ Hybridization method (FISH) revealed differences among the four sampling sites which could reflect an adaptive bacterial response to the different anthropogenic pressures.

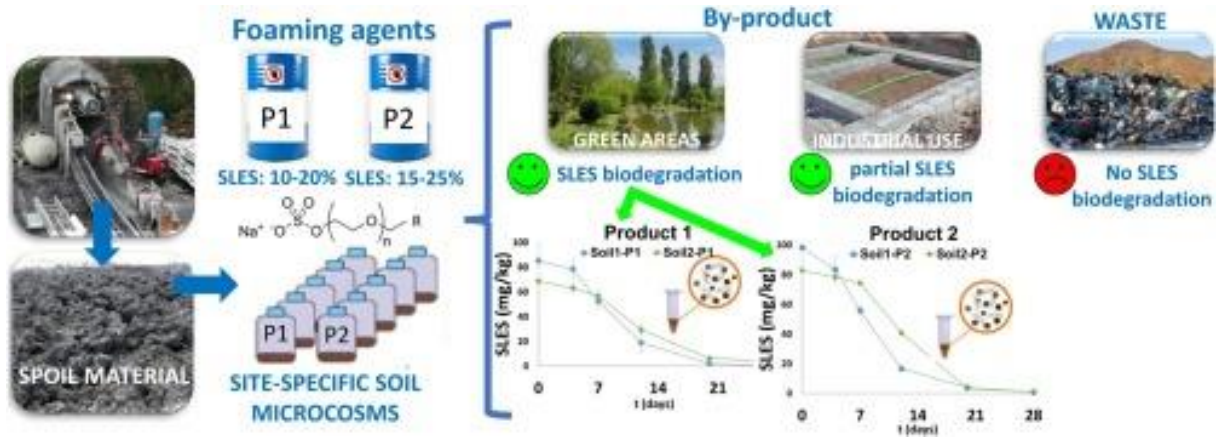
## Assessment of biodegradation of the anionic surfactant sodium lauryl ether sulphate used in two foaming agents for mechanized tunnelling excavation

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Journal of Hazardous Materials, 2019, 365: 538-545, doi10.1016/j.jhazmat.2018.11.002

**Autori:** Barra Caracciolo A, Ademollo N, Cardoni M, Grenni P, Pescatore T, Rauseo J, Patrolecco L.

**Abstract ENG:** The anionic surfactant sodium lauryl ether sulphate (SLES) is the main component in most foaming agents used for mechanized tunneling excavation. The process produces huge amounts of soil debris that can have a potential impact on ecosystems. The lack of accurate information about SLES persistence in excavated soil has aroused increasing concern about how it is recycled. The objective of this study was to assess SLES biodegradability in two commercial foaming agents (P1 and P2). Microcosm experiments were performed with two different soils collected from a tunnel construction site and conditioned with P1 or P2 (85.0 or 83.0 mg kg −1 of SLES, respectively). At selected times soil samples were collected for assessing the SLES residual concentration using Pressured Liquid Extraction followed by methylene blue active substance analysis (MBAS). Simultaneously, soil microbial abundance (DAPI counts), viability (Live/Dead method), activity (dehydrogenase analysis) and phylogenetic structure (Fluorescent In Situ Hybridization) were evaluated. SLES halved faster in the silty-clay soil (6 d) than in the gravel in a clay-silty-sand matrix (8–9 days). At day 28 it was degraded in both soils. Its Biodegradation was ascribed to the significant increase in Gamma-Proteobacteria. At this time, the spoil material can be considered as a by-product.



## Contribution of Pore-Scale Approach to Macroscale Geofluids Modelling in Porous Media

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Geofluids, 2019, 6305391, DOI:10.1155/2019/6305391

**Autori:** Emanuele Romano, Joaquín Jiménez-Martínez, Andrea Parmigiani, Xiang-Zhao Kong, and Ilenia Battiato

**Abstract ENG:** Understanding the fundamental mechanisms of fluid flows and reactive transport in natural systems is a major challenge for several fields of Earth sciences (e.g., hydrology, soil science, and volcanology) and geo/environmental engineering (CO2 sequestration, NAPLS contamination, geothermal energy, and oil and gas reservoir exploitation). The hierarchical structures of natural system (e.g., heterogeneity of geological formations) as well as the different behavior of single and multiphase fluids at the pore-scale coupled with the nonlinearity of underlying reactive processes necessitates investigating these aspects at the scale at which they physically occur, the scale of pore and fractures. Recent improvements in pore-scale computational modelling, together with the development of noninvasive microscopic imaging technology and the latest microfluidic technics are allowing the vast field of porous and fractured media research to benefit of major advances due to (1) an improved understanding and description of pore-scale mechanisms and (2) the ability of thinking in terms of coupled processes. The contributions collected in this special issue, although far from constituting a comprehensive picture of the "pore-scale world," however offer a good example of the potentialities of such an approach to investigate a wide range of processes usually observed at macroscale, but whose underlying physical and chemical processes take place at microscale.

## Impact of Synthetic Porous Medium Geometric Properties on Solute Transport Using Direct 3D Pore-Scale Simulations

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Geofluids, 2019, 6810467, 10.1155/2019/6810467

**Autori:** Paolo Roberto Di Palma, Nicolas Guyennon, Andrea Parmigiani, Christian Huber, Falk Hesse, and Emanuele Romano

**Abstract ENG:** Transport processes in porous media have been traditionally studied through the parameterization of macroscale properties, by means of volume-averaging or upscaling methods over a representative elementary volume. The possibility of upscaling results from pore-scale simulations, to obtain volume-averaging properties useful for practical purpose, can enhance the understanding of transport effects that manifest at larger scales. Several studies have been carried out to investigate the impact of the geometric properties of porous media on transport processes for solute species. However, the range of pore-scale geometric properties, which can be investigated, is usually limited to the number of samples acquired from microcomputed tomography images of real porous media. The present study takes advantage of synthetic porous medium generation to propose a systematic analysis of the relationships between geometric features of the porous media and transport processes through direct simulations of fluid flow and advection-diffusion of a non-reactive solute. Numerical simulations are performed with the lattice Boltzmann method on synthetic media generated with a geostatistically based approach. Our findings suggest that the advective transport is primarily affected by the specific surface area and the mean curvature of the porous medium, while the effective diffusion coefficient scales as the inverse of the tortuosity squared. Finally, the possibility of estimating the hydrodynamic dispersion coefficient knowing only the geometric properties of porous media and the applied pressure gradient has been tested, within the range of tested porous media, against advection-diffusion simulations at low Reynolds (<10-1) and Peclet numbers ranging from 101 to 10-2.

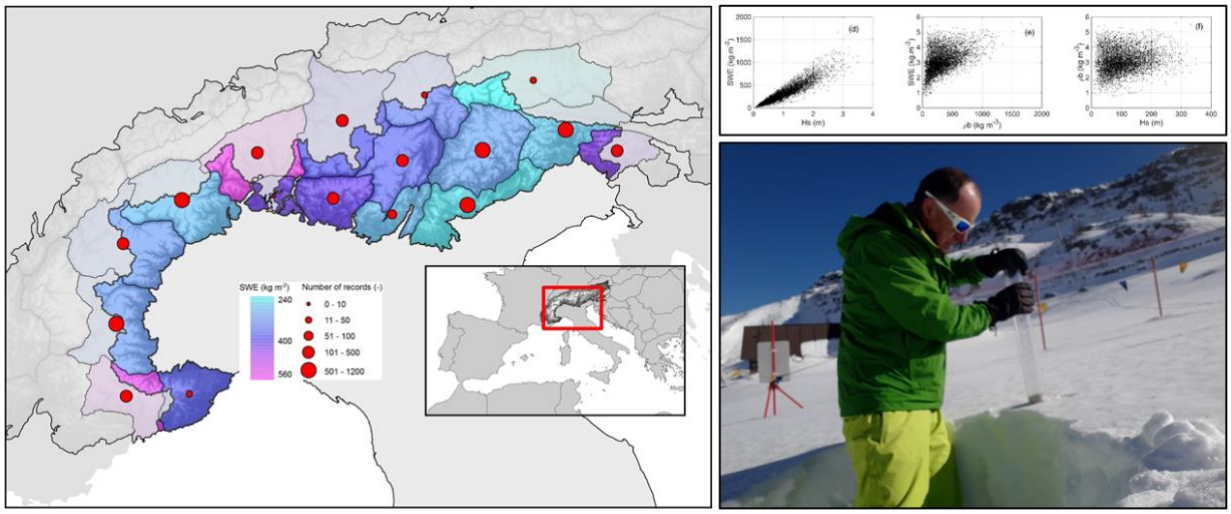
## Estimating the snow water equivalent from snow depth measurements in the Italian Alps

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Cold Regions Science and Technologyt, 2019, 167, 102859, DOI: 10.1016/j.coldregions.2019.102859

**Autori:** Guyennon, N., Valt, M., Salerno, F., Petrangeli, A. B., & Romano, E.

**Abstract ENG:** The Snow Water Equivalent (SWE), combining the information of snow depth (Hs) and snow bulk density (ρb) is a necessary variable for snow-hydrological studies and applications, as well as, for ecological function or avalanche forecasting. The SWE direct measurement is challenging, and estimating the SWE from the single Hs measurements presents many advantages compared to the direct SWE measurement or the implementation of complex model needing to be fed by local meteorological data. In this study we propose a spatial and temporal variability description of the SWE, Hs and ρb and compare existing approaches over the Italian Alps. Finally, we propose a simple parametrization, introducing non-linearity in the snow bulk density variability. The resulting overall uncertainty on SWE is 15.6%. The proposed model has the potential to be a valuable tool to estimate the SWE from the only HS measurement in the Italian Alps, presenting even better performances during the late season (13.9%, 12.9% and 14.3% in March, April and May, respectively) that makes it particularly suitable for snow-hydrology studies. © 2019 Elsevier B.V.



## A multi-method approach for the assessment of natural background levels in groundwater

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Science of The Total Environment, 2019, 659, 884-894, doi: 10.1016/j.scitotenv.2018.12.350

**Autori:** Parrone D., Ghergo S., Preziosi E.

**Abstract ENG:** The assessment of geochemical Natural Background Levels (NBLs) in groundwater, aims at distinguishing the naturally high levels of geogenic compounds from anthropogenic pollution. This is a fundamental issue in groundwater management, in particular when the concentration of inorganic compounds exceeds the threshold values set for the evaluation of the groundwater chemical status, as requested by environmental regulations. In this paper, we describe a new procedure that integrates the pre-selection method and statistical techniques, using the example of two case studies. The pre-selection aims to identify suitable groundwater samples for the NBLs assessment. The nitrate concentration threshold, for the removal of the groundwater samples affected by human activities, is established locally through different graphical and statistical approaches. Then, the statistical distribution of each compound is analyzed and the outliers are identified. Normality tests on the datasets allow one to select the most appropriate value, e.g. one percentile, to be adopted as NBL within the data distribution. In the selected case studies, we have defined the NBLs for As, F, Mn, Fe and SO4. The two sites are part of a volcanic-sedimentary aquifer in central Italy, where the geochemical background is frequently well above the standards for human consumption. The results of the simple and easily reproducible pre-selection method are strengthened by integration with statistical techniques, notably in selecting the appropriate percentile. New criteria are suggested for the choice of the nitrate threshold to be used for the pre-selection of uncontaminated samples.

## Disentangling natural and anthropogenic impacts on groundwater by hydrogeochemical, isotopic and microbiological data: Hints from a municipal solid waste landfill

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Waste Management, 2019, 84, 245-255, doi: 10.1016/j.wasman.2018.12.005

**Autori:** Preziosi E.; Frollini E.; Zoppini A.; Ghergo S.; Melita M.; Parrone D.; Rossi D.; Amalfitano S.

**Abstract ENG:** Within human-impacted areas, high levels of inorganic compounds in groundwater are broadly and preventively attributed to local anthropogenic pollution, thoroughly disregarding geogenic natural background levels. Particularly in landfills, a proper evaluation of the significant adverse environmental effects should be completed through a detailed groundwater characterization, and appropriate reference values established prior to landfill onset. However, the monitoring network may lack a full hydrogeological representativeness of the site and of the background conditions of groundwater. This study aimed at disentangling natural and anthropogenic impacts through a synoptic analysis of hydrogeochemical, isotopic and microbiological characteristics of groundwaters from a municipal solid waste landfill area in Central Italy. Samples were collected during four seasonal monitoring surveys from the mostly anoxic aquifer underlying the target area. Field parameters, inorganic and organic compounds, environmental isotopes, faecal contamination, and microbial community characteristics were determined, along with a detailed hydrogeological conceptual model. Key inorganic contaminants (As, Fe and Mn) exceeded the local threshold values in most of the sampling points, while organic contamination was generally very low. Stable isotopes suggested that groundwater originated mainly from local rainfall, except at one monitoring points where tritium levels might indicate moderate impact. Microbiological data and the microbial community characterization, assessed by flow cytometry and BIOLOG assays, provided further supportive information, also highlighting fundamental effects of groundwater quality alterations. Overall, an integrated multi-parametric approach proved suitable to distinguish geogenic and anthropogenic impacts, thus improving strategies and schemes for protection and management of groundwaters in landfills and waste related industrial areas.

## An updated list of chironomid species from Italy with biogeographic considerations (Diptera, Chironomidae)

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Biogeographia – The Journal of Integrative Biogeography, 2019, 34, DOI: 10.21426/B634043047

**Autori:** Rossaro B., Pirola N., Marziali L., Magoga G., Boggero A., Montagna M.

**Abstract ENG:** In a first list of chironomid species from Italy from 1988, 359 species were recognized. The subfamilies represented were Tanypodinae, Diamesinae, Prodiamesinae, Orthocladiinae and Chironominae. Most of the species were cited as widely distributed in the Palearctic region with few Mediterranean (6), Afrotropical (19) or Panpaleotropical (3) species. The list also included five species previously considered Nearctic. An updated list was thereafter prepared and the number of species raised to 391. Species new to science were added in the following years further raising the number of known species. The list of species known to occur in Italy is now updated to 580, and supported by voucher specimens. Most species have a Palearctic distribution, but many species are distributed in other biogeographical regions; 366 species are in common with the East Palaearctic region, 281 with the Near East, 248 with North Africa, 213 with the Nearctic, 104 with the Oriental, 23 species with the Neotropical, 23 with the Afrotropical, 16 with the Australian region, and 46 species at present are known to occur only in Italy. On the basis of new findings in Italy and in nearby areas it is stated that the knowledge of chironomid fauna is still incomplete.

## Integrated Multitrophic Aquaculture by-products with added value: the polychaete Sabella spallanzanii and the seaweed Chaetomorpha linum as potential dietary ingredients

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Marine Drugs, 2019, 17, 677, doi: 10.3390/md17120677

**Autori:** Stabili L., Cecere E., Licciano M., Petrocelli A., Sicuro B., Giangrande A.

**Abstract ENG:** Recent studies have shown that marine algae represent a great source of natural compounds with several properties. The lipidic extract of the seaweed Chaetomorpha linum (Chlorophyta, Cladophorales), one of the dominant species in the Mar Piccolo of Taranto (Mediterranean, Ionian Sea), revealed an antibacterial activity against Vibrio ordalii and Vibrio vulnificus, common pathogens in aquaculture, suggesting its potential employment to control fish and shellfish diseases due to vibriosis and to reduce the public health hazards related to antibiotic use in aquaculture. This extract showed also an antioxidant activity, corresponding to 170.960 ± 16. mmol Trolox equivalent/g (oxygen radical absorbance capacity assay—ORAC) and to 30.554 ± 2.30 mmol Trolox equivalent/g (Trolox equivalent antioxidant capacity assay—TEAC). The chemical characterization of the extract, performed by 1D and 2D NMR spectroscopy, highlighted the presence of free, saturated (SAFAs), unsaturated (UFAs) and polyunsaturated (PUFAs) fatty acids. The high content of ω-6 and ω-3 PUFAs confirmed also by gas chromatography indicates the potentiality of this algal species in the production of fortified food. The antibacterial activity seems related to the presence of linolenic acid present at high density, while the antioxidant activity could be likely ascribable to molecules such as carotenoids and chlorophylls (characterized also by thin-layer chromatography), known for this property. The presence of polyhydroxybutyrate, a biopolymer with potentiality in the field of biodegradable bioplastics was also detected. The exploitation of C. linum for a future biotechnological application is also encouraged by the results from a first attempt of cultivating this species in an integrated multi-trophic aquaculture (IMTA) system

## A 20-year update on the state of seaweed resources in Italy

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Botanica Marina, 2019, 62 (3), 249-264, doi: 10.1515/bot-2018-0072

**Autori:** Petrocelli A., Cecere E.

**Abstract ENG:** This article presents an update of the situation regarding the seaweed resources of Italy twenty years after the first assessment. A search for companies working with seaweed in Italy was conducted. In addition, the literature published over the last 20 years on seaweed biodiversity, alien species, harvests, industrial processing and biomass use was carefully examined and the results are discussed. There are a great many floristic studies, tackling both indigenous and non-indigenous species, although some geographical areas are less studied than others. The number of studies of the use of biomass has increased in the last decade. However, it is apparent that despite the considerable know-how concerning seaweed species, their properties and potential applications, Italy is still behind in seaweed exploitation compared to other countries.

## Successions of phytobenthos species in a Mediterranean transitional water system: the importance of long term observations

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Nature Conservation, 2019, 4, 217–246, doi: 10.3897/natureconservation.34.30055

**Autori:** Petrocelli A., Cecere E., Rubino F.

**Abstract ENG:** The availability of quantitative long term datasets on the phytobenthic assemblages of the Mar Piccolo of Taranto (southern Italy, Mediterranean Sea), a lagoon like semi-enclosed coastal basin included in the Italian LTER network, enabled careful analysis of changes occurring in the structure of the com-munity over about thirty years. The total number of taxa differed over the years. Thirteen non-indigenous species in total were found, their number varied over the years, reaching its highest value in 2017. The dominant taxa differed over the years. The number of species in each taxonomic division also varied. In addition to the centuries-old exploitation of its biotic resources, mainly molluscs, the basin has been subject for a long time to a range of anthropogenic driving forces linked to urbanisa-tion, shipbuilding, agriculture and military activities, which have caused chemical and biological pollu-tion, eutrophication and habitat destruction. It may therefore be assumed that these changes were closely related to human activities. Indeed, it was observed that the reduction of only one of these forces, i.e. urban sewage discharge, triggered the recovery of phytobenthos. Therefore, it may be as-sumed that if the anthropogenic pressure on the Mar Piccolo was eased, it could once again become the paradisiacal place it was held to be in ancient times.

## Port Baseline Biological Surveys and seaweed bioinvasions in port areas: What's the matter in the Adriatic Sea?

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Marine Pollution Bulletin, 2019, 147, 98-116, doi: 10.1016/j.marpolbul.2018.04.004

**Autori:** Petrocelli A., Antolić B., Bolognini L., Cecere E., Cvitković I., Despalatović M., Falace A., Finotto S., Iveša L., Mačić V., Marini, M., Orlando-Bonaca M., Rubino F., Trabucco B., Zuljević A.

**Abstract ENG:** One of the objectives of the BALMAS project was to conduct Port Baseline Biological Surveys of native and non-indigenous benthic flora in 12 Adriatic ports. Samples of macroalgae growing on vertical artificial substrates were collected in spring and autumn 2014 and/or 2015. A total number of 248 taxa, 152 Rhodophyta, 62 Chlorophyta, and 34 Ochrophyta, were identified. Of these, 13 were non-indigenous seaweeds, mainly filamentous macroalgae, that were probably introduced through hull fouling. Some of these taxa had already been described in the study areas, others were recorded for the first time, a few were no longer detected at sites where they had previously been recorded (e.g. Sargassum muticum). Some other NISS reported for the Adriatic Sea, were not collected at any sampling site (i.e. Caulerpa cylindracea, Codium fragile). Possible reasons for the absence of these species are discussed.

## Screening of Chaetomorpha linum lipidic extract as a new potential source of bioactive compounds

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Marine Drugs, 2019, 17, 313, doi: 10.3390/md17060313

**Autori:** Stabili L., Acquaviva M.I., Angilè F., Cavallo R.A., Cecere E., Del Coco L., Fanizzi F.P., Gerardi C., Narracci M., Petrocelli A.

**Abstract ENG:** Recent studies have shown that marine algae represent a great source of natural compounds with several properties. The lipidic extract of the seaweed Chaetomorpha linum (Chlorophyta, Cladophorales), one of the dominant species in the Mar Piccolo of Taranto (Mediterranean, Ionian Sea), revealed an antibacterial activity against Vibrio ordalii and Vibrio vulnificus, common pathogens in aquaculture, suggesting its potential employment to control fish and shellfish diseases due to vibriosis and to reduce the public health hazards related to antibiotic use in aquaculture. This extract showed also an antioxidant activity, corresponding to 170.960 ± 16. mmol Trolox equivalent/g (oxygen radical absorbance capacity assay—ORAC) and to 30.554 ± 2.30 mmol Trolox equivalent/g (Trolox equivalent antioxidant capacity assay—TEAC). The chemical characterization of the extract, performed by 1D and 2D NMR spectroscopy, highlighted the presence of free, saturated (SAFAs), unsaturated (UFAs) and polyunsaturated (PUFAs) fatty acids. The high content of ω-6 and ω-3 PUFAs confirmed also by gas chromatography indicates the potentiality of this algal species in the production of fortified food. The antibacterial activity seems related to the presence of linolenic acid present at high density, while the antioxidant activity could be likely ascribable to molecules such as carotenoids and chlorophylls (characterized also by thin-layer chromatography), known for this property. The presence of polyhydroxybutyrate, a biopolymer with potentiality in the field of biodegradable bioplastics was also detected. The exploitation of C. linum for a future biotechnological application is also encouraged by the results from a first attempt of cultivating this species in an integrated multi-trophic aquaculture (IMTA) system.

## Marine alien species in Italy: a contribution to the implementation of descriptor D2 of the Marine Strategy Framework Directive

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Mediterranean Marine Science, 2019, 20 (1), 1-48, doi: 10.12681/mms.18711

**Autori:** Servello G., Andaloro F., Azzurro E., Castriota L., Catra M., Chiarore A., Crocetta F., D'Alessandro M., Denitto F., Froglia C., Gravili C., Langer M.R., Lo Brutto S., Mastroto-taro F., Petrocelli A., Pipitone C., Piraino S., Relini G., Serio D., Xentidis N.J., Zenetos A.

**Abstract ENG:** A re-examination of marine alien species or Non Indigenous Species (NIS) reported in Italian Seas, until December 2018, is provided, focusing on establishment success, year of first record, origin, potential invasiveness, and likely pathways, in particular. Furthermore, their distribution is assessed according to the marine subregions outlined by the European Union (EU) Marine Strate- gy Framework Directive: Adriatic Sea (ADRIA), Ionian Sea and Central Mediterranean Sea (CMED), and Western Mediterranean Sea (WMED). In Italy, 265 NIS have been detected with the highest number of species being recorded in the CMED (154 species) and the WMED (151 species) subregions, followed by the ADRIA (143) subregion. Most of these species were recorded in more than one subregion. One hundred and eighty (180 or 68%) NIS have established stable populations in Italian Seas among which 26 have exhibited invasive traits. As regards the taxa involved, Macrophyta rank first with 65 taxa. Fifty-five of them are established in at least one subregion, mostly in the ADRIA and the CMED. Crustacea rank second with 48 taxa, followed by Polychaeta with 43 taxa, Mollusca with 29 taxa, and Fishes with 28 taxa, which were mainly reported from the CMED. In the period 2012-2017, 44 new alien species were recorded, resulting in approximately one new entry every two months. Approximately half of the NIS (~52%) recorded in Italy have most likely arrived through the transport-stowaway pathway related to shipping traffic (~28% as biofoulers, ~22% in ballast waters, and ~2% as hitchhikers). The second most common pathway is the unaided movement with currents (~19%), followed by the transport-contaminant on farmed shellfishes pathway (~18%). "Unaided" is the most common pathway for alien Fishes, especially in the CMED; escapes from confinement account for ~3% and release in nature for ~2%. The present NIS distribution hotspots for new introductions were defined at the first recipient area/location in Italy. In the ADRIA, the hotspot, Venice, accounts for the highest number of alien taxa introduced in Italy, with 50 newly recorded taxa. In the CMED subregion, the hotspots of introduction are the Taranto and Catania Gulfs, hosting 21 first records each. The Strait of Sicily represents a crossroad between alien taxa from the Atlantic Ocean and the Indo-Pacific area. In the WMED, bioinvasion hotspots include the Gulfs of Naples, Genoa and Livorno. This review can serve as an updated baseline for future coordination and harmonization of monitoring initiatives under international, EU and regional policies, for the compilation of new data from established monitoring programs, and for rapid assessment surveys.

## Il progetto REMEDIA-Life: le macroalghe come biorimediatori e fonte di composti bioattivi

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Biologia Marina Mediterranea, 2019

**Autori:** Stabili L., Acquaviva M.I., Alabiso G., Cecere E., Gerardi C., Narracci M., Petrocelli A., Cavallo R.A.

**Abstract ENG:** In this work we report the presence of an antioxidant activity in the lipidic extract of some seaweeds collected in the Northern Ionian Sea, Italy in order to select which species could be useful for a biotechnologically exploitation as a source of antioxidant bioactive compounds when cultivated in an Integrated Multi-Trophic Aquaculture (IMTA) system

## Simile, a geospatial enabler of the monitoring of sustainable development goal 6 (ensure availability and sustainability of water for all)

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** The international archives of the photogrammetry, remote sensing and spatial information sciences, 2019, 3, 10, DOI: 10.5194/isprs-archives-XLII-4-W20-3-2019

**Autori:** Brovelli, M. A.; Cannata, M.; Rogora, M.

**Abstract ENG:** The paper presents SIMILE (Italian acronym for "Integrated monitoring system for knowledge, protection and valorization of the subalpine lakes and their ecosystems), a cross-border Italian-Swiss project whose general objectives are the strengthening of the coordinated management of the water of the great subalpine lakes in the so-called Insubric region and the intensification of stakeholder participation in the processes of knowledge and monitoring of the water resource. The project fits the purpose of SDG 6 and involves administrations, monitoring agencies, universities and research centers, and citizens. SIMILE is a system where geospatial data, information, and techniques play a pivotal role. The system strongly benefits the information derived from the analysis of Sentinel 1 and Sentinel 3 imagery, in situ authoritative data, and user-contributed georeferenced data. A Business Intelligence (BI) platform, i.e. a web data-driven decision support system, will allow the integration, analysis, and synthesis of the information derived from the different types of data, heterogeneous in format, coordinate system, information content, and access method. The technologies that will be used are based on open software so as to guarantee the replicability and sustainability of the system.

## Stable Isotope Analysis and Persistent Organic Pollutants in Crustacean Zooplankton: The Role of Size and Seasonality

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Water, 2019, 11, 1490, doi: 10.3390/w11071490

**Autori:** Roberta Piscia, Michela Mazzoni, Roberta Bettinetti, Rossana Caroni, Davide Cicala, Marina Marcella Manca

**Abstract ITA:** abstract-ITA

**Abstract ENG:** Zooplankton is crucial for the transfer of matter, energy, and pollutants through aquatic food webs. Primary and secondary consumers contribute to the abundance and standing stock biomass, which both vary seasonally. By means of taxa- and size-specific carbon and nitrogen stable isotope analysis, the path of pollutants through zooplankton is traced and seasonal changes are addressed, in an effort to understand pollutant dynamics in the pelagic food web. We analyzed zooplankton plurennial changes in concentration of polychlorinated biphenyls (PCBs) and dichlorodiphenyltrichloroethane and its relatives (DDTs) and in taxa-specific δ15N signatures in two size fractions, ≥450 µm and ≥850 µm, representative of the major part of zooplankton standing stock biomass and of the fraction to which fish predation is mainly directed, respectively. Our work is aimed at verifying: (1) A link between nitrogen isotopic signatures and pollutant concentrations; (2) the predominance of size versus seasonality for concentration of pollutants; and (3) the contribution of secondary versus primary consumers to carbon and nitrogen isotopic signatures. We found a prevalence of seasonality versus size in pollutant concentrations and isotopic signatures. The taxa-specific δ15N results correlated to pollutant concentrations, by means of taxa contribution to standing stock biomass and δ15N isotopic signatures. This is a step forward to understanding the taxa-specific role in pollutant transfer to planktivores and of zooplankton enrichment in PCBs and DDTs.

## Organic Contaminants in Zooplankton of Italian Subalpine Lakes: Patterns of Distribution and Seasonal Variations

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Water, 2019, 11, 1901, doi: 10.3390/w11091901

**Autori:** Simona Pascariello, Michela Mazzoni, Roberta Bettinetti, Marina Manca, Martina Patelli. Roberta Piscia, Sara Valsecchi, Stefano Polesello

**Abstract ITA:** Abstract - ITA

**Abstract ENG:** Zooplankton is a key node in many trophic webs, both for food that for persistent organic contaminants that can accumulate in biota. Zooplankton of different size was seasonally sampled for two years in three deep Italian subalpine lakes (Maggiore, Como, Iseo) with the aim of determining the concentrations of perfluoroalkyl substances (PFAS), DDT, and PCB, and assessing the seasonality impacts on contaminants concentrations. In general, Lake Maggiore showed the highest concentrations for each group of contaminants, with mean values of 7.6 ng g−1 ww for PFAS, 65.0 ng g−1 dw for DDT, and 65.5 ng g−1 dw for PCB. When considering the composition pattern, perfluorooctane sulfonate (PFOS) was detected in 96% of the samples and it was the predominant PFAS compound in all of the lakes. pp' DDE was the most detected congener among DDTs and their metabolites, while for PCBs, the prevalent group was hexa-CB that constituted 35.4% of the total PCB contamination. A seasonal trend was highlighted for all contaminant groups with concentrations in colder months greater than in spring and summer; it was evident that the contaminant concentrations were more dependent from seasonality than from size, trophic levels, and taxa composition of zooplankton. Principal component analysis showed that one of the main driver for the accumulation of most of the studied contaminants is their lipophilicity, except for perfluorooctanoic acid (PFOA) and octachlorobiphenyl.

## Long-Term Changes in the Zooplankton Community of Lake Maggiore in Response to Multiple Stressors: A Functional Principal Components Analysis

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Water, 2019,11, 962, doi: 10.3390/w11050962

**Autori:** Andrea Arfè, Piero Quatto, Antonella Zambon, Hugh J. MacIsaac, Marina Manca

**Abstract ITA:** Abstract - ITA

**Abstract ENG:** We describe the long-term (1981–2008) dynamics of several physico-chemical and biological variables and how their changes may have influenced zooplankton structure in Lake Maggiore (Italy). Data was available for the 1981–1992 and 1995–2008 periods. Standardized time-series for temperature and total phosphorus (TP), chlorophyll-a, phytoplankton density (cel m−3 ), and cell size (µm3 ), as well as zooplankton structure (Copepoda, Cladocera, and Rotifera density, ind m−3 ) were smoothed using penalized B-splines and analyzed using Functional Principal Components (FPCs) to assess their dominant modes of variation. The first four FPCs explained 55% of 1981–1992 and 65% of 1995–2008 overall variation. Results showed that temperature fluctuated during the study period, particularly during 1988–1992 with a general tendency to increase. TP showed a declining trend with some reversions in the pattern observed in the years 1992, 1999, and 2000. Phytoplankton estimators and chlorophyll-a concentration showed a variable trend along the study period. Zooplankton groups also had a variable trend along the study period with a general increase in density of large carnivorous (mainly Bythotrephes longimanus) and a decrease of large herbivorous (mainly Daphnia), and a similar increase in the ratio of raptorial to microphagous rotifers. Our results suggest that the lake experienced a strong trophic change associated with oligotrophication, followed by pronounced climate-induced changes during the latter period. TP concentration was strongly associated with changes in abundance of some zooplankton taxa.

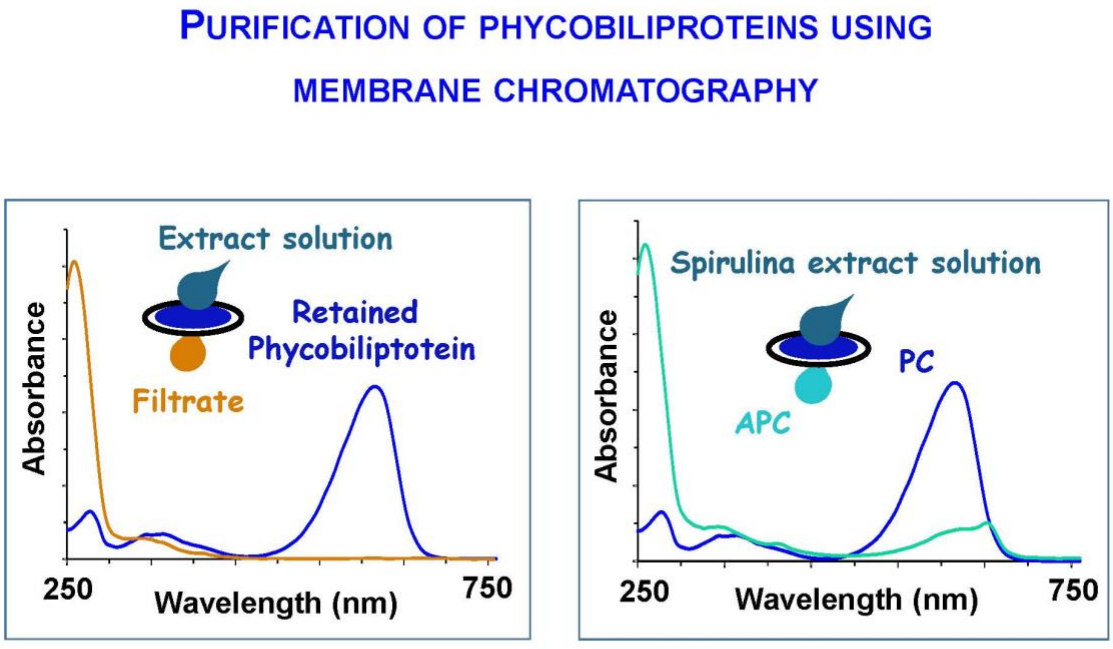
## A simple method for rapid purification of phycobiliproteins from *Arthrospira platensis* and *Porphyridium cruentum* biomass

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** ALGAL RESEARCH-BIOMASS BIOFUELS AND BIOPRODUCTS, 2019, 44, 101685, DOI: 10.1016/j.algal.2019.101685

**Autori:** Lauceri, R; Zittelli, GC; Torzillo, G

**Abstract ENG:** Membrane chromatography was exploited to purify allophycocyanin, phycocyanin and B-phycoerythrin from aqueous extracts of fresh or freeze-dried biomass of *Arthrospira platensis* (*Cyanobacteria*) and *Porphyridium cruentum* (*Rhodophyta*). The method can be tuned to obtain products having various degree of purity and avoids expensive and time consuming column chromatography and ultrafiltration steps. A commercial polyvinylidene fluoride (PVDF) microfiltration membrane (hydrophilic and low protein binding) was used as an ammonium sulphate responsive stationary phase to carry out the purification process. Analytical grade purity was achieved for phycocyanin (purity = 4.2-4.5, yield = 75-82 %) and B-phycoerythrin (purity = 4.5-4.8, yield = 69-71 %). Good purification, even if lower than analytical grade, was achieved for allophycocyanin (purity = 3.3-3.7, yield = 42-47%).



## Antibiotic disturbance affects aquatic microbial community composition and food web interactions but not community resilience

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** MOLECULAR ECOLOGY, 2019, 28, 5, 1170-1182, DOI: 10.1111/mec.15033

**Autori:** Eckert, EM; Quero, GM; Di Cesare, A; Manfredini, G; Mapelli, F; Borin, S; Fontaneto, D; Luna, GM; Corno, G

**Abstract ENG:** Notwithstanding the fundamental role that environmental microbes play for ecosystem functioning, data on how microbes react to disturbances are still scarce, and most factors that confer stability to microbial communities are unknown. In this context, antibiotic discharge into the environment is considered a worldwide threat for ecosystems with potential risks to human health. We therefore tested resilience of microbial communities challenged by the presence of an antibiotic. In a continuous culture experiment, we compared the abundance, composition and diversity of microbial communities undisturbed or disturbed by the constant addiction of tetracycline in low (10 mu g/L) or intermediate (100 mu g/L) concentration (press disturbance). Further, the bacterial communities in the three treatments had to face the sudden pulse disturbance of adding an allochthonous bacterium (Escherichia coli). Tetracycline, even at low concentrations, affected microbial communities by changing their phylogenetic composition and causing cell aggregation. This, however, did not coincide with a reduced microbial diversity, but was mainly caused by a shift in dominance of specific bacterial families. Moreover, the less disturbed community (10 mu g/L tetracycline) was sometimes more similar to the control and sometimes more similar to heavily disturbed community (100 mu g/L tetracycline). All in all, we could not see a pattern where the communities disturbed with antibiotics were less resilient to a second disturbance introducing E. coli, but they seemed to be able to buffer the input of the allochthonous strain in a similar manner as the control.

## Applicability of a one-dimensional coupled ecological-hydrodynamic numerical model to future projections in a very deep large lake (Lake Maggiore, Northern Italy/Southern Switzerland)

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** ECOLOGICAL MODELLING, 2019, 392, 38-51, DOI: 10.1016/j.ecolmodel.2018.11.005

**Autori:** Fenocchi, A; Rogora, M; Morabito, G; Marchetto, A; Sibilla, S; Dresti, C

**Abstract ENG:** One-dimensional coupled ecological-hydrodynamic numerical models of lakes require extensive calibration of their chemical and biological parameters. Application of these models to future projections relies on the time invariance of the calibrated model parameters and of the adopted schematisation. This is mere speculation for real ecosystems, so that it is relevant to explore the limits of coupled models over extended periods. To date, almost all applications in literature have been calibrated over a couple of years at most, with comparable validation periods, if present. Furthermore, past studies mostly concerned shallow to moderately deep small lakes, so that reproducing the hypolimnetic chemical evolution of very deep large lakes has generally been overlooked. Last, most works did not compare with observations or even model the succession of phytoplankton species, but only dealt with total Chlorophyll-alpha. Here, the GLM-AED2 (General Lake Model - Aquatic EcoDynamics) coupled model was calibrated and validated for an overall 16.75-year period for the 370-m deep and 213-km$^2$ wide Lake Maggiore (Northern Italy/Southern Switzerland), focusing on the reproduction of both deep-water chemistry and phytoplankton biomass and succession. Despite the modelling simplifications needed for this complex basin, the resulting performances are comparable to those in literature for shallower and smaller lakes over shorter periods. Still, extreme care must be put when interpreting the results of coupled ecological-hydrodynamic models for long-term projections, especially regarding the evolution of phytoplankton.

## Assessment of Atmospheric Deposition and Vitality Indicators in Mediterranean Forest Ecosystems

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** SUSTAINABILITY, 2019, 11, 6805, DOI: 10.3390/su11236805

**Autori:** Jakovljevic, T; Marchetto, A; Lovreskov, L; Potocic, N; Seletkovic, I; Indir, K; Jelic, G; Butorac, L; Zgrablic, Z; De Marco, A; Simioni, G; Ognjenovic, M; Tusek, J

**Abstract ENG:** Considering the fragility of the Mediterranean environment, there is an increasing need to improve the knowledge of this forest environment. The aim of this study was to examine the effects of air pollution on the forest ecosystem's condition by analyzing tree vitality. The study area was chosen to represent the most important and the most common species in Mediterranean forest ecosystems of the Eastern Adriatic coast. *Quercus pubescens*, *Quercus ilex*, *Pinus halepensis*, and *Pinus nigra* plots were equipped with rain collectors and dendrometer bands. Sampling, measurements, and analyses of atmospheric deposition, foliar nutrient, defoliation, and growth were all carried out. Results showed that actual N deposition loads were the lowest in Aleppo pine forest and the highest in holm oak forests. This, however, did not have an effect on the concentrations of N in foliage. Most elements' concentrations were in the plausible range. No relevant differences in mean defoliation between the plots were observed. The plots with a lower percentage of basal area increment (BAP%) were found to have lower defoliation. The research was conducted to bridge the gap in the knowledge of air pollutants and vitality indicators in different forest types. These findings are a valuable contribution to the sustainable forest management of Mediterranean forest.

## Atmospheric deposition control of soil acidification in central Italy

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** CATENA, 2019, 182, 104102, DOI: 10.1016/j.catena.2019.104102

**Autori:** Cecchini, G; Andreetta, A; Marchetto, A; Carnicelli, S

**Abstract ENG:** Acidification is a major soil-forming process, and concerns about acidifying anthropogenic atmospheric deposition make it a significant environmental issue. In the long term, the depletion of exchangeable base cations (SCEs) is the main process underpinning soil acidification. In south-central Italy, acidic soils are not rare and are often located in areas with no excess rainfall over potential evapotranspiration. Many such soils are understood to have been derived from long-term weathering, although whether acidification is an active process remains an open question. Data from the International Co-operative Programme (ICP-Forests) monitoring system revealed that BCE atmospheric deposition was high and stable in south-central Italy and allowed us to estimate the BCE budget of some acidic forest soils. We estimated the overall BCE budget of four sites in this network. Tracer approaches using conservative ions, $Na^+$ and $Cl^-$ were calibrated to estimate dry BCE deposition and soil water fluxes. The contribution of atmospheric deposition to the BCE budget was such that potassium was found to be regularly accumulating at all sites at the rate of 0.08 to 0.42 $g.m^{-2}.y^{-1}$, while calcium was accumulating at a rate of 1.11 $g.m^{-2}.y^{-1}$ at a central Italy site. For $Ca^{2+}$ at the other sites and for magnesium at all sites, the effect of deposition was such that the rate of BCE depletion was significantly reduced. Soil acidification appeared to be a non-active process in the central, lowland and hilly areas of Italy.

## Cladoceran (Crustacea) Niches, Sex, and Sun Bathing-A Long-Term Record of Tundra Lake (Lapland) Functioning and Paleo-Optics

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** WATER, 2019, 11, 2008, DOI: 10.3390/w11102008

**Autori:** Nevalainen, L; Kivila, EH; Rantala, MV; Luoto, TP

**Abstract ENG:** Under fundamental ecosystem changes in high latitude lakes, a functional paleolimnological approach may increase holistic understanding of lake responses and resilience to climate warming. A similar to 2000-year sediment record from Lake Loaejavri in the tundra of northern Finnish Lapland was examined for fossil Cladocera assemblages to examine long-term environmental controls on aquatic communities. In addition, cladoceran functional attributes, including functional diversity (FD), UV absorbance (ABS(UV)) of Alona carapaces, and sexual reproduction (ephippia) in Bosmina and Chydoridae were analyzed. Cladoceran communities responded to a major change in benthic habitat quality, reflected as elevated (increasingly benthic) sediment organic matter delta C-13 signal since the 17th century. FD fluctuations showed association with climate oscillation, FD being generally higher during warm climate periods. These ecological changes were likely attributable to diversification of littoral-benthic consumer habitat space. ABS(UV), irrespective of increases during the Little Ice Age (LIA) due to higher UV transparency of lake water, was lower under increasing autochthony (benthic production) suggesting establishment of physical UV refugia by the benthic vegetative substrata. Bosmina ephippia exhibited a decreasing trend associated with increasing benthic production, indicating favorable environmental regime, and, together with chydorid ephippia, transient increases during the climate cooling of the LIA driven by shorter open-water season.

## Contamination levels and spatial distribution in the lagoons of the Po river delta: Are chemicals exerting toxic effects?

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** ESTUARINE COASTAL AND SHELF SCIENCE, 2019, 231, 106467, DOI: 10.1016/j.ecss.2019.106467

**Autori:** Viganò, L; Stefani, F; Casatta, N; Mascolo, G; Murgolo, S; Roscioli, C; Zonta, R

**Abstract ENG:** Composite sediment samples were collected from 18 deposition areas located in seven lagoons of the Po Delta. Samples were analysed for contents of legacy (DDT, PCB) and priority organic pollutants (AP, PBDE), and the sediments showed, with some exceptions, low/moderate levels of contamination. It seemed evident that the Po River has a clear role in controlling the input and distribution of chemicals to the lagoons, generally resulting in an overall north-south pattern of increasing contamination, as well as some contaminant contents exceeding quality guidelines or threshold values (NP, PBDE, PCB). Interestingly, more negative delta C-13 values were observed in the lagoons exposed to freshwater inflows, with higher concentrations of DDTs in their sediments. Regarding potential toxic effects, different sex ratios were observed in Manila clams (*Ruditapes philippinarum*) previously exposed for 3 months to six lagoons of the Po Delta, and these ratios ranged from a marked male to female prevalence. Notably, the male clam percentage was inversely correlated with sedimentary PCB and partially correlated with PBDE, bioaccumulated PCB, PBDE and to a lesser extent APs and DDTs. A delay in gonad development was also present in the clams most exposed to sedimentary APs and in general to inland waters. For the first time, this study evidenced endocrine disruption in Manila clams exposed to the Po Delta lagoons that was apparently the result of exposure to major contaminant classes. These ecotoxicological results need to be further investigated, in light of the many other endocrine disrupters recently identified in Po lagoons.

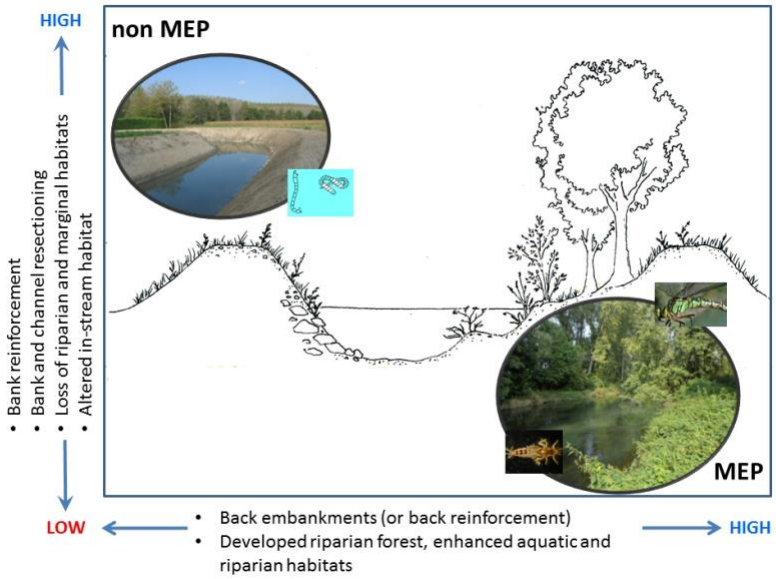
## Defining Maximum Ecological Potential for heavily modified lowland streams of Northern Italy

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** SCIENCE OF THE TOTAL ENVIRONMENT, 2019, 684, 196-206, DOI: 10.1016/j.scitotenv.2019.05.348

**Autori:** Erba, S; Terranova, L; Cazzola, M; Cason, M; Buffagni, A

**Abstract ENG:** In relation to hydromorphological alteration the Water Framework Directive (WFD), a major piece of European legislation, has introduced the concept of Heavily Modified Water Bodies (HMWB). In water bodies falling in this category, hydromorphological modifications are permanent, significantly alter the character of the river and cannot be removed without compromising the use of the water body. In HMWBs a dedicated approach to the evaluation of their status is set, and their Ecological Potential must be assessed. Crucial to the process is the definition of Maximum Ecological Potential (MEP) as the reference conditions for HMWB. In the present paper we aim to define MEP conditions for Italian heavily modified lowland rivers, affected by strong bank protection (i.e. levees or bank reinforcement) in reason of flood protection and land drainage uses. The approach applied to identify MEP conditions follows the one considered for natural (not heavily modified) rivers in Italy and large part of Europe and bases on the identification of 'reference sites' representative for the river category and alteration. For the selection of MEP sites environmental features representing mitigation measures and/or expected natural features were considered. The ability of such features in discriminating MEP and disturbed sites was verified by multivariate analyses run on abiotic features (Principal Component Analysis) and biological communities (nonmetric multidimensional scaling). We demonstrated differences both in terms of invertebrate community and biological metrics used to assess ecological status (and potential) between MEP and impaired river stretches. Finally, we recognized relevant habitat features able to clearly separate MEP reaches from nonMEP reaches with indication on the type and quantity of measures significant for benthic invertebrates and applicable in lowland Heavily Modified Water Bodies.



## Demographic processes underlying fitness restoration in bdelloid rotifers emerging from dehydration

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** FRESHWATER BIOLOGY, 2019, 64 (7), 1295-1302, DOI: 10.1111/fwb.13305

**Autori:** Sommer, S; Fontaneto, D; Ozgul, A

**Abstract ENG:** Bdelloid rotifers are able to survive habitat desiccation in a dehydrated state termed anhydrobiosis. They suffer from decreasing fitness when they are exposed to permanent hydration, yet they restore fitness when they go through anhydrobiosis. The demographic processes underlying this rejuvenation, however, are still largely unknown. To investigate these processes in detail, we analysed life tables of permanently hydrated and repeatedly desiccated lines of two species of bdelloid rotifers, Macrotrachela quadricornifera and Adineta ricciae. Experimental lineages of these two species originated from habitats with contrasting desiccation frequencies. First, we built a three-stage life cycle including juveniles as well as prime and senescent adults. Next, we estimated stage-specific vital rates (survival, development, and reproduction) and used the estimates to project the asymptotic population growth rates lambda (= eA (R)). Finally, we applied life-table response experiment methods and performed elasticity analysis to assess the contributions of each vital rate to differences in lambda and to estimate effects of proportional changes in vital rates on lambda, respectively. We demonstrated that repeatedly desiccated lines grew faster than permanently hydrated lines. In addition, we confirmed that offspring of post-anhydrobiotic individuals had higher fecundities and matured faster than individuals of the permanently hydrated lines. Survival rates usually did not differ between the two lines, but lambda was most elastic to survival rates of prime adults and juveniles. These general life-history patterns were observed in both species. The analyses performed here provide a detailed investigation of the demographic processes underlying fitness restoration in anhydrobiotic bdelloid rotifers. They reveal that habitat desiccation has profound and consistent effects on the life histories of the two study species. Because laboratory lineages of these species originated from habitats characterised by different wet/dry regimes, we suggest that the desiccation responses identified here may be representative for the entire taxon. As such, our study offers a starting point for comparative analyses beyond bdelloid rotifers.

## Developing a standard approach for assessing the hydromorphology of lakes in Europe

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** AQUATIC CONSERVATION-MARINE AND FRESHWATER ECOSYSTEMS, 2019, 29, (4), 655-669, DOI: 10.1002/aqc.3015

**Autori:** Boon, P; Argillier, C; Boggero, A; Ciampittiello, M; England, J; Peterlin, M; Radulovic, S; Rowan, J; Soszka, H; Urbanic, G

**Abstract ENG:** Methods for assessing the hydrology and morphology of lakes ('hydromorphology') are needed for reporting under national and international legislation, as well as to assist in lake management and restoration. Despite this, no consistent approaches have been developed around Europe for monitoring lake hydromorphology. To address this need, representatives from 12 countries met at a series of workshops to develop two protocols for monitoring, published under the auspices of the European Committee for Standardization (CEN). The first standard (EN 16039) describes six categories for assessing lake hydromorphology: hydraulics, morphometry, bedforms/landforms and substrate, connectivity and continuity, and land cover. The second standard (EN 16870) sets out a scoring system for assessing the degree of modification of lake hydromorphology, which was designed, tested and refined using data from 127 lakes in seven European countries. The CEN standards focus on four lake zones-riparian, shore, littoral, and open water-but recognize the importance of considering lakes within their wider catchment context. The field techniques described are based largely on Lake Habitat Survey but also rely on existing databases, maps and remote-sensing data. These standards are aimed at scientists, conservation bodies and environmental regulators, and are relevant not only for monitoring lakes under the Water Framework Directive, but also for contributing to programmes of lake conservation. For example, in the UK, parts of the CEN standards have been incorporated within the methods used for monitoring and reporting on the condition of Special Areas of Conservation (under the Habitats Directive) and Sites of Special Scientific Interest under national legislation. It is hoped that this pan-European approach will improve the ability to compare data across many countries, and ultimately ensure that the results of monitoring are translated into measures for improving the hydromorphological condition of lakes and the biological communities they contain.

## Dynamics of the Pacific oyster pathobiota during mortality episodes in Europe assessed by 16S rRNA gene profiling and a new target enrichment next-generation sequencing strategy

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** ENVIRONMENTAL MICROBIOLOGY, 2019, 21 (12), 4548–4562, DOI: 10.1111/1462-2920.14750

**Autori:** Lasa, A; di Cesare, A; Tassistro, G; Borello, A; Gualdi, S; Furones, D; Carrasco, N; Cheslett, D; Brechon, A; Paillard, C; Bidault, A; Pernet, F; Canesi, L; Edomi, P; Pallavicini, A; Pruzzo, C; Vezzulli, L

**Abstract ENG:** Infectious agents such as the bacteria Vibrio aestuarianus or Ostreid herpesvirus 1 have been repeatedly associated with dramatic disease outbreaks of Crassostrea gigas beds in Europe. Beside roles played by these pathogens, microbial infections in C. gigas may derive from the contribution of a larger number of microorganisms than previously thought, according to an emerging view supporting the polymicrobial nature of bivalve diseases. In this study, the microbial communities associated with a large number of C. gigas samples collected during recurrent mortality episodes at different European sites were investigated by real-time PCR and 16SrRNA gene-based microbial profiling. A new target enrichment next-generation sequencing protocol for selective capturing of 884 phylogenetic and virulence markers of the potential microbial pathogenic community in oyster tissue was developed allowing high taxonomic resolution analysis of the bivalve pathobiota. Comparative analysis of contrasting C. gigas samples conducted using these methods revealed that oyster experiencing mortality outbreaks displayed signs of microbiota disruption associated with the presence of previously undetected potential pathogenic microbial species mostly belonging to genus Vibrio and Arcobacter. The role of these species and their consortia should be targeted by future studies aiming to shed light on mechanisms underlying polymicrobial infections in C. gigas.

## Echoes from the past: a genetic trace of native brown trout in the Italian Alps

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** ENVIRONMENTAL BIOLOGY OF FISHES, 2019, 102, 1327–1335, DOI: 10.1007/s10641-019-00899-y

**Autori:** Stefani, F; Anzani, A; Marieni, A

**Abstract ENG:** Mitochondrial dloop and nuclear tnfa II sequences were sequenced from brown trout collected in the Vesta River (Italian Alps), situated in the middle of a Pleistocene ice free refugia area east of the Lake Garda. Haplotypes belonging to the native Adriatic lineage were mixed with other from the Atlantic and Marble lineages. A probabilistic approach, based on simulations, indicated the likelihood of a past introgression of Atlantic haplotypes into native populations belonging to the Adriatic lineage. These results argue in favor of a past natural presence of brown trout in the Italian Alps, in particular in ice free refugia areas, which have been almost completely wiped out by the massive and extensive introduction of Atlantic hatchery stocks.

## Ecology and trophic role of Oncholaimus dyvae sp. nov. (Nematoda: Oncholaimidae) from the lucky strike hydrothermal vent field (Mid-Atlantic Ridge)

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** BMC ZOOLOGY, 2019, 4, 6, DOI: 10.1186/s40850-019-0044-y

**Autori:** Zeppilli, D; Bellec, L; Cambon-Bonavita, MA; Decraemer, W; Fontaneto, D; Fuchs, S; Gayet, N; Mandon, P; Michel, LN; Portail, M; Smol, N; Sorensen, MV; Vanreusel, A; Sarrazin, J

**Abstract ENG:** Background: Nematodes are an important component of deep-sea hydrothermal vent communities, but only few nematode species are able to cope to the harsh conditions of the most active vent sites. The genus Oncholaimus is known to tolerate extreme geothermal conditions and high sulphide concentrations in shallow water hydrothermal vents, but it was only occasionally reported in deep-sea vents. In this study, we performed morphological, genetic and ecological investigations (including feeding strategies) on an abundant species of Oncholaimus recently discovered at Lucky strike vent field on the Mid-Atlantic Ridge at 1700 m water depth. Results: We described this species as Oncholaimus dyvae sp. nov.. This new species differs from all other members of the genus by the combination of the following characters: body length (up to 9 mm), the presence of a long spicule (79 mu m) with a distally pointed end, a complex pericloacal setal ornamentation with one precloacal papilla surrounded by short spines, and a body cuticule with very fine striation shortly posterior to the amphid opening. Overall, O. dyvae sp. nov. abundance increased with increasing temperature and vent emissions. Carbon isotopic ratios suggest that this species could consume both thiotroph and methanotrophic producers. Furthermore sulfur-oxidizing bacteria related to Epsilonproteobacteria and Gammaproteobacteria were detected in the cuticle, in the digestive cavity and in the intestine of O. dyvae sp. nov. suggesting a potential symbiotic association. Conclusions: This study improves our understanding of vent biology and ecology, revealing a new nematode species able to adapt and be very abundant in active vent areas due to their association with chemosynthetic micro-organisms. Faced by the rapid increase of anthropogenic pressure to access mineral resources in the deep sea, hydrothermal vents are particularly susceptible to be impacted by exploitation of seafloor massive sulfide deposits. It is necessary to document and understand vent species able to flourish in these peculiar ecosystems.

## Effects of Perfluoralkyl Substances on a Multigenerational Scale: A Case Study with Chironomus riparius (Diptera, Chironomidae)

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY, 2019, 38, (5), 988-999, DOI: 10.1002/etc.4392

**Autori:** Marziali, L; Rosignoli, F; Valsecchi, S; Polesello, S; Stefani, F

**Abstract ENG:** A multigenerational test with Chironomus riparius was performed to assess long-term effects on life-traits of exposure to selected perfluoroalkyl compounds: perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), and perfluorobutane sulfonate (PFBS). These persistent contaminants are widespread in aquatic ecosystems at low concentrations, possibly exerting long-term toxicity. Larvae of C. riparius of a native population were exposed for 10 generations to 10 mu g/L nominal concentrations of PFOS, PFOA, and PFBS, comparable with the maximum values found in European rivers. All treatments showed reduced growth at most/several generations. No effects on survival, development, and reproduction were found. A final tolerance-induction test was performed exposing the pre-exposed experimental cohorts to 100 mu g/L PFOS and 150 mu g/L PFOA for a whole life cycle. Factorial analysis of variance revealed no difference between treatments (i.e., PFOS vs PFOA), indicating no induced tolerance. Instead, organisms pre-exposed to PFBS were the most stressed, followed by those pre-exposed to PFOA and PFOS, with earlier emergence and reduced adult weight. The results may be related to general stress and genetic erosion induced by long-term laboratory culture, but also to long-term toxicant exposure. However, no effects at the population level (population growth rate) were proved, and thus a toxicity risk in real ecosystems at the tested concentrations seems unlikely. Environ Toxicol Chem 2019;00:1-12. (c) 2019 SETAC

## Effluents of wastewater treatment plants promote the rapid stabilization of the antibiotic resistome in receiving freshwater bodies

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** WATER RESEARCH, 2019, 158, 72-81, DOI: 10.1016/j.watres.2019.04.031

**Autori:** Corno, G; Yang, Y; Eckert, EM; Fontaneto, D; Fiorentino, A; Galafassi, S; Zhang, T; Di Cesare, A

**Abstract ENG:** Treated wastewater discharged into the environment acts as a disturbance of the natural microbial communities in terms of taxonomic composition and of functional gene pool, including antibiotic resistance genes. We tested whether stochastic and heterogeneous site-specific trajectories or generalities, potentially driven by deterministic processes, control the fate of allochthonous bacteria from anthropogenic sources and the persistence of their functional traits in freshwater. Finding generalities would allow the identification of wastewater treatments that could be effective in abating determinants of antibiotic resistance, We analysed the short-term response of native bacterial communities in waters exposed to the disturbance of wastewater at different dilutions, using a metagenomic approach that revealed both microbial community composition and the scope and abundance of the resistome that can pose indirect risks to human health. We found that the taxonomic composition of the communities after the disturbance was driven by case-specific stochastic processes, whereas the resistome had a deterministic trajectory, rapidly stabilising its functional traits with higher proportions of wastewater effluents, regardless of differences in taxonomic composition, richness of antibiotic resistance genes and of bacterial taxa, phenotypic features of the bacterial communities, and type of wastewater treatment. The observed deterministic proliferation of resistomes in freshwater bodies receiving wastewater effluents, suggests that this process may contribute to the global propagation of antibiotic resistance, and thus calls for new legislations promoting alternative tertiary treatments for the wastewater reuse, and targeting bacterial functional traits and not only bacterial abundances. (C) 2019 Elsevier Ltd. All rights reserved.

## Elevation-dependent warming of maximum air temperature in Nepal during 1976-2015

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** ATMOSPHERIC RESEARCH, 2019, 228 (1), 261-269, DOI: 10.1016/j.atmosres.2019.06.006

**Autori:** Thakuri, S; Dahal, S; Shrestha, D; Guyennon, N; Romano, E; Colomboe, N; Salerno, F

**Abstract ENG:** Significant elevation-dependent warming (EDW) of maximum near-surface air temperature and diurnal temperature range (DTR) has been observed in Nepal (southern central Himalaya) until 2566 m a.s.l., over the last four decades (1976-2015). During this period, on the average and across the entire country, maximum air temperature increased ( + 0.045 degrees C y (-1), p < .001) more than minimum temperature ( + 0.009 degrees C y(-1), p < .05) and, as a consequence, DTR also increased significantly ( + 0.034 degrees C y(-1), p < .001). Maximum temperature increases have been observed during all seasons of the year. This warming pattern differs from the symmetrical one observed at global level in the same period, and it is in contrast to more prominent minimum temperature increases observed in the north of Himalaya (Tibetan Plateau). Furthermore, the near-surface air temperature change observed in Nepal contrasts the global evidence of main increasing trends occurring during the winter months. We point out that this asymmetric warming pattern could have more serious impacts in Nepal than in other regions of the world, considering the consequences of associated warm maximum-temperature extremes (heatwaves, hot days) on human life, increased primary production, and modifications in the hydrological cycle. We conclude sustaining that the observed EDW of maximum temperature and the DTR could be attributed to the monsoon weakening, namely to the reduced number of rainy days observed in the region during the last decades. These phenomena could have been accompanied by decreasing cloudiness and consequent increasing of daytime shortwave and decreasing of nighttime longwave incoming solar radiation.

## Engineering cytoplasmic acetyl-CoA synthesis decouples lipid production from nitrogen starvation in the oleaginous yeast Rhodosporidium azoricum

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** MICROBIAL CELL FACTORIES, 2019, 18, 199, DOI: 10.1186/s12934-019-1250-6

**Autori:** Donzella, S; Cucchetti, D; Capusoni, C; Rizzi, A; Galafassi, S; Chiara, G; Compagno, C

**Abstract ITA:** I lieviti oleaginosi sono in grado di accumulare livelli molto elevati di lipidi neutri soprattutto in condizioni di eccesso di carbonio e di limitazione di azoto (condizioni di crescita con alto rapporto C/N). Ciò rende necessario l'uso di processi a due fasi per ottenere un alto livello di biomassa e lipidi. Per semplificare il processo, può essere utile il disaccoppiamento della sintesi lipidica dalla carenza di azoto, stabilendo una via di formazione citosolica dell'acetil-CoA alternativa a quella catalizzata dall'ATP-citrato liasi. In questo lavoro, abbiamo introdotto una nuova via metabolica per la formazione di acetil-CoA (AcCoA) nel citoplasma di Rhodosporidium azoricum, sovraesprimendo geni che codificano per una fosfochetolasi (omologa, Xfpk) e una fosfotransacetilasi (eterologa, Pta). Il ceppo ingegnerizzato PTAPK4 mostra un contenuto lipidico più elevato e produce una concentrazione lipidica più elevata rispetto al ceppo wild type quando coltivato in terreni contenenti diversi rapporti C/N. In bioreattore, con una miscela glucosio/xilosio per simulare un processo industriale per la produzione di lipidi da materiali lignocellulosici, abbiamo ottenuto un aumento dell'89% della concentrazione di lipidi finali dal ceppo ingegnerizzato rispetto al tipo selvatico. Ciò indica che il ceppo trasformato può un quantitativo di biomassa cellulare più elevato con un alto contenuto di lipidi rispetto al tipo selvatico. Il ceppo trasformato ha inoltre mostrato rese maggiori, essendo la resa in lipidi rispettivamente dello 0,13 contro lo 0,05 del ceppo selvatico. I nostri risultati mostrano quindi che la sovraespressione di attività del gene omologo Xfpk con il gene eterologo di Pta in R. azoricum crea un nuovo apporto citosolico di AcCoA che disaccoppia la produzione di lipidi dalla carenza di azoto. Questa modifica metabolica consente di migliorare la produzione di lipidi in condizioni colturali che possono essere adatte allo sviluppo di bioprocessi industriali che utilizzano idrolizzati lignocellulosici.

**Abstract ENG:** Background Oleaginous yeasts are able to accumulate very high levels of neutral lipids especially under condition of excess of carbon and nitrogen limitation (medium with high C/N ratio). This makes necessary the use of two-steps processes in order to achieve high level of biomass and lipid. To simplify the process, the decoupling of lipid synthesis from nitrogen starvation, by establishing a cytosolic acetyl-CoA formation pathway alternative to the one catalysed by ATP-citrate lyase, can be useful. Results In this work, we introduced a new cytoplasmic route for acetyl-CoA (AcCoA) formation in Rhodosporidium azoricum by overexpressing genes encoding for homologous phosphoketolase (Xfpk) and heterologous phosphotransacetylase (Pta). The engineered strain PTAPK4 exhibits higher lipid content and produces higher lipid concentration than the wild type strain when it was cultivated in media containing different C/N ratios. In a bioreactor process performed on glucose/xylose mixture, to simulate an industrial process for lipid production from lignocellulosic materials, we obtained an increase of 89% in final lipid concentration by the engineered strain in comparison to the wild type. This indicates that the transformed strain can produce higher cellular biomass with a high lipid content than the wild type.

The transformed strain furthermore evidenced the advantage over the wild type in performing this process, being the lipid yields 0.13 and 0.05, respectively. Conclusion Our results show that the overexpression of homologous Xfpk and heterologous Pta activities in R. azoricum creates a new cytosolic AcCoA supply that decouples lipid production from nitrogen starvation. This metabolic modification allows improving lipid production in cultural conditions that can be suitable for the development of industrial bioprocesses using lignocellulosic hydrolysates.

## Environmental factors as drivers for macroinvertebrate and diatom diversity in Alpine lakes: New insights from the Stelvio National Park (Italy)

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** JOURNAL OF LIMNOLOGY, 2019, 78 (2), 147-162, DOI: 10.4081/jlimnol.2019.1863

**Autori:** Boggero, A; Zaupa, S; Musazzi, S; Rogora, M; Dumnicka, E; Lami, A

**Abstract ENG:** Information on the biodiversity of high altitude lakes in the Stelvio National Park was scarce and fragmentary, in most cases limited to a few studies on a single biological issue. To fill this gap, a multidisciplinary research program was established in 2011 to investigate macroinvertebrates, diatoms, and water chemistry in 8 high altitude lakes within the boundaries of the Park (Rhaetian Alps, Eastern Alps). The results of this study were compared with data on biological assemblages and chemical parameters of Alpine lakes in the Pennine-Lepontine Alps (Western Alps), to evaluate the role of local drivers with respect to regional ones. This comparison was possible thanks to the adoption of standardized sampling methodologies developed since the '90s by the National Research Council-Water Research Institute (Verbania), in collaboration with several European Research centers. Despite located in a restricted geographical area, the lakes of the Stelvio National Park showed a high variability of chemical composition, and of sensitivity to acidification, lower than that of the Pennine-Lepontine Alpine lakes. Macroinvertebrate and diatom taxa were ubiquitous and frequent along the Alps, and mainly represented by cold-stenothermal species. Richness, Shannon, Simpson, and Pielou indices applied to phyto- and zoobenthos highlighted significantly lower values in Stelvio National Park lakes than in those of the Pennine-Lepontine Alps for macroinvertebrates, while no significant differences were found for diatoms. Two groups of lakes were identified by Cluster Analysis, mainly on the basis of major ion concentrations. Canonical Correspondence Analysis showed that the macroinvertebrate assemblage of the lakes studied is driven mainly by altitude and lake surface, and, to a lesser extent, by nutrient content. On the contrary, pH and acid-related variables played a secondary role for diatoms, while nutrients and, more in general, ionic content had significant effects on their species composition. Overall, the results of this first investigation showed that the high elevation of these lakes affects their macroinvertebrate assemblages, while their diatom communities are comparable throughout the Alps.

## Evaluation and quantification of antimicrobial residues and antimicrobial resistance genes in two Italian swine farms

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** ENVIRONMENTAL POLLUTION, 2019, 255, 113183, DOI: 10.1016/j.envpol.2019.113183

**Autori:** Petrin, S; Patuzzi, I; Di Cesare, A; Tiengo, A; Sette, G; Biancotto, G; Corno, G; Drigo, M; Losasso, C; Cibin, V

**Abstract ENG:** Antimicrobial resistance genes (ARGs) are considered emerging environmental pollutants, posing potential risks for human and animal health: the misuse of antimicrobials in food-producing animals could favour the maintenance and spread of resistances in bacteria. The occurrence of ARGs in Italian swine farming - which has specific characteristics - was investigated in order to explore resistance spread dynamics. Two farrow-to-finish pig farms were longitudinally monitored: faecal samples from animals and environmental samples were collected. DNA was extracted and tetA, ermB, qnrS and mcr1 ARGs were analysed by qPCR for their ability to confer resistance to highly or critically important antimicrobials (CIAs). Moreover, 16SrDNA gene was analysed to assess bacterial abundance. ermB and tetA genes were found in animal samples and manure samples. On the contrary, mcr1 was exclusively found in weaners, while qnrS occurred in all animal categories but sows and finishers. Among the analysed genes, ermB and tetA showed the highest absolute and relative abundances. Our results indicate that ermB and tetA ARGs are widely disseminated in the explored farms, suggesting efficient maintenance among bacteria and persistence in the environment. Interestingly, the presence of qnrS and mcr1, limited to just a few animal categories, highlights inefficient dissemination of these genes in the farm environment, in particular for mcr1, a stable plasmid gene conferring resistance to the last-resort antimicrobial, colistin. Paying close attention only to the finishing phase would have hampered the discovery of resistances to CIAs at farm level, which we instead identified thanks to an intensive longitudinal monitoring programme. (C) 2019 Elsevier Ltd. All rights reserved.

## Evaluation of GPM-era Global Satellite Precipitation Products over Multiple Complex Terrain Regions

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** REMOTE SENSING, 2019,11, 2936, DOI: 10.3390/rs11242936

**Autori:** Derin, Y; Anagnostou, E; Berne, A; Borga, M; Boudevillain, B; Buytaert, W; Chang, CH; Chen, HN; Delrieu, G; Hsu, YC; Lavado-Casimiro, W; Manz, B; Moges, S; Nikolopoulos, EI; Sahlu, D; Salerno, F; Rodriguez-Sanchez, JP; Vergara, HJ; Yilmaz, KK

**Abstract ENG:** The great success of the Tropical Rainfall Measuring Mission (TRMM) and its successor Global Precipitation Measurement (GPM) has accelerated the development of global high-resolution satellite-based precipitation products (SPP). However, the quantitative accuracy of SPPs has to be evaluated before using these datasets in water resource applications. This study evaluates the following GPM-era and TRMM-era SPPs based on two years (2014-2015) of reference daily precipitation data from rain gauge networks in ten mountainous regions: Integrated Multi-SatellitE Retrievals for GPM (IMERG, version 05B and version 06B), National Oceanic and Atmospheric Administration (NOAA)/Climate Prediction Center Morphing Method (CMORPH), Global Satellite Mapping of Precipitation (GSMaP), and Multi-Source Weighted-Ensemble Precipitation (MSWEP), which represents a global precipitation data-blending product. The evaluation is performed at daily and annual temporal scales, and at 0.1 deg grid resolution. It is shown that GSMaPV07 surpass the performance of IMERGV06B Final for almost all regions in terms of systematic and random error metrics. The new orographic rainfall classification in the GSMaPV07 algorithm is able to improve the detection of orographic rainfall, the rainfall amounts, and error metrics. Moreover, IMERGV05B showed significantly better performance, capturing the lighter and heavier precipitation values compared to IMERGV06B for almost all regions due to changes conducted to the morphing, where motion vectors are derived using total column water vapor for IMERGV06B.

## Evaluation of morpho-physiological traits and contaminant accumulation ability in Lemna minor L. treated with increasing perfluorooctanoic acid (PFOA) concentrations under laboratory conditions

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** SCIENCE OF THE TOTAL ENVIRONMENT, 2019, 695, 133828, DOI: 10.1016/j.scitotenv.2019.133828

**Autori:** Pietrini, F; Passatore, L; Fischetti, E; Carloni, S; Ferrario, C; Polesello, S; Zacchini, M

**Abstract ENG:** There is increasing concern about the effects of releasing emerging contaminants (i.e. endocrine-disrupting chemicals, pharmaceuticals, personal-care products and flame retardants) into the environment. Particular attention is being paid to perfluoroalkyl substances (PFAS) because of their persistence and bioaccumulation, especially in the aquatic environment. In this paper, we present results of a study aimed at evaluating the effects of different perfluorooctanoic acid (PFOA) concentrations (2, 20 and 200 mu g/L) on morpho-physiological traits in Lemna minor L. plants. The accumulation of PFOA in the plant's tissues was also monitored. L minor was selected as a model plant for ecotoxicological studies, and we performed a seven-day assay for this investigation. The results highlight the lack of inhibitory effects on biomethc parameters such as mean frond area, total frond number, multiplication rate, doubling time of frond number and average specific growth rate, for each of tested PFOA concentrations. Also, at photosynthetic level, physiological measurements showed that chlorophyll content and electron transport rate (ETR) were not affected by the exposure to PFOA. Remarkably, the chlorophyll fluorescence images, used for the first time in a study on PFOA, evidenced no impairment to the photosynthetic efficiency, measured by the maximum quantum yield of photosystem II (PSII) photochemistry (Fv/Fm), the quantum efficiency of PSII photochemistry ((Phi PSII) and the non-photochemical quenching (NPQ) over the leaf surface of PFOA-treated plants, in comparison to control. Quantification of PFOA in the growth medium at the end of the seven-day test revealed no statistically different concentrations in plates with or without L. minor plants. We detected increasing PFOA accumulation in plant tissues, in accordance with the PFOA concentrations in the medium. Therefore, the L. minor plants were capable of taking up and accumulating PFOA. The ecological impact of the environmentally relevant PFOA concentrations tested in this work on biological organisms of the aquatic environment is discussed. 

## Evolutionary and demographic correlates of Pleistocene coastline changes in the Sicilian wall lizard Podarcis wagleriana

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** JOURNAL OF BIOGEOGRAPHY, 2019, 46 (1), 224-237, DOI: 10.1111/jbi.13479

**Autori:** Senczuk, G; Harris, DJ; Castiglia, R; Mizan, VL; Colangelo, P; Canestrelli, D; Salvi, D

**Abstract ENG:** Aim Emergence of coastal lowlands during Pleistocene ice ages might have provided conditions for glacial expansions (demographic and spatial), rather than contraction, of coastal populations of temperate species. Here, we tested these predictions in the insular endemic Sicilian wall lizard Podarcis wagleriana. Location Sicily and neighbouring islands. Methods We sampled 179 individuals from 45 localities across the whole range of P. wagleriana. We investigated demographic and spatial variations through time using Bayesian coalescent models (Bayesian phylogeographic reconstruction, Extended Bayesian Skyline plots, Isolation-with-migration models) based on multilocus DNA sequence data. We used species distribution modelling to reconstruct present and past habitat suitability. Results We found two main lineages distributed in the east and west portions of the current species range and a third lineage restricted to a small area in the north of Sicily. Multiple lines of evidence from palaeogeographic (shorelines), palaeoclimatic (species distribution models), and multilocus genetic data (demographic and spatial Bayesian reconstructions) indicate that these lineages originated in distinct refugia, located in the north-western and south-eastern coastal lowlands, during Middle Pleistocene interglacial phases, and came into secondary contact following demographic and spatial expansions during the last glacial phase. Main conclusions This scenario of interglacial contraction and glacial expansion is in sharp contrast with patterns commonly observed in temperate species on the continent but parallels recent findings on other Mediterranean island endemics. Such a reverse expansion-contraction (EC) dynamic has been likely associated with glacial increases of climatically suitable coastal lowlands, suggesting this might be a general pattern in Mediterranean island species and also in other coastal regions strongly affected by glacial marine regressions during glacial episodes. This study provides explicit predictions and some methodological recommendations for testing the reverse EC model in other region and taxa.

## Facing Adversity: Dormant Embryos in Rotifers

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** BIOLOGICAL BULLETIN, 2019, 237 (2), 119-144, DOI: 10.1086/705701

**Autori:** Garcia-Roger, EM; Lubzens, E; Fontaneto, D; Serra, M

**Abstract ENG:** An in-depth look at the basic aspects of dormancy in cyclic parthenogenetic organisms is now possible thanks to research efforts conducted over the past two decades with rotifer dormant embryos. In this review, we assemble and compose the current knowledge on four central themes: (1) distribution of dormancy in animals, with an overview on the phylogenetic distribution of embryo dormancy in metazoans, and (2) physiological and cellular processes involved in dormancy, with a strong emphasis on the dormant embryos of cyclically parthenogenetic monogonont rotifers; and discussions of (3) the selective pressures and (4) the evolutionary and population implications of dormancy in these animals. Dormancy in metazoans is a widespread phenomenon with taxon-specific features, and rotifers are among the animals in which dormancy is an intrinsic feature of their life cycle. Our review shows that embryo dormancy in rotifers shares common functional pathways with other taxa at the molecular and cellular level, despite the independent evolution of dormancy across phyla. These pathways include the arrest of similar metabolic routes and the usage of common metabolites for the stabilization of cellular structures and to confer stress resistance. We conclude that specific features of recurrent harsh environmental conditions are a powerful selective pressure for the fine-tuning of dormancy patterns in rotifers. We hypothesize that similar mechanisms at the organism level will lead to similar adaptive consequences at the population level across taxa, among which the formation of egg banks, the coexistence of species, and the possibility of differentiation among populations and local adaptation stand out. Our review shows how studies of rotifers have contributed to improved knowledge of all of these aspects.

## Fine-scale spatial heterogeneity of invertebrates within cryoconite holes

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** AQUATIC ECOLOGY, 2019, 53, 179–190, DOI: 10.1007/s10452-019-09681-9

**Autori:** Zawierucha, K; Buda, J; Fontaneto, D; Ambrosini, R; Franzetti, A; Wierzgon, M; Bogdziewicz, M

**Abstract ENG:** Cryoconite holes (water-filled reservoirs) are considered ecologically simple ecosystems but represent biological hotspots of biodiversity on glaciers. In order to check for fine-scale spatial distribution of metazoans on the bottom of the holes, in this study, we analysed three groups of grazing invertebrates as a model: tardigrades, rotifers, and mites. We addressed differences within cryoconite holes comparing the distribution of invertebrates within and between separate holes and between glaciers at a worldwide scale. We divided each cryoconite hole into three sampling zones (established in relation to water flow on a glacier) and collected nine subsamples within cryoconite holes on glaciers in the Arctic (Longyearbreen), Norway (Blaisen), the Alps (Forni) and maritime Antarctic (Ecology Glacier). Generally, we found no consistent difference in sampling zones within cryoconite holes, which suggests homogeneity on the hole floors. However, we did find strong differences and high heterogeneity between subsamples, even within the same zone. Invertebrate densities ranged between 52 and 426 individuals per ml in subsamples collected from the same hole. We found from zero to four trdigrade species in the cryoconite hole on Longyearbreen. Our results show that benthic animals in cryoconite holes in various climatic zones have heterogeneous spatial distribution, even if no preference could be highlighted for upstream versus downstream areas with respect to water flow. The distribution of invertebrates may result from ecosystem disturbance by flushing water and animals' active movement. Cryoconite holes, usually considered to be simple ecosystems, seem to be complex habitats where hidden spatial heterogeneity may affect abundance and diversity of organisms.

## First Isolation of Pseudogymnoascus destructans, the Fungal Causative Agent of White-Nose Disease, in Bats from Italy

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** MYCOPATHOLOGIA, 2019, 184, 637–644, DOI: 10.1007/s11046-019-00371-6

**Autori:** Garzoli, L; Riccucci, M; Patriarca, E; Debernardi, P; Boggero, A; Pecoraro, L; Picco, AM

**Abstract ENG:** White-nose disease, caused by the dermatophyte Pseudogymnoascus destructans, is a devastating pathology that has caused a massive decline in the US bat populations. In Europe, this fungus and the related infection in bats have been recorded in several countries and for many bat species, although no mass mortality has been detected. This study reports for the first time the presence of P. destructans in Italy. The fungus was isolated in the Rio Martino cave, a site located in the Western Alps and included in the Natura 2000 network. Twenty bats, belonging to five different species, were analysed. The fungus was retrieved on eight individuals of Myotis emarginatus. The allied keratolytic species P. pannorum was observed on two other individuals, also belonging to M. emarginatus. Strains were isolated in pure culture and characterized morphologically. Results were validated through molecular analyses. Future work should be dedicated to understand the distribution and the effects of the two Pseudogymnoascus species on Italian bats.

## High export of nitrogen and dissolved organic carbon from an Alpine glacier (Indren Glacier, NW Italian Alps)

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** AQUATIC SCIENCES, 2019, 81, 74, DOI: 10.1007/s00027-019-0670-z

**Autori:** Colombo, N; Bocchiola, D; Martin, M; Confortola, G; Salerno, F; Godone, D; D'Amico, ME; Freppaz, M

**Abstract ENG:** Mountain glaciers can export large amounts of nitrogen (N) and carbon (C) to downstream aquatic ecosystems. To date, however, the number of studies that analysed concentrations and fluxes of N forms and dissolved organic carbon (DOC) from glaciers in the European Alps and worldwide is limited, given the high complexity of data gathering in harsh high-elevation environments. In this work, we rely upon new, unexploited data from field campaigns pursued during 2012-2015 at high elevations (> 3000 m a.s.l.) of the Indren Glacier (NW Italian Alps) to (1) develop glacio-hydrological modelling and stream flow estimates within a heavily glacier-fed catchment, (2) provide N forms and DOC concentrations and estimated fluxes in meltwater, and (3) provide possible explanations of cryospheric control upon water chemistry. Water and soil samples were also collected at two lower-elevation sites along the glacial stream to investigate the downstream variability of N forms and DOC. Nitrate-N, dissolved organic nitrogen, and DOC concentrations (0.21 +/- 0.12, 0.19 +/- 0.14, 1.16 +/- 0.63 mg L-1, respectively) and yields (220, 210, 1279 kg km(-2) year(-1), respectively) were among the highest considering other glaciated areas of the globe, probably due to high atmospheric N and C depositions. Limited effect of soil on water characteristics was found and attributed to the reduced soil development in recently deglaciated areas (after the Little Ice Age), thus underlining the role of glacier melting in determining N and C dynamics in high-elevation, Alpine surface waters.

## High-quality treated wastewater causes remarkable changes in natural microbial communities and intI1 gene abundance

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** WATER RESEARCH, 2019, 167, 114895, DOI: 10.1016/j.watres.2019.114895

**Autori:** Subirats, J; Di Cesare, A; della Giustina, SV; Fiorentino, A; Eckert, EM; Rodriguez-Mozaz, S; Borrego, CM; Corno, G

**Abstract ENG:** We carry out a mesocosms experiment to assess the impact of high-quality treated wastewater intended for agricultural reuse (HQWR) on freshwater bacteria seldom exposed to anthropogenic pollution. Effects were assessed by comparing the abundance and composition of bacterial communities as well as their resistance profile under control (source water from an unpolluted lake) and treatment conditions (source water mixed 1:1 with HQWR, with and without 5 mu g L-1 of cefotaxime). We investigated the effect of the different conditions on the abundance of genes encoding resistance to beta-lactams and carbapenems (blaTEM, blaCTX-M, blaOXA, and blaKPC), fluoroquinolones (gnrS), tetracyclines (tetA), sulfonamides (sul2), macrolides (ermB), arsenic and cadmium (arsB and czcA, respectively), and on the gene encoding the Class 1 integron integrase (intI1). Bacterial communities exposed to HQWR showed a significant higher abundance of tetA, arsB, czcA, and intI1 genes, whereas those exposed to Cefotaxime-amended HQWR did not. Genes conferring resistance to carbapenems, beta-lactams, fluoroquinolones, and macrolides were below detection limit in all treatments. Besides, the higher availability of nutrients under treatment conditions favored bacterial growth in comparison to those exposed to control conditions. Particularly, Acinetobacter spp. and Pseudomonas spp. were significantly enriched after 22 days of treatment exposure. The presence of cefotaxime (a third generation cephalosporine) in the feeding medium caused an enrichment of bacterial communities in sequences affiliated to Acinetobacter thus suggesting that these resistant forms may possess resistance genes other than those studied here (blaCTX-M, blaOXA, and blaKPC). Although derived from a mesocosm experiment in continuous cultures, our results call attention to the need of refined regulations regarding the use of reclaimed water in agriculture since even high-quality treated wastewater may lead to undesired effects on receiving bacterial communities in terms of composition and dissemination of antibiotic resistance genes. (C) 2019 Published by Elsevier Ltd.

## Impact of industrial wastewater on the dynamics of antibiotic resistance genes in a full-scale urban wastewater treatment plant

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** SCIENCE OF THE TOTAL ENVIRONMENT, 2019, 646, 1204-1210, DOI: 10.1016/j.scitotenv.2018.07.370

**Autori:** Fiorentino, A; Di Cesare, A; Eckert, EM; Rizzo, L; Fontaneto, D; Yang, Y; Corno, G

**Abstract ENG:** Urban Wastewater Treatment Plants (UWTPs) treating mixed urban sewage and industrial wastewater are among the major hotspots for the spread of Antibiotic Resistance Genes (ARGs) into the environment. This study addresses the impact of the wastewater origin on ARG dynamics in a full-scale UWTP (15,000 Population Equivalent, PE) by operating the plant with and without industrial wastewater. Composite samples (4 L) from different treatment points were characterized for their chemical composition, bacterial abundance and for the abundance of four resistance genes against tetracycline, sulfonamides, erythromycin, and quinolones (tetA, sul2, ermB, and qnrS), and of the class 1 integrons (intI1). Although the chemical composition of the outflow significantly differed when the plant operated with or without industrial wastewater, the system efficiency in the removal of bacterial cells, ARGs, and intI1 was constant. The final disinfection by peracetic acid (PAA) did not affect the removal of ARGs, independently of the wastewater origin and the chemical characteristics of the inflows. Our results demonstrated that a well-functioning small size UWTP could treat a significant amount of industrial wastewater mixed in the urban sewagewithout affecting the overall ARGs and class 1 integrons released into the environment. 

## Impacts of air pollution on human and ecosystem health, and implications for the National Emission Ceilings Directive: Insights from Italy

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** ENVIRONMENT INTERNATIONAL, 2019, 125, 320-333, DOI: 10.1016/j.envint.2019.01.064

**Autori:** De Marco, A; Proietti, C; Anav, A; Ciancarella, L; D'Elia, I; Fares, S; Fornasier, MF; Fusaro, L; Gualtieri, M; Manes, F; Marchetto, A; Mircea, M; Paoletti, E; Piersanti, A; Rogora, M; Salvati, L; Salvatori, E; Screpanti, A; Vialetto, G; Vitale, M; Leonardi, C

**Abstract ENG:** Across the 28 EU member states there were nearly half a million premature deaths in 2015 as a result of exposure to PM2.5, $O_3$ and $NO_2$. To set the target for air quality levels and avoid negative impacts for human and ecosystems health, the National Emission Ceilings Directive (NECD, 2016/2284/EU) sets objectives for emission reduction for $SO_2$, NOx, NMVOCs, $NH_3$ and PM2.5 for each Member State as percentages of reduction to be reached in 2020 and 2030 compared to the emission levels into 2005. One of the innovations of NECD is Article 9, that mentions the issue of monitoring air pollution impacts on ecosystems. We provide a clear picture of what is available in term of monitoring network for air pollution impacts on Italian ecosystems, summarizing what has been done to control air pollution and its effects on different ecosystems in Italy. We provide an overview of the impacts of air pollution on health of the Italian population and evaluate opportunities and implementation of Article 9 in the Italian context, as a case study beneficial for all Member States. The results showed that $SO_4^{2-}$ deposition strongly decreased in all monitoring sites in Italy over the period 1999-2017, while $NO_3^-$ and $NH_4^+$ decreased more slightly. As a consequence, most of the acid-sensitive sites which underwent acidification in the 1980s partially recovered. The $O_3$ concentration at forest sites showed a decreasing trend. Consequently, AOT40 (the metric identified to protect vegetation from ozone pollution) showed a decrease, even if values were still above the limit for forest protection (5000 ppb $h^{-1}$), while PODy (flux-based metric under discussion as new European legislative standard for forest protection) showed an increase. National scale studies pointed out that PM10 and NO2 induced about 58,000 premature deaths (year 2005), due to cardiovascular and respiratory diseases. The network identified for Italy contains a good number of monitoring sites (6 for terrestrial ecosystem monitoring, 4 for water bodies monitoring and 11 for ozone impact monitoring) distributed over the territory and will produce a high number of monitored parameters for the implementation of the NECD.

## Influence of permafrost, rock and ice glaciers on chemistry of high-elevation ponds (NW Italian Alps)

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** SCIENCE OF THE TOTAL ENVIRONMENT, 2019, 685, 886-901 , DOI: 10.1016/j.scitotenv.2019.06.233

**Autori:** Colombo, N; Salerno, F; Martin, M; Malandrino, M; Giardino, M; Serra, E; Godone, D; Said-Pullicino, D; Fratianni, S; Paro, L; Tartari, G; Freppaz, M

**Abstract ENG:** Permafrost degradation, rock-glacier thawing, and glacier retreat are influencing surface water quality at high elevations. However, there is a lack of knowledge on the dominant geochemical reactions occurring in different cryospheric conditions and how these reactions change during the ice-free season. In the Col d'Olen area (LTER site, NW Italian Alps), four ponds with similar sizes, located in basins with different cryospheric features (glacier, permafrost, rock glacier, none of these), are present in a geographically limited area. All ponds were sampled weekly in 2015 and partially in 2014. Major ions, selected trace elements, and biotic parameters (dissolved organic carbon-DOC, fluorescence index-Fl, and nitrate) are examined to evidence the effect of different cryospheric features on water characteristics. Where cryospheric conditions occur chemical weathering is more intensive, with strong seasonal increase of major ions. Sulphide oxidation dominates in glacier and permafrost lying on acid rocks, probably driven by enhanced weathering of freshly exposed rocks in subglacial environment and recently degladated areas, and active layer thickness increase. Differently, carbonation dominates for the rock glacier lying on ultramafic rocks. There, high Ni concentrations originate from dissolution of Mg-bearing rocks in the landform. In all settings, pH neutralisation occurs because of the presence of secondary carbonate lihology and ultramafic rocks. Nitrate highest concentrations and changes occur in cryospheric settings while DOC and Fl do not show strong differences and seasonal variations. The establishment of more frequent monitoring for water quality in high-elevated surface waters is necessary to provide greater statistical power to detect changes on longer time scales. 

## Insights Into the Evolution of Picocyanobacteria and Phycoerythrin Genes (mpeBA and cpeBA)

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** FRONTIERS IN MICROBIOLOGY, 2019, 10, 45, DOI: 10.3389/fmicb.2019.00045

**Autori:** Sanchez-Baracaldo, P; Bianchini, G; Di Cesare, A; Callieri, C; Chrismas, NAM

**Abstract ENG:** Marine picocyanobacteria, Prochlorococcus and Synechococcus, substantially contribute to marine primary production and have been the subject of extensive ecological and genomic studies. Little is known about their close relatives from freshwater and non-marine environments. Phylogenomic analyses (using 136 proteins) provide strong support for the monophyly of a Glade of non-marine picocyanobacteria consisting of Cyanobium, Synechococcus and marine Sub-cluster 5.2; this Glade itself is sister to marine Synechococcus and Prochlorococcus. The most basal lineage within the Syn/Pro Glade, Sub-Cluster 5.3, includes marine and freshwater strains. Relaxed molecular clock (SSU, LSU) analyses show that while ancestors of the Syn/Pro Glade date as far back as the end of the Pre-Cambrian, modern crown groups evolved during the Carboniferous and Triassic. Comparative genomic analyses reveal novel gene cluster arrangements involved in phycobilisome (PBS) metabolism in freshwater strains. Whilst PBS genes in marine Synechococcus are mostly found in one type of phycoerythrin (PE) rich gene cluster (Type III), strains from non-marine habitats, so far, appear to be more diverse both in terms of pigment content and gene arrangement, likely reflecting a wider range of habitats. Our phylogenetic analyses show that the PE genes (mpeBA) evolved via a duplication of the cpeBA genes in an ancestor of the marine and nonmarine picocyanobacteria and of the symbiotic strains Synechococcus spongiarum. A 'primitive' Type III-like ancestor containing cpeBA and mpeBA had thus evolved prior to the divergence of the Syn/Pro Glade and S. spongiarum. During the diversification of Synechococcus lineages, losses of mpeBA genes may explain the emergence of pigment cluster Types I, II, IIB, and III in both marine and non-marine habitats, with few lateral gene transfer events in specific taxa.

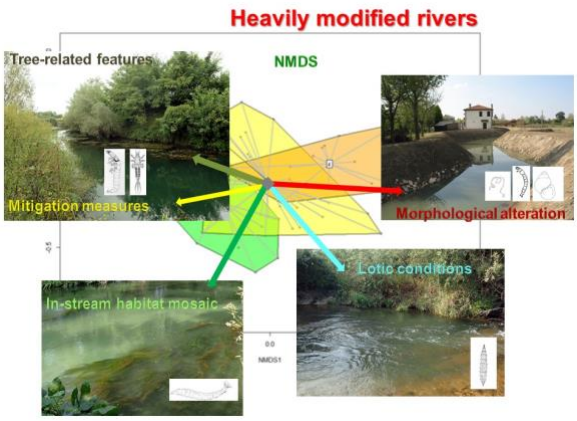
## In-stream microhabitat mosaic depicts the success of mitigation measures and controls the Ecological Potential of benthic communities in heavily modified rivers

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** SCIENCE OF THE TOTAL ENVIRONMENT, 2019, 673, 489-501, DOI: 10.1016/j.scitotenv.2019.04.124

**Autori:** Buffagni, A; Barca, E; Erba, S; Balestrini, R

**Abstract ENG:** The positive effect of mitigation measures on in-stream habitat conditions and the benthic community is recognised. In heavily modified rivers, though, the response of aquatic invertebrates to mitigation measures and habitat mosaic changes is scarcely documented. We used non-metric multidimensional scaling to explore the benthic community of leveed rivers in the agricultural lowlands of Northern Italy. The relevance of in-stream substrate microhabitat for the benthic community was assessed, together with the impact of mitigation measures. We proposed a straightforward approach to quantify similarity of microhabitat mosaic between sites testing its statistical significance based on Bayesian statistics. We hypothesised that changes of microhabitat mosaic would reflect the level of implementation of mitigation measures and benthic invertebrates would respond accordingly. Alpha, beta diversity and benthic metrics used to classify ecological status potential were considered and their variation tested against different levels of measure implementation. Lastly, ecological potential classification was paralleled to both the level of measure implementation and habitat attributes. The microhabitats found at sites where measures were fully implemented differed from those observed elsewhere and they clearly mirrored morphological alteration and mitigation measures. Moreover, alongside morphological alteration, microhabitat diversity and mosaic were the main factors for benthic community structure. While benthic beta diversity strictly reflected microhabitat diversity, alpha diversity and ecological status metrics copied the mosaic gradient. Microhabitat attributes and most benthic metrics showed significant changes following measure implementation and they were accompanied by a gradual shift in ecological potential classes. We demonstrated the importance of in-stream substrate microhabitats as a bridge between mitigation measures and the benthic community. Particularly when ecological classification is under focus, microhabitat mosaic should be evaluated for achieving a better understanding of biological responses. The huge amount of data available worldwide could support a straightforward use of river mosaic information for river management.



## Intensive monitoring of conventional and surrogate quality parameters in a highly urbanized river affected by multiple combined sewer overflows

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** WATER SCIENCE AND TECHNOLOGY-WATER SUPPLY, 2019, 19 (3), 953-966, DOI: 10.2166/ws.2018.146

**Autori:** Copetti, D; Marziali, L; Viviano, G; Valsecchi, L; Guzzella, L; Capodaglio, AG; Tartari, G; Polesello, S; Valsecchi, S; Mezzanotte, V; Salerno, F

**Abstract ENG:** The paper reports results of four intensive campaigns carried out on the Seveso River (Milan metropolitan area, Italy) between 2014 and 2016, during intense precipitation events. Laboratory analyses were coupled with on-site, continuous measurements to assess the impact of pollutants on water quality based on both conventional and surrogate parameters. Laboratory data included total suspended solids, caffeine, total phosphorus and nitrogen, and their dissolved forms. Screening of trace metals (Cr, Cu, Pb, Ni, Cd) and PBDEs (polybromodiphenylethers) was carried out. Continuous measurements included water level, physico-chemical variables and turbidity. Nutrient concentrations were generally high (e.g. average total phosphorus > 1,000 mu g/L) indicating strong sewage contributions. Among monitored pollutants Cr, Cu, Pb, and Cd concentrations were well correlated to TSS, turbidity and discharge, being bound mostly to suspended particulate matter. A different behavior was found for Ni, that showed an early peak occurring before the flow peak, as a result of first flush events. PBDEs correlated well to nutrient concentrations, showing the highest peaks soon after activation of the combined sewer overflows, likely because of its accumulation in sewers. In addition to showing the existing correlations between quality parameters, the paper highlights the importance of surrogate parameters as indicators of anthropic pollution inputs.

## Long-distance passive dispersal in microscopic aquatic animals

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** MOVEMENT ECOLOGY, 2019, 7, 10, DOI: 10.1186/s40462-019-0155-7

**Autori:** Fontaneto, D

**Abstract ENG:** Given their dormancy capability (long-term resistant stages) and their ability to colonise and reproduce, microscopic aquatic animals have been suggested having cosmopolitan distribution. Their dormant stages may be continuously moved by mobile elements through the entire planet to any suitable habitat, preventing the formation of biogeographical patterns. In this review, I will go through the evidence we have on the most common microscopic aquatic animals, namely nematodes, rotifers, and tardigrades, for each of the assumptions allowing long-distance dispersal (dormancy, viability, and reproduction) and all the evidence we have for transportation, directly from surveys of dispersing stages, and indirectly from the outcome of successful dispersal in biogeographical and phylogeographical studies. The current knowledge reveals biogeographical patterns also for microscopic organisms, with species-specific differences in ecological features that make some taxa indeed cosmopolitan with the potential for long-distance dispersal, but others with restricted geographic distributions.

## Mammals of Italy: an annotated checklist

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** HYSTRIX-ITALIAN JOURNAL OF MAMMALOGY, 2019, 30 (2), 87–106, DOI: 10.4404/hystrix-00196-2019

**Autori:** Loy, A; Aloise, G; Ancillotto, L; Angelici, FM; Bertolino, S; Capizzi, D; Castiglia, R; Colangelo, P; Contoli, L; Cozzi, B; Fontaneto, D; Lapini, L; Maio, N; Monaco, A; Mori, E; Nappi, A; Podesta, M; Russo, D; Sara, M; Scandura, M; Amori, G

**Abstract ENG:** Checklists represent a basic tool for conservation and management of regional faunas. However, our knowledge on species composition in a territory changes over time due to species movements across borders, extinctions, introductions, as well as to new taxonomic evidence. We aimed to provide the most updated data on native and non-native species of mammals occurring, or that used to occur until recently, on the Italian political territory and seas. The checklist only includes species whose taxonomic status was explicitly agreed in the most recent peer-reviewed literature and based on the most updated taxonomic approaches. For each species, we provided the following information: scientific and common name, global and Italian range, relevant information for management and conservation (e.g. whether it is endemic, allochthonous, or listed in international regulations and red list assessments), as well as remarks on taxonomy and distribution. This new check list of Italian mammal fauna includes nine marine and 114 terrestrial species, belonging to seven orders (Erin-aceomorpha, Soricomorpha, Chiroptera, Carnivora, Cetartiodactyla, Rodentia, Lagomorpha), and 28 families. Vespertilionidae represents the richest family (n=27 species), followed by Cricetidae (n=12) and Soricidae (n=11). The list includes 15-16 allocthonous species. Considering the relative small size of the country, Italy is confirmed as a hotspot of mammal diversity in Europe, hosting the highest species richness in relation to the total area.

## Multi-year trends and determinants of the hydrochemistry of high mountain lakes in the Western Italian Alps

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** AQUATIC SCIENCES, 2019, 81, 54, DOI: 10.1007/s00027-019-0650-3

**Autori:** Tiberti, R; Nelli, L; Marchetto, A; Tartari, G; Wienckowski, E; Rogora, M

**Abstract ENG:** High mountain lakes (HML) provide essential ecosystem services, have tremendous conservation and aesthetic value, and are good model ecosystems to study the ecological consequences of global change. Multi-year (2008-2017) chemical data from 25 HML from the Gran Paradiso National Park (Western Italian Alps) were used to address two specific objectives: (1) assess the major determinants of HML hydrochemistry; (2) identify any multi-years trend attributable to global change. Local trends in climatic variables and $NO_3^-$, $NH_4^+$, and $SO_4^{2-}$ deposition were evaluated over the same period as possible drivers of lake chemistry. We were able to explain most of the variance associated to the major ion concentration, but much less of that associated with nutrient content and with variables related to atmospheric deposition (e.g. $Cl^-$, $Na^+$, inorganic N). The explanation of which probably requires studies at a regional scale. As a whole, lake chemistry depends on the interplay of several environmental variables, including the impact of human activities (i.e. point source of organic pollutants). Catchment geology and vegetation cover influence several variables related to weathering processes, which show a general increase over the last 10years. This general trend can be attributable to climatic variability enhancing weathering processes in lake catchments. However, a concomitant decrease of precipitation amount and the deposition of acidifying compounds may have contributed to the observed trends. Meteorological data were almost unrelated to HML hydrochemistry, suggesting that lake chemical composition would depend more strongly on long-term climatic variations rather than on short-term meteorological events.

## Patterns of diversity and endemism of soft-bodied meiofauna in an oceanic island, Lanzarote, Canary Islands

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** MARINE BIODIVERSITY, 2019, 49, 2033–2055, DOI: 10.1007/s12526-019-01007-0

**Autori:** Martinez, A; Di Domenico, M; Leasi, F; Curini-Galletti, M; Todaro, MA; Dal Zotto, M; Gobert, S; Artois, T; Norenburg, J; Jorger, KM; Nunez, J; Fontaneto, D; Worsaae, K

**Abstract ENG:** Oceanic islands, characterized by high levels of endemism and distinct faunas when compared to neighbouring continents, represent natural evolutionary laboratories for biologists to understand ecological and evolutionary processes. However, most studies on oceanic islands have focused on terrestrial and marine macrofaunal organisms, and ignored microscopic animals. We present here an inventory of all soft-bodied meiofaunal organisms collected during a 2-week workshop on the oceanic island of Lanzarote, Canary Islands. Our checklist included 239 species, with 88 of them endemic to the archipelago. The number of endemic species was lower in groups with a higher proportion of parthenogenetic species, while it was not significantly affected by body size and percentage of species with dispersal stages. A higher percentage of endemic species was found in isolated habitats and environments, with only annelids showing significantly higher number of endemic species in anchialine caves. Our results might be biased by the high number of indeterminate species found in our samples and the lack of knowledge of the meiofauna of the African coast. Our findings, however, provide the first insight of patterns of diversity of soft-bodied meiofauna in Atlantic oceanic islands, suggesting that island endemic species might also exist amongst microscopic animals.

## Perfluoroalkyl acids in fish of Italian deep lakes: Environmental and human risk assessment

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** SCIENCE OF THE TOTAL ENVIRONMENT, 2019, 653, 351-358, DOI: 10.1016/j.scitotenv.2018.10.274

**Autori:** Mazzoni, M; Buffo, A; Cappelli, F; Pascariello, S; Polesello, S; Valsecchi, S; Volta, P; Bettinetti, R

**Abstract ENG:** Determination of 20 PFASs in a fish species (Alosa agone) of commercial interest has been carried out in five Italian subalpine lakes to assess the risk for humans and predators for fish consumption. PFOS still presents the highest concentrations (0.9-16.6 ng g(-1) ww) among the analysed PFASs, in spite of its normative restrictions. PFOS concentrations measured in all lakes, except in Lake Maggiore, are homogeneous with an average of 3.1 +/- 1.9 ng g(-1) ww, which could be considered the anthropogenic background concentration of PFOS in fish of lakes located in an industrialised and urbanised region but without point sources. In Lake Maggiore, fish concentrations always exceed the EU EQSbiota (9.1 ng g(-1) ww) based on human fish consumption. Considering the effective consumption of fish in this area, an actual risk for fish consumption by humans is not evidenced, while a moderate risk of secondary poisoning for predators is highlighted. PFOA has been detected in significant concentration only in one sample in Lake Maggiore, while long chain PFCAs have been detected without significant differences among the lakes (0.3 to 2.7 ng g(-1) ww). The present study demonstrates that biota monitoring of fish can be used as a valuable tool to classify the quality status of water bodies regarding bioaccumulative PFAAs, even if the water concentrations are close to the reachable detection limits. (c) 2018 Published by Elsevier B.V.

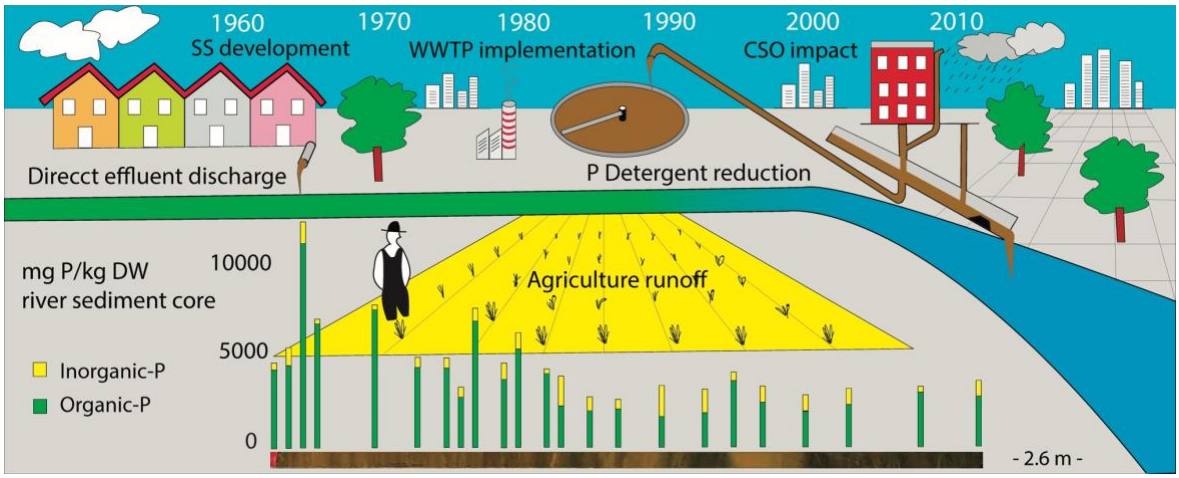
## Phosphorus content in a deep river sediment core as a tracer of long-term (1962-2011) anthropogenic impacts: A lesson from the Milan metropolitan area

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** SCIENCE OF THE TOTAL ENVIRONMENT, 2019, 646, 37-48, DOI: 10.1016/j.scitotenv.2018.07.256

**Autori:** Copetti, D; Tartari, G; Valsecchi, L; Salerno, F; Viviano, G; Mastroianni, D; Yin, HB; Viganò, L

**Abstract ENG:** Reconstructions of past fluvial contamination through the analysis of deep sediment cores are rarely reported in literature. We examined the phosphorus fractions in a deep (2.6 m) sediment core of the Lambro River downstream of the highly anthropized Milan metropolitan area and upstream of the Po river the main Italian watercourse. The core covered the period 1962-2011. Total phosphorus concentrations resulted typical of a strongly impacted environment (4788 mg P kg DW-1 on average) with the highest concentrations related to the 1960s (7639 mg P kg DW-1) reflecting the period of maximum demographic growth. Afterwards, phosphorus concentrations decreased thanks to the infrastructural and legislative initiatives carried out in the 1980s and the 1990s to reduce the impact of urban point sources. Subsequently, total phosphorus concentrations stabilized on values around 3000 mg P kg DW-1 and did not diminish further, even after the second phase of infrastructural interventions carried out in the second half of the 2000s. This was related to the increasing relative impact of the combined sewer overflows in the sewage system and to the strong phosphorus enrichment of the basin. Most of the phosphorus was in inorganic forms (86% of the total) that have been identified as the final target of the domestic effluent inputs. The contribution of organic phosphorus was lower but constant over the period 1962-2011. It likely originated from the agricultural areas located south of the city of Milan. In conclusion, this study underlines how past interventions have been effective in reducing urban point sources but it also highlights the current difficulties related to the growing importance of other sources influenced by the surface runoff (i.e., combined sewer overflows and agriculture). The study also emphasizes a general phosphorus enrichment of the Lambro River basin and its impact on the Po River and the Adriatic Sea.



### Plastic sources: A survey across scientific and grey literature for their inventory and relative contribution to microplastics pollution in natural environments, with an emphasis on surface water

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** SCIENCE OF THE TOTAL ENVIRONMENT, 2019, 693, 133499, DOI: 10.1016/j.scitotenv.2019.07.305

**Autori:** Galafassi, S; Nizzetto, L; Volta, P

**Abstract ITA:** I rifiuti plastici sono attualmente riconosciuti come una potenziale minaccia emergente per gli ambienti naturali, la fauna selvatica e gli esseri umani. Negli ultimi anni è stata rivolta una crescente attenzione allo studio della presenza della plastica negli ecosistemi, comprese le acque superficiali. La letteratura scientifica ne descrive l'ingestione da parte della fauna acquatica, il trasferimento nelle reti alimentari e la potenziale azione come vettore di composti tossici o microrganismi alieni. Sebbene la comunità scientifica stia affrontando questo problema con notevole impegno, molte domande rimangono aperte. In particolare, sono state recentemente riconosciute nuove fonti di microplastiche, che potrebbero rappresentare importanti input ambientali rispetto a quelli precedentemente considerati. Oltre alle fonti già note come lo sgretolamento di frammenti plastica abbandonate in ambiente e microsfere rilasciate dai prodotti per la cura della persona, le microplastiche possono essere rilasciate anche dal lavaggio di indumenti sintetici, dall'abrasione degli pneumatici e dall'erosione di diversi tipi di vernici. Questa pubblicazione cerca di enumerare in modo esaustivo tutte le possibili fonti ambientali di plastica e microplastica che sono state identificate finora e di riportare valutazioni quantitative dei loro input riportate nella letteratura scientifica e nei report tecnici, con una particolare attenzione alle acque superficiali.

**Abstract ENG:** Plastic debris are at present recognized as an emerging potential threat for natural environments, wildlife and humans. In the past years an increasing attention has been addressed to investigate the presence and concentration of plastic debris in the ecosystems, including surface waters. Scientific literature extensively describes the ingestion by aquatic fauna, the transfer into food webs and the potential action as a vector for toxic compounds or alien microorganisms. Although the scientific community addresses this issue with considerable effort, many questions remain open. In particular, new sources of microplastics have been recently recognized, possibly representing major environmental inputs compared to those previously considered. In addition to the already renowned sources such as the embrittlement of plastic litter and microbeads released from personal care products, microplastic can be released also by washing of synthetic clothes, abrasion of vehicles tyres and from the weathering of different kind of paints. This review tries to exhaustively enumerate all the possible sources of plastic litter that have been identified so far and to report quantitative assessments of their inputs on microplastics pollution to natural environments reported in scientific and grey literature, with an emphasis on surface waters.

### Recent environmental changes inferred from sediments in a shallow lake of the Argentinian pampas

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** JOURNAL OF PALEOLIMNOLOGY, 2019, 61, 37–52, DOI: 10.1007/s10933-018-0043-y

**Autori:** Plastani, MS; Laprida, C; de Oca, FM; Massaferro, J; Panarello, HO; Mercau, JR; Lami, A

**Abstract ENG:** The Pampas are fertile lowland plains that extend across east-central Argentina and are renowned for their agricultural importance. The low geomorphologic relief of the region accounts for the occurrence of numerous shallow lakes whose sediments constitute paleoenvironmental archives of the outcomes of natural processes and human activities in the Pampas. We identified the main forcing factors behind hydrological shifts during the past ca. 200 years in La Barrancosa, a shallow lake located in the southeastern Pampas. The data provide a historical context to better understand environmental changes in the area during the twentieth century. Variations in biological (ostracods, chironomids and pigments), geochemical and sedimentological variables were interpreted in terms of lake level and trophic state changes. The low diversity of biological assemblages and the autoecology of the ostracod and chironomid taxa suggest that during parts of the record assigned to the nineteenth century, near the end of the Little Ice Age, La Barrancosa was a shallow, ephemeral, subsaline wetland, indicating drier-than-present conditions. Thereafter, a hiatus from ca. AD 1860-1940 is attributed to denudation processes during the Pampas Dust Bowl drought of the 1930s. The onset of wetter conditions around 1940 brought higher lake levels and establishment of a perennial shallow lake, inferred mostly from shifts in sedimentological and geochemical variables. Marked variations in fossil pigments and in ostracod and chironomid assemblages reveal that the basin shifted from being endorheic to arheic around 1970, in spite of increased precipitation, forced by changes in global circulation patterns. This shift coincided with an inferred increase in primary production and was coeval with profound land use changes and technological innovations in the region. Further changes in sedimentological, geochemical and biological variables indicate that eutrophication accelerated from 1990 onwards, most likely as a consequence of the increase in planted area around the lake, massive application of fertilizer, and cultivation of pesticide-intensive transgenic soybeans. This study provides an historical perspective into ongoing environmental deterioration of shallow lakes in the Argentinian Pampas.

## Reconstruction of trophic state shifts over the past 90 years in a eutrophicated lake in western Switzerland, inferred from the sedimentary record of photosynthetic pigments

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** JOURNAL OF PALEOLIMNOLOGY, 2019, 61, 129–145, DOI: 10.1007/s10933-018-0049-5

**Autori:** Makri, S; Lami, A; Lods-Crozet, B; Loizeau, JL

**Abstract ENG:** Anthropogenic eutrophication can initiate vast and persistent ecosystem state changes in lakes. Such changes may be characterized by increased phytoplankton taxa variability, which can affect the effectiveness and time of lake recovery mechanisms. Lake Morat in Switzerland has undergone intense eutrophication in the twentieth century (phosphorous concentrations up to 150 mu g L-1) caused by excessive nutrient loadings from agricultural intensification and urbanization. Phosphorous reduction measures since 1986, such as the ban of phosphates in detergents and decreased use of fertilizers in agriculture, have resulted in total phosphorous concentrations up to 20 mu g L-1 today. Despite this drastic reduction of total phosphorous, total biomass production stays high. We investigate historical changes in the phytoplankton community during the eutrophication and re-oligotrophication periods by comparing historical limnological data with sediment pigment concentrations measured by HPLC and other geochemical proxies in a radiodated sediment core. For the last 90 years, we identified four major trophic state changes in Lake Morat. The first period (AD 1924-1937) is characterized by low pigment concentrations and nutrient inputs, with good oxygen conditions. This section represents trophic conditions before the intensive eutrophication phase. The second period (AD 1937-1970) revealed an abrupt increase in pigment concentrations with higher primary production, cyanobacteria dominance and reduced oxygen levels. Oscillaxanthin indicated a Planktothrix rubescens dominance (AD 1954-1970) with concentrations up to 800 nmol g(-1) OM. Their decline after AD 1970 suggests the initiation of an intense eutrophication phase (AD 1970-1983) associated with the dominance of other cyanobacteria species, higher total phosphorous inputs, and intense anoxia. In the restoration period (AD 1983-2014), there was a shift in the phototrophic community from cyanobacteria to green algae dominance, yet some cyanobacteria species remain present. Rapid phytoplankton community changes were identified in the studied period, yet overall primary production response was low. Limnological data revealed a delay of phosphorous reduction due to phosphorous recycling from the sediments. The observation of complex lake ecosystem reactions to prolonged eutrophication and subsequent re-oligotrophication, as shown by the paleolimnological and limnological data in this study, emphasize the importance of careful lake management to revert eutrophication back to historical reference biomass values.

## Research priorities for freshwater mussel conservation assessment

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** BIOLOGICAL CONSERVATION, 2019, 231, 77-87, DOI: 10.1016/j.biocon.2019.01.002

**Autori:** Ferreira-Rodriguez, N; Akiyama, YB; Aksenova, OV; Araujo, R; Barnhart, MC; Bespalaya, YV; Bogan, AE; Bolotov, IN; Budha, PB; Clavijo, C; Clearwater, SJ; Darrigran, G; Do, VT; Douda, K; Froufe, E; Gumpinger, C; Henrikson, L; Humphrey, CL; Johnson, NA; Klishko, O; Klunzinger, MW; Kovitvadhi, S; Kovitvadhi, U; Lajtner, J; Lopes-Lima, M; Moorkens, EA; Nagayama, S; Nagel, KO; Nakano, M; Negishi, JN; Ondina, P; Oulasvirta, P; Prie, V; Riccardi, N; Rudzite, M; Sheldon, F; Sousa, R; Strayer, DL; Takeuchi, M; Taskinen, J; Teixeira, A; Tiemann, JS; Urbanska, M; Varandas, S; Vinarski, MV; Wicklow, BJ; Zajac, T; Vaughn, CC

**Abstract ENG:** Freshwater mussels are declining globally, and effective conservation requires prioritizing research and actions to identify and mitigate threats impacting mussel species. Conservation priorities vary widely, ranging from preventing imminent extinction to maintaining abundant populations. Here, we develop a portfolio of priority research topics for freshwater mussel conservation assessment. To address these topics, we group research priorities into two categories: intrinsic or extrinsic factors. Intrinsic factors are indicators of organismal or population status, while extrinsic factors encompass environmental variables and threats. An understanding of intrinsic factors is useful in monitoring, and of extrinsic factors are important to understand ongoing and potential impacts on conservation status. This dual approach can guide conservation status assessments prior to the establishment of priority species and implementation of conservation management actions.

## Seasonality of the antibiotic resistance gene bla(CTX-M) in temperate Lake Maggiore

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** HYDROBIOLOGIA, 2019, 843, 143–153, DOI: 10.1007/s10750-019-04043-w

**Autori:** Eckert, EM; Di Cesare, A; Malki, LS; Villiger, J; Pernthaler, J; Callieri, C; Bertoni, R; Corno, G

**Abstract ENG:** The beta lactamase gene bla(CTX-M), responsible of the resistance to cephalosporins, has been detected in microbes from hospitals to open waters. We studied the seasonality and stability of bla(CTX-M) in Lake Maggiore over 3 years and the role of potential inputs of allochthonous bacteria and/or antibiotic pollution in promoting its occurrence. bla(CTX-M) was mainly present from January to July in the pelagic microbial community and the gene occurrence was significantly related to low water temperature. To evaluate its temporal stability in the bacterial community over a short period, we measured bla(CTX-M) daily over the course of 6 days. The gene was below the limit of quantification except for one sampling when its abundance peaked, suggesting a point contamination. The bacterial community of the lake in which bla(CTX-M) was detected suggests that at least two distinct bacterial populations contained the gene. The occurrence of known bla(CTX-M) containing genera and the occurrence of the gene, however, did not overlap. Furthermore, the experimental addition of cefotaxime to lake water incubations did not promote abundance of the gene. These data imply that bla(CTX-M) was present in the environmental microbial community. Increases of gene abundances were likely caused by environmental parameters other than antibiotic contamination.

## Staying young and fit? Ontogenetic and phylogenetic consequences of animal anhydrobiosis

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** JOURNAL OF ZOOLOGY, 2019, 309, 1–11, DOI: 10.1111/jzo.12677

**Autori:** Kaczmarek, L; Roszkowska, M; Fontaneto, D; Jezierska, M; Pietrzak, B; Wieczorek, R; Poprawa, I; Kosicki, JZ; Karachitos, A; Kmita, H

**Abstract ENG:** Although gradual deterioration of life functions with age is not a fundamental rule, it is pervasive among living organisms, regardless of their mode of reproduction and the number of constituent cells. However, deterioration can be temporarily arrested or slowed down due to the process of anhydrobiosis. Two modes of anhydrobiosis can be distinguished for the developmental and adult stages of animals. Developmental resting stages are reported for different animals, including sponges (Porifera), stingers (Cnidaria), flatworms (Platyhelminthes), insects (Insecta), copepods (Copepoda) and branchiopods (Branchiopoda). However, anhydrobiosis occurring at any stage of animal life, including adults, is found only in a few invertebrate phyla, namely roundworms (Nematoda), wheel animals (Rotifera) and water bears (Tardigrada). Notably, in the second group anhydrobiosis has been proposed to eliminate or slow-down aging symptoms. This, in turn, may correlate with higher fitness and fecundity, and increased offspring longevity. We present available data concerning anhydrobiosis of tardigrades, bdelloid rotifers and nematodes, the only animals known to be capable of anhydrobiosis as adult individuals. The impact of anhydrobiosis on animal aging is illustrated by two models based on experimental data, namely the Sleeping Beauty and Picture of Dorian Grey models. According to the Sleeping Beauty model, anhydrobiotic organisms do not age during anhydrobiosis, whereas the Picture of Dorian Grey model predicts that the anhydrobiotic organism ages, at least during the initial stage of anhydrobiosis. Finally, we discuss possible implications of these models for individual longevity and survival as well as phenotypic diversity of taxa and their evolution. A better understanding of life strategies of anhydrobiotic animals both at the ontogenetic and phylogenetic levels can provide answers to many fundamental questions and useful practical outputs in branches of applied sciences.

## Target and suspect contaminants of emerging concern in the Po River Delta lagoons

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** ESTUARINE COASTAL AND SHELF SCIENCE, 2019, 230, 106424, DOI: 10.1016/j.ecss.2019.106424

**Autori:** Mascolo, G; Murgolo, S; Stefani, F; Viganò, L

**Abstract ENG:** A comprehensive analytical screening has been applied for the first time to surficial sediment samples collected from seven lagoons of the Po River Delta. This screening has been used to gain further insights into the exposure conditions potentially present in the Po lagoons. Despite a certain degree of variability was observable within the lagoons, this study confirmed the general tendency that the northernmost Caleri lagoon is less contaminated than the other lagoons of the delta, which conversely are more exposed to river waters and particularly to the Po River. This screening identified 23 suspect and 8 target contaminants in the investigated lagoons. The target contaminants were quantified by means of authentic analytical standards, and showed concentration values ranging from 0.01 ng/g for irbesartan, to 80 ng/g for DEET, respectively. The surveyed molecules included pharmaceuticals, industrial chemicals, personal care products, pesticides as well as illicit substances mainly originating from inland waters and the anthropic activities of their (sub)basins. Notably, many of these chemicals, such as flame retardants (TPhP, TCEP, TCPP), phthalates (DnBP, DiBP, DnOP), synthetic hormones (norethisterone, trenbolone) and several parabens (methyl-, ethyl-, butylparaben) are endocrine disruptors and have been detected in all Po Delta lagoons. This study showed that the lagoons of the Po Delta are exposed to a multitude of chemicals substances whose multiple interactions are very likely. As suggested by other studies conducted in this area, the disrupting activities of chemicals capable to interfere with the endocrine system of aquatic organisms should be thoroughly investigated.

## TEP production under oxidative stress of the picocyanobacterium Synechococcus

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** JOURNAL OF LIMNOLOGY, 2019, 78, 3, 271-283, DOI: 10.4081/jlimnol.2019.1907

**Autori:** Callieri, C; Sathicq, MB; Cabello-Yeves, PJ; Eckert, EM; Hernandez-Aviles, JS

**Abstract ENG:** Transparent exopolymer particles (TEP) are mainly acidic polysaccharides directly or indirectly formed by phytoplankton and bacteria. These particles are often colonized by picoplankton and considered a hot spot for microbial activity. Recent studies suggested an important role of Synechococcus in TEP production found in lakes and prompted us to further investigate this issue using monoclonal xenic cultures of Synechococcus. We tested TEP production under oxidative stress in two treatments, one with hydrogen peroxide and another treated with ultraviolet radiation (UVR) and high photosynthetic active radiation (PAR), compared with an unstressed control. Our results showed a cell-normalized TEP production, ranging from 12 to 238 ng C cell(-1) among strains, not only under stress but also in the control with non-limiting nutrients. Our data prove that freshwater communities of Synechococcus and their associated heterotrophic microflora, are capable of producing TEP even during growth phase. The oxidative stress induced extra production of TEP up to 400 ng C cell(-1) in one of our phycocyanin-type (PC) strain. The phycoerythrin-type (PE) strains increased TEP production, particularly under UV-PAR stress, whereas the PC strains did it under H2O2 stress. This study provides new perspectives on the potential role of freshwater Synechococcus in TEP production.

## The mesopelagic anoxic Black Sea as an unexpected habitat for Synechococcus challenges our understanding of global deep red fluorescence

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** ISME JOURNAL, 2019, 13, 1676–1687, DOI: 10.1038/s41396-019-0378-z

**Autori:** Callieri, C; Slabakova, V; Dzhembekova, N; Slabakova, N; Peneva, E; Cabello-Yeves, PJ; Di Cesare, A; Eckert, EM; Bertoni, R; Corno, G; Salcher, MM; Kamburska, L; Bertoni, F; Moncheva, S

**Abstract ENG:** The Black Sea is the largest meromictic sea with a reservoir of anoxic water extending from 100 to 1000 m depth. These deeper layers are characterised by a poorly understood fluorescence signal called deep red fluorescence, a chlorophyll a-(Chl a) like signal found in deep dark oceanic waters. In two cruises, we repeatedly found up to 10(3) cells ml(-1) of picocyanobacteria at 750 m depth in these waters and isolated two phycoerythrin-rich Synechococcus sp. strains (BS55D and BS56D). Tests on BS56D revealed its high adaptability, involving the accumulation of Chl a in anoxic/dark conditions and its capacity to photosynthesise when re-exposed to light. Whole-genome sequencing of the two strains showed the presence of genes that confirms the putative ability of our strains to survive in harsh mesopelagic environments. This discovery provides new evidence to support early speculations associating the deep red fluorescence signal to viable picocyanobacteria populations in the deep oxygen-depleted oceans, suggesting a reconsideration of the ecological role of a viable stock of Synechococcus in dark deep waters.

## The pre-79 CE alluvial environment south of Pompeii's city walls

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** GEOARCHAEOLOGY-AN INTERNATIONAL JOURNAL, 2019, 34 (6), 727-744, DOI: 10.1002/gea.21737

**Autori:** Nicosia, C; Bonetto, J; Furlan, G; Musazzi, S

**Abstract ENG:** The environment in the suburban area of Pompeii between Porta Marina and Porta Stabia at the time of the 79 CE volcanic event was investigated by means of a series of core drillings. These revealed the presence of a ubiquitous dark brown layer (referred to as Phase 2 interval) immediately below the 79 CE eruption deposits. Its stratigraphic interpretation relied on 14C dates, diatom analysis and micromorphology, and on comparisons and correlations with the available stratigraphic logs and excavation data. Phase 2 interval represents the sedimentary accretion that took place from ca. 900-750 cal a BCE to 79 CE. Its formation is the result of periodic flooding by the Sarno river in this distal reach of its floodplain (i.e., backswamps). The resulting picture is that of a patchy environment with weakly developed alluvial soil juxtaposed to areas with stagnating waters. No indication of artificial or natural watercourses derived from the Sarno river, of navigable lagoons, or of harbor basins was found.

## We are ready for faunistic surveys of bdelloid rotifers through DNA barcoding: the example of Sphagnum bogs of the Swiss Jura Mountains

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** LIMNETICA, 2019, 38 (1), 213-225 , DOI: 10.23818/limn.38.02

**Autori:** Fontaneto, D; Eckert, EM; Anicic, NE; Lara, E; Mitchell, EAD

**Abstract ENG:** The identification of biological diversity through DNA barcoding and metabarcoding of the organisms living in the field has the potential to revolutionise the way biological surveys and monitoring are performed. Yet, we still do not know if the current representativeness of the reference database of DNA sequence data is sufficient to allow such approaches. Here, we show that, at least for bdelloid rotifers (Metazoa, Rotifera, Bdelloidea) in Europe, current knowledge is ripe to perform such surveys. We show the results of an exercise performed on bdelloid rotifers in Sphagnum bogs of the Swiss Jura Mountain. The results of DNA-based identifications were rather consistent with the morphology-based identifications, and the few cases of mismatch could be used as a cautionary tale to avoid potential misinterpretations of results. The mismatches were due to cases of the closest match not being genetically very close, and to the occurrence of cryptic species.

## Widespread diminishing anthropogenic effects on calcium in freshwaters

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** SCIENTIFIC REPORTS, 2019, 9, 10450, DOI: 10.1038/s41598-019-46838-w

**Autori:** Weyhenmeyer, GA; Hartmann, J; Hessen, DO; Kopacek, J; Hejzlar, J; Jacquet, S; Hamilton, SK; Verburg, P; Leach, TH; Schmid, M; Flaim, G; Noges, T; Noges, P; Wentzky, VC; Rogora, M; Rusak, JA; Kosten, S; Paterson, AM; Teubner, K; Higgins, SN; Lawrence, G; Kangur, K; Kokorite, I; Cerasino, L; Funk, C; Harvey, R; Moatar, F; de Wit, HA; Zechmeister, T

**Abstract ENG:** Calcium (Ca) is an essential element for almost all living organisms. Here, we examined global variation and controls of freshwater Ca concentrations, using 440 599 water samples from 43 184 inland water sites in 57 countries. We found that the global median Ca concentration was 4.0 mg L-1 with 20.7% of the water samples showing Ca concentrations <= 1.5 mg L-1, a threshold considered critical for the survival of many Ca-demanding organisms. Spatially, freshwater Ca concentrations were strongly and proportionally linked to carbonate alkalinity, with the highest Ca and carbonate alkalinity in waters with a pH around 8.0 and decreasing in concentrations towards lower pH. However, on a temporal scale, by analyzing decadal trends in > 200 water bodies since the 1980s, we observed a frequent decoupling between carbonate alkalinity and Ca concentrations, which we attributed mainly to the influence of anthropogenic acid deposition. As acid deposition has been ameliorated, in many freshwaters carbonate alkalinity concentrations have increased or remained constant, while Ca concentrations have rapidly declined towards or even below pre-industrial conditions as a consequence of recovery from anthropogenic acidification. Thus, a paradoxical outcome of the successful remediation of acid deposition is a globally widespread freshwater Ca concentration decline towards critically low levels for many aquatic organisms.

## Different trends of neighboring populations of Lesser Kestrel: Effects of climate and other environmental conditions

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** POPULATION ECOLOGY, 2019, 61 (3), 300-314, DOI: 10.1002/1438-390X.1032

**Autori:** Morganti, M; Ambrosini, R; Sara, M

**Abstract ENG:** The sensitivity of population trends to the climate and environment is generally considered a species-specific trait. However, evidence that populations may show different responses to the climate and environmental conditions is growing. Whether this differential sensitivity may arise even among neighboring populations remains elusive. We compared the trends of two neighboring populations of the Lesser Kestrel Falco naumanni, using data from a 12-year survey of 158 colonies in Sicily, Italy; the two populations inhabiting a lowland and an highland area, respectively. Population trends were modeled through the TRIM algorithms implemented in R (package rtrim). A reversed U-shaped population trend was observed in the lowland, while the highland population showed oscillations around a stable trend. Sahel rainfall 2 years before each annual survey significantly affected population variation in the lowland, while rainfall in March and an index of primary productivity in the breeding areas affected population variation in the highland. This suggests that the population in the lowland may be limited mainly by winter survival in Sahel, because the lowland may be an optimal breeding area for this species. In contrast, the highland population, which occupies a different part of the climatic niche of the species, may be limited mainly by reproductive output, because rainfall in March and the primary productivity in May could represent prey availability immediately before and during the breeding months. Overall, our findings suggest that population-specific environmental sensitivity might occur even over small (<100 km) geographical scales, highlighting the need for population-specific conservation strategies.

## Multi-species habitat models highlight the key importance of flooded reedbedsfor inland wetland birds: implications for management and conservation

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** AVIAN RESEARCH, 2019, 10 (15), DOI: 10.1186/s40657-019-0154-9

**Autori:** Morganti, M; Manica, M; Bogliani, G; Gustin, M; Luoni, F; Trotti, P; Perin, V; Brambilla, M

**Abstract ENG:** BackgroundInland wetlands are crucial for biodiversity conservation, especially in highly-urbanized landscapes. In the European Union, many wetlands are included in the EU Natura 2000' network, the main tool for biodiversity conservation over the continent, which requires the development of site-specific management plans. Clear and feasible recommendations are necessary to provide site managers with effective tools for the maintenance of biodiversity in these unstable environments. Birds are excellent umbrella species, therefore a management targeted at increasing habitat suitability for focal bird species would likely benefit broader wetland biological communities. MethodsDuring spring-summer 2017, we collected presence/absence data for 10 bird species of conservation interest at a site scale for 21 Natura 2000 sites. We also carried out a point count survey to detect presence/absence of four reedbed-dwelling species at 75 points. At the site level, we estimated landscape characteristics from regional GIS-layers, whereas fine-scaled habitat composition was recorded on the field within a 100m-buffer around the 75 points. We analysed the effect of the extent of different habitats on species' occurrence probability by means of multi-species binomial multivariate adaptive regression splines (MARS) at both scales. We also run species-specific MARS models to compare their performance with those of multi-species models.ResultsAt the site scale, the extent of the reedbeds/mires was positively associated with the occurrence of all species of conservation concern. At the point-count scale, reedbed extent positively predicted species' occurrence, but only in presence of patches of clear shallow water. Species-specific MARS models showed qualitatively similar results for some species, but generally were outperformed by multi-species ones.ConclusionsMulti-species MARS models confirmed to be an efficient tool in disclosing species-habitat relationships even for set of species including scarce taxa and when only short-term monitoring data are available. In terms of conservation measures, our findings stress the importance of Phragmites australis reedbed as a key habitat for avian biodiversity, but only when it is flooded and interspersed with scattered patches of open water. The preservation of wide (>100/150ha) and flooded reedbeds structured in spots of no less than 2ha emerges as the main conservation measure for the long-term conservation of the threatened avifauna of inland pre-Alpine wetlands.

## Sulfamethoxazole persistence in a river water ecosystem and its effects on the natural microbial community and Lemna minor plant

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Microchemical Journal 149 (2019) 103999 doi: 10.1016/j.microc.2019.103999

**Autori:** Grenni P, Rauseo J, Spataro F, Di Lenola M, Patrolecco L, Zacchini M, Pietrini F, Di Baccio D, Stanton IC, Gaze WH, Barra Caracciolo A

**Abstract ENG:** Sulfamethoxazole (SMX) is a sulfonamide antibiotic commonly used in human and veterinary medicine and frequently detected in surface water as a micro-contaminant. The presence of this antibiotic and its main transformation product N4-acetyl-sulfamethoxazole (Ac-SMX) was evaluated in an Italian river water by Solid Phase Extraction (SPE) and subsequent LC MS/MS determination. River water microcosm experiments were set up in the presence and absence of duckweed (Lemna minor L.) adding SMX (500 μg L−1) with the aim of evaluating the persistence of antibiotic and its effects on both the microbial community naturally occurred in a river and the plant. The concentrations of SMX and Ac-SMX were measured at fixed times over a period of 28 days. The microbial abundance, intI1 gene and plant morphophysiological analyses were also conducted. In the river water samples, SMX was not detected as a parent compound, but its acetylate metabolite Ac-SMX was found as a micro-contaminant. The results of the microcosm experiment showed that SMX did not substantially degrade, except in the presence of L. minor where a slight decrease (17%) was observed. The river residual concentration of Ac-SMX remained quite constant during the experimental period. The river microbial community was initially affected by adding the antibiotic with a decrease in its abundance; however, although it was not able to degrade SMX, it displayed an overall antibiotic resistance. In fact, the intI1 gene was found throughout the entire experimental period. Finally, SMX did not cause evident inhibition or suffering symptoms for the plant.

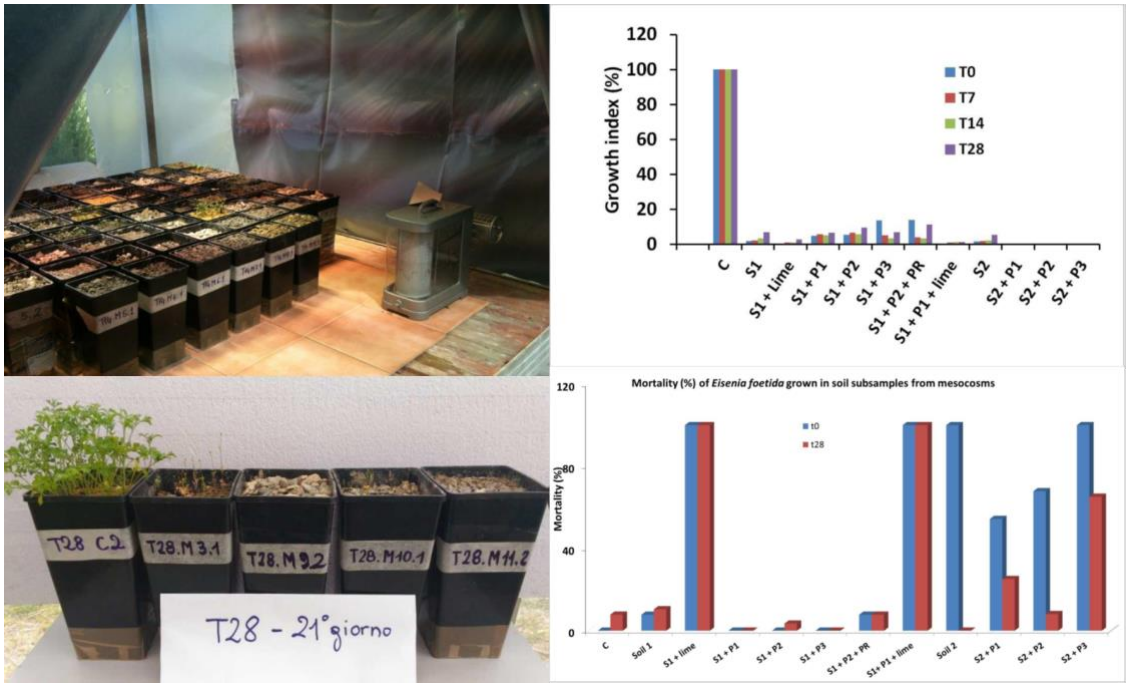
## Ecotoxicity of foaming agent conditioned soils tested on two terrestrial organisms

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Environmental Engineering and Management Journal (2019) 18 (8):1703-1710. doi: 10.30638/EEMJ.2019.160

**Autori:** Galli E, Muzzini VG, Finizio A, Fumagalli P, Grenni P, Barra Caracciolo A, Rauseo J, Patrolecco L

**Abstract ENG:** Huge amounts of soil debris are produced during the underground excavation with Earth Pressure Balance-Tunnel Boring Machines (EPB-TBM). Soil debris may contain residual concentrations of the anionic surfactant sodium lauryl ether sulphate (SLES), the main component in some foaming agents used as excavation additives. The reuse of this debris or its discharge as waste is a critical environmental question in construction engineering. There are only few studies on ecotoxicological effects on soil debris coming from a real excavation site. The aim of this study was to evaluate the ecotoxicity of two deep soils, with different lithological compositions, conditioned with three foaming agents. In some cases, lime was added to the soil. The soils were placed in mesocosms (1 m3) to simulate the temporary storage of the soil debris at a construction site. At fixed times, soil sub-samples were collected and ecotoxicological tests on terrestrial organisms (Lepidium sativum, Eisenia foetida) and an assessment of SLES concentration were performed with soils and aqueous elutriates produced from them. Results showed that at day 28, a SLES reduction was observed in both the soil and aqueous elutriates, with various rates of decrease. The differences were due to different soil lithological compositions and foaming agent products composition. In general, the two soils were not suitable for both plant growth and earthworm reproduction, but in Soil 1 the earthworm mortality was very low, except when lime was added. Tests with soil elutriates showed that 7 days after conditioning no toxic effect was found for the organisms tested.



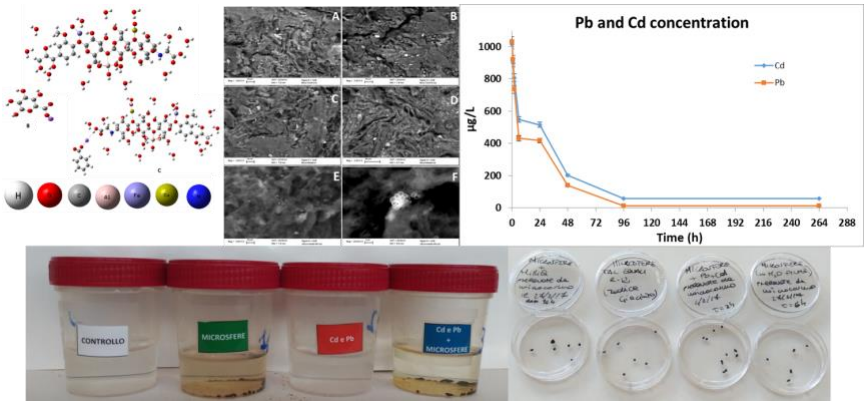
## Effectiveness of a new green technology for metal removal from contaminated water

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Microchemical Journal (2019) 147: 1010-1020. doi:10.1016/j.microc.2019.04.026

**Autori:** Grenni P, Barra Caracciolo A, Mariani L, Cardoni M, Riccucci C, Elhaes H, Ibrahim MA

**Abstract ENG:** Water pollution by heavy metals is a matter of growing concern due to their potential toxicity for biota. The development of new and cost-effective remediation strategies is a priority in this field. For this purpose, a green technology, consisting of organic waste made up of a composite of water hyacinth dry matter and sodium alginate in microsphere form, was tested for its potential to adsorb lead and cadmium in river water samples. The water hyacinth-sodium alginate composite molecular conformation was analysed first in order to obtain the potential energy surfaces. A high dipole moment, useful for the adsorption of heavy metals, was found. Accordingly, the cross-linked microspheres were prepared by combining water hyacinth dry matter and sodium alginate in a 1:1 ratio. Their metal adsorption and any effect on the natural microbial river community were verified with laboratory microcosm experiments lasting 11 days, using river water spiked with lead and cadmium (1 mg/L each). For this purpose, chemical (metal concentrations) and microbial (microbial abundance, viability and taxonomic composition) analyses were performed. Moreover, the ecotoxicity (with Vibrio fischeri - ISO 11348-3:2007) of water samples from microcosms in the presence/absence of the microspheres and metals was assessed. Effective concentrations (EC20 and EC50) of Pb and Cd were also determined. Finally, electron microscopy analyses were performed with a Field Emission Scanning Electron Microscope (FE-SEM) to visualize the metal adsorption capacity of the microspheres and investigate the metal distribution on the spheres (adsorbed on the surface or inside). The overall results showed that the microspheres were able to remove high heavy metal concentrations (about 1 mg/L) from river water in a short time (at 96 h just 1.3% and 5.8% of the Pb and Cd initial concentrations were detected) and no ecotoxicological effects were recorded. Moreover, the microspheres had a positive effect on the microbial community by promoting an increase in live cell numbers, probably through the release of organic carbon. Further analyses (at about four months) showed that the microspheres were able to keep metals adsorbed for a long time. These results show that the green technology proposed is an effective remediation method for Pb and Cd removal from river water and is very promising, not least because of its low cost.



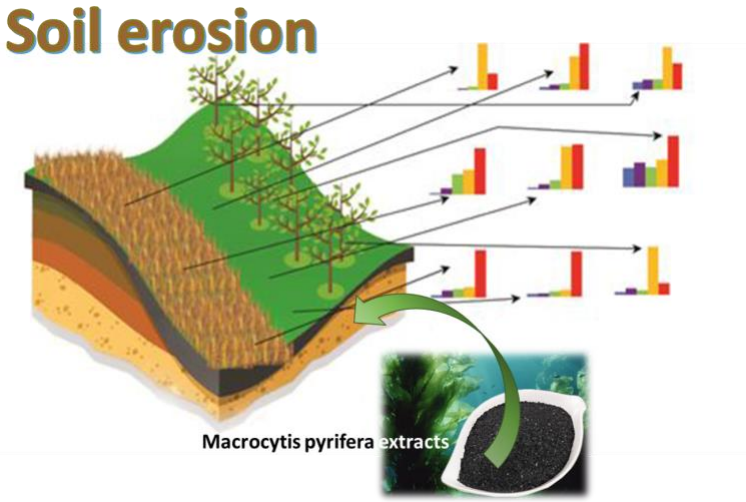
## Biological indicators for evaluating soil quality improvement in a soil degraded by erosion processes

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Journal of Soils and Sediments (2019), 19 (5), 2393–2404 doi:10.1007/s11368-018-02236-9.

**Autori:** Onet A, Dincă LC, Grenni P, Laslo V, Teusdea AC, Vasile DL, Enescu RE, Crisan VE

**Abstract ENG:** Purpose Erosion is one of the main soil degradation problems. It diminishes soil biological activity and therefore its quality. The aim of the study was to evaluate if the application of two biostimulation processes could significantly increase biological activity, and therefore productivity, in soils deteriorated by erosion. This was done without synthetic fertilizers but with treatments accessible for farmers, in line with the 2030 Agenda for Sustainable Development. In particular, the addition of a soil microorganism suspension or Macrocystis pyrifera algae concentrate was evaluated. Materials and methods Soil samples were taken from a field area (Bihor County, Romania) affected by surface erosion processes. In particular, microbial mass, dehydrogenase activity (DHA), and the bacteria and fungi presence were analyzed for three soil uses (corn, black locust and uncultivated field with terracing) and in different locations (above a slope, at the midpoint and below it). A bio-stimulation process (addition of a microbial suspension or seaweed concentrate based on the Macrocystis pyrifera algae; incubation for 24 h) was used in order to improve the activity of the soil with the lowest values of activity. Results and discussion Statistical differences in DHA, bacterial numbers, and microbial biomass were found depending on field use and the areas from which the soil samples were gathered. Higher values of the biological parameters were in general recorded in the middle part of the slope, because they favor bioaccumulation processes (e.g., actual and potential dehydrogenase activity values of about 3 mg TPF/10 g dry soil). The use of microbial suspensions did not significantly stimulate DHA for the soils with a low biological potential. This activity was stimulated by adding the seaweed concentrate to the soil. Conclusions The use of the seaweed concentrate can be a good practice for improving activity in eroded soil. The study provides useful indications for better soil fertility management, in line with many of the goals of the 2030 Agenda For Sustainable Development.



## The contrasting evolution of twin volcanic lakes (Monticchio, Mt. Vulture, Italy) inferred from literature records

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Advances in Oceanography and Limnology, 2019, 10 (1), doi: 10.4081/aiol.2019.7949

**Autori:** Renato Spicciarelli, Aldo Marchetto

**Abstract ENG:** Lago Piccolo and Lago Grande di Monticchio lie in the collapsed caldera of the volcanic structure of Mt. Vulture (Basilicata, Italy). In over two centuries, a number of studies on their water and on their submerged and riparian vegetation, were carried out, demonstrating an interesting biodiversity. The entire lake area, which is impacted by strong tourist pressure, is part of the "Monte Vulture" Special Area of Conservation (SAC IT9210210). The aim of this paper is to review the literature studies on these lakes, in order to identify the more suitable limnological parameters to infer the history of the trophic status of the two lakes. For this reason, we assess the current ecological status of the two lakes on the basis of physical, chemical and biological analyses deriving from two recent surveys carried out in 2005-2007 and in 2015, and compare these data with sparse, but relevant, historical records, in order to assess how human impacts affected both these lakes and to understand the differences in their present trophic status. Because of its peculiar water chemistry, Lago Piccolo is resulted in good and stable ecological conditions. On the contrary, water transparency of Lago Grande came out very low in summer, while total phosphorus and nitrogen concentration are proved high, leading to the persistence of critical environmental conditions in this lake, with high algal biomass and durable algal blooms in late summer, dominated by cyanobacteria.

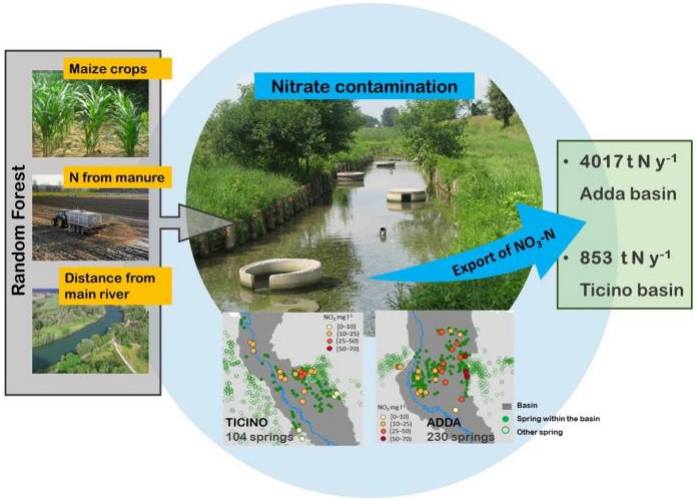
## Dynamic of nitrogen and dissolved organic carbon in an alpine forested catchment: Atmospheric deposition and soil solution trends

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Nature Conservation, 2019, 34, 41–66, 10.3897/natureconservation.34.30738

**Autori:** Balestrini, R., Delconte, C.A., Buffagni, A., Fumagalli, A., Freppaz, M., Buzzetti, I., Calvo, E.

**Abstract ENG:** A number of studies have reported decreasing trends of acidifying and N deposition inputs to forest areas throughout Europe and the USA in recent decades. There is a need to assess the responses of the ecosystem to declining atmospheric pollution by monitoring the variations of chemical species in the various compartments of the forest ecosystem on a long temporal scale. In this study, we report on patterns and trends in throughfall deposition concentrations of inorganic N, dissolved organic N (DON) and C (DOC) over a 20-year (1995–2015) period in the LTER site -Val Masino (1190 m a.s.l.), a spruce forest, in the Central Italian Alps. The same chemical species were studied in the litter floor leachates and mineral soil solution, at three different depths (15, 40 and 70 cm), over a 10-year period (2005–2015). Inorganic N concentration was drastically reduced as throughfall and litter floor leachates percolated through the topsoil, where the measured mean values (2 µeq L-1) were much lower than the critical limits established for coniferous stands (14 µeq L-1). The seasonal temperature dependence of throughfall DOC and DON concentration suggests that the microbial community living on the needles was the main source of dissolved organic matter. Most of DOC and DON infiltrating from the litter floor were retained in the mineral soil. The rainfall amount was the only climatic factor exerting a control on DOC and N compounds in throughfall and forest floor leachates over a decadal period. Concentration of SO4 and NO3 declined by 50% and 26% respectively in throughfall deposition. Trends of NO3 and SO4 in forest floor leachates and mineral soil solution mirrored declining depositions. No trends in both DON and DOC concentration and in DOC/DON ratio in soil solutions were observed. These outcomes suggest that the declining NO3 and SO4 atmospheric inputs did not influence the dynamic of DON and DOC in the Val Masino forest. The results of this study are particularly relevant, as they are based on a comprehensive survey of all the main compartments of the forest ecosystem. Moreover, this kind of long-term research has rarely been carried out in the Alpine region.



## Climatic and pedoclimatic factors driving C and N dynamics in soil and surface water in the alpine tundra (NW-Italian Alps)

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Nature Conservation, 2019, 4, 67–90, https://doi.org/10.3897/natureconservation.34.30737

**Autori:** Freppaz, M., Viglietti, D., Balestrini, R., Lonati, M., Colombo, N.

**Abstract ENG:** In alpine tundra the interannual and seasonal variability of C and N forms in soil and lake water during the short snow-free season could be significant and related to climatic and pedoclimatic variables. The hypothesis that not only the climatic and pedoclimatic parameters recorded during the summer season but also the ones measured during the previous snow-covered season could contribute to explaining the C and N dynamics in soil and surface water was tested along 10 snow-free seasons in 3 sites in the alpine tundra in the north-western Italian Alps (LTER site Istituto Mosso). Among the considered parameters, the snow cover duration (SCD) exerted a primary control on soil N-NH4 +, DOC, Cmicr, Nmicr and DOC:DON ratio, with an inverse relationship. A long SCD might cause the consumption of all the subnival substrata by the soil microorganisms, determining a C starvation during the subsequent snow-free season. An opposite trend was observed for the lake water, where a longer SCD corresponded to a higher content of inorganic N forms. Among the pedoclimatic indices, the number of soil freeze/thaw cycles (FTC) recorded during the snow-covered season had a positive relation with most of soil C and N forms and N-NO3 − in lake water. Only the soil DON showed an inverse pattern, and this result is consistent with the hypothesis that FTC released soil DON, subsequently decomposed and mineralized. Only N-NO3 − had a significant intraseasonal variability, reaching the highest values in September both in soil and water, revealing a significant slowdown of the contribution of soil N immobilization processes.

## Squaring the cycle: The integration of Groundwater processes in nutrient budgets for a basin-oriented remediation Strategy

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Rendiconti Online Societa Geologica Italiana, 2019, 47, 73-78, DOI: 10.3301/ROL.2019.14

**Autori:** Musacchio, A., Re, V., Delconte, C.A Erica Racchetti, E. Soana, R. Balestrini, M. Bartoli, P. Viaroli, E. Sacchi

**Abstract ENG:** Long term projection of N and P concentrations in surface and ground waters cannot be entirely achieved unless groundwater features and processes affecting nutrients at the watershed scale are considered. This work presents the general approach of the INTEGRON project whose aim is to "square the cycle" in nutrient budgets, evaluating the role of groundwater as a temporary/permanent sink or as a release term at the catchment scale, in the Adda and the Ticino basins (northern Italy). An integrated approach is currently tested, which considers surface and groundwater, N and P species combining hydrogeology, biogeochemistry and socio-hydrogeology. The availability of nutrient excess, the nutrient increase in rivers during the irrigation period, and nitrate trends in different groundwater bodies confirm that groundwater in the area acts as both sink and source term of nutrients. Given the complexity of the studied system, the proposed multidisciplinary approach can permit to effectively implement science-based management strategies for water protection that consider both the social and environmental domains.

## Jellyfish summer outbreaks as bacterial vectors and potential hazards for marine animals and humans health? The case of Rhizostoma pulmo (Scyphozoa, Cnidaria)

**Anno di pubblicazione:** 2019

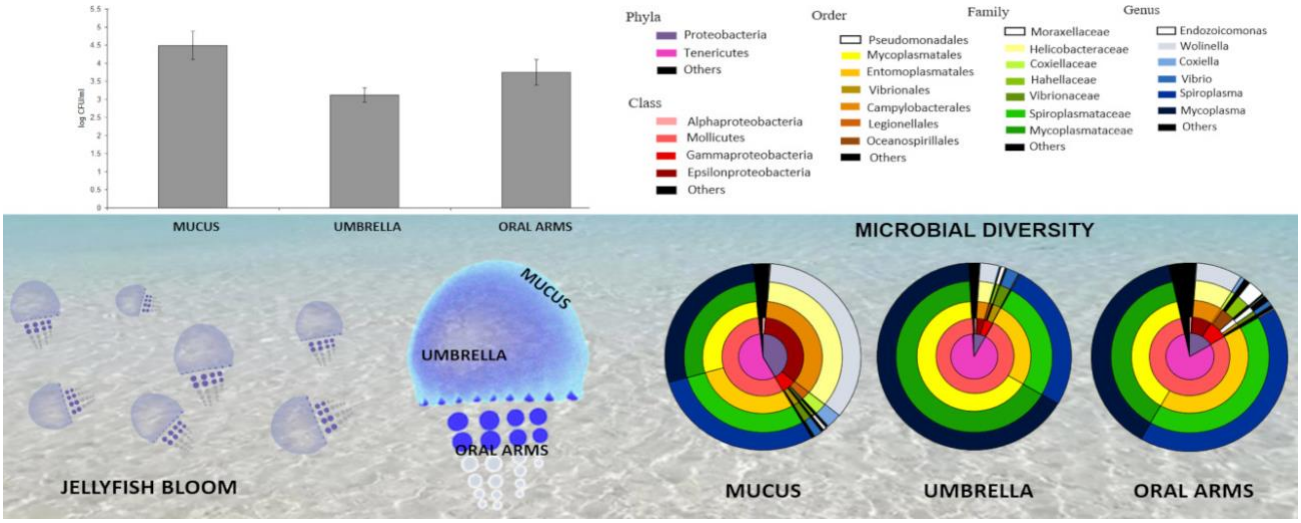
**Riferimento rivista con DOI:** Science of the Total Environment, 2019, 692, 305-318, https://doi.org/10.1016/j.scitotenv.2019.07.155

**Autori:** Lorena Basso, Lucia Rizzo, Marinella Marzano, Marianna Intranuovo, Bruno Fosso, Graziano Pesole, Stefano Piraino, Loredana Stabili

**Abstract ITA:** Le meduse rappresentano una componente importante delle reti alimentari marine caratterizzate da grandi fluttuazioni della densità di popolazione, con la capacità di formare improvvisamente blooms , seguiti da periodi di rarità. Nonostante i considerevoli sforzi per indagare su come le popolazioni di meduse stanno rispondendo a livello globale al cambiamento antropogenico, le prove disponibili rimangono ancora poco chiare. Negli ultimi 50 anni, le meduse sono apparentemente in aumento in un certo numero di aree costiere, incluso il Mar Mediterraneo, dove le fioriture di meduse diventano periodicamente un problema per le attività umane marine e marittime. Il loro impatto sul benessere degli organismi marini è stato scarsamente quantificato. La medusa, Rhizostoma pulmo, è una scyphomedusa le cui grandi popolazioni si sono diffuse in tutto il Mediterraneo, con periodicità crescente e abbondanza variabile. Gli studi sulle meduse hanno suggerito che esse sono importanti vettori di patogeni batterici. Nel presente studio, combinando metodi colturali convenzionali e un approccio HTS (sequenziamento di ampliconi ad alto rendimento), abbiamo caratterizzato la diversità della comunità batterica associata a questa medusa durante il loro bloom estivo. Tre distinti compartimenti delle meduse, vale a dire l'ombrello, le braccia orali e la secrezione di muco ottenuta da campioni interi, sono stati sottoposti a screening per il microbiota specificamente associato. Un totale di 17 phyla, 30 classi, 73 ordini, 146 famiglie e 329 generi di organismi microbici erano rappresentati nei campioni di R. pulmo con tre cladi principali (cioè Spiroplasma, Mycoplasma e Wolinella) che rappresentano oltre il 90% delle sequenze totali recuperate. L'inventario microbico tassonomico è stato quindi combinato con i dati ottenuti dal profilo metabolico mediante il sistema Biolog Eco-Plate. Sono state rilevate differenze significative tra i compartimenti delle meduse in termini di abbondanza batterica, diversità e utilizzo metabolico di 31 diverse fonti di carbonio con il più alto valore di abbondanza e potenziale metabolico nella secrezione di muco rispetto all'ombrello e alle braccia orali. I risultati vengono discussi nel quadro dell'ecologia delle specie e del potenziale pericolo per la salute per gli organismi marini e gli esseri umani

**Abstract ENG:** Jellyfish represent an important component of marine food webs characterized by large fluctuations of population density, with the ability to abruptly form outbreaks, followed by rarity periods. In spite of considerable efforts to investigate how jellyfish populations are responding globally to anthropogenic change, available evidence still remains unclear. In the last 50 years, jellyfish are seemingly on the rise in a number of coastal areas, including the Mediterranean Sea, where jellyfish blooms periodically become an issue to marine and maritime human activities. Their impacts on marine organism welfare have been poorly quantified. The jellyfish, Rhizostoma pulmo, is an outbreak-forming scyphomedusa whose large populations spread across the Mediterranean, with increasing periodicity and variable abundance. Studies on cnidarian

jellyfish suggested being important vectors of bacterial pathogens. In the present study, by combination of conventional culture-based methods and a high-throughput amplicon sequencing (HTS) approach, we characterized the diversity of the bacterial community associated with this jellyfish during their summer outbreak. Three distinct jellyfish compartments, namely umbrella, oral arms, and the mucus secretion obtained from whole specimens were screened for specifically associated microbiota. A total of 17 phyla, 30 classes, 73 orders, 146 families and 329 genera of microbial organisms were represented in R. pulmo samples with three major clades (i.e. Spiroplasma, Mycoplasma and Wolinella) representing over 90% of the retrieved total sequences. The taxonomic microbial inventory was then combined with metabolic profiling data obtained from the Biolog Eco-Plate system. Significant differences among the jellyfish compartments were detected in terms of bacterial abundance, diversity and metabolic utilization of 31 different carbon sources with the highest value of abundance and metabolic potential in the mucus secretion compared to the umbrella and oral arms. Results are discussed in the framework of the species ecology as well as the potential health hazard for marine organisms and humans



## Sabella spallanzanii mucus contain a galactose-binding lectin able to agglutinate bacteria. Purification and characterization

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** ISJ - Invertebrate Survival Journal, 2019, 16, 15-24, 10.25431/1824-307X/isj.v0i0.15-24

**Autori:** M. Cammarata, G. Benenati, M. Dara, M.G Parisi, D. Piazzese, F. Falco, L. Stabili

**Abstract ITA:** Le lectine sono presenti in quasi tutti gli organismi viventi e sono coinvolte in diversi processi biologici, comprese le risposte immunitarie. Nel presente studio, una lectina legante il galattosio dipendente dal calcio che mostra un MW apparente di 43 kDa è stata caratterizzata e purificata dal muco del polichete Sabella spallanzanii utilizzando sia la cromatografia di affinità che metodi cromatografici liquidi ad alta pressione. La sua attività agglutinante verso gli eritrociti di coniglio è stata significativamente modificata dall'aggiunta di calcio o EDTA. L'attività è stata ottimale a valori di temperatura compresi tra 4 e 18 ° C, mantiene un 50% di attività tra 20 e 37 ° C, ed è stata ridotta dopo esposizione a 50 ° C, ed è stata annullata a 90 ° C. La lectina legante il galattosio (SsGBL) di S. spallanzani è stata in grado di agglutinare i batteri e di riconoscere preferenzialmente i batteri Gram-negativi. La più forte attività agglutinante è stata osservata verso Vibrio alginolyticus ed Escherichia coli, ed in in misura minore verso Aeromonas hydrophyla ed i Gram-positivi Micrococcus lysodeikticusthus suggerendo il suo coinvolgimento nelle interazioni del patogeno ospite

**Abstract ENG:** Lectins are present in almost all living organisms and are involved in several biological processes, including immune responses. In the present study, a calcium dependent galactose-binding lectin exhibiting an apparent MW of 43 kDa has been characterized and purified from the mucus of the polychaete Sabella spallanzaniiby using both affinity chromatography and high-pressure liquid chromatographic methods. Its agglutinating activity towards rabbit erythrocytes was significantly modified by the additionof calcium or EDTA. The activity was optimal at temperature values comprised between 4 and 18°C, maintain a 50% of activity between 20 and 37°C, was significant deletedafter exposure at 50 °C, and was depleted at 90 °C. The S. spallanzaniiGalactose-Binding Lectin (SsGBL) was able to agglutinate bacteria and to preferentially recognize Gram-negative bacteria. The strongest agglutinating activity was observed towards Vibrio alginolyticusandEscherichia coli, by contrast mucus agglutinated in a lesser extent both Aeromonas hydrophylaand the Gram-positive Micrococcus lysodeikticusthus suggesting its involvement in host pathogen interactions

## First insight on the mucus of the annelid Myxicola infundibulum (Polychaeta, Sabellidae) as a potential prospect for drug discovery

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Marine Drugs, 2019, 17, 396, DOI: 10.3390/md17070396

**Autori:** L Stabili, M Licciano, A Giangrande, C Gerardi, SA De Pascali, FP Fanizzi

**Abstract ITA:** Molti organismi marini, inclusi gli invertebrati, producono matrici mucose con funzioni diverse. Oltre alla protezione meccanica, il muco di molti invertebrati contiene composti specifici per rendere l'animale velenoso e / o sgradevole o irritante. La presenza di molecole antibiotiche è più vantaggiosa per alcuni invertebrati per contrastare l'attacco batterico. Nel presente studio abbiamo studiato il muco della specie mediterranea Myxicola infundibulum che vive in un involucro gelatinoso costituito da muco denso. Le attività antimicrobiche lisozima-simili e antiossidanti sono state studiate per evidenziare il potenziale interesse del muco del verme come fonte di composti bioattivi per applicazioni biotecnologiche. Per capire quale tipo di composti potesse essere responsabile delle attività rilevate, il muco di M. infundibulum è stato caratterizzato chimicamente in termini di composizione elementare, contenuto di proteine, lipidi e carboidrati. Un'ulteriore caratterizzazione chimica è stata ottenuta mediante la tecnica analitica avanzata della spettroscopia NMR multinucleare e multidimensionale. La spettroscopia NMR ha rivelato la scarsità di lipidi che risultavano preferenzialmente di origine alcolica, e diversi aminoacidi (valina, leucina e alanina) nell'estratto acquoso in relazione alla natura proteica del muco di M. infundibulum . Il muco infatti è composto principalmente da acqua (94% ± 0,7%) mentre il suo peso secco è costituito da proteine (36% ± 2,3%) seguite da lipidi (2,9% ± 0,07%) e carboidrati (2% ± 0,31%). Il muco esercitava una naturale attività antibatterica lisozima simile corrispondente a 1,14 mg mL-1 di lisozima di bianco d'uovo di pollo e un'attività antiossidante corrispondente a 483,00 ± 79,22 nmolTE (equivalente Trolox / mL di campione come Trolox Equivalent Antioxidant Capacity (TEAC) e 276,26 ± 50,76 nmolTE / mL campione come capacità ORAC. Pertanto, i nostri risultati hanno potenziali implicazioni dovute alla continua presenza di infezioni dovute a batteri resistenti agli antibiotici e alla necessità di scoprire nuovi agenti antibatterici. Inoltre, l'attività antiossidante osservata è intrigante tenendo conto della necessità di trovare antiossidanti naturali utili per la salute umana.

**Abstract ENG:** Many marine organisms, including invertebrates, produce mucosal matrices having different functions. Besides mechanical protection, the mucus of many invertebrates contains specific compounds to make the animal poisonous and/or distasteful or irritating. The presence of antibiotic molecules is more advantageous for some invertebrates to contrast bacterial attack. In the present study we investigated the mucus of the Mediterranean annelid species Myxicola infundibulum living in a gelatinous envelope made up of dense mucus. Antimicrobial lysozyme-like and antioxidant activities were investigated to highlight the potential interest of the worm mucus as a source of bioactive compounds for biotechnological applications. In order to understand which kind of compounds could be responsible for the detected activities, the mucus of M. infundibulum was chemically characterized in terms of elemental composition, protein, lipid and carbohydrate content. Further chemical characterization was achieved by the advanced analytical technique of multinuclear and multidimensional NMR spectroscopy. NMR spectroscopy revealed the scarcity of

lipids which preferentially resulted of alcoholic origin, or otherwise hydroxylate and several aminoacids (valine, leucine and alanine) in the aqueous extract in relation to the protein nature of M. infundibulum mucus. The mucus indeed is mainly composed by water (94% ± 0.7%) whereas its dry weight is made of proteins (36% ± 2.3%) followed by lipids (2.9% ± 0.07%) and carbohydrates (2% ± 0.31%). The mucus exerted a natural antibacterial lysozyme-like activity corresponding to 1.14 mg mL-1 of hen egg-white lysozyme and an antioxidant activity corresponding to 483.00 ± 79.22 nmolTE (Trolox equivalent)/mL sample as Trolox Equivalent Antioxidant Capacity (TEAC) and 276.26 ± 50.76 nmolTE/mL sample as Oxygen Radical Absorbance Capacity (ORAC). Therefore, our findings have potential implications due to the ongoing explosion of antibiotic resistant infections and the need to discover antibacterial agents. Additionally, the observed antioxidant activity is intriguing taking into account the need to find natural antioxidants useful for human health.

## The jellyfish Rhizostoma pulmo (Cnidaria): biochemical composition of ovaries and antibacterial lysozyme-like activity of the oocyte lysate

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Marine Drugs, 2019,17, 17, DOI: 10.3390/md17010017

**Autori:** Loredana Stabili, Lucia Rizzo, Francesco Paolo Fanizzi, Federica Angilè, Laura Del Coco, Chiara Roberta Girelli, Silvia Lomartire, Stefano Piraino, Lorena Basso

**Abstract ITA:** I blooms di meduse nelle zone costiere marine rappresentano un problema emergente in tutto il mondo, con conseguenze negative sulle attività umane e sul funzionamento dell'ecosistema. Tuttavia, i potenziali effetti positivi della proliferazione della biomassa di medusa possono essere considerati come una fonte naturale di composti bioattivi di interesse farmaceutico. Abbiamo studiato la composizione biochimica delle gonadi femminili mature e l'attività antibatterica del lisozima degli ovociti nella medusa del barile mediterraneo Rhizostoma pulmo. La caratterizzazione chimica è stata eseguita mediante spettroscopia NMR multinucleare e multidimensionale. Le ovaie di R. pulmo erano composte principalmente da acqua (93,7 ± 1,9% del peso umido), con materia organica (OM) e peso secco costituite rispettivamente da proteine (761,76 ± 25,11 µg mg-1 e 45,7 ± 1,5%), lipidi (192,17 ± 10,56 µg mg-1 e 9,6 ± 0,6%) e carboidrati (59,66 ± 2,72 µg mg-1 e 3,7 ± 0,3%). L'estratto acquoso delle gonadi di R. pulmo conteneva amminoacidi liberi, acidi organici e derivati; l'estratto lipidico era composto da trigliceridi (TG), acidi grassi polinsaturi (PUFA), acidi grassi diinsaturi (DUFA), acidi grassi monoinsaturi (MUFA), acidi grassi saturi (SFA) e componenti minori come steroli e fosfolipidi. Il lisato di ovociti di R. pulmo ha mostrato un'attività antibatterica lisozima simile (diametro medio della lisi di 9,33 ± 0,32 mm corrispondente a 1,21 mg / mL di lisozima bianco d'uovo di pollo). La presenza di molecole di difesa è un meccanismo cruciale per garantire uno sviluppo sano di uova mature ed embrioni fecondati (e il successo riproduttivo della specie) prevenendo la proliferazione batterica marina. Come corollario, questi risultati richiedono indagini future per uno sfruttamento delle biomasse di R. pulmo come risorsa di metaboliti bioattivi di importanza biotecnologica, compresi i prodotti farmaceutici e la nutrizione.

**Abstract ENG:** ellyfish outbreaks in marine coastal areas represent an emergent problem worldwide, with negative consequences on human activities and ecosystem functioning. However, potential positive effects of jellyfish biomass proliferation may be envisaged as a natural source of bioactive compounds of pharmaceutical interest. We investigated the biochemical composition of mature female gonads and lysozyme antibacterial activity of oocytes in the Mediterranean barrel jellyfish Rhizostoma pulmo. Chemical characterization was performed by means of multinuclear and multidimensional NMR spectroscopy. The ovaries of R. pulmo were mainly composed of water (93.7 ± 1.9% of wet weight), with organic matter (OM) and dry weight made respectively of proteins (761.76 ± 25.11 µg mg-1 and 45.7 ± 1.5%), lipids (192.17 ± 10.56 µg mg-1 and 9.6 ± 0.6%), and carbohydrates (59.66 ± 2.72 µg mg-1 and 3.7 ± 0.3%). The aqueous extract of R. pulmo gonads contained free amino acids, organic acids, and derivatives; the lipid extract was composed of triglycerides (TG), polyunsaturated fatty acids (PUFAs), diunsaturated fatty acids (DUFAs), monounsaturated fatty acids (MUFAs), saturated fatty acids (SFAs), and minor components such as sterols and phospholipids. The R. pulmo oocyte lysate exhibited an antibacterial lysozyme-like

activity (mean diameter of lysis of 9.33 ± 0.32 mm corresponding to 1.21 mg/mL of hen egg-white lysozyme). The occurrence of defense molecules is a crucial mechanism to grant healthy development of mature eggs and fertilized embryos (and the reproductive success of the species) by preventing marine bacterial overgrowth. As a corollary, these results call for future investigations for an exploitation of R. pulmo biomasses as a resource of bioactive metabolites of biotechnological importance including pharmaceuticals and nutrition.

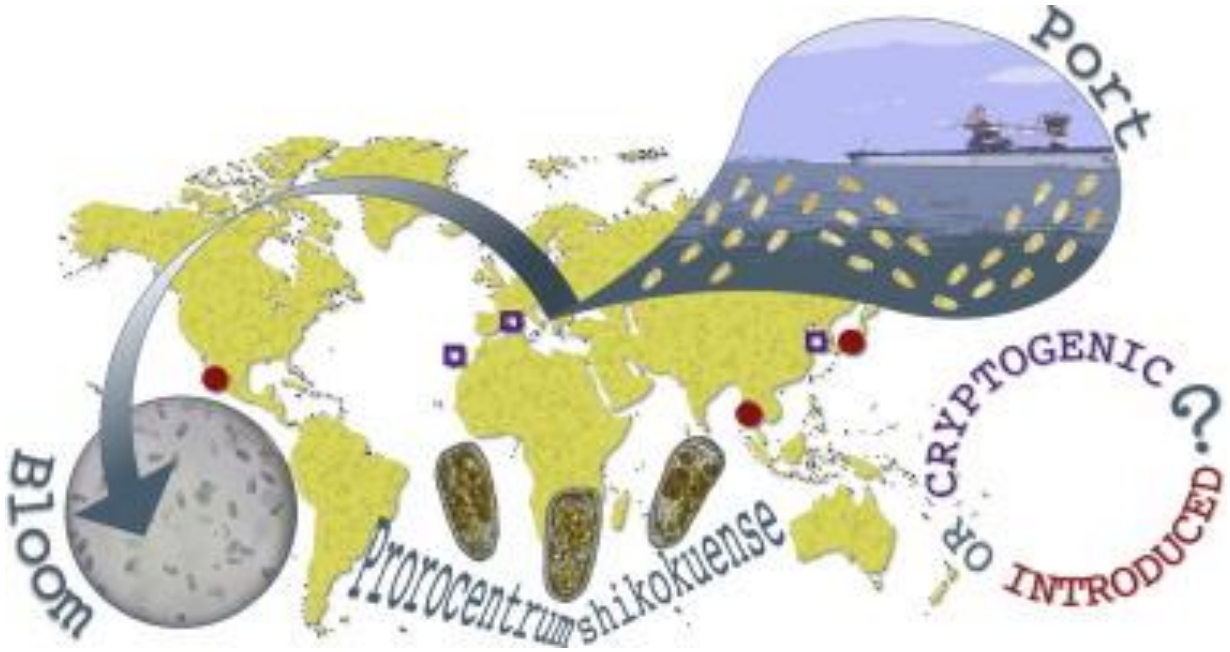
## First bloom event of the small dinoflagellate Prorocentrum shikokuense in the Mediterranean Sea: cryptogenic or introduced?

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Marine Pollution Bulletin, 2019, 139, 197-204, 10.1016/j.marpolbul.2018.12.034

**Autori:** Roselli L., Vadrucci M.R., Fanelli F., Ungaro N., Caroppo C.

**Abstract ENG:** A bloom of putatively non-indigenous species (NIS) *Prorocentrum shikokuense* was detected for the first time in the Mediterranean Sea at the Brindisi harbor (Southern Adriatic Sea) on September 2016, in the context of EU Marine Strategy Framework Directive monitoring in the ports. This species is usually observed in the East China Sea and Japanese and Korean waters. In the Brindisi harbor this dinoflagellate reached the concentration 10(5) cell/L and represented from 30 to 50% of the total phytoplankton population. Besides this event, *Prorocentrum shikokuense* has not been found blooming until today in Mediterranean waters. This study suggests the necessity to improve the monitoring surveys in areas that are known vulnerable systems to alien and invasive species, such as ports.



## Multidisciplinary tools for sustainable management of an ecosystem service: The case study of mussel farming in the Mar Piccolo of Taranto (Mediterranean, Ionian Sea).

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Ocean and Coastal Management, 2019, 176, 11-23, DOI: 10.1016/j.ocecoaman.2019.04.013

**Autori:** Giordano L., Portacci G., Caroppo C.

**Abstract ENG:** This paper describes the development of multidisciplinary simulation tools based on a system approach, and its contribution to local political debate on sustainable shellfish farming in a Mediterranean coastal site (Mar Piccolo of Taranto, Ionian Sea). Remote sensing images were used for the first time to count mussel culture plants and to validate information provided by stakeholders and farmers. The data obtained were even more important considering the lack of reliable official statistics, Further, a model was developed to simulate exploratory scenarios. In the modelling platform, the ecosystem and individual mussel growth models (built in the frame of the EU Integrated Project SPICOSA, Science and Policy Integration for Coastal System Assessment) are combined with the Mussel Farm Model (MFM). The simulated scenarios suggested that: 1. Farming is unsustainable, because it exceeds the system carrying capacity; 2. Plant overloading is exacerbated by the negative effects of recurrent heatwaves; 3. Sustainable management measures should be applied to obtain individuals of good quality as well as to extend the juveniles sale period and cope with climate crises. The results show that the described tools may help in the design of viable policies based on operational objectives and feasible technical options. Since until now, production trends cannot be determined based on natural and social factors alone, once applied, this tool will allow for a more exemplary production system. It could also become a good practice example towards a more sustainable development of coastal zones.

## Multispectral data by the new generation of high-resolution satellite sensors for mapping phytoplankton blooms in the Mar Piccolo of Taranto (Ionian Sea, Southern Italy).

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** European Journal of Remote Sensing, 2019, 52 (1), 400–418, DOI: 10.1080/22797254.2019.1625726

**Autori:** Borfecchia F., Micheli C., Cibic T., Pignatelli V., De Cecco L., Consalvi N., Caroppo C., Rubino F., Di Poi E., Kralj M., Del Negro P.

**Abstract ENG:** The HR (High-Resolution) EO (Earth Observation) satellite systems Landsat 8 OLI and Sentinel 2 were tested for mapping the frequent phytoplankton blooms and Chl a distributions in the sea basin of the Mar Piccolo of Taranto (Ionian Sea, southern Italy), using the sea truth calibration data acquired in 2013. The data were atmospherically corrected for accounting of the aerosol load on optically complexes waters (case II). Various blue-green and additional spectral indices ratios, were then satisfyingly tested for mapping the distribution of Chl a and differently sized phytoplankton populations through PLS (Partial Least Square regression) models, regressive statistical models and bio-optical algorithms. The PLS models demonstrated higher robustness for assessing the distribution of all the phytoplankton and Chl a except for those related to sub-surface micro-phytoplankton. The distributions obtained via a bio-optical approach (OC3 algorithm and full physically based inversion) showed a general agreement with the previous ones produced by statistical methods. The reflectance signals, captured by OLI and Sentinel 2 sensors in the visible and shorter wavelengths once atmospherically corrected, were found to be useful to map the coastal variability at detailed scale of Chl a and different phytoplankton populations, in the optically complexes waters of the Mar Piccolo.

## Harmful algal blooms in an ancient shellfish farming site: evolution of the management strategies

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Biologia Marina Mediterranea, 2019, 26 (1): 235-238

**Autori:** Caroppo C., Portacci G., Alabiso G., Giandomenico S., Odermatt D., Politi E., Philipson P., Bruno M.

**Abstract ENG:** HABs, more specifically red tides, have been responsible for massive shellfish kills in the Mar Piccolo (Gulf of Taranto, Ionian Sea) since 1787, but in the last years, the problem is worsening. This paper describes the history of HABs in the Mar Piccolo in relation to the management strategies of the shellfish farming up to the current use of remote sensing techniques. Based on in situ and remote sensing researches, future efforts should concentrate on building models and early-warning tools that will allow authorities to make timely decisions in order to minimize the sanitary and economic damages caused by HABs.

## Microbial response to anthropic and natural forcings in two coastal Antarctic sites (Ross Sea).

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Biologia Marina Mediterranea, 2019, 26 (1): 379-380

**Autori:** Caruso G., Azzaro M., Dell'Acqua O., Lo Giudice A., Fazi S., Caroppo C., Azzaro F., La Ferla R., Maimone G., Laganà P., Marinelli F., Berini F., Marcone G.L., Raffa F., Chiantore M.

**Abstract ENG:** Microbial enzyme activities on organic polymers were tested as possible sentinels of anthropic and natural forcings during a two-year study in two coastal Antarctic areas (Road Bay and Tethys Bay respectively). In Road Bay high proteolytic activity rates were measured at a site impacted by the Italian research station sewage, due to faecal wastes; in Tethys Bay low salinity waters related to glacier presence were characterized by high enzyme activities probably associated to detritus from ice melting.

## Performance of secondary wastewater treatment methods for the removal of contaminants of emerging concern implicated in crop uptake and antibiotic resistance spread: A review.

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Science of the Total Environment, (2019) , 648, 1052–1081 - https://doi.org/10.1016/j.scitotenv.2018.08.130

**Autori:** KRZEMINSKI, P., TOMEI, M.C., KARAOLIA, P., LANGENHOFF., A, ALMEIDA C. M. R., FELIS E., GRITTEN F., ANDERSEN H. R., FERNANDES T, MANAIA C. M., RIZZO, L., FATTA-KASSINOS, D.

**Abstract ENG:** Contaminants of emerging concern (CEC) discharged in effluents of wastewater treatment plants (WWTPs), not specifically designed for their removal, pose serious hazards to human health and ecosystems. Their impact is of particular relevance to wastewater disposal and re-use in agricultural settings due to CEC uptake and accumulation in food crops and consequent diffusion into the food-chain. This is the reason why the chemical CEC discussed in this review have been selected considering, besides recalcitrance, frequency of detection and entity of potential hazards, their relevance for crop uptake. Antibiotic-resistant bacteria (ARB) and antibiotic resistance genes (ARGs) have been included as microbial CEC because of the potential of secondary wastewater treatment to offer conditions favourable to the survival and proliferation of ARB, and dissemination of ARGs. Given the adverse effects of chemical and microbial CEC, their removal is being considered as an additional design criterion, which highlights the necessity of upgrading conventionalWWTPs with more effective technologies. In this review, the performance of currently applied biological treatment methods for secondary treatment is analysed. To this end, technological solutions including conventional activated sludge (CAS), membrane bioreactors (MBRs), moving bed biofilm reactors (MBBRs), and nature-based solutions such as constructed wetlands (CWs) are compared for the achievable removal efficiencies of the selected CEC and their potential of acting as reservoirs of ARB&ARGs.With the aim of giving a picture of real systems, this review focuses on data from fullscale and pilot-scale plants treating real urban wastewater. To achieve an integrated assessment, technologies are compared considering also other relevant evaluation parameters such as investment and management costs, complexity of layout andmanagement, present scale of application and need of a post-treatment. Comparison results allow the definition of design and operation strategies for the implementation of CEC removal in WWTPs, when agricultural reuse of effluents is planned.

## Improving grey water footprint assessment: Accounting for uncertainty

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Ecological Indicators, 2019, 102, 822-833, DOI: 10.1016/j.ecolind.2019.03.040

**Autori:** Anna Maria De Girolamo, Pierluigi Miscioscia, Tiziano Politi, Emanuele Barca

**Abstract ENG:** The grey water footprint (GWF) refers to the amount of freshwater required to dilute pollutants to meet water-quality standards. The aim of this paper was to estimate the GWF and its uncertainty for crop production at the basin scale. The proposed approach was tested in the Rio Mannu Basin (Sardinia, Italy) for durum wheat production. The fraction of nutrients flowing into the river and groundwater was evaluated using the Soil and Water Assessment Tool model that was calibrated with in-stream monitoring data. A bootstrap technique coupled with Monte Carlo simulations was used to estimate the uncertainty of the GWF due to the variability of the primary input data and the unknown natural background level of nutrients in the waters. The GWF for total phosphorus (TP) input (3284 m3 t−1) was higher than that for dissolved inorganic nitrogen (DIN) (275 m3 t−1), despite the lower rate of phosphorus fertiliser application. The uncertainty was found to be relevant for both DIN (60%) and TP (18%). The environmental sustainability of durum wheat production was assessed throughout the water pollution level. This showed that the TP load exceeded the assimilation capacity at the reach scale, and that further analyses are needed to assess the environmental sustainability at the basin scale.

## A Spatial Analysis to Define Data Requirements for Hydrological and Water Quality Models in Data-Limited Regions

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Water, 2019, 11, 267, DOI: 10.3390/w11020267

**Autori:** Ersilia D'Ambrosio, Anna Maria De Girolamo*, Marinella Spanò, Vera Corbelli, Gennaro Capasso, Massimo Morea, Raffaele Velardo, Ossama MM Abdelwahab, Antonio Lonigro, Fabio Milillo, Giovanni Francesco Ricci, Giovanni Romano, Angelantonio Calabrese, Barbara Casale, Roberto Mauro, Giuseppe Pappagallo, Francesco Gentile

**Abstract ENG:** The objective of the present work is a spatial analysis aimed at supporting hydrological and water quality model applications in the Canale d'Aiedda basin (Puglia, Italy), a data-limited area. The basin is part of the sensitive environmental area of Taranto that requires remediation of the soil, subsoil, surface water, and groundwater. A monitoring plan was defined to record the streamflow and water quality parameters needed for calibrating and validating models, and a database archived in a GIS environment was built, which includes climatic data, soil hydraulic parameters, groundwater data, surface water quality parameters, point-source parameters, and information on agricultural practices. Based on a one-year monitoring of activities, the average annual loads of N-NO3 and P-PO4 delivered to the Mar Piccolo amounted to about 42 t year−1, and 2 t year−1, respectively. Knowledge uncertainty in monthly load estimation was found to be up to 25% for N-NO3 and 40% for P-PO4. The contributions of point sources in terms of N-NO3 and P-PO4 were estimated at 45% and 77%, respectively. This study defines a procedure for supporting modelling activities at the basin scale for data-limited regions

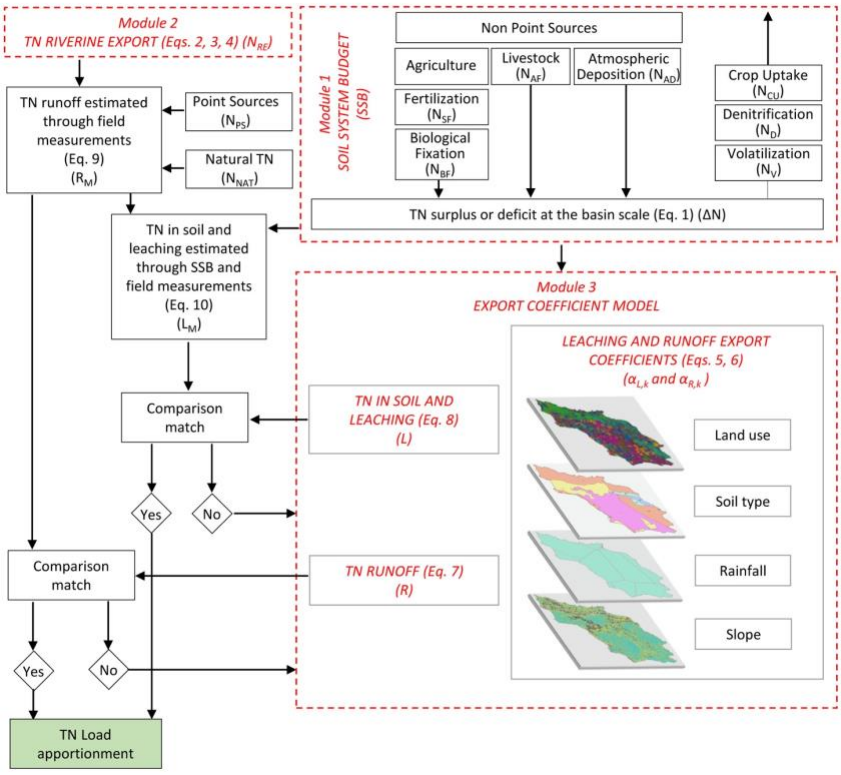
## Developing a nitrogen load apportionment tool: Theory and application

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Agricultural Water Management, 2019, 226, 105806, DOI: 10.1016/j.agwat.2019.105806

**Autori:** Anna Maria De Girolamo, Marinella Spanò, Ersilia D'Ambrosio, Giovanni Francesco Ricci, Francesco Gentile

**Abstract ENG:** In this work, a new nitrogen load apportionment tool was developed to quantify the anthropogenic pressures from point sources and diffuse sources (DSs) on the water in a basin, and to identify the areas contributing most of the total nitrogen (TN). The model, which is an alternative approach to complex conceptual models, was tested in the Canale d'Aiedda Basin (SE Italy). It integrates the TN soil system budget (SSB), TN riverine export (NRE) and TN export coefficient modelling. The results of the SSB showed a TN surplus for productive land (~60 kg ha−1 yr−1). Major TN inputs were derived from fertilisers (~89 kg ha−1 yr−1, 77% of the total input) and animal manure (~13 kg ha−1 yr−1, 11% of the total input). Crop uptake was the main output (~39 kg ha−1 yr−1, 70% of the total output). NRE was estimated through the measurement of streamflow and TN concentrations in two stream sections. The average NRE per unit area of productive land was 5.22 kg ha−1 yr−1. Groundwater was the major receptor of the TN from DSs. The TN runoff export coefficients, estimated on the basis of environmental factors and calibrated with riverine load measurements, were lower than the TN leaching fractions. The results show that setting export coefficients based only on environmental factors, without any calibration, leads to an overestimation of TN load in runoff, and to an underestimation of TN load in leaching.



## Modelling the silting-up of a small reservoir fed by a temporary river: the Torrebianca reservoir study case (Puglia, SE Italy)

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Journal of Materials and Environmental Sciences, 2019, 10 (3), 225-233, ISSN 2028;2508

**Autori:** Raffaele Di Pillo, Anna Maria De Girolamo, Maria T. Todisco

**Abstract ENG:** The paper presents a first attempt to quantify the siltation in a man-made reservoir (Torrebianca) in South-East Italy. The FLORENCE model was used to quantify siltation and a multi-scale modelling approach was developed to identify the main source areas of the transported material. The total specific wet sediment production at the reservoir was quantified in 13.15 t ha-1 yr-1. The Celone river basin is the major source of both sediment and water feeds into reservoir. At sub-basin scale the modelling results show that within the Celone river basin the main source areas of sediment were the upstream zone and the valley area. The floodplain area, where the river assumes a braided morphology features, instead acts as a sink for the coarse material. Based on these results, it was estimated that, from 2000 to 2017, in the absence of appropriate removal operations, the reservoir may have lost 13.77%. These results suggest that a better management measures to reduce sediment transport and silting are needed.

## Microbiome dynamics and phaC synthase genes selected in a pilot plant producing polyhydroxyalkanoate from the organic fraction of urban waste

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Science of The Total Environment, 2019, 689, 765-773, DOI: 10.1016/j.scitotenv.2019.06.491

**Autori:** Crognale Simona, Tonanzi Barbara, Valentino Francesco, Majone Mauro, Rossetti Simona

**Abstract ENG:** This study analyses the bacterial population dynamics of a mixedmicrobial community (MMC) selected in a pilot plant producing polyhydroxyalkanoate (PHA) from the fermentation of the organic fraction of urban waste (OFMSW) and sewage sludge (SS). 16S rRNA gene high-throughput sequencing revealed the occurrence of a variety of PHA accumulating bacteria that ensured a stable PHA production in an open system operating with real substrates and without temperature control. The Volatile Fatty Acids (VFA) changes in the feed and the temperature variation affected the dynamics of the PHA-accumulating bacteria over the plant operation. Remarkably, the higher PHA contentwas associated to aMMC largely comprising of Hydrogenophaga species during the operation at higher working temperature. The involvement of a heterogeneous PHA-accumulatingMMC was associated with a high phaC synthase genes biodiversity confirming the occurrence of a functional redundancy.

## Biological As(III) oxidation in biofilters by using native groundwater microorganisms

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Science of The Total Environment, 2019, 651, 1, 93-102, DOI: 10.1016/j.scitotenv.2018.09.176

**Autori:** Crognale Simona, Casentini Barbara, Amalfitano Stefano, Fazi Stefano, Petruccioli Maurizio, Rossetti Simona

**Abstract ENG:** Arsenic (As) contamination in drinking water represents a worldwide threat to human health. During last decades, the exploitation of microbial As-transformations has been proposed for bioremediation applications. Among biological methods for As-contaminated water treatment, microbial As(III)-oxidation is one of the most promising approaches since it can be coupled to commonly used adsorption removal technologies, without requiring the addition of chemicals and producing toxic by-products. Despite the As(III) oxidation capability has been described in several bacterial pure or enrichment cultures, very little is known about the real potentialities of this processwhenmixed microbial communities, naturally occurring in As contaminatedwaters, are used. This study highlighted the contribution of native groundwater bacteria to As(III)-oxidation in biofilters, under conditions suitable for a household-scale treatment system. This work elucidated the influence of a variety of experimental conditions (i.e., various filling materials, flow rates, As(III) inflow concentration, As(III):As(V) ratio, filter volumes) on the microbially-mediated As(III)-oxidation process in terms of oxidation efficiency and rate. The highest oxidation efficiencies (up to 90% in 3 h) were found on coarse sand biofilters treating total initial As concentration of 100 μg L−1. The detailed microbial characterization of the As(III) oxidizing biofilms revealed the occurrence of several OTUs affiliated with families known to oxidize As(III) (e.g., Burkholderiaceae, Comamonadaceae, Rhodobacteraceae, Xanthomonadaceae). Furthermore, As-related functional genes increased in biofilter systems in line with the observed oxidative performances.

## Global diversity and biogeography of bacterial communities in wastewater treatment plants

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Nature Microbiology, 2019, 4, 1183–1195, doi: 10.1038/s41564-019-0426-5

**Autori:** Wu, Linwei; Ning, Daliang; Zhang, Bing; Li, Yong; Zhang, Ping; Shan, Xiaoyu; Zhang, Qiuting; Brown, Mathew; Li, Zhenxin; Van Nostrand, Joy D.; Ling, Fangqiong; Xiao, Naijia; Zhang, Ya; Vierheilig, Julia; Wells, George F.; Yang, Yunfeng; Deng, Ye; Tu, Qichao; Wang, Aijie; Zhang, Tong; He, Zhili; Keller, Jurg; Nielsen, Per H.; Alvarez, Pedro J.J.; Criddle, Craig S.; Wagner, Michael; Tiedje, James M.; He, Qiang; Curtis, Thomas P.; Stahl, David A.; Alvarez-Cohen, Lisa; Rittmann, Bruce E.; Wen, Xianghua; Zhou, Jizhong; Acevedo, Dany; Agullo-Barcelo, Miriam; Andersen, Gary L.; de Araujo, Juliana Calabria; Boehnke, Kevin; Bond, Philip; Bott, Charles B.; Bovio, Patricia; Brewster, Rebecca K.; Bux, Faizal; Cabezas, Angela; Cabrol, LÃ©a; Chen, Si; Etchebehere, Claudia; Ford, Amanda; Frigon, Dominic; GÃ³mez, Janeth Sanabria; Griffin, James S.; Gu, April Z.; Habagil, Moshe; Hale, Lauren; Hardeman, Steven D.; Harmon, Marc; Horn, Harald; Hu, Zhiqiang; Jauffur, Shameem; Johnson, David R.; Keucken, Alexander; Kumari, Sheena; Leal, Cintia Dutra; Lebrun, Laura A.; Lee, Jangho; Lee, Minjoo; Lee, Zarraz M.P.; Li, Mengyan; Li, Xu; Liu, Yu; Luthy, Richard G.; MendonÃ§a-Hagler, Leda C.; de Menezes, Francisca Gleire Rodriguez; Meyers, Arthur J.; Mohebbi, Amin; Oehmen, Adrian; Palmer, Andrew; Parameswaran, Prathap; Park, Joonhong; Patsch, Deborah; Reginatto, Valeria; de los Reyes, Francis L.; Noyola, Adalberto; Rossetti, Simona; Sidhu, Jatinder; Sloan, William T.; Smith, Kylie; de Sousa, Oscarina Viana; Stephens, Kyle; Tian, Renmao; Tooker, Nicholas B.; De los Cobos Vasconcelos, Daniel; Wakelin, Steve; Wang, Bei; Weaver, Joseph E.; West, Stephanie; Wilmes, Paul; Woo, Sung Geun; Wu, Jer Horng

**Abstract ENG:** Microorganisms in wastewater treatment plants (WWTPs) are essential for water purification to protect public and environmental health. However, the diversity of microorganisms and the factors that control it are poorly understood. Using a systematic global-sampling effort, we analysed the 16S ribosomal RNA gene sequences from ~1,200 activated sludge samples taken from 269 WWTPs in 23 countries on 6 continents. Our analyses revealed that the global activated sludge bacterial communities contain ~1 billion bacterial phylotypes with a Poisson lognormal diversity distribution. Despite this high diversity, activated sludge has a small, global core bacterial community (n = 28 operational taxonomic units) that is strongly linked to activated sludge performance. Meta-analyses with global datasets associate the activated sludge microbiomes most closely to freshwater populations. In contrast to macroorganism diversity, activated sludge bacterial communities show no latitudinal gradient. Furthermore, their spatial turnover is scale-dependent and appears to be largely driven by stochastic processes (dispersal and drift), although deterministic factors (temperature and organic input) are also important. Our findings enhance our mechanistic understanding of the global diversity and biogeography of activated sludge bacterial communities within a theoretical ecology framework and have important implications for microbial ecology and wastewater treatment processes.

## Monitoring, isolation and characterization of Microthrix parvicella strains from a Chinese wastewater treatment plant

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Water Science and Technology, 2019, 79 (7), 1406–1416, doi: 10.2166/wst.2019.136

**Autori:** Fan N., Yang M., Rossetti S., Levantesi C., Qi R.

**Abstract ENG:** Microthrix parvicella is a filamentous bacterium that frequently causes severe bulking events in wastewater treatment plants (WWTPs) worldwide. In this study, sludge properties and dynamics of filamentous bacteria in a Beijing WWTP seasonally suffering from M. parvicella bulking were continuously monitored over a duration of 15 months, and the correlations between M. parvicella and operating parameters were evaluated. The predominance of M. parvicella was observed at low temperatures (14-18.8 degrees C) with the relative abundance of around 30% (estimated by both qPCR and FISH analysis). Using micromanipulation technology, 545 filaments of M. parvicella were micromanipulated from bulking sludge (SVI> 180 mL g(-1)) on six different media. After 3-month purification and enrichment, six strains, phylogenetically closely related to Candidatus Microthrix parvicella, were successfully acquired on R(2)A medium (20 degrees C) in pure cultures. Considering the limitation and extremely slow growth rate of M. parvicella filaments, newly isolated strains represent valuable sources for further investigations on the physiology and behavior of this filamentous bacterium, with the focus on the establishment of bulking control strategy.

## RISANAMENTO DI UN LAGO: l'approccio virtuoso di Varese

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** PANTA REI, 2019, 4 (15), 38-43

**Autori:** Pietro Volta, Michela Rogora, Aldo Marchetto

**Abstract ITA:** L'articolo tratta in modo divulgativo il tema dell'eutrofizzazione nei laghi illustrando nello specifico il caso del Lago di Varese e del suo progetto di risanamento, attualmente in corso. "Panta Rei" Rivista periodica è associata alla Unione Stampa Periodica Italiana. Società UNIACQUE (Ed.) - Bergamo. https://www.uniacque.bg.it/export/sites/default/documenti/Archivio-Panta-Rei/Panta-Rei_n15_5.pdf

**Abstract ENG:** The paper deals with the problem of the eutrophication of Lake Varese and the project of its recovery. "Panta Rei" Rivista periodica è associata alla Unione Stampa Periodica Italiana. Società UNIACQUE (Ed.) - Bergamo. https://www.uniacque.bg.it/export/sites/default/documenti/Archivio-Panta-Rei/Panta-Rei_n15_5.pdf

## MICROPLASTICHE: problema locale, problema globale.

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** PANTA REI, 2019, 4 (13), 22-27

**Autori:** Silvia Galafassi, Andrea di Cesare, Gianluca Corno, Pietro Volta

**Abstract ITA:** L'articolo tratta in modo divulgativo il tema delle microplastiche in ambiente. Uniacque, società di depurazione della Provincia di Bergamo, in seguito finanzierà a CNR-IRSA una ricerca sulle microplastiche nei suoi impianti di depurazione. In: INQUINAMENTO AMBIENTALE, i nuovi pericoli da microplastiche e contaminanti emergenti. 2019. "Panta Rei" Rivista periodica associata alla Unione Stampa Periodica Italiana. Società UNIACQUE (Ed.) - Bergamo. https://www.uniacque.bg.it/export/sites/default/documenti/Archivio-Panta-Rei/Panta-Rei_n13_5.pdf

**Abstract ENG:** The paper deals with the problems of Microplastics in the environment. In: INQUINAMENTO AMBIENTALE, i nuovi pericoli da microplastiche e contaminanti emergenti. 2019. "Panta Rei" Rivista periodica associata alla Unione Stampa Periodica Italiana. Società UNIACQUE (Ed.) - Bergamo. https://www.uniacque.bg.it/export/sites/default/documenti/Archivio-Panta-Rei/Panta-Rei_n13_5.pdf

## Capability of diffuse reflectance spectroscopy to predict soil water retention and related soil properties in an irrigated lowland district of southern Italy

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Water, 2019, 11, 1712, DOI 10.3390/w11081712

**Autori:** A. P. Leone; G. Leone; N. Leone; C. Galeone; E. Grilli; N. Orefice; V. Ancona

**Abstract ITA:** In questo studio abbiamo esaminato le potenzialità della spettroscopia di riflettanza vis-NIR, accoppiata ad analisi partial least squares regression (PLSR), per la valutazione e la predizione della ritenzione idrica del suolo alla capacità di campo (FC) e punto di avvizzimento permanente (PWP) e delle relative proprietà di base del suolo [contenuto di carbonio organico (OC), sabbia, limo e argilla] in un'area agricola irrigua dell'Italia meridionale. Le proprietà del suolo sono state determinate in laboratorio con riferimento ai metodi ufficiali italiani per l'analisi del suolo. Gli spettri di riflettanza vis-NIR sono stati misurati in laboratorio, utilizzando uno spettroradiometro ad alta risoluzione. Tutte le variabili del suolo, ad eccezione del limo, hanno influenzato in maniera evidente alcune caratteristiche spettrali specifiche. Sono state eseguite calibrazioni multivariate per predire le proprietà del suolo dagli spettri di riflettanza. La PLSR è stata utilizzata per calibrare i dati spettrali utilizzando due terzi dei campioni per la calibrazione e un terzo per la validazione. I dati spettroscopici sono stati pre-processati [correzione della dispersione moltiplicativa (MSC), varianza normale standard (SNV), detrazione wavelet (WD), trasformazione della derivata prima e seconda e filtraggio] prima della calibrazione multivariata. I risultati hanno rivelato modelli molto buoni (2.0 <RPD <2.5) per la predizione di FC, PWP e sabbia, ed eccellenti (RPD> 2.5) per la predizione di argilla e OC, mentre un modello predittivo scarso (RPD <1.4) è stato ottenuto per limo.

**Abstract ENG:** In this study, we examined the potential of vis-NIR reflectance spectroscopy, coupled with partial least squares regression (PLSR) analysis, for the evaluation and prediction of soil water retention at field capacity (FC) and permanent wilting point (PWP) and related basic soil properties [organic carbon (OC), sand, silt, and clay contents] in an agricultural irrigated land of southern Italy. Soil properties were determined in the laboratory with reference to the Italian Official Methods for Soil Analysis. Vis-NIR reflectance spectra were measured in the laboratory, using a high-resolution spectroradiometer. All soil variables, with the exception of silt, evidently affected some specific spectral features. Multivariate calibrations were performed to predict the soil properties from reflectance spectra. PLSR was used to calibrate the spectral data using two-thirds of samples for calibration and one-third for validation. Spectroscopic data were pre-processed [multiplicative scatter correction (MSC), standard normal variance (SNV), wavelet detrending (WD), first and second derivative transformation, and filtering] prior to multivariate calibration. The results revealed very good models (2.0 < RPD < 2.5) for the prediction of FC, PWP and sand, and excellent (RPD > 2.5) models for the prediction of clay and OC, whereas a poor (RPD < 1.4) prediction model was obtained for silt.

## Using Spectrometric Colour Measurement for the Prediction of Soil PCBs in a Contaminated Site of Southern Italy

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Water, air and soil pollution, 2019, 230, 74, DOI 10.1007/s11270-019-4103-3

**Autori:** V. Ancona; N. Leone.; C. Galeone; G. Bagnuolo.; V.F. Uricchi; A.P.Leone

**Abstract ITA:** La contaminazione del suolo da policlorobifenili (PCB) è uno dei problemi ambientali più rilevanti nel SIN (Sito di Interesse Nazionale) di Taranto (Regione Puglia, Sud Italia) e nell'area circostante. La valutazione del contenuto di PCB e della loro distribuzione spaziale è un prerequisito essenziale per la bonifica del suolo. Le analisi di laboratorio convenzionali, sebbene utili e insostituibili per una precisa e dettagliata valutazione di questi contaminanti, sono costose e richiedono molto tempo, quindi non molto adatte per indagini su grandi aree. Pertanto, è necessario sviluppare/validare tecniche alternative, rapide ed economiche, da utilizzare come sostitutive o integrative degli approcci analitici convenzionali. In questo studio, è stata valutata l'utilità del colore del suolo, sulla base di misure spettrometriche, insieme all'analisi di regressione. Finora non è mai stata realizzata un'indagine analoga. Nell'indagine sono stati utilizzati ventotto campioni di suolo, precedentemente raccolti all'interno di un'area (l'ex-MATRA) altamente contaminata dallo smaltimento di olio utilizzato come fluido dielettrico, composto da una miscela di congeneri di PCB. Le coordinate del colore in diversi sistemi colorimetrici sono state calcolate a partire dalle misure spettroradiometriche sui campioni di suolo. Diciotto congeneri di PCB (12 PCB dioxin-like e sei PCB "indicatori" non dioxin-like), la loro somma (PCB) e il contenuto di alogeni organici estraibili (EOX) - che è un'espressione del contenuto totale di alogeni in composti organoclorurati, compresi i PCB - sono stati determinati mediante analisi di laboratorio convenzionali. È stata eseguita un'analisi di regressione lineare semplice per prevedere i valori di PCB e EOX sulla base delle variabili di colore. Eccellenti modelli predittivi (R> 0.80) per PCB ed EOX, così come per alcuni dei singoli congeneri di PCB, sono risultati dall'analisi di regressione. Pertanto, la determinazione spettroscopica del colore del suolo può essere considerata uno strumento promettente per uno screening rapido dei PCB nei suoli contaminati.

**Abstract ENG:** Soil contamination with polychlorinated biphenyls (PCBs) is one the most relevant environmental problem in the SIN (Site of National Interest) of Taranto (Apulia Region, Southern Italy) and the surrounding area. Evaluation of PCB contents and their spatial distribution is an essential pre-requisite for soil remediation. Conventional laboratory analyses, although useful and irreplaceable for a precise and detailed evaluation of these contaminants, are costly and time-consuming, thus not very suitable for investigation over large areas. Then, there is a need to develop/validate alternative, rapid and cost-effective techniques, to use as substitutive or integrative to conventional analytical approaches. In this study, the usefulness of soil colour, based on spectrometric measurements, coupled with regression analysis, was assessed. Until now, never an analogous investigation has been realised. Twenty-eight soil samples, previously collected within an area (the ex-MATRA) highly contaminated by the disposal of oil used as dielectric fluid, composed by a mixture of PCB congeners, were used in the investigation. Colour coordinates in different colour systems were calculated from spectroradiometric measurements over the soil

samples. Eighteen PCB congeners (i.e. 12 dioxin-like PCBs and six non-dioxin-like "indicator" PCBs), their sum (PCBs ) and the extractable organic halogen content (EOX) - which is an expression of the total content of halogen in organochlorine compounds, including the PCBs - were determined through conventional laboratory analysis. Simple linear regression analysis was carried out to predict the values of PCBs and EOX on the basis of colour variables. Excellent predictive models ($R > 0.80$) for PCBs and EOX, as well as for some of the individual PCB congener, resulted from the regression analysis. Thus, spectroscopic determination of soil colour can be considered as a promising tool for a rapid screening of PCBs in contaminated soils.

## Wastewater Biofilm Photosynthesis in Photobioreactors

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Microorganisms, 2019, 7(8), 252, doi: 10.3390/microorganisms7080252

**Autori:** Antonella Guzzon, Francesca Di Pippo, Roberta Congestri

**Abstract ENG:** Photosynthetic performance of algal-bacterial biofilms from an Italian wastewater treatment plant was studied in a flow-lane photobioreactor at different irradiances, temperatures, and flow regime to evaluate the effects of these environmental parameters on biofilms' functioning, in view of application of these communities in wastewater biological treatment. Pulse amplitude modulated fluorescence was used to estimate the effective quantum yield of PSII (ΔF/Fm') of the light-acclimated biofilms and to perform rapid light curves (RLCs) for the determination of the photosynthetic parameters (rel.ETRmax, α, Ik). Chl a, ash free dry weight (AFDW), and dry weight (DW) were measured to assess phototrophic and whole biofilm biomass development over time. From the analysis of photosynthetic parameter variation with light intensity, temperature and flow rate, it was possible to identify the set of experimental values favoring biofilm photosynthetic activity. Biomass increased over time, especially at the highest irradiances, where substrata were fastly colonized and mature biofilms developed at all temperatures and flow conditions tested.

## Gasification treatment of poplar biomass produced in a contaminated area restored using plant assisted bioremediation

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Journal of environmental management, 2019, 239, 137-141, doi: 10.1016/j.jenvman.2019.03.038

**Autori:** Ancona, Valeria; Barra Caracciolo, Anna ; Campanale, Claudia; De Caprariis, Benedetta; Grenni, Paola; Uricchio, Vito Felice; Borello, Domenico

**Abstract ITA:** Remediation of polluted soils using phytoremediation techniques is an effective strategy. However, the use of the biomass from these soils for energy purposes may raise efficiency and pollution emission problems and there is currently little research on this issue. In this work, the main results of a fluidized-bed gasification treatment conducted on poplar biomass pruning residues from a multi-contaminated area are presented. The samples were collected from an experimental site in which a plant-assisted bioremediation (PABR) technology has been applied since 2013 to reduce the soil heavy metal (HM) and polychlorinated biphenyl (PCB) contents. The main goal of this study was to identify the specific treatment necessary, in addition to conventional tar reforming, for trapping possible residues of HMs and PCBs in ashes during the gasification process. In our study, we demonstrate that gasification of contaminated biomass coming from PABR (where contaminant residues are concentrated mainly in the roots and are insignificant in the shoots) produces syngas whose characteristics are similar to those obtained using non-contaminated biomass. The results showed that contaminant concentrations in the prunings were negligible; the total amount of PCBs was 1.63 ng/g, while HMs ranged from 0.01 to 0.70 mg/kg, except for Cu and Zn (~20 mg/kg). Furthermore, the presence in the biomass of Ca and traces of other metals showed a possible catalytic effect with an improvement in the tar conversion in the gasifier leading to a reduction of 5-10% in tar content. The overall results suggest that a specific treatment for pollutant capture is necessary only when the roots, the part of the plants where these contaminants are concentrated, are sampled and used for the gasification process. Although energy from biomass produced on a contaminated site is currently considered waste and involves disposal costs, this paper shows that the poplar biomass grown on a multi-contaminated soil can be used for energy purposes without any impact on the environment.

**Abstract ENG:** Remediation of polluted soils using phytoremediation techniques is an effective strategy. However, the use of the biomass from these soils for energy purposes may raise efficiency and pollution emission problems and there is currently little research on this issue. In this work, the main results of a fluidized-bed gasification treatment conducted on poplar biomass pruning residues from a multi-contaminated area are presented. The samples were collected from an experimental site in which a plant-assisted bioremediation (PABR) technology has been applied since 2013 to reduce the soil heavy metal (HM) and polychlorinated biphenyl (PCB) contents. The main goal of this study was to identify the specific treatment necessary, in addition to conventional tar reforming, for trapping possible residues of HMs and PCBs in ashes during the gasification process. In our study, we demonstrate that gasification of contaminated biomass coming from PABR (where contaminant residues are concentrated mainly in the roots and are insignificant in the shoots) produces syngas whose characteristics are similar to those obtained using non-

contaminated biomass. The results showed that contaminant concentrations in the prunings were negligible; the total amount of PCBs was 1.63 ng/g, while HMs ranged from 0.01 to 0.70 mg/kg, except for Cu and Zn (~20 mg/kg). Furthermore, the presence in the biomass of Ca and traces of other metals showed a possible catalytic effect with an improvement in the tar conversion in the gasifier leading to a reduction of 5-10% in tar content. The overall results suggest that a specific treatment for pollutant capture is necessary only when the roots, the part of the plants where these contaminants are concentrated, are sampled and used for the gasification process. Although energy from biomass produced on a contaminated site is currently considered waste and involves disposal costs, this paper shows that the poplar biomass grown on a multi-contaminated soil can be used for energy purposes without any impact on the environment.

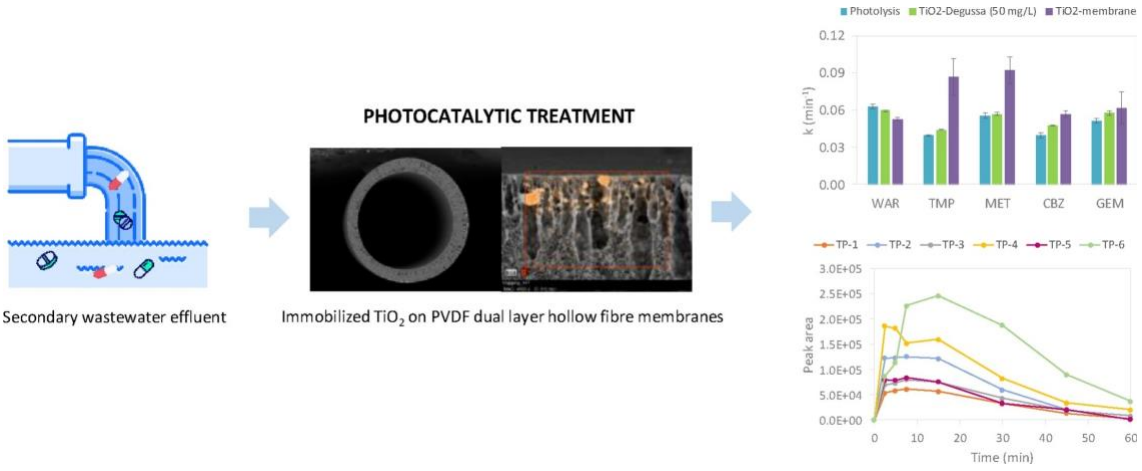
## Application of immobilized TiO2 on PVDF dual layer hollow fibre membrane to improve the photocatalytic removal of pharmaceuticals in different water matrices

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Applied Catalysis B: Environmental, 2019, 240, 9-18, DOI: 10.1016/j.apcatb.2018.08.067

**Autori:** Paredes, L., Murgolo, S., Dzinun, H., M.H.D. Othman, A.F. Ismail, Carballa, M., Mascolo, G.

**Abstract ENG:** A promising membrane configuration based on immobilized TiO2 on poly(vinylidene fluoride) (PVDF) dual layer hollow fibre membranes was prepared and successfully employed for the photocatalytic degradation of eight pharmaceuticals. Experiments were carried out in a flow reactor of 0.5 L equipped with a lamp emitting at 254 nm, treating groundwater and secondary wastewater effluent. The efficiency of the new catalyst to phototransform target micropollutants was demonstrated, being dependent on the selected compound. Only the application of photocatalysis using the supported catalyst allowed to increase the phototransformation rate of trimethoprim, metoprolol and carbamazepine treating secondary wastewater effluent (1.4–2.2 times faster than photolysis). The determination of electrical energy per order of magnitude of transformation (EEO) confirmed the lowest energy requirements to transform selected pharmaceuticals in secondary effluent employing the supported catalyst (33–58 kW h m−3 compared to 49–79 kW h m−3 applying only photolysis). The detection and identification of transformation products formed during the investigated treatments was performed by UPLC-QTOF/MS/MS. 156 transformation products were detected showing two different types of time profiles, namely a bell-shape trend or a constant increase along reaction time thus accumulating in the reaction mixture. The chemical structure for 19 out of 156 detected compounds was proposed as derived from parent compounds spiked in the secondary effluent.



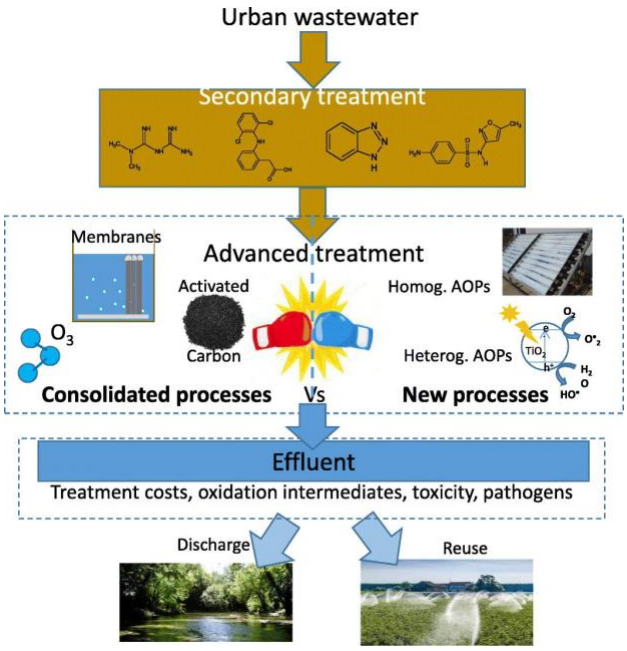
## Consolidated vs new advanced treatment methods for the removal of contaminants of emerging concern from urban wastewater

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Science of the Total Environment, 2019, 655, 986-1008, doi: 10.1016/j.scitotenv.2018.11.265

**Autori:** Luigi Rizzo, Sixto Malato, Demet Antakyali, Vasiliki G.Beretsou, Maja B. Đolić, Wolfgang Gernjak, Ester Heath, Ivana Ivancev-Tumbas, Popi Karaolia, Ana R.Lado Ribeiro, Giuseppe Mascolo, Christa S. McArdell, Heidemarie Schaar, Adrián M.T. Silva, Despo Fatta-Kassinos

**Abstract ENG:** Urban wastewater treatment plants (WWTPs) are among the main anthropogenic sources for the release of contaminants of emerging concern (CECs) into the environment, which can result in toxic and adverse effects on aquatic organisms and consequently on humans. Unfortunately, WWTPs are not designed to remove CECs and secondary (e.g., conventional activated sludge process, CAS) and tertiary (such as filtration and disinfection) treatments are not effective in the removal of most CECs entering WWTP. Accordingly, several advanced treatment methods have been investigated for the removal of CECs from wastewater, including consolidated (namely, activated carbon (AC) adsorption, ozonation and membranes) and new (such as advanced oxidation processes (AOPs)) processes/technologies. This review paper gathers the efforts of a group of international experts, members of the NEREUS COST Action ES1403 who for three years have been constructively discussing the state of the art and the best available technologies for the advanced treatment of urban wastewater. In particular, this work critically reviews the papers available in scientific literature on consolidated (ozonation, AC and membranes) and new advanced treatment methods (mainly AOPs) to analyse: (i) their efficiency in the removal of CECs from wastewater, (ii) advantages and drawbacks, (iii) possible obstacles to the application of AOPs, (iv) technological limitations and mid to long-term perspectives for the application of heterogeneous processes, and (v) a technical and economic comparison among the different processes/technologies.



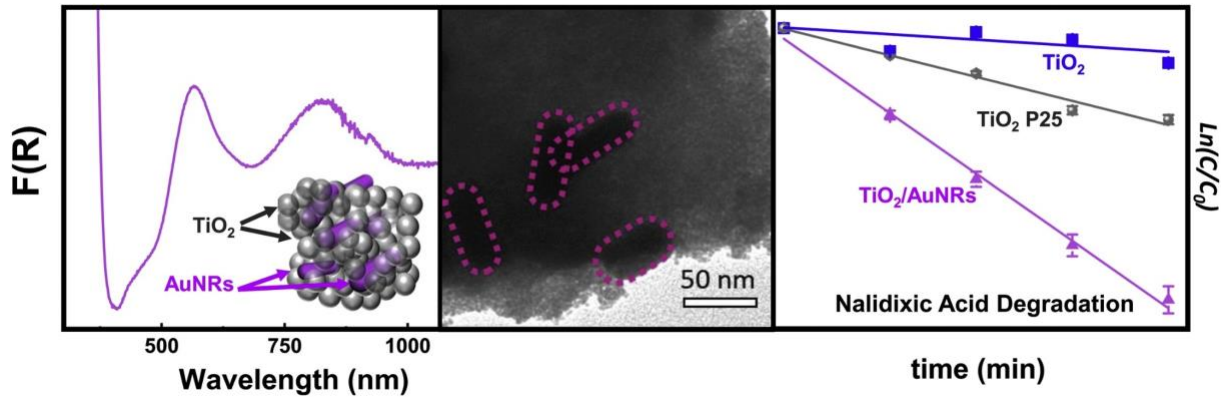
## Gram-scale synthesis of UV–vis light active plasmonic photocatalytic nanocomposite based on TiO2/Au nanorods for degradation of pollutants in water

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Applied Catalysis B: Environmental, 2019, 243, 604-613, doi: 10.1016/j.apcatb.2018.11.002

**Autori:** A. Truppi, F. Petronella, T. Placido, V. Margiotta, G. Lasorella, L. Giotta, C. Giannini, T. Sibillano, S. Murgolo, G. Mascolo, A. Agostiano, M.L. Curri, R. Comparelli

**Abstract ENG:** Semiconductor/metal nanocomposites based on anatase TiO2 nanoparticles and Au nanorods (TiO2/AuNRs) were prepared by means of a co-precipitation method and subsequently calcinated at increasing temperature (from 250° to 650 °C) obtaining up to 20 g of catalysts. The structure and the morphology of the obtained nanocomposite material were comprehensively characterized by means of electron microscopy (SEM and TEM) and X-ray diffraction techniques. The photocatalytic performance of the TiO2/AuNRs nanocomposites was investigated as a function of the calcination temperature in experiment of degradation of water pollutants under both UV and UV–vis irradiation, Photocatalytic experiments under UV irradiation were performed by monitoring spectrophotometrically the decolouration of a target compound (methylene blue, MB) in aqueous solution. UV–vis light irradiation was, instead, used for testing the photocatalytic removal of an antibiotic molecule, Nalidixic acid, by monitoring the degradation process by HPLC-MS analysis. Interestingly, TiO2/AuNRs calcined at 450 °C was up to 2.5 and 3.2 times faster than TiO2P25 Evonik, that is a commercially available reference material, in the photocatalytic degradation of the Methylene Blue and the Nalidixic Acid, under UV and visible light, respectively. The same nanocomposite material showed a photocatalytic degradation rate for the two target compounds up to 13 times faster than the bare TiO2-based catalysts. The obtained results are explained on the basis of the structure and morphology of the nanocomposites, that could be tuned according to the preparative conditions. The role played by the plasmonic domain in the heterostructured materials, either under UV and UV–vis illumination, is also highlighted and discussed. The overall results indicate that the high photoactivity of TiO2/AuNRs in the visible range can be profitably exploited in photocatalytic applications, thanks also to the scalability of the proposed synthetic route, thus ultimately envisaging potential innovative solution for environmental remediation.



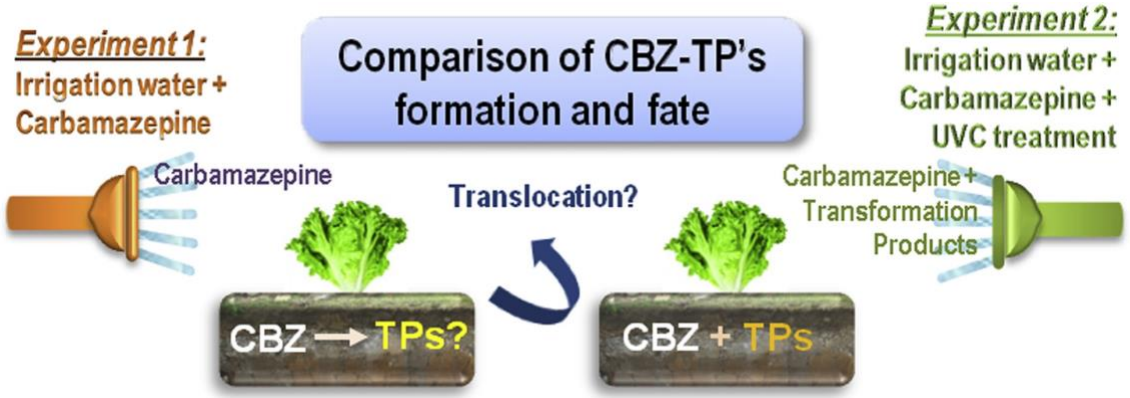
## Identification of transformation products of carbamazepine in lettuce crops irrigated with Ultraviolet-C treated water

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Environmental Pollution, 2019, 247, 1009-1019, doi: 10.1016/j.envpol.2019.02.001

**Autori:** A.B. Martínez-Piernas, S. Nahim-Granados, M.I. Polo-López, P .Fernández-Ibáñez, S. Murgolo, G. Mascolo, A. Agüera

**Abstract ENG:** Transformation of organic microcontaminants (OMCs) during wastewater treatments results in the generation of transformation products (TPs), which can be more persistent than parent compounds. Due to reuse of reclaimed wastewater (RWW) for crop irrigation, OMCs and TPs are released in soils being capable to translocate to crops. Furthermore, OMCs are also susceptible to transformation once they reach the soil or crops. The recalcitrant antiepileptic carbamazepine (CBZ) and some of its frequently reported TPs have been found in agricultural systems. However, there is no knowledge about the fate in reuse practices of multiple CBZ TPs that can be formed during wastewater treatment processes. For the first time, this work presents a study of the behavior of CBZ TPs generated after a conventional Ultraviolet-C (UVC) treatment in an agricultural environment. The UVC-treated water was used for the irrigation of lettuces grown under controlled conditions. The latter was compared to the fate of TPs generated in the peat and plant by irrigation with non-treated water containing CBZ. A suspect screening strategy was developed to identify the TPs using liquid chromatography coupled to quadrupole-time-of-flight (LC-QTOF-MS). The results revealed the presence of 24 TPs, 22 in UVC-treated water, 11 in peat and 9 in lettuce leaves. 4 of the TPs identified in peat (iminostilbene, TP 271B, TP 285A-B); and 3 in leaves (10–11 dihydrocarbamazepine, TP 271A-B) were not previously reported in soils or edible parts of crops, respectively. Comparing the TPs found in peat and lettuces derived from both irrigation conditions, no significant differences regarding TPs formation or occurrence were observed. UVC treatment did not contribute to the formation of different TPs than those generated by transformation or metabolism of CBZ in peat or plant material. This research improves the current knowledge on the fate of CBZ TPs in agricultural systems because of reuse practices. A lab scale study has evidenced the potential translocation of non-previously reported CBZ TPs in a lettuce crop irrigated with UVC-treated water which contained CBZ.



## Degradation of emerging organic pollutants in wastewater effluents by electrochemical photocatalysis on nanostructured TiO2 meshes

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Water Research, 2019, 164,114920, doi: 10.1016/j.watres.2019.114920

**Autori:** S. Murgolo, S. Franz, H. Arab, M. Bestetti, E. Falletta, G. Mascolo

**Abstract ENG:** An immobilized photoactive TiO2 coating grown directly on titanium meshes was successfully exploited for the electrochemical photocatalytic degradation of carbamazepine in real secondary wastewater effluent. The catalyst was prepared by Plasma Electrolytic Oxidation and during the photocatalytic water treatment an electrical polarization (bias) was applied to the catalyst. The investigated process was compared with the conventional one employing suspended TiO2 powder (Degussa P25). Results showed that carbamazepine degradation rate follows the order UV/supported TiO2+bias ≈ UV/TiO2 Degussa P25 > UV/supported TiO2 > UV. The investigation also included the identification of other micropollutants and degradation products. This allowed the detection of 201 compounds present in the secondary wastewater effluent employed for the photocatalysis tests, 51 of them also successfully associated to compounds of emerging concern (CECs), and 194 to transformation products (TPs). The degradation of detected compounds followed first-order kinetics and the mean kinetic constant values of the 51 CECs resulted to be 0.048, 0.035 and 0.043 min−1 for the TiO2+Bias + UV, TiO2+UV and UV, respectively. As for TPs, results showed that the TiO2+Bias + UV treatment is much more efficient than both TiO2+UV and UV in minimizing the intensity of the organics in the real wastewater. Such a better performance was more pronounced at higher reaction time reaching 60% reduction of mean peak area of TPs at 90 min of reaction. Among the detected TPs also compounds belonging to known carbamazepine TPs were found. This allowed to propose a degradation pathway of carbamazepine. The supported catalyst was positively tested for 15 cycles demonstrating that it has the potential to be used in real wastewater tertiary steps aimed at removing CECs.

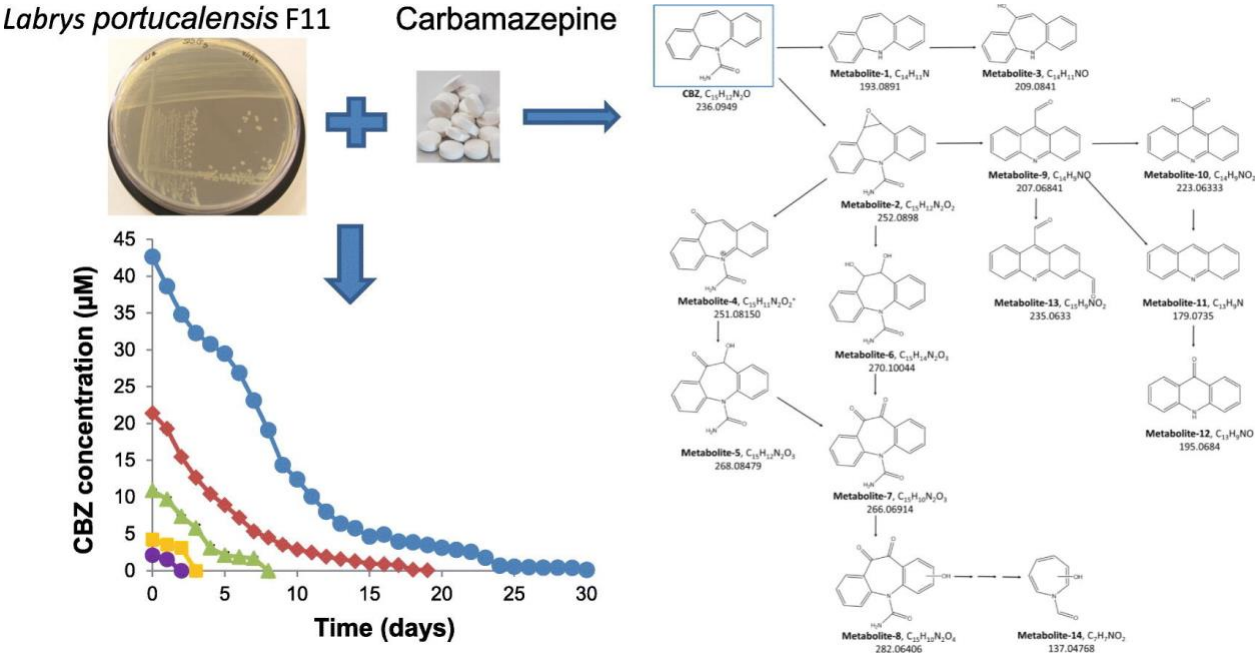
## Carbamazepine is degraded by the bacterial strain Labrys portucalensis F11

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Science of the Total Environment, 2019, 690, 739-747, doi: 10.1016/j.scitotenv.2019.06.461

**Autori:** Bessa, V.S., Moreira, I.S., Murgolo, S., Mascolo, G., Castro, P.M.L.

**Abstract ENG:** The occurrence of pharmaceuticals in the environment is a topic of concern. Carbamazepine (CBZ) is a widespread antiepileptic drug and due to its physical-chemical characteristics minimal removal is achieved in conventional water treatments, and thus has been suggested as a molecular marker of wastewater contamination in surface water and groundwater. The present study reports the biotransformation of CBZ by the bacterial strain Labrys portucalensis F11. When supplied as a sole carbon source, a 95.4% biotransformation of 42.69 μM CBZ was achieved in 30 days. In co-metabolism with acetate, complete biotransformation was attained at a faster rate. Following a target approach, the detection and identification of 14 intermediary metabolites was achieved through UPLC-QTOF/MS/MS. Biotransformation of CBZ by the bacterial strain is mostly based on oxidation, loss of -CHNO group and ketone formation reactions; a biotransformation pathway with two routes is proposed. The toxicity of untreated and treated CBZ solutions was assessed using Vibrio Fischeri and Lepidium sativum acute toxicity tests and Toxi-Chromo Test. The presence of CBZ and/or its degradations products in solution resulted in moderate toxic effect on Vibrio Fischeri, whereas the other organisms were not affected. To the best of our knowledge this is the first report that proposes the metabolic degradation pathway of CBZ by a single bacterial strain.



## Functional Response of MBR Microbial Consortia to Substrate Stress as Revealed by Metaproteomics

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Microbial Ecology, 2019, 78, 873–884, DOI: 10.1007/s00248-019-01360-4

**Autori:** Carlo Salerno, Giovanni Berardi, Giuseppe Laera, Alfieri Pollice

**Abstract ITA:** I consorzi batterici hanno un ruolo primario nelle degradazioni biologiche che avvengono nei fanghi attivi per il trattamento delle acque reflue per la loro capacità di metabolizzare la materia inquinante. Pertanto la conoscenza delle principali vie metaboliche per la degradazione degli inquinanti diventa fondamentale per una corretta progettazione e funzionamento degli impianti di depurazione. L'attività metabolica dei diversi gruppi batterici nei fanghi attivi viene comunemente studiata attraverso la respirometria. Inoltre negli ultimi anni lo sviluppo di approcci "omici" ha offerto maggiori opportunità per integrare o sostituire i saggi microbiologici convenzionali e per comprendere a fondo la tassonomia e le dinamiche di consorzi microbici complessi. Nel presente lavoro è stato installato e messo in funzione uno sperimentale bioreattore a membrana (MBR) per il trattamento delle acque reflue urbane, e sono stati studiati gli effetti di un'improvvisa diminuzione della fornitura organica sui fanghi attivi. Sia l'approccio respirometrico che quello metaproteomico hanno rivelato una resistenza dei batteri autotrofi allo stress del substrato, in particolare dei batteri nitrificanti. Inoltre, la metaproteomica ha consentito l'identificazione tassonomica del consorzio microbico in base alla sua espressione proteica, svelando la prevalenza dei generi Sorangium e Nitrosomonas sia prima che dopo la diminuzione del carico organico. Inoltre sono stati confermati i risultati ottenuti attraverso la respirometria con la rivelata generale espressione di proteine coinvolte nel metabolismo e nel trasporto dell'azoto, o appartenenti a specie nitrificanti come Nitrosomonas europeae, Nitrosomonas sp. AL212 o Nitrospira defluvii.

**Abstract ENG:** Bacterial consortia have a primary role in the biological degradations occurring in activated sludge for wastewater treatment, for their capacities to metabolize the polluting matter. Therefore, the knowledge of the main metabolic pathways for the degradation of pollutants becomes critical for a correct design and operation of wastewater treatment plants. The metabolic activity of the different bacterial groups in activated sludge is commonly investigated through respirometry. Furthermore, in the last years, the development of "omic" approaches has offered more opportunities to integrate or substitute the conventional microbiological assays and to deeply understand the taxonomy and dynamics of complex microbial consortia. In the present work, an experimental membrane bioreactor (MBR) was set up and operated for the treatment of municipal wastewater, and the effects of a sudden decrease of the organic supply on the activated sludge were investigated. Both respirometric and metaproteomic approaches revealed a resistance of autotrophic bacteria to the substrate stress, and particularly of nitrifying bacteria. Furthermore, metaproteomics allowed the identification of the taxonomy of the microbial consortium based on its protein expression, unveiling the prevalence of Sorangium and Nitrosomonas genera both before and after the organic load decrease. Moreover, it confirmed the results obtained through respirometry and revealed a general expression of proteins involved in metabolism and transport of nitrogen, or belonging to nitrifying species like Nitrosomonas europeae, Nitrosomonas sp. AL212, or Nitrospira defluvii.

## The present state of Lake Bracciano: hope and despair

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Rendiconti Lincei. Scienze Fisiche e Naturali (2019) 30:83–91 https://doi.org/10.1007/s12210-018-0733-4

**Autori:** Rossi David, Romano E., Guyennon N., Rainaldi M., Ghergo S., Mecali A., Parrone D., Taviani S., Scala A., Perugini E.

**Abstract ITA:** Nel 2017, le risorse idriche superficiali dell'Italia centrale hanno sofferto di una combinazione di clima secco e aumento dell'estrazione umana. In particolare, il livello dell'acqua della principale riserva idrica strategica di acqua potabile superficiale della città di Roma (Lago di Bracciano) si trova attualmente a livelli minimi storici e l'ecosistema lacustre è in uno stato instabile. Lo scopo di questo studio è descrivere lo stato attuale del Lago di Bracciano attraverso un approccio multidisciplinare alla luce delle variazioni climatiche e idrologiche dell'ultimo decennio. La ricostruzione digitale della cuvetta del lago ha permesso di quantificare gli effetti delle oscillazioni nel livello del lago sul la battigia, mentre è stato indagato mediante monitoraggio il potenziale impatto del forzante meteorologico sulle oscillazioni a livello del lago anomalie nelle velocità di precipitazione ed evaporazione. I risultati preliminari indicano che l'attuale crisi del Lago di Bracciano deriva principalmente da precipitazioni inferiori alla media dal 2015, aggravate da una significativa captazione di acqua. negli ultimi 3 anni, non c'è stata quasi nessuna fase di recupero invernale, con una perdita totale di acqua pari a 114 milioni di m3, dato questo mai verificatosi in precedenza. Nel novembre 2017, il livello del lago ha raggiunto un minimo storico di - 198 cm rispetto allo zero idrometrico (corrispondente ad una riduzione del 13,5% della superficie del letto del lago responsabile dell'autodepurazione), notevolmente inferiore il livello sostenibile di - 150 cm. Concludiamo che le scarse precipitazioni (- 50% nel 2017 rispetto al 1961–1990 baseline), un'evaporazione intensa (6,7 mm / giorno durante l'estate 2017) e le captazioni hanno portato l'ecosistema lacustre e di conseguenza i servizi ecosistemici ad esso associati a condizioni di gravi stress.

**Abstract ENG:** In 2017, the surface water resources of central Italy suffered from a combination of dry weather and increased human extraction. Specifically, the water level of the main surface drinking water reservoir supplying the City of Rome (Lake Bracciano) is currently low and the lacustrine ecosystem is in an unstable state. The aim of this study is to describe the current state of Lake Bracciano via a multidisciplinary approach in the light of the climate and hydrological variation over the past decade. The digital reconstruction of the lake cuvette made it possible to quantify the effects of oscillations in the level of the lake on the shoreline, while the potential impact of meteorological forcing on the lake-level oscillations was investigated by monitoring anomalies in precipitation and evaporation rates. The preliminary results indicate that the present Lake Bracciano crisis mainly results from below-average precipitation since 2015, compounded by significant water extraction. Indeed, in the past 3 years, there has been almost no winter recovery phase, resulting in a total water loss of 114 millions of m3, which has never been observed before. In November 2017, the lake level reached a historic low of − 198 cm with respect to the hydrological zero (corresponding to a 13.5% reduction in the area of the lake bed responsible for self-purification), considerably below the sustainable level of − 150 cm. We conclude that the persistent low precipitation (− 50% in 2017 with respect to the 1961–1990 baseline), intense evaporation

(6.7 mm/day during summer 2017), and extraction have brought the ecological state and associated ecosystem services of Lake Bracciano to conditions of serious stress.

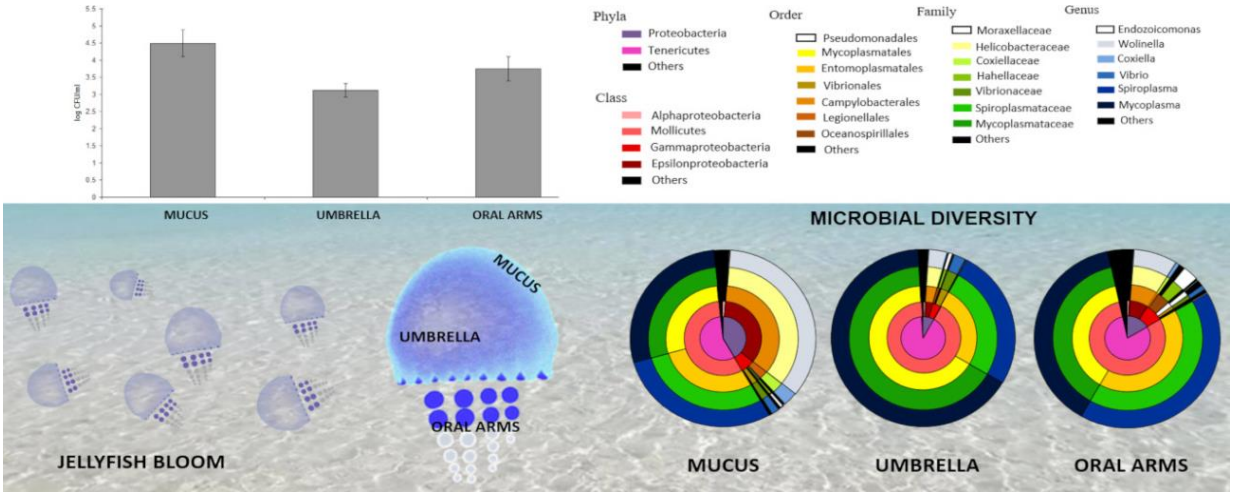
## Metal hydrated-salts as efficient and reusable catalysts for pre-treating waste cooking oils and animal fats for an effective production of biodiesel

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Renewable Energy, 2019, 143, 1193-1200, DOI: 10.1016/j.renene.2019.0Attività di docenza0

**Autori:** di Bitonto, L., Pastore, C.

**Abstract ENG:** A very efficient chemical pre-treatment method that uses cheap and safe hydrated-salts as catalysts for the conversion of waste cooking oils and animal fats having a high Free Fatty Acids (FFAs) content into an oily feedstock convertible into biodiesel through a conventional route (basic catalysis) was investigated. These hydrated-salts allow FFAs to be efficiently (>99%) esterified with alcohols under very mild conditions (343 K, 2 h). At the end of this treatment, a very convenient separation of products was verified. Two different phases were eventually obtained: an upper alcoholic phase, which contains most of the unreacted alcohol, water obtained by direct-esterification (>95%), and the salt that was used as catalyst (recovery >99%); and a lower oily-phase mainly composed of glycerides, methyl-esters derived from direct-esterification of FFAs (residual acidity of about 0.8 mg KOH/g), and part of unreacted alcohol (7–10%wt). Such a separation was convenient because the oily-phase could be directly trans-esterified through conventional base-catalysis, without any further pre-treatments, thus avoiding production of salty-waste. Also, the alcoholic phase could be recovered and directly re-used for new pre-treatments cycles of fresh waste-oils. A final scheme of the proposed process was discussed and the relevant advantages with respect to conventional routes were highlighted.



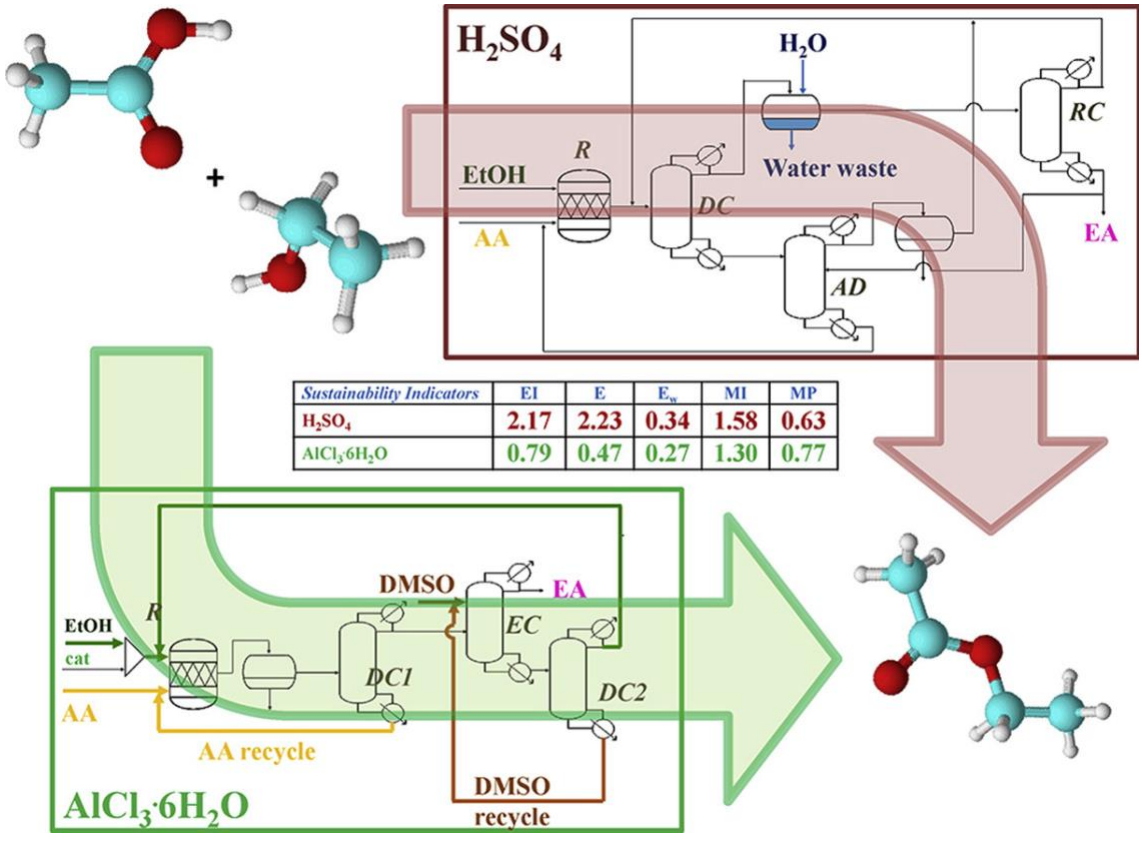
## Process intensification for the production of the ethyl esters of volatile fatty acids using aluminium chloride hexahydrate as a catalyst

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Journal of Cleaner Production, 2019, 239, 18122, DOI: 10.1016/j.jclepro.2019.118122

**Autori:** di Bitonto, L., Menegatti, S., Pastore, C.

**Abstract ENG:** A new process for obtaining the ethyl esters of volatile fatty acids with ethanol by using aluminium chloride hexahydrate as a catalyst is proposed. Aluminium chloride not only exhibits good activity, composition equilibrium is achieved within 3–4 h at 343 K, but also induces a phase separation with a convenient distribution of the components. In fact, more than 99 %wt of the ethyl esters, together with most of the unreacted acid and ethanol, were found in the upper layer, which was well separated from the bottom phase, which contained the co-formed water and over 97.8 %wt of the catalyst. The intensification of this reaction and separation was thoroughly investigated and the operational conditions optimised. The effects of this separation on the purification of the final ethyl esters is fully investigated. A new configuration of unit operations is designed for the specific production of ethyl acetate, simulated through Aspen Plus V9® and compared with the current industrial process based on sulfuric acid catalysis. The overall production and purification of ethyl acetate is economically competitive, reduces the energy requirements by more than 50%, and is potentially a zero-waste process, resulting in cleaner production.



## Pilot scale cellulose recovery from sewage sludge and reuse in building and construction material

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Waste Management, 2019, 100, 208-218, DOI: 10.1016/j.wasman.2019.09.015

**Autori:** Palmieri, S., Cipolletta, G., Pastore, C., Giosuè, C., Akyol, Ç., Eusebi, A.L., Frison, N., Tittarelli, F., Fatone, F.

**Abstract ENG:** The recovery of cellulose in toilet paper from municipal wastewater is one of the most innovative actions in the circular economy context. In fact, fibres could address possible new uses in the building sector as reinforcing components in binder-based materials. In this paper, rotating belt filters were tested to enhance the recovery of sludge rich in cellulose fibres for possible valorisation in construction applications. Recovered cellulosic material reached value up to 26.6 gm−3 with maximum solids removal of 74%. Content of cellulose, hemicellulose and lignin was found averagely equal to 87% of the total composition. Predictive equation of cellulosic material was further obtained. The addition of recovered cellulose fibres in mortars bring benefits in terms of lightness, microstructure and moisture buffering value (0.17 g/m2%UR). Concerning mechanical properties, flexural strength was improved with the addition of 20% of recovered cellulose fibres. In addition, a simplified economic assessment was reported for two possible pre-mixed blends with 5% and 20% of recovered fibres content.

## Toilet paper recovery from municipal wastewater and application in building sector

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** IOP Conference Series: Earth and Environmental Science, 2019, 296, 012024, DOI: 10.1088/1755-1315/296/1/012024

**Autori:** Cipolletta, G., Eusebi, A.L., Palmieri, S., Giosuè, C., Tittarelli, F., Frison, N., Pastore, C., Foglia, A., Fatone, F.

**Abstract ENG:** One of the most innovative applications for a circular economy approach is the recovery of cellulose fibres from municipal wastewater. Recovered cellulose fibres from the wastewater could bring benefits to the construction industry in terms of reducing the amount of non-renewable raw materials and increasing sustainability. Rotating belt filter was used to obtain cellulose fibre-rich sludge from real urban influent. Recovered cellulosic material reached values up to 26.59 g m-3 when the solids removal efficiency was higher than 70%. Treated cellulosic sludge had an average of 87% content of cellulose, hemicellulose and lignin. The recovered cellulose fibres were analysed and used in mortar mix to understand their possible impact in the building sector and the effect on the properties of hydraulic lime-based mortars. Properties of fibre addition were investigated in terms of microstructure and mechanical strength. Cellulose fibres were added by mix volume up to 20%. The overall results with the maximum content of cellulose fibres indicated the improvement of mortars performance in terms of increased lightness, flexural strength and hygrometric properties.

## An overall perspective for the energetic valorization of household food waste using microbial fuel cell technology of its extract, coupled with anaerobic digestion of the solid residue

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Applied Energy, 2019, 242, 1064-1073, DOI: 10.1016/j.apenergy.2019.03.082

**Autori:** Antonopoulou, G., Ntaikou, I., Pastore, C., di Bitonto, L., Bebelis, S., Lyberatos, G.

**Abstract ENG:** The valorization of typical household food waste (HFW) produced at municipality level was studied for the production of electricity in a microbial fuel cell (MFC) from its extract, and methane, through anaerobic digestion of the solid extraction residue. HFW, after heat drying and shredding, was subjected to extraction using warm water, which resulted in a liquid fraction (extract) and a solid residue. The rich in soluble chemical oxygen demand extract was used for electricity production in a four air– cathodes single chamber MFC, operating under different organic loading rates, while the solid residue from the extraction process was used as substrate for methane production in biochemical methane potential experiments. On the basis of the energy outputs estimated for the optimum operational conditions of both aforementioned processes, it can be concluded that the exploitation of dried HFW is quite appealing as it leads to promising energy recovery.

## An economically viable two-step process for biodiesel production from waste cooking oils

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Bulgarian Chemical Communications, 2019, 51, Special Issue B, 67-69, DOI: 10.34049/bcc.51.B.022

**Autori:** Errico, M., Pastore, C.

**Abstract ENG:** A real sample of waste cooking oil having an acidity of 8 mgKOH/goil and a water content of 700 ppm was efficiently converted into biodiesel. The process consisted in a two-step reaction: a preliminary treatment with AlCl3·6H2O to convert free fatty acids into the respective methyl esters, followed by alkaline transesterification using KOH as a catalyst. In detail, pretreatment with AlCl3·6H2O (345 K, 4 h, weight ratio MeOH:oil:catalyst of 1:3:0.01) allowed to obtain an efficient conversion of starting free fatty acid into the relevant fatty acid methyl esters (yield > 95%). After the reaction a convenient separation of phases was obtained. Two different phases were isolated: an oily phase with a methanol content of 7 % wt, in which methyl esters were dissolved in, with most of glycerides and with a very limited content of water to one side, and a lighter phase, in which most of unreacted methanol and catalyst together with water were solubilized. Such a separation made possible the direct use of the pretreated oily phase with AlCl3·6H2O in the transesterification without any further treatments, unless to adequate the methanol content. KOH was used to complete the conversion in the second step. Reaction occurred completely in 4 hours and the final biodiesel was conform to EN14214.

## Mexican biomass wastes: Valorization for potential application in bioenergy

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Bulgarian Chemical Communications, 2019, 51, Special Issue B, 99-102, DOI: 10.34049/bcc.51.B.003

**Autori:** di Bitonto, L., Reynel-Avila, H.E., Mendoza-Castillo, D.I., Pastore, C., Bonilla-Petriciolet, A.

**Abstract ENG:** The conversion of biomass into biofuels and biochemicals, represent a useful way to reduce the use of fossil fuels and maintain a sustainable energy production. In this context, Mexico is a country with a wide variety of exploitable agricultural resources that can be used to support its economic growth. In this study, several Mexican biomass wastes (avocado seeds, palm seeds, peppers, flamboyant fruit, jatropha seeds, coconut shells and nance seeds) were analyzed and fully characterized, in order to obtain a complete exploitation of their energy potential.

## Avocado seeds valorization as adsorbents of priority pollutants from water

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Bulgarian Chemical Communications, 2019, 51, Special Issue B, 124-127, DOI: 10.34049/bcc.51.B.009

**Autori:** Mendoza-Castillo, D.I., Reynel-Ávila, H.E., Bonilla-Petriciolet, A., Pastore, C., di Bitonto, L.

**Abstract ENG:** This study has focused on the synthesis of lanthanum-, cerium- and calcium-functionalized adsorbents to remove heavy metal ions from aqueous solutions. Avocado seeds were used as a feedstock to obtain carbon-based adsorbents via pyrolysis and these adsorbents were further functionalized with lanthanum, cerium and calcium species using different experimental conditions to improve its adsorption properties. These adsorbents were utilized for the adsorption of heavy metals from aqueous solutions. At tested experimental conditions, the raw adsorbent showed an adsorption capacity of 7.04, 10.91, 11.41 and 6.38 mg/g for cadmium, nickel, copper and zinc, respectively. These adsorption capacities increased up to 70 % after adsorbent surface functionalization. These results suggested that the adsorption capacity of avocado-based adsorbents appeared to be dependent of the adsorbate properties.

## Synthesis, characterization and applications of carbon-based calcium catalysts deriving from avocado seeds for biodiesel production from waste cooking oil

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Bulgarian Chemical Communications, 2019, 51, Special Issue B, 85-88, DOI: 10.34049/bcc.51.B.002

**Autori:** di Bitonto, L., Reynel-Ávila, H.E., Mendoza-Castillo, D.I., Bonilla-Petriciolet, A., Durán-Valle, C.J., Pastore, C.

**Abstract ENG:** In this work, avocado seeds were successfully used as precursors to produce carbon-based calcium catalysts for biodiesel production. The catalysts were synthetized via precipitation method, by loading different amounts of calcium nitrate on carbonized supports obtained by pyrolysis under nitrogen flow of dried biomass. The effect of Ca loaded on the structure and the activity of the catalysts for biodiesel synthesis from sunflower oil with methanol was investigated. Results showed that supported catalyst loaded with 20%wt of Ca, efficiently promote the trans-esterification process (FAMEs content >80%) with the catalyst that was easily recovered and reused. Reaction conditions were then optimised using the desirability function applied on the response surface methodology analysis of a Box–Behnken factorial design of experiments. Finally, the optimized conditions were adopted on several non-edible oils with Free Fatty Acids content range between 1 and 15 mg KOH/g. In all cases, a FAMEs content >95% was in any case obtained.

## The potential use of calcium-doped flamboyant char as a heterogeneous catalyst in triglycerides transesterification

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Bulgarian Chemical Communications, 2019, 51, Special Issue B, 128-131, DOI: 10.34049/bcc.51.B.007

**Autori:** Diaz-Muñoz, L.L., Reynel-Avila, H.E., Di Bitonto, L., Mendoza-Castillo, D.I., Pastore, C., Bonilla-Petriciolet, A.

**Abstract ENG:** This study reports the synthesis of heterogeneous catalysts from flamboyant biomass and their evaluation on the transesterification reaction of safflower oil with methanol to produce biodiesel. The optimization of catalyst preparation conditions was performed. Results showed that the concentration of doping metallic specie was the main variable that affected the performance of flamboyant-based catalyst in the reactive system to obtain the biofuel where the highest formation of methyl esters was 93 %. Physicochemical characterization of the carbon-based catalysts was done with X-ray diffraction and FTIR.

## Assessing of potential of Aronia Berries residue after juice extraction as a feedstock for platform molecules production

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Bulgarian Chemical Communications, 2019, 51, Special Issue B, 103-105, DOI: 10.34049/bcc.51.B.004

**Autori:** Angelini, A., di Bitonto, L., Zikou, E., Santzouk, S., Santzouk, G., Roda-Serrat, M.C., Errico, M., Pastore, C.

**Abstract ENG:** The recovery of fruit industrial waste for the production of added value compounds is a topic of great importance for the application of circular economy principle. Pomace waste coming from Aronia melanocarpa industrial utilization is an interesting source of bioactive compounds such as dietary fibre, pectins, cell wall polysaccharides, vitamins, polyphenols, phospholipides. The extraction of bioactive substances has been carried out through an enzymatic approach followed by ultrafiltration technique. The obtained residues have been collected and characterized. The obtained data revealed the presence of free and complex sugars such as glucose, fructose, sorbitol, EHS and cellulose that could be considered starting feedstock for platform molecule production.

## ZnO/ionic liquid catalyzed biodiesel production from renewable and waste lipids as feedstocks

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Catalysts, 2019, 71, 1, DOI: 10.3390/catal9010071

**Autori:** Casiello, M., Catucci, L., Fracassi, F., Fusco, C., Laurenza, A.G., Di Bitonto, L., Pastore, C., D'accolti, L., Nacci, A.

**Abstract ENG:** A new protocol for biodiesel production is proposed, based on a binary ZnO/TBAI (TBAI = tetrabutylammonium iodide) catalytic system. Zinc oxide acts as a heterogeneous, bifunctional Lewis acid/base catalyst, while TBAI plays the role of phase transfer agent. Being composed by the bulk form powders, the whole catalyst system proved to be easy to use, without requiring nano-structuration or tedious and costly preparation or pre-activation procedures. In addition, due to the amphoteric properties of ZnO, the catalyst can simultaneously promote transesterification and esterification processes, thus becoming applicable to common vegetable oils (e.g., soybean, jatropha, linseed, etc.) and animal fats (lard and fish oil), but also to waste lipids such as cooking oils (WCOs), highly acidic lipids from oil industry processing, and lipid fractions of municipal sewage sludge. Reusability of the catalyst system together with kinetic (Ea) and thermodynamic parameters of activation (ΔG‡ and ΔH‡) are also studied for transesterification reaction.

## Integrated Approach for Supporting Sustainable Water Resources Management of Irrigation Based on the WEFN Framework

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Water Resources Management, 2019, 33, 1281-1295, doi: 10.1007/s11269-019-2196-5

**Autori:** de Vito, R., Pagano, A., Portoghese, I., Giordano, R., Vurro, M., & Fratino, U.

**Abstract ITA:** L'agricoltura irrigua svolge un ruolo vitale per lo sviluppo socio-economico dell'area mediterranea, sebbene abbia impatti significativi sia sulle risorse idriche che energetiche. Pertanto, in un contesto in cui anche le risorse idriche stanno subendo crescenti pressioni, vi è un'urgente necessità di sostenere la loro gestione sostenibile. Questo può essere un compito estremamente impegnativo, soprattutto a scala locale, a causa delle diverse dinamiche interconnesse che influenzano lo stato di un complesso sistema irriguo. Infatti, una molteplicità di attori è coinvolta nei processi decisionali e l'uso delle risorse naturali (e delle loro reciproche interazioni) dipende fortemente dai modelli di comportamento, che influenzano il sistema nel suo complesso. In questo contesto, il presente studio propone una metodologia integrata, basata sul Water Energy Food Nexus (WEFN), specificamente focalizzata sulla gestione sostenibile delle risorse idriche per l'irrigazione. In primo luogo, viene sviluppato un modello basato su Causal Loop Diagrams (CLD) al fine di ottenere una visione approfondita delle dinamiche chiave alla base di un complesso sistema di irrigazione. In secondo luogo, vengono individuati tre indici basati sul concetto di “impronta”, al fine di sintetizzare tali dinamiche. L'integrazione di questi due approcci supporta lo studio dell'intero sistema e, in particolare, la comprensione dell'influenza di più attori decisionali su di esso, nonché il ruolo di una serie di fattori chiave e vincoli. Ciò potrebbe anche consentire di trarre alcune conclusioni rilevanti, utili a supportare decisioni efficaci orientate ad una gestione sostenibile delle risorse idriche. Si fa specifico riferimento ad un caso studio, il sistema irriguo della Capitanata, situato nel Sud Italia.

**Abstract ENG:** Irrigated agriculture plays a vital role for the socio-economic development of the Mediterranean area, although it has significant impacts on both water and energy resources. Therefore, in a context in which water resources are also experiencing increasing pressures, there is an urgent need for supporting their sustainable management. This may be an extremely challenging task, especially at the local scale, due to the several interconnected dynamics affecting the state of a complex irrigation system. In fact, multiple actors are involved in decision-making processes, and the use of natural resources (and their mutual interactions) strongly depends on their behaviors, which affect the system as a whole. In this context, the present study proposes an integrated methodology, based on the Water Energy Food Nexus (WEFN), specifically focused on the sustainable management of water resources for irrigation. Firstly, a model based on Causal Loop Diagrams (CLD) is developed in order to get a deep insight into the key dynamics behind a complex irrigation system. Secondly, three indices based on the “footprint” concept are identified, in order to synthesize such dynamics. The integration of these two approaches support investigating the whole system and, particularly, understanding the influence of multiple decisional actors on it, as well as the role of a set of key drivers and constraints. This might also allow drawing some relevant conclusions, useful for supporting effective decisions oriented to a sustainable water resources

management. Specific reference is made to a case study, the Capitanata irrigation system, located in the Southern Italy.

## Impatti economici dell'interruzione del servizio irriguo consortile nell'area della Capitanata (Puglia). Stima empirica per il pomodoro da industria nel periodo 2001-2016

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Aestimum, 2019, 74, 101-114, doi: 10.13128/aestim-7382

**Autori:** Giannoccaro, G., Casieri, A., de Vito, R., Zingaro, D., & Portoghese, I.

**Abstract ITA:** In questa ricerca viene proposta una valutazione empirica degli impatti economici sulla produzione di pomodoro dovuti alla ridotta disponibilità di acqua per l'irrigazione. Si considera una serie storica di 16 anni (2001-2016) per quanto riguarda il distretto agricolo del Tavoliere delle Puglie. Gli eventi di siccità verificatisi nel periodo di interesse hanno determinato impatti economici in termini di prodotto lordo e costi di irrigazione, con perdite che hanno raggiunto il 30% rispetto ad anni di regolare disponibilità idrica. Questi risultati preliminari richiedono un più ampio piano di gestione della siccità in cui sono inclusi anche strumenti economici con l'obiettivo di ridurre al minimo gli impatti economici della carenza di acqua per l'irrigazione.

**Abstract ENG:** In this research an empirical evaluation of the economic impacts on tomato production due to the reduced water availability for irrigation is proposed. A 16-years' time series is considered (2001-2016) with regard to the Tavoliere delle Puglie agricultural district. Drought events occurred in the period of interest have caused economic impacts in terms of gross product and irrigation costs, with losses reaching 30% compared to years with regular water availability. These preliminary results calls for a wider drought management plan in which also economic instruments are included with the aim of minimizing economic impacts of irrigation water shortage.

## Water Distribution Networks Resilience Analysis: a Comparison between Graph Theory-Based Approaches and Global Resilience Analysis

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Water Resources Management, 2019, 33 (8), 2925-2940, 10.1007/s11269-019-02276-x

**Autori:** Pagano, A., Sweetapple, C., Farmani, R., Giordano, R., Butler, D.

**Abstract ITA:** La struttura e la connettività dei sistemi infrastrutturali come le reti di distribuzione idrica (WDN) influiscono sulla loro affidabilità, efficienza e resilienza. Occorre sviluppare tecniche idonee a comprendere i potenziali impatti di rotture sul sistema, sia derivanti da fenomeni "interni" (ad es. colpi d'ariete) sia da forzanti esterne (ad es. rischi naturali). Questo articolo mira a confrontare in particolare due tecniche: la teoria dei grafi (GT) e la Global Resilience Analysis (GRA). Esse sono applicate ad una rete reale - L'Aquila (Centro Italia) - e due reti benchmark - D-Town ed EXNET. Le metriche basate sulla GT si concentrano sulla topologia delle reti, mentre la GRA fornisce una misura basata sulle performance, in termini di resilienza, di un sistema in condizioni di failure. Entrambi i metodi forniscono informazioni sulla risposta delle reti a condizioni di failure, ma richiedono dati diversi e quindi comportano costi di calcolo diversi con una precisione differente nei risultati. I risultati mostrano che, sebbene le misure basate sulla teoria dei grafi forniscano una buona descrizione del comportamento e delle caratteristiche della rete a livello globale, le analisi basate sulle prestazioni come la GRA (che forniscono informazioni dettagliate sulla durata e l'entità del failure) sono cruciali per comprendere meglio la risposta locale del sistema. Infatti, in particolare per reti complesse, le caratteristiche topologiche potrebbero non essere pienamente rappresentative delle prestazioni idrauliche e degli impatti di rotture.

**Abstract ENG:** The structure and connectivity of infrastructure systems such as water distribution networks (WDNs) affect their reliability, efficiency and resilience. Suitable techniques are required to understand the potential impacts of system failure(s), which can result from internal (e.g. water hammer) or external (e.g. natural hazards) threats. This paper aims to compare two such techniques: Graph Theory (GT) and Global Resilience Analysis (GRA). These are applied to a real network – L'Aquila (central Italy) – and two benchmark networks – D-Town and EXNET. GT-based metrics focus on the topology of WDNs, while GRA provides a performance-based measure of a system's resilience to a given system failure mode. Both methods provide information on the response of WDNs to pipe failure, but have different data requirements and thus different computational costs and precision. The results show that although GT measures provide considerable insight with respect to global WDN behavior and characteristics, performance-based analyses such as GRA (which provide detailed information on supply failure duration and magnitude) are crucial to better understand the local response of WDNs to pipe failure. Indeed, particularly for complex networks, topological characteristics may not be fully representative of hydraulic performances and pipe failure impacts.

## Engaging stakeholders in the assessment of NBS effectiveness in flood risk reduction: A participatory System Dynamics Model for benefits and co-benefits evaluation

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Science of the Total Environment, 2019, 690, 543-555, 10.1016/j.scitotenv.2019.07.059

**Autori:** Pagano, A., Pluchinotta, I., Pengal, P., Cokan, B., Giordano, R

**Abstract ITA:** Vi è la necessità a livello mondiale di individuare approcci efficaci per affrontare i water-related risks che si manifestano, principalmente, con inondazioni sempre più frequenti, così come con gravi siccità. In particolare, i decisori stanno cercando di identificare strategie 'sistemiche' che, andando oltre la mera riduzione del rischio, dovrebbero essere in grado di risolvere contemporaneamente molteplici sfide (come la resilienza climatica, salute e benessere per le comunità, migliore qualità della vita), fornendo così benefici addizionali. In questa direzione, il contributo delle Nature Based Solutions (NBS) è rilevante, sebbene la loro più ampia implementazione sia ancora ostacolata da diversi ostacoli, come l'incertezza e la mancanza di informazioni sul loro comportamento a lungo termine e la difficoltà di valutare quantitativamente i loro impatti multidimensionali . Le attività descritte nel presente lavoro, svolte nell'ambito del progetto Europeo NAIAD , mirano principalmente a sviluppare un System Dynamic Model sul base partecipativa, in grado di valutare quantitativamente l'efficacia delle NBS nel mitigare il rischio di piena, producendo una molteplicità di co-benefit. L'adozione di un approccio partecipativo ha supportato sia l'aumento della conoscenza disponibile che la consapevolezza del potenziale associato ad NBS e misure ibride (ad esempio una combinazione di NBS e misure socio-istituzionali). Nel lavoro si fa specifico riferimento a uno dei casi studio del progetto NAIAD, ovvero il caso studio del fiume Glinščica (Slovenia).

**Abstract ENG:** There is an imperative worldwide need to identify effective approaches to deal with water-related risks, and mainly with increasingly frequent floods, as well as with severe droughts. Particularly, policy and decision-makers are trying to identify systemic strategies that, going beyond the mere risk reduction, should be capable to deal simultaneously with multiple challenges (such as climate resilience, health and well-being, quality of life), thus providing additional benefits. In this direction, the contribution of Nature Based Solutions (NBS) is relevant, although their wider implementation is still hampered by several barriers, such as the uncertainty and lack of information on their long-term behavior and the difficulty of quantitatively valuing their multidimensional impacts. The activities described in the present paper, carried out within the EU funded project NAIAD, mainly aim at developing a participatory System Dynamic Model capable to quantitatively assess the effectiveness of NBS to deal with flood risks, while producing a multiplicity of co-benefits. The adoption of a participatory approach supported both to increase the available knowledge and the awareness about the potential of NBS and hybrid measures (e.g. a combination of NBS and socio-institutional ones). Specific reference is made to one of the demos of the NAIAD project, namely the Glinščica river case study (Slovenia).

## Variability of food waste chemical composition: Impact of thermal pre-treatment on lignocellulosic matrix and anaerobic biodegradability

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Journal of Environmental Management, 2019, 236, 100-107, doi: 10.1016/j.jenvman.2019.01.084

**Autori:** Pagliaccia, P., Gallipoli, A., Gianico, A., Gironi, F., Montecchio, D., Pastore, C., Di Bitonto, L., Braguglia, C.M.

**Abstract ENG:** A comprehensive sustainable Food Waste (FW) management is globally needed in order to reduce the environmental pollution and the financial costs due to FW disposal; anaerobic digestion is considered as one of the best environmental-friendly alternatives to this aim. A deep investigation of the chemical composition of different Food waste types (cooked kitchen waste (CKW), fruit and vegetable scraps (FVS) and organic fraction of municipal solid waste (OFMSW)) is here reported, in order to evaluate their relevant substance-specific properties and their impact on anaerobic biodegradability by means of a sophisticated automatic batch test system. Suitability for a mild thermal pre-treatment (T=134 °C and p=3.2 bar) to enhance the biological degradation of hardly accessible compounds was investigated. The pre-treatment affected significantly the carbohydrates solubilisation, and was able in reducing part of the lignocellulosic matrix. Moreover, in mesophilic conditions, the high solubilized sugars content favoured the initial recovery of hydrogen (not consumed by hydrogenotrophic methanogenesis), allowing to newly assess the extent of prompt fermentability. Pre-treatment enhanced hydrogen yields of FVS and OFMSW, with gains up to +50%, while the successive methane production, occurring in the same reactor, resulted affected by the lack of the soluble part of carbohydrates, “subtracted” for H2 production. Only in thermophilic conditions, when no hydrogen in the biogas was detected, pre-treatment of OFMSW significantly increased methane yield (from 0.343 to 0.389 L CH4/gVSfed). A thermal pre-treatment seems the recommended solution in order to reduce part of the recalcitrant lignocellulosic matrix of food waste, to improve energy recovery and to eliminate the extra cost needed for pasteurization.

## Anaerobic co-digestion of food waste and waste activated sludge: ADM1 modelling and microbial analysis to gain insights into the two substrates' synergistic effects

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Waste Management Journal, 2019, 97, 27-37, doi: 10.1016/j.wasman.2019.07.036

**Autori:** Montecchio, D., Astals, S., Di Castro, V., Gallipoli, A., Gianico, A., Pagliaccia, P., Piemonte, V., Rossetti, S., Tonanzi, B., Braguglia, C.M.

**Abstract ENG:** The reasons for the acidification problem affecting Food Waste (FW) anaerobic digestion were explored, combining the outcomes of microbiological data (FISH and CARD-FISH) and process modelling, based on the Anaerobic Digestion Model nr 1 (ADM1). Long term semi continuous experiments were carried out, both with sole FW and with Waste Activated Sludge (WAS) as a co-substrate, at varying operational conditions (0.8–2.2 gVS/L/d) and FW/WAS ratios. Acidification was observed along FW mono-digestion, making it necessary to buffer the digesters; ADM1 modelling and experimental results suggested that this phenomenon was due to the methanogenic activity decline, most likely related to a deficiency in trace elements. WAS addition, even at proportions as low as 10% of the organic load, settled the acidification issue; this ability was related to the promotion of the methanogenic activity and the consequent enhancement of acetate consumption, rather than to WAS buffering capacity. The ability of the ADM1 to model processes affected by low microbial activity, such as FW monodigestion, was also assessed. It was observed that the ADM1 was only adequate for digestions with a high activity level for both bacteria and methanogens (FISH/CARD-FISH ratio preferably >0.8) and, under these conditions, the model was able to correctly predict the relative abundance of both microbial populations, extrapolated from FISH analysis.

## Assessing stakeholders' risk perception to promote Nature Based Solutions as flood protection strategies: The case of the Glinščica river (Slovenia)

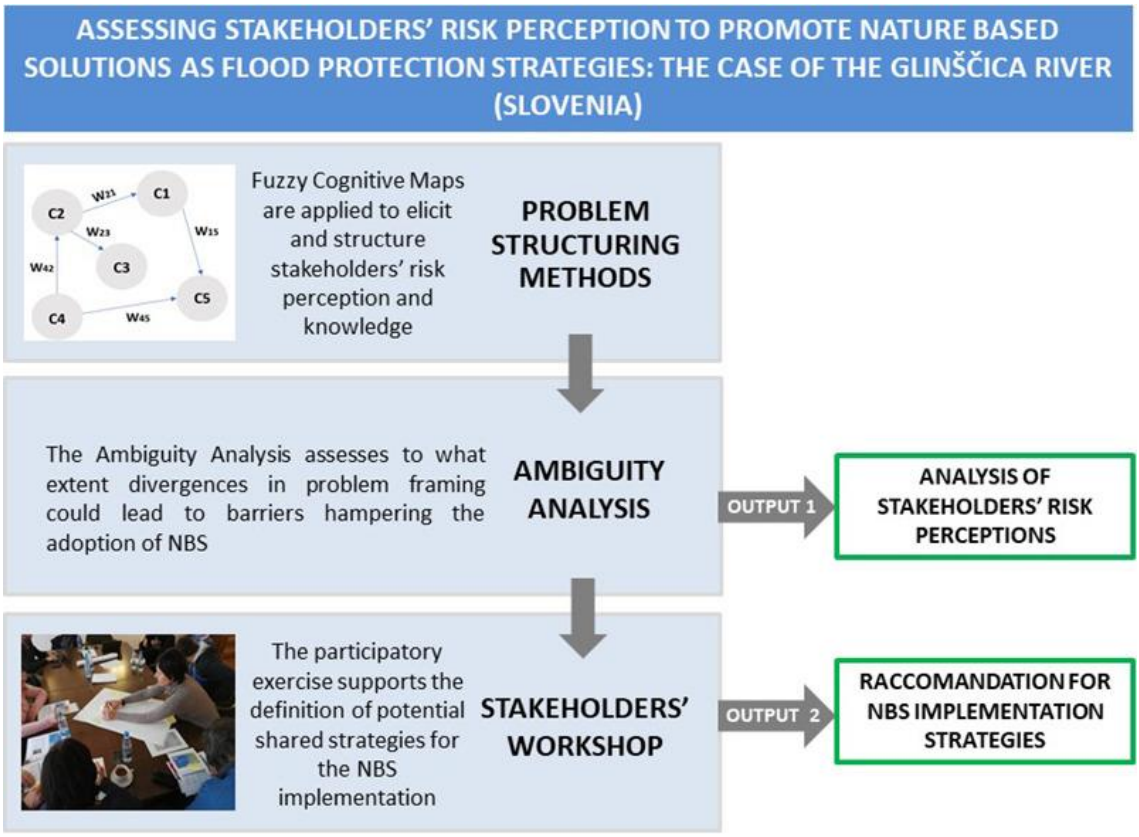
**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Science of Total Environment, 2019, 655, 188-201, https://doi.org/10.1016/j.scitotenv.2018.11.116

**Autori:** Stefania Santoro, Irene Pluchinotta, Alessandro Pagano, Polona Pengal, Blaž Cokan, Raffaele Giordano

**Abstract ITA:** Evidenze empiriche in merito alla gestione del rischio di alluvione hanno dimostrato come una profonda comprensione dei principali fenomeni fisici da affrontare spesso non sia sufficiente. Dovrebbe essere integrata con la conoscenza e la percezione del rischio da parte degli stakeholder. In particolare, l'efficacia delle strategie di gestione del rischio di alluvione dipende fortemente dalla percezione ed atteggiamento degli stakeholder, che giocano un ruolo critico su come gli individui e le istituzioni agiscono per contrastare i rischi. Inoltre, professionisti e responsabili politici si sono resi conto che le infrastrutture grigie potrebbero non essere la soluzione più adatta ridurre il rischio di inondazioni e che è necessario un passaggio dalle da infrastrutture hard alle soluzioni NBS. All'interno di questo framework, il presente lavoro descrive una metodologia per migliorare l'implementazione di Nature Based Solutions facilitando la generazione, l'acquisizione e la diffusione delle percezioni del rischio dei diversi stakeholder. È basato su la combinazione di metodi di strutturazione del problema per l'elicitazione delle percezioni del rischio degli stakeholder attraverso Fuzzy Cognitive Map individuali Mappe cognitive fuzzy e analisi dell'ambiguità per lo studio delle differenze nelle percezioni del rischio e di definizione del problema. I risultati dell'Analisi dell'ambiguità, utilizzati durante un seminario partecipativo, hanno facilitato il dialogo volto ad allineare le divergenze e promuovere l'accettazione sociale delle soluzioni basate sulla natura. Questi risultati di viene discussa l'implementazione di questa metodologia in più fasi nel bacino del fiume Glinščica (Slovenia).

**Abstract ENG:** Evidence from flood risk management demonstrated a deep understanding of the main physical phenomena to be addressed is often not enough but should be also integrated with stakeholders' knowledge and risk perception. Particularly, the effectiveness of flood risk management strategies is highly dependent on stakeholders' perception and attitudes, which play a critical role in how individuals and institutions act to mitigate risks. Furthermore, practitioners and policy-makers realized that grey infrastructures may not be the most suitable solution to reduce flood risk and that a shift from grey solutions to Nature-Based Solutions is required. Within this framework, the present work describes a methodology to enhance the Nature Based Solutions implementation by facilitating the generation, acquisition and diffusion of different stakeholders' risk perceptions. It is based on the combination of Problem Structuring Methods for the elicitation of stakeholders' risk perceptions through individual Fuzzy CognitiveMaps, andAmbiguity Analysis for the investigation of differences in risk perceptions and problem framing. The outputs of the Ambiguity Analysis, used during a participatory workshop, facilitated a dialogue aligning the divergences and promoting the social acceptance of Nature-Based Solutions. These results of the implementation of this multi-step methodology in the Glinščica river basin (Slovenia) are discussed.


ASSESSING STAKEHOLDERS' RISK PERCEPTION TO PROMOTE NATURE BASED SOLUTIONS AS FLOOD PROTECTION STRATEGIES: THE CASE OF THE GLINŠČICA RIVER (SLOVENIA)
C1
C2
C3
C4
C5
W21
W23
W15
W42
W45
Fuzzy Cognitive Maps are applied to elicit and structure stakeholders' risk perception and knowledge
PROBLEM STRUCTURING METHODS
The Ambiguity Analysis assesses to what extent divergences in problem framing could lead to barriers hampering the adoption of NBS
AMBIGUITY ANALYSIS
OUTPUT 1
ANALYSIS OF STAKEHOLDERS' RISK PERCEPTIONS
The participatory exercise supports the definition of potential shared strategies for the NBS implementation
STAKEHOLDERS' WORKSHOP
OUTPUT 2
RACCOMANDATION FOR NBS IMPLEMENTATION STRATEGIES

## Design Theory for Generating Alternatives in Public Decision Making Processes

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Group Decision & Negotiation, 2019, 28, 341-375, doi.org/10.1007/s10726-018-09610-5

**Autori:** Irene Pluchinotta · Akin O. Kazakçi · Raffaele Giordano · Alexis Tsoukiàs

**Abstract ITA:** Questo lavoro descrive una metodologia innovativa, basata sull'integrazione tra Problem Structuring Method e Concept-Knowledge Methodology, per supportare il design di politiche di tutela e gestione delle risorse ambientali.

**Abstract ENG:** Literature about public decision making experiences, including stakeholders' engagement, offers best practices but also reports of unsuccessful case studies. Meaningful participation activities require direct integration of stakeholders into all the phases of the public decision process to unleash innovation. Often, policy making incorporates participation late in the process, after the problem definition has occurred, alternatives have been defined, without considering stakeholders' knowledge and problem understanding. The early stage of policy alternatives design is essential to the development of policy. Our research presents an extensive literature review with respect to policy design and design theory in order to show that the formal process of generation of alternatives has been little investigated. There is a demand for methodologies aiming at supporting policy makers and relevant stakeholders during policy design. In this regard, this paper introduces (and explores) the operational role of design theory in the policy making process for the generation of policy alternatives. Design thinking, as a way to inform a collective problem definition leading to innovation, highlights the value of early stakeholders' engagement. The aim of this paper is to understand, from an operational point of view, what "design" means in a policy making context, developing an innovative approach for assisting the formalization of policy design. The paper uses the results of a pilot case study to illustrate the application of the Concepts–Knowledge (C-K) theory framework to support the innovative design of policy alternatives for the groundwater protection policy of the Apulia Region (southern Italy).

## A transversal method of lines for the numerical modeling of vertical infiltration into the vadose zone

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Applied Numerical Mathematics, 2019, 135, 264-275, doi: 10.1016/j.apnum.2018.08.013

**Autori:** M. Berardi - F. Difonzo - F. Notarnicola - M. Vurro

**Abstract ITA:** In questo lavoro vengono studiati alcuni problemi, relativi alla soluzione numerica dell'equazione di Richards in un dominio spaziale unidimensionale mediante una tecnica basata sul Metodo Trasversale delle Linee (TMoL). L'idea centrale dell'approccio TMoL è di semi-discretizzare la derivata temporale dell'equazione di Richards: successivamente viene derivato un sistema di equazioni differenziali del secondo ordine nella variabile spaziale come un problema ai valori iniziali. La struttura computazionale di questo metodo richiede condizioni al contorno di Dirichlet e Neumann nella parte superiore della colonna. Viene discussa la motivazione pratica per la scelta di una tale condizione. Mostreremo che, con la scelta delle suddette condizioni iniziali, il nostro approccio TMoL porta a soluzioni confrontabili con quelle ottenute dai metodi classici delle linee (di seguito denominati MoL) con corrispondenti condizioni al contorno standard: in particolare, una norma appropriata viene introdotto per confrontare efficacemente i test numerici ottenuti con l'approccio MoL e TMoL e viene eseguita un'analisi di sensitività tra i due metodi attraverso il punto di vista del bilancio di massa. Viene introdotto un ulteriore algoritmo per dedurre in modo autosufficiente la condizione al contorno del gradiente in alto nel contesto TMoL.

**Abstract ENG:** Here some issues are studied, related to the numerical solution of Richards' equation in a one dimensional spatial domain by a technique based on the Transversal Method of Lines (TMoL). The core idea of TMoL approach is to semi-discretize the time derivative of Richards' equation: afterward a system of second order differential equations in the space variable is derived as an initial value problem. The computational framework of this method requires both Dirichlet and Neumann boundary conditions at the top of the column. The practical motivation for choosing such a condition is argued. We will show that, with the choice of the aforementioned initial conditions, our TMoL approach brings to solutions comparable with the ones obtained by the classical Methods of Lines (hereafter referred to as MoL) with corresponding standard boundary conditions: in particular, an appropriate norm is introduced for effectively comparing numerical tests obtained by MoL and TMoL approach and a sensitivity analysis between the two methods is performed by means of a mass balance point of view. A further algorithm is introduced for deducing in a self-sustaining way the gradient boundary condition on top in the TMoL context.

## Proximate, fatty acids and metals in edible marine bivalves from Italian market: Beneficial and risk for consumers health

**Anno di pubblicazione:** 2019

**Riferimento rivista con DOI:** Science of the Total Environment, 2019, 648, 153-163, DOI: 10.1016/j.scitotenv.2018.07.382

**Autori:** E. Prato, F. Biandolino, I. Parlapiano, S. Giandomenico, G. Denti, M. Calò, L. Spada, A. Di Leo

**Abstract ITA:** I frutti di mare sono una scelta alimentare sana grazie all'elevato contenuto di nutrienti essenziali, inclusi gli acidi grassi polinsaturi (PUFA) della famiglia n-3. Tuttavia, i frutti di mare sono spesso contaminati da composti tossici, che hanno effetti negativi sulla salute umana. Lo scopo di questo studio era fornire informazioni sulla percentuale di parte edibile, indice di condizione e il rischio-beneficio per la salute dei consumatori associati al consumo di otto specie di bivalvi (Flexopecten glaber, Mimachlamys varia, Modiolus barbatus, Mytilus galloprovincialis, Ostrea edulis , Ruditapes philippinarum, Solen marginatus e Venus venucosa) di elevato valore commerciale, acquistati presso i mercati ittici di Taranto. In tutte le specie analizzate è stata riscontrata un'alta percentuale di commestibilità e indice di condizione. Il contenuto proteico relativamente alto, i bassi livelli di lipidi e l'alta percentuale di PUFA n-3 sani rendono M. varia. O. edulis, S. marginatus, M. galloprovincialis, M. barbatus più adatti a beneficio dei consumatori. L'assunzione settimanale tollerabile provvisoria e l'indice di pericolosità calcolato sulla base dei metalli in traccia nei tessuti commestibili, hanno indicato raccomandazioni specifiche per un consumo quotidiano responsabile di molluschi. Per la maggior parte delle specie studiate, l'equilibrio stimato tra benefici e rischi per i consumatori consiglia una porzione giornaliera (RDP) inferiore a 60 g / persona / giorno rispetto a M. galloprovincialis, O. edulis e R. philippinarum (> = 60 g / persona / giorno). Un'attenta considerazione del rapporto rischio-beneficio dovrebbe promuovere il consumo di frutti di mare riducendo al minimo l'esposizione a contaminanti tossici.

**Abstract ENG:** Seafood is recognized as a healthy food choice due to high contents of essential nutrients, including polyunsaturated fatty acids (PUFAs) of the n-3 family. However, seafood is often contaminated by toxic compounds, which have adverse effects on human health. The aim of this study was to provide information about the percentage of edible part, condition index and the benefit and risk for human consumers health associated to the consumption of eight bivalve species (Flexopecten glaber, Mimachlamys varia, Modiolus barbatus, Mytilus galloprovincialis, Ostrea edulis, Ruditapes philippinarum, Solen marginatus and Venus venucosa) of high commercial value, purchased from Taranto local fish markets. High percentage of edibility and condition index were found in all analysed species. The relatively high protein content, low levels of lipid and high percentage of healthy n-3 PUFAs make M. varia. O. edulis, S. marginatus, M. galloprovincialis, M. barbatus more suitable for benefit to consumers. Provisional tolerable weekly intake and hazard index calculated on the basis of trace metals in edible tissues, indicated specific recommendations for a responsible daily consumption of shellfish. For the most part of studied species, the estimated balance between beneficial and risk for consumers recommend a daily portion (RDP) lesser of 60 g/person/day than M. galloprovincialis, O. edulis and R. philippinarum (>= 60 g/person/day). Careful risk-benefit considerations should promote seafood consumption while minimizing exposure to toxic contaminants.

## Chronic sublethal effects of ZnO nanoparticles on Tigriopus fulvus (Copepoda, Harpacticoida)

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Environmental Science and Pollution Research, 2020, 27, 30957–30968, doi: 10.1007/s11356-019-07006-9

**Autori:** Ermelinda Prato, Isabella Parlapiano, Francesca Biandolino, Alice Rotini, Loredana Manfra, Maria Teresa Berducci, Chiara Maggi, Giovanni Libralato, Luigi Paduano, Federica Carraturo, Marco Trifuoggi, Maurizio Carotenuto, Luciana Migliore

**Abstract ITA:** Questo studio ha esaminato per la prima volta gli effetti dell'esposizione cronica a nanoparticelle di ZnO (NP) (28 giorni) su Tigriopus fulvus. È stata valutata anche la tossicità acuta (48 h) di tre forme chimiche di Zn: (a) nanoparticelle di ZnO (NP), (b) Zn2 + dalla sospensione di ZnO NP dopo centrifugazione (supernatante) e (c) ZnSO4 H2O. Sono state usate microscopie fisico-chimiche ed elettroniche per caratterizzare i mezzi di esposizione (medium). I risultati hanno mostrato che la dissoluzione di ZnO NPs era significativa, con una dissoluzione completa alle concentrazioni di prova più basse, ma erano sempre presenti nano e microaggregati. Il test acuto ha evidenziato una tossicità significativamente maggiore per lo Zn2 + e ZnSO4 rispetto a ZnO NP. L'esposizione cronica a ZnO NP ha causato effetti negativi sui tratti riproduttivi, ovvero durata della covata, dimensioni della covata e numero di covata a concentrazioni molto inferiori (≥ 100 µg / L). La comparsa di femmine ovigere è stata ritardata a concentrazioni più elevate di ZnO NP, mentre il tempo richiesto per il rilascio della prole e la percentuale di uova non vitali per femmina sono stati significativamente aumentati. L'esposizione subcronica di ZnO NP ha evidenziato la sua capacità di ridurre l'idoneità riproduttiva individuale di T. fulvus, suggerendo che l'uso e il rilascio di ZnO NP devono essere attentamente monitorati.

**Abstract ENG:** This study investigated for the first time the effects of ZnO nanoparticle (NP) chronic exposure (28 days) on Tigriopus fulvus. Acute toxicity (48 h) of three Zn chemical forms was assessed as well including the following: (a) ZnO nanoparticles (NPs), (b) Zn2+ from ZnO NP suspension after centrifugation (supernatant) and (c) ZnSO4 H2O. Physical-chemical and electronic micros- copies were used to characterize spiked exposure media. Results showed that the dissolution of ZnO NPs was significant, with a complete dissolution at lowest test concentrations, but nano- and micro-aggregates were always present. Acute test evidenced a significant higher toxicity of Zn2+ and ZnSO4 compared to ZnO NPs. The chronic exposure to ZnO NPs caused negative effects on the reproductive traits, i.e. brood duration, brood size and brood number at much lower concentrations (≥ 100 µg/L). The appearance of ovigerous females was delayed at higher concentrations of ZnO NPs, while the time required for offspring release and the percentage of non-viable eggs per female were significantly increased. ZnO NP subchronic exposure evidenced its ability to reduce T. fulvus individual reproductive fitness, suggesting that ZnO NPs use and release must be carefully monitored.

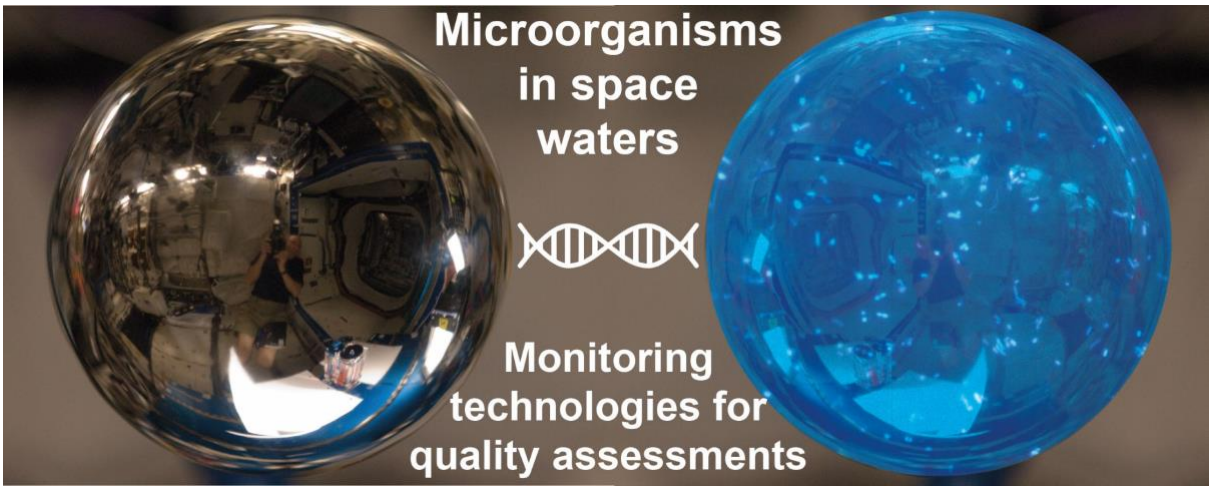
## Water and microbial monitoring technologies towards the near future space exploration

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Water Research, 2020, 177, 115787, doi: 10.1016/j.watres.2020.115787

**Autori:** Amalfitano, Stefano; Levantesi, Caterina; Copetti, Diego; Stefani, Fabrizio; Locantore, Ilaria; Guarnieri, Vincenzo; Lobascio, Cesare; Bersani, Francesca; Giacosa, Donatella; Detsis, Emmanouil; Rossetti, Simona

**Abstract ENG:** Space exploration is demanding longer lasting human missions and water resupply from Earth will become increasingly unrealistic. In a near future, the spacecraft water monitoring systems will require technological advances to promptly identify and counteract contingent events of waterborne microbial contamination, posing health risks to astronauts with lowered immune responsiveness. The search for bio-analytical approaches, alternative to those applied on Earth by cultivation-dependent methods, is pushed by the compelling need to limit waste disposal and avoid microbial regrowth from analytical carryovers. Prospective technologies will be selected only if first validated in a flight-like environment, by following basic principles, advantages, and limitations beyond their current applications on Earth. Starting from the water monitoring activities applied on the International Space Station, we provide a critical overview of the nucleic acid amplification-based approaches (i.e., loop-mediated isothermal amplification, quantitative PCR, and high-throughput sequencing) and early-warning methods for total microbial load assessments (i.e., ATP-metry, flow cytometry), already used at a high readiness level aboard crewed space vehicles. Our findings suggest that the forthcoming space applications of mature technologies will be necessarily bounded by a compromise between analytical performances (e.g., speed to results, identification depth, reproducibility, multiparametricity) and detrimental technical requirements (e.g., reagent usage, waste production, operator skills, crew time). As space exploration progresses toward extended missions to Moon and Mars, miniaturized systems that also minimize crew involvement in their end-to-end operation are likely applicable on the long-term and suitable for the in-flight water and microbiological research.



## Does weighting presence records improve the performance of species distribution models? A test using fish larval stages in the Yangtze Estuary

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Science of the Total Environment, 2020, 741, 1, DOI: 10.1016/j.scitotenv.2020.140393

**Autori:** Zhixin Zhang, Stefano Mammola, Hui Zhang

**Abstract ENG:** To obtain realistic forecasts of the impacts of climate change on species habitat suitability, novel approaches based on species distribution models (SDMs) are being developed and scrutinized. We argue here that, when dealing with data from long-term monitoring programmes, incorporating a temporal weight on the occurrence points may result in a more realistic prediction of a species' potential distribution. Using larval fish presence re- cords collected from 1999 to 2013 in the Yangtze Estuary, China, we compared the performance of ensembles of standard SDMs versus SDMs constructed with weighted time-series presence records in predicting the present and future distributions of the larval stages of two dominant fish. The results of the ensemble SDMs showed that weighted presence records can significantly improve SDM performance, as measured through standard val- idation metrics. The SDM projections suggest that suitable habitat for both species will decrease under future cli- mate scenarios, with one species (Stolephorus commersonnii) predicted to be more susceptible to climate change than the other (Engraulis japonicus). In addition to range contraction, model projections suggest that the future habitats of both species will shift northward—an implication of climate change that should be considered in fu- ture management and conservation strategies for the Yangtze Estuary.

## To invade or not to invade? Exploring the niche-based processes underlying the failure of a biological invasion using the invasive Chinese mitten crab

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Science of the Total Environment, 2020, 728, 1, 138815, DOI: 10.1016/j.scitotenv.2020.138815

**Autori:** Zhixin Zhang, Stefano Mammola, Colin L. McLay, César Capinha, Masashi Yokota

**Abstract ENG:** Invasive alien species represent a serious threat to global biodiversity, causing considerable damage to native ecosystems. To better assess invasion risks, it is essential to better understand the biological processes that deter- mine the success or failure of invasions. The catadromous Chinese mitten crab Eriocheir sinensis, whose native dis- tribution is the Pacific Coast of China and Korea, has successfully invaded and established populations in North America and Europe. In Japan, where E. sinensis is also regarded as potentially invasive and multiple introduction vectors exist, the species is not yet established. These settings can be used to explore niche-based processes un- derlying the apparent failure of a biological invasion. We first quantified native and invasive realized niches of E. sinensis in freshwater habitats using geometrical n-dimensional hypervolumes. Based on the assumption of niche conservatism, we then projected habitat suitability of this species in Japan using species distribution models (SDMs) calibrated with distinct sets of distribution data: native occurrences, invasive occurrences, and both. Re- sults showed that E. sinensis has undergone either niche shifts or niche contractions during invasions in different areas of the world. Projections from SDMs indicate that although part of Japan is suitable for E. sinensis, this does not include the freshwater habitats around the Ariake Sea, which is considered to be a suitable marine environ- ment for E. sinensis larvae. The mismatch between suitable freshwater and marine environments provides a possible explanation for the failure of establishment of E. sinensis in Japan to date. Our findings have useful gen- eral implications for the interpretation of biological invasions.

## Future climate change will severely reduce habitat suitability of the Critically Endangered Chinese giant salamander

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Freshwater biology, 2020, 65, 5, 971-980, DOI: 10.1111/fwb.13483

**Autori:** Zhang Z, Mammola S, Liang Z, Capinha C, Ye H, Wei Q, Wu Y, Zhou J, Wang C

**Abstract ENG:** 1. Being the largest extant amphibian in the world, the IUCN Critically Endangered Chinese giant salamander Andrias davidianus is a charismatic species with great in- ternational public interest. While threats such as commercial overexploitation and habitat degradation have been extensively documented to affect natural popula- tions of A. davidianus, still no information is available about the species sensitivity to climate change. 2. Here, we develop an ensemble of species distribution models (SDMs) for A. da- vidianus and projected its habitat suitability under present-day and future climate change scenarios. We based our SDMs on bioclimatic and topographic predictors, and recent (2012–2018) field-collected occurrence data across the whole distribu- tion range of the species. 3. TheensembleSDMsexhibitedgoodpredictivecapacityandsuggestedthatslope, maximum temperature of warmest month, precipitation of driest month, and iso- thermality are the most influential predictors in determining distribution patterns in this species. The projections of our models point to a pronounced impact of climate changes over A. davidianus, with more than two-thirds of its suitable range expected to be lost in all scenarios of future climates tested. 4. In concert with the numerous other threats that are affecting this species, climate change poses a serious hindrance to the long-term survival of A. davidianus. We emphasise the urgent need of undertaking strict measures to manage this spe- cies and safeguard the few remaining available suitable habitats. We suggest that adaptive management strategies including designation of new reserves should be considered to mitigate the impacts of climate change on A. davidianus.

## On deepest caves, extreme habitats, and ecological superlatives

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Trends in Ecology and Evolution, 2020, 35, 6, 469-472, DOI: 10.1016/j.tree.2020.02.011

**Autori:** Stefano Mammola

**Abstract ENG:** In an environment where the impact of research is central, scientists face the dilemma of choosing between orthodox writing for objectivity and sensational writing to provoke interest. The use of superlatives in high-ranking ecology journals has increased significantly in recent years, a writing behavior that works against scientific objectivity.

## Innovative two-steps thermo-chemical pretreatment for sludge reduction and energy recovery: cost and energy assessment

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Water and Environment journal, 2020, 34, 540–550, doi: 10.1111/wej.12558

**Autori:** Gianico, A., Acebes Tosti, L., Fiorin, D., Gallipoli, A., Montecchio, D., Pagliaccia P., Braguglia, C.M

**Abstract ITA:** I pretrattamenti chimici e termici dei fanghi di depurazione si sono dimostrati efficaci per migliorare il processo di digestione anaerobica aumentando la produzione di metano e la stabilizzazione dei fanghi. Al fine di ottimizzare questa tecnologia verso la riduzione dei fanghi combinata con il recupero energetico, è stata condotta una sperimentazione su scala di laboratorio per valutare l'efficienza di un innovativo pretrattamento acido-alcalino a 2 fasi per migliorare le prestazioni del processo di digestione anaerobica. I risultati su scala di laboratorio hanno suggerito di adottare alcune misure volte a garantire migliori prestazioni anaerobiche e prevenzione dei rischi di squilibrio del processo. Il processo ha consentito di ottenere elevate efficienze di riduzione dei fanghi (fino al 66% di rimozione di TSS), e di ottenere rese produttive di metano elevate (0,25 vs 0,18 Nm3 / kgVSalimentati del controllo) assicurando un'elevata stabilità del processo. Il recupero d'energia elettrica del processo combinato idrolisi-digestione, valutato su uno scenario di piena scala, è risultato maggiore rispetto a quello ottenibile da un processo di digestione convenzionale. La riduzione dei fanghi ottenuta consente di abbattere i costi di smaltimento fino al 32%.

**Abstract ENG:** Chemical and thermal pretreatments of sewage sludge have proven to be effective to improve anaerobic digestion process by increasing methane production and sludge stabilization. In order to improve this technology towards sludge reduction combined with energy recovery, lab-scale experimentation was carried out to assess the efficiency of a 2-steps acid-alkali innovative pretreatment to enhance the anaerobic digestion process. Lab-scale results suggested to adopt some measures intended to ensure better anaerobic performances and imbalance risks prevention. The process allowed to achieve high sludge reduction efficiencies (up to 66% TSS removal), and to obtain high methane production yields (0.25 vs. 0.18 Nm3/kgVSfed of the control) assuring high process stability. The electric energy recovery of the combined hydrolysis-digestion process, assessed on fullscale scenario, resulted higher with respect to a conventional digestion process. The sludge reduction obtained could imply cost savings of up to 32% compared to traditional scenarios.

## Fundamental research questions in subterranean biology

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Biological reviews, 2020, 95, 6, 1855-1872, DOI: 10.1111/brv.12642

**Autori:** Mammola S, Amorim IR, Bichuette ME, Borges PAV, Cheeptham N, Cooper SJB, Culver DC, Deharveng L, Eme D, Ferreira RL, Fišer C, Fišer Ž, Fong DW, Griebler C, Jeffery WR, Kowalko J, Jugovic J, Lilley TM, Malard F, Manenti R, Martínez A, Meierhofer MB, Niemiller M, Northup DE, Pellegrini TG, Pipan P, Protas M, Reboleira AS, Venarsky MP, Wynne JJ, Zagmajster M, Cardoso P

**Abstract ENG:** Five decades ago, a landmark paper in Science titled The Cave Environment heralded caves as ideal natural experimental lab- oratories in which to develop and address general questions in geology, ecology, biogeography, and evolutionary biology. Although the 'caves as laboratory' paradigm has since been advocated by subterranean biologists, there are few examples of studies that successfully translated their results into general principles. The contemporary era of big data, modelling tools, and revolutionary advances in genetics and (meta)genomics provides an opportunity to revisit unresolved questions and challenges, as well as examine promising new avenues of research in subterranean biology. Accordingly, we have developed a roadmap to guide future research endeavours in subterranean biology by adapting a well-established meth- odology of 'horizon scanning' to identify the highest priority research questions across six subject areas. Based on the expert opinion of 30 scientists from around the globe with complementary expertise and of different academic ages, we assembled an initial list of 258 fundamental questions concentrating on macroecology and microbial ecology, adap- tation, evolution, and conservation. Subsequently, through online surveys, 130 subterranean biologists with various backgrounds assisted us in reducing our list to 50 top-priority questions. These research questions are broad in scope and ready to be addressed in the next decade. We believe this exercise will stimulate research towards a deeper under- standing of subterranean biology and foster hypothesis-driven studies likely to resonate broadly from the traditional boundaries of this field.

## Let research on subterranean habitats resonate!

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Subterranean Biology, 2020, 36, 63–71, doi: 10.3897/subtbiol.36.59960

**Autori:** Stefano Mammola, Alejandro Martínez

**Abstract ENG:** Whereas scientists interested in subterranean life typically insist that their research is exciting, adventur- ous, and important to answer general questions, this enthusiasm and potential often fade when the results are translated into scientific publications. This is because cave research is often written by cave scientists for cave scientists; thus, it rarely “leaves the cave”. However, the status quo is changing rapidly. We analysed 21,486 articles focused on subterranean ecosystems published over the last three decades and observed a recent, near-exponential increase in their annual citations and impact factor. Cave research is now more often published in non-specialized journals, thanks to a number of authors who are exploiting subter- ranean habitats as model systems for addressing important scientific questions. Encouraged by this posi- tive trend, we here propose a few personal ideas for improving the generality of subterranean literature, including tips for framing broadly scoped research and making it accessible to a general audience, even when published in cave-specialized journals. Hopefully, this small contribution will succeed in condensing and broadcasting even further the collective effort taken by the subterranean biology community to bring their research “outside the cave”.

## Towards a taxonomically unbiased EU Biodiversity Strategy for 2030.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Proceedings of the Royal Society B: Biological sciences, 2020, 287, 20202166, DOI:

**Autori:** Mammola S, Riccardi N, Correia R, Cardoso P, Lopes-Lima M, Sousa R

**Abstract ENG:** Through the Habitats Directive (92/43/EEC) and the LIFE projects financial investments, Europe has been the world's experimental arena for biological conservation. With an estimated budget of €20 billion/year, the EU Biodiversity Strategy for 2030 has set an ambitious goal of reaching 30% Protected Areas and ensure no deterioration in conservation trends and status of all protected species. We analyzed LIFE projects focused on animals from 1992 to 2018 and we found that investment towards vertebrates has been six times higher than that for invertebrates (€970 vs €150 million), with birds and mammals alone accounting for 72% species and 75% total budget. Budget allocation is primarily explained by species' popularity. We propose a roadmap to achieve unbiased conservation targets for 2030 and beyond.

## Automated discovery of relationships, models and principles in ecology.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Frontiers in Ecology and Evolution, 2020, 8, 530135, DOI: 10.3389/fevo.2020.530135

**Autori:** Cardoso P, Branco VV, Borges PAV, Carvalho JC, Rigal F, Gabriel R, Mammola S, Cascalho J, Correia L

**Abstract ENG:** Ecological systems are the quintessential complex systems, involving numerous high-order interactions and non-linear relationships. The most used statistical modeling techniques can hardly accommodate the complexity of ecological patterns and processes. Finding hidden relationships in complex data is now possible using massive computational power, particularly by means of artificial intelligence and machine learning methods. Here we explored the potential of symbolic regression (SR), commonly used in other areas, in the field of ecology. Symbolic regression searches for both the formal structure of equations and the fitting parameters simultaneously, hence providing the required flexibility to characterize complex ecological systems. Although the method here presented is automated, it is part of a collaborative human–machine effort and we demonstrate ways to do it. First, we test the robustness of SR to extreme levels of noise when searching for the species-area relationship. Second, we demonstrate how SR can model species richness and spatial distributions. Third, we illustrate how SR can be used to find general models in ecology, namely new formulas for species richness estimators and the general dynamic model of oceanic island biogeography. We propose that evolving free-form equations purely from data, often without prior human inference or hypotheses, may represent a very powerful tool for ecologists and biogeographers to become aware of hidden relationships and suggest general theoretical models and principles.

## Environmental Fate and Effects of Foaming Agents Containing Sodium Lauryl Ether Sulphate in Soil Debris from Mechanized Tunneling

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Water, 2020, 12(8), 2074, DOI: 10.3390/w12082074

**Autori:** Luisa Patrolecco, Tanita Pescatore, Livia Mariani, Ludovica Rolando, Paola Grenni, Antonio Finizio, Francesca Spataro, Jasmin Rauseo, Nicoletta Ademollo, Valerio G Muzzini, Enrica Donati, Ines Lacchetti, Sara Padulosi, Anna Barra Caracciolo

**Abstract ENG:** A wide use of foaming agents as lubricants is required in mechanized tunneling. Their main component, the anionic surfactant sodium lauryl ether sulphate (SLES), can remain in residual concentrations in soil debris, influencing their potential reuse as by-product. This study aimed at evaluating the environmental fate and effects of a foaming product used for conditioning soils collected from real excavation sites, in the presence/absence of an anti-clogging polymer, both containing SLES. Soil microcosm experiments were set-up and incubated for 28 days. Over time, soils and their water extracts (elutriates) were collected to perform both ecotoxicological tests (*Vibrio fischeri*, *Lepidium sativum, Eisenia foetida, Hetereocypris incongruens, Danio rerio*) and SLES analysis. The results showed that, just after conditioning, SLES did not exert any hazardous effect on the organisms tested except for the bacterium *V. fischeri*, which was the most sensitive to its presence. However, from day seven the toxic effect on the bacterium was never observed thanks to the SLES decrease in the elutriates (<2 mg/L). SLES degraded in soils (half-lives from 9 to 25 days) with higher disappearance rates corresponding to higher values of microbial abundances. This study highlights the importance of site-specific studies for assessing the environmental reuse of spoil materials.

## Isolation and characterization in a soil conditioned with foaming agents of a bacterial consortium able to degrade sodium lauryl ether sulfate

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Frontiers in Microbiology, 2020, 11,1542, DOI: 10.3389/fmicb.2020.01542

**Autori:** Ludovica Rolando, Jasmin Rauseo, Tanita Pescatore, Luisa Patrolecco, Gian luigi Garbini, Andrea Visca, Paola Grenni, Anna Barra Caracciolo

**Abstract ENG:** The anionic surfactant Sodium Lauryl Ether Sulfate (SLES) is the principal component of several commercial foaming products for soil conditioning in the tunneling industry. Huge amounts of spoil material are produced during the excavation process and the presence of SLES can affect its re-use as a by-product. Anionic surfactants can be a risk for ecosystems if occurring in the environment at toxic concentrations. SLES biodegradability is a key issue if the excavated soil is to be reused. The aim of this study was to identify bacteria able to degrade SLES, so that it could potentially be used in bioaugmentation techniques. Enrichment cultures were performed using bacterial populations from spoil material collected in a tunnel construction site as the inoculum. A bacterial consortium able to grow in a few hours with SLES concentrations from 125 mg/L to 2 g/L was selected and then identified by Next Generation Sequencing analysis. Most of bacteria identified belonged to Gamma-Proteobacteria (99%) and Pseudomonas (ca 90%) was the predominant genus. The bacterial consortium was able to degrade 94% of an initial SLES concentration of 250 mg/L in 9 h. A predictive functional analysis using the PICRUSt2 software showed the presence of esterase enzymes, responsible for SLES degradation. The bacterial consortium selected could be useful for its possible seeding (bioaugmentation) on spoil material from tunneling excavation.

## Functional diversity metrics using kernel density n-dimensional hypervolumes.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Methods in Ecology and Evolution, 2020, 11, 8, 986-995, DOI: 10.1111/2041-210X.13424

**Autori:** Mammola S, Cardoso P

**Abstract ENG:** 1. The use of n-dimensional hypervolumes in trait-based ecology is rapidly increasing. By representing the functional space of a species or community as a Hutchinsonian niche, the abstract Euclidean space defined by a set of independent axes corresponding to individuals or species traits, these multidimensional techniques show great potential for the advance of functional ecology theory. 2. In the panorama of existing methods for delineating multidimensional spaces, the r package hypervolume (Global Ecology and Biogeography, 23, 2014, 595–609) is cur- rently the most used. However, functions for calculating the standard set of functional diversity (FD) indices—richness, divergence and regularity—have not been developed within the hypervolume framework yet. This gap is delaying its full ex- ploitation in functional ecology, meanwhile preventing the possibility to compare its performance with that of other methods. 3. We develop a set of functions to calculate FD indices based on n-dimensional hypervolumes, including alpha (richness), beta (and respective components), dispersion, evenness, contribution and originality. Altogether, these indices pro- vide a coherent framework to explore the primary mathematical components of FD within a multidimensional setting. These new functions can work either with hypervolume objects or with raw data (species presence or abundance and their traits) as input data, and are versatile in terms of input parameters and options. 4. These functions are implemented within bat (Biodiversity Assessment Tools), an r package for biodiversity assessments. As a coherent corpus of functional indices based on a common algorithm, it opens the possibility to fully ex- plore the strengths of the Hutchinsonian niche concept in community ecology research.

## Media framing of spiders may exacerbate arachnophobic sentiments.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** People and Nature, 2020, 2, 1145–1157, DOI: 10.1002/pan3.10143

**Autori:** Mammola S, Nanni V, Pantini P, Isaia M

**Abstract ENG:** 1. Spiders are able to arouse strong emotional reactions in humans. While spider bites are statistically rare events, our perception is skewed towards the potential harm spiders can cause to humans. Nevertheless, there is still limited understand- ing of the role of the media in spreading (mis)information about them thereby promoting this distorted perception of risk. 2. We examined the human dimension of spiders through the lens of traditional media, by analysing spider-related news published online in Italian newspapers between 2010 and 2020 (n = 314). We assessed the accuracy, circulation and sensationalistic content of each article, and assessed how each of these features drove news' share on social media. 3. We observed a recent, exponential increase in the frequency of the news, par- ticularly those focused on medically important spiders—the Mediterranean black widow Latrodectus tredecimguttatus and the Mediterranean recluse Loxosceles rufescens. The news quality was generally poor: 70% contained different types of error, 32% were sensationalistic, and in virtually none was an expert consulted. 4. The risk scenario depicted by the media reports was unnecessarily alarmist, espe- cially with regard to L. rufescens. A conservative estimate would suggest that less than 10% of the bites reported in the media reports analysed here were delivered by the species described in the report. Moreover, two out of three casualties as- sociated with a bite of the Mediterranean recluse were fake news, while the third was unverifiable. 5. Overstated news referring to spider bites was shared significantly more on social media, thus contributing to frame a distorted perception of the risk. This is impor- tant given that these negative sentiments may ultimately lead to lowering public tolerance towards spiders and reducing conservation efforts towards them. We discuss open questions and avenues for future research concerning the media coverage of widely feared animals, that will help bridge knowledge gaps regarding the role of traditional and social media in framing our perception of the natural world.

## Taxonomic and functional homogenization of macroinvertebrate communities in recently intermittent Alpine watercourses.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Freshwater biology, 2020, 65, 12, 2096-2107, DOI: 10.1111/fwb.13605

**Autori:** Piano E, Doretto A, Mammola S, Falasco F, Fenoglio S, Bona F

**Abstract ENG:** 1. Mountain streams in southwestern European Alps are currently shifting from perennial to intermittent flow due to the combined effects of climate change and local anthropogenic pressures. Given that flow intermittency is a recently docu- mented phenomenon in the Alps, only scattered studies have investigated func- tional and taxonomical diversity of benthic invertebrate communities in recently intermittent Alpine streams. 2. We used a hierarchical sampling design to investigate patterns in taxonomic and functional diversity of benthic invertebrate communities in 13 recently intermit- tent Alpine streams in north-west Italy. in April 2017, we sampled benthic com- munities in two reaches of each stream with different hydrological conditions: a control reach, with permanent flow; and an intermittent reach, which recently experienced non-flow periods in summer. 3. We tested for the response of taxonomic richness at multiple spatial scales by partitioning total diversity into the average richness of local communities and the richness due to variation among local communities both within and among reaches. By partitioning total diversity (γ) into its local (α) and turnover (β) compo- nents we showed a decrease in local and regional species richness both within and among reaches, whereas variation among communities was significantly lower in intermittent reaches at the reach scale only. 4. The analysis of multidimensional trait space of macroinvertebrate communities in reaches with different hydrological conditions revealed a significant reduction of functional diversity, dispersion, and evenness in intermittent reaches. There was trait overdispersion in intermittent reaches, as these hosted both typical Alpine taxa and organisms adapted to flow intermittency. In particular, we observed the replacement of taxa with aquatic respiration and those preferring medium- to fast-flowing oligotrophic waters by taxa adapted to lentic habitats, air breathing and with larval dormancy phases. 5. These results indicate that recent flow intermittency has caused drastic changes in benthic invertebrate communities in Alpine streams. Our work highlights the importance of integrating taxonomic and functional diversity to thoroughly assess the impacts of flow intermittency.

## Integrating multiple lines of evidence to explore intraspecific variability in a rare endemic alpine plant and implications for its conservation.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Plants, 2020, 9 (9), 1160, doi: 10.3390/plants9091160

**Autori:** Adamo M, Mammola S, Noble V, Mucciarelli M

**Abstract ENG:** We studied the ecology, distribution, and phylogeography of Tephroseris balbisiana, a rare plant whose range is centered to the South-Western Alps. Our aim was to assess the extent of intraspecific variability within the nominal species and the conservation status of isolated populations. We studied genetic diversity across the whole species range. We analyzed leaf traits, which are distinctive morphological characters within the Tephroseris genus. A clear pattern of genetic variation was found among populations of T. balbisiana, which clustered according to their geographic position. On the contrary, there was a strong overlap in the morphological space of individuals across the species' range, with few peripheral populations diverging in their leaf morphology. Studying habitat suitability by means of species distribution models, we observed that T. balbisiana range is primarily explained by solar radiation and precipitation seasonality. Environmental requirements could explain the genetic and morphological uniformity of T. balbisiana in its core distribution area and justify genetic, morphological, and ecological divergences found among the isolated populations of the Apennines. Our findings emphasize the need to account for the whole diversity of a species, comprising peripheral populations, in order to better estimate its status and to prioritize areas for its conservation.

## Standardised spider (Arachnida, Araneae) inventory of Kilpisjärvi, Finland.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Biodiversity Data Journal, 2020, 8: e56486, doi: 10.3897/BDJ.8.e56486

**Autori:** Kiljunen N, Pajunen T, Fukushima C, Soukainen A, Kuurne J, Korhonen T, Saarinen J, Falck I, Laine E, Mammola S, Urbano F, Macías-Hernández N, Cardoso P

**Abstract ENG:** Background  A spider taxonomy and ecology field course was organised in Kilpisjärvi Biological Station, northern Finland, in July 2019. During the course, four 50 × 50 m plots in mountain birch forest habitat were sampled following a standardised protocol. In addition to teaching and learning about spider identification, behaviour, ecology and sampling, the main aim of the course was to collect comparable data from the Kilpisjärvi area as part of a global project, with the purpose of uncovering global spider diversity patterns.  New information  A total of 2613 spiders were collected, of which 892 (34%) were adults. Due to uncertainty of juvenile identification, only adults are included in the data presented in this paper. The observed adult spiders belong to 51 species, 40 genera and 11 families, of which the Linyphiidae were the most rich and abundant with 28 (55%) species and 461 (52%) individuals. Lycosidae had six species and 286 individuals, Gnaphosidae five species and 19 individuals, Thomisidae four species and 24 individuals, Theridiidae two species and 23 individuals. All other six families had one species and less than 40 individuals. The most abundant species were the linyphiid Agnyphantes expunctus (204) and the lycosids Pardosa eiseni (164) and Pardosa hyperborea (107).

## Exploring the homogeneity of terrestrial subterranean communities at a local spatial scale.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Ecological Entomology, 2020, 45, 1053–1062, DOI: 10.1111/een.12883

**Autori:** Mammola S, Chiappetta N, Giachino PM, Antić DŽ, Zapparoli M, Isaia M

**Abstract ENG:** 1. Although caves are generally perceived as isolated habitats, at the local scale, they are often interconnected via a network of fissures in the bedrock. Accordingly, caves in close proximity are expected to host the same, or very similar, animal communities. 2. We explored the extent to which subterranean arthropod communities are homoge- nous at a local spatial scale of less than 1km2, along with which cave-specific envi- ronmental features result in a departure from the expected homogeneous pattern. We approached this question by studying richness and turnover in terrestrial invertebrate communities of 27 caves in a small karst massif in the Western Italian Alps. 3. Specialised subterranean species were homogeneously distributed among caves and were not influenced by seasonality. The only factor driving their distribution was the distance from the cave entrance, with deeper caves yielding a greater diversity of species. 4. Significant spatio-temporal turnover in species not specialised to subterranean life was observed. In summer, there was a significant homogenisation of the community and a more even distribution of species among sites; in winter, these species were missing or found exclusively at greater depths, where environmental conditions were more stable. Furthermore, caves at lower elevations yielded, on average, a greater diversity and abundance of these species. 5. This study demonstrated that the theoretical expectation of no turnover in commu- nity composition in caves in close proximity is not always met. Turnover can be mostly attributed to seasonal patterns and sampling depth; thus, our findings have implications for planning sampling and monitoring activities in caves.

## Towards establishment of a centralized spider traits database.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Journal of Arachnology, 2020, 48, 2, 103–109, DOI: 10.1636/0161-8202-48.2.103

**Autori:** Lowe E, Wolff JO, Aceves-Aparicio A, Birkhofer K, Branco VV, Cardoso P, Chichorro F, Fukushima CS, Gonçalves-Souza T, Haddad CR, Isaia M, Krehenwinkel H, Audisio TL, Macías-Hernández N, Malumbres-Olarte J, Mammola S, McLean DJ, Michalko R, Nentwig W, Pekár S, Pétillon J, Privet K, Scott C, Uhl G, Urbano-Tenorio F, Wong BH, Herbestein ME

**Abstract ENG:** A main goal of ecological and evolutionary biology is understanding and predicting interactions between populations and both abiotic and biotic environments, the spatial and temporal variation of these interactions, and the effects on population dynamics and performance. Trait-based approaches can help to model these interactions and generate a comprehensive understanding of ecosystem functioning. A central tool is the collation of databases that include species trait information. Such centralized databases have been set up for a number of organismal groups but is lacking for one of the most important groups of predators in terrestrial ecosystems – spiders. Here we promote the collation of an open spider traits database, integrated into the global Open Traits Network. We explore the current collation of spider data and cover the logistics of setting up a global database, including which traits to include, the source of data, how to input data, database governance, geographic cover, accessibility, quality control and how to make the database sustainable long-term. Finally, we explore the scope of research questions that could be investigated using a global spider traits database.

## Environmental filtering and convergent evolution determine the ecological specialisation of subterranean spiders.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Functional Ecology, 2020, 34, 5, 1064–1077, DOI: 10.1111/1365-2435.13527

**Autori:** Mammola S, Arnedo MA, Fišer C, Cardoso P, John Dejanaz A, Isaia M

**Abstract ENG:** 1. Ecological specialization is an important mechanism enhancing species coexist- ence within a given community. Yet, unravelling the effect of multiple selective evolutionary and ecological factors leading the process of specialization remains a key challenge in ecology. Subterranean habitats provide highly replicated experimental arenas in which to disentangle the relative contribution of evolu- tionary history (convergent evolution vs. character displacement) and ecological setting (environmental filtering vs. competitive exclusion) in driving community assembly. 2. We tested alternative hypotheses about the emergence of ecological speciali- zation using the radiation of a lineage of sheet-weaver cave-dwelling spiders as model system. We observed that at the local scale, a differential specializa- tion to cave microhabitats generally parallels moderate levels of morphologi- cal similarity and close phylogenetic relatedness among species. Conversely, geographic distance contributed little in explaining microhabitat occupation, possibly mirroring a limited role of competitive exclusion. Yet, compared to non-coexisting species, co-occurring species adapted to different microhabitats showed lower morphological niche overlap (i.e. higher dissimilarity) and deeper genetic distance. 3. The framework here developed suggests that in the subterranean domain, habitat specialization is primarily driven by environmental filtering, secondarily by con- vergent evolution, and only marginally by character displacement or competitive exclusion. This pattern results in the establishment of replicated communities across geographical space, composed by ecologically equivalent species. Such process of community assembly well explains the numerous adaptive radiations observed in subterranean habitats, an eco-evolutionary pattern well documented in oceanic islands or mountain summit communities.

## Alien crayfish species in the deep subalpine Lake Maggiore (NW-Italy), with a focus on the biometry and habitat preferences of the Spiny-Cheek crayfish.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Water, 2020, 12 (5), 1391, doi: 10.3390/w12051391

**Autori:** Garzoli L, Mammola S, Ciampittiello M, Boggero A

**Abstract ENG:** Invasive alien species are a major threat to biodiversity. Thus, it is fundamental to implement control strategies at the early stages of invasions. In the framework of the Italian-Swiss Alien Invasive Species in Lake Maggiore cooperative programme, we performed an extensive study on the occurrence and ecology of alien crayfish, one of the most significant invaders of freshwater habitats. From April 2017 to July 2018, we inspected seventy-five sites along the coastline to verify crayfish occurrence. We recorded, for the first time, the signal crayfish Pacifastacus leniusculus. Additionally, we found few individuals and remains of the red swamp crayfish Procambarus clarkii, and confirmed the presence of a consistent population of the spinycheek crayfish Orconectes limosus. Given the high number of O. limosus' individuals found, it was possible to perform in-depth biometric and ecological analyses for this abundant species only. We observed no significant differences of biometric measures between males and females of O. limosus. We explore its habitat preferences with a generalized linear model, detecting a significant relationship between mean annual temperatures and the presence of shelters of this species. These results, together, have direct implications for planning rapid management response actions on alien crayfish in large and deep lakes.

## Global wildlife trade permeates the Tree of Life.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Biological conservation, 2020, 247, 108503, DOI: 10.1016/j.biocon.2020.108503

**Autori:** Fukushima C, Mammola S, Cardoso P

**Abstract ENG:** Legal and illegal wildlife trade is a multibillion dollar industry that is driving several species toward extinction. Even though wildlife trade permeates the Tree of Life, most analyses to date focused on the trade of a small selection of charismatic vertebrate species. Given that vertebrate taxa represent only 3% of described species, this is a significant bias that prevents the development of comprehensive conservation strategies. In this short contribution, we discuss the significance of global wildlife trade considering the full diversity of organisms for which data are available in the IUCN database. We emphasize the importance of being fast and effective in filling the knowledge gaps about non-vertebrate life forms, in order to achieve an in-depth understanding of global trading patterns across the full canopy of the Tree of Life, and not just its most appealing twig.

## Social media and large carnivores: sharing biased news on attacks on humans

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Frontiers in Ecology and Evolution, 2020, 8, 71, DOI: 10.3389/fevo.2020.00071

**Autori:** Nanni V, Caprio E, Bombieri G, Schiapparelli S, Chiorri C, Mammola S, Pedrini P, Penteriani V.

**Abstract ENG:** The Internet and social media have profoundly changed the way the public receives and transmits news. The ability of the web to quickly disperse information both geographically and temporally allows social media to reach a much wider audience compared to traditional mass media. A powerful role is played by sharing, as millions of people routinely share news on social media platforms, influencing each other by transmitting their mood and feelings to others through emotional contagion. Thus, social media has become crucial in driving public perception and opinion. Humans have an instinctive fear of large carnivores, but such a negative attitude may be amplified by news media presentations and their diffusion on social media. Here, we investigated how reports of predator attacks on humans published in online newspapers spread on social media. By means of multi-model inference, we explored the contribution of four factors in driving the number of total shares (NTS) of news reports on social media: the graphic/sensationalistic content, the presence of images, the species, as well as the newspaper coverage. According to our results, the information delivered by social media is highly biased toward a graphic/sensationalistic view of predators. Thus, such negative coverage might lead to an unjustified and amplified fear in the public with consequent lower tolerance toward predators and decrease in the support for conservation plans. However, because social media represents a powerful communication tool, its role might be reversed to positive if used appropriately. Thus, constant engagement of scientists on social media would be needed to both disseminate more accurate information on large carnivores and stem the tide of misinformation before its widespread diffusion, a crucial step for effective predator conservation.

## Scientists' warning to humanity on insect extinctions

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Biological Conservation, 2020, 242, 108426, DOI: 10.1016/j.biocon.2020.108426

**Autori:** Cardoso P, Barton P, Birkhofer K, Chichorro F, Deacon C, Fartmann T, Dr Fukushima C, Gaigher R, Habel JC, Hallmann C, Hill M, Hochkirch A, Kaila L, Kwak M, Maes D, Mammola S, Noriega JA, Orfinger A, Pedraza F, Pryke JS, Roque F, Settele J, Simaika J, Stork N, Suhling F, Vorster C, Samways M.

**Abstract ENG:** Here we build on the manifesto 'World Scientists' Warning to Humanity, issued by the Alliance of World Scientists. As a group of conservation biologists deeply concerned about the decline of insect populations, we here review what we know about the drivers of insect extinctions, their consequences, and how extinctions can negatively impact humanity. We are causing insect extinctions by driving habitat loss, degradation, and fragmentation, use of polluting and harmful substances, the spread of invasive species, global climate change, direct overexploitation, and co-extinction of species dependent on other species. With insect extinctions, we lose much more than species. We lose abundance and biomass of insects, diversity across space and time with consequent homogenization, large parts of the tree of life, unique ecological functions and traits, and fundamental parts of extensive networks of biotic interactions. Such losses lead to the decline of key ecosystem services on which humanity depends. From pollination and decomposition, to being resources for new medicines, habitat quality indication and many others, insects provide essential and irreplaceable services. We appeal for urgent action to close key knowledge gaps and curb insect extinctions.

## Solutions for humanity on how to conserve insects

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Biological Conservation, 2020, 242, 108427, DOI: 10.1016/j.biocon.2020.108427

**Autori:** Samways M, Barton P, Birkhofer K, Chichorro F, Deacon C, Fartmann T, Dr Fukushima C, Gaigher R, Habel JC, Hallmann C, Hill M, Hochkirch A, Kaila L, Kwak M, Maes D, Mammola S, Noriega JA, Orfinger A, Pedraza F, Pryke JS, Roque F, Settele J, Simaika J, Stork N, Suhling F, Vorster C, Cardoso P.

**Abstract ENG:** The fate of humans and insects intertwine, especially through the medium of plants. Global environmental change, including land transformation and contamination, is causing concerning insect diversity loss, articulated in the companion review Scientists' warning to humanity on insect extinctions. Yet, despite a sound philosophical foundation, recognized ethical values, and scientific evidence, globally we are performing poorly at instigating effective insect conservation. As insects are a major component of the tapestry of life, insect conservation would do well to integrate better with overall biodiversity conservation and climate change mitigation. This also in- volves popularizing insects, especially through use of iconic species, through more media coverage, and more inclusive education. Insect conservationists need to liaise better with decision makers, stakeholders, and land managers, especially at the conceptually familiar scale of the landscape. Enough evidence is now available, and synthesized here, which illustrates that multiple strategies work at local levels towards saving insects. We now need to expand these locally-crafted strategies globally. Tangible actions include ensuring maintenance of biotic complexity, especially through improving temporal and spatial heterogeneity, functional connectivity, and metapopulation dynamics, while maintaining unique habitats, across landscape mosaics, as well as instigating better communication. Key is to have more expansive sustainable agriculture and forestry, improved regulation and prevention of environmental risks, and greater recognition of protected areas alongside agro-ecology in novel landscapes. Future-proofing insect diversity is now critical, with the benefits far reaching, including continued provision of valuable ecosystem services and the conservation of a rich and impressive component of Earth's biodiversity.

## Modelling the potential impacts of climate change on the distribution of ichthyoplankton in the Yangtze Estuary, China.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Diversity and Distribution, 2020, 26(1), 126–137, DOI: 10.1111/ddi.13002

**Autori:** Zhang Z, Mammola S, Xian W, Zhang H

**Abstract ENG:** Aim: Species distribution models (SDMs) are an effective tool to explore the potential distribution of terrestrial, freshwater and marine organisms; however, SDMs have been seldom used to model ichthyoplankton distributions, and thus, our understand- ing of how larval stages of fishes will respond to climate change is still limited. Here, we developed SDMs to explore potential impacts of climate change on habitat suit- ability of ichthyoplankton. Location: Yangtze Estuary, China. Methods: Using long-term ichthyoplankton survey data and a large set of marine pre- dictor variables, we developed ensemble SDMs for five abundant ichthyoplankton species in the Yangtze Estuary (Coilia mystus, Hypoatherina valenciennei, Larimichthys polyactis, Salanx ariakensis and Chelidonichthys spinosus). Then, we projected their habitat suitability under present and future climate conditions. Results: The ensemble SDMs had good predictive performance and were successful in estimating the known distributions of the five species. Model projections high- lighted two contrasting patterns of response to future climates: while C. mystus will likely expand its range, the ranges of the other four species will likely contract and shift northward. Main conclusions: According to our SDM projections, the five ichthyoplankton spe- cies that we tested in the Yangtze Estuary are likely to respond differently to future climate changes. These projected different responses seemingly reflect the differ- ential functional attributes and life-history strategies of these species. To the extent that climate change emerges as a critical driver of the future distribution of these species, our findings provide an important roadmap for designing future conserva- tion strategies for ichthyoplankton in this region.

## Effect of temperature and duration of immersion on the stability of prepared feeds in echinoculture

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** JOURNAL OF APPLIED AQUACULTURE, 2020, doi: 10.1080/10454438.2020.1724845

**Autori:** Marco Secci, Maria Paola Ferranti, Angelica Giglioli, Viviana Pasquini, Doriana Sicurelli, Giovanni Fanelli, and Ermelinda Prato

**Abstract ITA:** Lo scopo di questo studio era fornire nuove informazioni sulla stabilità in acqua dei mangimi preparati per l'echinocultura. I test di stabilità di quattro mangimi preparati sono stati effettuati in laboratorio in due differenti prove corrispondenti a differenti livelli di temperatura (24 ° C e 19 ° C) e quattro differenti tempi di immersione (fino a 72 h). La temperatura e la durata dell'immersione hanno influenzato in modo significativo la stabilità dei mangimi. Il mangime 1 era il più stabile mentre il mangime 3 era il mangime meno stabile, poiché ha iniziato a dissolversi in poche ore. Feed 2 e Feed 4 sono rimasti stabili a 19 ° C per tutto il processo, mentre a 24 ° C sono rimasti intatti solo per 30 h. Per ottimizzare la pratica dell'echinocoltura a temperature> 19 ° C, si consiglia un regime di alimentazione almeno 3 volte a settimana, mentre a temperature più basse si consiglia un regime di alimentazione intermittente.

**Abstract ENG:** The aim of this study was to provide new insights into the stability in water of the prepared feeds for echinoculture. The stability tests of four prepared feeds were carried out in labora- tory in two different trials corresponding to different tempera- ture levels (24°C and 19°C) and four different times of immersion (up to 72 h). Temperature and duration of immersion significantly affected the stability of feeds. Feed 1 was the most stable whereas Feed 3 was the least stable feed, as it started to dissolve in a few hours. Feed 2 and Feed 4 remained stable at 19°C all along the trial, whereas at 24°C remained intact for only 30 h. To optimize the echinoculture practice at temperature >19°C, we recommend a feeding regime at least 3 times a week, whereas at lower temperature we suggest an intermittent feeding regime.

## Bioactive fatty acids in seafood from Ionian Sea and relation to dietary recommendations

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** International Journal of Food Sciences and Nutrition Volume, 2020, 71 (6), 693-705 , doi: 10.1080/09637486.2020.1719388

**Autori:** Ermelinda Prato, Giovanni Fanelli, Isabella Parlapiano and Francesca Biandolino

**Abstract ITA:** L'obiettivo del presente studio era determinare il contenuto lipidico, la composizione degli acidi grassi e la porzione giornaliera raccomandata per 13 specie di pesci, nove bivalvi, sei crostacei, tre echinodermi e tre specie di cefalopodi, provenienti dal Mar Mediterraneo (Italia meridionale). Il profilo degli acidi grassi è variato significativamente tra le specie (p <.05); gli acidi grassi polinsaturi rappresentano una proporzione importante, con una elevata presenza digli acidi docosaesaenoico ed eicosapentaenoico. . In tutte le specie è stato riscontrato un elevato rapporto n3 / n6 (da 1,0 nella parete corporea di Holothuria polii e H. tubulosa a 10,9 in Mytilus galloprovincialis). Gli indici di qualità nutrizionale dei lipidi (indice aterogenico, indice di trombogenicità e rapporto di acidi grassi ipocolesterolemici / ipercolesterolemici) hanno evidenziato che i crostacei Parapaeneus longirostris, Plesionika martia, Melicertus kerathurus, Nephrops norvegicus possono essere più benefici per la salute del consumatore. Questo documento sarà di valore pratico dal punto di vista della salute per le popolazioni che consumano frutti di mare e un potente strumento di marketing per gli acquicoltori

**Abstract ENG:** The objective of the present study was to determine lipid content, fatty acid composition and the recommended daily portion of 13 fish species, nine bivalves, six crustacean, three echino- derm and three cephalopod species, from the Mediterranean Sea (Southern Italy). Fatty acids profile varied significantly among species (p<.05); polyunsaturated fatty acids represented an important proportion, with docosahexaenoic and eicosapentaenoic acids in the highest amount. A high n3/n6 ratio was found in all species (from 1.0 in body wall of Holothuria polii and H. tubu- losa to 10.9 in Mytilus galloprovincialis). The lipid nutritional quality indices (atherogenic index, thrombogenicity index and hypocholesterolaemic/hypercholesterolaemic fatty acid ratio) showed crustaceans Parapaeneus longirostris, Plesionika martia, Melicertus kerathurus, Nephrops norvegicus, as likely to be more beneficial for the consumer health. This paper will be of practical value from a health perspective for populations who consume seafood and a powerful marketing tool for farmers.

## Nanoparticles: An Experimental Study of Zinc Nanoparticles Toxicity on Marine Crustaceans. General Overview on the Health Implications in Humans

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Frontiers in Public Health, 2020, 8, 192, doi: 10.3389/fpubh.2020.00192

**Autori:** Vimercati L, Cavone D, Caputi A, De Maria L, Tria M., Prato E. and Ferri G.M .(2020)

**Abstract ITA:** La presenza di prodotti contenenti nanoparticelle o nanofibre è in rapida crescita. La nanotecnologia coinvolge un ampio spettro di settori industriali. Mancano informazioni sulla tossicità di queste nanoparticelle nei mezzi acquosi. È stata valutata la potenziale tossicità acuta di ZnO NP utilizzando due specie di crostacei marini: il copepode Tigriopus fulvus e l'amphypod Corophium insidiosum. Test acuti sono stati condotti su adulti di T. Fulvus nauplii e C. insidiosum. Entrambe le specie in esame sono state esposte per 96 ore a 5 concentrazioni crescenti di ZnO NP e ZnSO4 H2 O e l'endpoint era la mortalità. L'analisi statistica ha rivelato che i valori medi di LC50 di ZnO NP e ZnSO4H2O (ZnO NP: F = 59,42; P <0,0015; ZnSO4H2O: F = 25,57; P <0,0015) erano significativamente inferiori per Tigriopus fulvus rispetto a Corophium insidiosum. Questo risultato conferma che l'effetto tossico potrebbe essere principalmente attribuito agli ioni Zn, confermando che i processi di dissoluzione giocano un ruolo cruciale nella tossicità delle NP ZnO.

**Abstract ENG:** The presence of products containing nanoparticles or nanofibers is rapidly growing. Nanotechnology involves a wide spectrum of industrial fields. There is a lack of information regarding the toxicity of these nanoparticles in aqueous media. The potential acute toxicity of ZnO NPs using two marine crustacean species: the copepod Tigriopus fulvus and the amphypod Corophium insidiosum was evaluated. Acute tests were conducted on adults of T. Fulvus nauplii and C. insidiosum. Both test species were exposed for 96 h to 5 increasing concentrations of ZnO NPs and ZnSO4 H2 O, and the endpoint was mortality. Statistical analysis revealed that the mean LC50 values of both ZnO NPs and ZnSO4H2O (ZnO NPs: F = 59.42; P < 0.0015; ZnSO4H2O: F = 25.57; P < 0.0015) were significantly lower for Tigriopus fulvus than for Corophium insidiosum. This result confirms that the toxic effect could be mainly attributed to the Zn ions, confirming that the dissolution processes play a crucial role in the toxicity of the ZnO NPs.

## Estimation of Growth Parameters of the Black Scallop Mimachlamys varia in the Gulf of Taranto (Ionian Sea, Southern Italy)

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Water, 2020,12, 3342, doi: 10.3390/w12123342

**Autori:** Ermelinda Prato , Francesca Biandolino, Isabella Parlapiano, Loredana Papa, Giuseppe Denti and Giovanni Fanelli

**Abstract ITA:** Il presente studio esamina la crescita giovanile di nove coorti di Mimachlamys varia in una zona costiera del Mar Ionio, da gennaio 2014 a maggio 2015. I risultati hanno mostrato che M. varia potrebbe raggiungere dimensioni commerciali in meno di un anno di coltivazione, ma significativo differenze nel tasso di crescita assoluto (AGR) e nel tasso di crescita specifico (SGR) sono state trovate tra le coorti ($p < 0,05$). Sono state inoltre identificate le relazioni tra la crescita delle capesante (dimensioni e peso) e le variabili ambientali (temperatura dell'acqua, ossigeno disciolto e concentrazione di clorofilla). La relazione lunghezza-peso mostrava una crescita allometrica negativa e indicava un'elevata correlazione con R2, compresa tra 0,95 e 0,82. I parametri di crescita di Von Bertalanffy hanno mostrato i valori più alti di $L\infty$ nelle coorti raccolte in gennaio, aprile e febbraio (52,2, 51,2 e 50,3), rispettivamente. L'indice di performance della crescita ($\varphi$ ') era compreso tra 2,52 (coorte raccolta a giugno) e 3,03 (coorte raccolta ad agosto). I dati ottenuti aggiungono conoscenze di base alle prestazioni di crescita di questa specie, rendendola una buona opportunità per facilitare la diversificazione dell'acquacoltura in questa parte del Mar Mediterraneo.

**Abstract ENG:** The present study examines the juvenile growth of nine cohorts of Mimachlamys varia in a coastal area of the Ionian Sea, from January 2014 to May 2015. The results showed that M. varia could reach commercial size in less than one year of cultivation, but significant differences in absolute growth rate (AGR) and specific growth rate (SGR) were found among cohorts ($p < 0.05$). Relationships between scallop growth (size and weight) and environmental variables (water temperature, dissolved oxygen and chlorophyll concentration) were also identified. The length–weight relationship showed negative allometric growth and indicated high correlation with R2, ranging from 0.95 to 0.82. Von Bertalanffy growth parameters showed the highest values of $L\infty$ in the cohorts collected in January, April and February (52.2, 51.2 and 50.3), respectively. The growth performance index ($\varphi$') ranged between 2.52 (cohort collected in June) and 3.03 (cohort collected in August). The obtained data add basic knowledge to the growth performance of this species, making this a good opportunity to facilitate aquaculture diversification in this part of Mediterranean Sea.

## Comparative Characteristics of Percentage Edibility, Condition Index, Biochemical Constituents and Lipids Nutritional Quality Indices of Wild and Farmed Scallops (Flexopecten Glaber)

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**Riferimento rivista con DOI:** Water, 2020,12, 1777, doi: 10.3390/w12061777

**Autori:** Francesca Biandolino, Isabella Parlapiano, Asia Grattagliano, Giovanni Fanelli and Ermelinda Prato

**Abstract ITA:** Il consumo di prodotti marini è notevolmente aumentato negli ultimi decenni; tuttavia, le scorte di frutti di mare selvatici sono risorse limitate, quelli coltivati rappresentano una possibile valida alternativa. Lo scopo di questo studio era di confrontare capesante selvatiche e coltivate di Flexopecten glaber, sulla base dei loro indici di commerciabilità e caratteristiche biochimiche. Esemplari selvatici e coltivati sono stati raccolti dal Mar Ionio (Mar Mediterraneo centrale). Le proteine e i lipidi erano significativamente differenti tra le capesante, con valori di proteine di 8,50 e 11,6 g / 100 ge lipidi di 1,45 e 1,70 g / 100 g rispettivamente per le capesante selvatiche e coltivate. Per quanto riguarda gli acidi grassi (FA), sono state rilevate anche differenze statistiche. Le specie coltivate hanno mostrato acidi grassi polinsaturi (PUFA) significativamente ($p < 0,05$) più alti rispetto alla sua controparte selvatica. L'acido eicosapentaenoico (EPA, 20: 5 n3) e l'acido docosaesaenoico (DHA, 22: 6: 3) erano i principali acidi grassi polinsaturi, sebbene solo il DHA mostrasse differenze significative tra capesante selvatiche e colture ($p < 0,05$). Il rapporto di PUFA n3 / n6 ha mostrato valori elevati, con 2,7 e 3,1 rispettivamente per capesante selvatiche e coltivate. Gli indici aterogenici e trombogenici e il rapporto tra acidi grassi ipocolesterolemici / ipercolesterolemici indicavano un ruolo importante nella dieta umana. Le apprezzate proprietà nutritive di questa specie potrebbero sostenere l'interesse a promuoverne la coltivazione, garantendo un elevato valore nutritivo degli alimenti per gli acquirenti.

**Abstract ENG:** The consumption of seafood has considerably increased over recent decades; however, as wild seafood stocks are limited, the cultured ones represent a possible valuable alternative. The purpose of this study was to compare wild and cultured scallops, Flexopecten glaber, on the basis of their marketability indices and biochemical characteristics. Wild and cultured specimens were harvested from the Ionian Sea (the Central Mediterranean Sea). Protein and lipid were significantly different between scallops, with the values of protein of 8.50 and 11.6 g/100 g and lipid of 1.45 and 1.70 g/100 g for wild and cultured scallops, respectively. Regarding fatty acids (FAs), statistical differences were also detected. The cultured species showed significantly ($p < 0.05$) higher polyunsaturated fatty acids (PUFAs) than its wild counterpart. Eicosapentaenoic (EPA, 20:5 n3) and docosahexaenoic acid (DHA, 22:6:3) were the major polyunsaturated fatty acids, although only DHA showed significant differences between wild and culture scallops ($p < 0.05$). The ratio of n3/n6 PUFA showed high values, with 2.7 and 3.1 for wild and cultured scallops, respectively. The atherogenic and thrombogenic indices and hypocholesterolemic/hypercholesterolemic fatty acid ratio indicated an import role in human diet. The appreciated nutritional properties of this species could support the interest to promote its cultivation, ensuring high food nutritive value for the purchasers.

## A New Network for the Advancement of Marine Biotechnology in Europe and Beyond

**Anno di pubblicazione:** 2020

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**Autori:** Rotter A, Bacu A, Barbier M, Bertoni F, Bones AM, Cancela ML, Carlsson J, Carvalho MF, Cegłowska M, Dalay MC, Dailianis T, Deniz I, Drakulovic D, Dubnika A, Einarsson H, Erdog˘ an A, Eroldog˘ an OT, Ezra D, Fazi S, FitzGerald RJ, Gargan LM, Gaudêncio SP, Ivoševic´ DeNardis N, Joksimovic D, Kataržyte˙ M, Kotta J, Mandalakis M, Matijošyte˙ I, Mazur-Marzec H, Massa-Gallucci A, Mehiri M, Nielsen SL, Novoveská L, Overlinge˙ D, Portman ME, Pyrc K, Rebours C, Reinsch T, Reyes F, Rinkevich B, Robbens J, Rudovica V, Sabotic˘ J, Safarik I, Talve S, Tasdemir D, Schneider XT, Thomas OP, Torun´ ska-Sitarz A, Varese GC and Vasquez MI

**Abstract ENG:** Marine organisms produce a vast diversity of metabolites with biological activities useful for humans, e.g., cytotoxic, antioxidant, anti-microbial, insecticidal, herbicidal, anticancer, pro-osteogenic and pro-regenerative, analgesic, anti-inflammatory, anticoagulant, cholesterol-lowering, nutritional, photoprotective, horticultural or other beneficial properties. These metabolites could help satisfy the increasing demand for alternative sources of nutraceuticals, pharmaceuticals, cosmeceuticals, food, feed, and novel bio-based products. In addition, marine biomass itself can serve as the source material for the production of various bulk commodities (e.g., biofuels, bioplastics, biomaterials). The sustainable exploitation of marine bio-resources and the development of biomolecules and polymers are also known as the growing field of marine biotechnology. Up to now, over 35,000 natural products have been characterized from marine organisms, but many more are yet to be uncovered, as the vast diversity of biota in the marine systems remains largely unexplored. Since marine biotechnology is still in its infancy, there is a need to create effective, operational, inclusive, sustainable, transnational and transdisciplinary networks with a serious and ambitious commitment for knowledge transfer, training provision, dissemination of best practices and identification of the emerging technological trends through science communication activities. A collaborative (net)work is today compelling to provide innovative solutions and products that can be commercialized to contribute to the circular bioeconomy. This perspective article highlights the importance of establishing such collaborative frameworks using the example of Ocean4Biotech, an Action within the European Cooperation in Science and Technology (COST) that connects all and any stakeholders with an interest in marine biotechnology in Europe and beyond.

## The dissolved organic matter in a tropical saline-alkaline lake of the East African Rift Valley.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Water Research, 2020, 173, 115532, DOI: 10.1016/j.watres.2020.115532

**Autori:** Butturini A., P. Herzsprung, O. Lechtenfeld, S. Venturi, S. Amalfitano, E. Vazquez, N. Pacini, D. Harper, S. Fazi.

**Abstract ENG:** Saline-alkaline lakes of the East African Rift are known to have an extremely high primary production supporting a potent carbon cycle. To date, a full description of carbon pools in these lakes is still missing. More specifically, there is not detailed information on the quality of dissolved organic matter (DOM), the main carbon energy source for heterotrophs prokaryotes. We report the first exhaustive description of DOM molecular properties in the water column of a meromictic saline-alkaline lake of the East African Rift. DOM availability, fate and origin were studied either quantitatively, in terms of dissolved organic carbon (DOC) and nitrogen (DON) or qualitatively, in terms of optical properties (absorbance) and molecular characterization of solid-phase extracted DOM (SPE-DOM) through negative electrospray ionization Fourier-transform ion cyclotron resonance mass spectrometry (FT-ICR-MS). DOM availability was high (DOC ~ 8.1 mM in surface waters) and meromixis imprinted a severe quantitative and qualitative change on DOM pool. At the surface, DOM was rich in aliphatic and moderately in aromatic molecules and thus mirroring autochthonous microbial production together with photodegradation. At the bottom changes were extreme: DOC increased up to 5 times (up to 50 mM) and, molecular signature drifted to saturated, reduced and non-aromatic DOM suggesting intense microbial activity within organic sediments. At the chemocline, DOC was retained indicating that this interface is a highly reactive layer in terms of DOM processing. These findings underline that saline-alkaline lakes of the East African Rift are carbon processing hot spots and their investigation may broaden our understanding of carbon cycling in inland waters at large.

## Investigating the influences of quorum quenching and nutrient conditions on activated sludge flocs at a short-time scale.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Chemosphere, 2020, 248, 125917, DOI: 10.1016/j.chemosphere.2020.125917

**Autori:** Salehiziri M., S. Amalfitano, A. Gallipoli, A. Gianico, H. Amini Rad, C.M. Braguglia, S. Fazi

**Abstract ENG:** Quorum sensing signals regulate various functions within activated sludge processes such as formation of microbial aggregates. Disturbance of this signaling system, known as quorum quenching (QQ), provides opportunities for eliminating some problems related to biological wastewater treatment (e.g., biofouling and excess sludge production). However, it is poorly understood how and to what extent QQ systems can affect the microbial aggregation processes and the following floc formation. In particular, an in-depth structural characterization at the scale of microbial aggregate while considering nutrient conditions in the reactor is still largely disregarded. Here, we evaluated the QQ effects at the short-term time scale (i.e., after 4 h for the exogenous period and 19 h for exogenous/endogenous period), by combining advanced techniques for microbial characterization (flow cytometry, CARD-FISH, and confocal laser scanning microscopy) and conventional physical-chemical assessments. The results indicated that by implementing QQ agents (immobilized Acylase I enzyme in porous alginate beads) the abundance of single cells and suspended microbial aggregates in the supernatant did not show significant changes during the exogenous period. Conversely, at the end of the exogenous/endogenous period a significant increase of single prokaryotic cells, small and large microbial aggregates favored the growth of grazers, including free-living nanoflagellates and ciliates. Flocs became looser and thinner than those in the control reactor, thus affecting the sludge settling behavior. Inability of microbial community in degradation of soluble protein during the endogenous period confirmed that the QQ agents are likely to inhibit the secretion of protease enzyme within microbial communities of activated sludge.

## Geochemical characterization of an urban lake in the centre of Rome (Lake Bullicante, Italy)

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Italian Journal of Geosciences, 2020, 139, 3, 436-449, DOI: 10.3301/IJG.2020.15

**Autori:** Procesi M., Cinti D., Casentini B., Cabassi J., Amalfitano S., Pizzino L., Capecchiacci F., Butturini A., Fazi S.

**Abstract ENG:** Urban lakes have become increasingly important in the planning of urban ecology, green infrastructure and green areas in European cities. This paper describes the chemical, isotope and microbial features of Lake Bullicante, a small artificial lake located within the urban area of the city of Rome. It has an anthropogenic origin due to excavation works that intercepted the underlying aquifer, giving rise to a water body. The lake area is 7.000 m2, with a maximum depth of 7 m and located on the distal deposits of the Alban Hills Volcanic District in an area named “Acqua Bullicante” (i.e. Bubbling Water), where degassing phenomena were historically recorded. The proximity of this volcanic district motivated the study on Lake Bullicante as a potential open-air laboratory to trace possible degassing phenomena in a highly urbanized area. A preliminary geochemical and microbial sampling survey was carried out in winter 2018. Samples were collected along a vertical profile of the lake from the surface to the maximum depth. Major, minor, trace elements, dissolved gases and stable isotopes (δD-H2O, δ18OH 2O, δ13C-CO2) were analyzed, along with the analysis of 87Sr/86Sr ratio. The microbial community characteristics were analysed by epifluorescence microscopy (CARD-FISH) and flow cytometry. The chemical composition and water isotopes suggest that lake water has a meteoric origin and is related to a Ca-HCO3 shallow aquifer hosted in volcanic rocks. This is confirmed by both the 87Sr/86Sr ratio of lake water, which falls in the range of values of Alban Hills volcanites, and the chemical-isotopic composition of neighboring wells. A relatively high concentration of dissolved CO2, its isotopic signature (δ13C-CO2 20‰ V-PDB), and the high content in organic matter (DOC 10-30 mg/L) suggest for the lake an eutrophication state with denitrification also occurring. Considering the relatively high concentrations of dissolved CO2, an external input of carbon dioxide cannot be completely excluded and as a consequence, not even the hypothesis of mixing processes between biotic and inorganic CO2. This makes further investigations necessary especially during the summer, when the lake is stratified. A summer survey could be also useful to better understand the microbial processes into the lake, its eutrophication evolution and health status, and to plan eventual proper remediation strategies, providing important tools to the local administration and stakeholders to improve, protect and preserve this ecological niche.

## Prokaryotic community composition and distribution in coastal sediments following a Po river flood event (northern Adriatic Sea, Italy)

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Estuarine Coastal and Shelf Science, 2020, 233, 5, 106547, DOI: 10.1016/j.ecss.2019.106547

**Autori:** Fazi, Stefano; Baldassarre, Laura; Cassin, Daniele; Quero, Grazia Marina; Pizzetti, Ilaria; Cibic, Tamara; Luna, Gian Marco; Zonta, Roberto; Del Negro, Paola

**Abstract ENG:** The influence of the freshwater runoff on marine prokaryotes has been largelly studied in the pelagic environment, little is known about the effects on the prokaryotes in coastal sediments. We investigated the distribution of benthic prokaryotes in the northern Adriatic Sea, when an extreme Po River flood event determined high heterogeneity along the estuarine salinity gradient (from mainly freshwater to marine). The microbial diversity was assessed by 16S rRNA gene Illumina sequencing, the quantification of the dominant taxa of Bacteria and Archaea by microscopy techniques (CARD-FISH). Our results showed dominance of Bacteria (eight-fold higher) over Archaea, and highlighted Proteobacteria as the most represented phylum, followed by Bacteroidetes. Prokaryotic abundance, quantified by DAPI staining, was mainly affected by sediment characteristics (Total Organic C and Total N contents, and silt fraction). Abundance reached the highest values in sites directly affected by the plume (range 7.3 × 108 - 2.8 × 109 cell g−1). A considerable difference in prokaryotes composition was observed along the salinity gradient, with an increasing presence of freshwater taxa at stations more influenced by the river discharge. CARD-FISH analyses corroborated these findings, showing higher abundance of beta-Proteobacteria and Planctomycetes at stations closest to the river mouths. Nevertheless, a core microbiome (about 10% of the total OTUs) was present across all the study areas, indicating the ability of this assemblage to survive in rather diverse environmental conditions, differently impacted by the river plume. Our results show that the river plume can affect the diversity and distribution patterns of benthic prokaryotes far into the pro-delta, although further investigations are needed in order to understand how the mixing of bacterial communities of different origin might reflect on ecosystem functioning.

## Application of QMRA to MAR operations for safe agricultural water reuses in coastal areas

**Anno di pubblicazione:** 2020

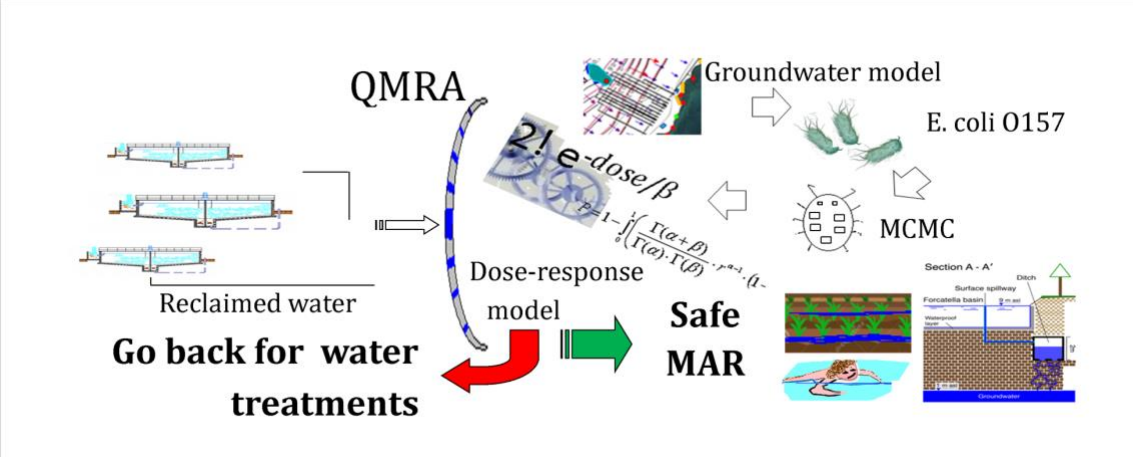
**Riferimento rivista con DOI:** WATER RESEARCH X, 2020, 8, 100062 ; doi: 10.1016/j.wroa.2020.100062

**Autori:** Costantino Masciopinto, Michele Vurro, Nicole Lorusso, Charls Nathan Haas

**Abstract ITA:** Un modello patogeno di Escherichia coli (E.coli) O157: H7 e O26: H11 è stato messo a punto per un valutazione quantitativa del rischio microbico (QMRA) delle malattie trasmesse dall'acqua associate alle pratiche di gestione e di ricarica degli acquiferi (MAR) nelle regioni semiaride. La struttura MAR a Forcatella (Sud Italia) è stata selezionata per l'applicazione QMRA. L'obiettivo del modello determina il numero di patogeni ingeriti o inalati accidentalmente dall'ospite mangiando colture crude contaminate o mentre si fa il bagno sulle spiagge della zona costiera. La concentrazione dei patogeni è stata determinata da applicando il metodo bayesiano della catena Monte Carlo Markov (MCMC) ai risultati del campionamento dell'acqua. Il MCMC ha fornito il numero di patogeni più probabile che raggiunge l'obiettivo e ha consentito la minimizzazione del numero di campionamenti dell'acqua e, quindi, riducendo i costi associati alla sperimentazione. Le stazioni di campionamento lungo la costa sono state posizionate sulla base dei risultati di un modello di flusso di acque sotterranee e trasporto di patogeni, che ha evidenziato le vie di flusso preferenziali dell'E. coli trasportato nelle fratture della falda acquifera costiera. L'analisi QMRA ha indicato rischi per la salute tollerabili (<10 -6 DALY) per la balneazione sulle spiagge e l'irrigazione con acque reflue, con 0,4 malattie infettive all'anno (11,4% di probabilità di insorgenza) associate al riutilizzo dell'acqua di recupero tramite irrigazione del suolo anche se si supera il limite di 10 CFU di E. coli / 100 ml della normativa fino a cinque volte. I risultati mostrano un rischio per la salute trascurabile e impatti insignificanti sulla costa qualità dell'acqua dovuta a E. coli patogeno nelle acque reflue utilizzate per MAR. Tuttavia, la siccità e la qualità dell'acqua bonificata possono essere considerate come le principali problematiche associate alle pratiche MAR nelle regioni semiaride dove ulteriori trattamenti di acqua depurata e ulteriori stress-test tramite QMRA considerando patogeni più persistenti rispetto al E. coli sono necessari.

**Abstract ENG:** quantitative microbial risk assessment (QMRA) of the waterborne diseases associated with managed aquifer recharge (MAR) practices in semiarid regions. The MAR facility at Forcatella (Southern Italy) was selected for the QMRA application. The target counts of pathogens incidentally exposed to hosts by eating contaminated raw crops or while bathing at beaches of the coastal area were determined by applying the Monte Carlo Markov Chain (MCMC) Bayesian method to the water sampling results. The MCMC provided the most probable pathogen count reaching the target and allowed for the minimization of the number of water samplings, and hence, reducing the associated costs. The sampling stations along the coast were positioned based on the results of a groundwater flow and pathogen transport model, which highlighted the preferential flow pathways of the transported E. coli in the fractured coastal aquifer. QMRA indicated tolerable (<10 -6 DALY) health risks for bathing at beaches and irrigation with wastewater, with 0.4 infectious diseases per year (11.4% probability of occurrence) associated with the reuse of reclaimed water via soil irrigation even though exceeding the E. coli regulation limit of 10 CFU/100 mL by five times. The results show negligible health risk and insignificant impacts on the coastal water quality due to pathogenic E. coli in the wastewater used for MAR. However, droughts and reclaimed water quality

can be considered the main issues of MAR practices in semiarid regions suggesting additional reclaimed water treatments and further stress-tests via QMRAs by considering more persistent pathogens than E. coli.



## Conductive Magnetite Nanoparticles Enhance the Microbial Electrosynthesis of Acetate from CO2 while Diverting Electrons away from Methanogenesis

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Fuel Cell, 2020, 20 (1), 98-106, DOI: 10.1002/fuce.201900152

**Autori:** Carolina Cruz Viggi, Simone Colantoni, Francesco Falzetti, Alessandro Bacaloni, Daniele Montecchio and Federico Aulenta

**Abstract ENG:** Microbial electrosynthesis (MES) is an emerging technology which exploits microbial cells to convert CO2 into fuels, and value-added chemicals using electrons supplied by a solid-state cathode. Methane and acetic acid are typically the main CO2-reduction products attained in microbial electrosynthesis studies, although the production of other more valuable products has also been reported. So far, however, practical strategies to manipulate and steer the distribution of CO2 reduction products during microbial electrosynthesis, particularly when mixed microbial cultures are employed as catalysts, are lacking. To specifically address this issue, here we investigated the influence of magnetite nanoparticles (NPs) supplementation (to a final concentration of 300 mg Fe L−1) on the microbial electrosynthesis process. Results demonstrated, that cells supplemented with magnetite NPs, exhibited a substantially higher yield of acetate production relative to unamended controls (up to 8.5 times higher, during the run with the cathode set at a potential of −700 mV vs. SHE, with a corresponding cathode capture efficiency of 17%) and, correspondingly, a lower yield of methane production (52% in the magnetite-supplemented cell vs. 74% in the unamended control cell). Abiotic experiments indicated that the observed effects derived from magnetite catalyzing the biotic and abiotic hydrogen evolution reaction.

## Marine hydrocarbon-degrading bacteria breakdown poly(ethylene terephthalate) (PET)

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Science of the Total Environment, 2020, 749, 141608, DOI: 10.1016/j.scitotenv.2020.141608

**Autori:** Renata Denaro, Federico Aulenta, Francesca Crisafi, Francesca Di Pippo, Carolina Cruz Viggi, Bruna Matturro, Paolo Tomei, Francesco Smedile, Andrea Martinelli, Valerio Di Lisio, Cristina Venezia and Simona Rossetti

**Abstract ENG:** Pollution of aquatic ecosystems by plastic wastes poses severe environmental and health problems and has prompted scientific investigations on the fate and factors contributing to the modification of plastics in the marine environment. Here, we investigated, by means of microcosm studies, the role of hydrocarbon-degrading bacteria in the degradation of poly(ethylene terephthalate) (PET), the main constituents of plastic bottles, in the marine environment. To this aim, different bacterial consortia, previously acclimated to representative hydrocarbons fractions namely, tetradecane (aliphatic fraction), diesel (mixture of hydrocarbons), and naphthalene/phenantrene (aromatic fraction), were used as inocula of microcosm experiments, in order to identify peculiar specialization in poly(ethylene terephthalate) degradation. Upon formation of a mature biofilm on the surface of poly(ethylene terephthalate) films, the bacterial biodiversity and degradation efficiency of each selected consortium was analyzed. Notably, significant differences on biofilm biodiversity were observed with distinctive hydrocarbons-degraders being enriched on poly(ethylene terephthalate) surface, such as Alcanivorax, Hyphomonas, and Cycloclasticus species. Interestingly, ATR-FTIR analyses, supported by SEM and water contact angle measurements, revealed major alterations of the surface chemistry and morphology of PET films, mainly driven by the bacterial consortia enriched on tetradecane and diesel. Distinctive signatures of microbial activity were the alteration of the FTIR spectra as a consequence of PET chain scission through the hydrolysis of the ester bond, the increased sample hydrophobicity as well as the formation of small cracks and cavities on the surface of the film. In conclusion, our study demonstrates for the first time that hydrocarbons-degrading marine bacteria have the potential to degrade poly(ethylene terephthalate), although their degradative activity could potentially trigger the formation of harmful microplastics in the marine environment

## Bacterial diversity and microbial functional responses to organic matter composition and persistent organic pollutants in deltaic lagoon sediments

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Estuarine, Coastal and Shelf Science, 2020, 233, 106508, doi: 10.1016/j.ecss.2019.106508

**Autori:** Zoppini A; Bongiorni L; Ademollo N; Patrolecco L; Cibic T; Franzo A; Melita M; Bazzaro M; Amalfitano S.

**Abstract ITA:** Le lagune nei delta dei fiumi sono sistemi altamente produttivi che ricevono carichi elevati di materia organica e nutrienti. Tra i principali fattori di stress ambientale e le questioni legate alla salute umana, la contaminazione antropica è particolarmente preoccupante, poiché le lagune costiere sono sfruttate intensamente per le attività di acquacoltura. Sebbene le comunità microbiche costituiscano la frazione più abbondante della biomassa bentonica, fornendo anche preziosi servizi ecosistemici, i collegamenti tra la qualità dei sedimenti e i processi microbici sono stati ampiamente ignorati. In questo studio, abbiamo mirato a chiarire se diversi livelli di influenza fluviale potrebbero fornire condizioni ambientali favorevoli o avverse per sostenere la diversità e i processi microbici. I sedimenti raccolti da quattro lagune del delta del fiume Po sono stati analizzati per valutare la composizione biochimica (carbonio biopolimerico, Bio-PC), inquinanti organici bersaglio (idrocarburi policiclici aromatici, IPA; nonilfenoli; bisfenolo A) e proprietà della comunità microbica (composizione della comunità batterica, biomassa procariotica, tasso di produzione di carbonio procariotico, PCP, tasso di respirazione della comunità, CR, attività degli enzimi extracellulari, EEA). Le principali proprietà fisiche e chimiche dei sedimenti hanno permesso di identificare due gruppi di sedimenti statisticamente distinti con un'influenza fluviale relativamente bassa (LI) e alta (HI). I sedimenti HI sono stati caratterizzati da concentrazioni più elevate di Bio-PC e IPA, insieme a una potenziale tossicità relativamente alta di IPA stimata con l'approccio della concentrazione Toxic Equivalent. Risultati contrastanti sono stati ottenuti collegando la presenza di taxa batterici dominanti (cioè le famiglie Desulfobulbaceae e Desulfobacteraceae) ai modelli di contaminazione dei sedimenti. In particolare, è probabile che i crescenti livelli di inquinamento influenzino positivamente la presenza della famiglia Desulfuromonadales Sva1033, mentre sono stati riscontrati effetti dannosi contro la famiglia Ectothiorhodospiraceae. Inoltre, il concomitante aumento del rapporto PCP / CR insieme ai principali EEA, ha evidenziato che la comunità microbica bentonica potrebbe contribuire costantemente ad accelerare la degradazione degli inquinanti organici persistenti, con potenziali implicazioni sui processi di autodepurazione dei sedimenti.

**Abstract ENG:** Lagoons in river deltas are highly productive systems that receive high loads of organic matter and nutrients. Among the major environmental stress factors and human health-related issues, the anthropogenic contamination is of particular concern, since coastal lagoons are intensively exploited for aquaculture activities. Although microbial communities constitute the most abundant fraction of the benthic biomass, also providing valuable ecosystem services, the links between sediment quality and microbial processes were largely disregarded. In this study, we aimed to elucidate whether different levels of riverine influence could provide favourable or adverse environmental conditions to sustain microbial diversity and processes. Sediments collected from four lagoons of the Po River delta were analysed to assess biochemical composition

(biopolymeric carbon, Bio-PC), target organic pollutants (polycyclic aromatic hydrocarbons, PAHs; nonylphenols; bisphenol A), and microbial community properties (bacterial community composition, prokaryotic biomass, prokaryotic carbon production rate, PCP, community respiration rate, CR, extracellular enzyme activities, EEAs). The major physical and chemical sediment properties allowed identifying two statistically distinct groups of sediments with relatively low (LI) and high (HI) riverine influence. HI sediments were characterised by higher Bio-PC and PAHs concentrations, along with relatively high PAHs potential toxicity estimated by the Toxic Equivalent concentration approach. Contrasting results were obtained by linking the occurrence of dominant bacterial taxa (i.e.,Desulfobulbaceae and Desulfobacteraceae families) to sediment contamination patterns. Notably, the increasing pollution levels were likely to positively affect the occurrence of the Desulfuromonadales Sva1033 family, whereas detrimental effects were found against the family Ectothiorhodospiraceae. In addition, the concurrent increase of PCP/CR ratio along with key EEAs, highlighted that the benthic microbial community could consistently contribute to accelerate the degradation of persistent organic pollutants, with potential implication on the sediment self-purification processes.

## Intermittent rivers and ephemeral streams: what water managers need to know.

**Anno di pubblicazione:** 2020

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**Autori:** Gómez R., Martí E., von Schiller D., Bernal S., del Campo R., Gionchetta G., Mendoza-Lera C., Nizzoli D., Robinson C., Romaní A. M., Zoppini A.

**Abstract ITA:** I fiumi intermittenti ed effimeri (IRES) drenano oltre metà della superficie terrestre del mondo e sono diffusi in tutta Europa. Spesso gli IRES rappresentano "hot spots" della biodiversità regionale, sono fondamentali per l'integrità funzionale delle reti fluviali, e spesso sfruttati per soddisfare le richieste crescenti di acqua e altri servizi ecosistemici. Tuttavia, soffrendo di percezioni negative e storicamente trascurati dai ricercatori rispetto a fiumi e torrenti perenni, gli IRES sono degradati a ritmi allarmanti e incrementano i tentativi di escluderli dalle legislazioni. Negli ultimi due decenni, si è sviluppata la ricerca sull'ecoidrologia di questi ecosistemi unici e i problemi di gestione si sono intensificati perché tutti gli scenari di cambiamento climatico prevedono espansione per estensione globale dell'IRES. Inoltre, molti fiumi perenni stanno gradualmente diventando intermittente e gli IRES diventeranno in futuro la tipologia dominante di corpi idrici. Perciò, supportati da COST (European Cooperation in Science and Technology, www.cost.eu), abbiamo ha riunito una fitta rete di accademici e manager europei di diverse discipline che abbracciano idrologia, ecologia, biogeochimica e scienze sociali. Questo consorzio, SMIRES (Science and Management of Intermittent Rivers and Ephemeral Streams, www.smires.eu) mira a implementare la conoscenza frammentata sugli IRES Europei per una migliore comprensione di questi ecosistemi. Sebbene permangano importanti lacune nella ricerca, il nostro obiettivo è stato quello di tradurre l'attuale livello di conoscenza nella gestione , protezione e ripristino di diversi tipi di IRES in Europa. Questo sforzo ha portato al presente manuale, che è il primo, a nostra conoscenza, a fornire raccomandazioni e linee guida per la maggior parte degli aspetti legati alle problematiche di gestione degli IRES. Il nostro impegno continuerà nel prossimo futuro, in particolare all'interno del gruppo di lavoro ECOSTAT che integrerà IRES nell'attuale gestione sforzi guidati dalla direttiva quadro sulle acque. I fiumi o torrenti sono definiti da acque correnti confinate all'interno di canali fluviali (tranne durante inondazioni) e si spostano in una direzione: i fiumi sono generalmente più grandi e profondi dei torrenti, ma questo è un ampia distinzione di uso comune. Lo stesso vale per descrivere diversi tipi di non perenne regimi di flusso: "effimero" implica una durata del flusso più breve e una prevedibilità inferiore rispetto a "Intermittente", ma non esistono confini fissi. Mentre la letteratura scientifica è costellata di tentativi di assegnare nomi a classi di torrenti e fiumi i cui flussi cessano per periodi variabili con prevedibilità variabile, un consenso globale non è statoo ancora raggiunto. Pertanto, piuttosto che aprire questo campo minato della semantica, in questo consorzio e manuale ci riferiamo a "fiumi intermittenti e flussi effimeri con l'acronimo" IRES " come abbreviazione per indicare tutte le acque correnti che cessano di scorrere e / o si asciugano completamente ad un certo punto lungo il loro corso. Ringraziamo il team che ha supervisionato la preparazione di questo manuale, i molti contributori dei diversi capitoli, e tutti i contributori dei gruppi di lavoro di SMIRES, che hanno svolto un lavoro magnifico durante i 4 anni dell'azione. Infine, questo manuale è il primo a concentrarsi interamente sulla gestione dell'IRES e c'è ancora molto da imparare questi ecosistemi dinamici e il modo migliore per proteggere la loro bellezza, integrità ecologica e altri aspetti sociali valori.

**Abstract ENG:** Intermittent rivers and ephemeral streams (IRES) drain over half the world's land surface and are common water bodies throughout Europe. Often 'hotspots' of regional biodiversity and pivotal for the functional integrity of river networks, many IRES are exploited to achieve growing human demands for water and other ecosystem services. However, suffering from negative perceptions and historically overlooked by researcher compared to perennial rivers and streams, IRES are degraded at alarming rates, and attempts to exclude them from legislations are growing. In the last two decades, research into the ecohydrology of these prevalent and unique ecosystems has bloomed and management issues have intensified because all climate change scenarios predict expansion in the global extent of IRES. Also, many perennial rivers are gradually becoming intermittent and IRES will become the dominant type of water bodies in the future. Therefore, supported by COST (European Cooperation in Science and Technology, www.cost.eu), we have gathered a dense network of European academics and managers from different disciplines spanning hydrology, ecology, biogeochemistry, and social sciences. This consortium, SMIRES (Science and Management of Intermittent Rivers and Ephemeral Streams, www.smires.eu) aims to compile the scattered knowledge on IRES across Europe for a better understanding of these ecosystems. Although important research gaps remain, our aim was to translate the current level of knowledge to manage, protect, and restore the diverse types of IRES across Europe. This effort resulted in the present handbook, which is the first, to our knowledge, to provide recommendations and guidelines for most aspects related to IRES management issues. Our effort will continue in the near future, notably within the ECOSTAT working group that will integrate IRES into the current management efforts driven by the Water Framework Directive. Rivers or streams are defined by flowing waters confined within river channels (except during floods) and moving into one direction: rivers are usually larger and deeper than streams, but this is a loose distinction of common usage. The same applies to describing different types of non-perennial flow regimes: "ephemeral" implies a shorter flow duration and lower predictability than "intermittent", but no fixed boundaries exist. Whereas the scientific literature is peppered with attempts to assign names to classes of streams and rivers whose flows cease for varying periods with varying predictability, a global consensus remains elusive and probably will continue to do so. Therefore, rather than opening this semantic minefield, we refer to "intermittent rivers and ephemeral streams" and adopt the acronym "IRES" in this consortium and handbook as a shorthand term for all flowing waters that cease flow and/or dry completely at some point along their course. We are indebted to the core team, which supervised this handbook preparation, to the many contributors of the different chapters, ant to all the contributors of the working groups of SMIRES, who have done a magnificent job throughout the 4-year timeframe of the action. Last, if this handbook is the first to focus entirely on the management of IRES, there is still much to learn about these dynamic ecosystems and how best to protect their beauty, ecological integrity, and other social values.

## A data set on the distribution of Rotifera in Antarctica.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Biogeographia –The Journal of Integrative Biogeography, 2020, 35, 17-25, DOI: 10.21426/B635044786

**Autori:** Garlaschè G., Karimullah K., Iakovenko N., Velasco-Castrillón A., Janko K., Guidetti R., Rebecchi L., Cecchetto M., Schiaparelli S., De Smet W.H. & Fontaneto D.

**Abstract ITA:** We present a data set on Antarctic biodiversity for the phylum Rotifera, making it publicly available through the Antarctic Biodiversity Information facility. We provide taxonomic information, geographic distribution, location, and habitat for each record. The data set gathers all the published literature about rotifers found and identified across the Continental, Maritime, and Subantarctic biogeographic regions of Antarctica. A total of 1455 records of rotifers in Antarctica found from 1907 to 2018 is reported, with information on taxonomic hierarchies, updated nomenclature, geographic information, geographic coordinates, and type of habitat. The aim is to provide a georeferenced data set on Antarctic rotifers as a baseline for further studies, to improve our knowledge on what has been considered one of the most diverse and successful groups of animals living in Antarctica.

**Abstract ENG:** We present a data set on Antarctic biodiversity for the phylum Rotifera, making it publicly available through the Antarctic Biodiversity Information facility. We provide taxonomic information, geographic distribution, location, and habitat for each record. The data set gathers all the published literature about rotifers found and identified across the Continental, Maritime, and Subantarctic biogeographic regions of Antarctica. A total of 1455 records of rotifers in Antarctica found from 1907 to 2018 is reported, with information on taxonomic hierarchies, updated nomenclature, geographic information, geographic coordinates, and type of habitat. The aim is to provide a georeferenced data set on Antarctic rotifers as a baseline for further studies, to improve our knowledge on what has been considered one of the most diverse and successful groups of animals living in Antarctica.

## Global CO2 emissions from dry inland waters share common drivers across ecosystems

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Nature Communications, 2020, 11 (1), 2126, DOI: 10.1038/s41467-020-15929-y

**Autori:** P. S. Keller, N. Catalán, D. von Schiller, H.-P. Grossart, M. Koschorreck, B. Obrador, M. A. Frassl, N. Karakaya, N. Barros, J. A. Howitt, C. Mendoza-Lera, A. Pastor, G. Flaim, R. Aben, T. Riis, M. I. Arce, G. Onandia, J. R. Paranaíba, A. Linkhorst, R. del Campo, A. M. Amado, S. Cauvy-Fraunié, S. Brothers, J. Condon, R. F. Mendonça, F. Reverey, E.-I. Rõõm, T. Datry, F. Roland, A. Laas, U. Obertegger, J.-H. Park, H. Wang, S. Kosten, R. Gómez, C. Feijoó, A. Elosegi, M. M. Sánchez-Montoya, C. M. Finlayson, M. Melita, E. S. Oliveira Junior, C. C. Muniz, L. Gómez-Gener, C. Leigh, Q. Zhang & R. Marcé

**Abstract ITA:** Molte delle acque interne sono affette da un essiccamento, completo o parziale, o sono svanite a causa del cambiamento globale, portando ad un' esposizione dei sedimenti all'atmosfera. Tuttavia, i dati sulle emissioni di anidride carbonica (CO2) prodotte da questi sedimenti sono carenti per permettere la formulazione di modelli idonei ad essere adattati su scala globale, nonché per comprendere meglio i principali meccanismi che le guidano. Qui presentiamo i risultati di un'indagine globale condotta su 196 siti acque interne in disseccamento, condotta in diversi tipi di ecosistemi e zone climatiche. Abbiamo dimostrato che le diverse emissioni di CO2 condividono fattori fondamentali e costituiscono una sostanziale frazione del ciclo del carbonio proveniente dalle acque interne. Le emissioni di CO2 hanno mostrato una certa coerenza tra i diversi tipi di ecosistema e le zone climatiche, con caratteristiche locali che spiegavano gran parte della variabilità. La calcolo di tali emissioni aumenta le stime globali delle emissioni di carbonio dalle acque interne del 6% (~ 0,12 Pg C y − 1). I nostri risultati indicano che le emissioni delle acque interne secche rappresentano una componente significativa e probabilmente in aumento del ciclo del carbonio delle acque interne.

**Abstract ENG:** Many inland waters exhibit complete or partial desiccation, or have vanished due to global change, exposing sediments to the atmosphere. Yet, data on carbon dioxide (CO2) emissions from these sediments are too scarce to upscale emissions for global estimates or to understand their fundamental drivers. Here, we present the results of a global survey covering 196 dry inland waters across diverse ecosystem types and climate zones. We show that their CO2 emissions share fundamental drivers and constitute a substantial fraction of the carbon cycled by inland waters. CO2 emissions were consistent across ecosystem types and climate zones, with local characteristics explaining much of the variability. Accounting for such emissions increases global estimates of carbon emissions from inland waters by 6% (~0.12 Pg C y−1). Our results indicate that emissions from dry inland waters represent a significant and likely increasing component of the inland waters carbon cycle.

## Prioritizing marine invasive alien species in the EU through Horizon Scanning

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Aquatic Conservation: Marine and Freshwater Ecosystems, 2020, 30, 794–845, doi: 10.1002/aqc.3267

**Autori:** Tsiamis K., Azzurro E., Bariche M., Çinar M.E., Crocetta F., De Clerck O., Galil B., Gómez F., Hoffman R., Jensen K., Kamburska L., Langeneck J., Langer M. R., Levitt-Barmats Y., Lezzi M., Marchini A., Occhipinti-Ambrogi A., Ojaveer H., Piraino S., Shenkar N., Yankova M. Zenetos A., Žuljević A., Cardoso A. C

**Abstract ITA:** Questo studio, il primo EU-scale Horizon Scanning (HS) focalizzato sulle specie aliene invasive marine, è stato condotto con lo scopo di fornire una graduatoria delle specie che dovrebbero essere considerate con alta priorità nella valutazione dei rischi (Article 5 of the EU IAS Regulation). Specie assenti o con una limitata diffusione nelle acque marine dell'Unione Europea sono state oggetto di studio. In totale, 363 specie aliene sono state inizialmente studiate per HS da un gruppo di esperti, includendo una vasta gamma di gruppi tassonomici. Le specie sono state valutate per la loro probabilità di arrivo, insediamento, diffusione e impatto nelle acque della Unione Europea.

**Abstract ENG:** 1. The disproportionately low presence of marine species in the list of invasive alien species (IAS) of Union concern of the European Union (EU) Regulation 1143/2014 does not fully acknowledge the threat they pose to the EU marine environment. 2. In this study, the first EU-scale Horizon Scanning (HS) focusing on marine alien species was performed, aiming to deliver a ranked list of species that should be of high priority for risk assessment (Article 5 of the EU IAS Regulation). 3. Species absent from or with a limited distribution in EU marine waters were targeted. In total, 363 alien species were initially screened for HS by a panel of experts, including a broad range of taxonomic groups. Species were scored for their likelihood of arrival, establishment, spread, and impact in EU waters. 4. A consensus workshop ranked 267 species, including a subset of 26 prioritized species. These species are considered to be mainly introduced by shipping (fouling and ballast water), via the Suez Canal, and aquaculture activities. The 26 priority species were also scrutinized in terms of feasibility of their management; 18 of them were suggested for performing risk assessments on the basis of the EU IAS Regulation. 5. Since biological invasions are dynamic and connected with accelerated globalization and diversified human activities, we recommend HS to be repeated periodically to review the species already listed and assess new ones.

## Methodology for the implementation of monitoring plans with different spatial and temporal scales of plant protection products residues in water bodies based on site-specific environmental pressures assessments

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Human and Ecological Risk Assessment: An International Journal, 2020, 26 (5), 1341-1358, DOI: 10.1080/10807039.2019.1578945

**Autori:** C. Massarelli, V. Ancona, C. Galeone, V.F. Uricchio

**Abstract ENG:** The awareness of plant protection products residues causing problems in water bodies is increasing more and more. A lot of effort is being made by countries in investigating the situation of diffuse pesticide pollution. This article illustrates a new methodology developed for the implementation of monitoring plans for plant protection products residues in rivers, lakes and groundwater, at river basin scale, based on an operational workflow which, by integrating different databases, let to evaluate site-specific environmental pressures affecting the definition of the related monitoring networks. It follows that sampling and analytical activities, carried out in the monitoring network nodes, not only are functional to water bodies ecological and chemical quality status assessment but are able to highlight possible compromises of environmental balance in agro-ecosystems, deriving from plant protection products use, through the application of environmental modeling able to bring out evolutive trends. This information would allow the Administrators to take increasingly effective initiatives both in the field of controls and authorizations for particular substances, in the light of the negative effects shown, and in the field of spatial planning, being able to dispose of the necessary knowledge in order to take safeguard measures before a certain evolutionary process of degradation becomes irreversible.

## Anaerobic phenol biodegradation: kinetic study and microbial community shifts under high-concentration dynamic loading

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Applied Microbiology and Biotechnology 104(15), 6825-6838 (2020) http://dx.doi.org/10.1007/s00253-020-10696-8

**Autori:** Mosca Angelucci D.; Clagnan E.; Brusetti L.; Tomei M.C.

**Abstract ENG:** The anaerobic biodegradation of phenol has been realised in a sequencing batch reactor (SBR) under anaerobic conditions with phenol as sole carbon and energy source and with glucose as co-substrate. A step-change increase of phenol loading (from 100 up to 2000 mg/L of phenol concentration in the feed solution) has been applied during the acclimation phase in order to progressively induce the development of a specialised microbial consortium. This approach, combined with the dynamic sequence of operations characterising SBRs and with the high biomass retention time, led to satisfactory phenol and COD removal efficiencies with values > 70% for the highest phenol input (2000 mg/L) fed as the single carbon and energy source. Analysis of removal efficiencies and biodegradation rates suggested that the use of glucose as co-substrate did not induce a significant improvement in process performance. Kinetic tests have been performed at different initial phenol (400–1000 mg/L) and glucose (1880–0 mg/L) concentrations to kinetically characterise the developed biomass: estimated kinetic constants are suitable for application and no inhibitory effect due to high concentrations of phenol has been observed in all investigated conditions. The microbial community has been characterised at different operating conditions through molecular tools: results confirm the successful adaptation-operation approach of the microbial consortium showing a gradual increase in richness and diversity and the occurrence and selection of a high proportion of phenol-degrading genera at the end of the experimentation.

## Self-regenerating polymeric tubing bioreactor for removal of toxic substrates: operational strategies to face long-term severe dynamic loading conditions

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Science of the Total Environment 723, 138019 (2020) http://dx.doi.org/10.1016/j.scitotenv.2020.138019

**Autori:** Tomei M.C., Mosca Angelucci D., Daugulis, A.J.

**Abstract ENG:** A tubing TPPB (Two-Phase Partitioning Bioreactor) was operated with the objective of verifying the effective treatment of a phenolic syntheticwastewaterwith simultaneous polymeric tubing bioregeneration by introducing tubing effluent recycle and modifications to the Hydraulic Retention Time (HRT). 2,4-dichlorophenol (DCP) was employed as the target substrate and the bioreactorwas operated for a 3month period under severe loading conditions (from77 to 384 mg/L d) with HRT in the tubing in the range of 2-4 h. Tubing effluent recycle (recycle flow rate/influent flow rate ratio= 0.3) was applied when a loss of performance was detected arising from the increased load. For HRT values of 3 and 4 h, almost complete DCP removalwas achieved after a fewdays (1-5) of operationwhile for the 2 h HRT (i.e. in themost severe loading condition) the DCP removalwas >=97%. A beneficial effect on the process performance arising from recycle application was evident for all the operating conditions investigated, and was confirmed by statistical analysis. Essentially complete polymer bioregeneration was achievedwhen the bioreactorwas operated at the lowest HRT (i.e. 2 h), combinedwith the application of tubing effluent recycle. The results of this study highlighted several advantages of the tubing TPPB configuration in a comparative analysis of different regeneration options, including the possibility of operating continuously with simultaneous bioregeneration and without the need for additional units or operational steps and extra-energy consumption.

## Microbiome changes and oxidative capability of an anaerobic PCB dechlorinating enrichment culture after oxygen exposure

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** New Biotechnology, 2020, 56, 96-102, DOI: 10.1016/j.nbt.2019.12.004

**Autori:** Bruna Matturro, Giuseppe Mascolo, Simona Rossetti

**Abstract ENG:** Marine sediments may represent a sink of persistent organic pollutants including polychlorinated biphenyls (PCBs), toxic compounds prone to reductive or oxidative biodegradation pathways depending on the degree of chlorination and the positions of the chlorine atoms on the biphenyl rings. Superficial marine sediments can be subjected to episodic sediment resuspension by boat traffic and wind action causing the exposure of the underlying anaerobic layer to oxygen. Under these dynamic conditions, a deeper knowledge of the adaptation capability of the autochthonous microbial communities towards severe changes of the reaction environment is required. Insights into the metabolic potential of sediment community members may contribute greatly to the definition of efficient and reliable in situ bioremediation strategies. In this study, an anaerobic PCB-dechlorinating microbial consortium, developed from the chronically polluted marine sediment of Mar Piccolo (Taranto, Italy), was used to evaluate the response of the sediment microbiome to the imposition of aerobic conditions after prolonged anaerobic incubation. Compared to the anaerobic control, a dramatic change in microbiome composition, with a marked increase of Alphaproteobacteria of up to 39.2 % of total operational taxonomic units (OTUs) was revealed by high-throughput 16S rRNA gene sequencing. Accordingly, a decrement of low chlorinated PCBs (up to 58.3 ± 7.5 % for PCB 18) and the concomitant appearance of genes coding for PCB-degrading biphenyl dioxygenase (bph) were observed at the end of the aerobic incubation, suggesting the occurrence of oxidative PCB biodegradation processes.

## Does the Darcy–Buckingham Law Apply to Flowthrough Unsaturated Porous Rock?

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Water, 2020,12, 2668, doi: 10.3390/w12102668

**Autori:** Antonietta C. Turturro, Maria C. Caputo*, Kim S. Perkins and John R. Nimmo

**Abstract ENG:** The Darcy–Buckingham (DB) law, critical to the prediction of unsaturated flow, is widely used but has rarely been experimentally tested, and therefore may not be adequate in certain conditions. Failure of this law would imply that the unsaturated hydraulic conductivity is not constant for a given water content, as assumed in nearly all subsurface flow models. This study aims to test the DB law on unsaturated porous rock, complementing the few previous tests, all done on soils. Two lithotypes of calcareous porous rocks were tested. The quasi-steady centrifuge method was used to measure the flux density for different centrifugal driving forces while maintaining essentially constant water content, as required. Any deviations from the direct proportionality of the measured flux and the applied force would indicate a violation of the DB law. Our results show that, for the tested rocks and conditions, no physical phenomena occurred to cause a failure of the DB law.

## Anaerobic Sequencing Biofilter (AnSBio): A novel approach for high-quality biogas production from low-strength wastewaters at ambient temperature

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Bioresource Technology reports, 2020, 12, 100554, DOI: 10.1016/j.biteb.2020.100554

**Autori:** Pentassuglia, S., De Sanctis, M., Altieri, V.G., Sgherza, D., Di Iaconi, C.

**Abstract ENG:** The Anaerobic Sequencing Biofilter (AnSBio) treating municipal sewage was operated for 370-days at ambient temperature with an organic loading rate (OLR) of 0.4–0.7 kgCOD/m3·d. Temperature did not affect soluble chemical oxygen demand (CODsol) removal efficiency (RE), which averaged 89 ± 3%, whereas, total COD (CODtot) RE, ranging 82 ± 5%, exhibited an unclear profile due to suspended solids (SS) loss under cooler temperatures. The inherent filtering capacity resulted in reduced bed porosity under psychrophilic temperatures, manifested as head loss increase (348 ± 34 and 314 ± 19 cm during first and second winter, respectively). Hydrolysis of particulate matter at mesophilic temperatures caused head loss decrease (271 ± 58 cm). Biogas yields were 124 and 315 NmL/gCODremoved at the lowest (14 °C) and the highest (35 °C) reactor operating temperature, respectively. Biogas methane content was 85 ± 4%. The AnSBio is a valid alternative for low-strength wastewater treatment at ambient temperature.

## Full-scale sludge reduction in the water line of municipal wastewater treatment plant

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Journal of Environmental Management, 2020, 269,110714, DOI: 10.1016/j.jenvman.2020.110714

**Autori:** Di Iaconi, C., De Sanctis, M., Altieri, V.G.

**Abstract ENG:** Nowadays, sludge management represents one of the most critical challenges in the field of sewage treatment for economic and environmental impacts. Therefore, the reduction of sludge has become a major issue for the operators of municipal wastewater treatment plants. In the present paper, a new system, whose acronym is MULESL (MUch LEss SLudge), is proposed and tested at full scale for reducing the quantity of sludge in the water line of the sewage treatment plant. MULESL system takes the advantage of maintenance metabolism to significantly reduce the sludge production. The effectiveness of MULESL system in removing the typical pollutants and reducing sludge production was evaluated at full scale by using 3500 PE unit located in Putignano's WWTP (Puglia, Italy). This unit was obtained by retrofitting an existing activated sludge basin. The results obtained over 1-year period, during which MULESL unit treated the effluent of the preliminary treatment step, have indicated that it was characterized by a specific sludge production as low as 0.13 kg of dry sludge per kg of COD removed; 77% lower than that recorded for primary and secondary treatments of the conventional plant during the same period. This sludge reduction was obtained with a plant volume 27% smaller than that of the conventional water line. Furthermore, the organic matter of the sludge was already stabilized, thus allowing to save investment costs for digestion process facilities. Finally, MULESL unit guaranteed a mean removal efficiency higher than 95% for COD, BOD5, TSS, TKN, NH3 and TN.

## Aerobic granular-based technology for water and energy recovery from municipal wastewater

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** New Biotechnology, 2020, 56, 71-78, DOI: 10.1016/j.nbt.2019.12.002

**Autori:** De Sanctis, M., Altieri, V.G., Piergrossi, V., Di Iaconi, C.

**Abstract ENG:** In the present study, the possibility of recovering both thermal energy and water for agricultural purposes from sewage is evaluated. A treatment plant, based on a sequencing batch biofilter granular reactor (SBBGR) followed by sand filtration and coupled with a solar wastewater source heat pump, was operated from September to November 2018 at a set-point temperature of 14 °C to verify the stability of heat recovery efficiency and the suitability of plant effluent to be reused for irrigation. Heat recovery did not influence the SBBGR treatment and disinfection efficiency, which removed about 90% of suspended solids, chemical and biochemical oxygen demand and ammonia, as well as 70% of total nitrogen, 3 log10 units of Escherichia coli and more than 1 log10 unit of Clostridium perfringens. Furthermore, after sand filtration, water quality complied with the standards for agricultural reuse currently in force in several countries. Energy extracted from SBBGR was mainly influenced by environmental conditions, affecting wastewater temperature, and also by wastewater composition, affecting the energy release due to bacterial metabolic activity for carbon and nitrogen removal. Notably, no evident deterioration of energy extraction efficiency from the SBBGR was observed, suggesting negligible fouling phenomena on the submerged thermal exchanger.

## A plot-scale uncertainty analysis of saturated hydraulic conductivity of a clay soil

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Journal of Hydrology, 2020, 125694, doi.org/10.1016/j.jhydrol.2020.125694

**Autori:** Vincenzo Bagarello Emanuele Barca Mirko Castellini Massimo Iovino Renato Morbidelli Carla Saltalippi Alessia Flammini

**Abstract ITA:** La simulazione dei processi idrologici del suolo su scala parcellare o di campo richiede l'utilizzo di valori spazialmente rappresentativi della conducibilità idraulica del suolo saturo, Ks. Le campagne di campionamento dovrebbero produrre una media affidabile di K con un carico di lavoro sostenibile poiché misurare K in molti punti è impegnativo. L'analisi dell'incertezza può essere utilizzata per determinare il numero più basso di misurazioni che producono un valore Ks medio con un livello di precisione specificato. Il potenziale e i limiti di questa analisi sono stati testati in questa indagine per diverse estensioni dell'area campionata e densità di campionamento. Un terreno argilloso è stato campionato in modo intensivo su due lotti (area del lotto = 44 m2), due date e utilizzando anelli sia piccoli (0,15 m di diametro) che grandi (0,30 m). Con gli anelli piccoli, un campionamento intensivo di una porzione appropriata dell'area totale del diagramma dovrebbe essere sufficiente per stabilire il numero di misurazioni che producono un certo livello di accuratezza per l'intero diagramma poiché questo livello è rimasto pressoché costante quando lo stesso numero di misurazioni è stato eseguito su aree più grandi . Inoltre, per queste aree, la risoluzione spaziale delle misurazioni non ha influenzato in modo apprezzabile l'ampiezza dell'intervallo di confidenza del valore Ks medio. Tuttavia, si raccomandava di lavorare con anelli più grandi poiché, in questo caso, l'area campionata non ha influenzato affatto i livelli di confidenza normalizzati che, inoltre, variavano solo leggermente con il numero delle misurazioni di Ks considerate. In pratica, la caratterizzazione delle parcelle richiedeva rispettivamente circa 20 e 10 misurazioni con gli anelli più piccoli e quelli più grandi. L'analisi dell'incertezza sembra promettere di pianificare campagne di campionamento del suolo praticamente sostenibili.

**Abstract ENG:** Simulating soil hydrological processes at the plot or field scale requires using spatially representative values of the saturated soil hydraulic conductivity, Ks. Sampling campaigns should yield a reliable mean of Ks with a sustainable workload since measuring Ks at many points is challenging. Uncertainty analysis can be used to determine the lowest number of measurements that yield a mean Ks value with a specified accuracy level. Potential and limitations of this analysis were tested in this investigation for different extents of the sampled area and sampling densities. A clay soil was sampled intensively on two plots (plot area = 44 m2), two dates and using both small (0.15 m in diameter) and large (0.30 m) rings. With the small rings, intensively sampling an appropriate portion of the total plot area should be enough to establish the number of measurements yielding a certain accuracy level for the entire plot since this level remained nearly constant when the same number of measurements was performed on larger areas. Moreover, for these areas, the spatial resolution of the measurements did not influence appreciably the width of the confidence interval of the mean Ks value. However, working with larger rings was recommended since, in this case, the sampled area did not affect at all normalized confidence levels that, in addition, varied only a little with the number of the considered measurements of Ks. In practice, characterizing the plots required about 20 and 10 measurements with the smaller and the

larger rings, respectively. The uncertainty analysis appears promising to plan practically sustainable soil sampling campaigns.

## A new supervised classifier exploiting spectral-spatial information in the Bayesian framework.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** International Journal of Applied Earth Observation and Geoinformation, 2020, 86, 101990, doi 10.1016/j.jag.2019.101990

**Autori:** E Barca, A Castrignanò, S Ruggieri, M Rinaldi

**Abstract ITA:** I metodi di apprendimento automatico convenzionali spesso non sono in grado di raggiungere livelli elevati di precisione quando nel processo di classificazione sono coinvolti solo i dati spettrali. La ragione principale di tale inesattezza può essere ricondotta all'omissione dell'informazione spaziale nella classificazione. Il presente documento suggerisce un modo per combinare efficacemente le informazioni spettrali e spaziali e migliorare l'accuratezza della classificazione. In pratica, viene proposta una metodologia bayesiana a due fasi che incorpora due miglioramenti: i) un approccio di classificazione non parametrica geostatistica, l'indicatore universale kriging e ii) il metodo del kernel multivariato liscio. Il primo fornisce un priore informativo, mentre il secondo supera l'ipotesi (spesso non vera) di indipendenza dei dati spettrali. Il caso studio riporta una domanda di classificazione della copertura del suolo in un'area di studio situata nella regione Puglia (Italia meridionale). Le prestazioni della metodologia in termini di accuratezza complessiva sono state confrontate con cinque metodi all'avanguardia, ovvero Bayes naïve, Random Forest, reti neurali artificiali, macchine vettoriali di supporto e alberi decisionali. È dimostrato che la metodologia proposta supera tutti i metodi confrontati e che anche una grave riduzione del training set non influisce seriamente sulla precisione media del metodo presentato.

**Abstract ENG:** Conventional machine learning methods are often unable to achieve high degrees of accuracy when only spectral data are involved in the classification process. The main reason of that inaccuracy can be brought back to the omission of the spatial information in the classification. The present paper suggests a way to combine effectively the spectral and the spatial information and improve the classification's accuracy. In practice, a Bayesian two-stage methodology is proposed embodying two enhancements: i) a geostatistical non-parametric classification approach, the universal indicator kriging and ii) the smooth multivariate kernel method. The former provides an informative prior, while the latter overcomes the assumption (often not true) of independence of the spectral data. The case study reports an application to land-cover classification in a study area located in the Apulia region (Southern Italy). The methodology performance in terms of overall accuracy was compared with five state-of-the-art methods, i.e. naïve Bayes, Random Forest, artificial neural networks, support vector machines and decision trees. It is shown that the proposed methodology outperforms all the compared methods and that even a severe reduction of the training set does not affect seriously the average accuracy of the presented method.

## Archival Aerial Images Georeferencing: A Geostatistically-Based Approach for Improving Orthophoto Accuracy with Minimal Number of Ground Control Points

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** remote sensing, 2020, 12 (14), 2232, doi:10.3390/rs12142232

**Autori:** Manuela Persia Emanuele Barca Roberto Greco Maria Immacolata Marzulli Patrizia Tartarino

**Abstract ITA:** Le immagini aeree d'archivio georeferenziate sono elementi chiave per lo studio dell'evoluzione del paesaggio nell'ambito della pianificazione e gestione del territorio. Il processo di georeferenziazione procede applicando alle fotografie tecniche fotogrammetriche digitali avanzate integrate con una serie di verità di terra chiamate punti di controllo a terra (GCP). Alla fine di quella fase, l'accuratezza del file l'ortomosaico finale viene valutato mediante calcolo dell'errore quadratico medio (RMSE). Se il valore di tale indice è ritenuto insoddisfacente, il processo viene rieseguito dopo aver aumentato il numero GCP. Purtroppo la ricerca di GCP è un'operazione costosa, anche se visivamente effettuata da recenti immagini digitali. Pertanto, una questione aperta è quella di ottenere la precisione desiderata dell'ortomosaico con un numero minimo di GCP. Il presente documento propone una metodologia basata sulla geostatizzazione che comporta l'esecuzione della spazializzazione degli errori GCP ottenuti da una prima versione grossolana di l'ortomosaico georeferenziato per produrre una mappa degli errori. Quindi, il posizionamento di un piccolo file il numero di nuovi GCP all'interno delle sotto-aree caratterizzate dai più alti errori locali consente un più fine georeferenziazione da realizzare. La metodologia proposta è stata applicata a 67 fotografie storiche

**Abstract ENG:** Georeferenced archival aerial images are key elements for the study of landscape evolution in the scope of territorial planning and management. The georeferencing process proceeds by applying to photographs advanced digital photogrammetric techniques integrated along with a set of ground truths termed ground control points (GCPs). At the end of that stage, the accuracy of the final orthomosaic is assessed by means of root mean square error (RMSE) computation. If the value of that index is deemed to be unsatisfactory, the process is re-run after increasing the GCP number. Unfortunately, the search for GCPs is a costly operation, even when it is visually carried out from recent digital images. Therefore, an open issue is that of achieving the desired accuracy of the orthomosaic with a minimal number of GCPs. The present paper proposes a geostatistically-based methodology that involves performing the spatialization of the GCP errors obtained from a first gross version of the georeferenced orthomosaic in order to produce an error map. Then, the placement of a small number of new GCPs within the sub-areas characterized by the highest local errors enables a finer georeferencing to be achieved. The proposed methodology was applied to 67 historical photographs taken on a geo-morphologically complex study area, located in Southern Italy, which covers a total surface of approximately 55,000 ha. The case study showed that 75 GCPs were sufficient to garner an orthomosaic with coordinate errors below the chosen threshold of 10 m. The study results were compared with similar works on georeferenced images and demonstrated better performance for achieving a final orthomosaic with the same RMSE at a lower information rate expressed in terms of nGCPs/km2.

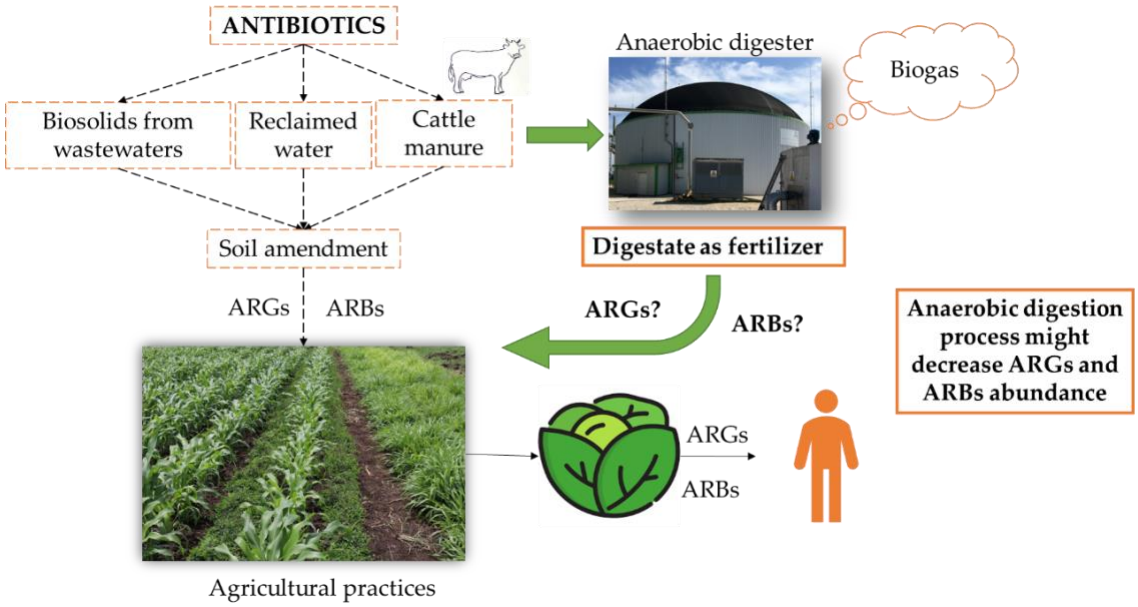
## Environmental Fate of Antibiotics and Resistance Genes in Livestock Waste and Digestate from Biogas Plants

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Environmental Science, Pollution Research and Management, 2020, doi: 10.37722/ESPRAM.2020

**Autori:** Barra Caracciolo A, Visca A, Massini G, Patrolecco L, Mazzurco Miritana V, Grenni P,

**Abstract ENG:** Huge amounts of antibiotics are currently being used in both human and veterinary medicine. Moreover, most are recalcitrant to biodegradation and can persist in the environment. In fact these compounds have been increasingly found as micro-contaminants in natural ecosystems and cause particular concern because of the development of multi-resistant bacteria, posing serious risks for human and animal health. In particular, the antibiotics used in livestock farms can persist in manure, causing environmental contamination if used as a biofertilizer. However, farm manure can also be a feed for biogas reactors and the digested effluent (digestate) used as fertilizer or soil improver. The fact that the latter can still contain antibiotic residues and possibly antibiotic resistance genes still remains to be clarified.



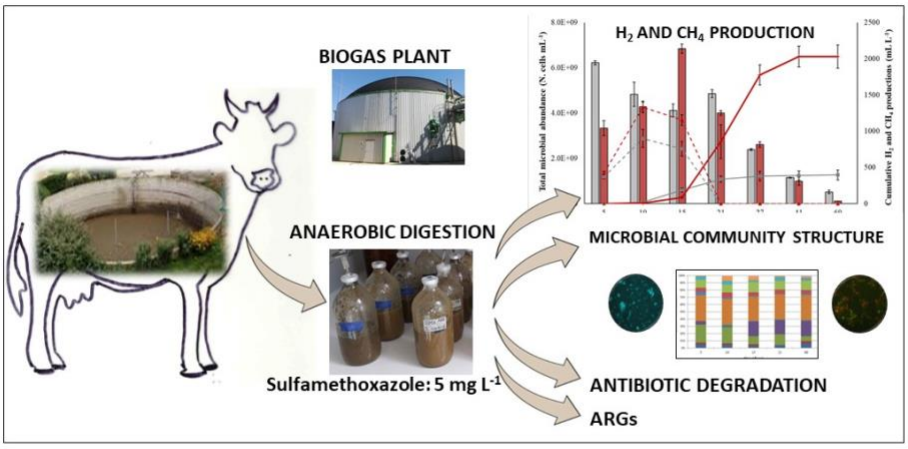
## Effects of sulfamethoxazole on the microbial community dynamics during the anaerobic digestion process

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Frontiers in Microbiology, 2020, 11, 537783. doi: 10.3389/fmicb.2020.537783

**Autori:** Mazzurco Miritana V, Massini G, Visca A, Grenni P, Patrolecco L, Spataro F, Rauseo J, Garbini GL, Signorini A, Rosa S, Barra Caracciolo A.

**Abstract ENG:** Anaerobic digestion (AD) treatment of cattle manure and slurry makes it possible to produce biogas, a renewable and storable biofuel, as well as digestate, a residual organic matter that can be used to replace chemical fertilizers. On the other hand, the intense use of antibiotics (e.g., sulfamethoxazole) in animal husbandry practices is showing increasing negative impacts resulting from the release of still metabolically active molecules into agroecosystems. In the present study, cattle manure collected from an AD plant-feeding tank was used as feedstock for AD experiments in which some batches were spiked with 5 mg L?1 of sulfamethoxazole (SMX). Adding the antibiotic affected the microbial community dynamic; in particular, the efficiency of the acidogenic and acetogenic phases of the process corresponded to higher CH4 and H2 production than in the control. SMX was also degraded, and at the end of the experiment (69 days), just 20% of its initial concentration was found. The relative abundance (ARG/16S) of resistance genes sul1, sul2, and the proxy intI1 initially found in the ingestate decreased during the AD in both the spiked and control batches, suggesting that this process lowers the likelihood of antibiotic resistance genes spreading.



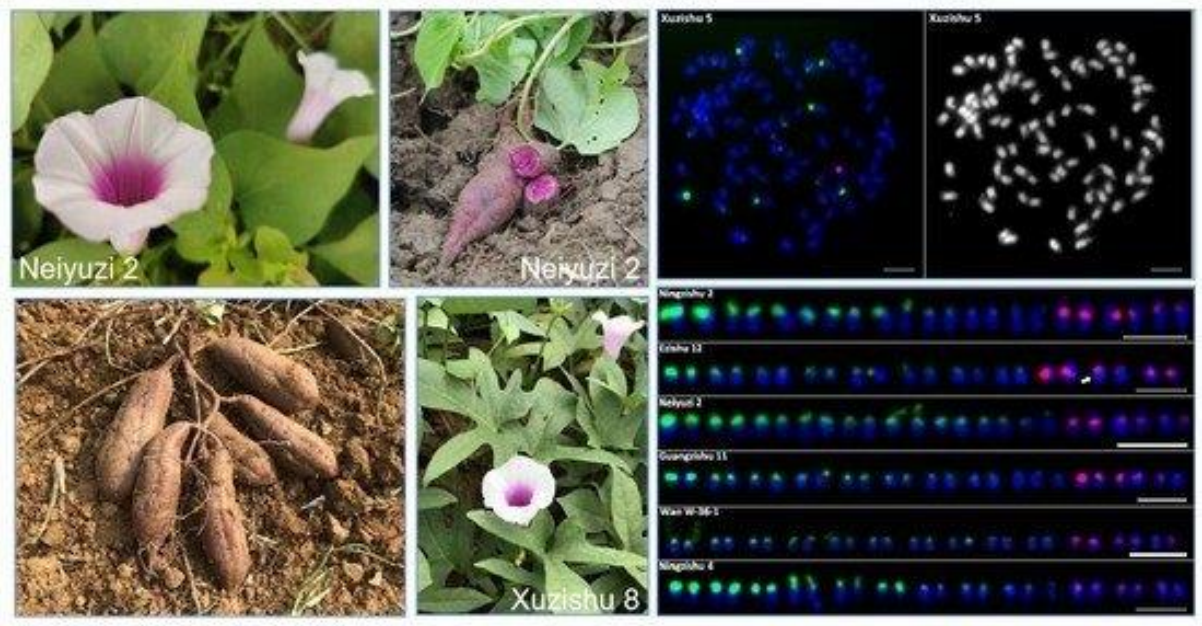
## Effects of soil fertilization on terpenoid and other carbon-based secondary metabolites in Rosmarinus officinalis plants: a comparative study

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Plants, 2020, 9, 830; doi: 10.3390/plants9070830

**Autori:** Bustamante MA, Michelozzi M, Barra Caracciolo A, Grenni P, Verbokkem J, Geerdink P, Safi C Nogues I.

**Abstract ENG:** Rosmarinus officinalis is an evergreen aromatic plant with important commercial interest as it contains numerous essential oils (composed of terpenoid compounds) and phenolic constituents (natural antioxidant compounds). This work aims at evaluating the concomitant effects of different inorganic and organic fertilization treatments and the subsequent increases in soil nutrient availability on terpenoids and other carbon-based secondary metabolites, e.g., flavonoids and phenolic compounds, in Rosmarinus officinalis leaves. The results showed that, as expected, the structural carbohydrate content (lignocellulosic compounds) in stems was higher in fertilized plants than in controls. Additionally, positive correlations were observed of the absolute amounts of total terpenoids and some single terpenoid compounds with N or P contents in leaves. On the contrary, the phenolic and flavonoid concentrations in all the rosemary plant parts were lower with the fertilization treatments. Indeed, negative correlations between the phenolic compounds (and flavonoids) and N in rosemary leaves were also found. Overall, the results suggest that the terpenoid production's response to fertilization was due to N, which is essential for protein synthesis and terpene synthase activity, and to P, which is necessary for the synthesis of both terpenoid precursors and ATP and NADPH, also needed for terpenoid synthesis. On the other hand, the basis for the fertilization's effects on the production of phenolic compounds is the direct nitrogen trade-of between growth and the shikimic acid pathway by which phenolics compounds are synthesized.




Cytogenetics study on Purple-fleshed sweet potato

## Environmental compatibility of soils debris conditioned with foaming agents containing sodium lauryl ether sulphate in a tunnelling scenario

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Water 2020, 12(8), 2074 doi:10.3390/w12082074

**Autori:** Patrolecco L., Pescatore T, Grenni P, Mariani L, Rolando L, Finizio A, Spataro F, Rauseo J, Ademollo N, Muzzini VG, Lacchetti I, Barra Caracciolo A, 2020

**Abstract ENG:** A wide use of foaming agents as lubricants is required in mechanized tunneling. Their main component, the anionic surfactant sodium lauryl ether sulphate (SLES), can remain in residual concentrations in soil debris, influencing their potential reuse as by-product. This study aimed at evaluating the environmental fate and effects of a foaming product used for conditioning soils collected from real excavation sites, in the presence/absence of an anti-clogging polymer, both containing SLES. Soil microcosm experiments were set-up and incubated for 28 days. Over time, soils and their water extracts (elutriates) were collected to perform both ecotoxicological tests (Vibrio fischeri, Lepidium sativum, Eisenia foetida, Hetereocypris incongruens, Danio rerio) and SLES analysis. The results showed that, just after conditioning, SLES did not exert any hazardous effect on the organisms tested except for the bacterium V. fischeri, which was the most sensitive to its presence. However, from day seven the toxic effect on the bacterium was never observed thanks to the SLES decrease in the elutriates (<2 mg/L). SLES degraded in soils (half-lives from 9 to 25 days) with higher disappearance rates corresponding to higher values of microbial abundances. This study highlights the importance of site-specific studies for assessing the environmental reuse of spoil materials.

## Characterization of the belowground microbial community in a poplar-phytoremediation strategy of a multi-contaminated soil

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Frontiers in Microbiology, 2020, 11, 2073. doi: 10.3389/fmicb.2020.02073

**Autori:** Barra Caracciolo A, Grenni P; Garbini GL, Rolando L, Campanale C, Aimola G, Fernandez-Lopez M, Fernandez-Gonzalez AJ; Villadas PJ; Ancona V,

**Abstract ENG:** Due to their widespread use in industrial applications in recent decades, Polychlorobiphenyls (PCBs) and heavy metals (HMs) are the most common soil contaminants worldwide, posing a risk for both ecosystems and human health. In this study, a poplar-assisted bioremediation strategy has been applied for more than 4 years to a historically contaminated area (PCBs and HMs) in Southern Italy using the Monviso poplar clone. This clone was effective in promoting a decrease in all contaminants and an increase in soil quality in terms of organic carbon and microbial abundance. Moreover, a significant shift in the structure and predicted function of the belowground microbial community was also observed when analyzing both DNA and cDNA sequencing data. In fact, an increase in bacterial genera belonging to Proteobacteria able to degrade PCBs and resist HMs was observed. Moreover, the functional profiling of the microbial community predicted by PICRUSt2 made it possible to identify several genes associated with PCB transformation (e.g., bphAa, bphAb, bphB, bphC), response to HM oxidative stress (e.g., catalase, superoxide reductase, peroxidase) and HM uptake and expulsion (e.g., ABC transporters). This work demonstrated the effectiveness of the poplar clone Monviso in stimulating the natural belowground microbial community to remove contaminants and improve the overall soil quality. It is a practical example of a nature based solution involving synergic interactions between plants and the belowground microbial community.

## Isolation and characterization of a bacteria consortium able to degrade sodium lauryl ether sulphate from a soil conditioned with foaming agents

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Frontiers in Microbiology, 2020, 11, 1542, doi: 10.3389/fmicb.2020.01542

**Autori:** Rolando L, Rauseo J, Pescatore T, Patrolecco L, Garbini GL, Visca A, Grenni P, Barra Caracciolo A,

**Abstract ENG:** The anionic surfactant Sodium Lauryl Ether Sulfate (SLES) is the principal component of several commercial foaming products for soil conditioning in the tunneling industry. Huge amounts of spoil material are produced during the excavation process and the presence of SLES can affect its re-use as a by-product. Anionic surfactants can be a risk for ecosystems if occurring in the environment at toxic concentrations. SLES biodegradability is a key issue if the excavated soil is to be reused. The aim of this study was to identify bacteria able to degrade SLES, so that it could potentially be used in bioaugmentation techniques. Enrichment cultures were performed using bacterial populations from spoil material collected in a tunnel construction site as the inoculum. A bacterial consortium able to grow in a few hours with SLES concentrations from 125 mg/L to 2 g/L was selected and then identified by Next Generation Sequencing analysis. Most of bacteria identified belonged to Gamma-Proteobacteria (99%) and Pseudomonas (ca 90%) was the predominant genus. The bacterial consortium was able to degrade 94% of an initial SLES concentration of 250 mg/L in 9 h. A predictive functional analysis using the PICRUSt2 software showed the presence of esterase enzymes, responsible for SLES degradation. The bacterial consortium selected could be useful for its possible seeding (bioaugmentation) on spoil material from tunneling excavation.

## Toxic response of the bacterium Vibrio fischeri to sodium lauryl ether sulphate residues in excavated soils

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Ecotoxicology, 2020, 29(7), 815–824, doi: 10.1007/s10646-020-02202-7

**Autori:** Mariani L, Grenni P, Barra Caracciolo A, Donati E, Rauseo J, Rolando L, Patrolecco L, 2020.

**Abstract ENG:** Sodium lauryl ether sulphate (SLES) is the main chemical component in several lubricant products used for soil conditioning in the mechanized excavation industry using Earth Pressure Balance-Tunnel Boring Machines. During the tunnelling process, huge amounts of excavated soil are produced and the SLES presence can affect the subsequent re-use of this material as a by-product. Currently, there is still no regulatory indication of reliable and sensitive bioassays for monitoring soil quality during the excavation process. The main objective of this work was to verify if the Vibrio fischeri screening test was suitable as a consistent and precautionary tool for this specific purpose. Firstly, the ecotoxicity (EC20 and EC50) of the SLES standard solution and three commercial products (SLES content from 10 to 50%) were evaluated to select the most environmental friendly product. Subsequently, soil samples from about 2 years of tunnelling in a real construction site, conditioned with the selected product, were evaluated for their environmental compatibility with the prescriptions of an Italian site-specific protocol. The latter established 2 mg/L as a threshold value for SLES concentration in soil water extracts and a no toxic response (≤20%) for the Vibrio fischeri test. The comparison of the bacterium bioluminescence inhibition values (%) with analytical determinations showed an ecotoxicity when SLES was >2 mg/L. The toxicity was directly related to SLES concentration, indicating that the V. fischeri test and the SLES analyses are suitable tools for assessing excavated soil as a by-product, ensuring its safe reuse in accordance with a green production process (circular economy).

## Co-presence of the anionic surfactant sodium lauryl ether sulphate and the pesticide chlorpyrifos and effects on a natural soil microbial community

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Environmental Science and Pollution Research, 2020, 27 (25), 30987–30997, doi:10.1007/s11356-020-08840-y

**Autori:** Pescatore T, Patrolecco L, Rolando L, Spataro F, Rauseo J, Grenni P, Ademollo N, Barra Caracciolo A, 2020.

**Abstract ENG:** There is a growing concern about the simultaneous presence in the environment of different kinds of pollutants, because of the possible synergic or additive effects of chemical mixtures on ecosystems. Chlorpyrifos (CPF) is an organophosphate insecticide extensively used in agricultural practices. The anionic surfactant sodium lauryl ether sulphate (SLES) is the main component of several commercial products, including foaming agents used in underground mechanised excavation. Both compounds are produced and sold in high amounts worldwide and can be found in the environment as soil contaminants. The persistence of SLES and CPF in agricultural soils and their possible effects on the natural microbial community was evaluated in microcosms. The experimental set consisted of soil samples containing the autochthonous microbial community and treated with only SLES (70 mg/kg), only CPF (2 mg/kg) or with a mix of both compounds. Control microcosms (without the contaminants) were also performed. Soil samples were collected over the experimental period (0, 7, 14, 21 and 28 days) and analysed for CPF, SLES and themainmetabolite of CPF (3, 5, 6-trichloropyridinol, TCP). The half-life time (DT50) of each parent compoundwas estimated in all experimental conditions. At the same time, the abundance, activity and structure of the microbial community were also evaluated. The results showed that the co-presence of SLES and CPF did not substantially affect their persistence in soil (DT50 of 11 and 9 days with co-presence and 13 and 10 days, respectively, when alone); however, in the presence of SLES, a higher amount of the metabolite TCP was found. Interestingly, some differences were found in the bacterial community structure, abundance and activity among the various conditions.

## Environmental risk assessment of the anionic surfactant sodium lauryl ether sulphate in site-specific conditions arising from mechanized tunnelling

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Journal of Hazardous Materials, 2020, 383, 121116, doi:10.1016/j.jhazmat.2019.121116

**Autori:** Finizio A, Patrolecco L, Grenni P, Galli E, Muzzini VG, Rauseo J, Rizzi C, Barra Caracciolo A, 2020.

**Abstract ENG:** Sodium lauryl ether sulphate (SLES) is the anionic surfactant commonly utilized as the main synthetic chemical component in most foaming agents used in mechanized tunnelling. This produces huge amounts of soil debris which can contain residual concentrations of SLES. The absence of environmental quality standards for soil and water and the limited information about SLES persistence in real excavated soils do not facilitate any re-use of soil debris as by-products. The environmental risk assessment (ERA) of foaming agents containing SLES can be a valid tool for this purpose. In this study, an ERA analysis of SLES in 12 commercial formulations (cf) used for tunnelling excavation was performed. Various soils from different tunnel excavation sites were conditioned with the selected foaming agents containing SLES. Predicted or measured environmental concentrations (PECs, MECs) were determined and then compared with the Predicted No Effect Concentrations (PNECs) for both the terrestrial and aquatic compartments. The results indicate a reduction of the potential risk over time for these ecosystems, with differences depending on both the commercial foaming formulation and the spoil material characteristics. However, because potential threats to the natural environment cannot be excluded, some risk management and mitigation actions are discussed.

## Impact of bacterial motility on biosorption and cometabolism of pyrene in a porous medium

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Science of the Total Environment, 2020, 717, 137210, doi: 10.1016/j.scitotenv.2020.137210

**Autori:** Rolando L, Vila J, Posada-Baquero R, Castilla JC, Barra Caracciolo A, Ortega-Calvo JJ. 2020

**Abstract ENG:** The risks of pollution by polycyclic aromatic hydrocarbons (PAHs)may increase in bioremediated soils as a result of the formation of toxic byproducts and the mobilization of pollutants associated to suspended colloids. In this study, we used the motile and chemotactic bacterium Pseudomonas putida G7 as an experimental model for examining the potential role of bacterial motility in the cometabolism and biosorption of pyrene in a porous medium. For this purpose, we conducted batch and column transport experiments with 14C-labelled pyrene loaded on silicone O-rings, which acted as a passive dosing system. In the batch experiments, we observed concentrations of the 14C-pyrene equivalentswell above the equilibrium concentration observed in abiotic controls. This mobilization was attributed to biosorption and cometabolism processes occurring in parallel. HPLC quantification revealed pyrene concentrations well below the 14C-based quantifications by liquid scintillation, indicating pyrene transformation into water-soluble polarmetabolites. The results from transport experiments in sand columns revealed that cometabolic-active, motile cells were capable of accessing a distant source of sorbed pyrene. Using the same experimental system, we also determined that salicylate-mobilized cells, inhibited for pyrene cometabolism, but mobilized due to their tactic behavior, were able to sorb the compound and mobilize it by biosorption. Our results indicate that motile bacteria active in bioremediation may contribute, through cometabolism and biosorption, to the risk associated to pollutant mobilization in soils. This research could be the starting point for the development ofmore efficient, low-risk bioremediation strategies of poorly bioavailable contaminants in soils.

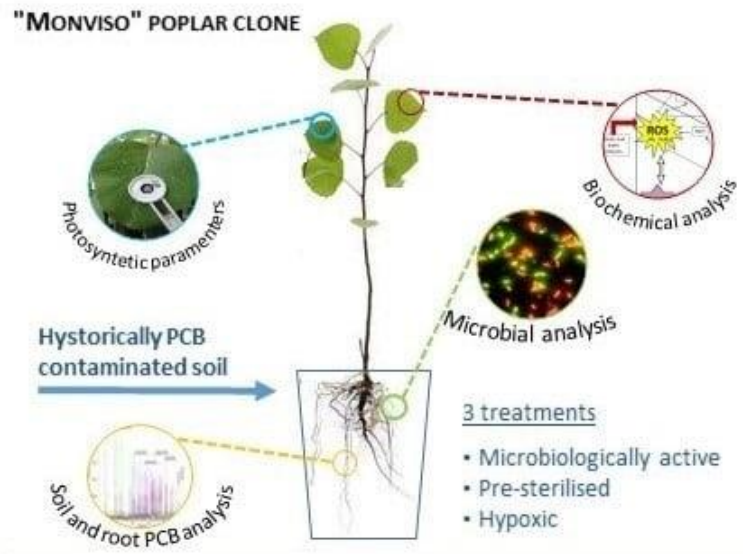
## Microcosm Experiment to Assess the Capacity of a Poplar Clone to Grow in a PCB-Contaminated Soil

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Water, 2020, 11 (11); doi:10.3390/w11112220

**Autori:** Nogues I, Grenni P, Di Lenola M, Passatore L, Guerriero E, Benedetti P, Massacci A, Rauseo J, Barra Caracciolo A, 2019

**Abstract ENG:** Polychlorinated byphenyls (PCBs) are a class of Persistent Organic Pollutants extremely hard to remove from soil. The use of plants to promote the degradation of PCBs, thanks to synergic interactions between roots and the natural soil microorganisms in the rhizosphere, has been proved to constitute an effective and environmentally friendly remediation technique. Preliminary microcosm experiments were conducted in a greenhouse for 12 months to evaluate the capacity of the Monviso hybrid poplar clone, a model plant for phytoremediation, to grow in a low quality and PCB-contaminated soil in order to assess if this clone could be subsequently used in a field experiment. For this purpose, three different soil conditions (Microbiologically Active, Pre-sterilized and Hypoxic soils) were set up in order to assess the capacity of this clone to grow in the polluted soil in these different conditions and support the soil microbial community activity. The growth and physiology (chlorophyll content, chlorophyll fluorescence, ascorbate, phenolic compounds and flavonoid contents) of the poplar were determined. Moreover, chemical analyses were performed to assess the concentrations of PCB indicators in soil and plant roots. Finally, the microbial community was evaluated in terms of total abundance and activity under the different experimental conditions. Results showed that the poplar clone was able to grow effciently in the contaminated soil and to promote microbial transformations of PCBs. Plants grown in the hypoxic condition promoted the formation of a higher number of higher-chlorinated PCBs and accumulated lower PCBs in their roots. However, plants in this condition showed a higher stress level than the other microcosms, producing higher amounts of phenolic, flavonoid and ascorbate contents, as a defence mechanism.



## Deeper waters are changing less consistently than surface waters in a global analysis of 102 lakes

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Scientific reports, 2020, 10, 20514, doi: 10.1038/s41598-020-76873-x

**Autori:** Rachel M. Pilla, Craig E. Williamson, Boris V. Adamovich, Rita Adrian, Orlane Anneville, Sudeep Chandra, William Colom-Montero, Shawn P. Devlin, Margaret A. Dix, Martin T. Dokulil, Evelyn E. Gaiser, Scott F. Girdner, K. David Hambright, David P. Hamilton, Karl Havens, Dag O. Hessen, Scott N. Higgins, Timo H. Huttula, Hannu Huuskonen, Peter D. F. Isles, Klaus D. Joehnk, Ian D. Jones, Wendel Bill Keller, Lesley B. Knoll, Johanna Korhonen, Benjamin M. Kraemer, Peter R. Leavitt, Fabio Lepori, Martin S. Luger, Stephen C. Maberly, John M. Melack, Stephanie J. Melles, Dörthe C. Müller-Navarra, Don C. Pierson, Helen V. Pislegina, Pierre-Denis Plisnier, David C. Richardson, Alon Rimmer, Michela Rogora, James A. Rusak, Steven Sadro, Nico Salmaso, Jasmine E. Saros, Émilie Saulnier-Talbot, Daniel E. Schindler, Martin Schmid, Svetlana V. Shimaraeva, Eugene A. Silow, Lewis M. Sitoki, Ruben Sommaruga, Dietmar Straile, Kristin E. Strock, Wim Thiery, Maxim A. Timofeyev, Piet Verburg, Rolf D. Vinebrooke, Gesa A. Weyhenmeyer & Egor Zadereev

**Abstract ENG:** Globally, lake surface water temperatures have warmed rapidly relative to air temperatures, but changes in deepwater temperatures and vertical thermal structure are still largely unknown. We have compiled the most comprehensive data set to date of long-term (1970–2009) summertime vertical temperature profiles in lakes across the world to examine trends and drivers of whole-lake vertical thermal structure. We found significant increases in surface water temperatures across lakes at an average rate of + 0.37 °C decade−1, comparable to changes reported previously for other lakes, and similarly consistent trends of increasing water column stability (+ 0.08 kg m−3 decade−1). In contrast, however, deepwater temperature trends showed little change on average (+ 0.06 °C decade−1), but had high variability across lakes, with trends in individual lakes ranging from − 0.68 °C decade−1 to + 0.65 °C decade−1. The variability in deepwater temperature trends was not explained by trends in either surface water temperatures or thermal stability within lakes, and only 8.4% was explained by lake thermal region or local lake characteristics in a random forest analysis. These findings suggest that external drivers beyond our tested lake characteristics are important in explaining long-term trends in thermal structure, such as local to regional climate patterns or additional external anthropogenic influences.

## Arsenic-fluoride co-contamination in groundwater: Background and anomalies in a volcanic-sedimentary aquifer in central Italy

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Journal of Geochemical Exploration, 2020, 217, 106590, doi: 10.1016/j.gexplo.2020.106590

**Autori:** Parrone D.; Ghergo S.; Frollini E.; Rossi D.; Preziosi E.

**Abstract ENG:** In a volcanic-sedimentary aquifer in central Italy, we investigate the co-existence of arsenic and fluoride in groundwater, aiming at identifying the most probable processes deductible at regional/groundwater body scale leading to the observed co-contamination in groundwater. Further, the areas at risk for human health where high concentrations can produce a significant risk to human health have been investigated. The study area is located in Latium (Central Italy) where silica-undersaturated alkali-potassic formations of Plio-Pleistocene age largely outcrop above marine and continental sand and clay deposits (Neogene) and continental alluvial deposits (Lower Pleistocene-Middle Pleistocene). Geochemical data from groundwater at 322 wells and 76 springs have been analyzed through statistical methods including clustering/PCA and geostatistical analysis. The results show exceedances of the drinking water standards for F (1.5 mg/L) and As (10.0 ?g/L) in 29% and 55% of the sampled groundwater, respectively. Multivariate statistics suggest a widespread process of water-rock interaction with the K-alkaline volcanic formations releasing As, F, K, Si, V, Rb and PO to the groundwater. As and F show a good correlation (Pearson's r = 0.61, Spearman's r = 0.59) and define a separate PCA component, confirming that their background in groundwater might be governed by a common process. Kriging interpolations have been used to study the spatial distribution of the two parameters, identifying areas with the highest concentrations and highest probability of exceeding the standards for human consumption. Moreover, by resampling the As-F data with the jackknife technique it was possible to identify the variations of their correlation index in the study area, due to specific As or F anomalies. While in the peripheral areas of the volcanic districts, dominated by sedimentary deposits, the As-F correlation index does not present important fluctuations, Indicator Kriging shows specific As or F correlation anomalies within the volcanic groundwater bodies and along the Tyrrhenian coastline. These anomalies seem to correspond to the zones with the highest thermal flux and/or are located near important structural lineaments. Fluoride correlation anomalies close to mining sites (fluorite) have also been observed. We hypothesize that, unlike the regional co-contamination, these local anomalies are related to the upwelling of geothermal fluids along fracture/fault systems that mix with cold groundwater, or to the interaction with mineral deposits particularly enriched of these elements.

## Application of time-lapse ERT to determine the impact of using brackish wastewater for maize irrigation

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Journal of Hydrology, 2020, 582, 124465, doi: 10.1016/j.jhydrol.2019.124465

**Autori:** Lorenzo De Carlo, Adriano Battilani, Domenico Solimando, Maria Clementina Caputo

**Abstract ENG:** In agricultural practices the huge demand on fresh water for irrigation, together with water scarcity, encourages the reuse of wastewater as a water resource. Integrated management of water resources by considering the efficient use of wastewater could result in fresh water saving. A field experiment was conducted to compare the effects of two irrigation water sources, brackish secondary treated wastewater and surface canal fresh water, on maize crop. During the irrigation cycle, soil water content distribution was estimated by means of time-lapse mode electrical resistivity tomography (ERT), soil electrical resistivity being highly sensitive to soil moisture and water salinity. The effects of the two water sources on the spatial-temporal distribution of ERT-derived soil moisture values were assessed, and different roots' behaviors observed. Results show a decreased root water uptake with brackish irrigation water with respect to fresh water. This result implies an increase in water savings due to reduced crop water requirement, which has significant implications for economic and environmental management

## Monitoring the Drainage Efficiency of Infiltration Trenches in Fractured and Karstified Limestone via Time-Lapse Hydrogeophysical Approach

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** WATER, 2020, 12 (7), 2009, DOI: 10.3390/w12072009

**Autori:** Lorenzo De Carlo , Maria Clementina Caputo , Rita Masciale , Michele Vurro, Ivan Portoghese

**Abstract ENG:** In the test site of Castellana Grotte (Southern Italy), since 2016, around 2300 m3d−1 of tertiary treated wastewater has been alternatively spread in nine infiltration trenches, dug into fractured and karstified limestone. In one of these trenches, located upstream, seasonal variations in the infiltration rate were observed, with a lower infiltration rate during summer than in winter. This effect could be due to the occurrence of a bioclogging phenomenon in the warm season. In addition, time-lapse electrical resistivity tomography (ERT) was carried out in two different periods, corresponding to the wet and dry seasons, in order to investigate the infiltration process dynamics below the bottom of the trench. Remarkable variability was observed between the south and north sides of the trench—clearly related to the local-scale heterogeneity of the rock formation of the trenches. The results suggest that such an integrated approach should be considered of great interest in case of using infiltration trenches as managed aquifer recharge (MAR) plants. This methodology could provide useful information about the heterogeneities of the rock formation, supporting an alert system for the identification of clogging effects during the life cycle of the plant.

## Composition, structure and abundance of the ichthyofauna in the Mar Piccolo of Taranto 2007-2009

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Dynamic Ecological Information Management System - Site and dataset registry, 2020, http://doi.org/10.23728/b2share.acce360f58aa42d6b119274552cfa006

**Autori:** Prato E., Biandolino F.

**Abstract ITA:** È stato valutato il popolamento ittico del Mar Piccolo di Taranto (Italia meridionale), un importante ecosistema del Mar Mediterraneo. Un totale di 6514 individui sono stati raccolti mensilmente, tra luglio 2007 e aprile 2009, identificando 28 specie all'interno di 16 famiglie. Mugilidae, Atherinidae, Labridae e Gobidae erano le famiglie dominanti. I Mugilidi erano rappresentati da 5 specie, contribuivano per circa il 36% all'abbondanza numerica del pescato totale, e consistevano principalmente in Liza aurata (25%) L. saliens (7,6%), L. ramada (1,2%), Mugil cephalus (1,2%) e Chelon labrosus (0,7%). Sebbene Atherinidae fosse rappresentato da Atherina boyeri, il tasso di contribuzione di questa specie era piuttosto alto (27,3%) delle catture totali con 1776 individui totali. Labridae e Gobidae erano le successive famiglie dominanti che rappresentavano rispettivamente il 14,2% e il 10,8%. I risultati hanno mostrato che la fauna ittica trovata è simile all'ittiofauna di altri ecosistemi di transizione nel Mediterraneo

**Abstract ENG:** The fish assemblage of the Mar Piccolo of Taranto (Southern Italy), an important ecosystem in the Mediterranean Sea, was assessed. A total of 6514 individuals were monthly collected, between July 2007 and April 2009 identifying 28 species within 16 families. Mugilidae, Atherinidae, Labridae and Gobidae were the dominant families. The Mugilidae were represented by 5 species, contributed for about 36% of the numerical abundance of the total catch, and mostly consisted of Liza aurata (25%) L. saliens (7.6%), L. ramada (1.2%), Mugil cephalus (1.2%) and Chelon labrosus (0.7%). Although Atherinidae was represented by Atherina boyeri, the contribution rate of this species was quite high (27.3%) of total catches with 1776 of total individuals. Labridae and Gobidae were the next dominant families accounting for 14.2% and 10.8% respectively. The results showed that the fish fauna found is similar to the ichthyofauna of other transitional ecosystems in the Mediterranean.

## Benthic macro invertebrate community in the Mar Piccolo of Taranto 2002-2004

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Dynamic Ecological Information Management System - Site and dataset registry, 2020, http://doi.org/10.23728/b2share.29aaa071fe564bc6a04b2d09583275b5

**Autori:** Prato E.

**Abstract ITA:** Lo scopo di questo studio è stato quello di determinare la struttura delle comunità di macroinvertebrati bentonici nel Mar Piccolo di Taranto (Mar Ionio, Mediterraneo centrale). Il campionamento è stato effettuato su base annuale per tre anni (dal 2002 al 2004) e i campioni sono stati prelevati utilizzando un Van Veen. Sono state identificate 258 specie in totale. La composizione dei macroinvertebrati bentonici era dominata dalla presenza di Molluschi e Crostacei che costituivano il 63% delle specie. Anellida rappresentava l'11,6% delle specie, seguita da Echinodermata e Tunicata con 7,4 e 7,8% rispettivamente e Porifera con il 5,1% del totale delle specie identificate. Briozoa e Cnidaria rappresentavano circa il 3 e il 2%. Durante i tre anni di studio la comunità bentonica è rimasta pressoché costante

**Abstract ENG:** The aim of this study was to determine the structure of the benthic macroinvertebrate communities in Mar Piccolo of Taranto (Ionian Sea, Central Mediterranean). The sampling was done on annual basis for three years (from 2002 to 2004), and the samples were taken using a Van Veen. A total of 258 species were identified. Benthic macroinvertebrate composition was dominated by the presence of Mollusca and Crustaceans that made up 63% of the species. Anellida represented 11.6% of species, followed by Echinodermata and Tunicata with 7.4 and 7.8% respectively and Porifera with 5.1% of the total species identified. Briozoa and Cnidaria accounted for about 3 and 2%. During the three years of study the benthic community remained almost constant.

## Settlement and spreading of the introduced seaweed Caulacanthus okamurae (Rhodophyta) in the Mediterranean Sea

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Diversity, 2020, 12, 129, doi: 10.3390/d12040129

**Autori:** Petrocelli A., Wolf M.A., Cecere E., Sciuto K., Sfriso A.

**Abstract ENG:** In this study we report the first finding of the non-indigenous seaweed Caulacanthus okamurae (Rhodophyta) in the Ionian and Adriatic Sea (Mediterranean). Specimens were identified through molecular analyses based on the plastid ribulose-1,5-bisphosphate carboxylase/oxygenase (rbcL) marker. The sequences obtained during this study represent the first molecular evidence of the presence of this taxon in the Mediterranean Sea. Stable populations have been detected in the whole lagoon of Venice and in some areas of the Mar Piccolo of Taranto (Italy), forming dense patches of low turf that reach high biomasses. Turf-forming algae are common in the intertidal zones of tropical regions but are rare in temperate ones. The particular environmental conditions of transitional water systems, such as the Venice Lagoon and the Mar Piccolo of Taranto, together with the water temperature increase observed in the last years could have favored the settlement and spread of this introduced species.

## Invasive or not? The case of Grateloupia turuturu (Rhodophyta, Halymeniales) in the Northern Ionian Sea (Mediterranean Sea)

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Marine Pollution Bulletin, 2020, 161, Part B, 111748, doi: 10.1016/j.marpolbul.2020.111748

**Autori:** Petrocelli A., Alabiso G., Cecere E., Ricci P., Carlucci R.

**Abstract ENG:** It has been predicted that Grateloupia turuturu, native of the cold-temperate waters of Japan, is one of the most invasive marine species considered as a threat to global marine biodiversity. However, few studies have been carried out to assess the extent of its spread worldwide. Its seasonal dynamics in the Mar Piccolo of Taranto, a transitional water system in the Northern Ionian Sea, were observed for ten years. Systematic monthly observations were carried out from 2008 to 2018. The length of thalli and density were measured alongside the seawater temperature. Data were processed by means of non-parametric statistical analyses. No invasive behavior was detected for G. turuturu. It seems well established in the Mar Piccolo even though its population is limited to the station of first detection. However, due to its shown preference for plastic substrate, it could become a vector of another urgent threat, that is plastic pollution.

## An innovative IMTA system: polychaetes, sponges and macroalgae co-cultured in a Southern Italy inshore mariculture plant (Ionian Sea)

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Journal of Marine Science and Engineering, 2020, 8, 733, doi: 10.3390/jmse8100733

**Autori:** Giangrande A., Pierri C., Arduini D., Borghese J., Licciano M., Trani R., Corriero G., Basile G., Cecere E., Petrocelli A., Stabili L., Longo C.

**Abstract ENG:** We report data from the first year of rearing of a set of filter feeder bioremediator organisms: macrobenthic invertebrates (polychaete worms and sponges) coupled with macroalgae, realized in a mariculture fish-farm. This innovative Integrated Multi-Trophic Aquaculture (IMTA) system was realized at a preindustrial level in the Gulf of Taranto (Southern Italy, Northern Ionian Sea), within the framework of a EU Life project. Long lines containing different collector typologies were placed around the fish breeding cages. Vertical collectors were utilized for both polychaetes and sponges, whilst macroalgae were cultivated in horizontal collectors. Data on growth and mortality of the target species after the first year of rearing and cultivation are given with the biomass estimation of the main target species. Polychaete biomass was obtained from natural settlement on ropes previously hung in the system, while sponges and macroalgae were derived from explant and/or inocules inserted in the collectors. The description of the successional pattern occurring on collectors used for settling until reaching of a “stable” point is also described, with indication on additional filter feeder macroinvertebrates other than polychaetes and sponges, easily obtainable and useful in the system as bioremediators as well. The results call for an easily naturally obtaining of large biomass of sabellid polychaetes settling especially from about 4 to 10 meter depth. Sponges and macroalgae need to be periodically cleaned from the fouling covering. Macroalgae cycle was different from that of invertebrates and call for the cultivation of two different species with about a 6 month-cycle each one. The present study represents one of the first attempts of IMTA in the Mediterranean area where invertebrates and macroalgae are co-cultured in an inshore fish farm. Possible utilization of produced biomass is also suggested.

## Testing the Use of Standardized Laboratory Tests to Infer Hg Bioaccumulation in Indigenous Benthic Organisms of Lake Maggiore (NW Italy)

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Applied Sciences, 2020, 10, 1970, DOI: 10.3390/app10061970

**Autori:** Vignati D.A.L., Bettinetti R., Boggero A., Valsecchi S.

**Abstract ENG:** The chronic toxicity of mercury essentially derives from its strong tendency to biomagnify along food webs. For this reason, the European regulatory framework establishes an environmental quality standard for Hg based on the total Hg concentration in prey fish to protect top predators. A considerable part of the Hg burden of prey fish can come from the ingestion of benthic organisms that, in the presence of contaminated sediments, may remobilize substantial amounts of Hg towards the pelagic food webs. The present study evaluated whether Hg accumulation in assemblages of indigenous chironomids and oligochaetes could be predicted using standardized laboratory bioaccumulation tests with Chironomus riparius and Lumbriculus variegatus. Indigenous chironomids and oligochaetes were recovered at different sites in a lake suffering from legacy Hg pollution and analyzed for total Hg content. Sediment aliquots from the same sites were used to assess Hg bioaccumulation using laboratory-reared C. riparius and L. variegatus. Mercury concentrations in indigenous versus laboratory organisms showed a good correlation ($p < 0.05$; Spearman correlation test) only in the case of C. riparius versus indigenous chironomids, suggesting the possibility of using linear regressions to predict Hg accumulation by these benthic invertebrates. Further research needs and caveats as to the applicability of the present results to other aquatic systems are identified and discussed.

## Biological, Chemical, and Ecotoxicological Assessments Using Benthos Provide Different and Complementary Measures of Lake Ecological Status

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Water, 2020, 12, 1140, DOI: 10.3390/w12041140

**Autori:** Bettinetti R., Zaupa S., Fontaneto D., Boggero A.

**Abstract ENG:** The Water Framework Directive (WFD) aims to monitor continental water bodies in Europe to achieve good ecological status. Indexes based on biological quality elements (BQEs), ecotoxicological tests, and chemical characterizations are commonly used with standardized protocols to assess sediment quality and the associated risks. Here, we compare the results of quality assessment of benthic macroinvertebrates as BQEs as required by theWFDwith the results of ecotoxicological tests and assessment of selected persistent organic pollutants (POPs) in sediments of the same eight water bodies in Italy. The aim was to verify if the assessment of quality through macroinvertebrates through POPs analyses and ecotoxicological tools can yield comparable, overlapping, or complementary results. We used the Benthic Quality Index (BQIES) for macroinvertebrates (two different applications), legacy POPs (dichloro-diphenyl-trichloroethane and metabolites (DDTs) and polychlorinated-biphenyls (PCBs)), and the emergence ratio (ER) and development rate (DR) for ecotoxicology. The results showed that the two indices within each approach were highly correlated, but between approaches, each result can lead to a completely different scenario, with rather different results of the assessment of ecosystem quality. The most striking result was that very few significant correlations existed between sediment quality assessment through macroinvertebrates and the risk assessment through analyses of micropollutants and ecotoxicological tests. The highest absolute r-value (0.81) was for the correlation between the BQIESbottom index and PCBs for micropollutants, whereas all other pairwise comparisons between indices had r-values ranging between 0.07 and 0.53. Our analysis calls for a caveat in the blind application of one or only a few indices of water/sediment quality, as the results of a single index may not represent the complexity of a freshwater ecosystem.

## A ten-year geographic data set on the occurrence and abundance of macroinvertebrates in the River Po basin (Italy)

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Biogeographia – The Journal of Integrative Biogeography, 2020, 35, 91-103, DOI: 10.21426/B635048312

**Autori:** RICCARDO FORNAROLI, ALESSANDRA AGOSTINI, ELENA ARNAUD, ALBERTO BERSELLI, EUGENIA BETTONI, ANGELA BOGGERO, CRISTINA BORLANDELLI, GIUSEPPE CADROBBI, MANUELA CASON, LUCIANO CASTELLI, SILVIA CEREA, LAURA CONTARDI, SARA COSTA, SILVIA COSTARAOSS, VALENTINA DALLAFIOR, ALESSANDRO DAL MAS, FRANCESCO ELVIO, MARCO FIORAVANTI, DAVIDE FORTINO, SILVIA FRANCESCHINI, LAURA FRAVEZZI, ALESSIA FUGANTI, MATTEO GALBIATI, FILIPPO GALIMBERTI, PIETRO GENONI, DANIELA GERBAZ, ALESSIA LEA, DANIELA LUCCHINI, ANNA MARIA MANZIERI, MANUELA MARCHESI, CATIA MONAUNI, PAOLA MONTANARI, FEDERICA MORCHIO, SILVIA PIOVANO, NATALE PIZZOCHERO, MARA RAVIOLA, FILIPPO RICHIERI, VALERIA ROATTA, DANIELA ROCCA, ATTILIO SARZILLA, ORNELLA SICILIANO, PAOLA TESTA, DAVIDE TONNA, MARIA ENZA TUMMINELLI, FRANCA TURCO, LUCIANA VICQUERY, ALEX LAINI

**Abstract ENG:** Rivers serve many societal functions and are one of the most intensively human influenced ecosystems worldwide, and, due to their importance, are included under the monitoring programs of the Water Framework Directive across Europe. Macroinvertebrates play an important role when monitoring running waters for the assessment of their environmental quality due to their reliability as bioindicators and utility in long-term studies. Macroinvertebrates do not constitute a systematic unit but they are formed by a set of different taxa, grouped according to taxonomic ranks, size and habitat preferences. They represent the base of the aquatic food chain, serving as a food source for amphibians, birds, reptiles, fish and humans, and contributing in the organic matter processing. Despite the large amount of data collected on Italian river macroinvertebrates and the increased interest in the study of this group, only few data are available for research scientist and managers. In this paper, we collected and homogenized knowledge on the presence, distribution and abundances of macroinvertebrates taxa inhabiting the River Po catchment (Northern Italy) in the last decade. The data set includes 130,727 records collected between 2007 and 2018 including 143 taxa of macroinvertebrates, mostly identified at family rank level. Moreover, the data set provides information on the geographic distribution of these families and their abundance by sub-catchment, altitude, meso- and micro-habitat.

## Gamberi invasori nel distretto del lago maggiore

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Le Rive, 2020, 1, 33-41, http://www.verbanensia.org/riviste.asp?step=1&rivista=Le%20Rive

**Autori:** Boggero Angela, Migliori Luca, Mantovani Leonardo, Garzoli Laura

**Abstract ITA:** Progetto SPAM: Specie Aliene invasive nel bacino del lago Maggiore. Aggiornamento divulgativo sulle attività svolte dal CNR-IRSA di Verbania sui macrocrostacei invasivi del lago

**Abstract ENG:** SPAM Project: Invasive Alien Species in the Lake Maggiore basin. Informative update on the activities carried out by the CNR-IRSA of Verbania on invasive macrocrustaceans of the lake

## IL LAGO MAGGIORE E LA DIGA DELLA MIORINA: un futuro insieme è davvero possibile?

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Le Rive, 2020. 2-3, 25-33, http://www.verbanensia.org/riviste.asp?step=1&rivista=Le%20Rive

**Autori:** Kamburska Lyudmila, Ciampittiello Marzia, Di Lorenzo Tiziana, Rogora Michela, Riccardi Nicoletta, Boggero Angela

**Abstract ITA:** Progetto Interreg Parchi Verbano Ticino: aggiornamento divulgativo sullo stato delle conoscenze della gestione delle acque del Lago Maggiore, sulla nascita di un Tavolo Tecnico e sull'idea di mettere a punto un progetto per evidenziare gli effetti della gestione estiva delle acque sulla fauna litorale

**Abstract ENG:** Interreg Project Parks Verbano Ticino: informative update on the state of knowledge of Lake Maggiore water management, on the birth of a Technical Table and on the idea of developing a project to highlight the effects of summer water management on coastal fauna

## Climate projections in Lake Maggiore watershed using Statistical DownScaling Model

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Climate Research, 2020, 81, 113-130, doi: 10.3354/cr01613

**Autori:** Helmi Saidi, Claudia Dresti, Dario Manca, Marzia Ciampittiello

**Abstract ITA:** Il bilancio idrologico del Lago Maggiore è fortemente influenzato dall'andamento delle precipitazioni e della temperatura. Le comunità locali in Italia e in Svizzera fanno affidamento sul bacino idrologico del lago per l'agricoltura, il turismo e la produzione di energia idroelettrica. Accurate proiezioni climatiche sono quindi fondamentali per affrontare gli impatti derivanti dal cambiamento climatico e tuttavia sono ancora carenti. In questo articolo, il clima futuro è stato studiato applicando lo Statistical DownScaling Model (SDSM) e utilizzando i predittori CanESM2. Sono stati adottati tre scenari, definiti da RCP2.6, RCP4.5 e RCP8.5. Sulla base dei nostri risultati, SDSM è in parte applicabile per la simulazione delle precipitazioni e della temperatura in un'area alpina. I risultati indicano che il riscaldamento sarà da 2 a 3 volte maggiore se non ci sarà una mitigazione globale da oggi alla fine del secolo. Si stima che la temperatura aumenterà per tutto il XXI secolo, con una tendenza al riscaldamento più accentuata nella parte nord-orientale della regione rispetto a quella sud-occidentale. La forza del riscaldamento di fine secolo dipende fortemente dallo scenario considerato, con un aumento fino a 1.7 °C per lo scenario RCP2.6 rispetto a 4.2 °C per lo scenario non mitigato RCP8.5. Le precipitazioni stagionali dovrebbero cambiare a seconda degli scenari futuri. Si prevede che la maggior parte della regione mostrerà un incremento delle precipitazioni stagionali durante la stagione fredda e viceversa, indicando uno spostamento della stagione delle forti piogge dall'autunno all'inverno. Questi risultati suggeriscono che l'area di studio potrebbe essere vulnerabile al cambiamento globale e forniranno informazioni utili per sviluppare una migliore strategia per la gestione delle risorse idriche e per studiare le misure da adottate per gestire i disastri alluvionali.

**Abstract ENG:** Precipitation and temperature over the Lake Maggiore watershed greatly influence its water balance. Local communities from both Italy and Switzerland rely on the watershed for agriculture, tourism and hydropower production. Accurate climate projections in this area are vital in dealing with their impacts and yet are still lacking. Future climate was assessed by applying the Statistical DownScaling Model (SDSM) and using CanESM2 predictors. Three scenarios defined by RCP2.6, RCP4.5 and RCP8.5 were adopted. Based on our results, SDSM is to a certain degree applicable for simulating precipitation and temperature in an Alpine area. Results indicate that warming from now until the end of the century will be about 2 to 3 times greater without global mitigation. Temperature is estimated to increase throughout the 21st century, with a stronger warming trend in the northeastern part of the region than in the southwestern part. The strength of the warming at the end of the century highly depends on the scenario considered, with an increase up to 1.7 C for the mitigation scenario RCP2.6 compared to 4.2 C for the unmitigated scenario RCP8.5. Seasonal precipitation is expected to change depending on the future scenarios. Most of the region is expected to display a seasonally positive precipitation change during the cold season and vice versa, resulting in a shift in the peak rainy season from autumn to winter. These findings suggest that the area might be vulnerable to global change and will provide useful insight to develop a better strategy for the management of water resources and to study the adoptive measures to manage flood disasters.

## Trophic Magnification of Legacy (PCB, DDT and Hg) and Emerging Pollutants (PFAS) in the Fish Community of a Small Protected Southern Alpine Lake (Lake Mergozzo, Northern Italy)

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Water, 2020,12, 1591, doi: 10.3390/w12061591

**Autori:** Michela Mazzoni, Claudia Ferrario, Roberta Bettinetti, Roberta Piscia, Davide Cicala, Pietro Volta, Katrine Borgå, Sara Valsecchi, Stefano Polesello

**Abstract ITA:** Abstract - ITA

**Abstract ENG:** The biomagnification of mercury, polychlorobiphenyls (PCBs), dichlorodiphenyltrichl oroethane and its metabolites (DDTs) and perfluoroalkyl acids substances (PFASs) was evaluated in the trophic web of Lake Mergozzo, a small and deep Italian subalpine lake, which has been chosen because it is a protected environment, and discharges into the lake are mostly avoided. Carbon source and relative trophic levels were calculated by using 13C and 15N stable isotopes,respectively, and trophic magnification factors (TMFs) were derived. Zooplankton and thirteen species of fish were collected and analyzed, and the results showed the elevated level of biota contamination from both legacy and emerging pollutants, even if direct discharges were avoided. Concentrations in biota, expressed as sums of compounds, ranged from 0.4 to 60 µg kg−1 wet weight (ww) for PFASs, from 16 to 1.3 104 µg kg−1 lipid content (lw) for DDTs, from 17 to 1.5 104 µg kg−1 lw for PCBs and from 20.0 to 501 µg kg−1 ww for mercury (Hg). TMFs of this deep, cold lake, with a prevalent pelagic trophic chain, were high and clearly indicated fish biomagnification, except for PFAS. The biomagnification capability of PFAS in a fish-only food web was discussed by using the biomagnification of Hg as a benchmark for assessing their bioaccumulation potential.

## Trophic Niches, Trophic Positions, and Niche Overlaps between Non-Native and Native Fish Species in a Subalpine Lake

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Water, 2020, 12 (12), 3475, doi: 10.3390/w12123475

**Autori:** Davide Cicala, Gianluca Polgar, Jordi René Mor, Roberta Piscia, Stefano Brignone, Silvia Zaupa, Pietro Volta

**Abstract ITA:** Abstract - ITA

**Abstract ENG:** In the last century, Italian freshwater ecosystems have been invaded by several non-native fish species. In the subalpine Lake Mergozzo (northern Italy), several recently introduced non-native species dramatically expanded their populations. We used carbon and nitrogen stable isotopes to describe the isotopic niches and trophic positions of native and non-native fish species in Lake Mergozzo. We evaluated their trophic niches, trophic diversity, trophic redundancy and trophic evenness utilizing isotopic niche metrics, and estimated asymmetrical niche overlaps. The trophic traits of non-native fish species and Perca fluviatilis clearly define them as trophic generalists, in terms of among-individual variability of their isotopic niches. The historical increase in abundance of fish non-native species in this lake, their dominance by numbers and biomass within the assemblage, and their broad asymmetrical niche overlaps suggest that their higher degree of trophic generalism might have been one of the key factors that have promoted the invasion of the recipient community.

## Climate warming restructures an aquatic food web over 28 years

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Global Change Biology, 2020, 26, 6852–6866, DOI: 10.1111/gcb.15347

**Autori:** Andrew J. Tanentzap, Giuseppe Morabito, Pietro Volta, Michela Rogora, Norman D. Yan, Marina Manca

**Abstract ITA:** Abstract - ITA

**Abstract ENG:** Climate warming can restructure lake food webs if trophic levels differ in their thermal responses, but evidence for these changes and their underlying mechanisms remain scarce in nature. Here we document how warming lake temperatures by up to 2°C, rather than changes in trophic state or fishing effort, have restructured the pelagic food web of a large European lake (Lake Maggiore, Italy). Our approach exploited abundance and biomass data collected weekly to yearly across five trophic levels from 1981 to 2008. Temperature generally had stronger effects on taxa than changes in fish predation or trophic state mediated through primary productivity. Consequently, we found that, as the lake warmed, the food web shifted in numerical abundance towards predators occupying middle trophic positions. Of these taxa, the spiny water flea (Bythotrephes longimanus) most prospered. Bythotrephes strongly limited abundances of the keystone grazer Daphnia, strengthening top-down structuring of the food web. Warmer temperatures partly restructured the food web by advancing peak Bythotrephes densities by approximately 60 days and extending periods of positive population growth by three times. Nonetheless, our results suggested that advances in the timing and size of peak Bythotrephes densities could not outpace changes in the timing and size of peak densities in their Daphnia prey. Our results provide rare evidence from nature as to how long-term warming can favour higher trophic levels, with the potential to strengthen top-down control of food webs.

## A global multinational survey of cefotaxime-resistant coliforms in urban wastewater treatment plants

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** ENVIRONMENT INTERNATIONAL, 2020, 144, 106035, DOI: 10.1016/j.envint.2020.106035

**Autori:** Marano, RBM; Fernandes, T; Manaia, CM; Nunes, O; Morrison, D; Berendonk, TU; Kreuzinger, N; Telson, T; Corno, G; Fatta-Kassinos, D; Merlin, C; Topp, E; Jurkevitch, E; Henn, L; Scott, A; Hess, S; Slipko, K; Laht, M; Kisand, V; Di Cesare, A; Karaolia, P; Michael, SG; Petre, AL; Rosal, R; Pruden, A; Riquelme, V; Aguera, A; Esteban, B; Luczkiewicz, A; Kalinowska, A; Leonard, A; Gaze, WH; Adegoke, AA; Stenstrom, TA; Pollice, A; Salerno, C; Schwermer, CU; Krzeminski, P; Guilloteau, H; Donner, E; Drigo, B; Libralato, G; Guida, M; Burgmann, H; Beck, K; Garelick, H; Tacao, M; Henriques, I; Martinez-Alcala, I; Guillen-Navarro, JM; Popowska, M; Piotrowska, M; Quintela-Baluja, M; Bunce, JT; Polo-Lopez, MI; Nahim-Granados, S; Pons, MN; Milakovic, M; Udikovic-Kolic, N; Ory, J; Ousmane, T; Caballero, P; Oliver, A; Rodriguez-Mozaz, S; Balcazar, JL; Jager, T; Schwartz, T; Yang, Y; Zou, SC; Lee, YH; Yoon, Y; Herzog, B; Mayrhofer, H; Prakash, O; Nimonkar, Y; Heath, E; Baraniak, A; Abreu-Silva, J; Choudhury, M; Munoz, LP; Krizanovic, S; Brunetti, G; Maile-Moskowitz, A; Brown, C; Cytryn, E

**Abstract ENG:** The World Health Organization Global Action Plan recommends integrated surveillance programs as crucial strategies for monitoring antibiotic resistance. Although several national surveillance programs are in place for clinical and veterinary settings, no such schemes exist for monitoring antibiotic-resistant bacteria in the environment. In this transnational study, we developed, validated, and tested a low-cost surveillance and easy to implement approach to evaluate antibiotic resistance in wastewater treatment plants (WWTPs) by targeting cefotaxime-resistant (CTX-R) coliforms as indicators. The rationale for this approach was: i) coliform quantification methods are internationally accepted as indicators of fecal contamination in recreational waters and are therefore routinely applied in analytical labs; ii) CTX-R coliforms are clinically relevant, associated with extended-spectrum beta-lactamases (ESBLs), and are rare in pristine environments. We analyzed 57 WWTPs in 22 countries across Europe, Asia, Africa, Australia, and North America. CTX-R coliforms were ubiquitous in raw sewage and their relative abundance varied significantly (< 0.1% to 38.3%), being positively correlated ($p < 0.001$) with regional atmospheric temperatures. Although most WWTPs removed large proportions of CTX-R coliforms, loads over 10(3) colony-forming units per mL were occasionally observed in final effluents. We demonstrate that CTX-R coliform monitoring is a feasible and affordable approach to assess wastewater antibiotic resistance status.

## A Holocene record of aquatic bio-optics in subarctic fennoscandia

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** QUATERNARY SCIENCE REVIEWS, 2020, 243 (1), 106491, DOI: 10.1016/j.quascirev.2020.106491

**Autori:** Nevalainen, L; Rantala, MV; Meyer-Jacob, C; Kivila, EH; Ojala, AEK; Smol, JP; Luoto, TP

**Abstract ENG:** We investigated a Holocene (since similar to 10 500 cal yr BP) sediment core from a high-altitude, UV-sensitive tundra lake in northwestern Finnish Lapland to disentangle long-term dynamics in underwater UV exposure, lake-catchment coupling processes, and aquatic community development under changing climate. We analyzed biogeochemical and paleobiological proxies indicative of catchment impact, lake production and water transparency, including inferences of lake-water total organic carbon (TOC), sediment chlorophyll-a and UV-induced cladoceran (Crustacea) melanin (ABS(UV)), cladoceran communities, and elemental and isotopic fingerprints of sediment organic matter (OM). The results depicted a general climate-mediated ontogeny of early, mid- and late Holocene limnological regimes. The rapid postglacial temperature increase and the regionally early Holocene temperature maximum initiated lacustrine changes with rapid community turnovers, increasing benthic-dominated autochthonous production and high UV exposure due to low input of terrestrial OM (TOC similar to 1-2 mg L-1) from the deglaciated catchment. The mid-Holocene regime was characterized by a general stabilization of the catchment and a benthic-dominated aquatic community that became gradually more productive under the warm and dry climate conditions. Superimposed on late Holocene climate cooling and increasing effective moisture, TOC increased to the highest Holocene values (>3 mg L-1), which was associated with abundant aquatic macrophytes and a phytophilous Acroperus harpae dominated cladoceran community around 4500-3000 cal yr BP. Over the past three millennia, TOC declined to low modern values (similar to 2 mg L-1) and UV-resistant Alonopsis elongata became the dominant taxon indicating a regime of increased underwater UV exposure. ABS(UV) was consistently higher around similar to 1500-1000 cal yr BP after the late Holocene TOC decline, suggesting a photoprotective response to the new UV regime, possibly through a reduction of available UV refugia among aquatic macrophytes. While ABS(UV) did not show a straightforward relationship with TOC or solar forcing over the Holocene, the cladoceran community shift suggested a clear limno-ecological response to altering TOC and underwater UV regimes. (C) 2020 Published by Elsevier Ltd.

## A rock-glacier - pond system (NW Italian Alps): Soil and sediment properties, geochemistry, and trace-metal bioavailability

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** CATENA, 2020, 194, 104700, DOI: 10.1016/j.catena.2020.104700

**Autori:** Colombo, N; Ferronato, C; Antisari, LV; Marziali, L; Salerno, F; Fratianni, S; D'Amico, ME; Ribolini, A; Godone, D; Sartini, S; Paro, L; di Cella, UM; Freppaz, M

**Abstract ENG:** Rock-glacier sediment transfer and ice melting can impact surface waters located downstream. However, there is a lack of knowledge on the influence of rock-glacier dynamics on the geochemical, hydrochemical, and ecological characteristics of adjacent impounded surface waters. In the Col d'Olen area (Long-Term Ecological Research site, NW Italian Alps), an intact rock glacier terminates into a pond and solute-enriched waters originating from the rock glacier flow into the pond through a subsurface hydrological window. In this study, we performed geophysical and ground surface temperature measurements. Moreover, we sampled soils and sediments in different compartments of the investigated rock-glacier - pond system and we further sampled benthic invertebrates in the pond. Cold ground thermal regime, ground-ice presence, and coarse debris cover on the rock glacier together with its lithology (serpentinites) influence the rock-glacier geochemistry and ecology with respect to surrounding areas. Pond geochemistry is affected by transfer of trace-metal-enriched fine-grained debris and meltwaters from the rock glacier. Enhanced bioavailability of serpentinite-associated trace metals was proved, with concentrations of Ni and Cr in benthic invertebrates up to 384 and 110 mg kg(-1) d.w., respectively, potentially exerting toxic effects on pond biota. The advancing movement of the rock glacier not only has delivered sediments to the pond, but it has progressively filled the valley depression where the pond is located, creating a dam that could have modified the level of impounded water. This process likely constituted a sediment trap in which serpentinitic rock-glacier sediments could be deposited at the pond bottom, with related geochemical and ecological implications. This study illustrates the importance of rock glaciers in influencing the characteristics of downstream freshwater bodies and highlights the need to improve our knowledge about climate-change-related impacts of rock-glacier dynamics on alpine headwaters.

## Alpine headwaters emerging from glaciers and rock glaciers host different bacterial communities: Ecological implications for the future

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** SCIENCE OF THE TOTAL ENVIRONMENT, 2020, 717, 137101, DOI: 10.1016/j.scitotenv.2020.137101

**Autori:** Tolotti, M; Cerasino, L; Donati, C; Pindo, M; Rogora, M; Seppi, R; Albanese, D

**Abstract ENG:** Mountain glacier shrinkage represents a major effect of the current global warming and 80-100% of the Alpine glaciers are predicted to vanish within the next few decades. As the thawing rate of mountain permafrost ice is much lower than for glacier ice, a shift fromglacial to periglacial dynamics is predicted for Alpine landscapes during the 21st century. Despite the growing literature on the impacts of deglaciation on Alpine hydrology and ecosystems, chemical and biological features of waters emerging from Alpine rock glaciers (i.e. permafrost landforms composed by a mixture of ice and debris) have been poorly investigated so far, and knowledge on microbial bio-diversity of headwaters is still sparse. A set of glacier-, rock glacier- and groundwater/precipitation-fed streams was investigated in the Italian Central Alps in late summer 2016, aiming at exploring bacterial community composition and diversity in epilithic and surface sediment biofilm and at verifying the hypothesis that rock glacier-fed headwaters represent peculiar ecosystems from both a chemical and biological point of view. Rock glacier-fed waters showed high values of electrical conductivity and trace elements related to their bedrock lithology, and their highly diverse bacterial assemblages significantly differed from those detected in glacier-fed streams. Bacterial taxonomic composition appeared to be mainly related to water and substrate type, as well as to water chemistry, the latter including concentrations of nutrients and trace metals. The results of this study confirm the chemical and biological peculiarity of rock glacier-fed waters compared to glacial waters, and suggest a potential driving role of thawing permafrost in modulating future ecological traits of Alpine headwaters within the context of progressing deglaciation. 

## An EnvironmentalEscherichia coliStrain Is Naturally Competent to Acquire Exogenous DNA

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** FRONTIERS IN MICROBIOLOGY, 2020, 11, 574301, DOI: 10.3389/fmicb.2020.574301

**Autori:** Riva, F; Riva, V; Eckert, EM; Colinas, N; Di Cesare, A; Borin, S; Mapelli, F; Crotti, E

**Abstract ENG:** The diffusion of antibiotic resistance determinants in different environments, e.g., soil and water, has become a public concern for global health and food safety and many efforts are currently devoted to clarify this complex ecological and evolutionary issue. Horizontal gene transfer (HGT) has an important role in the spread of antibiotic resistance genes (ARGs). However, among the different HGT mechanisms, the capacity of environmental bacteria to acquire naked exogenous DNA by natural competence is still poorly investigated. This study aimed to characterize the ability of the environmentalEscherichia colistrain ED1, isolated from the crustaceanDaphniasp., to acquire exogenous DNA by natural competence. Transformation experiments were carried out varying different parameters, i.e., cell growth phase, amount of exogenous DNA and exposition to artificial lake water (ALW) and treated wastewater to mimic environmental-like conditions that may be encountered in the agri-food system. Results were compared with those showed by the laboratoryE. colistrain DH5 alpha. Our experimental data, supported by genomic sequencing, showed that, when exposed to pure water, ED1 strain was able to acquire exogenous DNA with frequencies (10(-8)-10(-9)) statistically higher than the ones observed for DH5 alpha strain (10(-10)). Interestingly, higher values were retrieved for ED1 than DH5 alpha strains exposed to ALW (10(-7)vs. 10(-9), respectively) or treated wastewater (10(-8)vs. 10(-10), respectively). We tested, therefore, ED1 strain ability to colonize the rhizosphere of lettuce, a model plant representative of raw-consumed vegetables of high economic importance in the ready-to-eat food industry. Results showed that ED1 strain was able to efficiently colonize lettuce rhizosphere, revealing a stable colonization for 14 days-long period. In conclusion, ED1 strain ability to acquire exogenous DNA in environmental-like conditions by natural competence, combined with its ability to efficiently and stably colonize plant rhizosphere, poses the attention to food and human safety showing a possible route of diffusion of antibiotic resistance in the agri-food system, sustaining the One Health warnings related to the antibiotic spread.

## Assemblage structure, distribution and habitat type of the grapsoid crabs (Brachyura: Grapsoidea) of the coastal forested swamps of northern Borneo

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** REGIONAL STUDIES IN MARINE SCIENCE, 2020, 37, 101323, DOI: 10.1016/j.rsma.2020.101323

**Autori:** Ribero, L; Lim, PE; Ramli, R; Polgar, G

**Abstract ENG:** Several intertidal and supratidal systems were investigated in the Brunei Bay to assess the diversity and assemblage structure of grapsoid crabs (Brachyura: Grapsoidea) in different salinity and substrate conditions, type of vegetation, and distance from water bodies. The structure of the assemblages differed remarkably across and within sites, and several taxa were not previously recorded from this region. Diversity decreased towards more terrestrial conditions, with systems closer to the sea supporting more diversified assemblages. High and low intertidal areas also hosted different assemblages in terms of taxonomic composition. Most of these species can be considered habitat specialists, and only occurred in a small number of the investigated areas. A small number of habitat generalists were found in several areas, exhibiting eurytopic ecological traits. A time-based sampling method was used to estimate population densities. A few habitat specialists were recorded in high densities, suggesting adaptations to specific environmental conditions in which these species can bloom. These results highlight how the diversity of these assemblages needs to be considered in management plans, to prevent local extinctions and loss of diversity in the area. 

## Biodiversity analyses in freshwater meiofauna through DNA sequence data

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** HYDROBIOLOGIA, 2020, 847, 2597–2611, DOI: 10.1007/s10750-019-04067-2

**Autori:** Schenk, J; Fontaneto, D

**Abstract ENG:** Microscopic animals (also referred to as meiofauna) in freshwater habitats include several common, abundant and species-rich phyla, whose patterns of diversity are poorly known. Several approaches using DNA sequence data can be used to improve our knowledge on their biodiversity. In this review, we focus on studies using DNA data for taxonomy, and for environmental studies through metabarcoding on freshwater meiofauna. The results of the literature survey reveal that the use of DNA data is still rather limited. We screen the available literature on the topic and analyse the details of the current use and choices of the methods in freshwater meiofauna, the potential problems and limitations, and the flawed parts that still need to be improved. We conclude the review with a perspective on the still unexploited potentials in future applications to address biodiversity shortfalls in species diversity and taxonomy, and in the ecological and biogeographical patterns of species distribution.

## Biogeochemical and photobiological responses of subarctic lakes to UV radiation

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** JOURNAL OF PHOTOCHEMISTRY AND PHOTOBIOLOGY B-BIOLOGY, 2020, 209, 111932, DOI: 10.1016/j.jphotobiol.2020.111932

**Autori:** Nevalainen, L; Rantala, MV; Kivila, EH; Lami, A; Wauthy, M; Rautio, M; Luoto, TP

**Abstract ENG:** Solar ultraviolet radiation (UV) induces photodegradation of optically and functionally important organic compounds in lakes and may negatively impact aquatic biota. We disentangled UV impacts on dissolved organic matter (DOM) transformation, and algal and zoobenthic micro-organisms in two shallow subarctic lakes in NW Finnish Lapland; in a high-UV + low-DOM (tundra, Iso-Jehkas) and a low-UV + high-DOM (mountain birch woodland, Mukkavaara) system. In addition to site and seasonal comparisons, in situ experiments with three treatments (DARK, photosynthetically active radiation [PAR], UV + PAR) were set up floating on the lakes for four weeks during midsummer. Lake water and experimental lake water were analyzed for basic limnology, optical properties (dissolved organic carbon [DOC], specific UV absorbance [SUVA], colored DOM [CDOM], and DOM compounds) as well as for photosynthetic and photoprotective pigments in algae and microzoobenthos. DOC concentrations remained largely unchanged after the exposure period in seasonal and experimental samples in both lakes yet the biochemical composition of the carbon pools was distinctly altered. CDOM and SUVA decreased seasonally and under UV exposure in the experiments, and terrestrial DOM compounds decreased in the experiments, suggesting UV induced photodegradation of large molecular size DOM of terrestrial origin. Higher seasonal and experimental (UV + PAR vs. PAR) proportional CDOM degradation occurred in Iso-Jehkas (32%, 29%) than in Mukkavaara (19%, 9%). Accordingly, the high-UV + low-DOM lake was more sensitive to photodegradation despite originally low CDOM relative to the low-UV + high-DOM system where DOM biodegradation likely prevailed. Experimental results showed elevated algal carotenoid/chlorophyll ratios and microzoobenthic melanin under UV exposure indicating photoinhibition and photoprotective pigmentation. UV has a significant impact on aquatic food webs of subarctic lakes altering the biogeochemical composition of organic matter and organisms through mechanisms of photodegradation, photoinhibition and photoprotection.

## Calculating autoecological data (optima and tolerance range) for multiple species with the 'optimos.prime' R package

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** AUSTRAL ECOLOGY, 2020, 45 (6), 845-850, DOI: 10.1111/aec.12868

**Autori:** Sathicq, MB; Gelis, MMN; Cochero, J

**Abstract ENG:** The calculation of autoecological data, such as optima and tolerance ranges to environmental variables, can be useful to establish the distribution and abundance of the species. These calculations, although mathematically not complex, can be prone to error when using a large database. We show how to calculate the optimum value and tolerance ranges of multiple species to multiple environmental factors in a single run, by weighted average using a specific R package ('optimos.prime'). Using sample data from a phytoplankton database, we exemplify the use of the R package and its functions. A stand-alone version for Windows is also provided, and source code and documents are freely available on GitHub to encourage collaborative work.

## Changes in Planktivory and Herbivory Regimes in a Shallow South American Lake (Lake Blanca Chica, Argentina) Over the Last 250 Years

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** WATER, 2020, 12, 597, DOI: 10.3390/w12020597

**Autori:** Carrozzo, D; Musazzi, S; Lami, A; Cordoba, FE; Sagrario, MDG

**Abstract ENG:** Shallow lakes are vulnerable ecosystems impacted by human activities and climate change. The Cladocera occupy a central role in food webs and are an excellent paleoecological indicator of food web structure and trophic status. We conducted a paleolimnological study in Lake Blanca Chica (Argentina) to detect changes on the planktivory and herbivory regimes over the last 250 years. Generalized additive models were fitted to the time series of fish predation indicators (ephippial abundance and size, mucrone size, fish scales, and the planktivory index) and pheophorbide a concentration. The cladoceran assemblage changed from littoral-benthic to pelagic species dominance and zooplankton switched from large-bodied (Daphnia) to small-bodied grazers (Bosmina) ca. 1900 due to increased predation. The shift in planktivory regime (ca. 1920-1930), indicated by fish scales and the planktivory index, as well as herbivory (ca. 1920-1950), was triggered by eutrophication. Changes in planktivory affected the size structure of Bosmina, reducing its body size. This study describes the baseline for the lake as well as the profound changes in the composition and size structure of the zooplankton community due to increased predation and the shift in the planktivory regime. These findings will provide a reference status for future management strategies of this ecosystem.

## Climate-Water-Ecosystem-Interactions: Insights from Four Continent's Case Studies

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** WATER, 2020,12, 1445, DOI: 10.3390/w12051445

**Autori:** Copetti, D; Salerno, F

**Abstract ENG:** The interaction of climate with aquatic ecosystems is a multidisciplinary field of research involving water quantity and quality issues and having strong socio-economic implications. This special issue hosts 10 studies undertaken in 7 countries of 4 continents: Asia, Africa, Europe, and North America. The issue provides a wide spectrum of natural and artificial case-studies and covers a broad range of climatic conditions. Most of the studies adopted a modelling (50%) or a field (40%) approach and focused on water-quantity (60%), while the remaining were equally subdivided between water-quality and biogeochemistry. Forty percent of the papers directly face climate change. The diversity of approaches and case studies is the main aspect characterizing this special issue. Despite this high diversification, in relation to water-quantity related issues, we can identify the following messages: high attention to extreme meteorological events, drought in particular, even in regions once considered rich in water (e.g., northern Italy); fragility of agricultural and water supply systems in the face of extreme weather events, in particular in low-income countries (e.g., Madagascar); more attention to climate change compared to land cover/use change but importance of natural land cover to efficiently face the incoming climate change, in particular, in agriculture ecosystems. From a water quality biogeochemistry point of view, we can point out: sensitivity of lakes to climate change with the risk of biodiversity loss; need to reduce nutrient loads to mitigate eutrophication related problems, exacerbated by climate change; in particular, reduction of nitrogen loads from agriculture run-off, to reduce N2O emissions in large-shallow Chinese environments.

## Combination of flow cytometry and molecular analysis to monitor the effect of UVC/H2O2 vs UVC/H2O2/Cu-IDS processes on pathogens and antibiotic resistant genes in secondary wastewater effluents

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** WATER RESEARCH, 2020, 184, 116194, DOI: 10.1016/j.watres.2020.116194

**Autori:** Di Cesare, A; De Carluccio, M; Eckert, EM; Fontaneto, D; Fiorentino, A; Corno, G; Prete, P; Cucciniello, R; Proto, A; Rizzo, L

**Abstract ENG:** The efficiency of a new Advanced Oxidation Process (AOP), namely the photo Fenton like process UV-C/H2O2/IDS-Cu, in removing determinants of antibiotic resistance and pathogenic bacteria was compared to a consolidated AOP (namely UV-C/H2O2) in a secondary treated municipal WasteWater (WW). A reductionist experimental laboratory-based approach was applied on real WW and the parameters were collected by an alternative integrated approach using (i) flow cytometry to enumerate bacteria and test for the fitness of the bacterial communities and (ii) molecular analyses to define the community composition (16S rRNA amplicon sequencing) and the abundances of Antibiotic Resistance Genes (ARGs) and of the class 1 integron (intI1 gene) (by quantitative PCR). The same approach was applied also to posttreatment regrowth tests (24 h) to define the potential persistence of the tested parameters. These experiments were performed in both, human pathogens favorable conditions (HPC, in rich medium and 37 degrees C) and in environmental mimicking conditions (EMC, original WW and 20 degrees C). UV-C/H2O2/IDS-Cu process resulted to be more effective than the UV-C/H(2)O(2)in inactivating bacterial cells in the EMC post-treatment regrowth experiments. Both AOPs were efficiently abating potential human pathogenic bacteria and ARGs in the HPC regrowth experiments, although this trend could not be detected in the measurements taken immediately after the disinfection. In comparison with the UV-C/H2O2, the UV-C/H2O2/IDS-Cu process did not apparently offer significant improvements in the abatement of the tested parameters in the WW effluent but, by evaluating the results of the regrowth experiments it was possible to extrapolate more complex trends, suggesting contrasting efficiencies visible only after a few hours. This study offers a detailed view on the abatement efficiency of microbiological/genetic parameters for the UV-C/H2O2/IDS-Cu process, calling for technical adjustments for this very promising technology. At the same time, our results clearly demonstrated the inadequacy of currently applied methodologies in the evaluation of specific parameters (e.g. determinants of antibiotic resistance and pathogenic bacteria) in WW. 

## Contribution of soft-bodied meiofaunal taxa to Italian marine biodiversity

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** EUROPEAN ZOOLOGICAL JOURNAL, 2020, 87 (1), 369-384, DOI: 10.1080/24750263.2020.1786607

**Autori:** Curini-Galletti, M; Artois, T; Di Domenico, M; Fontaneto, D; Jondelius, U; Jorger, KM; Leasi, F; Martinez, A; Norenburg, JL; Sterrer, W; Todaro, MA

**Abstract ENG:** Meiofauna includes an astonishing diversity of organisms, whose census is far from being complete. Most classic ecological studies have focused on hard-bodied Ecdysozoan taxa (notably Copepoda and Nematoda), whose cuticle allows determination at species-level after fixation, rather than soft-bodied, Spiralian taxa, which most often lose any diagnostic feature in fixed samples. Yet, metabarcoding studies have recently revealed a species-richness of soft-bodied taxa comparable, and in cases superior, to that of Copepoda and Nematoda together. However, given objective difficulties inherent to their study, which necessarily has to be performed on living individuals, and their limited utilisation for ecological and applicative research, taxonomic expertise on soft-bodied organisms has declined over the years, and diversity of these phyla in most areas of the world is presently completely unknown. Here we present an expert-based survey of current knowledge on the composition and distribution of soft-bodied meiofaunal taxa in Italy, with special references to the predominantly or exclusively meiobenthic phyla Gastrotricha, Gnathostomulida, Platyhelminthes, Rotifera, Xenacoelomorpha, and macrofaunal taxa with conspicuous meiofaunal representatives (Annelida, Mollusca and Nemertea). A total of 638 described species have been reported from Italian coasts; furthermore, the existence of a large number of undescribed species is mentioned. Knowledge of Annelida, Gastrotricha, and Rotifera appears particularly detailed, placing Italy among the best-known country worldwide. In contrast, knowledge of Platyhelminthes and Xenacoelomorpha appears patchy, and limited to few areas. Sampling effort has been uneven, with most species recorded from the Tyrrhenian Sea, while large sections of the Adriatic and Ionian seas have been poorly explored. Results highlight the role that Marine Biological Stations, notably the Zoological Station Anton Dohrn in Naples, have had in promoting the study of soft-bodied taxa in Italy.

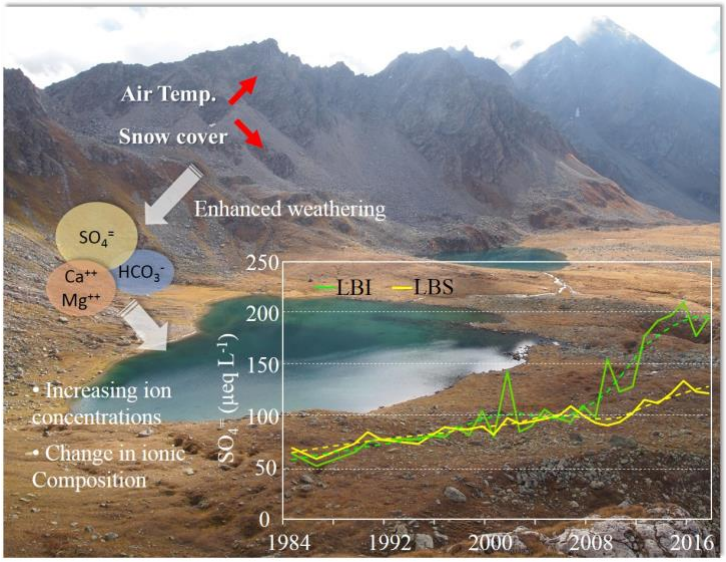
## Decadal trends in water chemistry of Alpine lakes in calcareous catchments driven by climate change

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** SCIENCE OF THE TOTAL ENVIRONMENT, 2020, 708, 135180, DOI: 10.1016/j.scitotenv.2019.135180

**Autori:** Rogora, M; Somaschini, L; Marchetto, A; Mosello, R; Tartari, GA; Paro, L

**Abstract ENG:** High mountain lakes are considered sensitive indicators of the effects of natural and anthropogenic drivers, including atmospheric deposition and climate change. In this study, we assess long-term trends in the chemistry of a group of high altitude lakes in the Western Alps, Italy, lying in bedrock with a relevant presence of basic, soluble rocks. An in-depth investigation was performed on two key-sites (Lakes Boden Inferiore and Superiore) for which continuous chemical data are available for a period of 30 years. A group of 10 additional lakes in the same area was also considered; these lakes were sampled at the end of the ice-free period during irregular surveys in the period 1980-2017. Water samples were analysed for the main chemical variables, including pH, electrical conductivity, major ions ($Ca^{2+}$, $Na^{+}$, $K^{+}$, $HCO_3^{-}$, $Cl^{-}$, $SO_4^{2-}$, $NO_3^{-}$) and algal nutrients (phosphorus and nitrogen compounds, reactive silica). A steep increase in conductivity and ion concentrations was detected at the key-sites: conductivity increased from 40-45 to 60-70 mu S $cm^{-1}$ over the period 1984-2017; sulphate concentrations more than doubled over the same period (from 50-60 to 120-180 mu eq $L^{-1}$) and base cations increased from 400-500 to 600-750 mu eq $L^{-1}$. An increase in the solute content was also detected in the survey lakes (average conductivity from 39 +/- 20 to 57 +/- 23 mu S $cm^{-1}$). The analysis of meteorological data revealed a significant increase of air temperature (0.019 degrees C $y^{-1}$ over the period 1950-2017), mainly in spring and summer (0.033 degrees C $y^{-1}$), and a decrease of snow cover depth and duration. Meteo-climatic drivers were identified as the responsible for the chemical changes occurred in the lakes. Climate-driven effects on weathering rates were mainly indirect and occurred by affecting the flow paths of water at both surface and subsurface level. Cryosphere modification (reduced snow cover and permafrost thawing) also played a role. (C) 2019 Elsevier B.V. All rights reserved.



## Different substrates within a lake harbour connected but specialised microbial communities

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** HYDROBIOLOGIA, 2020, 847, 1689–1704, DOI: 10.1007/s10750-019-04068-1

**Autori:** Eckert, EM; Amalfitano, S; Di Cesare, A; Manzari, C; Corno, G; Fontaneto, D

**Abstract ENG:** Natural water bodies contain physically interconnected habitats suitable for microbes, such as different water layers and substrates for biofilms. Yet, little is known on the extent to which microbial communities are shared between such habitats and whether differences and similarities are consistent between sites. Here we explicitly tested hypotheses on similarities between aquatic bacterial communities found floating in water, in association with daphnids and with copepods, within bottom sediments, and on littoral stones of a lake. Through high-throughput 16S rDNA amplicon sequencing, distinguishable patterns were retrieved between habitats. In particular, community composition was more similar between the two zooplankton taxa, between the two water depths, and was rather different in sediments, where a large fraction of the total diversity was present. Most bacterial taxa were restricted to one or few habitats, whereas only few were found as generalists on different habitats. Our results indicate a limited role of source-sink dynamics between habitats for aquatic bacteria. Similarly to patterns of diversity in larger organisms, community composition was different between habitats, potentially because of specific mechanisms creating and maintaining habitat filtering.

## Early growing-season precipitation drives radial growth of alpine juniper shrubs in the central Himalayas

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** GEOGRAFISKA ANNALER SERIES A-PHYSICAL GEOGRAPHY, 2020, 102 (3), 317-330, DOI: 10.1080/04353676.2020.1761097

**Autori:** Pandey, J; Sigdel, SR; Lu, XM; Salerno, F; Dawadi, B; Liang, E; Camarero, JJ

**Abstract ENG:** Shrubs growing at higher latitudes and altitudes are considered to be highly sensitive to climate warming. In particular, alpine shrubs are potential climate proxies for understanding responses of high-elevation treeless ecosystems to warmer conditions. However, little is known about how alpine shrub radial growth responds to climate variables, specifically temperature and precipitation. This lack of knowledge is particularly notable in the Himalayas where shrubs reach some of their worldwide uppermost limits. Herein, we investigated the climatic response of alpine juniper shrub (Juniperus indica) to climate in two areas (dry Manang valley; wet Everest valley) situated in the central Himalayas. In spite of different sites and elevations, the radial growth of juniper shrub is positively correlated with spring precipitation in both areas, and also with summer precipitation in the dry area. Juniper shrub shares common climatic responses with Himalayan treeline tree populations, whose growth dynamics are also controlled by moisture availability. Thus, radial growth of juniper in the central Himalayas may experience drought stress if climate warming leads to drier conditions. We conclude that alpine shrubs are crucial indicators of the responses of alpine ecosystem to global climate warming.

## Effect of pollution on early diatom colonisation on artificial substrata in urban lowland streams

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** MARINE AND FRESHWATER RESEARCH, 2020, 72 (3), 365-375, DOI: 10.1071/MF19293

**Autori:** Gelis, MMN; Cochero, J; Sathicq, MB; Gomez, N

**Abstract ENG:** The colonisation patterns of diatom assemblages were studied on artificial substrates in lowland streams with different urban pollution levels. Density, diversity, colonisation rates, ecological guilds and cell size classes of the assemblage at each of two sites were followed for 1 week. In addition, assemblages growing on glass, in natural epipelic biofilm and in water were compared at each site. At both sites, diatom colonisation on glass substrates had already started after 30-min exposure. At the less polluted site, total diatom density was higher, along with the proportion of low-profile and motile species, and there was a higher amount of diatoms in size class 5 (>1500 mu m(3)). At the more polluted site, species from the high-profile guild and size class 3 (300-599 mu m(3)) dominated. Ecological traits (ecological guilds and size class) were not sensitive enough descriptors of early colonisation in nutrient-rich lowland, but the largest cells constituted the first settlers. The results show that the assemblage developed on artificial substrata was a good proxy of the composition in the sediment.

## Effects of climate and land-use changes on fish catches across lakes at a global scale

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** NATURE COMMUNICATIONS, 2020, 11 (1), DOI: 10.1038/s41467-020-14624-2

**Autori:** Kao, YC; Rogers, MW; Bunnell, DB; Cowx, IG; Qian, SS; Anneville, O; Beard, TD; Brinker, A; Britton, JR; Chura-Cruz, R; Gownaris, NJ; Jackson, JR; Kangur, K; Kolding, J; Lukin, AA; Lynch, AJ; Mercado-Silva, N; Moncayo-Estrada, R; Njaya, FJ; Ostrovsky, I; Rudstam, LG; Sandstrom, ALE; Sato, Y; Siguayro-Mamani, H; Thorpe, A; van Zwieten, PAM; Volta, P; Wang, YY; Weiperth, A; Weyl, OLF; Young, JD

**Abstract ENG:** Globally, our knowledge on lake fisheries is still limited despite their importance to food security and livelihoods. Here we show that fish catches can respond either positively or negatively to climate and land-use changes, by analyzing time-series data (1970-2014) for 31 lakes across five continents. We find that effects of a climate or land-use driver (e.g., air temperature) on lake environment could be relatively consistent in directions, but consequential changes in a lake-environmental factor (e.g., water temperature) could result in either increases or decreases in fish catch in a given lake. A subsequent correlation analysis indicates that reductions in fish catch was less likely to occur in response to potential climate and land-use changes if a lake is located in a region with greater access to clean water. This finding suggests that adequate investments for water-quality protection and water-use efficiency can provide additional benefits to lake fisheries and food security. Lake fisheries are vulnerable to environmental changes. Here, Kao et al. develop a Bayesian networks model to analyze time-series data from 31 major fisheries lake across five continents, showing that fish catches can respond either positively or negatively to climate and land-use changes.

## Embryo/larval toxicity and transcriptional effects in zebrafish (*Danio rerio*) exposed to endocrine active riverbed sediments

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH, 2020, 27, 10729–10747, DOI: 10.1007/s11356-019-07417-8

**Autori:** Viganò, L; Casatta, N; Farkas, A; Mascolo, G; Roscioli, C; Stefani, F; Vitelli, M; Olivo, F; Clerici, L; Robles, P; Dellavedova, P

**Abstract ENG:** Sediment toxicity plays a fundamental role in the health of inland fish communities; however, the assessment of the hazard potential of contaminated sediments is not a common objective in environmental diagnostics or remediation. This study examined the potential of transcriptional endpoints investigated in zebrafish (*Danio rerio*) exposed to riverbed sediments in ecotoxicity testing. Embryo-larval 10-day tests were conducted on sediment samples collected from five sites (one upstream and four downstream of the city of Milan) along a polluted tributary of the Po River, the Lambro River. Sediment chemistry showed a progressive downstream deterioration in river quality, so that the final sampling site showed up to eight times higher concentrations of, for example, triclosan, galaxolide, PAH, PCB, BPA, Ni, and Pb, compared with the uppermost site. The embryo/larval tests showed widespread toxicity although the middle river sections evidenced worse effects, as evidenced by delayed embryo development, hatching rate, larval survival, and growth. At the mRNA transcript level, the genes encoding biotransformation enzymes (*cyp1a, gst, ugt*) showed increasing upregulations after exposure to sediment from further downstream sites. The genes involved in antioxidant responses (*sod, gpx*) suggested that more critical conditions may be present at downstream sites, but even upstream of Milan there seemed to be some level of oxidative stress. Indirect evidences of potential apoptotic activity (*bcl2/bax* < 1) in turn suggested the possibility of genotoxic effects. The genes encoding for estrogen receptors (*erα*, *erβ1*, *erβ2*) showed exposure to (xeno)estrogens with a progressive increase after exposure to sediments from downstream sites, paralleled by a corresponding downregulation of the *ar* gene, likely related to antiandrogenic compounds. Multiple levels of thyroid disruption were also evident particularly in downstream zebrafish, as for thyroid growth (*nkx2.1*), hormone synthesis and transport (*tg, ttr, d2*), and signal transduction (*trα*, *trβ*). The inhibition of the *igf2* gene reasonably reflected larval growth inhibitions. Although none of the sediment chemicals could singly explain fish responses, principal component analysis suggested a good correlation between gene transcripts and the overall trend of contamination. Thus, the combined impacts from known and unknown covarying chemicals were proposed as the most probable explanation of fish responses. In summary, transcriptional endpoints applied to zebrafish embryo/larval test can provide sensitive, comprehensive, and timeliness information which may greatly enable the assessment of the hazard potential of sediments to fish, complementing morphological endpoints and being potentially predictive of longer studies.

## Energy-based top-down and bottom-up relationships between fish community energy demand or production and phytoplankton across lakes at a continental scale

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** LIMNOLOGY AND OCEANOGRAPHY, 2020, 65 (4), 892-902, DOI: 10.1002/lno.11434

**Autori:** Bartrons, M; Mehner, T; Argillier, C; Beklioglu, M; Blabolil, P; Hesthagen, T; Sweden, KH; Jeppesen, E; Krause, T; Podgornik, S; Volta, P; Winfield, IJ; Brucet, S

**Abstract ENG:** Fish community feeding and production rates may differ between lakes despite similar fish biomass levels because of differences in size structure and local temperature. Therefore, across-lake comparisons of the strength and direction of top-down and bottom-up fish-phytoplankton relationships should consider these factors. We used the metabolic theory of ecology to calculate size- and temperature-corrected community energy demand (CEDom) and community production (CP) of omnivorous fishes in 227 European lakes from major habitat types (MHTs) of polar freshwaters, temperate floodplain rivers and wetlands, and temperate coastal rivers. We related CEDom with total phosphorus (TP)-corrected chlorophyll a (Chl a) concentrations to evaluate a potential top-down directed trophic cascade from fish to phytoplankton. Furthermore, we related Chl a with CP to demonstrate potential bottom-up effects of phytoplankton on fish. For both analyses, we added the CED of piscivorous fishes (CEDpi) as a predictor to account for potential predation effects on the omnivorous fish community. CEDom was weakly positively related with TP-corrected Chl a, but the strength of the relationship differed between MHTs. In contrast, CP was consistently positively related with Chl a in the entire dataset. CEDpi did not contribute to top-down or bottom-up relationships. The application of metabolic variables characterizing fish community feeding and production rates makes these results robust because the approach accounted for the usually neglected effects of fish size and temperature in across-lake comparisons. Our results suggest that bottom-up effects from phytoplankton on fish secondary production in lakes are substantially stronger than top-down effects from fish on phytoplankton biomass.

## Evaluation of the Egg Bank of Two Small Himalayan Lakes

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** WATER, 2020, 12, 491, DOI: 10.3390/w12020491

**Autori:** Piscia, R; Bovio, S; Manca, M; Lami, A; Guilizzoni, P

**Abstract ENG:** High mountain lakes are biodiversity treasures. They host endemic taxa, adapted to live in extreme environments. Among adaptations, production of diapausing eggs allows for overcoming the cold season. These diapausing eggs can rest in the sediments, providing a biotic reservoir known as an egg bank. Here, we estimated changes in abundance of the egg bank in two lakes in the Khumbu Region of the Himalayas, during the last ca. 1100 and 500 years, respectively, by analyzing two sediment cores. We tested viability of the diapausing eggs extracted from different layers of the sediment cores under laboratory conditions. We found that only diapausing eggs of the Monogont rotifer Hexarthra bulgarica nepalensis were able to hatch, thus suggesting that a permanent egg bank is lacking for the other taxa of the lakes, not least for the two Daphnia species described from these sites. Our results confirm previous studies suggesting that in high mountain lakes, the production of diapausing is mainly devoted to seasonal recruitment, therefore leading to a nonpermanent egg bank. The different ability of different taxa to leave viable diapausing eggs in the sediments of high mountain lakes therefore poses serious constraints to capability of buffering risk of biodiversity loss in these extremely fragile environments.

## Every fifth published metagenome is not available to science

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** PLOS BIOLOGY, 2020, 18, 4, e3000698, DOI: 10.1371/journal.pbio.3000698

**Autori:** Eckert, EM; Di Cesare, A; Fontaneto, D; Berendonk, TU; Burgmann, H; Cytryn, E; Fatta-Kassinos, D; Franzetti, A; Larsson, DGJ; Manaia, CM; Pruden, A; Singer, AC; Udikovic-Kolic, N; Corno, G

**Abstract ENG:** Have you ever sought to use metagenomic DNA sequences reported in scientific publications? Were you successful? Here, we reveal that metagenomes from no fewer than 20% of the papers found in our literature search, published between 2016 and 2019, were not deposited in a repository or were simply inaccessible. The proportion of inaccessible data within the literature has been increasing year-on-year. Noncompliance with Open Data is best predicted by the scientific discipline of the journal. The number of citations, journal type (e.g., Open Access or subscription journals), and publisher are not good predictors of data accessibility. However, many publications in high-impact factor journals do display a higher likelihood of accessible metagenomic data sets. Twenty-first century science demands compliance with the ethical standard of data sharing of metagenomes and DNA sequence data more broadly. Data accessibility must become one of the routine and mandatory components of manuscript submissions-a requirement that should be applicable across the increasing number of disciplines using metagenomics. Compliance must be ensured and reinforced by funders, publishers, editors, reviewers, and, ultimately, the authors.

## Food Web Complexity of High Mountain Lakes is Largely Affected by Glacial Retreat

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** ECOSYSTEMS, 2020, 23, 1093–1106, DOI: 10.1007/s10021-019-00457-8

**Autori:** Tiberti, R; Buscaglia, F; Callieri, C; Rogora, M; Tartari, G; Sommaruga, R

**Abstract ENG:** High mountain lakes provide essential ecosystem services and have a high conservation value. Therefore, understanding how glacier retreat will affect their ecological functioning and water quality is crucial. Here, we tested how shallow high mountain lakes having different glacial influences differ in their abiotic main features and food web structure using a multiple ecological indicator approach. We identified 13 functional groups within the planktonic and littoral communities, each one representing a biotic indicator and a node in a simplified food web network. The abiotic environment and most functional groups differed significantly as a consequence of the glacial influence. In general, runoff from glacial meltwaters resulted in highly simplified food webs. Considering that many turbid glacially fed lakes are losing their hydrological connection with disappearing/retreating glaciers and shifting to a clear state, our results suggest that this shift could enhance food web complexity, but at the cost of losing specific habitats. Further, retreat of large glaciers will form new glacially fed lakes, but it remains unclear whether this will buffer the expected habitat and biodiversity loss.

## Functional response of fish communities in a multistressed freshwater world

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** SCIENCE OF THE TOTAL ENVIRONMENT, 2020, 740, 139902, DOI: 10.1016/j.scitotenv.2020.139902

**Autori:** Stefani, F; Schiavon, A; Tirozzi, P; Gomarasca, S; Marziali, L

**Abstract ENG:** Freshwater fish communities are impacted by multiple pressures, determining loss of functional diversity and redundancy. Our aim was to disentangle the roles and relevancies of different pressures in shaping fish communities in small streams of the Po plain (North Italy). Long term trend (1998-2018) of functional diversity of 31 fish communities was assessed and modeled in respect to three potential pressures: temperature increase, intensity of exotic fish invasion, and habitat quality degradation. Ecological traits mostly influenced by the pressures were also identified. Reduction of functional richness mostly due to local extinction or contraction of cold adapted predators, such as salmonids, was linked to increasing temperatures. Warming probably also led to a shift of generalist and dominant species, which became more abundant in streams hosting mixed communities of salmonids and cyprinids, and determined the increase of functional dispersion and uniqueness. Reduction of functional redundancy and increasing functional dispersion were both also related to the introduction of new ecological traits brought by expanding exotic species. Low functional overlap was found among native and exotic species, indicating that the invasion process was mainly controlled by competitive interactions and/or resource opportunism. Functional response to habitat quality was not clearly evident. In conclusion, the impact of temperature increase and exotic species on fish functional diversity was effective, idiosyncratic and mediated by the scale of analysis and by the intensity of pressures. 

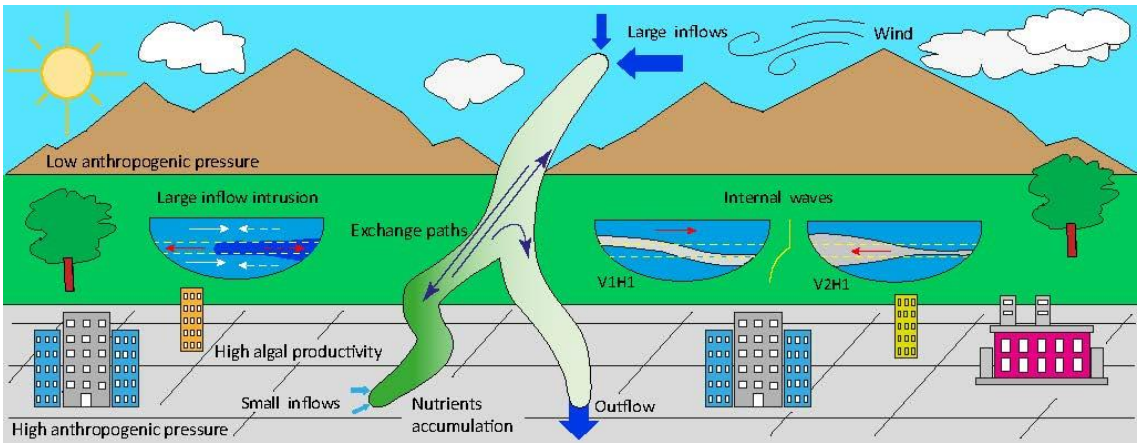
## Generation and dispersion of chemical and biological gradients in a large-deep multi-basin lake (Lake Como, north Italy): The joint effect of external drivers and internal wave motions

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** SCIENCE OF THE TOTAL ENVIRONMENT, 2020, 749, 141587, DOI: 10.1016/j.scitotenv.2020.141587

**Autori:** Copetti, D; Guyennon, N; Buzzi, F

**Abstract ENG:** The formation of chemical and biological heterogeneity in lakes can be favored by physical and morphometric constrains. This study describes the results of four whole-lake field campaigns carried out in Lake Como (north Italy) during thermal stratification. The aim was to analyze the distribution of chemical-biological variables in a multi-basin lake as a result of internal and external physical drivers and constrains. Lake Como has a y-like shape encompassing three main sub-basins: northern, south-eastern, and south-western. Field data underlined: the presence of chemical-biological gradients between the south-western basin and the rest of the lake and the propagation of a fresher water-plume (formed by the two main northern inflows) into the northern basin and then into the south-westem closed arm. The use of a three-dimensional hydrodynamic model showed a periodic movement of this plume that tends to enter the south-western basin first and then to return toward north, moving forward and back through the junction of the three arms. The entrance into the eastern basin, instead, occurs only secondarily. Wavelet transform analysis revealed common periodicity between the plume movement and the action of different external and internal lake-stressors, including: the discharge of the main inflow (period centered at 1, 3.3, and 6.5 day), the wind intensity (0.5 and 1 day) and the two main basin-scale internal wave motions: (3.3 day and 7.1 day).The periodic movement of the fresher water-plume enhances the water exchange and reduces the chemical-biological gradients between the westem closed basin and the main lake, playing a crucial role in distributing both inorganic and organic materials at the lake basin-scale. (C) 2020 Elsevier B.V. All rights reserved.



## Genomic Comparison and Spatial Distribution of DifferentSynechococcusPhylotypes in the Black Sea

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** FRONTIERS IN MICROBIOLOGY, 2020, 11, 1979, DOI: 10.3389/fmicb.2020.01979

**Autori:** Di Cesare, A; Dzhembekova, N; Cabello-Yeves, PJ; Eckert, EM; Slabakova, V; Slabakova, N; Peneva, E; Bertoni, R; Corno, G; Salcher, MM; Kamburska, L; Bertoni, F; Rodriguez-Valera, F; Moncheva, S; Callieri, C

**Abstract ENG:** Picocyanobacteria of the genusSynechococcusare major contributors to global primary production and nutrient cycles due to their oxygenic photoautotrophy, their abundance, and the extensive distribution made possible by their wide-ranging biochemical capabilities. The recent recovery and isolation of strains from the deep euxinic waters of the Black Sea encouraged us to expand our analysis of their adaptability also beyond the photic zone of aquatic environments. To this end, we quantified the total abundance and distribution ofSynechococcusalong the whole vertical profile of the Black Sea by flow cytometry, and analyzed the data obtained in light of key environmental factors. Furthermore, we designed phylotype-specific primers using the genomes of two new epipelagic coastal strains - first described here - and of two previously described mesopelagic strains, analyzed their presence/abundance by qPCR, and tested this parameter also in metagenomes from two stations at different depths. Together, whole genome sequencing, metagenomics and qPCR techniques provide us with a higher resolution ofSynechococcusdynamics in the Black Sea. Both phylotypes analyzed are abundant and successful in epipelagic coastal waters; but while the newly described epipelagic strains are specifically adapted to this environment, the strains previously isolated in mesopelagic waters are able, in low numbers, to withstand the aphotic and oxygen depleted conditions of deep layers. This heterogeneity allows differentSynechococcusphylotypes to occupy different niches and underscores the importance of a more detailed characterization of the abundance, distribution, and dynamics of individual populations of these picocyanobacteria.

## Human access impacts biodiversity of microscopic animals in sandy beaches

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** COMMUNICATIONS BIOLOGY, 2020, 3, 175, DOI: 10.1038/s42003-020-0912-6

**Autori:** Martinez, A; Eckert, EM; Artois, T; Careddu, G; Casu, M; Curini-Galletti, M; Gazale, V; Gobert, S; Ivanenko, VN; Jondelius, U; Marzano, M; Pesole, G; Zanello, A; Todaro, MA; Fontaneto, D

**Abstract ENG:** Whereas most work to understand impacts of humans on biodiversity on coastal areas has focused on large, conspicuous organisms, we highlight effects of tourist access on the diversity of microscopic marine animals (meiofauna). We used a DNA metabarcoding approach with an iterative and phylogeny-based approach for the taxonomic assignment of meiofauna and relate diversity patterns to the numbers of tourists accessing sandy beaches on an otherwise un-impacted island National Park. Tourist frequentation, independently of differences in sediment granulometry, beach length, and other potential confounding factors, affected meiofaunal diversity in the shallow swash zone right at the mean water mark; the impacts declined with water depth (up to 2 m). The indicated negative effect on meiofauna may have a consequence on all the biota including the higher trophic levels. Thus, we claim that it is important to consider restricting access to beaches in touristic areas, in order to preserve biodiversity. Martinez et al. use DNA metabarcoding and a phylogeny-based approach to demonstrate the effects of tourist access on meiofauna diversity of beaches in Asinara National Park. Their results show that tourist frequentation decreases meiofaunal diversity at the shallow swash zone, and can be used to inform tourist access and management of beaches.

## Impact of disinfection processes on bacterial community in urban wastewater: Should we rethink microbial assessment methods?

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** JOURNAL OF ENVIRONMENTAL CHEMICAL ENGINEERING, 2020, 8 (5), 104393, DOI: 10.1016/j.jece.2020.104393

**Autori:** Di Cesare, A; Corno, G; Manaia, CM; Rizzo, L

**Abstract ENG:** The development of new methods and technologies for microbial characterization as well as their increasing availability at more affordable costs, has made evident the limitations of the conventional and routinely applied (typically cultivation based) methods to exhaustively and fully characterize the actual effect of disinfection process in urban wastewater treatment plants (UWWTPs). Such problem is even more relevant and of concern if microbial challenges, such as the occurrence of pathogens as well as the spread of antibiotic resistance, are taken into account. Such threats move scientists to investigate new and more effective disinfection processes from one side and new methods, techniques and approaches to characterize disinfection process efficiency from the other side. In this opinion paper, the limitations of routine detection methods are discussed according to the relevant and updated scientific literature to explain how research oriented methods and technologies (namely, quantitative real-time PCR, flow cytometry, metagenetics and metagenomics) can allow a better evaluation of disinfection processes. After a short introduction to the main disinfection processes, the application of different microbial characterization methods is discussed according to distinct challenges, such as pathogens inactivation or antibiotic resistance dissemination, when wastewater safety is of concern (for example in reuse scenarios). The routine and research oriented techniques can be successfully used in complementary way to evaluate disinfection process efficiency. Recommendations for UWWTPs managers for internal control of disinfection process are proposed.

## Inferring the occurrence of regime shifts in a shallow lake during the last 250 years based on multiple indicators

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** ECOLOGICAL INDICATORS, 2020, 117, 106536, DOI: 10.1016/j.ecolind.2020.106536

**Autori:** Sagrario, MDG; Musazzi, S; Cordoba, FE; Mendiolar, M; Lami, A

**Abstract ENG:** Regime shifts are ecosystem-scale phenomena. In lake studies, most supporting evidence is frequently based on a single state variable. We examined the sediment record of the shallow lake Blanca Chica (Argentina) to explore the response of multiple proxies belonging to different trophic levels (nutrients, chlorophyll and carotenoid pigments, diatoms, Cladocera remains, and Rotifera resting eggs) over the last 250 yr. We explored different ecological indicators to assess changes consistent with regime shifts. To do so, first we identified the timing of transitional periods on multiple-proxies. Then, we explored (1) the nature of the change (linear versus non-linear dynamics), (2) different indicators of a shift across the food web: multimodality and resilience indicators (standard deviation and autocorrelation), and (3) examined the synchronicity of the detected indicators at multiple-trophic levels. Generalized additive models fitted to the ordination scores of the assemblages analyzed revealed two transitions: ca. 1860-1900, and 1915-1990. Ecological indicators of regime shifts revealed that the first transition is consistent with a threshold state response (change in the ecosystem state manifest as a jump when the driver exceeds a state threshold), and the second one with a critical transition (hysteretic transition in which the system change to an alternate stable state). After the first transition lake structure shifted from littoral to pelagic species dominance (evidenced by Cladocera and diatom assemblages), and turbidity increased, in-dicating a rise in lake water level. This transition was non-linear, showed multimodality, and is most likely driven by an increase in precipitation registered in the region since 1870. During the second transition, nutrient levels rose, all indicators showed multimodality, non-linear dynamics and an increase in standard deviation prior to the regime shift. These dynamics are consistent with a critical transition in response to eutrophication, and coincides with a post-1920 change in land use. Our results show that several ecological indicators of regime shifts need to be examined to perform an accurate diagnosis. We highlight the relevance of a multi-proxy ap-proach including multiple-trophic level responses as the appropriate scale of analysis to determine the occur-rence, type and dynamics of regime shifts. We also show that resilience indicators and critical transitions can be detectable in the whole food web and that shallow lakes can undergo different types of regime shifts.

## Late-Holocene variability in chironomid functional assemblages and carbon utilization in a tundra lake food web

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** HYDROBIOLOGIA, 2020, 847, 895–911, DOI: 10.1007/s10750-019-04151-7

**Autori:** Kivil, EH; Luoto, TP; Rantala, MV; Nevalainen, L

**Abstract ENG:** High latitude freshwater systems are facing changes in catchment-mediated allochthonous input, as well as physical and chemical controls triggered by on-going climate change, which may alter their carbon processing and ecological characteristics. To explore changes in chironomid functional responses and carbon utilization in relation to long-term environmental change, we studied a sediment core covering ca. 2000 years from a tundra lake in northern Finland, which was analysed for sediment geochemistry, isotopic composition of chironomid remains and their functional assemblages. We aimed to relate changes in chironomid functional feeding assemblages and resource utilization, based on Bayesian stable isotope modelling, and determined that the long-term resource utilization was more controlled by sediment geochemistry (resource availability) and climatic variables, reflecting changes in habitat and lake ontogeny, rather than the functional feeding assemblage composition. Change horizons were observed for both sediment geochemistry and functional assemblage composition. However, different timing of these changes suggests different drivers affecting the dynamics of primary production and chironomid community functionality. We also compared the recent warming period to Medieval Climate Anomaly (MCA), observing divergent patterns, which suggests that MCA may not be a good analogue for changes induced by on-going climate warming.

## Long-term effects of fish biomanipulation and macrophyte management on zooplankton functional diversity and production in a temperate shallow lake

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** LIMNOLOGY, 2020, 21, 305–317, DOI: 10.1007/s10201-020-00617-z

**Autori:** Setubal, RB; Riccardi, N

**Abstract ENG:** Eutrophication still is one of the greatest anthropogenic impacts affecting aquatic ecosystems. Food web manipulations to reverse eutrophic conditions have been applied, mainly by reducing fish stocks. However, the long-term results of biomanipulation are still ambiguous. The objective of this study was to evaluate biomanipulation effects on zooplankton functional diversity and production during 24 years of monitoring a shallow temperate lake. Temporal variation in crustacean biomass (CB), zooplankton resource use efficiency (RUE), limnological variables, functional diversity indices and functional traits were assessed using the Mann-Kendall test. The effects of the limnological and functional variables on zooplankton production (CB and RUE) were analyzed by generalized least squares models (GLSs). We found decreasing trends for almost all the limnological variables, indicating a reduction in lake eutrophic conditions. We also observed a decreasing trend in functional traits related to pelagic habitat, filter-feeding mode, herbivore feeding preference and body size. The GLS results showed that functional dispersion and chlorophyll a are important determinants of zooplankton production. The effects of fish biomanipulation produced no significant temporal trends in zooplankton biomass. In fact, the increase in submerged macrophytes promoted littoral food webs, which was likely the main determining factor of the changes in zooplankton functional traits and production.

## Macroinvertebrate metrics responses to morphological alteration in Italian rivers

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** HYDROBIOLOGIA, 2020, 847, 2169–2191, DOI: 10.1007/s10750-020-04242-w

**Autori:** Erba, S; Cazzola, M; Belfiore, C; Buffagni, A

**Abstract ENG:** The responses of river macroinvertebrates to hydromorphological alteration are often considered weak or unclear. It is therefore crucial to verify if and how existing invertebrate-based approaches can reveal the effects of hydromorphological modification. We analyzed the responses of benthic metrics to morphological impairment, with emphasis on the STAR_ICM index, legally required for macroinvertebrate-based ecological status assessment in Italy. A Principal Component Analysis (PCA) was run to condense information on morphological impairment. The major gradient (Component 1) expressed a combination of bank and channel modifications opposed to tree-related features indicating the presence of comparatively unmodified habitats. Jointly, habitat descriptors including Habitat Modification Score (HMS) derived from the application of a habitat survey method were calculated. Spearman rank correlations between biological metrics and morphological impairment indicators (PCA scores and HMS) were significant. A linear mixed-effects regression approach was applied to relate HMS and STAR_ICMi across a wide geographical context. HMS explained > 60% of STAR_ICMi variability, in the absence of apparent water pollution. Results demonstrated that morphological information resumed with habitat survey methods is meaningful for the biological community and that HMS can support the interpretation of ecological status across rivers' types and in different environmental settings.

## Meiofauna as a model to test paradigms of ecological metacommunity theory

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** HYDROBIOLOGIA, 2020, 847, 2645–2663, DOI: 10.1007/s10750-020-04185-2

**Autori:** Gansfort, B; Fontaneto, D; Zhai, M

**Abstract ENG:** The metacommunity concept incorporates spatial dynamics into community ecology, shedding light on how local and regional processes interact in structuring ecological communities, and to which measure they are deterministic or stochastic. We reviewed metacommunity studies on freshwater meiobenthos published since 2004, when the main principles of metacommunity theory were conceptualized. The studies (together 19) were observational, focused mainly on ostracods, and rarely on rotifers and nematodes. In accordance with general expectations, the prevalent structuring force was species sorting. Ostracods showed more dispersal limitations than nematodes and rotifers, and there was very little support for dispersal surplus. We discussed the role of body size, dispersal mode, and attachment to sediment for the meiofauna dispersal. Effects of metacommunity context (habitat connectivity, spatial extent, and environmental heterogeneity), study design (e.g., sample size), and statistical approach could not be sufficiently disentangled due to the low number of studies. Local stochasticity, consistent with neutral theory and patch dynamics, was indicated for taxa with weak specialization and metacommunities in small habitats. Our understanding of meiofaunal metacommunities is only fragmentary and it would highly benefit from direct comparisons of taxa with different species traits and between different spatial scales, and studies incorporating temporal dynamics and hypothesis-driven experiments.

## Microcondylaea bonellii as a new host for the European bitterling Rhodeus amarus

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** KNOWLEDGE AND MANAGEMENT OF AQUATIC ECOSYSTEMS, 2020, 421, 4, DOI: 10.1051/kmae/2019047

**Autori:** Sousa, R; Bogan, AE; Goncalves, DV; Lajtner, J; Prie, V; Riccardi, N; Shumka, S; Teixeira, A; Urbanska, M; Varandas, S; Lopes-Lima, M

**Abstract ENG:** We report for the first time that the freshwater mussel Microcondylaea bonellii (Ferussac, 1827) functions as a suitable host for the European bitterling Rhodeus amarus (Bloch, 1782). Given the recent expansion of R. amarus in Europe, the possible physiological cost (e.g. competition for oxygen, reduction in water circulation, and consequent impairment of filter-feeding) of this interaction may further affect the already poor conservation status of M. bonellii populations.

## Microplastic Contamination in Freshwater Environments: A Review, Focusing on Interactions with Sediments and Benthic Organisms

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** ENVIRONMENTS, 2020, 7, 30, DOI: 10.3390/environments7040030

**Autori:** Bellasi, A; Binda, G; Pozzi, A; Galafassi, S; Volta, P; Bettinetti, R

**Abstract ITA:** La plastica è uno dei materiali più comunemente prodotti e utilizzati al mondo grazie alle sue eccezionali proprietà. Tuttavia, il vasto utilizzo e la cattiva gestione dei rifiuti hanno portato alla sua diffusione in tutti gli ambienti, con impatti negativi sugli ecosistemi. La degradazione della plastica nell'ambiente porta alla generazione di particelle di dimensioni inferiori a5 mm, che vengono definite microplastiche (MP). Queste rappresentano una preoccupazione globale a causa della loro ampia dispersione negli ambienti acquatici e dei potenziali effetti ecotossicologici, ancora non chiari. Sono stati condotti diversi studi con l'obiettivo di valutare la presenza e gli impatti delle MP nell'ambiente marino. Tuttavia, la presenza di MP nei sistemi di acqua dolce è ancora scarsamente studiata. Lo scopo di questa pubblicazione è quello di identificare i principali aspetti riguardanti le fonti di inquinamento da MP in laghi e fiumi. Verrà data particolare attenzione ai sedimenti di acqua dolce perchè sito di accumulo e habitat degli organismi bentonici, componenti chiave delle catene trofiche che svolgono un ruolo fondamentale nei processi di trasferimento di energia e di contaminanti, ma ancora scarsamente considerati negli studi sulle MP. Attraverso questa revisione, vengono analizzate le fonti e il destino delle MP in acqua dolce, vengono riassunti studi ecotossicologici incentrati sui sedimenti e sulla fauna bentonica, vengono riportate le strategie di campionamento e analisi più frequentemente utilizzate e vengono proposte accorgimenti per i futuri studi sulle MP in questo campo.

**Abstract ENG:** Plastic is one of the most commonly produced and used materials in the world due to its outstanding features. However, the worldwide use of plastics and poor waste management have led to negative impacts on ecosystems. Plastic degradation in the environment leads to the generation of plastic particles with a size of <5 mm, which are defined as microplastics (MPs). These represent a global concern due to their wide dispersion in water environments and unclear potential ecotoxicological effects. Different studies have been performed with the aim of evaluating the presence and impacts of MPs in the marine environment. However, the presence of MPs in freshwater systems is still poorly investigated, making data retrieval a difficult task. The purpose of this review is to identify the main aspects concerning MPs pollution sources in lakes and rivers, with a focus on freshwater sediments as a site of accumulation and as the habitat of benthic organisms, which are key components of food webs and play a fundamental role in energy/contaminant transfer processes, but are still poorly considered. Through this review, the sources and fate of MPs in freshwater are analysed, ecotoxicological studies focused on sediments and benthic fauna are exposed, the most frequently used sampling and analysis strategies are reported, and future trends of MPs analysis in this field are proposed.

## Mountain lakes of Mont Avic Natural Park: ecological features and conservation issues

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** JOURNAL OF LIMNOLOGY, 2020, 79 (1), 43-58, DOI: 10.4081/jlimnol.2019.1923

**Autori:** Tiberti, R; Buscaglia, F; Armodi, M; Callieri, C; Ribelli, F; Rogora, M; Tartari, G; Bocca, M

**Abstract ENG:** Mountain lakes provide some fundamental ecosystem services (i.e., water supply for drinking and energy production) and have an enormous aesthetic and conservation value. Ecological knowledge on mountain lakes, however, is still scarce and limited to a few geographical areas and mainly to abiotic features. To fill this gap, a limnological campaign was carried out on 19 lakes of the Mont Avic Natural Park (Aosta, Western Italian Alps). Bathymetric maps of the lakes are provided in this paper, as is data on the lakes' physical properties, chemistry, nano- and pico-plankton, zooplankton, littoral macroinvertebrates, amphibians and introduced fish. The aim of this study was to create a reference database of ecological data for the development of new studies and conservation measures/actions. To this end, ecological data are discussed from both a limnological and a conservation perspective, allowing for the identification of major threats affecting the lakes in the protected area. Despite local threats which include water exploitation, organic pollution, and introduced fish, water quality was good. Lake biota can however be affected by such threats, in particular introduced fish (Salmonidae and Cyprinidae), representing a challenging conservation problem.

## Nitrogen deposition is the most important environmental driver of growth of pure, even-aged and managed European forests

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**Riferimento rivista con DOI:** FOREST ECOLOGY AND MANAGEMENT, 2020, 458, 117762, DOI: 10.1016/j.foreco.2019.117762

**Autori:** Etzold, S; Ferretti, M; Reinds, GJ; Solberg, S; Gessler, A; Waldner, P; Schaub, M; Simpson, D; Benham, S; Hansen, K; Ingerslev, M; Jonard, M; Karlsson, PE; Lindroos, AJ; Marchetto, A; Manninger, M; Meesenburg, H; Merila, P; Nojd, P; Rautio, P; Sanders, TGM; Seidling, W; Skudnik, M; Thimonier, A; Verstraeten, A; Vesterdal, L; Vejpustkova, M; de Vries, W

**Abstract ENG:** Changing environmental conditions may substantially interact with site quality and forest stand characteristics, and impact forest growth and carbon sequestration. Understanding the impact of the various drivers of forest growth is therefore critical to predict how forest ecosystems can respond to climate change. We conducted a continental-scale analysis of recent (1995-2010) forest volume increment data (Delta Vol, $m^3$ $ha^{-1}$ $yr^{-1}$), obtained from ca. 100,000 coniferous and broadleaved trees in 442 even-aged, single-species stands across 23 European countries. We used multivariate statistical approaches, such as mixed effects models and structural equation modelling to investigate how European forest growth respond to changes in 11 predictors, including stand characteristics, climate conditions, air and site quality, as well as their interactions. We found that, despite the large environmental gradients encompassed by the forests examined, stand density and age were key drivers of forest growth. We further detected a positive, in some cases non-linear effect of N deposition, most pronounced for beech forests, with a tipping point at ca. 30 kg N $ha^{-1}$ $yr^{-1}$. With the exception of a consistent temperature signal on Norway spruce, climate-related predictors and ground-level ozone showed much less generalized relationships with Delta VoL Our results show that, together with the driving forces exerted by stand density and age, N deposition is at least as important as climate to modulate forest growth at continental scale in Europe, with a potential negative effect at sites with high N deposition.

## Paleolimnological reconstruction of the centennial eutrophication processes in a sub-tropical South American reservoir

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** JOURNAL OF SOUTH AMERICAN EARTH SCIENCES, 2020, 103, 102707, DOI: 10.1016/j.jsames.2020.102707

**Autori:** Halac, S; Mengo, L; Guerra, L; Lami, A; Musazzi, S; Loizeau, JL; Ariztegui, D; Piovano, EL

**Abstract ENG:** Reservoirs hold a detailed record of the changes in the input of sediments and nutrients over decades to centuries. Paleolimnological multi-proxy analysis makes it possible to reconstruct baseline conditions to infer early evidence of environmental change. Our study aims to reconstruct historical human impacts derived from urban development on the San Roque reservoir (Cordoba, Argentina) related to the centennial dynamics of sedimentary and eutrophication processes. A paleolimnological record, dated by Pb-210 and Cs-137, made it possible to identify two stages during the environmental evolution of the San Roque reservoir. Physical processes, such as fluvial discharge and water level variation, dominantly ruled stage 1 (Unit C) during the initial infilling of the reservoir. Nutrient load and eutrophication processes controlled stage 2 (Units B and A). Stage 1 (77-55 cm; AD 1921 to 1965) occurred before and after the second dam was built and while the level of water increased by approximate to + 8 m; it displayed a high variation in mean grain size and maximum values of magnetic susceptibility. Stage 2 (AD 1965-2017) records a new reservoir base level and the maintenance of high water levels and comparatively more stable conditions. Regarding the eutrophication process throughout stage 2, three sub-stages were defined: a) Sub-stage I (AD 1965-1985) is a period of incipient eutrophication; b) Sub-stage II (AD 1985-2005) is an interval of increase of eutrophication as shown by the increase in several organic proxies related to the abundance of phytoplankton. Echinenone, zeaxanthin and myxoxanthophyll indicate that cyanobacteria increased concentration by three-to four-fold in comparison with the previous sub-stage. c) Sub-stage III (AD 2005-2017) shows the transition to a hypereutrophic state. Diatomea (fuco and diato), dinophyceae (diadino), chlorophyta (lut) and cryptophyta (alto) groups show a comparatively higher contribution. Our results mostly highlight that during the last century the main drivers of changes in the environmental state of the San Roque reservoir were trophic, fluvial and hydrometeorological. These results might provide tools for anticipating future scenarios for water management plans under increasing anthropic pressure.

## Parasites in sympatric populations of native and invasive freshwater bivalves

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** HYDROBIOLOGIA, 2020, DOI: 10.1007/s10750-020-04284-0

**Autori:** Taskinen, J; Urbanska, M; Ercoli, F; Andrzejewski, W; Ozgo, M; Deng, BL; Choo, JM; Riccardi, N

**Abstract ENG:** An increasing threat to local, native freshwater mussels (Unionida)-an ecologically important but globally alarmingly declining group-is the invasion by exotic bivalves. The Enemy Release Hypothesis predicts that introduced species should benefit from enemy-mediated competition because they are less likely to be harmed by natural enemies, such as parasites, than their native competitors. We investigated within-site differences in parasitism between sympatric native (tot. five spp.) and invasive (tot. three spp.) bivalves in eight northern European waterbodies, which harboured totally 15 parasite taxa. In paired comparisons using within-site averages, the mean number of parasite species in the native bivalves was 2.3 times higher, and the sum of parasite prevalences 2.4 times higher, than in the invasive bivalves. This may lead to enemy-mediated competitive release of invaders and contribute to the success of invasive freshwater bivalves, in general. However, while the invasive clam Corbicula fluminea was completely free from parasites, parasite parameters of the other invader, Sinanodonta woodiana, were relatively high, indicating that the role of parasites can be invader-specific and urges further research. Understanding the factors affecting success of freshwater bivalve invasions, such as parasitism, can aid invasion control and conservation of local, native (endangered) bivalves.

## Phylogeny of European Anodontini (Bivalvia: Unionidae) with a redescription of Anodonta exulcerata

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** ZOOLOGICAL JOURNAL OF THE LINNEAN SOCIETY, 2020, 189 (3), 745–761, DOI: 10.1093/zoolinnean/zlz136

**Autori:** Riccardi, N; Froufe, E; Bogan, AE; Zieritz, A; Teixeira, A; Vanetti, I; Varandas, S; Zaccara, S; Nagel, KO; Lopes-Lima, M

**Abstract ENG:** Freshwater bivalves are highly threatened and globally declining due to multiple anthropogenic impacts, making them important conservation targets. Because conservation policies and actions generally occur at the species level, accurate species identification and delimitation is critical. A recent phylogenetic study of Italian mussel populations revalidated an Anodonta species bringing the number of known European Anodontini from three to four species. The current study contributes to the clarification of the taxonomy and systematics of European Anodontini, using a combination of molecular, morphological and anatomical data, and constructs phylogenies based on complete mitogenomes. A redescription of A. exulcerata and a comparative analysis of morphological and anatomical characters with respect to the other two species of Anodonta present in the area are provided. No reliable diagnostic character has emerged from comparative analysis of the morphometric characters of 109 specimens from 16 sites across the Italian peninsula. In fact, the discriminant analysis resulted in a greater probability of correct assignment to the site of origin than to the species. This confirms the difficulties of an uncritical application of visual characters for the delimitation of species, especially for Anodontinae.

## Presence and infectivity of SARS-CoV-2 virus in wastewaters and rivers

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**Riferimento rivista con DOI:** SCIENCE OF THE TOTAL ENVIRONMENT, 744, 140911, DOI: 10.1016/j.scitotenv.2020.140911

**Autori:** Rimoldi, SG; Stefani, F; Gigantiello, A; Polesello, S; Comandatore, F; Mileto, D; Maresca, M; Longobardi, C; Mancon, A; Romeri, F; Pagani, C; Cappelli, F; Roscioli, C; Moja, L; Gismondo, MR; Salerno, F

**Abstract ENG:** The presence of SARS-CoV-2 in raw wastewaters has been demonstrated in many countries affected by this pandemic. Nevertheless, virus presence and infectivity in treated wastewaters, but also in the receiving water bodies are still poorly investigated. In this study, raw and treated samples from three wastewater treatment plants, and three river samples within the Milano Metropolitan Area, Italy, were surveyed for SARS-CoV-2 RNA detection by means of real time RT-PCR and infectivity test on culture cells. SARS-CoV-2 RNA was detected in raw, but not in treated wastewaters (four and two samples, respectively, sampled in two dates). The isolated virus genome was sequenced, and belonged to the strain most spread in Europe and similar to another found in the same region. RNA presence in raw wastewater samples decreased after eight days, probably following the epidemiological trend estimated for the area. Virus infectivity was always null, indicating the natural decay of viral pathogenicity in time from emission. Samples from receiving rivers (three sites, sampled in the same dates as wastewaters) showed in some cases a positivity to real time RT-PCR, probably due to non-treated, or inefficiently treated discharges, or to the combined sewage overflows. Nevertheless, also for rivers infectivity was null. Risks for public health should be limited, although a precautionary approach to risk assessment is here advocated, giving the preliminary nature of the presented data. 

## Recent cyanobacteria abundance in a large sub-tropical reservoir inferred from analysis of sediment cores

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** JOURNAL OF PALEOLIMNOLOGY, 2020, 63, 195–209, DOI: 10.1007/s10933-020-00110-8

**Autori:** Gangi, D; Plastani, MS; Laprida, C; Lami, A; Dubois, N; Bordet, F; Gogorza, C; Frau, D; de Tezanos Pinto, P

**Abstract ENG:** Salto Grande is a large South American reservoir on the border between Uruguay and Argentina that was impounded in 1979 and experiences recurrent, massive cyanobacteria blooms. A water-monitoring program was initiated 20 years after the dam was built, hence the causes and onset of cyanobacteria blooms remain poorly known. We collected two sediment cores from the old river channel in the reservoir (z = 17 m) and used physical, chemical and biological variables in the sediments, along with existing limnological data, to explore the history of cyanobacteria in the sub-tropical water body. Cyanobacteria fossil pigments were present at low concentrations during the first 24 years after impoundment, but more than doubled thereafter. Phytoplankton abundance tracked shifts in cyanobacteria pigment concentration, indicating an overall increase in all primary producers. Several sediment variables indicate a decline in water quality after 2003, such as increases in the number of photosynthetic sulfur bacteria and a reduction in sediment magnetic susceptibility. Akinetes (dormant cyanobacteria cells, Order Nostocales) in recent reservoir deposits were abundant and five species germinated under laboratory conditions, underscoring the ability of akinetes to initiate cyanobacteria blooms. The germinated assemblage reflected closely the composition of cyanobacteria blooms in the reservoir. Recorded increases in air temperature and decreases in wind speed, together with other variables (e.g. nutrients), can promote the large, recurrent cyanobacteria blooms. Invasion of the bivalve Limnoperna fortunei apparently promoted cyanobacteria blooms by preferential feeding on other phytoplankton taxa, and perhaps by altering nutrient concentrations and ratios. This work highlights the potential for using multiple variables in sediment cores from large reservoirs to better understand the responses of biota to multiple environmental stressors.

## Recurrent pattern of picophytoplankton dynamics in estuaries around the world: The case of Rio de la Plata

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** MARINE ENVIRONMENTAL RESEARCH, 2020, 161, 105136, DOI: 10.1016/j.marenvres.2020.105136

**Autori:** Sathicq, MB; Unrein, F; Gomez, N

**Abstract ENG:** The picoplankton is an important component of aquatic food webs and plays a significant biogeochemical and ecological role in the environment. Little is known about this fraction of the plankton in temperate estuaries and especially in South America. In this article, we study the absolute and relative importance of the picoplankton along an annual cycle, and their relationship with physical and chemical variables in the Rio de la Plata estuary. We also review the existing research in estuaries around the world concerning this community and present our results in a global context. The seasonal variation in the abundance of the different groups analyzed was very noticeable. Phycocyanin-rich picocyanobacteria (Pcy) were the main component (in abundance and in biovolume) of the picophytoplankton (PPP) almost during the whole year, with a maximum abundance of 7.3 x 10(5) cell mL(-1) in summer, three orders of magnitude higher compared to autumn-winter. Picoeukaryotes, larger phytoplankton and heterotrophic bacteria showed the same seasonal trend, although with a lower range of variation than that of the Pcy. Considering all the phototrophic planktonic fractions, in terms of biomass, the PPP reached a maximum of 43% of the total biomass in spring. The dynamics of PPP found in this area are consistent with the observed in other temperate estuaries, where temperature is the main variable that influences its development, and with a high seasonal variation. Additionally, the absolute and relative importance of Pcy showed a consistently increasing trend towards lower latitude estuaries. The review also showed us that there is scarce information related to the picoplankton fraction in the Southern Hemisphere, its sanitary implications due to their potential of toxicity or their ecological role in coastal zones. The results presented here show the importance of this fraction, not only in Rio de la Plata, but in many estuaries of the world, with a clear increase of relative abundance as we approach the equator.

## Re-examination of *Cyclotella lacunarum* Hustedt (Bacillariophyta) from lakes in the Pamir Mountains, western China, and description of two similar Lindavia taxa collected from Tajikistan and Nepal

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** DIATOM RESEARCH, 2020, 35 (1), 63-84, DOI: 10.1080/0269249X.2020.1745896

**Autori:** Rioual, P; Peng, YM; Jin, ZD; Lami, A; Marchetto, A; Mischke, S; Zhang, F; Zhang, ZY; Yang, XP

**Abstract ENG:** Originally described from a sample collected in the Pamir Mountains at the end of the nineteenth century, *Cyclotella lacunarum* Hustedt is a centric diatom species that is not-well defined and seldom reported in the scientific literature. Our investigations revealed that the type locality of this taxon, now referred to as *Lindavia lacunarum* (Hustedt) Nakov et al., is actually in western China and not in Tajikistan, as wrongly assumed previously. Light microscope (LM) and scanning electron microscope (SEM) observations of the type material and of modern material collected at the type locality allowed us to emend the description of this species. Its most remarkable character is that it possesses central fultoportulae with only two satellite pores instead of three as generally reported for similar species of *Lindavia*. *Lindavia lacunarum* was then compared to two similar populations of Lindavia collected from high elevation lakes in Tajikistan and Nepal. These two populations were originally identified as *Cyclotella/Lindavia lacunarum* and represent the only reported occurrences of this taxon outside its type locality. The population from Tajikistan differs from *L. lacunarum* by having cells of smaller size, with an almost flat valve face and has been described as a new variety *Lindavia lacunarum* var. *karakulensis* var. nov. The Nepalese population is more clearly differentiated from *L. lacunarum* by having a different type of colliculate pattern in the central area and significantly lower density of central fultoportulae and is therefore described as a new species, *Lindavia nepalensis* sp. nov.

## Rotifers from inland water bodies of continental Ecuador and Galapagos Islands: An updated checklist

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** ZOOTAXA, 2020, 4768 (4), 551-564, DOI: 10.11646/zootaxa.4768.4.6

**Autori:** Lopez, C; Soto, LM; Lafuente, W; Stamou, G; Michaloudi, E; Papakostas, S; Fontaneto, D

**Abstract ENG:** We present an updated checklist of the rotifer fauna from inland aquatic habitats in continental Ecuador and the Galapagos islands based on published rotifer records found in the literature. The checklist summarizes the status of the current taxonomic and faunistic knowledge on rotifers in Ecuador, updates the nomenclature, and reports the regions where each species has been found in the country. A total of 287 valid species (269 monogononts and 18 bdelloids was found. The Ecuadorian region with the highest number of records was Amazonia (228) followed by the Coastal region (139) and the Andes (121), whereas in the Galapagos Archipelago only 40 species have been recorded. Studies of the rotifer fauna of the areas are scarce and quite recent, pointing to important gaps in our knowledge on taxonomy and biogeography of Ecuadorian rotifers.

## Spatial and Temporal Patterns of Macroinvertebrate Assemblages in the River Po Catchment (Northern Italy)

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** WATER, 2020, 12, 2452, DOI: 10.3390/w12092452

**Autori:** Fornaroli, R; White, JC; Boggero, A; Laini, A

**Abstract ENG:** In the last decade, large scale biomonitoring programs have been implemented to obtain a robust understanding of freshwater in the name of helping to inform and develop effective restoration and management plans. A comprehensive biomonitoring dataset on the macroinvertebrate assemblages inhabiting the rivers of the Po Valley (northern Italy), comprised a total of 6762 sampling events (period 2007-2018), was analyzed in this study in order to examine coarse spatial and temporal trends displayed by biotic communities. Our results showed that macroinvertebrate compositions and derived structural and functional metrics were controlled by multiple environmental drivers, including altitude and climate (large scale), as well as habitat characteristics (local scale). Altitude proved to be the primary geographic driver, likely due to its association with thermal and precipitation regimes, thus explaining its overriding influence on macroinvertebrate assemblages. Significant temporal variations were observed across the study period, but notably in 2017, the overall taxonomic richness and diversity increased at the expense of Ephemeroptera, Plectoptera and Trichoptera taxa during an unprecedented heatwave that occurred across southern Europe. The detail of this study dataset allowed for important environmental attributes (e.g., altitude, habitat characteristics) shaping biotic communities to be identified, along with ecologically vulnerable regions and time periods (e.g., extreme climatic events). Such research is required globally to help inform large-scale management and restoration efforts that are sustainable over long-term periods.

## Spatial distribution of antibiotic and heavy metal resistance genes in the Black Sea

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** MARINE POLLUTION BULLETIN, 2020, 160, 111635, DOI: 10.1016/j.marpolbul.2020.111635

**Autori:** Sabatino, R; Di Cesare, AD; Dzhembekova, N; Fontaneto, D; Eckert, EM; Corno, G; Moncheva, S; Bertoni, R; Callieri, C

**Abstract ENG:** Antibiotic resistance genes (ARGs) and antibiotic resistant bacteria (ARB) are worldwide considered as emerging contaminants of large interest, and a primary threat to human health. It is becoming clear that the environment plays a central role in the transmission, spread, and evolution of antibiotic resistance. Although marine systems have been largely investigated, only a few studies have considered the presence of ARGs in mesoand bath-ypelagic waters. To date, no molecular based studies have yet been made to investigate the occurrence of ARGs in the Black Sea, the largest meromictic basin in the world, receiving water from a number of important European rivers and their residues of anthropogenic activities in permanently stratified mesopelagic water masses. In this study, we determined the presence and the abundance of five ARGs (blaCTXM, ermB, qnrS, sul2, tetA) and of the heavy metal resistance gene (HMRG) czcA, in different sampling sites in the eastern and western Black Sea, at several depths (up to 1000 m) and various distances from the shoreline. Three ARGs (blaCTXM, sul2, and tetA) and czcA were present in at least 43% of the analysed samples, whereas ermB and qnrS were never detected. In particular, sul2 abundances increased significantly in coastal location, whereas tetA increased with sampling depth. These findings point out the Black Sea as a source of ARGs and HMRGs distributed along the whole water column.

## The Benthic Quality Index to Assess Water Quality of Lakes May Be Affected by Confounding Environmental Features

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** WATER, 2020, 12, 2519, DOI: 10.3390/w12092519

**Autori:** Boggero, A; Zaupa, S; Bettinetti, R; Ciampittiello, M; Fontaneto, D

**Abstract ENG:** To assess if environmental differences other than water quality may affect the outcome of the Benthic Quality Index, a comparison of the application of four different methods (Benthic Quality Index-BQIES, Lake Habitat Modification Score-LHMS, Lake Habitat Quality Assessment-LHQA and Organisation for Economic Co-operation and Development-OECD) used to classify the lake ecological and hydro-morphological status of 10 Italian lakes was performed. Five lakes were natural and five were reservoirs belonging to both Alpine and Mediterranean Ecoregions. The 10 lakes were sampled using the Water Framework Directive compliant standardized national protocol, which includes sampling soft sediment in the littoral, sublittoral and deep layers along transects with a grab of 225 cm(2) during spring and autumn. The application of Generalised Linear Mixed Effect Models both at the lake level and at the single station of each lake highlighted that, at the lake level, no significant correlations existed between any couple of hydro-morphological, ecological and trophic status assessments, with each metric representing a different facet of human impact on the environment. At the single site level, we found significant effects of depth on the metrics of biodiversity. The best approximation of single-site macroinvertebrates diversity among the metrics of overall lake quality was with the LHMS, but not with the BQIES. Our hypotheses that lake macroinvertebrates assemblages depend also on other potential confounding variables of habitat degradation and intrinsic differences between lakes were confirmed, with depth playing a major role. Therefore, the assessment of lakes with different depths may produce different whole-lake BQIES values, only because of the effect of depth gradient and not because of differences in lake quality.

## The genetic diversity of two invasive sympatric bivalves (Corbicula fluminea and Dreissena polymorpha) from Lakes Garda and Maggiore, Northern Italy

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** JOURNAL OF GREAT LAKES RESEARCH, 2020, 46 (1), 225-229, DOI: 10.1016/j.jglr.2019.11.006

**Autori:** Gomes, C; Mendes, T; Borges, R; Guarneri, I; Marchi, I; Guilhermino, L; Vasconcelos, V; Riccardi, N; Antunes, A

**Abstract ENG:** Corbicula fluminea and Dreissena polymorpha are two non-indigenous species (NIS), known to provoke biodiversity loss of the existent native communities and alterations in the ecosystem functioning structure. Both of these NIS have successfully founded well established populations in Lakes Maggiore and Garda (Northern Italy). Here, we evaluated the mitochondrial COI genetic diversity of C fluminea and D. polymorpha populations from the aforementioned lakes. The COI gene analysis revealed one C. fluminea haplotype, belonging to the FW5 androgenetic invasive lineage. Two D. polymorpha haplotypes - LM1 and LM2 - were detected in Lake Maggiore. The D. polymorpha comparative phylogeographical haplotype analysis between Lake Maggiore and the retrieved COI data available from Lake Garda revealed that LM1 is the dominant haplotype in both populations, whereas LM2 a rare haplotype was only detected in Lake Maggiore. These findings contribute for a better understanding of the demographic history of these highly invasive species in these Italian lakes, thus suggesting that C. fluminea and D. polymorpha populations present a similar genetic pattern. The low genetic diversity detected in both of these bivalve populations seems to reflect a pre-existent low genetic pool prevenient from the introductory source(s). (C) 2019 Published by Elsevier B.V. on behalf of International Association for Great Lakes Research.

## The NORMAN Association and the European Partnership for Chemicals Risk Assessment (PARC): let's cooperate!

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** ENVIRONMENTAL SCIENCES EUROPE, 2020, 32 (1), 100, DOI: 10.1186/s12302-020-00375-w

**Autori:** Dulio, V; Koschorreck, J; van Bavel, B; van den Brink, P; Hollender, J; Munthe, J; Schlabach, M; Aalizadeh, R; Agerstrand, M; Ahrens, L; Allan, I; Alygizakis, N; Barcelo, D; Bohlin-Nizzetto, P; Boutroup, S; Brack, W; Bressy, A; Christensen, JH; Cirka, L; Covaci, A; Derksen, A; Deviller, G; Dingemans, MML; Engwall, M; Fatta-Kassinos, D; Gago-Ferrero, P; Hernandez, F; Herzke, D; Hilscherova, K; Hollert, H; Junghans, M; Kasprzyk-Hordern, B; Keiter, S; Kools, SAE; Kruve, A; Lambropoulou, D; Lamoree, M; Leonards, P; Lopez, B; de Alda, ML; Lundy, L; Makovinska, J; Marigomez, I; Martin, JW; McHugh, B; Miege, C; O'Toole, S; Perkola, N; Polesello, S; Posthuma, L; Rodriguez-Mozaz, S; Roessink, I; Rostkowski, P; Ruedel, H; Samanipour, S; Schulze, T; Schymanski, EL; Sengl, M; Tarabek, P; Ten Hulscher, D; Thomaidis, N; Togola, A; Valsecchi, S; van Leeuwen, S; von der Ohe, P; Vorkamp, K; Vrana, B; Slobodnik, J

**Abstract ENG:** The Partnership for Chemicals Risk Assessment (PARC) is currently under development as a joint research and innovation programme to strengthen the scientific basis for chemical risk assessment in the EU. The plan is to bring chemical risk assessors and managers together with scientists to accelerate method development and the production of necessary data and knowledge, and to facilitate the transition to next-generation evidence-based risk assessment, a non-toxic environment and the European Green Deal. The NORMAN Network is an independent, well-established and competent network of more than 80 organisations in the field of emerging substances and has enormous potential to contribute to the implementation of the PARC partnership. NORMAN stands ready to provide expert advice to PARC, drawing on its long experience in the development, harmonisation and testing of advanced tools in relation to chemicals of emerging concern and in support of a European Early Warning System to unravel the risks of contaminants of emerging concern (CECs) and close the gap between research and innovation and regulatory processes. In this commentary we highlight the tools developed by NORMAN that we consider most relevant to supporting the PARC initiative: (i) joint data space and cutting-edge research tools for risk assessment of contaminants of emerging concern; (ii) collaborative European framework to improve data quality and comparability; (iii) advanced data analysis tools for a European early warning system and (iv) support to national and European chemical risk assessment thanks to harnessing, combining and sharing evidence and expertise on CECs. By combining the extensive knowledge and experience of the NORMAN network with the financial and policy-related strengths of the PARC initiative, a large step towards the goal of a non-toxic environment can be taken.

## The ratio of lentic to lotic habitat features strongly affects macroinvertebrate metrics used in southern Europe for ecological status classification

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** ECOLOGICAL INDICATORS, 2020, 117, 106563, DOI: 10.1016/j.ecolind.2020.106563

**Autori:** Buffagni, A; Erba, S; Cazzola, M; Barca, E; Belfiore, C

**Abstract ENG:** Biological quality in rivers based on benthic macroinvertebrates is typically assessed by comparison with ex-pected reference conditions, which represent relatively undisturbed situations. Commonly, reference conditions are set in agreement with river typologies to handle major ecological differences and limit biological variability. Although natural hydrological variation can be highly influential, site-specific tuning of reference conditions is rare in Mediterranean countries. River flow and local hydraulics change continuously over time, shaping the occurrence of lentic and lotic habitat features. Thus, biological reference conditions might require site-specific adjustment based on the ratio of lentic to lotic habitats assessed at the time of sampling. This would help reducing systematic bias in ecological assessments, interpreting benthic invertebrate responses to pressures, and diminishing the amount of unexplained biological variability. In this study, the response to the lentic-lotic character of river reaches was assessed for nineteen macroinvertebrate metrics and indices commonly used for the classification of ecological status in South European rivers. The study sites, with a prevalent temporary character, were located in Sardinia, southwestern Italy. Most metrics were significantly related to the lentic-lotic habitat conditions, both in pool and riffle mesohabitats, and their response curves were either parabolic or linearly decreasing at increasing lentic conditions. Taxonomic richness, score-based metrics, ovoviviparous taxa and multi-metric indices related well to the lentic-lotic conditions, while abundance metrics correlated less. The potential impact on ecological status classification was tested for the method formally used in Italy, which had a major role in comparing and inter-calibrating European assessment methods for the Water Framework Directive. After adjusting for bias due to the ratio of lentic to lotic habitat features, quality classification shifted towards better ecological status for approximate to 23% samples. This highlighted the impact of ignoring lentic-lotic information when defining reference conditions for assessing ecological status, varying from difficulties in understanding the biological response to pressures, to largely biased ecological status classification. The observed response of macroinvertebrate metrics to lentic-lotic conditions should be a key consideration for realistic ecological status assessment and could further be a valuable input for evaluating the effects of human-induced hydrological alteration and for assessing environmental flows.

## The role of metal contamination in shaping microbial communities in heavily polluted marine sediments

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** ENVIRONMENTAL POLLUTION, 2020, 265, Part B, 114823, DOI: 10.1016/j.envpol.2020.114823

**Autori:** Di Cesare, A; Pjevac, P; Eckert, E; Curkov, N; Sparica, MM; Corno, G; Orlic, S

**Abstract ENG:** Microorganisms in coastal sediments are fundamental for ecosystem functioning, and regulate processes relevant in global biogeochemical cycles. Still, our understanding of the effects anthropogenic perturbation and pollution can have on microbial communities in marine sediments is limited. We surveyed the microbial diversity, and the occurrence and abundance of metal and antibiotic resistance genes is sediments collected from the Pula Bay (Croatia), one of the most significantly polluted sites along the Croatian coast. With a collection of 14 samples from the bay area, we were able to generate a detailed status quo picture of a site that only recently started a cleaning and remediation process (closing of sewage pipes and reduction of industrial activity). The concentrations of heavy metals in Pula Bay sediments are significantly higher than in pristine sediments from the Adriatic Sea, and in some cases, manifold exceed international sediment quality guidelines. While the sedimentary concentrations of heavy metals did significantly influence the abundance of the tested metal resistance genes, no strong effect of heavy metal pollution on the overall microbial community composition was observed. Like in many other marine sediments, Gammaproteobacteria, Bacteroidota and Desulfobacterota dominated the microbial community composition in most samples, and community assembly was primarily driven by water column depth and nutrient (carbon and nitrogen) availability, regardless of the degree of heavy metal pollution. 

## The vertical distribution of tetA and intI1 in a deep lake is rather due to sedimentation than to resuspension

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** FEMS MICROBIOLOGY ECOLOGY, 2020, 96, 2, fiaa002,, DOI: 10.1093/femsec/fiaa002

**Autori:** Di Cesare, A; Eckert, EM; Cottin, C; Bouchez, A; Callieri, C; Cortesini, M; Lami, A; Corno, G

**Abstract ENG:** Lakes are exposed to anthropogenic pollution including the release of allochthonous bacteria into their waters. Antibiotic resistance genes (ARGs) stabilize in bacterial communities of temperate lakes, and these environments act as long-term reservoirs of ARGs. Still, it is not clear if the stabilization of the ARGs is caused by a periodical introduction, or by other factors regulated by dynamics within the water column. Here we observed the dynamics of the tetracycline resistance gene (tetA) and of the class 1 integron integrase gene intI1 a proxy of anthropogenic pollution in the water column and in the sediments of subalpine Lake Maggiore, together with several chemical, physical and microbiological variables. Both genes resulted more abundant within the bacterial community of the sediment compared to the water column and the water-sediment interface. Only at the inset of thermal stratification they reached quantifiable abundances in all the water layers, too. Moreover, the bacterial communities of the water-sediment interface were more similar to deep waters than to the sediments. These results suggest that the vertical distribution of tetA and intI1 is mainly due to the deposition of bacteria from the surface water to the sediment, while their resuspension from the sediment is less important.

## Tossed 'good luck' coins as vectors for anthropogenic pollution into aquatic environment

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** ENVIRONMENTAL POLLUTION, 2020, 259, 113800, DOI: 10.1016/j.envpol.2019.113800

**Autori:** Martinez, A; Di Cesare, A; Mari-Mena, N; Garcia-Gomez, G; Garcia-Herrero, A; Corno, G; Fontaneto, D; Eckert, EM

**Abstract ENG:** Superstition has it that tossing coins into wells or fountains brings good luck, thereby causing a potential accumulation of microbially contaminated metal particles in the water. Here, we characterized the microbiota and the resistance profile in biofilm on such coins and their surrounding sediments. The study site was a tidal marine lake within a touristic center located in a natural reserve area. Notwithstanding the fact that coin-related biofilms were dominated by typical marine taxa, coin biofilms had specific microbial communities that were different from the communities of the surrounding sediment. Moreover, the communities were different depending on whether the coin were made mainly of steel or of copper. Sequences affiliated with putative pathogens were found on every third coin but were not found in the surrounding sediment. Antibiotic resistance genes (ARGs) were detected on most of the coins, and interestingly, sediments close to the area where coins accumulate had a higher frequency of ARGs. We suggest that the surface of the coins might offer a niche for ARGs and faecal bacteria to survive, and, thus, tossed coins are a potential source and vector for ARGs into the surrounding environment. (C) 2019 Published by Elsevier Ltd.

## Uptake and translocation of perfluoroalkyl acids (PFAA) in red chicory (Cichorium intybus L.) under various treatments with pre-contaminated soil and irrigation water

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** SCIENCE OF THE TOTAL ENVIRONMENT, 2020, 708, 134766, DOI: 10.1016/j.scitotenv.2019.134766

**Autori:** Gredelj, A; Nicoletto, C; Valsecchi, S; Ferrario, C; Polesello, S; Lava, R; Zanon, F; Barausse, A; Palmeri, L; Guidolin, L; Bonato, M

**Abstract ENG:** Perfluoroalkyl acids (PFAAs), particularly short-chained ones, have high potential for crop uptake, posing a threat to human health in contaminated areas. There is a scarcity of studies using contaminated water as the medium for PFAAs delivery to crops, and a lack of data on the partitioning of PFAA mixtures in growing media. In this context, a controlled experimental study was carried out in a greenhouse to investigate the uptake of a PFAA mixture into red chicory, a typical crop from a major PFAA contamination hot-spot in northern Italy, under treatments with environmentally relevant concentrations in spiked irrigation water and soil, separately and simultaneously. To our knowledge, this is the first study involving multiple exposure media and laboratory adsorption/desorption batch tests as a way of assessing the decrease in the bioavailability of PFAAs from soil. Exposure concentrations for each of the 9 utilized PFAAs were 0, 1, 10 and 80 mu g/L in irrigation water and 0, 100 and 200 ng/g(dw) in soil, combined into 12 treatments. The highest bioaccumulation was measured for PFBA in roots (maximum of 43 mu g/g(dw)), followed by leaves and heads of the chicory plants in all treatments, with the concentrations exponentially decreasing with an increasing PFAA chain length in all plant compartments. The use of irrigation water as the delivery medium increased the transport of PFAAs to the aerial chicory parts, long-chain substances in particular. Additionally, the distribution of PFAAs in the soil was assessed by depth and compared with laboratory measured soil-water equilibrium partition coefficients, revealing only partial dependency of PFAAs bioavailability on the adsorption in soil. 

## Uptake and translocation of perfluoroalkyl acids (PFAAs) in hydroponically grown red chicory (Cichorium intybus L.): Growth and developmental toxicity, comparison with growth in soil and bioavailability implications

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** SCIENCE OF THE TOTAL ENVIRONMENT, 2020, 720, 137333, DOI: 10.1016/j.scitotenv.2020.137333

**Autori:** Gredelj, A; Nicoletto, C; Polesello, S; Ferrario, C; Valsecchi, S; Lava, R; Barausse, A; Zanon, F; Palmeri, L; Guidolin, L; Bonato, M

**Abstract ENG:** Short-chain perfluoroalkyl acids (PFAAs) have shown a high potential for plant (crop) uptake, making them possibly significant contributors to the total dietary exposure to PFAAs. The plant uptake of PFAAs is a complex process that needs better characterization, as it does not only depend on perfluoroalkyl chain length, but also on their polar terminal group, on the plant species and the exposure media. Here, a plant uptake study with nine perfluoroalkyl acids (PFAAs) was carried out under the hydroponic (soilless) exposure conditions. Red chicory was grown in a nutrient solution, spiked with PFAAs mixture at three different concentrations (i.e. 62.5, 125 and 250 mu g/L), in order to extend the range of levels tested and reported in the literature so far. Bioaccumulation metrics and transpiration stream concentration factors (TSCFs) were employed for the plant uptake characterization and consequent comparison with the results of soil uptake experiment we previously performed with the same crop. The results showed that calculated root concentration factors (RCFs) increase with PFAA chain length, while the opposite chain length dependence was present for shoots. Plants from two treatments with the highest PFAAs concentrations manifested physiological changes (discoloration, inhibited roots and leaves growth), despite of the used exposure concentrations beingmuch lower than previously published phytotoxicity thresholds. A comparison among RCFs and TSCFs derived from hydroponic and from the soil experiment has emphasized their different magnitudes and PFAAs chain length dependence patterns. They could not be ascribed only to soil sorption as a process decreasing PFAAs bioavailability for plants, but also to developmental differences between the root systems formed in soil and in nutrient solution and to the potential competitive PFAAs sorption to roots in hydroponics. The interchangeable use of bioaccumulation and translocation parameters derived in hydroponic and soil systems would lead to erroneous conclusions and plant uptake predictions. 

## Urbanization drives cross-taxon declines in abundance and diversity at multiple spatial scales

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** GLOBAL CHANGE BIOLOGY, 2020, 26 (3), 1196-1211, DOI: 10.1111/gcb.14934

**Autori:** Piano, E; Souffreau, C; Merckx, T; Baardsen, LF; Backeljau, T; Bonte, D; Brans, KI; Cours, M; Dahirel, M; Debortoli, N; Decaestecker, E; De Wolf, K; Engelen, JMT; Fontaneto, D; Gianuca, AT; Govaert, L; Hanashiro, FTT; Higuti, J; Lens, L; Martens, K; Matheve, H; Matthysen, E; Pinseel, E; Sablon, R; Schon, I; Stoks, R; Van Doninck, K; Van Dyck, H; Vanormelingen, P; Van Wichelen, J; Vyverman, W; De Meester, L; Hendrickx, F

**Abstract ENG:** The increasing urbanization process is hypothesized to drastically alter (semi-)natural environments with a concomitant major decline in species abundance and diversity. Yet, studies on this effect of urbanization, and the spatial scale at which it acts, are at present inconclusive due to the large heterogeneity in taxonomic groups and spatial scales at which this relationship has been investigated among studies. Comprehensive studies analysing this relationship across multiple animal groups and at multiple spatial scales are rare, hampering the assessment of how biodiversity generally responds to urbanization. We studied aquatic (cladocerans), limno-terrestrial (bdelloid rotifers) and terrestrial (butterflies, ground beetles, ground- and web spiders, macro-moths, orthopterans and snails) invertebrate groups using a hierarchical spatial design, wherein three local-scale (200 m x 200 m) urbanization levels were repeatedly sampled across three landscape-scale (3 km x 3 km) urbanization levels. We tested for local and landscape urbanization effects on abundance and species richness of each group, whereby total richness was partitioned into the average richness of local communities and the richness due to variation among local communities. Abundances of the terrestrial active dispersers declined in response to local urbanization, with reductions up to 85% for butterflies, while passive dispersers did not show any clear trend. Species richness also declined with increasing levels of urbanization, but responses were highly heterogeneous among the different groups with respect to the richness component and the spatial scale at which urbanization impacts richness. Depending on the group, species richness declined due to biotic homogenization and/or local species loss. This resulted in an overall decrease in total richness across groups in urban areas. These results provide strong support to the general negative impact of urbanization on abundance and species richness within habitat patches and highlight the importance of considering multiple spatial scales and taxa to assess the impacts of urbanization on biodiversity.

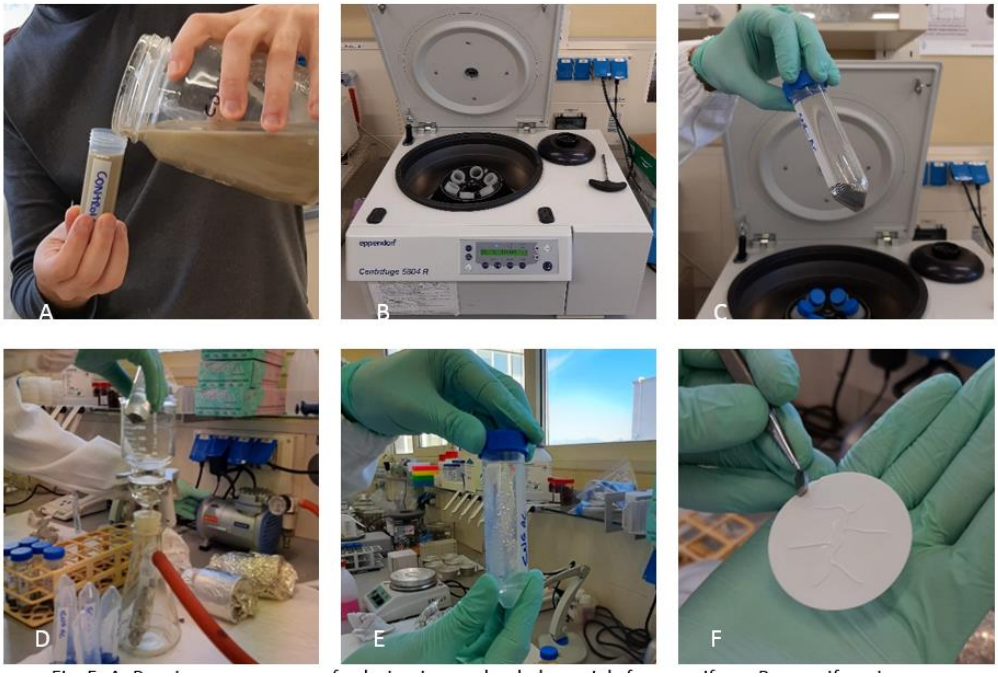
## The Most Common Laboratory Procedures for the Evaluation of EPB TBMs Excavated Material Ecotoxicity in Italy: A Review

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Geoingegneria e attività estrattiva, 2020, 160, 44-56, doi:10.19199/2020.2.1121-9041.044

**Autori:** Firouzei Y, Grenni P, Barra Caracciolo A, Patrolecco L, Todaro C, Martinelli D, Carigi A, Hajipour G, Hassanpour J, Peila D

**Abstract ENG:** The rapid development of the mechanized tunneling in current decades has raised serious concerns about the environmental impact of large quantities of the muck. EPB-TBMs require the use of foaming agents for optimizing the soil conditioning. These agents could contain some chemicals (e.g., sodium lauryl ether sulfate – SLES) that are not included in the current legislation at the Italian or EU level. In order to minimize the project costs, it is useful to re-use the excavated soil as a reusable by-product that requires that it does not have any environmental impact on the ecosystems. For this purpose, to draw up a site-specific protocol is a practical and successful tool to evaluate the environmental compatibility of excavated soil during the tunneling. It can rely on one-month experiments at a microcosm or mesocosm scale using soil coming from the excavated site. At fixed times (from 0 to 28 days) the chemical degradation of the chemical together with ecotoxicological tests can be performed on soil or soil-water extracts. Both aquatic and terrestrial organisms are used and the choice of the tests depends on the final destination site. The results of the residual concentration of SLES in soil and in the elutriates, together with those of the ecotoxicological tests, make it possible to evaluate the temporary storage of spoil material and the time necessary for obtaining a safe soil debris to be used as a by-product. These data are usually included in the site-specific protocol to be applied during the excavation phase. This paper describes the main methodological aspects regarding microcosm experiments.



## Latitudinal gradients in body size in marine tardigrades.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Zoological Journal of the Linnean Society, 2020, 188 (3), 820–838, DOI: 10.1093/zoolinnean/zlz080

**Autori:** Paul J Bartels, Diego Fontaneto, Milena Roszkowska, Diane R Nelson, Łukasz Kaczmarek

**Abstract ENG:** Homeotherms and many poikilotherms display a positive relationship between body size and latitude, but this has rarely been investigated in microscopic animals. We analysed all published records of marine Tardigrada to address whether microscopic marine invertebrates have similar ecogeographical patterns to macroscopic animals. The data were analysed using spatially explicit generalized least squares models and linear models. We looked for latitudinal patterns in body size and species richness, testing for sampling bias and phylogenetic constraints. No latitudinal pattern was detected for species richness, and sampling bias was the strongest correlate of species richness. A hump-shaped increase in median body size with latitude was found, and the effect remained significant for the Northern Hemisphere but not for the Southern. The most significant effect supporting the latitudinal gradient was on minimum body size, with smaller species disappearing at higher latitudes. Our results suggest that biogeographical signals were observed for body size, albeit difficult to detect in poorly studied groups because of swamping from biased sampling effort and from low sample size. We did not find a significant correlation with the latitudinal pattern of body size and ecologically relevant net primary productivity.

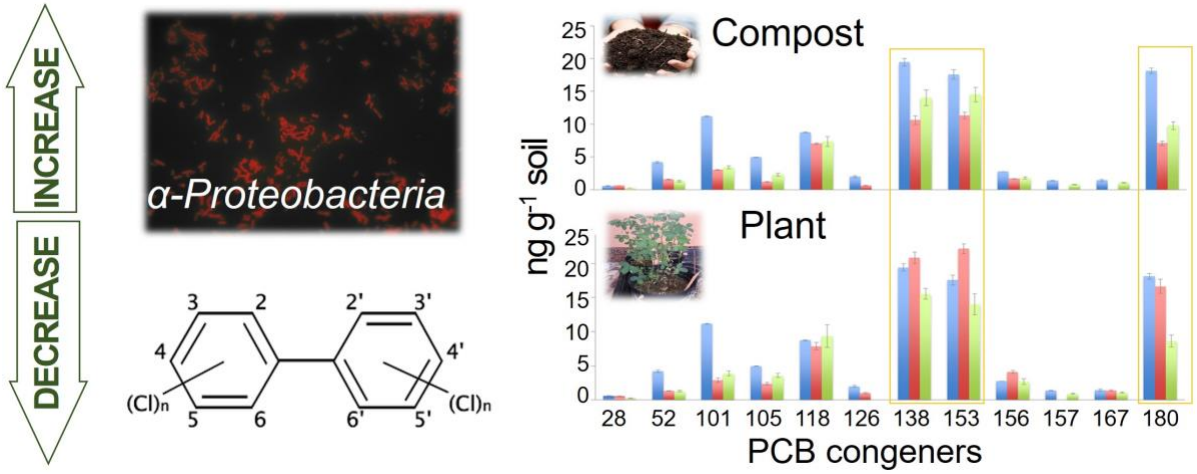
## Combined Effects of Compost and Medicago sativa in Recovery a PCB Contaminated Soil

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Water (2020), 12(3), 860. doi:10.3390/w12030860

**Autori:** Di Lenola M, Barra Caracciolo A, Ancona V, Laudicina VA, Garbini GL, Mascolo G, Grenni P

**Abstract ENG:** The effectiveness of adding compost and the plant Medicago sativa in improving the quality of a soil historically contaminated by polychlorinated biphenyls (PCBs) was tested in greenhouse microcosms. Plant pots, containing soil samples from an area contaminated by PCBs, were treated with the compost and the plant, separately or together. Moreover, un-treated and un-planted microcosms were used as controls. At fixed times (1, 133 and 224 days), PCBs were analysed and the structure (cell abundance, phylogenetic characterization) and functioning (cell viability, dehydrogenase activity) of the natural microbial community were also measured. The results showed the effectiveness of the compost and plant in increasing the microbial activity, cell viability, and bacteria/fungi ratio, and in decreasing the amount of higher-chlorinated PCBs. Moreover, a higher number of α-Proteobacteria, one of the main bacterial groups involved in the degradation of PCBs, was found in the compost and plant co-presence.



## Difficulties in Waste Ecotoxicological Tests for HP14 Classification: Debate on Legislation and Test Challenges

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** SETAC Globe (2020), 21 (8) https://globe.setac.org/setac-scicon-session-summaries/

**Autori:** Maggi L, Marchesini D, Mensi C, Neri MC, Tiberg C, Beggio G, Pivato A, Grenni P

**Abstract ENG:** Managing waste is one of society's greatest challenges! The shift underway in waste management is closely linked to EU legislation on the topic. Waste also represents an economic loss and burden to our society. There is a lot of debate about the legislation concerning hazardous waste classification. In fact, the requirements (in particular the ecotoxicological test batteries) for the HP 14 criterion (established by Regulation 2008/440/EC, the decision 200/532/CE and the Regulation 2017/997/EU) have not been fixed. The environmental data requirements and guidance used under the various different regulations cannot always be fully applied and the authorities in the various European Countries do not have a harmonized and precise method for HP 14 classification. In the absence of defined criteria, each experimental test can be carried out and evaluated according to the procedures established by the classification labeling and packaging (CLP) regulation, with many remaining issues regarding solution preparation and sample representativeness. Waste is a multi-component matrix and are therefore considered UVCB substances (substances of unknown or variable composition) with particular physical-chemical properties. Therefore, the preparation of solutions used for ecotoxicological assessment needs to be performed according to OECD 23, a guidance document on aquatic toxicity, testing of difficult substances and mixtures. Moreover, ecotoxicological concentration limits for classification of HP14 need to be clarified and defined among the various European Countries. The idea of the session originated from two Italian meetings in 2019, both promoted by the Italian Institute for Environmental Protection and Research: "First meeting of applied ecotoxicology" (organized in Livorno by Ecotox s.r.l.) and "New methodology for waste classification: case studies and guidelines for its application" (organized in Pavia by Lab Control).

## Growth, mortality and yield of Atherina boyeri Risso, 1810 from Lesina lagoon (Adriatic Sea, Italy)

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Acta Adiatica, 2020, 61 (2), 163-174, doi: 10.32582/aa.61.2.4

**Autori:** Ermelinda PRATO, ASIA GRATTAGLIANO, Daniela LUMARE, Febo LUMARE, Andrea RUSCITO and Francesca BIANDOLINO

**Abstract ITA:** stata studiata la struttura della popolazione, la crescita, l'età, la mortalità e lo stato di sfruttamento di Atherina boyeri, catturata nel periodo da giugno 2013 a maggio 2014 nella laguna di Lesina (regione Puglia, Adriatico meridionale). I campioni sono stati prelevati ogni mese utilizzando sciabiche da spiaggia. La relazione lunghezza-peso di tutti i campioni di odore di sabbia è stata descritta dall'equazione W = 0,012 * TL 3,10; (R2 = 0,84). I parametri della popolazione tra cui la lunghezza asintotica (L∞) e il coefficiente di crescita (K) sono stati valutati per valutare lo stato dello stock. Il modello di reclutamento è stato modellato con una routine FiSAT. La lunghezza asintotica (L∞) era di 111,0 mm, mentre il coefficiente di crescita (K) era di 0,68 anno − 1. L'indice di performance di crescita ((φ ') ha raggiunto 3,92. Il coefficiente di mortalità totale "Z", il coefficiente di mortalità naturale "M" e il coefficiente di mortalità per pesca "F" sono stati stimati rispettivamente di 2,24, 1,48 e 0,76 anno-1. tasso per la popolazione di A. boyeri nella laguna di Lesina stimato in 0,34 è risultato ancora inferiore al valore massimo previsto di Emax 0,59. La probabilità di cattura indicava che L50 era di 55,57 mm, indicando che lo stock del latteino nella laguna di Lesina non viene pescato eccessivamente.

**Abstract ENG:** Population structure, growth, age, mortality and exploitation status of Atherina boyeri, caught in the period from June 2013 to May 2014 in the Lesina lagoon (Apulia region, southern Adriatic) was studied. Samples were taken each month by using beach seines . The length–weight relationship of all sand smell specimens was described by the equation W=0.012*TL 3.10; (R2= 0.84). Population parameters including the asymptotic length (L∞) and growth coefficient (K) were assessed to evaluate the stock status. The recruitment pattern was modeled with a FiSAT routine. The asymptotic length (L∞) was 111.0 mm, while the growth coefficient (K) was 0.68 year−1. The growth performance index ((φ') reached 3.92. The total mortality coefficient “Z”, the natural mortality coefficient “M” and the fishing mortality coefficient “F” were estimated as 2.24, 1.48 and 0.76 year-1, respectively. Exploitation rate for the population of A. boyeri in the Lesina lagoon estimated as 0.34 was resulted still lower than the predicted maximum value of Emax 0.59. The probability of capture indicated that L50 was of 55.57 mm, indicating that the stock of sand smelt in Lesina lagoon is not being over-fished.

## Detection of Metal-Doped Fluorescent PVC Microplastics in Freshwater Mussels.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Nanomaterials, 2020, 10 (12), 2363; doi: 10.3390/nano10122363

**Autori:** Facchetti, S.V., La Spina, R., Fumagalli, F., Riccardi, N., Gilliland, D., Ponti, J.

**Abstract ITA:** Non disponibile

**Abstract ENG:** The large-scale production of plastic and the resulting release of waste is leading to a huge accumulation of micro-sized particles in the environment that could have an impact on not only aquatic organisms but also on humans. Despite the extensive literature on the subject, there is still an insufficient harmonization of methodologies for the collection and analysis of microplastics (MPs) in complex matrices; especially for high density polymers; such as polyvinyl chloride (PVC), which tend to sink and accumulate in sediments, becoming available to benthonic organisms. In this article, mussels have been chosen as model for microplastic accumulation due to their extensive filtering activity and their wide distribution in both fresh and salt water basins. To facilitate the identification and quantification of microplastics taken up by mussels, novel fluorescent and metal-doped PVC microplastics (PVC-Platinum octaethylporphyrin (PtOEP) MPs in the size range of 100 µm) have been synthesized and characterized. For the analysis of the mussels following exposure, an enzymatic protocol using amylase, lipase, papain, and SDS for organic material digestion and a sucrose-ZnCl2 density gradient for the selective separation of ingested microplastics has been developed. The final identification of MPs was performed by fluorescence microscopy. This work can greatly benefit the scientific community by providing a means to study the behavior of PVC MPs, which represent an example of a very relevant yet poorly studied high density polymeric contaminant commonly found in complex environmental matrices.

## Mesozoic mitogenome rearrangements and freshwater mussel (Bivalvia: Unionoidea) macroevolution.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Heredity, 2020, 124, 182–196, doi: 10.1038/s41437-019-0242-y.

**Autori:** Froufe E, Bolotov I, Aldridge DC, Bogan AE, Breton S, Han Ming Gan, Kovitvadhi U, Kovitvadhi S, Riccardi N, Secci-Petretto G, Sousa R, Teixeira A, Varandas S, Zanatta D, Zieritz A, Fonseca MM, Lopes-Lima M

**Abstract ITA:** Non disponibile

**Abstract ENG:** Using a new fossil-calibrated mitogenome-based approach, we identified macroevolutionary shifts in mitochondrial gene order among the freshwater mussels (Unionoidea). We show that the early Mesozoic divergence of the two Unionoidea clades, Margaritiferidae and Unionidae, was accompanied by a synchronous split in the gene arrangement in the female mitogenome (i.e., gene orders MF1 and UF1). Our results suggest that this macroevolutionary jump was completed within a relatively short time interval (95% HPD 201–226 Ma) that coincided with the Triassic–Jurassic mass extinction. Both gene orders have persisted within these clades for ~200 Ma. The monophyly of the so-called "problematic" Gonideinae taxa was supported by all the inferred phylogenies in this study using, for the first time, the M- and F-type mitogenomes either singly or combined. Within Gonideinae, two additional splits in the gene order (UF1 to UF2, UF2 to UF3) occurred in the Mesozoic and have persisted for ~150 and ~100Ma, respectively. Finally, the mitogenomic results suggest ancient connections between freshwater basins of East Asia and Europe near the Cretaceous–Paleogene boundary, probably via a continuous paleo-river system or along the Tethys coastal line, which are well supported by at least three independent but almost synchronous divergence events.

## The Microbial Community Associated with Rhizostoma pulmo: Ecological Significance and Potential Consequences for Marine Organisms and Human Health

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Marine Drugs 2020, 18, 437; doi:10.3390/md18090437

**Autori:** L Stabili, L Rizzo, L Basso, M Marzano, B Fosso, G Pesole, S Piraino

**Abstract ITA:** I blooms di meduse sono frequenti e diffuse nelle zone costiere del mondo, spesso associate con significative conseguenze ecologiche e socio economiche. Anche studi recenti hanno suggerito che le meduse possono agire come vettori di patogeni batterici. La scyphomedusa Rhizostoma pulmo è una medusa che formablooms ampiamente presenti in tutto il bacino del Mediterraneo. Usando la combinazione di approcci basati su metodi colturali e un sequenziamento di amplicon ad alto rendimento (HTS) abbiamo confrontato il microbioma della comunità associata alla medusa adulta R. pulmo nel Golfo di Taranto (Mar Ionio) tra periodi di campionamento estivo (luglio 2016) e invernale (febbraio 2017). Il microbiota associato alle meduse è stato studiato in tre compartimenti distinti, vale a dire ombrello, braccia orali e muco.Actinobacteria, Bacteroidetes, Chlamydiae, Cyanobacteria, Deinococcus-Thermus, Firmicutes, Fusobatteri, Planctomiceti, Proteobatteri, Rhodothermaeota, Spirochaetes, Tenericutes e Thaumarchaeota erano i phyla isolati da tutti e tre i compartimenti di R. pulmo . In particolare, i principali generi Mycoplasma e Spiroplasma, appartenenti alla classe Mollicutes (phylum Tenericutes), sono stati identificati in tutti e tre i compartimenti delle meduse. I dati microbici di tipo tassonomico sono stati accoppiati con i profili metabolici risultanti dall'utilizzo di 31 differenti sorgenti di carbonio presenti nel sistema BIOLOG Eco-Plate. Sono stati caratterizzati i microrganismi associati al muco caratterizzati da grande diversità. In questo compartimento la conta dei batteri eterotrofi coltivabili e le potenziali attività metaboliche sono risultate notevoli. I risultati vengono discussi in relazione all' ecologia di R. pulmo, e al potenziale pericolo per la salute per la vita marina e umana, nonché per le potenziali applicazioni biotecnologiche relative al microbioma associato.

**Abstract ENG:** Jellyfish blooms are frequent and widespread in coastal areas worldwide, often associated with significant ecological and socio-economic consequences. Recent studies have also suggested cnidarian jellyfish may act as vectors of bacterial pathogens. The scyphomedusa Rhizostoma pulmo is an outbreak-forming jellyfish widely occurring across the Mediterranean basin. Using combination of culture-based approaches and a high-throughput amplicon sequencing (HTS), and based on available knowledge on a warm-affinity jellyfish-associated microbiome, we compared the microbial community associated with R. pulmo adult jellyfish in the Gulf of Taranto (Ionian Sea) between summer (July 2016) and winter (February 2017) sampling periods. The jellyfish-associated microbiota was investigated in three distinct compartments, namely umbrella, oral arms, and the mucus secretion. Actinobacteria, Bacteroidetes, Chlamydiae, Cyanobacteria, Deinococcus-Thermus, Firmicutes, Fusobacteria, Planctomycetes, Proteobacteria, Rhodothermaeota, Spirochaetes, Tenericutes, and Thaumarchaeota were the phyla isolated from all the three R. pulmo compartments in the sampling times. In particular, the main genera Mycoplasma and Spiroplasma, belonging to the class Mollicutes (phylum Tenericutes), have been identified in all the three jellyfish compartments. The taxonomic microbial data were coupled with metabolic

profiles resulting from the utilization of 31 different carbon sources by the BIOLOG Eco-Plate system. Microorganisms associated with mucus are characterized by great diversity. The counts of culturable heterotrophic bacteria and potential metabolic activities are also remarkable. Results are discussed in terms of R. pulmo ecology, the potential health hazard for marine and human life as well as the potential biotechnological applications related to the associated microbiome.

## 1H NMR Metabolic Profile of Scyphomedusa Rhizostoma pulmo (Scyphozoa, Cnidaria) in Female Gonads and Somatic Tissues: Preliminary Results

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Molecules, 2020, 25 (4), 806, DOI: 10.3390/molecules25040806

**Autori:** Angilè F, Del Coco L, Girelli CR, Basso L, Rizzo L, Piraino S, Stabili L, Fanizzi FP.

**Abstract ITA:** Il bacino del Mediterraneo è una delle regioni più colpite dai fenomeni di fioritura delle meduse, principalmente per la presenza di scyphozoi, come Rhizostoma pulmo. Le meduse hanno pochi predatori naturali e il loro corpo rappresenta un substrato ricco di sostanze organiche in grado di supportare una rapida crescita batterica con un grande impatto sulla struttura delle reti alimentari marine. Nei paesi asiatici, le meduse sono ampiamente studiate per i loro benefici per la salute, ma i loro valori nutrizionali e nutraceutici rimangono ancora poco caratterizzati. In questo studio, sono state studiate le differenze nei profili metabolici della spettroscopia NMR 1H delle gonadi femminili di R. pulmo e delle frazioni corporee (inclusi ombrello e braccia orali), in diversi periodi di campionamento. Per ogni compartimento corporeo sono stati caratterizzati sia estratti lipidici che acquosi e i loro profili metabolici 1H NMR sono stati sottoposti ad analisi multivariata. Da un'analisi statistica degli estratti, è stato osservato un contenuto più elevato di acidi grassi polinsaturi ω-3 (PUFA), aminoacidi e osmoliti (omarina, betaina, taurina) con ruoli importanti negli invertebrati marini nelle gonadi femminili, mentre per l'ombrello e le braccia orali sono stati osservati profili metabolici simili. Questi risultati supportano uno sfruttamento sostenibile della medusa per l'estrazione di composti bioattivi utili in campo nutraceutico, nutricosmetico e alimentare.

**Abstract ENG:** The Mediterranean basin is one of the regions heavily affected by jellyfish bloom phenomena, mainly due to the presence of scyphozoans, such as Rhizostoma pulmo. The jellyfish have few natural predators, and their bodies represent an organic-rich substrate that can support rapid bacterial growth with great impact on the structure of marine food webs. In Asiatic countries, jellyfish are widely studied for their health benefits, but their nutritional and nutraceutical values still remain poorly characterized. In this study, the differences in the 1H NMR spectroscopy metabolic profiles of R. pulmo female gonads and body fractions (including umbrella and oral arms), in different sampling periods, were studied. For each body compartment both lipid and aqueous extracts were characterized and their 1H NMR metabolic profiles subjected to multivariate analysis. From a statistical analysis of the extracts, a higher contents of ω-3 polyunsaturated fatty acids (PUFAs), amino acid and osmolytes (homarine, betaine, taurine) with important roles in marine invertebrates were observed in female gonads, whereas umbrella and oral arms showed similar metabolic profiles. These results support a sustainable exploitation of the jellyfish for the extraction of bioactive compounds useful in nutraceutical, nutricosmetics, and functional food fields.

## First characterization of activated sludge bacterial bioma by biomolecular (PCR) method

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** IOSR Journal of Biotechnology and Biochemistry, 2020, 6 (6), 36-44, DOI: 10.9790/264X-0606013644

**Autori:** Angelantonio Calabrese , Laura Mandrelli , Erika Loi and Massimo Blonda

**Abstract ENG:** The water treatment carried out with biological processes artificially reproduces the natural process of the biogeochemical cycle of the detritus present in aquatic environments and partly in the soil. The growing biomass in the plant is called "activated sludge"; usually it is mainly composed by bacteria (95%) and by Protozoa and Metazoans (5%). Microorganisms composing activated sludge have always been of great interest to microbiologists. The sludge biological composition is e a good indicator of its state of health, and can show the need for process or management changes, the treatment potential, the possible presence in the sewage of substances harmful to the process, the sludge pathologies and the best approach to further treatment of the mud. This work is part of a full-scale experimentation project of the AS Diffusion system for the abatement of osmogenic compounds emitted by biological treatment processes (TOASD project). The task of the project concerns the verification of any effects of selective pressure on the composition of the biological sludge induced by the AS diffusion system, applied to a biological line, in comparison with a parallel line on which the system is not applied. An initial characterization of the microorganisms present in the activated sludge of the plant chosen for the project is carried out before starting the project. The characterization is carried out through the extraction of DNA, with its quantification and determination of quality. A PCR analysis follows with the identification of the main Kingdoms and phylum of bacteria, for a first screening in order to continue the investigations to identify the species present. A performance check was carried out on the preparatory and DNA extraction procedures from the biological sludge matrix and an initial characterization of the microorganisms present before the project was started, with the quantification and determination of the quality of the extracted DNA. The NucleoSpin® Soil kit from MACHEREY-NAGEL demonstrated improved qualitative and quantitative efficacy. A DNA extraction procedure from samples stored by freezing in 150 ml aliquots and gradually thawed was found to be qualitatively and quantitatively better. All sequencing confirmed the amplification of the sequence sought and produced by the PCR. DNA of generic bacteria and archaea are always present in the 16S region. The Phylum Bacteroidetes, Termotogae (Fervidobacteria sp), Chlorobi, Spirochetes are absent in the present case. Furthermore, the Deltaprotebacteria class is absent. On the confirmation of bacterial presence, the subsequent research work by species and subsequently quantification with realtime PCR will be developed.

## Earlier Observation of Applicability of Biomolecular and Chemical Analysis to Soil and Shallow Groundwater in Nitrogen Biogeochemical Local Cycle Evaluation

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** IOSR Journal of Biotechnology and Biochemistry, 2020, 6 (1), 58-69, DOI: 10.9790/264X-0601015869

**Autori:** Angelantonio Calabrese, Laura Mandrelli and Massimo Blonda

**Abstract ENG:** The presence of nitrate in groundwater has long been considered as one of the main issues on a global scale. The identification of various contamination sources is then particularly relevant, along with the assessment of the negative impact of agricultural activities. This work presents the first attempt to apply the developed methodologies to phenomena of groundwater contamination from nitrates, with the purpose of distin-guishing the type of contamination when related to particular microbiomes environ-ments of soil and shallow groundwater. Analyses of the main chemical parameters and of the microbiome involved in the nitrogen biogeochemical cycle were carried out through specific definition of metagenomics techniques. The analytical procedure adopted, implemented with further quantitative real-time to estimate specific microbial communities in different matrices, showed to be suitable for the identification of factors responsible for nitrate contamination. In addition, it provides useful information on the relationship and possible interaction between soil and groundwater. Interesting differences emerge between the possible chemical and microbiological exchange between soil and groundwater, and the quality of soil itself, due to different agronomic practices a soil use. Future application of the Real Time and the quantification of population abundance per species will allow more detailed information about these phenomena.

## Chemical and Microbiological Characterization of Soil under Different Agronomical Use and Practical: First Focus on Nitrogen Cycles

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** IOSR Journal of Biotechnology and Biochemistry, 2020, 6 (3), 45-57, DOI: 10.9790/264X-0603024557

**Autori:** Angelantonio Calabrese, Laura Mandrelli,Erika Loi, Massimo Blonda

**Abstract ENG:** The study of soil ecology and the knowledge of its chemical and biological composition is become one of the principal aim of the environmental research. Most recent studies, based on consolidated knowledge, gives a specific analytical framework that allows to start correlating the biochemical composition of the soil with its particular characteristics and uses. For a sustainable agriculture, it must be adopted alternatives to a disproportionate use of non-organic fertilizers and agro-pharmaceuticals. The practice adopted has also an important effect on the soil and its characteristics, particularly on its chemical and microbiological composition, which varies the capacity of the soil to create and provide eco-systemic activity. The chemical and microbiological composition of the soil has also effect on the quantity and quality of the agricultural product. Today we have the possibility to scientifically measure the effect of these different practices on soil composition and mainly on its biodiversity. In this study some first chemical and biome characterizations, related to the nitrogen cycle, were conducted in sites with different land use and with different agronomic practices, combining methods of chemical and metagenomics analysis. Resulted a high variability in the concentration of organic substance in the soil and no correlation of organic carbon concentration versus organic nitrogen concentration, denoting differences in the quality of the organic matter present. The soil of the ancient biodynamic vineyard shows the highest concentration of DNA found. Unexpectedly, the vegetable garden managed under biological methods shows the lowest concentration of DNA found. The composition of the biome for the bacterial species of nitrogen cycle shows a very complex picture. Some species are always absent and some always present; in a worrying case only the Neisseria species was detected. The work will continue by applying quantitative PCR techniques (Real Time), with which a complete photograph of the state of the microbiome of the analyzed soils will be possible. The applied method seems particularly suitable for bio-geo-chemical insights on the nitrogen cycle in the soil, referred to different use of the soil and in relation to the agronomic practices adopted.

## Cnidarian Immunity and the Repertoire of Defense Mechanisms in Anthozoans

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Biology 2020, 9, 283; doi:10.3390/biology9090283

**Autori:** MG Parisi, D Parrinello, L Stabili, M Cammarata

**Abstract ITA:** Gli antozoi appartengono al phylum Cnidaria che è filogeneticamente basale all'interno del Metazoa. È un gruppo interessante per studiare l'evoluzione dei mutualismi e immunità, perché nonostante la loro semplicità morfologica, gli antozoi sono inaspettatamente immunologicamente complessi, con grandi genomi . Le prove indicano che il sistema immunitario innato degl antozoi non è solo coinvolto nella distruzione dei microrganismi dannosi , ma è anche cruciale nella strutturazione delle comunità microbiche associate ai tessuti che sono componenti essenziali dello cnidario holobionte utili alla salute dell'animale per diverse funzioni tra cui il metabolismo, la difesa immunitaria, lo sviluppo e il comportamento. Riportiamo qui l'attuale stato dell'arte dell'immunità degli antozoi . Come altri invertebrati, gli antozoi possiedono un sistema immunitario basato su meccanismi di riconoscimento del non-self. Sebbene manchino di immunità adattativa, essi usano un repertorio diversificato di percorsi di segnalazione del recettore immunitario (PRR) per riconoscere un'ampia gamma di modelli molecolari associati a microrganismi conservati (MAMP). La segnalazione intracellulare le cascate portano alla trascrizione genica fino agli endpoint di rilascio di molecole che uccidono i patogeni, che consentono di difendere il self mantenendo l'omeostasi e di modulare il processo di riparazione delle ferite. Le cellule giocano a ruolo fondamentale nell'immunità, in quanto mostrano attività fagocitiche e secernono muco, che agisce come barriera fisico-chimica che impedisce o rallenta la proliferazione di potenziali invasori. Infine, descriviamo lo stato attuale delle conoscenze di alcuni effettori immunitari nelle specie di antozoi, compreso il ruolo potenziale delle tossine e la risposta infiammatoria nell'Antozoo mediterraneo Anemonia viridis a seguito di iniezione di varie particelle estranee differenti per tipo e dimensioni, compresi i batteri patogenetici.

**Abstract ENG:** Anthozoa is the most specious class of the phylum Cnidaria that is phylogenetically basal within the Metazoa. It is an interesting group for studying the evolution of mutualisms and immunity, for despite their morphological simplicity, Anthozoans are unexpectedly immunologically complex, with large genomes and gene families similar to those of the Bilateria. Evidence indicates that the Anthozoan innate immune system is not only involved in the disruption of harmful microorganisms, but is also crucial in structuring tissue-associated microbial communities that are essential components of the cnidarian holobiont and useful to the animal's health for several functions including metabolism, immune defense, development, and behavior. Here, we report on the current state of the art of Anthozoan immunity. Like other invertebrates, Anthozoans possess immune mechanisms based on self/non-self-recognition. Although lacking adaptive immunity, they use a diverse repertoire of immune receptor signaling pathways (PRRs) to recognize a broad array of conserved microorganism-associated molecular patterns (MAMP). The intracellular signaling cascades lead to gene transcription up to endpoints of release of molecules that kill the pathogens, defend the self by maintaining homeostasis, and modulate the wound repair process. The cells play a fundamental role in immunity, as they display phagocytic activities and secrete mucus, which acts as a physicochemical barrier preventing or slowing down the proliferation of potential invaders. Finally, we describe the current state of knowledge of some immune effectors in Anthozoan species,

including the potential role of toxins and the inflammatory response in the Mediterranean Anthozoan Anemonia viridis following injection of various foreign particles differing in type and dimensions, including pathogenetic bacteria.

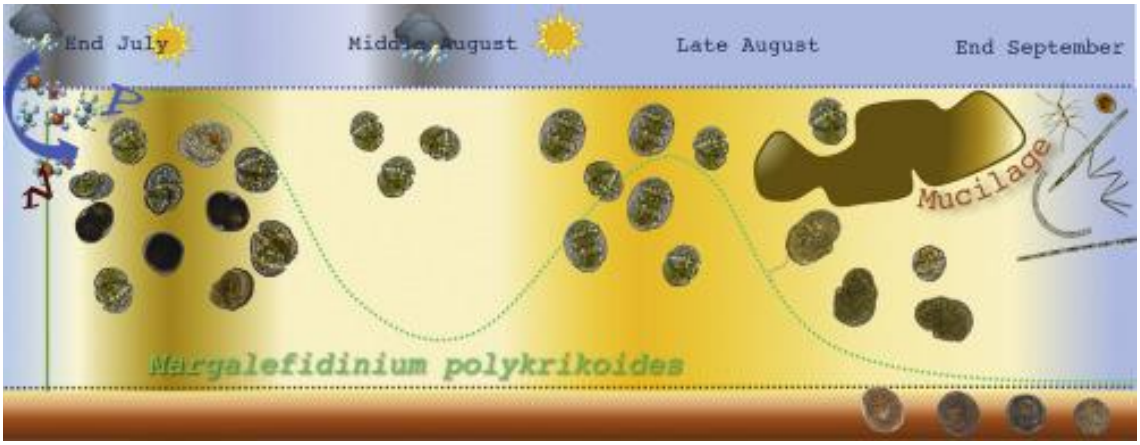
## Two-stages bloom of *Margalefidinium* cf. *polykrikoides* in a Mediterranean shallow bay (Ionian Sea, Italy).

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Marine Pollution Bulletin, 2020, 151, 110825, DOI: 10.1016/j.marpolbul.2019.110825

**Autori:** Roselli L., Vadrucci M.R., Belmonte M., Ciciriello P., Rubino F., Ungaro N., Caroppo C.

**Abstract ENG:** The emergence of a red tide resulting in yellow-brownish discoloration of waters in Porto Cesareo bay (Italy) during July-August 2018 is reported. The species responsible for the bloom was the dinoflagellate *Margalefidinium* cf. *polykrikoides*. Cell densities reached 9.1 x $10^6$ cells $L^{-1}$ during the initial outbreak. A second peak was observed about three weeks later reaching 6.7 x $10^5$ cells $L^{-1}$. Study of live specimens showed great variation in cell size and shape. Different cyst morphotypes were found in the water samples and in the sediment. For the first time, we followed several stages of the life cycle of *Margalefidinium* cf. *polykrikoides* in natural samples. Fish die-offs in the bay were not observed, however this high-density bloom may have caused consequences on the ecosystem (amount of mucilage on the beach) and in turn, on tourism that is the main activity in the area during the summer season.



## The marine sponge *Petrosia ficiformis* harbours different cyanobacteria strains with potential biotechnological application.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Journal of Marine Science and Engineering, 2020, 8, 638, DOI: 10.3390/jmse8090638

**Autori:** Pagliara P., Barca A., Verri T., Caroppo C.

**Abstract ENG:** Marine cyanobacteria are a source of bioactive natural compounds, with a wide range of biotechnological applications. However, information on sponge-associated cyanobacteria are relatively scarce to date. In this paper, we carried out the morphological and molecular characterization of eight cyanobacterial strains, previously isolated from the Mediterranean sponge *Petrosia ficiformis*, and evaluated their biological activities on epithelial- and neuron-like cultured cells of human and murine origin. The new analysis allowed maintaining the assignment of three strains (*Cyanobium* sp., *Leptolyngbya ectocarpi*, and *Synechococcus* sp.), while two strains previously identified as *Synechococcus* sp. and *Leptolyngbya* sp. were assigned to *Pseudanabaena* spp. One strain, i.e., ITAC104, and the ITAC101 strain corresponding to *Halomicronema metazoicum*, shared extremely high sequence identity, practically representing two clones of the same species. Finally, for only one strain, i.e., ITAC105, assignment to a specific genus was not possible. Concerning bioactivity analyses, incubation of cyanobacterial aqueous cell supernatants induced variable responses in cultured cells, depending on cell type, with some of them showing toxic activity on human epithelial-like cells and no toxic effects on human and rat neuron-like cells. Future investigations will allow to better define the bioactive properties of these cyanobacteria strains and to understand if they can be useful for (a) therapeutic purpose(s).

## Influence of lateral advection on phytoplankton size-structure and composition in a Mediterranean coastal area.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Continental Shelf Research, 2020, 209, 104216, doi: 10.1016/j.csr.2020.104216

**Autori:** Decembrini F., Caroppo C., Bergamasco A.

**Abstract ENG:** Phytoplankton size is a significant functional trait affecting many ecological processes and influencing the carbon fate and the trophic regimes of the ecosystems. In this study, we examined the effect of the lateral advection of nutrient-rich Messina Mixed Waters on the phytoplankton size structure and community composition in the euphotic layer of the Gulf of Augusta (Western Ionian Sea) in early autumn. The chlorophyll a concentration ranged from 0.08 to 0.8 mg $m^{-3}$ and the phytoplankton abundances ranged from 21 × $10^3$ to 245 × $10^3$ cells $L^{-1}$. The size structure of phytoplankton biomass, obtained by sequential filtration of water samples, suggested the dominance of micro-planktonic diatoms in an active Deep Chlorophyll Maximum (DCM) whereas smaller forms were mainly represented by phytoflagellates. A short-term tidal-induced variability of the assemblage structure was observed at a "sentinel" station located at the Gulf shelf-break where lateral advection due to meso-scale dynamics sustained most of the phytoplankton biomass. Our research shows that, in stratified conditions, nutrient enrichment by lateral advection at DCM modifies the size-structure of phytoplankton with respect to that expected from the reference baseline oceanic model validated in open ocean waters. In particular, while smaller fraction incidences reveal a surface oligotrophic system, an increase of the micro-sized fraction is triggered at DCM: this indicates the prevalence of "new production" processes which is a quite unusual condition for the Mediterranean DCM in early autumn, when trophic web is typically sustained by "regenerate production". Our observations suggest that both "microbial" and "herbivore" pathways could coexist and regulate the carbon flow in the Gulf in this season.

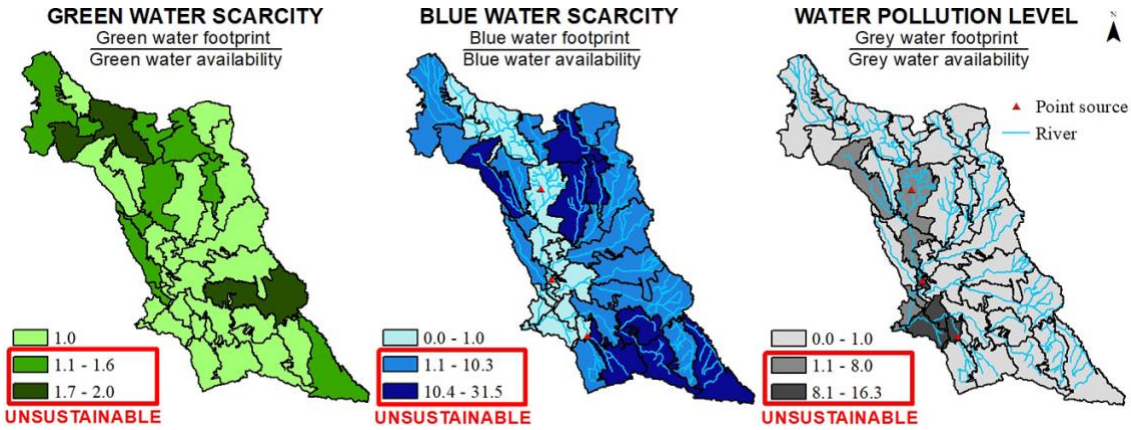
## Using water footprint concepts for water security assessment of a basin under anthropogenic pressures

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Science of The Total Environment, 2020, 748, 141356, doi: 10.1016/j.scitotenv.2020.141356

**Autori:** Ersilia D'Ambrosio, Giovanni Francesco Ricci, Francesco Gentile, Anna Maria De Girolamo

**Abstract ENG:** The evaluation of water shortages and pollution levels is crucial for watershed management and sustainable development. This paper proposes a water footprint (WF) sustainability assessment approach to analyse water security in a river basin under human pressures. The methodology involves a comprehensive assessment of the current water security at different spatial and temporal levels, and identifies suitable response formulations to achieve sustainability. Field surveys and measurements (streamflow, water quality) were carried out, and the Soil and Water Assessment Tool model was used for assessing water balance components and water quality. The study was carried out in the Canale d'Aiedda river basin (Taranto, Italy), which is part of the 'area of environmental crisis' of Taranto, which requires remediation of surface water, groundwater, soil and subsoil. Considering all the anthropogenic activities in the basin, including agriculture and the treated effluent disposed of via wastewater treatment plants (WWTPs), the average WF was 213.9 Mm3 y−1, of which 37.2%, 9.2% and 53.6% comprised respectively for WFgreen, WFblue and WFgrey. The WF sustainability assessment revealed that pollution was the main factor affecting surface water security. In particular, point sources contributed with 90% to the total WFgrey, and lower pollutant thresholds should be fixed for effluent from WWTPs in order to increase water quality of the receiving water body. In addition, for assuring water security the extension of the natural areas should be increased to support biodiversity in the river basin and soil management strategies should be improved to allow more water to be retained in the soil and to reduce nutrients in surface runoff. This study demonstrates that the WF sustainability assessment is a feasible approach for integrated water resources management, as well as offering a much broader perspective on how water security can be achieved in a Mediterranean basin affected by multiple anthropogenic stressors.



## Holistic Approach to Phosphorus Recovery from Urban Wastewater: Enhanced Biological RemovalCombined with Precipitation.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Sustainability , (2020), 12, 575 - doi:10.3390/su12020575

**Autori:** TOMEI M.C, STAZI V, DANESHGAR S., CAPODAGLIO A.G.

**Abstract ENG:** Combined phosphorus (P) removal and recovery from wastewater is a sensible and sustainable choice in view of potential future P-resource scarcity, due to dwindling primary global reserves. P-recovery from wastewater, notwithstanding the relatively small fraction of total global amounts involved (less than 1/5 of total global use ends up in wastewater) could extend the lifespan of available reserves and improve wastewater cycle sustainability. The recovery of the resource, rather than its mere removal as ferric or aluminum salt, will still allow to achieve protection of receiving waters quality, while saving on P-sludge disposal costs. To demonstrate the possibility of such a recovery, a strategy combining enhanced biological phosphorus removal and mineral P-precipitation was studied, by considering possible process modifications of a large treatment facility. Process simulation, a pilot study, and precipitation tests were conducted. The results demonstrated that it would be possible to convert this facility from chemical -precipitation to its biological removal followed by mineral precipitation, with minimal structural intervention. Considerable P-recovery could be obtained, either in form of struvite or, more sustainably, as calcium phosphate, a mineral that also has possible fertilizing applications. The latter would present a cost about one order of magnitude lower than the former.

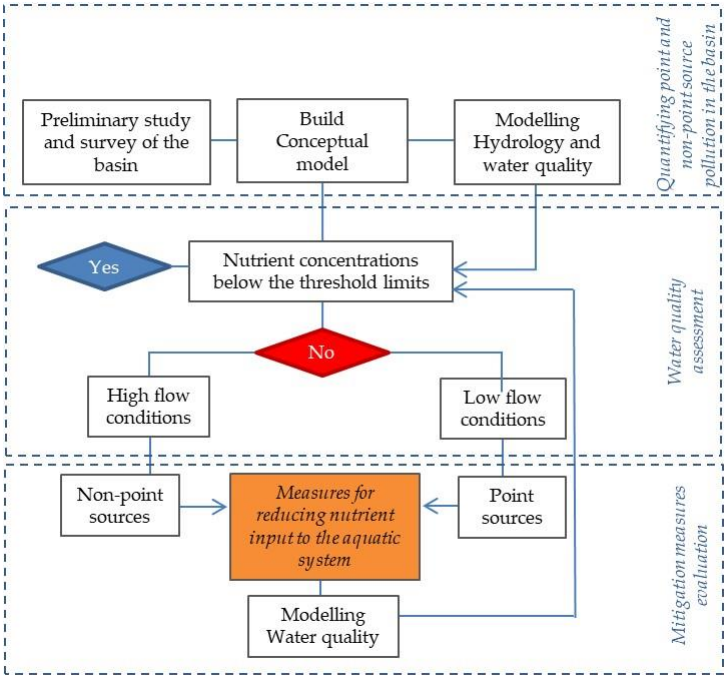
## Source Apportionment of Nutrient Loads to a Mediterranean River and Potential Mitigation Measures

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Water, 2020,12, 577, doi: 10.3390/w12020577

**Autori:** Anna Maria De Girolamo, Antonio Lo Porto

**Abstract ENG:** The aims of the study were to quantify nutrient loads from point and diffuse pollution sources in the Rio Mannu stream and to simulate mitigation measures for reducing nutrient loads delivered to the Santa Gilla wetland. The Soil and Water Assessment Tool model was used for simulating hydrology, nutrient balance and water quality. At the basin scale, the input from fertilisers was 80.3 kg ha−1 year−1 total nitrogen (TN) (87.6% of the total input) and 27.6 kg ha−1 year−1 of total phosphorus (TP) (99.8% of the total input). Atmospheric deposition and biological N-fixation together accounted for about 12% of the total TN input. The TN and TP from wastewater treatment plants (WWTPs) were about 14.2 t year−1 and 3.1 t year−1, respectively. Nutrient loads delivered to the river system differed among the sub-basins, with TP ranging from 0.2 kg ha−1 year−1 to 2.7 kg ha−1 year−1, and the sum of organic N and NO3-N ranging from 1.8 kg ha−1 year−1 to 22.9 kg ha−1 year−1. Under high flow conditions, NO3-N and TP accounted for 89% and 99% of the total load, respectively. The low flow contribution to the total load was very low, with NO3-N and TP accounting for 2.8% and 0.7%, respectively. However, the natural hydrological regime in the study area is intermittent, and low flow represents a critical condition for the water quality due to the high concentrations of TP and NO3-N from WWTP discharge. To improve the water quality, the reuse of treated wastewater from three WWTPs for irrigation purposes on olive cultivation, coupled with a 20% reduction in fertiliser application, was simulated. The results showed a reduction in nutrient loads at the outlet for all hydrological conditions. However, additional measures are needed for improving water quality.



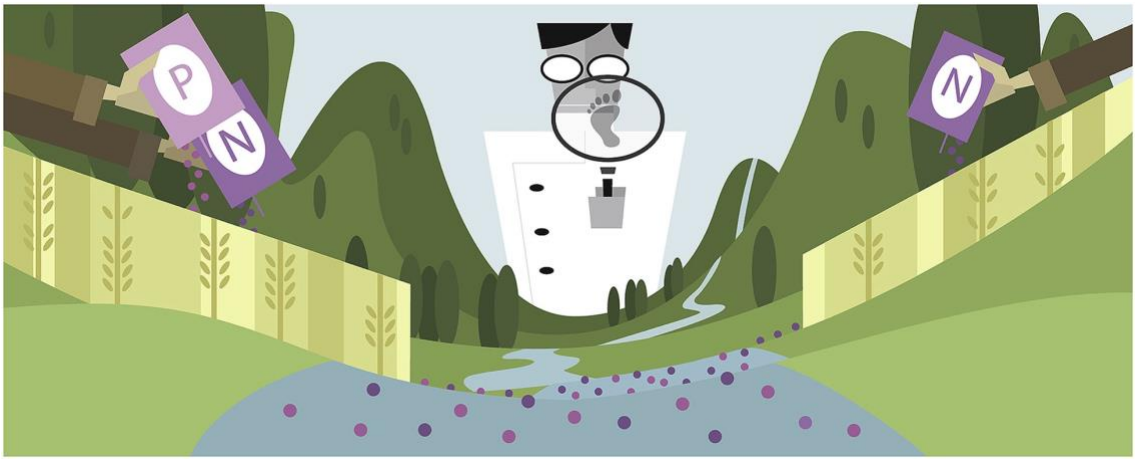
## Assessing the sustainability in water use at the basin scale through water footprint indicators

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Journal of Cleaner Production, 2020, 244, 118847, doi: 10.1016/j.jclepro.2019.118847

**Autori:** Ersilia D'Ambrosio, Francesco Gentile, Anna Maria De Girolamo

**Abstract ENG:** This study aimed to assess the sustainability in water use at the basin scale through the water footprint (WF). The methodology proposed by the Water Footprint Network was integrated with a hydrological and water quality model and in-stream monitoring data to assess the WF in the Canale D'Aiedda Basin (SE Italy). The Soil and Water Assessment Tool was used to estimate runoff, evapotranspiration and nutrients in the runoff. A bootstrap technique, coupled with Monte Carlo simulations, was applied to evaluate the WF uncertainty related to the variability in input data and the unknown natural background level of nutrients in the surface waters. The WF at the basin scale was 124.4 Mm3, of which 78.3%, 17.4% and 4.3% was constituted by the WFgreen, WFblue and WFgrey, respectively. The crops with the highest mean crop water use were vineyards (752.6 mm), followed by olive groves (583.1 mm) and durum wheat (489.1 mm). For the surface water, the total WFblue was unsustainable because the actual runoff (Ract) was not sufficient to satisfy the irrigation requirements. The WFgrey was unsustainable because the Ract was not enough to dilute the pollutant load associated with the diffuse and point sources to reduce it to below the maximum acceptable concentration. The surface water quality was impaired more by the point sources than the agriculture. The proposed modelling framework could be useful for improving water resources management.



## Uptake/release of organic contaminants by microplastics: a critical review of influencing factors, mechanistic modelling and thermodynamic prediction methods

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Critical Reviews in Environmental Science and Technology (2020) https://doi.org/10.1080/10643389.2020.1856594

**Autori:** Mosca Angelucci D., Tomei, M.C.

**Abstract ENG:** The role of microplastics (MPs) as a vector of chemicals is generally recognized: a wide range of micropollutants have been detected in MPs sampled in different environmental compartments, and, due to their ubiquitous distribution, they can be transferred through aquatic and terrestrial organisms into the food chain. Providing representative models is challenging due to the intrinsic dynamic evolution characterizing the natural phenomena, which cannot be adequately investigated in lab experiments. On the other side, simulation/prediction tools are strongly required because of the long time-scale characterizing the MPs' persistence in the environment. This article provides a review of the updated literature on mechanistic models and predictive thermodynamic methods applied (or applicable), to describe the uptake/release processes of pollutants by MPs. Intrinsic and environmental factors influencing the process kinetics and the equilibrium distribution are discussed in detail. Mechanistic models and thermodynamic prediction methods are analyzed and their potentialities for application to MPs highlighted with specific examples. Finally, a critical analysis of the limitations related to the simplifying assumptions in modeling and to the representativeness of the lab-scale data is performed to evaluate their effects on the reliability of the predictions and to identify knowledge gaps and address future research needs.

## Effectiveness and feasibility of different management practices to reduce soil erosion in an agricultural watershed

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Land Use Policy, 2020, 90, 104306, doi: 10.1016/j.landusepol.2019.104306

**Autori:** Giovanni Francesco Ricci, Jaeak Jeong, Anna Maria De Girolamo, Francesco Gentile

**Abstract ENG:** Erosion is the most widespread form of soil degradation in Europe. EU Member States are called to identify areas prone to high risk of soil erosion and to adopt Best Management Practices (BMPs) to decrease land degradation. This study is aimed at identifying effective BMPs and their economic feasibility for controlling soil erosion in south-central Italy where lands are largely cultivated with winter wheat. The Soil and Water Assessment Tool (SWAT) was applied to simulate the baseline hydrologic and soil erosion processes of the Carapelle basin in the Puglia region, Italy. Calibrated sediment loads were reasonably accurate when statistically evaluated against measured data (R2 = 0.5, NSE = 0.5, PBIAS=−2.8 %). The model performed equally well for simulating stream flow rates (R2 = 0.6, NSE = 0.6, PBIAS = 5.3 %). The model maintained reliable performance during the validation period as well. Average annual specific sediment load was estimated 5.95 t ha-1 yr-1 mostly contributed by cultivated croplands. Based on regional agricultural policies, four management scenarios were implemented using the calibrated SWAT model: contour farming (BMP1), no tillage (BMP2); reforestation (BMP3) and contour farming and reforestation (BMP4). A threshold of sediment yield greater than 10 t ha-1yr-1 was selected to discretize target treatment areas where these BMPs were applied. Result show that combining contour farming and reforestation (BMP4) was the most effective (38 % reduction; from 5.95 to 3.70 t ha-1) for erosion control, followed by BMP2 (29 %; from 5.95 to 4.20 t ha-1), BMP1 (22 %; from 5.95 to 4.61 t ha-1) and BMP3 (15 %; from 5.95 to 5.04 t ha-1). An analysis of the farmer return-production cost ratio (FR/PC) indicated that the baseline (conventional tillage) and BMP1 were both economically sustainable in areas with slope <20 % (FR/PC = 1.12 and 1.11, respectively). BMP2 received the highest FR/PC rating of 1.67 in areas with slope <20 %. The baseline scenario had no economic advantage (FR/PC = 0.93) in steep slope areas. BMP3 was ranked at the top (FR/PC = 1.49) followed by BMP2 (FR/PC = 1.41) in areas with slope>20 %. The results show that a program of measures can be effective for controlling soil erosion but it must be implemented over long time frames and it requires relevant investments from the public and private sectors.

## Accounting for flow intermittency in environmental flows design

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Journal of Applied Ecology, 2020, 57 (4), 742-753, doi: 10.1111/1365-2664.13590

**Autori:** Vicenç Acuña, Dídac Jorda-Capdevila, Paolo Vezza, Anna Maria De Girolamo, Michael E. McClain, Rachel Stubbington, Amandine V. Pastor, Nicolas Lamouroux, Daniel von Schiller, Antoni Munné, Thibault Datry

**Abstract ENG:** Setting environmental flow requirements for temporary waterways requires modification and enhancement of existing approaches and methodologies, most notably the explicit consideration of non-flow events and greater integration of specific geomorphic, hydrogeologic and hydraulic elements. Temporary waterways are among the freshwater ecosystems most vulnerable to alterations in flow regimes, and they are also under great pressure. The methodological modifications recommended in this paper will aid water managers in protecting key components of temporary flow regimes, thereby preserving their unique ecology and associated services.

## Geographical and temporal distribution of SARS-CoV-2 clades in the WHO European Region, January to June 2020

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Eurosurveillance, 2020, 25, 32, 7-14, DOI: 10.2807/1560-7917.ES.2020.25.32.2001410

**Autori:** Erik Alm, Eeva K Broberg, Thomas Connor, Emma B Hodcroft, Andrey B Komissarov, Sebastian Maurer-Stroh, Angeliki Melidou, Richard A Neher, Áine O'Toole, Dmitriy Pereyaslov , The WHO European Region sequencing laboratories and GISAID EpiCoV group (include Fabrizio Stefani, Stefano Polesello e Franco Salerno di IRSA-CNR)

**Abstract ENG:** We show the distribution of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) genetic clades over time and between countries and outline potential genomic surveillance objectives. We applied three genomic nomenclature systems to all sequence data from the World Health Organization European Region available until 10 July 2020. We highlight the importance of real-time sequencing and data dissemination in a pandemic situation, compare the nomenclatures and lay a foundation for future European genomic surveillance of SARS-CoV-2.

## Biopolymers from Urban Organic Waste: Influence of the Solid Retention Time to Cycle Length Ratio in the Enrichment of a Mixed Microbial Culture (MMC)

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** ACS Sustainable Chem. Eng., 2020, 8, 38, 14531–14539, doi: 10.1021/acssuschemeng.0c04980

**Autori:** Moretto Giulia, Lorini Laura, Pavan Paolo, Crognale Simona, Tonanzi Barbara, Rossetti Simona, Majone Mauro, Valentino Francesco

**Abstract ENG:** In this study, the performance of the selection process for polyhydroxyalkanoate (PHA) production from mixed microbial cultures (MMCs) at pilot scale was deeply investigated with the solid retention time (SRT) to cycle length (CL) ratio as main affecting parameter. Four different runs were tested by varying the SRT/CL ratio maintaining the same organic loading rate (OLR). The pilot-scale selection and accumulation reactors were fed with a fermented mixture of source-selected organic fraction of municipal solid waste (OFMSW) and waste activated sludge (WAS), refined with a centrifuge and membrane unit for the coarse solid removal. The selected biomass obtained in the most performing run was characterized by a specific storage rate of 375 mg CODP/g CODXa h and a storage yield of 0.46 CODP/CODSOL. Accumulations performed with the same biomass were characterized by a storage yield of 0.62 CODP/CODVFA. The microbiome composition was assessed. In the most performing run, putative PHA-storing bacteria affiliated with Paracoccus genus were found at high abundance (36.8%), in contrast to all other runs. An overall PHA yield of 110 g PHA/kg VS was estimated for the best scenario, revealing an interesting perspective for biorefinery technology chains based on the three-stage process for PHA production.

## Enrichment of a mixed microbial culture of PHA-storing microorganisms by using fermented hardwood spent sulfite liquor

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** New Biotechnology, 2020, 56, 79-86, doi: 10.1016/j.nbt.2019.12.003

**Autori:** Pereira J.,Queirós D., Lemos P.C., Rossetti S., Serafim L.S.

**Abstract ENG:** Pulp and paper factories produce several residues that can be explored and valorized through poly-hydroxyalkanoate (PHA) production via a three-step process. The objective of this work was focused on the selection step. Acidified hardwood spent sulfite liquor (HSSL), a fermented waste stream from a pulp and paper factory, was used to select a mixed microbial culture (MMC) in a sequencing batch reactor (SBR) operated for 156 days under different operational conditions. The MMC adapted to the imposed conditions, revealing its robustness whenever the operational parameters were changed. Feast-to-Famine ratio was kept below or equal to 0.2, with constant production of a copolymer of P(3HB-co-3 HV), and with storage contents values over 30 %. Changes in the operational conditions, namely cycle length, and organic load rate (OLR), successfully led to the selection of an MMC with a stable accumulation capacity and an increased biomass concentration. Next Generation Sequencing analysis was performed on samples collected during the SBR operational period. The analysis of the microbial composition of the MMC showed a rise in PHA-accumulating bacteria over time. Acidovorax and Comamonas species were found mainly to drive the PHA storage process during the first two periods of operation. After an increase in the OLR, in the last period, a shift towards Comamonas dominance occurred, suggesting a higher tolerance to the inhibitory compounds of the HSSL for this genus.

## Human access negatively impacts biodiversity on sandy beaches

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Communications Biology, 2020, 3, 175, doi: 10.1038/s42003-020-0912-6

**Autori:** Alejandro Martínez, Ester M. Eckert, Tom Artois, Stefan Gobert, Giovanni Careddu, Aldo Zanello, Marco Curini-Galletti, Marco Casu, Viatcheslav N. Ivanenko, Ulf Jondelius, Marinella Marzano, Graziano Pesole, M. Antonio Todaro, Diego Fontaneto

**Abstract ENG:** Whereas most work to understand impacts of humans on biodiversity on coastal areas has focused on large, conspicuous organisms, we highlight effects of tourist access on the diversity of microscopic marine animals (meiofauna). We used a DNA metabarcoding approach with an iterative and phylogeny-based approach for the taxonomic assignment of meiofauna and relate diversity patterns to the numbers of tourists accessing sandy beaches on an otherwise un-impacted island National Park. Tourist frequentation, independently of differences in sediment granulometry, beach length, and other potential confounding factors, affected meiofaunal diversity in the shallow "swash" zone right at the mean water mark; the impacts declined with water depth (up to 2 m). The indicated negative effect on meiofauna may have a consequence on all the biota including the higher trophic levels. Thus, we claim that it is important to consider restricting access to beaches in touristic areas, in order to preserve biodiversity.

## Anchialine biodiversity in Turks and Caicos – new discoveries and current faunal composition

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** International Journal of Speleology, 2020, 49 (2), 71-86, doi: 10.5038/1827-806X.49.2.2316

**Autori:** Brett C. Gonzalez*, Alejandro Martínez*, Jørgen Olesen, Sarit B. Truskey, Lauren Ballou, Marc Allentoft-Larsen, Joost Daniels, Paul Heinerth, Naqqi Manco, Jon Ward, Thomas M. Iliffe, Karen J. Osborn, Katrine Worsaae (*shared first authorship)

**Abstract ENG:** Lying at the southernmost point of the Lucayan Archipelago, the Turks and Caicos Islands are amongst the better studied localities for anchialine cave biodiversity. For nearly five decades, novel invertebrate fauna, comprised primarily of crustaceans, have been collected from these tidally influenced pools – but new findings are always on the horizon. Herein we present new records of crustaceans and annelids from anchialine blue holes and horizontal caves of the Turks and Caicos. These findings include two potentially new species of meiofaunal annelids and a new species of remipede collected from a shallow water cave pool. Our 2019 expedition additionally expands known faunal distributions for several taxa across the Caicos islands, and raises the biodiversity of the region to 35 species, 13 of them considered endemic. This is the first comprehensive faunal list for the anchialine systems in the Caicos Bank.

## Soil texture prediction via reduced K-means Principal Component Multinomial Regression

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Socio-economic planning sciences, 2020, 100871, doi.org/10.1016/j.seps.2020.100871

**Autori:** Antonio Lucadamo, Pietro Amenta, Natalia Leone

**Abstract ITA:** La tessitura è una delle proprietà fisiche più importanti dei suoli per la sua influenza su altre proprietà fondamentali. È definita in base alla distribuzione granulometrica, che può essere accuratamente misurata in laboratorio. Tuttavia, queste misure sono costose e richiedono molto tempo, pertanto sono necessarie valide alternative. Negli ultimi anni sono state utilizzate alcune tecniche statistiche per prevedere la classificazione della tessitura utilizzando valori di spettrometria della riflettanza come variabili esplicative. La stima dei parametri del modello può non essere troppo accurata, influenzando la previsione quando c'è multicollinearità tra i predittori. Un altro problema può essere il gran numero di variabili esplicative solitamente necessarie per spiegare la risposta. Al fine di migliorare l'accuratezza della previsione nei problemi di classificazione in multicollinearità e per ridurre la dimensione del problema con covariate continue, in questo articolo introduciamo una nuova tecnica, basata su metodi di classificazione e riduzione delle dimensioni. Mostriamo come la nuova proposta possa migliorare l'accuratezza della previsione, considerando un problema riguardante la classificazione tessiturale dei suoli della regione Campania.

**Abstract ENG:** Texture is one of the most important physical property of the soils for its influence on other fundamental properties. It is defined according to particle size distribution, that can be accurately measured in laboratory. However, these measurements are costly and very time consuming, therefore valid alternatives are necessary. In last years some statistical techniques have been used to predict textural classification using values of reflectance spectrometry as explicative variables. The estimation of the model parameters can be not too accurate, affecting prediction when there is multicollinearity among predictors. Another issue can be the great number of explicative variables usually necessary to explain the response. In order to improve the accuracy of the prediction in classification problems under multicollinearity and to reduce the dimension of the problem with continuous covariates, in this paper we introduce a new technique, based on classification and dimension reduction methods. We show how the new proposal can improve the accuracy of prediction, considering a problem concerning the textural classification of soils of Campania region.

## Ecotoxicological testing of sediments and dredged material: an overlooked opportunity?

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Journal of Soils and Sediments, 2020, 20, 4218–4228, DOI: 10.1007/s11368-020-02798-7

**Autori:** Heise, Susanne; Babut, Marc; Casado, Carmen; Feiler, Ute; Ferrari, Benoit J. D.; Marziali, Laura

**Abstract ENG:** Purpose Basing decisions for the management of contaminated sediments on ecotoxicological data is still often met with skepticism by European stakeholders. These concerns are discussed as they pertain to bioassays to show how ecotoxicological data may provide added value for the sustainable management of sediment in aquatic systems. Materials and methods Five "concerns" are selected that are often raised by stakeholders. The ecotoxicological practice is discussed in light of the knowledge gained in recent decades and compared with chemical sediment analysis and chemical data. Results and discussion Common assumptions such as a higher uncertainty of biotest results for sediments compared to chemical analyses are not supported by interlaboratory comparisons. Some confusion also arises, because the meaning of biotest data is often misunderstood, questioning their significance in light of a limited number of organisms and altered test conditions in the lab. Because biotest results describe a sediment property, they should not be directly equated with an impact upon the biological community. To identify a hazard, however, the possibility of false-negative results due to the presence of contaminants that are not analyzed but are toxic is lower. Conclusions The cost of increased investment in ecotoxicological tests is, in our view, small compared with that of making false-negative assessments of sediment/dredged material that can ultimately have long-term environmental costs. As such, we conclude that ecotoxicological testing is an opportunity for sediment management decision-making that warrants more attention and confidence in Europe.

## Microplastic-associated biofilms in lentic Italian ecosystems

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Water Research, 2020, 187, 116429, 10.1016/j.watres.2020.116429

**Autori:** Francesca Di Pippo, Cristina Venezia, Maria Sighicelli, Loris Pietrelli, Stefania Di Vito, Simone Nuglio, Simona Rossetti

**Abstract ENG:** In this study, 16S rRNA gene high throughput sequencing and Fluorescence In Situ Hybridization (FISH) combined with confocal laser scanning microscopy (CLSM) were used to assess for the first time biodiversity and structure of microplastic-associated biofilms (plastisphere) collected from Italian lentic ecosystems. The analysis revealed clear differences in microbial community composition among biofilms and corresponding planktonic populations indicating a selective adhesion on microplastics (MP). Although geographical variations in taxa composition were observed, a plastisphere core microbiome, composed by known biofilm formers found in freshwater ecosystems (e.g. Sphingorhabdus, Sphingomonas, Rhodobacter, Aquabacterium and Acidovorax genera) was found. Species composition of plastisphere did not substantially differ between the diverse polymers, while a clear link with the MP exposure time was found by Fourier Transform Infrared spectroscopy (FT-IR) and Scanning Electron Microscopy (SEM) analysis. Generalist planktonic taxa (e.g. members of the families Sphingomonadaceae and Rhodobacteraceae) were found on MPs with the lowest degradation level whereas the biodiversity increased with the increase of MP degradation. FISH-CLSM analysis confirmed the Burkolderiaceae dominance in most of the analyzed plastisphere samples and revealed a patchy microbial colonization and a complex biofilm architecture with bacterial micro-colonies and cyanobacterial aggregates occurring together with microalgae assemblages.

## Chromium Pollution in European Water, Sources, Health Risk, and Remediation Strategies: An Overview

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** International journal of environmental research and public health, 2020, 17, 5438, doi: 10.3390/ijerph17155438

**Autori:** Tumolo, Marina; Ancona, Valeria; De Paola, Domenico; Losacco, Daniela; Campanale, Claudia; Massarelli, Carmine; Uricchio, Vito Felice

**Abstract ITA:** Chromium is a potentially toxic metal occurring in water and groundwater as a result of natural and anthropogenic sources. Microbial interaction with mafic and ultramafic rocks together with geogenic processes release Cr (VI) in natural environment by chromite oxidation. Moreover, Cr (VI) pollution is largely related to several Cr (VI) industrial applications in the field of energy production, manufacturing of metals and chemicals, and subsequent waste and wastewater management. Chromium discharge in European Union (EU) waters is subjected to nationwide recommendations, which vary depending on the type of industry and receiving water body. Once in water, chromium mainly occurs in two oxidation states Cr (III) and Cr (VI) and related ion forms depending on pH values, redox potential, and presence of natural reducing agents. Public concerns with chromium are primarily related to hexavalent compounds owing to their toxic effects on humans, animals, plants, and microorganisms. Risks for human health range from skin irritation to DNA damages and cancer development, depending on dose, exposure level, and duration. Remediation strategies commonly used for Cr (VI) removal include physico-chemical and biological methods. This work critically presents their advantages and disadvantages, suggesting a site-specific and accurate evaluation for choosing the best available recovering technology.

**Abstract ENG:** Chromium is a potentially toxic metal occurring in water and groundwater as a result of natural and anthropogenic sources. Microbial interaction with mafic and ultramafic rocks together with geogenic processes release Cr (VI) in natural environment by chromite oxidation. Moreover, Cr (VI) pollution is largely related to several Cr (VI) industrial applications in the field of energy production, manufacturing of metals and chemicals, and subsequent waste and wastewater management. Chromium discharge in European Union (EU) waters is subjected to nationwide recommendations, which vary depending on the type of industry and receiving water body. Once in water, chromium mainly occurs in two oxidation states Cr (III) and Cr (VI) and related ion forms depending on pH values, redox potential, and presence of natural reducing agents. Public concerns with chromium are primarily related to hexavalent compounds owing to their toxic effects on humans, animals, plants, and microorganisms. Risks for human health range from skin irritation to DNA damages and cancer development, depending on dose, exposure level, and duration. Remediation strategies commonly used for Cr (VI) removal include physico-chemical and biological methods. This work critically presents their advantages and disadvantages, suggesting a site-specific and accurate evaluation for choosing the best available recovering technology.

## Enhancement of Chromium (VI) Reduction in Microcosms Amended with Lactate or Yeast Extract: A Laboratory-Scale Study

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** International journal of environmental research and public health, 2020, 17, 704, doi: 10.3390/ijerph17030704

**Autori:** Ancona, Valeria; Campanale, Claudia; Tumolo, Marina; De Paola, Domenico; Ardito, Claudio; Volpe, Angela; Uricchio, Vito Felice

**Abstract ITA:** A laboratory-scale study was carried out to evaluate the groundwater bioremediation potential of hexavalent chromium (Cr(VI)), taking into account the chromate pollution of an industrial site located in Southern Italy (Apulia Region). The reduction of Cr(VI) was studied on laboratory microcosms, set up in different experimental conditions, namely: ABIO (soil and water sterilized), BIO (soil and water not sterilized), LATT (with the addition of lactate), and YE (with the addition of yeast extract). Control test lines, set up by using sterilized matrices and amendments, were employed to assess the occurrence of the pollutant reduction via chemical processes. By combining molecular (microbial abundance, specific chromate reductase genes (ChR) and the Shewanella oinedensis bacterial strain) with chemical analyses of chromium (VI and III) in the matrices (water and soil) of each microcosm, it was possible to investigate the response of microbial populations to different experimental conditions, and therefore, to assess their bioremediation capability in promoting Cr(VI) reduction. The overall results achieved within this work evidenced the key role of amendments (lactate and yeast extract) in enhancing the biological reduction of hexavalent chromium in the contaminated aqueous phase of laboratory microcosms. The highest value of Cr(VI) removal (99.47%) was obtained in the YE amended microcosms at seven days.

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## Microbial fuel cell: An energy harvesting technique for environmental remediation

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** International journal of environmental impacts, 2020,12, 860, doi: 10.3390/w12030860

**Autori:** Ancona V, Barra Caracciolo A, Borello D, Ferrara V, Grenni P, Pietrelli A

**Abstract ITA:** Pollution of soil and water environments is mainly due to different anthropogenic factors and the presence of organic contaminants, in particular persistent, bioaccumulative and toxic ones, arouses concern for their possible effects on environment and human health. One nature-based technology that can be used in biodegradation of contaminated soil and water is the microbial fuel cell (MFC). They are also capable of producing energy and of being used as environmental sensors. In this context, this article aims at presenting the capacity of MFCs to reduce environmental pollution by exploiting the process of bioelectrochemical utilisation of organic matter via microbial metabolism, to generate usable by-products, fuels and bio-electricity. The main characteristic of an MFC, when used for energy harvesting, is the absence of emissions of pollutant gases like CO, CO2, SOx, or NOx. This characteristic, together with the intrinsic capacity of bioreactors to decontaminate soils and water, is stimulating the research into engineering solutions exploiting the MFC potential. Among the different types of MFCs, as bioelectrochemical systems (BESs), the terrestrial microbial fuel cells (TMFC) and the wastewater microbial fuel cells (WWMFC) convert energy using a biocatalysts (microorganism) and a biofuel (organic substrate) in basic environments such as soil and water. Consequently, MFCs can be used as energy sources for powering sensors with low power and low voltage characteristics or complete single nodes of a distributed wireless sensor network (WSN), if coupled with smart although more complex electronic circuit. Moreover, MFCs can be environmental sensors, suited to monitor some environmental parameters influencing MFC functional behaviour like as pH and temperature. This article introduces the scenarios of polluted environments where these technologies suitably could be applied together with the description of two main type of MFC structures and their functioning. Furthermore, some case studies in which MFCs are used in decontamination of polluted environments are described.

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environments such as soil and water. Consequently, MFCs can be used as energy sources for powering sensors with low power and low voltage characteristics or complete single nodes of a distributed wireless sensor network (WSN), if coupled with smart although more complex electronic circuit. Moreover, MFCs can be environmental sensors, suited to monitor some environmental parameters influencing MFC functional behaviour like as pH and temperature. This article introduces the scenarios of polluted environments where these technologies suitably could be applied together with the description of two main type of MFC structures and their functioning. Furthermore, some case studies in which MFCs are used in decontamination of polluted environments are described.

## PM2.5 in Indoor Air of a Bakery: Chemical Characterization and Size Distribution

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Atmosphere, 2020, 11, 415, doi: 10.3390/atmos11040415

**Autori:** Pierina Ielpo, Claudia Marcella Placentino, Alessandra Genga, Valeria Ancona, Vito Felice Uricchio, Paola Fermo

**Abstract ITA:** In current literature, studies on indoor air quality mostly concern environments such as hospitals, schools and homes, and less so on spaces producing food, such as bakeries. However, small- and medium-sized bakeries are typical and very common food production spaces, mostly in Southern Italy. Considering this, the present study investigated size trends of the aerosol particles during bakery working activities and the indoor particulate matter PM2.5 chemical speciation at the same time, in order to characterize the aerosol particulate matter emissions. In particular, indoor air monitoring was performed using a silent sequential sampler and an optical particle counter monitor during 7-19 April 2013. For each daily sampling, four PM2.5 samples were collected. In each sample, OC (organic carbon), EC (elemental carbon), LG (levoglucosan) Cl- (chloride), NO2- (nitrite), NO3-(nitrate), SO42- (sulfate), C2O42- (oxalate), Na+ (sodium), NH4+ (ammonium), K+ (potassium), Mg2+(magnesium) and Ca2+ (calcium) concentrations were determined. The main sources of particleswere wood burning, the cleaning of ovens (ash removal) and the baking of bread. While levoglucosan was associated with the source wood burning, potassium in this case can be considered as a marker of the contribution of the bakery activities. This work represents the second part of indoor research activities performed in the bakery. The first part was published in Ielpo et al. (2018).

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## Heavy metal phytoremediation of a poplar clone in a contaminated soil in southern Italy

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Journal of chemical technology and biotechnology, 2020, 95 (4), 940-949, doi: 10.1002/jctb.6145

**Autori:** Ancona, Valeria; Barra Caracciolo, Anna; Campanale, Claudia; Rascio, Ida; Grenni, Paola; Di Lenola, Martina; Bagnuolo, Giuseppe; Uricchio, Vito Felice

**Abstract ITA:** BACKGROUND The Monviso clone previously tested successfully to remediate a lindane-contaminated soil in central Italy was then applied in a historically heavy metal contaminated area in southern Italy. RESULTS The results obtained at 900 days from the poplar planting showed a strong decrease below Italian national legal limits (D.Lgs 152/06) for most heavy metals (HMs). The highest reduction of HM concentrations was observed in soil samples collected near the trunk (25 cm distant from poplar) and in the rhizosphere. The values of the HM bioaccumulation factor (BAF, considering roots and leaves) and of the translocation factor (TF) suggest that poplar trees were able to phytostabilize HMs. The soil organic carbon content increased compared to the previous sampling in all plots planted. The highest values were observed for the rhizosphere soils of each target tree, while the phosphorous available strongly decreased. Microbial results showed an overall increase in cell viability, dehydrogenase activity and microbial abundance of some bacterial groups. CONCLUSION Overall results showed that the poplar-based phytoremediation strategy was able to promote the phytostabilization of the HMs and to improve the soil quality in terms of both organic carbon content and microbial community structure and activity.

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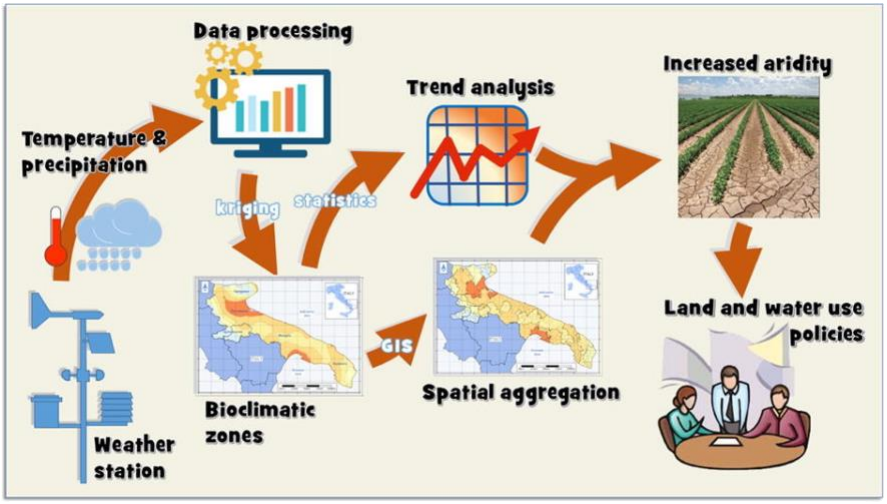
## Spatial and temporal classification of coastal regions using bioclimatic indices in a Mediterranean environment

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Science of the total environment, 2020, 700, 134415, DOI: 10.1016/j.scitotenv.2019.134415

**Autori:** Passarella, Giuseppe; Bruno, Delia; Lay-Ekuakille, Aime; Maggi, Sabino; Masciale, Rita; Zaccaria, Daniele

**Abstract ENG:** Bioclimatic indices combine atmospheric parameters to provide analytical indication of climatic features and their evolution in space and time that can directly relate with natural resource availability, distribution, and related bio-physical processes. The availability of bioclimatic information can provide natural resource managers with analytical means to assess the magnitude and temporal evolution of drought and climate change parameters that could affect the availability, demand and use of natural resources for various sectors. This paper presents a methodology to process bioclimatic data in the space and time domains for assessing the moisture/dryness level and water requirements of a region, and inform water resource planning and management decisions related to drought, climate variability and change. The methodology relies on a modular assembly of statistical tests and methods, and utilizes point scale measurements of meteorological data to perform the analysis of the spatial behavior of derived bioclimatic indicators at the continuous regional scale, and evaluate the significance of the temporal trends. Also, the article presents an application of the proposed methodology to a coastal area of southern Italy (the Apulia Region) that is characterized by recurring water supply limitations, involving the use of the popular De Martonne bioclimatic aridity index. The methodology allowed to obtain qualitative and quantitative information about the aridity level of the Apulia region, the identification of main bioclimatic zones, and the evaluation of spatial pattern and time evolution of aridity. The determination of bioclimatic zones showed that nearly 40% of the regional territory is characterized by dry sub-humid (Mediterranean) climate, about 30% by sub-humid climate, while nearly 10% and 20% are characterized by semi-arid and humid climates, respectively. The temporal analysis revealed that the Salento and the Ionian coastal zone are areas at risk of increasing aridity, with resulting impacts on the water supply and demand for irrigated agriculture.



## A Detailed Review Study on Potential Effects of Microplastics and Additives of Concern on Human Health

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Int. J. Environ. Res. Public Health, 2020,17, 1212, doi: 10.3390/ijerph17041212

**Autori:** Claudia Campanale * , Carmine Massarelli , Ilaria Savino, Vito Locaputo and Vito Felice Uricchio

**Abstract ENG:** The distribution and abundance of microplastics into the world are so extensive that many scientists use them as key indicators of the recent and contemporary period defining a new historical epoch: The Plasticene. However, the implications of microplastics are not yet thoroughly understood. There is considerable complexity involved to understand their impact due to different physical–chemical properties that make microplastics multifaceted stressors. If, on the one hand, microplastics carry toxic chemicals in the ecosystems, thus serving as vectors of transport, they are themselves, on the other hand, a cocktail of hazardous chemicals that are added voluntarily during their production as additives to increase polymer properties and prolong their life. To date, there is a considerable lack of knowledge on the major additives of concern that are used in the plastic industry, on their fate once microplastics dispose into the environment, and on their consequent effects on human health when associated with micro and nanoplastics. The present study emphasizes the most toxic and dangerous chemical substances that are contained in all plastic products to describe the effects and implications of these hazardous chemicals on human health, providing a detailed overview of studies that have investigated their abundance on microplastics. In the present work, we conducted a capillary review of the literature on micro and nanoplastic exposure pathways and their potential risk to human health to summarize current knowledge with the intention of better focus future research in this area and fill knowledge gaps.

## A Practical Overview of Methodologies for Sampling and Analysis of Microplastics in Riverine Environments

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Sustainability, 2020, 12, 6755, doi: 10.3390/su12176755

**Autori:** Claudia Campanale, Ilaria Savino, Iulian Pojar , Carmine Massarelli and Vito Felice Uricchio

**Abstract ENG:** Microplastics have recently been stated as being remarkable contaminants of all environmental matrices. The lack of consistent and standardised methods and protocols used to evaluate and quantify microplastics present in riverine systems made a comparison among different studies a critical issue. Based on literature research and the practical expertise of the authors, this work presents a complete collection and analysis of procedures concerning the monitoring of microplastics in riverine environments, focusing on their sampling and analytical protocols to identify, quantify, and characterise them. Further details regarding the advantages and disadvantages of each analytical technique described, such as general recommendations and suggestions, are provided to give practical support for analytical procedures. In particular, microplastics studies consist firstly of their sampling from the aquatic compartment (aqueous and solid phase). Based on the goal of the research, specific devices can be used to collect particles from different matrices. It follows their quantification after extraction from the environmental matrix, adopting different protocols to isolate microplastics from a large amount of organic matter present in a riverine system. In the end, additional qualitative analyses (e.g., RAMAN and FTIR spectroscopy, GC-MS) are required to identify the chemical composition of particles for a better image regarding the abundance of polymer types, their origin, or other information related to manufacturing processes.

## A Relevant Screening of Organic Contaminants Present on Freshwater and Pre-Production Microplastics

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Toxics, 2020, 8, 100, doi: 10.3390/toxics8040100

**Autori:** Claudia Campanale * , Georg Dierkes,, Carmine Massarelli , Giuseppe Bagnuolo and Vito Felice Uricchio

**Abstract ENG:** Microplastics (MPs) have recently been discovered as considerable pollutants of all environmental matrices. They can contain a blend of chemicals, some of them added during the manufacture of plastic to improve their quality (additives) and others adsorbed from the surrounding environment. In light of this, a detailed study about the identification and quantification of target organic pollutants and qualitative screening of non-target compounds present on MPs was carried out in different types of samples: environmental MPs, collected from an Italian river, and pre-production MPs, taken from the plastic industry. Polychlorobiphenyls (PCBs), organochlorine pesticides (OCPs), and polycyclic aromatic hydrocarbons (PAHs) were chosen as target compounds to be quantified by Gas Chromatography-Mass Spectrometry (GC–MS), while the non-target screening was carried out by High Resolution Gas Chromatography-Mass Spectrometry (HRGC–MS). The target analysis revealed concentrations of 16 priority Polycyclic Aromatic Hydrocarbons by Environmental Protection Agency (EPA-PAHs) in the range of 29.9–269.1 ng/g; the quantification of 31 PCBs showed values from 0.54 to 15.3 ng/g, identifying CB-138, 153, 180, 52, and 101 primarily; and the detected OCPs (p,p'-DDT and its metabolites) ranged between 14.5 and 63.7 ng/g. The non-target screening tentatively identified 246 compounds (e.g., phthalates, antioxidants, UV-stabilizers), including endocrine disruptors, toxic and reprotoxic substances, as well as chemicals subjected to risk assessment and authorisation. The large assortment of plastic chemicals associated with MPs showed their role as a presumable source of pollutants, some of which might have high bioaccumulation potential, persistence, and toxicity.

## Microplastics and their possible sources: The example of Ofanto river in southeast Italy

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Environmental Pollution, 2020, 258, 113284 , doi: 10.1016/j.envpol.2019.113284

**Autori:** Claudia Campanale * , Friederike Stock , Carmine Massarelli, Christian Kochleus , Giuseppe Bagnuolo, Georg Reifferscheid , Vito Felice Uricchio

**Abstract ENG:** Monitoring studies have quantified microscopic plastic debris, so-called microplastics, in freshwater systems, including banks, surface waters and sediments. However, there is a lack of knowledge of freshwater and terrestrial environments. When microplastics are released in freshwater environments, they will be transported and will not remain stationary. Moreover, their transport from sink to source (land-based to river systems) may depend on several factors such as weather conditions and river hydrology. The present study aims to investigate the abundance and composition of microplastics in the most important river of Apulia Region (Southeast Italy) evaluating the main drivers and possible input sources of microplastic debris. The following work is the first study showing an Italian river context. For this research five sampling campaigns have been conducted west of the Ofanto river mouth. Microplastics were collected by three surface plankton nets fixed in the middle of the river in order to reduce the spatial and temporal variability. For each campaign, a total of six replicates were sampled during two time slots. Microplastic concentrations ranged from 0.9 ± 0.4 p/m 3 to 13 ± 5 p/m 3 showing comparable values to or greater than those ones reported in other studies. A statistically significant difference in the average microplastic concentrations in different campaigns of this study has been observed, suggesting thus a temporal variation in plastic abundances. These significant differences could be explained by the hy- drology of the river that influences the particle concentration with its physical forces such as flow ve- locity, water level and seasonal variability. Microplastics were found at higher concentrations during wet periods indicating a land-based origin probably connected to waste produced by the surroundings agricultural areas. In fact, Spearman's correlation results show a strong positive statistically significant correlation between the concentration of microplastics and the water level (R 1/4 0.8475, p < 0.0001)

## Geochemistry drives the allometric growth of the hydrothermal vent tubeworm Riftia pachyptila (Annelida: Siboglinidae)

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Zoological Journal of the Linnean Society, 2020, zlaa148, doi: 10.1093/zoolinnean/zlaa148

**Autori:** Nadezhda Rimskaya-Korsakova, Diego Fontaneto, Sergey Galkin, Vladimir Malakhov, Alejandro Martínez

**Abstract ENG:** The tubeworm Riftia pachyptila is a key primarily producer in hydrothermal vent communities due to the symbiosis with sulphur-oxidizing bacteria, which provide nourishment to the worm from sulphides, oxygen and carbon dioxide. These substances diffuse from the vent water into the bloodstream of the worm through their tentacular crowns, and then to the bacteria, hosted in a specialized organ of the worm, called a trophosome. The uptake rates of these substances depend on the surface/volume relationship of the tentacles. We here describe two morphotypes, 'fat' and 'slim', respectively, from the basalt sulphide-rich vents at 9 °N and 21 °N at the East Pacific Rise, and the highly sedimented, sulphide-poor vents at 27 °N in the Guaymas Basin. The 'fat' morphotype has a thicker body and tube, longer trunk and smaller tentacular crowns, whereas the 'slim' morphotype has shorter trunk, thinner body and tube, and presents longer tentacular crowns and has a higher number of tentacular lamellae. Given the dependence on sulphides for the growth of R. pachyptila, as well as high genetic connectivity of the worm's populations along the studied localities, we suggest that such morphological differences are adaptive and selected to keep the sulphide uptake near to the optimum values for the symbionts. 'Fat' and 'slim' morphotypes are also found in the vestimentiferan Ridgeia piscesae in similar sulphide-rich and poor environments in the northern Pacific

## Degradation of carbamazepine by photo(Electro)catalysis on nanostructured TiO2 meshes: Transformation products and reaction pathways

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Catalysts, 2020, 10(2), 169, doi: 10.3390/catal10020169

**Autori:** Silvia Franz, Ermelinda Falletta, Hamed Arab, Sapia Murgolo, Massimiliano Bestetti, Giuseppe Mascolo

**Abstract ENG:** Licensee MDPI, Basel, Switzerland. Carbamazepine (CBZ) is a pharmaceutical compound recalcitrant to conventional wastewater treatment plants and widely detected in wastewater bodies. In the present study, advanced oxidation processes for carbamazepine removal are investigated, with particular regard to the degradation pathways of carbamazepine by photoelectrocatalysis and conventional photocatalysis. Photoelectrocatalysis was carried out onto TiO2 meshes obtained by Plasma Electrolytic Oxidation, a well-known technique in the field of industrial surface treatments, in view of an easy scale-up of the process. By photoelectrocatalysis, 99% of carbamazepine was removed in 55 min while only 65% removal was achieved by photolysis. The investigation of the transformation products (TPs) was carried out by means of UPLC-QTOF/MS/MS. Several new TPs were identified and accordingly reaction pathways were proposed. Above 80 min the transformation products disappear, probably forming organic acids of low-molecular weight as final degradation products. The results demonstrated that photoelectrocatalysis onto TiO2 meshes obtained by plasma electrolytic oxidation is a useful alternative to common advanced oxidation processes as wastewater tertiary treatment aimed at removing compounds of emerging concern.

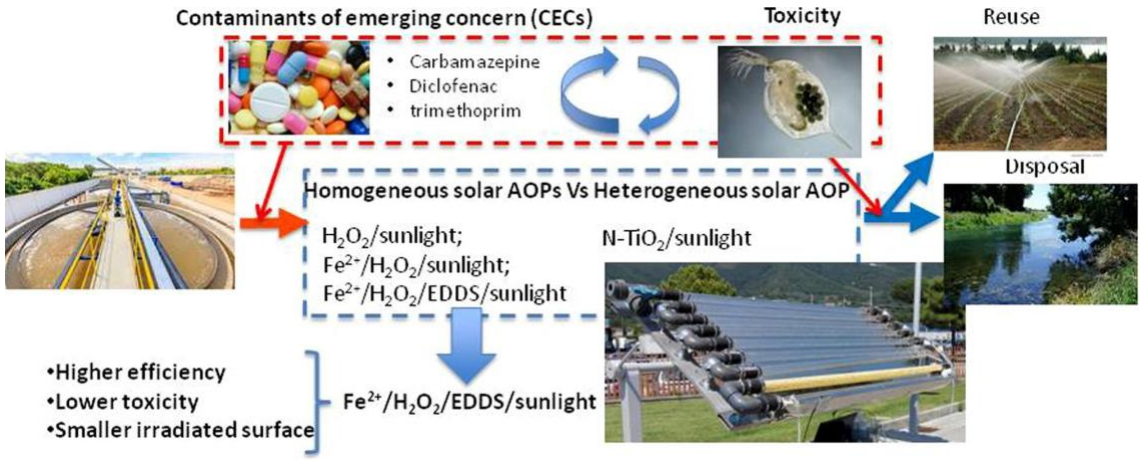
## Comparison between heterogeneous and homogeneous solar driven advanced oxidation processes for urban wastewater treatment: Pharmaceuticals removal and toxicity

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Separation and Purification Technology, 2020, 236,116249, doi: 10.1016/j.seppur.2019.116249

**Autori:** G. Maniakova, K. Kowalska, S. Murgolo, G. Mascolo, G. Libralato, G. Lofrano, O. Sacco, M. Guida, L. Rizzo

**Abstract ENG:** The release of toxic contaminant of emerging concern from urban wastewater treatment plants (UWTPs) into the environment calls for more effective (tertiary) treatment methods. In this manuscript, homogeneous solar-driven advanced oxidation processes (AOPs), namely H2O2/sunlight, solar photo-Fenton (Fe+2/H2O2/sunlight) and solar photo-Fenton with ethylenediamine-N,N'-disuccinic acid (EDDS) complex (Fe+2/H2O2/EDDS/sunlight) were compared to a new heterogeneous process (supported nitrogen-doped TiO2 (N-TiO2)/sunlight), with the aim of contributing to fill the gap between lab scale tests and full scale applications as well as to provide a sustainable solution for tertiary treatment in small UWTPs. Process efficiency was evaluated in terms of effluent toxicity and degradation of a mixture of three pharmaceuticals (namely carbamazepine (CBZ), diclofenac and trimethoprim), at initial concentration of 200 µg/L each, in deionized water (DW) and real wastewater (WW). Fe2+/H2O2/EDDS/sunlight was found to be the most effective process (98% removal of CBZ from WW in 60 min, 5.6 kJ/L as cumulative solar energy per unit of volume). Conventional solar photo Fenton was drastically and negatively affected by water matrix, due to the spontaneous neutral pH and iron precipitation in real WW. Although N-TiO2/sunlight process was not so affected by water matrix, it was found to be less efficient (30% removal of CBZ in 180 min, 13.3 kJ/L) than Fe2+/H2O2/EDDS/sunlight process. Toxicity values were found to be lower in WW compared to DW matrix. Class weight scores for WW samples showed a toxicity reduction up to the no acute toxicity level for N-TiO2/sunlight and Fe2+/H2O2/EDDS/sunlight treatments, while H2O2/sunlight and Fe2+/H2O2/sunlight increased the final effluent toxicity up to slightly acute levels.



## Gold-Speckled SPION@SiO2 Nanoparticles Decorated with Thiocarbohydrates for ASGPR1 Targeting: Towards HCC Dual Mode Imaging Potential Applications

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Chemistry - A European Journal, 2020, 26 (48), 11048-11059, DOI: 10.1002/chem.202002142

**Autori:** Giulia Siciliano, Michela Corricelli, Rosa Maria Iacobazzi, Fabio Canepa, Daniela Comegna, Elisabetta Fanizza, Annarita Del Gatto, Michele Saviano, Valentino Laquintana, Roberto Comparelli, Giuseppe Mascolo, Sapia Murgolo, Marinella Striccoli, Angela Agostiano, Nunzio Denora, Laura Zaccaro, M. Lucia Curri, Nicoletta Depalo

**Abstract ENG:** Efforts are made to perform an early and accurate detection of hepatocellular carcinoma (HCC) by simultaneous exploiting multiple clinically non-invasive imaging modalities. Original nanostructures derived from the combination of different inorganic domains can be used as efficient contrast agents in multimodal imaging. Superparamagnetic iron oxide nanoparticles (SPIONs) and Au nanoparticles (NPs) possess well-established contrasting features in magnetic resonance imaging (MRI) and X-ray computed tomography (CT), respectively. HCC can be targeted by using specific carbohydrates able to recognize asialoglycoprotein receptor 1 (ASGPR1) overexpressed in hepatocytes. Here, two different thiocarbohydrate ligands were purposely designed and alternatively conjugated to the surface of Au-speckled silica-coated SPIONs NPs, to achieve two original nanostructures that could be potentially used for dual mode targeted imaging of HCC. The results indicated that the two thiocarbohydrate decorated nanostructures possess convenient plasmonic/superparamagnetic properties, well-controlled size and morphology and good selectivity for targeting ASGPR1 receptor.

## Microbiological and chemical assessment of wastewater discharged by infiltration trenches in fractured and karstified limestone (Sca.re.s. project 2019–2020)

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Pathogens, 2020, 9 (12), 1010, doi: 10.3390/pathogens9121010

**Autori:** Maria Teresa Montagna, Osvalda De Giglio, Carla Calia, Chrysovalentinos Pousis, Francesco Triggiano, Sapia Murgolo, Cristina De Ceglie, Francesco Bagordo, Francesca Apollonio, Giusy Diella, Marcella Narracci, Maria Immacolata Acquaviva, Giusy Bonanno Ferraro, Pamela Mancini, Carolina Veneri, Silvia Brigida, Tiziana Grassi, Antonella De Donno, Claudio Di Iaconi, Maria Clementina Caputo, Rosa Anna Cavallo, Giuseppina La Rosa, Giuseppe Mascolo

**Abstract ENG:** This study investigated the environmental contamination of groundwater as a consequence of the discharge of treated wastewater into the soil. The investigation focused on a astewater treatment plant located in an area fractured by karst in the Salento peninsula (Apulia, Italy). Water samples were collected at four sites (raw wastewater, treated wastewater, infiltration trench, and monitoring well), monthly from May to December 2019 (with the exception of August), and were tested for (1) panel of bacteria; (2) enteric viruses; and (3) chemical substances. A gradual reduction in the concentration of bacteria, viruses and contaminants of emerging concern was observed across the profile of soil fissured by karst. All monitored bacteria were absent from the monitoring well, except for Pseudomonas aeruginosa. Pepper mild mottle virus and adenovirus were detected at all sampling sites. Personal care products and X-ray contrast media showed the greatest decrease in concentration from infiltration trench to the monitoring well, while the highest residual concentrations in the monitoring well were found for anticonvulsants (78.5%), antimicrobials (41.3%), and antipsychotic drugs (38.6%). Our results show that parameters provided by current law may not always be sufficient to evaluate the sanitary risk relating to the discharge of treated wastewater to the soil.

## Produrre ortaggi di qualità reimpiegando le acque reflue

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Colture protette, 2020, 11, 54-56

**Autori:** D'Imperio M., Montesano F.F., Baruzzi F., Pinto L., Pollice A., Berardi G., Boari F., Parente A.

**Abstract ITA:** L'UTILIZZO DI SISTEMI DI COLTIVAZIONE SENZA SUOLO IN FLOATING SYSTEM A CICLO CHIUSO PUÒ ESSERE UNA BUONA STRATEGIA PER RIUTILIZZARE UNA RISORSA IDRICA AL MOMENTO POCO VALORIZZATA

**Abstract ENG:** The adoption of soil-less cultivation systems in closed loop floating systems can be a good strategy for reusing water resources that are currently underevaluated.

## Isotopic biomonitoring of N pollution in rivers embedded in complex human landscapes

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Science of the Total Environment, 2020, 706, 136081, 10.1016/j.scitotenv.2019.136081

**Autori:** Calizza E., Favero F., Rossi David, Careddu G., Fiorentino F., Caputi S. Sporta, Rossi L., Costantini M. L.

**Abstract ITA:** La struttura dinamica e gerarchica dei fiumi, insieme all'interruzione del continuum naturale del fiume da parte delle attività umane, rende di difficile identificare e localizzare le fonti di inquinamento da nutrienti che interessano le acque e osservarne la dispersione, compromettendo così gli sforzi del monitoraggio. L'identificazione di indicatori affidabili per gli apporti di azoto antropogenico nei bacini idrografici è quindi fondamentale per ottenere una gestione efficace dei fiumi inquinati. Abbiamo testato la capacità delle firme isotopiche N (δ15N) di epilite e lumache per fornire indicazioni utili di input di N antropogenici organici e inorganici in tre fiumi mediterranei che differiscono in termini di uso del suolo circostante e condizioni fisico-chimiche. Abbiamo utilizzato un approccio combinato basato su (i) analisi delle concentrazioni di nutrienti nell'acqua, (ii) classificazione della copertura del suolo CORINE e modelli di drenaggio nei bacini idrografici e (iii) analisi isotopica del biota fluviale per verificare se le variazioni isotopiche fossero indicative di attività antropiche nel bacino idrico, alterazione della qualità dell'acqua e conseguente impatto sull'abbondanza e la diversità delle lumache. La variazione del δ15N all'interno e tra i fiumi rifletteva input di N localizzati e diffusi da fonti inorganiche e organiche. I valori di δ15N (b0 ‰) negativo indicano inquinamento inorganico da agricoltura. I valori compresi tra 4 ‰ e 8 ‰ e quelli superiori a 8 ‰ indicavano rispettivamente un moderato inquinamento organico proveniente dalle aree urbane e un elevato inquinamento organico, principalmente da acque reflue. La diversità e l'abbondanza di lumache è diminuita con l'aumento dell'inquinamento dell'acqua. Sebbene le loro variazioni isotopiche riflettessero le differenze tra i fiumi, non sono riusciti a indicare variazioni all'interno dei fiumi negli input antropogenici. In conclusione, l'epilite era un indicatore affidabile delle fonti di azoto antropogenico in un'ampia gamma di concentrazioni di nutrienti e input antropici, e l'approccio proposto ci ha permesso di determinare la natura degli inquinanti azotati, le loro fonti, la posizione e la dispersione lungo i fiumi incorporati in complessi paesaggi umani.

**Abstract ENG:** The dynamic and hierarchical structure of rivers, together with disruption of the natural river continuum by human activities, makes it difficult to identify and locate sources of nutrient pollution affecting receiving waters and observe its dispersion, thus impairing monitoring efforts. The identification of reliable indicators of anthropogenic nitrogen inputs in catchments is therefore key to achieving effective management of polluted rivers. We tested the capacity of N isotopic signatures (δ15N) of epilithon and snails to provide useful indications of organic and inorganic anthropogenic N inputs in threeMediterranean rivers differing in terms of surrounding land use and physicochemical conditions. We used a combined approach based on (i) analysis of nutrient concentrations inwater, (ii) CORINE land cover classification and drainage patterns in catchments and (iii) isotopic analysis of river biota to verifywhether isotopic variationswere indicative of anthropic activities in thewatershed, the associated alteration of water quality, and the consequent impact on snail abundance and diversity. Variation in the δ15N of epilithon within and between rivers reflected localised and diffuse N inputs from inorganic and organic sources. Negative

epilithon δ15N values (b0‰) indicated inorganic pollution from agriculture. Values between 4‰ and 8‰ and those above 8‰respectively indicated moderate organic pollution from urban areas, and high organic pollution, mostly from waste waters. The diversity and abundance of snails decreased with increasing water pollution. While their isotopic variations reflected between-river differences, they failed to indicate within-river variations in anthropogenicN inputs, since the proportion of epilithon in their diet varied along the rivers. Concluding, epilithonwas a reliable indicator of anthropogenic N sources across a wide range of nutrient concentrations and anthropogenic inputs, and the proposed approach allowed us to determine the nature of nitrogen pollutants, their sources, location and dispersion along rivers embedded in complex human landscapes.

## Responses to local and global stressors in the large southern perialpine lakes: Present status and challenges for research and management

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Journal of Great Lakes Research, 2020, 46 (4), 752-766, doi: 10.1016/j.jglr.2020.01.017

**Autori:** Nico Salmaso, Fabio Buzzi, Camilla Capelli, Leonardo Cerasino, Barbara Leoni, FabioLepori, Michela Rogora

**Abstract ENG:** Here, we review the state-of-the-art of limnological investigations in the large and deep lakes south of the Alps (DSLs), lakes Garda, Maggiore, Como, Iseo and Lugano. In the pre-industrial age, these lakes were ultra- or oligotrophic. Increasing anthropogenic pressure and the impact of global warming has led to an acceleration of eutrophication and a decrease in the frequency of full mixing episodes, which have induced a state of meromixis in lakes Lugano and Iseo. In the last two decades, other changes have been identified, including fundamental variations in the long-term dynamics and structure of phytoplankton communities, identification of new toxigenic cyanobacteria and cyanotoxins, increases in the introduction and establishment of allochthonous species, and continuous detection of new, emerging chemical pollutants. Overall, these fundamental changes are quickly transforming the features of the DSLs. The ability to document and reconstruct changes in lake aquatic biota and micropollutants was strongly dependent on both research efforts and the availability of technologies to appraise these changes. In this context, the ongoing adoption of new technological tools, such as high-frequency monitoring and high throughput sequencing, is opening the way to a new level of comprehension of physical, chemical and biological processes, and aquatic biodiversity. New outlooks and new conceptual frameworks are necessary to cope with the huge dimensions of high-throughput data and analysis of big data.

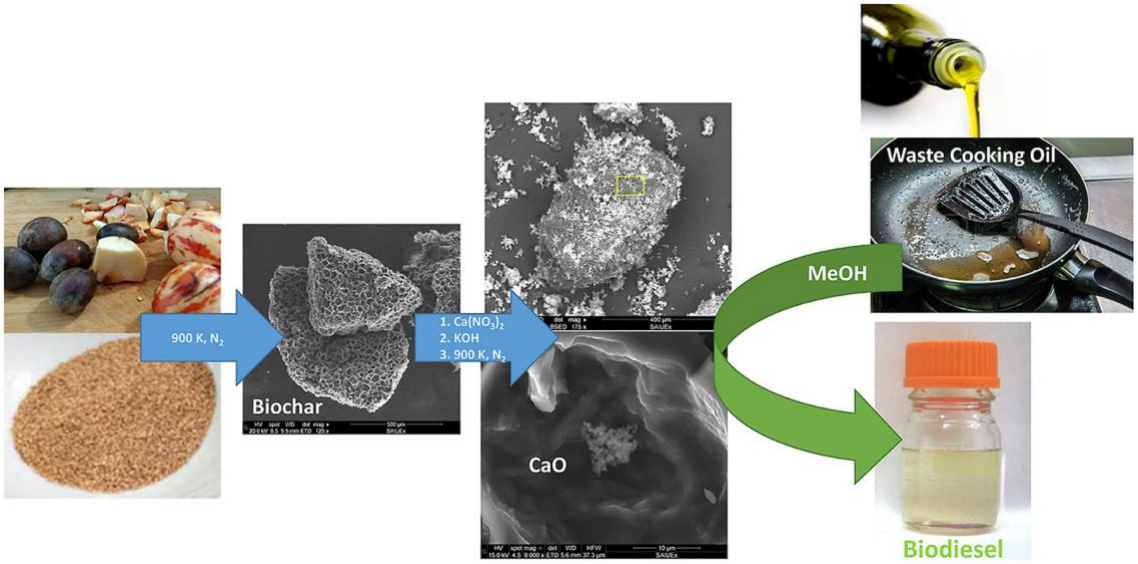
## Synthesis and characterization of nanostructured calcium oxides supported onto biochar and their application as catalysts for biodiesel production

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Renewable Energy, 2020, 160, 52-66, DOI: 10.1016/j.renene.2020.06.045

**Autori:** di Bitonto, L., Reynel-Ávila, H.E., Mendoza-Castillo, D.I., Bonilla-Petriciolet, A., Durán-Valle, C.J., Pastore, C.

**Abstract ENG:** Nanostructured calcium oxides supported onto biochar obtained by pyrolysis of avocado seeds were prepared, characterized and successfully used as catalysts to produce biodiesel from waste oils. The effect of increasing calcium load (5, 10 and 20 wt%) was investigated. Elemental analysis, FTIR, XRD, SEM, BET, acid and basic sites were used to characterize the resulting carbon-based calcium oxides. Supported systems efficiently promoted the transesterification of oil with methanol, but differently from calcium oxide, they were easily recoverable and reusable for three cycles without any loss of activity. Kinetic data were better fitted by a pseudo-second order model with an activation energy of 39.9 kJ mol−1. Thermodynamic parameters of activation energy were also determined for the transesterification reaction (Δ‡ G: 98.68-106.08 kJ mol−1, Δ‡ H: 37.05 kJ mol−1 and Δ‡S: 0.185 kJ mol−1 K). Finally, reaction conditions were optimized using the desirability function applied on the response surface methodology analysis of a Box–Behnken factorial design of experiments. By carrying out the reaction at 99.5 °C for 5 h with 7.3 wt% of catalyst and a molar ratio of methanol to oil of 15.6, a FAME content over 96% was achieved. Even starting from waste cooking oil, final biodiesel was conform to the main EN14214 specifications.



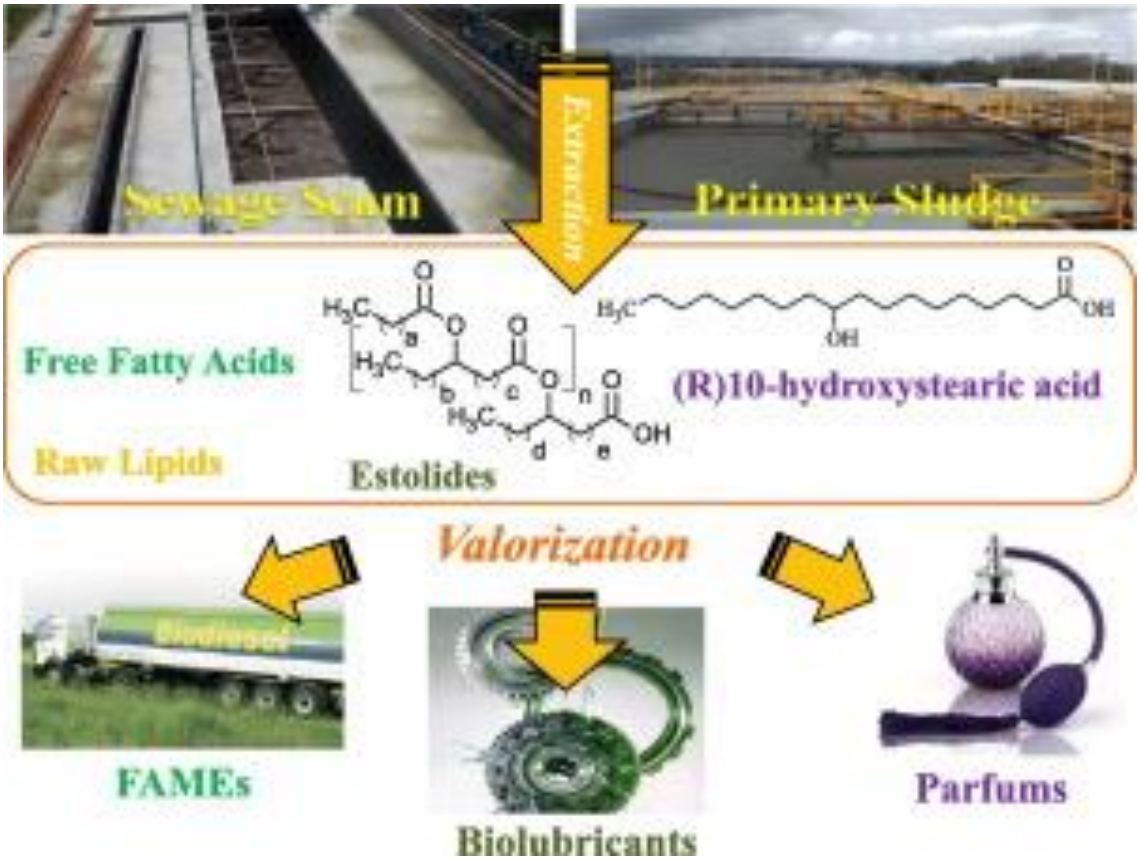
## Urban sewage scum and primary sludge as profitable sources of biodiesel and biolubricants of new generation

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Bioresource Technology Reports, 2020, 9, 100382, DOI: 10.1016/j.biteb.2020.100382

**Autori:** di Bitonto, L., Todisco, S., Gallo, V., Pastore, C.

**Abstract ENG:** Lipids of sewage scum and primary sludge taken from several wastewater treatment plants were quantified and characterised. In sewage scum, lipids represented 36–50% of total solids and were primarily composed of free fatty acids (45–60%) and calcium soaps (27–35%). In primary sludge, total lipids were 20–24% of total solids, and 71–82% of these were calcium soaps. Estolides and 10-hydroxystearic acid (prevalently present as R enantiomer, with an enantiomeric excess >92%) were also identified and quantified. A scheme of valorisation was then specifically designed and positively tested for both the sludge. Lipids were first recovered (92–99%), activated and finally reacted with methanol and AlCl3·6H2O (343 K, 2 h, yield >96%). Besides biodiesel, methyl estolides and methyl 10-hydroxystearate were efficiently isolated and purely separated in different fractions. A preliminary feasibility study was finally conducted and a possible integration of processes into a wastewater treatment plant was proposed and positively evaluated.



## Direct Lewis-Brønsted acid ethanolysis of sewage sludge for production of liquid fuels

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Applied Energy, 2020, 259, 114163, DOI: 10.1016/j.apenergy.2019.114163

**Autori:** di Bitonto, L., Locaputo, V., D'Ambrosio, V., Pastore, C.

**Abstract ENG:** Ethanolysis carried out under Lewis-Brønsted acid catalysis was investigated as a possible process to valorize the organic fraction of urban sewage sludge, with the aim of selectively obtaining liquid biofuels. In a single reactive step, the conversion of lipids into fatty acid ethyl esters, of carbohydrates into ethyl levulinate, furanic compounds and ethyl glycosides and of proteins into ethyl ester of amino acids was achieved. The optimization of reactive conditions was conducted using pure chemicals as model compounds. The effect of the co-presence of water was also considered. Then, real samples of sewage sludge (as dried and wet centrifuged samples) were reacted in ethanol in the presence of the appropriate combination of homogeneous Lewis-Brønsted acid catalysts, namely 1 %wt aluminium chloride hexahydrate and sulfuric acid respect to ethanol. After 6 h at 453 K, 99% of lipids and almost 60% of initial complex sugars were effectively converted into the abovementioned target products. Conversions and yields were quite similar to those obtained by reacting pure compounds singularly, confirming the robustness of the process and its applicability to differently composed sludge. At the end of the reaction, products were easily recovered and purified from the alcoholic phase, whereas only a very limited amount of solids remain as inert materials. Final refined biofuels have high calorific values (37 and 40 MJ kg−1) and actually represent the 68.5 and 59.2% of the initial energy content of starting sludge, respectively. This strategy combines valorization of the starting organic fraction of sewage sludge and a considerable reduction of final solid waste (in a stabilised form) to be disposed of. Finally, through a preliminary feasibility study, this acid ethanolysis resulted in a competitive alternative to the anaerobic digestion of mixed sewage sludge to obtain biofuels.

## Residual Mexican biomasses for bioenergy and fine chemical production: correlation between composition and specific applications

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Biomass Conversion and Biorefinery, 2020, DOI: 10.1007/s13399-020-00616-1

**Autori:** di Bitonto, L., Reynel-Ávila, H.E., Mendoza-Castillo, D.I., Bonilla-Petriciolet, A., Pastore, C.

**Abstract ENG:** The conversion of renewable biomasses into biofuels and chemicals represents a strategic way to reduce the use of fossil feedstock, by contributing in switching to a more sustainable society. The use of agro-industrial wastes does not subtract resources destined for food consumption. In addition, waste utilization would result in a reduction of its accumulation, with a consequent decrease of environmental impact and financial losses due to the relevant disposal. In this context, a wide variety of exploitable agricultural resources can be used to support this sustainable growth. However, the characterization represents the first step towards a targeted and proficient exploitation of the chemical and energetic potential of a residual biomass. In this work, some representative residual (Mexican) biomasses were investigated: pepper residues (Hungarian yellow and red variety), coconut shells (Cocos nucifera), flamboyant pods (Delonix regia), seeds of avocado (Persea Americana), palm (Palma de Coroco) and nance (Byrsonima crassifolia) were chemically characterized and the relevant potential applications for the synthesis of biofuels and fine chemicals were specifically evaluated. Lipids, structural carbohydrates, and lignin were specifically valorized in a proficient cascade of technologies, which aim to exploit the correspondent potential, according to the principles of biorefinery and circular economy.

## The Self-Forming Dynamic Membrane BioReactor (SFD MBR) as a suitable technology for agro-industrial wastewater treatment

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** New Biotechnology, 2020, 56, 87-95 , doi: 10.1016/j.nbt.2019.12.005

**Autori:** Pompilio Vergine, Carlo Salerno, Giovanni Berardi, Giuseppe Pappagallo, Alfieri Pollice

**Abstract ITA:** Due Self-Forming Dynamic Membrane BioReactors (SFD MBR) da banco, dotati di reti in nylon da 50 µm, sono stati installati e gestiti in condizioni aerobiche per trattare le acque reflue di cantina e conservificio. I risultati hanno mostrato comportamenti differenti dei due sistemi, confermando la forte dipendenza delle prestazioni del SFD MBR dal tipo di biomassa e, a sua volta, dal tipo di refluo da trattare. Entrambi gli impianti hanno ottenuto buoni risultati in termini di qualità degli effluenti, dimostrando l'idoneità della tecnologia proposta. Le mediane dei valori di torbidità degli effluenti sono state 2,7 e 15,4 NTU nei reattori alimentati, rispettivamente, con acque reflue di conservificio e acque reflue di cantina. La rimozione della materia organica (come COD, domanda chimica di ossigeno) era costantemente superiore al 90%, sebbene la ritenzione dei solidi sospesi fosse variabile e in qualche modo dipendente dalle condizioni operative e dalla composizione dell'alimentazione. È stato osservato che le caratteristiche dei fanghi attivi influenzano le prestazioni di filtrazione. In particolare il capillary suction time (CST) è stato un possibile indicatore di efficienza, con un valore di soglia di 11 s al di sopra del quale le prestazioni di filtrazione sono diminuite. Questo parametro viene proposto come strumento di preallarme per i cambiamenti nelle prestazioni di filtrazione di un SFD MBR, sia per la qualità degli effluenti che per le necessità di lavaggio.

**Abstract ENG:** Two bench-scale Self-Forming Dynamic Membrane BioReactors (SFD MBR), equipped with 50 µm nylon meshes were set up and operated under aerobic conditions in order to treat canning and winery wastewaters. The results showed different behaviors of the two systems, confirming the strong dependence of SFD MBR performance on the type of biomass and, in turn, on the type of stream being treated. Both plants achieved good results in terms of effluent quality, demonstrating the suitability of the proposed technology. Median values of effluent turbidity were 2.7 and 15.4 NTU (Nephelometric Turbidity Units) in the reactors fed with canning wastewater and winery wastewater, respectively. The removal of organic matter (as COD, Chemical Oxygen Demand) was consistently above 90 %, although the retention of suspended solids was variable and somewhat dependent on operating conditions and feed composition. The activated sludge characteristics were observed to affect filtration performance and in particular the capillary suction time (CST) was a possible indicator of efficiency, with a threshold value of 11 s above which filtration performance decreased. This parameter is proposed as an early warning tool for changes in the filtration performance of an SFD MBR, both for effluent quality and cleaning requirements.

## Reuse of ultrafiltered effluents for crop irrigation: On-site flow cytometry unveiled microbial removal patterns across a full-scale tertiary treatment

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Science of The Total Environment, 2020, 718, 137298, doi: 10.1016/j.scitotenv.2020.137298

**Autori:** Pompilio Vergine, Stefano Amalfitano, Carlo Salerno, Giovanni Berardi, Alfieri Pollice

**Abstract ITA:** Il riutilizzo delle acque reflue trattate per l'irrigazione delle colture è stato ampiamente adottato per mitigare gli effetti della scarsità d'acqua sui raccolti agricoli e per aiutare a preservare l'integrità degli ecosistemi acquatici. Questo documento presenta i risultati di un anno di monitoraggio di un impianto in piena scala per il trattamento delle acque reflue agroindustriale finalizzato al riutilizzo dell'acqua trattata. Il trattamento terziario multistadio è basato su filtrazione a sabbia, ultrafiltrazione a membrana, stoccaggio e disinfezione UV. Si è mirato a testare la citometria a flusso come strumento di monitoraggio per fornire indicazioni in loco sulle prestazioni del trattamento terziario e sulla qualità delle acque reflue trattate lungo lo schema di trattamento. L'ultrafiltrazione a membrane ha trattenuto le cellule procariotiche e gli E. Coli (> 3 log). Durante lo stoccaggio degli effluenti trattati, è stato osservato un significativo decadimento di E. coli insieme alla crescita di cellule procariotiche ed eucariotiche e la disinfezione UV è stata efficace solo contro gli indicatori fecali. La qualità microbica dell'effluente trattato era paragonabile a quella delle acque sotterranee di controllo utilizzate localmente per l'irrigazione. Le rapide misure in loco di citometria a flusso effettuate immediatamente dopo il campionamento hanno permesso di svelare aspetti cruciali che influenzano la qualità microbiologica del permeato dell'ultrafiltrazione e dell'effluente finale dopo UV, comprese le prestazioni operative dell'impianto e i modelli di rimozione microbica lungo lo schema di trattamento terziario.

**Abstract ENG:** Reuse of treated wastewater for crop irrigation has been widely adopted to mitigate the effects of water scarcity on agricultural yields and to help preserving the integrity of aquatic ecosystems. This paper presents the outcomes of one-year monitoring of a full-scale agro-industrial wastewater treatment plant designed for water reuse, with a multistage tertiary treatment based on sand filtration, membrane ultrafiltration, storage and on-demand UV disinfection. We aimed to test flow cytometry as a monitoring tool to provide on-site indications on tertiary treatment performances and on the quality of treated wastewater along the treatment scheme. Membrane ultrafiltration retained prokaryotic cells and E. coli (>3 log). During storage of treated effluents, a significant decay of E. coli was observed together with the growth of prokaryotic and eukaryotic cells, and the UV disinfection was effective only against fecal indicators. The microbial quality of the treated effluent was comparable to the control groundwater locally used for irrigation. On-site rapid assessments by flow cytometry allowed unveiling crucial aspects affecting the microbiological quality of ultrafiltration permeate and treated effluent immediately after sampling, including plant operating performances and microbial removal patterns across the treatment train.

## Combined discharge and thermo-salinity measurements for the characterization of a karst spring system in Southern Italy

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Sustainability, 2020, 12 (8), 3311, doi: 10.3390/su12083311

**Autori:** Portoghese, I., Masciale, R., Caputo, M.C., De Carlo, L., Malcangio, D.

**Abstract ITA:** Il monitoraggio idrologico delle sorgenti è uno strumento ausiliario e indispensabile che si affianca alle indagini in pozzo per ricostruire un modello fenomenologico concettuale di un sistema falda acquifera e delle sue interazioni con le acque superficiali. Le modalità per effettuare tale monitoraggio sono molteplici, ma la scelta di quale è significativa per una corretta conoscenza qualitativa e quantitativa dei sistemi sorgentizi. Il presente lavoro si concentra sulla caratterizzazione dei regimi termo-salini e di flusso del sistema delle sorgenti di Tara lungo la costa settentrionale di Taranto (Italia meridionale), dove un bacino idrico sotterraneo carsico è la principale sorgente del fiume Tara e della zona umida costiera circostante. Sono state effettuate una serie di misurazioni sul sitema sorgivo a supporto di uno studio di fattibilità tecnica per il possibile utilizzo dell'acqua salmastra di questo fiume per alimentare un futuro impianto di dissalazione. Per stimare la portata, è stato effettuato un confronto tra diversi metodi di misurazione della portata in un canale di derivazione. Attraverso l'analisi del dataset disponibile, si evidenzia la risposta dell'acquifero alla ricarica autunno-inverno, per la quale non erano disponibili misurazioni idrologiche aggiornate.

**Abstract ENG:** The hydrological monitoring of springs is an auxiliary and indispensable tool that goes alongside investigations in wells to reconstruct a conceptual phenomenological model of an aquifer–groundwater system and its interactions with surface waters. There are manifold ways to carry out this monitoring, but the choice of which way is significant for a correct qualitative and quantitative knowledge of spring systems. The present work focuses on the characterization of the thermo-saline and flow regimes of the Tara spring system along the northern coast of Taranto (southern Italy), where a karst groundwater basin is the major source of the Tara River and the surrounding coastal wetland. A series of measurements was carried out on the spring system to support a technical feasibility study on the possible use of the brackish water of this river to feed a future desalination plant. To estimate the flow rate, a comparison was made between different flow measurement methods in a derivation channel. Through an analysis of the available dataset, the response of the aquifer to the autumn–winter recharge, for which updated hydrologic measurements were not available, is highlighted.

## Anaerobic digestion of mixed urban biowaste: The microbial community shift towards stability

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** New Biotechnology, 2020, 55, 108-117, doi: 10.1016/j.nbt.2019.10.008

**Autori:** Tonanzi, B., Braguglia, C.M., Gallipoli, A., Montecchio, D., Pagliaccia, P., Rossetti, S., Gianico, A.

**Abstract ENG:** Anaerobic digestion is applied worldwide to treat food waste (FW) with the aim of obtaining renewable bioenergy by exploiting the methane gas produced. However, there are several problems in practical applications, primarily due to system instability. Although exhaustive knowledge regarding anaerobic microbial community composition has been established, few studies have investigated long-term correlations between microbial consortia, operative conditions and feedstock characteristics. Here, microbial community shifts as a response to feedstock variations were investigated in long-term semi-continuous systems, which were evaluated by an in situ cell detection method and 16S rRNA gene amplicon sequencing. FW digestion showed progressive system instability caused by the inhibition of methanogens, which resulted in volatile fatty acid accumulation and process failure at the low organic loading rate (OLR). Conversely, by co-digesting FW with waste-activated sludge (WAS), a stable process with methane yields of up to 0.27 Nm3 kg−1VSfed for OLR=1.7 gVS L−1d−1 was achieved. This stabilizing effect was not related to the buffering capacity of WAS, but to its capacity to avoid volatile fatty acid accumulation and falls in pH by overcoming methanogenic activity inhibition. WAS addition promoted the establishment of a stable and active archaeal population in anaerobic co-digestion (AcoD) reactors. The continuous supply of trace elements together with the seeding of microbial functional groups were the main drivers that positively affected process stability.

## Kitchen waste valorization through a mild-temperature pretreatment to enhance biogas production and fermentability: Kinetics study in mesophilic and thermophilic regimen.

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Journal of Environmental Sciences, 2020, 89, 167-179, doi: 10.1016/j.jes.2019.10.016

**Autori:** Gallipoli, A., Braguglia, C.M., Gianico A., Montecchio, D., Pagliaccia, P.

**Abstract ENG:** Biowaste valorization through anaerobic digestion is an attractive option to achieve both climate protection goals and renewable energy production. In this paper, a complete set of batch trials was carried out on kitchen waste to investigate the effects of mild thermal pretreatment, temperature regimen and substrate/inoculum ratio. Thermal pretreatment was effective in the solubilisation of macromolecular fractions, particularly carbohydrates. The ability of the theoretical methodologies in estimating hydrogen and methane yields of complex substrates was evaluated by comparing the experimental results with the theoretical values. Despite the single batch configuration, a significant initial hydrogen production was observed, prior to methane yield. Main pretreatment effect was the gain in hydrogen production; the extent was highly variable according to the other parameters values. High hydrogen yields, up to 113 mL H2/g VSfed, were related to the prompt transformation of soluble sugars. Thermophilic regimen resulted, as expected, in faster digestions (up to 78 mL CH4/gVS/day) and sorted out pH inhibition. The relatively low methane yields (342e398 mL CH4/g VSfed) were the result of the consistent lignocellulosic content and low lipid content. Thermal pretreatment proved to be a promising option for the enhancement of hydrogen production in food waste dark fermentation.

## Enhancing nature-based solutions acceptance through stakeholders' engagement in co-benefits identification and trade-offs analysis

**Anno di pubblicazione:** 2020

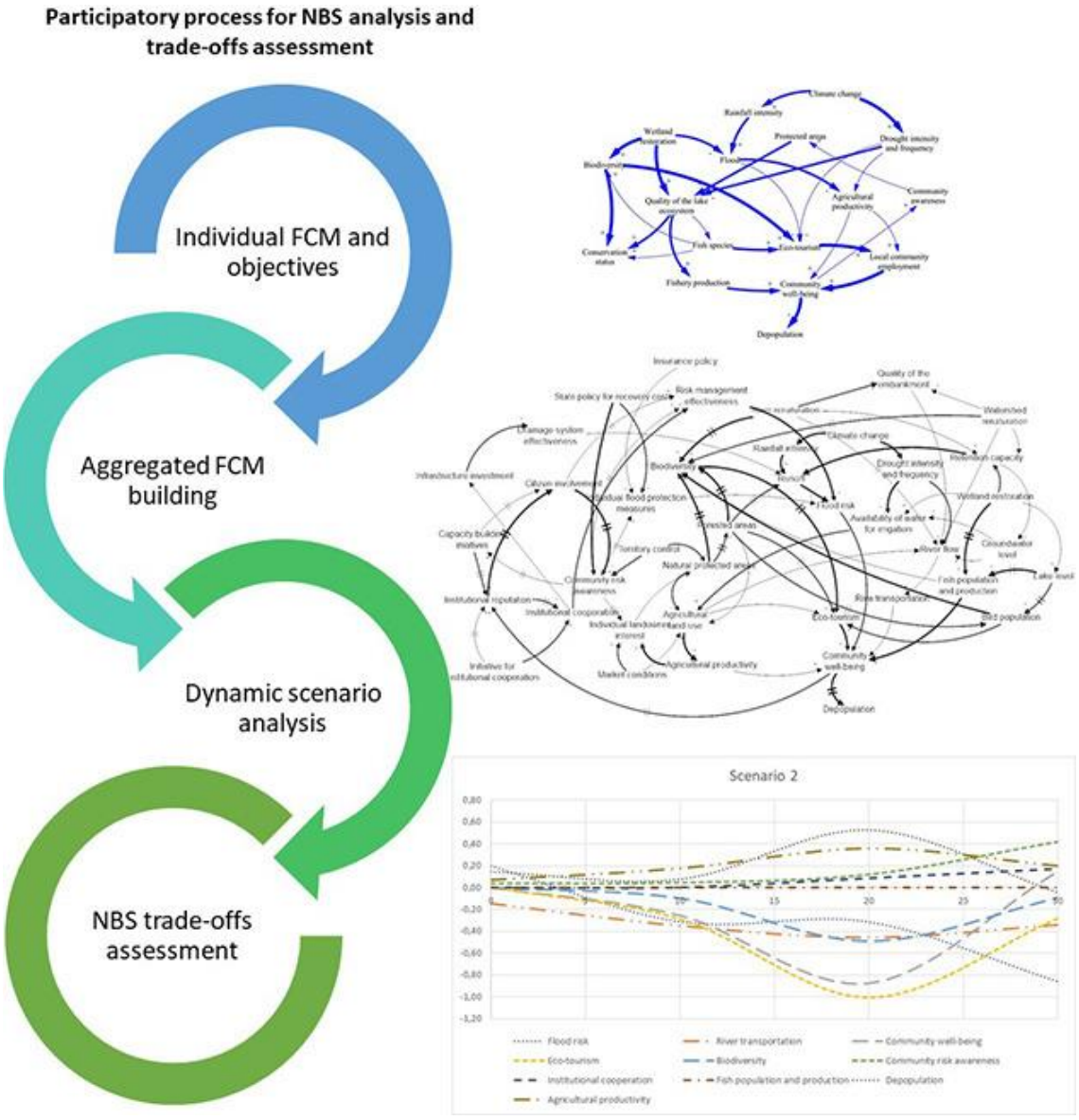
**Riferimento rivista con DOI:** Science of Total Environment, 2020, 713, 136552, https://doi.org/10.1016/j.scitotenv.2020.136552

**Autori:** R. Giordano, I. Pluchinotta, A. Pagano, A. Scrieciu, F. Nanu

**Abstract ITA:** Le Nature-Based Solutions sono sempre più frequentemente riconosciute come una valida alternativa alle infrastrutture grigie - ovvero hard, strutture progettate dall'uomo - come misure per ridurre i rischi legati al clima. Sono numerose le evidenze empiriche che dimostrano come le NBS possano ridurre i rischi per persone e proprietà con la stessa efficacia delle tradizionali infrastrutture grigie, ma offrendo molti vantaggi aggiuntivi, ad es. migliorare l'habitat naturale per la fauna selvatica, migliorare l'acqua e l'aria qualità, miglioramento delle condizioni socioculturali delle comunità. La crescente attenzione sulla NBS, ha innescato un aumento interesse nello sviluppo di quadri integrati e multidisciplinari per valutare l'efficacia della contabilità NBS per la produzione di co-benefici. Partendo dall'analisi dei quadri esistenti, questo lavoro sostiene per un coinvolgimento più diretto delle parti interessate, ovvero i beneficiari dei co-benefici, nello sviluppo della valutazione NBS struttura. Questo lavoro mira a dimostrare che le differenze nella percezione e nella valutazione dei benefici collaterali potrebbero portare a compromessi e, quindi, a potenziali conflitti. Una metodologia innovativa che utilizza una Fuzzy CognitiveMap quasi dinamica è stato sviluppato un approccio basato su più fasi temporali per valutare l'efficacia della NBS e per rilevare e analizzare i compromessi tra le parti interessate a causa delle differenze nella percezione dei benefici collaterali. Il sviluppato la metodologia è stata implementata nel caso di studio del Danubio inferiore. L'analisi del trade-off tra gli stakeholder mostra che sono piuttosto bassi nel breve termine. La maggior parte dei potenziali conflitti può essere rilevata nel lungo termine termine, coinvolgendo principalmente gli stakeholder che hanno attribuito un valore elevato alla variabile di produttività agricola

**Abstract ENG:** Nature-based solutions (NBS) are increasingly recognized as a valid alternative to grey infrastructures - i.e. hard, human-engineered structures – as measures for reducing climate-related risks. Increasing evidences demonstrated that NBS can reduce risks to people and property as effectively as traditional grey infrastructures, but potentially offering many additional benefits, e.g. improving the natural habitat for wildlife, enhancing water and air quality, improving socio-cultural conditions of communities. The growing attention on the NBS, triggered an increasing interest in developing integrated and multi-disciplinary frameworks for assessing NBS effectiveness accounting for the co-benefits production. Starting from the analysis of the existing frameworks, this work claims for a more direct engagement of stakeholders – i.e. co-benefits beneficiaries – in developing NBS assessment framework. This work aims at demonstrating that differences in co-benefits perception and valuation might lead to trade-offs and, thus, to potential conflicts. An innovative methodology using a quasi-dynamic Fuzzy CognitiveMap approach based on multiple-time-steps was developed in order to assess NBS effectiveness, and to detect and analyze trade-offs among stakeholders due to differences in co-benefits perception. The developed methodology was implemented in the Lower Danube case study. The trade-off analysis among stakeholders shows

that they are quite low in the short term. Most of the potential conflicts can be detected in the long term, involving mainly the stakeholders that assigned a high value to the agricultural productivity variable.



## Using a system thinking approach to assess the contribution of nature based solutions to sustainable development goals

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Science of Total Environment, 2020, 738, 139693, https://doi.org/10.1016/j.scitotenv.2020.139693

**Autori:** Eulalia Gómez Martín, Raffaele Giordano, Alessandro Pagano, Peter van der Keur, María Máñez Costa

**Abstract ITA:** Questo articolo descrive un approccio innovativo per l'analisi integrata dell'efficacia delle NBS, individuando ed analizzando potenziali trade-off per quanto riguarda la produzione di co-benefit.

**Abstract ENG:** Climate change and the overexploitation of natural resources increase the need to integrate sustainable development policies at both national and international levels to fit the demands of a growing population. In 2015 the United Nations (UN) established the 2030 Agenda for sustainable development with the aim of eradicating extreme poverty, reducing inequality and protecting the planet. The Agenda 2030 highlights the importance of biodiversity and the functioning of ecosystems to maintain economic activities and the well-being of local communities. Nature Based Solutions (NBS) support biodiversity conservation and the functioning of ecosystems. NBS are increasingly seen as innovative solutions to manage water-related risks while transforming natural capital into a source of green growth and sustainable development. In this context, NBS could potentially contribute to the achievement of several Sustainable Development Goals (SDGs) by promoting the delivery of bundles of ecosystem services together generating various social, economic and environmental co-benefits. However, to achieve the full potential of NBS, it is necessary to recognize the trade-offs and synergies of the co-benefits associated with their implementation. To this aim, we have adopted a system perspective and a multi-sectoral approach to analyse the potential of NBS to deliver co-benefits while at the same time reducing the negative effects of water-related hazards. Using the case study of Copenhagen, we have analysed the relationships between the co-benefits associated with the scenario of the restoration of the Ladegaardsaa urban river. Our hypothesis is that enhancing the understanding of the social, economic and environmental factors of the system, including mutual influences and trade-offs, could improve the decision-making process and thereby enhance the capability of NBS to contribute to the achievement of the SDGs.

## A Method for Enhancing Capacity of Local Governance for Climate Change Adaptation

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Earth's Future, 2020, https://doi.org/10.1029/2020EF001506

**Autori:** D. S. Williams, L. Celliers, K. Unverzagt, N. Videira, M. Máñez Costa, R. Giordano

**Abstract ITA:** Questo articolo descrive un approccio integrato e basato su Fuzzy Cognitive Map per valutare la capacità di un determinato sistema territoriale, con particolare riferimento all'analisi del sistema di governance territoriale.

**Abstract ENG:** The lack of capacity for climate change adaptation at the subnational level has been highlighted as a key barrier to implementing the UNFCCC National Adaptation Plans. At the same time, the adaptive capacity of local governance is highly context sensitive, making a “one-size fits all” approach inappropriate. Thus, a versatile methodological approach for application in various local contexts is required. There are several indicator-based local governance assessment methods for evaluating the effectiveness of local governance for climate change adaptation. However, they fall short of identifying and prioritizing between key factors within local governance for enhancing adaptive capacity and driving positive change. Building on adaptation theory, the authors propose combining two methodological approaches, the Capital Approach Framework for evaluating the adaptive capacity of local governance and Fuzzy Cognitive Mapping for identifying leverage points, into one integrated modeling approach, which can be applied by local researchers. This paper describes the process and benefits of combining the methodological approaches, with an example provided as supporting information. Assisting decision-makers and policy planners from subnational governance in identifying leverage points to focus and maximize impact of capacity-enhancing measures would make a key contribution for successful implementation of the UNFCCC National Adaptation Plans.

## Urban adaptation to climate change: Climate services for supporting collaborative planning

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Climate Service, 2020, 17, 100100, https://doi.org/10.1016/j.cliser.2019.04.004

**Autori:** Raffaele Giordano, Karoliina Pilli-Sihvola, Irene Pluchinotta, Raffaella Matarrese, Adriaan Perrels

**Abstract ITA:** Questo lavoro descrive un approccio partecipativo per la definizione di un climate service a supporto della definizione di strategie per l'adattamento dei cambiamenti climatici in ambito urbano. In particolare, la necessità di supportare il collaborative decision-making è stato al centro delle attività.

**Abstract ENG:** There is a mounting international interest about how to address the implications of climate change for urban areas. The availability and sharing of "good" knowledge and information is a key prerequisite for a successful planning in cities. Urban planning for adaptation is largely considered as a collective process. This raises the importance of the availability/usability of proper "planner/user friendly" interfaces to interpret and translate the available information into adaptation decisions, and to facilitate the information sharing and collaborative decision making within the interaction network in which the different actors are embedded. Nevertheless, collaborative planning is far from being the standard in urban adaptation. The activities carried out in EU-MACS aimed at detecting and analysing the main barriers hampering the process. To this aim, Problem Structuring Methods and Social Network Analysis were implemented. The evidences collected in an urban case study – i.e. Helsinki – demonstrated that ambiguity in problem understanding and information needs, and missing connections in the mechanisms of interaction among actors-resources-tasks could hamper the effectiveness of collaborative planning and create inefficient flow between information production and decision process. Starting from these premises, and referring to the results of an extensive literature review about existing tools, our research aimed at facilitating the use of climate services to enable the collective decision-making process.

## A mixed MoL–TMoL for the numerical solution of the 2D Richards' equation in layered soils

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Computers & Mathematics with Applications, 2020, 79 (7), 1990-2001, doi: 10.1016/j.camwa.2019.07.026

**Autori:** M. Berardi - F. Difonzo - L. Lopez

**Abstract ITA:** In questo lavoro viene studiata l'infiltrazione dell'acqua nei suoli stratificati, considerando un dominio spaziale bidimensionale. In particolare, viene studiato il trattamento della discontinuità all'intersezione di suoli non sovrapposti. La novità di questo articolo si basa su un "mixed MoL-TMoL", che unisce le caratteristiche desiderabili sia del Metodo delle Linee (MoL) che del Metodo Trasversale delle Linee (TMoL); un tale approccio numerico consente il trattamento numerico della soluzione alle interfacce discontinue mediante la teoria di Filippov per sistemi dinamici. Per validare questo approccio sono fornite simulazioni numeriche, basate su schemi impliciti e semi-impliciti di bassa accuratezza.

**Abstract ENG:** Water infiltration into layered soils is studied, considering a two dimensional spatial domain. The focus is on the treatment of discontinuity at the intersection of non-overlapping soils. The novelty of this paper is based on a mixed MoL–TMoL, which merges desirable features of both Method of Lines (MoL) and Transversal Method of Lines (TMoL); such a numerical approach allows us the numerical treatment of the solution at the discontinuous interfaces by means of Filippov theory for dynamical systems. Numerical simulations, based on implicit and semi-implicit schemes of low accuracy, are provided for validating this approach.

## Strong solutions for Richards' equation with Cauchy conditions and constant pressure gradient

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Environmental Fluid Mechanics, 2020, 20, 165–174, doi: 10.1007/s10652-019-09705-w

**Autori:** M. Berardi - F. V. Difonzo

**Abstract ITA:** In questa nota viene studiata l'equazione di Richards per due terreni stratificati in un dominio spaziale bidimensionale. Il modello è dotato di gradiente di pressione e valori di pressione nella parte superiore del dominio e nessuna condizione è posta nella parte inferiore del dominio. Un risultato di esistenza e unicità di soluzioni forti si ottiene per un tale problema assumendo un gradiente di pressione costante.

**Abstract ENG:** In this note, Richards' equation for two layered soils is considered in a two-dimensional spatial domain. It is endowed by pressure gradient and pressure condition at the top of domain, and no condition is posed at the bottom of domain. An existence and uniqueness result of strong solutions is obtained for such a problem assuming constant pressure gradient.

## Moss, Lichens and Phytobenthos Bioindicators of Pollution

**Anno di pubblicazione:** 2020

**Riferimento rivista con DOI:** Open Access Journal of Waste Management & Xenobiotics, 2020, 3 (2), 138, doi: 10.23880/oajwx-16000138

**Autori:** Nicoletta Guerrieri, Laura Fantozzi, Arianna Orrù

**Abstract ITA:** L'uso di licheni, muschi e fitobentos come bioindicatori di inquinamento di aria e acqua da metalli pesanti è discusso sulla base della letteratura e dell'esperienza degli autori. L'utilità delle tecniche di monitoraggio disponibili è stata valutata criticamente. Muschi e licheni sono considerati biodindicatori molto utili soprattutto per studi su larga scala sulla deposizione di metalli pesanti dall'atmosfera. Organizzazioni nazionali e internazionali hanno standardizzato e condiviso protocolli di monitoraggio. Abbiamo analizzato la letteratura recente dal 2019 all'aprile 2020 e selezionato alcuni casi studio significativi che contribuiscono a un miglioramento dei metodi analitici e allo sviluppo di nuovi metodi. Una vasta letteratura riporta il monitoraggio dell'inquinamento atmosferico con muschi e licheni, sia naturali che trapiantati. L'uso dei muschi trapiantati come bioindicatori dell'inquinamento delle acque è meno rappresentato nella letteratura disponibile. Il fitobentos rappresenta una nuova frontiera nel monitoraggio dell'ecosistema acquatico e anche se non è stato ancora finalizzato un metodo standardizzato, rappresenta un potenziale bioindicatore molto utile di inquinamento da metalli, inquinanti emergenti e anche microplastiche in ambiente acquatico. Nuovi metodi, nuove tecnologie stanno emergendo nella letteratura recente e il rapporto tra ambiente e salute umana inizia ad essere studiato da un diverso punto di vista.

**Abstract ENG:** The use of lichens, mosses and phytobenthos as biomonitors of air and water pollution by heavy metals is discussed on the basis of the literature and the author's own experience. The usefulness of the available monitoring techniques is critically evaluated. Moss and lichens are considered very useful biodindicators especially for large-scale studies of heavy-metal deposition from the atmosphere. National and international organization standardized and shared monitoring protocols. We analysed the recent literature from 2019 to April 2020 and selected some significant case studies that contribute to an improvement of the analytical methods and to a development of new tools. A wide literature reports monitoring of air pollution with moss and lichens, both natural and transplanted. The use of transplanted moss as bioindicator of water pollution is less represented in the available literature. Phytobenthos represents a new frontier in the aquatic ecosystem monitoring and even if a standardized method has not yet been finalized, it represents a potential very useful biomonitor of metals, emergent pollutants and also microplastics in aquatic environment. New tools, new technologies are emerging from recent literature and the relationship between environment and human health starts to be studied from a different point of view.

## Monografie e contributi in volumi

**Lanzarote and Chinijo Islands: An Anchialine UNESCO Global Geopark. In: Mateo E., Martínez-Frías J., Vegas J. (eds) Lanzarote and Chinijo Islands Geopark: From Earth to Space. Geoheritage, Geoparks and Geotourism (Conservation and Management Series). Springer, Cham, pp. 109-121.**

**Anno di pubblicazione:** 2019

**Autori:** Martínez A., García-Gómez G., García-Herrero Á., Di Cesare A., Corno G., Herrera R., Moro L., Eckert E. & Fontaneto D.

**Riferimento monografia con ISBN:** 978-3-030-13130-2

**Abstract ITA:** The Lanzarote and Chinijo Islands UNESCO Global Geopark hosts one of the most extensive and diverse volcanic anchialine ecosystems in the world, consisting of water bodies with marine origin that penetrated inland through coastal crevicular systems. Marine infiltration is facilitated by the low rainfall and the permeability of the coastal terrains. Best known for Túnel de la Atlántida, Lanzarote has other types of anchialine habitats, such as pools, lakes, and even hand-made wells, all of them interconnected with the crevicular system. So far, 39 endemic stygobitic species of crustacean, annelids, and platyhelminthes have been described in the island. Some of them belong to lineages previously interpreted as Tethyan vicariant relicts because they belong in ancient groups restricted to caves situated in areas along the coastline of the ancient Tethys Sea, such as Mexico, Bahamas or Western Australia. Others, instead, have clear affinities with deep-sea lineages, suggesting that their ancestors might have dispersed into the island from surrounding deep-sea environments. In overall, while the anchialine habitats of Lanzarote are relatively small in comparison to other regions, the presence of so many species with such a diverse origin have puzzled zoologists and biogeographers throughout the 20th century, who have regarded the island as a model to understand the origin and evolution of similar groups in other areas of the world. The anchialine habitats in Lanzarote are subject to intense recreational use and the island itself is a major touristic destination. However, geologist and biologist working in the local government offices, as well as in UNESCO Global Geopark and Biosphere Reserve Institutions have started close collaborations with the touristic centers and independent scientist from several universities and research centers around the world with the goal of implementing novel conservation policies based on the results of state-of-art research. This strategy will ensure not only a better understanding of the anchialine ecosystems in the island in the near future, but also its long-term preservation.

**Abstract ENG:** The Lanzarote and Chinijo Islands UNESCO Global Geopark hosts one of the most extensive and diverse volcanic anchialine ecosystems in the world, consisting of water bodies with marine origin that penetrated inland through coastal crevicular systems. Marine infiltration is facilitated by the low rainfall and the permeability of the coastal terrains. Best known for Túnel de la Atlántida, Lanzarote has other types of anchialine habitats, such as pools, lakes, and even hand-made wells, all of them interconnected with the crevicular system. So far, 39 endemic stygobitic species of crustacean, annelids, and platyhelminthes have been described in the island. Some of them belong to lineages previously interpreted as Tethyan vicariant relicts because they belong in

ancient groups restricted to caves situated in areas along the coastline of the ancient Tethys Sea, such as Mexico, Bahamas or Western Australia. Others, instead, have clear affinities with deep-sea lineages, suggesting that their ancestors might have dispersed into the island from surrounding deep-sea environments. In overall, while the anchialine habitats of Lanzarote are relatively small in comparison to other regions, the presence of so many species with such a diverse origin have puzzled zoologists and biogeographers throughout the 20th century, who have regarded the island as a model to understand the origin and evolution of similar groups in other areas of the world. The anchialine habitats in Lanzarote are subject to intense recreational use and the island itself is a major touristic destination. However, geologist and biologist working in the local government offices, as well as in UNESCO Global Geopark and Biosphere Reserve Institutions have started close collaborations with the touristic centers and independent scientist from several universities and research centers around the world with the goal of implementing novel conservation policies based on the results of state-of-art research. This strategy will ensure not only a better understanding of the anchialine ecosystems in the island in the near future, but also its long-term preservation.

## Note tecniche su crisi idriche siccità e servizio idrico integrato. Cap. 1 - Aspetti Generali e Definizioni

**Anno di pubblicazione:** 2019

**Autori:** Stefano Mariani, Giovanni Braca, Simone Ambrosetti, Ciro Carpiniello, Zoida Tafilaj, Andrea Duro, Cinzia Conte, Francesco Campopiano, Emanuele Romano, Nicolas Guyennon, Anna Bruna Petrangeli

**Riferimento monografia con ISBN:** 9788899879037

## Note tecniche su crisi idriche siccità e servizio idrico integrato. Cap. 4 - Il monitoraggio delle condizioni di siccità e scarsità e il preannuncio delle crisi idriche

**Anno di pubblicazione:** 2019

**Autori:** Stefano Mariani, Giovanni Braca, David Peres, Antonino Cancelliere, Giuseppe Rossi, Simone Ambrosetti, Ciro Carpiniello, Zoida Tafilaj, Andrea Duro, Cinzia Conte, Francesco Campopiano, Emanuele Romano, Nicolas Guyennon, Anna Bruna Petrangeli

**Riferimento monografia con ISBN:** 9788899879037

## Monitoraggio chimico, isotopico e delle comunità microbiche delle acque sotterranee: strategie per una migliore comprensione dei processi naturali e antropici

**Anno di pubblicazione:** 2019

**Autori:** Elisabetta Preziosi, Eleonora Frollini, Stefano Amalfitano, Stefano Ghergo, Marco Melita, Daniele Parrone, Annamaria Zoppini

**Riferimento monografia con ISBN:** Geologia dell'ambiente, 2019, supplemento al n. 2/2019, 231-238, SSN 1591-5352

**Abstract ENG:** n industrial areas, the alteration of groundwater quality is generally attributed to human activities, while the role of natural geogenic background levels is largely disregarded. Owing to the migration of leachate and various contaminants, the municipal landfi lls are one of the main threats for aquifers. Th e current regulatory framework is limited to indicating generic concentration thresholds for contaminants, after which it is assumed that the protection systems have failed, without relying on the comparison with the site's conceptual hydrogeological model. Th rough a series of studies conducted in diff erent sites in Latium, we attempted to defi ne an integrated methodological approach suitable to distinguish the anthropogenic impacts from the natural geochemical background, through a synoptic analysis of the hydrogeochemical characteristics, isotopic and microbiological groundwater. Th is paper describes one of the case studies, where key inorganic contaminants (i.e., As, Fe, and Mn) exceeded the local threshold values in most of the sampling points, while hazardous organic contaminants were generally very low. Tritium values and d13C were helpful to single out the possibly impacted groundwater within the study area, where a moderate impact was apparent and the inorganic levels seemed altered. Th e groundwater microbial community was characterized by fl ow cytometry, BIOLOG MicroPlates assay, and faecal indicators providing further supportive information on the landfi ll-induced alterations. Finally, a multivariate statistical approach facilitated the integrated elaboration of the diff erent inorganic, organic, isotope and microbiological parameters. Th e high levels of inorganic compounds were attributed to the natural water-rock interaction with the thick lacustrine sequence rich in geogenic organic matter and residual volcanic products in anoxic conditions. Th e presence of faecal contamination and the heterogenic microbiological properties showed that aquifer alterations involved the microbial community structure and the functional profi les related to organic carbon utilization. In conclusion, this integrated multiparametric approach was suitable to distinguish geogenic and anthropogenic impacts, thus suggesting appropriate strategies for groundwater management in landfi lls.

## Problems and perspectives in the use of C and N Stable Isotope Analysis for exploring lacustrine food webs

**Anno di pubblicazione:** 2019

**Autori:** Rossana Caroni, Roberta Piscia, Amedeo Fadda, Marina Manca

**Riferimento monografia con ISBN:** ISBN 978 88 8080 307 2

**Abstract ITA:** Abstract - ITA

**Abstract ENG:** Ten years ago, the Institute of Ecological Studies was asked by the limnological subcommittee of CIPAIS (Commissione Internazionale per la Protezione delle Acque Italo-Svizzere) to present innovative projects to improve the knowledge deriving from the monitoring of Lake Maggiore and its catchment area. The occasion was pivotal, starting a characterization of the pelagic food web of the lake and for identifying zooplankton trophic relationships, together with their seasonal changes in relation to abiotic and biotic variables. Studies for the characterization of biotic relationships, including predation and competition dynamics within the zooplankton community, dependence on phytoplankton food sources and predatory pressure from fish had been conducted in the past using statistical analyses on zooplankton population dynamics. These early studies combined with laboratory expertise and with zooplankton elemental and microscopic analyses (see Manca & Tognota 1993; Manca et al. 1994, 1995, 1997), to provide the background of the newly established project. Our interest in the molecular approach to investigate trophic interactions was also stimulated by observations of a strong population decline of the cladoceran Daphnia in Lake Maggiore during the period 1989-1996, and by the need to disentangle the roles of predation vs. competition pressure and food limitation. On this issue, and particularly on the possibility of tracing Daphnia food limitation, the late Annie Duncan had already developed a methodology based on elemental analysis and seasonal changes in relation to the quantity and quality of food resources (Duncan 1985). Applying this method allowed us to have an insight into zooplankton taxa dynamics and developmental stages in different seasons, coupled with laboratory zooplankton elemental analysis. Carbon and nitrogen stable isotopes analyses were successfully applied to an alpine lake, providing a useful contribution to the debate on isotopic nitrogen signal dynamics in fishless lakes (Cattaneo et al. 2004). Over a period of ten years, the project has been enriched with other aspects connected to the analyses of persistent pollutants and to biomagnification estimates, providing a fundamental contribution to the understanding of pathway flows of persistent pollutants in aquatic food webs, and of the crucial role of zooplankton in this (cfr. Bettinetti and Manca 2017). Further investigations were promoted by the ad-hoc subcommittee within the CIPAIS, after recent DDT pollution in Lake Maggiore was detected in June 1996 (cfr. http://www.cipais.org/html/lago-maggiore-pubblicazioni.asp for further information).

## Problemi e prospettive dell'uso di analisi di isotopi stabili di carbonio e azoto per lo studio di reti trofiche lacustri

**Anno di pubblicazione:** 2019

**Autori:** Rossana Caroni, Roberta Piscia, Amedeo Fadda, Marina Manca

**Riferimento monografia con ISBN:** ISBN 978 88 8080 308 9

**Abstract ITA:** Quando, dieci anni or sono, la Commissione Internazionale per la Protezione delle Acque Italo-Svizzere (CIPAIS) richiese all'Istituto per lo Studio degli Ecosistemi di presentare progetti in ambito limnologico innovativi che servissero ad arricchire le conoscenze derivanti dal monitoraggio del lago Maggiore e del suo bacino imbrifero, l'occasione fu propizia per avviare indagini che servissero ad una caratterizzazione della rete pelagica lacustre nelle sue diverse componenti, individuando i rapporti trofici e la loro evoluzione nel tempo, in relazione al variare di parametri abiotici e biotici. Studi relativi alla caratterizzazione di rapporti biotici, includendo dinamiche di predazione e competizione all'interno dello zooplancton, dipendenza dalla base alimentare fitoplanctonica e dalla pressione predatoria da parte della fauna ittica, erano stati condotti in passato con metodi di analisi statistica, basati sull'utilizzo di dati derivanti dall'analisi della dinamica delle popolazioni zooplanctoniche. La consapevolezza dell'importanza delle conoscenze derivanti da questi primi studi, unita all'interesse personale per attività che potessero coniugare esperienze di laboratorio, di analisi elementari (cfr. Manca & Tognota 1993; Manca et al. 1994, 1995, 1997) con quelle microscopiche alla base della caratterizzazione del popolamento zooplanctonico del lago, sono stati gli elementi che hanno portato alla formulazione del progetto d'indagine della rete trofica pelagica del lago Maggiore anche attraverso l'uso di analisi di isotopi stabili di carbonio e azoto. La passione e l'interesse per approcci molecolari volti allo studio delle interazioni trofiche nasceva anche, proprio sul caso di studio "lago Maggiore", dal desiderio di comprendere le ragioni del forte declino di Daphnia, osservato nel periodo 1989-1996, per il quale non poteva essere esclusa l'ipotesi di una forte limitazione dalla base alimentare. Su questo tema, la compianta studiosa Annie Duncan aveva lavorato, con la messa a punto di un metodo basato su analisi elementari di Daphnia e del loro variare stagionale in relazione alle risorse alimentari (Duncan 1985). L'utilizzo di questo metodo permetteva di arricchire le indagini usuali, improntate alla caratterizzazione della densità di popolazione del popolamento zooplanctonico, nelle sue diverse entità tassonomiche e nei diversi stadi di sviluppo, con quelle attività di laboratorio che mi avevano vista per tanti anni lavorare al fianco di Riccardo de Bernardi e, nello specifico delle analisi elementari, con Gianluigi Giussani. L'utilizzo dell'analisi degli isotopi stabili di C ed N era da me già stato impiegato per un lago alpino sul quale lavoravo da tempo, con l'intento di caratterizzarne la rete trofica planctonica, anche in relazione al dibattito sulla dinamica del segnale isotopico dell'azoto in laghi privi di pesci (Cattaneo et al. 2004). Furono queste le basi conoscitive dalle quali scaturì il progetto d'indagine sul lago Maggiore, andatosi arricchendo nell'arco di dieci anni anche con aspetti più propriamente legati al flusso di inquinanti persistenti e alla stima della biomagnificazione, dando in tal modo un fondamentale contributo alle indagini sulle sostanze inquinanti ed al ruolo cruciale svolto dallo zooplancton in questo contesto, indagini promosse e finanziate dalla sottocommissione ad hoc istituita in seno alla CIPAIS a seguito della scoperta dell'inquinamento da DDT del lago e delle comunità in esso insediate. Con questo progetto la modernità degli studi su base molecolare si coniugava con la tradizione di un approccio

ecosistemico allo studio dei laghi, connaturata con l'Istituto ed espressa nella sua mission, per la quale fondamentale è stato il poter contare su un gruppo di lavoro multidisciplinare in grado di contribuire, con le specifiche competenze, alle diverse e complesse fasi delle attività.

**Abstract ENG:** Abstract - ENG

## Knowledge gaps and research needs in bacterial co-resistance in the environment

**Anno di pubblicazione:** 2019

**Autori:** Grenni P, Corno G

**Riferimento monografia con ISBN:** Knowledge gaps and research needs in bacterial co-resistance in the environment. In: SM Mandal, Debarati P (Eds) Bacterial Adaptation to Co-resistance. Springer Singapore (2019) ISBN: 978-981-13-8502-5 DOI: 10.1007/978-981-13-8503-2

**Abstract ENG:** This chapter describes the different factors that increase or stimulate the pres-ence of resistance to antibiotics in bacteria in the environment. Particular factors accentuating the spread and evolution of antibiotic resistance are various pollu-tants such as heavy metals, disinfectant products, other organic pollutants and nu-trients. In particular, co-factors inducing resistance in water and sediments are ex-plained. A particular emphasis is placed on the co-selection of antibiotic re-sistance genes due to the presence of metals, both in soil and in waters. Moreover, the role of nutrients and other organic contaminants in improving antibiotic re-sistance in bacteria is also highlighted. Finally, the role of the disinfection of wa-ters and wastewaters in abatement of antibiotic resistance genes is reported.

## Microbial Ecology for Assessing Structure and Functioning of Communities of Microbes in Different Environments, from Natural Soil and Water to Cultural Heritage

**Anno di pubblicazione:** 2019

**Autori:** Grenni P, Cardoni M, Di Lenola M, Barra Caracciolo A

**Riferimento monografia con ISBN:** Sciences and Technologies applied to Cultural Heritage I (STACH 1), Baldi M, Capriotti Vittozzi G (Eds.) , pp. 108-127. Consiglio Nazionale Delle Ricerche, Centro Archeologico Italiano – Istituto Italiano Di Cultura. ISBN 978 88 8080 347 8

**Abstract ENG:** Microbial ecology is the study of microbes in the environment and their interactions with each other. Microbes are the smallest and most numerous living organisms on Earth. Despite their small size, natural microbial communities have a huge impact on our environment. They have a key role in biogeochemical cycles (e.g. nitrogen fixation, methane metabolism and sulphur metabolism) and in organic matter degradation. They harbour an amazing physiological versatility and catabolic potential for the breakdown of an enormous number of organic molecules, including xenobiotics, thanks to their great adaptability to different conditions. Natural microbial communities provide several regulating ecosystem services, maintaining soil and water quality1. Soil and water ecosystem recovery from contamination relies on the presence of abundant and diverse microbial communities with the ability to degrade contaminants. Finally, the microbial community structure reflects the impacts of environmental and anthropogenic factors on ecosystems. Even if most natural microbial populations provide benefits to humans (ecosystem services), some microbial processes can have deleterious effects on the conservation of cultural heritage owing to their biodeteriorative potential. This phenomenon is particularly evident in the case of outdoor cultural heritage, which is continuously exposed to abiotic and biotic factors; at the same time, some selected microorganisms and/or enzymes have recently been used for its bio-cleaning and bio-restoration. Microbial ecology makes it possible to study structure–function relationships between microbial communities and their environment at different levels through, for example, the evaluation of microbial abundance, diversity and activity. For example, the knowledge of species involved in the deterioration of cultural heritage can be very useful for managing their conservation, through suitable recovery measures. Trends in modern microbiology emphasize the need to know and understand the structure and function of complex microbial communities. Most types of microbes remain unknown. It is estimated that we know less than 1% of the microbial species on Earth. Yet microbes surround us everywhere - air, water, soil. An average gram of soil contains one billion (1,000,000,000) microbes representing probably several thousand species. Culture-independent molecular techniques are valuable tools for investigating the diversity and structure of bacterial communities. These techniques can be used on cultivable as well as non-cultivable bacteria. Several techniques for assessing microbial abundance, viability, activity and diversity that have been successfully applied in several environmental projects, can also be applied in cultural heritage ones.

## Fluorescence in Situ Hybridization Technique: a Tool Useful for Detecting Cultural Heritage Biodeteriogens

**Anno di pubblicazione:** 2019

**Autori:** Cardoni M, Barra Caracciolo A, Grenni P

**Riferimento monografia con ISBN:** Sciences and Technologies applied to Cultural Heritage I (STACH 1), Baldi M, Capriotti Vittozzi G (Eds.) 2019, pp. 37-46. Consiglio Nazionale Delle Ricerche, Centro Archeologico Italiano – Istituto Italiano Di Cultura. ISBN 978 88 8080 347 8

**Abstract ENG:** Microorganisms such as Bacteria and Archaea can damage monuments and stone artworks through various mechanisms, including biofilm formation, chemical reaction with the substrate and production of pigments. The biogenic release of inorganic and/or organic corrosive acids is probably the best known and most commonly investigated biogeochemical damage mechanism concerning inorganic materials. For example, aerobic microorganisms producing respiratory carbon dioxide, which becomes carbonic acid, contribute to dissolving stone and forming soluble salts. Moreover, the production of organic acids, such as lactic, oxalic and acetic, has been associated with the dissolution of calcite in calcareous stones. For these reasons, the phylogenetic classification of microorganisms colonizing cultural heritage substrates is very important, in order to detect the taxa involved in biodeterioration and apply the appropriate countermeasures. Fluorescence in situ hybridization (FISH) technique is a rapid and highly valuable culture-independent molecular method for detecting and identifying individual microbial cells in environmental samples using rRNAtargeted oligonucleotide probes. When used for detecting and identifying Cultural Heritage biodeteriogens, the FISH method can be performed in two ways: on powdered samples from the surface studied or more recently on adhesive tape strips applied on the surface and immediately removed. In contrast to other identification approaches, the FISH method largely maintains the characteristics of the targeted microorganisms and makes it possible to have a mirror image of the whole microbial community of a sample.

## Site-specific protocols for evaluating environmental compatibility of spoil materials produced by EPB-TBM

**Anno di pubblicazione:** 2019

**Autori:** Grenni P, Barra Caracciolo A, Patrolecco P

**Riferimento monografia con ISBN:** Tunnels and Underground Cities: Engineering and Innovation meet Archaeology, Architecture and Art. Proceedings of the WTC 2019 ITA-AITES World Tunnel Congress (WTC 2019), May 3-9, 2019, Naples, Italy. D. Peila, G. Viggiani & T. Celestino (Eds), Taylor & Francis Group, London, p. 360-366. ISBN 978-1-138-38865-9, DOI: 10.1201/9780429424441

**Abstract ENG:** The EPB-TBM performance relies on the selection of the appropriate conditioning additives. The anionic surfactant sodium lauryl ether sulphate (SLES) is the main component of several foaming agents. Consequently, tunneling spoil material can contain SLES residual concentrations. Owing to the lack of SLES threshold limits in soil in both European and Italian legislation, it is necessary to apply an ecological approach to produce a site-specific Protocol to be used during the excavation phase for classifying spoil material as a by-product. The approach includes: preliminary environmental risk assessment based on the ecotoxicity of each compound inside the conditioning additives; microcosm/mesocosms studies for evaluating the SLES biodegradability in the spoil materials during their temporary deposit and, finally, the evaluation of the potential ecotoxicity on test organisms selected on the basis of the possible scenarios of soil and water exposure to SLES residual concentrations in the final destination site.

## ATMOSPHERIC DEPOSITION IN EUROPEAN FORESTS IN 2017

**Anno di pubblicazione:** 2019

**Autori:** Aldo Marchetto, Peter Waldner, Arne Verstraeten

**Riferimento monografia con ISBN:** ALEXA MICHEL, ANNE-KATRIN PRESCHER & KAI SCHWÄRZEL (Eds.)Forest Condition in Europe 2019 Technical Report of ICP Forests Report under the UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP) BFW-Dokumentation 27/2019 ISBN 978-3-903258-17-4

**Abstract ENG:** Studying the effects of atmospheric pollution on forest ecosystems requires an evaluation of air quality and of the amount of pollutants carried to the forests by atmospheric deposition, which mainly follows two pathways: wet deposition of compounds dissolved in rain and snow and dry deposition of particulate matter through gravity or filtration, for example by the forest canopy. Pollutant deposition shows a relatively high local variability, related to the distribution of pollutant sources and the local topography, and in-situ measurement is needed to obtain accurate evaluations and to validate model estimates. In 2017, the chemical composition of open field bulk and below canopy throughfall deposition was measured at 278 and 297 intensive monitoring (Level II) plots, including data from 27 and 49 plots kindly provided by the Swedish Throughfall Monitoring Network (SWETHRO), respectively. In this report, we focus on throughfall deposition of acidifying, buffering, and eutrophying compounds. High throughfall deposition of nitrate was mainly found in Central Europe (Germany, Switzerland, the Czech Republic, Austria and Belgium-Flanders), while for ammonium high deposition was also found in northern Italy, southwestern UK, southern Romania and western Poland. The area of high deposition is smaller for sulphate, including some plots in Hungary, Greece, the Czech Republic, Slovakia, Bulgaria and in Belgium-Flanders near the port of Antwerp. High values in coastal areas are partially due to deposition of marine aerosol, and they are less evident after sea-salt correction. Calcium, potassium and magnesium deposition can buffer the acidifying effect of atmospheric deposition. High values of calcium throughfall deposition are reported in southern Europe, mainly related to the deposition of Saharan dust, and in Eastern Europe. The correction for the marine contribution does not affect their spatial pattern. On the contrary, in the case of magnesium, the distribution of the highest values is markedly reduced by the sea salt correction. Note that the total deposition to the forest can be higher (typically for nitrate and ammonia) or lower (typically for buffering compounds) than the throughfall deposition, due to canopy exchange processes.

## Professor Oscar Ravera: Long Life in Science.

**Anno di pubblicazione:** 2019

**Autori:** N. RICCARDI

**Riferimento monografia con ISBN:** Dormancy in Aquatic Organisms. Theory, Human Use and Modeling (Alekseev, V. Ed) Monographiae Biologicae book series (MOBI, volume 92) DOI: 10.1007/978-3-030-21213-1_1

**Abstract ITA:** Necrologio del volume dedicato alla memoria del Professor Oscar Ravera

**Abstract ENG:** Oscar Ravera obituary: preface of the volume printed "Ad memoriam Professor Osca Ravera"

### Chapter 4 “Solid-liquid partitioning bioreactors for industrial wastewater treatment”

**Anno di pubblicazione:** 2019

**Autori:** TOMEI M.C., DAUGULIS A.J.

**Riferimento monografia con ISBN:** In: Advances and Applications of Partitioning Bioreactors, (2019) Volume 54, 1st Edition. Eds. S. Huerta-Ochoa, C. Castillo-Araiza, G. Quijano, pp.318, Elsevier Academic press, ISBN: 9780128149966.

**Abstract ENG:** In two-phase solid–liquid partitioning bioreactors (TPPBs), inexpensive and inert commercial polymers are used to replace immiscible organic solvents to absorb and release toxic organic molecules for degradation by mixed populations. In such systems, the polymers act exactly as does an organic solvent, with uptake/release occurring via absorption, and reduced aqueous contaminant levels arising from the maintenance of a thermodynamic equilibrium between the aqueous and polymer phases. The use of commercial, non-volatile, non-flammable, biocompatible and easily-shaped polymers as the sequestering phase is a step forward in the development of “green,” solvent-free bio-treatment strategies. In this chapter, the principle of operation, applications and demonstrated results of solid–liquid TPPBs operated with polymeric sequestering phases are reported for biological industrial wastewater treatment.

## Toce River

**Anno di pubblicazione:** 2019

**Autori:** Volta Pietro, Paolo Sala

**Riferimento monografia con ISBN:** In: Rivers of the Alps. Diversity in Nature and Culture, Ed.: Muhar, S., Muhar, A., Egger, G., Siegrist, D. (2019), Bern: Haupt Verlag, ISBN 978-3-258-08117

**Abstract ITA:** Il volume, si occupa di descrivere tutti i principali corsi d'acqua dell'areale alpino.

**Abstract ENG:** The book aims to describe major rivers and lake of the alpine area.

**Il Paesaggio BioWine del Sannio Beneventano. Atti del Congresso "Turismo, Paesaggio e Beni Culturali: prospettive di tutela, valorizzazione e sviluppo sostenibile", XI Riunione Scientifica SISTUR**

**Anno di pubblicazione:** 2019

**Autori:** A.P. Leone, P. Magliulo, N. Leone, M. Beatrice, M. L. Varricchio, N. Ciarleglio, G. Quaranta

**Riferimento monografia con ISBN:** 9788825539189

**Abstract ITA:** Il paesaggio rurale è un elemento fortemente caratterizzante il Sannio Beneventano. In particolare, in questa terra riveste un ruolo importante, economico ed estetico, il paesaggio viticolo, frutto delle complesse interazioni, avvenute nel corso dei millenni, tra l'uomo e i diversi elementi dell'ambiente fisico: suolo, litologia, morfologia e topo-clima. La superficie vitata del Sannio, nella sua interazione con il rilievo, i suoli e la sottostante litologia, oltre alla produzione di vini di pregio, dà vita a scenari di particolare bellezza, ponendosi, in tal modo, come un importante attrattore turistico del territorio. Il paesaggio viticolo del Sannio, mostra tuttavia anche elementi di particolare fragilità, riconducibili all'impatto dell'uomo sul territorio e alla peculiarità del territorio stesso: l'uso degli agrochimici, le lavorazioni dei suoli, la forma del rilievo, la natura dei suoli, le caratteristiche dei substrati geologici, l'aggressività climatica, sono alcuni degli elementi che concorrono a determinare il rischio di degrado ambientale. Pertanto, il paesaggio viticolo del Sannio necessita di essere tutelato, con regole adeguate a preservare e garantire alle nuove generazioni le sue peculiarità estetiche e produttive. Una risposta concreta, in tal senso, è venuta dalle amministrazioni comunali delle più importanti aree viticole del Sannio, le quali hanno inserito nei Piani Urbanistici Comunali adeguate norme di gestione dei territori agricoli. Le azioni individuali delle singole Amministrazioni hanno trovato convergenza in un importante progetto PON-Governance, denominato BioWine (Biological Wine Innovative Enviroment). Esso rappresenta un importante esempio di trasferimento di know-how e buone pratiche tra i diversi comuni aderenti al progetto, sui temi della tutela dell'ambiente, oltre che dell'innovazione tecnologica in agricoltura e del marketing territoriale. Il presente Capitolo illustra sinteticamente l'approccio metodologico ed i risultati ottenuti nello studio del Paesaggio BioWine del Sannio Beneventano.

**Abstract ENG:** The rural landscape is a strongly characterizing element of Sannio Beneventano. In particular, in this land plays an important economic and aesthetic role the viticultural landscape, the result of the complex interactions, which took place over the millennia, between man and the various elements of the physical environment: soil, lithology, morphology and topography. climate. The vineyard area of the Sannio, in its interaction with the relief, the soils and the underlying lithology, in addition to the production of fine wines, gives life to scenarios of particular beauty, thus becoming an important tourist attraction of the territory. The viticultural landscape of Sannio, however, also shows elements of particular fragility, attributable to the impact of man on the territory and to the peculiarity of the territory itself: the use of agrochemicals, the processing of the soils, the shape of the relief, the nature of the soils, the characteristics of the geological substrates, the climatic aggressiveness, are some of the elements that contribute to determining the risk of environmental degradation. Therefore, the viticultural landscape of Sannio needs to be protected, with adequate rules to preserve and guarantee its aesthetic and productive peculiarities to the new generations. A concrete response, in this sense, came from the municipal administrations of the most important wine-growing areas of the Sannio, which have included adequate management rules

for agricultural territories in the Municipal Urban Planning Plans. The individual actions of the individual Administrations have found convergence in an important PON-Governance project, called BioWine (Biological Wine Innovative Environment). It represents an important example of the transfer of know-how and good practices between the various municipalities participating in the project, on the issues of environmental protection, as well as technological innovation in agriculture and territorial marketing. This Chapter briefly illustrates the methodological approach and the results obtained in the study of the BioWine Landscape of Sannio Beneventano.

## Uso di misure spettroradiometriche del colore per la predizione dei contenuti di policlorobifenili (PCB) nei suoli: caso studio di un'area industriale dismessa del sud Italia

**Anno di pubblicazione:** 2019

**Autori:** V. Ancona, N. Leone, C. Galeone, G. Bagnuolo, V. F. Uricchio, G. Leone, A. P. Leone

**Riferimento monografia con ISBN:** Geologia dell'ambiente, SIGEA-Roma, supplemento al n. 2/2019

**Abstract ITA:** La contaminazione dei suoli da policlorobifenili (PCB) è un problema di grande rilevanza in diverse aree indu- striali d'Italia. La valutazione del contenuto e della distribuzione spaziale di questi composti organici è un prerequisito essenziale per le attività di caratterizzazione e riquali cazione di siti contaminati. Le analisi convenzionali di laboratorio, sebbene utili e praticamente insostituibili per una precisa e dettagliata valutazione della presenza di questi contaminanti, sono costose e richiedono tempi lunghi, quindi sono poco idonee per indagini su aree vaste; da qui, la necessità di sviluppare/validare tecniche alternative rapide e a basso costo da utilizzare come sostitutive o integrative delle analisi convenzionali. Nel presente studio sono state valutate le potenzialità del colore del suolo, basato su misure spettroradiometriche, combinato con l'analisi statistica di regressione, per la predizione del contenuto di PCB. A tal fine, sono stati utilizzati 28 campioni di suolo, prelevati in un'area industriale dismessa della provincia di Taranto (ex-MATRA), fortemente contaminata dallo sversamento di oli utilizzati come fluidi dielettrici, composti da una miscela di diversi congeneri di PCB. Per i predetti campioni sono state determinate le coordinate del colore in differenti sistemi colorimetrici. Attraverso analisi convenzionali di laboratorio, per gli stessi campioni sono stati determinati i contenuti di PCB (diciotto congeneri e la loro somma) oltre che di alogeni organici estraibili (Extractable Organic Halogens, EOX). Per predire i valori di PCB e di EOX in funzione delle variabili del colore del suolo, è stata condotta un'analisi statistica di regressione lineare semplice, dalla quale sono stati ottenuti modelli predittivi eccellenti (R2>0.80).

**Abstract ENG:** Soil contamination with polychlorinated biphenyls (PCBs) is a major problem in several Italian industrial areas. e evaluation of the content and spatial distribution of these organic compounds is an essential pre-requisite for the characterization and rehabilitation of contaminated sites. Conventional laboratory analyses, although useful and irreplaceable for a precise and detailed evaluation of the presence of these contaminants, are expensive and time- consuming, thus not very suitable for investigation over large areas; hence, the need to develop/validate alternative rapid and low-cost techniques, to use as substitutive or integrative to conventional analytical approaches. In this study, the potential of soil color based on spectrometric measurements, combined with regression analysis, for the prediction of PCBs content, were assessed. To this end, 28 soil samples were used, sampled in an abandoned industrial area of the province of Taranto (ex-MATRA), heavily contaminated by the spillage of oils used as dielectric fluids, containing a mixture of different PCBs congeners. The color coordinates in different color systems were determined for the afore- mentioned samples. rough conventional laboratory analyses, the contents of PCBs (eighteen congeners and their sum) were determined for the same samples, as well as Extractable Organic Halogens (EOX). To predict the PCB and EOX values as a function of soil color variables, a simple

linear regression statistical analysis was performed, from which excellent predictive models were obtained (R2>0.80).

**A plunge into the river Aniene: how polluted is our water? In Accademia dei Lincei (Ed.) Strategie di adattamento alla domanda e alla disponibilità di risorse idriche – XVII Giornata mondiale dell'Acqua. Collana: Atti dei Convegni Lincei, Vol. 324 Bardi Edizioni. 129-137.**

**Anno di pubblicazione:** 2019

**Autori:** Grenni P, Rossi D, Falconi F, Di Lenola M, Ghergo S, Mastroianni D, Alfarone A, Berardi D, Basosi M, Berardi M, Bravo V, Caico O, Ceccarelli F, Cianfoni G, De Angelis S, De Cesaris C, De Mattia A, Dino LS, Lattanzio A, Ledda L, Leoni J, Pellegrino F, Petrone M, Tonni A, Serpa I, Valterio M, Minicocci E, 2019.

**Riferimento monografia con ISBN:** ISBN: 978-88-218-1176-0

**Abstract ITA:** The River Aniene, a left bank tributary of the River Tiber in Central Italy, is almost certainly affected by various industrial and urban sources of pollution, even if information on its characteristics within the city of Rome is poor or limited to a few elements. In order to awaken students from a high school specialized in science (Rocci High School in Passo Corese, in the province of Rieti) to this problem, in the framework of an "Alternanza scuola-lavoro" project conducted by CNR-IRSA, the water quality of the River Aniene was verified at two sampling points inside the city of Rome analysing a number of parameters foreseen in the Italian Decree 152/2006. In particular many physico-chemical parameters plus anions and metals were measured; moreover, some microbiological parameters, both those foreseen in Italian Decree 152/2006 (faecal contamination) and others (such as total microbial number and viability), were evaluated. The results showed widespread faecal contamination of the water sampled. Some values for chemicals were also not in accordance with the good quality water status standards foreseen in the Water Framework Directive (2000/60/EC) of the European Union and in the Italian Decree 152/2006. Among the various geo-genic and human activity elements influencing the water pollution the human ones were the most significant for the bad river water quality.

**Tecniche di biorimedio fitoassistito per il recupero di suoli contaminati: applicazioni sperimentali. In: Atti del IV Workshop Nazionale BONIFICA, RECUPERO AMBIENTALE E SVILUPPO DEL TERRITORIO: ESPERIENZE A CONFRONTO SUL FITORIMEDIO-RemTech Expo 2018. DEA Edizioni, Baronissi (Italia), ISBN: 978-88-944325-0-3**

**Anno di pubblicazione:** 2019

**Autori:** Grenni P, Ancona V, Campanale C, Aimola G, Uricchio VF, Barra Caracciolo A

**Riferimento monografia con ISBN:** Atti del IV Workshop Nazionale BONIFICA, RECUPERO AMBIENTALE E SVILUPPO DEL TERRITORIO: ESPERIENZE A CONFRONTO SUL FITORIMEDIO-RemTech Expo 2018. DEA Edizioni, Baronissi (Italia), ISBN: 978-88-944325-0-3

**Abstract ITA:** Il biorimedio fitoassistito è una tecnologia verde utile per rimuovere, trasformare o contenere le sostanze tossiche nei suoli, sedimenti e in diversi casi anche di acque contaminate. Questa tecnologia si basa sull'applicazione di una o più specie vegetali opportunamente selezionate (in base ad esempio al contaminante da rimuovere e alle condizioni sito-specifiche), per stimolare l'attività di biodegradazione attraverso le relazioni sinergiche che si instaurano tra la pianta ed i microrganismi naturali della rizosfera (la porzione di suolo che circonda le radici). Il biorimedio fitoassistito, sfruttando e stimolando la capacità naturale dei microrganismi di rimuovere le sostanze inquinanti, è un rimedio naturale e in linea con la sostenibilità ambientale per la riqualificazione di aree contaminate. Sebbene possa avere tempi più lunghi rispetto ad altre tecnologie di bonifica (come ad esempio l'utilizzo di agenti chimici ossidanti), ha costi di applicazione molto contenuti. Una problematica frequente nelle aree inquinate risiede nella presenza diffusa di contaminazione multipla (ad esempio composti tossici organici e inorganici) e ciò rende fondamentale lo studio delle interazioni pianta-microorganismi per la realizzazione di strategie di rimedio efficaci

**Abstract ENG:** Il biorimedio fitoassistito è una tecnologia verde utile per rimuovere, trasformare o contenere le sostanze tossiche nei suoli, sedimenti e in diversi casi anche di acque contaminate. Questa tecnologia si basa sull'applicazione di una o più specie vegetali opportunamente selezionate (in base ad esempio al contaminante da rimuovere e alle condizioni sito-specifiche), per stimolare l'attività di biodegradazione attraverso le relazioni sinergiche che si instaurano tra la pianta ed i microrganismi naturali della rizosfera (la porzione di suolo che circonda le radici). Il biorimedio fitoassistito, sfruttando e stimolando la capacità naturale dei microrganismi di rimuovere le sostanze inquinanti, è un rimedio naturale e in linea con la sostenibilità ambientale per la riqualificazione di aree contaminate. Sebbene possa avere tempi più lunghi rispetto ad altre tecnologie di bonifica (come ad esempio l'utilizzo di agenti chimici ossidanti), ha costi di applicazione molto contenuti. Una problematica frequente nelle aree inquinate risiede nella presenza diffusa di contaminazione multipla (ad esempio composti tossici organici e inorganici) e ciò rende fondamentale lo studio delle interazioni pianta-microorganismi per la realizzazione di strategie di rimedio efficaci

**Biorimedio fito-assistito per il recupero di aree multi-contaminate e la valorizzazione energetica della biomassa. In: Bonifica dei Siti Inquinati - Daniele Baldi Editore. Geologia dell'Ambiente (Società Italiana di Geologia Ambientale) Suppl. 2/2019: 22-26. ISSN 1591-5352**

**Anno di pubblicazione:** 2019

**Autori:** Ancona V, Grenni P, Borello D, Uricchio VF, Ferrara L, Barra Caracciolo A

**Riferimento monografia con ISBN:** Bonifica dei Siti Inquinati - Daniele Baldi Editore. Geologia dell'Ambiente (Società Italiana di Geologia Ambientale) Suppl. 2/2019: 22-26. ISSN 1591-5352

**Abstract ITA:** I trattamenti chimico-fisici di bonifica di suoli multi-contaminati da composti organici e inorganici sono caratterizzati da costi economici elevati, da complesse procedure di realizzazione perché necessitano di strumentazioni/apparecchiature da utilizzare on/off site con costi energetici considerevoli, nonché da costi ambientali per lo smaltimento di eventuali sotto-prodotti indesiderati. Le fitotecnologie (nature based solution) utilizzate in alternativa ai trattamenti fisico-chimici sono tecnologie sostenibili per il recupero di terreni contaminati. In particolare, il biorimedio fito-assistito o fitorimedio bioassistito sfrutta l'azione sinergica tra le radici delle piante e i microrganismi naturali (batteri e funghi) per rimuovere, trasformare o stabilizzare sostanze tossiche nel suolo, nei sedimenti o nelle acque. Tale tecnologia può essere efficacemente applicata in numerosi casi di aree contaminate, dove opportune specie vegetali vengono selezionate per stimolare l'attività di biodegradazione naturale dei microrganismi della rizosfera (ad esempio attraverso la produzione di essudati radicali o rilascio di ossigeno). La realizzazione di impianti di biorimedio fito-assistito produce biomassa legnosa che può essere utilizzata e recuperata con diverse tipologie di trattamento al fine di ottenere un prodotto (es. un ammendante o materia prima per produzione di syngas) economicamente vantaggioso. Tale "riutilizzo" può essere realizzato dopo un'analisi accurata che dimostri che tale biomassa non abbia accumulato inquinanti pericolosi dal terreno o che sia possibile realizzare trattamenti di cattura di tali inquinanti prima della re-immissione in atmosfera.

**Abstract ENG:** Chemical-physical treatments for remediation of soils multi-contaminated from organic and inorganic compounds are characterized by high economic costs, by complex construction procedures because they require equipment to be used on/off site with considerable energy costs, as well as environmental costs for the disposal of any undesired sub-products. Phyto-technologies (nature based solution) used as an alternative to physical-chemical treatments are sustainable technologies for the recovery of contaminated soils. In particular, the plant assisted bioremediation strategy uses the synergistic action between plant roots and natural microorganisms (bacteria and fungi) to remove, transform or stabilise toxic substances in soil, sediments or waters. This technology can be effectively applied in many cases of contaminated areas, where appropriate plant species are selected to stimulate the natural biodegradation activity acted by the microorganisms of the rhizosphere (e.g. through the radical exudates or oxygen release). The application of plant-assisted bioremediation technology produces woody biomass that can be used and recovered with different types of treatment in order to obtain a product (e.g. a soil amendment or raw material for the production of syngas) economically convenient. This "reuse" can be achieved after an accurate analysis showing that this biomass has not accumulated

hazardous pollutants from the ground or that it is possible to carry out capture treatments of these pollutants before re-entering the atmosphere.

## The Problem of Microplastics and Regulatory Strategies in Italy

**Anno di pubblicazione:** 2019

**Autori:** Claudia Campanale, Carmine Massarelli, Giuseppe Bagnuolo, Ilaria Savino, and Vito Felice Uricchio

**Riferimento monografia con ISBN:** In: Plastics in the Aquatic Environment - Part II: Stakeholders Role against Pollution, Friederike Stock, Georg Reifferscheid, Nicole Brennholt, and Evgeniia Kostianaia (eds.), DOI 10.1007/698_2019_419, Springer Nature Switzerland AG 2019

**Abstract ENG:** The term “microplastics” was first used in 2004 to describe very small fragments of plastic (~50 μm) in the water column and in sediments. In 2009, Arthur et al. (Proceedings of the International Research Workshop on the Occurrence, Effects and Fate of Microplastic Marine Debris, Sep 9–11, 2008. NOAA Technical Memo- randum NOS-OR&R-30. 49 p, 2009) proposed that microplastics should include all fragments <5 mm. Over the past decade, microplastic debris in both marine and freshwater systems has become an emerging environmental issue. Currently, the topic of microplastics is regulated at the European level only in the marine environment with the Marine Strategy Framework Directive (MSFD), ignoring that a very high percentage of microplastics that reach the sea come from inland waters and are closely connected with consumption styles. Recently, the Italian Parliament has adopted a proposal of the Italian NGO Marevivo to forbid microbeads scrub particles in cosmetics as of 2020. In addition, Italy has been the first country in the world to ban plastic non-biodegradable cotton buds as of 1 January 2019. In this way, the excellence of the Italian cosmetic industry focuses on the environment and on sustainability: an example that we hope will be emulated in other sectors. Although 70–95% of the marine litter, including microplastics, comes from the land environment, studies of microplastics in freshwater systems are limited in comparison to those focused on marine habitats. Rivers and inland waters are responsible for microplastics transport to marine habitats and could represent a vector for the downstream transport of pollutants suggesting an overlooked and potentially significant component of the global microplastics life cycle. In this frame, the MICROPLASMA (MIcro and maCRO PLAStic pollution Monitor- ing with Advanced technologies) research project funded by Apulia region aims to set up an integrated and innovative monitoring system along an urban river located in South Italy focusing on the seasonal and spatial trends of plastic wastes.

## Commissione Internazionale per la protezione delle acque italo-svizzere. Ricerche sull'evoluzione del Lago Maggiore. Aspetti limnologici. Programma triennale 2019 – 2021, Campagna 2019

**Anno di pubblicazione:** 2019

**Autori:** Michela Rogora, Martina Austoni, Roberto Bertoni, Cristiana Callieri, Marzia Ciampittiello, Mario Contesini, Gianluca Corno, Evelina Crippa, Andrea Di Cesare, Claudia Dresti, Ester M. Eckert, Diego Fontaneto, Giuseppe Garlaschè, Paola Giacomotti, Mattia Iaia, Dario Manca, Marina Manca, Aldo Marchetto, Rosario Mosello, Arianna Orrù, Roberta Piscia, Helmi Saidi, Tommaso Sforzi, Gabriele A. Tartari, Pietro Volta, Silvia Zaupa

**Riferimento monografia con ISBN:** ISSN: 1013-8099

**Abstract ITA:** Il rapporto illustra i risultati emersi dalle ricerche sul Lago Maggiore realizzate dall'Istituto di Ricerca sulle Acque del Consiglio Nazionale delle Ricerche (CNR-IRSA) nel corso del 2019 per conto della Commissione Internazionale per la Protezione delle Acque Italo-Svizzere (CIPAIS). Il 2019, che costituisce il primo anno del nuovo programma di ricerche (2019-2021), presenta numerosi elementi di continuità rispetto ai programmi precedenti, allo scopo di mantenere e aggiornare le serie storiche, ma anche diversi elementi di novità. Le ricerche si propongono in primo luogo di proseguire attività che, grazie al finanziamento da parte della CIPAIS, hanno consentito ad oggi di seguire l'evoluzione del Lago Maggiore in un'ottica ecosistemica, considerando gli aspetti meteo-climatici, fisici, chimici e biologici. Questo approccio multidisciplinare ed integrato ha permesso di indagare i principali processi alla base delle tendenze evolutive del lago. Accanto a queste caratteristiche note sono stati introdotti alcuni approfondimenti volti ad indagare aspetti dell'ecologia del Lago Maggiore che gli organismi di controllo istituzionali non sono tenuti ad affrontare, anche mediante metodologie ed approcci innovativi.

**Abstract ENG:** The present report describes the results of the limnological campaign carried on Lake Maggiore in 2019 by the CNR Water Research Institute for the International Commission for the Protection of Italian-Swiss Waters (CIPAIS). This activity is part of the 3-year research program (2019-2021) which contains both long-terms studies continuing researches already active in the previous programs and new activities analysing novel limnological aspects of emerging concern. Long-term studies on Lake Maggiore have led to the establishment of high quality time series of limnological data. Thanks to these datasets, it was possible to follow the evolution of the lake caused by both natural and anthropogenic drivers, including climate change for the last 5 decades. Data collected in 2019 implemented the time series and allowed a detailed discussion on both, seasonal and interannual changes of the main physical, chemical, and biological parameters. Beside long-term research, some in-depth investigations, based on innovative methodologies and novel approaches, started in 2019 in order to better understand the ecological functioning of the ecosystem of the lake and of its basin.

## Determinazione in continuo del mercurio gassoso disciolto (DGM) nelle acque con dispositivo di misura portatile

**Anno di pubblicazione:** 2019

**Autori:** Laura Fantozzi, Romano Ferrara

**Riferimento monografia con ISBN:** Notiziario dei Metodi Analitici & IRSA News - ISSN 2465-017X

**Abstract ITA:** E' stato sviluppato un metodo per l'analisi in continuo della concentrazione di mercurio gassoso disciol- to (DGM) in acque naturali. Il metodo è stato messo a punto realizzando un dispositivo automatico con- trollato da un computer portatile, dotato di uno spettrofotometro ad assorbimento atomico con limite di rilevabilità di 0,5 pg. La risoluzione temporale del dispositivo di misura è di 10-15 minuti. Una caratteri- stica particolare di questo dispositivo di misura è la portabilità, che ne rende adatto l'uso in luoghi re- moti mediante una batteria per auto. Sono stati confrontati i risultati ottenuti usando il dispositivo in modalità continua e in modalità discreta. Dal confronto emerge un buon accordo, considerando che i campioni di acqua sono stati campionati con uno sfasamento temporale. Per confrontare campioni raccolti contemporaneamente, è stato utilizzato un secondo dispositivo analitico, funzionante in moda- lità discreta. I risultati delle misure eseguite con la modalità discreta sono leggermente superiori a quel- li delle misure eseguite in modalità continua. Evitando la manipolazione del campione, è stato possibile ridurre la contaminazione da fonti esterne e raggiungere bassi valori di bianco strumentale (1-2 pg). Le prestazioni sul campo di questo metodo sono state testate in acqua di mare e in acqua di laguna. In quest'ultimo caso, è stato determinato l'andamento giornaliero del DGM. In accordo con diversi autori, è stato notato uno sfasamento temporale tra DGM e intensità della radiazione solare superiore alla risoluzione temporale strumentale.

**Abstract ENG:** An analytical method for continuous analysis of dissolved gaseous mercury (DGM) concentration in natu- ral waters, is described. The method has been developed with the implementation of a fully automatic device controlled by a Notebook, equipped with an Atomic Absorption Spectrometer with a detection limit of 0.5 pg. Time resolution of the device is 10-15 min. A particular feature of this instrument is the portabil- ity, making its use suitable in remote locations by means of a car battery. Results obtained using the de- vice in the continuous mode and in the discrete mode have been compared. They show good agreement taking into consideration that water samples were collected with shifting sampling times. To compare samples collected at the same time, a second analytical device, running in the discrete mode, was used. In this case results show that measurements performed with the discrete mode are slightly higher than the continuous one. Avoiding the sample handling it was possible to reduce the contamination from exter- nal sources and to achieve low instrumental blank values (1-2 pg). The field performance of this portable instrument was tested on seawater and lagoon water, where the DGM daily behavior was measured. In agreement with several authors, a time shifting between DGM and solar radiation intensity higher than the instrumental resolution time was noted.

**Phylum Rotifera. Chapter 8. In: Damboreana C., Rogers D.C. & Thorp J.H. (eds.), Thorp and Covich's Freshwater Invertebrates (Fourth Edition). Volume 5: Keys to Neotropical and Antarctic Fauna. Academic Press, Elsevier, pp. 145-200.**

**Anno di pubblicazione:** 2020

**Autori:** José de Paggi S.B., Wallace R., Fontaneto D. & Marinone M.C.

**Riferimento monografia con ISBN:** 978-0-12-804225-0

**Abstract ITA:** Chapter Outline Introduction 145 Rotifers of the Neotropics and Antarctica 146 Systematics 146 Class Bdelloidea 146 Class Monogononta 146 Limitations 146 Terminology and Morphology 147 Glossary 147 Material Preparation and Preservation 148 Key to Rotifera 150 Rotifera: Classes 150 Rotifera: Bdelloidea: Orders 150 Rotifera: Bdelloidea: Philodinavida: Philodinavidae: Genera 150 Rotifera: Bdelloidea: Adinetida: Adinetidae: Genera 150 Rotifera: Bdelloidea: Philodinida: Families 150 Rotifera: Bdelloidea: Habrotrochidae: Genera 150 Rotifera: Bdelloidea: Philodinidae: Genera 151 Rotifera: Monogononta: Orders 152 Rotifera: Monogononta: Flosculariaceae: Families 153 Rotifera: Monogononta: Flosculariaceae: Trochosphaeridae: Genera 153 Rotifera: Monogononta: Flosculariaceae: Testudinellidae: Genera 154 Rotifera: Monogononta: Flosculariaceae: Flosculariidae: Genera 154 Rotifera: Monogononta: Flosculariaceae: Conochilidae: Conochilus: Subgenera 158 Rotifera: Monogononta: Collothecacea: Families 159 Rotifera: Monogononta: Collothecacea: Collothecidae: Genera 159 Rotifera: Monogononta: Collothecacea: Atrochidae: Genera 160 Rotifera: Monogononta: Ploima: Families 160 Rotifera: Monogononta: Ploima: Asplanchnidae: Genera 167 Rotifera: Monogononta: Ploima: Dicranophoridae: Genera 170 Rotifera: Monogononta: Ploima: Epiphanidae: Genera 172 Rotifera: Monogononta: Ploima: Proalidae: Genera 173 Rotifera: Monogononta: Ploima: Trichotriidae: Genera 173 Rotifera: Monogononta: Ploima: Lepadellidae: Genera 173 Rotifera: Monogononta: Ploima: Mytilinidae: Genera 179 Rotifera: Monogononta: Ploima: Euchlanidae: Genera 179 Rotifera: Monogononta: Ploima: Brachionidae: Genera 182 Rotifera: Monogononta: Ploima: Synchaetidae: Genera 187 Rotifera: Monogononta: Ploima: Trichocercidae: Genera 187 Rotifera: Monogononta: Ploima: Gastropodidae: Genera 187 Rotifera: Monogononta: Ploima: Notommatidae: Genera 191 References 197

**Abstract ENG:** Chapter Outline Introduction 145 Rotifers of the Neotropics and Antarctica 146 Systematics 146 Class Bdelloidea 146 Class Monogononta 146 Limitations 146 Terminology and Morphology 147 Glossary 147 Material Preparation and Preservation 148 Key to Rotifera 150 Rotifera: Classes 150 Rotifera: Bdelloidea: Orders 150 Rotifera: Bdelloidea: Philodinavida: Philodinavidae: Genera 150 Rotifera: Bdelloidea: Adinetida: Adinetidae: Genera 150 Rotifera: Bdelloidea: Philodinida: Families 150 Rotifera: Bdelloidea: Habrotrochidae: Genera 150 Rotifera: Bdelloidea: Philodinidae: Genera 151 Rotifera: Monogononta: Orders 152 Rotifera: Monogononta: Flosculariaceae: Families 153 Rotifera: Monogononta: Flosculariaceae: Trochosphaeridae: Genera 153 Rotifera: Monogononta: Flosculariaceae: Testudinellidae: Genera 154 Rotifera: Monogononta: Flosculariaceae: Flosculariidae: Genera 154 Rotifera: Monogononta: Flosculariaceae: Conochilidae: Conochilus: Subgenera 158 Rotifera: Monogononta: Collothecacea: Families 159 Rotifera: Monogononta: Collothecacea: Collothecidae: Genera 159 Rotifera: Monogononta: Collothecacea: Atrochidae: Genera 160 Rotifera: Monogononta: Ploima: Families 160 Rotifera: Monogononta:

## Dangerous risk factors to be considered for a proper management of agro-ecosystems.

**Anno di pubblicazione:** 2020

**Autori:** C. Massarelli, C. Campanale, V.F. Uricchio

**Riferimento monografia con ISBN:** DOI: http://dx.doi.org/10.5772/intechopen.91824, ISBN 978-1-83880-384-1

**Abstract ENG:** Our work aims to identify the main risks existing in the agroecosystems of southern Italy, providing, at the same time, information about innovative and fast methodologies. The goal is to understand the magnitude of the phenomena that could compromise them if no action is taken for water and soil matrices. Regarding the former we will consider plant protection product residues in water bodies and the importance of agroecosystems as source of microplastic pollution and their role as a vector of pollutants; regarding the latter, we will present a rapid and low-cost methodology to detect asbestos-containing materials and significantly transformed areas. Furthermore, indications are provided on how to implement effective monitoring plans in order to certainly identify the problem affecting one or more matrices and provide practical instructions to the administrators to implement the appropriate remediation strategies.

## Bonifica per via biologica di sedimenti marini contaminati da PCB: il caso del Mar Piccolo di Taranto

**Anno di pubblicazione:** 2020

**Autori:** Matturro B., Di Franca M.L., Rossetti S.

**Riferimento monografia con ISBN:** Il contributo dell'innovazione scientifica ed amministrativa verso la riforma del settore delle bonifiche", RemTech Expo Libro degli abstract, Cnr Edizioni, 2020. ISBN versione digitale: 978 88 8080 378 2 ISBN, versione cartacea: 978 88 8080 379 9

**Abstract ITA:** I sedimenti marini rappresentano una matrice ambientale elettiva per l'accumulo di molti composti organici tossici quali i policlorobifenili (PCB), molecole clorurate di sintesi rappresentate da 209 congeneri diversi. A causa dell'impiego massivo in diversi settori industriali e dell'inadeguato smaltimento, la persistenza di tali contaminanti negli ambienti marini è ad oggi un problema ambientale rilevante. Il biorisanamento di siti contaminati da PCB può essere realizzato promuovendo la crescita (biostimulation) o aggiungendo in situ (bioaugmentation) microorganismi autoctoni specializzati, in grado di ridurre la tossicità di tali contaminanti in condizioni anaerobiche o effettuare la loro completa degradazione mediante processi ossidativi. Nella presentazione, saranno riportate tutte le attività condotte sui sedimenti contaminati del Mar Piccolo di Taranto, finalizzate all'applicazione di strategie di biorisanamento in situ o bioaugmentation con microorganismi arricchiti/isolati ottenuti dallo stesso sito contaminato. In particolare,saranno presentati i risultati relativi i) ai biomarcatori sinora identificati utili ai fini del corretto e rapido biomonitoraggio dei processi di biorisanamento e ii) all'efficienza dei processi biologici di biodegradazione dei PCB in ambiente marino in diverse condizioni di reazione che si stabiliscono nei vari strati di sedimento (anaerobiosi, aerobiosi e condizioni dinamiche di anaerobiosi/aerobiosi in seguito alla risospensione del sedimento superficiale). 112 Nel dettaglio, sono stati monitorati la composizione del microbioma dei sedimenti contaminati, i biomarcatori dei processi di biodegradazione anaerobica (geni funzionali: PcbA1, PcbA4, PcbA5) ed aerobica (gene funzionale: bphA), nei sedimenti originali del Mar Piccolo di Taranto e nel corso degli studi di microcosmo effettuati nelle diverse condizioni redoxa partire da tali sedimenti. Sono state inoltre sviluppate sia colture decloranti altamente selezionate caratterizzate da batteri coinvolti nella declorazione riduttiva anaerobica dei PCB (ad es. uncultured Dehalobium), che colture puredi batteri in grado di biodegradare i PCB per via ossidativa (es. Marinobactersp., Rhodococcussp.). Le colture microbiche ottenute in questo studio rappresentano una fonte importante di microorganismi autoctoni provenienti dal Mar Piccolo di Taranto i quali, essendo stati selezionati per le loro potenzialità metaboliche nei processi di biodegradazione dei PCB, possono trovare impiego nell'implementazione degli interventi di biorisanamento in situ dell'area contaminata di provenienza.

## L’acqua è di Tutti

**Anno di pubblicazione:** 2020

**Autori:** Barra Caracciolo A.

**Riferimento monografia con ISBN:** Agenda 2030 a scuola la scienza per lo sviluppo sostenibile - Zanichelli Editore online.zanichelli.it/agenda2030ascuola

**Abstract ITA:** Obiettivo 6 6.1 Ottenere entro il 2030 l’accesso universale ed equo all’acqua potabile che sia sicura ed economica per tutti. 6.2 Ottenere entro il 2030 l’accesso a impianti sanitari e igienici adeguati ed equi per tutti e porre fine alla defecazione all’aperto, prestando particolare attenzione ai bisogni di donne e bambine e a chi si trova in situazioni di vulnerabilità. 6.3 Migliorare entro il 2030 la qualità dell’acqua eliminando le discariche, riducendo l’inquinamento e il rilascio di prodotti chimici e scorie pericolose, dimezzando la quantità di acque reflue non trattate e aumentando considerevolmente il riciclaggio e il reimpiego sicuro a livello globale. 6.4 Aumentare considerevolmente entro il 2030 l’efficienza nell’utilizzo dell’acqua in ogni settore e garantire approvvigionamenti e forniture sostenibili di acqua potabile, per affrontare la carenza idrica e ridurre in modo sostanzioso il numero di persone che ne subisce le conseguenze. 6.5 Implementare entro il 2030 una gestione delle risorse idriche integrata a tutti i livelli, anche tramite la cooperazione transfrontaliera, in modo appropriato. 6.6 Proteggere e risanare entro il 2030 gli ecosistemi legati all’acqua, comprese le montagne, le foreste, le paludi, i fiumi, le falde acquifere e i laghi. 6.a Espandere entro il 2030 la cooperazione internazionale e il supporto per creare attività e programmi legati all’acqua e agli impianti igienici nei paesi in via di sviluppo, compresa la raccolta d’acqua, la desalinizzazione, l’efficienza idrica, il trattamento delle acque reflue e le tecnologie di riciclaggio e reimpiego. b Supportare e rafforzare la partecipazione delle comunità locali nel miglioramento della gestione dell’acqua e degli impianti igienici.

## Ground Based Remote Sensing of the Shallow Subsurface: Geophysical Methodsfor Environmental Applications

**Anno di pubblicazione:** 2020

**Autori:** Giorgio Cassiani, Jacopo Boaga, Ilaria Barone, Maria Teresa Perri, Gian Piero 6Deidda, Giulio Vignoli, Claudio Strobbia, Laura Busato, Rita Deiana, Matteo Rossi, Maria Clementina Caputo, Lorenzo De Carlo

**Riferimento monografia con ISBN:** In: Developments in Earth Surface Processes, Chapter 3, 978-0444641779

**Abstract ENG:** Non-invasive methods for the characterization of the shallow subsurface havebeen used routinely for some twenty to thirty years. The growth in these methods have been driven by a variety of breakthroughs in the use of electrical, electromagnetic and seismic methods, to mention only the most commontechniques. Increasing field capabilities and computational power have yet to yieldall their potential fruits. In this chapter we introduce the readersto the basic concepts, guide themthrough some of the physical details, and present a number of application examples all derived from our own experience, concerning both structural characterization and (fluid)-dynamic understanding of the shallow subsurface. Finally, we propose ideas concerning the future development of this wide and exciting discipline.

## Ricercatrici e ricercatori della Rete LTER in cammino: da Bagnoli a Taranto verso un futuro condiviso per il mare

**Anno di pubblicazione:** 2020

**Autori:** De Lazzari A., Bergami C., Petrocelli A., Pugnetti A., L'Astorina A.

**Riferimento monografia con ISBN:** Ambiente e clima. Il presente per il futuro ISBN-9788898822218

**Abstract ITA:** Nell'ambito di un'iniziativa di comunicazione informale dell'ecologia, alcune ricercatrici e ricercatori della Rete Italiana di Ricerca Ecologica di lungo Termine (LTER) hanno sperimentato un modo per coinvolgere alcuni giovani studenti nell'immaginare un futuro sostenibile del mare di due città italiane con forte impatto antropico. Lungo un itinerario cittadino è stata stimolata l'osservazione del mare, come attraverso un caleidoscopio, evidenziando tutti i suoi aspetti e forme per non perderne le molteplici e preziose identità. La proposta è un esempio di possibilità di avvicinare il pubblico alla ricerca e agli scienziati, spesso percepiti come distanti, allo scopo di stringere alleanze consapevoli e sostenibili tra scienza e società, soprattutto in situazioni socio-ecologiche complesse.

**Abstract ENG:** In the framework of an informal science communication initiative in ecology, researchers from the Long- T erm Ecological Research Network (L TER) experimented a way to involve students in imagining a sustainable future of the sea in two Italian cities, characterized by a strong anthropic impact. Following an urban itinerary, the students were stimulated to observe the sea, as through a kaleidoscope, highlighting all its aspects and trying not to lose its multiple and precious identities. The proposal represents an opportunity to engage the public into research, often perceived as distant, in order to build conscious and sustainable alliances between science and society, particularly in multifaceted socio-ecological conditions.

## Il Progetto Parchi Verbano Ticino: verifica e sperimentazione di scenari di gestione sostenibili e condivisi

**Anno di pubblicazione:** 2020

**Autori:** Angela Boggero, Lyudmila Kamburska, Michela Rogora, Nicoletta Riccardi, Dario Manca, Marzia Ciampittiello, Tiziana Di Lorenzo

**Riferimento monografia con ISBN:** Notiziario dei Metodi Analitici & IRSA News 1/2020: ISSN: 2465-017X

**Abstract ITA:** Lancio del Progetto finanziato nell'ambito del Programma di Cooperazione INTERREG V-A ITALIA-SVIZZERA 2014 – 2020 (Asse 2 – Obiettivo specifico 2.1 Aumento delle strategie comuni per la gestione sostenibile della risorsa idrica)

**Abstract ENG:** Launch of the project funded under the INTERREG V-A ITALY-SWITZERLAND 2014 - 2020 Cooperation Program (Axis 2 - Specific objective 2.1 Increase of common strategies for sustainable management of water resources)

## Effetti della contaminazione sugli ecosistemi naturali e attività della SETAC Italia

**Anno di pubblicazione:** 2020

**Autori:** Grenni P, Barra Caracciolo A

**Riferimento monografia con ISBN:** Ecotossicologia e salute: approcci metodologici. Mancini L, Lacchetti I, Caciolli S, Carere M (Eds.). Istituto Superiore di Sanità. Rapporti ISTISAN (2020) 20/6, pp. 14-22. ISSN: 1123-3117

**Abstract ITA:** La contaminazione degli ecosistemi acquatici e terrestri è una problematica complessa legata alla co-presenza di diverse classi di contaminanti di cui alcuni normati e per i quali gli effetti tossici sono noti (es. pesticidi, PCB, idrocarburi policiclici aromatici, ecc.) e di altri (contaminanti emergenti) per i quali non sono stati ancora stabiliti i limiti di legge e le concentrazioni di effetto, come per esempio alcuni prodotti per la cura personale e i farmaci. Questi ultimi sono molecole altamente reattive anche a basse concentrazioni e la loro presenza può costituire un rischio per la salute dell'uomo e dell'ambiente per possibili effetti sub-letali. Gli ecosistemi hanno la capacità di rispondere alla presenza di contaminanti e di recuperare il loro stato di buona qualità attraverso il servizio ecosistemico di Regolazione, fornito principalmente dalle comunità microbiche naturali responsabili della loro biodegradazione. I microrganismi hanno un ruolo chiave nella decomposizione della sostanza organica e riciclo dei nutrienti, nonché nella degradazione dei contaminati grazie alla loro grande adattabilità e capacità di rispondere ai cambiamenti ambientali in tempi molto brevi. Essi mostrano capacità di resistenza e di resilienza nei confronti degli inquinanti. L'analisi delle comunità microbiche naturali permette di definire lo stato di qualità e la capacità potenziale di recupero naturale di un ecosistema, gli effetti della contaminazione multipla anche a concentrazioni residuali che possono non essere rilevate da analisi chimiche puntuali. Gli effetti diretti degli xenobiotici su una comunità microbica naturale si possono riflettere in cambiamenti nella sua struttura, in termini di perdita di biodiversità, con possibili conseguenze su importanti funzioni ecosistemiche. Allo stesso modo la presenza di contaminanti può indurre alcune popolazioni microbiche ad adattarsi e sviluppare capacità degradative nei loro confronti e la loro presenza può dunque essere considerata indicatrice di recupero, fornendo uno strumento di indagine utile a supportare i controlli analitici di routine.

## Saggio con l'ostracode Heterocypris incongruens: applicazione per la valutazione ecotossicologica di terre e rocce da scavo trattate con agenti schiumogeni

**Anno di pubblicazione:** 2020

**Autori:** Mariani L, Barra Caracciolo A, Grenni P

**Riferimento monografia con ISBN:** Notiziario dei Metodi Analitici & IRSA News 1/2020: ISSN: 2465-017X

**Abstract ITA:** La valutazione della contaminazione multipla (da sostanze normate ed emergenti) di matrici ambientali (acqua, suolo, sedimenti) è ad oggi una delle sfide più importanti della comunità scientifica al fine di proporre delle metodologie utili non solo per la determinazione simultanea di più contaminanti, ma anche per valutare i possibili effetti sull'ecosistema. A tal fine, i test ecotossicologici applicati a matrici reali sono uno strumento valido che fornisce informazioni sulle miscele di sostanze chimiche presenti nell'ambiente. Nell'articolo viene riportata un'applicazione del test con il crostaceo ostracode Heterocypris incongruens a terre e rocce prodotte durante lo scavo meccanizzato di gallerie sotterranee, per il quale è previsto l'utilizzo di prodotti commerciali schiumogeni. L'organismo test è una specie autoctona e, vivendo nell'interfacies acqua-suolo, è risultato adatto a valutare i possibili effetti delle concentrazioni residuali di tensioattivi anionici contenuti nei prodotti utilizzati nelle attività di scavo.

**Abstract ENG:** The evaluation of different contaminants (regulated and emerging substances) in environmental matrices (water, soil, sediments) is today one of the most important challenges for the scientific community. Useful methodologies for chemical analyses of different contaminants and for evaluating their possible effects on ecosystems need to be found. Ecotoxicological tests performed on matrices in real study cases are a valid tool for obtaining information on chemical mixtures in the environment. In this paper, the application of the test with Heterocypris incongruens (Crustacea, Ostracoda) to excavated soil from mechanized tunnelling, in which commercial foaming agents are used, is reported. The test organism is an autochthonous species; it lives in the water-soil interface and therefore is particularly suitable for assessing the possible effects of residual concentrations of the anionic surfactants of foaming agents used in excavated soils


Leica

## Sostanze ad azione antimicrobica da organismi marini

**Anno di pubblicazione:** 2020

**Autori:** Marcella Narracci, Loredana Stabili, Maria Immacolata Acquaviva, Rosa Anna Cavallo

**Riferimento monografia con ISBN:** Rapporti ISTISAN, Acqua e Salute: elementi di analisi di rischio in nuovi scenari ambientali e climatici. . ISSN: 1123-3117 (cartaceo) • 2384-8936 (online)

**Abstract ITA:** L'articolo propone una panoramica sulla recente ricerca di composti bioattivi derivati da organismi marini che ha portato alla caratterizzazione di numerose sostanze con potenziale efficacia contro batteri, virus e funghi. Gli studi condotti hanno riguardato soprattutto alghe, molluschi, spugne, coralli, tunicati, con una attenzione particolare alla ricerca di composti attivi contro i batteri patogeni.

**Abstract ENG:** In recent years studies on bioactive compounds derived from marine organisms had a notable development leading to the characterization of numerous substances with potential effectiveness against bacteria, viruses and fungi. The attention was focused on algae, molluscs, sponges, corals, tunicates, for searching active compounds against pathogenic bacteria.

## Ecologia e tossicità delle specie algali dannose e loro impatto sulla maricoltura

**Anno di pubblicazione:** 2020

**Autori:** Caroppo C.

**Riferimento monografia con ISBN:** Rapporti ISTISAN, 20/19, pp.153-156. ISSN 2384-8936

**Abstract ITA:** Le attività umane, in particolare i fenomeni di eutrofizzazione, possono determinare una alterazione della composizione e dinamica delle comunità fitoplanctoniche e provocare lo sviluppo di fioriture dominate da una singola specie o da un gruppo di specie. Quando queste fioriture sono responsabili di effetti indesiderabili per l'uomo e l'ambiente, sono definite "fioriture algali dannose" (Harmful Algal Blooms, HABs). Le specie fitoplanctoniche dannose sono quelle potenziali produttrici sia di tossine, che possono influire negativamente sulla salute umana, sia di molecole efficaci contro l'attacco dei predatori (zooplancton). Tuttavia, gli effetti negativi delle HABs non sono solo legati alla produzione di biomolecole nocive, ma anche alla formazione di cospicua biomassa algale che provoca la perdita della buona qualità ambientale (fenomeni di ipossia e anossia, alterazione della catena alimentare e morte di specie selvatiche e allevate). Considerando che in futuro l'incidenza di questi fenomeni tenderà a espandersi ulteriormente, una conoscenza più approfondita dei processi responsabili delle HABs è diventata urgente

**Catalyzed Reporter Deposition Fluorescence In Situ Hybridization (CARD-FISH) for complex environmental samples/ Chapter 9 in Methods Molecular Biology, Vol. 2246, Nuno F. Azevedo and Carina Almeida (Eds): Fluorescence In-Situ Hybridization (FISH) for Microbial Cells**

**Anno di pubblicazione:** 2020

**Autori:** Bruna Matturro, Simona Rossetti, Patrícia Leitão

**Riferimento monografia con ISBN:** 978-1-0716-1114-2

**Abstract ENG:** CARD-FISH technique allows to increase microbial cell detection compared to traditional FISH assays. Specific non-fluorescent oligonucleotide probes targeting 16S rRNA genes are employed and are chemically activated by the binding of tyramide molecules,the latter able to generate a cascade of fluorescent signals improving sensitivity and reducing background noise. The technique has been successfully applied for the detection of microorganisms in different environmental matrices and under different growth conditions (including those where cells are characterized by low physiological activity and low ribosome content). This chapter presents a straightforward procedure to execute CARD-FISH analysis, from sample preparation and fixation, to microscopic visualization, along with relevant technical notes.

## A catalogue of European intermittent rivers and ephemeral streams. Technical report SMIRES COST Action CA15113

**Anno di pubblicazione:** 2020

**Autori:** Tobias Gauster, Gregor Laaha, Maria Helena Alves, Patrick Arnaud, Kazimierz Banasik, Aurélien Beaufort, Atila Bezdan, Thibault Datry, Anna Maria De Girolamo, Gerald Dörflinger, Alper Elçi, Kolbjørn Engeland, Joan Estrany, Alice Fialho, Josep Fortesa, Vivien Hakoun, Tzviatka Karagiozova, Silvia Kohnova, Jurate Kriauciuniene, Manuela Morais, Plamen Ninov, Marzena Osuch, Edite Reis, Agnieszka Rutkowska, Rachel Stubbington, Ourania Tzoraki, Mirosław Żelazny

**Riferimento monografia con ISBN:** doi: 10.5281/zenodo.3763419

**Abstract ENG:** SMIRES (Datry et al., 2017) is a COST Action addressing the Science and Management of Intermittent Rivers & Ephemeral Streams (coord. T. Datry, INRAE, and G. Singer, University of Innsbruck; http://www.smires.eu). This COST Action had brought together scientists from various research field and stakeholders to develop a European multidisciplinary network for synthesising the fragmented and recent knowledge on temporary water courses, improving our understanding of Intermittent Rivers and Ephemeral Streams (IRES) and translating this into a science-based, sustainable management of river networks. The working group "Prevalence, distribution and trends of IRES" (WG1) has the central role to provide the physical basis of the SMIRES Action. One of the tasks of WG1 was to compile flow gauging data at the European scale. As part of this work, examples of intermittent rivers and ephemeral streams were collected across Europe, including gauged catchments with both natural and highly influenced river flow regimes. A total of 40 examples have been put together in this catalogue to provide an overview of the variety of IRES in Europe. The selected IRES are not meant to be representative of all intermittent water courses in Europe but rather highlight the variety in these water courses. Introductory pages describe the procedures used to create the catalogue including definitions of the statistical measures reported for the individual intermittent rivers and ephemeral streams, and provide an overview of the catalogued water courses. Information on the selected gauged intermittent rivers and ephemeral streams is summarised in a two-page document: - The first standardized page describes the main characteristics of the catchments (land-use, geology, climate, etc.) and the river flow regime. Two panels display the hydrographs and flow durations curves, and a table gives metrics specific to river flow intermittence relevant for ecology. - The second page is dedicated to the description and reasons for intermittence. A short description about the spatio-temporal pattern of zero-flow events. This section may describe the seasonal behaviour of the stream, observed long-term trends, locations with frequently observed zero-flow events along the river network, etc. The monitoring network, including gauging stations and other types of observations (e.g. visual inspection of the flow states at different locations along the river) in the catchment, are also described.

## Environmental flows: assessment and implementation in IRES. CAP 6. in Intermittent Rivers and Ephemeral streams: What water managers need to know

**Anno di pubblicazione:** 2020

**Autori:** Amandine Valérie Pastor, Monica Bardina, Francesco Comiti, Thibault Datry, Joan Estrany, Francesc Gallart, Anna Maria De Girolamo, Didac Jorda-Capdevila, Claire Magand, Antoni Munné, Avi Uzan, Paolo Vezza

**Riferimento monografia con ISBN:** http://doi.org/10.5281/zenodo.3888474

**Abstract ENG:** According to the Guidance Document No. 31 of the implementation of the Water Framework Directive (WFD) (EC, 2015), ecological flows or "Eflows" are considered within the context of the WFD as "an hydrological regime consistent with the achievement of the environmental objectives of the WFD in natural surface water bodies as mentioned in Article 4(1)". There are more than 200 methods for determining Eflows, but a few of them are compatible with IRES. In order to value IRES and design and implement Eflows for IRES, eco-hydrological relationships must be studied beyond the flowing period and include also the "pool" period. Implementation of Eflows can take place via valuation of ecosystem services and/or included in future allocation of water rights. To reach good ecological status in the EU, each country must perform a cost-benefit analysis to find the best way to implement Eflows while satisfying economic and social needs.

**Modeling the Effect of Different Management Practices for Soil Erosion Control in a Mediterranean Watershed. In Innovative Biosystems Engineering for Sustainable Agriculture, Forestry and Food Production. Lecture Notes in Civil Engineering 67, 125-132**

**Anno di pubblicazione:** 2020

**Autori:** Giovanni Francesco Ricci, Anna Maria De Girolamo, Francesco Gentile

**Riferimento monografia con ISBN:** 978-3-030-39298-7; https://doi.org/10.1007/978-3-030-39299-4

**Abstract ENG:** To counteract the threat of soil erosion, European countries are called to identify the high-risk erosion areas and to adopt Best Management Practices (BMPs). The Soil and Water Assessment Tool (SWAT) was used to identify the critical source areas, for the current management, in the Carapelle watershed, an agricultural watershed located in the Puglia region (Southern Italy). SWAT was calibrated and validated both manually and automatically, using SWAT-CUP, for runoff and sediment load at daily time scale for a 5-years period. Results show that in the Carapelle the average annual sediment load is 5.95 t ha−1 y−1. A threshold of sediment yield 10 t ha−1 y−1 was selected to discretize the high erosion-risk areas, resulting in 59 HRUs characterized by agricultural land use. Three BMPs scenarios, based on the regional policies, were modeled: contour farming, no-tillage and reforestation. No-tillage is the most effective scenario, reducing soil erosion to 4.20 t ha−1. The study offers to watershed managers a methodology to discretize the high erosion-risk areas, test and choose the most effective BMPs for sediment load reduction.

**Microplastiche nel comparto acquatico. In GdL-MIE. 2020. Inquinanti Emergenti. A cura di: Tartari G., Bergna G., Lietti M., Rizzo A., Lazzari F. e Brioschi C. Lombardy Energy Cleantech Cluster, Milano. 249 pp.**

**Anno di pubblicazione:** 2020

**Autori:** Malpei F., Antonelli M., Bergna G., Bernasconi M., Binelli A., Depero L.E., Di Guardo A., Federici S., Gabrielli M., Galafassi S., Gugliandolo M.C., Magni S., Malacrida C., Mossotti R., Pedrazzani R., Sala A., Stefanoni M., Terzaghi E., Volta P.

**Riferimento monografia con ISBN:** Malpei F., Antonelli M., Bergna G., Bernasconi M., Binelli A., Depero L.E., Di Guardo A., Federici S., Gabrielli M., Galafassi S., Gugliandolo M.C., Magni S., Malacrida C., Mossotti R., Pedrazzani R., Sala A., Stefanoni M., Terzaghi E., Volta P. 2020. Microplastiche nel comparto acquatico. In: GdL-MIE. Inquinanti Emergenti. A cura di: Tartari G., Bergna G., Lietti M., Rizzo A., Lazzari F. e Brioschi C. Lombardy Energy Cleantech Cluster, Milano: 164-210. ISBN: 9788894555707

**Abstract ITA:** Le microplastiche (MP) sono state riscontrate in ogni comparto ambientale, incluso il biota. La definizione esatta di "microplastica" è ancora in discussione e sarà probabilmente soggetta ad una evoluzione nel tempo. Attualmente prevale come definizione quella di "particelle polimeriche comprese fra 1µm e 5 mm". Le nanoplastiche, non trattate in questo contesto, hanno invece dimensioni inferiori, comprese tra 1 e 100 nm. Le MP sono tutte di origine antropica e sono composte da numerosi polimeri (ad esempio: PE, PA, PVC, PS, PET, PAN) e da additivi funzionali. Le MP si originano da o sono presenti in moltissimi prodotti di uso corrente (cosmetici, tessuti sintetici, plastiche monouso, pneumatici, ...) e si ritrovano in ambiente per effetto di numerose cause, tra le quali prima di tutto il non adeguato trattamento e smaltimento dei rifiuti plastici, seguito da fenomeni di rilascio ed usura di oggetti di uso quotidiano (es: lavaggio indumenti in materiali sintetici) o manufatti plastici usati in ambiente. La presenza di microplastiche nei corpi idrici presenta significative differenze a livello mondiale. Alcuni Autori lo ritengono, ad oggi, un problema ancora limitato ad alcune zone del pianeta, ma è necessario comprendere pienamente il livello di rischio delle MP per gli esseri umani e gli ecosistemi e, quindi, se del caso, le modalità di prevenzione e controllo da mettere in atto. In questo quadro, la corretta divulgazione scientifica e tecnica verso i diversi portatori di interesse, i decisori e la popolazione deve promuovere la consapevolezza sul tema, sulla sua origine, diffusione ed ampiezza, chiarendo i non pochi aspetti che sono ancora oggetto di studio o non noti compiutamente. Con questi fini è stato condotto e svolto il presente lavoro, basato sulle conoscenze attuali, in dinamico e continuo aggiornamento ed espansione. Tali conoscenze sono nel seguito sintetizzate e seguite da alcune conclusioni ed indicazioni generali.

**Abstract ENG:** Microplastics (MPs) have been found in every environmental compartment, including biota. The definition of "microplastics" is still under discussion and it is likely it will evolve in the future. Currently, MPs are mainly referred as polymer particles between 1 µm and 5 mm. Nanoplastics, which are not dealt with in this report, have much smaller size, between 1 and 100 nm. MPs are of anthropogenic origin and are composed of numerous polymers (e.g. PE, PA, PVC, PS, PET, PAN) and functional additives. MPs originate from many products (cosmetics, synthetic fabrics, disposable plastics, tyres, etc.) of daily use. They are found in the environment due to

several causes, the first being the unproper disposal of plastic wastes, together with and aging an tearing of plastic based materials and textiles. Microplastics are detected in almost all water bodies, at concentration that are however highly variable worldwide. Some Authors consider the problem to be, to date, present mainly in some areas of the planet. However, it is a topic that need to be investigated throughout, to understand the risk level of MPs for humans and ecosystems and, therefore, if necessary, the prevention and control methods to be implemented. In this framework, the correct scientific and technical dissemination to the various stakeholders, decision-makers and the population must promote awareness on the problem, underlying what is known but also the many aspects that need to be yet deeply researched. This is aim of the chapter, based on the present state of art, that is however evolving very quickly with continuous updating and expansions. The state of the art is summarized below and followed by some general conclusions and indications.

## IDENTIFICAZIONE DELLE AREE SORGENTI DI SEDIMENTO A SCALA DI BACINO MEDIANTE IL MODELLO SWAT

**Anno di pubblicazione:** 2020

**Autori:** Giovanni Francesco Ricci, Anna Maria De Girolamo, Abdelwahab OssamaM.M., Francesco Gentile

**Riferimento monografia con ISBN:** in: Quaderno di Idronomia montana 35, 978-88-97181-61-3

**Abstract ITA:** Il modello Soil and Water Assessment Tool (SWAT) è stato applicato al bacino del torrente Carapelle (Puglia, Italia) in modo tale da valutarne i deflussi e la produzione di sedimento per un periodo di cinque anni, discretizzando i sottobacini caratterizzati da un alto tasso di erosione. I dati raccolti nella stazione di misura posta a Ordona sono stati utilizzati per l'analisi di sensitività, la calibrazione e la validazione del modello idrologico. Si è evidenziato che i fattori influenzanti la perdita di suolo sono, principalmente, la distribuzione delle piogge e la pendenza dei versanti. Inoltre, il grano duro e gli uliveti sono le colture che producono annualmente più sedimento. A scala di bacino la portata media annua (186 mm) corrisponde al 27% della pioggia totale (686 mm) e la media annuale del carico di sedimento è di 6.2 t ha-1 yr-1. A livello di sottobacino può essere individuato un gradiente, per quanto concerne la produzione di sedimento, caratterizzato da una differenza sostanziale tra le zone a monte e quelle a valle dell'area di studio. Per quanto riguarda la sedimentazione, invece, i valori più alti si sono individuati nella parte centrale del bacino, in corrispondenza della prima piana alluvionale. Lo studio conferma che il modello SWAT può essere uno strumento utile per l'individuazione di aree ad alto rischio di erosione e per la stima degli effetti dell'applicazione di pratiche di protezione del territorio in ecosistemi fragili come quello Mediterraneo.

**Abstract ENG:** In this study, the SWAT model was applied in the Carapelle watershed (Puglia, Southern Italy) to assess streamflow and sediment yield during a five years period record, in order to identify sub-basins with high erosion rates. For this purpose data collected at the Ordona, measuring station were used to carry out a sensitivity analysis, calibration, and validation processes for both runoff and sediment yield. It was noticed that the driving factors that influenced soil losses were rainfall and slope. Winter wheat and olive groves were the major source areas in terms of annual sediment yield. At basin scale, average total water yield (186 mm) corresponds to 27% of the total rainfall (686 mm) and average annual sediment load was 6.2 t ha-1 yr-1. At sub-basin scale, a gradient of sediment yield can be found which is characterized by a high difference between the upper central and the lower part of the study area. Deposition, instead, has its highest values in the central part of the watershed where there is the first alluvial plain. This study confirms that SWAT model can be a useful tool to identify areas at high erosion risk and estimate the effect of soil protection practices in a fragile-ecosystem such as the Mediterranean one.

**Fate and Removal of Pharmaceuticals in CAS for Water and Sewage Sludge Reuse. Chap. 666 in: Removal and Degradation of Pharmaceutically Active Compounds in Wastewater Treatment, Hdb Env Chem, DOI 10.1007/698_2020_666,**

**Anno di pubblicazione:** 2020

**Autori:** Marc Castaño-Trias, Monica Brienza, Maria Concetta Tomei, and Gianluigi Buttiglieri

**Riferimento monografia con ISBN:** ISSN: 1867-979X

**Abstract ENG:** Among organic micropollutants, pharmaceutical active compounds (PhACs) have been extensively investigated in the last decades due to their potential adverse ecological and/or human health effects. Wastewater treatment plants are one of the first barriers in preventing them from reaching sensible ecosystems. In particular, conventional activated sludge (CAS) systems may be only partially effective in PhAC removal or degradation. The present work presents an overview of the fate of PhACs in CAS. Several parameters and constraints affecting PhAC removal are given and discussed including the physicochemical properties of the compounds and the operating parameters like the influent concentration, its seasonal variation, CAS hydraulic retention time and sludge retention time. A detailed data analysis is dedicated to selected representative compounds (i.e. carbamazepine, ibuprofen and sulfamethoxazole) in the water line of CAS systems, while for the sludge line, different treatment options are discussed, with special focus on the sequential anaerobic-aerobic digestion, a promising alternative to improve the removal of organic micropollutants, including PhACs, in the sludge matrix. Finally, the criteria for safe reuse of treated effluent and agricultural application of the produced sludge, related to PhACs, are discussed and analysed in the frame of EU and other regulations.

## ATMOSPHERIC DEPOSITION IN EUROPEAN FORESTS IN 2018

**Anno di pubblicazione:** 2020

**Autori:** Aldo Marchetto, Peter Waldner, Arne Verstraeten, Daniel Žlindra

**Riferimento monografia con ISBN:** Michel A, Prescher A-K, Schwärzel K, editors (2020) Forest Condition in Europe: The 2020 Assessment. ICP Forests Technical Report under the UNECE Convention on Long-range Transboundary Air Pollution (Air Convention). Eberswalde: Thünen Institute. https://doi.org/10.3220/ICPTR1606916913000: 20-33. ISBN 978-3-86576-219-1

**Abstract ENG:** Studying the effects of atmospheric pollution to forest ecosystems requires an evaluation of air quality and of the amount of pollutants carried to the forests by atmospheric deposition. Pollutant flux towards ecosystems through deposition mainly follows two pathways: wet deposition of compounds dissolved in rain, snow, sleet or similar, and dry deposition of particulate matter through gravity or adsorption on forest canopy for example. Pollutant deposition shows a relatively high local variability, related to the distribution of pollutant sources and the local topography, and in-situ measurement is needed to obtain accurate evaluations and to validate model estimates. In 2018, the chemical composition of atmospheric deposition was measured in 293 ICP Forests Level II permanent plots throughout Europe. In this report, we focus on acidifying, buffering, and eutrophying compounds. High values of nitrate deposition were mainly found in central Europe (Germany, Denmark, Belgium and eastern Austria), while for ammonium they were also found in northern Italy and Poland. The area of high deposition is smaller for sulphate, including some plots in Germany, Greece and Poland. High sulphate values are also measured in Belgium, but they are partially due to deposition of marine aerosol, and they are less evident after sea-salt correction. Calcium and magnesium deposition can buffer the acidifying effect of atmospheric deposition. High values of calcium deposition are reported in southern Europe, mainly related to the deposition of Saharan dust, and in eastern Europe. The correction for the marine contribution of calcium matters mainly for sites in central Europe and in Spain. On the contrary, in the case of magnesium, the distribution of the highest values is markedly reduced by the sea salt correction. The atmosphere contains a large number of substances of natural and anthropogenic origin. A large part of them can settle, or be adsorbed to receptor surfaces, or be included in rain and snow and finally reach land surface as wet and dry deposition. In the last century human activities led to a dramatic increase in the deposition of nitrogen and sulphur compounds. Sulphur deposition almost completely occurs in the form of sulphate ($SO_4^{2-}$), derived from marine aerosol and from sulphuric acid formed in the atmosphere by the interaction of gaseous sulphur dioxide ($SO_2$) with water. $SO_2$ emission derives from coal and fuel combustion, volcanoes, and forest fires and has increased since the 1850s, causing an increase in the deposition of sulphate and in deposition acidity. Acidifying inputs can be partly buffered by the deposition of the base cations calcium ($Ca^{2+}$) and magnesium ($Mg^{2+}$). Natural sources of nitrogen (N) in the atmosphere are mainly restricted to the emission of $N_2O$ and $N_2$ during denitrification and the decomposition of the nitrogen gas molecule in the air during lightning. However, human activities cause the emission of large amounts of nitrogen oxides ($NO_x$), released during combustions, and of ammonia ($NH_3$) deriving from agriculture and farming. They are found in atmospheric deposition in the form of nitrate ($NO_3^-$) and ammonium ($NH_4^+$). Nitrogen compounds have two effects on the ecosystems: they are important plant nutrients that can produce ecosystem eutrophication, and both have strong effects on plant

metabolism (e.g., Silva et al. 2015), forest ecosystem processes (e.g. Meunier et al. 2016) and biodiversity (e.g., Bobbink et al. 2010), but they can also act as acidifying compounds (Bobbink and Hettelingh 2011). Emission and deposition of inorganic nitrogen are recently decreasing, but the trend is less evident than for $SO_4^{2-}$ (Waldner et al. 2014; EEA 2016).

**Copepoda.**

**Anno di pubblicazione:** 2020

**Autori:** Kai Horst George, Sahar Khodami, Terue Cristina Kihara, Pedro Martínez Arbizu, Alejandro Martínez, Nancy Mercado Salas, Karin Pointner, Gritta Veit-Köhler

**Riferimento monografia con ISBN:** In: Guide to the Identification of Marine Meiofauna, Chapter 27, pp. 465-533, 978-3-89937-244-1

## Assetto geologico e geomorfologico dei territori di Guardia Sanframondi e San Lorenzello

**Anno di pubblicazione:** 2020

**Autori:** N. Leone, P. Magliulo

**Riferimento monografia con ISBN:** Carta Archeologica e Ricerche in Campania, XV suppl., fascicolo 11. ISBN 978-88-913-0952-5

**Abstract ITA:** Nel capitolo vengono descritte le caratteristiche geologiche e geomorfologiche dei territori di Guardia Sanframondi e San Lorenzello. Lo studio è stato condotto mediante tecniche classiche di rilevamento e analisi geologica e geomorfologica. I dati sono stati elaborati e graficamente restituiti mediante cartografie tematiche realizzate in ambiente GIS. Gran parte dell'area di studio è risultata impostata su successioni calcareo-dolomitiche, di età giurassico-cretacica, e su successioni calcareo-arenaceo-marnose, di età compresa tra il Cretacico e il Pliocene, intensamente tettonizzate. Su tali successioni, poggiano, in discordanza, depositi quaternari alluvionali, piroclastici e, in subordine, di versante. Il paesaggio dell'area in studio è risultato piuttosto articolato e, nella sua genesi ed evoluzione morfologica, è stato condizionato dall'interazione tra attività tettonica e variazioni climatiche, oltre che dalla diversa erodibilità dei differenti litotipi che ne costituiscono il substrato. Per la sua configurazione, esso può essere schematicamente suddiviso in tre macrosettori: il settore montuoso, che comprende i rilievi carbonatici posti all'estremo limite nord-orientale e nel settore settentrionale-nord occidentale dell'area, caratterizzati da versanti regolari, da moderatamente acclivi a scoscesi, ad andamento rettilineo che riflette la loro origine tettonica; il settore collinare, caratterizzato da morfologie più dolci, costituito in gran parte da lunghi versanti irregolari a debole pendenza incisi dal reticolo idrografico minore, ampiamente interessati da fenomeni franosi e processi di erosione idrica; il settore vallivo, che comprende le piane alluvionali attive e fossili del fiume Calore e del torrente Titerno, caratterizzate da diversi ordini di superfici terrazzate. Le principali unità litostratigrafiche affioranti e i principali elementi geomorfologici che caratterizzano l'area di studio sono stati descritti in dettaglio e rappresentati nella "Carta Geologica" e nella "Carta Geomorfologica" riportate nel presente capitolo. Infine, lo studio dell'assetto geologico e geomorfologico del territorio investigato e dei processi morfodinamici che su di esso hanno agito (e tuttora agiscono) hanno consentito di individuare superfici più o meno stabili dal punto di vista dei processi erosivi (fluviali e di versante), rappresentate nella "Carta della stabilità relativa delle superfici geomorfologiche".

**Abstract ENG:** In this chapter, the main geological and geomorphological features of the Guardia Sanframondi and San Lorenzello territories are outlined. The study was carried out by means of classical techniques of geological and geomorphological survey and analysis. Using GIS, data were stored, processed and graphically represented through thematic maps. The substratum of the study area was mainly made up of tectonically-deformed limestones and dolostones, Jurassic to Cretaceous in age, and of calcareous-marly-arenaceous sedimentary successions, Cretaceous to Pliocene aged. On such pre-Quaternary substratum, alluvial, pyroclastic and slope deposits, Pleistocene to Holocene in age, unconformably rest. From a geomorphological standpoint, the local landscape was fairly complex. Both the morphogenesis and evolution were here conditioned by interactions between climate and tectonics and by the different erodibility of the outcropping lithotypes. According to the main geological and geomorphological features, the local landscape was schematically subdivided into three main sectors, i.e. the mountainous sector, the hilly sector and

the valley sector. The first includes the calcareous relieves located at the far northeastern and north-northeastern boundaries of the study area, bordered by steep and straight slopes of tectonic origin. The second sector is gently-rolling, dominated by long and gently-sloping land surfaces, deeply dissected by the tributary streams network and intensely affected by mass and water erosion processes. Finally, the valley sector includes both the fossil and active floodplains of the Calore River and Titerno Torrent and is characterized by several orders of terraces. The spatial distribution of both the main lithological units and landforms in the study area were synthesized and graphically represented by means of object-oriented, full-coverage thematic maps (i.e., a Geolithological Map and a Geomorphological Map). Furthermore, the analysis of the spatial distribution of geomorphological evidence of morphodynamic processes allowed discriminating the most stable land surfaces from those more severely affected by erosive and depositional processes. The results were graphically represented by means of a "Map of relative stability of the land surfaces".

## Determinazione del metilmercurio in sedimenti e biota d'acqua dolce mediante Analizzatore Automatico di mercurio e GC-MS

**Anno di pubblicazione:** 2020

**Autori:** Lucia Valsecchi, Claudio Roscioli, Clara Zanini, Alfredo Schiavon, Licia Guzzella, Laura Marziali

**Riferimento monografia con ISBN:** Notiziario dei Metodi Analitici & IRSA News 1/2020: ISSN: 2465-017X

**Abstract ITA:** Negli ecosistemi d'acqua dolce il mercurio è adsorbito principalmente nei sedimenti, dove può essere parzialmente convertito in metilmercurio (MeHg), un composto del mercurio più tossico e bioaccumulabile rispetto alle forme inorganiche. La sua analisi può fornire quindi utili informazioni per valutare il rischio ambientale legato alla contaminazione da mercurio. La determinazione del MeHg nelle matrici ambientali risulta spesso difficile per le basse concentrazioni e per la presenza di diversi interferenti. Scopo di questo lavoro è sviluppare e confrontare due protocolli per l'analisi del MeHg in campioni di organismi e di sedimenti d'acqua dolce, mediante Analizzatore Automatico di Mercurio (AMA 254) e mediante GC-MS. La valutazione dei metodi è stata effettuata tramite analisi di materiali di riferimento certificati e di campioni di invertebrati bentonici di fiume, pesci e sedimenti lacustri. La metodica in AMA 254 prevede una doppia estrazione liquido-liquido con toluene e L-cisteina. Il protocollo in GC-MS utilizza la tecnica dello spazio di testa statico, usando il metodo di quantificazione della diluizione isotopica con standard interno. Entrambe le metodiche hanno mostrano una buona performance, con recuperi dell'86-102 % rispetto ai valori certificati e coefficienti di variazione (CV) del 2,5-13,2 %. Per i campioni naturali, la ripetibilità è risultata buona, con CV inferiori al 20 %. Il limite di quantificazione calcolato per il metodo in AMA 254 (21 µg MeHg kg-1) può risultare non adeguato per l'analisi di sedimenti naturali, mentre il metodo in GC-MS risulta più sensibile (LOQ = 1,4 µg MeHg kg-1). Una comparazione preliminare tra i due metodi sembrerebbe indicare equivalenza, nonostante la metodica in GC-MS dia recuperi tendenzialmente più alti rispetto a quella in AMA 254.

**Abstract ENG:** In freshwater ecosystems mercury is mainly adsorbed on sediments and it can be partially transformed into methylmercury (MeHg), which is more toxic than inorganic species of mercury and shows higher bioaccumulation capability. Thus, MeHg analysis can provide useful information for environmental risk assessment in mercury contaminated sites. The determination of MeHg in environmental matrices is often difficult due to low concentrations and to the presence of interfering substances. The aim of this work is to develop and compare two analytical protocols for the analysis of MeHg in freshwater organisms and sediments, by using an Automated Mercury Analyzer (AMA 254) and by GC-MS. The evaluation of the methods was carried out by analysis of certified reference materials and samples of riverine benthic invertebrates, as well as lacustrine fish and sediments. AMA 254 protocol involves a double liquid-liquid extraction with toluene and L-cysteine. GC-MS protocol is carried out by static headspace, using the internal standard isotopic dilution quantification method. Both methods showed a good performance, with recoveries of 86-102 % compared to certified values and with variation coefficients (CV) of 2.5-13.2 %. For natural samples, repeatability was good, with CVs below 20 %. The quantification limit calculated for AMA 254 protocol (21 µg MeHg kg-1) may be not adequate for the analysis of natural sediments, while

GC-MS protocol proved to be more sensitive (LOQ = 1.4 µg MeHg kg-1). A preliminary comparison between methods showed potential agreement, even if GC-MS protocol generally showed higher recoveries than AMA 254 protocol.

## FISH in suspension or in adherent cells

**Anno di pubblicazione:** 2020

**Autori:** Francesca Di Pippo, Diogo Queirós, Joana Pereira, Paulo C. Lemos, Luísa S. Serafim *, Simona Rossetti

**Riferimento monografia con ISBN:** Fluorescence In-Situ Hybridization (FISH) for Microbial Cells ISBN 978-1-0716-1114-2

**Abstract ENG:** Fluorescence in situ hybridization (FISH) enables the detection and enumeration of microorganisms in a diversity of samples. Short-length oligonucleotide DNA probes complementary to 16S or 23S rRNA sequences are generally used to target different phylogenetic levels. The protocol for the application of FISH to aggregated or suspended cells in mixed microbial communities is described in this chapter, with a special emphasis on environmental samples.

Inquinanti emergenti

**Anno di pubblicazione:** 2020

**Autori:** A cura di: Tartari G., Bergna G., Lietti M., Rizzo A., Lazzari F. e Brioschi C. Lombardy Energy Cleantech Cluster, Milano. 249 pp. (2020)

**Riferimento monografia con ISBN:** 9788894555707

**Abstract ITA:** Lombardy Energy Cleantech Cluster (LE2C), il Cluster Tecnologico Lombardo per l'energia e l'ambiente, nel 2018 ha costituito il Gruppo di Lavoro Microinquinanti Emergenti (GdL-MIE) coinvolgendo esperti delle università, degli enti di ricerca e dei servizi idrici integrati della Lombardia delineando una collaborazione multidisciplinare con l'obiettivo di contribuire, mediante la raccolta e la diffusione di informazioni dettagliate sul fenomeno degli inquinanti emergenti, alla definizione di strategie gestionali per la protezione ambientale. Vista la crescente emergenza per le microplastiche negli ambienti acquatici, il GdL-MIE ha rivolto la propria attenzione anche a questo problema, realizzando un focus sullo stato delle conoscenze e delle capacità di ricerca nell'ambito regionale lombardo. Il volume, che rappresenta il Rapporto delle attività svolte dal GdL-MIE, fornisce una sintesi delle conoscenze sugli inquinanti emergenti nel contesto lombardo. Utilizzando un approccio metodologico rigoroso e una rappresentazione semplice, ma esaustiva, dei risultati ottenuti da quasi un milione di dati forniti dai sei Data Owner (ARPA Lombardia, MM, Gruppo CAP, BrianzAcque, CNR-IRSA e IRFMN) ha prodotto una sintesi della conoscenza disponibile, mettendo in luce le criticità delle conoscenze nei comparti acquatici considerati (acque sotterranee, fiumi, laghi, acque potabili, acque reflue, sedimenti, matrici biologiche). L'ampia sezione dedicata allo stato delle tecnologie di trattenimento degli inquinanti emergenti da parte delle strutture depurative, sostenuta dai risultati di una indagine conoscitiva rivolta alle strutture lombarde, ha permesso di cogliere lo stato dell'arte della capacità di contenimento della diffusione nell'ambiente di questi inquinanti. Con un approccio simile è stato anche affrontato il problema delle microplastiche, anch'esso supportato da una indagine conoscitiva presso aziende del servizio idrico integrato, fornendo in questo caso una immagine più orientata allo stato dell'arte della ricerca e sulle attuali conoscenze di un fenomeno fortemente in crescita in questi ultimi anni.

**Abstract ENG:** Lombardy Energy Cleantech Cluster (LE2C), the Lombardy Technology Cluster for Energy and the Environment, in 2018 established the Emerging Micropollutants Working Group (GdL-MIE) involving experts from universities, research bodies and integrated water services of Lombardy outlining a multidisciplinary collaboration with the aim of contributing, through the collection and dissemination of detailed information on emerging pollutants, to the definition of management strategies for environmental protection. Given the growing emergency for microplastics in aquatic environments, the GdL-MIE has also turned its attention to this problem, creating a focus on the state of knowledge and research skills in the Lombardy region. The volume, which represents the Report of the activities carried out by the GdL-MIE, provides a summary of the knowledge on emerging pollutants in the Lombard context. Using a rigorous methodological approach and a simple but exhaustive representation of the results obtained from almost one million data provided by the six Data Owners (ARPA Lombardia, MM, CAP Group, BrianzAcque, CNR-IRSA and IRFMN), have been produced a synthesis of knowledge available, highlighting the criticalities of knowledge in the aquatic compartments considered (groundwater, rivers, lakes, drinking water, waste water, sediments, biological matrices). The large section dedicated to the

state of the treatment technologies of emerging pollutants, supported by the results of a survey in the Lombard structures, has allowed to delineate the state of the art of the capacity to reduce the diffusion of these pollutants in the environment. With a similar approach, the problem of microplastics was also addressed, also supported by a regional survey, providing in this case a state-of-the-art on the research activities and on knowledge of a phenomenon strongly growing in recent years.

## Artificial intelligence and water cycle management

**Anno di pubblicazione:** 2020

**Autori:** Massarelli C., Campanale C. and Uricchio V.F

**Riferimento monografia con ISBN:** AMBIENT INTELLIGENCE, IntechOpen, 2020. London, ISBN 978-1-83969-069-3

**Abstract ENG:** The “White Paper on Artificial Intelligence - A European Approach to Excellence and Trust”, COM (2020) 65, highlights how digital technology has improved our lives allowing easier access to knowledge and content. Nowadays, Europe is called to make two transformations (green and digital) which, in the water management sector, could have common objectives: the first requires to take actions towards more sustainable solutions, the second consists in directing the social transformations in such a way that every citizen can take full and maximum benefit. In line with these objectives, the applications of artificial intelligence can contribute to preserving the environment and first of all the most precious resource: water.

## Ambient Intelligence

**Anno di pubblicazione:** 2020

**Autori:** Massarelli Carmine

**Riferimento monografia con ISBN:** AMBIENT INTELLIGENCE, IntechOpen, 2020. London, ISBN 978-1-83969-069-3

**Abstract ENG:** Ambient Intelligence" aims to collect the most significant contributions related to sensitive and responsive ambient intelligent applications in the environmental field with a high degree of innovation, especially about the intelligence component. The applications are those related to intelligent monitoring activities such as the quality assessment of the environmental matrices through the use of innovative approaches, case studies, best practices with bottom-up approaches, machine learning techniques, systems development (for example algorithms, sensors, etc.) to predict alterations of environmental matrices. The goal is also to be able to protect natural resources by making their use increasingly sustainable.

## Self Forming Dynamic Membrane BioReactors (SFD MBR) for wastewater treatment: principles and applications.

**Anno di pubblicazione:** 2020

**Autori:** Alfieri Pollice, Pompilio Vergine

**Riferimento monografia con ISBN:** Mannina G., Pandey A., Larroche C., Ng H.Y., Ngo H.H. (Eds.): "Advanced Membrane Separation Processes for Sustainable Water and Wastewater Management – Case Studies and Sustainability Analysis" Elsevier book series on "Current Developments in Biotechnology and Bioengineering". ISBN: 978-0-12-819854-4

**Abstract ITA:** Il capitolo presenta una descrizione della tecnologia SFD MBR, ne illustra i principi, le applicazioni più rilevanti riportate nella letteratura tecnica e i principali fattori che influenzano i processi.

**Abstract ENG:** The chapter provides an overview of the SFD MBR technology, illustrating the principles, the most relevant applications described in the technical literature, and the main factors influencing the process.

## Trends and patterns in surface water chemistry in Europe and North America between 1990 and 2016, with particular focus on changes in land use as a confounding factor for recovery

**Anno di pubblicazione:** 2020

**Autori:** Øyvind A Garmo, Øyvind Kaste, Jens Arle, Kari Austnes, Heleen de Wit, Jens Fölster, Daniel Houle, Jakub Hruška, Iveta Indriksone, Don Monteith, Michela Rogora, James E Sample, Sandra Steingruber, John L Stoddard, Reet Talkop, Wayne Trodd, Rafał Piotr Ulańczyk, Jussi Vuorenmaa

**Riferimento monografia con ISBN:** Report number: 7479, Norwegian Institute for Water Research, DOI: 10.13140/RG.2.2.18604.82566, ISBN 978-82-577-7214-7

**Abstract ENG:** The report presents trends in sulphate, nitrate, chloride, base cations, ANC (acid neutralising capacity), pH and DOC at circa 500 ICP Waters sitesin Europe and North America for the period 1990-2016.Time series were analysed for trends in annual median values, annual extreme values and change points, that indicate years with sudden changes in trend or level.Also provided isa brief overview of possible implications of land use change for recovery of acidified surface water

## Geostatistical analysis of soil reflectance spectra for field-scale digital soil mapping. A case study

**Anno di pubblicazione:** 2020

**Autori:** N. Leone, V. Ancona, D. Fragnito, D. Vitale, M. Bilancia

**Riferimento monografia con ISBN:** Metodi e Analisi Statistiche, Dipartimento di Economia e Finanza, Università degli studi di Bari Aldo Moro, ISBN 978-88-6629-023-0

**Abstract ITA:** La conoscenza della variabilità del suolo alla scala di campo è essenziale per una gestione sostenibile del suolo. Le tecniche tradizionali, basate sull'analisi del suolo, sono costose e richiedono molto tempo. Un metodo alternativo sarebbe l'uso della spettroscopia di riflettanza nel visibile-infrarosso abbinata all'analisi multivariata, in particolare all'analisi delle componenti principali (PCA) e alla geostatistica. In questo studio, dopo brevi review riguardanti la spettroscopia di riflettanza, la PCA e la geostatistica, abbiamo presentato un approccio metodologico per la mappatura digitale del suolo in un'area di studio del Sud Italia. Gli spettri di riflettanza di 240 campioni di suolo superficiale raccolti in siti georeferenziati sono stati decomposti mediante PCA. Le prime tre componenti (PC1, PC2, PC3) spiegavano la maggior parte (98%) della varianza totale del set di dati iniziale, pertanto sono state considerate per la valutazione della variabilità spaziale del suolo mediante variografia e kriging (geostatistica). Le risultanti mappe di kriging PC1, PC2 e PC3 sono state interpretate alla luce dei contenuti informativi degli spettri di riflettanza e confrontate con i risultati di una precedente indagine convenzionale del suolo. La strategia presentata sembra essere efficiente e affidabile per la mappatura della variabilità spaziale del suolo.

**Abstract ENG:** Knowledge of field-scale soil variability is essential for sustainable soil management. Traditional techniques, based on soil analysis, are costly and timeconsuming. An alternative method would be the use of visible-infrared reflectance spectroscopy coupled with multivariate analysis, specifically principal component analysis (PCA) and geostatistics. In this study, after brief reviews regarding reflectance spectroscopy, PCA, and geostatistics, we presented a methodological approach for digital soil mapping in a study area of Southern Italy. Reflectance spectra of 240 surface soil samples collected at geo-referenced sites, were decomposed by PCA. The first three components (PC1, PC2, PC3) explained most (98%) of the total variance of the initial data set, therefore, they were considered for the assessment of soil spatial variability by variography and kriging (geostatistics). The resulting PC1, PC2 and PC3 kriging maps were interpreted in the light of the information contents on reflectance spectra and compared with the results of a previous, conventional soil survey. The presented strategy seems to be efficient and reliable for mapping soil spatial variability.

## Comparison of different multivariate calibrations and ensemble methods for estimating selected soil properties with vis-NIR reflectance spectroscopy

**Anno di pubblicazione:** 2020

**Autori:** D. Fragnito, N. Leone, V. Ancona, D. Vitale, A. Lucadamo

**Riferimento monografia con ISBN:** Metodi e Analisi Statistiche, Dipartimento di Economia e Finanza, Università degli studi di Bari Aldo Moro, ISBN 978-88-6629-023-0, pp. 135-162

**Abstract ITA:** La gestione sostenibile del suolo richiede una corretta valutazione delle proprietà chimiche e fisiche del suolo stesso. Storicamente, questo è stato ottenuto tramite analisi di laboratorio convenzionali, considerate costose e che richiedono molto tempo, in particolare quando è necessario analizzare un gran numero di campioni di suolo. Un approccio alternativo, più veloce e meno costoso, si basa sull'uso della spettroscopia di riflettanza nel dominio vis-NIR. Questo approccio implica la calibrazione di modelli predittivi che mettono in relazione la riflettanza spettrale con le proprietà del suolo. La bontà dei modelli può essere particolarmente influenzata dai metodi multivariati utilizzati. In questo articolo vengono confrontate le prestazioni di diversi metodi multivariati e statistici per stimare alcune proprietà di base del suolo, quali sabbia, limo, argilla e carbonio organico nelle specifiche condizioni pedo-ambientali di un'importante area agricola dell'Italia meridionale.

**Abstract ENG:** Sustainable soil management requires a correct assessment of soil chemical and physical properties. Historically, this has been gained through conventional laboratory analyses, which are considered costly and time-consuming, particularly when a large number of soil samples need to be analysed. An alternative, faster and less expensive, approach is based on the use of reflectance spectroscopy in the vis-NIR domain. This approach implies the calibration of predictive models that relate the spectral reflectance to soil properties. The goodness of the models can be particularly influenced by the multivariate methods used. In this article, we compare the performance of different multivariate and statistical ensemble methods for estimating some basic soil properties, such as sand, silt, clay, and organic carbon in the specific pedo-environmental conditions of an important agricultural area in southern Italy.

## Up-grading of Waste Oil: A Key Step in the Future of Biofuel Production

**Anno di pubblicazione:** 2020

**Autori:** Luigi di Bitonto, Carlo Pastore

**Riferimento monografia con ISBN:** Process Systems Engineering for Biofuels Development, Wiley Series in Renewable Resources, Wiley, Edited by ADRIÁN BONILLA-PETRICIOLET & GADE PANDU RANGAIAH ISBN: 978-1-119-58033-1, August 2020, 384 Pages

**Abstract ENG:** Biodiesel is a mixture of fatty acid methyl esters (FAMEs), which has very similar physical and chemical properties to petroleum-derived fuel. It is industrially produced by transesterification of glycerides (animal and/or vegetal) with methanol (MeOH) under homogeneous alkaline conditions, by using sodium or potassium hydroxide, carbonates, or alkoxides. Despite the fact that the use of a co-solvent would facilitate the formation of a single phase by improving the reaction rate (tetrahydrofuran, dimethyl sulfoxide, acetone, cyclic esters, and n-hexane have been thoroughly investigated), in an industrial context, homogeneous basic catalysis is adopted in the presence of MeOH only, for the cost-effectiveness and the relevant good performances. However, such application can only be adopted on refined oils or highly pure fat: free fatty acids (FFAs) content must not exceed 0.1–0.5wt% and moisture has to be absent. For this reason, the industrial production of biodiesel was initially conducted to specifically convert dedicated and refined feedstocks (namely, first-generation biodiesel). However, such an approach was soon inappropriate: for an economic reason, since the overall production cost was strongly influenced (>80%) by the price of the starting vegetable oil to the point that it compromised the entire profitability of the industrial production chain with respect to fossil fuel, as well as for an ethical concern, due to the land for fuel use.

## How to Use Ambiguity in Problem Framing for Enabling Divergent Thinking: Integrating Problem Structuring Methods and Concept-Knowledge Theory

**Anno di pubblicazione:** 2020

**Autori:** Raffaele Giordano, Irene Pluchinotta, Dimitrios Zikos, Tobias Krueger and Alexis Tsoukiàs

**Riferimento monografia con ISBN:** Behavioral Operational Research - A Capabilities Approach, White, L., Kunc, M., Burger, K., Malpass, J. (Eds.) (2020). Palgrave Macmillan9, ISBN 78-3-030-25404-9

**Abstract ITA:** Questo lavoro descrive un approccio innovativo per il co-design di politiche ambientali per la gestione e tutela delle risorse idriche, partendo da un'approfondita analisi dell'ambiguità delle percezioni e degli obiettivi dei diversi decisori.

**Abstract ENG:** This work describes an innovative approach for co-designing environmental policies for the management and protection of water resources, starting from an in-depth analysis of the ambiguity of the perceptions and objectives of the various decision-makers.

## THE OFFSHORE ENVIRONMENTAL IMPACT BY SARNO RIVER IN NAPLES BAY (SOUTH-WEST ITALY)

**Anno di pubblicazione:** 2020

**Autori:** Antonella Di Leo; Santina Giandomenico; Lucia Spada; Nicola Cardellicchio; Francesco Paolo Buonocunto; Eliana Esposito; Luciana Ferraro; Laura Giordano; Alfonsa Milia; Crescenzo Violante

**Riferimento monografia con ISBN:** In: Monitoring of Mediterranean Coastal Areas. Problems and Measurement Techniques, Edited by: Bonora, L.; Carboni, D.; De Vincenzi, M. Export citation, ISBN: 978-88-5518-147-1

**Abstract ITA:** Il bacino del fiume Sarno (Italia sud-occidentale) è uno dei bacini fluviali più inquinati d'Europa a causa della diffusa industrializzazione e dell'agricoltura intensiva. Dal punto di vista geologico si colloca tra il complesso vulcanico Somma-Vesuvio e le formazioni calcaree della catena campano-appenninica. L'obiettivo di questo lavoro è stato quello di stabilire l'influenza del fiume Sarno sull'attuale sedimentazione nella piattaforma continentale del Golfo di Napoli valutando l'apporto di sostanza organica e l'inquinamento. I campioni di sedimenti sono stati raccolti, da van Veen grab, in 71 stazioni situate al largo del fiume Sarno tra le coste vesuviane e della penisola sorrentina. Le caratteristiche dei sedimenti superficiali sono state analizzate per evidenziare gli andamenti spaziali nella (i) granulometria (granulometria); (ii) azoto totale, carbonio organico e fosforo totale; (iii) contenuto di metalli (Hg, Cd, Pb, As, Cr, Cu, Ni, Zn, Fe e Mn). La distribuzione dei sedimenti ha suggerito che i sedimenti del fiume Sarno prevalessero nella parte centrale della baia tra i depositi di granulosità del Vesuvio e i sedimenti a grana più grossa della Penisola Sorrentina. La deposizione del fiume Sarno è caratterizzata da limo / argille ricche di elementi organici ad alto contenuto d'acqua. Un confronto con un precedente studio effettuato a terra nel bacino del fiume Sarno ha permesso di interpretare le elevate concentrazioni di Pb, Zn, Cd e Hg molto probabilmente legate a fonti geologiche e antropiche, a rocce vulcaniche sottostanti, e contaminazioni da combustione di combustibili fossili associate con vicini centri urbani. In particolare, come verificato a terra, la contaminazione da Ni e Cr è molto probabilmente originata da fonti antropiche come l'industria conciaria Solofra; i risultati suggeriscono che questi metalli sono stati dispersi al largo. Tutti questi elementi consentono di identificare la distribuzione dell'attuale prodeltra del Sarno e di identificare l'influenza dell'inquinamento antropico a terra nell'area sottomarina adiacente. I primi risultati di questo studio evidenziano l'influenza del prodelta del Sarno nel Golfo di Napoli e rappresentano il primo passo nella caratterizzazione di un'area marina fortemente influenzata da una costa molto popolata e turistica. Pertanto, lo studio rappresenta una base di dati per la valutazione dell'impatto ambientale offshore.

**Abstract ENG:** The Sarno River Basin (South-west Italy) is one of the most polluted river basins in Europe due to widespread industrialization and intensive agriculture. From the geological point of view, it lies between the Somma-Vesuvius volcanic complex and the limestone formations of the Campania-Apennine Chain. The goal of this work has been to establish the influence of the Sarno river on the present sedimentation in the Naples bay continental shelf by evaluating organic matter contribution and pollution. Sediments samples were collected, by van Veen grab, in 71 stations located offshore the Sarno river between Vesuvian and Sorrento Peninsula coasts. The characteristics of the surface sediments were analysed to highlight spatial trends in the (i) granulometry (grain-size); (ii) total nitrogen, organic carbon and total phosphorus; (iii) metal content (Hg, Cd, Pb, As, Cr, Cu, Ni, Zn, Fe and Mn). The sediment distribution suggested that

sediments from the Sarno River prevailed in the central part of the bay between the sand grained deposits from Vesuvius and coarser grained sediments from Sorrento Peninsula. The Sarno River deposition is characterized by silt/clays rich in organic elements with a high water content. A comparison with a previous study carried out onshore in the Sarno river basin has allowed to interpret the elevated Pb, Zn, Cd, and Hg concentrations most likely related to geological and anthropogenic sources, to underlying volcanic rocks, and contamination from fossil fuel combustion associated with nearby urban centres. In particular, as verified onshore, Ni and Cr contamination is most likely originating from anthropogenic sources as the Solofra tannery industry; the results suggest as these metals have been dispersed offshore. All these elements permit to identify the distribution of the present Sarno prodelta and to identify the influence of the onshore anthropogenic pollution in the adjacent submarine area. First results from this study highlight the influence of the Sarno prodelta in Naples Bay and represent the first step in the characterization of a marine area strongly influenced by a very high populated and touristic coast. Therefore, the study represents a data base for the offshore environmental impact evaluation.

## Contributi in convegni internazionali

### Use of biosolids in Europe: possibilities and constraints

**Autori:** Gianico, A., Mininni, G., Braguglia, C.M., Sagnotti, G., Porrega, M.

**Riferimenti evento/brevetto:** ECSM 2019 – 5th European Conference on Sludge Management, Liège, Belgium, 6 - 8 October 2019.

**Tipo di presentazione:** orale

**Website:** https://events.uliege.be/ecsm2019/

### Optimization of sampling design for total organic carbon assessment using spatial simulated annealing: comparison of different variogram models performances

**Autori:** Barca E., Stellacci A.M., Debenedetto D.

**Riferimenti evento/brevetto:** XLVIII Congress of the Italian Society of Agronomy (SIA), Perugia, 18-20/09/2019.

**Tipo di presentazione:** orale

### Microbial functional responses to water quality alterations in a landfill-impacted aquifer

**Autori:** Melita M., Amalfitano S., Preziosi E., Ghergo S., Frollini E., Parrone D., Zoppini A.

**Riferimenti evento/brevetto:** SAME XVI, 2019, 16th Symposium of Aquatic Microbial Ecology, Postdam (Germany), 1-6 settembre 2019

**Tipo di presentazione:** poster

### An innovative bioreactor for sustainable industrial wastewater treatment finalized to process water reuse and resource recovery

**Autori:** Tomei, M.C., Mosca Angelucci, D.

**Riferimenti evento/brevetto:** IWA Water Reuse 2019 - 12th IWA International Conference on Water Reclamation and Reuse. 16 - 20 June 2019 - Berlin, Germany

**Tipo di presentazione:** poster

**Website:** http://iwareuse2019.org/

### Towards resource recovery from industrial wastewater treatment by tubing two-phase partitioning bioreactors: challenges and perspectives

**Autori:** Tomei, M.C., Mosca Angelucci, D.

**Riferimenti evento/brevetto:** IWA-IDB Innovation Conference on Sustainable Use of Water: Cities, Industry and Agriculture, 30 September – 03 October 2019, Guayaquil, Ecuador

**Tipo di presentazione:** orale

**Website:** https://www.globalsustainablewater.org/

### The REMEDIA-Life project and the cultivation of macroalgae as bioremediators: ex-ploitation of their biomass for biotechnological purposes

**Autori:** Stabili L., Acquaviva M.I., Cavallo R.A., Cecere E., Gerardi C., Narracci M., Portacci G., Petrocelli A.

**Riferimenti evento/brevetto:** 7th International Conference on Sustainable Solid Waste Management, Heraklion, Greece, 26-29 June 2019

**Tipo di presentazione:** poster

**Website:** https://www.heraklion2019.uest.gr/

### The REMEDIA-Life project: macroalgae as bioremediators and source of compounds for biotechnological purposes

**Autori:** Stabili L., Acquaviva M.I., Cecere E., Narracci M., Petrocelli A., Cavallo R.A.

**Riferimenti evento/brevetto:** 6th European Conference on Water, Waste and Energy Management, Stockholm, Sweden, 13-14 May 2019

**Tipo di presentazione:** poster

**Website:** https://leonardo-energy.pl/event/6th-edition-of-european-conference-on-water-waste-and-energy-management/

### Keynote – Guest Speaker; Jinan (Cina) : WATER AND WASTEWATER REUSE: EXPERIENCES IN CHINA AND IN THE EU

**Autori:** Antonio Lo Porto

**Riferimenti evento/brevetto:** Congresso internazionale Settimana Italia-Cina della Scienza, della Tecnologia e dell'Innovazione, Pechino e Jinan 30 Ottobre 2019

**Tipo di presentazione:** orale

### Keynote – Guest Speaker; Chengdu (Cina) - China-Europe Water Platform (CEWP): A multilateral Cooperation Platform as a stepping stone for European water business development in China

**Autori:** Antonio Lo Porto

**Riferimenti evento/brevetto:** Congresso internazionale "2019 Ecology and Environment Global Forum" ; Consolato Generale d'Italia a Chongqing / Ministero Ambiente, 21 March 2019

**Tipo di presentazione:** orale

### Keynote – Guest Speaker; Pechino (Cina) - WATER AND WASTEWATER REUSE: A CHALLENGE

**Autori:** Antonio Lo Porto Alfieri Pollice

**Riferimenti evento/brevetto:** Congresso internazionale China-EU Water Policy Dialogue - First Meeting, 1-3 April 2019, Pechino

**Tipo di presentazione:** orale

### Keynote – Guest Speaker; Pechino (Cina) - "Impact of Climate Change on Water Management – A Program Launched by the Italian Ministry of Environment"

**Autori:** Antonio Lo Porto

**Riferimenti evento/brevetto:** Qingdao International Water Conference, 25-28 June 2019, Shandong (Cina)

**Tipo di presentazione:** orale

### Keynote – Guest Speaker; Pechino (Cina) - "The EU Platform on Water Technoly (WssTP) and the Sustainable Development Goals"

**Autori:** Antonio Lo Porto

**Riferimenti evento/brevetto:** Qingdao International Water Conference, 25-28 June 2019, Shandong (Cina)

**Tipo di presentazione:** orale

### HOW MUCH SEAFOOD YOU MUST EAT FOR YOUR WELL-BEING? IMPLICATIONS FOR DIETARY GUIDELINES

**Autori:** Ermelinda Prato, Giovanni Fanelli, Isabella Parlapiano, Francesca Biandolino

**Riferimenti evento/brevetto:** World Seafood Congress

**Tipo di presentazione:** orale

### Ecological status and morphological impairment: the evaluation of invertebrate response in rivers affected by bank and channel reinforcement and resectioning

**Autori:** Erba Stefania, Andrea Buffagni, Marcello Cazzola

**Riferimenti evento/brevetto:** 6th Biennial Symposium of the International Society for River Science, University of Natural Resources and Life Sciences, 8-13/9/2019, Vienna, Austria

**Tipo di presentazione:** orale

### In-stream substrate and invertebrates assemblages: the importance of microhabitat mosaic in defining the Ecological Potential in heavily modified rivers

**Autori:** Stefania Erba, Marcello Cazzola, Emanuele Barca, Raffella Balestrini

**Riferimenti evento/brevetto:** 6th Biennial Symposium of the International Society for River Science, University of Natural Resources and Life Sciences, 8-13/9/2019, Vienna, Austria

**Tipo di presentazione:** orale

### An innovative bioreactor for sustainable treatment of high salinity wastewater aimed to process water reuse

**Autori:** Tomei, M.C., Mosca Angelucci, D.

**Riferimenti evento/brevetto:** 8th IWA-ASPIRE Conference Exhibition. Smart Solutions for Water Resilience. 31 Ottobre- 2 Novembre 2019, Hong Kong

**Tipo di presentazione:** orale

**Website:** https://www.iwaaspire2019.org/index1.html

### A catalogue of the representative European intermittent rivers.

**Autori:** Eric Sauquet, Ilja van Meerveld, Cath Sefton, Francesc Gallart, Gregor Laaha, Atila Bezdan, Kazimierz Banasik, Anna Maria De Girolamo, Tzviatka Karagiozova, Jurate Kriauciuniene, Ninov Plamen, Marzena Osuch, Simon Parry, Agnieszka Rutkowska, and Rania Tzoraki

**Riferimenti evento/brevetto:** EGU General Assembly 2019, Vol. 21, EGU2019, Vienna, 7-12 aprile 2019

**Tipo di presentazione:** orale

### Modelling streamflow in intermittent rivers: a case study in SE Italy.

**Autori:** Anna Maria De Girolamo, Ersilia D'Ambrosio, Giovanni Francesco Ricci, Francesco Gentile

**Riferimenti evento/brevetto:** 21 EGU General Assembly 2019, Vol. 21, EGU2019-10554, Vienna, 7-12 aprile 2019

**Tipo di presentazione:** orale

### Modeling regional management scenarios for soil erosion control in a Mediterranean watershed.

**Autori:** Giovanni Francesco Ricci, Jaehak Jeong, Anna Maria De Girolamo, Francesco Gentile

**Riferimenti evento/brevetto:** 21 EGU General Assembly 2019, Vol. 21, EGU2019-13646, Vienna, 7-12 aprile 2019

**Tipo di presentazione:** orale

### Combining spectrometric and morphometric data with multivariate and geostatistical methods and image classification for hig-resolution digital soil mapping

**Autori:** A. P. Leone, E. Barca, C. Galeone, P. Magliulo, N. Leone, A. M. Stellacci, V. Ancona

**Riferimenti evento/brevetto:** Spacial Statistics 2019: Towards Spatial Data Science, 10-13 July 2019, Sitges, Spagna

**Tipo di presentazione:** poster

### PREDICTION OF SOIL PCBs CONTENT IN A HISTORICALLY CONTAMINATED SITE OF THE SIN OF TARANTO (SOUTHERN ITALY)

**Autori:** C. Galeone, N. Leone, A. P. Leone, R. Ciannarella, N. Rapanà, G. Banguolo, G. Mascolo, V. F. Uricchio, V. Corbelli, V. Ancona

**Riferimenti evento/brevetto:** RemTech Expo 2019, RemTech Europe-European Conference on remediation markets and technologies, Ferrara, 21-25 September 2020

**Tipo di presentazione:** poster

### Using Visible and Near infrared reflectance spectroscopy for the prediction of soil heavy metals in the Environmental Crisis Area of Taranto (Southern Italy)

**Autori:** N. Leone, C. Galeone, V. Ancona, C. Massarelli, P. Coturno, D. V. Miniero, V. F. Uricchio, V. Corbelli, A. P. Leone

**Riferimenti evento/brevetto:** RemTech Expo 2019, RemTech Europe-European Conference on remediation markets and technologies, Ferrara, 21-25 September 2020

**Tipo di presentazione:** poster

### The use of microbial fuel cells for soil remediation: a preliminary study on DDE. In: Cigolotti V (Ed.), Proceedings

**Autori:** Aimola G, Gagliardi GG, Barra Caracciolo A, Ancona V, Grenni P, Bagnuolo G, Rolando L, Garbini GL, Uricchio VF, Borello D, 2019

**Riferimenti evento/brevetto:** 8th European Fuel Cell Technology & Applications Piero Lunghi Conference - EFC19, 8-10 December 2019, Naples

**Tipo di presentazione:** orale

**Effects of the co-presence of the anionic surfactant sodium lauryl ether sulphate and pesticide chlorpyrifos on a natural soil microbial community. In: Great Together: Separate Challenges and Collective Solutions. Abstract Book, SETAC (Ed.), pp. 402. ISSN 1087-8939**

**Autori:** Patrolecco L, Pescatore T, Barra Caracciolo A, Rolando L, Grenni P, Rauseo J, Spataro F, Ademollo N, 2019

**Riferimenti evento/brevetto:** SETAC North America 40th Annual Meeting 3–7 November 2019 Toronto, Ontario, Canada

**Tipo di presentazione:** poster

**Website:** https://cdn.ymaws.com/www.setac.org/resource/resmgr/abstract_books/SETAC-Toronto-abstract-book-.pdf

**Occurrence of antibiotics and related resistance genes in the feed and in the digestate of biogas plants. In: Great Together: Separate Challenges and Collective Solutions. Abstract Book SETAC (Ed.), pp. 540. ISSN 1087-8939**

**Autori:** Barra Caracciolo A, Patrolecco L, Spataro F, Ademollo N, Rauseo J, Pescatore T, Grenni P, Rolando L, Mariani L, Visca A, Mazzurco Miritana V, Signorini A, S Rosa, Petrazzuolo F, Piccinini F, Massini G, 2019.

**Riferimenti evento/brevetto:** SETAC North America 40th Annual Meeting 3–7 November 2019 Toronto, Ontario, Canada,

**Tipo di presentazione:** poster

**Website:** https://cdn.ymaws.com/www.setac.org/resource/resmgr/abstract_books/SETAC-Toronto-abstract-book-.pdf

**A multidisciplinary approach for evaluating fate and effects of mixtures of emerging compounds on aquatic and soil ecosystems. In: Great Together: Separate Challenges and Collective Solutions. Abstract Book SETAC (Ed.), pp. 402. ISSN 1087-8939**

**Autori:** Patrolecco L, Rauseo J, Pescatore T, Ademollo N, Spataro F, Grenni P, Rolando L, Mariani L, Balducci D, Visca A, Garbini G, Barra Caracciolo A, 2019

**Riferimenti evento/brevetto:** SETAC North America 40th Annual Meeting 3–7 November 2019 Toronto, Ontario, Canada

**Tipo di presentazione:** poster

**Website:** https://cdn.ymaws.com/www.setac.org/resource/resmgr/abstract_books/SETAC-Toronto-abstract-book-.pdf

**Environmental compatibility of soils debris conditioned with foaming agents containing sodium lauryl ether sulphate in a tunnelling scenario. In: One Environment. One Health. Sustainable Societies Abstract Book, SETAC (Ed.), pp. 249 ISSN 2309-8031**

**Autori:** Pescatore T, Rolando L, Barra Caracciolo A, Spataro F, Mariani L, Grenni P, Rauseo J, Ademollo N, Galli E, Finizio A, Patrolecco L, 2019

**Riferimenti evento/brevetto:** SETAC Europe 29th Annual Meeting, 26–30 May 2019, Helsinki, Finland,

**Tipo di presentazione:** poster

**Website:**
https://www.monitoolproject.eu/images/Publications/MONITOOL_SETAC_Europe_29th_Annual_Meeting_2019.pdf

**Microbial Fuel Cells (MFCs) for promoting DDE degradation. In: One Environment. One Health. Sustainable Societies Abstract Book, SETAC (Ed.), pp. 143 ISSN 2309-8031**

**Autori:** Aimola G, Barra Caracciolo A, Gagliardi GG, Borello D, Grenni P, Rolando L, Ancona V, 2019

**Riferimenti evento/brevetto:** SETAC Europe 29th Annual Meeting, 26–30 May 2019, Helsinki, Finland

**Tipo di presentazione:** poster

**Website:**
https://www.monitoolproject.eu/images/Publications/MONITOOL_SETAC_Europe_29th_Annual_Meeting_2019.pdf

**Identification of bacteria involved in sodium lauryl ether sulphate biodegradation in conditioned soil from a tunnelling construction site. In: One Environment. One Health. Sustainable Societies Abstract Book, SETAC (Ed.), pp. 143 ISSN 2309-8031**

**Autori:** Rolando L, Grenni P, Rauseo J, Patrolecco L, Barra Caracciolo A, 2019

**Riferimenti evento/brevetto:** SETAC Europe 29th Annual Meeting, 26–30 May 2019, Helsinki, Finland

**Tipo di presentazione:** poster

**Website:**
https://www.monitoolproject.eu/images/Publications/MONITOOL_SETAC_Europe_29th_Annual_Meeting_2019.pdf

**Microbial community of the rhizosphere of a poplar-assisted bioremediation strategy applied to recover from PCBs a contaminated soil. In: One Environment. One Health. Sustainable Societies Abstract Book, SETAC (Ed.), pp. 12-13 ISSN 2309-8031**

**Autori:** Barra Caracciolo A, Grenni P, Cardoni M, Di Lenola M, Campanale C, Garbini GL, Aimola G, Uricchio VF, Fernandez Lopez M, Ancona V, 2019

**Riferimenti evento/brevetto:** SETAC Europe 29th Annual Meeting, 26–30 May 2019, Helsinki, Finland

**Tipo di presentazione:** poster

**Website:**
https://www.monitoolproject.eu/images/Publications/MONITOOL_SETAC_Europe_29th_Annual_Meeting_2019.pdf

**Selective potential of the sulfamethoxazole antibiotic on the spread of resistant genes in natural microbial communities. In: One Environment. One Health. Sustainable Societies Abstract Book, SETAC (Ed.), pp. 192 ISSN 2309-8031**

**Autori:** Rauseo J, Ademollo N, Barra Caracciolo A, Gaze WH, Grenni P, Pescatore T, Spataro F, Stanton IC, Patrolecco L, 2019

**Riferimenti evento/brevetto:** SETAC Europe 29th Annual Meeting, 26–30 May 2019, Helsinki, Finland

**Tipo di presentazione:** poster

**Website:**
https://www.monitoolproject.eu/images/Publications/MONITOOL_SETAC_Europe_29th_Annual_Meeting_2019.pdf

**Can the anionic surfactant sodium lauryl ether sulphate (SLES) affect the persistence of the pesticide chlorpyrifos in soil? In: One Environment. One Health. Sustainable Societies Abstract Book, SETAC (Ed.), pp. 143 ISSN 2309-8031**

**Autori:** Pescatore T, Ademollo N, Barra Caracciolo A, Grenni P, Rolando L, Rauseo J, Spataro F, Patrolecco L, 2019

**Riferimenti evento/brevetto:** SETAC Europe 29th Annual Meeting, 26–30 May 2019, Helsinki, Finland

**Tipo di presentazione:** poster

**Website:**
https://www.monitoolproject.eu/images/Publications/MONITOOL_SETAC_Europe_29th_Annual_Meeting_2019.pdf

**Environmental issues due to antibiotic occurrence in manure and digestate: the AZeRO antibiotics Project. In: One Environment. One Health. Sustainable Societies Abstract Book, SETAC (Ed.), pp. 190 ISSN 2309-8031**

**Autori:** Massini G, Grenni P, Patrolecco L, Mazzurco Miritana V, Ademollo N, Rosa S, Signorini A, Petrazzuolo F, Piccinini F, Rauseo J, Spataro F, Rolando L, Mariani L, Barra Caracciolo A, 2019

**Riferimenti evento/brevetto:** SETAC Europe 29th Annual Meeting, 26–30 May 2019, Helsinki, Finland

**Tipo di presentazione:** poster

**Website:**
https://www.monitoolproject.eu/images/Publications/MONITOOL_SETAC_Europe_29th_Annual_Meeting_2019.pdf

**DDE degradation in soil by using Microbiabl Fuel Cells (MFCs). In: Dubrovnik 14thConference on Sustainable Development of Energy, Water and Environment Systems, Book of abstracts, ISSN 1847-7186**

**Autori:** Gagliardi G., Aimola G., Campanale C., Grenni P., Barra Caracciolo A., Ancona V., Borello D.

**Riferimenti evento/brevetto:** 14th Conference on Sustainable Development of Energy, Water and Environment Systems, Dubrovnik, Croatia, 01-06/10/2019

**Tipo di presentazione:** poster

**The use of Microbial Fuel Cells for soil remediation: a preliminary study on DDE. In: 14th Conference on Sustainable development of energy, water and Environment Systems, Digital proceeding, SDEWES19_FP_736, pg 1-11. (ISSN): 1847-7178**

**Autori:** Gagliardi G., Aimola G., Campanale C., Grenni P., Barra Caracciolo A., Ancona V., Borello D.

**Riferimenti evento/brevetto:** 14th Conference on Sustainable Development of Energy, Water and Environment Systems, Dubrovnik, Croatia, 01-06/10/2019

**Tipo di presentazione:** poster

**Fluidized bed gasification of biomass from plant-assisted bioremediation: characterization of products. In: 14th Conference on Sustainable development of energy, water and Environment Systems, Digital proceeding, SDEWES19_FP_753, pg 1-14. (ISSN): 1847-7178**

**Autori:** Gallucci F., Carnevale M., Paris E., Plescia P., Ancona V., De Caprariis B., Borello D.

**Riferimenti evento/brevetto:** 14th Conference on Sustainable Development of Energy, Water and Environment Systems, Dubrovnik, Croatia, 01-06/10/2019

**Tipo di presentazione:** orale

**Potential of vis-NIR reflectance spectroscopy for the prediction of soil PCBs content in a historically contaminated site of the SIN of Taranto (Southern Italy).**

**Autori:** V. Ancona, C. Galeone, N. Leone, G. Bagnuolo, V. F. Uricchio, A. P. Leone

**Riferimenti evento/brevetto:** First Join Meeting on Soil and Plant System Sciences (SPSS 2019), 23-26 September 2019, Bari (Italy)

**Tipo di presentazione:** poster

**Advanced Oxidation Processes for water remediation**

**Autori:** Giuseppe Mascolo

**Riferimenti evento/brevetto:** Nanonnovation Conference & Exhibition, Rome, JUNE 11-14 2019

**Tipo di presentazione:** orale

**Website:** https://www.nanoinnovation2019.eu/

**Feasibility of tertiary treated wastewater reuse in the irrigation of grapes and olives**

**Autori:** Carlo Salerno, Pompilio Vergine, Giovanni Berardi, Giuseppe Pappagallo, Alfieri Pollice

**Riferimenti evento/brevetto:** IX International Symposium On Irrigation Of Horticultural Crops, Matera, 17-20/06/2019

**Tipo di presentazione:** poster

**Website:** http://www.irrigationmatera2019.com/

### Acid ethanolysis of sewage sludge: a viable route to obtain fuel and fine-chemicals from an exhausted biomass

**Autori:** di Bitonto Luigi, Pastore Carlo

**Riferimenti evento/brevetto:** 3RD IWA RESOURCE RECOVERY CONFERENCE 2019 – IWARR2019, Venice (Italy), 08 – 12 September 2019

**Tipo di presentazione:** poster

### FAMEs, Estolides and Methyl-10-Hydroxystearate: Sewage Sludge as Possible Source of Biodiesel and Bio-lubricants of New Generation

**Autori:** Pastore Carlo, di Bitonto Luigi, Gallo Vito, Todisco Stefano

**Riferimenti evento/brevetto:** 3RD IWA RESOURCE RECOVERY CONFERENCE 2019 – IWARR2019, Venice (Italy), 08 – 12 September 2019

**Tipo di presentazione:** orale

### Lipids extraction from sewage sludge through Green biobased solvents

**Autori:** Villalobos-Delgado, Felipe J.; di Bitonto, Luigi; Reynel-Ávila, H. Elisabeth; Mendoza-Castillo, D. Ileana; Bonilla Petriciolet, Adrian; Pastore, Carlo

**Riferimenti evento/brevetto:** International Symposium on Constructed Wetlands & Small Decentralized Wastewater Treatment Plants – ISCW2019 Patras, Greece, August 29-31, 2019

**Tipo di presentazione:** poster

### Preparation and characterization of new lanthanum functionalized adsorbents from a residual lignocellulosic biomass and their use in arsenic adsorption

**Autori:** Mendoza-Castillo, D. Ileana; di Bitonto, Luigi; Reynel-Ávila, H. Elisabeth; Bonilla Petriciolet, Adrian; Pastore, Carlo

**Riferimenti evento/brevetto:** International Symposium on Constructed Wetlands & Small Decentralized Wastewater Treatment Plants – ISCW2019 Patras, Greece, August 29-31, 2019

**Tipo di presentazione:** orale

### Valorization of mexican waste biomasses for bioenergy applications

**Autori:** di Bitonto, Luigi; Reynel-Avila, H. Elisabeth; Mendoza-Castillo, D. Ileana; Pastore, Carlo; Bonilla-Petriciolet, Adrian

**Riferimenti evento/brevetto:** 7th International Conference on Sustainable Solid Waste Management, Heraklion, 26-29 June 2019

**Tipo di presentazione:** poster

### Preparation of lanthanum functionalized adsorbents from a lignocellulosic biomass and their application in arsenic adsorption

**Autori:** Mendoza-Castillo, D. Ileana; di Bitonto, Luigi; Reynel-Ávila, H. Elisabeth; Bonilla Petriciolet, Adrian; Pastore, Carlo

**Riferimenti evento/brevetto:** 7th International Conference on Sustainable Solid Waste Management, Heraklion, 26-29 June 2019

**Tipo di presentazione:** poster

### Green solvent extraction of lipids from sewage sludge of wastewater treatment plants

**Autori:** Villalobos-Delgado, Felipe J.; di Bitonto, Luigi; Reynel-Ávila, H. Elisabeth; Mendoza-Castillo, D. Ileana; Bonilla Petriciolet, Adrian; Pastore, Carlo

**Riferimenti evento/brevetto:** 7th International Conference on Sustainable Solid Waste Management, Heraklion, 26-29 June 2019

**Tipo di presentazione:** poster

### A sustainable pathway to convert volatile fatty acids coming from fermented food waste into bio-based solvents

**Autori:** di Bitonto, Luigi; Pastore, Carlo

**Riferimenti evento/brevetto:** 7th International Conference on Sustainable Solid Waste Management, Heraklion, 26-29 June 2019

**Tipo di presentazione:** orale

### Synthesis, characterization and applications of carbon-based calcium catalysts deriving from avocado seeds for biodiesel production

**Autori:** di Bitonto, Luigi; Reynel-Ávila, H. Elisabeth; Mendoza-Castillo, D. Ileana; Bonilla-Petriciolet, Adrian; Pastore, Carlo

**Riferimenti evento/brevetto:** 7th International Conference on Sustainable Solid Waste Management, Heraklion, 26-29 June 2019

**Tipo di presentazione:** orale

### An integrated system based on MAR and reclaimed water reuse for sustainable agriculture irrigation under climate change conditions in Mediterranean countries.

**Autori:** Vurro, M., Portoghese, I., Al-Raggad, M., Bouden, S., Doveri, M., El-Mansouri, B., Fernández-Escalante, E., Giordano, R., Lobo-Ferreira, J.P., Mahjoub, O., Michiel, C., Monacelli G., Rossetto R., Santoro, O., Sapiano, M., & Tuccinardi, F.

**Riferimenti evento/brevetto:** 10th International Symposium on Managed Aquifer Recharge (ISMAR 10), 20-24 May 2019, Madrid, Spain

**Tipo di presentazione:** poster

**Website:** https://www.ismar10.net/en/ismar10-3/

### Atlas of infiltration ponds for treated wastewater disposal in the Apulia region: suitable indicators of potential environmental threats and benefits

**Autori:** Demichele, F., Fidelibus, D., Vurro, M., e Portoghese, I.

**Riferimenti evento/brevetto:** 10th International Symposium on Managed Aquifer Recharge (ISMAR 10), 20-24 May 2019, Madrid, Spain

**Tipo di presentazione:** poster

**Website:** https://www.ismar10.net/en/ismar10-3/

### Enhancing the introduction of Nature Based Solutions to deal with water-related risks using participatory approaches

**Autori:** Pagano A., Giordano R., Pluchinotta I., Basile R., Santoro S., Scrieciu A., Nanu F

**Riferimenti evento/brevetto:** ICONHIC Conference, 2nd International Conference on Natural Hazards & Infrastructure, 23-26 June, 2019, Chania, Greece

**Tipo di presentazione:** orale

### Anaerobic digestion as attractive multistep bio-refinery: research and application with your bio-waste

**Autori:** Braguglia, C.M., Gallipoli, A., Gianico, A., Montecchio, D., Pagliaccia, P., Tonanzi, B., Rossetti S.

**Riferimenti evento/brevetto:** Proceedings of: BioEconomy biological sources for a sustainable world, Rome 6 March 2019, pag. 38. ISBN 978-88-97987-21-5

**Tipo di presentazione:** orale

### Exploring the complex role of pre-treatments in anaerobic digestion: from batch to continuous mode

**Autori:** A. Gallipoli, A. Gianico, D. Montecchio, P. Pagliaccia, C.M. Braguglia.

**Riferimenti evento/brevetto:** AD16 - 16th World Conference on Anaerobic Digestion 23-27 June 2019, Delft, the Netherlands.

**Tipo di presentazione:** orale

### Insights into the synergistic effects of the anaerobic co-digestion of sludge and food waste through the modelization of semi-continuous experimental tests.

**Autori:** AD - 16th World Conference on Anaerobic Digestion 23-27 June 2019, Delft, the Netherlands.

**Riferimenti evento/brevetto:** AD16 - 16th World Conference on Anaerobic Digestion 23-27 June 2019, Delft, the Netherlands.

**Tipo di presentazione:** orale

### Waste Activated Sludge Addition Assures the Stable Anaerobic Digestion of Food Waste: Microbiome Changes and Link with Key Process Parameters.

**Autori:** Tonanzi, B., Braguglia, C.M., Gallipoli, A., Gianico, A., Pagliaccia, P., Rossetti, S.

**Riferimenti evento/brevetto:** MEWE 2019, Hiroshima, 17-20 November 2019

**Tipo di presentazione:** poster

### Mercury flux evasion from the Mediterranean Sea during three oceanographic campaigns: Evaluation of spatial variability and uncertainty of estimates

**Autori:** Laura Fantozzi

**Riferimenti evento/brevetto:** 2ndInternational Conference on Environmental Sustainability and Climate Change November 28–29, 2019 - Rome, Italy

**Tipo di presentazione:** poster

### Application of QMRA to MAR operations for safe agricultural reuse and marine recreational impacts in coastal areas

**Autori:** Costantino Masciopinto, Michele Vurro, Domenico Santoro, Charls Nathan Haas

**Riferimenti evento/brevetto:** EGU-2020 Vienna, Online, 4–8 May 2020

**Tipo di presentazione:** orale

**Website:** https://meetingorganizer.copernicus.org/egu2020/abstractinformation

### All-in-one: removal of oxidizable (hydrocarbons) and reducible (sulfate) contaminants from contaminated groundwater in a single bioelectrochemical reactor

**Autori:** Matteo Tucci, Carolina Cruz Viggi, Paolo Tomei, Bruna Matturro, Simona Crognale, Ilaria Pietrini, Simona Rossetti, Federico Aulenta

**Riferimenti evento/brevetto:** 71st annual meeting ISE (International Society of Electrochemistry) (On-line meeting). Belgrade (Serbia). 31 Agosto-4 Settembre 2020

**Tipo di presentazione:** orale

**Website:** https://annual71.ise-online.org/

### The VIOLA project: functional responses of groundwater microbial community across the salinity gradient in a coastal karst aquifer

**Autori:** Melita M., Amalfitano S., Frollini E., Ghergo S., Masciale R., Parrone D., Passarella G., Preziosi E., Vurro M., Zoppini A.

**Riferimenti evento/brevetto:** EGU General Assembly 2020, Vienna (Austria), 3-8 Maggio 2020

**Tipo di presentazione:** poster

**Website:** https://meetingorganizer.copernicus.org/EGU2020/EGU2020-7630.html

### SIMILE: An integrated monitoring system to understand, protect and manage sub-alpine lakes and their ecosystem

**Autori:** Strigaro, D., M. Cannata, F. Lepori, C. Capelli, M. Rogora, M. Brovelli.

**Riferimenti evento/brevetto:** 22nd EGU General Assembly, held online 4-8 May 2020, id.19393

**Tipo di presentazione:** poster

### Terrestrial Microbial fuel cells for degrading persistent organic pollutants. In: Open Science for Enhanced Global Environmental Protection Abstract Book: 252

**Autori:** Barra Caracciolo A, Aimola G, Gagliardi G, Ancona V, Grenni P, Bagnuolo G, Rolando L, Garbini GL, Uricchio VF, Sanchez E, Borello D, 2020.

**Riferimenti evento/brevetto:** Virtual SETAC Europe 30th Annual Meeting, 3-7 May

**Tipo di presentazione:** poster

**Website:** https://dublin.setac.org/wp-content/uploads/2020/04/SETAC-SciCon-Abstract-book_v2.pdf

**Building participative scenarios for transitional areas: what knowledge do we need?**

**Autori:** L'Astorina A., Molinaroli E., De Lazzari A., Petrocelli A., Pugnetti A.

**Riferimenti evento/brevetto:** International Congress EuroLag 2020, Venezia 20-24/01/2020

**Tipo di presentazione:** orale

**Website:** https://www.eurolag9.it/

**Bioaugmentation of a consortium isolate for the degradation of Sodium Lauryl Ether Sulphate in soil. In: Open Science for Enhanced Global Environmental Protection Abstract Book.**

**Autori:** Rolando L, Grenni P, Pescatore T, Rauseo J, Visca A, Patrolecco L, Barra Caracciolo, A 2020.

**Riferimenti evento/brevetto:** Virtual SETAC Europe 30th Annual Meeting, Dublin 3-7 May.

**Tipo di presentazione:** poster

**Website:** https://dublin.setac.org/wp-content/uploads/2020/04/SETAC-SciCon-Abstract-book_v2.pdf

**Antibiotic and resistance gene occurrence in cattle manure and digestate of anaerobic digestion plants fed with agrozootechnical waste. In: Open Science for Enhanced Global Environmental Protection Abstract Book.**

**Autori:** Visca A, Barra Caracciolo A, Grenni P, Rauseo J, Spataro F, Ademollo N, Patrolecco L, Rolando L, Garbini GL, Rosa S, Signorini A, Piccinini F, Massini G, Mazzurco Miritana V, 2020.

**Riferimenti evento/brevetto:** Virtual SETAC Europe 30th Annual Meeting, Dublin 3-7 May

**Tipo di presentazione:** poster

**Website:** https://dublin.setac.org/wp-content/uploads/2020/04/SETAC-SciCon-Abstract-book_v2.pdf

**Mechanized tunnelling and management of spoil material containing foaming agents: currents trends and future perspectives. In: Open Science for Enhanced Global Environmental Protection Abstract Book.**

**Autori:** Grenni P, Mariani L, Patrolecco L, Rauseo J, Spataro F, Pescatore T, Ademollo N, Garbini G, Visca A, Rolando L, Barra Caracciolo A, 2020.

**Riferimenti evento/brevetto:** Virtual SETAC Europe 30th Annual Meeting, Dublin 3-7 May

**Tipo di presentazione:** poster

**Website:** https://dublin.setac.org/wp-content/uploads/2020/04/SETAC-SciCon-Abstract-book_v2.pdf

**Influence of soil organic amendments on carbon based metabolites in rosemary (Rosmarinus officinalis L.) plants. In: Open Science for Enhanced Global Environmental Protection Abstract Book.**

**Autori:** Nogues I, Barra Caracciolo A, Grenni P, Geerdink P, Safi C, Bustamante MA, 2020.

**Riferimenti evento/brevetto:** Virtual SETAC Europe 30th Annual Meeting, Dublin 3-7 May

**Tipo di presentazione:** poster

**Website:** https://dublin.setac.org/wp-content/uploads/2020/04/SETAC-SciCon-Abstract-book_v2.pdf

**Shotgun DNA, pollen and biological multi-proxy analysis of Lateglacial lake sediments from Monticchio, Italy**

**Autori:** Laura Parducci, Kevin Nota, Willy Tinner, Jacqueline van Leeuwen, Pim van der Knaap, Dirk Sachse, Zuobing Liang, Achim Brauer, Markus J. Schwab, Xuery Zhao, Aldo Marchetto, Andrea Lami, and Sabine Wulf

**Riferimenti evento/brevetto:** EGU General Assembly 2020, Vienna , Austria, 4-8 May 2020

**Tipo di presentazione:** orale

### Estimation of Trophic Magnification Factor (TMF) in a real trophic web: a case study of Lake Mergozzo (Northern Italy). Poster presentato a SETAC Europe 30th annual meeting, 3-7 May 2020

**Autori:** Stefano Polesello, Michela Mazzoni, Claudia Ferrario, Roberta Piscia, Davide Cicala, Pietro Volta, Sara Valsecchi

**Riferimenti evento/brevetto:** Estimation of Trophic Magnification Factor (TMF) in a real trophic web: a case study of Lake Mergozzo (Northern Italy)

**Tipo di presentazione:** poster

**Website:** https://dublin.setac.org/

### Hydrological regime and sediment transport in two Mediterranean intermittent rivers and ephemeral streams (IRESs)

**Autori:** Giovanni Francesco Ricci, Josep Fortesa, Julián García-Comendador, Francesco Gentile, Joan Estrany, Eric Sauquet, Thibault Datry, Anna Maria De Girolamo

**Riferimenti evento/brevetto:** 22nd EGU General Assembly, held online 4-8 May, 2020, id.4807

**Tipo di presentazione:** orale

### Potential flow regime alterations under climate change in an intermittent river system

**Autori:** Anna Maria De Girolamo, Antonio Lo Porto

**Riferimenti evento/brevetto:** 22nd EGU General Assembly, held online 4-8 May, 2020, id. id.22542

**Tipo di presentazione:** orale

### An EU-wide citizen science network to monitor hydrological conditions in intermittent rivers and ephemeral streams

**Autori:** Eric Sauquet, Ilja van Meerveld, Cath Sefton, Josep Fortesa, Helena Ramos Ribeiro, Iakovos Tziortzis, Anna Maria de Girolamo, July England, Joan Estrany, Pau Fortuño, Antoni Munné, Zoltan Csabai, Manuela Morais, Helena Alves, Thibault Datry

**Riferimenti evento/brevetto:** 22nd EGU General Assembly, held online 4-8 May, 2020

**Tipo di presentazione:** orale

**Website:** https://doi.org/10.5194/egusphere-egu2020-1790

### Technological research on water issues: Pollutants pressures, impacts and removal. How to grant access to quality water for everybody?

**Autori:** TOMEI, M.C.

**Riferimenti evento/brevetto:** International Science Foresight Workshop: Global Challenges and Research Gaps. September 9-11, 2020, Royaumont, Paris.

**Tipo di presentazione:** orale

### Biodiversity and structure of plastisphere in lentic ecosystems

**Autori:** Francesca Di Pippo, Cristina Venezia, Maria Sighicelli, Loris Pietrelli, Stefania Di Vito, Simone Nuglio, Simona Rossetti

**Riferimenti evento/brevetto:** MICRO 2020, 23-27 November 2020, Lanzarote, Spain

**Tipo di presentazione:** orale

**Website:** https://micro2020.sciencesconf.org/

### Green roofs in Milan metropolitan area: runoff water quality and quantity

**Autori:** Laura Marziali1, Lucia Valsecchi1, Diego Copetti1, Riccardo Minoia1, Alfredo Schiavon1, Franco Salerno1, Gianni Tartari1, Claudio Roscioli1, Licia Guzzella1, Benedetta Barozzi2, Alice Bellazzi2, Alberto Sala3

**Riferimenti evento/brevetto:** SETAC SciCon, SETAC Europe 30th Annual Meeting, held online, 3-7 May 2020

**Tipo di presentazione:** orale

**Website:** https://dublin.setac.org/

### Sediment flushing in North Italian reservoirs: matching research, governance and management

**Autori:** Laura Marziali1, Licia Guzzella1, Lucia Valsecchi1, Alfredo Schiavon1, Stefano Tasselli1, Erika Oteri1, Pietro Arrighetti1, Gianni Tartari1, Cristina Borlandelli2, Erika Lorenzi2, Pietro Genoni2, Clara Bravi3

**Riferimenti evento/brevetto:** SETAC SciCon, SETAC Europe 30th Annual Meeting, held online, 3-7 May 2020

**Tipo di presentazione:** poster

**Website:** https://dublin.setac.org/

### Ecotoxicological testing for HP14 Classification of Waste: state of the art and current challenges

**Autori:** Grenni Paola

**Riferimenti evento/brevetto:** SUM2020/5TH SYMPOSIUM ON URBAN MINING AND CIRCULAR ECONOMY (on-line), 17-19 Nov. 2020

**Tipo di presentazione:** orale

**Website:** https://www.urbanmining.it/

### Bioaugmentation involving a bacterial consortium isolated from a foaming agent conditioned soil from tunnelling. BOOK of Abstracts. Poster presentation. id 46.

**Autori:** Rolando L, Grenni P, Pescatore T, Rauseo J, Visca A, Garbini GL, Patrolecco L, Anna Barra Caracciolo

**Riferimenti evento/brevetto:** EcotoxicoMic 2020, 2nd International Conference on Microbial Ecotoxicology, Virtual Edition (6th-9th October, 2020)

**Tipo di presentazione:** poster

**Website:** https://ecotoxicomic.org/wp-content/uploads/2020/10/Book-of-Abstract-EcotoxicoMic2020-3.pdf

### The ostracod Heterocypris incongruens toxicity test for evaluating chemical mixture effects in excavated soil.

**Autori:** Mariani L, Grenni P, Patrolecco L, Pescatore T, Narciso A, Barra Caracciolo A

**Riferimenti evento/brevetto:** 9th Biennial ECOtoxicology MEeting (BECOME 2020), Managing aquatic and terrestrial environments: an ecotoxicological perspective, 24-28 Novembre 2020

**Tipo di presentazione:** orale

**Website:** https://www.isprambiente.gov.it/files2020/eventi/ecotossicologia/Invito%202020%20giornate%20ecotossicologia.docx.pdf

### Evaluation of ecotoxicity (HP14) of solid waste: critical issues.

**Autori:** Grenni P, Mariani L, Tediosi E, Neotti MG, Marchesini D, Mensi C, L. Maggi

**Riferimenti evento/brevetto:** 9th Biennial ECOtoxicology MEeting (BECOME 2020), Managing aquatic and terrestrial environments: an ecotoxicological perspective, 24-28 Novembre 2020

**Tipo di presentazione:** orale

**Website:**
https://www.isprambiente.gov.it/files2020/eventi/ecotossicologia/Invito%202020%20giornate%20ecotossicologia.docx.pdf

### Assessment of compost and biochar in improving plant-assisted bioremediation of a multi-contaminated soil. In: Open Science for Enhanced Global Environmental Protection Abstract Book. Virtual SETAC Europe 30th Annual Meeting, 3-7 May: 69: 252. ONLINE ISSN 2310-3043

**Autori:** Ancona V, Grenni P, Aimola G, Garbini GL, Losacco D, Napolitano D, Rolando L, Uricchio VF, Barra Caracciolo A

**Riferimenti evento/brevetto:** Open Science for Enhanced Global Environmental Protection Abstract Book. Virtual SETAC Europe 30th Annual Meeting, 3-7 May, 2020: 69: 252.

**Tipo di presentazione:** orale

**Website:** https://dublin.setac.org/wp-content/uploads/2020/04/SETAC-SciCon-Abstract-book_v2.pdf

### The Study of Natural Microbial Community as a Tool for Assessing the Recovery of Polluted Environments. Keynote presentation, 23-24 September, 2020, National Research Centre, Cairo, Egypt

**Autori:** Grenni P.

**Riferimenti evento/brevetto:** The Second International Conference on Molecular Modeling and Spectroscopy (ICMMS2), 23-24 September, 2020 National Research Centre, Cairo, Egypt

**Tipo di presentazione:** orale

**Website:** http://www.astronomy.ohio-state.edu/~nahar/presentations/prog-icmms-nrc20.pdf

### Green technology for metal removal from contaminated water

**Autori:** Grenni P., Barra Caracciolo A, Mariani L, Cardoni M, Ricucci C, Henanes H

**Riferimenti evento/brevetto:** he Second International Conference on Molecular Modeling and Spectroscopy (ICMMS2), 23-24 September, 2020, National Research Centre, Cairo, Egypt

**Tipo di presentazione:** poster

**Website:** http://www.astronomy.ohio-state.edu/~nahar/presentations/prog-icmms-nrc20.pdf

### Clear water as a common right

**Autori:** Anna Barra Caracciolo

**Riferimenti evento/brevetto:** Invited speaker alla Digital Round Table "Access to Energy and Water in Rural India" - 05/10/2020

**Tipo di presentazione:** orale

### URBAN SEWAGE SLUDGE AS A SOURCE OF BIOFUELS AND BIOLUBRICANTS

**Autori:** Pastore Carlo, di Bitonto Luigi

**Riferimenti evento/brevetto:** FIFTH SYMPOSIUM ON URBAN MINING AND CIRCULAR ECONOMY VIRTUAL EVENT / 18-20 NOVEMBER 2020

**Tipo di presentazione:** orale

### Assessing arsenic bioremediation potential of epilithic biofilms affected by acid-mine drainage-Biofilm9 Conference 2020

**Autori:** Sarah Zecchin, Nicoletta Guerrieri, Evelien Jongepier, Leonardo Scaglioni, Gigliola Borgonovo, Gerard Muyzer and Lucia Cavalca

**Riferimenti evento/brevetto:** Abstr. Comun. Biofilm 9 Conference (online), 29 settembre - 1 ottobre 2020, pag.120 Biofilm9-81

**Tipo di presentazione:** poster

**Website:** https://doi.org/10.5194/biofilms9-81

### Multivariate tools to investigate the occurrence of pollutants in a highly anthropised marine area

**Autori:** Francesco Paolo Buonocunto1, Nicola Cardellicchio2, Antonella Di Leo2, Eliana Esposito1, Luciana Ferraro1, Santina Giandomenico2, Alfonsa Milia1, Lucia Spada2, Crescenzo Violante1, Matilda Mali3 1 Istitute of Marine Sciences, National Research Council, Italy 2 Water Research Institute - National Research Council, Italy 3 DICATECh - Polytechnic University of Bari, Italy

**Riferimenti evento/brevetto:** EGU General Assembly 2020, Vienna , Austria, 4-8 May 2020

**Tipo di presentazione:** orale

**Website:** https://www.egu2020.eu

### THE OFFSHORE ENVIRONMENTAL IMPACT BY SARNO RIVER IN NAPLES BAY (SOUTH-WEST ITALY)

**Autori:** Di Leo A.; Giandomenico S.; Spada L.; Cardellicchio N.; Buonocunto F.P.; Esposito E.; Ferraro L.; Giordano L.; Milia A.; Violante C. IRSA - CNR ISMAR - CNR

**Riferimenti evento/brevetto:** Eighth International Symposium “Monitoring of Mediterranean Coastal Areas. Problems and Measurement Techniques”, Livorno (Italy), 16/06/2020

**Tipo di presentazione:** poster

### Presentazione su invito

**Autori:** De Girolamo Anna Maria

**Riferimenti evento/brevetto:** SMIRES Cost Action Final conference, Tirana, Albania, 4-5 February 2020

**Tipo di presentazione:** orale

**Website:** https://www.smires.eu/events/

## Contributi in convegni nazionali

### Biohydrogen and bioproducts from microalgae

**Autori:** Giuseppe Torzillo, Graziella Chini Zittelli, Cecilia faraloni, Rosaria Lauceri

**Riferimenti evento/brevetto:** BioEconomy: biological sources for a sustainable world, 6 marzo 2019, Roma

**Tipo di presentazione:** orale

**Website:** https://www.cnr.it/it/evento/16134/bioeconomy-biological-sources-for-a-sustainable-world

### In Cammino con la rete LTER da Bagnoli a Taranto alla ricerca di un futuro condiviso per il mare

**Autori:** De Lazzari A., L'Astorina A., Bergami C., Petrocelli A., Portacci G., Pugnetti A., Rubino F.

**Riferimenti evento/brevetto:** Convegno Donne e Scienza 2019, Lecce, 14-16 novembre 2019

**Tipo di presentazione:** orale

**Website:** http://www.donnescienza.it/convegno-donne-e-scienza-2019-lecce-14-16-novembre/

### Il progetto SIMILE: monitoraggio della qualità delle acque dei laghi insubrici da immagini satellitari

**Autori:** Giulia Luciani, Mariano Bresciani, Daniela Carrion, Michela Rogora, Maria Antonia Brovelli

**Riferimenti evento/brevetto:** ASITA 2019

**Tipo di presentazione:** poster

### Taranto, 2 agosto 1916: storia di un disastro ambientale. L'esplosione della Nave Leonardo da Vinci.

**Autori:** Portacci G., Caroppo C.

**Riferimenti evento/brevetto:** Taranto due mari di libri - La Fiera della letteratura del mare, Taranto 2-5 maggio 2019

**Tipo di presentazione:** orale

**Website:** https://www.cnr.it/en/event/16276/taranto-due-mari-di-libri-la-fiera-della-letteratura-del-mare

### CyanoAlert: Mar Piccolo e Mar Grande di Taranto. Progetto CyanoAlert – Il controllo Copernicus nello inquinamento delle acque.

**Autori:** Caroppo C., Bruno M.

**Riferimenti evento/brevetto:** Progetto CyanoAlert – Il controllo Copernicus nello inquinamento delle acque. Roma, 21 maggio 2019.

**Tipo di presentazione:** orale

**Website:** https://www.cnr.it/it/evento/16312/progetto-cyanoalert-il-controllo-copernicus-nell-inquinamento-delle-acque

### Ecologia e tossicità delle specie algali dannose e loro impatto sulla maricoltura.

**Autori:** Caroppo C.

**Riferimenti evento/brevetto:** 3° Summer School Qualità dell'acqua e salute. Bari, 27 giugno 2019.

**Tipo di presentazione:** orale

**Website:** http://www.irsa.cnr.it/index.php/ita/news-2/item/364-convegno-prospettive-di-sburocratizzazione-in-materia-ambientale

### Marine phytoplankton database of Latium coastal waters (Middle Tyrrhenian Sea – Italy): checklist and Self Organizing Maps analyses of data collected from 2002 to 2017.

**Autori:** Bianco I., Russo T., Viaggiu E., Sarno D., Caroppo C., Congestri R.

**Riferimenti evento/brevetto:** Riunione Scientifica del Gruppo di Lavoro per la Algologia, Bari 15-16 novembre 2019

**Tipo di presentazione:** orale

**Website:** https://www.uniba.it/eventi-alluniversita/2019/riunione-scientifica.-gruppo-di-lavoro-per-lalgologia-societa-botanica-italiana

### First occurrence of *Margalefidinium* cf. *polykrikoides* blooms in Ionian Sea, Italy.

**Autori:** Roselli L., Vadrucci M.R., Belmonte M., Ciciriello P., Rubino F., Ungaro N., Caroppo C.

**Riferimenti evento/brevetto:** Riunione Scientifica del Gruppo di Lavoro per la Algologia, Bari 15-16 novembre 2019

**Tipo di presentazione:** orale

**Website:** https://www.uniba.it/eventi-alluniversita/2019/riunione-scientifica.-gruppo-di-lavoro-per-lalgologia-societa-botanica-italiana

### Gestione delle popolazioni selvatiche di trota lacustre del Garda: il caso del torrente Toscolano - Management of wild lake trout in the Lake Garda: the case study of the Toscolano river

**Autori:** Marieni A., Anzani A, Stefani F.

**Riferimenti evento/brevetto:** Atti XVII Congresso Nazionale Associazione Italiana Ittiologi Acque Dolci – Roma, 2019

**Tipo di presentazione:** orale

**Website:** http://www.aiiad.it/ijfi/index.php/ijfi/issue/view/7

### L'esotica Oncorhynchus mykiss (Wallbaum 1792) nel bacino idrografico di un corpo idrico mediterraneo: fattori che hne favoriscono l'insediamento ed i rischi associati – The exotic Oncorhynchus mykiss (Wallbaum 1792) in a Mediterranean water body basin: factors promoting the establishment and associated risks.

**Autori:** Marieni A., Anzani A, Stefani F.

**Riferimenti evento/brevetto:** Atti XVII Congresso Nazionale Associazione Italiana Ittiologi Acque Dolci – Roma, 2019

**Tipo di presentazione:** orale

**Website:** http://www.aiiad.it/ijfi/index.php/ijfi/issue/view/7

### Progetto REMEDIA-LIFE: attività antibatterica di estratti algali

**Autori:** R.A. CAVALLO, M.I. ACQUAVIVA, E. CECERE, M. NARRACCI, A. PETROCELLI, L. STABILI

**Riferimenti evento/brevetto:** 52° Congresso Nazionale Società di Igiene Medicina Preventiva e Sanità Pubblica, Perugia, 16-19 ottobre 2019

**Tipo di presentazione:** orale

### Applicazione del Protocollo analitico per la caratterizzazione ecotossicologica e chimica dei sedimenti (PrATo) dell'invaso della Valgrosina

**Autori:** Borlandelli Cristina, Lorenzi Erika, Genoni Pietro, Guzzella Licia, Marziali Laura, Bravi Clara

**Riferimenti evento/brevetto:** 8th Biannual ECOtoxycology MEeting (BECOME 2018), Livorno, 26-28 Novembre 2018

**Tipo di presentazione:** poster

**Website:**
https://www.isprambiente.gov.it/files2019/pubblicazioni/atti/ATTI_2019_Ecotossicologia_8a_ed.pdf

### Valutazione della tossicità dei sedimenti degli invasi ai fini della fluitazione: il protocollo PrATo

**Autori:** Marziali L., Valsecchi L., Oteri E., Schiavon A., Tirozzi P., Tasselli S., Tartari G., Genoni P., Borlandelli C., Lorenzi E., Castelli S., Bellomi A., Bravi C., Guzzella L.

**Riferimenti evento/brevetto:** 8th Biannual ECOtoxycology MEeting (BECOME 2018), Livorno, 26-28 Novembre 2018

**Tipo di presentazione:** orale

**Website:**
https://www.isprambiente.gov.it/files2019/pubblicazioni/atti/ATTI_2019_Ecotossicologia_8a_ed.pdf

### Terreni provenienti da scavi meccanizzati: valutazione della loro ecotossicità. In: Mugnai C., "Giornate di Studio 8° Edizione, Atti

**Autori:** Lacchetti I, Gucci PMB, Grenni P, Patrolecco L, Galli E, Muzzini VG, Donati E, Finizio A, Barra Caracciolo A, 2019

**Riferimenti evento/brevetto:** giornate di studio su: l'Ecotossicologia come strumento di gestione degli ambienti acquatici e terrestri

**Tipo di presentazione:** poster

### Analisi di resilienza di reti idriche urbane con indicatori topologici

**Autori:** A. Pagano, U. Fratino, M. Vurro, R. Giordano

**Riferimenti evento/brevetto:** VIII Seminario Tecnologie e Strumenti Innovativi per le Infrastrutture Idrauliche "TeSI" Napoli, 8-9 Luglio 2019

**Tipo di presentazione:** orale

### First investigation of atmospheric mercury pollution around the chlor-alkali plant of Pieve Vergonte (Italian central Alps)

**Autori:** Fantozzi L., Marziali L., Valsecchi L., Schiavon A., Orrù A., Guerrieri N.

**Riferimenti evento/brevetto:** Abstr. Comun. SIMP-SGI-SOGEI 2019, Il tempo del pianeta terra e il tempo dell'uomo: Le geoscienze tra passato e futuro, pag. 678, 16-19 settembre 2019

**Tipo di presentazione:** poster

**Website:** https://doi.org/10.3301/ABSGI.2019.05

### Use of moss bags for PAHs monitoring in a protected Nature Park: preliminary results.

**Autori:** A. Di Leo, S. Giandomenico, G. Grassi, L. Spada

**Riferimenti evento/brevetto:** XVIII Congresso Nazionale Chimica dell'Ambiente e dei Beni Culturali. Urbino, 24-27 giugno 2019.

**Tipo di presentazione:** poster

### Social Perception and IRES

**Autori:** De Girolamo Anna Maria

**Riferimenti evento/brevetto:** Presentazione su invito in Cost Action SMIRES: 6th WG2 meeting in Niš, Serbia, February 4th and 5th 2019, on Social Perception and IRES

**Tipo di presentazione:** orale

### Tecniche di change detection e overlay mapping per l'individuazione di aree interessate da fenomeni di degrado: le attività nell'Area di Crisi Ambientale di Taranto.

**Autori:** C. Massarelli, C. Galeone, V. F. Uricchio, V. Corbelli

**Riferimenti evento/brevetto:** RemTech Expo, ATTI RemTech Expo – Hub tecnologica Campania. 4-5 Giugno 2020. Napoli. ISBN digitale 978 88 8080 378 2, ISBN cartaceo 978 88 8080 379 9

**Tipo di presentazione:** orale

**Website:** http://remtechexpo.com/index.php/it/hub/programma

### Utilizzo di tecniche di analisi multivariata per la definizione ed il monitoraggio di zone interessate da fenomeni di degrado del suolo nell'Area di Crisi Ambientale Taranto

**Autori:** C. Galeone, C. Massarelli, V. F. Uricchio, V. Corbelli

**Riferimenti evento/brevetto:** RemTech Expo, ATTI RemTech Expo – Hub tecnologica Campania. 4-5 Giugno 2020. Napoli. ISBN digitale 978 88 8080 378 2, ISBN cartaceo 978 88 8080 379 9

**Tipo di presentazione:** orale

**Website:** http://remtechexpo.com/index.php/it/hub/programma

### La ricerca in EU su Cambiamento Climatico ed agricoltura.

**Autori:** Antonio Lo Porto

**Riferimenti evento/brevetto:** Seminario Nazionale SIGEA "ANALISI ED EFFETTI DEL CAMBIAMENTO CLIMATICO IN AMBIENTE MEDITERRANEO", Roma, 27 novembre 2020

**Tipo di presentazione:** orale

**Website:** https://www.sigeaweb.it/documenti/convegni/programma-climatici-roma-2020.pdf

### Applicazione della spettroscopia vis-NIR per la predizione del contenuto di metalli pesanti nei suoli: il caso studio dell'Area di Crisi Ambientale di Taranto. In "Il contributo dell'innovazione scientifica ed amministrativa verso la riforma del settore delle bonifiche", pp. 60-61, CNR Edizioni 2020 ISBN 9788880803782

**Autori:** V. Ancona, N. Leone, C. Galeone, V F. Uricchio, A. P. Leone, V. Corbelli

**Riferimenti evento/brevetto:** HUB TECNOLOGICA CAMPANIA, Digital Edition 04 - 05 Giugno 2020

**Tipo di presentazione:** poster

**Website:** http://remtechexpo.com/index.php/it/hub/programma

**Piano di indagini di caratterizzazione per la definizione dello stato di qualità ambientale delle aree agricole: studio preliminare nell'Area Vasta esterna al SIN di Taranto nel territorio comunale di Statte. In "Il contributo dell'innovazione scientifica ed amministrativa verso la riforma del settore delle bonifiche", pp. 38-39, CNR Edizioni 2020, ISBN: 9788880803782**

**Autori:** A. Gatto, V. Ancona, N. Leone, C. Galeone, A. P. Leone, A. Basile, G. Scannicchio, M. De Molfetta, V. F. Uricchio

**Riferimenti evento/brevetto:** RemTech Expo, ATTI RemTech Expo – Hub tecnologica Campania. 04-05 Giugno 2020. Napoli. ISBN digitale 978 88 8080 378 2

**Tipo di presentazione:** poster

**Website:** http://remtechexpo.com/index.php/it/hub/programma

**La gestione agronomica in impianti di biorimedio fito-assistito per il recupero di aree contaminate. In: Uricchio VF, Paparella S, "Il contributo dell'innovazione scientifica ed amministrativa verso la riforma del settore delle bonifiche". Libro degli abstract. Cnr Edizioni, 2020 ISBN 978 88 8080 379 9. pp. 158-159.**

**Autori:** Ancona V, Rascio I, Barra Caracciolo A, Carmignano P, Aimola G, Losacco D, Napolitano D, Spalluto V, Convertini S, Uricchio VF, Grenni P

**Riferimenti evento/brevetto:** RemTech Expo HUB Tecnologica Campania, 4-5 Giugno 2020, Digital Edition

**Tipo di presentazione:** poster

**Website:** http://remtechexpo.com/index.php/it/hub/volume-scientifico

### Biorimedio fitoassistito e biochar per il recupero di un suolo multi-contaminato. In: Uricchio VF, Paparella S, "Il contributo dell'innovazione scientifica ed amministrativa verso la riforma del settore delle bonifiche". Libro degli abstract. Cnr Edizioni, 2020 ISBN 978 88 8080 379 9. pp. 156-157

**Autori:** Ancona V, Aimola G, Grenni P, Garbini GL, Losacco D, Rascio I, Gattullo CE, Porfido C, Terzano R, Uricchio VF, Barra Caracciolo A

**Riferimenti evento/brevetto:** RemTech Expo HUB Tecnologica Campania, 4-5 Giugno 2020, Digital Edition

**Tipo di presentazione:** poster

**Website:** http://remtechexpo.com/index.php/it/hub/volume-scientifico

### Presentazione dei risultati del Gruppo di Lavoro Microinquinanti Emergenti (MIE) in Lombardia

**Autori:** Tartari Gianni

**Riferimenti evento/brevetto:** Inquinanti Emergenti - Presenza, tecnologie e ricerca su microinquinanti e microplastiche nelle acque lombarde. (Convegno on-line). 12/10/2020

**Tipo di presentazione:** orale

**Website:** http://www.energycluster.it/it/aree-di-competenza/water-energy-nexus/progetto-microinquinanti-emergenti

### Inquinanti emergenti: presenza, tecnologie e ricerca su microinquinanti e microplastiche nelle acque lombarde

**Autori:** Tartari Gianni

**Riferimenti evento/brevetto:** Ecomondo. Sessione: Digitalizzazione e innovazione tecnologica per monitorare e ottimizzare la sicurezza..., Rimini, 6/11/2020

**Tipo di presentazione:** orale

**Website:** https://www.ecomondo.com/link/seminari-e-convegni/e12403213/wastewater-management-and-integrated-valorization.html

### Sistema innovativo di campionamento automatizzato per il monitoraggio di microplastiche in ambienti fluviali

**Autori:** Claudia Campanale , Cesare Pierpaolo De Palma , Barbara Bollino , Carmine Massarelli , Vito Felice Uricchio

**Riferimenti evento/brevetto:** RemTech Expo, ATTI RemTech Expo – Hub tecnologica Campania. 4-5 Giugno 2020. Napoli. ISBN digitale 978 88 8080 378 2, ISBN cartaceo 978 88 8080 379 9

**Tipo di presentazione:** orale

**Website:** http://remtechexpo.com/index.php/it/hub/programma

### Le microplastiche nel fiume Ofanto ed il loro ruolo come possibili vettori di trasporto di metalli pesanti

**Autori:** Claudia Campanale, Ilaria Savino, Carmine Massarelli, Giuseppe Bagnuolo, Vito Felice Uricchio

**Riferimenti evento/brevetto:** RemTech Expo, ATTI RemTech Expo – Hub tecnologica Campania. 4-5 Giugno 2020. Napoli. ISBN digitale 978 88 8080 378 2, ISBN cartaceo 978 88 8080 379 9

**Tipo di presentazione:** orale

**Website:** http://remtechexpo.com/index.php/it/hub/programma

### Legislazione nazionale e utilizzo di nuove tecnologie: messa a punto di una piattaforma informatica con lo scopo di alimentare il dibattito parlamentare in materia di bonifica dei siti contaminati

**Autori:** Massimo Ianigro, Roberta Lamaddalena, Carmine Massarelli, Vito Felice Uricchio

**Riferimenti evento/brevetto:** RemTech Expo, ATTI RemTech Expo – Hub tecnologica Campania. 4-5 Giugno 2020. Napoli. ISBN digitale 978 88 8080 378 2, ISBN cartaceo 978 88 8080 379 9

**Tipo di presentazione:** orale

**Website:** http://remtechexpo.com/index.php/it/hub/programma

### Utilizzo di microrganismi nelle tecnologie di Biorimedio

**Autori:** D. Bisaccia, C. Massarelli, A. Ostuni, V. F. Uricchio

**Riferimenti evento/brevetto:** RemTech Expo, ATTI RemTech Expo – Hub tecnologica Campania. 4-5 Giugno 2020. Napoli. ISBN digitale 978 88 8080 378 2, ISBN cartaceo 978 88 8080 379 9

**Tipo di presentazione:** orale

**Website:** http://remtechexpo.com/index.php/it/hub/programma

### Oli ed idrocarburi nei fanghi: dal monitoraggio sugli impianti al metodo di analisi

**Autori:** Carlo Pastore

**Riferimenti evento/brevetto:** WATER CYCLE MANAGEMENT AND VALORIZATION, La gestione dei fanghi di depurazione, Workshop Ecomondo, Ecomondo 04 Novembre 2020, Rimini

**Tipo di presentazione:** orale

### Fanghi di depurazione urbana come fonte di biodiesel e biolubrificanti

**Autori:** Pastore, Carlo, Luigi di Bitonto

**Riferimenti evento/brevetto:** 8° Workshop Nazionale GRUPPO INTERDIVISIONALE DI GREEN CHEMISTRY CHIMICA SOSTENIBILE, 29 Settembre 2020

**Tipo di presentazione:** orale

**Website:**
https://www.soc.chim.it/sites/default/files/VIII%20Workshop%20Interdivisionale%20GC-CS%20-%20Evento%20Virtuale%20-%20Libro%20degli%20abstract.pdf

### Intensification of processes for the production of ethyl levulinate using AlCl3·6H2O.

**Autori:** Carlo Pastore, Luigi di Bitonto

**Riferimenti evento/brevetto:** XX CONGRESSO NAZIONALE CIRIAF Perugia, 16 e 17 aprile 2020

**Tipo di presentazione:** orale

## Brevetti

### Impianto per il trattamento dei reflui urbani

**Autori:** Di Iaconi Claudio, De Sanctis Marco, Lorenzo Ferrara

**Abstract ITA:** L'invenzione riguarda un impianto per il trattamento delle acque reflue urbane in grado di abbattere significativamente (fino a 80%) la produzione dei fanghi di risulta di un depuratore di reflui municipali, la cui gestione incide per circa il 60% dei costi complessivi della depurazione. L'impianto proposto opera grazie alla conversione dello stadio biologico in un sistema a biomassa granulare ibrida (metodologia SBBGR). Questa metodologia di depurazione può essere applicata anche a impianti preesistenti, attuando le opportune modifiche alla vasca principale dell'impianto presente in-situ. A regime l'impianto proposto permette di abbattere sostanzialmente i costi di trattamento dei reflui urbani, in spazi contenuti e con ridotto impatto ambientale (non necessita infatti di vasche di decantazione dei fanghi).

**Riferimenti evento/brevetto:** brevetto nazionale n. 102017000130809

### Plant and method for treating urban waste water

**Autori:** DI IACONI C, DE SANCTIS M, FERRARA L

**Abstract ENG:** The plant allows to implement a biological process able to increase the concentration of sludge present to reduce the quantity of sludge in excess to be disposed of compared to what occurs with the plants known at the state of the art, and which allows to obtain,

in the plant outlet, a yet stabilized excess sludge, i.e. having an organic content of not less than 60%. It is able to reduce significantly the quantity of sludge which is usually produced during purification.

**Riferimenti evento/brevetto:** Brevetto internazionale: WO 2019/097463 (PCT)

### PROCESSO DI SEPARAZIONE E PURIFICAZIONE

**Autori:** Rosaria Lauceri, Graziella Chini Zittelli, Giuseppe Torzillo

**Abstract ITA:** Il brevetto riguarda un processo per la purificazione delle ficobiliproteine, cromoproteine di origine vegetale contenute in microrganismi cianobatteri ed in alcune alghe. Il processo si applica sia ad estratti di biomassa disidratata (ad esempio per liofilizzazione o essiccamento) sia ad estratti di biomassa fresca e consente di separare e purificare le ficobiliproteine contenute in essi alla purezza (P) desiderata, fino al grado analitico (P>=4). Il processo proposto è semplice, veloce e a basso costo, tutte caratteristiche che lo rendono un valido candidato per i processi di purificazione delle ficobiliproteine su scala industriale, in sostituzione ai metodi finora noti ed impiegati, costosi e con tempi di esecuzione decisamente più lunghi.

**Abstract ENG:** The patent concerns a process for the purification of phycobiliproteins, chromoproteins produced by cyanobacteria and some algae. The process applies both to dehydrated biomass extracts (for example by freeze-drying or drying) and to fresh biomass extracts; it allows to separate and purify the phycobiliproteins to the desired purity (P), up to the analytical grade (P> = 4). The proposed process is simple, fast and not expensive. These characteristics make it a valid candidate for the purification processes of phycobiliproteins on an industrial scale, as an alternative to the methods currently known, which are more expensive and long lasting.

**Riferimenti evento/brevetto:** No. Brevetto nazionale: 102018000006062. Anno di deposito 2018. Anno di concessione 2020

### Processo per la produzione di biogas tramite digestione anaerobica di fanghi di depurazione pretrattati tramite idrolisi ossidativa termo-alcalina

**Autori:** ACEBES TOSTI Lorenzo; FIORIN David; GIANICO Andrea; GALLIPOLI Agata

**Abstract ITA:** La presente invenzione riguarda un processo per la produzione di biogas, che comprende: - sottoporre un fango di depurazione ad una fase di pretrattamento che comprende, come unica fase di idrolisi, una fase di idrolisi ossidativa termo-alcalina; - sottoporre il fango così pretrattato a un processo di digestione anaerobica così da ottenere il biogas. Tale processo è

applicabile ad una vasta gamma di fanghi di depurazione urbani e industriali, in particolare su fanghi di depurazione con elevati tenori di salinità, caratterizzati da un tenore complessivo di solfati e cloruri pari o superiore a 800 mg/L. Tale processo consente di incrementare la frazione di metano all'interno del biogas prodotto, così da migliorarne la qualità in termini di resa energetica.

**Riferimenti evento/brevetto:** Domanda di brevetto n. 102020000016144 presentata in data 03/07/2020

# Progetti di ricerca

## Progetti di ricerca internazionali

### Titolo: Rotifers in small coastal dams

**Abstract ITA:** Barcoding molecolare e metabarcoding di rotiferi in ambienti acquatici lungo le coste norvegesi.

**Abstract ENG:** DNA barcoding and metabarcoding of rotifers in aquatic habitats along the shores of Norway.

**Fonte di finanziamento ITA:** ArtsProjected Norway

**Fonte di finanziamento ENG:** ArtsProjected Norway

**Coordinatore:** Øystein Nordeide Kielland, NTNU Oslo, Norway

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 2020 - 2022

### Titolo: LIFE15 NAT/IT/000823

**Acronimo:** IdroLIFE

**Abstract ITA:** Finalità del progetto: IdroLIFE prevede: a. Attività di conservazione diretta mediante ripopolamenti mirati di specie ittiche e astacicole in Direttiva Habitat 92/43 b. Deframmentazione corridoi fluviali del fiume Toce e del Torrente San Bernardino (VB). c. Divulgazione scientifica e citizen science con la popolazione locale. d. Monitoraggio funzionalità passaggi per pesci e. Contenimento specie ittiche aliene invasive

**Abstract ENG:** Conservation of fish and crayfish included in the Directive Habitat 92/43 Improvement of Tove river and San Bernardino river connectivity by building fish passages. Alien fish species control Dissemination among stakeholders and local population

**Fonte di finanziamento ITA:** Comutità Europea, programma Life Natura

**Website:** https://idrolife.eu

**Coordinatore:** Pietro Volta CNR-IRSA

**Referente IRSA:** PIetro Volta

**Periodo di attivita:** 15/11/2016 - 15/03/2022

**Titolo: Sistema informativo per il monitoraggio integrato dei laghi insubrici e dei loro ecosistemi**

**Acronimo:** SIMILE

**Abstract ITA:** Il progetto riguarda i Laghi Maggiore e Como, parte del sito LTER_EU_IT_008 – Laghi Sudalpini, ed il Lago di Lugano e vede come capofila Politecnico di Milano e Scuola Universitaria Professionale della Svizzera Italiana (SUPSI) e come partner CNR IRSA di Verbania, Regione Lombardia e Canton Ticino. Il progetto ha come obiettivo principale quello di supportare il sistema decisionale e la definizione di politiche di gestione dell'area interessata (Laghi Maggiore, Como e Lugano) tramite un sistema informativo avanzato, basato su dati provenienti da approcci e sistemi innovativi per il monitoraggio dei laghi, tra cui sensori, mappe satellitari e citizen science. Scopo di questi sistemi è quello di affiancare e supportare il monitoraggio tradizionale o discreto, estendendo le scale spaziali e temporali di indagine e sviluppando sistemi di early warning rispetto ad alcune criticità che interessano i laghi quali i bloom algali. Il progetto avrà una durata di 36 mesi e vedrà lavorare a stretto contatto Enti tecnici e di ricerca ed Enti gestionali, tramite un processo partecipato tra partner, cittadini, associazioni ed enti locali.

**Abstract ENG:** SIMILE (Italian acronym for "Integrated monitoring system for knowledge, protection and valorization of the subalpine lakes and their ecosystems), a cross-border Italian-Swiss project whose general objectives are the strengthening of the coordinated management of the water of the great subalpine lakes in the so-called Insubric region and the intensification of stakeholder participation in the processes of knowledge and monitoring of the water resource. The project fits the purpose of SDG 6 and involves administrations, monitoring agencies, universities and research centers, and citizens. SIMILE is a system where geospatial data, information, and techniques play a pivotal role. The system strongly benefits the information derived from the analysis of Sentinel 1 and Sentinel 3 imagery, in situ authoritative data, and user-contributed georeferenced data. A Business Intelligence (BI) platform, i.e. a web data-driven decision support system, will allow the integration, analysis, and synthesis of the information derived from the different types of data, heterogeneous in format, coordinate system, information content, and access method. The technologies that will be used are based on open software so as to guarantee the replicability and sustainability of the system.

**Fonte di finanziamento ITA:** Programma di Cooperazione INTERREG Italia-Svizzera 2014-2020

**Altre informazioni ITA:** Politecnico di Milano / SUPSI - Scuola universitaria professionale della Svizzera italiana /Regione Lombardia / CNR Istituto di Ricerca sulle Acque / Fondazione Politecnico di Milano / Repubblica e Cantone Ticino Importo del finanziamento € 1.145.710,00 CHF 160.733,00

**Website:** https://progetti.interreg-italiasvizzera.eu/it/b/78/sistemainformativoperilmonitoraggiointegratodeilaghiinsubriciedeiloroe

**Coordinatore:** Maria Brovelli, Politecnico di Milano

**Referente IRSA:** Michela Rogora

**Periodo di attivita:** 2019-2021

### Titolo: Programma Ricerche Limnologiche sul Lago Maggiore. Triennio 2019-2021

**Acronimo:** CIPAIS

**Abstract ITA:** Le ricerche si propongono in primo luogo di proseguire attività che, grazie al finanziamento da parte della CIPAIS, hanno consentito ad oggi di seguire l'evoluzione del Lago Maggiore in un'ottica ecosistemica, considerando gli aspetti meteo-climatici, fisici, chimici e biologici. Questo approccio multidisciplinare ed integrato ha permesso di indagare i principali processi alla base delle tendenze evolutive del lago. Nel programma di ricerca 2019-2021 sono stati introdotti alcuni approfondimenti volti ad indagare aspetti dell'ecologia del Lago Maggiore che gli organismi di controllo istituzionali non sono tenuti ad affrontare, anche mediante metodologie ed approcci innovativi, tra cui l'utilizzo della metagenomica.

**Abstract ENG:** Long-term studies on Lake Maggiore have led to the establishment of high quality time series of limnological data. Thanks to these datasets, it was possible to follow the evolution of the lake caused by both natural and anthropogenic drivers, including climate change for the last 5 decades. Data collected in 2019 implemented the time series and allowed a detailed discussion on both, seasonal and interannual changes of the main physical, chemical, and biological parameters. Beside long-term research, some in-depth investigations, based on innovative methodologies and novel approaches, started in 2019 in order to better understand the ecological functioning of the ecosystem of the lake and of its basin.

**Fonte di finanziamento ITA:** Accordo di collaborazione. Finanziamento della Commissione Internazionale per la Protezione delle Acque Italo-Svizzere (CIPAIS)

**Altre informazioni ITA:** Importo finanziamento per il triennio 2019-2021: 63Attività di docenza0

**Website:** http://www.cipais.org/

**Coordinatore:** Michela Rogora

**Referente IRSA:** Michela Rogora

**Periodo di attivita:** 2019-2021

**Titolo: Programma Cooperativo Internazionale ONU-ECE ICP WATERS (International Cooperative Programme on Assessment and Monitoring Effects of Air Pollution on Rivers and Lakes), sotto l'egida della Convenzione per il Trasporto a Lungo Raggio degli Inquinanti atmosferici (CLRTAP)**

**Acronimo:** ICP WATERS

**Abstract ITA:** Il Programma ONU-ECE ICP WATERS è stato lanciato nel 1985 con l'obiettivo di valutare gli effetti dell'inquinamento atmosferico sulle acque superficiali, in particolare per quanto concerne acidificazione, metalli pesanti e composti organici persistenti. Obiettivi specifici: (i) valutare l'estensione geografica e l'entità degli impatti dell'inquinamento atmosferico, in particolare dell'acidificazione, sulle acque superficiali; (ii) raccogliere dati sulla relazione dose/risposta; (iii) descrivere e valutare i trend a lungo termine nella chimica e biologia delle acque attribuibili all'inquinamento atmosferico; (iV) promuovere un'armonizzazione internazionale delle pratiche di monitoraggio.

**Abstract ENG:** The ICP Waters programme was established in 1985 with the specific objective of assessing the degree to which atmospheric pollution has affected surface waters, particularly with regard to issues such as acidification, heavy metals and persistent organic pollutants. Aims and objectives: (i) Assess the degree and geographic extent of the impact of atmospheric pollution, in particular acidification, on surface waters; (ii) collect information to evaluate dose/response relationships; (iii) describe and evaluate long-term trends and variations in aquatic chemistry and biota attributable to atmospheric pollution; (iv) maintain and develop an international network of surface water monitoring sites; (iv) promote international harmonisation of monitoring practices.

**Descrizione estesa ITA:** Ruolo svolto: Rappresentante del National Focal Center italiano Attività svolta: coordinamento delle attività di campionamento ed analisi dei siti italiani afferenti al Programma e validazione dei risultati; collaborazione con il Centro di Coordinamento del Programma (NIVA di Oslo) e con i National Focal Center nazionali, interazione con il Ministero dell'Ambiente, referente per i Programmi ONU-ECE; presenza ai meeting annuali della Task Force; partecipazione alle elaborazioni congiunte di dati e alla produzione di report e articoli scientifici.

**Fonte di finanziamento ITA:** The programme is financed by the Norwegian Environment Agency and UNECE

**Fonte di finanziamento ENG:** The programme is financed by the Norwegian Environment Agency and UNECE

**Website:** http://www.icp-waters.no/

**Coordinatore:** Heleen de Wit (Chair), Kari Austnes (Head of Programme Centre), Norwegian Institute for Water Research (NIVA)

**Referente IRSA:** Michela Rogora

**Periodo di attivita:** Programma cooperativo a lungo termine

**Titolo: Caratterizzazione idrogeologica dell'area di Pwales Valley/Hydrogeological Characterisation of the Pwales Groundwater Body**

**Acronimo:** MaltaMAR

**Abstract ITA:** L'Agenzia per l'energia e l'acqua (EWA) di Malta sta progettando di sviluppare un programma pilota di Managed Aquifer Recharge (MAR) nella Pwales Valley per migliorare lo stato quantitativo e qualitativo del corpo idrico sotterraneo. Lo scopo del progetto è quello di caratterizzare dal punto di vista idrogeologico la falda acquifera costiera di Pwales per pianificare correttamente il primo impianto MAR dell'isola. Questo impianto rappresenterà l'impianto pilota per i futuri impianti MAR di Malta.

**Abstract ENG:** The Energy and Water Agency (EWA) of Malta is planning to develop a pilot Managed Aquifer Recharge (MAR) scheme in Pwales Valley to improve the quantitative and qualitative status of the groundwater body. The aim of the project is to characterize from the hydrogeological point of view the coastal Pwales aquifer to correctly plan the first MAR plant of the island. This plant will represent the pilot plant for the future MAR plants in Malta.

**Fonte di finanziamento ITA:** L'Agenzia per l'energia e l'acqua (EWA), agenzia governativa di Malta

**Fonte di finanziamento ENG:** The Energy and Water Agency (EWA), an agency of the Government of Malta

**Coordinatore:** Caputo Maria Clementina

**Referente IRSA:** Caputo Maria Clementina

**Periodo di attivita:** 15/10/2020-15/01/2022

**Titolo: Infrastruttura di ricerca LifeWatch-ITA, componente italiana dell'infrastruttura europea LifeWatch (ESFRI)**

**Acronimo:** LifeWatch-ITA

**Abstract ITA:** Infrastruttura Europea di e-Science su biodiversità ed ecosistemi con obiettivo il rafforzamento della ricerca scientifica sulla biodiversità costruendo sulla rete ambienti di Laboratorio Virtuale flessibili ed avanzati. L'infrastruttura si basa su scienza e tecnologia ICT e comprende risorse strumentali che hanno tre componenti essenziali: i dati, che l'infrastruttura rende disponibili capitalizzando studi e ricerche già svolte, gli strumenti necessari a gestire i dati in

termini di standardizzazione, integrazione ed interoperabilità, i servizi necessari ad utilizzare i dati per le sperimentazioni proposte, in termini di analisi numerica, modellistica e grafica, di presentazione, pubblicazione e disseminazione dei risultati. Si propone quindi di cooperare con le iniziative che raccolgono e gestiscono i dati e con i fornitori di dati per offrire ai ricercatori accesso a dati disponibili con tipologia, scala, densità e livello di replicazione appropriati ad affrontare domande innovative che vadano oltre i confini delle discipline.

**Abstract ENG:** European e-Science infrastructure on biodiversity and ecosystems with the aim of strengthening scientific research on biodiversity by building flexible and advanced Virtual Laboratory environments on the network. The infrastructure is based on ICT science and technology and includes instrumental resources that have three essential components: the data, which the infrastructure makes available by capitalizing on studies and research already carried out, the tools necessary to manage data in terms of standardization, integration and interoperability, the services necessary to use the data for the proposed trials, in terms of numerical analysis, modeling and graphics, presentation, publication and dissemination of results. It therefore proposes to cooperate with initiatives that collect and manage data and with data providers to offer researchers access to available data with the type, scale, density and level of replication appropriate to address innovative questions that go beyond the boundaries of disciplines.

**Rilevanza scientifica e risultati ITA:** LifeWatch Italia ha proposto a livello Europeo il caso di studio Ecosystem vulnerability to invasive and alien species attraverso il quale testare i prodotti sviluppati dai Centri Tematici di cui dispone (Collezioni, Interazioni, Mediterraneo e Biomolecolare). I prodotti consistono in mappe di distribuzione biogeografica di specie, facilities per lo scaricamento di dati da web server, modelli ecologici, facilities per la gestione di dati e collezioni museali, workflows, R script, etc il CNR-IRSA di Verbania gestisce le attività relative alle acque dolci: • promuovendo sessioni tematiche a convegni nazionale e internazionali, • pubblicando manoscritti scientifici per testare i prodotti sviluppati, • contribuendo al controllo qualitativo del data set italiano relativo alle acque dolci e alle specie aliene tramite il coinvolgimento degli esperti tassonomi presenti al suo interno • contribuendo alla messa a punto del Thesaurus sulle specie aliene online sul sito web di LifeWatch

**Rilevanza scientifica e risultati ENG:** LifeWatch Italy has proposed at European level the Ecosystem vulnerability to invasive and alien species case study through which to test the products developed by the Thematic Centers at its disposal (Collections, Interactions, Mediterranean and Biomolecular). The products consist of biogeographical distribution maps of species, facilities for downloading data from web servers, ecological models, facilities for managing data and museum collections, workflows, R scripts, etc. the CNR-IRSA of Verbania manages the activities relating to fresh water: • promoting thematic sessions at national and international conferences, • publishing scientific manuscripts to test the developed products, • contributing to the quality control of the Italian data set relating to freshwater and alien species through the involvement of the expert taxonomists present within it • contributing to the development of the Thesaurus on Alien Species online on the LifeWatch website

**Fonte di finanziamento ITA:** MIUR, tramite assegnazione FOE

**Fonte di finanziamento ENG:** MIUR, through FOE assignment

**Altre informazioni ITA:** Università del Salento  Università di Bari  CNR IRET  CNR IREA  CNR-ISMAR  € 4.900.000

**Altre informazioni ENG:** Università del Salento  Università di Bari  CNR IRET  CNR IREA  CNR-ISMAR  € 4.900.000

**Website:** https://www.lifewatch.eu/italy

**Coordinatore:** Alberto Basset, Università del Salento

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 2010 - oggi

**Titolo: Il Lago Maggiore, il Fiume Ticino sublacuale e le aree naturali protette. Verifica e sperimentazione di scenari di gestione sostenibili e condivisi**

**Acronimo:** Interreg PVT

**Abstract ITA:** Le attività prevedono l'esecuzione di rilievi e analisi relativamente a specie target del Lago Maggiore in funzione della gestione dei livelli per verificare l'insorgenza di effetti negativi sullo stato di conservazione degli habitat. Il CNR IRSA si occupa dello studio delle componenti di macro- e meiofauna bentonica e bivalvi bioindicatrici di qualità dell'ecosistema per mettere a punto indici di impatto finalizzati alla valutazione degli effetti delle variazioni di livello.

**Abstract ENG:** The activities provide for the execution of surveys and analyzes relating to target species of Lake Maggiore according to the management of levels to verify the occurrence of negative effects on the conservation status of the habitats. The CNR IRSA deals with the study of the components of benthic macro- and meiofauna and bivalve bioindicators of ecosystem quality to develop impact indices aimed at assessing the effects of level changes.

**Rilevanza scientifica e risultati ITA:** Nel 2019 sono stati raccolti a analizzati 36 campioni di macrofauna e 36 campioni di meiofauna lungo transetti distribuiti dalla riva ad una profondità massima di 1,2 m in siti soggetti a diverso grado di esposizione alla variabilità del livello con la stagione estiva. I Molluschi sono stati campionati negli stessi siti solamente in settembre 2019 a profondità maggiori (comprese fra 50 cm e 5 m). Le analisi sono ancora in corso

**Rilevanza scientifica e risultati ENG:** In 2019, 36 macrofauna and 36 meiofauna samples along transects distributed from the shore to a maximum depth of 1.2 m were collected and analyzed in sites subject to different degrees of exposure to the variability of the level with the summer season. Mollusks were sampled in the same sites only in September 2019 at greater depths (between 50 cm and 5 m). The analyzes are still ongoing

**Fonte di finanziamento ITA:** Progetto di cooperazione Interreg V-A Italia-Svizzera 2014-2020

**Fonte di finanziamento ENG:** Progetto di cooperazione Interreg V-A Italia-Svizzera 2014-2020

**Altre informazioni ITA:** Ente di gestione delle aree protette del Ticino e del Lago Maggiore Parco Lombardo della valle del Ticino Consorzio del Ticino Università degli Studi dell'Insubria, Dipartimento di Scienze Teoriche e Applicate Riserva Naturale Pian di Spagna – Lago di Mezzola Fondazione Bolle di Magadino, Svizzera € 250.004,77

**Altre informazioni ENG:** Ente di gestione delle aree protette del Ticino e del Lago Maggiore Parco Lombardo della valle del Ticino Consorzio del Ticino Università degli Studi dell'Insubria, Dipartimento di Scienze Teoriche e Applicate Riserva Naturale Pian di Spagna – Lago di Mezzola Fondazione Bolle di Magadino, Svizzera € 250.004,77

**Website:** https://progetti.interreg-italiasvizzera.eu/it/b/78/illagomaggioreilfiumeticinosublacualeeleareenaturaliprotetteverificaes

**Coordinatore:** Ente di gestione delle aree protette del Ticino e del Lago Maggiore

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 2019-2022

## Titolo: Unlocking wastewater treatment, water re-use and resource recovery opportunities for urban and periurban areas in India

**Acronimo:** Pavitra Ganga

**Abstract ITA:** Le risorse idriche dell'India sono sottoposte a un forte stress derivante dallo sfruttamento eccessivo e dall'inquinamento. Il governo indiano ha avviato il programma Namami Gange in linea con gli obiettivi di sviluppo sostenibile (SDG), compreso il miglioramento del trattamento delle acque reflue. PAVITRA GANGA si collega direttamente a questi programmi e si basa sulla cooperazione esistente tra UE / India, sostenuta dai governi nazionali. L'obiettivo è soddisfare l'SDG6 sbloccando il potenziale ambientale ed economico delle soluzioni di trattamento e riutilizzo delle acque reflue municipali per le aree urbane e periurbane in India. Il massimo impatto verrà ottenuto attraverso i tre pilastri principali del progetto: - creare consapevolezza sociale attraverso un approccio di monitoraggio partecipativo; prendere di mira i gruppi sociali vulnerabili fornendo soluzioni di trattamento per fognature aperte; creare una comunità di professionisti mediante la creazione di siti di test sull'innovazione aperta e una rete di formazione e apprendimento. - concentrarsi sul ripristino ambientaledel fiume rimuovendo inquinamento organico, metalli pesanti e composti emergenti che hanno il maggiore impatto sui corsi d'acqua indiani; fornire innovazioni tecnologiche per aggiornare l'infrastruttura esistente delle acque reflue e migliorare i sistemi di trattamento con recapito negli scarichi aperti, con conseguente miglioramento della qualità dei fiumi riceventi. - applicare i principi dell'Economia Circolare e sfruttare le opportunità economiche della termovalorizzazione, del riutilizzo dell'acqua e del

recupero delle risorse. In collaborazione con le parti interessate locali e con il supporto di partner industriali verranno realizzati due siti pilota presso il Barapullah Drain (Nuova Delhi) e l'impianto di Jajmau (Kanpur).

**Abstract ENG:** India's water resources are under severe stress resulting from overexploitation and pollution. The Indian government has started the Namami Gange programme in line with the sustainable development goals (SDG), including the improvement of wastewater treatment. PAVITRA GANGA links directly to these programmes and builds on existing cooperation between EU/India, supported by national governments. The objective is to fulfil SDG6 by unlocking the environmental and economic potential of municipal wastewater treatment and reuse solutions for urban and peri-urban areas in India. By focussing on three pillars we ensure maximum impact: - to create social awareness through a participatory monitoring approach; to target social vulnerable groups by providing treatment solutions for open drains; to create a community of practitioners by the establishment of open innovation test sites and a training & learning network. - focus on rejuvenation of the river by removing organic pollution, heavy metals and emerging compounds that have the biggest impact on Indian streams; to provide technology innovations to upgrade existing wastewater infrastructure and to add treatment systems to open drains, resulting in improved quality of receiving rivers. - to apply the principles of the Circular Economy and exploit the economic opportunities of waste-to-energy, water reuse and resource recovery. In collaboration with local stakeholders and supported by industrial partners two pilot sites at the Barapullah Drain (New Delhi) and the Jajmau plant (Kanpur) will be set-up.

**Rilevanza scientifica e risultati ITA:** Il consorzio di progetto composto da 14 partner include: - 5 istituti di ricerca dell'UE e 3 indiani con esperienza nei settori del trattamento delle acque reflue, governance dell'acqua, supporto alle politiche e monitoraggio ambientale - 3 PMI e industria dell'UE, 2 industrie indiane e 1 ONG indiana partner con esperienza nei settori del trattamento delle acque reflue, governance dell'acqua e sostegno alle politiche e monitoraggio ambientale

**Rilevanza scientifica e risultati ENG:** The 14 partner strong project consortium includes: - 5 EU and 3 Indian research institutes with expertise in the fields of wastewater treatment, water governance and policy support, and environmental monitoring - 3 EU SME and Industry, 2 Indian Industry and 1 Indian NGO partners with expertise in the fields of wastewater treatment, water governance and policy support, and environmental monitoring

**Fonte di finanziamento ITA:** EU HORIZON 2020 Call H2020-SC5-2018-2019-2020, Topic: SC5-12-2018 - EU-India water co-operation Type of action: RIA Proposal number: SEP-210495711

**Fonte di finanziamento ENG:** EU HORIZON 2020 Call H2020-SC5-2018-2019-2020, Topic: SC5-12-2018 - EU-India water co-operation Type of action: RIA Proposal number: SEP-210495711

**Altre informazioni ITA:** Importo totale finanziamento 4.731.647 euro Importo finanziamento per Unità Operativa 273.585 euro Periodo di attività dal 01/02/2019 al 31/01/2023 IRSA contribuisce al WP3 nello sviluppo di tecnologie di trattamento delle acque reflue urbane per la produzione di effluenti che possono essere riutilizzati e nel WP5 dove queste tecnologie vengono testate su scala pilota. IRSA contribuisce anche alle attività del WP4 con particolare riferimento al Task 4.3 in cui vengono svolte attività di modellistica a scala di bacino e regionale al fine di valutare gli effetti di scenari gestionali e / o tecnologici alternativi adottati o proposti. Nel WP4 IRSA

contribuisce anche allo sviluppo dello strumento web-based che fornisce i risultati dell'attività di modellazione. Nel WP6 IRSA fornisce input ai workshop della rete di apprendimento fornendo formazione ai gestori delle risorse idriche sull'SFD-MBR a basso costo e a basso consumo energetico e sul dashboard WQ.

**Altre informazioni ENG:** Total EU funding 4.731.647 euro Funding for IRSA 273.585 euro From 01/02/2019 to 31/01/2023 IRSA contributes to WP3 in the development of urban wastewater treatment technologies for the production of effluents that can be reused, and in WP5 where these technologies are tested at the pilot scale. CNR-IRSA also contributes to WP4 activities with special reference to the Task 4.3 in which modelling activities are carried out at river basin and regional scale in order to assess the effects of adopted or proposed alternative management and/or technological scenarios. Within WP4 IRSA also contributes to the development of the proposed mapping deliverables and the web-based tool providing the outcomes of the modelling activity. In WP6 IRSA provides input to the Learning Network workshops providing training to water managers on the low-cost, low energy SFD-MBR and the WQ Dashboard.

**Website:** https://pavitra-ganga.eu/

**Coordinatore:** Paul Campling, VITO (Belgium)

**Referente IRSA:** Alfieri Pollice

**Periodo di attivita:** 01/02/2019 - 31/01/2023

**Titolo: Environmental Cooperation Iran – Enhancing self-reliance in addressing challenges related to water re-sources management, air quality, waste management, and the marine environment in Iran**

**Acronimo:** EUIP

**Abstract ITA:** l degrado ambientale è un grave problema in Iran. Il paese deve affrontare sfide profonde, che comprendono scarsità d'acqua, inquinamento atmosferico, cattiva gestione dei rifiuti e pressione sugli ecosistemi marini. Le sfide sono il risultato di una combinazione di crescenti effetti del cambiamento climatico e di una gestione domestica non ottimale. Gli impatti influenzano negativamente il potenziale di sviluppo socioeconomico del paese se non viene aumentata l'efficacia della gestione ambientale. L'UE e l'Iran hanno deciso di cooperare in materia di protezione ambientale nel 2016 nell'ambito di una misura speciale sul sostegno allo sviluppo sostenibile. L'obiettivo generale del programma è migliorare le capacità di gestione ambientale collaborativa e partecipativa del governo iraniano. Il programma mira a migliorare la qualità e l'attuazione delle politiche esistenti per la gestione sostenibile di (1) acqua, (2) aria, (3) rifiuti e (4) ambiente marino. Esperti di otto istituzioni europee insieme a esperti iraniani del Ministero dell'Energia e del Dipartimento dell'Ambiente e altre organizzazioni competenti esaminano la legislazione ambientale, le procedure di pianificazione e gli standard tecnici. Gli aspetti relativi al cambiamento climatico sono considerati per le politiche settoriali. In due regioni pilota, vengono rafforzati i processi

orientati alle parti interessate per l'implementazione della gestione integrata dell'acqua, nonché per la qualità dell'aria e la gestione dei rifiuti solidi. Le esperienze della sperimentazione vengono utilizzate per supportare i partner iraniani nella revisione delle politiche nazionali. Tramite i partner iraniani, i risultati saranno resi disponibili in tutto il paese. Il programma è progettato per un periodo di 3 anni. L'implementazione è iniziata nel gennaio 2020. Questa azione multi-donatore è cofinanziata congiuntamente dall'Unione europea e dal Ministero Federale tedesco per l'ambiente, la conservazione della natura e la sicurezza nucleare (BMU). GIZ è incaricato dalla BMU dell'attuazione del programma insieme ai Partner Europei Environment Agency Austria (UBA), Finnish Meteorological Institute (FMI), Finnish Environment Institute (SYKE), International Office for Water (OIEau), Istituto di Ricerca sulle Acque IRSA-CNR, The Energy & Water Agency – Ministry for Energy and Water Management Malta (EWA), e l'Istituto di Ricerca sull'Inquinamento Atmosferico CNR-IIA.

**Abstract ENG:** Environmental degradation is a major problem in Iran. The country faces profound chal-lenges, which comprise water scarcity, air pollution, poor waste management, and pressure on marine ecosystems. The challenges are the result of a combination of both increasing climate change-effects and sub-optimal domestic management. The impacts negatively affect the socioeconomic development potential of the country if effectiveness of environ-mental management is not increased. The EU and Iran decided to cooperate on environmental protection in 2016 under a Special Measure on Support to Sustainable Development. The programme's overarching goal is to improve collaborative and participatory environmental management capacities of the Irani-an government. The programme aims to enhance the quality and implementation of exist-ing policies for sustainable management of (1) water, (2) air, (3) waste, and (4) marine envi-ronment. Experts from eight European institutions jointly with Iranian experts from the Minis-try of Energy and the Department of Environment and further relevant organisations review environmental legislation, planning procedures and technical standards. Climate change related aspects are considered for the sectoral policies. In two pilot regions, stakeholder oriented processes for the implementation of integrated water management as well as for air quality and solid waste management are strengthened. Experiences from the piloting are used to support the Iranian partners in revising national policies. Via the Iranian part-ners, results are to be made available across the entire country.The programme is de-signed for a period of 3 years. Implementation is intended to start in January 2020. This Multi-donor Action is jointly co-financed by the European Union and the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). GIZ is commissioned by the BMU with the implementation of the programme along with the Euro-pean Implementing Partners Environment Agency Austria (UBA), Finnish Meteorological Institute (FMI), Finnish Environment Institute (SYKE), International Office for Water (OIEau), Water Research Institute (CNR-IRSA), The Energy & Water Agency – Ministry for Energy and Water Management Malta (EWA), and the Institute of Atmospheric Pollution Research (CNR-IIA).

**Fonte di finanziamento ITA:** EC DG DEVCO Ministo Federale Tedesco per l'ambiente, la conservazione della natura e la sicurezza nucleare (BMU)

**Fonte di finanziamento ENG:** EC DG DEVCO German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)

**Altre informazioni ITA:** Importo totale finanziamento 8.500.000 euro (8.5 Milioni euro) Importo finanziamento per Unità Operativa 500.000 euro (0.5 Milioni euro)

**Altre informazioni ENG:** Total Funding 8.500.000 euro Funding for IRSA 500.000 euro

**Coordinatore:** George-Sebastian Holzer - GIZ (Germany)

**Referente IRSA:** Antonio Lo Porto

**Periodo di attivita:** 18/12/2019 - 18/12/2023

**Titolo: Integrated services and approaches for Assessing effects of climate change and extreme events for fire and post fire risk prevention**

**Acronimo:** SERV-FORFIRE

**Abstract ITA:** Gli obiettivi principali del progetto SERV_FORFIRE sono fornire servizi integrati per la valutazione degli incendi e strategie di mitigazione, su scale temporali climatiche (da scale temporali stagionali a scale temporali più lunghe), per creare un ponte tra osservazioni, sviluppo di modelli, prodotti operativi, traduzione di informazioni e utilizzo da parte degli utenti . Il progetto SERV_FORFIRE contribuirà a creare una comunità collaborativa internazionale di fornitori di informazioni sul clima, esperti in telerilevamento, suolo e vegetazione, gestione e mitigazione del rischio, insieme a utenti, responsabili delle decisioni e autorità di pianificazione al fine di: - rafforzare il nesso scienza-politica-società utilizzando un approccio partecipativo, migliorando i servizi climatici già operativi o sperimentalmente testati in Europa, adattando le informazioni pertinenti per i decisori e i responsabili politici attraverso un approccio partecipativo e circolare, strumenti incentrati sull'utente per lo sviluppo di capacità, programmi di formazione specifici , attività di divulgazione, - aumentare l'efficienza della risposta delle autorità decisionali e dei responsabili politici, per migliorare il livello di preparazione delle nostre società e per limitare l'elevato costo economico dell'impatto della variabilità climatica sui rischi di incendio e post incendio, sviluppare metodi e procedure specifiche nell'ambito di incendi e post incendi gestione del rischio in Europa su scale temporali climatiche (da scale temporali stagionali a scale temporali più lunghe). Uno dei principali obiettivi di SERV_FORFIRE è migliorare la qualità dei servizi e degli approcci per la valutazione degli effetti dei cambiamenti climatici su incendi e post incendi per rischio al fine di definire strategie adeguate per azioni di prevenzione e mitigazione. Gli strumenti e le metodologie sviluppati nel quadro del progetto SERV_FORFIRE consentiranno un'armonizzazione integrata, valutazione comparativa e adattamento delle previsioni meteorologiche osservative (informazioni ausiliarie, telerilevamento, analisi in situ, copertura del suolo, ecc.) (Stagionali e settimanali fino a climatiche) modelli e dati climatici derivati che migliorano il contenuto informativo di questi prodotti. Le attività sinergiche e complementari di tutti i partner coinvolti nel consorzio SERV_FORFIRE porteranno allo sviluppo di un portafoglio di prodotti "fuoco e post incendio" migliorato e integrato, complementare a quanto EFFIS (da JRC- http://forest.jrc.ec.

europa.eu/effis/) e Copernicus Climate Change. Il servizio fornirà regolarmente per la gestione degli incendi (http://emergency.copernicus.eu/mapping/sites/default/files/files/00d_EMS%20Dec%202014%20REA.pdf) o http://www.gisprocess.com/presentationer_2015/Copernicus_klimatGIS_TKL.pdf). Nell'ambito del progetto SERV_FORFIRE, i rischi e i disturbi causati da incendi e post incendio saranno modellati su più scale spaziali e temporali da scale temporali stagionali a scale temporali più lunghe e verranno sviluppate e impostate procedure di stima

**Abstract ENG:** The main objectives of SERV_FORFIRE project is to provide integrated services for forest fire assessment and mitigation strategies, at climatic time scales (from seasonal to longer time scales), to create a bridge between observations, model development, operational products, information translation and user uptake. SERV_FORFIRE project will contribute at creating an international collaborative community of climate information providers, expert in remote sensing, soil and vegetations, risk management and mitigation, along with users, decision makers and planning authorities in order to: - strengthen the science-policy-society nexus using a participatory approach, by improving already operational or experimentally tested climate services in Europe, tailoring relevant information for decision and policy makers through a participative and circular approach, capacity building user centric tools, specific training programs, dissemination activities, - increase efficiency of decision and policy makers authorities response, to improve the preparedness level of our societies and to limit the high economic cost of climate variability impact on fire and post fire risks, develop methods and specific procedures within the framework of fire and post fire risk management in Europe at climatic time scales (from seasonal to longer time scales). One of the main objectives of SERV_FORFIRE is to improve quality of services and approaches for assessing effects of climate change on fire and post fire for risk in order to define suitable strategies for prevention and mitigation actions. The tools and methodologies developed in the framework of SERV_FORFIRE project will enable an integrated harmonization, benchmarking evaluation and tailoring of observational (ancillary information, remote sensing, in situ analysis, land cover, etc.) weather forecasting (seasonal and weekly up to climatic) models and derived climate data enhancing the information content of these products. The synergic and complementary activities of all the partners involved in the SERV_FORFIRE consortium will lead to the development of an improved and integrated “fire and post fire” product portfolio complementary to what EFFIS (from JRC- http://forest.jrc.ec.europa.eu/effis/) and the Copernicus Climate Change. Service will routinely deliver for fire management (http://emergency.copernicus.eu/mapping/sites/default/files/files/00d_EMS%20Dec%202014%20REA.pdf) or http://www.gisprocess.com/presentationer_2015/Copernicus_klimatGIS_TKL.pdf). In the framework of SERV_FORFIRE project, fire occurrence and post fire induced risks and disturbance will be modelled at multiple spatial and temporal scales from seasonal to longer time scales and estimation procedures will be developed and setup.

**Fonte di finanziamento ITA:** ERANET ERA4CS

**Fonte di finanziamento ENG:** ERANET ERA4CS

**Altre informazioni ITA:** Importo totale finanziamento 1.200.112 euro Importo finanziamento per Unità Operativa 166.667 euro

**Altre informazioni ENG:** Total funding 1.200.112 euro  Funding for IRSA 166.667 euro

**Website:** https://servforfire-era4cs.eu/

**Coordinatore:** Rosa Lasaponara - IMAA-CNR

**Referente IRSA:** Antonio Lo Porto

**Periodo di attivita:** 15/09/2017 - 14/03/2021

### Titolo: Implementing nature-based solutions for creating a resourceful circular city

**Acronimo:** Cost Action CA17133 Circular Cities

**Abstract ITA:** Questa azione COST mira a stabilire una rete per testare l'ipotesi che: "Un sistema di flusso circolare che implementa Nature Base Solutions per la gestione di nutrienti e risorse all'interno della biosfera urbana porterà a un ambiente urbano resiliente, sostenibile e sano". Per affrontare questa sfida, cinque gruppi di lavoro (WG) danno il loro contributo alla chiusura del ciclo delle risorse all'interno della biosfera urbana. I cinque gruppi di lavoro tratteranno l'ambiente costruito, l'acqua urbana, il recupero delle risorse, l'agricoltura urbana e gli strumenti di trasformazione che collegano i gruppi di lavoro e l'impatto socioeconomico.

**Abstract ENG:** This COST Action aims to establish a network testing the hypothesis that: “A circular flow system that implements Nature Base Solutions for managing nutrients and resources within the urban biosphere will lead to a resilient, sustainable and healthy urban environment”. To tackle this challenge five working groups (WGs) give their contribution on closing the resource cycle within the urban biosphere. The five WGs will deal with the built environment, urban water, resource recovery, urban farming and transformation tools connecting the WGs and the socio-economic impact.

**Rilevanza scientifica e risultati ITA:** Responsabile Unità Operativa  Rappresentante Nazionale nel Management Committee (Nomina MIUR)

**Fonte di finanziamento ITA:** EU COST

**Fonte di finanziamento ENG:** EU COST

**Altre informazioni ITA:** Altri partner italiani o stranieri del progetto  39 Nazioni dell’area COST; 5 Nazioni “COST Near Neighbour Countries”; 2 Nazioni “COST International Partner Countries”

**Altre informazioni ENG:** Other Partners:  39 Countries in the COST Area; 5 Countriesi “COST Near Neighbour Countries”; 2 Countries “COST International Partner Countries”

**Website:** https://circular-city.eu/

**Coordinatore:** Gunter Langergraber - Boku University (Austria)

**Referente IRSA:** Antonio Lo Porto

**Periodo di attivita:** 22/10/2018 - 21/10/2022

### Titolo: Payments for Ecosystem Services (Forests for Water)

**Acronimo:** CA15206 - PESFOR-W

**Abstract ITA:** È necessario sviluppare nuovi strumenti economici, in combinazione con l'ottimizzazione spaziale, per garantire la realizzazione di soluzioni economicamente vantaggiose, compresa la piantumazione di alberi a vantaggio dell'acqua. I pagamenti per i servizi ecosistemici (SPI) sono meccanismi flessibili basati su incentivi che potrebbero svolgere un ruolo importante nella promozione del cambiamento dell'uso del suolo per raggiungere obiettivi di qualità dell'acqua. L'azione PESFOR-W COST consoliderà l'apprendimento dai boschi esistenti per i sistemi PES dell'acqua in Europa e aiuterà a standardizzare gli approcci per valutare l'efficacia ambientale e il rapporto costo-efficacia delle misure relative ai boschi. Creerà anche una rete europea attraverso la quale gli schemi SPI possono essere agevolati, estesi e migliorati, ad esempio incorporando altri servizi ecosistemici collegati agli obiettivi del più ampio nesso della politica foreste-carbonio.

**Abstract ENG:** New economic instruments, in combination with spatial targeting, need to be developed to ensure cost-effective solutions - including tree planting for water benefits - are realised. Payments for Ecosystem Services (PES) are flexible, incentive-based mechanisms that could play an important role in promoting land use change to deliver water quality targets. The PESFOR-W COST Action will consolidate learning from existing woodlands for water PES schemes in Europe and help standardize approaches to evaluating the environmental effectiveness and cost-effectiveness of woodland measures. It will also create a European network through which PES schemes can be facilitated, extended and improved, for example by incorporating other ecosystem services linking with aims of the wider forests-carbon policy nexus.

**Rilevanza scientifica e risultati ITA:** 33 Nazioni dell'area COST; 5 Nazioni "COST Near Neighbour Countries"; 3 Nazioni "COST International Partner Countries"; International Organisations OECD, European Forest Institute

**Rilevanza scientifica e risultati ENG:** 33 Countries in the COST area; 5 Countries "COST Near Neighbour Countries"; 3 Countries "COST International Partner Countries"; International Organisations OECD, European Forest Institute

**Fonte di finanziamento ITA:** EU COST

**Fonte di finanziamento ENG:** EU COST

**Website:** https://www.forestresearch.gov.uk/research/pesforw/

**Coordinatore:** Gregory Valatin - Forest Research (UK)

**Referente IRSA:** Antonio Lo Porto

**Periodo di attivita:** 18/10/2016 - 17/04/2021

**Titolo: LIFE project PHOENIX "Perfluorinated compounds HOlistic ENvironmental Interistitutional eXperience**

**Acronimo:** LIFE project PHOENIX

**Abstract ITA:** • Istituire una Commissione Regionale Permanente supportata da un panel di esperti, che, attraverso linee guida per la prevenzione del rischio sanitario e ambientale, implementi misure di policy e azioni di prevenzione dei problemi causati da contaminazioni da sostanze organiche mobili e persistenti detti PMOC (PFAS a catena corta in particolare). • Fornire strumenti rapidi per prevenire eventi di contaminazione da PMOC, utilizzando metodi basati sull'analisi del rischio. • Fornire strategie di mitigazione, attraverso tecnologie innovative e naturali. • Rendere più consapevoli la popolazione e i diretti interessati dell'importanza di un efficace sistema di protezione e prevenzione della risorsa idrica. mediante le seguenti azioni: • Adottare, attraverso la Commissione Regionale Permanente, il panel di esperti, linee guida e protocolli di prevenzione, controllo e gestione delle problematiche relative alla contaminazione da PMOC. • Costruire un datawarehouse e un portale web di consultazione immediata, disponibili agli addetti ai lavori. • Dimostrare l'efficacia di metodi tecnologici innovativi (resine a scambio ionico) per l'acqua potabile. • Provare l'efficacia dell'azione di mitigazione (fitodepurazione) dell'impianto pilota su scala reale in 3 aree umide del Veneto. • Verificare la possibilità di "early warning", attraverso la valutazione dell'assunzione dei PMOC dispersi in ambiente in organismi bioindicatori animali (terricoli e acquatici) e vegetali, e conseguenti stati di stress.

**Abstract ENG:** • Establish a Permanent Regional Commission supported by a panel of experts, which, through guidelines for the prevention of health and environmental risk, implements policy measures and actions to prevent problems caused by contamination by mobile and persistent organic substances called PMOC (PFAS short chain in particular). • Provide rapid tools to prevent PMOC contamination events, using methods based on risk analysis. • Provide mitigation strategies, through innovative and natural technologies. • Make the population and those directly involved more aware of the importance of an effective system of protection and prevention of the water resource. through the following actions: • To adopt, through the Permanent Regional Commission, the panel of experts, guidelines and protocols for the prevention, control and management of problems relating to PMOC contamination. • Building a data warehouse and a web portal for immediate consultation, available to professionals. • Demonstrate the effectiveness of innovative technological methods (ion exchange resins) for drinking water. • Test the effectiveness of the mitigation action (phytodepuration) of the pilot plant on a full scale in 3 wetlands of Veneto. •

Verify the possibility of "early warning", through the assessment of the intake of PMOC dispersed in the environment in animal (terrestrial and aquatic) and plant bioindicator organisms, and consequent status of stress.

**Fonte di finanziamento ITA:** European Commission: LIFE16-ENV_IT_000488

**Fonte di finanziamento ENG:** European Commission: LIFE16-ENV_IT_000488

**Altre informazioni ITA:** Coordinatore: Regione Veneto, Partner: ARPAV, Università di Padova, Azienda Zero

**Website:** https://www.lifephoenix.eu

**Coordinatore:** Regione Veneto

**Referente IRSA:** Stefano Polesello

**Periodo di attivita:** dal 18/09/2017 al 31/03/21

### Titolo: Graphene Flagship Spearhead Project SH1

**Acronimo:** GRAPHIL

**Abstract ITA:** Produzione di filtri innovativi a base di materiali polimero-grafene compositi per il trattamento di acque domestiche e per dispositivi portatili per la purificazione dell'acqua. In particolare, obiettivo è di sfruttare le proprietà del grafene per la rimozione di inquinanti emergenti (farmaci, additivi, prodotti per l'igiene e la cura personale, pigmenti, 'endocrine disruptors'), di difficile eliminazione con i trattamenti convenzionali, dalle acque potabili. Il CNR e gli altri partners accademici supporteranno Medica e gli altri partners industriali di GRAPHIL (Polymem, FR e ICON-LifeSAver (UK) nello sviluppo industriale dei materiali filtranti, nella loro caratterizzazione e integrazione nei dispositivi commerciali finiti.

**Abstract ENG:** Production of innovative filters based on polymer-graphene composite materials for the treatment of domestic water and for portable devices for water purification. In particular, the objective is to exploit the properties of graphene for the removal of emerging pollutants (drugs, additives, hygiene and personal care products, pigments, 'endocrine disruptors'), which are difficult to eliminate with conventional treatments, from water. drinking. CNR and other academic partners will support Medica and other industrial partners of GRAPHIL (Polymem, FR and ICON-LifeSAver (UK) in the industrial development of filter materials, in their characterization and integration in finished commercial devices.

**Fonte di finanziamento ITA:** EU Project, 881603-GrapheneCore3-H2020-SGA-FET-GRAPHENE-2019

**Fonte di finanziamento ENG:** EU Project, 881603-GrapheneCore3-H2020-SGA-FET-GRAPHENE-2019

**Altre informazioni ENG:** Medica S.p.A. (IT, coordinator), Polymem (FR), Culligan Italia S.p.A., ICON-Lifesaver (UK), University of Manchester (UK), Chalmers University of technology (SE).

**Coordinatore:** Medica S.p.A.

**Referente IRSA:** Barbara Casentini

**Periodo di attivita:** 24/07/2019-23/07/2022

## Titolo: INDAGINI SULLE SOSTANZE PERICOLOSE NELL'ECOSISTEMA DEL LAGO MAGGIORE

**Acronimo:** CIPAIS DDT

**Abstract ITA:** In questo nuovo triennio di indagini sulle sostanze pericolose nell'ecosistema del Lago Maggiore l'aspetto più innovativo è rappresentato dalla sperimentazione dei cosiddetti "effect-based tools" (capitoli 9, 10 e 11). Infatti, nel programma delle attività del 2019 è stato deciso di integrare in via sperimentale le informazioni provenienti dalle analisi chimiche dei sedimenti e del biota con indagini ecotossicologiche sui loro effetti, basate sul "biomarker approach", che permette di evidenziare gli eventi intermedi tra l'esposizione dell'organismo all'inquinante e l'osservazione del danno biologico, attraverso l'esame di possibili alterazioni biochimiche, fisiologiche o comportamentali degli organismi. Le basi teoriche di questo approccio sono ampiamente delineate nell'introduzione al capitolo 9 del rapporto. A fianco di questa sperimentazione, è proseguito l'aggiornamento delle serie storiche acquisite nel tempo sulla presenza e la distribuzione di alcuni microinquinanti particolarmente rilevanti nell'ecosistema del Lago Maggiore.

**Abstract ENG:** In this three-year period, the most innovative aspect is represented by the experimentation of the so-called "effect-based tools", together with the updating of the time series acquired over time on the presence and distribution of some pollutants particularly relevant in the ecosystem of Lake Maggiore. The updating of the time series concerned the qualitative and quantitative analysis of dangerous substances and trace elements in fish, the study of the path of these substances along the trophic network, through zooplankton, and their presence in filter mollusks, typical coastal organisms, and the evaluation of the origin of the pollution through the analysis of the sediments of the tributaries.

**Rilevanza scientifica e risultati ITA:** In generale, le ricerche del 2019 hanno confermato ancora una volta l'importanza del regime idrologico per l'apporto di inquinanti al Lago Maggiore. Infatti, se la prima parte del 2018 non è stata né particolarmente piovosa né particolarmente siccitosa, vi sono stati eventi notevoli di precipitazione e di piena degli immissari durante l'autunno 2018 e nei mesi di luglio, agosto ed ottobre 2019. Questi eventi hanno portato ancora una volta all'aumento delle concentrazioni di inquinanti rilevati nel biota nel 2019, molto probabilmente a causa rilascio di

inquinanti depositati in passato nei terreni e nei sedimenti fluviali e mobilizzati rispettivamente dalle piogge intense e dagli eventi di piena. Questo quadro generale è particolarmente evidente nel caso delle analisi dei sedimenti alla foce dei tributari, che hanno lo scopo di comprendere l'origine dei microinquinanti organici e dei metalli in traccia presenti nel Lago Maggiore. La scelta dei tributari e dei composti in ciascun tributario dipende dalle conoscenze sulle pressioni gravanti nel presente e nel passato sul territorio e dalle analisi compiute in passato, che hanno permesso di escludere alcune sostanze presenti in quantità trascurabile in alcuni immissari. Ad esempio, due grandi immissari come il Ticino Immissario e il Maggia, non sono stati inclusi, in quanto in passato avevano mostrato un livello di contaminazione molto ridotto. Il DDT e i suoi metaboliti (indicati collettivamente come DDx) sono stati misurati quindi solo nel Ticino Emissario e nel Toce, a monte (Domodossola. Prata) e a valle (Bosco Tenso, Premosello, Ornavasso e Gravellona Toce) del sito industriale dove questo composto veniva prodotto. A Gravellona Toce sono stati rilevati valori piuttosto variabili, particolarmente elevati a luglio e ad ottobre, come ci si attende a seguito di intense precipitazioni, e con un'elevata frazione (> 60%) del composto parentale non metabolizzato (p,p'-DDT), indicatore di un apporto recente di inquinamento. Invece, a Bosco Tenso e Ornavasso, la concentrazione di DDx era più elevata a febbraio, dopo le intense piogge autunnali, per tornare ai valori precedenti in ottobre. La prevalenza del p,p'-DDT nella forma parentale non metabolizzata, era meno marcata che nel sedimento prelevato a Gravellona Toce in luglio. Al contrario, per gli altri composti (PCB, PBDE, HBCD, DBPDE, Hg) i valori medi erano simili o inferiori a quelli del 2018. I fiumi Boesio e Bardello rimangono comunque i tributari che contribuiscono principalmente alla contaminazione nel lago, rispettivamente da PBDE e PCB, ma anche da Hg. Inoltre, nel Tresa si conferma la presenza di una sorgente di contaminazione che ha determinato già nel 2015, picchi di concentrazione per IPA e Hg. Si deve segnalare nel caso del Boesio che nel campionamento di aprile 2019, mostra un picco di PBDE di 400 ng/g, che ripercorrendo la storia di questo fiume dal 2018, primo anno di analisi, ad oggi risulta tra i valori più elevati. Questo quadro generale è stato confermato anche dalle analisi degli invertebrati bentonici, tra cui i ditteri e i gammaridi si sono dimostrati ancora una volta come i principali accumulatori di DDx e Hg, con un pattern spaziale simile: i valori misurati erano sempre marcatamente più alti a valle del sito industriale e i valori massimi di concentrazione per entrambi i gruppi sono stati misurati a Ornavasso per i DDx e a Bosco Tenso per il mercurio. Per i DDx, nei ditteri, i valori di Bosco Tenso erano simili a quelli di Premosello, mentre nei gammaridi l'aumento verso valle era più costante, con valori a Premosello maggiori rispetto a quelli della stazione di Bosco Tenso. Analogamente, anche nei molluschi filtratori i tenori di DDx e Hg sono tornati a valori elevati, confrontabili con quelli del 2015 e del 2017 quando vi erano stati picchi di contaminazione, pur restando nel range di valori tipici degli ultimi 10 anni, generalmente inferiori al periodo precedente. Per quanto riguarda la fauna ittica del Lago Maggiore, anche quest'anno gli agoni si sono rilevati maggiormente contaminati da DDx e PCB rispetto alle altre specie studiate. In particolate sono stati rilevati valori di DDx superiori allo standard di qualità per il biota in tre campioni di agoni grandi e uno (quello primaverile) di agoni piccoli, mentre nessun valore dei PCB indicatori ha superato gli standard di qualità. L'andamento delle concentrazioni dei PCB è molto simile a quello dei DDx, confermando che i valori misurati di PCB sono in generale in buon equilibrio rispetto al loro contenuto di lipidi. Anche il valore soglia di 6,5 pg TEQ $g^{-1}$ p.f. di PCB dioxin like (PCB-dl) su agoni e coregoni del Lago Maggiore, non è stato superato nel 2019 per nessuna specie. Anche quest'anno, le concentrazioni di Hg e PBDE nei tessuti muscolari dei pesci superano largamente gli standard di qualità per il biota. Infine le concentrazioni di HBCD sono risultate sempre sotto i limiti di quantificazione di 1 ng $g^{-1}$ p.f., ad eccezione dell'agone

grande che in inverno lo supera come già avvenuto nel 2017, senza raggiungere il limite per lo standard di qualità, mentre il DBDPE non è mai stato rilevato nei campioni ittici. Nel caso dello zooplancton, è da sottolineare ancora una volta la presenza significativa del composto parentale dei DDx a gennaio 2019 e, in misura minora, a novembre 2019, anche se i metaboliti dominanti sono risultati il p,p'-DDE e le due forme di DDD. L'analisi di Hg mostra per le prime due stagioni valori paragonabili a quelle degli anni precedenti, anche se l'analisi è ancora parziale, in quanto i valori maggiori si registrano generalmente in inverno, un dato ad oggi ancora in fase di elaborazione. Per quanto riguarda la fauna ittica dei tributari, l'attività del 2018 e del 2019 ha fatto seguito allo studio preliminare del 2017, volto ad individuare gli ambienti e le specie da analizzare con maggiore attenzione nell'anno successivo. Anche in questa campagna di campionamento, le analisi hanno evidenziato per i composti organici uno stato di contaminazione abbastanza omogeneo tra i diversi tributari, con i valori massimi misurati nel Boesio per tutti gli inquinanti, compresi i DDx. I valori misurati cadevano comunque entro i limiti imposti dalla normativa italiana per caratterizzare lo stato di qualità dei corpi idrici, ad eccezione dei PBDE, che presentano un SQAbiota più basso rispetto a quanto previsto per gli altri contaminanti. Al contrario, l'analisi del Hg ha mostrato una concentrazione significativamente maggiore per i cavedani del Toce, con un valore in linea con la soglia di qualità. Come già riscontrato per i pesci del lago, anche trote e cavedani dei tributari superano lo SQAbiota per il mercurio. Confrontando i livelli di contaminazione misurati nel 2019 nella fauna ittica degli immissari rispetto a quelli degli anni precedenti, si registra ancora un abbassamento della contaminazione da DDx, più evidente nel F. Toce rispetto agli altri tributari, ad eccezione dei pesci del Boesio. Come si è detto, nel programma delle attività del 2019 è stato deciso di integrare in via sperimentale le informazioni provenienti dalle analisi chimiche dei sedimenti e del biota con indagini ecotossicologiche sui loro effetti, basate sul "biomarker approach". Per quanto riguarda la fauna ittica dei tributari, sono stati esaminati due enzimi di detossificazione (EROD e GST) e tre enzimi antiossidanti (SOD, CAT e GPx), mentre non è stato possibile esaminare un biomarker di neurotossicità (AChE) a causa delle limitazioni dovute all'emergenza sanitaria. Verrà fatto un tentativo di svolgere queste analisi quando gli accessi ai laboratori saranno ripristinati, sempre che i campioni conservati siano ancora utilizzabili. I risultati hanno mostrato attività enzimatiche simili tra gli esemplari di cavedano prelevati nei quattro immissari (Boesio, Margorabbia, San Giovanni e Toce), rispecchiando i risultati delle analisi chimiche che avevano indicato valori di contaminazione da composti lipofili simili tra i cavedani dei diversi immissari. Nel caso delle trote fario, invece, gli enzimi antiossidanti hanno mostrato attività significativamente più bassa (SOD) e più alta (GPx) nel torrente più contaminato, il Boesio, suggerendo che la trota fario sia più sensibile agli effetti dei contaminanti rispetto al cavedano. Le attività enzimatiche sono state misurate anche nei campioni di chironomidi provenienti da 5 tributari (Tresa, Boesio, Margorabbia, Toce, Bardello) e dal Ticino immissario. Anche in questo caso sono stati analizzati enzimi di detossificazione (GST) e antiossidanti (CAT), mentre l'emergenza sanitaria ha impedito di effettuare le analisi di altri enzimi. Per quanto riguarda l'enzima di detossificazione (GST), sono stati misurati valori più elevati nei chironomidi raccolti nel Tresa e nel Ticino Emissario, indicando rispettivamente come il primo sia un'importante sorgente di inquinanti lipofili, e come dal Verbano esca costantemente una miscela di inquinanti lipofili che andrà a interessare gli ecosistemi posti a valle. L'enzima antiossidante (CAT) ha mostrato valori elevati nel Toce, indicando la presenza della contaminazione, e valori più bassi di controlli per i tre campioni del Tresa e per i campioni di ottobre del Toce, Bardello e Ticino emissario. Questi valori molto bassi potrebbero indicare un'elevata contaminazione, tale da provocare un'inibizione da substrato dell'enzima. Da questa

sperimentazione appare come le analisi dei biomarker enzimatici nei chironomidi siano uno strumento promettente per il monitoraggio ambientale, ma anche che l'interpretazione dei risultati richiederebbe l'analisi di una batteria più ampia di enzimi, con la necessità di prelevare quantità più elevate di organismi. Un terzo test sperimentato è stato il saggio di tossicità subcronica dei sedimenti dei tributari sull'ostracode Hetercypris incongruens.

**Rilevanza scientifica e risultati ENG:** In general, the 2019 research has confirmed once again the importance of the hydrological regime for the supply of pollutants to Lake Maggiore. In fact, if the first part of 2018 was neither particularly rainy nor particularly dry, there were remarkable floods during autumn 2018 and in the months of July, August and October 2019. These events led to the increase in the concentrations of pollutants detected in biota in 2019, most likely due to the release of pollutants deposited in the past in the soils and river sediments and mobilized by intense rains and flood events respectively. This general picture is particularly evident in the case of sediment analyzes at the mouth of the tributaries, which are intended to understand the origin of organic pollutants and trace metals present in Lake Maggiore. The choice of tributaries and compounds in each tributary depends on the present and past human pressures and on the analyzes made in the past, which allowed to exclude some substances present in negligible quantities in some inlets. For example, two large inlets such as Ticino Immissario and Maggia were not included, as in the past they had shown a very low level of contamination. DDT and its metabolites (collectively referred to as DDx) were therefore measured only in the Ticino River (lake outlet) and in the Toce River, upstream (Domodossola and Prata) and downstream (Bosco Tenso, Premosello, Ornavasso and Gravellona Toce) of the industrial site. In Gravellona Toce they showed quite variable values, particularly high in July and October, as expected following intense rainfall, and with a high fraction (> 60%) of the non-metabolized parental compound (p, p'-DDT ), an indicator of a recent contribution of pollution. Instead, in Bosco Tenso and Ornavasso, the DDx concentration was higher in February, after the intense autumn rains, to return to previous values in October. The prevalence of p, p'-DDT in the non-metabolized parental form was less marked than in the sediment taken from Gravellona Toce in July. On the contrary, for the other compounds (PCB, PBDE, HBCD, DBPDE, Hg) the average values were similar or lower than those of 2018. The Boesio and Bardello rivers are once again the tributaries that contribute to a larger extent to the contamination in the lake, respectively by PBDE and PCB, but also from Hg. In addition, the presence of a source of contamination in Tresa is confirmed by peaks of concentration for PAH and Hg, similar to those already occurred in 2015. This general picture was also confirmed by the analyzes of benthic invertebrates, among which Diptera and gammarids are the main accumulators of DDx and Hg, with a similar spatial pattern: the measured values were always markedly higher downstream of the industrial site and the maximum concentration values for both groups were measured at Ornavasso for the DDx and at Bosco Tenso for the mercury. For DDx, in Diptera, the Bosco Tenso values were similar to those of Premosello, while in the gammarids the increase downsteam valley was more constant, with values in Premosello higher than those of the Bosco Tenso station. Similarly, in filtering molluscs, the levels of DDx and Hg were comparable to the high values found in 2015 and 2017, while remaining within the range of typical values of the last 10 years, generally lower than the previous period. As regards the fish fauna of Lake Maggiore, Alosa agone was found to be more contaminated by DDx and PCB than the other species studied. In particular, DDx values higher than the quality standard for biota were detected in three samples of large specimen and one (the spring one) of small specimen, while no value of the indicator PCBs exceeded the quality standards. The

trend of PCB concentrations is very similar to that of DDx, confirming that the measured values of PCBs are generally in good balance with respect to their lipid content. The concentrations of Hg and PBDE in the muscle tissues of fish far exceed the quality standards for biota. Finally, the concentration of HBCD was generally below the quantification limits of 1 ng $g^{-1}$ fresh weight. In the case of zooplankton, it should be emphasized once again the significant presence of the parental compound of DDx in January 2019 and, to a lesser extent, in November 2019, even if the dominant metabolites were p, p'-DDE and the two forms of DDD. As regards the river fish fauna, the activity of 2018 and 2019 followed the preliminary study of 2017, aimed at identifying the environments and species to be analyzed with greater attention in the following year. Also in this sampling campaign, the analyzes showed for organic compounds a fairly homogeneous state of contamination between the different tributaries, with the maximum values measured in Boesio for all pollutants, including DDx. The measured values, however, fell within the limits imposed by Italian legislation to characterize the quality status of water bodies, with the exception of PBDEs, which have a lower limit. On the contrary, the analysis of the Hg showed a significantly higher concentration for the chubs of the Toce. As already found for lake fish, trout and chub of the tributaries exceed the quality limit for mercury. As mentioned above, in the 2019 program of activities it was decided to experimentally integrate the information from the chemical analyzes of sediments and biota with ecotoxicological investigations on their effects, based on the "biomarker approach" As regards the detoxification enzyme (GST), higher values were measured in the chironomids collected in the Tresa and Ticino Emissary, indicating respectively how the former is an important source of lipophilic pollutants, and how a mixture constantly comes from Verbano of lipophilic pollutants that will affect the downstream ecosystems. The antioxidant enzyme (CAT) showed high values in the Toce, indicating the presence of contamination, and lower values of controls for the three samples of the Tresa and for the October samples of the Toce, Bardello and Ticino emissary. These very low values could indicate a high contamination, such as to cause an inhibition of the enzyme substrate. From this experiment it appears that the analysis of the enzymatic biomarkers in the chironomids are a promising tool for environmental monitoring, but also that the interpretation of the results would require the analysis of a larger battery of enzymes, with the need to take higher quantities of organisms. A third experiment tested was the subchronic toxicity test of tributary sediments on the ostracode Hetercypris incongruens. With this test, no significant mortality was detected, while there was a reduction in growth in the autumn samples of Bardello and Ticino Rivers, with inhibition of 33% and 23% respectively, in line with the inhibition of catalase activity found in chironomids.

**Fonte di finanziamento ITA:** Commissione Internazionale per la Protezione delle Acque Italo-Svizzere (CIPAIS)

**Website:** http://www.cipais.org

**Coordinatore:** Aldo Marchetto

**Referente IRSA:** Aldo Marchetto

**Periodo di attivita:** 01/01/2019 - 31/12/2021

**Titolo: Commissione Internazionale per la Protezione delle Acque Italo- Svizzere (CIPAIS) - Ambienti litorali e tematiche emergenti**

**Acronimo:** CIPAIS Ecorive

**Abstract ITA:** Il programma di indagini è stato formulato sulla base delle linee di azione della CIPAIS per il Lago Maggiore e si propone diversi obiettivi: 1) promuovere attività integrative di tassonomia molecolare e morfologica (diatomee, macrofite, macroinvertebrati, macrocrostacei, molluschi) per migliorare le conoscenze di base sulla biodiversità lacustre litorale; 2) valutare l'efficacia degli interventi di rinaturalizzazione intrapresi lungo le sponde del lago sulla fauna e sulla flora sia qualitativamente che quantitativamente; 3) realizzare una carta delle emergenze floristiche perilacuali e una carta della presenza delle specie invasive, utili agli enti gestori di aree naturali o agli amministratori territoriali preposti alla tutela e conservazione del lago, 4) verificare la concentrazione di microplatiche e/o parassitosi emergenti rilevabili nelle acque comuni e nelle specie autoctone ed alloctone di bivalvi (scelti come rappresentativi del comparto litorale).

**Abstract ENG:** The project was designed on the basis of the CIPAIS action lines for Lake Maggiore with several goals: 1) to promote integrative activities on molecular and morphological taxonomy (diatoms, macrophytes, macroinvertebrates, macrocrustaceans, molluscs) to improve knowledge on littoral lake biodiversity; 2) to evaluate, both qualitatively and quantitatively, the effectiveness of the renaturalization measures undertaken along the shores of the lake on the fauna and flora; 3) to create a map of perilacual flora of natural importance and of the presence of invasive species, useful for managers of natural areas or for local administrators appointing for lake protection and conservation, 4) checking the concentration of detectable microplastics and / or parasites in the lake and in native and non-native bivalves species (chosen as representative of the littoral areas).

**Rilevanza scientifica e risultati ITA:** I dati acquisiti nel primo anno di indagini (2019) hanno confermato, sia a livello morfologico sia a livello di DNA, specie note nel Lago Maggiore e aggiunto specie mai rinvenute prima. Attività ancora in corso. I dati di densità delle specie native ed invasive confermano sia il forte declino delle specie native in atto dopo il 2010, che la tendenza alla riduzione di Dreissena polymorpha (specie invasiva ormai naturalizzata). Entrambe le evidenze coincidono con l'espansione di Corbicula flunminea, suggerendo un possibile effetto di interazione competitiva.

**Fonte di finanziamento ITA:** Commissione Internazionale per la Protezione delle Acque Italo-Svizzere (CIPAIS)

**Fonte di finanziamento ENG:** Commissione Internazionale per la Protezione delle Acque Italo-Svizzere (CIPAIS)

**Altre informazioni ITA:** € 162.200

**Altre informazioni ENG:** € 162.200

**Website:** http://www.cipais.org/upload_files/Programma%20ricerche%20Sezione%203.pdf

**Coordinatore:** Angela Boggero

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 2019-2022

**Titolo: MULTIHAZARD FRAMEWORK for WATER RELATED RISKS MANAGEMENT**

**Acronimo:** MUHA

**Abstract ENG:** Effective natural and man-induced disaster management needs to be addressed through a complex preparedness-response-mitigation-rebuild cycle to be implemented at different and synergic levels in the ADRION countries. The MUHA project will connect the observed and modelled hazards and risks related to the integrated water cycle with the existing and improved coping capacity developed by national, bilateral and EU Civil Protection Mechanisms, following the rationale defined by the Sendai framework. Four water related risks will be addressed, regarded as components of one single complex water system prone to different hazards: accidental pollution, flooding, drought and failure of critical infrastructure due to earthquakes. Current status of water system and multi-hazard anticipated scenarios must result in complex disaster response mechanisms. The MUHA rationale is based on the necessity to effectively link different aspects of the water cycle in an improved response system, which will integrate functions of the analysis, forecasting and incident command systems, to be integrated in Common Alerting Protocols, thus enabling efficient transnational response. The interconnected role of water utilities through the water safety plans and civil protection mechanisms is crucial and currently not sufficiently harmonized. While the involved countries have already developed own different planning and response mechanisms at different levels, MUHA is expected to produce a long-term robust networking, based on a joint transnational management to address the common challenges of water-related response to hazard. Moreover, the definition of common action plans, methods and tools to be implemented in pilot actions are expected to improve response time and effectiveness of the coping capacity developed by national, bilateral and EU Civil Protection mechanisms.

**Descrizione estesa ENG:** The report from the commission to the European Parliament, the Council, the European economic and Social committee "on the implementation of EU macro-regional strategies" (2016), points out that efficient coordination is still a common limit to all MRS, while a better governance is a priority for the EUSAIR. Concerning the EUSAIR, a "clear need for sharing existing knowledge and scientific assets" has been identified as a main cross cutting aspect while mitigating and adapting to climate change effects as well as managing disaster risks were recognised as horizontal principles for all four pillars ("For a prosperous and integrated Adriatic And Ionian region" (2014)). All these challenges are faced in the MUHA project, which aims at gathering existing national systems capacity and knowledge to manage and reduce the impact of natural and manmade hazard to improve the transnational joint response to water-related hazards. The ADRION area has been subjected to relevant environmental impacts over recent decades as a result of the increasing anthropic pressures and climate change: decreasing in water availability (due to quantity and quality issues) (EEA Report No 1/2017), as well as vulnerability of water infrastructures due to earthquake. In line with the EUSAIR strategy, MUHA project will connect the

observed and modelled hazards and risks related to the integrated water cycle, by effectively merging them with the existing and improved coping capacity. The core project actions will integrate functions of the incident command system (ICS), related also by the CAP (Common Alerting Protocols) enabling thus efficient transnational response to any water hazard related risk, contributing to make the programme area more resilient and secure to risks related to water safety. It is worth to note that improving water supply resilience and quality through joint transnational response is particularly important as the EUSAIR is facing a major migration crisis.

**Rilevanza scientifica e risultati ENG:** MUHA will connect the observed and modelled hazards and risks related to the integrated water cycle, by effectively join them with the existing and improved coping capacity developed by national, bilateral and EU Civil Protection Mechanisms, following the rationale defined by the Sendai framework. Four water related risks will be faced: accidental pollution, floods, droughts, failure of critical infrastructure due to earthquake. MUHA will initially scope the status of water hazard management and safety plans in the 6 PP countries. Hazard assessment methodologies and management differences among the approaches will be addressed and more harmonized methods delineated. Particular attention will be placed in the harmonization between water safety plans and Civil protection mechanisms at a transnational level. A set of guidance documents will be developed and harmonized among the partners in order to set a uniform approach towards the improved multi-hazard management of WSS and applied in six pilot actions, in which management & operation of water supply utilities are compared with the addressed hazards. Pilot actions will verify implementation status of applicable measures. Specific tools and procedures will be developed on the basis of gaps or weakness identified and harmonized action plan, methods and tools devoted to Improved Water Safety Plan for the Adriatic-Ionian area will be elaborated. MUHA is expected to support a joint transnational management to hazards on WSS in the Adriatic-Ionian area, with improved response time and effectiveness of the coping capacity. Such objectives require a partnership that covers the whole emergency chain for civil protection and water safety purposes, from both the technical and procedural sides. The strategic added value in MUHA stands in the collaboration of civil protection, water utilities and public authorities in the partnership, distributed over 6 countries in the Adriatic-Ionian area .

**Fonte di finanziamento ENG:** Commissione Europea tramite il programma INTERREG-ADRION, second call

**Altre informazioni ENG:** Partner's list: • University of Ljubljana (SI) • Jaroslav Černi Water Institute (RS) • Croatian Geological Institute (HR) • Water utility of Istria (HR) • Municipality of Kamnik (SI) • University of Thessaly (EL) • Public utility Vodovod i kanalizacija, Nikšić (ME) • Italian Civil Protection Department (IT) • Decentralized Administration of Macedonia-thrace, Water Department (EL) Total funding: 2 396 858.00 euro CNR funding: 365 293.00 euro

**Website:** https://muha.adrioninterreg.eu

**Coordinatore:** Emanuele Romano - IRSA-CNR

**Referente IRSA:** Emanuele Romano - IRSA

**Periodo di attivita:** 01/03/2020 - 31/08/2022

**Titolo: Alien species: impacts and exploitation for the biomonitoring of microplastics and parasitic diseases; CIPAIS – Ecorive**

**Acronimo:** CIPAIS-ECORIVE-MICROPLASTICS

**Abstract ITA:** Non disponibile

**Abstract ENG:** The project ALIEN SPECIES: IMPACTS AND EXPLOITATION AS BIONDICATORS FOR THE MONITORING OF PARASITOSIS AND MICROPLASTICS started in 2019 with a twofold purpose: to continue the monitoring of the native and alien populations of bivalves of Lake Maggiore started in 2010; use bivalves to explore two emerging problems, parasitosis and microplastics. Bivalves have been selected as accumulator organisms to microplastic abundance and distribution in Lake Maggiore because of their well-known advantages as traditional biological indicators and mounting evidence of microplastics uptake and assimilation (see review by Li et al. 2019).

**Descrizione estesa ITA:** La serie dei dati disponibili per le specie invasive di molluschi, monitorati senza finanziamento a partire dal 2010 (anno del primo rinvenimento di Corbicula e Sinanodonta) ha consentito di mettere in luce e assegnare una priorità alle criticità relative agli impatti sulla biodiversità, sulle reti trofiche pelagiche e bentoniche, e sulla fruibilità delle aree rivierasche. Tra queste, si è ritenuto di affrontare in prima istanza il problema emergente delle parassitosi, di crescente gravità sia a causa dell'ingresso delle specie invasive che dell'aumento dello stress climatico. Oltre a comprendere molte specie aliene di maggiore impatto, delle quali tre già presenti nel Lago Maggiore (Dreissena polymorpha, Corbicula fluminea e Sinanodonta woodiana) i molluschi bivalvi sono anche i migliori indicatori per rilevamento, identificazione e mappatura della distribuzione di inquinanti chimici, fisici e biologici. Ampiamente usati per questi scopi a livello globale, la loro efficienza è stata dimostrata anche per l'attuale problema delle microplastiche (es. Browne et al. 2008; Von Moos et al., 2012; De Witte et al., 2014; Avio et al., 2015; Li et al., 2015, 2016; Kolandhasamy et al. 2018). Benchè non ancora concluso, il progetto per l'identificazione dell'indicatore migliore per le microplastiche (www.cleansea-project.eu), cita il Mussel Watch quale esempio di biondicatore di valenza elevata e ribadisce le caratteristiche utili per la scelta dell'indicatore stesso. i) deve appartenere al livello più basso della piramide trofica (filtratore o pascolatore) perchè rappresenta l'ingresso degli inquinanti verso tutti i livelli della rete trofica. ii) deve essere sessile, in modo da riflettere l'esposizione nel luogo in cui è stato raccolto (o appositamente esposto, nel caso di biomonitoraggio attivo); iii) deve possedere capacità di bioconcentrazione elevate per facilitare l'individuazione dei contaminanti presenti in tracce; iv) deve essere incapace di biotrasformare ed eliminare molte sostanze tossiche per: a) facilitarne il rilevamento; b) fornire un dato di concentrazione proporzionale alla concentrazione nell'ambiente; c) fornire informazioni relative allo scenario peggiore, rappresentato da organismi privi di sistemi di detossificazione; v) deve essere poco sensibile all'inquinante, in modo che possa sopravvivere all'esposizione e ad altre condizioni avverse senza morire prima che i contaminanti accumulati possano essere misurati; vi) deve essere tollerante al mantenimento in gabbie per l'allestimento di

un sistema di biomonitoraggio attivo (Mussel Watch; Mosselmonitor); vii) infine, deve appartenente agli invertebrati, che richiedono personale meno addestrato per la raccolta e la manipolazione rispetto ai vertebrati (abbattimento del costo effettivo) Oltre ai punti sopra menzionati, quando si selezionano le specie da usare come indicatori è bene considerare alcuni aspetti aggiuntivi quali: i) Il campionamento può essere effettuato in modo economicamente vantaggioso mediante sinergie con programmi esistenti: ad es., il campione di Dreissena (raccolto per l'analisi di contaminanti nella Sezione 2) e il campione di bivalvi e gasteropodi (raccolti per analisi molecolare e parassitosi nella Sezione 3) possono essere utilizzati anche per l'analisi della concentrazione e distribuzione di microplastiche nelle aree litorali. ii) le specie utilizzate forniscono indici direttamente collegabili all'impatto e agli effetti sull'intera comunità (es. mappa di distribuzione, concentrazione in ambiente). Per questo è utile la scelta di: a) "specie ombrello" (che per la loro reattività possono essere utilizzate per identificare gli impatti sulle altre specie) e b) specie per le quali è facile misurare la rata di assunzione dell'alimento e/o dell'inquinante (es. ingestione, assorbimento) per risalire alla concentrazione nell'ambiente, es i bivalvi filtratori; iii) la stessa specie può essere utilizzata per valutare l'evoluzione temporale e la distribuzione spaziale dell'inquinante, nonché l'efficacia delle azioni di mitigazione, ad esempio permettendo di confrontare mappe di distribuzione dell'inquinante nel tempo e nello spazio. Rispetto a quanto elencato, i bivalvi posseggono tutte le caratteristiche necessarie per essere qualificati come i bioindicatori più efficienti, utilizzati sia come bio-sentinelle per i sistemi di allarme precoce (Early Warning) che come bioaccumulatori sul breve e lungo termine (ad es: Browne et al. 2008; Wegner et al. 2012; Von Moos et al., 2012; Wright et al. 2013; De Witte et al., 2014; Van Cauwenberghe e Janssen, 2014; Van Cauwenberghe et al., 2015; Canesi et al. 2015; Paul-Pont et al., 2016; Setälä et al., 2016; Kolandhasamy et al. 2018). L'uso dei molluschi bivalvi come bioindicatori appare, inoltre, appropriato per gli scopi della Sezione 3, poiché sono organismi chiave che rappresentano la comunità dell'area costiera litorale e/o sub-litorale. In conclusione, per ottenere massima efficienza, ottimizzazione delle risorse disponibili, e dati certi di presenza/concentrazione di inquinante, si propone di sfruttare come bioindicatori i bivalvi delle specie native ed aliene che verranno raccolti nell'ambito del progetto "Specie aliene". I bivalvi raccolti lungo il perimetro lacuale verranno analizzati sia per la verifica delle parassitosi che per l'analisi biomolecolare che per fornire un dato indicativo della presenza e distribuzione di microplastiche lungo il perimetro lacuale. Per consentire di affrontare due problemi emergenti di pari interesse ed urgenza, mediante l'uso dello stesso bioindicatore, senza eccedere il budget disponibile si propone quindi: - di potenziare la raccolta dei bivalvi lungo il perimetro lacuale aumentando il numero di stazioni e di campioni, ma effettuando i campionamenti una sola volta in ogni area; - di utilizzare il medesimo campione sia per la verifica delle parassitosi che per la ricerca delle microplastiche ingerite e/o adese (Kolandhasamy et al. 2018); - di utilizzare i campioni congelati storici disponibili presso il CNR ISE per la valutazione dell'evoluzione storica delle parassitosi e delle microplastiche in ambiente lacustre; - di effettuare approfondimenti analitici o ripetizioni del campionamento solo qualora i risultati del primo screening lo rendessero necessario.

**Descrizione estesa ENG:** Nonb disponibile

**Fonte di finanziamento ITA:** Commissione per la Protezione delle Acque Italo Svizzere

**Altre informazioni ITA:** CNR IRSA

**Coordinatore:** Nicoletta Riccardi

**Referente IRSA:** Nicoletta Riccardi

**Periodo di attivita:** 2019-2021

**Titolo: Rescuing Microcondylaea bonellii: a testimonial for non- iconic neglected species. Project ID 192522810**

**Acronimo:** MicroRESCUE

**Abstract ITA:** Non disponibile

**Abstract ENG:** The main purpose of the project is to start a propagation program to strengthen the populations that still exist and prevent extinction of the species. The rapidity of the declining trend makes it necessary to attempt artificial reproduction until it is possible to recover wild animals from the extant populations. The species is currently under IUCN revaluation and its listing under the highest risk category Critically Endangered (CR A2ac). Underestimation of the risk category and the inclusion of the species only in Annex V of the Habitats Directive prevented the implementation of adequate protection measures against real threats. The project also aims to complete the survey over the whole range, and particularly in the Balkans where a previously unknown population, genetically divergent from the Italian ones, was found in 2019. To increase the chances of success of ex-situ reproduction it is important to have the largest number of source populations with wide genetic variability. Furthermore, since the habitat conditions seem to provide greater chances of survival in the Balkan countries, the identification of other residual populations for re-introduction contributes to the success of species recovery.

**Fonte di finanziamento ITA:** The Mohamed bin Zayed Species Conservation Fund

**Fonte di finanziamento ENG:** The Mohamed bin Zayed Species Conservation Fund

**Website:** https://grant.speciesconservation.org/index.php?ll=2020-09-30%2014:31:08&n=1

**Coordinatore:** Nicoletta Riccardi

**Referente IRSA:** Nicoletta Riccardi

**Periodo di attivita:** 2020-2021

**Titolo: Assessing microplastic abundance and distribution in Lake Maggiore using native and invasive freshwater mussels: a case study exploitation to improve bio-monitoring methodologies.**

**Acronimo:** microPA-LKM

**Abstract ITA:** Non disponibile

**Abstract ENG:** The project has two complementary purposes: 1) Answering the local request to assess the abundance and distribution of microplastic in the coastal area of Lake Maggiore in agreement with the monitoring needs of the CIPAIS (Commission for the Protection of Italian-Swiss Waters) 2) a more general one aimed at contributing new knowledge to help optimization of survey protocols by bioaccumulators. To match both aims, the project includes the analysis of wild mussels (field assessment) and the laboratory exposure of mussels taken in the wild and standardized under laboratory conditions.

**Descrizione estesa ITA:** Non disponibile

**Descrizione estesa ENG:** 1) Field assessment: Sampling: Sampling strategy represents a challenge in designing a representative and adequately replicated monitoring scheme. Patchiness of microplastics in different spatial and temporal scales may lead to variable amounts within mussels. The extent to which these factors change microplastic abundance or type in the environment varies with sampling sites. Therefore, sampling time and sites should be variable factors considered during the investigation. Environmental factors, changing with local shore shape and season (e.g., wind, currents, rainfall, temperature, human activity) may affect microplastic distribution. Therefore, we planned the following sampling strategy taking into account the above mentioned variables. To improve representativeness, sampling will be performed in 6 sites representative of different levels of anthropogenic impact and characterized by different habitat features on two seasonal periods, autumn 2019 and spring 2020 (theoretically corresponding to the minimum and maximum lake water levels). Since the type of substrate can influence both the distribution of mussels and that of microplastics, sampling will be carried out in A) 3 sites with slightly sloping shores and predominantly muddy soft substrate and B) 3 sites with steep slopes and mixed substrate (rock, stones, boulders with small patches of soft sediment included between the hard substrates). Lake Maggiore is presently hosting four native species (Unio elongatulus, Anodonta anatina, A. cygnea and A. exulcerata) and three invasive bivalves (Sinanodonta woodiana, Corbicula fluminea, Dreissena polymorpha). To avoid impoverishing the local populations of Anodonta, rarer than Unio. the project will only compare the most abundant native Unio elongatulus with the two most abundant invasive species (Corbicula fluminea, Dreissena polymorpha). In each site a representative number of specimens will be collected and pooled to obtain a representative sample for each of the 3 target species. Sample preservation and processing: To minimize the risk of samples contamination, specimens will be identified visually for species assignment and preserved immediately after collection according the procedures agreed with the JRC researchers involved in the analytical task. Sample processing will be designed according the suggestions of the researchers of the Nanobiotechnology laboratory involved in the analytical procedure, taking into account the requirements that must be fulfilled for each analytical approach. The total body burden of microplastics in mussels goes beyond ingestion. Besides uptake through the gut and across the gills, microplastics adhere to mussel's soft tissue (mantle, gonad, adductor, visceral tissue and foot) can

further contribute to microplastic presence within individuals. Since the dissection of the organs can be a source of contamination, as a first step the whole tissues will be analysed to verify the mussel's bioaccumulation capacities. As a second step, mussel dissection will be eventually performed to specifically target the critical organs and/or to compare organ specific accumulation rates. Number of samples to be analysed: 36 Analytical methods: Current methods for microplastic identification involve visual sorting (with the aid of polarized light microscopy), Nile Red staining, Fourier transformed infrared spectrometry (FT-IR), attenuated total reflectance (ATR), Raman spectrometry, pyrolysis-gas chromatography combined with mass spectroscopy (Pyr-GC-MS), high temperature gel-permeation chromatography (HT-GPC) with IR detection, SEM-EDS, thermal extraction desorption gas chromatography mass spectrometry (TED-GC-MS) and liquid extraction. Since no single method is able to obtain the physical (size, shape and colour) and chemical (polymer type) characteristics of particles in a single step, the combination of several parallel approaches will be applied after discussion with the researchers of the Nanobiotechnoloy Lab. Extraction procedure will be defined accordingly. Procedural blanks will be carried out to monitor contamination and correct empirical data. 2) Laboratory exposure: The exposure in standard laboratory conditions is indispensable for measuring crucial parameters for the evaluation of the efficiency of biological models and analytical procedures, for the interpretation of monitoring data and for the large-scale extrapolation of local data. Wild mussels collected in Lake Maggiore will be cleaned of epibionts, measured by a digital caliper (length, width, eight) and tagged for individual identification. Before experimental exposure, mussels will be acclimated in a 10 x 8 m artificial pond, 1.5-m deep (provided with daily water renewal) for at least 1 week to recover from transport stressors. A stock of approximately 50 specimens of each species (Unio elongatulus, Corbicula fluminea, Dreissena polymorpha) will be acclimatized for 2 weeks in three large flow-through maintenance tanks, each containing ca. 150 L of filtered (1 µm). Lake Maggiore water at 15±1°C, which will be entirely turned over about once a day. A low- pressure air blower will be used to maintain aeration. Mussels will be fed a commercial shellfish diet every day. Water inflow will be stopped for 1–2 h during feeding. The exposure experiments will be carried out in 2 L glass beakers filled with filtered (0,45 µm) lake water and/or dechlorinated tap water at a constant temperature of 15±1°C and a 12 h light-dark illumination regime. The animals for the exposure experiments will be randomly selected from the maintenance tanks. As the three model species vary widely in size, to obtain comparable results, the number of specimens per beaker will be calculated to obtain the same animal biomass: water volume ratio. For each species three beakers will receive the artificial plastic beds treatment and one beaker will serve as unexposed negative control. Experiment duration and biomass:water volume ratio will be planned in order to avoid feeding the animals during exposure. Based on previous preliminary experiments, exposure times can be tentatively planned at 3, 6, 12 and 24 h, and the number of specimens/beaker at 3 Unio elongatulus, 5 Corbicula fluminea, 10 Dreissena polymorpha.

**Rilevanza scientifica e risultati ITA:** I primi risultati sono stati pubblicati: 2. Facchetti, S.V., La Spina, R., Fumagalli, F., Riccardi, N., Gilliland, D., Ponti, J. 2020. Detection of Metal-Doped Fluorescent PVC Microplastics in Freshwater Mussels. Nanomaterials, 10, 2363; doi:10.3390/nano10122363

**Rilevanza scientifica e risultati ENG:** First results are published: Facchetti, S.V., La Spina, R., Fumagalli, F., Riccardi, N., Gilliland, D., Ponti, J. 2020. Detection of Metal-Doped Fluorescent PVC Microplastics in Freshwater Mussels. Nanomaterials, 10, 2363; doi:10.3390/nano10122363

**Fonte di finanziamento ITA:** Commissione per la Protezione delle Acque Italo-Svizzere

**Fonte di finanziamento ENG:** Commissione per la Protezione delle Acque Italo-Svizzere

**Coordinatore:** Nicoletta Riccardi

**Referente IRSA:** Nicoletta Riccardi

**Periodo di attivita:** 2019-2021

## Titolo: National Representative, Member of the COST Action Core Group, Science Communication Manager of of COST Action: CA 18239 Conservation of freshwater mussels: a pan-European approach

**Acronimo:** CONFREMU

**Abstract ITA:** Non disponibile

**Abstract ENG:** "Freshwater bivalves are a large, diverse and important group, since they can dominate in some habitats in terms of quantity and biomass. At the same time they are among the World's most imperiled taxonomic groups. Studies on freshwater bivalves' ecology and conservation provide the ground for inter- and trans-disciplinary research and innovation, integrating knowledge into practice of freshwater protection. Freshwater bivalves provide crucial ecosystem functions and services such as water purification or nutrient cycling, thus can be used as nature-based tools for improving ecosystem functions and services as well as indicators of ecosystem health. Through development of international cooperation of scientists from various fields within and outside biological sciences, with participation of administration and NGO sector, we want to draw the full picture of freshwater mussels biodiversity crisis in Europe and develop scientific basis to halt the loss of biodiversity and ecosystem services mediated by these organisms. "

**Descrizione estesa ITA:** Non disponibile

**Descrizione estesa ENG:** Specific Objectives To achieve the main objective described in this MoU, the following specific objectives shall be accomplished: ● Mussels' biodiversity: integration of phylogeny and genetic diversity data, synthesized with distribution and abundance data to identify spatial diversity patterns, evolutionarily significant units, biodiversity hotspots, the spread of invasive and alien species, species and populations needing urgent conservation actions. ● Collating data and metanalysis of the mussels' biological features, juxtaposed with features of their environment to reveal crucial features of the environment responsible for the mussels' decline or resilience. Designation and implementation of effective monitoring schemes for freshwater

ecosystems and their catchments based on freshwater mussels. ● Mussels as providers of key ecosystem functions and services: stimulation of research into the mussels' role in ecosystem functioning and services, with an emphasis on ecosystem restoration and water purification. Preparation of a Best Practice Book. ● Strategic Agenda for mussels and freshwater management on a European scale. Horizon scan, synthesis of the Working Groups achievements, habitat and environmental change modelling to develop future scenarios for European freshwater mussels and their habitats (including climate change and spread of IAS). ● Raising the awareness and commitment of societies. European societies are scarcely aware of the important ecological role of mussels. The Action will develop efficient communication and education tools, as well as establish an citizens' science methodology and long term networks comprised of citizens, water managers, politicians, local leaders and NGOs.

**Fonte di finanziamento ITA:** COST Action

**Fonte di finanziamento ENG:** COST Action

**Altre informazioni ITA:** Involved in the Action as Member of the Core Group, National Representative and with the role of Science Communication Manager

**Altre informazioni ENG:** Involved in the Action as National Representative and with the role of Science Communication Manager

**Coordinatore:** Tadeusz Zając

**Referente IRSA:** Nicoletta Riccardi

**Periodo di attivita:** 2019-2022

### Titolo: Nanoplastics' uptake and bioaccumulation in target organisms

**Acronimo:** Nano_PA_bioaccumulation

**Abstract ITA:** Non disponibile

**Abstract ENG:** The aim of the Task that involves CNR IRSA into the CAS project is the study of nanoplastics' bioaccumulation in living organisms selected as relevant models in the trophic chain transfer in both freshwater and seawater environment. The proposed project is mainly divided into two parts: (i) method's development (year 2020-2021) and (ii) nanoplastics environmental monitoring (year 2022-2023). The task will be carried out thanks to a cooperation between JRC Ispra and CNR Pallanza. The knowledge transfer of CNR Pallanza is essential to the development/optimization of culture protocols at the JRC for fito-zooplankton and annelid. In addition, CNR will provide mussels (native and invasive species), obtained by environmental sampling, and maintained under controlled laboratory conditions at both CNR and JRC. All the selected models will be used for further development of the method for extraction, quantification

and identification of nanoplastics in complex matrices. The nanoplastics accumulation, will be qualitatively, and where possible, quantitatively measured by the unique and promising method, now under implementation/optimization, discovered by JRC in collaboration with the US-National Institute for Standard and Technology. In particular, this method is considered important for future development of screening tests for environmental nanoplastics detection, combining different techniques such as separation and visualization of nanoplastics by Scanning-Transmission Electron Microscopy and Raman spectroscopy. "

**Fonte di finanziamento ITA:** JRC DG DIRECTORATE A.5 ISPRA (VA)

**Fonte di finanziamento ENG:** JRC DG DIRECTORATE A.5 ISPRA (VA)

**Coordinatore:** Nicoletta Riccardi

**Referente IRSA:** Nicoletta Riccardi

**Periodo di attivita:** 2020-2023

### Titolo: Freshwater bivalves at the edge: adaptation genomics under climate change scenarios

**Acronimo:** EDGEOMICS

**Abstract ITA:** Non disponibile

**Abstract ENG:** Climate change, encompassing a global tendency for warming, is reshuffling the geographic distributions of species, making rear edge populations seriously threatened. Mediterranean Basin Peninsulas, e.g. Iberian and Italian, among the most vulnerable Mediterranean regions to water shortage and desertification, are home to the higher number of freshwater mussel endemisms showing confined and fragmented distributions. Global warming threatens the stability of freshwater ecosystems by disrupting the persistence of freshwater mussel populations. These climatic assumptions together with the fact that freshwater mussels are undergoing a major global decline, make these organisms a unique model system to assess genomic changes and responses associated with the extreme climatic adaptations, under a scenario of climate change. For that, in this project, we will use an integrative approach combining well-designed experiments, i.e. experimental studies of ecological performance (manipulating the abiotic environment to mimic predicted future climate) and environmental and behavioral strategies characterization in the field, with state-of-the-art population genome and transcriptome-wide techniques. More, with the main goal of assessing genomic changes and responses associated with the extreme climatic adaptations, we will use the multidisciplinary data gathered from three freshwater mussel species along a latitudinal and temperature gradient, from the Mediterranean to Scandinavia. We expect to obtain novel insights into the processes by which freshwater species with broad geographical ranges can adapt to local environmental conditions and gain a clearer understanding of the evolutionary

history of these imperiled organisms with eventual pay-offs in future management actions devoted to the conservation of these extraordinary organisms.

**Fonte di finanziamento ITA:** Foundation for Science and Technology, Portugal

**Fonte di finanziamento ENG:** Foundation for Science and Technology, Portugal

**Coordinatore:** Elsa Froufe

**Referente IRSA:** Nicoletta Riccardi

**Periodo di attivita:** 2021-2022

### Titolo: A New Life for Mar Piccolo

**Acronimo:** Life4MarPiccolo

**Abstract ITA:** L'obiettivo generale del progetto Life4MarPiccolo è la riqualificazione ambientale del Mar Piccolo di Taranto, attraverso un'azione diretta di bonifica di porzioni discrete contaminate dei fondali e delle acque, mediante la progettazione e messa in opera di un impianto pilota di depurazione. Le acque e i fondali di questo bacino costiero risultano, infatti, gravemente contaminate da metalli pesanti, Idrocarburi Policiclici Aromatici (IPA) e PoliCloroBifenili (PCB). Oltre a rappresentare un elemento di grave disturbo per il delicato equilibrio del bacino, l'inquinamento ha reso problematiche anche le attività di maricoltura, con notevoli danni a questo settore economico d'importanza nazionale. Alla luce dei dati raccolti e dall'analisi delle problematiche ambientali dettagliatamente descritte nel Form B2, gli obiettivi specifici di questo progetto possono essere così sintetizzati: - obiettivo A: bonificare una porzione discreta del bacino (circa 3000 mq) utilizzando un impianto pilota di depurazione basato sulla microfiltrazione a membrana e in grado di salvaguardare l'ecosistema presente. Tale approccio permetterà di abbattere significativamente la contaminazione da PCB, IPA e metalli pesanti dai fondali, e conseguentemente dalla colonna d'acqua, raggiungendo concentrazioni entro i limiti imposti dalle attuali norme nazionali e comunitarie. Per rendere l'impianto di depurazione ecocompatibile, verrà installato anche un impianto fotovoltaico in grado di produrre l'energia necessaria a garantirne l'auto-sostentamento; - obiettivo B: fornire agli enti preposti validi strumenti per la gestione ecosostenibile delle aree marine. A tal fine verrà elaborato un protocollo d'intervento per il risanamento ambientale di siti marini costieri italiani ed europei (lagune interne, zone portuali, ecc.) con problematiche di inquinamento analoghe a quelle del Mar Piccolo di Taranto. L'elaborazione di questo protocollo prevede anche la realizzazione di un kit diagnostico multi-determinativo per la valutazione della qualità delle acque marine.

**Abstract ENG:** The main object of Life4MarPiccolo project is the requalification of Taranto Mar Piccolo through a recovery action of a contaminated portion of the seabed and seawater, through the design and implementation of a purification pilot plant. The waters and seabed of this coastal

basin are, in fact, severely contaminated by heavy metals, polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs). These pollutants, besides, representing a serious disturbance to the delicate balance of the basin, have also affected mariculture activities, with significant damage to this economic sector of national importance. In light of the data collected and the analysis of environmental issues described in detail in Form B2, the specific objectives of this project can be summarized as follows: - objective A: to restore a reasonable portion of the basin (about 3000 square meters) using a purification pilot plant based on membrane microfiltration able to protect the present ecosystem. This approach will allow us to bring down contamination of PCBs, PAHs and heavy metals from the seabed, and consequently from the water column, reaching concentrations within the limits imposed by existing National and Community legislation. To make purification plant eco-friendly, a photovoltaic system able to produce the energy needed to ensure the plant self-sufficiency will be installed. - objective B: to provide valuable tools for the sustainable management of marine areas to bodies in charge. For this purpose, an intervention protocol for the environmental recovery of Italian and European coastal marine sites (inland lagoons, port areas, etc..) with similar pollution problems to those of the Mar Piccolo of Taranto will be developed. The development of this protocol will include the construction of a multi-assay diagnostic kit for assessing the quality of marine waters. At the end of the project activities, the reclaimed area of 3000 square meters will have its sea bottom free of bioavailable pollutants and it will be again usable. Moreover, the prototype developed during the project can be re-used, and in case re-modulated, for reclaiming wider areas within Mar Piccolo and in other Italian and European marine and coastal areas.

**Fonte di finanziamento ITA:** Il progetto Life4MarPiccolo è cofinanziato dal Programma Life della Commissione Europea e realizzato sotto il coordinamento del Centro Ricerche ENEA Trisaia.

**Altre informazioni ITA:** Partner del progetto: ENEA Trisaia (coordinatore) CNR IRSA - sede di Taranto Comune di Taranto Nova Consulting srl

**Website:** https://www.lifemarpiccolo.it

**Coordinatore:** Gaetano Perrotta Enea Trisaia

**Referente IRSA:** Antonella, Magda Di Leo

**Periodo di attivita:** 1/2/2016-30/9/2021

**Titolo: Biofilm on microplastic particles coming from wastewater treatment facility: characterization of the microbial community and its associated resistome**

**Acronimo:** BioMPs

**Abstract ITA:** I frammenti di plastica di dimensioni inferiori a 5 mm (le cosiddette microplastiche, MP) sono, attualmente riconosciuti come una potenziale minaccia emergente per gli ambienti

naturali, la fauna selvatica e gli esseri umani. Negli ultimi anni è stata rivolta una crescente attenzione allo studio della presenza e concentrazione di MP in ambienti naturali, comprese le acque superficiali. La letteratura scientifica riporta ampiamente casi di ingestione da parte della fauna acquatica, il trasferimento nelle reti alimentari e la potenziale azione come vettore di composti tossici o microrganismi pericolosi. Sebbene la comunità scientifica affronti questo problema con uno sforzo considerevole, molte questioni rimangono aperte, come il ruolo delle MP come veicolo di batteri potenzialmente patogeni o altri microrganismi alloctoni. Gli impianti di trattamento delle acque reflue sono punti nodali per l'immissione nell'ambiente di batteri patogeni e resistenti agli antibiotici. I depuratori spesso non riescono a trattenere completamente le MP presenti nel refluo in ingresso: una proporzione variabile dall'1% al 30% può infatti essere rilasciata nell'effluente e quindi in ambiente. Considerando l'elevato volume di acque reflue trattate dai depuratori e l'alta concentrazione di MP in ingresso, la quantità di MP rilasciate in ambiente può essere cospicua. Inoltre, le MP rilasciate possono essere colonizzati da un'elevata percentuale di batteri pericolosi, di cui i depuratori sono solitamente piuttosto ricchi. Poiché le colonie batteriche sotto forma di biofilm sono solitamente più resistenti al trattamento di sanificazione, il passaggio di MP attraverso i depuratori può essere un'importante fonte di inquinamento microbico e pericolosità per l'ambiente ricevente. Questo progetto mira all'identificazione e alla caratterizzazione delle MP in ingresso e in uscita da diversi depuratori situati nel Nord Italia, caratterizzati da diversi processi di trattamento, popolazione servita e tipo di acque reflue trattate. La composizione delle MP sarà correlata alla comunità microbica che forma il biofilm e il suo resistoma (qui definito come il contenuto totale di geni di resistenza agli antibiotici) al fine di valutare la sua potenziale azione come veicolo di materiale biologico pericoloso.

**Abstract ENG:** Plastic debris smaller than 5 mm (the so-called microplastic, MP) are, at present, recognized as an emerging potential threat for natural environments, wildlife and humans. In the past years, increasing attention has been addressed to investigate the presence and concentration of MP in natural environments, including surface waters. Scientific literature extensively reports cases of ingestion by aquatic fauna, the transfer into food webs and the potential action as a vector for toxic compounds or allochtonous microorganisms. Although the scientific community addresses this issue with considerable effort, many questions remain open such as the role of MPs as vehicle of potentially pathogenic bacteria and other microorganism. Wastewater treatment plants (WWTP) are hotspot for the input into the environment of pathogenic and antibiotic resistant bacteria. WWTPs frequently miss to retain also a fraction of MPs present in the inlet: a variable proportion of 1% up to 30% can in fact be released in the environment. Considering the high volume of wastewater treated by WWTP and the high concentration of MPs in inlet, the amount of MPs released can be conspicuous. Furthermore, MPs released can be colonized by a high proportion of dangerous bacteria, of which the WWTPs is usually quite rich. Since bacterial colonies in the form of biofilm are usually more resistant to sanitization treatment, the passage of MPs through WWTPs can be an important source of microbial pollution and dangerousness for the receiving environment. This project aims at the identification and characterization of the MPs in the inlet and outlet of several different WWTPs located in North of Italy, differing for the treatment process, volume of population served and kind of sewage treated. The MPs composition will be related to the microbial community forming the biofilm and its resistome (here defined as the total content of antibiotic resistance genes) in order to assess its potential action as a vehicle for dangerous biological material.

**Coordinatore:** Silvia Galafassi

**Referente IRSA:** Silvia Galafassi

**Periodo di attivita:** 21/01/2020 to 21/07/2020

### Titolo: Space Based Cyanobacteria Information & Services

**Acronimo:** CyanoAlert

**Abstract ITA:** CyanoAlert si propone di sviluppare un'applicazione completamente automatizzata per monitorare le fioriture di cianobatteri e/o specie algali potenzialmente tossiche nei sistemi acquatici a livello globale, utilizzando la rivoluzionaria tecnologia Copernicus Earth Observation. Il servizio ha previsto un doppio sistema di diffusione delle informazioni specifiche sulla presenza di bloom algali rivolto sia agli utenti che acquisteranno il servizio sia al pubblico che potrà usufruire di un servizio di informazione gratuito e aperto basato sulla telecomunicazione mobile. Le piccole e medie imprese europee collaboreranno con gli utenti dei settori ambientale e commerciale, al fine di stabilire una "supply chain", basata su un solido modello di business, per portare questo servizio innovativo sul mercato.

**Abstract ENG:** CyanoAlert aims to develop a fully automated application to assess the cyanobacteria and / or potentially toxic algal blooms in aquatic systems, using the Copernicus Earth Observation technology. The service provided for the dissemination of specific information on the presence of algal blooms to users who purchase the service. Moreover, a free information service open wil be provided to the public based on mobile telecommunications. European SMEs collaborate with users of the environmental and commercial sectors in order to establish a "supply chain", based on a solid business model, to bring this innovative service to the market.

**Descrizione estesa ENG:** This project aims to bring an innovative service and application for monitoring and forecasting of cyanobacteria blooms in lakes and coastal seas to the market. This is towards the aims of: • Improving the management and health of aquatic ecosystems around the globe (environment) • Reducing the risks to human, animal and ecosystem health from cyanotoxins (health) • Reducing the long-¬-term cost of monitoring a large number of widespread water bodies by taking ad-¬-vantage of Copernicus' wealth of information (economy) • Creating a sustainable business model generating significant turnover and new jobs in Europe and abroad (economy) • Significantly changing the way water quality is monitored around the globe to address emergency, se-¬-curity and climate change concerns (environment) The objectives were: 1. To provide a warning and monitoring service based on integrated Copernicus Earth Observation and ground data for cyanobacteria blooms and eutrophication in lakes and enclosed seas to public, commercial and research users in a customer-¬-specific and targeted manner. The service will be the first worldwide with the ability to distinguish harmful cyanobacteria from other algae and aims to take cutting-¬-edge research findings and deliver these to customers via a

commercial service. 2. To develop a commercial service platform, supported by a fully automated production process capable of producing and delivering to customers the EO information products (Impact 1). 3. To customise, shaped by user needs and requirements, the EO information service platform and application to maximise its utility to customers and uptake by the market (Impact 2). 4. To achieve complete integration of the customised EO information into the customer's workflow processes (e.g., monitoring, analysis, dissemination, reporting tasks and public communication mandate) (Impact 2B). WP1 includes a component dedicated to integrating the EO information services into the customers various 5. To validate the customised EO information and intermediate products provided by the service application to increase customer acceptance and reduce uncertainty estimates (Impact 2A). 6. To establish service level models and quality of service agreements with customers in targeted transnational communities (e.g., water utilities, regional authorities, commercial companies) (Impact 2A). 7. To demonstrate the business case, commercial value and economic viability of the service, through the establishment of sustainable supply chains based on proven market revenues (Impact 3). 8. To establish an economically viable business that generates significant turnover and creates new jobs in Europe and abroad after the end of public funding, through transnational and international partnerships between SMEs and customers (Impact 3). This objective is aimed at boosting business activity in Europe, and establishing European technology as the world leader in EO based water quality services, thereby demonstrating that the investment in Copernicus space infrastructure is justified.

**Rilevanza scientifica e risultati ENG:** Legislation from countries around the world (including Europe, America, Australia, South Africa etc.) and global organisations (e.g., World Health Organisation, UNEP, see Chorus & Bartram, 1999) have highlighted the demand for documentation of natural habitats by monitoring temporal variation and spatial distribution of the most sensitive and essential habitats requiring long-¬term protection. Some of these international, national and regional agreements, directives and management plans aim to protect and monitor freshwaters and coastal waters in order to ensure the sustainable management of these ecosystems. The need to restore and protect water bodies from further degradation has resulted in formulation of the European Union Water Framework Directive 2000/60/EC (WFD). The directive aims to harmonize European legislation on water and calls for Member States to establish programs for monitoring the status of all water bodies larger than 0.5 km2, in order to guarantee the quality and quantity of inland waters in the future. The directive demands that ecological status should be assessed, and action plans for a sustainable management and protection of freshwater resources should be established. In practice, this means that extensive and expensive sampling programs are needed. For aquatic environments, the fulfilment of the monitoring requirements is an acknowledged problem due to the size of the largest lakes, the enormous number of lakes in total, their considerable temporal and spatial variability and, in some cases, their inaccessibility. Several countries have received criticisms from the EU regarding a number of spatial and temporal shortcomings in their existing monitoring programs. In addition, not all lakes are monitored because of lack of resources. The ecological status of a water body can be described by various biological and physical-chemical quality measurements and several of these important ecological parameters can be monitored from space. Some of these are addressed by the proposed service, including cyanobacteria dominance in total phytoplankton biomass, frequency and intensity of blooms, and chlorophyll concentration. The service seeks to take advantage of market opportunities in the sector through addressing users' needs through integration with existing programmes,

leading to significantly improved spatial and temporal frequency of monitoring and forecasting and long-term cost savings. Therefore there is considerable incentive from economic, health and social perspectives to establish an effective service for monitoring cyanobacteria blooms in the world's freshwater resources and marine environments. In the frame of the CyanoAlert project and the MERIS retrospective analyzes, IRSA-CNR provided chemical-physical and biological data of the Taranto Seas for the years 2007-2009. Furthermore, IRSA contributed to WT 5.1 and 5.3 by carrying out samples for the validation of the Copernicus system in the Mar Piccolo and Mar Grande of Taranto (Southern Italy), affected by eutrophication problems and harmful algal blooms. Seawater samples were analyzed to assess the presence of harmful algal species and toxins (cyanotoxins in particular) and to possibly establish the link between the algal blooms signaled by remote sensing and the levels of biotoxins. The results of the project have been disseminated in national and international conferences and a master's degree thesis on the algal communities of the Mar Piccolo of Taranto (University of Bari) has been produced. The collected data are under the elaboration phase.

**Fonte di finanziamento ITA:** Horizon 2020, Call H2020-EO-2016

**Fonte di finanziamento ENG:** Horizon 2020, Call H2020-EO-2016

**Altre informazioni ITA:** Brockmann Consult GMBH (Germany), Odermatt & Brockmann GmbH (Switzerland), Brockmann Geomatics Sweeden AB (Sweden), "Danube Delta" National Institute for Research and Development (Romania), Istituto Superiore di Sanità (Italy)

**Altre informazioni ENG:** Brockmann Consult GMBH (Germany), Odermatt & Brockmann GmbH (Switzerland), Brockmann Geomatics Sweeden AB (Sweden), "Danube Delta" National Institute for Research and Development (Romania), Istituto Superiore di Sanità (Italy)

**Website:** https://www.cyanoalert.com/

**Coordinatore:** Petra Philipson, Brockmann Geomatics Sweeden AB (Sweden)

**Referente IRSA:** Caroppo Carmela

**Periodo di attivita:** 01/11/2016-30/06/2020

**Titolo: Interreg ITA/CH SHARESALMO - Gestione Ittica integrata e condivisa per la conservazione dei salmonidi nativi ed il contrasto delle specie aliene invasive.**

**Acronimo:** SHARESALMO

**Abstract ITA:** Obiettivo generale del progetto è la conservazione della biodiversità ittica dei bacini del Fiume Ticino e del Fiume Sesia, agendo in particolare a favore dei Salmonidi nativi: temolo (Thymallus aeliani), trota marmorata (Salmo marmoratus) e trota lacustre (Salmo spp.), i cui areali trovano nel territorio d 'azione INTERREG l'area più critica per la loro conservazione in natura,

riconoscendo nei laghi Maggiore e Ceresio, cuore del corridoio ecologico fluviale, l'emblema stesso della connotazione transazionale del progetto. I molti servizi ecosistemici resi dalla biodiversità ittica, di carattere naturalistico, ecologico, storico-culturale ed economico, motivano il progetto. Esso è volto a promuovere la gestione sostenibile della risorsa ittica attraverso un approccio integrato e condiviso tra i due Paesi e tra i soggetti interessati, assicurando la conservazione a lungo termine della risorsa a livello professionale, dilettantistico e turistico per una pesca informata e consapevole.

**Abstract ENG:** The aim of the project is to enhance the conservation of native salmonids in the basin of the Ticino and Sesia rivers.

**Fonte di finanziamento ITA:** Comunità Europea

**Altre informazioni ITA:** Parco del Ticino Lombardo (capofila italiano) Canton Ticino (capofila svizzero) Graia srl Canton Grigioni Società Valsesiana Pescatori Sportivi Unione Montana Comuni della Valsesia Gal Terre del Sesia S.C.A.R.L. Importo totale finanziamento Euro 1.789.916 CHF 196.717 Importo Unità Operativa Euro 411.163

**Coordinatore:** Adriano Bellani, Parco del Ticino Lombardo

**Referente IRSA:** Pietro Volta

**Periodo di attivita:** 2019-2022

### Titolo: Indagini sulla fauna ittica del Lago Maggiore

**Acronimo:** Indagini CISPP

**Abstract ITA:** Verificare le dinamiche di popolazione delle specie ittiche Coregonus lavaretus e Alosa agone nel Lago Maggiore ai fini di una valutazione della sostenibilità delle modalità di pesca attualmente in uso. Verificare la sovrapposizione trofica tra la componente ittica di interesse per la pesca e quella alloctona di recente comparsa Mappare le aree attuali e potenziali di riproduzione di Coregonus lavaretus

**Abstract ENG:** Aim is to carry on studie on the population dynamics of the coregondis in Lake Maggiore and on the food niche overlap among native and non native species.

**Fonte di finanziamento ITA:** Commissariato italiano per la convenzione italo-svizzera per la pesca

**Fonte di finanziamento ENG:** Commissariato italiano per la convenzione italo-svizzera per la pesca

**Coordinatore:** Pietro Volta CNR-IRSA

**Referente IRSA:** Pietro Volta CNR-IRSA

**Periodo di attivita:** 2019-2023

**Titolo: REmediation of Marine Environment and Development of Innovative Aquaculture: exploitaiton of edible/not edible biomass**

**Acronimo:** REMEDIA Life

**Abstract ITA:** A livello Europeo, il settore dell'acquacoltura, in particolare la maricoltura, è in forte crescita con impatti ambientali negativi non trascurabili (V. form B2). Urge perciò mettere a punto sistemi di mitigazione/abbattimento di tali impatti mirati nel rispetto sia degli interessi di mercato che della normativa comunitaria, con particolare riferimento alla Marine Strategy Framework Directive. In tal senso REMEDIA si pone due ambiziosi obiettivi. Ob.1) Messa a punto di un sistema IMTA-Integrated Multi Trophic Aquaculture innovativo a livello europeo che porti ad una migliore mitigazione degli impatti ambientali negativi degli impianti di maricoltura in ambiente marino confinato Il Progetto prevede per la prima volta in Europa l'utilizzo di un sistema integrato che oltre all'allevamento dei pesci include un nuovo set di organismi biorimediatori, policheti e poriferi, che hanno un effetto di biorisanamento maggiore rispetto agli organismi comunemente utilizzati (mitili e macroalghe). Questi nuovi organismi presentano un'elevata tolleranza alle condizioni di stress ambientale e la loro efficacia è stata già ampiamente dimostrata nel corso di precedenti ricerche condotte dai proponenti. I risultati positivi ottenuti hanno determinato il passaggio alla successiva fase dimostrativa (V. form B2). Il Progetto mira a dimostrare che le tecnologie di biorimediazione sviluppate possono essere applicate con successo ad un impianto industriale di maricoltura in ambiente confinato con ricadute positive nel settore specifico e nell'ottica dell'utilizzo biotecnologico e commercializzazione a chilometro zero delle biomasse prodotte (eduli e non) e di una gestione ecofriendly dell'impresa Ob.2) Ingresso del nuovo sistema IMTA nel mercato e sviluppo di un circolo virtuoso che incentivi la maricoltura sostenibile a livello europeo NOTA. Il sistema IMTA prevede anche migliori performance di allevamento (relative essenzialmente all'abbattimento della carica microbica in impianto) e vantaggi economici aggiuntivi per l'impresa (legati alla diversificazione delle produzioni e alla vendita delle biomasse non eduli). Il confronto e la comunicazione tra stakeholders (dal locale alla scala europea) sui vantaggi ambientali e la sostenibilità economica del nuovo metodo IMTA proposto in REMEDIA sperimentato nel sito pilota potranno incentivare l'ingresso nel mercato di tale sistema. Con queste azioni si potranno anche incentivare scelte politiche e normative e finanziamenti specifici

**Abstract ENG:** At European level, the aquaculture industry, particularly mariculture, is growing strongly with not negligible negative environmental impacts (see form B2 ).Therefore new strategies targeted to the reference context in accordance with both the market interests and the Community legislation, in particular the Marine Strategy Framework Directive, are urgently needed to control and minimize the impact of aquaculture activities in the marine environment. In this context REMEDIA aims to two ambitious goals: Ob. 1 ) Developing an IMTA - Integrated Multi Trophic Aquaculture system innovative at European level improving the mitigation of the negative

environmental impacts due to mariculture activities in confined environment. The project aims to develop , for the first time at European level, the employment of a fish farming system integrated to a new set of bioremediators such as polychaetes and sponges which have greater bioremediation performances compared to the commonly used organisms (mussels and macroalgae). These organisms are characterized by high tolerance to environmental stress conditions and their efficiency as bioremediators has been already demonstrated by the proponents. The positive results outcome in the previously performed research activity led to the following demonstration phase (see Form B2 ). The project aims to demonstrate that the developed bioremediation technologies can be successfully applied to an industrial mariculture farm in confined environment with relapses not only in the specific aquaculture field but also in the light of a "farm-to-table" employment of the produced biomass (edible or not), its biotechnological exploitation and an aquaculture ecofriendly management. Ob. 2) Entrance of the new IMTA system into the market and development of a virtuous circle which would encourage sustainable mariculture in Europe. NOTE. Best farming performance (mainly considering the decreasing of microbial load in the farm) and additional economic benefits to the enterprises (related to the diversification of production and the exploitation of non-edible biomass) are expected by the IMTA system. The entrance of the new IMTA method proposed in REMEDIA and tested in the pilot site, will be promoted throughout stakeholder communication and relationships (from local to European scale) on the environmental benefits and the economic sustainability. These actions will also stimulate policies and directives as well as specific funding.

**Rilevanza scientifica e risultati ITA:** 1) Riduzione degli Impatti ambientali dell'impianto: miglioramento della qualità ambientale. A breve/medio termine ci si aspetta una biorimediazione del 70% delle acque circostanti l'impianto ed un ritrovato equilibrio dell'ambiente marino considerato che i policheti e i poriferi sono più efficienti dei mitili. Si stima un miglioramento della qualità chimico-fisica delle acque superiore al 50% in termini di ossigeno disciolto. Relativamente al TRIX index usato per classificare lo stato di qualità delle acque marino-costiere in rapporto allo stato trofico si prevede che da un valore 5<trix<6 che corrisponde a mediocre si passi a un valore 2<trix<5 tra buono/elevato grazie all'azione di biorimediazione. Relativamente agli indicatori di contaminazione fecale si prevede una riduzione di circa l'80%. Altri parametri su cui si attende un miglioramento sono quelli usati attualmente per valutare lo stato di salute ecologico degli ecosistemi (come previsto dall'Italian Ministerian Decree, 260/10 e la Marine Strategy) quali CARLIT index che da un valore attuale di RQE = 0.57 (sufficiente) potrebbe passare a un valore di 0.75 (elevato/buono) così come il PREY index che potrebbe passare dall'attuale 0.1-0.5 (scarso/sufficiente) a 0.55-1 (elevato/buono) e infine il M-AMBI index che potrebbe passare dall'attuale sufficiente (<0.6) a uno stato elevato/buono( 0.60-0.81). 2) Diversificazione delle produzioni per l'azienda pilota con l'apertura verso nuovi mercati in relazione alla commercializzazione dalle biomasse non eduli che rappresentano un by product ad elevato valore commerciale; produzione di composti biotecnologici da esse ottenuti; migliori performances di allevamento; riduzione del rischio di contaminazione batterica dei prodotti ittici. Ad ogni ciclo produttivo si prevede oltre all'allevamento delle specie ittiche e la produzione di militi, la raccolta di 1.36 tonnellate di policheti, e 200-250 litri di poriferi. 3) Sviluppo di un Piano Manageriale dell'azienda pilota per la sostenibilità delle proprie attività imprenditoriali e Firma di tre convenzioni tra stakeholders a livello internazionale per la replicabilità ed il trasferimento dell'esperienza progettuale. 4) Redazione di linee guida metodologiche validate ed applicabili a

scala europea; definizione di un After Life Plan. 5) Azioni di comunicazione e sensibilizzazione (eventi legati a "REMEDIA life", sito web, logo, materiale divulgativo, organizzazione di un workshop transnazionale e convegno finale).

**Rilevanza scientifica e risultati ENG:** 1) Reduction of environmental impacts of aquacolture activities: improving the environmental quality. Taking into account that polychaetes and sponges are bioremediators more efficient than mussels, in the short/medium term it is expected a bioremediation of 70% of the seawater surrounding the plant and a recovered balance of the marine environment. We estimate an improvement of the chemicalphysical quality of the water higher than 50% (dissolved oxygen). As far as the measurement of the trophic conditions of the marine coastal waters, it is expected that after bioremediation by the proposed organisms the TRIX index value of 5 <trix <6 corresponding to a mediocre trophic state of the seawater, will change into 2 <trix <5 which indicates a good/high quality state for a marine area. The indicators of fecal contamination are expected to be reduced of about 80%. Other indicators considered for the classification of the marine water quality status (according to the Italian Ministerian Decree, 260/10 and the Marine Strategy) and expected to be improved, are the CARLIT index rating from 0.57 (sufficient) to 0.75 (good/high), the PREY index rating from 0.1-0.5 (low / sufficient) at 0.55-1 (good/high) and M-AMBI index with an improvement from sufficient (<0.6) to a good/high condition of the marine water ecological status (0.60-0.81). 2) Diversification of the farm production towards new markets in relation to the commercialization of not edible biomass representing a by-product of high commercial value; production of biotechnological compounds derived from the biomasses; improvement of the rearing performances; reduction of risks associated with bacterial contamination of fish products. At each productive cycle, in addition to the reared fish products and the production of mussels, 1.36 tons of polychaetes and 200-250 liters of sponges are expected. 3) Development of a Management Plan by the pilot farm aimed to support its own business activities and three signatures of the agreement by international stakeholders for the replicability-transferability of the project. 4) Production of methodological guidelines validated and applicable across Europe; preparation of the After Life Plan. 5) Communication and awareness raising actions (events related to "REMEDIA life", website, logo, promotional material, organization of a transnational workshop and a final conference)

**Fonte di finanziamento ITA:** Comunità Europea

**Fonte di finanziamento ENG:** European Community

**Altre informazioni ITA:** Name of the coordinating beneficiary: Università del Salento - Dipartimento di Scienze e Tecnologie Biologiche e Ambientali Name of the associated beneficiary: Istituto per la Ricerca sulle Acque IRSA CNR S.S. Taranto Maricoltura Mar Grande S.r.l. Università degli Studi di Bari Aldo Moro Total project budget: 2,476,304 Euro Total eligible project budget: 2,453,354 Euro EU financial contribution requested: 1,344,137 Euro

**Altre informazioni ENG:** LIST OF BENEFICIARIES Name of the coordinating beneficiary: Università del Salento - Dipartimento di Scienze e Tecnologie Biologiche e Ambientali Name of the associated beneficiary: Istituto per la Ricerca sulle Acque IRSA CNR S.S. Taranto Maricoltura Mar Grande S.r.l. Università degli Studi di Bari Aldo Moro Total project budget: 2,476,304 Euro Total eligible project budget: 2,453,354 Euro EU financial contribution requested: 1,344,137 Euro

**Website:** https://remedialife.eu/

**Coordinatore:** Adriana Giangrande, Università del Salento

**Referente IRSA:** Loredana Stabili

**Periodo di attivita:** 01/07/2017- 1/07/2023

### Titolo: COST Action CA19123 - Protection, Resilience, Rehabilitation of damaged environment

**Acronimo:** Phoenix

**Abstract ENG:** Humanity faces unprecedented challenges: global warming, overuse of fossil fuel energy and rapidly growing urbanisation. While the development, validation and cost-efficiency improvement of energy-aware and limited-complexity solutions are becoming increasingly time-consuming, microorganisms represent one realistic hope. For millennia microbes have tirelessly been shaping the Earth's ecosystems and with the right approach, they can help re-introduce environmental equilibrium. PHOENIX aims to demonstrate the effectiveness of Bio-electrochemical systems (BESs); BESs are low environmental impact systems that exploit the biological activity of live organisms for pollutant reduction, recycling of useful elements, synthesis of new products and production of electricity, in the case of microbial fuel cells (MFC). Recent advances in the field of low power electronics enable the exploitation of these sustainable and environmentally-friendly technologies. The activities of PHOENIX will be related to the characterization of BESs technologies and their implementation as bio-remediator, bio-sensors, and bio-reactors connected to sustainable urban planning, educational and socio-economic aspects. The integration of bio-technologies in the urban context is a key priority for appropriate rational urban planning and minimum environmental impact.

**Fonte di finanziamento ITA:** Comunità Europea

**Altre informazioni ENG:** Participants: 33 European States; Funding: 130,000 € / year

**Website:** https://www.cost.eu/actions/CA19123/#tabs|Name:overview

**Coordinatore:** Dr Andrea PIETRELLI, Université Lumière Lyon 2

**Referente IRSA:** Paola Grenni

**Periodo di attivita:** 21/09/2020-20/09/2024

### Titolo: Integrated Process and Product Design for Sustainable Biorefineries

**Acronimo:** IPROPBIO

**Abstract ITA:** La piena valorizzazione del potenziale chimico delle biomasse di scarto richiede conoscenze specialistiche e sinergie tra diverse competenze. L'obiettivo generale di IProPBio è lo scambio di conoscenze teoriche e sperimentali complementari di ricerca mediante interazione diretta tra unità di Personale afferenti ai diversi partner di ricerca. IProPBio si divide in 4 Work Packages tematici, più due di supporto per la condivisione interna della conoscenza e la diffusione dei risultati. Caratterizzazione di materie prime alternative e prodotti di alto valore, schemi tecnologici alternativi per la conversione economica ed eco-compatibile delle biomasse di scarto in prodotti di alto valore, studi di integrazione di massa ed energia per ridurre gli sprechi e aumentare la redditività, valutazione del ciclo di vita dei processi disegnati sono i principali problemi affrontati.

**Fonte di finanziamento ITA:** European Union's Horizon 2020 research and innovation programme under Marie Skłodowska-Curie grant agreement No 778168

**Fonte di finanziamento ENG:** European Union's Horizon 2020 research and innovation programme under Marie Skłodowska-Curie grant agreement No 778168

**Coordinatore:** Massimiliano Errico

**Referente IRSA:** Carlo Pastore

**Periodo di attivita:** 01/01/2018-31/12/2022

### Titolo: REsources from URban BIo-waSte

**Acronimo:** RES URBIS

**Abstract ITA:** Finalità del progetto: Rendere possibile la conversione di diversi tipi di rifiuti organici urbani in preziosi prodotti a base biologica, in un'unica bioraffineria integrata di rifiuti organici e fanghi di depurazione. I prodotti a base biologica includono il poliidrossialcanoato (PHA) e le relative bioplastiche a base di PHA, nonché le produzioni ausiliarie: biosolventi (da utilizzare nell'estrazione di PHA) e fibre (da utilizzare per i biocompositi PHA).

**Fonte di finanziamento ITA:** EU Horizon 2020 Programme (topic: H2020-CIRC-05-2016) under Grant Agreement No. 730349

**Fonte di finanziamento ENG:** EU Horizon 2020 Programme (topic: H2020-CIRC-05-2016) under Grant Agreement No. 730349

**Coordinatore:** Mauro Majone

**Referente IRSA:** Carlo Pastore

**Periodo di attivita:** 01/01/2017-31/12/2019

### Titolo: Urban Flood Resilience research project

**Acronimo:** Urban Flood Resilience research project

**Abstract ITA:** Il progetto mira a studiare come la pianificazione, la progettazione, il funzionamento e l'organizzazione dei sistemi idrici urbani esistenti e di nuova costruzione possano essere sfruttati al meglio e trasformati al fine di fornire molteplici vantaggi (inclusa la resilienza alle inondazioni) in condizioni di alluvione, normali e di siccità.

**Abstract ENG:** The research team will investigate how planning, design, operation and organisation of both existing and new urban water systems might be envisaged and transformed in order to deliver multiple benefits (including flood resilience) under flood, normal and drought conditions.

**Fonte di finanziamento ENG:** EPSRC (Engineering and Physical Science Research Council)

**Altre informazioni ITA:** Lo scrivente ha svolto il ruolo di External Research Consultant nel periodo Gennaio 2019 - Luglio 2019, al fine di sviluppare un modello di Participatory System Dynamics Modelling per la gestione sostenibile delle risorse idriche nell'insediamento di Ebbsfleet (una garden city)

**Coordinatore:** Colin Thorne (University of Nottingham, UK)

**Referente IRSA:** Alessandro Pagano

**Periodo di attivita:** http://www.urbanfloodresilience.ac.uk/research/research-overview.aspx

### Titolo: Nature Insurance Value: assessment and demonstration

**Acronimo:** NAIAD

**Abstract ITA:** NAIAD è un progetto finanziato nell'ambito di H2020. Ha avuto come obiettivo principale la definizione di metodologie e strumenti per incrementare l'implementazione e l'efficacia delle Nature-Based Solution per ridurre i rischi connessi con le risorse idriche.

**Abstract ENG:** NAIAD is a project funded under H2020. Its main objective was the definition of methodologies and tools to increase the implementation and effectiveness of Nature-Based Solution as means to reduce the risks associated with water resources.

**Website:** http://naiad2020.eu/

**Coordinatore:** Duero River Basin Authority

**Referente IRSA:** Raffaele Giordano

**Periodo di attivita:** 01/12/2016 - 30/05/2020

## Progetti di ricerca nazionali

### Titolo: Azioni sull'ecosistema dell'Area di Crisi Ambientale di Taranto

**Acronimo:** Area Vasta

**Abstract ITA:** La presente azione si compone di numerosi Task che mirano allo studio integrato del territorio di Area Vasta, nelle sue componenti abiotiche e biotiche. Base necessaria è l'inquadramento geologico, geomorfologico, strutturale ed idrogeologico della risorsa suolo di tutta l'ampia area in esame (564 km2). Obiettivo dell'azione è quello di definire lo stato di qualità dell'area in esame non soltanto da un punto di vista di una eventuale contaminazione del suolo bensì anche di una possibile trasmissione di tali inquinanti lungo la rete trofica che potrebbero giungere sino all'uomo. Essendo l'area molto vasta e non essendo tecnicamente possibile (né per il tempo necessario né, tantomeno, per i relativi costi), poter caratterizzare tutta la zona con una maglia molto stretta, si è optato per una strategia che vede due piani temporalmente consequenziali, per soffermarsi poi soltanto su quelle aree che risulteranno realmente degradate e critiche che verranno sottoposte a specifiche analisi chimiche, biololecolari ed ecotossicologiche. La valutazione della documentazione acquisita, le analisi sino ad oggi condotte, le verifiche in atto, la configurazione dello scenario derivante nonché l'evoluzione storica dell'uso del suolo consentiranno di pervenire ad una prima pianificazione delle indagini e dei successivi interventi. Sulla base dei risultati ottenuti e delle criticità individuate, la maglia delle campagne che saranno effettuate, potrà essere eventualmente integrata ed infittita. Le indagini sono sviluppate in maniera sequenziale fra i vari task e, laddove tecnicamente possibile, anche in modo parallelo al fine di poter economizzare le spese evitando di duplicare le indagini, soprattutto quelle più costose. In particolare le attività svolte dal CNR si riferiscono a: - Task A1: Land-use - Task A2: Change detection - Task A3: Indagine spettrale sui siti potenzialmente inquinati dell'area di crisi ambientale di Taranto 18 - Task A5: Identificazione e caratterizzazione delle comunità batteriche dei suoli

**Descrizione estesa ITA:** Task A1: Land-Use Nel corso del primo anno di attività sono state studiate e cartografate le caratteristiche dell'uso del suolo dell'intera Area Vasta (560 km2), ad una scala di

grande dettaglio (> 1:5.000), integrando metodi tradizionali di fotointerpretazione e di rilievi di campo, con tecniche innovative di analisi di immagini telerilevate da piattaforme satellitari e da sistemi a pilotaggio remoto (droni). Il risultato è stato una Carta dell'Uso del suolo, in formato digitale georeferito e, come tale, rapidamente "interrogabile", aggiornabile ed integrabile con gli altri strati informativi riguardanti l'area d'indagine, prodotti dagli altri Task. La Carta realizzata rappresenta uno strumento operativo essenziale per a) la valutazione delle effettive potenzialità produttive agricole e paesaggistiche del territorio d'interesse e, pertanto, per la definizione di corrette strategie di bonifica oltre che di valorizzazione e conservazione del territorio; b) la valutazione (per confronto con informazioni preesistenti) dei cambiamenti avvenuti nei sistemi agricoli e non agricoli nel corso del tempo, utile per la individuazione di aree di "potenziale allerta" ambientale; c) la definizione di una "base-line" di riferimento per il monitoraggio di futuri cambiamenti nell'uso del suolo. Task A2: Change detection Tramite la comparazione delle foto storiche georiferite e successivamente elaborate sono state individuate e perimetrate n. 447 aree in cui si sono verificati dei significativi cambiamenti nel periodo 1954-2013; tali aree sono state riportate su shapefile con i seguenti attributi: valore attributo "id" (numero univoco elemento) e valore attributo "anno" (anno della mappa di base utilizzata per la mappatura). Sulla base di tali dati sono stati suggeriti differenti scenari di campionamento in base ad un criterio geometrico ed uno ragionato basato su mappe di concentrazione e di interpolazione ed effettuare una ricostruzione storica dei cambiamenti in modalità "time-lapse". Le indicazioni acquisite attraverso le tecniche di change detection sono state proficuamente utilizzate anche per l'individuazione dei siti di campionamento e saranno utili alla ricostruzione del modello concettuale complessivo Task A3: Indagine spettrale sui siti potenzialmente inquinati dell'Area di Crisi Ambientale di Taranto Nell'ambito del Task è stata sviluppata una metodologia per l'analisi speditiva di suoli contaminati da composti organici persistenti (Policlorobifenili – PCB) mediante indagini spettroradiometriche in laboratorio che sta portando alla creazione di librerie spettrali sui suoli contaminati funzionali allo screening rapido/speditivo di aree potenzialmente inquinate. Tale strategia investigativa potrà essere applicabile in tutti i siti di interesse nazionale ed internazionale interessati dalle tipologie di contaminanti esaminate nel presente progetto. L'impiego della spettroradiometria nel dominio visibile-infrarosso vicino vis-NIR quale tecnologia investigativa per l'analisi rapida e a basso costo dei suoli potenzialmente contaminati dell'area di crisi ambientale, esprime significative potenzialità per la caratterizzazione speditiva di siti interessati da fenomeni di inquinamento. Per la prima volta a livello internazionale, saranno acquisite attraverso tale tecnica investigativa, oltre 1.000 firme spettrali dei suoli e saranno create specifiche librerie spettrali che consentiranno di diagnosticare ed associare l'informazione della contaminazione a quella della pedologia dei territori. L'integrazione di tali informazioni spettrali con quelle acquisite mediante analisi chimiche tradizionali e attraverso la metagenomica (nell'ambito della quale si realizzano indagini biomolecolari sui suoli prelevati dall'area di studio - 564 km2), consentirà di creare database utili per la calibrazione e la validazione di elaborazione di nuovi modelli statistici, diagnostici e predittivi dell'inquinamento, utilizzabili, inoltre, per la identificazione delle più opportune strategie di bonifica da realizzare sui siti inquinati. I primi risultati ottenuti, riguardanti un'area contaminata da PCB (ex-Matra) nell'Area di Statte, hanno confermato la validità delle metodologie di caratterizzazione basate sull'uso della spettroscopia vis-NIR. Task A5: Identificazione e caratterizzazione delle comunità batteriche dei suoli al fine di individuare un'eventuale compromissione dei suoli Dalle prime analisi effettuate sui 67 campioni, è stato effettuato un primissimo screerning in cui stata rilevata una significativa variabilità di presenza (sia in termine numerico che di biodiversità) di

microrganismi (da 8.4x105 a 3.6x 106) nello strato più superficiale con una diminuzione proporzionale nello strato più profondo. In tutti i campioni è stata riscontrata un'elevata vitalità cellulare dei microrganismi che si aggira prevalentemente intorno all' 80% della popolazione microbica del suolo. Tale variazione è stata confermata dalla quantità di DNA estratto che è in fase di analisi e speciazione. Tali determinazioni stanno portando alla costruzione di uno straordinario database sito-microbico contenete informazioni metagenomiche e connesse alle attività metaboliche. L'informazione biomolecolare genera valore aggiunto rispetto al dato chimico fornendo indicazioni sull'effetto sinergico di inquinanti anche eventualmente non compresi nelle normative vigenti. Infine tali informazioni sono particolarmente utili per l'attivazione di percorsi di biorisanamento: un approccio di bonifica sostenibile sia sul piano ambientale che economico.

**Rilevanza scientifica e risultati ITA:** In particolare gli aspetti più innovativi applicati per la prima volta in ambito europeo in un territorio così esteso riguardano: 1. L'impiego della spettroradiometria quale tecnologia investigativa per l'analisi a basso costo dei suoli potenzialmente contaminati dell'area di crisi ambientale, esprime significative potenzialità per la caratterizzazione speditiva di siti interessati da fenomeni di inquinamento. Per la prima volta a livello internazionale, saranno acquisite attraverso tale tecnica investigativa, oltre 1.000 firme spettrali dei suoli e saranno create specifiche librerie spettroradiometriche che consentiranno di diagnosticare ed associare l'informazione della contaminazione a quella della pedologia dei territori. L'integrazione di tali informazioni spettrali con quelle acquisite mediante analisi chimiche tradizionali e attraverso la metagenomica (nell'ambito della quale si realizzano indagini biomolecolari sui suoli prelevati dall'area di studio - 564 km2), consentirà di creare database utili per elaborazione di nuovi modelli statistici, diagnostici e predittivi dell'inquinamento, utilizzabili, inoltre, per la identificazione delle più opportune strategie di bonifica da realizzare sui siti inquinati. 2. Ulteriore innovazione che permetterà l'analisi speditiva di ampie porzioni di territorio (Area Vasta) si riferisce ad applicazioni di metodologie biomolecolari, che attraverso l'identificazione e la caratterizzazione delle comunità batteriche autoctone dei suoli, consentiranno di valutare l'eventuale stato di degrado e compromissione dei suoli. Tali metodologie hanno il pregio di valutare lo stato di contaminazione riferibile ad un numero estremamente ampio di parametri analitici esaminando, nel contempo, eventuali effetti sinergici. L'analisi delle comunità batteriche consentirà, in aggiunta, di definirne le potenzialità di biorisanamento attraverso un processo di decontaminazione basato sull'eventuale stimolazione in situ dell'attività di specifici microrganismi autoctoni: anche tale attività realizzata in una porzione così estesa del territorio è unica nel suo genere in Italia ed in Europa. Le analisi basate sull'identificazione del DNA dei ceppi batterici presenti nel sito monitorato, attraverso l'utilizzo di tecnologie di ultima generazione e con creazione di una metodologia standardizzata è applicabile in altri siti potenzialmente contaminati. 3. Al contempo, il programma di azioni sull'ecosistema avviato, comprende la realizzazione di attività quali: land use, change detection, ecotossicologia e valutazione del bioaccumulo degli inquinanti che consentono di ampliare la conoscenza ambientale del territorio e degli effetti della contaminazione sullo stesso. L'integrazione delle informazioni ottenute da ciascuna attività di indagine consentirà di costruire un sistema di "Indagine" di area vasta, estremamente approfondito e completo che tenga conto delle caratteristiche sito specifiche e al contempo sia finalizzato a ridurre i costi rispetto alle indagini tradizionali.

**Fonte di finanziamento ITA:** Fondi Commissario Straordinario

**Website:** http://commissariobonificataranto.it/

**Coordinatore:** Fabio Trincardi

**Referente IRSA:** Vito Felice Uricchio

**Periodo di attivita:** 29/1/2017 - 23/8/2020

**Titolo: Biorimedio fitoassistito: una strategia verde per il recupero di aree contaminate e la valorizzazione di biomassa**

**Acronimo:** Soluzioni Verdi

**Abstract ITA:** Il presente progetto intende sviluppare una filiera tecnologica innovativa basata su soluzioni verdi in linea con la sostenibilità ambientale partendo dal biorimedio fitoassistito, quale tecnologia di bonifica verde per il recupero di aree multi-contaminate. In particolare attraverso una collaborazione con ISPRA saranno messi a punto protocolli innovativi per la biodegradazione di specifici inquinanti organici ad elevata persistenza nell'ambiente e pericolosità per la salute umana (policlorobifenili, PCB) e la rimozione di inquinanti inorganici (metalli pesanti), e saranno sviluppate strategie finalizzate a migliorare l'efficienza del biorimedio fitoassistito nella decontaminazione di aree severamente inquinate per mettere a disposizione una tecnologia non solo enormemente più economica ed ecocompatibile rispetto alle bonifiche classiche, ma anche competitiva dal punto di vista temporale. Al contempo, saranno sviluppati protocolli innovativi per il trattamento della biomassa legnosa ottenuta dall'area di sperimentazione, al fine di trasformare una "materia" che potenzialmente può essere definita un rifiuto (a causa del potenziale accumulo di contaminanti) in risorsa. In tal senso, saranno messi a punto e testati trattamenti finalizzati alla produzione di compost di qualità (tra cui il biochar), che consentono di incrementare l'efficienza di decontaminazione dei suoli, riducendo la biodisponibilità degli inquinanti; saranno altresì, sviluppati e testati trattamenti di valorizzazione energetica della biomassa legnosa, prodotta nell'area di indagine, in impianti di gassificazione a letto fisso di tipo 'downdraft', progettati ad hoc per la produzione distribuita di energia elettrica e termica allo scopo di alimentare le utenze presenti nell'area di indagine.

**Fonte di finanziamento ITA:** Regione Puglia

**Website:** http://www.soluzioniverdi.eu/

**Coordinatore:** Vito Felice Uricchio, Valeria Ancona

**Referente IRSA:** Vito Felice Uricchio, Valeria Ancona

**Periodo di attivita:** 31/10/2018-30/04/21

### Titolo: Sorveglianza attività estrattive Puglia

**Acronimo:** Cave

**Abstract ITA:** La Regione Puglia Sezione Ciclo Rifiuti e Bonifiche, si avvale delle strutture tecniche del C.N.R. - I.R.S.A. per l'individuazione degli scavi sospetti abusivi, da controllare successivamente sul territorio e verificare le attività di estrazione, trasporto ed utilizzo di materiale di cava e di ripristino ambientale. Il CNR-IRSA fornisce assistenza tecnico scientifica per l'individuazione e la gestione di strategie informatizzate più idonee a rendere efficaci le attività di controllo delle attività estrattive, anche avvalendosi di un sistema informativo di gestione.

**Fonte di finanziamento ITA:** Regione Puglia

**Altre informazioni ITA:** Regione Puglia Legione Carabinieri Comando Tutela Ambiente Carabinieri

**Coordinatore:** Vito Felice Uricchio, Carmine Massarelli

**Referente IRSA:** Vito Felice Uricchio, Carmine Massarelli

**Periodo di attivita:** 8/5/2020 - 8/5/2023

### Titolo: Micro and maCRO PLAStic pollution Monitoring with Advanced technologies

**Acronimo:** MICROPLASMA

**Abstract ITA:** Negli ultimi anni la plastica ha rivoluzionato la vita quotidiana determinando al contempo un sensibile incremento del volume dei rifiuti prodotti e della loro permanenza nell'ambiente a causa dell'elevata resistenza alla degradazione. Il Mar Mediterraneo, in quanto bacino semi- chiuso, è particolarmente sensibile a questo tipo di inquinamento e rivela le più alte concentrazioni di plastiche (208-760 kg/anno pro-capite) diventando una delle zone più colpite nel mondo. Alla luce di ciò, il presente progetto intende sviluppare un monitoraggio integrato delle plastiche (macro e micro) presenti sulle spiagge e lungo l'asta fluviale del fiume Ofanto attraverso l'elaborazione di protocolli innovativi di campionamento associando al contempo attività di rilevazione in tempo reale di parametri di qualità delle acque del corpo idrico e della relativa foce. Il monitoraggio delle microplastiche (frammenti < 5mm) sarà eseguito con un prototipo di campionatore di microplastiche per ambienti fluviali in grado di monitorare in maniera continua le microparticelle presenti in prossimità della foce del fiume Ofanto studiando il loro trasporto dalle acque interne all'ambiente marino. Il campionatore sarà inoltre accessoriato con opportuni sensori che misureranno differenti parametri indicatori tra cui la torbidità. Il sistema di monitoraggio delle macroplastiche sarà di tipo osservazionale seguendo il metodo del "visual census". Le informazioni

relative a descrizione, posizione gps, foto e video dei rifiuti osservati verranno raccolte da cittadini e Associazioni mediante l'utilizzo di un'applicazione per smartphone appositamente realizzata. Informazioni di tipo qualitativo e/o quantitativo volte all'acquisizione e alla validazione dei dati registrati "a terra" saranno raccolte anche attraverso tecniche di remote sensing basate su sensori aviotrasportati utilizzati per la definizione spaziale e temporale di alcuni parametri di qualità delle acque (torbidità, dispersione sedimenti).

**Fonte di finanziamento ITA:** Regione Puglia

**Coordinatore:** Vito Felice Uricchio, Carmine Massarelli

**Referente IRSA:** Vito Felice Uricchio, Carmine Massarelli

**Periodo di attivita:** 17/12/2018-17/12/2020

### Titolo: Accordo Quadro Ministero dell'Ambiente e della Tutela del Territorio e del Mare

**Acronimo:** MATTM

**Abstract ITA:** II Ministero dell'Ambiente e della Tutela del Territorio e del Mare ha individuato nel CNR -IRSA i necessari requisiti, oggettivi e soggettivi, per fornire supporto scientifico qualificato all'espletamento dei seguenti settori e tematiche di interesse, individuati d'intesa con la Direzione Generale per la Salvaguardia del Territorio e delle Acque, ed aventi carattere di preminenza scientifica: attuazione della Direttiva Nitrati; valutazione del rischio ambientale associato alla contaminazione da sostanze perfluoro-alchiliche (PFAS) e supporto all'implementazione della normativa nazionale ed europea sull'inquinamento chimico delle acque superficiali e sotterranee; l'attuazione della Common Implementation Strategy e bonifica dei siti contaminati. In particolare l'obiettivo è quello di perseguire una serie di attività tra cui: attività di supporto tecnico scientifico per l'attuazione della Common Implementation Strategy 2016-2018, attività di supporto tecnico scientifico all'attuazione della Direttiva Nitrati, attività di supporto tecnico alla valutazione del rischio ambientale associato alla contaminazione da sostanze prefluoro-alcaliniche (PFAS) e supporto all'implementazione della normativa nazionale ed europea sull'inquinamento chimico delle acque superficiali e sotterranee, attività di supporto tecnico scientifico in materia di bonifica dei siti contaminati e a supporto della Direzione Generale per la Salvaguardia del Territorio e delle Acque (STA).

**Descrizione estesa ITA:** Personale coinvolto e Tavoli attivi: a) attuazione italiana della Common Implementation Strategy per la Direttiva Quadro Acque con particolare riferimento alle attività tecnico-scientifiche dei Working Group previsti nella programmazione 2016-2018. In particolare IRSA segue i seguenti aspetti, partecipando ai seguenti tavoli di lavoro: 1) Sistema di classificazione e aggiornamento DM260/2010 (macroinvertebrati, fiumi) (A. Buffagni, S. Erba) 2) Monitoraggio e classificazione secondo la componente macrobentonica fluviale: monitoraggio di sorveglianza e d'indagine (A. Buffagni, S. Erba) 3) Classificazione corpi idrici fortemente modificati (HMWB, fiumi)

(A. Buffagni, S. Erba) 4) Validazione dei valori di riferimento per le metriche biologiche (benthos) e supporto a Regioni/ARPA (A. Buffagni, S. Erba) 5) Definizione di linee Guida Nazionali per l'applicazione del deflusso ecologico (A. Buffagni, S. Erba, De Girolamo A.M.) 6) Grandi fiumi: partecipazione all'esercizio di intercalibrazione europeo (A. Buffagni, S. Erba) 7) Adeguamento die criteri tecnici per la valutazione del deflusso minimo vitale (E. Romano, A.M. Zoppini, A. Buffagni) b) Coordinamento (IRSA) di un Tavolo Nazionale tecnico-scientifico sull'attuazione della Direttiva Nitrati e declinazione nazionale, attraverso il coordinamento/partecipazione ai seguenti tavoli (con la partecipazione di MiPAF): 8) Definizione di linee guida per la designazione/revisione delle Zone Vulnerabili da Nitrati di origine agricola (ZVN). Sviluppo di protocolli per il monitoraggio dei corpi idrici delle ZVN a supporto delle operazioni di aggiornamento/revisione delle ZVN (R. Balestrini, V.F. Uricchio, A. Lo Porto, V. Ancona, A.M. Basile, A.M. De Girolamo, P. Ielpo, D. Copetti, L. Marziali) 9) Sviluppo di protocolli per il monitoraggio ed il controllo dello stato di qualità delle acque superficiali e sotterranee 10) Definizione di nuovi indici per la valutazione dello stato di eutrofizzazione dei corpi idrici (S. Erba, R. Balestrini, L. Marziali) 11) Sviluppo di protocolli sperimentali innovativi basati su tecniche metagenomiche per l'identificazione di contaminanti nelle matrici ambientali (acqua e suolo) (A. Calabrese, V. Ancona, D. De Paola, V.F. Uricchio) c) Attività di supporto tecnico scientifico alla valutazione del rischio ambientale associato alla contaminazione da sostanze perfluoro-alchiliche (PFAS) e supporto all'implementazione della normativa nazionale ed europea sull'inquinamento chimico delle acque superficiali e sotterranee: 12) Prioritizzazione delle sostanze chimiche, attraverso la partecipazione dei delegati italiani (CNR-IRSA) (S. Polesello, S. Valsecchi) 13) Derivazione degli standard di qualità e i limiti allo scarico per le sostanze pericolose (S. Polesello, S. Valsecchi) 14) Valutazione dei valori di fondo nelle acque sotterranee (S. Polesello, S. Valsecchi, E. Preziosi, S. Ghergo) 15) Linee Guida per il monitoraggio di acque superficiali e biota (S. Polesello, S. Valsecchi, E. Preziosi, S. Ghergo) d) Attività di supporto tecnico scientifico in materia di bonifica dei siti contaminati 16) Definizione di protocolli e procedure per l'applicazione di tecniche di bonifica in sito. Sviluppo di linee guida per la valutazione dell'efficienza delle strategie di decontaminazione di siti inquinati 17) Individuazione dei valori di riferimento per le matrici ambientali di corpi idrici ricompresi nei Siti di Bonifica di Interesse Nazionale (SIN) (L. Guzzella, S. Ghergo, L. Marziali) 18) Definizione delle Linee guida per l'Analisi di Rischio Ecologico (ERA) di Siti di Interesse Nazionale (SIN) (L. Guzzella, L. Marziali) e) Attività di supporto tecnico scientifico alla valutazione del rischio ambientale associato al riuso delle terre e rocce provenienti dallo scavo meccanizzato 19) Partecipazione a Tavoli Tecnici convocati da MATTM con la partecipazione di ISPRA, ISS e Arpa Regionali per la definizione di Protocolli Operativi da attuarsi in corso d'opera per il monitoraggio della compatibilità ambientale delle terre e rocce prodotte durante realizzazione di grandi opere in sotterraneo (L. Patrolecco; A. Barra Caracciolo) f) Altre attività: 20) Supporto scientifico per l'aggiornamento del decreto legislativo 27 gennaio 1992, n. 99, riferito all'utilizzazione dei fanghi di depurazione in agricoltura (G. Mininni, C. Braguglia) 21) Aggiornamento normativo in materia di riuso acque depurate per fini irrigui (A. Pollice) 22) Linee guida per il campionamento delle acque per finalità analitiche (S. Ghergo, E. Preziosi).

**Fonte di finanziamento ITA:** MATTM

**Coordinatore:** Vito Felice Uricchio

**Referente IRSA:** Vito Felice Uricchio

**Periodo di attivita:** 12/12/2015 - 12/12/2020

### Titolo: Network innovativo di sensori avanzati per il monitoraggio ambientale

**Acronimo:** NETSIGN

**Abstract ITA:** Il progetto NETSIGN ha l'ambizioso obiettivo di rispondere ad una domanda rilevante ed attuale del territorio regionale ossia il monitoraggio di ampie aree contaminate e degradate o a rischio contaminazione attraverso una rete di sensori prototipali ed innovativi, che coopereranno all'interno di un sistema esperto specializzato in materia ambientale, sviluppato anch'esso nell'ambito del progetto ed in grado di elaborare dati in modo automatico e fornire avvisi o allarmi relativi alla compromissione delle matrici ambientali. La zona prescelta per tale sperimentazione/attuazione progettuale è quella di Taranto, area rientrante nel SIN a causa dell'accertato grado di compromissione delle varie matrici ambientali: Aria, Acqua e Suolo.

**Fonte di finanziamento ITA:** POR Puglia FESR-FSE 2014-2020. Fondo Europeo Sviluppo Regionale. Azione 1.6 – Avviso pubblico "InnoNetwork"

**Coordinatore:** Vito Felice Uricchio, Carmine Massarelli

**Referente IRSA:** Vito Felice Uricchio, Carmine Massarelli

**Periodo di attivita:** 25/03/2019-25/03/21

### Titolo: Smart Water Resource Management – Networks

**Acronimo:** SWaRM-Net

**Abstract ITA:** Il Progetto mira a coniugare la domanda d'innovazione e alta specializzazione nel settore della tutela delle risorse idriche con la scelta strategica di puntare su "smart cities" che prevedano un coinvolgimento attivo dei cittadini nella gestione del territorio e nell'attuazione delle politiche ambientali, in stretto raccordo con la strategia Europa 2020 che ha individuato crescita intelligente, crescita sostenibile e crescita inclusiva quali motori di rilancio dell'economia. L'ambito primario di riferimento è "Gestione Risorse idriche", fortemente interconnesso con "Waste Management", che assume un ruolo centrale di raccordo tra disponibilità della risorsa idrica, il suo utilizzo e le azioni per una sua restituzione all'ambiente con standards di qualità idonei a minimizzare gli impatti sullo stato ecologico e la salute dei cittadini. Alcune attività concernenti il monitoraggio e la gestione degli eventi estremi s'interfacciano anche con l'ambito "Sicurezza del territorio", mentre altre riguardanti raccolta e immagazzinamento dei dati, la loro diffusione e il loro

uso interoperabile s'interfacciano con l'ambito "Domotica e Smart Grids" in particolare con riferimento ad aspetti riferiti al miglioramento della qualità della vita negli ambienti domestici, alla riduzione dei costi di gestione ed alla trasmissione delle informazioni mediante Power Line Communication (PLC) ed alla loro memorizzazione utilizzando la tecnologia Cloud. Il progetto risponde all'esigenza di una gestione integrata delle acque in grado di coniugare da un lato la tutela della risorsa mediante strategie e tecnologie innovative, al fine di incrementare l'efficienza nell'utilizzo e le performances delle reti e degli impianti di trattamento presenti nel territorio, e dall'altro lo sviluppo di nuovi ed affidabili sistemi di monitoraggio distribuiti e di facile accesso per un controllo diffuso dello stato di qualità. Tale approccio favorisce il diretto coinvolgimento delle Smart Communities per assicurare la tutela, la conservazione e la razionale ed ottimale utilizzazione delle risorse in un regime di Adaptive Water Management in grado di evolversi con le mutate esigenze del territorio e della popolazione. Lo sviluppo di tecnologie interoperative, anche indirizzate nella progettazione attraverso il coinvolgimento delle comunità locali, in grado favorire diffusione e scambio di informazioni tra decisori, gestori e le Smart Communities genera una base di conoscenza diffusa finendo con l'incidere direttamente sul versante educativo e dei comportamenti e avrà come risultato una migliore protezione ambientale. In tale direzione l'ubiquità dell'acqua, in ogni declinazione della vita sociale e produttiva, costituisce l'elemento naturale per canalizzare informazioni e per consolidare una nuova cultura di Smart Communities.

**Descrizione estesa ITA:** SWaRM-Net mira a coniugare la domanda d'innovazione e alta specializzazione nel settore della tutela delle risorse idriche con la scelta strategica di puntare su "smart cities" che prevedano un coinvolgimento attivo dei cittadini nella gestione del territorio e nell'attuazione delle politiche ambientali, in stretto raccordo con la strategia Europa 2020 che ha individuato crescita intelligente, crescita sostenibile e crescita inclusiva quali motori di rilancio dell'economia. L'ambito primario di riferimento è "Gestione Risorse idriche", fortemente interconnesso con "Waste Management", che assume un ruolo centrale di raccordo tra disponibilità della risorsa idrica, il suo utilizzo e le azioni per una sua restituzione all'ambiente con standards di qualità idonei a minimizzare gli impatti sullo stato ecologico e la salute dei cittadini. Alcune attività concernenti il monitoraggio e la gestione degli eventi estremi s'interfacciano anche con l'ambito "Sicurezza del territorio", mentre altre riguardanti raccolta e immagazzinamento dei dati, la loro diffusione e il loro uso interoperabile s'interfacciano con l'ambito "Domotica e Smart Grids" in particolare con riferimento ad aspetti riferiti al miglioramento della qualità della vita negli ambienti domestici, alla riduzione dei costi di gestione ed alla trasmissione delle informazioni mediante Power Line Communication (PLC) ed alla loro memorizzazione utilizzando la tecnologia Cloud. L'idea progettuale risponde all'esigenza di una gestione integrata delle acque in grado di coniugare da un lato la tutela della risorsa mediante strategie e tecnologie innovative, al fine di incrementare l'efficienza nell'utilizzo e le performances delle reti e degli impianti di trattamento presenti nel territorio, e dall'altro lo sviluppo di nuovi ed affidabili sistemi di monitoraggio distribuiti e di facile accesso per un controllo diffuso dello stato di qualità. Ciò favorirà il diretto coinvolgimento delle Smart Communities per assicurare la tutela, la conservazione e la razionale ed ottimale utilizzazione delle risorse in un regime di Adaptive Water Management in grado di evolversi con le mutate esigenze del territorio e della popolazione. Le attività proposte sono caratterizzate da elevato grado di innovazione con l'intento di promuovere un uso più efficiente delle risorse in accordo con l'iniziativa Resource Efficient Europe della strategia Europa 2020. Tale obiettivo verrà perseguito con interventi volti sia alla riduzione dei consumi domestici, irrigui e industriali che allo sviluppo di

tecnologie e green infrastructures per il riutilizzo. Verranno sperimentati sistemi intelligenti di conturizzazione delle utenze che operino come interfaccia tra utente e gestore, informando il primo su consumi, costi e qualità dell'acqua erogata e fornendo dati in tempo reale sulla domanda che consentano attraverso semplici bilanci di massa valutazioni puntuali sulle perdite delle reti di distribuzione e una più efficiente gestione delle pressioni di esercizio. Si sperimenteranno tecnologie di valorizzazione del potenziale termico dell'acqua che fluisce nella rete acquedottistica. Verrà realizzato un monitoraggio intelligente dei carichi inquinanti per orientare azioni di controllo sui carichi diffusi e generati a seguito di overflow della rete fognaria e su quelli produttivi, al fine di ridurre la presenza di contaminanti metallici e organici e massimizzare il recupero di nutrienti. Verranno, inoltre, realizzati dispositivi innovativi per il controllo dello stato di efficienza delle fognature urbane. Ciò favorirà il raggiungimento del buono stato ecologico nei corpi idrici previsto dalla Direttiva europea 2000/60/CE considerando in prospettiva le nuove Direttive sul tema delle acque. In risposta a quanto fortemente auspicato da Amministratori, gestori e cittadini si propone l'impiego di indicatori precoci di allerta e strategie di mitigazione su scala locale degli eventi estremi riconducibili ai cambiamenti climatici e alle conseguenti modifiche nel regime delle precipitazioni. Nel settore della depurazione, accanto allo sviluppo di nuove tecnologie che migliorino l'efficienza e la versatilità degli impianti, saranno privilegiate tecnologie a basso impatto ambientale, in termini di superfici occupate, produzione di fanghi e emissioni odorigene, volte a massimizzare il recupero energetico e il recupero di materie prime e in particolare nutrienti e biocombustibili. Lo sviluppo di tecnologie interoperative, anche indirizzate nella progettazione attraverso il coinvolgimento delle comunità locali, in grado favorire diffusione e scambio di informazioni tra decisori, gestori e le Smart Communities genererà una base di conoscenza diffusa finendo con l'incidere direttamente sul versante educativo e dei comportamenti e avrà come risultato una migliore protezione ambientale. In tale direzione l'ubiquità dell'acqua, in ogni declinazione della vita sociale e produttiva, costituisce l'elemento naturale per canalizzare informazioni e per consolidare una nuova cultura di Smart Communities. Le azioni che saranno sviluppate in relazione ai diversi obiettivi programmatici, che vedranno coinvolti in gran parte, ma non solo, i comuni di Milano e Monza, hanno implicazioni socio-economiche in termini di prodotti innovativi, coinvolgimento delle Smart Communities e potenzialità ICT espressa e sono in grado di generare un effetto moltiplicatore che può propagarsi all'intero territorio nazionale e trovare riscontro anche in ambito internazionale.

**Altre informazioni ITA:** Consiglio Nazionale delle Ricerche (3 Istituti), Metropolitana Milanese S.p.A, VITROCISET S.p.A, TELECOM ITALIA S.p.A, Università degli Studi di Brescia, Politecnico di Milano, Università degli Studi di Milano Bicocca, SWaRM-Net-ATI (le seguenti imprese Omnitech s.r.l., SITAEL S.p.A., BRIANZACQUE s.r.l., ETG s.r.l., L.A.V.s.r.l., SIT s.r.l., SYSTEA S.p.A., DEGREMONT S.p.A.)

**Coordinatore:** Vito Felice Uricchio

**Referente IRSA:** Vito Felice Uricchio

**Periodo di attivita:** 1/9/2016-28/2/2022

**Titolo: Tecnologie e processi per l'Abbattimento di inquinanti e la bonifica di siti contaminati con Recupero di mAterie prime e produzioNe di energia TOtally green (TARANTO)**

**Acronimo:** PON Taranto - Energie per l'Ambiente

**Abstract ITA:** Il presente progetto è finalizzato allo sviluppo di un insieme di tecnologie innovative funzionali a generare energia rinnovabile conseguendo contestualmente effetti di bonifica delle matrici ambientali contaminate e favorendo l'economia circolare e la decarbonizzazione. Le tecnologie proposte promuovono l'efficienza energetica trasformando gli scarti (reflui, fanghi, biomasse da bonifiche) in fonti rinnovabili di energia, stimolando una profonda riconsiderazione del modo di produrre ed utilizzare energia e di fare impresa. Il progetto TARANTO è articolato in 6 Obiettivi Realizzativi: 1) Coordinamento del progetto, valorizzazione e diffusione dei risultati; 2) Progettazione e realizzazione di catalizzatori e foto-catalizzatori nanostrutturati per la rimozione di inquinanti prioritari ed emergenti in matrice acquosa e loro integrazione in impianti pilota - Sintesi e caratterizzazione chimico-fisica e funzionale di nano-fotocatalizzatori; Sintesi di ossidi misti con proprietà acido-base modulabili per la produzione di biodiesel da biomasse di scarto; Immobilizzazione dei catalizzatori su matrici solide, 3) Produzione di biofuel da biomasse derivate dal trattamento di acque reflue - Caratterizzazione, pretrattamenti e preparazione biomasse; Produzione di biodiesel liquidi; Produzione di biofuel gassosi, 4) Sviluppo di processi di trattamento intensivi per la rimozione di inquinanti da siti contaminati e da acque di scarico dell'area di Taranto - Processi di ossidazione avanzata per la rimozione di inquinanti organici; Integrazione di processi chimico-biologici per l'efficientamento energetico del trattamento di scarichi recalcitranti; Biorimedio fitoassistito di suoli e sedimenti contaminati; Bonifica di sedimenti contaminati presso il Mar Piccolo di Taranto mediante processi ossidativi e biorisanamento; 5) Depurazione e recupero di materia e energia dalle acque di scarico - Recupero di energia termica dalla depurazione delle acque di scarico urbane mediante pompe di calore; Trattamento di acque di scarico mediante schemi semplificati per il riutilizzo in agricoltura; Trattamento di acque di scarico per il riuso a fini irrigui tramite bioreattori anaerobici a membrana e sistemi naturali di fitodepurazione; e 6) Studio dell'impatto ambientale e Life Cycle Assessment (LCA) per la valutazione delle tecnologie e dei processi implementati nel progetto e studio di un modello di Fiscalità Circolare – La dimensione giuridica; Sviluppo di software; LCA.

**Abstract ENG:** The project aims at the development of an ensemble of technologies suitable to generate renewable energy, and consequently achieve remediation effects in the polluted enviromental compartments, thus favouring circular economy and decarbonization practices. The proposed innovative technologies intend to promote efficiency, transforming wastes ((waste water, sludge, biomass from remediation) in renewable energy sources, stimulating a profound reconsideration of how to produce and use energy and doing business. The TARANTO project is organized into 6 realization objectives: 1) Coordination of the project, exploitation and dissemination of the results; 2) Design and implementation of nanostructured catalysts and photo catalysts for the removal of priority and emerging pollutants in aqueous matrix and their integration into pilot plants - Synthesis and characterization of chemical- physical and functional nano-photocatalysts; Synthesis of mixed oxides with acid-base properties that can be modulated to produce biodiesel from waste biomass; Immobilization of catalysts on solid matrices; 3) Production of biofuel from biomass derived from waste water treatment - Characterization, pretreatment and biomass preparation; Production of liquid biodiesel; Production of gaseous biofuels, 4)

Development of intensive treatment processes for the removal of pollutants from contaminated sites and drainage areas of the Taranto area - Advanced oxidation processes for the removal of organic pollutants; Integration of chemical- biological processes for the energy efficiency of the treatment of recalcitrant discharges; Phytoassisted bioremediation of contaminated soil and sediments; Remediation of contaminated sediments in Mar Piccolo sea area (Taranto, Italy) through oxidative processes and bioremediation; 5) Depollution and recovery of matter and energy from waste water - Recovery of thermal energy from the purification of urban waste water by means of heat pumps; Wastewater treatment by simplified schemes for re-use in agriculture; Waste water treatment for irrigation re-use by anaerobic membrane bioreactors and natural phytodepuration systems; and 6) Environmental impact study and Life Cycle Assessment (LCA) for the evaluation of technologies and processes implemented in the design and study of a circular tax model - The legal issues; Software development; LCA.

**Altre informazioni ITA:** Partner: • Project leader: Consiglio Nazionale delle Ricerche – CNR - OdR • CISA Spa (CISA) – Grande Impresa • Biotec S.r.l. (BIOTEC) – PMI • Astra Engineering S.r.l. (ASTRA) – PMI • COMFORT ECO S.r.l. (COMFORTECO) - PMI • Ecopan S.r.l. (ECOPAN) – PMI • ICMEA S.r.l. (ICMEA) - PMI • Socrate S.r.l. (SOCRATE) – PMI • Omnitech S.r.l. (OMNITECH) – PMI • Università degli Studi di Bologna (UNIBO) OdR • Università degli Studi di Bari (UNIBA) - OdR.

**Website:** https://www.taranto.cnr.it/w/?page_id=71

**Coordinatore:** Vito Felice Uricchio

**Referente IRSA:** Vito Felice Uricchio

**Periodo di attivita:** 22/11/2018-21/05/2022

### Titolo: Barcoding and metabarcoding diversity in Terra Nova Bay

**Acronimo:** BTN-CODE

**Abstract ITA:** Barcoding molecolare e metabarcoding della biodiversita' in ambienti aquatici in Antartide

**Abstract ENG:** Barcoding and metabarcoding of biodiversity in aquatic habitats in Antarctica

**Fonte di finanziamento ITA:** PNRA

**Fonte di finanziamento ENG:** PNRA

**Coordinatore:** Stefano Schiaparelli

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 2018 - 2020

**Titolo: Innovative disinfection treatments to reduce the prevalence of determinants of antibiotic resistance in treated wastewater**

**Acronimo:** DISARM

**Abstract ENG:** Wastewater treatment plants (WWTPs) constitute an important hotspot for the spread of antibiotic resistant bacteria (ARB), which can directly reach natural fresh- and marine-waters, or could be reused for human activities (e.g. agriculture). In both cases, the treated wastewater with its content of ARB can affect the environmental microbial community and ARB could possibly come back to human (e.g. by food-chain) causing resistant infections. According to the Italian and European legislations the treated wastewaters should meet a number of parameters regarding chemical, physical, and microbiological pollutants. However antibiotic resistance is not considered among the parameters to monitor, and running WWTPs are not designed to actively remove determinants of antibiotic resistance, namely ARB and antibiotic resistance genes (ARGs). ARGs content in the effluents from WWTPs is currently under evaluation for the incoming revision of the European Water Directives for the next decade, thus it is reasonable to forecast that a precise definition and a possible reduction of the antibiotic resistome (the total ARGs content of a water sample) in the treated wastewaters will be required in the next future. In WWTPs, the abatement of bacterial abundance is mainly performed by the final disinfection, a step that has a direct impact on the microbial community of the treated wastewater. As also stated above, disinfections to date employed in WWTPs, either chemical (e.g. by peracetic acid, chlorine) or physical (e.g. UV radiation, sand filtration) are not specific in the removal of ARB and in some cases they could even select for ARGs and for bacterial resistant forms (e.g. aggregates). Thus, an appropriated disinfection process should be designed to address this problem. Furthermore, an improvement in the methodology applied to estimate the overall resistome and its potential influence on the environmental microbial community is needed. In fact, to evaluate the resistome of an environmental microbial community, different molecular methods have been used (e.g. high throughput qPCR, metagenomics), however to realistically test the effectiveness of a disinfection process, these methods should be coupled with a dedicated transcriptomic analysis in order to understand which ARG, mobile elements, and bacterial taxa are expressed and can possibly affect the environmental microbial community. With the DISARM project we aim to design and to test two innovative disinfection processes i.e. (i) ZVI (Zero Valent Iron)-Fenton in presence of H2O2; and (ii) membrane process, performing a selective removal of contaminants by surface exclusion based on size and on charge. These innovative processes will be compared with a classical disinfection based on UV radiation, in use at the selected WWTP, in terms of removal and reduction of the expression of ARGs, mobile elements, metal resistance genes, toxin-antitoxin systems (responsible of the selection of ARGs) and pathogenic bacteria. The best performing disinfection process will be selected with the objective to return to the environment a treated wastewater of high quality, possible reusable for human activities, without affecting the environmental or human microbial community and without promoting the spread of resistances in it.

**Fonte di finanziamento ITA:** LifeWatch Italy VREs & MoBiLab

**Coordinatore:** Di Cesare Andrea

**Referente IRSA:** Di Cesare Andrea

**Periodo di attivita:** in corso

**Titolo: Platform for Integrated Operation Research and Management of Public Water towards 2030 - PerFORM WATER 2030**

**Acronimo:** PerFORM WATER 2030

**Abstract ITA:** Finalità del progetto: Il progetto formerà una piattaforma diffusa di ricerca, sviluppo e implementazione di tecnologie e strumenti decisionali volti a garantire una sempre più efficace gestione del servizio idrico integrato, con i seguenti obiettivi: • attuare strategie in termini di innovazione, focalizzate su esigenze specifiche, ovvero implementare nuove tecnologie che affianchino lo sviluppo sostenibile del territorio, in ottica di economia circolare; • consolidare un network diffuso di competenze per rispondere alle sfide del futuro relative alla gestione della risorsa idrica. PerFORM WATER 2030 sarà la prima realtà in Italia di questo genere, un vero e proprio living lab che consente l'implementazione rapida delle innovazioni e delle tecnologie da validare o già industrializzate. • rendere permanente la piattaforma di collaborazione e fare in modo che PerFORM WATER 2030 diventi anche un centro di formazione di riferimento nel settore per studenti, ricercatori, operatori del settore delle varie aziende che così avranno modo di confrontarsi con un set di tecnologie esteso sul mondo dell'acqua e dell'energia; • alimentare questa realtà attirando anche nuovi partner. Gli ambiti di ricerca che saranno sviluppati sono: • LINEA ACQUA: controllo della qualità delle acque di approvvigionamento e ottimizzazione delle reti di distribuzione, ottimizzazione dei processi di trattamento delle acque reflue con tecnologie innovative per soddisfare i più stringenti limiti di qualità allo scarico, monitoraggio di inquinanti emergenti ed emissioni in atmosfera. • LINEA FANGHI: riduzione della produzione dei fanghi di depurazione, valorizzazione termica dei fanghi e recupero di energia e materie prime. • LINEA RECUPERO ENERGIA E MATERIA: recupero di energia e materia all'interno degli impianti, upgrade del biogas a biometano, ottimizzazione dei processi di digestione anaerobica ed incremento produzione biogas. • LINEA ACCETTABILITÀ' SOCIALE ED ECONOMICA DELLE TECNOLOGIE attraverso il coinvolgimento degli stakeholder e analisi avanzate di costi, tariffazione e Operation & Maintenance.

**Abstract ENG:** Purpose of the project: The project will form a widespread platform for research, development and implementation of technologies and decision-making tools aimed at guaranteeing an increasingly effective management of the integrated water service, with the following objectives: • implement strategies in terms of innovation, focused on specific needs, or implement new technologies that support the sustainable development of the territory, with a view to circular

economy; • consolidate a widespread network of skills to meet the challenges of the future relating to the management of water resources. PerFORM WATER 2030 will be the first reality in Italy of this kind, a real living lab that allows the rapid implementation of innovations and technologies to be validated or already industrialized. • make the collaboration platform permanent and ensure that PerFORM WATER 2030 also becomes a reference training center in the sector for students, researchers, operators in the sector of the various companies who will thus be able to deal with a set of technologies extended to the world water and energy; • nourish this reality by also attracting new partners. The research areas that will be developed are: • WATER LINE: quality control of supply water and optimization of distribution networks, optimization of wastewater treatment processes with innovative technologies to meet the most stringent quality limits at discharge, monitoring of emerging pollutants and emissions into the atmosphere. • SLUDGE LINE: reduction in the production of sewage sludge, thermal enhancement of sludge and recovery of energy and raw materials. • ENERGY AND MATTER RECOVERY LINE: recovery of energy and material within the plants, upgrade of biogas to biomethane, optimization of anaerobic digestion processes and increase of biogas production. • SOCIAL AND ECONOMIC ACCEPTABILITY LINE OF TECHNOLOGIES through the involvement of stakeholders and advanced cost, pricing and Operation & Maintenance analyzes.

**Fonte di finanziamento ITA:** POR (Programma Operativo Regionale) FESR (Fondo Europeo di Sviluppo Regionale) 2014-2020 e della Call d'innovazione "Accordi per la Ricerca e l'Innovazione" di Regione Lombardia

**Website:** http://www.performwater2030.it/

**Coordinatore:** Desdemona Oliva, Gruppo CAP: coordinato scientificamente da prof. Francesca Malpei, Politecnico di Milano

**Referente IRSA:** Licia Maria Guzzella

**Periodo di attivita:** 02/05/2017-30/04/2021

## Titolo: Characterization of Radiative-chemical processes at the Air/Snow Interface

**Acronimo:** CRASI

**Abstract ITA:** Obiettivo primario del progetto è approfondire le conoscenze sui processi chimico-fisici che avvengono all'interfaccia aria-neve. Le attività di ricerca saranno svolte presso la base italo-francese a Dome-C, combinando tra loro diverse metodologie di indagine basate su osservazioni dirette al terreno, a distanza "ravvicinata", e da satellite combinate con modelli di trasferimento radiativo. La complessità degli scambi interconnessi all'interfaccia aria-neve sarà analizzata considerando il trasferimento radiativo e la fotochimica che si verificano in superficie. Le attività saranno focalizzate sull'integrazione delle osservazioni già effettuate presso la stazione di misura fissa con le misure spaziali delle caratteristiche microfisiche della superficie nevosa (forma e dimensioni del grano), della rugosità superficiale, dell'albedo spettrale / a banda larga e misure

chimiche delle diverse matrici coinvolte (aria e neve). La definizione della variabilità spaziale e temporale del manto nevoso, abbinata alla descrizione dettagliata già disponibile per le postazioni fisse, contribuirà a valutare l'impatto dei diversi tipi di copertura nevosa sugli scambi radiativi e chimici all'interfaccia aria-neve e permetterà di validare i prodotti satellitari relativi alle coperture nevose. Le attività sul campo saranno supportate da un lavoro preparatorio, da effettuare in Italia, focalizzato sullo sviluppo tecnologico, sulla standardizzazione delle misure e sull'analisi dati. Le misure radiative a terra saranno eseguite in modo diffuso usando una strategia distribuita spazialmente e, contemporaneamente, in una postazione fissa. Misure di alcune specie fotochimicamente attive (composti azotati ed organici volatili) e dei relativi flussi atmosferici saranno effettuate nella neve e nell'aria. L'obiettivo finale del progetto consisterà nell'integrare i dati già disponibili con le nuove misure per ottenere una conoscenza più dettagliata sulla variabilità spaziale delle coperture nevose.

**Abstract ENG:** The air-snow interface is a critical layer that controls several processes and for this reason a deeper knowledge about driving parameters is the primary objective of this project. This goal will be approached at the Italian-French research facility at Dome-C combining different methodologies based on ground observations, proximal sensing, remote sensing and snow radiative modelling. The complexity of interconnected exchanges at the air-snow interface will be investigated considering the radiative transfer and photochemistry occurring at the surface. Both processes are strongly affected by the available snow surface area that is described by the roughness at a micro- and macro- scales. Activities will be focused on integrating already-operating observations at fixed position with spatial measurements about microphysical features of the snowed surface, the superficial roughness, the spectral/broadband albedo and the chemistry of the different involved matrices. The definition of the spatial and temporal variability of the snow cover, coupled to the detailed description available from long time-series at fixed positions, will contribute to assess the impact of different snow cover types on radiative and chemical exchanges at the air-snow interface and to support the validation of satellite snow-products. Furthermore, the field activities will be supported by a preparatory work operated in Italy that will be focused on the technological development, on the standardization of measurements and the analyses of the acquired observations. While radiative measurements at the ground will be performed spatially distributed, simultaneous measurements of some photochemically active species (nitrogen and volatile organic compounds) in snow and air and their relative atmospheric fluxes will be also conducted. The final goal of the project will consists in integrating available datasets with novel measurements for obtaining a ground-truth reliable in terms of spatial variability.

**Rilevanza scientifica e risultati ENG:** (1) Extend the knowledge about the albedo and the bidirectional reflectance factor in the solar spectral range 350-2500 nm; verify the compatibility between spectral and broadband albedo defining narrowband-to-broadband conversion site specific parameters. (2) Assess the spatial variability of the snow cover in terms of spectral albedo and roughness under different meteo-climatic conditions. (3) Determine implications for reactive nitrogen and carbon recycling (release, loss, oxidation, deposition) at the air-snow interface for the evaluation of photochemistry and oxidative capacity over Dome-C. (4) Develop a database concerning surface reflectivity with accessory information about snow micro-physical features (grain size and shape, SSA, density) and surface roughness. (5) Develop a high quality surface based reference dataset aimed to enhance CAL/VAL activities for MODIS and Sentinel-2/3 snow products

over Dome-C. (6) Develop photochemical models linking chemical and radiative exchange processes at air-snow interface to test various global change scenarios and derive the responsiveness of the chemical and physical/radiative mechanisms to photochemistry and global changes.

**Fonte di finanziamento ENG:** Programma Nazionale di Ricerca in Antartide - PNRA D.D. 1314 del 25/05/2018 CNR funding: 135 000 euro

**Altre informazioni ENG:** Partners list: Institute des Geosciences dè l'Environnment Royal Holloway University of London Consiglio Nazionale delle Ricerche

**Coordinatore:** Roberto Salzano - IIA-CNR

**Referente IRSA:** Emanuele Romano

**Periodo di attivita:** 01/01/2020 - 31/12/2020

**Titolo: IntEractions between hydrodyNamics flows and bioTic communities in fluvial Ecosystems: advancement in dischaRge monitoring and understanding of Processes Relevant for ecosystem sustaInability by the development of novel technologieS with fIeld observatioNs and laboratory testing**

**Acronimo:** ENTERPRISING

**Abstract ITA:** Non disponibile

**Abstract ENG:** The overall objective of the project is the development of advanced technologies and innovative methods that, using radar, biological sensors, hydrodynamic models and algorithms, allow, for the first time, to predict the river flows also during high floods as well as the impact of hydrodynamic processes on the river biotic communities. The project aims to face a twofold challenge, the first is that raised by World Meteorological Organization to identify advanced techniques for discharge monitoring at high flow, of interest to control extreme events and the second challenge is that of the European Biodiversity Strategy to 2020 (EU COM 244, 2011) for a better protection of ecosystems along with the contribution to averting global biodiversity loss. The basic idea of the project comes from recent studies conducted by involved Research Units that have highlighted how the integrated use of advanced technology and a refined eco-hydraulic modeling can lead to new insights on discharge monitoring and ecosystem-river processes. To achieve the target, ENTERPRISING is articulated in different levels of activity synergistically connected and concern: 1)the monitoring of river flow by developing innovative no-contact technology; 2) the identification and modeling of interaction mechanisms between hydrodynamics processes and biotic communities; 3) the development of advanced technologies for monitoring the response of biotic communities to hydro-morphological changes with the testing in laboratory and field; and 4) the evaluation of the effects of hydrodynamic processes on river ecosystem communities in different environments as a base for the development of an effective Biological Early Warning

System (BEWS). ENTERPRISING finds its roots in the awareness that, in watercourse ecosystems is fundamental, on one hand, to have accurate discharge assessments for any flow condition also for inaccessible sites and, on the other hand, to understand modifications of the biotic environment in correlation with hydrodynamics, and geomorphological complexity, through a synergistic approach by blending expertise that spans fluvial processes and ecosystems sustainability. This is the core of the project, which is motivated by the idea that different environmental phenomena have to be jointly investigated by leveraging a wealth of multidisciplinary expertise in order to relate biotic indicators directly to flow characteristics measured with no-contact technologies. This needs i) a proper monitoring of key variables (water level and surface flow velocity) also during high flow conditions and when sediment transport is significant; ii) a physically based description of the main hydro-morphological processes, such as turbulence and sediment transport, generated within the channel and in perifluvial areas in different conditions of roughness, morphology, vegetation, and iii) a deep understanding of disturbance and impact on target biotic components to be used as indicators of fluvial ecosystem health. ENTERPRISING will contribute in improving the scientific and non-contact technological capabilities for a continuous, effective and accurate monitoring of surface velocity and water level by developing and testing an innovative multi-function lightweight radar sensor, able to operate in a wide variety of conditions such as during extreme events, at night, or on-board of drones so as to allow monitoring inaccessible sites too. A prototype of radar-drone system will be also tested in different river contexts. The surface velocity and water level measurements provided by the developed radar will feed a hydrodynamic, entropy-based model able to characterize the main turbulence structures of flow along with the intensity of associated sediment transport, also in presence of secondary currents and vegetation. Considering that the entropy-based model is a 2D site-based approach, a high resolution 3D numerical modelling will be also developed to refine the entropy-based velocity distribution mainly in the representation of turbulence structures close to the side-walls, where high-frequency fluctuations of velocity occur. The relevant hydrodynamic processes will be identified in flow domains also affected by bed-forms and grain textures, such as step and pools, riffle or dunes. A detailed determination of zones of high or small entraining stresses around the grains of the bed, will help to understand the dynamic of sediment transport. This analysis is meant to identify the hydraulic stressors for biotic ecosystems. To this end, the advanced on-line Biomonitoring Early Warning System that uses behavioral and/or physiological stress responses of caged test organisms (mussels), exposed in situ to hydro-morphological changes, will be tested through Case Studies in field and laboratory. ENTERPRISING's outcomes will be disseminated in a wide range of stakeholders and a strong knowledge network will be built also through a website platform design.

**Descrizione estesa ITA:** Non disponibile

**Descrizione estesa ENG:** The overall objective of the project is the development of advanced technologies and innovative methods that, using radar, biological sensors, hydrodynamic models and algorithms, allow, for the first time, to predict the river flows also during high floods as well as the impact of hydrodynamic processes on the river biotic communities. The project attempts to respond to a twofold challenge, the first is that raised by World Meteorological Organization to identify advanced techniques for discharge monitoring at high flow of interest to control extreme events and the second is that of the European Biodiversity Strategy to 2020 (EU COM,0244 Final;2011) for a better protection of ecosystems and services they provide along with contribution

to averting global biodiversity loss. To this end, ENTERPRISING will bring together scientists with different expertise to develop state-of-the-art operational tools for an innovative monitoring technology of key hydraulic variables that will be tested on field and by laboratory experiments, and whose measurements will initialize an enhanced modeling of hydrodynamic processes and hydraulic stressors for biotic ecosystems. Multiple innovative elements are included, as the project tackles interactions between fluvial dynamic and ecosystems in different climate environment and through a comprehensive approach based on innovative and synergistically connected activities able to provide an effective response to the minimum hydrodynamic conditions so that ecosystem quality holds. TARGETS 1) To develop an innovative technology for monitoring river hydraulic key variables also during high floods and ecosystems sustainability, to be tested in field and laboratory. For river flow monitoring ENTERPRISING intends to develop low-cost, miniaturized radar sensors which may be onboard drones, for the no-contact monitoring of river hydrodynamic parameters like surface velocity and water level, which initialize a hydrodynamic modeling. The sensor will be operational at a fixed station and onboard of a drone prototype, so that the monitoring can be also addressed for inaccessible river sites and for any flow condition. The merging of radar measurements with those by conventional techniques will allow, on one hand, to test the equipment in different river context and flow conditions and, on the other hand, to improve the data robustness. For the monitoring of biotic community, the project will explore the suitability of mussel behavior responses as a biomarker for the detection of hydro-morphological impacts on riverine communities. For that, it will be used a high-frequency non-invasive valvometry, an innovative online biomonitoring technique consisting in continuously monitoring the bivalves'opening and closing cycles to detect behavioral disturbances associated with the environment. In these invertebrates, any stress or stimulation leads to a significant increase in valve activity. Halls sensor technology and software [1,2] able to collect valvometric measurements with very high resolution in real-time can be adopted. The recording of gap changes provides evidence of a mussel's response to disturbances as the closing of a mussel's shells is an indicative evasion behavior. Experiments in laboratory will be performed by varying the hydraulic stressor and in field at gauged river sites where discharge is continuously monitored also with radar sensors 2) To identify and model the interaction mechanism between hydrodynamic processes and biotic communities; The target consists in identifying how river hydro-morphological changes may have impact on biotic communities. This will be addressed by analyzing the hydraulic stressors for biotic ecosystems to find significant correlations between biotic [and specifically mussels] behavioral response and hydrodynamic parameters such as discharge and velocity data. For that, it will be investigated the existence of an entropy constraint that links global flow parameters, in particular liquid and solid discharges, and flow section shape and area, to local quantities, easy to be measured in any natural streams, as the surface velocity and the water level, both provided by the developed no-contact radar sensor. The analysis will refine the entropy model by a high resolution three-dimensional (3D) numerical modelling able to provide a more accurate spatial distribution of velocity field also close the sidewalls and channel bottom, where the impact on ecosystems may be significant. In this way, the detection limits for hydraulic stressors and the exposure time needed to elicit an alarm response will be assessed, opening the way to understand the sensitivity of a sentinel-based behavioral system and its applicability to water monitoring 3) To develop a biological early warning system (BEWS) which is based on the different responses of organisms to hydraulic stressors. The last target concerns the analysis of effects of hydrodynamic processes on river ecosystem communities such as also fostered by the EU Directive Habitat (92/43/CEE) in

different environments. For that, based on surface velocity and water levels measured by the developed radar technology, the main hydrodynamic stressors will be identified and the valvometric responses will be tested as a function of changes in flow velocity, water level, sediment transport and particulate suspended solids. To select the most suitable indicator for a wide range of hydraulic regimes, the sensitivity of three native Italian species with different habitat requirements will be compared.

**Rilevanza scientifica e risultati ITA:** Non disponibile

**Rilevanza scientifica e risultati ENG:** In terms of flow monitoring, despite the technology has made progress, lightweights miniaturized radar sensors, are still not available as off-the-shelf products. Their development could have an enormous impact in estimating the hydrodynamic processes by refined hydraulic models initialized from the surface velocity and water level measurements provided by the radar. For that, it will be leveraged the FMCW-Doppler architecture in order to feature a velocity-range separation capability For that, the project will try to answer to several problems still open mainly for the monitoring using drone. The first problem is associated to the significant disturbance coming from the propellers. The enhanced idea is to distinguish between the Doppler effect coming from the nearby objects [propellers] to that due to far objects (river surface) and this can be done by a simultaneous Doppler-range measurements. The second problem is the velocity monitoring across the river that will be solved by developing an electronic scanning antenna for which suitable design approaches will be devised in order to apply them to low-cost miniaturized radar systems. The third open problem is the determination of the absolute water level and considering that a centimeter-level accuracy cannot be achieved due to the limited drone's GPS accuracy, it will be exploited the electronic scanning antenna to simultaneously measure the height of the drone with respect to both water surface and ground level. All these innovations will lead to a completely original sensor that is neither comparable to the present state-of-the-art, nor to any product available on the market. As regards the monitoring of impacts of hydro-morphological changes on biotic community, we focus on freshwater mussels monitoring, the most heavily impacted faunal group, which extirpation likely will alter ecosystem functioning. For that, a step forward will be the testing in field at river gage sites and in laboratory of three sub-lethal behavioral endpoints, with the aim of adapting the use of animal-attached remote-sensing technology to assess of hydrological ecosystem impacts and to define the "vital minimum outflow"for safeguarding communities and ecosystem services. The proposed new way to investigate the hydrodynamic processes by identifying the turbulence structures by an entropy law for whatever flow condition will help to understand the transport mechanism of substances and sediments linked to exchange between the free stream and the near-bed, overcoming the need of detailed measurements in the cross-sectional flow area. Indeed, the novelty of the approach is to allow the estimation of the velocity distribution, the effect of secondary circulation and turbulent intensity distribution, and consequently the processes of transport and dispersion, just starting from the measurement of the surface-velocity and water level only. This is of paramount importance for identifying an entropy constraint linking global flow parameters, in particular the liquid and solid discharges, and flow section shape and area, to local quantities, easy to be measured in any natural streams, e.g. the velocity at the free surface and the flow depth. The goal has an overwhelming and indisputable worth, because the evaluation of sediment-transport discharge is still a challenging, time-consuming and expensive undertaking, still far from being pursued, in small creek, almost impossible in large-

drainage and chief regional rivers. Furthermore, 3D mathematical representation of velocity distribution affected by bed-forms and grain textures, will refine the entropy model performance in particular in the zones of high or small entraining stresses around the grain paving the bed and banks. Another advances in knowledge concerns the assessment of the different responses of organisms to hydraulic stressors basic for the development of a Biological Early Warning System (BEWS). BEWS is already used for the continuous control of water chemical pollution, but for an effective ecosystem monitoring and management also the hydromorphological disturbance must be targeted. To improve our capability to detecting impacts of hydro-morphological changes, we focus on freshwater mussels, the most heavily impacted faunal group, which whose extirpation likely will alter ecosystem functioning. The novelty is also identify possible implications of near-wall flow field characteristics for mussel behavioural responses.

**Fonte di finanziamento ITA:** PRIN 2017, Ministero dell'Istruzione dell'Università e della Ricerca

**Fonte di finanziamento ENG:** PRIN 2017, Ministero dell'Istruzione dell'Università e della Ricerca

**Altre informazioni ITA:** Consiglio Nazionale delle Ricerche IRPI Università degli Studi di PADOVA Università degli Studi di PERUGIA Università degli Studi di PALERMO Università degli Studi di TRENTO

**Altre informazioni ENG:** Consiglio Nazionale delle Ricerche IRPI Università degli Studi di PADOVA Università degli Studi di PERUGIA Università degli Studi di PALERMO Università degli Studi di TRENTO

**Coordinatore:** Tommaso Moramarco

**Referente IRSA:** Nicoletta Riccardi

**Periodo di attivita:** 2019-2022

## Titolo: RIsanamento biologico dei Sedimenti del lago d'ORTA e biomonitoraggio attivo delle aree costiere

**Acronimo:** RIS-ORTA

**Abstract ITA:** Il progetto ha un duplice scopo: 1) Risanamento dei sedimenti littorali del Lago d'Orta (re-impianto): a) bioaccumulo di elementi tossici; b) incremento colonizzazione da parte di altri organismi benthonici = aumento indici di qualità (Direttiva Europea 2000/60/EC, Direttiva Quadro sulle Acque) 2) Biomonitoraggio (attivo) dello stato delle aree litorali sfruttando i bivalvi come "biosentinelle" (posa di gabbie con animali "segnalatori");

**Abstract ENG:** Non disponibile

**Descrizione estesa ITA:** L'intero progetto consiste in due tipologie di intervento: A) Re-introduzione di Unio elongatulus lungo il perimetro del Lago d'Orta al fine di promuovere il risanamento dei sedimenti littorali, cioè di quella parte di sedimenti lacustri che si trovano nella zona più soggetta a influenze esterne (accesso di bagnanti e di barche, ingresso di acqua di ruscellamento, ondazione, etc.) che causano un continuo rimescolamento del sedimento stesso e, di conseguenza, facilitano il rilascio nell'acqua delle sostanze tossiche presenti nei sedimenti. La deposizione di nuovo sedimento, non contenente sostanze tossiche, è il meccanismo che consente la formazione progressiva di uno strato pulito che isola gli strati di sedimento più profondi impedendo o riducendo progressivamente il rilascio delle sostanze contenute negli strati più profondi. Questo meccanismo funziona nelle aree più profonde del lago che si trovano nella zona pelagica, distante dalle rive. Al contrario, il "disturbo" continuo ed inevitabile del sedimento che avviene tipicamente lungo la linea di costa ostacola questo meccanismo di "isolamento" degli strati sedimentari profondi nelle aree littorali. Oltre ad avviare la decontaminazione (biologica) dei sedimenti, questa azione contribuisce al ripristino della "comunità biotica" del Lago d'Orta. Infatti, oltre ad essere bio-accumulatori (e quindi depuratori naturali) i bivalvi nativi facilitano la ricolonizzazione del fondale da parte delle altre specie che compongono la "comunità" bentonica (che vive a contatto o nei sedimenti). È questa una componente dell'ecosistema importante tanto quanto la "comunità" pelagica, più nota ai non esperti perché tramite la catena trofica (fitoplancton-zooplancton-pesce) sostiene l'attività economica della pesca. Tuttavia, un ecosistema composto solo dalla comunità pelagica è un sistema lontano dall'equilibrio, e quindi fragile, con ridotta capacità di "compensare" i fattori di disturbo. In altre parole, è un sistema con resilienza ridotta o nulla. Non a caso la Direttiva Quadro Europea, recepita dai diversi Paesi membri inclusa l'Italia, prevede la verifica del grado di complessità (biodiversità) e dello stato di equilibrio della comunità bentonica per la formulazione dell'indice di qualità degli ecosistemi acquatici. B) Biomonitoraggio attivo per la valutazione in continuo ed in tempo reale dello stato ecologico delle aree litorali sfruttando i bivalvi come bio-sentinelle. L'uso del bio-monitoraggio attivo si basa sulla necessità di rilevare i cambiamenti ambientali in tempo reale e a costi ridotti per ottimizzarne la gestione. I sistemi di monitoraggio in tempo reale sono stati gradualmente sviluppati per rilevare i cambiamenti fisico-chimici negli ecosistemi. I sensori sono fondamentali per qualsiasi sistema di monitoraggio di questo tipo; quindi, è stata sviluppata una gamma di sensori, la cui sensibilità migliora con i progressi della tecnologia. Attualmente, la maggior parte dei Paesi del mondo utilizza sistemi di monitoraggio in tempo reale sensibili ai fattori fisico-chimici per rilevare i disturbi agli ecosistemi acquatici, tra cui acque superficiali, acque sotterranee, effluenti e acqua potabile. I sensori fisico-chimici implicano costi di manutenzione elevati, riflettono solo variazioni localizzate e a breve termine degli ecosistemi acquatici; non possono essere usati per misurare gli effetti combinati di più fattori; non possono fornire informazioni sulle condizioni ecologiche in cui vivono gli organismi. Pertanto, sono stati sviluppati sistemi di allarme biologico (BEWS), che si basano sulle diverse risposte degli organismi ai disturbi. I bivalvi sono ampiamente usati a questo scopo già dal secolo scorso per la loro estrema sensibilità ai fattori di disturbo ambientale, per la rapidità ed affidabilità della loro risposta e per la facilità di rilevarla mediante metodi basati sulla registrazione di parametri comportamentali e fisiologici.

**Fonte di finanziamento ITA:** FAI, Fondo per l'Ambiente Italiano

**Coordinatore:** Nicoletta Riccardi

**Referente IRSA:** Nicoletta Riccardi

**Periodo di attivita:** 2021-2022

**Titolo: 3-routes platform for REcovery of high Value products, ENergy and bio-fertilizer from Urban biowastE**

**Acronimo:** REVENUE

**Abstract ITA:** La piattaforma REVENUE, approccio unico in Italia, consentirà di valorizzare gli scarti organici da raccolta differenziata portando benefici al territorio in termini ambientali, occupazionali e come volano di crescita e sviluppo sostenibile. La bioraffineria si basa sulla versatilità del processo di digestione anaerobica e prevede un pretrattamento innovativo degli scarti organici al fine di indurre la fermentazione ad acidi grassi ad alto valore aggiunto dalla frazione liquida,e la produzione di biometano e concime di qualità dal residuo solido. L'approccio multidisciplinare permetterà di generare innovazione e sviluppo nella gestione dei rifiuti urbani del territorio Lombardo,garantendo il rispetto della salute umana grazie all'attenta valutazione del rischio biologico dell'intera catena tecnologica.La sfida specifica sarà quella di ridurre i costi e di aumentare la sostenibilità ottenendo rese sufficientemente elevate dei prodotti nelle diverse fasi di conversione e purificazione.

**Abstract ENG:** The REVENUE project aims to propose an innovative biowaste valorization platform for the production of value-added chemicals, energy and high-quality safe fertilizer by drastically reducing environmental waste impact, contributing to a more resource-efficient and sustainable low-carbon economy and to increasing economic growth and employment. Main aim of this multidisciplinary research project is the upgrade of the AD process to virtuous multi-step biorefinery process to generate innovation and development in the management of urban biowaste in the territory of Lombardy Region, guaranteeing the respect of human health thanks to the careful evaluation of the biological risk of the entire technological chain. The REVENUE project in fact aims to find innovative feasible technological solutions for biowaste management in order to meet not only material and energy needs, but also more generally individual and community wellbeing, promoting social impact. The specific challenge is to reduce costs and improve sustainability associated with the pre-treatment step of biomass feedstock while making it possible to achieve of sufficiently high yields in the targeted product in the subsequent conversion steps.

**Fonte di finanziamento ITA:** Fondazione Cariplo

**Coordinatore:** Maurizio Masi (Politecnico di Milano)

**Referente IRSA:** Camilla Braguglia

**Periodo di attivita:** 01/02/2020-01/08/2022

**Titolo: PROGETTO ARETE' - ACQUA IN RETE: gestione virtuosa della risorsa idrica e degli agroecosistemi per l'incremento del capitale naturale**

**Acronimo:** ARETE'

**Abstract ITA:** Areté tra gli antichi Greci significava virtù, ovvero "ciò che rende la vita umana degna di essere vissuta, ricca di significato ed esempio per gli altri". Abbiamo scelto di darci questo nome perché riassume il nostro obiettivo generale: accrescere il valore ecologico di zone già tutelate, rafforzandone il ruolo di aree sorgente di biodiversità ed esportando le esperienze più virtuose. L'area in cui si sviluppa il progetto Aretè è molto vasta ed eterogenea: include un'ampia fascia di territorio tra Piemonte e Lombardia che ha come fulcro la Valle del Ticino e si irradia verso nord-est nella zona delle Colline Novaresi, verso sud interessando la Lomellina nella Zona di Protezione Speciale "Risaie della Lomellina" e verso ovest nell'area dell'Alto Milanese. La presenza in questo ampio spazio di un sistema interconnesso di Parchi, Riserve ed altre Aree protette, costituisce uno dei fattori strategici della nostra particolare proposta di conservazione. Pur essendo un territorio diversificato, l'area si uniforma per alcuni aspetti critici fondamentali: innanzitutto si riscontra una forte tendenza alla frammentazione degli habitat, dovuta alla presenza di aree urbanizzate e ad attività agricole intensive. Questo fenomeno ha come conseguenza un preoccupante calo di biodiversità. Altra questione comune è il problema della gestione della risorsa idrica, che necessita di strategie di ottimizzazione e risparmio. Sono urgenti interventi sia sugli aspetti strutturali-funzionali del reticolo idrico, sia di una rinaturalizzazione del reticolo stesso. Obiettivo cardine del progetto è implementare le migliori esperienze di gestione agro-ambientale, naturalistica e forestale realizzate finora nei Parchi, ed esportarle generando interventi innovativi e di elevato interesse per la biodiversità. Desideriamo incrementare il valore del territorio e rafforzare la connessione ecologica dalla Valle del Ticino verso ovest e verso est. Crediamo i Parchi debbano uscire dai propri confini, per diffondere modelli sostenibili e far valere le proprie competenze, dando un messaggio forte alla società civile. Nello specifico ci poniamo come traguardi: ● Mettere a sistema studi e progetti relativi ai nostri territori d'intervento, in modo da mappare in maniera efficace tutte le criticità; ● Individuare soluzioni operative, cercando di mantenere equilibrio tra le diverse esigenze - economiche, sociali, naturalistiche - espresse dalla realtà locale.; ● Assicurare alla comunità uno sviluppo eco-compatibile ed un ambiente vivibile, sforzo necessario in un contesto globale caratterizzato da rapida urbanizzazione ed eccessivo consumo energetico, considerati fattori scatenanti dei cambiamenti climatici; ● Promuovere lo scambio e la divulgazione di conoscenze sui problemi ambientali e lo sviluppo sostenibile.

**Descrizione estesa ITA:** l progetto ARETÉ, che per i Greci significava virtù, ovvero "ciò che rende la vita degna di essere vissuta, ricca di significato e esempio per gli altri", prevede l'attivazione di interventi volti ad accrescere il valore ecologico di zone già tutelate, rafforzandone il ruolo di aree sorgente di biodiversità e l'esportazione, fuori dai confini delle stesse, delle esperienze più virtuose ed efficaci di gestione agroambientale, naturalistica e forestale tramite la matrice acqua e il reticolo irriguo. L'ambito di progetto include la Valle del Ticino, intesa nel senso più ampio definito dalla

Riserva MAB Ticino Valley e dalle aree di ampliamento, la ZPS Risaie della Lomellina e le aree ricomprese fra questa e il territorio protetto dal Parco del Ticino lombardo e infine gli ambiti posti a est del Ticino, in cui sono ricompresi alcuni PLIS, in coerenza con le previsioni dei Piani di Rete ecologica delle due aree protette, dei Piani Provinciali e della Rete Ecologica Regionale. Obiettivo prioritario è incrementare il Capitale Naturale e le connessioni ecologiche di un territorio molto vasto, ponendo rimedio a situazioni di alterazione evidenti ma reversibili, e rafforzando o ricostituendo i fondamentali servizi ecosistemici a beneficio delle comunità locali. La sperimentazione di azioni pilota si pone l'obiettivo di codificare buone pratiche che siano replicabili su un vasto compendio per incrementarne i servizi ecosistemici forniti dalla rete irrigua e dagli agroecosistemi. Il progetto intende inoltre promuovere la presa di coscienza delle comunità locali sulla buona gestione delle risorse naturali e dei servizi eco sistemici, per garantire un presidio continuo degli interventi realizzati, e quantificare dei PES o 'quasi PES' in grado di sostenere economicamente la futura replicabilità degli interventi negli ambiti di progetto, così come in altri contesti territoriali. A garanzia di un'efficace realizzazione del progetto, il partenariato è costruito coinvolgendo tutti i soggetti che possono essere parte attiva nell'attuazione delle azioni. Asse portante è il reticolo irriguo oggetto di interventi di natura puntuale e diffusa sul territorio, quali la creazione/riqualificazione di aree umide, l'incremento delle marcite e dei prati allagati, la realizzazione di tessere agroambientali, la riqualificazione di boschi igrofili e altri interventi di miglioramento forestale. La validità scientifica e la verifica dell'efficacia degli interventi sono garantite da un monitoraggio ante e post-operam. Un tavolo di lavoro dedicato ha lo scopo di stimare i servizi eco sistemici degli ambiti di progetto tramite l'applicazione di modelli descritti in bibliografia. Il rapporto con le realtà attive sul territorio (az. agricole, associazioni, enti locali, scuole, GEV) è assicurato da un articolato piano di comunicazione e partecipazione.

**Rilevanza scientifica e risultati ITA:** L'attuazione del progetto porterà a un incremento del Capitale Naturale e delle connessioni ecologiche di un territorio molto vasto. In ambito irriguo si avrà un generale miglioramento della circolazione dell'acqua, un più adeguato e sostenibile approvvigionamento idrico, con un incremento diffuso della biodiversità. La valutazione dell'efficacia delle buone pratiche e la quantificazione dei PES consentiranno di disporre di strumenti tecnici, gestionali ed economici per la futura attuazione degli interventi negli ambiti di progetto, così come in altri contesti territoriali. Ci si attende un incremento del presidio territoriale e un aumento di consapevolezza di chi vive o frequenta il territorio interessato dal progetto.

**Fonte di finanziamento ITA:** Bando competitivo "Capitale Naturale 2018", Fondazione Cariplo

**Altre informazioni ITA:** Parco Lombardo della Valle del Ticino (capofila), CONSORZIO DI BONIFICA EST TICINO VILLORESI, Ente di gestione delle aree protette del Ticino e del Lago Maggiore, Associazione Irrigazione Est Sesia, Legambiente Lombardia ONLUS, Società Cooperativa Sociale Eliante, Società di Scienze Naturali del Verbano Cusio Ossola, Università degli Studi di Milano, Provincia di Pavia, IRSA-CNR (partners) Importo totale finanziamento: 1.250.479,78 €

**Website:** https://progettoarete.weebly.com/

**Coordinatore:** Valentina Parco, Parco Lombardo della Valle del Ticino

**Referente IRSA:** Fabrizio Stefani

**Periodo di attivita:** 01/01/2019-31/12/2021

**Titolo: ReLambro SE. Rete Ecologica Lambro Metropolitano Sud Est**

**Acronimo:** ReLambro SE

**Abstract ITA:** Il progetto ReLambro SE prende spunto dagli studi di fattibilità VOLARE e ReLambro per proporre e realizzare una serie di interventi di riconnessione ecologica lungo il corridoio ecologico del fiume Lambro e fra le aree prioritarie a sud e ad est del medesimo. Le azioni sono volte sia a favorire l'incremento della biodiversità, sia a quantificare ed incrementare la fornitura di servizi ecosistemici, oltre che a proporre sistemi di PES e quasi-PES agli stakeholders. E' prevista anche una fase di monitoraggio di tipo ecologico (in cui IRSA è coinvolta), ed una fase di comunicazione dei risultati e dei benefici del progetto al pubblico.L'ambizione del progetto è quello di instaurare dei meccanismi virtuosi di sostenibilità dell'uso delle risorse ambientali in uno dei contesti territoriali più problematici del panorama europeo, quale il bacino del Lambro.

**Descrizione estesa ITA:** Nell'ambito della strategia di intervento disegnata, il sistema Lambro, Vettabbia, Addetta rappresentano il sistema principale delle acque che "disegna" il territorio della parte sud orientale di Città Metropolitana milanese. Relativamente agli aspetti ecologici il piano di indagini e monitoraggio prevederà studi sulle componenti faunistiche acquatiche e terrestri, limitatamente alle aree riparie.. Nel presente progetto il piano di monitoraggio sarà così articolato: a) per quanto riguarda le acque saranno valutate le comunità di riferimento secondo quanto previsto dal DM 260/2010. Saranno applicati indici biotici per valutare gli effetti degli interventi in termini di qualità ecologica, con specifico riferimento alle comunità di macroinvertebrati e alla fauna ittica, laddove le condizioni ecologiche ne consentano l'insediamento (es. sufficiente e permanente presenza di acqua). Ciò consentirà di valutare l'eventuale miglioramento della qualità ecologica secondo approcci ormai di prassi, in modo da favorire la confrontabilità rispetto alle altre realtà di pregio naturalistico presenti nell'area di studio. b) sarà posta attenzione alla valutazione della consistenza numerica e alla struttura delle popolazioni di alcune specie chiave o indicatrici, secondo il principio delle "specie focali", con particolare attenzione verso le specie identificate come tali per le aree prioritarie per il mantenimento della rete ecologica regionale. La teoria in questione prevederà che qualora vengano mantenute le condizioni idonee alla persistenza e alla dispersione di particolari specie, si otterrà lo stesso grado di tutela anche per le specie meno esigenti o specializzate, favorendo pertanto la stabilità dell'intero ecosistema. c) saranno applicati indici innovativi in grado di valutare la struttura funzionale delle comunità indagate, ovvero quanto esse sono in grado di "sfruttare" le nicchie ecologiche disponibili, quanto sia omogeneo lo sfruttamento di tali nicchie e quanto le comunità riescano ad essere resistenti e resilienti alle perturbazioni (ridondanza ecologica); tali indici non considerano semplicemente la diversità tassonomica delle comunità studiate, ma valutano nel complesso lo spettro dei life traits e le preferenze ecologiche delle varie specie presenti (per quanto riguarda le comunità ittiche e macrobentoniche sarà utilizzato come riferimento il database www.freshwaterecology.info). Tali informazioni saranno

utili ai fini di determinare i possibili esiti, in termini di fornitura di servizi ecosistemici, derivanti da un miglioramento o peggioramento delle condizioni di un ecosistema. d) per il monitoraggio della fauna terrestre, con particolare riferimento alle comunità particolarmente sensibili alla frammentazione degli habitat (mammiferi, anfibi, rettili), verranno posizionate alcune fototrappole in punti di passaggio vincolato, in modo da fornire un monitoraggio costante degli spostamenti faunistici. Una prima campagna di censimento sia della fauna acquatica, sia della terrestre, sarà effettuata antecedentemente l'inizio degli interventi sui siti oggetto di intervento. A tal fine, verranno individuate e privilegiate le aree nodali del disegno progettuale, inclusi i varchi faunistici critici. Una seconda campagna di censimento, attuato secondo le medesime modalità e criteri della precedente, verrà effettuata a distanza di non meno di 6 mesi dal termine dei lavori di ripristino ambientale, ed i medesimi indici verranno applicati a posteriori, sia negli ambienti già presenti ed attivi in ante operam, sia in quelli di nuova creazione o riattivazione. Ciò consentirà di studiare l'evoluzione dei processi di ricolonizzazione, almeno nelle loro fasi iniziali, delle aree ripristinate e di verificare l'efficacia degli interventi anche in un ottica di "corridoi ecologici". Queste informazioni saranno usate in complemento con altre informazioni sulla funzionalità ecologica dei sistemi indagati nel valutare come l'elemento "acqua" agisca in termini migliorativi (o eventualmente peggiorativi) sui Servizi Ecosistemici prodotti. Saranno soggetti beneficiari il Parco Agricolo Sud Milano, Città Metropolitana e Regione in quanto gestori delle aree protette interessate (come ad esempio i fontanili della Muzzetta), le amministrazioni provinciale e regionale in generale, la popolazione afferente alle zone interessate dal progetto. Tutti questi soggetti avranno una serie di feedback relativi agli obiettivi di gestione ambientale espressi nel progetto. Utilizzatori dei dati ottenuti potranno anche essere le Amministrazioni Comunali del territorio, le associazioni ambientaliste e tutte le possibili altre associazioni presenti nell'area e nelle zone adiacenti. Potranno trarre utili riscontri per valutare nuovi approcci operativi anche gli agricoltori che su questi terreni vivono e lavorano. Infine Fondazione Cariplo, che potrà verificare la validità e l'efficacia degli interventi realizzati.

**Rilevanza scientifica e risultati ITA:** Il primo risultato corrisponderà nel mettere a disposizione ai vari stakeholders un quadro aggiornato della distribuzione e del valore della biodiversità legata: a) al sistema delle acque e del reticolo idrico b) alle aree agricole e naturali prossime o sconnesse da esse. Tutto ciò verrà effettuato a complemento delle informazioni, spesso non recenti o con scarsa copertura territoriale, attualmente disponibili. I nuovi dati, integrati con quelli "storici" oggi recuperabili, fungeranno da database di riferimento, per programmare nuove attività o progetti di riqualificazione ambientale. I dati ottenuti saranno utilizzati per costruire un quadro ecosistemico d'insieme propedeutico alla stima dei servizi ecosistemici ed alla contabilità ecosistemica in termini monetari. Come indicatori, si prevede la creazione di check-list delle biocenosi considerate, elaborazione di mappe di qualità ecologica dei sistemi indagati ante e post operam.

**Fonte di finanziamento ITA:** Bando competitivo "Capitale Naturale 2018", Fondazione Cariplo

**Altre informazioni ITA:** ERSAF (capofila), i Comuni di Milano, Segrate, Peschiera Borromeo, San Donato Milanese, Melegnano, Parco Nord, il Dipartimento di Scienze e Politiche Ambientali dell'Università di Milano, l'Istituto Nazionale di Urbanistica, il Dipartimento di Architettura e Studi Urbani del Politecnico di Milano, Legambiente Lombardia, Associazione "Grande Parco Forlanini" Importo complessivo: 1.195.163,42 €

**Website:**
http://www.contrattidifiume.it/export/sites/default/it/doc/Azioni/progetti_collegati/ReLambro-SE_Descrizione-dettagliata-del-progetto.pdf

**Coordinatore:** Daniela Masotti, ERSAF Lombardia

**Referente IRSA:** Fabrizio Stefani

**Periodo di attivita:** 01/03/2019 - 28/02/2022

### Titolo: LA MEMORIA DEL LAGO ROSSO Fonti per la ricerca sul Lago di Tovel e gli ecosistemi alpini

**Abstract ITA:** Il progetto è dedicato a ricostruire attraverso le fonti archivistiche le vicende storico-scientifiche che interessarono il Lago di Tovel, considerando la documentazione scientifica riferita a questo lago in maniera globale: riordinare il materiale conservato presso la sede di Verbania del CNR IRSA; identificare con metodo scientifico le fonti storiche delle ricerche idrobiologiche che interessarono il lago; operarne una digitalizzazione mirata per renderla fruibile in rete; stabilire più connessioni possibili con la storia naturale e paesaggistica del Trentino. L'accreditata competenza dell'Istituto sugli archivi sedimentari rende possibile ampliare la scala temporale della ricostruzione delle vicende del lago, stimolando la ricerca di nuove fonti documentali. L'area di intervento principale riguarda, a Verbania, l'Archivio Storico dell'Istituto e, in Trentino, l'Archivio storico e la biblioteca del comune di Ville d'Anaunia (TN), il Museo delle Scienze di Trento (Muse), la Fondazione Edmund Mach, il CAI SAT (Società degli Alpinisti Tridentini), e l'Archivio di Stato di Trento.

**Fonte di finanziamento ITA:** Fondazione Cassa di Risparmio Trento e Rovereto (CARITRO)

**Website:** http://www.lagoditovel.cnr.it/

**Coordinatore:** Andrea Lami

**Referente IRSA:** Andrea Lami

**Periodo di attivita:** 03/12/2018 - 02/01/2021

### Titolo: CYAnobacteria platform Optimised for bioproduction

**Acronimo:** CYAO

**Abstract ENG:** Successfulimplementation of green chemistry processes and sustainable alternative fuel production represent crucial challenges for the modern society, as highlighted by directive strategiesof the European Union Commission (H2020-BB-2016-2017, H2020-LCE-2016-2017).In this respect, one of the most attractive strategy relies on the use of aquatic photosynthetic unicellular organisms, particularly ofthe prokaryotic cyanobacteria,because they are generally well characterised, have plain nutritional requirements and posses large geneticdiversity. This makes them ideal candidates for the sustainable and biological production of valuable products, such as carotenoids, which are well known to act as effective antioxidant and that, in mammals, have to be introduced by dietary sources. Therefore a wide range of carotenoids have significant industrial interest, ranging from dietary supplements, cosmetics and food colouring. For instance, one of the main cost in salmon and rainbow trout aquaculture is the dietary supplement of the carotene astaxanthin(Asx), which gives the characteristic pink-orangecolour to the fish flesh. This is because the production of Asxfrom natural sources, generally preferred to increase the quality and value of the product, is at present cumbersome: marine and freshwater algal species able to naturally produce this carotene are difficult to culture. Cyanobacterial species which are most commonly employed for biotechnological applications, such as SynechocystisPCC6803 and SynechococcusPCC7942, do not naturally accumulate Asx. Their oxygenated carotenoidsbiosynthetic pathway leads to the accumulation of zeaxanthin, which is however the main metabolic precursor of Asx. Therefore, by introducing a single metabolic step, the production of Asxcan be promoted in these strains, which are easily cultured and harvested. In turn, this is expected to significantly lower the costs of Asxproduction from natural sources.In this context is however worth noticing that the overall productivity of photobioreactors(PBR)is nowadaysaffected bythe steep decrease of the light intensity through the culture, a process known as “self-shading”, which is common to all photosynthetic microorganisms. This process is one of the main sources limiting biomass accumulation in PBRs. Moreover, culture self-shading results in a great enrichmentin near-infrared and far-red lightsin the inner bioreactor layers. These portions of the solar spectrum are poorly absorbed by the vast majority of photosynthetic organisms. In order to limit the inhomogeneityof light penetration across the PBR layersdue to self-shading, the cultures are often thoroughly mixed, which constitutes an increase in the energy input required to run the plant. However, geometrical architecture aimed at reducing or avoiding mixingto improve the overall cost efficiency have been discussed. Recent studies demonstrated that, in aquatic environments, either marine or freshwater, somecyanobacterial species synthesiseunconventionalchlorophylls (known as Chldand f)havingred-shifted absorption compared to the otherwise ubiquitous Chl apigment. Thesenatural species inhabit ecological niches resemblingthe dimmed and far-red enriched conditions which occurin artificial bioreactors. We therefore propose to expand and extendthe light-harvesting potential of cyanobacterialcultures by controlling the synthesis of the unconventional Chl d, improving therebytheirgrowth rate and fitness under PBRrelevant conditions. We expect this to represent a major breakthrough in increasing the productivity of cyanobacteria therebyimprovingtheir biotechnological application potential.Therefore in this project, CYAnobacteria platform Optimised for bioproduction (CYAO), we propose to engineer the model cyanobacteria species SynechocystisPCC6803 and SynechococcusPCC7942i) to improve their growth yield in PBRs, and ii) to efficiently accumulate Asx, as this bioproduct has a potential economic return. The biotechnological potential of the CYAO strains will be evaluated in test trials of rainbow trout farming, which is a significant economicsector in our local territory.Principal

aims of the project:1.Development of cyanobacterial strains having improved growth yield and biomass accumulation by the engineering of their light-harvesting capacity.2.Development of cyanobacterial strains producing and accumulating high levels of Asx.3.Evaluation of the feasibility of rainbow trout aquaculturein which thebioproduct Asx,extracted from the engineered cyanobacterial strains, is used as feed supplement.

**Fonte di finanziamento ITA:** Fondazione Cassa di Rispsarmio delle Provincie Lomabarde (CARIPLO)

**Website:** http://www.cyaoproject.org/

**Coordinatore:** Stefano Santabarrbara (CNR-IBF)

**Referente IRSA:** Andrea Lami

**Periodo di attivita:** 01/03/2017 - 31/03/2020

### Titolo: Colonizzazione microbica di ambienti bentonici in Antartide: risposte di abbondanze, diversità e attività

**Acronimo:** ANT-Biofilm

**Abstract ITA:** Pressioni ambientali come disturbi antropici, inquinamento e cambiamenti climatici costituiscono gravi minacce per il biota presente nel continente antartico. I biofilms microbici rappresentano hot-spots di diversità microbica, fungendo da substrato per l'insediamento larvale di molte specie di invertebrati. Le comunità microbiche sono molto sensibili e rispondono rapidamente a mutevoli condizioni ambientali, agendo come potenziali "sentinelle" dello stato ambientale. Lo scopo dello studio è quello di valutare in diversi siti di Baia Terra Nova-BTN (Tethys Bay e Road Bay), gli effetti potenziali causati da perturbazioni naturali o antropiche, quali contaminanti o acqua di scioglimento dai ghiacciai, sul biofilm che si sviluppa su substrati artificiali a diversi livelli biologici (batteri, microalghe e reclute di organismi bentonici) al fine di mettere in luce eventuali ricadute tra i diversi comparti ecosistemici.

**Descrizione estesa ITA:** Pressioni ambientali come disturbi antropici, inquinamento e cambiamenti climatici costituiscono gravi minacce per il biota presente nel continente antartico. I biofilms microbici rappresentano hot-spots di diversità microbica, fungendo da substrato per l'insediamento larvale di molte specie di invertebrati. Le comunità microbiche sono molto sensibili e rispondono rapidamente a mutevoli condizioni ambientali, agendo come potenziali "sentinelle" dello stato ambientale. Lo scopo dello studio è quello di valutare in diversi siti di Baia Terra Nova-BTN (Tethys Bay e Road Bay), gli effetti potenziali causati da perturbazioni naturali o antropiche, quali contaminanti o acqua di scioglimento dai ghiacciai, sul biofilm che si sviluppa su substrati artificiali a diversi livelli biologici (batteri, microalghe e reclute di organismi bentonici) al fine di mettere in luce eventuali ricadute tra i diversi comparti ecosistemici. A tal fine, batteri e microalghe

saranno isolati da matrici biofilm, e analizzati per la loro diversità strutturale e funzionale, attraverso l'uso di metodi colturali [terreni batteriologici], microscopici [analisi tassonomica delle microalghe, abbondanza procariotica totale, saggi di vitalità e attività respiratoria microbica mediante colorazione con Live/Dead kit e cianotetrazolio cloruro-CTC], biochimici [saggi di produzione di biofilm, profili metabolici della comunità microbica mediante metodo Biolog, attività enzimatiche, profili di suscettibilità agli antibiotici; caratterizzazione dei metaboliti secondari prodotti dai ceppi microbici] e metodi molecolari [tecniche di Next Generation Sequencing (NGS) dei batteri associati al biofilm; Catalyzed Reporter Deposition Fluorescence In Situ Hybridization (CARD-FISH) con sonde oligonucleotidiche specifiche per 16S-rRNA in combinazione con la microscopia confocale a scansione laser (CLSM)]. Il disegno della ricerca e l'analisi dei dati verranno ottimizzati in collaborazione con ricercatori dell'Università di Zagabria (Croazia), e dell' Università di Girona (Spagna), che hanno un'ampia esperienza sulle comunità microbiche associate al biofilm. Un aspetto innovativo della proposta riguarda lo screening degli isolati microbici per la produzione di metaboliti secondari ed enzimi idrolitici. Infatti i microorganismi antartici rappresentano infatti una fonte importante e non completamente esplorata di molecole bioattive con applicazioni molteplici, dalla biomedicina, ai settori farmaceutico, cosmetico, biodegradazione, etc. Oltre all'interesse ecologico, relativo allo studio dei fattori e meccanismi che regolano la composizione e la struttura delle comunità microbiche, la proposta contribuirà alla valutazione delle capacità metaboliche e del potenziale biotecnologico (produzione di enzimi, molecole antibiotiche) di queste comunità, e dei loro risvolti applicativi. La ricerca è in linea con i temi di ricerca prioritaria indicati dal PNRA, quali Problematiche e rischi ambientali, con aspetti trasversali con i temi della Contaminazione, e dei Cambiamenti climatici e della Biodiversità. Si prevede che il progetto possa migliorare le attuali conoscenze su abbondanza, diversità ed attività della comunità microbica e sulle sue componenti principali (batteri e microalghe), contribuendo alla scoperta di nuove specie e prodotti microbici, e a chiarire le relazioni fra struttura e funzione e le interazioni fra diversi gruppi batterici, microalghe ed invertebrati bentonici in un ambiente estremo.

**Rilevanza scientifica e risultati ITA:** I biofilm marini sono sistemi complessi composti da microbi avviluppati in una matrice di polimeri extracellulari. Le comunità microbiche (batteri e microalghe) associate a biofilm mostrano modelli successionali e nicchie funzionali distinte; sono in grado di auto-organizzarsi strutturalmente in risposta a condizioni esterne ed alle attività delle varie componenti. Esse contribuiscono al funzionamento generale degli ecosistemi acquatici, regolando processi biologici fondamentali (es. degradazione della materia organica ed inquinanti ambientali, fotosintesi, fissazione dell'azoto). I biofilm microbici rappresentano hot-spots di diversità, nonchè substrati per l'insediamento larvale di molte specie di invertebrati. Le comunità microbiche sono inoltre sentinelle estremamente sensibili di variazioni nelle condizioni ambientali. Nonostante il crescente interesse verso i biofilm microbici, risultano ancora molto limitate le conoscenze sulla composizione della comunità dei biofilm marini e sulle loro risposta a disturbi naturali o antropici. In particolare, il biofilm microbico marino a Baia Terra Nova è in gran parte inesplorato e la crescente pressione antropica rende necessaria una più chiara comprensione delle dinamiche delle comunità microbiche. La ricerca proposta è perfettamente in linea con i temi di ricerca prioritaria indicati dal PNRA, come la Contaminazione, i Cambiamenti climatici e la Biodiversità.

**Fonte di finanziamento ITA:** Ministero dell'Istruzione, dell'Università e della Ricerca Programma Nazionale di Ricerche in Antartide Bando 2016

**Altre informazioni ITA:** Consiglio Nazionale delle Ricerche, Istituto per l'Ambiente Marino Costiero (IAMC), Messina Consiglio Nazionale delle Ricerche, Istituto per l'Ambiente Marino Costiero (IAMC), Taranto Consiglio Nazionale delle Ricerche, Istituto di Ricerca sulle Acque (IRSA), Roma Università degli studi di Genova, Dipartimento di Scienze della Terra dell'Ambiente e della Vita (DISTAV) Università degli studi di Messina, Dipartimento di Scienze Biomediche, Odontoiatriche e delle Immagini Morfologiche e funzionali Università degli studi dell'Insubria, Dipartimento di Biotecnologie e Scienze della Vita, Varese

**Website:** https://intranet.cnr.it/servizi/people/prodotto/scheda/i/377089

**Coordinatore:** Caruso Gabriella, Istituto di Scienze Polari (CNR)

**Referente IRSA:** Carmela Caroppo, Stefano Fazi

**Periodo di attivita:** 02/11/2017 - 31/12/2020

## Titolo: Tecnologia Innovativa per la gestione della Frazione Organica dei rifiuti solidi urbani con residuo di processo compatibile con un potenziale riutilizzo agronomico

**Acronimo:** HYDROFORSU

**Abstract ITA:** Il progetto si inserisce nella problematica relativa al trattamento della Frazione Organica dei Rifiuti Solidi Urbani (FORSU), con un approccio orientato ad impianti di piccola taglia in grado di trattare “in loco” il materiale raccolto. Gli impianti di piccola taglia, infatti, sono più facilmente accettati socialmente e distribuiscono equamente, fra le varie comunità il problema, considerando che ciascuna di esse tratterà il rifiuto da essa stessa prodotto. L’obiettivo potrà essere raggiunto se gli impianti sono fortemente automatizzati, controllabili in remoto e con costi di investimento e di esercizio contenuti. Nello specifico, il progetto si propone di dimostrare che la FORSU, sottoposta ad un processo di digestione anaerobica preceduto da una fase di idrolisi termica assistita chimicamente consente di aumentare significativamente la produzione di biogas e di rendere il digestato compatibile con un riutilizzo agronomico. L’impianto sarà in piccola scala, di tipo dimostrativo e sarà dimensionato per processare un quantitativo limitato di FORSU, ma sufficiente a dimostrare la completa funzionalità dell’impianto e le sue potenzialità interattive. L’impianto infatti sarà controllabile da remoto e sarà completato con un portale web informativo che consentirà ai vari utenti, con diversi livelli di accesso di esprimere commenti, suggerimenti e livello di gradimento; ovvero di monitorare lo stato di funzionamento dell’impianto e le sue prestazioni. Sarà verificata la compatibilità dell’utilizzo agronomico del digestato, eventualmente disidratato ed essiccato.

**Fonte di finanziamento ITA:** Progetto di ricerca industriale e sviluppo sperimentale - POR Puglia FESR-FSE 2014-2020- Fondo Europeo Sviluppo Regionale - Asse I "Ricerca, sviluppo tecnologico e innovazione" - Azione 1.4 "Promozione di nuovi mercati per l'innovazione" - Avviso pubblico "Innolabs"

**Coordinatore:** Coordinatore: Ing. Claudio Amorese, Icmea srl. Responsabile scientifico: Dr. Di Iaconi Claudio (CNR-IRSA)

**Referente IRSA:** Di Iaconi Claudio

**Periodo di attivita:** 25/02/2020-04/08/2021

### Titolo: Accordo con Ministero dell'Ambiente

**Acronimo:** Miscele

**Abstract ITA:** Accordo di collaborazione tra il Ministero dell'ambiente e della tutela del territorio e del mare e l'IRSA – C.N.R. per la per la definizione di un approccio metodologico alla valutazione degli effetti combinati delle sostanze chimiche-Miscele

**Fonte di finanziamento ITA:** Ministero dell'Ambiente

**Altre informazioni ITA:** Università Milano Bicocca (Antonio Finizio, Andrea Di Guardo)

**Coordinatore:** Paola Grenni

**Referente IRSA:** Anna Barra Caracciolo

**Periodo di attivita:** 04/12/2018-25/07/2020

### Titolo: I-ZEB - Verso Edifici Intelligenti a Energia Zero per la crescita della città intelligente

**Acronimo:** I-ZEB

**Abstract ITA:** Il progetto I-ZEB (Intelligent Zero Energy Buildings) vede come capofila l'Istituto per le Tecnologie della Costruzione (ITC-CNR) e come partner 10 istituti del CNR, tra cui l'IRSA. Obiettivo principale è di fornire soluzioni tecnologiche e materiali innovativi negli edifici da un punto di vista energetico, ambientale e strutturale in un'ottica n-ZEB (near Zero Energy Buildings). La direttiva 2010/31/UE ha infatti introdotto livelli stringenti dei requisiti energetici degli edifici di nuova costruzione, e, parallelamente, il tema dell'efficienza energetica sta interessando anche la scala urbana in ottica Smart Cities, attraverso reti tecnologiche intelligenti (Smart Grids) finalizzate alla trasformazione di quartieri in n-ZED (distretti a energia quasi zero). Tra le strategie proposte, i tetti vegetati stanno diventando una tecnologia diffusa nelle nostre città in una prospettiva n-ZEB, in quanto aumentano l'isolamento termico, l'inerzia e l'evapotraspirazione dei tetti e contribuiscono alla riduzione del consumo energetico per il riscaldamento e il raffrescamento degli edifici. Inoltre,

essi forniscono numerosi servizi ecosistemici in aree densamente popolate, come la riduzione del deflusso di acque piovane, la mitigazione dell'effetto isola di calore e dell'inquinamento acustico, il miglioramento estetico delle città. Un aspetto meno studiato, su cui l'attività dell'IRSA è focalizzata nell'ambito di questo progetto, è la potenzialità dei tetti verdi di ridurre l'inquinamento delle acque reflue urbane, grazie alla capacità di assorbire gli inquinanti provenienti dalle deposizioni atmosferiche. Recenti ricerche hanno infatti dimostrato che durante i periodi di intensa evapotraspirazione le sostanze contaminanti possono essere assorbite dal tetto verde, riducendo il trasferimento all'ambiente. Le concentrazioni nelle acque defluenti dal tetto verde sono generalmente paragonabili a quelle che si trovano nelle precipitazioni (ad es. azoto, elementi di traccia), ma la forte capacità di questi tetti di ridurre il deflusso di acque meteoriche può comportare una riduzione significativa del carico totale di inquinanti veicolati all'ambiente. Tuttavia, i tetti vegetati, se non correttamente progettati, possono contribuire all'inquinamento idrico, liberando contaminanti dal suolo, dai fertilizzanti o dai sistemi di drenaggio che li costituiscono: ad esempio, è stato evidenziato un significativo rilascio di nutrienti, DOC e di alcuni elementi di traccia. La capacità di fornire servizi ecosistemici in termini di qualità dell'acqua è fortemente determinato dal tipo/configurazione del tetto verde e dalle condizioni climatiche locali. Una ricerca sperimentale diretta effettuata dalla sede di Brugherio dell'IRSA chiarirà il potenziale di questa tecnologia nell'area metropolitana di Milano.

**Fonte di finanziamento ITA:** Regione Lombardia. Terzo Accordo Quadro tra CNR e Regione Lombardia sottoscritto il 1/10/2015: Avviso per la presentazione di proposte progettuali per l'attuazione di programmi di ricerca e sviluppo e valorizzazione del capitale umano con ricadute dirette sul sistema della ricerca e sul territorio lombardo (linea B) e rafforzamento delle infrastrutture (linea A).

**Coordinatore:** Italo Meroni, CNR-ITC

**Referente IRSA:** Laura Marziali

**Periodo di attivita:** 14 dicembre 2016 - 13 giugno 2019

### Titolo: FOtocatalizzatori NanosTrutturati e RAdiazioNe UV per un'Acqua più PULItA

**Acronimo:** FONTANAPULIA

**Abstract ITA:** Gli obiettivi principali del progetto FONTANAPULIA sono: i) studio e applicazione di procedure innovative per la sintesi di nanomateriali ad elevata attività fotocatalitica, ii) definizione di mezzi e processi per la produzione dei nanomateriali, già sperimentati su scala di laboratorio, su scala pilota (1-5 Kg), iii) studio di tecniche di immobilizzazione dei nanomateriali fotocatalitici su opportuni supporti solidi, iv) progettazione e caratterizzazione di sistemi fotocatalitici prototipali integrabili su impianti di abbattimento pilota, v) progettazione e realizzazione di un impianto pilota per l'abbattimento fotocatalitico di inquinanti organici prioritari ed emergenti in varie tipologie di

acque (acqua di falda contaminata, acque di scarico urbane, acque di scarico industriali), vi) sviluppo di sistemi ultrasonori per il controllo del processo di abbattimento (con particolare riferimento al controllo della stabilità del sistema fotocatalitico), vii) sviluppo di nuove metodiche per l'analisi qualitativa e quantitativa del carico inquinante in acque di scarico e viii) studio di impatto ambientale e di Life Cycle Assessment (LCA) sempre più richiesto dalla Comunità Europea per la valutazione dell'impatto ambientale di nuove tecnologie di depurazione quali la tecnologia FONTANAPULIA. Nel corso del progetto FONTANAPULIA verrà realizzato un impianto pilota innovativo, con capacità depurativa pari a 1-10 m3/h, per l'abbattimento di inquinanti prioritari ed emergenti in diverse tipologie di acqua contaminata: acqua di falda contaminata, acque di scarico urbane e acque di scarico industriali. L'impianto pilota verrà collaudato su siti industriali realmente inquinati, dove esistono effettive esigenze di depurazione delle acque difficilmente risolvibili con tecnologie convenzionali, per verificare l'efficacia depurativa della soluzione tecnologica proposta. Si prevede di utilizzare il prototipo pilota per: i) la bonifica di acqua di falda contaminata da inquinanti organici prioritari (policlorobifenili presenti in alcuni pozzi dell'Area di Crisi Ambientale di Taranto – si veda la Lettera d'Interesse sottoscritta dalla Dott.ssa Corbelli, Commissario Straordinario per gli interventi urgenti di bonifica, ambientalizzazione e riqualificazione di Taranto), ii) la rimozione di inquinanti organici emergenti in acque reflue urbane (come stadio di affinamento dopo un trattamento biologico innovativo attualmente in fase di realizzazione presso il depuratore della città di Putignano) e/o iii) la rimozione di tensioattivi da un'acqua di scarico di un insediamento industriale nell'area di Bari.

**Descrizione estesa ITA:** Circa la metà delle nazioni Europee sono interessate da situazioni di "water stress" nelle quali si registrano scarsità di acqua oppure deterioramento della qualità delle risorse idriche. Di conseguenza, diverse nazioni Europee hanno considerato la possibilità di riutilizzare acque di scarico urbane, dopo opportuno trattamento di depurazione, per usi agricoli, industriali ed urbani (non potabili). Il riutilizzo delle acque deve anche essere considerato nell'ambito del continuo deterioramento delle acque causato dalla sempre crescente diversificazione dei contaminanti. È noto che le acque di scarico urbane depurate di tutte le nazioni occidentali contengono residui di farmaci ed altri inquinanti emergenti a concentrazioni comprese tra i ng/l e i µg/l. La presenza di tali contaminanti nelle acque reflue depurate conferma che i processi convenzionali di depurazione delle acque reflue non sono efficaci nel rimuovere completamente i vari inquinanti organici presenti in tali acque e, pertanto, è necessario disporre di tecnologie di trattamento delle acque più avanzate al fine di ridurre sia il potenziale impatto ambientale negativo degli effluenti depurati che di attenersi alla legislazione che sta diventando sempre più restrittiva. Per minimizzare la presenza degli inquinanti prioritari ed emergenti nelle acque è necessario utilizzare nuove tecnologie di depurazione, molto più efficaci delle tecnologie convenzionali, quali i processi di ossidazione avanzata (advanced oxidation processes, AOP). Tra i processi AOP vi sono anche delle configurazioni tecnologiche che consentono di rimuovere gli inquinanti organici impiegando la combinazione di radiazione ultravioletta (UV) e catalizzatori (processo noto come fotocatalisi). Tale combinazione risulta molto interessante in quanto consente di evitare del tutto l'utilizzo di reagenti chimici e, pertanto, risulta essere particolarmente green. Particolarmente innovativo è l'utilizzo di catalizzatori supportati su o integrati in matrici solide, al fine di evitare l'impiego dei catalizzatori convenzionali in polvere la cui rimozione alla fine del trattamento di depurazione risulta essere molto problematica. Gli obiettivi principali del progetto FONTANAPULIA sono: i) studio e applicazione di procedure innovative per la sintesi di

nanomateriali ad elevata attività fotocatalitica, ii) definizione di mezzi e processi per la produzione dei nanomateriali, già sperimentati su scala di laboratorio, su scala pilota (1-5 Kg), iii) studio di tecniche di immobilizzazione dei nanomateriali fotocatalitici su opportuni supporti solidi, iv) progettazione e caratterizzazione di sistemi fotocatalitici prototipali integrabili su impianti di abbattimento pilota, v) progettazione e realizzazione di un impianto pilota per l'abbattimento fotocatalitico di inquinanti organici prioritari ed emergenti in varie tipologie di acque (acqua di falda contaminata, acque di scarico urbane, acque di scarico industriali), vi) sviluppo di sistemi ultrasonori per il controllo del processo di abbattimento (con particolare riferimento al controllo della stabilità del sistema fotocatalitico), vii) sviluppo di nuove metodiche per l'analisi qualitativa e quantitativa del carico inquinante in acque di scarico e viii) studio di impatto ambientale e di Life Cycle Assessment (LCA) sempre più richiesto dalla Comunità Europea per la valutazione dell'impatto ambientale di nuove tecnologie di depurazione quali la tecnologia FONTANAPULIA. Nel corso del progetto FONTANAPULIA verrà realizzato un impianto pilota innovativo, con capacità depurativa pari a 1-10 m3/h, per l'abbattimento di inquinanti prioritari ed emergenti in diverse tipologie di acqua contaminata: acqua di falda contaminata, acque di scarico urbane e acque di scarico industriali. L'impianto pilota verrà collaudato su siti industriali realmente inquinati, dove esistono effettive esigenze di depurazione delle acque difficilmente risolvibili con tecnologie convenzionali, per verificare l'efficacia depurativa della soluzione tecnologica proposta. Si prevede di utilizzare il prototipo pilota per: i) la bonifica di acqua di falda contaminata da inquinanti organici prioritari (policlorobifenili presenti in alcuni pozzi dell'Area di Crisi Ambientale di Taranto – si veda la Lettera d'Interesse sottoscritta dalla Dott.ssa Corbelli, Commissario Straordinario per gli interventi urgenti di bonifica, ambientalizzazione e riqualificazione di Taranto), ii) la rimozione di inquinanti organici emergenti in acque reflue urbane (come stadio di affinamento dopo un trattamento biologico innovativo attualmente in fase di realizzazione presso il depuratore della città di Putignano) e/o iii) la rimozione di tensioattivi da un'acqua di scarico di un insediamento industriale nell'area di Bari.

**Rilevanza scientifica e risultati ITA:** In un momento di crescente preoccupazione per l'inquinamento ambientale, la realizzazione di tecnologie innovative in grado di purificare opportunamente le acque contaminate risulta essere particolarmente importante. L'Italia, come anche circa la metà degli Stati della Comunità Europea, vive difficili problematiche legate alla scarsità di acqua, sia in termini di quantità che di deterioramento della qualità. È stimato che una percentuale compresa tra il 20 ed il 40% dell'acqua disponibile, in Italia come in Europa, viene smaltita come acqua di scarico. Inoltre, vari inquinanti prioritari (cioè inclusi nelle normative vigenti) ed emergenti (cioè non inclusi nelle normative vigenti, ma che la letteratura scientifica internazionale descrive come potenzialmente pericolosi) sono continuamente immessi nei corpi idrici superficiali, in quanto non completamente rimossi dagli impianti di trattamento delle acque reflue urbane ed industriali, causando la compromissione degli ecosistemi. Di conseguenza, la problematica della contaminazione delle acque da inquinanti organici riguarda sia le acque di falda che l'efficace depurazione delle acque reflue. Relativamente alle acque di falda, il problema dell'inquinamento delle falde in acquiferi alluvionali e/o fratturati da parte dei contaminanti organici di svariata natura chimica (idrocarburi aromatici ed alogenati, composti acrilici alogenati, pesticidi, ecc.) è particolarmente rilevante in numerose zone dell'Italia (in particolare, in quelle industrializzate in tempi recenti o remoti) e molto spesso aggravato per l'elevata persistenza e tossicità di numerosi di questi composti con i connessi rischi anche a livello sanitario. Accanto alle

tecnologie di tipo convenzionale utilizzate per la purificazione delle acque (attualmente le tecnologie maggiormente impiegate in Italia per la rimozione di inquinanti organici sono basate su carboni attivi: questa tecnologia non risulta essere appropriata dal punto di vista ambientale in quanto: i. consente solo il trasferimento del carico inquinante da una fase – acquosa - ad un'altra – solida - senza risolvere il problema ambientale e ii. i carboni attivi esausti devono essere poi smaltiti o rigenerati con conseguenti costi operativi e ricadute ambientali), si stanno progressivamente affermando tecnologie innovative denominate AOT (Advanced Oxidation Technologies), particolarmente efficaci nel rimuovere inquinanti organici difficilmente biodegradabili quali trialometani, solventi organici, fitofarmaci, ecc. Relativamente all'efficace depurazione delle acque reflue, diverse autorità nazionali degli Stati membri della Comunità Europea stanno prendendo in considerazione l'utilizzo di acque reflue depurate, sia in ambito urbano che industriale, per mitigare il problema della scarsità di risorse idriche. È opportuno sottolineare che gli impianti di trattamento delle acque reflue, che normalmente comprendono un trattamento primario (chimico-fisico) e un trattamento secondario (biologico ossidativo) ed una disinfezione, non sono progettati per la rimozione efficace di inquinanti prioritari e/o emergenti e risulta quindi necessario ricorrere alla tecnologia AOT che consentirebbe la rimozione di vari contaminanti organici inclusi quelli emergenti. In particolare, gli inquinanti emergenti, che sono normalmente presenti nelle acque reflue a concentrazioni comprese tra pochi ng/l e diversi µg/l, consistono in una moltitudine di composti organici di origine antropogenica che includono residui di farmaci, di prodotti per la cura personale, di ormoni steroidei, di composti usati nell'industria e di molti altri. La loro presenza a basse concentrazioni non solo complica la loro rilevazione e le procedure di analisi, ma pone anche notevoli sfide per i trattamenti di depurazione delle acque. Tali composti sono stati presi in considerazione dalle direttive comunitarie quale la Direttiva 2013/39/EU che rinforza diversi aspetti tra cui: i) la valutazione della qualità dei comparti acquatici, ii) il principio "chi inquina paga", iii) la necessità di disporre di tecnologie di trattamento delle acque innovative ed economicamente praticabili, iv) l'identificazione delle cause dell'inquinamento e di una lista di inquinanti prioritari da monitorare. Inoltre, con la Decisione 2015/495 del 20/03/2015, è stata definita una watch list di altri 10 composti inquinanti. Le tecnologie AOT, come precedentemente citato, sono basate sulla formazione di radicali idrossilici e possono essere realizzate mediante ozono ed acqua ossigenata, radiazioni ultraviolette ed acqua ossigenata e radiazioni ultraviolette e catalizzatori basati su biossido di titanio. Relativamente a quest'ultima opzione, i catalizzatori comunemente utilizzati consistono in polveri di biossido di titanio che sono di difficile rimozione dalla fase acquosa soggetta a trattamento con tecnologia AOT. In questa prospettiva, la fotocatalisi eterogenea assistita da biossido di titanio (TiO2), nelle forme cristalline di anatasio, rutilo e brookite, rappresenta una delle alternative più interessanti, offrendo una tecnologia sostenibile ed environmental friendly, dato che non richiede l'utilizzo di reagenti chimici, come avviene durante l'impiego della tecnologia UV/H2O2 che rappresenta il riferimento a livello internazionale e che sarà comunque presa come riferimento nel progetto FONTANAPULIA. I fotocatalizzatori disponibili in commercio, come il TiO2 Degussa P25, sono generalmente utilizzati in sospensione acquosa per sfruttare il massimo numero di siti superficiali disponibili. Tuttavia, le dimensioni micrometriche degli aggregati di nanoparticelle P25 rende difficile il recupero del catalizzatore al termine del trattamento, impedendone allo stesso tempo il riciclo. Inoltre, esiste il problema dell'effetto ombra, esercitato dalla sospensione del fotocatalizzatore rispetto alla radiazione, che risulta in una riduzione dell'intensità della radiazione stessa. Tra i numerosi sforzi compiuti per superare queste limitazioni, è stata, in particolare, esplorata la possibilità di

immobilizzare il fotocatalizzatore su un opportuno substrato, quale il vetro, l'acciaio, tessuti, fibra di vetro, carboni attivi, avvalendosi anche di matrici in grado di disperdere ed ospitare il catalizzatore stesso, che rappresenta una valida e promettente soluzione. Nel progetto FONTANAPULIA, il TiO2 nanostrutturato ed altri nanomateriali innovativi verranno immobilizzati su substrati opportunamente progettati e le dimensioni nanometriche del catalizzatore, che risultano in un rapporto superficie/volume estremamente alto e quindi in un elevato numero di siti catalitici attivi alla superficie, consentiranno di ridurre la perdita di performance fotocatalitica, causata dalla riduzione di superficie dovuta all'immobilizzazione. L'applicazione dei nanomateriali ad attività fotocatalitica sui substrati selezionati verrà condotta avvalendosi di due strategie fondamentali: i) utilizzo di matrici in grado di disperdere efficacemente le nanoparticelle di fotocatalizzatore e ii) utilizzo di metodi chimici per la deposizione del semiconduttore nanostrutturato sul substrato, compresi quelli aventi geometrie complesse, come i supporti curvi da integrare in reattori e in sistemi per il trattamento delle acque.

**Fonte di finanziamento ITA:** POR Puglia FESR - FSE 2014-2020. Fondo Europeo Sviluppo Regionale. Azione 1.6 – Avviso pubblico "InnoNetwork" approvato con A.D. n.498 del 19/12/2016 e A.D. n.16 del 23/02/2017.

**Altre informazioni ITA:** partener coinvolti: DHITECH – Distretto Tecnologico High Tech Scarl – Scarl BIOTEC ASTRA ENGINEERING CHEMISERVICE TCT ECHOLIGHT Consiglio Nazionale delle Ricerche (NANOTEC, IPCF, IRSA) Importo totale del progetto: € 1.739.630,96 Importo totale del finanziamento: € 1.323.435,89

**Coordinatore:** DHITECH – Distretto Tecnologico High Tech Scarl, Lecce

**Referente IRSA:** Giuseppe Mascolo

**Periodo di attivita:** 01/07/2018 - 31/12/2020

### Titolo: Valori di Fondo per i corpi idrici sotterranei pugliesi

**Acronimo:** VIOLA

**Abstract ITA:** La Regione Puglia è da tempo impegnata nell'attivazione di iniziative regolamentari ed infrastrutturali, finalizzate al miglioramento del Servizio Idrico Integrato (SII) per usi civili, anche attraverso la sperimentazione ed introduzione di tecnologie e misure innovative nella gestione dei servizi idrici e nella tutela dei corpi idrici finalizzate a garantire il raggiungimento o mantenimento degli obiettivi di qualità per i corpi idrici e per la tutela qualitativa e quantitativa. Con tali finalità, nell'ambito del Programma Operativo Regionale (POR) Puglia FESR FSE 2014/2020 ha inserito l'Azione 6.4 - Attività 6.4.a "Sostegno all'introduzione di misure innovative in materia di risparmio idrico, depurazione per il contenimento dei carichi inquinanti, riabilitazione dei corpi idrici degradati attraverso un approccio ecosistemico" dotata di risorse finanziarie destinate all'attuazione d'interventi finalizzati alla sperimentazione ed introduzione di tecnologie e misure

innovative nella gestione dei servizi idrici e nella tutela dei corpi idrici infrastrutturali. L'IRSA ha partecipato all'Avviso Pubblico per la presentazione di manifestazione di interesse al finanziamento di interventi rivolti alla sperimentazione ed introduzione di tecnologie e misure innovative nella gestione dei servizi idrici e nella tutela dei corpi idrici presentando una proposta progettuale dal titolo "VALORI DI FONDO NEGLI ACQUIFERI PUGLIESI" (acronimo VIOLA) avente come con obiettivi specifici: (i) la determinazione dei principali parametri chimico-fisici nelle AASS per le quali si renda necessario approfondire la conoscenza dei VFN; (ii) lo studio dei valori di fondo naturali con riferimento alle problematiche specifiche di tutti i corpi idrici sotterranei della regione Puglia; (iii) lo studio e la sperimentazione, anche con l'ausilio di dati di monitoraggio raccolti durante quattro campagne semestrali di campionamento nel corpo idrico sotterraneo della Murgia costiera, di approcci innovativi alla determinazione dei valori di fondo naturali in situazioni di salinizzazione dei corpi idrici sotterranei; (iv) la sperimentazione a piccola scala dell'uso di indicatori microbiologici innovativi per la valutazione dello stato delle acque sotterranee, in un'area della Regione Puglia, individuata in base a specifici requisiti delle AASS. La proposta, riscontrando l'interesse della Commissione Tecnica regionale di valutazione che l'ha giudicata vincente, è stata finanziata nel 2018 e terminerà nel 2021.

**Abstract ENG:** The Apulia Region has long been committed to the activation of regulatory and infrastructural initiatives to improve Integrated Water Services for civil uses, even by experimenting with innovative water services management actions to protect and preserve the qualitative and quantitative status of water resources. With these purposes, in the frame of the Regional Operational Program (ROP) EFRD-ESF 2014/2020, the Regional Water Authority published a Public Notice for expressions of interest for experimenting with innovative technologies in the management of water services and the protection of water bodies. The IRSA participated in the Public Notice proposing the research project "Natural Background Values in the Apulian Groundwater Bodies" (acronym: VIOLA) with the following specific objectives: (i) studying the presence of chemical-physical parameters in the regional groundwater bodies and evidencing those whose values override given thresholds on average; (ii) assessing the natural background values regarding the specific problems of all the Apulian groundwater bodies; (iii) studying and testing innovative approaches to the assessment of natural background values in salinized groundwater bodies, even using monitoring data collected during four biannual sampling campaigns in an ad hoc created monitoring wells network within coastal groundwater body of the Murgia; (iv) small-scale testing of innovative microbiological indicators for assessing the qualitative status of groundwater, in a study site of the Apulia region. The proposal has been considered remarkable by the Regional Evaluation Commission and funded in 2018; The Viola project will end in 2021.

**Fonte di finanziamento ITA:** Convenzione con Regione Puglia in ambito PO FESR 2014-2020, Azione 6.4- Attività 6.4.1 "Sostegno all'introduzione di misure innovative in materia di risparmio idrico, depurazione per il contenimento dei carichi inquinanti, riabilitazione dei corpi idrici degradati attraverso un approccio eco-sistemico"

**Coordinatore:** Giuseppe Passarella

**Referente IRSA:** Giuseppe Passarella

**Periodo di attivita:** 08/07/2018 - 31/12/2021

**Titolo: Valutazione della presenza di antibiotici nei reflui zootecnici e nel digestato di impianti a biogas: studio di strategie per la loro rimozione - Progetto N.ro 85-2017-15065"**

**Acronimo:** AZeRO

**Abstract ITA:** Il Progetto AZeRO Project (AØA) è una collaborazione di oltre tre anni tra l'IRSA-CNR di Roma e il Laboratorio Biomasse e Biotecnologie per l'Energia e per l'Industria dell'ENEA Casaccia (Responsabile scientifico ENEA: dott.ssa Giulia Massini). I principali obiettivi del progetto AZeRO sono: 1) valutare la presenza e la persistenza nei reflui zootecnici di antibiotici, (es. sulfametossazolo e l'enrofloxacina, di comune uso veterinario negli allevamenti convenzionali); 2) studiare come la presenza di tali antibiotici possa influire sul processo di digestione anaerobica all'interno di impianti per la produzione di biogas, alimentati con le deiezioni animali; 3) Individuare fattori e condizioni che possano incrementare e/o accelerare la degradazione di tali antibiotici e la diffusione dei geni della resistenza dalle pratiche agricole all'uomo.

**Abstract ENG:** The AZeRO Project (AØA) is a three-year joint collaboration between the Water Research Institute of the National Research Council (CNR-IRSA, Italy) and the lab of Biomass and Biotechnologies for Energy of the National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA, Italy). Main objectives of the project are: 1) to assess the occurrence of the mostly used veterinary antibiotics (e.g. sulfamethoxazole and ciprofloxacin) in cattle manure and digestate; 2) to study the kinetics of antibiotic biodegradation during the anaerobic digestion process; 3) to evaluate the antibiotics degradation in aerobic conditions, once the digestate is spread on agricultural soil. Feed and digestate samples are collected from various livestock farms equipped with biogas plants in the Lazio Region (Italy).

**Fonte di finanziamento ITA:** Progetti di gruppi di ricerca - Conoscenza e cooperazione per un nuovo modello di sviluppo", in attuazione della Legge Regionale n. 13 del 04 agosto 2008 e del Programma Strategico Regionale per la ricerca, l'innovazione ed il trasferimento tecnologico 2017-2020

**Website:** http://www.azeroantibiotici.eu/

**Coordinatore:** Barra Caracciolo Anna

**Referente IRSA:** Anna Barra Caracciolo

**Periodo di attivita:** 28/06/2018--01/06/2021

**Titolo: Nutrient cycling, ecosystem functioning and climate change in Arctic lake ecosystems**

**Acronimo:** EcoClimate

**Abstract ITA:** Il ciclo di nutrienti nei laghi artici sarà influenzato dai cambiamenti nella copertura nevosa e dall'abbondanza di uccelli migratori, con implicazioni per la stabilità degli ecosistemi lacustri e dei servizi che forniscono. Attraverso esperimenti sul campo, dati satellitari e modelli, il progetto quantificherà gli effetti del manto nevoso stagionale e dell'abbondanza di uccelli sull'origine e sulla quantità degli apporti di nutrienti nei laghi artici, l'assorbimento da parte della vegetazione o il trasferimento nell'atmosfera.

**Abstract ENG:** Nutrient cycling in Arctic lakes will be affected by changes in snow cover and abundance of migratory birds, with implications for the stability of lake ecosystems and the services they provide. Through field experiments, satellite data and modelling, the project will quantify the effects of seasonal snow cover and bird abundance on the origin and quantity of nutrient inputs in high Arctic lakes, their burial in sediment and soil, uptake by vegetation or recycling into the atmosphere.

**Fonte di finanziamento ITA:** MIUR Programma di Ricerche in Artico (PRA)

**Coordinatore:** Edoardo Calizza (Sapienza Università di Roma)

**Referente IRSA:** David Rossi

**Periodo di attivita:** 06/11/2020 al 31/12/2022

**Titolo: PRIN2017: Development and promotion of the Levulinic acid and Carboxylate platforms by the formulation of novel and advanced PHA-based biomaterials and their exploitation for 3D printed green-electronics applications**

**Acronimo:** VISION

**Abstract ITA:** Finalità del progetto: Il progetto VISION mira a contribuire allo sviluppo industriale di due piattaforme chimiche a base biologica, concentrandosi sullo sfruttamento degli acidi grassi volatili (VFA) e dell'acido levulinico (LA). VFA e LA rappresentano i co-substrati rinnovabili per la sintesi fermentativa di biopolimeri poli (idrossialcanoati) (PHA), in rapido sviluppo per la produzione industriale e lo sfruttamento commerciale. I PHA sono bioplastiche emergenti, con il CAGR più alto tra tutte le alternative biobased. Nel presente progetto, tali prodotti primari target saranno ottenuti da biomasse residue mediante l'applicazione di approcci termochimici e biotecnologici, rispettivamente. Inoltre, gli acidi verranno sfruttati come precursori per l'ottenimento di prodotti chimici avanzati e verdi, che verranno utilizzati congiuntamente al PHA, al

fine di ottenere formulazioni di compositi avanzati totalmente bioderivati. Quest'ultimo sarà testato come plastica stampata in 3D che supporta circuiti elettronici da applicare per il monitoraggio ambientale intelligente. La sostenibilità economica e ambientale dei prodotti finali sarà studiata mediante l'applicazione di analisi LCC e LCA.

**Coordinatore:** Fabio Fava

**Referente IRSA:** Carlo Pastore

**Periodo di attivita:** 15/09/2019-15/03/2023

### Titolo: Estrazione Biodiesel e Biometano (BioFuel and Biomethane from Sludge)

**Acronimo:** BFBioS

**Abstract ITA:** Sperimentazione di Tecnologie innovative per la costruzione di un modello di economia circolare per il trattamento dei fanghi da depurazione di reflui civili, articolata sostanzialmente su due livelli: - Valorizzare i fanghi di depurazione ottenuti dal normale trattamento delle acque attraverso la estrazione/produzione di biocarburanti (biodiesel e biometano); - Strutturare tutte le linee di trattamento con processi ad alta efficienza ed a bassa richiesta di energia (estrattore/separatore fasi lipidiche da fanghi, reattore di conversione dei lipidi in biodiesel, digestione anaerobica e produzione di biometano, essiccamento termico a bassa temperatura).

**Fonte di finanziamento ITA:** Acquedotto Pugliese S.p.A.

**Coordinatore:** Carlo Pastore

**Referente IRSA:** Carlo Pastore

**Periodo di attivita:** 15/07/2019-31/12/2021

### Titolo: Trasferimento di tecnologie innovative finalizzate al riutilizzo di acque reflue urbane affinate in areali salentini colpiti da Xylella

**Acronimo:** RIUBSAL

**Abstract ITA:** Il progetto RIUBSAL intende offrire alle comunità agricole salentine, ed in particolare a quelle colpite da Co.Di.Ro, un sistema innovativo ed integrato che favorisca il riutilizzo per uso irriguo di acque reflue urbane affinate, attraverso un dispositivo di controllo da remoto. Le attività

dell'IRSA nel contesto di questo progetto sono indirizzate sulla modellistica matematica della ferti-irrigazione.

**Abstract ENG:** The RIUBSAL project intends to offer Salento agricultural communities, and in particular to those affected by Co.Di.Ro, an innovative and integrated system that favors the reuse for irrigation of refined urban wastewater, through a remote control device. The activities of the IRSA in the context of this project are focused on the mathematical modeling of fertilization-irrigation.

**Fonte di finanziamento ITA:** PSR - Puglia

**Coordinatore:** G.A. Vivaldi

**Referente IRSA:** Marco Berardi

**Periodo di attivita:** 5/09/2020 - 4/09/2022

### Titolo: SISTEMA INNOVATIVO DI MONITORAGGIO E TRATTAMENTO DELLE ACQUE REFLUE PER IL MIGLIORAMENTO DELLA COMPATIBILITA' AMBIENTALE AI FINI DI UN'AGRICOLTURA SOSTENIBILE

**Acronimo:** Smart Water

**Abstract ITA:** Il progetto si propone, attraverso un approccio interdisciplinare, di fornire un DSS (Decision Support System) che attraverso un approccio user-friendly dia indicazioni del fabbisogno nutrizionale delle principali colture irrigate con acque reflue ad agricoltori ed enti di gestione

**Abstract ENG:** The project aims, through an interdisciplinary approach, to provide a DSS (Decision Support System) which, through a user-friendly approach, gives indications of the nutritional needs of the main crops irrigated with wastewater to farmers and management bodies.

**Fonte di finanziamento ITA:** Regione Puglia, Bando InnoNetwork

**Coordinatore:** G.A. Vivaldi

**Referente IRSA:** Michele Vurro

**Periodo di attivita:** 15/10/2018 - 14/10/2021

### Titolo: Sistema per acquisizione conoscenze di base del territorio

**Acronimo:** TEBAKA

**Abstract ITA:** Lo sviluppo tecnologico nel settore della sensoristica, delle piattaforme satellitari, aeree e terrestri (sistemi con e senza pilota a bordo), della capacità di acquisizione, gestione e fusione di grandi quantità di dati provenienti da sorgenti diverse, della loro manipolazione ed analisi, dello sviluppo di sistemi intelligenti in grado di imparare dai dati acquisiti (modelli data driven), della capacità di collegamento in rete (sia per lo sviluppo/gestione di applicazioni sia per la loro fruizione), sta rendendo possibile per il mondo dell'agricoltura (e più in generale della gestione dei fenomeni ambientali e territoriali), lo sviluppo di "piattaforme" tecnologiche/applicative" che possono essere messe a disposizione per fornire al mondo agricolo un importante supporto nello svolgimento delle proprie attività.

**Abstract ENG:** Lo sviluppo tecnologico nel settore della sensoristica, delle piattaforme satellitari, aeree e terrestri (sistemi con e senza pilota a bordo), della capacità di acquisizione, gestione e fusione di grandi quantità di dati provenienti da sorgenti diverse, della loro manipolazione ed analisi, dello sviluppo di sistemi intelligenti in grado di imparare dai dati acquisiti (modelli data driven), della capacità di collegamento in rete (sia per lo sviluppo/gestione di applicazioni sia per la loro fruizione), sta rendendo possibile per il mondo dell'agricoltura (e più in generale della gestione dei fenomeni ambientali e territoriali), lo sviluppo di "piattaforme" tecnologiche/applicative" che possono essere messe a disposizione per fornire al mondo agricolo un importante supporto nello svolgimento delle proprie attività.

**Fonte di finanziamento ITA:** PON MIUR Ricerca e Innovazione 2014-2020

**Altre informazioni ITA:** Nel progetto, il CNR è coinvolto in quanto socio del DTA (Distretto Tecnologico Aerospaziale). A sua volta, la gestione amministrativa del progetto in seno al CNR è in capo a STIIMA

**Coordinatore:** Luigi Ponti (ENEA)

**Referente IRSA:** Marco Berardi

**Periodo di attivita:** 01/11/2020 - 29/02/2024

## Convenzioni con enti pubblici

### Titolo: Accordo con Commissario Straordinario per gli interventi urgenti di bonifica, ambientalizzazione e riqualificazione di Taranto

**Acronimo:** SIN Taranto

**Abstract ITA:** Le attività dell'Accordo svolte in collaborazione con il Commissario Straordinario per gli interventi urgenti di bonifica, ambientalizzazione e riqualificazione di Taranto e l'Università degli Studi di Bari, mirano ad acquisire elementi necessari ad orientare gli interventi da effettuare ai fini

della messa in sicurezza e bonifica dell'Area di Taranto. In particolare l'analisi del contesto ambientale riferito al Mar Piccolo ed all'Area Vasta di Taranto punta a raccogliere elementi integrativi che possano aggiungere informazioni utili ai fini dell'individuazione dei percorsi e dei responsabili delle contaminazioni in atto, allo scopo di poter rimuovere alcune delle fonti primarie e secondarie rendendo più efficaci i successivi interventi di messa in sicurezza e bonifica. L'intervento complessivo s'inquadra nell'ambito dell'Accordo quadro stipulato ai sensi dell'art. 15 della Legge 241/90 tra Commissario Straordinario per gli interventi urgenti di bonifica, ambientalizzazione e riqualificazione di Taranto, l'Università degli Studi di Bari Aldo Moro e Consiglio Nazionale delle Ricerche - Dipartimento Scienze del Sistema Terra e Tecnologie per l'Ambiente, in data 29 gennaio 2015 e che pertanto prevede esclusivamente rimborsi di costi effettivamente sostenuti, non comprendendo costi interni riferiti al personale dipendente ed all'ammortamento delle attrezzature. In particolare l'attività in oggetto prevede l'impiego, non a costo, di importanti attrezzature recentemente acquisite nell'ambito del progetto di Potenziamento del Polo Scientifico Tecnologico "Magna Grecia" finanziato dal MIUR, conseguendo un ulteriore risparmio. La definizione delle attività rappresenta un punto di arrivo di un costruttivo confronto tra gli attori istituzionali direttamente coinvolti nel citato Accordo ed altre Istituzioni operanti sul territorio, allo scopo di stabilire un clima sinergico e di positive collaborazioni che punti ad ottimizzare i costi ed auspicabilmente a massimizzarne i risultati.

**Descrizione estesa ITA:** Il lavoro si articola in diverse fasi: attività di approfondimento su scarichi abusivi volta alla definizione dei responsabili; rilievo aereo ad alta risoluzione spaziale, con restituzione di ortofoto digitali con mappatura di rifiuti, strutture fatiscenti, elementi galleggianti, pontili, nonché di rifiuti derivanti da ulteriori attività antropiche presenti sulle sponde e sulla viabilità di servizio del Mar Piccolo ed implementazione di un sistema informativo finalizzato alla gestione delle informazioni acquisite; supporto scientifico orientato alla definizione delle tecniche di individuazione, rimozione sostenibile e smaltimento dei materiali di natura antropica sul fondale del Mar Piccolo; indagini geofisiche mediante tecniche del tipo "sub bottom profiler" utili alla definizione della stratigrafia dei fondali e alla individuazione sul fondale dei materiali di natura antropica; mappatura e monitoraggio di specie animali e vegetali di elevato valore conservazionistico nell' ecosistema del Mar Piccolo; analisi e valutazione della qualità e quantità delle acque in uscita dai citri presenti nel Mar Piccolo finalizzate sia al monitoraggio che al trattamento delle acque (trattenimento composti inquinanti); indagini ed analisi geochimiche, mineralogiche e sedimentologiche (con datazione) con ricostruzione del modello geologico; indagini ed analisi chimico-fisiche, microbiologiche ed ecotossicologiche dei sedimenti e del biota presente nel Mar Piccolo di Taranto. In particolare sono state svolte le seguenti attività: - Attività di approfondimento su scarichi abusivi volta alla definizione dei responsabili - Rilievo aereo ad alta risoluzione spaziale, con restituzione di ortofoto digitale con mappatura di rifiuti, strutture fatiscenti, elementi galleggianti, pontili, nonché di rifiuti derivanti da ulteriori attività antropiche presenti sulle sponde e sulla viabilità di servizio del Mar Piccolo ed implementazione di un sistema informativo finalizzato alla gestione delle informazioni acquisite - Supporto scientifico orientato alla definizione delle tecniche di individuazione, rimozione sostenibile e smaltimento dei materiali di natura antropica sul fondale del Mar Piccolo - Indagini geofisiche mediante tecniche del tipo "sub bottom profiler" utili alla definizione della stratigrafia dei fondali e alla individuazione sul fondale dei materiali di natura antropica - Mappatura e monitoraggio di specie animali e vegetali di elevato valore conservazionistico nell' ecosistema del Mar Piccolo - Analisi e valutazione della qualità e

quantità delle acque in uscita dai citri presenti nel Mar Piccolo finalizzate sia al monitoraggio che al trattamento delle acque (trattenimento composti inquinanti) - Indagini ed analisi geochimiche, mineralogiche e sedimentologiche (con datazione) con ricostruzione del modello geologico - Indagini ed analisi chimico-fisiche, microbiologiche ed ecotossicologiche dei sedimenti e del biota presente nel Mar Piccolo di Taranto

**Fonte di finanziamento ITA:** Fondi Commissario Straordinario

**Website:** http://commissariobonificataranto.it/

**Coordinatore:** Fabio Trincardi

**Referente IRSA:** Vito Felice Uricchio

**Periodo di attivita:** 29/1/2015 - 23/8/2020

### Titolo: Attività di tutela ambientale: programma di monitoraggio dei siti inquinati della regione Puglia

**Acronimo:** Accordo FF.00.

**Abstract ITA:** Il progetto, attraverso un coordinamento decisionale ed operativo che coinvolge l'Istituzione regionale in sinergia con le Forze dell'Ordine Operanti nel settore ambientale (Guardia di Finanza, Carabinieri del NOE, Comando Legione dei Carabinieri e Carabinieri Forestali), l'ARPA ed il CNR-IRSA, persegue attività monitoraggio di siti potenzialmente inquinati con attività avviata nel 2003 e realizzate attraverso ricognizioni aeree (con elicotteri e droni), perlustrazioni navali, sopralluoghi a terra e campionamenti, determinazioni analitiche, valutazione delle condizioni di rischio per la popolazione e per l'ambiente. L'interesse regionale si riferisce all'aggiornamento della situazione della contaminazione pugliese allo scopo di pianificare con criteri razionali le attività di caratterizzazione, messa in sicurezza e bonifica dei siti contaminati ed al contempo consente di popolare le banche dati con dati omogenei (acquisiti secondo specifici protocolli) l'anagrafe dei siti potenzialmente bonificati realizzata ai sensi dell'art. 251 del D.lgs. 152/2006, implementata dal CNR-IRSA. In tale ambito l'IRSA è impegnata nell'implementazione delle banche dati popolate dalle attività operative delle Forze dell'Ordine e dell'ARPA Puglia, garantendo l'interoperabilità rispetto alla "Banca data tossicologica del suolo" (realizzata da IRSA) ed alle altre Banche dati e Sistemi Informativi Territoriali della Regione Puglia (implementate da IRSA). Il supporto scientifico dell'IRSA è altresì orientato alla definizione di tecnologie di controllo ambientale sempre più innovative e prestazionali ed alle attività di formazione ed aggiornamento dei militari delle stesse Forze dell'Ordine impegnate nel citato Accordo. L'IRSA svolge attività di elaborazione e restituzione dei dati rilevati attraverso i droni della Guardia di Finanza al fine della quantificazione dei volumi utile per l'elevazione delle sanzioni e la riscossione dell'ecotassa.

**Descrizione estesa ITA:** Il rapporto sinergico tra Forze dell'Ordine impegnate nel settore ambientale quali Comando Tutela Ambiente dei Carabinieri, Guardia di Finanza e Carabinieri

Forestali (ex Corpo Forestale dello Stato), con la Regione Puglia, ARPA Puglia e l'Istituto di Ricerca Sulle Acque del Consiglio Nazionale delle Ricerche, consente di arricchire reciprocamente le reciproche esperienze e competenze facendole convergere verso la soluzione di problematiche e sul contrasto attivo alla criminalità ambientale. La mobilitazione di potenti mezzi e risorse umane fortemente professionalizzate nei diversi comparti della sicurezza, della ricerca e dell'amministrazione, consente quotidianamente di ottenere risultati significativi sia sul piano numerico (numero di sequestri, numero di arresti, imposte evase recuperate, etc.) che su quello qualitativo (offrendo alla magistratura ed alle amministrazioni dossier completi composti dall'analisi integrata di dati acquisiti da rilievi aerei con immagini ed informazioni, analisi chimiche e valutazioni ambientali). L'esperienza pugliese ha introdotto importanti innovazioni sul piano tecnologico, organizzativo e gestionale per il controllo e la tutela dell'ambiente, concorrendo alla prevenzione, alla scoperta degli illeciti e soprattutto dei responsabili, all'applicazione delle relative sanzioni per il perseguimento di obiettivi di contrasto ai pericoli per la salute umana e per l'ambiente. L'interesse scientifico all'applicazione di modelli matematici, all'implementazione di software specialistici, di sistemi di intelligenza artificiale e di dispositivi elettronici avanzati, ad applicazioni pratiche di interesse sociale, ambientale e soprattutto sanitario ed è assai rilevante anche in ragione della forte connotazione interistituzionale che assume, consentendo di sperimentare sul campo i risultati della ricerca ed ottenendo stimoli e suggerimenti per ulteriori implementazioni ed affinamenti promossi dagli stessi utilizzatori. I protocolli operativi messi a punto attraverso un'attività sinergica che ha coinvolto le Forze dell'Ordine (GdF, CC e CFS), i Magistrati operanti nei "pool ambiente" delle Procure pugliesi, il CNR e l'ARPA, hanno portato in Puglia ad importanti risultati operativi testimoniato dall'elevato numero di sequestri, numero di arresti, imposte evase recuperate. Obiettivi Le finalità generali che la citata collaborazione interistituzionale intende perseguire sono orientate a: • l'individuazione e l'implementazione di metodologie operative e strumenti efficaci per incrementare l'efficacia dell'azione di contrasto ai crimini ambientali, favorendo lo scambio delle best practices tra forze dell'ordine e del sistema amministrativo, anche attraverso il trasferimento di tecnologie provenienti dal sistema della ricerca; • lo sviluppo, il consolidamento e la valorizzazione di pratiche operative sinergiche mediante un processo che consenta di aggiornare, monitorare ed incrementare i flussi d'informazione tra soggetti differenti che sono alla base dell'efficacia dell'azione amministrativa, giudiziaria e scientifica; • l'aumento della comprensione dei fenomeni che sono alla base dello sviluppo dei traffici illeciti dei rifiuti; • le necessità di aggiornamento della situazione d'insieme del territorio pugliese in relazione allo stato di salute ambientale, allo scopo di accertare l'eventuale superamento delle condizioni di rischio e di porre in essere le necessarie misure tecnico-amministrative ivi comprese le azioni di caratterizzazione, messa in sicurezza e bonifica dei siti contaminati; •alimentare con informazioni costantemente aggiornate l'Anagrafe dei siti da bonificare, così come disposto dal comma 1 dell'art.241 del D.Lgs. 3 aprile 2006, n. 152 "Norme in materia ambientale" e succ. mod.; • favorire la circolarità delle informazioni attraverso un software integrato per la perimetrazione dei siti contaminati in grado di trasferire in tempo reale le informazioni alle Istituzioni coinvolte (Regione, Forze dell'Ordine, ARPA Puglia, CNR-IRSA, Magistratura, Amministrazioni Comunali, etc.), di determinare le caratteristiche metriche e di calcolare automaticamente l'ecotassa; • attivare sinergie con le Amministrazioni Provinciali e Comunali per velocizzare e promuovere il rapido risanamento specie per le situazioni di minor rischio (ad es. abbandoni di rifiuti) e per riportare sui certificati di destinazione urbanistica indicazioni in ordine all'eventuale superamento delle concentrazioni di rischio; • indurre un

effetto deterrente e dissuasivo su comportamenti illeciti e/o lesivi a danno del patrimonio ambientale, nel segno della prevenzione.

**Rilevanza scientifica e risultati ITA:** Gli aspetti innovativi realizzati nel presente accordo si riferiscono all'introduzione sistematica nelle pratiche operative d'indagine di metodologie basate sulle tecnologie d'"intelligence" e del "knowledge management" che consentono la raccolta, la valutazione, l'analisi, l'integrazione e l'interpretazione di tutte le informazioni disponibili che riguardano uno o più aspetti di una necessità decisionale o investigativa, consentendo di rappresentare le interazioni e le evoluzioni colte nel loro articolato dinamismo: la loro importanza è assolutamente strategica se si considera la pervasività in quasi tutti i settori della vita di un Paese che tende ad informatizzare, ai fini della gestione, qualsiasi informazione attinente alle grandi trasformazioni territoriali ed ambientali. L'efficace azione condotta in Puglia dalle Forze dell'Ordine impegnate nel settore ambientale, con risultati operativi di estrema rilevanza, incrementa quotidianamente le potenzialità di tali approcci, favorendo anche la formalizzazione dei modelli cognitivi utilizzati dagli investigatori per lo sviluppo delle indagini. Infatti, la matematica e l'informatica offrono differenti metodi per formalizzare la conoscenza, quali relazioni algebriche e linguaggi funzionali, mentre le ultime innovazioni consentono la formalizzazione dei cosiddetti "dati semantici" incasellabili in data base e riferiti anche a inferenze, algoritmi e modelli computazionali. In particolare sono stati altresì implementati i modelli cognitivi dello spazio geografico che consentono la formalizzazione di aspetti "sociali" in ambiente GIS, permettendo di riprodurre e ripercorrere i ragionamenti umani, con la possibilità di considerare un numero estremamente più ampio di dati georeferenziati ed informazioni alfanumeriche con i rigori delle regole strutturate. Tale tecnica favorisce l'approfondimento delle basi teoriche della predittività, attraverso l'analisi più intrinseca delle fattispecie che hanno condotto alla configurazione del reato, la ricostruzione del relativo modello e l'interpolazione, ai fini predittivi, di cosa e quando potrà manifestarsi. Nella costruzione dell'apparato modellistico riveste particolare interesse l'implementazione di metodologie per incrementare l'autoapprendimento dei sistemi informatici integrati allo scopo di allineare le logiche d'indagine alle logiche poste in essere dalla stessa organizzazione criminosa. I sistemi di autoapprendimento consentono di superare i più sofisticati meccanismi di modellazione di strutturazione delle informazioni e delle regole, attraverso la semplice acquisizione dei risultati (ad es. di indagine) ottenuti con esito positivo e la determinazione indiretta dei relativi algoritmi. In aggiunta sul versante organizzativo, la relativa ingegnerizzazione, ha riguardato i seguenti aspetti: - l'impianto organizzativo che si è avvalso della confluenza di professionalità con competenze diverse e tra loro complementari; - l'azione di sostegno esterno e la collaborazione informale dei mezzi di comunicazione che ha assunto un'importanza strategica nel dare risalto alle operazioni incrementando la percezione del controllo del territorio con conseguente effetto di deterrenza dei fenomeni criminosi a danno dell'ambiente; - il forte livello di coordinamento assicurato dalla costituzione di una apposita "Cabina di Regia" che ha permesso decisioni rapide e tecnicamente valide poiché derivanti dagli apporti di tutti i partners del progetto; - l'equipaggio misto a bordo dei mezzi di ricognizione (elicotteri ed unità navali) ha permesso l'integrazione delle conoscenze ed il mutuo scambio di esperienze, esprimendo valutazioni complete sul versante tecnico, scientifico e legale; - integrazione sul versante tecnologico reso possibile dall'impiego di dispositivi innovativi installati a bordo degli elicotteri accoppiati alla potenza di calcolo implementate dai partners scientifici; - la sussidiarietà delle competenze per la comprensione e l'interpretazione di fenomeni e di situazioni più complesse.

**Fonte di finanziamento ITA:** Regione Puglia

**Altre informazioni ITA:** - Regione Puglia – Assessorato alla Qualità dell'Ambiente - svolge un ruolo di finanziamento sia dell'intervento in essere che di azioni più complesse di caratterizzazione, messa in sicurezza e bonifica dei siti contaminati di coordinamento, assicurando il raccordo con le Amministrazioni Provinciali e Comunali. - Guardia di Finanza – svolge un ruolo di controllo sia dei traffici illeciti di rifiuti nei porti pugliesi che sulla viabilità principale utilizzando sensoristica avanzata (detectors a fotoionizzazione e rilevatori a cella catalitica entrambi interfacciati a sistemi di riconoscimento automatico delle anomali, FLIR – Forward Looking Infra-Red montati a bordo di elicotteri, sensori iperspettrali, etc.), verifica di profili economico-finanziari orientati anche alla tracciabilità dei flussi, etc. - Comando Tutela Ambiente dei Carabinieri – indagini complesse su aspetti ambientali e verifiche sui traffici, approfondimenti sui traffici di rifiuti radioattivi (anche attraverso l'utilizzazione di mezzi speciali e laboratori mobili – UNIMOG), gestione integrata delle informazioni. -Carabinieri Forestali (ex Corpo Forestale dello Stato) - attività specifica e pianificata di controllo nelle aree protette, verifica e contrasto agli smaltimenti illeciti nelle aree marine protette, vigilanza delle aree forestali con particolare riferimento alle aree del demanio regionale e delle zone vincolate idrogeologicamente e paesaggisticamente. -ARPA Puglia - pianificazione e realizzazione delle attività di campionamento delle matrici ambientali contaminate e dei rifiuti, determinazioni analitiche sui campioni prelevati, supporto alla definizione delle priorità di intervento. - Consiglio Nazionale delle Ricerche – Istituto di Ricerca Sulle Acque –implementazione di nuovi data base e fruizione telematica e relazionale delle informazioni, applicazione di tecniche di data mining e di Knowledge Discovery, interfacce per la gestione "intelligente" di dispositivi elettronici, supporto scientifico alla conduzione dell'azione (interpretazione di dati complessi, utilizzazione di tecniche diagnostiche avanzate, sperimentazione di tecnologie innovative, etc.)

**Coordinatore:** Vito Felice Uricchio

**Referente IRSA:** Vito Felice Uricchio

**Periodo di attivita:** 20/1/2007 - 31/10/2021

## Titolo: Commissario straordinario per la realizzazione degli interventi necessari all'adeguamento e alla normativa vigente delle discariche abusive presenti sul territorio nazionale

**Acronimo:** Commissario infrazioni bonifiche

**Abstract ITA:** Azione di collaborazione nel rispetto delle relative competenze, per la salvaguardia dell'ambiente e del territorio, per la promozione della sostenibilità nell'attività di bonifica delle discariche abusive sul territorio nazionale, per migliorare le buone pratiche di bonifica con particolare riguardo ai protocolli di analisi da seguire e da adottare e all'uniformità sul territorio nazionale, di cui alla Sentenza della Corte di Giustizia dell'Unione Europea del 2 dicembre 2014 e per l'implementazione della legalità in tale settore d'intervento. In particolare le attività riguardano:

il supporto tecnico scientifico per la verifica dei progetti e la predisposizione degli indirizzi progettuali con l'applicazione di tecniche innovative; l'effettuazione di caratterizzazioni, indagini geofisiche ed analisi chimiche sulle matrici potenzialmente contaminate; la promozione delle migliori pratiche d'intervento nel segno della sostenibilità economica ed ambientale per restituire ai cittadini porzioni importanti di territorio.

**Fonte di finanziamento ITA:** Commissario infrazioni bonifiche

**Website:** http://www.commissariobonificadiscariche.governo.it/it/

**Coordinatore:** Vito Felice Uricchio

**Referente IRSA:** Vito Felice Uricchio

**Periodo di attivita:** 20/5/2017 - 20/5/2021

### Titolo: Monitoraggio dei residui dei prodotti fitosanitari nei corpi idrici superficiali e sotterranei pugliesi e definizione delle relative reti di monitoraggio

**Acronimo:** Fitofarmaci Puglia

**Abstract ITA:** La presente azione ha come obiettivo il monitoraggio dei residui dei prodotti fitosanitari nei corpi idrici superficiali e sotterranei, utile, al reperimento in tempo utile di informazioni sullo stato delle risorse idriche della Regione Puglia rispetto alla loro eventuale compromissione derivante dall'uso dei fitofarmaci, anche basandosi su informazioni storiche, alla eventuale messa in opera di controlli più efficaci e all'individuazione di eventuali effetti negativi non previsti in fase autorizzativa delle sostanze. In tal senso le attività di monitoraggio, in linea con la strategia comunitaria e nazionale e con gli indirizzi tecnico– scientifici di ISPRA/SNPA, alla definizione di un sistema integrato di monitoraggio nelle acque, contestualizzato alle specificità del territorio regionale pugliese che tenga conto delle sostanze effettivamente utilizzate e delle diverse aree territoriali in cui tale uso si concretizza, al fine di orientare gli specifici approfondimenti e rilevazioni. Aspetto determinate nella formazione del Programma è costituito dalla scelta delle sostanze da monitorare che deve necessariamente considerare tutti gli aspetti che concorrono a determinare la possibilità di contaminazione delle acque e il conseguente rischio per l'uomo e per l'ambiente. La presente azione si è articolata in tre distinte fasi regolate da apposite convenzioni di cui la prima con la Regione Puglia e le altre due con ARPA Puglia.

**Fonte di finanziamento ITA:** Regione Puglia

**Coordinatore:** Vito Felice Uricchio, Carmine Massarelli

**Referente IRSA:** Vito Felice Uricchio, Carmine Massarelli

**Periodo di attivita:** 31/7/2019- 10/10/2023

**Titolo: Sistema di monitoraggio ambientale integrato nel territorio della Città di Barletta - Analisi di fattibilità degli interventi di messa in sicurezza e bonifica**

**Acronimo:** Barletta monitoraggio

**Abstract ITA:** Tra le misure di bonifica di siti contaminati, le tecnologie di biorisanamento in situ sfruttano la capacità dei microrganismi, naturalmente presenti nella falda, di degradare i contaminanti organici, utilizzandoli come fonte di energia o co-metabolizzandoli in presenza di opportuni substrati primari. I trattamenti consistono essenzialmente nello stimolare l'attività microbica (biostimulation) creando condizioni ambientali favorevoli per la crescita dei microrganismi, mediante l'aggiunta di nutrienti, ammendanti e, nel caso dei processi aerobici, ossigeno. In quest'ultimo caso, i sottoprodotti della degradazione sono tipicamente acqua e anidride carbonica mentre, nel caso di contaminanti di natura ossidata, come gli idrocarburi alifatici clorurati, si rende necessario un processo riduttivo, anaerobio, che porti alla loro conversione in composti di natura innocua, quali etilene, etano, metano etc.. Nel caso in cui non siano presenti microorganismi adatti a degradare i composti di interesse, si può procedere all'introduzione di opportune specie o comunità microbiche esogene (bioaugmentation). L'attività di ricerca proposta è basata sull'allestimento di reattori biologici in scala laboratorio (microcosmi), che consentano di valutare l'efficacia di degradazione degli inquinanti in condizioni controllate. I risultati attesi della sperimentazione sono le informazioni necessarie per una corretta progettazione delle varie fasi dell'intervento di bonifica (scelta della configurazione del sistema; dimensionamento delle componenti impiantistiche; realizzazione di pozzi di iniezione, estrazione e monitoraggio) e per stimare i costi del trattamento in piena scala.

**Fonte di finanziamento ITA:** Regione Puglia - Comune di Barletta

**Coordinatore:** Vito Felice Uricchio

**Referente IRSA:** Vito Felice Uricchio - Valeria Ancona

**Periodo di attivita:** 22/12/2017-30/6/2021

**Titolo: Convenzione operativa per la collaborazione ad attivita' di ricerca con Università degli Studi di Bari Aldo Moro, Dipartimento di Scienze del Suolo, della Pianta e degli Alimenti (DiSSPA).**

**Abstract ITA:** I contenuti e i temi della convenzione riguardano:

a) lo sviluppo di metodologie innovative di analisi spazio-temporale di dati agronomici e ambientali (per la caratterizzazione e il monitoraggio del sistema suolo-pianta) anche di tipo prossimale o remoto;

b) l'applicazione delle metodologie suddette a casi di studio di particolare rilevanza scientifica e/o applicativa;

c) la stesura di progetti nazionali e internazionali su tematiche di reciproco interesse;

d) attività di collaborazione alla didattica e di co-tutoraggio per lo svolgimento di tesi di laurea magistrale e di dottorato di ricerca.

**Descrizione estesa ITA:** La risorsa idrica è il nesso intorno alla quale ruotano una serie di comparti produttivi: industria, agricoltura, energia, etc. Lo studio sistematico per la valutazione qualitativa e quantitativa di tale risorsa non può prescindere dall'applicazione di metodologie di tipo spazio-temporale. Le metodologie spaziali ci forniscono un'istantanea della situazione della risorsa idrica mentre le metodologie temporali sono utili a verificare i trend quantitativi e qualitativi della risorsa considerata. E' attualmente in atto un'esplosione di tali metodologie e ne vengono sviluppate di sempre più potenti con altissima efficienza in termini di accuratezza e precisione. Obiettivo di questa convenzione è di sperimentare tali nuove metodologie e definire buone pratiche di applicazione in base alle quali scegliere, in base ai dati disponibili, il metodo di previsione più adatto.

**Fonte di finanziamento ITA:** Convenzione non onerosa

**Responsabili designati:** Emanuele Barca e Anna Maria Stellacci

**Referente IRSA:** Emanuele Barca

**Periodo di attività:** 29/1/2018 - 29/12/2022

**Titolo: Indagini integrative di caratterizzazione finalizzata alla comprensione degli aspetti ambientali e sanitari significativi e valutazione del rischio per le aree agricole" del sito denominato "Area Vasta del territorio comunale esterna al SIN di Taranto".**

**Acronimo:** Statte

**Abstract ITA:** Il progetto si riferisce alla collaborazione tra Regione Puglia Sezione Ciclo Rifiuti e Bonifiche, Comune di Statte e C.N.R. -I.R.S.A. per la realizzazione di indagini integrative di caratterizzazione finalizzata alla comprensione degli aspetti ambientali e sanitari significativi e valutazione del rischio per le aree agricole" del sito denominato "Area Vasta del territorio comunale esterna al SIN di Taranto". In particolare saranno svolte le seguenti attività: - analisi di dettaglio delle specie agricole/colturali presenti nell'aree agricole di interesse; - definizione di un Modello Concettuale Preliminare "Ambientale" dove il bersaglio ambientale è identificabile con le aree

agricole; più in particolare i bersagli ambientali sono i prodotti delle attività agricole e le sorgenti di contaminazione sono i suoli, le acque irrigue e l'aria interessati dalla presenza di sostanze contaminanti, le vie di trasporto sono gli organi vegetali ipogei ed epigei. - elaborare la Valutazione del rischio in aree agricole, con definizione dei modelli concettuali definitivi, dei contaminanti di interesse relativi alla vocazione colturale delle aree in studio, dei valori limite nel suolo/acque per scongiurare l'ingresso di inquinanti nella catena alimentare.

**Fonte di finanziamento ITA:** Regione Puglia

**Coordinatore:** Vito Felice Uricchio, Valeria Ancona

**Referente IRSA:** Vito Felice Uricchio - Valeria Ancona

**Periodo di attivita:** 18/09/2019-28/03/2022

**Titolo: Attuazione Direttiva 91/676/CEE relativa alla protezione delle acque dall'inquinamento provocato dai nitrati provenienti da fonti agricole - art. 92 del D. Lgs. 152/2006 - Revisione delle Zone Vulnerabili da Nitrati di origine agricola e aggiornamento del Programma d'Azione Nitrati**

**Acronimo:** Nitrati 2019-2021

**Abstract ITA:** Attività di supporto scientifico in un rapporto costante di collaborazione fra le parti, nel quale le attività di approfondimento legate alla protezione delle acque dall'inquinamento provocato dai nitrati provenienti da fonti agricole della Regione Puglia e del CNR-IRSA possano integrarsi e coordinarsi reciprocamente, con particolare riferimento all'attuazione della Direttiva Nitrati ed alle attività funzionali all'aggiornamento e revisione della designazione delle zone vulnerabili e dei programmi d'azione al fine di proteggere le acque dall'inquinamento provocato dai nitrati di origine agricola, comprendenti anche analisi biomolecolare per la qualificazione delle potenziali fonti di contaminazione.

**Fonte di finanziamento ITA:** Regione Puglia

**Coordinatore:** Vito Felice Uricchio

**Referente IRSA:** Vito Felice Uricchio, Carmine Massarelli

**Periodo di attivita:** 11/02/2019-21/12/2021

### Titolo: Strumenti di Studio, documentazione e ricerca a supporto delle politiche regionali verso i "Sustainable Development Goals" e test-focus sulla sostenibilità del geoscambio termico"

**Acronimo:** Consiglio Regionale Puglia

**Abstract ITA:** Lo Studio si pone i seguenti obiettivi: 1) costruire un luogo virtuale strutturato di collaborazione tra Istituzione con funzione legislativa e i due Istituti del CNR (estesa alle partnership di cui i due Istituti proponenti fanno parte ed estensibile nel tempo ad altri Soggetti), che consenta una raccolta e trasferimento di dati e best practices a livello locale, regionale, nazionale ed europeo, che siano funzionali ai progressi relativi alla implementazione, su lungo termine, degli OSS e che consenta altresì di esporli al decisore ed ai livelli istituzionali locali, nazionali ed internazionali; 2) realizzare una iniziativa conoscitiva di testing su un tema coerente con gli SDGs, fondamentale per lo sviluppo territoriale della Regione, strettamente connesso ad aspetti legislativi ed alla conoscenza esperta del territorio regionale e già oggetto di studi approfonditi da parte dei due Istituti.

**Fonte di finanziamento ITA:** Regione Puglia

**Website:** http://150.145.95.96/CC-RegionePuglia/

**Coordinatore:** Vito Felice Uricchio

**Referente IRSA:** Vito Felice Uricchio, Carmine Massarelli

**Periodo di attivita:** 26/10/2018-26.10.2022

### Titolo: Microplastics in aquatic animals

**Abstract ITA:** EU JRC (Joint Research Center) Tender per la messa a punto di metodi di rilevazione e quantificazione delle microplastiche accumulate in matrici biologiche.

**Abstract ENG:** EU JRC (Joint Research Center) Tender for the validation of methods to assess and quantify the accumulation of microplastics on aquatic animals.

**Fonte di finanziamento ITA:** EU JRC (Joint Research Center)

**Fonte di finanziamento ENG:** EU JRC (Joint Research Center)

**Coordinatore:** Andrea Valsesia

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 2019 - 2021

### Titolo: Rete di monitoraggio degli impatti dell'inquinamento atmosferico sugli ecosistemi

**Acronimo:** NEC Italia

**Abstract ITA:** L'Accordo di collaborazione tra MATTM e CUFA disciplina lo svolgimento di attività volte ad assicurare l'integrazione della dotazione strumentale e l'attività iniziale di gestione della Rete di monitoraggio degli impatti dell'inquinamento atmosferico sugli ecosistemi, denominata "Rete NEC Italia", istituita con il decreto del Ministro dell'Ambiente 26 novembre 2018, n. 319. Il CUFA svolge le attività di coordinamento e gestione della Rete NEC Italia, definendo appositi accordi con i soggetti titolari, finalizzati alla realizzazione di attività di monitoraggio degli effetti dell'inquinamento atmosferico sugli ecosistemi, in particolare: IRSA – CNR per le attività di monitoraggio delle deposizioni bulk e stemflow e degli ecosistemi d'acqua dolce, IRET – CNR per le attività di monitoraggio dei nutrienti fogliari e dei danni da ozono.

**Abstract ENG:** The agreement is aimed to coordinate the activities for the development of the national network for the monitoring of the impacts of air pollution on ecosystems (Nec Italy).

**Fonte di finanziamento ITA:** MATTM

**Altre informazioni ITA:** Partner: CNR IRET  Importo finanziamanto per unità operativa: 220.510

**Coordinatore:** Michela Rogora

**Referente IRSA:** Michela Rogora

**Periodo di attivita:** 2019-

### Titolo: Valutazione della qualità dei sedimenti marini  dell'area marino-costiera della regione Lazio (2019)

**Acronimo:** UNITOV

**Abstract ITA:** L'accordo di convenzione tra l'Università degli Studi Roma "Tor Vergata" e il CNR-IRSA di Taranto, si basa sulla valutazione della qualità dei sedimenti rimossi da porti, porti canali e foci di fiumi, per il loro eventuale riutilizzo nel cosidetto "Ripascimento morbido".  Affinchè i sedimenti rimossi possano essere fruibili è necessaria una caratterizzazione ecotossicologica. Al fine di ottenere conclusioni ecologicamente rilevanti sulla tossicità dei sedimenti, sono stati esaminati complessivamente 54 campioni di sedimenti, prelevati lungo la costa laziale (da febbraio a settembre 2019). E' stato applicato un approccio multi-organismi e multi-endpoint utilizzando una batteria di biotest con organismi marini appartenenti a diversi livelli trofici, e caratterizzati da elevata rappresentatività e diffusione nell'area del Mediterraneo. Per ogni campione sono stati

effettuati tre diversi biotest: test di mortalità acuta con anfipodi crostacei Corophium insidiosum, test di tossicità cronica con microalga Dunaliella tertiolecta e test di tossicità embrionale eseguito con larve di Mytilus galloprovincialis. Inoltre, per ogni biotest è stato previsto un controllo negativo con un sedimento di riferimento pulito proveniente da una zona lontana da fonti di inquinamento antropogeniche, che permette di stabilire che la mortalità, o altri effetti rilevati, sono proprio dovuti al contenuto del campione analizzato e non ad altri fattori (come i test sulla salute dell'organismo). Inoltre, è stato eseguito un controllo positivo, ovvero un test eseguito esponendo individui della specie bersaglio a soluzioni di sostanze tossiche note, per garantire che gli organismi rispondano adeguatamente e ottenere sempre lo stesso risultato. Per ciascuna di queste sostanze è stata determinata la concentrazione che causa la morte del 50% degli organismi (LC50), o che provoca un effetto rilevabile sul 50% degli organismi (EC50). I campioni ambientali e le soluzioni delle sostanze tossiche di riferimento sono stati testati effettuando tre prove in parallelo. I dati sono stati integrati ed elaborati utilizzando il software Sediqualsoft 109.0® messo a disposizione da ISPRA per l'applicazione del DM 173/2016. I risultati ottenuti hanno permesso di esprimere un giudizio di qualità per ogni campione testato.

**Abstract ENG:** The agreement between the University Roma "Tor Vergata" and the CNR-IRSA of Taranto, is based on evaluation of marine sediment quality for their possible re-use, in the so-called “soft nourishment”. For this purpose, a total of 54 sediment samples were taken along the Lazio coast, from February to September 2019) for the ecotoxicological evaluation. In order to obtain ecologically relevant conclusions on sediments toxicity, a multi-organisms and multi-endpoint approach was applied using a battery of bioassays with marine organisms belonging to different trophic levels, and characterized by high representativeness and spread in the Mediterranean area. Three different bioassays were carried out for each sample: acute mortality test with a crustacean amphipods Corophium insidiosum, chronic toxicity test with a microalga Dunaliella tertiolecta and an embryo-toxicity test performed with Mytilus galloprovincialis larvae. Moreover, for each bioassay has been provided a negative control with a clean reference sediment coming from an area far from anthropogenic sources of pollution, which makes it possible to determine that the mortality, or other effects detected, are really due to the content of the sample analysed and not to other factors (such as organism health testing). Moreover, has been performed a positive control, i.e. a test performed by exposing individuals of the target species to solutions of known toxic substances, to ensure that the organisms respond adequately and always obtain the same result. For each of these substances the concentration which causes the death of 50% of the organisms (LC50), or which causes a detectable effect on 50% of the organisms (EC50) was determined. The environmental samples and the solutions of the reference toxic substances were tested by conducting three tests in parallel. The data was integrated and processed using the Sediqualsoft 109.0® software made available by ISPRA for the application of Ministerial Decree 173/2016. The results obtained made it possible to express a quality judgment for each sample tested.

**Fonte di finanziamento ITA:** Università degli Studi Roma "Tor Vergata

**Coordinatore:** Luciana Migliore Università di Torvergata

**Referente IRSA:** Ermelinda PRATO- Responsabile Scientifico

**Periodo di attivita:** 16/01/2019 al 28/02/2019

**Titolo: Analisi Ecotossicologiche - Valutazione della qualità dei sedimenti marini con una batteria di saggi ecotossicologici (2020)**

**Acronimo:** UNITOV

**Abstract ITA:** L'accordo di convenzione tra l'Università degli Studi Roma "Tor Vergata" e il CNR-IRSA di Taranto, si basa sulla valutazione della qualità dei sedimenti rimossi da porti, porti canali e foci di fiumi, per il loro eventuale riutilizzo nel cosidetto "Ripascimento morbido". Affinchè i sedimenti rimossi possano essere fruibili è necessaria una caratterizzazione ecotossicologica. Al fine di ottenere conclusioni ecologicamente rilevanti sulla tossicità dei sedimenti, sono stati esaminati complessivamente 14 campioni di sedimenti, prelevati lungo la costa laziale (da settembre a ottobre 2020). E' stato applicato un approccio multi-organismi e multi-endpoint utilizzando una batteria di biotest con organismi marini appartenenti a diversi livelli trofici, e caratterizzati da elevata rappresentatività e diffusione nell'area del Mediterraneo. Per ogni campione sono stati effettuati tre diversi biotest: test di mortalità acuta con anfipodi crostacei Corophium insidiosum, test di tossicità cronica con microalga Dunaliella tertiolecta e test di tossicità embrionale eseguito con larve di Mytilus galloprovincialis. Inoltre, per ogni biotest è stato previsto un controllo negativo con un sedimento di riferimento pulito proveniente da una zona lontana da fonti di inquinamento antropogeniche, che permette di stabilire che la mortalità, o altri effetti rilevati, sono proprio dovuti al contenuto del campione analizzato e non ad altri fattori (come i test sulla salute dell'organismo). Inoltre, è stato eseguito un controllo positivo, ovvero un test eseguito esponendo individui della specie bersaglio a soluzioni di sostanze tossiche note, per garantire che gli organismi rispondano adeguatamente e ottenere sempre lo stesso risultato. Per ciascuna di queste sostanze è stata determinata la concentrazione che causa la morte del 50% degli organismi (LC50), o che provoca un effetto rilevabile sul 50% degli organismi (EC50). I campioni ambientali e le soluzioni delle sostanze tossiche di riferimento sono stati testati effettuando tre prove in parallelo. I dati sono stati integrati ed elaborati utilizzando il software Sediqualsoft 109.0® messo a disposizione da ISPRA per l'applicazione del DM 173/2016. I risultati ottenuti hanno permesso di esprimere un giudizio di qualità per ogni campione testato

**Abstract ENG:** The agreement between the University Roma "Tor Vergata" and the CNR-IRSA of Taranto, is based on evaluation of marine sediment quality for their possible re-use, in the so-called "soft nourishment". For this purpose, a total of 14 sediment samples were taken along the Lazio coast, from September to October 2020) for the ecotoxicological evaluation. In order to obtain ecologically relevant conclusions on sediments toxicity, a multi-organisms and multi-endpoint approach was applied using a battery of bioassays with marine organisms belonging to different trophic levels, and characterized by high representativeness and spread in the Mediterranean area. Three different bioassays were carried out for each sample: acute mortality test with a crustacean amphipods Corophium insidiosum, chronic toxicity test with a microalga Dunaliella tertiolecta and an embryo-toxicity test performed with Mytilus galloprovincialis larvae. Moreover, for each bioassay has been provided a negative control with a clean reference sediment coming from an area

far from anthropogenic sources of pollution, which makes it possible to determine that the mortality, or other effects detected, are really due to the content of the sample analysed and not to other factors (such as organism health testing). Moreover, has been performed a positive control, i.e. a test performed by exposing individuals of the target species to solutions of known toxic substances, to ensure that the organisms respond adequately and always obtain the same result. For each of these substances the concentration which causes the death of 50% of the organisms (LC50), or which causes a detectable effect on 50% of the organisms (EC50) was determined. The environmental samples and the solutions of the reference toxic substances were tested by conducting three tests in parallel. The data was integrated and processed using the Sediqualsoft 109.0® software made available by ISPRA for the application of Ministerial Decree 173/2016. The results obtained made it possible to express a quality judgment for each sample tested.

**Fonte di finanziamento ITA:** Università degli Studi Roma "Tor Vergata

**Coordinatore:** Luciana MIGLIORE

**Referente IRSA:** ermelinda PRATO- Responsabile Scientifico

**Periodo di attivita:** 08/09/2020 al 30/11/2020

### Titolo: Indagini per una caratterizzazione dei terreni dell'area del Parco Archeologico di Centocelle

**Acronimo:** Centocelle

**Abstract ITA:** L'Istituto di Ricerca sulle Acque è stato coinvolto dalla Direzione Rifiuti, Risanamenti e Inquinamenti di Roma Capitale per una indagine finalizzata ad una caratterizzazione di dettaglio del Parco Archeologico di Centocelle e comprende attività conoscitive nell'ambito dell'idrogeologia, della geochimica e della chimica ambientale.

**Fonte di finanziamento ITA:** Comune di Roma Capitale

**Website:** http://parcocentocelle.irsa.cnr.it/

**Coordinatore:** Stefano Ghergo

**Referente IRSA:** Stefano Ghergo

**Periodo di attivita:** 01/12/2018-02/12/2019

**Titolo: ACCORDO ORGANIZZATIVO per la esecuzione, da parte del CNR-IRSA ed in collaborazione con ARPA Puglia, delle indagini indirette presso la discarica in località Burgesi, nel Comune di Ugento, e successiva interpretazione dei dati tra AGENZIA REGIONALE PER LA PREVENZIONE E LA PROTEZIONE DELL'AMBIENTE e CONSIGLIO NAZIONALE DELLE RICERCHE - ISTITUTO DI RICERCA SULLE ACQUE – UOS di Bari**

**Acronimo:** BURGESI

**Abstract ITA:** Oggetto dell'Accordo fra ARPA e CNR IRSA riguarda un'indagine geofisica di tipo elettrico ed elettromagnetico ad elevata risoluzione sul corpo della discarica "Monteco srl" , al fine di: 1. caratterizzare da un punto di vista geofisico il corpo rifiuti ed individuare l'eventuale presenza di contaminazione organica; 2. stimare l'estensione di tale contaminazione organica, se presente; 3. verificare l'integrità della geomembrana posta sul fondo della discarica.

**Abstract ENG:** The Agreement between ARPA and CNR IRSA deals with high-resolution electrical and electromagnetic geophysical investigation of a dismissed landfill close to the town of Ugento. The aim of the geophysical tests is to: 1. characterize the waste body from a geophysical point of view and identify the potential presence of organic contamination; 2. estimate the extent of such organic contamination; 3. evaluate the integrity of the HDPE liner placed at the bottom of the landfill.

**Fonte di finanziamento ITA:** ARPA Puglia

**Altre informazioni ITA:** ARPA, IRSA CNR, importo del finanziamento € 84.917,00

**Coordinatore:** Lorenzo De Carlo, CNR IRSA

**Referente IRSA:** Lorenzo De Carlo

**Periodo di attivita:** 13/03/2019 - 30/05/2020

**Titolo: Movement ecology of Purple herons Ardea purpurea**

**Acronimo:** Purpurea

**Abstract ENG:** Purpurea project aims to investigate the movement ecology of purple herons Ardea purpurea during the whole life cycle. The purple heron is a threatened species, that establish colonies in the well-conserved wetlands through over Europe and overwinters in sub-Saharan Africa. By the means of miniaturized GPS/GSM devices installed on purple herons breeding in different wetlands of Europe, the project aims to explore behavioural parameters (feeding ecology, timing and performance of migration) and relation with land use elements (habitat selection, home range size, pre-migratory movements). Our results will shed light on the ecology of a poorly studied group of species and will produce suggestions for more effective targeted conservation actions.

**Fonte di finanziamento ENG:** - Donations from Vogelwarte-Sempach (CH) (30 GPS/GSM device) - Funding by University of Milan

**Altre informazioni ENG:** Involved partners: -Vogelwarte-Sempach (CH) https://www.vogelwarte.ch/en/projects/ecological-research/, Dott. Martin U. Gruebler : donation of ~30 GPS/GSM devices. Commercial values: ~45.000 euros - University of Milan (IT) Prof. Diego Rubolini

**Coordinatore:** Michelangelo Morganti

**Referente IRSA:** MIchelangelo Morganti

**Periodo di attivita:** 01/01/2020 31/12/2024

### Titolo: Predisposizione di linee guida per l'implementazione di nuove azioni e misure in CIFM in area planiziale

**Abstract ITA:** L'attività prevede l'aggiornamento delle attuali linee guida in uso per i corsi d'acqua di pianura nella Regione Veneto. L'attività sarà espletata traducendo in elementi di possibile implementazione diretta di azione gli elementi essenziali e le principali caratteristiche di habitat già identificati e descritti durante la collaborazione in ambito BSL4. Ciò consentirà di selezionare/suggerire misure e tipi di intervento integrativi o in gran parte innovativi rispetto a quanto in uso. Per l'elaborazione delle linee guida è necessario il contributo del CNR-IRSA a supporto di ARPAV nell'interlocuzione con la Regione del Veneto, al fine di proporre un'efficace traduzione delle conoscenze acquisite nelle misure di governo regionali.

**Fonte di finanziamento ITA:** Fondi ARPAV/Regione del Veneto, risorse finanziarie per Attività di monitoraggio ambientale nel Bacino Scolante e nella Laguna di Venezia Progetto BSL5"

**Coordinatore:** Andrea Stefano Buffagni

**Referente IRSA:** Andrea Stefano Buffagni

**Periodo di attivita:** 08/07/2019 - 31/06/2021

### Titolo: "iDEntificazione MEtagenomica delle fonTi di contaminazione da nitRAti e Sistemi di Supporto Decisionale (DSS) per una gestione agronomica sostenibile"

**Acronimo:** DEMETRA DSS

**Abstract ITA:** Con la Direttiva 91/676/CE, la UE ha introdotto l'obbligo di proteggere le acque dai nitrati di origine agricola. La Regione Puglia ha approvato il proprio 'Piano Azione Nitrati' (PAN) con D.G.R. n. 1788 del 2013, delimitando apposite Zone Vulnerabili da Nitrati (ZVN) e stabilendo vincoli alla gestione agronomica e adempimenti amministrativi a carico delle aziende agricole. La designazione delle ZVN, basata su studi territoriali e simulazioni modellistiche, richiede tuttavia appositi riscontri attraverso attività di monitoraggio per identificare le reali fonti di contaminazione da nitrati (scarichi urbani, effluenti zootecnici o fertilizzanti) e per una più efficace perimetrazione delle ZVN. Inoltre, un ulteriore problema è legato all'assenza di specifici servizi e strumenti informatici per la raccolta ed interpretazione dei dati, che possano supportare le aziende ad attuare una gestione coerente con il PAN, sia le istituzioni per gestire le attività di controllo e tracciare i processi. Partendo da questi fabbisogni, nell'ambito della propedeutica Misura 16.1 ('DEMETRA'), i partner SYSMAN e CNR-IRSA hanno promosso la costituzione di un GO, coinvolgendo aziende agricole (Sempreverde), cooperative (APOFRUIT, Cantine di Lizzano e Torricella) e organizzazioni di categoria (Confcooperative Puglia), in rappresentanza dei principali settori produttivi regionali. L'obiettivo della proposta progettuale è, da un lato, di impiegare metodi biomolecolari (meta-genomica) per l'identificazione delle fonti di contaminazione da nitrati nei principali areali delle ZVN (e zone di monitoraggio); dall'altro, di introdurre soluzioni digitali per gestire l'ampia mole di dati raccolti (dalle informazioni di campo ai risultati di laboratorio) all'interno di un unico Sistema di Supporto alle Decisioni (DSS), fruibile dalle aziende agricole e dalle istituzioni competenti. In tal modo, e coerentemente con il PAN, il progetto intende: 1) supportare le istituzioni competenti nelle attività di monitoraggio territoriale e di gestione delle fonti di contaminazione, e le aziende agricole nell'adeguamento ai vincoli imposti dalla normativa nelle ZVN; 2) introdurre innovazioni tecniche e tecnologiche in grado di migliorare la gestione aziendale dell'acqua e dell'azoto; 3) promuovere un tavolo tecnico tra i diversi stakeholders e le istituzioni competenti per la gestione della problematica in esame; 4) supportare il 'Piano di Comunicazione Nitrati' del PAN con specifiche iniziative di informazione e formazione tecnica. Le principali attività previste sono le seguenti: 1) Identificazione di aree di studio a livello regionale, con particolare riferimento alle ZVN e alle aree di monitoraggio, per la selezione di aziende 'pilota' per la realizzazione di un'ampia attività di campionamento delle acque ed analisi con metodi biomolecolari, per l'identificazione delle cause delle fonti di contaminazione da nitrati; 2) sviluppo di una piattaforma (DSS) di scala comprensoriale per la gestione di una geo-banca-dati inter-operativa basata sui dati immessi dalle aziende e dalle indagini biomolecolari su scala regionale; 3) implementazione di un DSS per le aziende agricole per l'adeguamento alle richieste del PAN in termini agronomici e documentali; 4) sperimentazione di tecnologie 'di precisione' (modelli, sensori) e di tecniche agronomiche (cover crops, fertilizzanti speciali) per l'ottimizzazione dell'uso dell'acqua e dei fertilizzanti azotati. Il GO si propone infine di realizzare attività di divulgazione coerenti con il 'Piano di comunicazione' previsto dal PAN regionale, per la sensibilizzazione sulle tematiche ambientali specifiche e la formazione sui contenuti tecnici e normativi. Il progetto prevede di impiegare differenti metodologie di divulgazione (open days, workshop, pubblicazioni, ecc.) e vari livelli di disseminazione (locale, regionale, RRN ed EIP-AGRI), con una particolare attenzione all'uso della comunicazione digitale e dei social media.

**Descrizione estesa ITA:** La presente progettualità scaturisce dalla necessità di valutare il contributo delle differenti fonti di contaminazione al fine di attribuire la presenza di nitrati nei corpi idrici sotterranei distinguendo gli apporti derivanti da scarichi urbani leciti ed illeciti, da effluenti

zootecnici e dall'utilizzo di fertilizzanti minerali, etc. Tale necessità di approfondimento deriva dagli esiti delle recenti attività di controllo svolte della Comunità Europea in relazione alle designazioni delle Zone Vulnerabili da Nitrati da impatto agricolo realizzate dalla Regione Puglia in ottemperanza alla Direttiva 91/676/CEE e s.m.i. Il percorso per la designazione delle nuove ZVN si è basato su un'approfondita analisi territoriale e sull'elaborazione dei dati derivanti dalle determinazioni analitiche sulle acque superficiali e sotterranee disponibili, considerando i parametri di riferimento acquisiti sulla base della normativa vigente ed attraverso valutazioni modellistiche finalizzate alla stima dei carichi di azoto provenienti da colture agricole prevalenti sul territorio, coltivazioni e fertilizzazioni in uso, specie animali allevate ed intensità degli allevamenti etc. Diviene di primaria importanza ottenere puntuali riscontri e conferme attraverso attività territoriali che identifichino i reali contributi delle fonti di contaminazione e le fonti stesse per attribuirne i giusti impatti per una più efficace perimetrazione. Ulteriore deficit è l'assenza di una piattaforma di servizi informatizzata per la raccolta ed elaborazione dei dati e che sia di supporto sia al mondo agricolo che alle istituzione per la gestione, la prevenzione e l'individuazione delle misure e azioni per l'ottimizzazione delle attività agricole. La presente progettualità intende affrontare le problematiche inerenti la valutazione delle fonti di contaminazione da nitrati creando un supporto per l'identificazione delle cause di contaminazione e per l'identificazione delle aree soggette alla pressione delle attività agricole, supportando il mondo agricolo attraverso la creazione di una piattaforma di servizio che faciliti l'adempimento degli obblighi di legge e l' intercomunicazione tra aziende del territorio e istituzioni territoriali. L'identificazione delle fonti di contaminazione da nitrati si effettuerebbe con la metagenomica,l a determinazione delle specie batteriche presenti e la loro quantificazione con l'analisi biomolecolari. Le tecniche molecolari basate sulla individuazione di specifiche sequenze del genoma microbico, tecnica di ultima generazione, si rivela più sensibile e più specifica dei metodi tradizionali. La genetica consente di identificare attraverso studi molecolare e analisi filogenetiche i contaminanti presenti, quantificarli e identificarne la provenienza con l'utilizzo del microrganismo come tracciante non invasivo per risalire alla fonte di contaminazione . Indispensabile è la creazione di una piattaforma territoriale in cui confluiscano dati aziendali e crei un supporto per la redazione delle procedure amministrative e per la tracciabilità dei composti di riutilizzo agricolo (letami/liquami). Tale piattaforma si baserà sul software Bluleaf® sviluppato dalla Sysman Progetti & Servizi s.r.l. dedicato all'agricoltura di precisione. Sarà fornito uno strumento ad hoc per ottemperare alle normative attraverso il rilascio della documentazione prevista creando interazioni dirette con le istituzioni territoriali. Lo scopo principale è l'individuazione e la gestione delle potenziali fonti di contaminazione distinguendo l'origine del nitrato da fertilizzanti minerali, effluenti zootecnici, reflui urbani, fanghi di depurazione, etc.. attraverso un'analisi integrata e spazializzata. Di conseguenza i principali risultati attesi sono: identificazione delle cause della contaminazione da nitrati distinguendo la fonte agricola, zootecnica o civile; stima dell'incidenza delle differenti tipologie di apporti; individuazione di fonti di contaminazione inattese o misconosciute; il perseguimento del trasferimento tecnologico in campo attraverso lo sviluppo di soluzioni semplici ed efficaci in grado di integrarsi con i processi di produzione aziendali la creazione di un sistema informatico a scala aziendale per la raccolta dei dati utili alla redazione delle documentazioni amministrative la creazione di una piattaforma a disposizione delle aziende per la gestione e la tracciatura dei traffici di effluenti a livello regionale la raccolta dei dati dal campo utili, a livello centrale per il monitoraggio delle sorgenti di contaminazione e dei traffici di effluenti. Il raggiungimento dei suddetti risultati darà la possibilità di attivare azioni di mitigazione orientate e scientificamente basate per poter agire con maggiore

incisività attraverso attività di prevenzione, controllo ed assistenza al mondo agricolo sui territori interessati da inquinamento da nitrati, orientando le possibili misure d'intervento e le metodologie per il risanamento del territorio e stimolando la continua collaborazione tra i settori della ricerca del mondo industriale e dell'agricoltura attraverso un continuo e costante coinvolgimento attivo.

**Fonte di finanziamento ITA:** Regione Puglia

**Coordinatore:** Erminio Efisio Riezzo, SYSMAN PROGETTI & SERVIZI SRL

**Referente IRSA:** Calabrese Angelantonio

**Periodo di attivita:** 16/07/2020-15/07/2022

### Titolo: Sperimentazione Abbattimento Odori per Diffusione in Vasca di Ossidazione Biologica presso il depuratore di Turi

**Acronimo:** TOASD

**Abstract ITA:** Il problema della emissione di sgradevoli odori, da parte degli impianti di depurazione dei reflui urbani, ha acquisito notevole importanza e attualità negli anni, a causa del sempre più significativo inserimento ambientale dei presidi nel contesto urbanistico e territoriale in genere, rappresentando il primario fattore di impatto ambientale degli impianti stessi nella comune percezione sociale. Attualmente i protocolli di intervento possibili, e generalmente applicati, riguardano una o più delle opzioni di seguito elencate: a) miglioramenti gestionali del processo; b) modifiche strutturali finalizzate al miglioramento gestionale; c) interventi a monte dell'impianto sulle condizioni del refluo; d) interventi di deodorizzazione. Numerosi sono i processi di trattamento utilizzati, di tipo biologico, chimico e chimico-fisico; tutti, va sottolineato, determinanti un notevole aggravio gestionale degli impianti, contrario al principio della loro semplificazione ed economicità, specie se realizzati quali interventi di adeguamento e non programmati dall'origine. Maggiormente utilizzati risultano i trattamenti con filtri a carboni attivi (vedi impianto di Turi), Scrubbers chimici o biologici, biofiltri o, più raramente, sistemi di ossidazione termica. Presso IRSA CNR è stato studiato il sistema semplificato di trattamento odori definito AS Diffusion (Activate Sludge Diffusion), che prevede l'immissione diretta nelle vasche di trattamento aerobico a fanghi attivi, dei volumi di aria aspirati dalle sezioni confinate dell'impianto, sfruttando queste, in sostanza, quali bioscrubber ove la degradazione dei composti osmogeni viene svolta dalla biomassa attiva del fango biologico, senza particolari modifiche strutturali o gestionali delle sezioni aerobiche stesse. Sono state condotte esperienze sia in scala laboratorio che in scala pilota; quest'ultima nell'ambito dell'Accordo di Programma Quadro in Materia di "Ricerca Scientifica" nella Regione Puglia, progetto esplorativo "messa a punto del processo as diffusion per l'abbattimento degli odori emessi dagli impianti di depurazione urbani" cod. cip: pe_066. emerge come l'adozione in piena e vasta scala del sistema AS Diffusion comporterebbe il risparmio di un'intera sezione di trattamento odori dedicata, sia come costi di investimento che come costi e complicazioni di gestione. Il processo consentirebbe

un risparmio in termini di costi di investimento e di conduzione stimabile almeno intorno al 50% rispetto ad altre soluzioni di pari efficacia proposte sul mercato. Ciò perché, rispetto a tutte le altre soluzioni disponibili, il processo da studiare non necessita di una sezione di trattamento degli odori specificamente dedicato, ma utilizzerà la vasca di ossidazione già presente in tutti gli impianti; quest'ultima non necessiterebbe di specifica copertura in quanto, se efficacemente condotta per l'abbattimento degli odori più persistenti, non emette la stessa tipologia di composti osmogeni. I possibili evidenti vantaggi dell'adozione di questa tecnologia giustificano gli studi e ricerche proposte. La finalità della presente proposta di sperimentazione è il consolidamento in piena scala dell'efficienza ed efficacia dello schema di processo AS Diffusion, attraverso la ulteriore verifica dell'assenza, a lungo termine, di influenza negativa sul processo di trattamento delle acque, ma soprattutto la definizione delle infrastrutture tecniche e i corretti dimensionamenti necessari al suo funzionamento, perché sia proponibile come soluzione applicabile in larga scala sugli impianti di depurazione urbani.

**Fonte di finanziamento ITA:** Acquedotto Pugliese S.p.A.

**Coordinatore:** Nicola Didonna (ACQUEDOTTO PUGLIESE)

**Referente IRSA:** Blonda Massimo

**Periodo di attivita:** 07/07/2019-30/12/2021

### Titolo: Quality and management of intermittent river and groundwater in the Mediterranean basins.

**Acronimo:** INWAT

**Abstract ITA:** La convenzione con Università degli Studi di Bari A. Moro nell'ambito del Programma di Ricerca Internazionale "Programma PRIMA" ha le seguenti finalità: sviluppare metodi innovativi per il monitoraggio idrologico e delle pressioni antropiche con particolare riferimento agli inquinanti emergenti (farmaci, fitofarmaci) sui fiumi temporanei, sviluppare metodologie innovative per valutare la water security e sostenibilità dell'uso delle risorse idriche a scala di bacino idrografico;

**Abstract ENG:** The aims of the agreement between the University of Bari and IRSA-CNR within the INWAT project (Quality and management of intermittent river and groundwater in the Mediterranean basins. PRIMA Framework) are (1) to develop innovative methods and tools for hydrological and water quality monitoring of temporary waterways; (2) to develop innovative methods and tools for estimating water security and sustainability of water use at the basin scale and (3) to provide the widest possible diversity of management scenarios under water scarcity conditions.

**Fonte di finanziamento ITA:** Convenzione con Università degli Studi di Bari A. Moro nell'ambito del Programma di Ricerca Internazionale "Programma PRIMA" (MIUR)

**Coordinatore:** IDAEA, Spain (Sandra Perez)

**Referente IRSA:** De Girolamo Anna Maria

**Periodo di attivita:** 01/07/2019-30/06/2022

### Titolo: Studio delle fluttuazioni del livello del lago di Viverone

**Abstract ITA:** Valutazione delle fluttuazioni del Livello del Lago di Viverone negli ultimi 20 anni considerando anche eventuali apporti della falda

**Fonte di finanziamento ITA:** Comune di Viverone

**Coordinatore:** Marzia Ciampittiello

**Referente IRSA:** Marzia Ciampittiello

**Periodo di attivita:** dal 01/04/2019 al 31/12/2019

### Titolo: ASL VCO

**Acronimo:** ASL VCO

**Abstract ITA:** Monitoraggio dei livelli di inquinamento chimico nel Lago Maggiore 2018-2021.

**Abstract ENG:** Monitoring the pollution in fish of Lake Maggiroe

**Fonte di finanziamento ITA:** ASL del Verbano Cusio Ossola  30000 Euro.

**Coordinatore:** Pietro Volta CNR-IRSA

**Referente IRSA:** Pietro Volta CNR-IRSA

**Periodo di attivita:** 2018-2021

**Titolo: Servizio di indagine conoscitiva di caratterizzazione della fauna acquatica dei laghi presenti nelle zone speciali di conservazione IT1110021 “Laghi di Ivrea” e IT 1110034 “Laghi di Meugliano e Alice”**

**Acronimo:** CITTA' METROPOLITANA DI TORINO - 1

**Abstract ITA:** Valutazione dello stato della fauna acquatica dei laghi della provincia di Ivrea inseriti nelle are protette della Rete Natura 2000.

**Abstract ENG:** Assessment of the sttus of the fish fauna in lakes of the protected areas belonging to the NATURA 2000 network of the Torino province.

**Fonte di finanziamento ITA:** CITTA' METROPOLITANA DI TORINO

**Coordinatore:** Pietro Volta - CNR IRSA

**Referente IRSA:** Pietro Volta

**Periodo di attivita:** 2019-2020

**Titolo: Servizio di realizzazione di azioni di conservazione della comunita’ ittica del Parco Naturale del Lago di Candia/ Zona Speciale di Conservazione IT1110036 “Lago di Candia” nell’ambito del Progetto: “PSR 2014-2020 Op. 4.4.3.**

**Acronimo:** CITTA' METROPOLITANA DI TORINO - 2

**Abstract ITA:** Il progetto prevede a. una attività di controllo e contenimento delle specie ittiche aliene nel Lago di Candia (TO); b. il supporto tecnico scientifico alla messa a punto di una struttura ittiogenica finalizzata alla riproduzione del luccio italico (Esox cisalpinus).

**Abstract ENG:** The project aims to contribute to the control of invasive alien fish species in Lake Candia (TO) and b. to the scientific support for the set up of an hatchery for the artificial reproduction of the italian pike Esox cisalpinus.

**Fonte di finanziamento ITA:** CITTA' METROPOLITANA DI TORINO

**Coordinatore:** Pietro Volta

**Referente IRSA:** Pietro Volta

**Periodo di attivita:** 2020-2021

**Titolo: Accordo di collaborazione Art. 15, L. 241/90 tra Regione Lombardia e Consiglio Nazionale delle Ricerche - Istituto di Ricerca Sulle Acque (CNR-IRSA) per l'implementazione di attività inerenti alla gestione delle acque superficiali e degli invasi**

**Acronimo:** Regione Lombardia Invasi

**Abstract ITA:** Il CNR-IRSA da alcuni anni collabora con Regione Lombardia e ARPA Lombardia per la messa a punto di un protocollo analitico per la caratterizzazione chimica ed ecotossicologica dei sedimenti degli invasi ai fini della fluitazione (acronimo PrATo). Il PrATo comprende i criteri e protocolli per il campionamento e per l'analisi chimica ed ecotossicologica dei sedimenti dell'invaso e del corpo idrico recettore della fluitazione, da effettuare prima e dopo le operazioni di rilascio a valle di sedimenti. Inoltre, comprende i criteri per la valutazione del rischio secondo un approccio simile al TRIAD. La caratterizzazione permette, in ultima analisi, di dare indicazioni gestionali utili ad una corretta conduzione delle operazioni di rilascio: in particolare, consente di definire il rapporto di diluizione dei sedimenti in acqua da rispettare durante la fluitazione per garantire il non superamento delle soglie di tossicità. Il protocollo è stato testato su casi reali caratterizzati da basse pressioni antropiche. Questo progetto consentirà l'applicazione su casi carateerizzati da livelli significativi di impatto antropico, ai fini di una validazione del PrATo in tutti i suoi aspetti.

**Fonte di finanziamento ITA:** Regione Lombardia

**Coordinatore:** Elena Colombo, Dirigente Regione Lombardia

**Referente IRSA:** Laura Marziali

**Periodo di attivita:** 13/02/2018-oggi

**Titolo: Valutazione del rischio igienico sanitario legato allo scarico dei reflui su suolo**

**Acronimo:** SCA.RE.S.

**Abstract ITA:** Valutare il rischio igienico-sanitario legato allo sversamento dei reflui depurati sul suolo attraverso lo studio di: • acque reflue in entrata e immediatamente all'uscita da 2 impianti di depurazione, selezionati in aree critiche del Salento e- se possibile -localizzati su due differenti tipologie di suolo : calcareo e poroso; • reservoirs idrici sotterranei -pozzi spia- a valle idrogeologica del depuratore per valutare eventuali interferenze dei fattori ambientali sulla qualità dei reflui depurati che sversano sul suolo. Lo studio prevede: 1. analisi geologica e idrogeologica del territorio selezionato, per poter definire le interazioni tra suolo e reflui e determinare la circolazione e il flusso della falda profonda; 2. sulle acque in entrata e in uscita dal depuratore, indagini microbiologiche (Escherichia coli, secondo la tabella n.4 del D.Lgs 1S2/2006; Salmonella; Pseudomonas aeruginosa e HAV, HEV, Adenovirus, Norovirus, Rotavirus, Enterovirus) e chimiche (parametri di base, anioni, cationi, composti volatili, idrocarbuti totali, IPA, metalli, nitrobenzene, pesticidi); 3. screening degli inquinanti emergenti negli effluenti dei due impianti di depurazione

presi in considerazione; 4. gli inquinanti emergenti presenti in concentrazione pill elevata negli effluenti depurati saranno monitorati selettivamente nelle acque dei pozzi spia; S. sulle acque prelevate dai pozzi spia, indagini microbiologiche e chimiche indicate nel punto 2; 6. valutazione dei fattori ambientali (variazioni climatiche, attività antropiche, industriali e agricole) che possono influenzare le caratteristiche dello scarico dei reflui, le ripercussioni in falda e la qualità delle acque sotterranee .

**Descrizione estesa ITA:** FASE l (novembre-dicembre 2018) 1.1 Censimento degli impianti di depurazione da esaminare e cartografia georeferenziata dei dati 1.2 individuazione di 2 depuratori con sistemi di smaltimento del tipo a TRINCEE drenanti su suolo, di cui uno attestato su substrato calcareo e l'altro su substrato poroso, per poter definire le interferenze del refluo scaricato in presenza di litologia differente 1.3 identificazione delle zone di sversamento dei reflui sul suolo : trincee drenanti con pozzi spia, eventualmente inclusi nell'elenco dei pozzi monitorati dal Progetto M.I.N .O.RE 1.4 verifica della circuitazione dei pozzi spia a valle dell'impianto di depurazione attraverso l'utilizzo di "traccianti" (naturalmente innocui per l'uomo e senza l'interruzione dell'emungimento) e/o di sonde multiparametriche 1.5 rappresentazione grafica dei modelli idrogeologici ricostruiti FASE 2 (gennaio-febbraio-dicembre 2019) 2.1 campionamento delle acque in entrata/uscita dai 2 impianti di depurazione e dei pozzi spia 2.2 analisi chimico-fisiche e microbiologiche con frequenza quindicinale 2.3 screening degli inquinanti emergenti negli effluenti dei due depuratori selezionati FASE 3 (gennaio-luglio 2020) 3.1 campionamento delle acque in entrata/uscita dai 2 impianti di depurazione e dei pozzi spia 3.2 analisi chimico-fisiche e microbiologiche con frequenza quindicinale 3.3 screening degli inquinanti emergenti negli effluenti dei due depuratori selezionati FASE 4 (settembre-dicembre 2020) 5.1 allestimento di appositi database per inserimento dati 5.2 analisi e valutazione dei risultati idrogeologici, chimico-fisici e microbiologici 5.3 processing dei dati relativi alle analisi degli inquinanti emergenti nei pozzi spia. 5.4 allestimento cartografie appropriate della circuitazione della zona di sversamento dei reflui 5.5 analisi dei fattori ambientali (caratteristiche del suolo, variazioni cl imatiche, attività antropiche) tramite statistica inferenziale (tabelle di contingenza, analisi di correlazione, analisi di regressione, etc.) e geostatistica (per es. analisi hot spot, kriging, co-kriging, idw, etc.)

**Fonte di finanziamento ITA:** Regione Puglia

**Altre informazioni ITA:** partner del progetto: Università degli Studi di Bari Aldo Moro, Dipartimento di Scienze Biomediche e Oncologia Umana (DIMO) CNR-IRSA importo del finanziamento al CNR-IRSA: € 38.000,00

**Coordinatore:** Prof. Maria Teresa Montagna, Dipartimento di Scienze Biomediche e Oncologia Umana (OlMO), Università degli Studi di Bari Aldo Moro

**Referente IRSA:** Giuseppe Mascolo

**Periodo di attivita:** 02/11/2018 - 31/12/2020

**Titolo: Programma di Monitoraggio qualitativo dei corpi idrici superficiali della Regione Puglia per il triennio 2019-2021**

**Acronimo:** ARPA Diossine e PBDE

**Abstract ITA:** La convenzione stipulata il 07/10/2020 tra ARPA Puglia e l'Istituto di Ricerche Sulle Acque del Consiglio Nazionale delle Ricerche (IRSA-CNR) è relativa ad una collaborazione per la determinazione della presenza di alcuni inquinanti, tra cui i difenileteribromati (PBDE), le policlorodibenzo-diossine (PCDD), i policlorodibenzo-furani (PCDF) ed i policlorobifenili diossina simili (PCB-DL) in matrici ambientali di sedimenti e di PBDE, acido perfluorottansolfonico e suoi sali (PFOS) e di esabromociclododecano (HBCDD) in matrici ambientali acquose al fine di dare attuazione al Programma di Monitoraggio qualitativo dei corpi idrici superficiali della Regione Puglia per il triennio 2019-2021" approvato con DGR n.1429 del 30 luglio 2019. Sulla base di attività di ricerca condotte in precedenza e di quanto sviluppato nella convenzione recentemente conclusa con ARPA Puglia, l'IRSA-CNR dispone di idonee metodiche analitiche per l'esecuzione delle determinazioni analitiche che vengono utilizzate dell'ambito della convenzione. Tali procedure analitiche sono state sviluppate partendo da metodiche analitiche consolidate a livello internazionale o da pubblicazioni scientifiche internazionali. La finalità di tali metodiche analitiche è di poter determinare i vari inquinanti organici sopra citati in varie matrici ambientali come di seguito riportato: - PBDE in campioni di acque CIS (Corpi Idrici Superficiali) con limite di rilevabilità (LOD) di 0,0002 µg/L per ciascun congenere (sommatoria congeneri 28, 47, 99, 100, 153 e 154). È opportuno sottolineare che anche se il LOD richiesto (così come modificato dal D.Lgs. 172/2015 - All. 1 alla Parte III - Tab. 1/A) è meno restrittivo di quanto utilizzato nella precedente convenzione si continuerà ad utilizzare la migliore metodica analitica disponibile con l'LOD sopra riportato. - Acido perfluoroctansolfonico e suoi Sali (PFOS) con LOD 1,3 10-4 µg/L. Per questa categoria di inquinanti organici verranno determinati sia gli analiti della famiglia degli acidi polifluoroalchilici (acido polifluoropentanoico (PFPeA), acido polifluoroesanoico (PFHxA), acido polifluoroeptanoico (PFHpA), acido polifluorooctanoico (PFOA) che gli analiti della famiglia degli acidi polifluorosolfonici (acido perfluorobutilsulfonico (L-PFBS), acido perfluoroesilsulfonico (L-PFHxS), acido perfluoroeptilsulfonico (L-PFHpS), acido perfluoroottilsulfonico (L-PFOS). - Esabromociclododecano (HBCDD) con LOD 0,0008 µg/L. - PCDD/PCDF e PCB in campioni di terreno/top soil con limite di rilevabilità di 0,00001 mg/kg come tossicità equivalente totale. - PCDD/PCDF, PCB e PBDE in campioni di sedimenti CIS con limite di rilevabilità di 2x10-3 µg/Kg s.s. per PCB e PCDD/F (sommatoria T.E. PCDD, PCDF (Diossine e Furani) e PCB diossina simili) e 0,01 µg/Kg s.s. per PBDE. Pertanto, le metodiche analitiche sviluppate hanno tenuto conto dei limiti di rilevabilità sopra riportati e hanno consentito una maggiore flessibilità ed operatività rispetto alle metodiche analitiche convenzionali. La finalità del presente documento è di riportare le metodiche analitiche già sviluppate che saranno utilizzate nella presente convenzione che potranno anche essere trasferite presso l'ARPA Puglia.

**Fonte di finanziamento ITA:** ARPA Puglia

**Altre informazioni ITA:** importo del finanziamento: € 244.440,00

**Coordinatore:** Giuseppe Mascolo

**Referente IRSA:** Giuseppe Mascolo, Sapia Murgolo

**Periodo di attivita:** 15/10/2020 - 14/10/2023

**Titolo: ACCORDO, AI SENSI DELL'ART. 15 DELLA LEGGE 7 AGOSTO 1990, N. 241, E DELL'ART. 4 DEL DECRETO LEGISLATIVO 2 GENNAIO 2018, N.1 TRA LA PRESIDENZA DEL CONSIGLIO DEI MINISTRI DIPARTIMENTO DELLA PROTEZIONE CIVILE E L'ISTITUTO DI RICERCA SULLE ACQUE (IRSA) PER LO SVILUPPO DI SISTEMI INFORMATIVI PER IL PREANNUNCIO DELLE CRISI IDRICHE E LA VALUTAZIONE DELLE MISURE FINALIZZATE ALL'APPROVVIGIONAMENTO IDRICO IN EMERGENZA (WP2)**

**Acronimo:** DPC 2019

**Abstract ITA:** WP 2 – Criteri, standard e linee guida per la selezione e la valutazione delle misure finalizzate all'approvvigionamento idrico in emergenza

**Abstract ENG:** WP 2 – Criteria, standards and guidelines to select and assess suitable measures to deal with emergency water supply

**Descrizione estesa ITA:** L'obiettivo del WP2 è realizzare un sistema di analisi finalizzato a suggerire, in condizioni di emergenza idrica, i possibili costi e benefici associati alla selezione di strategie di intervento strutturale (ad esempio relining) oppure non strutturale (ad esempio utilizzo autobotti), in modo da supportare il Dipartimento nella valutazione della più idonea soluzione operativa in relazione anche ai tempi necessari per la realizzazione delle opere provvisionali, all'urgenza dell'intervento, alle caratteristiche dell'utenza nonché ai più diffusi contesti di utilizzo, anche in considerazione di scenari multi-rischio.

**Rilevanza scientifica e risultati ITA:** L'attività del WP2 si è basata su: 1. Analisi bibliografica della letteratura scientifica disponibile sul tema, e della letteratura tecnica associata 2. Definizione dell'architettura il sistema di supporto alle decisioni (DSS), tramite la realizzazione di un database di informazioni utili ad effettuare un confronto semi-quantitativo tra le possibili strategie di gestione dell'emergenza. 3. Raccolta di dati sui costi delle specifiche misure strategiche strutturali e non strutturali comunemente adoperate, sulla relativa fattibilità tecnica, sui possibili vantaggi e svantaggi operativi, sulla loro validità a breve/medio/lungo termine, sui tempi medi di realizzazione delle singole strategie per poter valutare, in caso di necessità, quale sia la migliore nella considerazione complessiva delle variabili "costo"/"tempo di entrata in esercizio della misura". 4. Implementazione di un'analisi multicriteriale MCDA (Basata su AHP - Analytical Hierarchical Process) finalizzata a supportare il confronto tecnico ed economico tra diverse strategie di gestione dell'emergenza, attraverso metodi di strutturazione del giudizio esperto. 5. Analisi bibliografica relativa ai principali indicatori di performance e di resilienza delle reti acquedottistiche, atti a valutare analiticamente l'efficacia delle misure strutturali in termini di miglioramento delle condizioni operative delle reti. 6. Finalizzazione di report tecnico di sintesi, comprensivo di una descrizione dei casi studio analizzati i risultati delle attività sono presentati nel seguente lavoro: Pagano, A., Giordano, R., Vurro, M. "A Decision Support System Based on AHP for Ranking Strategies

to Manage Emergencies on Drinking Water Supply Systems" (2021) Water Resources Management, DOI: 10.1007/s11269-020-02741-y

**Fonte di finanziamento ITA:** PRESIDENZA DEL CONSIGLIO DEI MINISTRI, DIPARTIMENTO DELLA PROTEZIONE CIVILE

**Coordinatore:** Michele Vurro, IRSA-CNR

**Referente IRSA:** Michele Vurro, IRSA-CNR

**Periodo di attivita:** 09/01/2019-08/01/2020

**Titolo: Studio di alta specializzazione sullo stato quali-quantitativo del sistema "sorgente Tara", con particolare riguardo alla verifica della fattibilità tecnica di un eventuale impianto di dissalazione delle acque salmastre della sorgente**

**Acronimo:** AQP-TARA

**Abstract ITA:** lo studio svolto ha consentito una valutazione integrata dello stato quali-quantitativo del Fiume Tara e del sistema idrogeologico di alimentazione delle sue sorgenti, ricostruendo anche le dinamiche di utilizzazione di tale risorsa sin dalla realizzazione delle relative opere di captazione, avvenute alla fine degli anni '50. L'obiettivo generale dello studio è sintetizzato nei seguenti punti: - Caratterizzare lo stato di sfruttamento attuale del sistema sorgentizio del Tara e del suo sistema di captazione; - Caratterizzare lo stato di qualità attuale della risorsa idrica del sistema Tara; - Verificare la presenza e consistenza di possibili fonti di inquinamento a carico del sistema sorgentizio del Tara; - Prevedere i possibili impatti sul regime idrologico del F. Tara dovuti all'incremento dei prelievi. Le attività svolte, partendo dalla raccolta e analisi di una base di informazioni storiche disponibili sul complesso sorgentizio del Tara e sul suo sfruttamento, arricchite dai risultati emersi dalle attività di misura e monitoraggio condotte dall'IRSA nel 2016 e riprese nel 2018, hanno consentito di trarre alcune considerazioni fondamentali in vista della utilizzazione di una quota parte della portata complessiva del sistema sorgentizio del Tara a fini potabili.

**Abstract ENG:** The study carried out allowed an integrated assessment of the qualitative and quantitative state of the Tara River and of the hydrogeological system of its sources, also reconstructing the dynamics of use of this resource since the construction of the related collection system, which took place at the end of the 1950s. The general objective of the study is summarized in the following points: - Characterize the current state of exploitation of the Tara spring system and its collection system; - Characterize the current quality status of the water resource of the Tara system; - Check the presence and consistency of possible sources of pollution on the Tara source system; - Predict the possible impacts on the hydrological regime of the Tara River due to the increase in withdrawals. The activities carried out, starting from the collection and analysis of a base of historical information available on the Tara spring complex and its exploitation, enriched by

the results of the activities, measurement, and monitoring conducted by IRSA in 2016 and resumed in 2018, made it possible to draw some fundamental considerations in view of the use of a portion of the overall flow of the Tara spring system for drinking purposes.

**Fonte di finanziamento ITA:** Acquedotto Pugliese S.p.A.

**Coordinatore:** Ivan Portoghese, Maria C. Caputo

**Referente IRSA:** Ivan Portoghese, Maria C. Caputo

**Periodo di attivita:** 01/12/2015 - 15/02/2019

**Titolo: DPC – Accordo di collaborazione tra La Presidenza del Consiglio dei Ministri Dipartimento della Protezione Civile e l'Istituto di Ricerca sulle Acque per lo sviluppo di sistemi informativi per il preannuncio delle crisi idriche e la valutazione delle misure finalizzate all'approvvigionamento idrico - WP1 Sviluppo di sistemi operativi informatici per il preannuncio delle crisi idriche in sistemi idrici multirisorsa – multiutenza**

**Acronimo:** DPC2020

**Abstract ITA:** L'obiettivo fondamentale del WP1 è lo sviluppo ulteriore dello strumento di supporto alle decisioni INOPIAQGIS che ha costituito in versione beta il prodotto finale dell'Accordo di collaborazione DPC-IRSA del 09.01.2019. L'analisi dei risultati relativi all'Accordo citato ha permesso di individuare alcune linee di sviluppo del tool necessarie per aumentare la robustezza di INOPIAQGIS in termini di capacità di previsione, utilizzabilità da parte del SNPC e più in generale degli utenti, stabilità informatica: - moltiplicazione dei casi di studio, al fine di avere uno spettro più ampio delle condizioni meteo-climatiche, idrologiche, idrogeologiche, nonché delle caratteristiche infrastrutturali e delle possibili scelte gestionali dei diversi sistemi di approvvigionamento ubicati sul territorio nazionale - implementazione nel tool di algoritmi dinamici di allocazione delle risorse e/o di indirizzamento dei fabbisogni. - sviluppo di algoritmi specifici per la modellazione delle sorgenti - sviluppo di algoritmi specifici per lo sviluppo di scenari meteo-climatici di medio e lungo periodo. Gli obiettivi operativi sono i seguenti: - O.1 Individuazione dei casi-studio e relativa raccolta dati; - O.2 Sviluppo di una versione 1 (primo anno) e di una versione 2 (secondo anno) dello strumento operativo INOPIAQGIS; - O.3 Implementazione dello strumento INOPIAQGIS ai casi studio individuati - O.4 Disseminazione dello strumento operativo INOPIAQGIS presso il personale DPC

**Fonte di finanziamento ITA:** Presidenza del Consiglio dei Ministri - Dipartimento della Protezione Civile

**Altre informazioni ITA:** Totale finanziato per il WP1: 70,000 euro (2 anni)

**Coordinatore:** Emanuele Romano

**Referente IRSA:** Emanuele Romano

**Periodo di attivita:** 18/09/2020 - 17/09/2022

**Titolo: ACCORDO, AI SENSI DELL'ART. 15 DELLA LEGGE 7 AGOSTO 1990, N. 241, E DELL'ART. 4 DEL DECRETO LEGISLATIVO 2 GENNAIO 2018, N.1 TRA LA PRESIDENZA DEL CONSIGLIO DEI MINISTRI DIPARTIMENTO DELLA PROTEZIONE CIVILE E L'ISTITUTO DI RICERCA SULLE ACQUE (IRSA) DEL CONSIGLIO NAZIONALE DELLE RICERCHE (WP2)**

**Acronimo:** DPC 2020

**Abstract ITA:** WP 2 – Strumenti di supporto alle decisioni per la valutazione comparata e selezione delle misure di approvvigionamento idrico in emergenza

**Abstract ENG:** WP 2 – Decision Support Systems for the comparative assessment and selection of suitable measures to deal with emergency water supply

**Descrizione estesa ITA:** L'obiettivo del WP2 è quello di individuare criteri e strumenti finalizzati a supportare i decisori, in condizioni di emergenza idrica, in una valutazione comparata delle possibili strategie di intervento strutturale oppure non strutturale. Ciò al fine di supportare il Dipartimento nella valutazione della più idonea ed efficace soluzione operativa (non necessariamente 'limitata' alla gestione dell'emergenza e alla limitazione contingente degli impatti) in considerazione di una molteplicità di criteri e fattori, quali i tempi necessari per la realizzazione delle misure, l'urgenza dell'intervento, le caratteristiche dell'utenza nonché i più diffusi contesti di utilizzo. Lo strumento deve essere in grado di effettuare una valutazione integrata e flessibile, ed adatta a scenari multi-rischio

**Fonte di finanziamento ITA:** PRESIDENZA DEL CONSIGLIO DEI MINISTRI, DIPARTIMENTO DELLA PROTEZIONE CIVILE

**Coordinatore:** Emanuele Romano (IRSA-ROMA)

**Referente IRSA:** Emanuele Romano (IRSA-ROMA)

**Periodo di attivita:** 18/09/2020 - 17/09/2022

## Contratti con aziende/enti privati

### Titolo: Attività sperimentali di valutazione comparativa e verifica di fattibilità di interventi on-site ed in-situ di bonifica delle acque sotterranee insistenti nell'area della discarica di rifiuti speciali non pericolosi Formica Ambiente in agro di Brindisi

**Acronimo:** Formica

**Abstract ITA:** Attività di coordinamento e supervisione tecnico scientifica relativa alla sperimentazione di trattamento di filtrazione su carboni attivi di acque di falda contaminate da composti organici clorurati (e.g. 1,1 dicloroetilene). Attività di coordinamento e supervisione tecnico scientifica relativa alla sperimentazione di trattamento in situ, di acque di falda contaminate da composti organici clorurati (e.g. 1,1 dicloroetilene), mediante iniezione di gas reattivi ossidanti/riducenti e alla valutazione delle potenzialità di bioremediation dei suddetti trattamenti.

**Fonte di finanziamento ITA:** Formica Ambiente S.p.A.

**Coordinatore:** Vito Felice Uricchio

**Referente IRSA:** Vito Felice Uricchio - Valeria Ancona

**Periodo di attivita:** 20/1/2017 - 31/10/2021

### Titolo: Valutazione dello stato qualitativo della falda sottostante la Discarica Vergine ubicata in località Palombara: aspetti qualitativi

**Acronimo:** Vergine

**Abstract ITA:** Supporto scientifico alla valutazione dello stato qualitativo della falda sottostante la discarica Vergine comprensivo di studio idrogeologico, analisi critica delle informazioni disponibili, ricostruzione dell'andamento della superficie piezometrica, redazione del report finale.

**Fonte di finanziamento ITA:** LUTUM S.R.L.

**Coordinatore:** Vito Felice Uricchio, Maria Clementina Caputo

**Referente IRSA:** Vito Felice Uricchio, Maria Clementina Caputo

**Periodo di attivita:** 30/10/2019-30/6/2021

### Titolo: Servizio Valutazione Rischio Ambientale

**Acronimo:** Se.Va.R.A.

**Abstract ITA:** Implementazione di un primo ambiente di test del database geospaziale di supporto allo sviluppo del progetto SeVaRa, con dati a scala strettamente regionale e concepimento di una architettura multi-layer estendibile per capacità di storage, processamento e ridondanza. L'attività comprenderà sia il disegno di una architettura sofware e degli schemi per i dati utilizzabili per la prototipizzazione e la relativa implementazione con software allo stato dell'arte per i geodatabase, sia il disegno di una architettura più evoluta per la ingestione e gestione di grandi moli di dati su scala anche nazionale ed europea. Sono comprese le seguenti sub-attività: - progettazione di una architettura scalabile ed implementazione di una architettura per il test a scala max regionale su server Omnitech, secondo specifiche CNR; - definizione di un modello dati per il database geografico; - popolamento del database geografico con dati a distribuzione tipo 'open data' (per es. OSM e/o dati Regione Puglia) in base alla semantica utile per le applicazioni relative al progetto SeVaRa; - integrazione con i dati georiferiti di progetto (es. PS, stazioni meteo) a mezzo file queue o servizi REST; - concertazione delle query geospaziali in collaborazione con il partner Poliba, a mezzo servizi OGC o - REST; - tuning e profilazione del sistema test per ottenere indicazioni utili per la realizzazione di una architettura scalabile anche a livello europeo

**Fonte di finanziamento ITA:** Omnitech S.r.l.

**Website:** https://www.sevara.it/

**Coordinatore:** Vito Felice Uricchio

**Referente IRSA:** Vito Felice Uricchio, Carmine Massarelli

**Periodo di attivita:** 27/02/2019-27/02/2022

### Titolo: attivita' di ricerca di analisi e monitoraggio di n. 5 impianti presso Uniacque Spa - Bergamo.

**Acronimo:** UNIACQUE MICROPLASTICHE

**Abstract ITA:** ATTIVITA'1) Isolamento di microplastiche e batteri in campioni provenienti da 3 punti di 5 impianti della società UniAcque SpA (BG), esattamente dopo le griglie inziali, prima del trattamento di disinfezione primario e in uscita dell'impianto.2) Analisi delle microplastiche isolate nei campioni prelevati per determinarne le dimensioni, la forma ed il materiale costituente.3) Analisi della comunità batterica libera in acqua e adesa alle microplastiche con analisi del relativo resistoma.

**Fonte di finanziamento ITA:** UNIACQUE S.P.A.

**Coordinatore:** Di Cesare Andrea

**Referente IRSA:** Di Cesare Andrea

**Periodo di attivita:** 01/09/2019-31/03/2020

**Titolo: ALGARIA: pilot-scale production of phycocyanin and determination of phycocyanin production yield and spectrophotometric characterization of the pigment.**

**Acronimo:** ALGARIA

**Abstract ENG:** IRSA-VB has the necessary expertise to support the phycocyanin (PC) production activity planned in the project. The expertize concerns PC extraction (for example, freeze-thawing, sonication) and purification (for example ammonium sulphate precipitation, ultrafiltration, membrane chromatography), followed by spectrophotometric characterization. UV-Vis spectroscopy, in particular, is routinely used to determine the phycobiliprotein content of the extract and PC purity ratio (APC/A280), that is used to establish the commercial value of the product.

**Descrizione estesa ENG:** IRSA-VB has the necessary expertise to support the phycocyanin (PC) production activity planned in the project. The expertize concerns PC extraction (for example, freeze-thawing, sonication) and purification (for example ammonium sulphate precipitation, ultrafiltration, membrane chromatography), followed by spectrophotometric characterization. UV-Vis spectroscopy, in particular, is routinely used to determine the phycobiliprotein content of the extract and PC purity ratio (APC/A280), that is used to establish the commercial value of the product. The activity regards: • A Lab-scale approach to simulate and improve current phycocianin extraction process • A laboratory training to specialized technician • Analytical (spectrophotometric characterization and, if necessary, ultrafiltration using centrifugal devices with membranes of various molecular weight cutoff) and consultory support to pilot-scale tests for extraction of Phycocyanin by membrane technology • Support in defining the perfomance of pilot-scale tests and acquisition of process data • Analyses (spectrophotometer and mass balance quantification) of all streams to support pilot tests • Spectrophotometric Characterization of phycocyanin blue food-grade product

**Rilevanza scientifica e risultati ITA:** La ficocianina (PC) è pigmento blu brillante, altamente fluorescente, facente parte dei complessi antenna del sistema fotosintetico dei cianobatteri e di alcune alghe. PC ha numerose applicazioni biotecnologiche che richiedono diversi gradi di purezza. PC è l'unico colorante naturale blu disponibile in commercio. Il valore di PC sul mercato è determinato dalla particolare applicazione e, perciò, dal suo grado di purezza: Maggiore è la purezza, maggiore è il valore del prodotto. Attualmente, la produzione di PC di elevata qualità su larga scala rimane problematica e costosa, e vi è l'urgente necessità da parte dell'industria di avere a disposizione un metodo semplice ed economicamente sostenibile. I risultati del progetto ALGARIA permetteranno di valutare la sostenibilità economica del processo di estrazione e purificazione di PC estratta da Spirulina proposto nel Progetto. Tale processo è basato sulla rottura della parete

cellulare per freeze-thawing, estrazione in soluzione acquosa del pigmento e successiva separazione dalla biomassa per microfiltrazione e ultrafiltrazione, utilizzando un dispositivo realizzato da Membranology (spin out Swansea University, UK). Tuttavia sia il processo di estrazione che quello di separazione/purificazione devono essere messi a punto. La ricerca industriale a tal riguardo verrà condotta da IRSA, e punterà ad ottenere un prodotto di grado alimentare/cosmetico (purezza 1.5-2.5) di elevata qualità, cioè un prodotto in cui la struttura proteica di PC viene preservata, in modo da non alterare la stabilità e la bioattività della molecola. PC, in particolare, è poco stabile alla temperatura ed alla luce; inoltre, la sua struttura quaternaria va preservata evitando processi di estrazione e di purificazione troppo drastici. A PC sono riconosciute proprietà terapeutiche, come antiossidante, antinfiammatorio, neuroprotettivo, epatoprotettivo, antitumorale, antivirale, etc.. Tuttavia esistono pochi studi clinici e, in generale, non sono noti i meccanismi di azione. L'ottenimento di un prodotto che mantenga inalterate le proprie caratteristiche chimoco-fisiche è perciò di interesse non solo economico (per l'industria che lo produce), ma anche scientifico, perchè permetterebbe di avere a disposizione quantità sufficienti di PC di elevata qualità da utilizzare in studi clinici e biomedici in generale, rappesentando, il campo biomedico, uno dei settori in cui è crescente l'interesse verso questa cromoproteina.

**Fonte di finanziamento ITA:** ATRIA Innovation S.L., VAT: B99406647, Zaragoza (SP)

**Fonte di finanziamento ENG:** ATRIA Innovation S.L., VAT: B99406647, Zaragoza (SP)

**Altre informazioni ITA:** Finanziamento: 10.000 euro

**Website:** https://vidaproject.eu/

**Coordinatore:** James Baker, Centre of Expertise Water Technology, Netherlands

**Referente IRSA:** Rosaria Lauceri

**Periodo di attivita:** 19/12/2019 - 19/12/2020

## Titolo: Caratterizzazione della comunità macrozoobentonica e parametri morfometrici, indice di condizione di Mytilus galloprovincialisi(2019)

**Acronimo:** LABANALYSIS

**Abstract ITA:** Lo studio delle comunità macrozoobentoniche ha un ruolo chiave nell'ambito dei sistemi costieri, poiché ne rappresenta la memoria storica, ed esprime dinamiche che consentono una valutazione spazio-temporale delle modificazioni dell'ecosistema. Dall'analisi delle modificazioni nella struttura quali-quantitativa della comunità si possono, infatti, trarre informazioni sufficientemente complete circa la qualità dell'ambiente e le sue modificazioni. Tali capacità conferiscono all'intera comunità macrobentonica l'importante ruolo di indicatore ambientale. L'accordo di convenzione tra Labanalysis e il CNR-IRSA di Taranto, si basa sulla

caratterizzazione delle comunità macrozoobentoniche nel Mar Grande di Taranto per la valutazione della qualità dei sedimenti. Inoltre sono stati determinati i parametri morfometricie l'indice di condizione dei mitili sottoposti a protocollo Mussel Watch". Nell'ambito del progetto, sono state campionate 4 stazioni nel Mar Grande di Taranto. Il sedimento è stato campionato con una benna Van Veen con area di presa di 0,1 una capacità di 25 litri, prelevando in ogni stazione tre repliche. I campioni raccolti nelle 3 campagne di monitoraggio (Aprile, Agosto, Novembre 2019) sono stati esaminati in laboratorio, dove si è proceduto alla separazione degli individui dal sedimento. Gli organismi sono stati sottoposti a determinazione tassonomica, al fine di identificare a quale specie o gruppo tassonomico appartenevano, contati e pesati per quantificarne la biomassa. Sono stati utilizzati i seguenti parametri strutturali ed indici ecologici: Abbondanza (A), Indice di Ricchezza specifica di Margalef (d), Indice di diversità specifica di Shannon –Wiener (H'), Equitabilità di Pielou (J'), Indice di diversità Simpson. In base ai dati emersi dall'analisi del popolamento, le stazioni in esame sono caratterizzate da scarsi elementi faunistici, la maggior parte dei quali adatti a vivere su substrati sia fangosi che di sabbie. Alcune specie sono strettamente dipendenti da un substrato tipicamente sabbioso, come Owenia fusiformis. Le specie Corbula gibba e Nucula nucleus sono tipiche dei sedimenti fangosi e sabbioso-fangosi. Sono state rinvenute inoltre alcune specie indicatrici di arricchimento di sostanza organica, come l'echinoderma Amphiura chiajei. I risultati hanno inoltre evidenziato la struttura quali-quantitativa delle comunità, permettendo di evidenziare differenze sia tra le stazioni che tra le stagioni esaminate. Per quel che riguarda la valutazione dei parametri morfometrici e Indice di Condizione di Mytilus galloprovincialis sottoposti a protocollo "Mussel Watch" sono stati analizzati circa 100 individui provenienti da un vivaio sito in una zona lontana da fonti di contaminazione(bianco) e mitili provenienti dai 4 siti in esame dopo un periodo di immersione di 7 settimane. In laboratorio i mitili sono stati sottoposti ad analisi biometrica e alla determinazione dell'indice di Condizione (IC). L'analisi statistica dei dati ottenuti ha evidenziato differenze significative tra gli indici di condizione dei mitili provenienti dalla stazione investigata rispetto agli indici dei campioni di controllo non esposti.

**Abstract ENG:** The study of macrozoobenthic communities plays a key role in the context of coastal systems, since it represents their historical memory, and expresses dynamics that allow a space-time evaluation of ecosystem changes. In fact, from the analysis of the changes in the qualitative-quantitative structure of the community, sufficiently complete information can be obtained about the quality of the environment and its modifications. These capabilities give the entire macrobenthic community the important role of environmental indicator. The agreement between Labanalysis and the CNR-IRSA of Taranto is based on the evaluation of the macrozoobenthic community in the Mar Grande of Taranto for the assessment of sediment quality, as part of the project, 4 stations were sampled in the Mar Grande of Taranto. Moreover, the morphometric parameters and Condition Index of Mytilus galloprovincialis subjected to the "Mussel Watch" were analysed. The sediment was sampled with a Van Veen bucket (area of 0.1 and a capacity of 25 liters) taking three replicates at each station. The samples collected during 3 monitoring campaigns (April, August, November 2019) were examined in the laboratory, where the individuals were separated from the sediment. The organisms were subjected to taxonomic determination, in order to identify which species or taxonomic group they belong to, counted and weighed to quantify their biomass. The following structural parameters and ecological indices were used: Abundance (A), Margalef specific wealth index (d), Shannon-Wiener specific diversity index (H '), Pielou equitability (J'), Diversity index Simpson. Based on the data emerging from the analysis of the macrozoobenthic population, the

examined stations are characterized by few faunal elements, most of which are suitable for living on both muddy and sandy substrates. Some species are strictly dependent on a typically sandy substrate, such as Owenia fusiformis. Corbula gibba and Nucula nucleus species are typical of muddy and sandy-muddy sediments. Some species indicating enrichment of organic matter were also found, such as the echinoderma Amphiura chiajei. The results also highlighted the qualitative-quantitative structure of the communities, allowing to highlight differences both between the stations and between the seasons examined.As regards the evaluation of the morphometric parameters and Condition Index of Mytilus galloprovincialis subjected to the "Mussel Watch" protocol, about 100 individuals from a farm located in an area far from sources of contamination (white) and mussels from 4 sites (100 individuals from each site) under investigation after a 7-week immersion period were analysed. In the laboratory, the mussels were subjected to biometric analysis and the determination of the Condition Index (IC). The statistical analysis of the data obtained highlighted significant differences between the condition indices of the mussels from the investigated station compared to the indices of the unexposed control samples.

**Fonte di finanziamento ITA:** Labanalysis

**Fonte di finanziamento ENG:** Labanalysis

**Coordinatore:** Dott.ssa Carla Isella Massara- Labanalysis

**Referente IRSA:** Ermelinda PRATO

**Periodo di attivita:** 01/04/2019 al 30/11/2019

## Titolo: Analisi macrozoobenthos e parametri morfometrici, indice di condizione di Mytilus galloprovincialis (Febbraio 2019)

**Acronimo:** PETROLTECNICA

**Abstract ITA:** L'accordo di convenzione Petroltecnica e il CNR-IRSA di Taranto, si basa sulla caratterizzazione delle comunità macrozoobentoniche nel Mar Grande di Taranto per la valutazione della qualità dei sedimenti e sulla valutazione parametri morfometrici, Indice di Condizione di Mytilus galloprovincialis sottoposti a protocollo “Mussel Watch”. Nell’ambito del progetto, sono state campionate 4 stazioni nel Mar Grande di Taranto. Il sedimento è stato campionato con una benna Van Veen con area di presa di 0,1 una capacità di 25 litri, prelevando in ogni stazione tre repliche. I campioni raccolti nel Febbraio 2019 sono stati esaminati in laboratorio, dove si è proceduto alla separazione degli individui dal sedimento. Gli organismi sono stati sottoposti a determinazione tassonomica, al fine di identificare a quale specie o gruppo tassonomico appartenevano, contati e pesati per quantificarne la biomassa. Sono stati utilizzati i seguenti parametri strutturali ed indici ecologici: Abbondanza (A), Indice di Ricchezza specifica di Margalef (d), Indice di diversità specifica di Shannon –Wiener (H’), Equitabilità di Pielou (J’), Indice di diversità Simpson. In base ai dati emersi dall’analisi del popolamento, le stazioni in esame sono

caratterizzate da scarsi elementi faunistici. I risultati hanno inoltre evidenziato la struttura quali-quantitativa delle comunità, permettendo di evidenziare differenze sia tra le stazioni che tra le stagioni esaminate. Per quel che riguarda la valutazione dei parametri morfometrici e Indice di Condizione di Mytilus galloprovincialis sottoposti a protocollo “Mussel Watch” sono stati analizzati circa 100 individui provenienti da un vivaio sito in una zona lontana da fonti di contaminazione(bianco) e mitili provenienti dai 4 siti in esame dopo un periodo di immersione di 7 settimane. In laboratorio i mitili sono stati sottoposti ad analisi biometrica e alla determinazione dell’indice di Condizione (IC). L’analisi statistica dei dati ottenuti ha evidenziato differenze significative tra gli indici di condizione dei mitili provenienti dalla stazione investigata rispetto agli indici dei campioni di controllo non esposti.

**Abstract ENG:** The agreement between Petroltecnica and the CNR-IRSA of Taranto is based on the evaluation of the macrozoobenthic community in the Mar Grande of Taranto for the assessment of sediment quality as part of the project, 4 stations were sampled in the Mar Grande of Taranto. The sediment was sampled with a Van Veen bucket (area of 0.1 and a capacity of 25 liters) taking three replicates at each station. The samples collected during a monitoring campaign (February 2019) were examined in the laboratory, where the individuals were separated from the sediment. The organisms were subjected to taxonomic determination, in order to identify which species or taxonomic group they belong to, counted and weighed to quantify their biomass. The following structural parameters and ecological indices were used: Abundance (A), Margalef specific wealth index (d), Shannon-Wiener specific diversity index (H '), Pielou equitability (J'), Diversity index Simpson. Based on the data emerging from the analysis of the macrozoobenthic population, the examined stations are characterized by few faunal elements, most of which are suitable for living on both muddy and sandy substrates. The results also highlighted the qualitative-quantitative structure of the communities, allowing to highlight differences both between the stations and between the seasons examined. As regards the evaluation of the morphometric parameters and Condition Index of Mytilus galloprovincialis subjected to the "Mussel Watch" protocol, about 100 individuals from a farm located in an area far from sources of contamination (white) and mussels from 4 sites (100 individuals from each site) under investigation after a 7-week immersion period were analysed. In the laboratory, the mussels were subjected to biometric analysis and the determination of the Condition Index (IC). The statistical analysis of the data obtained highlighted significant differences between the condition indices of the mussels from the investigated station compared to the indices of the unexposed control samples.

**Fonte di finanziamento ITA:** Petroltecnica S.p.A.

**Coordinatore:** Luciano Dell'Omo Petroltecnica

**Referente IRSA:** Ermelinda PRATO

**Periodo di attivita:** 07/01/2019 al 04/03/2019

**Titolo: Caratterizzazione delle comunità macrozoobentoniche nel Mar Grande di Taranto e parametri morfometrici, Indice di Condizione di Mytilus galloprovincialis (2020)**

**Acronimo:** Labanalysis

**Abstract ITA:** L'accordo di convenzione Labanalysis e il CNR-IRSA di Taranto, si basa sulla caratterizzazione delle comunità macrozoobentoniche nel Mar Grande di Taranto per la valutazione della qualità dei sedimenti e sulla valutazione parametri morfometrici, Indice di Condizione di Mytilus galloprovincialis sottoposti a protocollo "Mussel Watch". Nell'ambito del progetto, sono state campionate 4 stazioni nel Mar Grande di Taranto. Il sedimento è stato campionato con una benna Van Veen con area di presa di 0,1 una capacità di 25 litri, prelevando in ogni stazione tre repliche. I campioni sono stati raccolti stagionalmente (Febbraio-Maggio-Agosto-Novembre 2020). In laboratorio gli organismi sono stati sottoposti a determinazione tassonomica, al fine di identificare a quale specie o gruppo tassonomico appartenevano, contati e pesati per quantificarne la biomassa. Sono stati utilizzati i seguenti parametri strutturali ed indici ecologici: Abbondanza (A), Indice di Ricchezza specifica di Margalef (d), Indice di diversità specifica di Shannon –Wiener (H'), Equitabilità di Pielou (J'), Indice di diversità Simpson. In base ai dati emersi dall'analisi del popolamento, le stazioni in esame sono caratterizzate da scarsi elementi faunistici. I risultati hanno inoltre evidenziato la struttura quali-quantitativa delle comunità, permettendo di evidenziare differenze sia tra le stazioni che tra le stagioni esaminate. Per quel che riguarda la valutazione dei parametri morfometrici e Indice di Condizione di Mytilus galloprovincialis sottoposti a protocollo "Mussel Watch" sono stati analizzati circa 100 individui provenienti da un vivaio sito in una zona lontana da fonti di contaminazione(bianco) e mitili provenienti dai 4 siti in esame dopo un periodo di immersione di 7 settimane. In laboratorio i mitili sono stati sottoposti ad analisi biometrica e alla determinazione dell'indice di Condizione (IC). L'analisi statistica dei dati ottenuti ha evidenziato differenze significative tra gli indici di condizione dei mitili provenienti dalle stazioni investigate rispetto agli indici dei campioni di controllo non esposti

**Abstract ENG:** The agreement between Labanalysis and the CNR-IRSA of Taranto is based on the evaluation of the macrozoobenthic community in the Mar Grande of Taranto and the evaluation of the morphometric parameters and Condition Index of Mytilus galloprovincialis subjected to the "Mussel Watch". As part of the project, 4 stations were sampled in the Mar Grande of Taranto. The sediment was sampled seasonally (February, March, August and November 2020) with a Van Veen bucket (area of 0.1 and a capacity of 25 liters) taking three replicates at each station. The samples were examined in the laboratory, where the individuals were separated from the sediment. The organisms were subjected to taxonomic determination, in order to identify which species or taxonomic group they belong to, counted and weighed to quantify their biomass. The following structural parameters and ecological indices were used: Abundance (A), Margalef specific wealth index (d), Shannon-Wiener specific diversity index (H '), Pielou equitability (J'), Diversity index Simpson. Based on the data emerging from the analysis of the macrozoobenthic population, the examined stations are characterized by few faunal elements, most of which are suitable for living on both muddy and sandy substrates. The results also highlighted the qualitative-quantitative structure of the communities, allowing to highlight differences both between the stations and between the seasons examined. As regards the evaluation of the morphometric parameters and Condition Index of Mytilus galloprovincialis subjected to the "Mussel Watch" protocol, about 100 individuals from a farm located in an area far from sources of contamination (white) and mussels

from 4 sites (100 individuals from each site) under investigation after a 5-week immersion period were analysed. In the laboratory, the mussels were subjected to biometric analysis and the determination of the Condition Index (IC). The statistical analysis of the data obtained highlighted significant differences between the condition indices of the mussels from the investigated station compared to the indices of the unexposed control samples.

**Fonte di finanziamento ITA:** Labanalysis

**Fonte di finanziamento ENG:** Labanalysis

**Coordinatore:** Dott.ssa Carla Isella Massara - Labanalysis

**Referente IRSA:** Ermelinda PRATO

**Periodo di attivita:** 15/01/2020 al 15/12/2020

### Titolo: Valutazione dello stato qualitativo della falda sottostante la Discarica Vergine ubicata in località Palombara: aspetti idrogeologici

**Acronimo:** Vergine

**Abstract ITA:** Supporto scientifico alla valutazione dello stato qualitativo della falda sottostante la discarica Vergine comprensivo di studio idrogeologico, analisi critica delle informazioni disponibili, ricostruzione dell'andamento della superficie piezometrica, redazione del report finale.

**Abstract ENG:** Scientific support for the evaluation of the qualitative state of the groundwater below the virgin landfill including hydrogeological study, critical analysis of the available information, reconstruction of the piezometric surface, and final report.

**Fonte di finanziamento ITA:** LUTUM S.R.L.

**Coordinatore:** Caputo Maria Clementina

**Referente IRSA:** Caputo Maria Clementina

**Periodo di attivita:** 30/10/2019-30/6/2021

### Titolo: Convenzione tra CAP-Holding e CNR-IRSA per Water Reuse Risk Management basato sul Sanitation Safety Plan

**Acronimo:** CAP WATER REUSE

**Abstract ITA:** Il progetto “Water Reuse Risk Management basato sul Sanitation Safety Plan” ha il fine di implementare un sistema di valutazione del rischio sanitario sulla base di linee guida consolidate a livello internazionale (approccio Water Safety Plans/Sanitation Safety Plans dell’OMS) e quindi valutarne la fattibilità alla luce di una possibile riforma normativa italiana nel settore del riuso delle acque reflue. Più specificamente si intende estendere il campo di ricerca in corso definendo criteri e procedure di valutazione dei rischi relativi alla pratica del riuso di acque reflue trattate in agricoltura, considerando il potenziale trasferimento di contaminanti chimici e biologici alle colture, al suolo, alle acque superficiali e a quelle sotterranee

**Abstract ENG:** The "Water Reuse Risk Management based on the Sanitation Safety Plan" project has the purpose of implementing a health risk assessment system based on internationally consolidated guidelines (WHO Water Safety Plans / Sanitation Safety Plans approach) and therefore evaluating the feasibility in the light of a possible Italian regulatory reform in the wastewater reuse sector. More specifically, we intend to extend the field of research in progress by defining risk assessment criteria and procedures relating to the practice of reusing treated wastewater in agriculture, considering the potential transfer of chemical and biological contaminants to crops, soil, surface waters and those underground

**Fonte di finanziamento ITA:** CAP-Holding

**Fonte di finanziamento ENG:** CAP-Holding

**Coordinatore:** amie Bertram, University of North Carolina at Chapel Hill, USA

**Referente IRSA:** Stefano Polesello

**Periodo di attivita:** 09/05/2019-31/10/2020

### Titolo: Contratto di collaborazione su tematiche poste dalla nuova proposta di Direttiva EU - DWD tra Metropolitane Milanesi e CNR-IRSA

**Abstract ITA:** L’attività della collaborazione prevede il supporto a Metropolitane Milanesi (MM), gestore unico del servizio idrico integrato di MIlano, per la revisione e aggiornamento di: 1. Piano annuale campionamenti (PCA) di MM : analizzare / proporre modifiche o giustificare le scelte adottate (parametri e frequenze) in funzione del rischio analitico, chimico, microbiologico e virologico. 2. Piano annuale campionamenti (PCA) di MM : indicare come deve essere modificato nel caso di approvazione della nuova Direttiva DWD per il periodo di screening iniziale (primi 3 anni) ai fini del superamento dell’approccio “too late, too little”; • Considerazioni in merito ai nuovi inquinanti target previsti nella DWD ed in merito a quelli non target ma che sarebbe opportuno inserire negli screening per la redazione del prossimo aggiornamento dei piani di sicurezza delle acque (PSA); • Considerazioni in merito ai parametri accreditati da MM e di prevista prossimo accreditamento ISO 17025; • Focus su microbiologia con riferimento in particolare al tema Legionella, Coliformi, colifagi e clostridium (in configurazione attuale e con la nuova Direttiva) e

proporre misure di controllo analitico o operativo; • Impatti della nuova direttiva DWD e del WSP sulle attività attuali del laboratorio Acquedotto di MM.

**Abstract ENG:** The collaboration activity provides support to Metropolitane Milanesi (MM), the sole manager of the integrated water service of Milan, for the revision and updating of: 1. MM annual sampling plan (PCA): analyze / propose changes or justify the choices adopted (parameters and frequencies) according to the analytical, chemical, microbiological and virological risk. 2. MM Annual Sampling Plan (PCA): indicate how it must be modified in the event of approval of the new DWD Directive for the initial screening period (first 3 years) in order to overcome the "too late, too little" approach; • Considerations regarding the new target pollutants envisaged in the DWD and regarding the non-target ones but which should be included in the screening for the preparation of the next update of the water safety plans (PSA); • Considerations regarding the parameters accredited by MM and the expected forthcoming ISO 17025 accreditation; • Focus on microbiology with particular reference to the topic Legionella, Coliforms, coliphages and clostridium (in current configuration and with the new Directive) and propose analytical or operational control measures; • Impacts of the new DWD directive and WSP on the current activities of the Acquedotto di MM laboratory.

**Fonte di finanziamento ITA:** Metropolitane Milanesi

**Fonte di finanziamento ENG:** Metropolitane Milanesi

**Coordinatore:** Stefano Polesello

**Referente IRSA:** Stefano Polesello

**Periodo di attivita:** 25/03/2019-30/04/2020

### Titolo: Supporto al monitoraggio di screening di inquinanti emergenti nei Piani di Sicurezza Acquedottistici -Water Alliance_ WHO

**Acronimo:** WATER ALLIANCE

**Abstract ITA:** L'attività prevista per il corrente progetto previsto dalla Convenzione è incentrata sullo screening di inquinanti emergenti (farmaci e prodotti per la cura della persona) su un campionamento significativo di acque di falda campionate dai diversi gestori. • Nella fase successiva, i composti determinati nella falda verranno determinati anche nelle acque distribuite (ovviamente solo per i campioni positivi in acqua grezza), per verificare l'efficacia dei sistemi di trattamento già in essere. • Verrà infine stabilita una lista di inquinanti emergenti effettivamente presenti nelle nostre acque di falda, per la quale mettere a punto un piano di monitoraggio target da integrare nei Piani di Sicurezza Acquedottistici (Water Safety Plan) secondo le linee guida WHO.

**Abstract ENG:** The activity envisaged for the current project envisaged by the Convention focuses on the screening of emerging pollutants (drugs and personal care products) on a significant sampling of groundwater sampled by the various managers. • In the next phase, the compounds determined in the groundwater will also be determined in the distributed water (obviously only for positive samples in raw water), to verify the effectiveness of the treatment systems already in place. • Finally, a list of emerging pollutants actually present in our groundwater will be established, for which a target monitoring plan to be integrated into the Water Safety Plan according to the WHO guidelines will be developed.

**Fonte di finanziamento ITA:** Water Alliance – Acque di Lombardia

**Website:** https://www.wateralliance.it/

**Coordinatore:** Sara Maria Valsecchi

**Referente IRSA:** Sara Maria Valsecchi

**Periodo di attivita:** 10/07/2018-31/12/2020

### Titolo: Presenza di olii e grassi vegetali e animali nelle acque reflue e nei fanghi

**Acronimo:** RENOILS

**Abstract ITA:** La presenza di olii e grassi vegetali e animali nelle acque reflue e nei fanghi rappresenta ancora un problema per il corretto esercizio dei depuratori e la successiva gestione dei fanghi prodotti. La conoscenza sulle origini di tali prodotti nonché sugli andamenti temporali e territoriali delle concentrazioni nei reflui costituisce il presupposto per attuare politiche virtuose di segregazione di tali risorse che hanno un valore intrinseco costituendo la materia prima per la produzione di combustibili derivati (bio-olio, bio-diesel). RENOILS intende avvalersi delle competenze di IRSA-CNR per l'esecuzione di attività aventi lo scopo di consolidare e approfondire il quadro delle conoscenze sulla presenza di oli e grassi vegetali e animali nelle acque reflue domestiche e industriali e per organizzare congiuntamente eventi volti alla diffusione delle conoscenze a livello istituzionale nazionale e locale, con il coinvolgimento anche dei portatori d'interesse.

**Fonte di finanziamento ITA:** Consorzio RenOils

**Coordinatore:** Giuseppe Mininni (IRSA-CNR)

**Referente IRSA:** Camilla Braguglia

**Periodo di attivita:** 01/07/2019-31/12/2020

### Titolo: Qualità dei fanghi di depurazione

**Acronimo:** FANGHI

**Abstract ITA:** Lo scopo della convenzione è di effettuare una valutazione compiuta, della qualità dei fanghi prodotti da alcuni impianti di depurazione di ACEA ATO2 S.p.A. rispetto alla normativa vigente in materia ma anche in relazione alle peculiarità territoriali, in base ai dati di caratterizzazione dei terreni e delle acque sotterranee messi a disposizione.

**Descrizione estesa ITA:** Nel corso del 2018 si è manifestata una grave criticità legata alla progressiva riduzione degli spazi nei siti di trattamento, presso cui conferire i fanghi provenienti dagli impianti di depurazione. Tale criticità è dipesa anche dal panorama normativo relativo alla disciplina specifica delle caratteristiche e dell'origine dei fanghi idonei al recupero agronomico. L'attesa di una nuova regolamentazione ha generato negli operatori del settore incertezza circa la normativa applicabile, causando criticità organizzative che spesso si sono concretizzate nella riduzione delle disponibilità dei siti ove è possibile effettuare nuovi conferimenti, talvolta per il mancato rinnovo dei titoli autorizzativi, talvolta, in via prudenziale, per non incorrere in sanzioni inibitorie. La situazione è stata resa ancora più critica dal susseguirsi di eventi meteorologici di carattere eccezionale. La materia è stata oggetto di tavoli di concertazione tra gli Enti pubblici coinvolti e le associazioni di categoria, per definire, nel minor tempo possibile, il contenuto del nuovo decreto di aggiornamento del D.Lgs. 99/92. Dopo il 20 Luglio 2018 a seguito della sentenza n. 1782 emanata dal TAR Lombardia, con la quale il Giudice amministrativo ha individuato nel combinato disposto delle norme contenute nei D. Lgs. n. 99/92 e n. 152/06 - e relativi allegati - la disciplina esaustiva dei valori consentiti nei fanghi destinati a utilizzo agricolo, si è verificato il blocco dei conferimenti presso gli impianti di trattamento, la cui potenzialità complessiva era assorbita per circa il 50% dai fanghi prodotti dalla Società, in quanto il trattamento eseguito on-site sugli impianti di produzione non era in grado di garantire il rispetto dei limiti summenzionati, pure se riguardanti sostanze la cui origine può dipendere dalla loro presenza come fondo naturale in terreni vulcanici come avviene in numerose aree del Lazio. L'emergenza fanghi causata dall'incertezza normativa è stata in gran parte arginata con l'emissione del Decreto Legge 109/2018, convertito con la legge n. 130/2018, contenente, all'articolo 41, le "Disposizioni urgenti sulla gestione dei fanghi di depurazione", con il quale sono stati introdotti nuovi limiti ai valori nei fanghi destinati ad uso agricolo. Acea Ato2 S.p.A. intende, a scopo meramente prudenziale e di ricerca scientifica, promuovere un'indagine specifica delle matrici solide prodotte dagli impianti di depurazione a fronte di quanto stabilito dalla normativa vigente.

**Fonte di finanziamento ITA:** ACEA S.p.A.

**Coordinatore:** Giuseppe Mininni (IRSA-CNR)

**Referente IRSA:** Camilla Braguglia

**Periodo di attivita:** 01/07/2019-01/07/2020

### Titolo: Tecnologie avanzate di riutilizzo di acque urbane e industriali

**Abstract ITA:** Il progetto si inserisce all'interno del Joint Research Agreement CNR-ENI del 24/03/2019 con il quale sono stati costituiti 4 centri di ricerca di eccellenza inerenti ad altrettante aree macrotematiche, ossia artico, fusione, acqua ed agricoltura. A Metaponto è stato costituito 1 dei 4 centri di ricerca sopra citati, denominato "Ipazia D'Alessandria", dedicato alla promozione di soluzioni e tecnologie innovative per l'efficienza e l'ottimizzazione della gestione delle acque volte ad una corretta valorizzazione delle risorse idriche. Le attività del centro di ricerca "Ipazia D'Alessandria" si articolano in 3 direttrici progettuali: 1) ottimizzazione dell'uso dell'acqua in agricoltura, 2) tecnologie avanzate di riutilizzo di acque urbane e industriali e 3) gestione ottimale delle acque sotterranee costiere e dei rischi di salinizzazione L'obiettivo del progetto 2 è quello di testare alcuni schemi di trattamento e recupero (a fini irrigui) dei reflui municipali che vadano nella direzione dell'innovazione e della semplificazione, salvaguardando comunque la salute pubblica. In particolare, il progetto prevede la realizzazione di una piattaforma sperimentale per il trattamento e recupero dei reflui dell'agglomerato di Ferrandina (MT). Tale piattaforma opererà in modo parallelo alla filiera di trattamento attualmente presente nel depuratore di Ferrandina. In particolare, la piattaforma preleverà il refluo dopo la sezione di grigliatura per eseguire un trattamento biologico all'interno di un SBBGR (Sequencing Batch Biofilter Granular Reactor), un sistema innovativo sviluppato dall'Istituto di Ricerca sulle Acque del CNR in grado di ridurre fino al 80% il quantitativo di fango che solitamente si forma nella depurazione delle acque di scarico con le tecnologie tradizionali. La qualità dell'effluente del sistema SBBGR della piattaforma sarà migliorata da due unità di affinamento, destinate in particolare alla disinfezione rispetto ai microrganismi patogeni e all'abbattimento degli inquinanti emergenti, che opereranno in parallelo: la cavitazione idrodinamica controllata e l'irraggiamento UV (eventualmente potenziate con acqua ossigenata) al fine di ridurre il rischio igienico-sanitario. L'effluente affinato sarà utilizzato per irrigare un campo sperimentale. Inoltre, verranno eseguiti su scala laboratorio test di affinamento basati su materiali adsorbenti e processi fotocatalitici assistiti da catalizzatori nanostrutturati.

**Fonte di finanziamento ITA:** ENI S.p.A.

**Coordinatore:** Dr. Mauro Centritto (CNR-IPSP)

**Referente IRSA:** Di Iaconi Claudio

**Periodo di attivita:** 24/03/2019-23/03/2024

**Titolo: Applicazione del sistema SBBGR per il trattamento delle acque di lavaggio dei beni e/o rifiuti a base di polietilene della società Recuperi Pugliesi per la riduzione dei fanghi di depurazione**

**Acronimo:** POLIECO

**Abstract ITA:** La sperimentazione oggetto del contratto di ricerca tra il Consorzio POLIECO e l'IRSA-CNR ha riguardato l'applicazione del sistema innovativo SBBGR (Sequencing Batch Biofilter Granular Reactor), sviluppato dell'IRSA-CNR, per il trattamento delle acque di lavaggio dell'impianto di produzione di granulo rigenerato LDPE della società Recuperi Pugliesi di Modugno (BA), al fine di ridurre il quantitativo di fango prodotto durante il processo di depurazione. Attualmente, tali acque vengono depurate nell'impianto di trattamento di proprietà della Recuperi Pugliesi per poi essere riutilizzate nello stadio di lavaggio.

**Descrizione estesa ITA:** La sperimentazione oggetto del contratto di ricerca tra il Consorzio POLIECO e l'IRSA-CNR ha riguardato l'applicazione del sistema innovativo SBBGR (Sequencing Batch Biofilter Granular Reactor), sviluppato dell'IRSA-CNR, per il trattamento delle acque di lavaggio dell'impianto di produzione di granulo rigenerato LDPE della società Recuperi Pugliesi di Modugno (BA), al fine di ridurre il quantitativo di fango prodotto durante il processo di depurazione. Attualmente, tali acque vengono depurate nell'impianto di trattamento di proprietà della Recuperi Pugliesi per poi essere riutilizzate nello stadio di lavaggio. L'impianto di depurazione è il classico impianto a sedimentazione primaria (avente un volume di 330 m3) seguita da uno stadio biologico a fanghi attivi (avente un volume di 650 m3). I fanghi prodotti nel processo di depurazione vengono estratti dal sedimentatore primario e inviati alla fase di disidratazione ottenuta per centrifugazione. L'impianto di depurazione viene alimentato con circa 8 m3/h di acqua proveniente dallo stadio di lavaggio dell'impianto di produzione di granulo rigenerato LDPE. Nel periodo gennaio-settembre 2019, la produzione di fango si è attestata intorno alle 44 tonnellate di fango al 45,5% di secco al mese. Considerando che l'impianto è operativo 24 ore al giorno, si ricava una produzione specifica di fango di 3,5 kg di secco per m3 di acqua di lavaggio depurata. Tali fanghi sono stati classificati dalla Recuperi Pugliesi con il codice CER 190814 (fanghi prodotti da altri trattamenti delle acque reflue industriali diversi da quelli di cui alla voce 190813). Dal 20/12/2018 al 16/07/2019 (periodo A), un impianto SBBGR bench scale presente nei laboratori IRSA-CNR di Bari è stato alimentato con le acque di lavaggio provenienti dallo stadio di lavaggio dell'impianto di produzione di granulo rigenerato LDPE della Recuperi Pugliesi. Sono stati utilizzati 20 stock differenti di acque di lavaggio per un volume complessivo di 1725 litri. La qualità dell'effluente del SBBGR, valutata in termini di valori dei principali gross parameter, è risultata essere migliore di quella dello stadio biologico del depuratore di Recuperi Pugliesi. Il trattamento delle acque di lavaggio con il sistema SBBGR è risultato essere caratterizzato da una produzione di fango di 0,105 kg di secco per m3 di acqua di lavaggio trattata. Tale valore è 33 volte più basso di quello registrato dall'azienda nello stesso periodo (ossia, 3,5 kg di fango secco per m3 di acqua di lavaggio trattata). Dal 16/07/2019 al 18/09/2019 (periodo B), il trattamento con SBBGR è stato potenziato con ozono al fine di valutare un miglioramento sia della qualità dell'effluente che dei fanghi prodotti. Durante tale periodo, l'impianto è stato alimentato con 6 stock differenti di acque di lavaggio per un volume complessivo di 768 litri. Il trattamento SBBGR potenziato ad ozono è risultato essere caratterizzato da una produzione di fango di 0,28 kg di secco per m3 di acqua di lavaggio trattata (ossia 12,5 volte più bassa di quella dell'impianto di Recuperi Pugliesi). Infine, dal 18/09/2019 al 18/11/2019 (periodo C), l'impianto SBBGR ha funzionato senza l'unità di ossidazione ad ozono. Durante tale

periodo, l'impianto ha operato ad un HRT di 3,1 giorni ed è stato alimentato con 6 stock differenti di acque di lavaggio per un volume complessivo di 366 litri (ossia, 6 litri al giorno). Le prestazioni dell'impianto sono risultate essere davvero eccellenti e addirittura migliori di quelle dei periodi precedenti. La qualità dell'effluente prodotto nel periodo C è risultata essere di gran lunga superiore a quella dell'impianto dell'azienda (in particolare per quanto riguarda i parametri COD e i solidi sospesi). Ciò ha risvolti interessanti sui costi operativi dell'impianto di estrusione in quanto richiede una minore manutenzione del filtro e, allo stesso tempo, una sua meno frequente sostituzione. Il trattamento con SBBGR durante il periodo C è risultato essere caratterizzato da una produzione di fango di 0,20 kg di secco per m3 di acqua di lavaggio trattata. Infine, i fanghi prodotti dal sistema SBBGR, con e senza il potenziamento chimico, sono stati opportunamente caratterizzati considerando più di 100 composti, al fine di ricercare i composti potenzialmente presenti nell'acqua reflua trattata con potenziale trasferimento nei fanghi prodotti nella depurazione. La caratterizzazione eseguita non ha evidenziato la presenza dei suddetti composti oltre i limiti che renderebbero pericolosi i fanghi di cui trattasi. Nei pochi casi in cui è stato possibile determinare un valore di concentrazione questo è risultato essere almeno 2 ordini di grandezza inferiore al limite che avrebbe reso pericoloso il rifiuto. Si può quindi concludere che ai fanghi prodotti dal trattamento biologico mediante SBBGR, con e senza potenziamento chimico, può essere attribuito il codice 190812 di rifiuto non pericoloso.

**Fonte di finanziamento ITA:** Consorzio Polieco

**Coordinatore:** Di Iaconi Claudio (CNR-IRSA)

**Referente IRSA:** Di Iaconi Claudio

**Periodo di attivita:** 08/03/2018 al 10/03/2020

**Titolo: "Completamento delle attività sperimentali e di consulenza tecnico-scientifica volte alla caratterizzazione ecotossicologica dei materiali da scavo durante il proseguimento dello scavo della galleria Santa Lucia della variante di valico dell'autostrada A1 Milano - Napoli, tratto Barberino – Firenze nord, ai sensi dell'art. 32, comma 14, d.lgs 18 aprile 2016", n. 50. Contratto n. 81009491**

**Acronimo:** Santa Lucia 2

**Abstract ITA:** Attività sperimentali e di consulenza tecnico-scientifica al fine di verificare la compatibilità ambientale dei campioni di terreno derivante dallo scavo meccanizzato della Galleria S. Lucia. Ciò è avvenuto seguendo le attività del cantiere di realizzazione della galleria, effettuando le analisi in laboratorio dei campioni di terreno prelevati dalle vasche di deposito temporaneo situate nello stesso, ed elaborando i risultati ottenuti.

**Rilevanza scientifica e risultati ITA:** Pubblicazioni scientifiche: Articoli Rolando L, Rauseo J, Pescatore T, Patrolecco L, Garbini GL, Visca A, Grenni P, Barra Caracciolo A, 2020. Isolation and characterization of a bacteria consortium able to degrade sodium lauryl ether sulphate from a soil

conditioned with foaming agents. Frontiers in Microbiology, section Microbiotechnology 11:1542. DOI: 10.3389/fmicb.2020.01542 Mariani L, Grenni P, Donati E, Rauseo J, Rolando L, Barra Caracciolo A, Patrolecco L, 2020. Toxic response of the bacterium Vibrio fischeri to sodium lauryl ether sulphate residues in excavated soils. Ecotoxicology 29:815–824 DOI: 10.1007/s10646-020-02202-7. Finizio A, Patrolecco L, Grenni P, Galli E, Muzzini VG, Rauseo J, Rizzi C, Barra Caracciolo A, 2020. Environmental risk assessment of the anionic surfactant sodium lauryl ether sulphate in site-specific conditions arising from mechanized tunnelling. Journal of Hazardous Materials 383:121116 Capitoli di libro Grenni P, Barra Caracciolo A, Patrolecco P, 2019. Site-specific protocols for evaluating environmental compatibility of spoil materials produced by EPB-TBM. In: D. Peila, G. Viggiani & T. Celestino (Eds), Tunnels and Underground Cities: Engineering and Innovation meet Archaeology, Architecture and Art. Proceedings of the WTC 2019 ITA-AITES World Tunnel Congress (WTC 2019), May 3-9, 2019, Naples, Italy. Taylor & Francis Group, London, p. 360-366. ISBN 978-1-138-38865-9, DOI: 10.1201/9780429424441 Lacchetti I, Gucci PMB, Grenni P, Patrolecco L, Galli E, Muzzini VG, Donati E, Finizio A, Barra Caracciolo A, 2019. Terreni provenienti da scavi meccanizzati: valutazione della loro ecotossicità. In: Mugnai C., "Giornate di Studio 8° Edizione, Atti delle giornate di studio su: l'Ecotossicologia come strumento di gestione degli ambienti acquatici e terrestri, La ricerca, il controllo da parte delle Agenzie, il mondo dei privati", Atti, Livorno 26-28 Novembre 2018, pp. 56-61. ISPRA, Atti 2019 ISBN 978-88-448-0954-6 http://www.isprambiente.gov.it/files2018/eventi/viii-edizione-giornate-di-studio-201cricerca-e-applicazione-di-metodologie-ecotossicologiche201d/abstracts2018.pdf/view Mariani L, Donati E, Patrolecco L, Rauseo J, Rolando L, Barra Caracciolo A, Grenni P, 2018. Use of the aquatic ecotoxicity test Vibrio fischeri for evaluating residual concentrations of the anionic surfactant sodium lauryl ethyl sulphate in excavated soil elutriates. In: VG Mihucz, MK Egyesülete (Eds.) XVI Hungarian-Italian Symposium on Spectrochemistry, Technological Innovation for water science and sustainable aquatic biodiversity. Budapest, 3-6 October 2018. Abstract Book, p. 22. ISBN 978-963-9970-92-2 Barra Caracciolo A, Grenni P, Galli E, Rauseo J, Ademollo N, Saccà ML, Palumbo MT, Muzzini VG, Donati E, Lacchetti I, Di Giulio A, Gucci PMB, Beccaloni E, Patrolecco L, 2018. Ecotoxicity evaluation of soil conditioned with foaming products by a bioassay battery. In: N Kalogerakis, F Fava, E J Olguin, E Manousaki, Joint Conference 7th European Bioremediation Conference (EBC-VII) and 11th International Society for Environmental Biotechnology conference (ISEB 2018) Chania, Crete, Greece, June 25 to 28, 2018. e-Book of Abstracts, 489-490. Oral presentation. ISBN 978-618-81537-6-9

**Fonte di finanziamento ITA:** Autostrade spa

**Coordinatore:** Paola Grenni

**Referente IRSA:** Paola Grenni

**Periodo di attivita:** 18/02/2020- 30/10/2021

### Titolo: Progetto CNR/Italferr S.p.A Palermo – Catania, Messina, Tratta 1

**Acronimo:** Italferr Caltanissetta Xirbi – Enna - Dittaino

**Abstract ITA:** Studio sperimentale per la verifica dell'impatto ecotossicologico di un terreno trattato con prodotti condizionati, come risultante da scavo meccanizzato con fresa TBM (Tunnel Boring Machine) di tipo EPB (Earth Pressure Balance), nell'ambito della realizzazione della galleria della Direttrice Ferroviaria Palermo – Catania – Messina, nuovo Collegamento Palermo – Catania, tratta Caltanissetta Xirbi – Enna e tratta Enna - Dittaino" –Palermo-Catania. L'attività sperimentale comprende studi sito-specifici per valutare i tempi di degradazione dei principali componenti dei prodotti schiumogeni nel terreno condizionato e l'esecuzione di una batteria di test ecotossicologici in campioni di terreno ed elutriato per selezionare il prodotto commerciale che non abbia impatto sull'ambiente.

**Fonte di finanziamento ITA:** Italferr S.p.A

**Fonte di finanziamento ENG:** Italferr S.p.A

**Coordinatore:** Paola Grenni

**Referente IRSA:** Anna Barra Caracciolo

**Periodo di attivita:** 25/07/19-30/05/2020

### Titolo: Progetto CNR/Italferr Palermo – Catania – Messina, Tratta 2

**Acronimo:** Italferr Fiumetorto – Lercara Dir.

**Abstract ITA:** Studio sperimentale per la verifica dell'impatto ecotossicologico di un terreno trattato con prodotti condizionati, come risultante da scavo meccanizzato con fresa TBM (Tunnel Boring Machine) di tipo EPB (Earth Pressure Balance), nell'ambito della realizzazione della galleria della Direttrice Ferroviaria Palermo – Catania – Messina, nuovo Collegamento Palermo – Catania, tratta Fiumetorto – Lercara Dir.

**Fonte di finanziamento ITA:** Italferr S.p.A

**Fonte di finanziamento ENG:** Italferr S.p.A

**Coordinatore:** Luisa Patrolecco (ISP)

**Referente IRSA:** Paola Grenni, Anna Barra Caracciolo

**Periodo di attivita:** 26/07/19-30/05/2020

### Titolo: Convenzione Fater IRSA CNR

**Acronimo:** BIODOM

**Abstract ITA:** La Convenzione prevede la realizzazione da parte dell'IRSA di un corso di aggiornamento sui principi di base di microbiologia generale e sullo stato dell'arte sui biofilm microbici La Convenzione prevede inoltre l'analisi della composizione microbica tramite sequenziamento Illumina del gene 16S rRNA batterico e l'analisi della carica microbica totale con metodo colturale di campioni di biofilm domestici prelevati e forniti da FATER

**Fonte di finanziamento ITA:** FATER S.p.A.

**Fonte di finanziamento ENG:** FATER S.p.A.

**Altre informazioni ITA:** Euro 15000

**Coordinatore:** Simona Rossetti

**Referente IRSA:** Simona Rossetti- Francesca Di Pippo

**Periodo di attivita:** Giugno 2020- Dicembre 2020

### Titolo: Progetto IRSA-CNR/ITALFERR Orsara – Bovino

**Acronimo:** ITALFERR - Orsara – Bovino

**Abstract ITA:** Studio sperimentale per la verifica dell'impatto ecotossicologico di un terreno trattato con prodotti condizionati, come risultante da scavo meccanizzato con fresa TBM (Tunnel Boring Machine) di tipo EPB (Earth Pressure Balance), nell'ambito della realizzazione della galleria della tratta Orsara – Bovino, rientrante nell'intervento di potenziamento della linea ferroviaria Napoli - Bari.

**Fonte di finanziamento ITA:** Italferr S.p.A

**Fonte di finanziamento ENG:** Italferr S.p.A

**Coordinatore:** Luisa Patrolecco (ISP)

**Referente IRSA:** Paola Grenni, Anna Barra Caracciolo

**Periodo di attivita:** 08/07/18-31/03/21

### Titolo: Progetto IRSA-CNR/ITALFERR Hirpinia – Orsara

**Acronimo:** ITALFERR_Hirpinia - Orsara

**Abstract ITA:** Studio sperimentale per la verifica dell'impatto ecotossicologico di un terreno trattato con prodotti condizionati, come risultante da scavo meccanizzato con fresa TBM (Tunnel Boring Machine) di tipo EPB (Earth Pressure Balance), nell'ambito della realizzazione della galleria della tratta Irpinia - Orsara, rientrante nell'intervento di potenziamento della linea ferroviaria Napoli - Bari. L'attività sperimentale comprende studi sito-specifici per valutare i tempi di degradazione dei principali componenti dei prodotti schiumogeni nel terreno condizionato e l'esecuzione di una batteria di test ecotossicologici in campioni di terreno ed elutriato per selezionare il prodotto commerciale che non abbia impatto sull'ambiente.

**Fonte di finanziamento ITA:** Italferr S.p.A

**Fonte di finanziamento ENG:** Italferr S.p.A

**Coordinatore:** Luisa Patrolecco (ISP)

**Referente IRSA:** Paola Grenni, Anna Barra Caracciolo

**Periodo di attivita:** 21/07/2018-31/03/2021

### Titolo: CONVENZIONE PER L'ESECUZIONE DI ANALISI SPECIALISTICHE tra VERITAS S.p.A. e IRSA CNR

**Acronimo:** VERITAS 2019

**Abstract ITA:** La Convenzione prevede analisi della presenza di oo-cisti di Giardia a Cryptosporidium in cartucce di concentrazione predisposte da Veritas ed inviate a CNR-IRSA. L'analisi è basata sulla eluizione, separazione immunomagnetica e determinazione in epifluorescenza

**Fonte di finanziamento ITA:** VERITAS S.p.A.

**Fonte di finanziamento ENG:** VERITAS S.p.A.

**Coordinatore:** Simona Rossetti

**Referente IRSA:** Simona Rossetti- Caterina Levantesi

**Periodo di attivita:** Settembre 2019- Dicembre 2022

**Titolo: Residui di inquinanti convenzionali ed emergenti nella potabilizzazione sperimentale delle acque affinate da reflui urbani**

**Acronimo:** MITOX

**Abstract ITA:** La convenzione ha per oggetto la sperimentazione in scala dimostrativa, di tre linee di trattamento facilmente integrabili nel contesto depurativo pugliese, finalizzati all'ottenimento di acque qualitativamente comparabili agli standard potabili caratteristici della Regione Puglia. La suddetta sperimentazione ha come influente l'acqua in uscita dall'impianto di affinamento di Fasano Forcatella, condotto da Aquasoil. La sperimentazione sulle tre linee di trattamento dovrà consentire di mettere a confronto l'efficienza delle stesse dal punto di vista tecnologico e dei rispettivi costi, al fine di individuare, tra le alternative esaminate, quella che presenta il miglior rapporto tra prestazioni e costi.

**Descrizione estesa ITA:** Definizione del piano di test per la validazione della tecnologia MITO3X, ai fini di: - Caratterizzare le performance della tecnologia in funzione della matrice testata; - Caratterizzare le performance della tecnologia in funzione di classi di microinquianti con diversa struttura molecolare e proprieta' chimico-fisiche; - Verifica delle prestazioni mediante misurazioni analitiche convenzionali ed avanzate secondo tre pacchetti analitici di riferimento: - Pacchetto 1: Misure convenzionali: caratterizzazione di macro-parametri caratterizzanti la matrice acquosa oggetto di trattamento (pH, TOC, conducibilità, alcalinità, trasmittanza UV, COD, BOD5, azoto ammoniacale, azoto nitrico, azoto nitroso, azoto totale e fosforo totale); - Pacchetto 2: Misure analitiche avanzate: su otto microinquinanti selezionati (due composti per meccanismo di ossidazione avanzata), opportunamente iniettati a monte del sistema MITO3X al fine di caratterizzare le rimozioni specifiche dei vari processi di ossidazione avanzata implementati, ovvero O3/H2O2, UV/H2O2, UV/O3 e O3. - Pacchetto 3: Misure analitiche avanzate di suspect screening su microinquinanti naturalmente presenti e iniettati a monte del sistema MITO3X al fine di caratterizzare le rimozioni specifiche dei vari processi di ossidazione avanzata implementati, ovvero O3/H2O2, UV/H2O2, UV/O3 e O3.

**Fonte di finanziamento ITA:** Aquasoil s.r.l.

**Altre informazioni ITA:** Partner del progetto: Aquasoil s.r.l. Università degli Studi di Bari Aldo Moro, Dipartimento di Scienze Biomediche e Oncologia Umana (DIMO) CNR-IRSA Importo del finanziamento al CNR-IRSA: € 60.000,00

**Coordinatore:** Giuseppe Mascolo

**Referente IRSA:** Sapia Murgolo

**Periodo di attivita:** 01/12/2020 31/12-2020

### Titolo: Progetto CNR/Italferr Palermo – Catania – Messina, Tratta 3

**Acronimo:** Italferr Fiumetorto – Lercara Dir.-Caltanisetta Xirbi

**Abstract ITA:** Progetto CNR/Italferr S.p.A riguardante loS tudio sperimentale per la verifica dell'impatto ecotossicologico di un terreno trattato con prodotti condizionati, come risultante da scavo meccanizzato con fresa TBM (Tunnel Boring Machine) di tipo EPB (Earth Pressure Balance), nell'ambito della realizzazione della galleria della Direttrice Ferroviaria Palermo – Catania – Messina, nuovo Collegamento Palermo – Catania, tratta Lercara Dir.- Caltanissetta Xirbi. L'attività sperimentale comprende studi sito-specifici per valutare i tempi di degradazione dei principali componenti dei prodotti schiumogeni nel terreno condizionato e l'esecuzione di una batteria di test ecotossicologici in campioni di terreno ed elutriato per selezionare il prodotto commerciale che non abbia impatto sull'ambiente.

**Fonte di finanziamento ITA:** Italferr S.p.A

**Fonte di finanziamento ENG:** Italferr S.p.A

**Coordinatore:** Barra Caracciolo Anna

**Referente IRSA:** Paola Grenni

**Periodo di attivita:** 26/07/19-30/05/2020

### Titolo: Contratto CNR/Sinergo Spa

**Acronimo:** Metro Napoli

**Abstract ITA:** Studio sperimentale per la verifica dell'impatto ambientale di terreni condizionati con prodotti schiumogeni nell'ambito della realizzazione delle gallerie di linea tratta Poggioreale-Capodichino della metro di Napoli. Lo studio prevede: 1. la valutazione teorica del Rischio ambientale di tre prodotti commerciali considerando due terreni rappresentativi dello scavo e differenti dosaggi (L/m3) di ciascun schiumogeno per ciascun terreno; 2. un pre-screening eco-tossicologico dei 3 prodotti schiumogeni tal quali utilizzando un organismo test sensibile ai prodotti stessi, in grado di fornire una scala relativa della loro ecotossicità; 3. una selezione del prodotto commerciale avente le caratteristiche intrinseche meno impattanti per l'ambiente e su cui effettuare i successivi studi sito-specifici con i terreni reali provenienti dal sito di scavo (studi di degradazione e batteria di test ecotossicologici) .

**Fonte di finanziamento ITA:** Sinergo S.p.A.

**Fonte di finanziamento ENG:** Sinergo S.p.A.

**Coordinatore:** Barra Caracciolo Anna

**Referente IRSA:** Paola Grenni

**Periodo di attivita:** 09/10/2019 -30/01/2020

### Titolo: Produzione di Acido Furan Dicarbossilico (FDCA) da scarti agroindustriali

**Acronimo:** CISA-FDCA

**Abstract ITA:** Finalità del progetto: I principali obiettivi del presente progetto possono essere così elencati: 1. Ottimizzazione del processo di sintesi dell'HMF e verifica della riciclabilità e riutilizzabilità dei reattivi. 2. Applicazione diretta di diversi scarti/rifiuti previamente analizzati per verificare la convertibilità della loro frazione zuccherina: fondi caffè, residui lattiero-caseari grezzi ed eventuali altri condivisi e forniti da CISA. 3. Preparazione dell'acido furandicarbossilico (FDCA) da HMF tal quale e formilato, isolato ed in soluzione. Il conseguimento di tali obiettivi e l'ottimizzazione di processi sostenibili di ottenimento dell'FDCA da scarti agro-industriali/alimentari, via HMF, consentirebbe la realizzazione di una bioraffineria unica nel suo genere, alimentata da biomasse di scarto per la produzione di PEF, materiale plastico bioderivato candidato a sostituire il PET (di origine fossile).

**Fonte di finanziamento ITA:** CISA S.p.A.

**Fonte di finanziamento ENG:** CISA S.p.A.

**Coordinatore:** Carlo Pastore

**Referente IRSA:** Carlo Pastore

**Periodo di attivita:** 15/10/2019; 15/03/2021

### Titolo: Uppark! Strategie di rete per il parco Terre delle Gravine

**Acronimo:** Uppark

**Abstract ITA:** Il progetto prevede una serie di attività molto diversificate fra loro per il contrasto dei principali rischi ambientali rilevati (incendi, discariche abusive, contaminazioni). Sono previste

azioni sia di monitoraggio ambientale, finalizzato a quantificare il livello di contaminazioni ambientali e a preservare la biodiversità, che di monitoraggio territoriale, svolto da detenuti sottoposti a misure alternative e volontari della protezione civile, per sorvegliare il parco e intervenire celermente in caso di incendi o altro tipo di emergenze e per mappare nuovi sentieri. Sono, inoltre, previste attività di educazione ambientale destinate alle scuole del territorio (elementari, medie e superiori); laboratori di riciclo creativo realizzati da donne detenute; il recupero di una masseria che diventerà un centro visite da utilizzare nel corso del progetto come luogo per incontri, eventi, convegni; la stesura di accordi per la gestione del parco con i Comuni dell'area; la protezione partecipata con il coinvolgimento dei cittadini.

**Abstract ENG:** The project envisages a series of very diversified activities to combat the main environmental risks detected (fires, illegal landfills, contamination). Actions are envisaged for both environmental monitoring, aimed at quantifying the level of environmental contamination and preserving biodiversity, and territorial monitoring, carried out by inmates subjected to alternative and voluntary civil protection measures, to monitor the park and intervene quickly in the event of fires. or other type of emergencies and to map new paths. Furthermore, environmental education activities are planned for local schools (elementary, middle and high schools); creative recycling workshops made by women inmates; the recovery of a farm that will become a visitor center to be used during the project as a place for meetings, events, conferences; the drafting of agreements for the management of the park with the municipalities of the area; participatory protection with the involvement of citizens.

**Fonte di finanziamento ITA:** Fondazione con il Sud

**Fonte di finanziamento ENG:** Fondazione con il Sud

**Coordinatore:** Gianni Grassi WWF Trulli e Gravine, Martina Franca - Taranto

**Referente IRSA:** Antonella, Magda Di Leo

**Periodo di attivita:** 2016-2019

## Titolo: Studio quali-quantitativo del bacino del Cillarese: regimi idrologici, effetti dei principali carichi antropici e industriali sulla qualità del lago e possibili azioni di mitigazione degli impatti.

**Acronimo:** Cillarese

**Abstract ITA:** Obiettivo del progetto è la caratterizzazione degli impatti dell'attività di produzione di un grosso impianto di trasformazione e inscatolamento di pomodori da conserva, sito in Mesagne (Br), avente come recapito un corso d'acqua non significativo, a sua volta recapitante in un piccolo invaso artificiale (Invaso del Cillarese). Il programma di campionamento e i relativi risultati, unitamente alle analisi idrologiche effettuate, hanno permesso di sviluppare un modello matematico

del bilancio idrico dell'invaso in grado di tenere conto anche della salinità e del carico di nutrienti dei diversi flussi idrici entranti ed uscenti dall'invaso stesso.

**Abstract ENG:** The aim of the project is to characterize the impacts of the production activity of a large plant for tomatoes processing and canning , located in Mesagne (Br), having as its receiving water body an minor watercourse, which in turn feeds into a small artificial reservoir (Invaso del Cillarese). The sampling program and the related results, together with the hydrological analyzes carried out, allowed the development of a mathematical model of the water balance of the reservoir capable of also taking into account the salinity and nutrient loads of the various water flows entering and exiting the reservoir.

**Fonte di finanziamento ITA:** Conserve Italia Soc. coop. agricola

**Coordinatore:** Ivan Portoghese, Alfieri Pollice

**Referente IRSA:** Ivan Portoghese, Alfieri Pollice

**Periodo di attivita:** 01/11/2019 - 15/02/2021

### Titolo: Zerosludge

**Acronimo:** Zerosludge

**Abstract ITA:** Newlisi intende migliorare e ottimizzare il processo di idrolisi chimica del fango di depurazione, con particolare riferimento al Brevetto sia in termini di resa del processo e costi, sia in termini di impatto del medesimo sulle correnti in uscita, in particolare sulla loro biodegradabilità e concentrazione di fosforo. Tramite questo rapporto di collaborazione si intende sviluppare ed ottimizzare il trattamento anaerobico del prodotto di idrolisi, al fine di recuperare energia e abbattere un'ulteriore frazione di solidi.

**Abstract ENG:** Aim of this project is the improvement and optimization of the thermo-chemical hydrolysis pateted by Newlisi, in terms of process yield, costs, but also impact on the output streams, in particular biodegradability and phosphorus concentration. The anaerobic treatment of the hydrolysis product in order to recover energy and remove an additonal fraction of solids will be optimized.

**Descrizione estesa ITA:** Nell'ambito della Convenzione il team dell'IRSA-CNR ha collaborato attivamente con il dott. Acebes di Newlisi in attività mirate alla: 1. Messa a punto ed ottimizzazione del processo ossidativo di idrolisi chimica con sola fase alcalina (denominata Newlisi Light) al fine di massimizzare la riduzione dei fanghi, ridurre i costi e produrre un eluato ricco di sostanza organica con elevato potenziale metanigeno.; 2) Caratterizzazione e valutazione della frazione biodegradabile ed inerte di COD del centrato post-digestione e dell'eluato mediante prove

respirometriche; 3) studio dell'applicabilità del processo Newlisi, ed eventuali modifiche operative, per il recupero del fosforo

**Rilevanza scientifica e risultati ITA:** Nell'ambito della Convenzione il team dell'IRSA-CNR ha collaborato attivamente con il dott. Acebes di Newlisi in attività mirate alla: 1. Messa a punto ed ottimizzazione del processo ossidativo di idrolisi chimica con sola fase alcalina (denominata Newlisi Light) al fine di massimizzare la riduzione dei fanghi, ridurre i costi e produrre un eluato ricco di sostanza organica con elevato potenziale metanigeno.; 2) Caratterizzazione e valutazione della frazione biodegradabile ed inerte di COD del centrato post-digestione e dell'eluato mediante prove respirometriche; 3) studio dell'applicabilità del processo Newlisi, ed eventuali modifiche operative, per il recupero del fosforo.

**Fonte di finanziamento ITA:** Newlisi S.p.A.

**Altre informazioni ITA:** E' stata presentata domanda di brevetto n. 102020000016144, presentata in data 03/07/2020 con Titolo: "Processo per la produzione di biogas tramite digestione anaerobica di fanghi di depurazione pretrattati tramite idrolisi ossidativa termo-alcalina" Inventore/i designato/i: ACEBES Lorenzo; FIORIN David; GIANICO Andrea; GALLIPOLI Agata

**Coordinatore:** Camilla Braguglia

**Referente IRSA:** Andrea Gianico

**Periodo di attivita:** 27/07/2019-27/12/2020

### Titolo: La gestione dei RIfiuti attraverso tecniche INNOVAtive

**Acronimo:** RINNOVA

**Abstract ITA:** Realizzazione del Piano formativo per la gestione dei rifiuti attraverso la: Predisposizione di strumenti di valutazione e di gradimento dell'attività formativa rivolta ai partecipanti; Stesura di un rapporto di valutazione e monitoraggio del Piano Formativo teso alla verifica dei risultati raggiunti.

**Abstract ENG:** Implementation of the training plan for waste management through: Preparation of tools for evaluating and satisfying the training activity aimed at participants; Drafting of an evaluation and monitoring report of the Training Plan aimed at verifying the results achieved.

**Fonte di finanziamento ITA:** Formedil Cpt Taranto

**Fonte di finanziamento ENG:** Formedil Cpt Taranto

**Coordinatore:** Francesco Pasanisi Direttore Formedil CPT Taranto

**Referente IRSA:** Antonella Magda Di Leo, Santina Giandomenico

**Periodo di attivita:** giugno 2018 - settembre 2019

# Terza missione

## Organizzazione congressi e convegni

### Titolo: HUB TECNOLOGICA CAMPANIA

**Referente IRSA:** Vito Felice Uricchio

**Periodo di attivita:** 4/2/2020-30/9/2020

### Titolo: REMTECH EXPO DIGITAL EDITION 2020

**Website:** https://remtech.meeters.space/

**Referente IRSA:** Vito Felice Uricchio

**Periodo di attivita:** 21/9/2020- 25/9/2020

### Titolo: Congresso SIMP-SGI-SOGEI 2019, organizzazione della sessione [S24] Geology-hydrogeology of karst environments and modeling of preferential flow in variably saturated fractures

**Website:** http://parma2019.socminpet.it/

**Referente IRSA:** Caputo Maria Clementina

**Periodo di attivita:** 16/09/2019-19/09/2019

### Titolo: Climate Change Impacts on Water Resources Management in EU and China

**Website:** https://cewp.eu/

**Referente IRSA:** Antonio Lo Porto

**Periodo di attivita:** 09/11/2019

**Titolo: Chair Session: Ecosystem health and chemical mixture risk assessment and management - In: Round Table "Towards Lecce 2021" for the Ecology day, 14 September 2021**

**Website:** https://www.congresso.ecologia.it/it/round-tables/ecosystem-health-and-chemical-mixture-risk-assessment-and-management/

**Referente IRSA:** Anna Barra Caracciolo

**Periodo di attivita:** 14/06/2020 al 14/09/2020

**Titolo: Chair Session Bioremediation and Phytoremediation of contaminated ecosystems, 30th SETAC Europe Annual Meeting, 5 Maggio 2020.**

**Website:** https://dublin.setac.org/programme/scientific-programme/scope-tracks/

**Referente IRSA:** Anna Barra Caracciolo

**Periodo di attivita:** 05/08/2019-05/05/2020

**Titolo: Chair Session Innovations in Biological Strategies for remediation of contaminated environments, 29th SETAC Europe Annual Meeting, 27 Maggio 2019**

**Website:** http://helsinki.setac.org/programme/scientific-programme/trackssessions/

**Referente IRSA:** Anna Barra Caracciolo

**Periodo di attivita:** 05/08/2018-27/05/2019

**Titolo: Workshop finale del progetto INTEGRON: Verso un approccio condiviso per la gestione integrata di acque e suolo in Lombardia**

**Website:** https://www.mi.cnr.it/news-menu/274-workshop-finale-del-progetto-integron-2019

**Referente IRSA:** Raffaella Balestrini

**Periodo di attivita:** Milano, 19 marzo 2019

**Titolo: Workshop "Applicazioni delle biotecnologie al plancton marino: obiettivi raggiunti e nuove sfide per la Blue Growth"**

**Website:** https://www.sibm.it/public/document-files/SIBM-WORKSHOP-APPLICAZIONI-DELLE-BIOTECNOLOGIE-AL-PLANCTON-MARINO-OBIETTIVI-RAGGIUNTI-E-NUOVE-SFIDE-PER-LA-BLUE-GROWTH.pdf

**Referente IRSA:** Caroppo Carmela

**Periodo di attivita:** 01/10/2019 - 21/02/2020

**Titolo: 1° FOCUS MEETING: SISTEMA IMTA, MIGLIORAMENTO DELLA SOSTENIBILITA' AMBIENTALE E ORGANISMI BIORISANATORI PRESENTAZIONE DEL PROGETTO REMEDIALIFE LIFE16 ENV/IT/000343 – REMEDIA Life Remediation of Marine Environment and Development of Innovative Aquaculture: exploitation of Edible / not Edible biomass**

**Referente IRSA:** Loredana Stabili

**Periodo di attivita:** 6 febbraio 2019

**Titolo: Focus meeting relativo al progetto REMEDIAlife dal titolo: Update on the advances and results of the Project. Fine del Meeting è stato quello di presentare i risultati del progetto REMEDIA Life relativi alla gestione degli ambienti che ospitano impianti di maricoltura e allo sfruttamento ecocompatibile delle biomasse ottenute come sottoprodotto del biorisanamento ambientale alla comunità scientifica internazionale**

**Referente IRSA:** Loredana Stabili

**Periodo di attivita:** 08/10/2020

**Titolo: VALUTAZIONE DEGLI EFFETTI COMBINATI DELLE MISCELE DI SOSTANZE CHIMICHE, Digital Workshop, 25 Giugno 2020**

**Website:** https://www.minambiente.it/pagina/digital-workshop-valutazione-degli-effetti-combinati-delle-miscele-di-sostanze-chimiche-25

**Referente IRSA:** Paola Grenni

**Periodo di attivita:** 25/06/2020

**Titolo: XVII Italian-Hungarian Symposium on Spectrochemistry "Current approaches in health and environmental protection". Turin (Italy), 14-18 June 2021**

**Website:** https://www.ihss2020.unito.it/it

**Referente IRSA:** Paola Grenni

**Periodo di attivita:** 25/09/2020-in corso

## Contributi ad eventi internazionali

**Titolo: Workshop Macroecology and microbial biogeography, CUSO, Neuchatel, Switzerland**

**Website:** https://biologie.cuso.ch/index.php?id=1456&L=0&tx_displaycontroller[showUid]=5215

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 08/01/2020 - 10/01/2020

**Organizzatore:** University of Neuchatel, Switzerland

**Titolo: Workshop An integrated approach to marine invertebrate biodiversity: evolutionary and functional adaptations, Chioggia, Venice, Italy**

**Website:** http://www.uzionlus.it/news/252-2-international-training-school-an-integrated-approach-to-marine-invertebrate-biodiversity-evolutionary-and-functional-adaptations.html

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 09/09/2019 - 13/09/2019

**Organizzatore:** COST Action Maristem

**Titolo: Workshop Exploring the marine meiofauna of the Azores, Ponta Delgada, Portugal**

**Website:** https://en.syszoo.bio.lmu.de/news/meiofauna_summerschool_2019/downloads/application.pdf

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 19/07/2019 - 25/07/2019

**Organizzatore:** University of Azores, Portugal

**Titolo: Purification of Phycocyanin using membrane chromatography**

**Website:** https://algaeworkshops.org/phycocyanin-from-algae/

**Referente IRSA:** Rosaria Lauceri

**Periodo di attivita:** 04/09/2020

**Organizzatore:** EABA - European Algae Biomass Association

### Titolo: Joint 27th ICP IM and 35th ICP Waters Task Force Meeting, Helsinki, Finland

**Website:** http://www.icp-waters.no/icp-waters-task-force-meetings/

**Referente IRSA:** Michela Rogora

**Periodo di attivita:** 04/06/2019-06/06/2019

**Organizzatore:** ICP Waters

### Titolo: 32nd Task Force meeting of ICP Waters (held on-line)

**Website:** http://www.icp-waters.no/icp-waters-task-force-meetings/

**Referente IRSA:** Michela Rogora

**Periodo di attivita:** 11/05/2020-12/05/2020

**Organizzatore:** ICP Waters

### Titolo: Program Chair - 2019 International SWAT Conference - Vienna, Austria

**Website:** https://swat.tamu.edu/conferences/2019-vienna/

**Referente IRSA:** Antonio Lo Porto

**Periodo di attivita:** 14/07/2019 - 19/07/2019

**Organizzatore:** USDA ARS - Texas A&M University

**Titolo: Management Committee substitute member, COST Action DNAquanet**

**Website:** https://dnaqua.net/

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 2016 - oggi

**Organizzatore:** University of Duisburg-Essen, Germany

**Titolo: EurAqua 25th Anniversary Event, Brussels - Aquatic Research and Social Sciences: EurAqua Group in Action on Ecosystem Services and Natural Capital**

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 11/06/2019

**Organizzatore:** EurAqua, Brussels

**Titolo: Scientific Committee of 29th and 30th SETAC (Society of Environmental Toxicology and Chemistry) Europe Annual Meeting 2020**

**Website:** https://dublin.setac.org/general-info/programme-committee/

**Referente IRSA:** Anna Barra Caracciolo

**Periodo di attivita:** 26-27/05/2019, 07/05/2020

**Organizzatore:** SETAC Europe

**Titolo: Co-Chair Session "La gestione delle terre e rocce da scavo" al World Tunnel Congress (WTC) 6 maggio, Napoli 2019**

**Website:** http://www.wtc2019.com/conference/program

**Referente IRSA:** Anna Barra Caracciolo

**Periodo di attivita:** 06/04/2019-06/05/2020

**Organizzatore:** Società Italiana Gallerie (SIC)

**Titolo: Groundwater-dependent ecosystems in agro-environments of the Po valley (Italy): their role in the nitrogen cycling.**

**Website:** http://riversociety.org/isrs-conference/2019-vienna-austria/

**Referente IRSA:** Raffaella Balestrini

**Periodo di attivita:** Vienna 9-13 settembre 2019

**Organizzatore:** International Society for River Science (ISRS)

**Titolo: Human Health and Water in a Changing Environment Developing a European Response to Pandemics (including Covid 19)**

**Website:**
https://www.euraqua.org/news/publicnews/euraquawebinarhumanhealthandwaterinachanginge nvironmentdevelopingaeuropeanresponsetopandemicsincludingcovid19.5.7342a03f17582337c284 fae.html

**Referente IRSA:** Fabrizio Stefani

**Periodo di attivita:** 07/12/2020

**Organizzatore:** EurAqua

**Titolo: European Climate Pact Ambassador**

**Website:** https://europa.eu/climate-pact/ambassadors/meet-our-ambassadors_en

**Referente IRSA:** Gianni Tartari

**Periodo di attivita:** 12/2020-12/2021

**Organizzatore:** European Commission - European Climate Pact Team

**Titolo: Invited expert at the I Expert Consultation on the "Use of Bio-climatic Indices to Assess Drought ad Climate Change in Semi-arid Irrigated Agricultural Areas", Fortaleza, Ceará State, Brazil,**

**Referente IRSA:** Giuseppe Passarella

**Periodo di attivita:** 30/10/2019 - 01/11/2019

**Organizzatore:** dr. Sílvio Carlos Ribeiro Vieira Lima of the Organizing Committee of INOVAGRI International Meeting.

**Titolo: Invited Expert at the II Expert Consultation on the "Use of Bio-climatic Indices to Assess Drought ad Climate Change in Semi-arid Irrigated Agricultural Areas" held at the UC Oakville Research and Extension Center in the Napa Valley, CA, USA**

**Referente IRSA:** Giuseppe Passarella

**Periodo di attivita:** 05/03/2020 - 06/03/2020

**Organizzatore:** dr. D. Zaccaria of the University of California, Davis convener of the International Expert Consultation.

**Titolo: Invited speaker at the V INOVAGRI International Meeting, the XXVIII National Congress of Irrigation and Drainage and the Latin American Salinity Symposium, Fortaleza, Ceará State, Brazil.**

**Website:** https://inovagri.org.br/en/sobre-o-meeting/

**Referente IRSA:** Giuseppe Passarella

**Periodo di attivita:** 30/10/2019 - 01/11/2019

**Organizzatore:** dr. Sílvio Carlos Ribeiro Vieira Lima of the Organizing Committee of INOVAGRI International Meeting.

**Titolo: Invited speaker at the INOVAGRI MEETING VIRTUAL 2020, the XXIX National Congress on Irrigation and Drainage and the IV BRAZILIAN SALINITY SYMPOSIUM, held in Fortaleza, Ceará State, Brazil.**

**Website:** https://inovagri.org.br/en/inovagri-meeting-virtual/

**Referente IRSA:** Giuseppe Passarella

**Periodo di attivita:** 07/12/2020 - 11/12/2020

**Organizzatore:** dr. Sílvio Carlos Ribeiro Vieira Lima of the Organizing Committee of INOVAGRI International Meeting.

**Titolo: DIGITALYinINDIA INNOVATION FORUM 2020**

**Referente IRSA:** Giuseppe Mascolo

**Periodo di attivita:** 23/06/2020

**Organizzatore:** Embassy of Italy, New Delhi, India

**Titolo: Assessing in-situ performance of sensors for automatic high frequency monitoring of algal pigments in Lake Maggiore (Italy)**

**Website:** https://gleon.org/meetings/gleon21.5/main

**Referente IRSA:** Michela Rogora

**Periodo di attivita:** 19/10/2020-22/10/2020

**Organizzatore:** GLEON 21.5 Virtual Meeting

**Titolo: QA/QC procedures for the development of a High Frequency Monitoring (HFM) system for Lake Maggiore, Italy**

**Website:** https://gleon.org/meetings/gleon21.5/main

**Referente IRSA:** Michela Rogora

**Periodo di attivita:** 19/10/2020-22/10/2020

**Organizzatore:** GLEON 21.5 Virtual Meeting

**Titolo: 3-ROUTES PLATFORM FOR RECOVERY OF HIGH VALUE PRODUCTS, ENERGY AND BIO-FERTILIZER FROM URBAN BIOWASTE: THE REVENUE PROJECT**

**Referente IRSA:** Camilla Braguglia

**Periodo di attivita:** 18/11/2020-20/11/2020

**Organizzatore:** / 5TH SYMPOSIUM ON URBAN MINING AND CIRCULAR ECONOMY

## Contributi ad eventi nazionali

**Titolo: Purificazione rapida delle ficobiliproteine**

**Website:** https://www.knowledge-share.eu/evento/techshare-day-2019-polito-unito/

**Referente IRSA:** Rosaria Lauceri

**Periodo di attivita:** 25/06/2019

**Organizzatore:** Politecnico di Torino -Università degli Studi di Torino

**Titolo: A simple method for rapid purification of phycobiliproteins based on membrane chromatography**

**Website:** https://www.aisam-microalghe.it/it/aisam2020.html

**Referente IRSA:** Rosaria Lauceri

**Periodo di attivita:** 07/09/2020

**Organizzatore:** Associazione Italiana per lo Studio e le Applicazioni delle Microalghe

**Titolo: Laboratorio: I laghi, tesori di biodiversità: conosci lo zooplancton. SALONE INTERNAZIONALE DEL LIBRO. Torino. Le vie dell'acqua: le microplastiche**

**Referente IRSA:** Roberta Piscia

**Periodo di attivita:** 09/05/2019

**Organizzatore:** CNR-Edizioni

**Titolo: Long-term limnological research in the subalpine lake district: An Italian-Swiss collaboration extending the Italian LTER network. Poster presentato al XXIV Congresso AIOL - Bologna– 5-7 giugno, 2019**

**Referente IRSA:** Ciampittiello Marzia, Piscia Roberta, Rogora Michela

**Periodo di attivita:** 05/06/2019-07/06/2019

**Organizzatore:** Associazione Italiana di Limnologia e Oceanografia

**Titolo: Evento Interreg SIMILE - Il progetto PARCHIVERBANOTICINO Il Lago Maggiore, il Fiume Ticino sublacuale e le aree naturali protette. Verifica e sperimentazione di scenari di gestione sostenibili e condivisi**

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 04/12/2019

**Organizzatore:** CNR-IRSA sede di Verbania

**Titolo: Concezioni passate e sfide future nello studio della biodiversità delle acque dolci**

**Website:** http://www.successionecologica.it/biodiv/biodiv19.php

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 23-24/09/2019

**Organizzatore:** Successione Ecologica, APS

**Titolo: "Workshop sul Deflusso Ecologico", Catanzaro. "Stato ecologico come elemento chiave per la definizione dei Deflussi Ecologici in area mediterranea"**

**Referente IRSA:** Andrea Stefano Buffagni

**Periodo di attivita:** 29/11/2019

**Organizzatore:** Autorità di Bacino Distrettuale dell'Appennino Meridionale.

**Titolo: Mettiamoci in RIGA - Linea d'intervento LQS - Piattaforma delle Conoscenze - Capitalizzazione delle esperienze e disseminazione dei risultati per la replicabilità di buone pratiche per l'ambiente e il clima". Seminario "pluriregionale" Buone pratiche per le Regioni Emilia-Romagna, Marche, Lombardia e la Provincia Autonoma di Bolzano. "INHABIT - Idromorfologia locale, habitat e Piani di Gestione: nuove misure per migliorare la qualità ecologica in fiumi e laghi sud europei"**

**Referente IRSA:** Andrea Stefano Buffagni

**Periodo di attivita:** 18/10/2019

**Organizzatore:** Ministero dell'Ambiente e della Tutela del Territorio e del Mare MATTM (DG SVI/AT)

**Titolo: Mettiamoci in RIGA - Linea d'intervento LQS - Piattaforma delle Conoscenze - Capitalizzazione delle esperienze e disseminazione dei risultati per la replicabilità di buone pratiche per l'ambiente e il clima". Seminario "pluriregionale" Buone pratiche per le Regioni Basilicata, Calabria, Campania, Puglia e Sicilia. "INHABIT - Idromorfologia locale, habitat e Piani di Gestione: nuove misure per migliorare la qualità ecologica in fiumi e laghi sud europei"**

**Referente IRSA:** Andrea Stefano Buffagni

**Periodo di attivita:** 15/12/2020

**Organizzatore:** Ministero dell'Ambiente e della Tutela del Territorio e del Mare MATTM (DG SVI/AT)

**Titolo: Salvaguardia idraulica e tutela ambientale - Insieme per la gestione del territorio. "I corpi idrici fortemente modificati nel Bacino scolante in Laguna di Venezia: miglioramento degli habitat e gestione sostenibile della vegetazione come chiave per il miglioramento dello Stato Ecologico"**

**Referente IRSA:** Andrea Stefano Buffagni

**Periodo di attivita:** 02/10/2020

**Organizzatore:** Consorzio di Bonifica Acque Risorgive, Venezia

**Titolo: Tutti i nitrati vengono a galla: i fontanili interfaccia tra acque superficiali e sotterranee**

**Referente IRSA:** Raffaella Balestrini

**Periodo di attivita:** 19 marzo 2019

**Organizzatore:** Università di Pavia, Università di Parma, IRSA-CNR

### Titolo: SARS-CoV-2 nel ciclo delle acque

**Website:** https://c42ab587-a-29c209db-s-sites.googlegroups.com/a/unifg.it/soc-chim-it-puglia/attivita-news/Covid%20Acque.png?attachauth=ANoY7coDxs4Ael88DR17VvIx42EoN-G0jbOwfDa6OZD_kB1MnCx_UOtWkwpbN2agyT2BhDOu3z4ZnRem_NRZbz8TJh9MY7MswYYJMJ1Cys1v5-CKUS1z9svJ_rG3thucYNFDLDq_Nc-GZIhR8JQfasZZqCAOcFKnxHvFxWHJH7AhNUFh6Xbgcpy7WGMbjBL9fsboPbaz9z6gpMF_kSV5y0N1iwK1ZxuZ1w_CR06omw5a4s4LfHBfgww%3D&attredirects=0

**Referente IRSA:** Fabrizio Stefani

**Periodo di attivita:** 18/06/2020

**Organizzatore:** Società Chimica Italiana, Puglia

### Titolo: LE ˝PIENE˝ DEL LAGO MAGGIORE Uno sguardo alla storia, preoccupazioni per il presente e il futuro – 9 novembre 2019

**Referente IRSA:** Marzia Ciampittiello

**Periodo di attivita:** 9 novembre 2019

**Organizzatore:** Il Circolo del Pallanzotto

### Titolo: Evento Notte Europea dei Ricercatori 2019

**Referente IRSA:** Domenica Mosca Angelucci

**Periodo di attivita:** 01/09/2019-27/09/2019

**Organizzatore:** CNR - MLIB

### Titolo: European Researcher Night 2020

**Website:** https://www.scienzainsieme.it/tour-virtuali/

**Referente IRSA:** Domenica Mosca Angelucci

**Periodo di attivita:** 01/09/2020-27/11/2020

**Organizzatore:** CNR - Scienza insieme Net Project

### Titolo: Notte Europea dei Ricercatori-Monza

**Website:** https://bnews.unimib.it/blog/la-scienza-che-piace-ai-milanesi-settembre-torna-meetmetonight

**Referente IRSA:** Stefano Polesello

**Periodo di attivita:** 28/09/2018 e 27/09/2019

**Organizzatore:** MEETmeTONIGHT 2018 - Università degli Studi di Milano - Bicocca

### Titolo: Acque e Innovazione: SFIDE E OPPORTUNITÀ PER IL TRATTAMENTO DELLE ACQUE

**Website:** https://www.consorzioproambiente.it/it/news/165-convegno-15-aprile-2019-sfide-e-opportunita-per-il-trattamento-delle-acque

**Referente IRSA:** Giuseppe Mascolo

**Periodo di attivita:** 15/04/2019

**Organizzatore:** Iniziativa promossa dalla EU Cluster Week 2018-2019, Evento patrocinato dalla Regione Emilia-Romagna e H2O

### Titolo: Water Day

**Website:** https://apps.unimi.it/web/eventi/resources/external/uploaded/4187_643.jpg

**Referente IRSA:** Giuseppe Mascolo, Vito Uricchio

**Periodo di attivita:** 18/12/2019

**Organizzatore:** Società Italiana di Medicina Ambientale, Università di Milano

## Partecipazione a commissioni, gruppi di lavoro, editorial board

### Titolo: Guest Editor - Water- Special Issue "Aquaculture: Balance among Environmental Impact, Sustainability, Safety and Nutritious Seafood"

**Website:** https://www.mdpi.com/journal/water/special_issues/Aquaculture_Seafood

**Referente IRSA:** Ermelinda PRATO

**Periodo di attivita:** 15/03/2020 al 30/11/2020

**Organizzatore:** WATER -MDPI

### Titolo: Editor in Chief - Journal of Limnology

**Website:** https://www.jlimnol.it/index.php/jlimnol

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 00/00/2016 - in attivita'

**Organizzatore:** PagePress

### Titolo: Editor in Chief - Biogeographia

**Website:** https://escholarship.org/uc/biogeographia

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 00/00/2015 - in attivita'

**Organizzatore:** eScholarship

### Titolo: Associate Editor in Chief - Hydrobiologia

**Website:** https://www.springer.com/journal/10750

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 00/00/2015 - in attivita'

**Organizzatore:** Springer

### Titolo: Associate editor - Diversity

**Website:** https://www.mdpi.com/journal/diversity

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 00/00/2020 - in attivita'

**Organizzatore:** MDPI

### Titolo: Guest Editor - Hydrobiologia 847(7): Emerging Trends in Aquatic Ecology III.

**Website:** https://link.springer.com/journal/10750/volumes-and-issues/847-7

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 2020

**Organizzatore:** Springer

### Titolo: Guest Editor - Hydrobiologia 844: Crossing Disciplinary Borders in Rotifer Research.

**Website:** https://link.springer.com/journal/10750/volumes-and-issues/844-1

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 2019

**Organizzatore:** Springer

**Titolo: Collegio di dottorato in "Scienze della Vita, Salute e Biotecnologie" of the University of Urbino**

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 2015 - 2019

**Organizzatore:** Università di Urbino

**Titolo: Commissione di dottorato: Clustering for the identification of high taxonomic level for metabarcoding (dottorando: Mohamed Anwar Abouabdallah)**

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 01/12/2020

**Organizzatore:** University of Bordeaux, Bordeaux, France

**Titolo: Commissione di dottorato: Exploring the diversity of a neglected group of soil invertebrates (Chilopoda) across the South-Eastern Prealps (dottorando: Emiliano Peretti)**

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 16/03/2020

**Organizzatore:** University of Padova

**Titolo: Commissione di dottorato: From individuals to groups and back: interactions between individual variation in behaviour and group performances in House Sparrow (dottorando: Beniamino Tuliozi)**

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 16/03/2020

**Organizzatore:** University of Padova

**Titolo: Commissione di dottorato: Exploration and characterization of Amoebozoa diversity and investigation of their diversity patterns at regional and global scales (dottorando: Quentin Blandenier)**

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 12/03/2020

**Organizzatore:** University of Neuchatel, Switzerland

**Titolo: Commissione di dottorato: Adaptive genetic variation and responses to thermal stress in brachionid rotifers (Sofia Paraskevopoulou)**

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 18/10/2019

**Organizzatore:** Potsdam University, Germany

**Titolo: Commissione di dottorato: From pond metacommunities to life in a droplet causes and consequences of movement in zooplankton (Pierluigi Colangeli)**

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 21/03/2019

**Organizzatore:** Potsdam University, Germany

### Titolo: Membro del consiglio dell'Unione Zoologica Italiana

**Website:** http://www.uzionlus.it/

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 2018 - in attivita'

### Titolo: Presidente della Commissione Fauna dell'Unione Zoologica Italiana

**Website:** http://www.uzionlus.it/

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 2018 - in attivita'

### Titolo: Management Committee member, COST Action DNAquanet

**Website:** https://dnaqua.net/

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 2016 - in attivita'

**Organizzatore:** DNAquaNet

### Titolo: Membro della Commissione Scientifica CITES

**Website:** https://www.minambiente.it/pagina/commissione-scientifica-cites

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 2015 - in attivita'

**Organizzatore:** Ministero dell'Ambiente e della Tutela del Territorio e del Mare

### Titolo: Commissione di valutazione di progetti EU-MSCA Fellowship

**Website:** https://ec.europa.eu/research/mariecurieactions/actions/individual-fellowships_en

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 2019

### Titolo: Guest Editor - Bioengineering (Mdpi): Bioengineering in Remediation of Polluted Environments

**Website:** https://www.mdpi.com/journal/bioengineering/special_issues/Polluted_Environments

**Referente IRSA:** Bruna Matturro

**Periodo di attivita:** 20/10/2020 - in corso

**Organizzatore:** Bruna Matturro

### Titolo: Guest Editor - Foods- Special Issue: "Functional and Bioactive Nutraceutical Compounds from Seafood and Seafood By-Products"

**Website:** https://www.mdpi.com/journal/foods/special_issues/Seafood_Byproducts

**Referente IRSA:** Ermelinda PRATO-Francesca Biandolino

**Periodo di attivita:** 15/11/2020 al 31/08/2021

**Organizzatore:** FOODS -MDPI

### Titolo: Consultative Group for the 9th World Water Forum - Dakar 2021

**Website:** https://www.worldwatercouncil.org/en/dakar-2021

**Referente IRSA:** Antonio Lo Porto

**Periodo di attivita:** 26/02/2020 - 31/03/2021

**Organizzatore:** WORLD WATER COUNCIL

### Titolo: Steering Committe della China-Europe Water Platform (CEWP)

**Website:** https://cewp.eu/

**Referente IRSA:** Antonio Lo Porto

**Periodo di attivita:** 01/01/2019 - in corso

**Organizzatore:** EU- DG DEVCO

### Titolo: Leader del Focus Group ""“Impacts of Climate Change on Water Resources" in CEWP

**Website:** https://cewp.eu/ClimateChangeGuimaraes

**Referente IRSA:** Antonio Lo Porto

**Periodo di attivita:** 01/01/2019 - in corso

**Organizzatore:** EU-DG DEVCO / CEWP

### Titolo: Member of the CNR delegation during the “Week of Science, Technology and Innovation – Italy/China”, Jinan (China)

**Website:** http://www.cittadellascienza.it/cina/wp-content/uploads/China-Italy-Week-Program-2019.pdf

**Referente IRSA:** Antonio Lo Porto

**Periodo di attivita:** 25/11/2019 - 30/11/2019

**Organizzatore:** MIUR (IT) - MRST (China)

**Titolo: Co-leader (together with Wageningen WUR) of the "Water-Smart Rural Areas" Vision Cluster of the Water Europe ETP**

**Website:** https://watereurope.eu/water-europe-ambassadors/#WE-CLUSTERS

**Referente IRSA:** Antonio Lo Porto

**Periodo di attivita:** 21/01/2020 - in corso

**Organizzatore:** Water Europe

**Titolo: National Support Boards per i Program Committee H2020 for the Societal Challenges SC2 and SC5**

**Referente IRSA:** Antonio Lo Porto

**Periodo di attivita:** 01/01/2019 - in corso

**Organizzatore:** Italian National Delegate in H2020 Program Committee

**Titolo: Panel Nazionale di supporto ai delegati italiani nei "Program Committee" di Horizon Europepresso la EC**

**Referente IRSA:** Antonio Lo Porto

**Periodo di attivita:** 01/01/2020- in corso

**Organizzatore:** APRE - Agenzia per la Ricerca Europea

**Titolo: Valutazione Proposte di Progetti presentati per la call "2019 EPA Cofunded Scholarship Scheme", lanciata dalla EPA - Environmental Protection Agency, Irlanda**

**Referente IRSA:** Antonio Lo Porto

**Periodo di attivita:** 10/05/2019 - 15/06/2019

**Organizzatore:** EPA - Environmental Protection Agency, Irlanda

**Titolo: International Journal of Applied Agricultural Research (IJAAR) - Editorial Board Member**

**Website:** http://www.ripublication.com/editorial_board_of_ijaar.htm

**Referente IRSA:** Antonio Lo Porto

**Periodo di attivita:** 01/01/2019 - in corso

**Organizzatore:** International Journal of Applied Agricultural Research (IJAAR)

**Titolo: Guest Editor - WATER – MDPI - Special Issue "Diffuse Water Pollution"**

**Website:** https://www.mdpi.com/journal/water/special_issues/Diffuse_Water_Pollution

**Referente IRSA:** Antonio Lo Porto

**Periodo di attivita:** 01/01/2019 - 31/12/2019

**Organizzatore:** MDPI

**Titolo: Membro della Commissione giudicatrice per il conferimento del titolo di Dottore di Ricerca (Università degli Studi di Trieste)**

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 2019 - 2020

**Organizzatore:** Università degli Studi di Trieste

### Titolo: Membro dell'Osservatorio permanente sugli utilizzi idrici in atto nel distretto idrografico del fiume Po

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 2019 - oggi

**Organizzatore:** Autorità di Distretto del Bacino fluviale del Po

### Titolo: Membro Commissione di valutazione research funding application internazionale

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 2019 - oggi

**Organizzatore:** Estonian Research Council

### Titolo: Membro del Tavolo Tecnico su "sperimentazione della regolazione estiva dei livelli del Lago Maggiore"

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 2016 - oggi

**Organizzatore:** Autorità di Distretto del Bacino fluviale del Po

### Titolo: Membro dell'International council of INVASIVESNET International Association for Open Knowledge on Invasive Alien Species

**Website:** https://www.invasivesnet.org/

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 2016 - oggi

**Organizzatore:** INVASIVESNET

**Titolo: Membro Gruppo di Lavoro "Tossicità di acque dolci, sedimenti e biodegradabilità" della Commissione Qualità dell'Acqua (WG2 TG5)**

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 01/09/2015 - oggi

**Organizzatore:** UNICHIM

**Titolo: Membro Gruppo di Lavoro per la definizione di una metodologia di classificazione dei corpi idrici fortemente modificati e artificiali per le acque fluviali e lacustri**

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 2014 - oggi

**Organizzatore:** MATTM

**Titolo: Membro Organo Tecnico CEN/TC230/WG2 “Water analysis. Biological methods co-ordination group”**

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 2014 - oggi

**Organizzatore:** UNICHIM

**Titolo: Membro del European Committee for Standardization CEN TC 230/WG 2/TG 5 Water quality**

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 2010 -2019

**Organizzatore:** CEN standard

**Titolo: Membro Gruppo di Lavoro per la messa a punto di metodologie di monitoraggio standardizzate, di indici per la valutazione dello Stato ecologico dei laghi e per la partecipazione ad esercizi di Intercalibrazione sovra-nazionali ad implementazione della Direttiva Quadro Comunitaria 2000/60/CE**

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 2006 - oggi

**Organizzatore:** Ministero dell'Ambiente e della Tutela del Territorio e del Mare (MATTM)

**Titolo: ERANET WaterWorks2014 - Water Works 2014-2019 in Support of the Water JPI**

**Referente IRSA:** Antonio Lo Porto

**Periodo di attivita:** 01/02/2015 - 31/01/2021

**Organizzatore:** Joint Programming Initiative WATER JPI

**Titolo: Consulente esperto dell'Agenzia Europea per l'Ambiente (EEA) in relazione a "EUNIS inland surface waters habitat revision"**

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 2019

**Organizzatore:** Agenzia Europea per l'Ambiente (EEA)

**Titolo: Member of the editorial Board Newsletter LifeWatch Italy - Referente per Centro Tematico Mediterraneo**

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 2017 - 2019

**Organizzatore:** LifeWatch Italy

**Titolo: Editorial board - Journal AVOCETTA**

**Website:** https://www.avocetta.org

**Referente IRSA:** Michelangelo Morganti

**Periodo di attivita:** 01/01/2020 31/12/2024

**Organizzatore:** Centro Italiano Studi Ornitologici (CISO)

**Titolo: Membro italiano del gruppo di lavoro internazionale ECOSTAT sui Temporary rivers**

**Referente IRSA:** Erba Stefania

**Periodo di attivita:** dal 18/09/2019 - in corso

**Organizzatore:** CIS - ECOSTAT

**Titolo: Tavolo tecnico MATTM - definizione metodologia nazionale di valutazione dell'eutrofizzazione per i corpi idrici superficiali in conformità alla direttiva quadro acque 2000/60/CE e alle direttive di base (direttiva Nitrati 911676/CEE e direttiva 91/271/CEE Acque Reflue Urbane)**

**Periodo di attivita:** dal 2017 - in corso

**Organizzatore:** Ministero dell'Ambiente della Tutela del Territorio e del Mare

**Titolo: GdL Ministeriale per la definizione di linee guida nazionali sui deflussi ecologici**

**Referente IRSA:** Erba Stefania

**Periodo di attivita:** dal 2016 - in corso

**Organizzatore:** Ministero dell'Ambiente della Tutela del Territorio e del Mare

**Titolo: Tavolo tecnico Ministeriale (Ministero dlel'Ambiente della Tutela del territorio e del Mare – MATTM) per la validazione della metodologia di classificazione del potenziale ecologico per i corpi idrici fortemente modificati e artificiali fluviali e lacustri - parte FIUMI**

**Referente IRSA:** Andrea Buffagni

**Periodo di attivita:** ottobre 2016 - in corso

**Organizzatore:** Ministero dell'Ambiente della Tutela del Territorio e del Mare

**Titolo: Working Group Chemical: Gruppo di lavoro di esperti per consulenza al MATTM della Strategia Comune di attuazione della Direttiva Quadro Acque (2000/60/CE) e della Direttiva Alluvioni (2007/60/EU) Common Implementation Strategy, CIS (programmazione 2013-2015, 2016-2018, 2019-2021)**

**Referente IRSA:** Stefano Polesello

**Periodo di attivita:** 01/01/2013-in corso

**Organizzatore:** European Commission, DG Environment

**Titolo: Ad hoc Technical Group on Water Reuse nell'ambito del CIS-WFD (Strategia Comune di Implementazione della Direttiva Quadro sulle Acque, WFD 2000/60/EC**

**Referente IRSA:** Stefano Polesello, Alfieri Pollice

**Periodo di attivita:** 23/02/2016-in corso

**Organizzatore:** European Commission, DG Environment

**Titolo: Editorial Board: Water (ISSN 2073-4441)**

**Website:** https://www.mdpi.com/journal/water/editors

**Referente IRSA:** Stefano Polesello

**Periodo di attivita:** 01/01/2019-incorso

**Organizzatore:** MDPI press

**Titolo: Comitato Permanente di studio (ex art 9, DM 26 marzo 1991) II sottocommissione di studio "Metodi Analitici"**

**Referente IRSA:** Stefano Polesello

**Periodo di attivita:** 21/04/2015-31/05/2019

**Organizzatore:** Istituto Superiore di Sanità

**Titolo: GdL MIE Microinquinanti Emergenti, Patrocinato da Regione Lombardia, organizzato da Cluster LE2C come attività dell'Area di Competenza Water Energy Nexus**

**Referente IRSA:** Gianni Tartari

**Periodo di attivita:** 5/02/2018-31/08/2020

**Organizzatore:** Cluster LE2C, Regione Lombardia

**Titolo: Comitato tecnico-scientifico permanente di supporto alla Commissione Ambiente e Salute della Regione Veneto con particolare riferimento all'acqua potabile**

**Referente IRSA:** Stefano Polesello

**Periodo di attivita:** 11/05/2018- in corso

**Organizzatore:** Regione Veneto

**Titolo: Supporto tecnico a MATTM in merito all'EU PILOT n. 9722/20/ENVI – Prima identificazione delle violazioni e possibili domande di verifica a seguito della valutazione del secondo ciclo dei Piani di gestione dei bacini idrografici di cui alla Direttiva 2000/60/CE - Parte Fiumi**

**Referente IRSA:** Andrea Stefano Buffagni

**Periodo di attivita:** 29/10/2020 - in corso

**Organizzatore:** MATTM - Direzione Generale per la Sicurezza del Suolo e dell'Acqua

**Titolo: European ECOSTAT (Ecological Status) WG A of the Common Implementation Strategy of the Water Framework Directive (EC 2000/60)**

**Referente IRSA:** Andrea Stefano Buffagni

**Periodo di attivita:** 01/03/2003 - ad oggi

**Organizzatore:** European Commission, ECOSTAT

**Titolo: Water editorial board member**

**Website:** https://www.mdpi.com/journal/water/editors#editorialboard

**Referente IRSA:** Erba Stefania

**Periodo di attivita:** 23/07/2020 - in corso

**Organizzatore:** Water (http://www.mdpi.com/journal/water)

### Titolo: Membro Tavolo Tecnico di Lavoro Lago di Lugano

**Referente IRSA:** Nicoletta Riccardi

**Periodo di attivita:** 2019-2022

**Organizzatore:** Comune di Porto Ceresio

### Titolo: external evaluator of Prof. Alan D. Christian for tenure; Clarkson University, USA

**Referente IRSA:** Nicoletta Riccardi

**Periodo di attivita:** 2020

**Organizzatore:** Clarkson University

### Titolo: Jury PhD Thesis A. Lepoutre, University of Rheims

**Referente IRSA:** Nicoletta Riccardi

**Periodo di attivita:** 2019

**Organizzatore:** University of Rheims

**Titolo: external evaluator of Dr. Wendell Haag, United States Forest Service Research & Development; USA**

**Referente IRSA:** Nicoletta Riccardi

**Periodo di attivita:** 2019

**Organizzatore:** United States Forest Service Research & Development; USA

**Titolo: Mollusc Specialist Group SSC - Species Survival Commission IUCN - International Union for Conservation of Nature**

**Referente IRSA:** Nicoletta Riccardi

**Periodo di attivita:** 2017-2023

**Organizzatore:** IUCN

**Titolo: Commissione Scientifica del Contratto di lago per il CUSIO**

**Referente IRSA:** Nicoletta Riccardi

**Periodo di attivita:** 2019-2022

**Organizzatore:** ECOMUSEO del Cusio

**Titolo: Commission for the CEN standard for monitoring and assessing the condition of freshwater mussels other than Margaritifera margaritifera throughout Europe**

**Referente IRSA:** Nicoletta Riccardi

**Periodo di attivita:** 2019-2022

**Organizzatore:** P. Boon (Freshwater Biological Association UK), J. Geist (Tech. Univ. Munich, Germany), E. Moorkens (Trinity College Dublin, Republic of Ireland)

**Titolo: International Committee of the Freshwater Mollusk Conservation Society (USA)**

**Referente IRSA:** Nicoletta Riccardi

**Periodo di attivita:** 2017-2023

**Organizzatore:** Freshwater Mollusk Conservation Society

**Titolo: Guest Editor S.I. Diffuse Water Pollution. Water**

**Website:** https://www.mdpi.com/journal/water/special_issues/Diffuse_Water_Pollution

**Referente IRSA:** De Girolamo Anna Maria

**Periodo di attivita:** 01/06/2019 al 30/04/2020

**Organizzatore:** Water, MDPI Journal

**Titolo: Componente commissione per assunzione con contratto di lavoro a tempo pieno e indeterminato di un unità di personale profilo Collaboratore Tecnico degli Enti di ricerca – VI livello professionale, per lo svolgimento di attività tecniche di supporto alla identificazione tassonomica del fitoplancton.**

**Website:** http://www.szn.it/index.php/it/bandi-e-concorsi/bandi-di-concorso/personale-tecnico-amministrativo/bandi-scaduti?start=20

**Referente IRSA:** Caroppo Carmela

**Periodo di attivita:** 07/12/2018 - 13/02/2019

**Organizzatore:** Stazione Zoologica "A. Dohrn", Napoli

### Titolo: Consiglio Direttivo (Vice-presidente) della Società Italiana di Biologia Marina

**Website:** https://www.sibm.it/index.php?p=associazione#consiglio-direttivo

**Referente IRSA:** Caroppo Carmela

**Periodo di attivita:** 01/01/2016 - 31/12/2021

**Organizzatore:** Società Italiana di Biologia Marina

### Titolo: Componente della commissione esaminatrice per l'attribuzione annuale del Premio "Giuseppe Bernardi"

**Website:** https://www.amptavolara.com/comunicazione/news/dettaglio-news/article/-84aca4ea95/

**Referente IRSA:** Caroppo Carmela

**Periodo di attivita:** 05/01/2016 - 30/06/2019

**Organizzatore:** Area Marina protetta Tavolara Punta Coda Cavallo, Società Italiana di Biologia Marina

### Titolo: Attività editoriale per lo Special Issue""A Glimpse into Future Research on Microalgae Diversity, Ecology and Biotechnology" della rivista Microorganisms

**Website:** https://www.mdpi.com/journal/microorganisms/special_issues/research_microalgae

**Referente IRSA:** Caroppo Carmela

**Periodo di attivita:** 20/07/2020 - 31/07/2021

**Organizzatore:** MDPI Publishers

### Titolo: Componente Editorial Board Journal of Environmental Chemical Engineeering -Elsevier

**Website:** https://www.journals.elsevier.com/journal-of-environmental-chemical-engineering/editorial-board

**Referente IRSA:** M. Concetta Tomei

**Periodo di attivita:** 01/01/2019- 31/12 2020

### Titolo: Componente Editorial Board Science of the Total Environment - Elsevier

**Website:** https://www.journals.elsevier.com/science-of-the-total-environment/editorial-board

**Referente IRSA:** M. Concetta Tomei

**Periodo di attivita:** 01/01/2019 - 31/12/2020

### Titolo: Valutazione di progetti per Marie Skłodowska-Curie Actions- Individual Fellowships MSCA-IF 2019 e 2020

**Referente IRSA:** M. Concetta Tomei

**Periodo di attivita:** 01/10/2019-15/12/2019, 01/10/2020-15/12/2020

**Organizzatore:** Research Executive Agency EU

### Titolo: Componente del Gruppo Di Lavoro “IWA (International Water Association) ITALIA"

**Referente IRSA:** M. Concetta Tomei

**Periodo di attivita:** 01/01/2019-31/12/2020

**Organizzatore:** International Water Association

**Titolo: Componente dello Specialist Group IWA "Sustainability in the Water Sector"**

**Referente IRSA:** M. Concetta Tomei

**Periodo di attivita:** 01/01/2019- 31/12/2020

**Organizzatore:** International Water Association

**Titolo: Osservatorio Permanente sugli utilizzi idrici nel Distretto Idrografico del Fiume Po**

**Referente IRSA:** Marzia Ciampittiello

**Periodo di attivita:** Dal 04/03/2019 in corso

**Organizzatore:** Autorità di Bacino del Fiume Po

**Titolo: Tavolo Tecnico per il coordinamento e la verifica delle attività di sperimentazione della regolazione estiva dei livelli del Lago Maggiore e di elaborazione dei risultati (Delib_1/2015 - Autorità di bacino del Fiume Po - Approvazione dell'avvio della sperimentazione della regolazione estiva dei livelli del Lago Maggiore)**

**Referente IRSA:** Marzia Ciampittiello

**Periodo di attivita:** Dal 21/08/215 in corso

**Organizzatore:** Autorità di Bacino del Fiume Po

**Titolo: Gruppo di lavoro sull'idromorfologia lacustre per l'implementazione della Direttiva Quadro 2000/60 per il Ministero dell'Ambiente e della Tutela del Territorio e del Mare**

**Referente IRSA:** Marzia Ciampittiello

**Periodo di attivita:** Dall'8/07/2010 in corso

**Organizzatore:** Ministero dell'Ambiente e della Tutela del Territorio e del Mare

### Titolo: Editorial board per la rivista Current World Environment

**Website:** https://www.cwejournal.org/

**Referente IRSA:** Marzia Ciampittiello

**Periodo di attivita:** Da settembre 2016 in corso

**Organizzatore:** Current World Environment

### Titolo: Water Special Issue "Zooplankton Diversity and Pelagic Food Webs: Investigating Present and Past with Different Techniques"

**Website:**
https://www.mdpi.com/journal/water/special_issues/Zooplankton_Diversity_Pelagic_Food

**Referente IRSA:** Roberta Piscia, Marina Manca

**Periodo di attivita:** 02/01/2019-31/03/2020

**Organizzatore:** Water MDPI

### Titolo: Piano Nazionale di contrasto dell'antimicrobico-resistenza PNCAR

**Website:**
http://www.salute.gov.it/portale/antibioticoresistenza/dettaglioContenutiAntibioticoResistenza.jsp?lingua=italiano&id=5281&area=antibiotico-resistenza&menu=vuoto

**Referente IRSA:** gianluca corno

**Periodo di attivita:** 2017- in corso

**Organizzatore:** ministero della salute

### Titolo: ANR Scientific Committee on Antibioresistance

**Referente IRSA:** Andrea Di Cesare

**Periodo di attivita:** 21/10/2020 , fine prevista 14/01/2021

**Organizzatore:** French Government, in partnership with the Ministry of Health, the Ministry of Research, the Ministry of Agriculture and the Ministry of Environment

### Titolo: Componente dell'Editorial Board della rivista "Journal of Marine Science and Engineering"

**Website:** https://www.mdpi.com/journal/jmse/editors

**Referente IRSA:** Caroppo Carmela

**Periodo di attivita:** 22/10/2020 - in corso

**Organizzatore:** MDPI Journals

### Titolo: Tavolo di coordinamento istituito da Regione Lombardia con CNR-IRSA in relazione alla caratterizzazione e gestione dei sedimenti degli invasi

**Referente IRSA:** Laura Marziali

**Periodo di attivita:** 13/02/2018-oggi

**Organizzatore:** Regione Lombardia, DG Enti Locali, Montagna e Piccoli Comuni

### Titolo: Comitato scientifico della rivista Biologia Ambientale

**Website:** http://www.cisba.eu/11-rivista

**Referente IRSA:** Laura Marziali

**Periodo di attivita:** 01/03/2018- oggi

**Organizzatore:** Centri Italiano Studi di Biologia Ambientale (CISBA)

### Titolo: Guest Editor S.I. "Water and Health", International Journal of Environmental Research and Public Health, MDPI

**Website:** https://www.mdpi.com/journal/ijerph/special_issues/health_water

**Referente IRSA:** Valeria Ancona

**Periodo di attivita:** 30/05/2019 - 30/06/2020

**Organizzatore:** IJERPH -MDPI

### Titolo: Gruppo di lavoro sui microinquinanti emergenti

**Website:** http://www.energycluster.it/it/aree-di-competenza/water-energy-nexus/progetto-microinquinanti-emergenti

**Referente IRSA:** Gianni Tartari

**Periodo di attivita:** 05/02/2018-12/10/2020

**Organizzatore:** Lombardy Energy Cleantech Cluster

### Titolo: Co-Chair Area di Competenza Water Energy Nexus

**Website:** http://www.energycluster.it/it/aree-di-competenza/water-energy-nexus

**Referente IRSA:** Gianni Tartari

**Periodo di attivita:** 12/2014-in corso

**Organizzatore:** Lombardy Energy Cleantech Cluster (LE2C)

### Titolo: Guest Editor S.I. "Surface Water Quality for Environment and Health"

**Website:** http://mdpi.com/si/20441

**Referente IRSA:** Gianni Tartari

**Periodo di attivita:** 06/2018 - 11/2019

**Organizzatore:** International Journal of Environmental Research and Public Health, MDPI. Basel, CH

### Titolo: Guest Editor S.I "Water Reuse and Environmental Sustainability"

**Website:**
https://www.mdpi.com/journal/sustainability/special_issues/Water_Reuse_Environmental_Sustainability

**Referente IRSA:** Gianni Tartari

**Periodo di attivita:** 01/09/2020-30/06/2021

**Organizzatore:** International Journal of Sustainability, MDPI. Basel, CH

### Titolo: Guest Editor S.I. "Unsaturated Zone: Advances in Experimental and Theoretical Investigations"

**Website:**
https://www.mdpi.com/journal/water/special_issues?section_id=0&search=Unsaturated+Zone%3A+Advances+in+Experimental+and+Theoretical+Investigations&sort=deadline&view=open&page_count=50&query=Unsaturated+Zone%3A+Advances+in+Experimental+and+Theoretical+Investigations

**Referente IRSA:** Maria Clementina Caputo

**Periodo di attivita:** 18/12/2020 - 31/01/2022

**Organizzatore:** Water (ISSN 2073-4441; CODEN: WATEGH) published semimonthly online by MDPI

### Titolo: Guest editor della rivista Sensors

**Website:**
https://www.mdpi.com/journal/sensors/special_issues?section_id=0&search=Sensors+and+Sensor+Systems+for+Hydrodynamics&sort=deadline&view=open&page_count=100&query=Sensors+and+Sensor+Systems+for+Hydrodynamics

**Referente IRSA:** Giuseppe Passarella

**Periodo di attivita:** 01/01/2019 - 31/12/2020

**Organizzatore:** Rivista Sensors (ISSN:1424-8220; IF:3.275)

### Titolo: Gruppo di Lavoro Miscele

**Referente IRSA:** Paola Grenni, Anna Barra Caracciolo

**Periodo di attivita:** 29/05/2019-in corso

**Organizzatore:** Ministero dell'Ambiente e IRSA-CNR

### Titolo: NORMAN Network Gruppo di Lavoro WG2 “Bioassays and biomarkers in water quality monitoring- The value of bioassays and biomarkers in water monitoring programmes: strategies for the interpretation of results”

**Website:** https://www.norman-network.net/?q=Home

**Referente IRSA:** Paola Grenni

**Periodo di attivita:** 15/10/2019- in corso

**Organizzatore:** Norman Network, Valeria DULIO  Executive Secretary of the NORMAN Association

**Titolo: Guest Editor dello Special Issue: Environmental Fate of Contaminants in the Aquatic Environment della rivista Water (MDPI))**

**Website:** https://www.mdpi.com/journal/water/special_issues/environmental_fate_contaminants

**Referente IRSA:** Anna Barra Caracciolo

**Periodo di attivita:** 01/01/2020-31/12/2020

**Organizzatore:** Water Journal (MDPI)

**Titolo: Guest Editor Special Issue Sustainability (MDPI): Nature Based Solutions to Support Climate Change Adaptation and Sustainable Development**

**Website:** https://www.mdpi.com/journal/sustainability/special_issues/suppslichan_susdevelop

**Referente IRSA:** Alessandro Pagano

**Periodo di attivita:** 01/12/2019 - in corso

**Organizzatore:** Alessandro Pagano

**Titolo: Topic Editor Sustainability (MDPI)**

**Referente IRSA:** Alessandro Pagano

**Periodo di attivita:** 01/09/2020 - in corso

**Organizzatore:** Alessandro Pagano

**Titolo: Commissione di valutazione: Esperto valutatore delle proposte progettuali nell'ambito dei Bandi MISE – FCS Fondo Per La Crescita Sostenibile – HORIZON 2020 – PON. Numeri di posizione 10 e 511.**

**Website:** https://www.mise.gov.it/index.php/it/incentivi/impresa/bando-horizon-2020-pon-i-c-2014-20

**Referente IRSA:** Andrea Gianico

**Periodo di attivita:** 01/01/2019 - 31/12/2020

**Organizzatore:** Ministero dello Sviluppo Economico

**Titolo: Advisory Board del Comitato Tecnico Scientifico di Ecomondo**

**Referente IRSA:** Camilla Braguglia

**Periodo di attivita:** 02/2019-11/2020

**Organizzatore:** Ecomondo-The green Technology Expo

**Titolo: Topic editor della rivista Sustainability**

**Website:** https://www.mdpi.com/journal/sustainability/topic_editors

**Referente IRSA:** Marco Berardi

**Periodo di attivita:** 2020 (in corso)

**Organizzatore:** Marco Berardi

**Titolo: Presidente della commissione esaminatrice relativa al "Concorso pubblico, per titoli ed esami, per l'assunzione di n. 2 unità di personale, profilo di Assistente Tecnico – Perito Chimico (Cat. C) da assegnare al dipartimento Provinciale di Taranto. Nomina C.E. D.D.G. ARPA PUGLIA N. 248 del 10/05-2019.**

**Periodo di attivita:** 01/06 23/12/2019

**Titolo: Associate Editor della rivista Water Science & Technology**

**Website:** https://iwaponline.com/wst

**Referente IRSA:** Giuseppe Mascolo

**Periodo di attivita:** 2017 - oggi

**Organizzatore:** IWA - International Water Association

**Titolo: Commissione di dottorato: Treatment of municipal WWTP secondary effluents by solar photo-Fenton: an implementation proposal based on continuous flow operation (dottorando: Sandra Yazmin Arzate Salgado)**

**Referente IRSA:** Giuseppe Mascolo

**Periodo di attivita:** Marzo 2020

**Organizzatore:** University of Almeria (Spain)

## Servizi erogati all'esterno

**Titolo: Analisi specialistiche di acque per la determinazione di microrganismi coinvolti in processi di decontaminazione biologica. Nello specifico forniamo servizi di quantificazione di biomarcatori di interesse mediante Real time PCR**

**Referente IRSA:** Simona Rossetti

**Periodo di attivita:** 01/04/2019 - 01/04/2021

### Titolo: Riordino dell'Archivio Storico del CNR IRSA, sede di Verbania Pallanza

**Website:** https://www.ise.cnr.it/it/archivio

**Referente IRSA:** Rosario Mosello

**Periodo di attivita:** 01/06/2010 - 31/12/2020

## Attivita di formazione

### Titolo: AFORED - Ambiente, Formazione, Ricerca, Educazione

**Website:** http://commissariobonificataranto.it/

**Referente IRSA:** Vito Felice Uricchio

**Periodo di attivita:** 29/1/2017 - 23/8/2020

**Organizzatore:** Commissario Straordinario Taranto

### Titolo: Arrività formativa per RUP: IL RUOLO DEI COMUNI NELLA GESTIONE DELLE BONIFICHE E DEI RIFIUTI IN CAMPANIA

**Website:** http://www.commissariobonificadiscariche.governo.it/it/

**Referente IRSA:** Vito Felice Uricchio

**Periodo di attivita:** 22/10/2020 -27/10/2020

**Organizzatore:** Commissario Straordinario per la Bonifica delle Discariche Abusive

**Titolo: I Edizione della "Settimana della Scienza"**

**Website:** https://www.marconi-galletti.it/wp/i-edizione-settimana-della-scienza/

**Referente IRSA:** Michela Rogora

**Periodo di attivita:** 20/01/2020-24/01/2020

**Organizzatore:** Istituto Marconi Galletti Einaudi, Domodossola

**Titolo: biodiversità di macroinvertebrati (Ditteri Chironomidi) con stage presso IRSA del dottorando Abdallah Aouadi, tesi: approccio morfologico e campionamento in diversi tipi di habitat d'acqua dolce**

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 19/01/2020 - 19/04/2020

**Organizzatore:** Università di Guelma (Algeria)

**Titolo: Stage di Sam Minekus - Study programme Applied Biology: Species- and genetic diversity of Oligochaetes in Lake Maggiore**

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 08/04/2019 - 23/08/2019

**Organizzatore:** HAS University of Applied Sciences Den Bosch, The Nederland

**Titolo: Stage di Dr. Bikashvili Ani - studio e monitoraggio di Ditteri Chironomidi in acque dolci alpine della Georgia**

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 02/06/2019 - 08/06/2019

**Organizzatore:** CNR-IRSA e Ilai State University, Tbilisi, Georgia

**Titolo: Stage di Dr. Japoshvili Bella - studio e monitoraggio di Oligocheti in acque dolci alpine della Georgia**

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 02/06/2019 - 08/06/2019

**Organizzatore:** CNR-IRSA e Ilai State University, Tbilisi, Georgia

**Titolo: stage di Tommaso Cancellario - WFD and Benthic Quality Index application to Italian lakes**

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 25/08/2019 - 07/09/2019

**Organizzatore:** CNR-IRSA sede di Verbania

**Titolo: stage post laurea Giulia Moramarco**

**Referente IRSA:** Nicoletta Riccardi

**Periodo di attivita:** 2019

**Organizzatore:** CNR IRSA

**Titolo: "Comunità microbiche naturali e il loro ruolo nella degradazione di contaminanti organici**

**Referente IRSA:** Paola Grenni

**Periodo di attivita:** 14/01/2019-22/02/2019

**Organizzatore:** Università di Pisa (Dipartimento Scienze della Terra) e IRSA-CNR

#### Titolo: Tirocinio - Machine learning for irrigation applications

**Website:** https://portiamovalore.uniba.it/

**Referente IRSA:** Marco Berardi

**Periodo di attivita:** dal 09-11-2020 al 07-05-2021

**Organizzatore:** Università degli Studi di Bari - Dipartimento di Matematica

## Organizzazione di scuole, corsi o seminari

#### Titolo: Corso teorico pratico su Macroinvertebrati bentonici negli ecosistemi lacustri rivolto agli operatori laureati in ARPA e a livello nazionale ad implementazione della Direttiva Quadro sulle Acque

**Referente IRSA:** Angela Boggero, IRSA Verbania

**Periodo di attivita:** 11/03/2019 - 15/03/2019

**Organizzatore:** ARPA Lazio

#### Titolo: Corso di Scientific Writing – ON LINE

**Website:** https://www.avocetta.org/courses

**Referente IRSA:** Michelangelo Morganti

**Periodo di attivita:** 02/2021

**Organizzatore:** Centro Italiano Studi Ornitologici (CISO) - Redazione Rivista Avocetta (Morganti)

### Titolo: MEETmeTONIGHT Notte Europea dei Ricercatori,“La vita in una goccia d'acqua”

**Referente IRSA:** Stefano Polesello

**Periodo di attivita:** 27/09/2019

**Organizzatore:** Università di Milano Bicocca

### Titolo: COVID-19: SICUREZZA DEL CICLO IDRICO INTEGRATO E PROSPETTIVE DI RICERCA

**Referente IRSA:** Stefano Polesello

**Periodo di attivita:** 18/05/2020

**Organizzatore:** Istituto Superiore di Sanità, CNR-IRSA

### Titolo: PFAS E CONTAMINANTI EMERGENTI

**Referente IRSA:** Stefano Polesello

**Periodo di attivita:** 06/10/2020

**Organizzatore:** ARPAV, CNR-IRSA

### Titolo: LIFE PHOENIX PER LA SCUOLA

**Website:** https://www.lifephoenix.eu/

**Referente IRSA:** Stefano Polesello

**Periodo di attivita:** 28/10/2020-30/10/2020

**Organizzatore:** Regione Veneto, ARPAV, Università di Padova, CNR-IRSA

**Titolo: PRIMA EDIZIONE DI "REMEDIA Life on the beach" 2019. Gli oltre 100 partecipanti, studenti che hanno aderito al percorso didattico a loro dedicato e comunità locale, hanno potuto conoscere più da vicino le attività di acquacoltura e l'IMTA (Integrated Multi-Trophic Aquaculture), esporre il materiale realizzato durante gli incontri in classe e degustare il pesce allevato con tecniche biologiche IMTA nell'impianto maricoltura Mar Grande di Taranto.**

**Referente IRSA:** Loredana Stabili

**Periodo di attivita:** Melendugno (Lecce) 25 Maggio 2019

**Organizzatore:** Adriana Giangrande, Loredana Stabili, Caterina Longo

**Titolo: Focus meeting: Aspetti normativi e amministrativi sull'acquacoltura in Italia.**

**Referente IRSA:** Loredana Stabili

**Periodo di attivita:** 20 maggio 2020

**Organizzatore:** Adriana Giangrande, Loredana Stabili, Caterina Longo

**Titolo: Seconda edizione relativa all' attività di sensibilizzazione ambientale nelle scuole , previste dal progetto europeo REMEDIA LIFE – Remediation of Marine Enviroment and Development of Innovative Aquaculture dedicata a 9 classi delle scuole I.T.I.S. "Archimede-Falanto", Liceo delle Scienze Umane "Vittorino da Feltre", Liceo Ginnasio Statale "Aristosseno", Liceo Scientifico "Archita" di Taranto, che grazie alla sperimentazione della didattica a distanza hanno scoperto cos'è l'acquacoltura e cos'è il sistema IMTA (Acquacoltura multi-trofica integrata).**

**Referente IRSA:** Loredana Stabili

**Periodo di attivita:** maggio 2020

**Organizzatore:** Adriana Giangrande, Loredana Stabili, Caterina Longo

## Tesi di laurea

**Titolo: SEAFOOD COME ALIMENTO FUNZIONALE: EFFETTO DI DIFFERENTI TIPI DI COTTURA SUL PROFILO LIPIDICO DEGLI ACIDI GRASSI DEL MOLLUSCO BIVALVE MYTILUS GALLOPROVINCIALIS**

**Referente IRSA:** Ermelinda PRATO

**Universita:** UNIVERSITA' DEGLI STUDI DI URBINO CARLO BO - Corso di Laurea Magistrale in Biologia Molecolare, Sanitaria e della Nutrizione

**Laureando/dottorando:** Veronica Di Nardo

**Titolo: Isolamento di microrganismi coinvolti nella degradazione aerobica di PCB da sedimenti marini contaminati**

**Referente IRSA:** Simona Rossetti

**Universita:** Sapienza - Università di Roma

**Laureando/dottorando:** Marta Ciccodicola

**Titolo: Valutazione ecotossicologica di due farmaci, Amoxicillina e Carbamazepina: effetti subletali cronici sul crostaceo marino Tigriopus fulvus**

**Referente IRSA:** Ermelinda PRATO

**Universita:** Università di Pavia - Laurea Magistrale in Biologia Sperimentale e Applicata

**Laureando/dottorando:** Elena Russo

**Titolo: CONFRONTO TRA I RISULTATI ANALITICI OTTENUTI CON DUE TECNICHE ANALITICHE COLORIMETRICHE PER LA DETERMINAZIONE DEL FOSFATO NELLE ACQUE SUPERFICIALI**

**Referente IRSA:** Michela Rogora

**Universita:** UNIVERSITA' DEGLI STUDI MILANO-BICOCCA

**Laureando/dottorando:** Luca Forcina

**Titolo: Valutazione dei potenziali effetti sull'ambiente di agenti schiumogeni lubrificanti contenenti tensioattivi anionici**

**Referente IRSA:** Anna Barra Caracciolo

**Universita:** Laurea magistrale in Ecobiologia – Sapienza Università di Roma

**Laureando/dottorando:** Alessandra Narciso

**Titolo: Comunità microbiche della rizosfera e promozione della decontaminazione del suolo da metalli pesanti**

**Referente IRSA:** Anna Barra Caracciolo

**Universita:** Laurea triennale in Biologia – Sapienza Università di Roma,

**Laureando/dottorando:** Valentina Terenzi

**Titolo: Approccio ecologico ed utilizzo di biotest per la valutazione della tossicità di terreni trattati con agenti schiumogeni lubrificanti**

**Referente IRSA:** Anna Barra Caracciolo

**Universita:** Laurea magistrale in Ecobiologia – Sapienza Università di Roma

**Laureando/dottorando:** Davide Balducci

**Titolo: Analisi della comunità microbica del fiume Danubio sottoposto a diversa pressione antropica**

**Referente IRSA:** Anna Barra Caracciolo

**Universita:** Laurea magistrale in Ecobiologia – Sapienza Università di Roma

**Laureando/dottorando:** Tommaso Mella

**Titolo: Tesi Specialistica: Breeding and foraging habitat selection of the Lesser Kestrel (Falco naumanni) at multiple spatial scales**

**Referente IRSA:** MIchelangelo Morganti

**Universita:** Università degli Studi di Milano

**Laureando/dottorando:** Aliona Pazhera

**Titolo: Tesi Specialistica: Multi-scale habitat selection of Lesser Kestrel at the northern edge of its distribution**

**Referente IRSA:** MIchelangelo Morganti

**Universita:** Università degli Studi di Milano

**Laureando/dottorando:** Sara Cioccarelli

**Titolo: Tesi Specialistica: Il Grillaio Falco naumanni come specie ombrello in pianura padana**

**Referente IRSA:** MIchelangelo Morganti

**Universita:** Università degli Studi di Milano

**Laureando/dottorando:** Alessandro Mercogliano

**Titolo: Studio dei fattori determinanti la distribuzione presente e futura in Tesi Specialistica: Pianura Padana del Grillaio (Falco naumanni) e implicazioni conservazionistiche**

**Referente IRSA:** MIchelangelo Morganti

**Universita:** Università degli Studi di Pavia

**Laureando/dottorando:** Alessandro Berlusconi

**Titolo: Applicazione di tecniche biomolecolari nello studio delle interazioni tra le matrici suolo e falda sottostante per la definizione dell'impatto agricolo da nitrati: verifica e adeguamento delle procedure e prime osservazioni**

**Referente IRSA:** Calabrese Angelantonio

**Universita:** Università degli Studi di Bari "Aldo Moro"

**Laureando/dottorando:** Mandrelli Laura

**Titolo: Trattamento anaerobico di un refluo domestico mediante tecnologia UASB con biomassa granulare**

**Referente IRSA:** M. Concetta Tomei

**Universita:** La Sapienza - Dipartimento di Ingegneria Chimica

**Laureando/dottorando:** Alessio Mancini

**Titolo: Correlatrice tesi di laurea "Caratterizzazione delle componenti dimensionali del fitoplancton nei Mari di Taranto"**

**Referente IRSA:** Caroppo Carmela

**Universita:** Università degli studi di Bari – Dipartimento di Biologia – Corso di laurea in Biologia Ambientale

**Laureando/dottorando:** Graziano Veccari

**Titolo: Studio delle comunità batteriche in campioni di acqua di un impianto di acquacoltura.**

**Referente IRSA:** Loredana Stabili

**Universita:** Università del Salento

**Laureando/dottorando:** Chiara Pellegrino

**Titolo: Fluitazione dei sedimenti dell'invaso di Pagnona (LC): biodisponibilità di elementi in traccia e tossicità per organismi macrobentonici**

**Referente IRSA:** Laura Marziali

**Universita:** Università degli Studi di Pavia, CDL in Biologia Sperimentale e Applicata

**Laureando/dottorando:** Erika Oteri

**Titolo: Tetti verdi: influenza sulla qualità e quantità dell'acqua in ambito urbano.**

**Referente IRSA:** Laura Marziali

**Universita:** Università degli Studi di Milano-Bicocca, CDL in Scienze e Tecnologie per l'Ambiente e il Territorio.

**Laureando/dottorando:** Riccardo Minoia

**Titolo: I chironomidi come bioindicatori della presenza di mercurio e DDT nei sedimenti del Fiume Toce**

**Referente IRSA:** Laura Marziali

**Universita:** Università degli Studi di Milano, CDL in Biogeoscienze: Analisi degli Ecosistemi e Comunicazione delle Scienze

**Laureando/dottorando:** Niccolò Pirola

**Titolo: Effetti della fluitazione dei sedimenti degli invasi sulla biodisponibilità di elementi in traccia e sulla tossicità per organismi macrobentonici: studio sperimentale sull'invaso di Pagnona (LC)**

**Referente IRSA:** Laura Marziali

**Universita:** Università degli Studi di Milano-Bicocca, CDL in Scienze e Tecnologie per l'Ambiente

**Laureando/dottorando:** Pietro Arrighetti

**Titolo: Analisi di comunità macrobentoniche del reticolo idrico minore del milanese e novarese: biodiversità e fattori di pressione**

**Referente IRSA:** Laura Marziali

**Universita:** Università degli Studi di Milano-Bicocca, CDL in Scienze e Tecnologie per l'Ambiente

**Laureando/dottorando:** Laura Besana

**Titolo: Tesi di Laurea Triennale**

**Referente IRSA:** Carlo Pastore

**Universita:** Politecnico di Bari

**Laureando/dottorando:** Claudio Cino Moreno

### Titolo: Tesi di Laurea Specialistica

**Referente IRSA:** Carlo Pastore

**Universita:** Politecnico di Bari

**Laureando/dottorando:** Lucia Polignano

### Titolo: Tesi di Laurea

**Referente IRSA:** Carlo Pastore

**Universita:** Università di Pisa

**Laureando/dottorando:** Valeria D'Ambrosio

### Titolo: Tesi di Laurea

**Referente IRSA:** Carlo Pastore

**Universita:** Istituto Tecnologico di Aguascalientes (Mexico)

**Laureando/dottorando:** FELIPE DE JESÚS VILLALOBOS DELGADO

### Titolo: Valutazioni preliminari finalizzate ad analisi di rischio connessa alla pratica dello scarico sul suolo dei reflui urbani trattati

**Referente IRSA:** Ivan Portoghese

**Universita:** Politecnico di Bari

**Laureando/dottorando:** Francesco Demichele

**Titolo: Tirocinio e Tesi di Laurea: "ANALISI DEL FUNZIONAMENTO IDRAULICO DI UN DISTRETTO IRRIGUO E POTENZIALITÀ DI INSERIMENTO DI SMART CONTROL"**

**Referente IRSA:** Alessandro Pagano

**Universita:** Politecnico di Bari

**Laureando/dottorando:** Ippolita ANTONINO

**Titolo: Tirocinio e tesi di Laurea: "Analisi e confronto di strategie di gestione dell'approvvigionamento potabile in emergenza"**

**Referente IRSA:** Alessandro Pagano

**Universita:** Politecnico di Bari

**Laureando/dottorando:** Domizia MODUGNO

**Titolo: PIATTAFORMA INTEGRATA CON PRETRATTAMENTO TERMICO PER LA VALORIZZAZIONE DEL FOOD WASTE: STUDIO SPERIMENTALE CON REATTORI IN SEMICONTINUO FINALIZZATO AL RECUPERO DI COMPOSTI AD ALTO VALORE AGGIUNTO**

**Referente IRSA:** Andrea Gianico

**Universita:** Campus Biomedico di Roma - FACOLTA' DI INGEGNERIA CORSO DI LAUREA MAGISTRALE IN INGEGNERIA CHIMICA PER LO SVILUPPO SOSTENIBILE

**Laureando/dottorando:** Ginevra Cetta

**Titolo: PIATTAFORMA INTEGRATA CON PRETRATTAMENTO TERMICO PER LA VALORIZZAZIONE DEL FOOD WASTE: STUDIO SPERIMENTALE CON REATTORI IN SEMICONTINUO FINALIZZATO ALLA PRODUZIONE DI ENERGIA.**

**Referente IRSA:** Camilla Braguglia

**Universita:** Campus Biomedico-Roma

**Laureando/dottorando:** Ludovica Mattiocco

**Titolo: Studio sui muschi e licheni come bioaccumulo di metalli pesanti nell'area geografica del fiume Toce-Tesi Laurea in Agrobiotecnologie per l'Ambiente e il Territorio, Università di Milano**

**Referente IRSA:** Guerrieri Nicoletta

**Universita:** Università degli Studi di Milano- Dipartimento per gli Alimenti, la Nutrizione e l'Ambiente (DEFENS)

**Laureando/dottorando:** Alberto Colombo

## Dottorati di ricerca

**Titolo: Microbial degradation of organic pollutants in different environmental compartments**

**Referente IRSA:** Anna Barra Caracciolo

**Universita:** Corso di Dottorato in Biologia Ambientale ed Evoluzionistica – Curriculum Scienze Ecologiche, 31° Ciclo, Università di Roma Sapienza

**Laureando/dottorando:** Jasmin Rauseo

**Titolo: Ecology, competition and niche overlap in a guild of raptors from an intensive agricultural landscape**

**Referente IRSA:** MIchelangelo Morganti

**Universita:** Università degli Studi dell'Insubria

**Laureando/dottorando:** Alessandro Berlusconi

**Titolo: Study of emerging pollutants distribution and fate in the water cycle using advanced screening methods**

**Referente IRSA:** Stefano Polesello

**Universita:** Università dell'Insubria

**Laureando/dottorando:** Francesca Cappelli

**Titolo: Recupero di energia e risorse dal trattamento di reflui urbani**

**Referente IRSA:** M. Concetta Tomei

**Universita:** La Sapienza Roma - Dipartimento di Ingegneria Chimica

**Laureando/dottorando:** Valentina Stazi

**Titolo: Co-Tutor dottorato di Ricerca in Ingegneria Civile ed Ambientale XXXII ciclo**

**Referente IRSA:** De Girolamo Anna Maria

**Universita:** Università degli Studi dell'Aquila

**Laureando/dottorando:** Raffaele Di Pillo

**Titolo: DOTTORATO DI RICERCA INTERATENEO "GESTIONE SOSTENIBILE DEL TERRITORIO"**

**Referente IRSA:** De Girolamo Anna Maria

**Universita:** DOTTORATO DI RICERCA INTERATENEO Politecnico di Bari-Università di Bari

**Laureando/dottorando:** Marianna Leone

**Titolo: Co-Tutor dottorato di Ricerca in Biodiversità, Agricoltura e Ambiente; Ciclo XXXI**

**Referente IRSA:** De Girolamo Anna Maria

**Universita:** Università degli Studi di B "A. Moro"ari

**Laureando/dottorando:** Giovanni Francesco Ricci

**Titolo: Co-Tutor of the reserach: "Study of Synthesized Nano Alloys Using Laser Ablation in Liquids and Their Effects on Microorganisms Isolated from Archaeological Artefacts" at the Departments of Laser Science and Interactions – Laser interaction with matter, National Institute of Laser Enhanced Science**

**Referente IRSA:** Paola Grenni

**Universita:** Cairo University

**Laureando/dottorando:** DINA MOHAMED MOHAMED ATWA KHALIL

**Titolo: Co-Tutor of the reserach: "Role of fungi in the deterioration of archaeological wood and using of innovative method for treatment of biodeteriorated wood by natural biocides".**

**Referente IRSA:** Paola Grenni

**Universita:** Cairo University

**Laureando/dottorando:** Shimaa Saad Ibrahim

**Titolo: Dottorato in Rischio, Sviluppo Ambientale, Territoriale ed Edilizio, XXXV ciclo, a.a. 2019-2020**

**Referente IRSA:** Ivan Portoghese

**Universita:** Politecnico di Bari

**Laureando/dottorando:** Silvia Brigida

**Titolo: Co-tutor Dottorato di ricerca "Urban flood risk management under deep uncertainty"**

**Referente IRSA:** Raffaele Giordano

**Universita:** Politecnico di Bari

**Laureando/dottorando:** Virginia Rosa Coletta

**Titolo: Anaerobic digestion of FOGs with as pre-treatments to improve biodegradation.**

**Referente IRSA:** Camilla Braguglia

**Universita:** National University of Galway

**Laureando/dottorando:** Yuchen Liu

**Titolo: Piattaforma integrata per il trattamento ed il recupero da fanghi di depurazione: il bio-leaching anaerobico accoppiato alla digestione-**

**Referente IRSA:** Camilla Braguglia

**Universita:** La Sapienza di Roma

**Laureando/dottorando:** Barbara Tonanzi

## Attivita di docenza

**Titolo: Introductory statistics with R**

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 06-08/11/2019, 13-16/01/2020, 04-06/05/2020, 26-29/10/2020, 04-06/11/2020

**Organizzatore:** TerreLogiche

### Titolo: Statistics and molecular ecology with R

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 10/02/2020 - 14/02/2020

**Organizzatore:** TerreLogiche

### Titolo: Marine Ecology

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 05-06/12/2019, 09/12/2020

**Organizzatore:** University of Fribourg, Switzerland

### Titolo: Molecular phylogenies for biodiversity

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 15/07/2019 - 18/07/2019

**Organizzatore:** Physalia

### Titolo: DNA barcoding and taxonomy

**Referente IRSA:** Diego Fontaneto

**Periodo di attivita:** 17/05/2019

**Organizzatore:** Kasetsart University, Bangkok, Thailand

**Titolo: Evento di presentazione del progetto INTERREG SIMILE "Tecnologia e innovazione per i laghi dell'area insubrica", presso CNR IRSA, Sede di Verbania**

**Referente IRSA:** Michela Rogora

**Periodo di attivita:** 04/12/2019

**Organizzatore:** Michela Rogora

**Titolo: Corso Biorimedio di ambienti acquatici e terrestri contaminati - Laurea Magistrale in Ecobiologia**

**Referente IRSA:** Anna Barra Caracciolo

**Periodo di attivita:** Anni Accademici 2018/2019 e 2019/2020

**Organizzatore:** Università di Roma Sapienza

**Titolo: Corso di Ecologia, Dip. Di Bioscienze, Univ. Statale Milano**

**Referente IRSA:** MIchelangelo Morganti

**Periodo di attivita:** aa. 2019/2020 e 2020/2021

**Organizzatore:** Università degli Studi di Milano - Prof. Diego Rubolini

**Titolo: Rimozione dei PFAS da acque reflue e rifiuti: normativa, stato dell'arte e tecnologie**

**Referente IRSA:** Stefano Polesello

**Periodo di attivita:** 03/12/2019

**Organizzatore:** FAST (Federazione delle Associazioni Scientifiche e Tecniche) Ambiente Academy

**Titolo: Molecular Microbial Ecology (14B026)**

**Referente IRSA:** Aldo Marchetto

**Periodo di attivita:** 04/08/2019 - 09/08/2019

**Organizzatore:** Università di Ginevra

**Titolo: Corso di Laurea Magistrale in "Coastal and Marine Biology and Ecology" presso il Dipartimento di Scienze e Tecnologie Biologiche e Ambientali (DiSTeBA), Università del Salento Materia di insegnamento Environmental Microbiology (Lezioni seminariali in inglese)**

**Referente IRSA:** Loredana Stabili

**Periodo di attivita:** Anno Accademico 2019-2020

**Organizzatore:** Università del Salento

**Titolo: Master di secondo livello in "Sistemi di Qualità: GxP & ISO" 2019 – 2020, lezione: L'importanza della qualità della ricerca in ecotossicologia: il ruolo della SETAC, Society of Environmental Toxicology and Chemistry".**

**Referente IRSA:** Paola Grenni

**Periodo di attivita:** 04/09/2020

**Organizzatore:** Università Cattolica del Sacro Cuore di Roma (UCSC), per iniziativa della Facoltà di Medicina e Chirurgia "A. Gemelli"

**Titolo: L'approccio ecologico e l'ecotossicologia per la valutazione del rischio ambientale delle sostanze chimiche alla Scuola di Specializzazione in Gestione e Valutazione del Rischio Chimico**

**Referente IRSA:** Anna Barra Caracciolo

**Periodo di attivita:** 09/10/2020, 25/10/2020

**Organizzatore:** Scuola di Specializzazione in Gestione e Valutazione del Rischio Chimico - Dipartimento di Chimica e Tecnologie del Farmaco, Università Sapienza

**Titolo: L' Ecotossicologia per la Sostenibilità Ambientale**

**Referente IRSA:** Ermelinda Prato

**Periodo di attivita:** dal 07/ 04/2020 e 28/04/2020

**Organizzatore:** Università Degli Studi Di Bari Aldo Moro Scuola Di Medicina Corso Di Laurea in Tecniche Della Prevenzione Nell'ambiente e nei Luoghi di Lavoro Sede d

**Titolo: Invited seminars/workshops presso Università di Newcastle (UK)**

**Referente IRSA:** Alessandro Pagano

**Periodo di attivita:** 20/05/2019 - 22/05/2019

**Organizzatore:** Università di Newcastle (Dr. Caspar J M Hewett)

**Titolo: Il Rio Rosso in Valle Anzasca: indagini sugli ecosistemi acquatici- seminario per Corso di laurea Magistrale in Scienze Agroambientali, Università degli Studi di Milano**

**Referente IRSA:** Guerrieri Nicoletta

**Periodo di attivita:** 30/10/2019

**Organizzatore:** Università degli Studi di Milano- Dipartimento di Scienza per gli Alimenti, la Nutrizione e l'Ambiente

## Alternanza scuola-lavoro

### Titolo: tirocini studenti scuole secondarie

**Referente IRSA:** Nicoletta Riccardi

**Periodo di attivita:** 2019

**Organizzatore:** IIS Cobianchi

### Titolo: “Il mare che vorrei: precauzioni per l’uso” (Fondi Strutturali Europei – PON 2014-2020: Progetto 10.2.5A-FSEPON-PU-2017-44)

**Referente IRSA:** Caroppo Carmela

**Periodo di attivita:** 21/02/2019 - 21/02/2020

**Organizzatore:** Liceo Scientifico Statale "G. Battaglini", Taranto

### Titolo: "Percorso Scienze Biosanitarie"

**Referente IRSA:** Caroppo Carmela

**Periodo di attivita:** 01/04/2018 - 28/02/2020

**Organizzatore:** Liceo Statale "G. Moscati" - Grottaglie (Taranto)

### Titolo: Comunicare la scienza: Ricercatori …… di plastica va in città - CORIPLA

**Referente IRSA:** Antonella Petrocelli

**Periodo di attivita:** 28/02/2019 - 09/05/2019

**Organizzatore:** Liceo Ginnasio Statale Aristosseno - Taranto

### Titolo: Alternananza scuola-lavoro

**Referente IRSA:** Roberta Piscia

**Periodo di attivita:** 01/05/2019 - 31/05/2019

**Organizzatore:** Liceo Scientifico G.Ferrari, Borgosesia

### Titolo: Alternananza scuola-lavoro

**Referente IRSA:** Roberta Piscia

**Periodo di attivita:** 01/05/2019 - 31/05/2019

**Organizzatore:** Istituto ISIS “John Keynes”, Gazzada Schianno (VA)

### Titolo: Alternananza scuola-lavoro

**Referente IRSA:** Roberta Piscia

**Periodo di attivita:** 01/06/2019 - 30/06/2019

**Organizzatore:** Istituto d'Istruzione Superiore Marconi-Galletti-Einaudi, Domodossola

### Titolo: Alternananza scuola-lavoro

**Referente IRSA:** Roberta Piscia

**Periodo di attivita:** 01/06/2019 - 31/07/2019

**Organizzatore:** I.I.S. Cobianchi, Verbania

### Titolo: Alternananza scuola-lavoro

**Referente IRSA:** Roberta Piscia

**Periodo di attivita:** 01/06/2019 - 31/07/2019

**Organizzatore:** Liceo Classico Scientifico Bonaventura Cavalieri, Verbania

### Titolo: Tetti verdi: influenza sulla qualità e quantità dell'acqua in ambito urbano.

**Referente IRSA:** Laura Marziali

**Periodo di attivita:** 20/01/2020-31/01/2020

**Organizzatore:** ISS Einstein, Vimercate

## Premi e riconoscimenti

### Titolo: Nomina come Presidente di EurAqua

**Autori:** Antonio Lo Porto

**Descrizione estesa ITA:** Nomina (4 anni) come Presidente di EurAqua. EurAqua è la rete degli Istituti Pubblici di ricerca sull'acqua in 26 Stati Membri UE oltre al Centro Comune di Ricerca

Europeo JRC-ISPRA. La rete comprende gli Istituti che nei rispettivi Paesi operano come Istituto di riferimento per il Governo nazionale sulle tematiche connesse alla gestione delle risorse idriche.

**Descrizione estesa ENG:** Appointment for four years of EurAqua (network of the Public Research Institutes on water in 26 EU Member States; it includes also the EU Joint Research Center JRC-ISPRA. EurAqua includes Institutes acting as reference for their respective Governments on water resources management

### Titolo: Nomina come Presidente dell'Advisory Board di Water JPI

**Autori:** Antonio Lo Porto

**Descrizione estesa ITA:** Nomina come Presidente dell'Advisory Board della Joint Programming Initiative on Water. La Water JPI è l'iniziativa lanciata dalla EU allo scopo di allineare le politiche di ricerca ed i relativi finanziamenti da parte degli Stati Membri aderenti e di individuare le tematiche di ricerca da sviluppare in bandi per progetti di ricerca. L'Advisory Board è la struttura di consulenza tecnico-scientifica della Water JPI

**Descrizione estesa ENG:** Appointment as Chair of the Advisory Board (AB) of the Joint Programming Initiative on Water. The Water JPI is the initiative launched by the EU to achieve the alignment of the research policies and funding strategies of participating EU Member States and to define research topics for call for proposals. The AB serves as scientific advisor for the Governing Board

### Titolo: Nomina come Membro dell'Advisory Board di FACCE JPI

**Autori:** Antonio Lo Porto

**Descrizione estesa ITA:** Nomina come Membro dell'Advisory Board della Joint Programming Initiative FACCE (Food, Agriculture and Climate Change). FACCE JPI è l'iniziativa lanciata dalla EU allo scopo di allineare le politiche di ricerca ed i relativi finanziamenti da parte degli Stati Membri aderenti e di individuare le tematiche di ricerca da sviluppare in bandi per progetti di ricerca. L'Advisory Board è la struttura di consulenza tecnico-scientifica della FACCE JPI

**Descrizione estesa ENG:** Appointment as Chair of the Advisory Board (AB) of the Joint Programming Initiative FACCE (Food, Agriculture and Climate Change). FACCE JPI is the initiative launched by the EU to achieve the alignment of the research policies and funding strategies of participating EU Member States and to define research topics for call for proposals. The AB serves as scientific advisor for the Governing Board

### Titolo: Nomina come Membro dello EU Strategic Coordination Group - WFD

**Autori:** Antonio Lo Porto

**Descrizione estesa ITA:** Nomina come Membro dello Strategic Coordination Group (SCG) della Common Implementation Strategy (CIS) lanciata dalla Commissione Europea relativamente alla Water Framework Directive. Lo SCG è il Gruppo di lavoro "top level" nella gerarchia della CIS e coordina lo sviluppo della normativa tecnica e della preparazione di rapporti relativa alla implementazione della Water Framework Directive.

**Descrizione estesa ENG:** Appointment as Member of the Strategic Coordination Group (SCG) in the Common Implementation Strategy (CIS) launched by the EC regarding the implementation of the Water Framework Directive. the SCG is the top level Workin Group in the CIS hierarchy with the aim of coordinating the development of technical documentation and reporting regarding the implementation of the Water Framework Directive.

### Titolo: Nomina come Membro di INBO (International Network of River Basin Organizations)

**Autori:** Antonio Lo Porto

**Descrizione estesa ITA:** Nomina come Membro dell'organizzazione Internazionale INBO (International Network of River Basin Organizations) in rappresentanza di EurAqua

**Descrizione estesa ENG:** Appointment as Member of International Organization INBO (International Network of River Basin Organizations) on behalf of EurAqua

### Titolo: Membro dello Steering Committee della EU Water Alliance

**Autori:** Antonio Lo Porto

**Descrizione estesa ITA:** Membro dello Steering Committee della EU Water Alliance, rete delle maggiori organizzazioni in EU (incluse WaterEurope, EurAqua, EWA) relative alla gestione delle risorse idriche in rapporto con le Direzioni Generali ed i Commissari Europei

**Descrizione estesa ENG:** Member of the Steering Committee of the EU Water Alliance, network of major EU-level water-related organizations (incl. WaterEurope, EurAqua, EWA) for addressing water/environmental issues in dialogue with EC Commissioners and DGs

### Titolo: Membro dello Steering Committee di PEER

**Autori:** Antonio Lo Porto

**Descrizione estesa ITA:** Membro (osservatore) dello Steering Committee di PEER (Partnership for European Environmental Research); organizzazione gemella di EurAqua, composta dai maggiori Istituti di ricerca in EU su tematiche ambientali

**Descrizione estesa ENG:** Observer Member of PEER (Partnership for European Environmental Research): organization (twinned to EurAqua) of the first class Research Institutes in EU on Environmental Research

### Titolo: Rappresentante MIUR in Knowledge Hub “Water-4-SDGs” su "water in international cooperation"

**Autori:** Antonio Lo Porto

**Descrizione estesa ITA:** Nomina come rappresentante MIUR nel Knowledge Hub "Water-4-SDGs” (lanciato da Water JPI) sulle tematiche connesse a "water in international cooperation"

**Descrizione estesa ENG:** Knowledge Hub “Water4SDGs” launched by the Water JPI on water-related issues in International Cooperation; National Expert named by the Italian Ministry of Research

### Titolo: Nomina come rappresentante IRSA in Water Europe (Piattaforma Tecnologica Europea sulla Acqua)

**Autori:** Antonio Lo Porto

**Descrizione estesa ITA:** Nomina come rappresentante IRSA in Water Europe, la Piattaforma Tecnologica Europea sulla Acqua lanciata dalla EU

**Descrizione estesa ENG:** Appointment as IRSA's representative in Water Europe, the EU Technology Platform on Water launched by the European Commission

### Titolo: Best Senior Researcher of the Year - 2019

**Autori:** Antonio Lo Porto

**Descrizione estesa ITA:** Pergamena "Best Senior Researcher of the Year - 2019". Assegnato da Texas A&M University (College Station) e US Department of Agriculture Agricultural Research Service (USDA ARS) in Temple (Texas- USA)

**Descrizione estesa ENG:** "Best Senior Researcher of the Year - 2019". Awarded by Texas A&M University (College Station) and US Department of Agriculture Agricultural Research Service (USDA ARS) in Temple (Texas- USA)

### Titolo: Nomina come "WaterEurope Ambassador

**Autori:** Antonio Lo Porto

**Descrizione estesa ITA:** Nomina come "WaterEurope Ambassador da parte del Water Europe Board e Water Europe Executive Committee

**Descrizione estesa ENG:** Nomination as "WaterEurope Ambassador" by the Water Europe Board and Water Europe Executive Committee

### Titolo: Lettera di encomio del Console Generale d'Italia in San Francisco

**Autori:** Console Generale d'Italia in San Francisco dott. Lorenzo Ortona

**Titolo: Membro Management Committee Azione COST CA17133 "Implementing nature-based solutions for creating a resourceful circular city". Nomina da MIUR**

**Autori:** Antonio Lo Porto

**Descrizione estesa ITA:** Questa azione COST mira a stabilire una rete per testare l'ipotesi che: "Un sistema di flusso circolare che implementa Nature Base Solutions per la gestione di nutrienti e risorse all'interno della biosfera urbana porterà a un ambiente urbano resiliente, sostenibile e sano". Per affrontare questa sfida, cinque gruppi di lavoro (WG) danno il loro contributo alla chiusura del ciclo delle risorse all'interno della biosfera urbana. I cinque gruppi di lavoro tratteranno l'ambiente costruito, l'acqua urbana, il recupero delle risorse, l'agricoltura urbana e gli strumenti di trasformazione che collegano i gruppi di lavoro e l'impatto socioeconomico.

**Descrizione estesa ENG:** This COST Action aims to establish a network testing the hypothesis that: "A circular flow system that implements Nature Base Solutions for managing nutrients and resources within the urban biosphere will lead to a resilient, sustainable and healthy urban environment". To tackle this challenge five working groups (WGs) give their contribution on closing the resource cycle within the urban biosphere. The five WGs will deal with the built environment, urban water, resource recovery, urban farming and transformation tools connecting the WGs and the socio-economic impact.

**Titolo: Membro Management Committee Azione COST CA15206 - PESFOR-W - Payments for Ecosystem Services (Forests for Water); Nomina da MIUR**

**Autori:** Antonio Lo Porto

**Descrizione estesa ITA:** È necessario sviluppare nuovi strumenti economici, in combinazione con l'ottimizzazione spaziale, per garantire la realizzazione di soluzioni economicamente vantaggiose, compresa la piantumazione di alberi a vantaggio dell'acqua. I pagamenti per i servizi ecosistemici (SPI) sono meccanismi flessibili basati su incentivi che potrebbero svolgere un ruolo importante nella promozione del cambiamento dell'uso del suolo per raggiungere obiettivi di qualità dell'acqua. L'azione PESFOR-W COST consoliderà l'apprendimento dai boschi esistenti per i sistemi PES dell'acqua in Europa e aiuterà a standardizzare gli approcci per valutare l'efficacia ambientale e il rapporto costo-efficacia delle misure relative ai boschi. Creerà anche una rete europea attraverso la quale gli schemi SPI possono essere agevolati, estesi e migliorati, ad esempio incorporando altri servizi ecosistemici collegati agli obiettivi del più ampio nesso della politica foreste-carbonio.

**Descrizione estesa ENG:** New economic instruments, in combination with spatial targeting, need to be developed to ensure cost-effective solutions - including tree planting for water benefits - are realised. Payments for Ecosystem Services (PES) are flexible, incentive-based mechanisms that could play an important role in promoting land use change to deliver water quality targets. The PESFOR-W COST Action will consolidate learning from existing woodlands for water PES schemes in Europe and help standardize approaches to evaluating the environmental effectiveness and cost-

effectiveness of woodland measures. It will also create a European network through which PES schemes can be facilitated, extended and improved, for example by incorporating other ecosystem services linking with aims of the wider forests-carbon policy nexus.

### Titolo: Mr Brown - dal residuo al produttivo - ForumPA 2019: II Edizione del Premio PA Sostenibile

**Autori:** Massimo Blonda, Angelantonio Calabrese, Campanale Mariavirginia, Leonardo Cascella

**Descrizione estesa ITA:** I produttori e gli agricoltori pugliesi non dispongono di un sistema tecnologico per il censimento, lo stoccaggio e la distribuzione di ammendanti naturali per gli impieghi agricoli. Non è possibile, pertanto, definire, in ambito regionale, quale sia la portata della domanda e offerta di materia organica utilizzabile (fanghi di depurazione urbana, digestati e compostati di deiezioni animali e acque di vegetazione), e questo comporta spesso comportamenti illeciti o spreco tramite smaltimento distruttivo di questa risorsa, con grave danno ambientale aggiuntivo. La soluzione proposta prevede la creazione di un sistema innovativo per il controllo della rete di distribuzione di concimi e ammendanti naturali, geolocalizzata, in risposta ai fabbisogni di produzione da un lato e impiego dall'altro. Appare evidente, quindi, il vantaggio derivante dal progetto in termini di riutilizzo delle biomasse, anche nel rispetto del "Piano Azione Nitrati" in vigore, ma anche della possibilità di orientare e condizionare la produzione di questi materiali secondo le necessità d'uso (es. aree infette da Xyilella, con richieste di ammendanti organici a tenore massimo consentito di zinco). La mappatura dei flussi di produzione ed impiego degli ammendanti per l'utilizzo agronomico garantirebbe anche un maggior controllo sugli effetti della pratica, la più facile individuazione delle pratiche illecite, nonché il loro disinnesco motivazionale. http://www.forumpachallenge.it/soluzioni/mr-brown

### Titolo: Falde e Nitrati: Indagine sulle cause della contaminazione attraverso il DNA dei Batteri - ForumPA 2019: II Edizione del Premio PA Sostenibile

**Autori:** Angelantonio Calabrese, Massimo Blonda e Mariavirginia Campanale

**Descrizione estesa ITA:** L'acqua di falda rappresenta un'importante e preziosa risorsa in campo agricolo, e potenzialmente, se opportunamente trattata, anche in campo alimentare. Il problema della contaminazione delle falde è stato affrontato, nel corso degli ultimi anni, con varie metodologie, con l'obiettivo di identificare gli inquinanti di varia natura. Non è stata adeguatamente sviluppata una tecnologia che identifichi le cause che provocano l'inquinamento. La soluzione proposta prevede l'indagine delle popolazioni di batteri che abitano le falde e che utilizzano come fonte primaria proprio gli inquinanti. Mappando i microrganismi, attraverso l'analisi del loro DNA, si può valutare il tipo di "fonte" che ha provocato la contaminazione: in uno scarico urbano ci

saranno batteri del genere "Bifidobacterium" che non si trovano nel letame animale, a parità di inquinante (Nitrato).

### Titolo: premio Franco Tatò 2020

**Autori:** Crognale Simona

**Descrizione estesa ITA:** Vincitrice del premio “Franco Tatò 2020” indetto dalla Società Italiana di Microbiologia Generale e Biotecnologie Microbiche (SIMGBM) per la miglior Tesi di Dottorato nel settore delle Biotecnologie Microbiche.

**Descrizione estesa ENG:** "Franco Tatò 2020" award announced by the Italian Society of General Microbiology and Microbial Biotechnology (SIMGBM) for the best PhD thesis in the field of Microbial Biotechnology.

### Titolo: Best Keynote presentation

**Autori:** Grenni P

**Descrizione estesa ENG:** Award as the best keynote presentation at “The Second International Conference on Molecular Modeling and Spectroscopy (ICMMS2), 23-24 September, 2020, National Research Centre, Cairo, Egypt (on-line conference).

**Titolo: EARTH PRIZE 2019**

**Autori:** Giuseppe Mascolo, Aldo Marchetto

**Descrizione estesa ITA:** La sede di Verbania Pallanza dell'Istituto di Ricerca sulle Acque (IRSA) nacque nel 1938 sul Lago Maggiore come Istituto Italiano di Idrobiologia, frutto della passione per la limnologia di un facoltoso cittadino, Marco De Marchi. Dopo la sua morte, la moglie Rosa Curioni per onorare la memoria del marito donò allo stato due ville sul Lago Maggiore e sul Lago di Como, ponendo la condizione che venisse creato un Istituto di Ricerca che studiasse gli ambienti acquatici, e in particolare i laghi. L'attività dell'Istituto proseguì anche negli anni difficili della seconda guerra mondiale, nonostante le importanti difficoltà economiche e di comunicazione. Alcuni giovani e promettenti ricercatori vi trovarono rifugio, come Adriano Buzzati Traverso, Luigi Luca Cavalli Sforza, Giuseppe Ramazzotti e Vittorio Tonolli, dando vita alla tradizione dell'Istituto Italiano di Idrobiologia di rappresentare un punto di incontro e discussione per la ricerca ecologica ed evoluzionistica nazionale e, successivamente, internazionale. Infatti, nel dopoguerra, vennero in visita a Pallanza, o vi trascorsero periodi di studio o di lavoro, ricercatori di fama mondiale come Ramon Margalef, G. Evelyn Hutchinson, Richard A. Vollenweider, Charles Goldman, Robert G. Wetzel, W. Thomas Edmondson, Theodosius Dobzhansky, John B. S. Haldane, Jacques Monod e James Watson. Nel 1977, l'Istituto Italiano di Idrobiologia divenne uno degli istituti del Consiglio Nazionale delle Ricerche e nel 2002, quando all'interno del CNR venne operata una ristrutturazione degli Istituti per ridurne il numero ed aumentarne le dimensioni, la sede di Verbania divenne la sede principale del neonato Istituto per lo Studio degli Ecosistemi (ISE), con sedi secondarie a Firenze, Pisa e Sassari. Successivamente, nel 2018 l'ISE venne soppresso e la sede di Verbania entrò a far parte dell'Istituto di Ricerca sulle Acque (IRSA), riaffermando così la vocazione dell'ex-Istituto Italiano di Idrobiologia per la ricerca ecologica nel campo delle acque dolci. Dobbiamo riconoscere ai coniugi Livia e Vittorio Tonolli, che si sono succeduti alla guida dell'Istituto Italiano di Idrobiologia dal 1950 al 1979, il merito di avere individuato una modalità di azione che ha caratterizzato e caratterizza ancora le attività dei ricercatori verbanesi, abbinando in modo indissolubile diversi aspetti fondamentali: 1) una attività di ricerca di alto livello, con numerose collaborazioni nazionali e internazionali: basti pensare che nel solo 2018 nella sede di Verbania 27 ricercatori, di cui 8 stranieri, hanno tenuto un seminario per descrivere le loro ricerche e che tra i 57 articoli pubblicati da ricercatori di Pallanza su riviste internazionali, 39 avevano co-autori stranieri. 2) un utilizzo rigoroso dei risultati della ricerca per indirizzare attività di risanamento ambientale: in particolare si possono ricordare gli interventi proposti per i laghi di Endine, Candia e Alserio oltre naturalmente all'intervento di liming del Lago d'Orta, che nel 1990 ha posto fine agli effetti deleteri di un pesante inquinamento industriale che perduravano da più di mezzo secolo su uno dei più grandi laghi italiani. L'attività di ripristino ecologico del Lago d'Orta è ancora in corso con la reintroduzione dei pesci pelagici (di acque profonde) da parte dei ricercatori dell'IRSA. 3) una continua collaborazione con le autorità per portare i principi di quella che ora viene definita "gestione sostenibile" nella normativa nazionale ed europea. 4) un'ampia attività di educazione ambientale svolta contemporaneamente su diversi fronti, dalla scuola, alle università ai

professionisti del settore. Infatti, nei primi anni della vita dell'Istituto Italiano di Idrobiologia il Direttore dell'Istituto svolgeva anche attività didattica presso l'Università di Milano. Successivamente, i ricercatori verbanesi si sono prestati a tenere corsi ufficiali in diverse università italiane. A fianco di questa attività, decine di studenti italiani e stranieri hanno passato a Pallanza periodi di formazione più o meni lunghi per acquisire le competenze necessarie in preparazione della loro laurea o del loro dottorato di ricerca. Molti di questi studenti sono poi diventati docenti in varie università italiane e straniere, ma anche nelle scuole secondarie, diffondendo a loro volta la cultura scientifica acquisita a Pallanza. Nei confronti dei giovani ricercatori e tecnici ambientali, i ricercatori verbanesi hanno tenuto spesso corsi su temi specifici e contribuito all'organizzazione di convegni scientifici nazionali ed internazionali. Altre attività di educazione ambientale sviluppate dal personale di Pallanza sono invece dirette direttamente ai cittadini, come ad esempio la mostra organizzata a Verbania nel 2013 per il 75° anniversario della fondazione dell'Istituto Italiano di Idrobiologia e gli eventi della Notte dei Ricercatori a settembre, ma sono soprattutto diretti alle scuole del territorio abbinando interventi nelle scuole, visite di scolaresche alla sede e attività sul campo. L'Istituto di Ricerca sulle Acque, di cui la sede di Verbania fa parte dal 2018, è uno dei più grandi Istituti di Ricerca del Consiglio Nazionale delle Ricerche e si occupa dello studio delle acque dolci nel loro complesso e della gestione e del trattamento delle stesse. Si tratta ovviamente di un tema di enorme importanza per le popolazioni umane, dal momento che la disponibilità di acqua non è omogenea nel tempo e nello spazio, e una gran parte della popolazione mondiale vive in aree dove l'acqua dolce è relativamente scarsa. Di conseguenza, assume sempre più importanza il tema di un uso sostenibile dell'acqua come risorsa, della necessità di conservarla in buona qualità e di regolare possibili conflitti tra utilizzatori diversi. In questo ambito l'IRSA svolge ricerche finalizzate alla messa a punto di metodi analitici per il monitoraggio chimico e biologico, anche con sensori avanzati, alla bonifica di siti contaminati, allo sviluppo di tecnologie per l'economia circolare, come la depurazione delle acque e il riuso dei fanghi, e alla valutazione della biodiversità, delle risorse biologiche e dei servizi ecosistemici. Infatti i corpi idrici non sono solo riserve di acqua, ma presentano anche una loro importanza intrinseca in quanto ecosistemi che ospitano comunità animali, vegetali e microbiche in complessa interazione. Nella sede di Verbania, l'attività principale è lo studio dell'ecologia degli ecosistemi acquatici, della loro biodiversità e delle condizioni necessarie alla loro protezione e alla loro corretta gestione. Naturalmente, però, questa attività viene declinata nel tempo in funzione delle sfide globali e locali poste dalla società. Nella seconda metà del secolo scorso, le principali pressioni che le attività umane esercitavano sulle acque superficiali erano prevalentemente legate all'inquinamento industriale e agli scarichi urbani. Questi ultimi portavano in particolare nei laghi ad un aumento della disponibilità di sali nutrienti e di conseguenza ad una crescita eccessiva delle alghe e ad una serie di conseguenze negative, come la carenza di ossigeno nelle acque profonde o lo sviluppo di alghe potenzialmente tossiche, riassunte nel concetto di "eutrofizzazione delle acque". A questi problemi ancora attuali si sono aggiunte nuove sfide: dapprima lo studio della presenza e degli impatti di inquinati, come pesticidi e composti acidificanti, provenienti da aree relativamente lontane attraverso le deposizioni atmosferiche, e successivamente lo studio dei nuovi inquinanti emergenti, come le microplastiche. Infine ha assunto un ruolo fondamentale lo studio dell'impatto dei cambiamenti climatici, per valutare e quantificare le possibili conseguenze e individuare possibili forme di mitigazione, che richiede da una parte un'integrazione delle conoscenze acquisite in modelli predittivi e scenari di cambiamento e dall'altra il mantenimento di lunghe serie temporali di informazioni ecologiche per seguire i cambiamenti in atto e verificare la correttezza dei modelli proposti. Ancora più

recentemente, la disponibilità di metodi relativamente rapidi di analisi genetica hanno aperto nuove prospettive di ricerca, in particolare nello studio della biodiversità attraverso metodi di riconoscimento genetico della presenza e del ruolo nell'ecosistema degli organismi e soprattutto dei microorganismi. Questi nuovi metodi di analisi hanno anche permesso di mettere in luce nuove problematiche, come la diffusione nell'ambiente dei geni di antibiotico-resistenza, cioè della capacità di alcuni batteri di sopravvivere in presenza di antibiotici. Purtroppo i batteri scambiano tra loro materiale genetico, e batteri pericolosi per la salute umana possono acquisire direttamente nell'ambiente questa resistenza ad alcuni antibiotici, causando gravi infezioni. Una delle linee di ricerca in corso a Verbania si occupa proprio di comprendere come questi geni si diffondono nell'ambiente, come sia possibile limitarne la diffusione, ma anche come sia possibile grazie alla collaborazione della autorità sanitarie e dei cittadini, ridurre l'uso di antibiotici e quindi la diffusione di batteri resistenti.

**Titolo: Best Poster Presentation Award 8° Workshop Nazionale GRUPPO INTERDIVISIONALE DI GREEN CHEMISTRY CHIMICA SOSTENIBILE**

**Autori:** Carlo Pastore

**Titolo: Best Poster Presentation Award International Symposium on Constructed Wetlands & Small Decentralized Wastewater Treatment Plants – ISCW2019**

**Autori:** Villalobos-Delgado, Felipe J.; di Bitonto, Luigi; Reynel-Ávila, H. Elisabeth; Mendoza-Castillo, D. Ileana; Bonilla Petriciolet, Adrian; Pastore, Carlo

**Titolo: Best Poster Presentation Award 3RD IWA RESOURCE RECOVERY CONFERENCE 2019 – IWARR2019", Venice (Italy), 08 – 12 September 2019**

**Autori:** Carlo Pastore, Luigi di Bitonto

## Spinoff

### Titolo: Spin Off - Technologies for Reliable and Innovative REMEdiation, TRIREME SrL

**Autori:** Bruna Matturro, Simona Rossetti