Consiglio Nazionale delle Ricerche

ISTITUTO DI RICERCA SULLE ACQUE

Annuario 2018

IRSA
CNR

Indice

Materiale raccolto a cura di **S. Ghergo**

Premessa

L'annualità 2018 si è caratterizzata per un significativo progresso sui temi principali della ricerca nel settore delle acque e le risposte che i ricercatori e tecnologi dell'Istituto di Ricerca Sulle Acque (IRSA) del CNR, hanno fornito sono stati numerosi e diversificati sia in termini di pubblicazioni scientifiche, che di contributi progettuali ed innovazioni valorizzabili attraverso azioni di trasferimento tecnologico.

Evento qualificante del 2018 è stato l'ampliamento dell'IRSA con il coinvolgimento della sede di Verbania dell'ex Istituto per lo Studio degli Ecosistemi e della sede di Taranto dell'Istituto per l' Ambiente Marino Costiero: un passaggio di straordinaria rilevanza, datato 19 settembre 2018, che attribuisce un rinnovato vigore all'IRSA con l'ampiamento delle sfere di competenza in ambiti integrativi e complementari rispetto ai preesistenti.

Il contributo delle competenze idrobiologiche e marino costiere determinano un decisivo arricchimento della capacità scientifiche dell'IRSA nell'affrontare i temi della ricerca sulla gestione del ciclo delle acque e dei delicati equilibri che rendono l'acqua centrale per la sopravvivenza delle naturalità e della stessa vita umana. Le più strette collaborazioni tra le 5 sedi del nuovo Istituto esprimono un ulteriore e rinnovato rispetto all'acqua, nei suoi luoghi e nelle sue varie forme, per essere vista come bene essenziale con un valore non solo culturale ma civile ed economico, in grado di influenzare la qualità dell'ambiente, della vita individuale ed il benessere sociale. In particolate come definito dal Provvedimento n.119/2018 di conferma e sostituzione dell'atto costitutivo dell'IRSA, le Aree tematiche di Istituto sono:

a) *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;*

b) *biodiversità e funzionalità degli ecosistemi acquatici attraverso l'analisi delle interazioni ecologiche e biochimiche tra componenti biotiche ed abiotiche;*

c) *tecnologie per la depurazione delle acque, anche ai fini del riutilizzo di reflui civili ed industriali; gestione e valorizzazione dei fanghi;*

d) *processi avanzati di recupero di risorse ed energia dal trattamento di reflui, rifiuti, biomasse nel segno dell'economia circolare;*

e) *tecnologie innovative per la caratterizzazione, messa in sicurezza e bonifica dei siti ed ambienti contaminati.*

Il nuovo IRSA promuove ulteriormente la costituzione di filiere organizzative/cognitive, capaci di migliorare, in termini di sinergia, le relazioni tra attività di ricerca pura, ricerca applicata precompetitiva, trasferimento tecnologico, implementazione industriale ed amministrativa con approccio orientato alla soluzione dei problemi. Sinergia che si estende con particolare efficacia alle collaborazioni in ambito europeo ed internazionali, oltre che nazionali con gli organi costituzionali dello Stato, comprendendo il Parlamento, con la Camera dei deputati ed il Senato della Repubblica, il Governo della Repubblica Italiana con particolare riferimento al Ministero dell' Ambiente e della Tutela del Territorio e del Mare, la Magistratura, le Forze dell'Ordine ed in generale la Pubblica Amministrazione, l'articolato sistema delle imprese.

In tale dimensione collaborativa ed interistituzionale la ricerca diviene fondamento essenziale per lo sviluppo delle politiche di gestione delle risorse idriche, per accompagnare la loro attuazione in ogni aspetto implementativo, al fine di assicurare la stabilità del sistema biota-abiota, costruito in milioni di anni di evoluzione della vita. Lo studio delle caratteristiche di stabilità degli equilibri omeostatici, basati su una complessa rete di relazioni dinamiche che, grazie a meccanismi autoregolatori, garantiscano al sistema capacità di resistenza ad eventi perturbanti e resilienza, pone le basi per lo sviluppo di tecnologie in grado di assicurare la capacità del sistema a rispondere a fenomeni alterativi.

Assumere come traguardo la sostenibilità, affiancando gli obiettivi della tutela e quelli dello sviluppo, richiede una attenzione scientifica straordinaria che attraverso la ricerca per l'implementazione di nuove tecnologie può assicurare livelli di compatibilità ambientale delle produzioni, determinando nuova conoscenza ed importanti innovazioni a cui l'iniziativa imprenditoriale si aggiunge per la creazione di valore in termini economici ed occupazionali.

Come traspare nelle pagine che seguono, la ricerca sulle acque ha continuato ad evolversi, ad ampliarsi e rinnovarsi nella consapevolezza del carattere complesso, multidimensionale e interdisciplinare del tema della ricerca sulle acque. L'innovazione nell'ambito delle acque, assume attualmente un significato ancora più ampio, mirando ad applicazioni tecnico-scientifiche in grado di stimolare fattori economici ed organizzativo-amministrativi. Come illustrato nei flash che seguono, la capacità di innovare interessa sia la produzione industriale che i sistemi di policy mirando a mutare e migliorare la governance ambientale e la rete dei servizi pubblico-privati erogati ai cittadini.

Il Direttore f.f.

Vito Felice Uricchio

L'Istituto

Sede 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

Nicoletta Ademollo	Ricercatrice	ademollo@irsa.cnr.it	06 90672 769
Stefano Amalfitano	Ricercatore	amalfitano@irsa.cnr.it	06 90672 854
Federico Aulenta	Ricercatore	aulenta@irsa.cnr.it	06 90672 751
Camilla Maria Braguglia	Ricercatrice	braguglia@irsa.cnr.it	06 90672 798
Anna Barra Caracciolo	Ricercatrice	caracciolo@irsa.cnr.it	06 90672 786
Barbara Casentini	Ricercatrice	casentini@irsa.cnr.it	06 90672 758
Renata Denaro	Ricercatrice	denaro@irsa.cnr.it	
Francesca Di Pippo	Ricercatrice	dipippo@irsa.cnr.it	06 90672 771
Francesca Falconi	Coll. Tecnico E.R.	falconi@irsa.cnr.it	06 90672 784
Stefano Fazi	Ricercatore	fazi@irsa.cnr.it	06 90672 790
Agata Gallipoli	Tecnologa	gallipoli@irsa.cnr.it	06 90672 753
Stefano Ghergo	I Tecnologo	ghergo@irsa.cnr.it	06 90672 763
Andrea Gianico	Ricercatore	gianico@irsa.cnr.it	06 90672 799
Paola Grenni	Ricercatrice	grenni@irsa.cnr.it	06 90672 785
Nicolas D. Guyennon	Ricercatore	guyennon@irsa.cnr.it	06 90672 780
Caterina Levantesi	Ricercatrice	levantesi@irsa.cnr.it	06 90672 781
Domenico Mastroianni	Coll. Tecnico E.R.	mastroianni@irsa.cnr.it	06 90672 783
Bruna Matturro	Ricercatrice	matturro@irsa.cnr.it	06 90672 793
Daniele Montecchio	Ricercatore	montecchio@irsa.cnr.it	06 90672 773
Domenica Mosca Angelucci	Ricercatrice	mosca@irsa.cnr.it	06 90672 771
Luisa Patrolecco	Ricercatrice	patrolecco@irsa.cnr.it	06 90672 797
Anna Bruna Petrangeli	Tecnologa	petrangeli@irsa.cnr.it	06 90672 791
Elisabetta Preziosi	Ricercatrice	preziosi@irsa.cnr.it	06 90672 778
Emanuele Romano	Ricercatore	romano@irsa.cnr.it	06 90672 779
Simona Rossetti	I Ricercatrice	rossetti@irsa.cnr.it	06 90672 697
David Rossi	Ricercatore	david.rossi@irsa.cnr.it	06 90672 766
Andrea Sbrilli	Tecnologo	sbrilli@irsa.cnr.it	06 90672 756
Francesca Spataro	Ricercatrice	spataro@irsa.cnr.it	
Maria Concetta Tomei	I Ricercatrice	tomei@irsa.cnr.it	06 90672 800
Carolina Cruz Viggi	Ricercatrice	cruzviggi@irsa.cnr.it	06 90672 770
Annamaria Zoppini	Ricercatrice	zoppini@irsa.cnr.it	06 90672 792

Personale amministrativo e di supporto

Roberto Amato	Operatore Tecn.	amato@irsa.cnr.it	06 90672 777
Bruno Benedetti	Coll. Tecnico E.R.	benedetti@irsa.cnr.it	06 90672 775
Patrizia D' Amico	Coll. Amministr.	damico@irsa.cnr.it	06 90672 764
Veronica Di Blasi	Operatore Tecn.	diblasi@irsa.cnr.it	06 90672 761
Riccardo Manca	Coll. Amministr.	manca@irsa.cnr.it	06 90672 765
Roberta Moretti	Coll. Tecnico E.R.	moretti@irsa.cnr.it	06 90672 788
Marco Pennazza	Coll. Amministr.	pennazza@irsa.cnr.it	06 90672 760
Christiana Vescera	Coll. Tecnico E.R.	vescera@irsa.cnr.it	06 90672 769

Sede di

Brugherio

Via del Mulino, 19 - 20861 Brugherio (MB)

Tel.: +39 039 216941

Fax: +39 039 2004692

Personale di Ricerca

Raffaella Balestrini	Ricercatrice	balestrini@irsa.cnr.it	039 21694 213
Andrea S. Buffagni	I Ricercatore	buffagni@irsa.cnr.it	039 21694 208
Marcello Cazzola	Coll. Tecnico E.R.	cazzola@irsa.cnr.it	
Diego Copetti	Ricercatore	copetti@irsa.cnr.it	039 21694 215
Carlo A. Delconte	Coll. Tecnico E.R.	delconte@irsa.cnr.it	
Stefania Erba	Ricercatrice	erba@irsa.cnr.it	039 21694 204
Licia Maria Guzzella	Dirig. di Ricerca	guzzella@irsa.cnr.it	039 21694 210
Laura Marziali	Ricercatrice	marziali@irsa.cnr.it	039 21694 207
Maria Teresa Palumbo	Coll. Tecnico E.R.	palumbo@irsa.cnr.it	
Stefano Polesello	I Ricercatore	polesello@irsa.cnr.it	039 21694 218
Claudio G. Roscioli	Coll. Tecnico E.R.	roscioli@irsa.cnr.it	039 21694 218
Franco Salerno	Ricercatore	salerno@irsa.cnr.it	039 21694 221
Fabrizio Stefani	Ricercatore	stefani@irsa.cnr.it	039 21694 232
Sara M. Valsecchi	I Ricercatrice	valsecchi@irsa.cnr.it	039 21694 211
Luigi Viganò	I Ricercatore	vigano@irsa.cnr.it	039 21694 212

Personale amministrativo e di supporto

Francesco Arena	Coll. Amministr.	arena@irsa.cnr.it	039 21694 202
Francesco Talarico	Operatore Tecn.	talarico@irsa.cnr.it	039 21694 214
Cristina Frana	Operatore Tecn.	frana@irsa.cnr.it	039 21694 201
Salvatore Guercio	Coll. Amministr.	guercio@irsa.cnr.it	

Sede di

Bari

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

Tel.: +39 080 5820511

Fax: +39 080 5313365

Personale di Ricerca

Valeria Ancona	Ricercatrice	valeria.ancona@ba.irsa.cnr.it	080 58205 34
Giuseppe Bagnuolo	Coll. Tecn. E.R.	giuseppe.bagnuolo@ba.irsa.cnr.it	080 58205 15
Emanuele Barca	Ricercatore	emanuele.barca@ba.irsa.cnr.it	080 58205 36
Massimo Blonda	Ricercatore	massimo.blonda@ba.irsa.cnr.it	080 58205 17
Domenico Bellifemine	Coll. Tecn. E.R.	domenico.bellifemine@ba.irsa.cnr.it	080 58205 65
Giovanni Berardi	Operatore Tecn.	giovanni.berardi@ba.irsa.cnr.it	080 58205 65
Marco Berardi	Ricercatore	marco.berardi@ba.irsa.cnr.it	080 58205 06
Delia E. Bruno	Ricercatrice	delia.bruno@ba.irsa.cnr.it	080 58205 36
Angelantonio Calabrese	Tecnologo	angelantonio.calabrese@ba.irsa.cnr.it	080 58205 36
Maria C. Caputo	Ricercatrice	maria.caputo@ba.irsa.cnr.it	080 58205 36
Lorenzo De Carlo	Ricercatore	lorenzo.decarlo@ba.irsa.cnr.it	080 58205 36
Ruggiero Ciannarella	Coll. Tecn. E.R.	ruggero.ciannarella@ba.irsa.cnr.it	080 58205 20
Anna Maria De Girolamo	Ricercatrice	annamaria.degirolamo@ba.irsa.cnr.it	080 58205 36
Marco De Sanctis	Ricercatore	marco.desanctis@ba.irsa.cnr.it	080 58205 03
Claudio Di Iaconi	I Ricercatore	claudio.diaconi@ba.irsa.cnr.it	080 58205 25
Monica Garnier	Ricercatrice	monica.garnier@ba.irsa.cnr.it	080 58205 29
Raffaele Giordano	Ricercatore	raffaele.giordano@ba.irsa.cnr.it	080 58205 34
Massimo Ianigro	Tecnologo	massimo.ianigro@ba.irsa.cnr.it	
Pierina Ielpo	Ricercatrice	pierina.ielpo@ba.irsa.cnr.it	080 58205 34
Antonio Lo Porto	Ricercatore	antonio.loporto@ba.irsa.cnr.it	080 58205 32
Vito Locaputo	Coll. Tecn. E.R.	vito.locaputo@ba.irsa.cnr.it	080 58205 21
Sabino Maggi	I Ricercatore	sabino.maggi@ba.irsa.cnr.it	080 58205 28
Rita Masciale	Ricercatrice	rita.masciale@ba.irsa.cnr.it	080 58205 36
Costantino Masciopinto	Ricercatore	costantino.masciopinto@ba.irsa.cnr.it	080 58205 37
Giuseppe Mascolo	I Ricercatore	giuseppe.mascolo@ba.irsa.cnr.it	080 58205 19
Carmine Massarelli	Tecnologo	carmine.massarelli@ba.irsa.cnr.it	080 58205 06
Raffaella Matarrese	Ricercatrice	raffaella.matarrese@ba.irsa.cnr.it	080 58205 40
Alessandro Pagano	Ricercatore	alessandro.pagano@ba.irsa.cnr.it	080 58205 06
Michele Pagano	Ricercatore	michele.pagano@ba.irsa.cnr.it	080 58205 05
V. Nicola Palmisano	Coll. Tecn. E.R.	vitonicola.palmisano@ba.irsa.cnr.it	080 58205 39
Giuseppe Pappagallo	Coll. Tecn. E.R.	giuseppe.pappagallo@ba.irsa.cnr.it	080 58205 36
Giuseppe Passarella	Ricercatore	giuseppe.passarella@ba.irsa.cnr.it	080 58205 38
Carlo Pastore	Ricercatore	carlo.pastore@ba.irsa.cnr.it	080 58205 14

Alfieri Pollice	I Ricercatore	alfieri.pollice@ba.irsa.cnr.it	080 58205 31
Ivan Portoghese	Ricercatore	ivan.portoghese@ba.irsa.cnr.it	080 58205 40
Carlo Salerno	Ricercatore	carlo.salerno@ba.irsa.cnr.it	080 53133 65
Vito F. Uricchio	Direttore f.f.	vito.uricchio@ba.irsa.cnr.it	080 58205 11
Pompilio Vergine	Ricercatore	pompilio.vergine@ba.irsa.cnr.it	080 53133 65
Angela Volpe	Ricercatrice	angela.volpe@ba.irsa.cnr.it	080 58205 02
Michele Vurro	Dir. di Ricerca	michele.vurro@ba.irsa.cnr.it	080 58205 49

Personale amministrativo e di supporto

Gina Dell'Olio	Coll. Tecnico E.R.	gina.dellolio@ba.irsa.cnr.it	080 58205 33
Francesco De Benedictis	Coll. Tecnico E.R.	francesco.debenedictis@ba.irsa.cnr.it	080 58205 29
Giuseppe Leone	Operatore Tecn.	giuseppe.leone@ba.irsa.cnr.it	080 58205 28
Anna Leuzzi	Coll. Amministr.	anna.leuzzi@ba.irsa.cnr.it	080 58205 43
Domenica Livorti	Operatore Tecn.	ketty.livorti@ba.irsa.cnr.it	080 58205 42
Sandro Menegatti	Coll. Tecnico E.R.	sandro.menegatti@ba.irsa.cnr.it	080 58205 43
Vincenzo Piscitelli	Coll. Amministr.	vincenzo.piscitelli@ba.irsa.cnr.it	080 58205 44
Giuseppe Tullo	Tecnologo	giuseppe.tullo@ba.irsa.cnr.it	080 58205 41
Vito Vulpis	Operatore Tecn.	vito.vulpis@ba.irsa.cnr.it	080 58205 11
Giuseppe Sgaramella	Coll. Tecnico E.R.	giuseppe.sgaramella@ba.irsa.cnr.it	080 58205 42

Sede di

Verbania

Largo Tonolli 50 - 28922 - Verbania Pallanza (VB)

Tel.: +39 0323 518300

Fax: +39 0323 556513

Personale di Ricerca

Angela Boggero	Ricercatrice	angela.boggero@irsa.cnr.it	0323 518 342
Cristiana Callieri	I Ricercatrice	cristiana.callieri@irsa.cnr.it	0323 518 321
Marzia Ciampittiello	Ricercatrice	marzia.ciampittiello@irsa.cnr.it	0323 518 363
Gianluca Corno	Ricercatore	gianluca.corno@irsa.cnr.it	0323 518 321
Andrea Di Cesare	Ricercatore	andrea.dicesare@irsa.cnr.it	06 4991 4769
Ester M. Eckert	Ricercatrice	ester.eckert@irsa.cnr.it	0323 518 321
Laura Fantozzi	Ricercatrice	laura.fantozzi@irsa.cnr.it	0323 518 331
Diego Fontaneto	Ricercatore	diego.fontaneto@irsa.cnr.it	0323 518 363
Nicoletta Guerrieri	Tecnologa	nicoletta.guerrieri@irsa.cnr.it	0323 518 318
Andrea Lami	I Ricercatore	andrea.lami@irsa.cnr.it	0323 518 358
Rosaria Lauceri	Ricercatrice	rosaria.lauceri@irsa.cnr.it	0323 518 317
Aldo Marchetto	I Ricercatore	aldo.marchetto@irsa.cnr.it	0323 518 361
Nicoletta Riccardi	Ricercatrice	nicoletta.riccardi@irsa.cnr.it	0323 518 336
Michela Rogora	Ricercatrice	michela.rogora@irsa.cnr.it	0323 518 331
Pietro Volta	Ricercatore	pietro.volta@irsa.cnr.it	0323 518 335

Personale amministrativo e di supporto

Camilla Arena	Coll. Amministr.	camilla.arena@irsa.cnr.it	0323 518 314
Monica Beltrami	Coll. Tecnico E.R.	monica.beltrami@irsa.cnr.it	0323 518 333
Evelina Crippa	Oper. Tecnico	evelina.crippa@irsa.cnr.it	0323 518 319
Nicola Di Chiano	Oper. Tecnico	nicola.dichiano@irsa.cnr.it	0323 518 300
Marina Ferrara	Coll. Amministr.	marina.ferrara@irsa.cnr.it	0323 518 314
Paola Giacomotti	Coll. Tecnico E.R.	paola.giacomotti@irsa.cnr.it	0323 518 326
Dario Manca	Coll. Tecnico E.R.	dario.manca@irsa.cnr.it	0323 518 332
Arianna Orrù	Coll. Tecnico E.R.	arianna.orru@irsa.cnr.it	0323 518 326
Roberta Piscia	Coll. Tecnico E.R.	roberta.piscia@irsa.cnr.it	0323 518 333
Agatina Salanitro	Coll. Amministr.	agatina.salanitro@irsa.cnr.it	0323 518 350
Gabriele Tartari	Coll. Tecnico E.R.	gabriele.tartari@irsa.cnr.it	0323 518 325
Tiziana Tonsi	Coll. Amministr.	tiziana.tonsi@irsa.cnr.it	0323 518 323

Sede di

Taranto

Via Roma, 3 - 74123 Taranto

Tel.: +39 099 4542 202

Fax: +39 099 4542 215

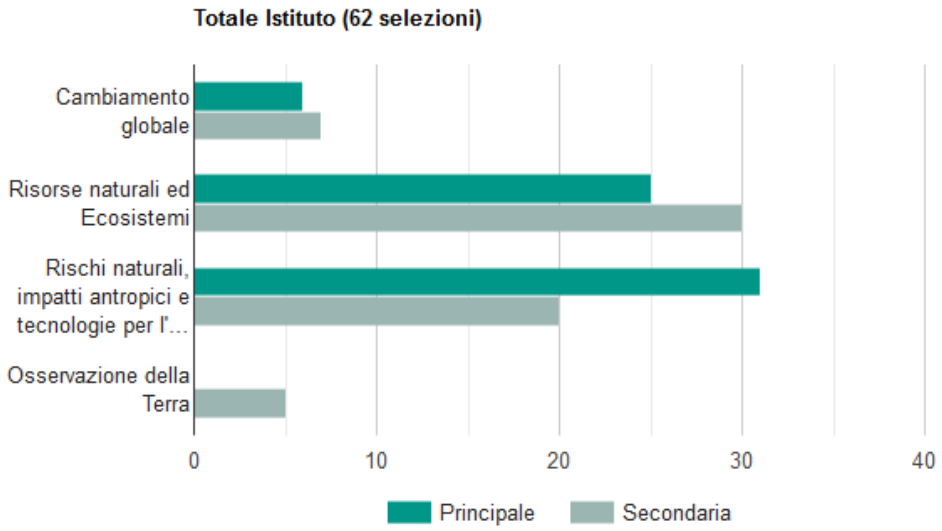
Personale di Ricerca

Maria I. Acquaviva	Coll. Tecnico E.R.	maria.acquaviva@irsa.cnr.it	099 4542 204
Francesca Biandolino	Ricercatrice	francesca.biandolino@irsa.cnr.it	099 4542 210
Carmela Caroppo	Ricercatrice	carmela.caroppo@irsa.cnr.it	099 4542 211
Rosa Anna Cavallo	Tecnologo	rosanna.cavallo@irsa.cnr.it	099 4542 204
Ester Cecere	I Ricercatrice	ester.cecere@irsa.cnr.it	099 4542 203
Vincenzo De Palmis	Oper. Tecnico	vincenzo.depalmis@irsa.cnr.it	099 4542 205
Antonella Di Leo	Ricercatrice	magda.dileo@irsa.cnr.it	099 4542 206
Giovanni Fanelli	Ricercatore	giovanni.fanelli@irsa.cnr.it	099 4542 200
Santina Giandomenico	Ricercatrice	santina.giandomenico@irsa.cnr.it	099 4542 226
Marcella Narracci	Ricercatrice	marcella.narracci@irsa.cnr.it	099 4542 204
Pasquale Pacifico	Coll. Tecnico E.R.	pasquale.pacifico@irsa.cnr.it	099 4542 226
Isabella Parlapiano	Ricercatrice	Isabella.parlapiano@irsa.cnr.it	099 4542 210
Antonella Petrocelli	Ricercatrice	antonella.petrocelli@irsa.cnr.it	099 4542 203
Giuseppe Portacci	Coll. Tecnico E.R.	giuseppe.portacci@irsa.cnr.it	099 4542 203
Ermelinda Prato	Ricercatrice	linda.prato@irsa.cnr.it	099 4542 210
Fernando Rubino	Ricercatore	fernando.rubino@irsa.cnr.it	099 4542 225
Lucia Spada	Coll. Tecnico E.R.	lucia.spada@irsa.cnr.it	099 4542 226
Loredana Stabili	I Ricercatrice	loredana.stabili@irsa.cnr.it	0832 298 971

Personale amministrativo e di supporto

Marianna D'Amato	Coll. Amministr.	marianna.damato@irsa.cnr.it	099 4542 202
Giuseppe Giacovazzo	Coll. Tecnico E.R.	giuseppe.giacovazzo@irsa.cnr.it	099 4542 202
Matteo Milillo	Coll. Tecnico E.R.	matteo.milillo@irsa.cnr.it	099 4542 202

Le Aree Strategiche



Indicazioni delle Aree Strategiche di riferimento del personale dell'Istituto.
Ogni ricercatore/tecnologo ha selezionato un'area principale ed una secodaria per inquadrare le proprie attività (dati aggiornati a febbraio 2019).

Area Strategica

Risorse Naturali ed Ecosistemi

Gestione sostenibile delle risorse idriche

Pianificazione di bacino. Sviluppo di modelli concettuali e matematici per la valutazione delle disponibilità idriche, dell'impatto antropico, delle dinamiche del flusso idrico in sistemi fratturati e porosi, del destino di sostanze inquinanti e sedimenti in condizioni sature e non. Idrologia delle acque sotterranee. Caratterizzazione idraulica di mezzi non saturi e valori di fondo. Metodi e strumenti per il monitoraggio ottimale delle risorse idriche. Resilienza dei sistemi di approvvigionamento, risk assessment di sistemi idrici, metodologie di collective decision making. Inquinamento da fonti diffuse e minimizzazione degli effetti sui corpi idrici. Acquacoltura. E-flow. Impatto dei cambiamenti climatici sulle risorse idriche superficiali e sotterranee per l'elaborazione di strategie di gestione e per la definizione delle misure di adattamento. Indicatori climatici e bioclimatici per la previsione e gestione di fenomeni siccitosi modelli di analisi di eventi estremi di pioggia e impatti sulla dinamica e gli ecosistemi fluvio-lacustri. Ricarica artificiale delle falde.

Funzionalità degli ecosistemi acquatici, comportamento dei contaminanti e relativi effetti

Funzionalità ecosistemica. Inquinamento, qualità delle acque e studio dei processi di accumulo, trasformazione e rimozione dei nutrienti nell'ecosistema acquatico. Biologia ed ecologia acquatica. Evoluzione delle comunità microbiche. Biodiversità e habitat. Ecologia molecolare. Bioindicatori. Destino ed effetti dei microinquinanti in ambiente acquatico. Criteri per la classificazione dei corpi idrici. Inquinanti emergenti e sostanze prioritarie. Dinamica ambientale di contaminanti prioritari e emergenti e interazione con gli organismi in ecosistemi acquatici temperati e polari. Studio degli effetti tossici dovuti alla contaminazione di tipo chimico sugli organismi acquatici e ricerca di marker di esposizione e di danno applicati a più livelli di complessità biologica. Bioaccumulo, metabolizzazione e ripartizioni di inquinanti nei corpi idrici. Valutazione del rischio ecologico associato a sedimenti contaminanti. Gestione e conservazione degli organismi acquatici.

Area Strategica

Rischi Naturali, Impatti Antropici e Tecnologie per l'Ambiente

Processi e tecnologie per il trattamento delle acque

Tecnologie per il trattamento delle acque di scarico civili ed industriali e riuso degli effluenti in ambito agricolo ed industriale. Produzione dei fanghi e tecnologie idonee per la loro riduzione. Rimozione di inquinanti caratterizzati da tossicità e persistenza presenti nelle acque a diversi livelli di concentrazione. Tecnologie di remediation, ecotossicologia e di monitoraggio e valutazione di impatti antropici. Tecnologie per garantire elevati standard di qualità e la sicurezza delle acque destinate ad uso potabile. Caratterizzazione e selezione microbica per l' ottimizzazione dei processi di degradazione biologici.

Recupero di risorse ed energia dal trattamento di reflui, rifiuti, biomasse

Costruzione della filiera circolare delle acque e dei rifiuti sulla base di criteri di compatibilità ambientale e sociale. Economia circolare e produzione di biocombustibili (es. biodiesel, idrocarburi sintetici, bioidrogeno, olii vegetali etc.), nutrienti (es. azoto e fosforo), energia termica e bioplastiche da reflui, rifiuti, biomasse. Tecniche di caratterizzazione chimica di biomasse organiche di scarto (fanghi di depurazione, rifiuti, scarti agricoli, alghe, ecc.). Valorizzazione della componente lipidica e ligno-cellulosica da rifiuti tramite l'ottimizzazione di trattamenti chimici per la produzione di prodotti ad elevato valore aggiunto, con potenziale applicativo. Recupero termico da processi di trattamento. Ottimizzazione delle procedure di estrazione e purificazione delle risorse da recuperare e nuove filiere produttive da materie recuperate.

Caratterizzazione e bonifica di siti contaminati ed ecosistemi acquatici compromessi e vulnerabili agli impatti delle attività antropiche e del cambiamento climatico

Tecnologie di caratterizzazione e bonifica di acque e suolo contaminati. Inquinanti emergenti, risk assessment, bioaccumulo. Definizione e sfruttamento delle potenzialità metaboliche di batteri ambientali e loro impiego ai fini del biorisanamento di matrici contaminate mediante l'applicazione di tecnologie biomolecolari avanzate incluse le tecniche omiche. Isolamento di ceppi microbici altamente performanti per la biodegradazione di contaminanti. Tecnologie di risanamento basate sull'impiego di elettrodi come donatori o accettori di elettroni nel

metabolismo microbico. Tecnologie di fitorimedio bioassitito in situ con minimo impatto ambientale e costi sostenibili basate sulla capacità dei microrganismi ambientali di metabolizzare un gran numero di sostanze organiche di origine xenobiotica. Bioaccumulo. Osservazioni a lungo termine di parametri ambientali anche con metodi paleolimnolgici, compresa la ricerca ecologica a lungo termine. Specie aliene, bloom algali. Tecniche geofisiche e remote sensing per la caratterizzazione delle compromissioni ambientali e tecniche strumentali al suolo e in acqua. Tecnologie di valutazione del grado di compromissione degli ambienti acquatici derivati da impatti antropici e cambiamenti climatici.

Area Strategica

Cambiamento globale

Impatti dei cambiamenti nella dinamica del ciclo idrologico sulla disponibilità delle risorse idriche nel tempo e nello spazio. Studio degli effetti legati a processi di fusione della criosfera sulla quantità, qualità e biodiversità delle risorse idriche in aree di alta quota. Studio della variabilità climatica attuale e futura in area mediterranea con particolare attenzione ai fenomeni siccitosi e conseguente impatto sui sistemi idrici, dunque tenendo in considerazione anche la variabilità delle domande idriche, le infrastrutture, fattori economici e opzioni di gestione. Analisi delle relazioni multidimensionali pressione-risposta per una valutazione della sostenibilità dell'uso della risorsa idrica sul lungo termine, individuando il ruolo specifico degli stressori di tipo antropico. Studio delle transizioni ecologiche in ambienti acquatici legati a cambiamento climatico e/o fattori antropici, mediante analisi dell'evoluzione di diverse componenti delle comunità biotiche. Analisi del ruolo funzionale dei corpi idrici naturali e artificiali e loro ruolo nel ciclo del carbonio a scala globale. Analisi delle interazioni di diversi drivers (carico di nutrienti, deposizione atmosferica, cambiamenti nel climate, nell'uso del suolo, ecc) nella valutazione dei cambiamenti di lungo termine nella chimica dell'acqua e nella componente biologica.

Pubblicazioni

Riepilogo delle Pubblicazioni elencate nell'Annuario 2018

Articoli in Rivista	*157*
Monografie / Contributi in volumi	*9*
Contributi nell'ambito di Convegni	*105*
Rapporti di Progetto	*8*
Manuali tecnici / Linee Guida	*1*

Articoli in Rivista

A bioassay battery for the ecotoxicity assessment of soils conditioned with two different commercial foaming products.

P. Grenni, A. Barra Caracciolo, L. Patrolecco, N. Ademollo, J. Rauseo, M.L. Saccà, M. Mingazzini, M.T. Palumbo, E. Galli, V.G. Muzzini, C.M. Polcaro, E. Donati, I. Lacchetti, A. Di Giulio, P.M.B. Gucci, E. Beccaloni, G. Mininni.

Ecotoxicology and Environmental Safety

Alkylethoxysulfate (AES) surfactants are the main component of most commercial products used for soil conditioning in the excavation industry, in particular as lubricants for mechanized tunnelling. Huge amounts of soil debris are produced during the excavation process and their possible re-use as by-products (e.g. land covering) or discharge as waste is a critical question in civil engineering. There can be an environmental impact from the potential ecotoxicity of the residual chemical mixture occurring in the foam-conditioned excavated soil. Chemical analyses are not able on their own to assess the potential hazards for the ecosystem ascribable to inadequate management of this kind of conditioned soil. Ecotoxicological tests, on the other hand, provide useful overall information about the potential effects of conditioned debris on soil and aquatic biota, including synergic ones, whether or not there is a detailed knowledge of the chemical composition of all the components of the commercial foaming products.

In this context, the objective of this work was to evaluate the overall ecotoxicity of excavated soil conditioned with two common foaming products containing sodium lauryl ether sulphate (SLES) as the main component, in order to verify their possible re-use as by-products. For this purpose, two soils with different geopedological characteristics were conditioned with the commercial foaming agents at the concentrations utilised for mechanized tunnelling and then used for microcosm laboratory experiments. Soil sub-samples were collected at different times (0, 7, 14, 28 days) of incubation and soil elutriates were produced to assess the effects of the foaming agents on five test species (Pseudokirchneriella subcapitata, Daphnia magna, Danio rerio, Vibrio fischeri and Lepidium sativum). The results of the tests were then compared with SLES residual concentrations in the elutriates, determined with the MBAS (methylene blue active substances) spectrophotometric method. Finally, the data were combined in a battery index, which proved effective at evaluating the overall ecotoxicity in a reallife situation of two different excavated soils conditioned with the two products analysed.

A Genomic Outlook on Bioremediation: The Case of Arsenic Removal.

Plewniak Frédéric, Crognale Simona, Rossetti Simona, Bertin Philippe N.

Frontiers in Microbiology

Microorganisms play a major role in biogeochemical cycles. As such they are attractive candidates for developing new or improving existing biotechnological applications, in order to

deal with the accumulation and pollution of organic and inorganic compounds. Their ability to participate in bioremediation processes mainly depends on their capacity to metabolize toxic elements and catalyze reactions resulting in, for example, precipitation, biotransformation, dissolution or sequestration. The contribution of genomics may be of prime importance to a thorough understanding of these metabolisms and the interactions of microorganisms with pollutants at the level of both single species and microbial communities. Such approaches should pave the way for the utilization of microorganisms to design new, efficient and environmentally-sound remediation strategies, as exemplified by the case of arsenic contamination, which has been declared as a major risk for human health in various parts of the world.

A global analysis of terrestrial plant litter dynamics in non-perennial waterways.

T. Datry, A. Foulquier, R. Corti, D. von Schiller, K. Tockner, C. Mendoza-Lera, J. C. Clément, M. O. Gessner, M. Moleón, R. Stubbington, B. Gücker, 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. J. Blessing, I. G. Boëchat, K. S. Boersma, M. T. Bogan, N. Bonada, N. R. Bond, K. C. Brintrup Barría, A. Bruder, R. M. Burrows, T. Cancellario, C. Canhoto, S. M. Carlson, S. Cauvy-Fraunié, N. Cid, M. Danger, Bianca de Freitas Terra, A. M De Girolamo, Evans de La Barra, R. del Campo, V. D. Diaz-Villanueva, F. Dyer, A. Elosegi, E. Faye, C. Febria, B. Four, S. Gafny, S. D. Ghate, R. Gómez, L. Gómez-Gener, M. A. S. Graça, S. Guareschi, F. Hoppeler, J. L. Hwan, J. I. Jones, S. Kubheka, A. Laini, S. D. Langhans, C. Leigh, C. J. Little, S. Lorenz, J. C. Marshall, E. Martín, A. R. McIntosh, E. I. Meyer, M. Miliša, M. C. Mlambo, M. Morais, N. Moya, P. M. Negus, D. K. Niyogi, A. Papatheodoulou, I. Pardo, P. Pařil, S. U. Pauls, V. Pešić, M. Polášek, C. T. Robinson, P. Rodríguez-Lozano, R. J. Rolls, M. M. Sánchez-Montoya, A. Savić, O. Shumilova, K. R. Sridhar, A. L. Steward, R. Storey, A. Taleb, A. Uzan, Ross Vander Vorste, N. J. Waltham, C. Woelfle-Erskine, D. Zak5, C. Zarfl and A. Zoppini.

Nature Geoscience

Perennial rivers and streams make a disproportionate contribution to global carbon (C) cycling. However, the contribution of intermittent rivers and ephemeral streams (IRES), which sometimes cease to flow and can dry completely, is largely ignored although they represent over half the global river network. Substantial amounts of terrestrial plant litter (TPL) accumulate in dry riverbeds and, upon rewetting, this material can undergo rapid microbial processing. We present the results of a global research collaboration that collected and analysed TPL from 212 dry riverbeds across major environmental gradients and climate zones. We assessed litter decomposability by quantifying the litter carbon-to-nitrogen ratio and oxygen (O_2) consumption in standardized assays and estimated the potential short-term CO_2 emissions during rewetting events. Aridity, cover of riparian vegetation, channel width and dry-phase duration explained most variability in the quantity and decomposability of plant litter in IRES. Our estimates indicate that a single pulse of CO_2 emission upon litter rewetting contributes up to 10% of the daily CO_2 emission from perennial rivers and stream, particularly

in temperate climates. This indicates that the contributions of IRES should be included in global C-cycling assessments.

A multi-lake comparative analysis of the General Lake Model (GLM): Stress-testing across a global observatory network.

Louise C. Bruce, Marieke A. Frassl, George B. Arhonditsis, Gideon Gal, David P. Hamilton, Paul C. Hanson, Amy L. Hetherington, John M. Melack, Jordan S. Read, Karsten Rinke, Anna Rigosi, Dennis Trolle, Luke Winslow, Rita Adrian, Ana I. Ayala, Serghei A. Bocaniov, Bertram Boehrer, Casper Boon, Justin D. Brookes, Thomas Bueche, Brendan D. Busch, Diego Copetti, Alicia Cortés, Elvira de Eyto, J. Alex Elliott, Nicole Gallina, Yael Gilboa, Nicolas Guyennon, Lei Huang, Onur Kerimoglu, John D. Lenters, Sally MacIntyre, Vardit Makler-Pick, Chris G. McBride, Santiago Moreira, Deniz Özkundakci, Marco Pilotti, Francisco J. Rueda, James A. Rusak, Nihar R. Samal, Martin Schmid, Tom Shatwell, Craig Snorthheim, Frédéric Soulignac, Giulia Valerio, Leon van der Linden, Mark Vetter, Brigitte Vinçon-Leite, Junbo Wang, Michael Weber, Chaturangi Wickramaratne, R. Iestyn Woolway, Huaxia Yao, Matthew R. Hipsey

Environmental Modelling & Software

The modelling community has identified challenges for the integration and assessment of lake models due to the diversity of modelling approaches and lakes. In this study, we develop and assess a onedimensional lake model and apply it to 32 lakes from a global observatory network. The data set included lakes over broad ranges in latitude, climatic zones, size, residence time, mixing regime and trophic level. Model performance was evaluated using several error assessment metrics, and a sensitivity analysis was conducted for nine parameters that governed the surface heat exchange and mixing efficiency. There was low correlation between input data uncertainty and model performance and predictions of temperature were less sensitive to model parameters than prediction of thermocline depth and Schmidt stability. The study provides guidance to where the general model approach and associated assumptions work, and cases where adjustments to model parameterisations and/or structure are required.

A system dynamics model for supporting decision-makers in irrigation water management.

Irene Pluchinotta, Alessandro Pagano, Raffaele Giordano, Alexis Tsoukiàsa

Journal of Environmental Management

Water management is a controversial environmental policy issue, due to the heterogeneity of interests associated with a shared resource and the increasing level of conflict among water uses and users. Nowadays, there is a cumulative interest in enhancing multi-stakeholder decision-making processes, overtaking binding mercantile business, in water management domain. This requires the development of dynamic decision-aiding tools able to integrate the different problem frames held by the decision makers, to clarify the differences, to support the creation of collaborative decision-making processes and to provide shared platforms of

interactions. In literature, these issues are faced by concepts such as Ostrom's action arena and Ostanello-Tsoukiàs' interaction space (IS). The analysis of the interactions structure and of the different problem framing involved are fundamental premises for a successful debate for the management of a common-pool resource. Specifically, the present paper suggests a dynamic evolution of the IS, highlighting its criticalities. It develops an alternative perspective on the problem, using a System Dynamics Model (SDM), exploring how different actions can influence the decision-making processes of various stakeholders involved in the IS. The SDM has been implemented in a multi-stakeholders decision-making situation in order to support water management and groundwater protection in the agricultural systems in the Capitanata area (Apulia region, Southern Italy).

A Stakeholder Oriented Modelling Framework for the Early Detection of Shortage in Water Supply Systems

Emanuele Romano, Nicolas Guyennon, Andrea Duro, Raffaele Giordano, Anna Bruna Petrangeli, Ivan Portoghese and Franco Salerno

Water

Management of water supply systems under shortage conditions due to drought requires computational tools able to relate the past precipitation regime over different time scales to future water resources availability. This work proposes a modelling framework to address the occurrence of shortage for water supply systems whose resource is constituted by natural or artificial reservoirs. The proposed methodology aims at identifying "management triggers" for possible mitigation measures. Emphasis is given on the use of standardized indices to promote information sharing. The implemented tool is structured into five modules: "hydrological" module; "scenarios" module; "reservoir" module; a module for the evaluation of "indices of shortage"; and a "support to early-warning" module. The whole procedure has been applied to three Italian reservoirs. For each water body, a case specific shortage early-warning system, based on standardized precipitation indices has been identified, allowing the implementation of efficient local mitigation measures.

Active and resting microbenthos in differently contaminated marine coastal areas: insights from the Gulf of Trieste (northern Adriatic, Mediterranean Sea)

Rogelja Manja, Cibic Tamara, Rubino Fernando, Belmonte Manuela, Del Negro Paola

Hydrobiologia

Marine benthic microalgae are a promising bioindicator of contamination. To date, however, investigations on the microbenthic communities subjected to multiple stressors in natural environments are still very rare. To assess whether the benthic processes of primary production and oxygen consumption, and the structure of active and resting microbenthos, were affected by sediment contamination, seven stations were sampled in different zones of the port of Trieste, subjected to multiple and diffuse contamination, and a reference site in the Marine Reserve of Miramare. No major differences in total abundance of active microbenthos

were observed among sites, but the dominance of stress-resistant species and the reduction of more sensitive ones, were registered nearby the main productive activities. The densities of resting microbenthos were higher in polluted areas, and represented by key dinoflagellate species that were clearly linked to contamination. The analysis of similarity applied to both active and resting communities significantly separated the most contaminated stations from the other ones. The photosynthetic capability of active microbenthos did not seem to be affected by contamination. The maximum oxygen consumption rates observed in sediments nearby the productive activities were likely ascribable to high organic C contents and the presence of metals in reduced chemical form.

Addressing biodiversity shortfalls in meiofauna

Fonseca G., Fontaneto D. & Di Domenico M.

Journal of Experimental Marine Biology and Ecology

Technological advances throughout different fields of research have enhanced our understanding of biodiversity, especially for meiofaunal organisms, which are notoriously difficult to study because of their small size. Scanning and transmission electron microscopy, together with confocal laser scanning microscopy, has increased the amount of external and internal morphological information, improving the quantity and quality of species descriptions, as well as deepening our understanding of the evolutionary adaptations of meiofauna. In ecology, the characterization of molecules such as stable isotopes and fatty acids have permitted us to infer trophic niches of meiofauna species, enhancing our understanding of their functional role in the ecosystem. In parallel, advances in DNA sequencing techniques have allowed us to quantify with much higher accuracy the phylogenetic position of meiofaunal species. We here review the main biodiversity shortfalls in the studies of meiofauna, discussing how such shortfalls could be addressed, especially by merging different approaches. Important steps towards such interdisciplinary approach are to promote data sharing, to explore new technologies that combine disciplines, and to base studies on a clear theoretical framework. Working at the interface between different disciplines imposes several challenges and will require creative approaches, but well-designed studies making use of different methodologies will quickly contribute to address the main biodiversity shortfalls in the study of meiofauna.

Aglaophenia octodonta (Cnidaria, Hydrozoa) and the Associated Microbial Community: a Cooperative Alliance?

Stabili L., Gravili C., Pizzolante G. Lezzi M., Tredici S.M., De Stefano M., Boero F., Alifano P.

Microbial Ecology

Recently, genetic approaches have revealed a surprising bacterial world as well as a growing knowledge of the enormous distribution of animal-bacterial interactions. In the present study, the diversity of the microorganisms associated to the hydroid Aglaophenia octodonta was studied with epifluorescence, optical, and scanning electron microscopy. Small subunit ribosomal RNA gene sequencing with "universal" and taxon-specific primers allowed the

assignment of the microalgae to Symbiodinium and the peritrich ciliates to Pseudovorticella, while the luminous vibrios were identified as Vibrio jasicida of the Harvey clade. To understand the possible relationships among Vibrio jasicida, Symbiodinium, A. octodonta, and Pseudovorticella, specific treatments were conducted in microcosm experiments, with the antibiotic ampicillin and other substances that interfere with bacterial and hydroid metabolism. Treatment of A. octodonta with ampicillin resulted in a decrease of bacterial luminescence followed by Pseudovorticella detachment and Symbiodinium expulsion and suggesting that these microorganisms form a "consortium" with beneficial metabolic interdependence. This hypothesis was reinforced by the evidence that low concentrations of hydrogen peroxide, which stimulate the bacterial oxidative metabolism and luminescence by releasing oxygen, were able to counteract the detrimental effect of ampicillin on the stability of the studied A. octodonta association. A model is proposed in which microalgae that release oxygen during photosynthesis are useful to luminous bacteria for their metabolism and for establishing/maintaining symbiosis leading to a close alliance and mutual benefit of the system A. octodonta-Vibrio jasicida-Pseudovorticella sp.-Symbiodinium sp.

Agro-industrial wastewater reuse for irrigation of a vegetable crop succession under Mediterranean conditions

Angela Libutti, Giuseppe Gatta, Anna Gagliardi, Pompilio Vergine, Alfieri Pollice, Luciano Beneduce, Grazia Disciglio, Emanuele Tarantino

Agricultural Water Management

In many countries of the Mediterranean region, characterized by frequent drought periods, agricultural production often occurs under water deficiency or conditions that cause the depletion of the existing water resources. In these areas, the reuse of reclaimed wastewater for crop irrigation could contribute to mitigate/decrease water shortage, support the agriculture sector and protect groundwater resources. In 1.5-year field experiments in Southern Italy (Apulia Region), the effects of irrigation with treated agro-industrial wastewater on soil properties, crops yield and qualitative traits of crop products, including their microbiological safety, were assessed. Groundwater (GW), secondary treated wastewater (SW) and tertiary treated wastewater (TW) from an innovative "on-demand" UV disinfection system were used to irrigate tomato and broccoli, cultivated in succession. The three irrigation water sources and the corresponding irrigated soils, plants and crop products were analyzed for the main physico-chemical characteristics, quali-quantitative parameters and fecal indicators. SW and TW showed higher values of the main physico-chemical parameters than GW. SW irrigated soil resulted in a significant increase of NH_4-N, Na^+, SAR, EC (below the threshold value beyond which a soil is defined as saline) during the first tomato crop cycle, and of pH during the broccoli growing season. Irrigation with treated wastewater did not significantly affect the marketable yield nor the qualitative traits of tomato and broccoli crops, except for the Na^+ and NO_3^- content (below the threshold levels defined by the European guidelines for vegetables). High levels of E. coli (above the Italian limit for reuse), Fecal coliforms and Fecal enterococci (up to 104CFU 100 ml-1) were observed in the SW and, when chlorination was not done, in the TW. Nevertheless, E. coli was not isolated from any sample of soil, plant and crop product, probably due to its rapid die-off. Moreover, low concentrations of Fecal coliforms and Total heterotrophic count were found in plant and crop product. The drip

irrigation system used, which avoided the close contact between water and plant, may have contributed to this. Under the conditions applied in this study, the reuse of treated agro-industrial wastewater for irrigation can be considered an effective way to cope with agriculturalwater shortage in the Mediterranean area.

An integrative review of granular sludge for the biological removal of nutrients and recalcitrant organic matter from wastewater

Mari-Karoliina Winkler, Christophe Meunier, Olivier Henriet, María Eugenia Suárez-Ojeda, Guido Del Moro, Marco De Sanctis, Claudio Di Iaconi and David Gregory Weissbrodt

Chemical engineering journal

Granular sludge aggregates are particular types of biofilms that display significantly different metrics and physical- chemical characteristics than activated sludge flocs. The efficiency of intensified processes using granular sludge relies on selection pressures created by engineering operational conditions to force microorganisms to form specific intrinsic physiological, phenotypic, and metabolic traits for granulation and high-rate biological removal of nutrients and/or recalcitrant organic matter. Granular sludge and conventional activated sludge share a core microbiome, while the distribution of the underlying populations can significantly differ in relative abundance and localization in the architecture of granules and flocs. Analogous ecological principles of microbial selection apply from activated sludge to granular sludge ecosystems with the essential difference that granules are governed by diffusion limitations through which different redox potentials are created on micrometre scale. Integrating the microbiology dimension together with the physical-chemical features of granules in engineering practice will make a difference at process level, besides offering new opportunities for bioaugmentation of granules in existing infrastructure. With this review article we critically examine the macro-scale factors impacting granulation, the physical-chemical characteristics of granular sludge, and fundamental and applied questions driven by the microbial ecology of granular sludge, toward the generation of useful concepts for process design and evaluation in engineering practice.

Anaerobic bioconversion of food waste into energy: A critical review

Braguglia C.M.; Gallipoli A.; Gianico A.; Pagliaccia P.

Bioresource technology

More than 400 papers in the last 5 years have been published on FW into energy. Food waste complexity and composition affects anaerobic conversion. Scaling up of the AD process is fundamental to assess the real methane potential. Methanogenesis is often rate limiting step leading to pH drop and instability. Strategies to improve AD performances and stability are here reviewed.

Anaerobic electrogenic oxidation of toluene in a continuous-flow bioelectrochemical reactor: Process performance, microbial community analysis, and biodegradation pathways

Palma E., Daghio M., Espinoza Tofalos A., Franzetti A., Cruz Viggi C., Fazi S., Petrangeli Papini M., Aulenta F.

Environmental science

Microbial electrochemical systems (MES) represent an innovative reagent-free technology for in situ remediation of groundwater contaminated by petroleum hydrocarbons. Here we describe the long-term (>160 days) anaerobic treatment of synthetic groundwater containing toluene (25 mg L^{-1}) in a novel laboratory-scale, continuous-flow bioelectrochemical reactor, termed the "bioelectric well". Under optimal operating conditions (i.e., anode potential potentiostatically controlled at +0.2 V vs. SHE and recycle flow-rate set at 75 mL min^{-1}), the observed electrogenic toluene oxidation rate was 67.2 ± 5.7 mg L d^{-1}, a value which is among the highest reported in the literature for laboratory-scale anaerobic treatment systems. Correspondingly, electric current was 5.1 ± 0.1 mA and the Coulombic efficiency (i.e., the yield of toluene conversion into electric current) was 79 ± 7%.

Anode potential selection for sulfide removal in contaminated marine sediments

Daghio Matteo, Vaiopoulou Eleni, Aulenta Federico, Sherry Angela, Head Ian, Franzetti Andrea, Rabaey, Korneel

Journal of hazardous materials

Sulfate reducing microorganisms are typically involved in hydrocarbon biodegradation in the sea sediment, with their metabolism resulting in the by-production of toxic sulfide. In this context, it is of utmost importance identifying the optimal value for anodic potential which ensures efficient toxic sulfide removal. Along this line, in this study the (bio)electrochemical removal of sulfide was tested at anodic potentials of - 205 mV, + 195 mV and + 300 mV (vs Ag/AgCl), also in the presence of a pure culture of the sulfur-oxidizing bacterium Desulfobulbus propionicus. Current production, sulfide concentration and sulfate concentration were monitored over time. At the end of the experiment sulfur deposition on the electrodes and the microbial communities were characterized by SEM-EDS and by next generation sequencing of the 16S rRNA gene respectively. Results confirmed that current production was linked to sulfide removal and D. propionicus promoted back oxidation of deposited sulfur to sulfate. The highest electron recovery was observed at + 195 mV vs Ag/AgCl, and the lowest sulfur deposition was obtained at - 205 mV vs Ag/AgCl anode polarization.

Anophthalmia and elongation of body appendages in cave scale worms (Aphroditiformia, Annelida)

Gonzalez B.C., Worsaae K., Fontaneto D. & Martinez Garcia A.

Zoologica Scripta

This study addresses whether cave dwelling annelids exhibited similar reductive and constructive traits equally as strong as those of arthropods and vertebrates inhabiting caves. Known as troglomorphism, these adaptations bring about striking morphologies across invertebrates and vertebrates from both aquatic and terrestrial cave habitats, and include varying degrees of eye and pigmentation loss, as well as hypertrophy of body appendages and sensorial structures. Employing phylogenetic comparative methods and ancestral character reconstructions on a worldwide data set of a group of annelids, the scale worms (Aphroditiformia), we investigate the behavioural and morphological traits of species living in marine caves in comparison with those species living outside caves. Our work demonstrated that cave scale worms respond similar to arthropods in cave environments, showing a significant elongation of sensory parapodial cirri, while lacking eyes and pigmentation. However, whereas elongation of sensory appendages likely occurred in correlation to cave colonization, eyes were plausibly lost in correlation with specialization and colonization of deep-sea habitats.

Assessing antibiotic resistance gene load in vegan, vegetarian and omnivore human gut microbiota

Losasso C., Di Cesare A., Mastrorilli E., Patuzzi I., Cibin V., Eckert E.M., Fontaneto D., Vanzo A., Ricci A. & Corno G.

International Journal of Antimicrobial Agents

Massive antimicrobial use in animal farming is considered as the greatest contributor to the presence of antimicrobial-resistant bacteria (ARB) in food of animal origin. Nevertheless, sewage from treated animals may impact on vegetables grown on fertilised fields, but it is largely unknown whether and to what extent ARB are transferred to vegetables and the human gut. It could be hypothesised that food of animal and vegetal origin have a different role in ARB transfer to the human gut and that different diets could be characterised by different antimicrobial resistance gene (ARG) loads. This study included three groups comprising vegans (n = 26), vegetarians (n = 32) and omnivores (n = 43). Metadata regarding food consumption and anthropometric parameters were collected. Gut microbial communities were investigated by 16S rDNA analysis. Four ARGs (sul2, tetA, blaTEM and strB) were quantified by qPCR. The results showed a lower total load of investigated ARGs in vegan diet (pairwise comparison adjusted results: omnivorous–vegan, P = 0.0119; omnivorous–vegetarian, P = 0.7416; and vegan–vegetarian, P = 0.0119). No significant differences in abundance of each gene separately were found between the three groups. Neither the amount of animal protein nor the occurrence of ARGs was significant in explaining differences in the gut microbial community of individuals, and a large proportion of the differences between community composition (PERMANOVA, 46.87%) was not explained by the analysed variables. The results support the role of omnivorous and vegetarian diets in accumulating ARGs, suggesting a possible role for animal-derived food consumption.

Assessing sustainability of agriculture through water footprint analysis and in-stream monitoring activities

Ersilia D'Ambrosio, Anna Maria De Girolamo, Maria Cristina Rulli

Journal of Cleaner Production

Agriculture is one of the main causes of water consumption and degradation. Assessing its sustainability is important to determining how the current use of water resources can affect their availability in the future and to safeguard their quantity and quality. In this context, this research was designed to develop a simple approach for the evaluation of agricultural sustainability, based on coupling the assessment of the total water footprint (WF) of catchment-scale crops and in-stream monitoring activities. The study focussed on a Mediterranean agricultural watershed (Celone, southeast Italy). Results for the study period (July 2010 e June 2011) show the total WF to be 79.9Mm^3 y^{-1}, subdivided into 30.3% green water, 0.5% blue water and 69.2% grey water, thus highlighting the importance of grey water in agricultural water use. The grey WF estimates are highly sensitive both to leaching and runoff fractions and applied water standards, and they are affected by large uncertainty. Tomato is the crop having the highest total crop water use (CWU), which is equal to 2521mm (286mm green CWU, 412mm blue CWU, 1823mm grey CWU). Legumes relied only on green water (217mm green CWU). The sustainability assessment of present water consumption, subdivided into the three WF components, indicates sustainable use of green water, fluctuating sustainability of blue water resources, depending on the season and the environmental flow requirement, and unsustainable grey water production and water pollution level for the Celone River. The methodology employed in this paper could be useful in watershed planning and management, helping farmers and decision-makers choose suitable crops for locally sustainable water use.

Assessment of gemfibrozil persistence in river water alone and in co-presence of naproxen

Paola Grenni, Luisa Patrolecco, Nicoletta Ademollo, Martina Di Lenola, Anna Barra Caracciolo.

Microchemical Journal

Gemfibrozil is a pharmaceutical commonly found in the aquatic compartment and its presence together with a mixture of several other biologically-active drugs raises concern about the possible long-term adverse effects on biota chronically exposed. Most research focus on its effect/degradation in wastewater treatment plant, while few investigations take into account its persistence in receiving aquatic ecosystems and its effects on natural microbial communities. In this context, the present work aims to evaluate gemfibrozil biodegradation, alone or in the co-presence of naproxen, comparing its persistence in the presence/absence of the river natural microbial community. For this purpose, water samples were collected from a river Tiber stretch inside the city of Rome and located downstream from a wastewater treatment plant and used for degradation experiments. Microbiologically active or sterile water microcosms were set up and treated with 100 μg L^{-1} of gemfibrozil alone or in the co-presence of naproxen (100 μg L^{-1}), in order to evaluate gemfibrozil degradation in the different

conditions. At fixed times water samplings were collected for both chemical and microbiological analysis. Moreover, the effects of the pharmaceuticals on the microbial community structure in terms of variations in its abundance and composition were also assessed. The overall results showed gemfibrozil to be a quite persistent molecule in the river water microcosms and the natural microbial community had a key role in its biodegradation. The copresence of naproxen, a non-steroidal anti-inflammatory drug commonly co-occurring with gemfibrozil, increased its persistence and affected negatively some bacterial groups presence.

Automatic processing of bioclimatic data in the space and time domains

Maggi S., Bruno D., Lay-Ekuakille A., Masciale R., Passarella G.

Journal of physics

This paper presents a software package for the automatic processing of bioclimatic data in the space and time domains whose final goal is to provide land and water management authorities with reliable information about the moisture/dryness level of a region and its water requirements. The current state of development of package is reported, presenting an example of application of the program to a specific case study.

Bacterial community structure along the subtidal sandy sediment belt of a high Arctic fjord (Kongsfjorden, Svalbard Islands)

Conte Antonella, Papale Maria, Amalfitano Stefano, Mikkonen Anu, Rizzo Carmen, Di Domenico Emilio, Michaud Luigi, Lo Giudice Angelina

Science of the total environment

Open fjords are subject to contrasting environmental conditions, owing to meltwater glacial inputs, terrestrial runoff, and marine water mass exchanges, which are exacerbated by anthropogenic and climate perturbations. Following a slope-dependent water circulation, the subtidal sandy sediment belt regulates the convergent transport of nutrients downward the fjord depths, and the effective entrapment of suspended particles and microorganisms. In this study, we aimed at testing how glacial and seawater inputs may influence the bacterial community structure of subtidal sand deposits in the Kongsfjorden. Through total and viable cell counting and an amplicon sequencing approach, we found relevant differences in bacterial community structure along the glacio-marine sampling transect. Viable and high nucleic acid content (HNA) cells represented an important fraction of the total community, generally decreasing toward the glacier front. Besides the predominance of Alpha- and Gammaproteobacteria, Bacteroidetes, Firmicutes and Parcubacteria, the bacterial community structure was likely affected by the glacial activity in the inner fjord, with the occurrence of distinctive phylotypes belonging to Gemmatimonadates, Nitrospirae, Acidobacteria, and Chloroflexi. Overall, our outcomes highlighted that exploring the bacterial community distribution and structure can provide new insights into the active role of sand deposits in coastal cold environments.

Belowground microbiota and the health of tree crops

Mercado-Blanco J., Abrantes I., Barra Caracciolo A., Bevivino A., Ciancio A., Grenni P., Hrynkiewicz K., Kredics L., Proenca D.N.

Frontiers in microbiology

Trees are crucial for sustaining life on our planet. Forests and land devoted to tree crops do not only supply essential edible products to humans and animals, but also additional goods such as paper or wood. They also prevent soil erosion, support microbial, animal, and plant biodiversity, play key roles in nutrient and water cycling processes, and mitigate the effects of climate change acting as carbon dioxide sinks. Hence, the health of forests and tree cropping systems is of particular significance. In particular, soil/rhizosphere/root-associated microbial communities (known as microbiota) are decisive to sustain the fitness, development, and productivity of trees. These benefits rely on processes aiming to enhance nutrient assimilation efficiency (plant growth promotion) and/or to protect against a number of (a)biotic constraints. Moreover, specific members of the microbial communities associated with perennial tree crops interact with soil invertebrate food webs, underpinning many density regulation mechanisms. This review discusses belowground microbiota interactions influencing the growth of tree crops. The study of tree-(micro)organism interactions taking place at the belowground level is crucial to understand how they contribute to processes like carbon sequestration, regulation of ecosystem functioning, and nutrient cycling. A comprehensive understanding of the relationship between roots and their associate microbiota can also facilitate the design of novel sustainable approaches for the benefit of these relevant agro-ecosystems. Here, we summarize the methodological approaches to unravel the composition and function of belowground microbiota, the factors influencing their interaction with tree crops, their benefits and harms, with a focus on representative examples of Biological Control Agents (BCA) used against relevant biotic constraints of tree crops. Finally, we add some concluding remarks and suggest future perspectives concerning the microbiota-assisted management strategies to sustain tree crops.

Barcoding of Chrysomelidae of Euro-Mediterranean area: efficiency and problematic species

Magoga G., Sahin D.C., Fontaneto D. & Montagna M.

Scientific Reports

Leaf beetles (Coleoptera: Chrysomelidae), with more than 37,000 species worldwide and about 2,300 in the Euro-Mediterranean region, are an ecological and economical relevant family, making their molecular identification of interest also in agriculture. This study, part of the Mediterranean Chrysomelidae Barcoding project (www.c-bar.org), aims to: (i) develop a reference Cytochrome c oxidase I (COI) library for the molecular identification of the Euro-Mediterranean Chrysomelidae; (ii) test the efficiency of DNA barcoding for leaf beetles identification; (iii) develop and compare optimal thresholds for distance-based identifications estimated at family and subfamily level, minimizing false positives and false negatives. Within this study, 889 COI nucleotide sequences of 261 species were provided; after the inclusion of information from other sources, a dataset of 7,237 sequences (542 species) was analysed. The

average intra-interspecific distances were in the range of those recorded for Coleoptera: 1.6–24%. The estimated barcoding efficiency (~94%) confirmed the usefulness of this tool for Chrysomelidae identification. The few cases of failure were recorded for closely related species (e.g., Cryptocephalus marginellus superspecies, Cryptocephalus violaceus - Cryptocephalus duplicatus and some Altica species), even with morphologically different species sharing the same COI haplotype. Different optimal thresholds were achieved for the tested taxonomic levels, confirming that group-specific thresholds significantly improve molecular identifications.

Bioaccumulation of nonylphenols and bisphenol A in the Greenland shark Somniosus microcephalus from the Greenland seawaters

Ademollo N., Patrolecco L., Rauseo J., Nielsen J., Corsolini S.

Microchemical journal

Recent climate changes associated with anthropogenic emissions of pollutants are triggering shifts in global biogeochemical cycles and polar marine ecosystem. The decrease of sea ice and the mechanism of ice formation/melting, may considerably have an impact on the mobility of contaminants and on the loss of biodiversity. In this work, we report the occurrence and bioaccumulation of selected endocrine-disrupting compounds (EDCs) in muscle and liver of the Greenland shark Somniosus microcephalus, an arctic species of interest for biogeography, migration, physiology, long- and short-term contaminant storage. The EDCs selected for this study were 4-nonylphenol (4-NP), its mono- (NP1EO) and di-ethoxylate (NP2EO) precursors and bisphenol A (BPA). There are currently very few scientific papers on the distribution and transport of these EDC s in the arctic marine food web and no such studies have been performed on the Greenland shark. Totally, muscles and liver samples were analyzed from 23 Greenland sharks (TL range 149-442 cm) sampled in W, SW, SE, and NE Greenland. Extraction of analytes from biological matrices were performed by ASE (Accelerated Solvent Extraction), followed by HPLC-Fluorescence (FLD) detection. Results showed higher contamination levels in muscle than in liver in the sharks from SE and NE Greenland, while in specimens from W and SW Greenland the liver was the tissue more contaminated. In fact, the 4-NP, NP1-2EO and BPA mean content in liver of SW Greenland specimens was 43.5 ng/g, 288.5 ng/g and 8.2 ng/g wet wt respectively, while in muscle mean concentrations was 20.3 ng/g for 4-NP, 171.1 ng/g wet wt for NP1-2EO and 7.9 ng/g for BPA. Results confirm the presence of selected EDCs in this species, suggesting the transfer of contamination in the Euro-Arctic marine trophic web.

Bioactive fatty acids of three commercial scallop species

Prato Ermelinda, Biandolino Francesca, Parlapiano Isabella, Papa Loredana, Kelly Maeve, Fanelli Giovanni

International journal of food properties

The fat content and fatty acid profile of commercially important scallops Flexopecten glaber, Mimachlamys varia, and Pecten jacobaeus were investigated in samples of adductor muscle, gonad, mantle, and viscera. The viscera showed the highest lipid content in all species

examined. Significant differences were found in the fatty acid composition among tissues and among scallops. All pectinids exhibited high levels of eicosapentaenoic and docosahexaenoic acids in the adductor muscle, with a maximum value of 211 mg/100 g tissue and 252 mg/100 g tissue in the viscera of F. glaber. Highest n3/n6 ratios were recorded in F. glaber gonad and viscera, in P. jacobaeus muscle, and in the gonad of M. varia. M. varia adductor muscle had the lowest values of atherogenicity and thrombogenicity indices used as indicators of beneficial health effects. These data contribute to the overall evaluation of the nutritional quality of scallops and suggest that their consumption may provide health benefits.

Biodegradation of Diclofenac by the bacterial strain Labrys portucalensis FI 1

Moreira Irina S., Bessa Vania S., Murgolo Sapia, Piccirillo Clara, Mascolo Giuseppe, Castro Paula M. L.

Ecotoxicology and environmental safety

Diclofenac (DCF) is a widely used non-steroidal anti-inflammatory pharmaceutical which is detected in the environment at concentrations which can pose a threat to living organisms. In this study, biodegradation of DCF was assessed using the bacterial strain Labrys portucalensis F11. Biotransformation of 70% of DCF (1.7-34 mu M), supplied as the sole carbon source, was achieved in 30 days. Complete degradation was reached via co-metabolism with acetate, over a period of 6 days for 1.7 mu M and 25 days for 34 mu M of DCF. The detection and identification of biodegradation intermediates was performed by UPLC-QTOF/MS/MS. The chemical structure of 12 metabolites is proposed. DCF degradation by strain F11 proceeds mainly by hydroxylation reactions; the formation of benzoquinone imine species seems to be a central step in the degradation pathway. Moreover, this is the first report that identified conjugated metabolites, resulting from sulfation reactions of DCF by bacteria. Stoichiometric liberation of chlorine and no detection of metabolites at the end of the experiments are strong indications of complete degradation of DCF by strain F11. To the best of our knowledge this is the first report that points to complete degradation of DCF by a single bacterial strain isolated from the environment.

Biofilm growth and control in cooling water industrial systems

Di Pippo F., Di Gregorio L., Congestri R., Tandoi V., Rossetti S.

FEMS microbiology

Matrix-embedded, surface-attached microbial communities, known as biofilms, profusely colonise industrial cooling water systems, where the availability of nutrients and organic matter favours rapid microbial proliferation and their adhesion to surfaces in the evaporative fill material, heat exchangers, water reservoir and cooling water sections and pipelines. The extensive growth of biofilms can promote micro-biofouling and microbially induced corrosion (MIC) as well as pose health problems associated with the presence of pathogens like Legionella pneumophila. This review examines critically biofilm occurrence in cooling water systems and the main factors potentially affecting biofilm growth, biodiversity and structure.

A broad evaluation of the most relevant biofilm monitoring and control strategies currently used or potentially useful in cooling water systems is also provided.

Biogeochemistry and biodiversity in a network of saline-alkaline lakes: implications of ecohydrological connectivity in the Kenyan Rift Valley

Fazi S., A. Butturini, F. Tassi, S. Amalfitano, S. Venturi, E. Vazquez, M. Clokie, S.W. Wanjala, N. Pacini, D. Harper

Ecohydrology & Hydrobiology

The volcanic and tectonic lakes of the eastern branch of the African Great Rift Valley are exposed to multiple stressors and characterised by different levels of hydrological connectivity. Past volcanic activity generated endorheic basins, in which the nature of the bedrock, its connection with groundwater, and local climatic conditions, favoured the formation of highly alkaline soda waters. While little is known about their nutrient dynamics, most lakes in this area experience considerable microbial blooms and harbour diverse and specifically adapted microbial populations, some of which could embody novel biotechnological potential. Here we review the geochemical and (micro)biological features of a cluster of lakes distributed within the East African Rift, ranging from fresh to hypersaline, under different levels of hydrological connectivity. Possibly no other location on Earth has a comparable range of lake types in close proximity to each other and representing such a remarkable microbial biodiversity. Environmental heterogeneity and habitat connectivity among adjacent aquatic ecosystems may have positive implications in terms of regional environmental stability by enhancing the overall carrying capacity, i.e. the resilience to various forms of impact, contributing to biodiversity protection. Within these ecosystems, microbial processes encompass the entire basis of their primary production, in particular those driven by cyanobacteria. Combining a multi-disciplinary ecohydrological approach with a biogeochemical investigation of the principles underlying their functioning, our study can contribute to the development of appropriate environmental protection measures to effectively maintain their natural capital.

Biological treatment of hypersaline wastewater in a continuous two-phase partitioning bioreactor: Analysis of the response to step, ramp and impulse loadings and applicability evaluation

Tomei M.C., Stazi V., Mosca Angelucci D.

Journal of cleaner production

The response of a continuous two-phase partitioning bioreactor (C-TPPB) operated with polymeric tubing treating hypersaline wastewater was investigated under dynamic load conditions of step, ramp and impulse inputs of the influent flow rate. Tests were performed with synthetic wastewater consisting of NaCl (100 g L^{-1}) and 2,4-dimethylphenol (DMP) (~1200mg L^{-1}) to simulate the organic fraction. A biomass specifically acclimatized to the compound was utilized in the tests. The experimental system provides separation of the toxic wastewater flowing inside the polymeric tubing (coiled in the bioreactor) from the microbial

culture present in the bulk bioreactor phase with the polymer providing permeability to the organic molecules as well as a barrier to salt transport. These features allowed achieving high performance even in the most severe loading conditions. Removal efficiencies >96% were obtained for DMP under all investigated load conditions (i.e. for influent salt and organic loads up to six times the base case load). A DMP mass balance at the end of the dynamic tests showed that 88% of the removed DMP was biodegraded and only 8% was retained into the polymer tubing itself. No significant variation of the DMP concentration in the bioreactor was observed in all cases thus demonstrating the complete removal of the transferred substrate and the effective performance of the biomass, which was not affected by the applied dynamic loads. A comparative analysis of C-TPPB results with the performance data of the classical technologies commonly applied for saline wastewater treatment has been performed to evaluate the system applicability.

Biomethanization of citrus waste: Effect of waste characteristics and of storage on treatability and evaluation of limonene degradation

Adriana Maria Lotito, Marco De Sanctis, Carlo Pastore, Claudio Di Iaconi

Journal of Environmental Management

This study proposes the evaluation of the suitability of mesophilic anaerobic digestion as a simple technology for the treatment of the citrus waste produced by small-medium agro-industrial enterprises involved in the transformation of Citrus fruits. Two different stocks of citrus peel waste were used (i.e., fresh and stored citrus peel waste), to evaluate the influence of waste composition (variability in the type of processed Citrus fruits) and of storage (potentially necessary to operate the anaerobic digester continuously over the whole year due to the seasonality of the production) on anaerobic degradation treatability. A thorough characterization of the two waste types has been performed, showing that the fresh one has a higher solid and organic content, and that, in spite of the similar values of oil fraction amounts, the two stocks are significantly different in the composition of essential oils (43% of limonene and 34% of linalyl acetate in the fresh citrus waste and 20% of limonene and 74% of linalyl acetate in the stored citrus waste). Contrarily to what observed in previous studies, anaerobic digestion was successful and no reactor acidification occurred. No inhibition by limonene and linalyl acetate even at the maximum applied organic load value (i.e., 2.72 $gCOD_{waste}/gVS_{inoculum}$) was observed in the treatment of the stored waste, with limonene and linalyl acetate concentrations of 104 mg/l and 385mg/l, respectively. On the contrary, some inhibition was detected with fresh citrus peel waste when the organic load increased from 2.21 to 2.88 $gCOD_{waste}/gVS_{inoculum}$, ascribable to limonene at initial concentration higher than 150 mg/l. A good conversion into methane was observed with fresh peel waste, up to 0 0.33 $l_{CH4}/g_{CODremoved}$ at the highest organic load, very close to the maximum theoretical value of 0.35 $l_{CH4}/g_{CODremoved}$, while a lower efficiency was achieved with stored peel waste, with a reduction down to 0.24 $l_{CH4}/g_{CODremoved}$ at the highest organic load.

Biostimolanti per l'agricoltura da macroalghe: progetto preliminare nei mari di Taranto

A. Petrocelli, G. Portacci, V. Russo, E. Cecere

Biologia Marina Mediterranea

Seaweed extracts used as biostimulants in agriculture proved able to mitigate biotic and abiotic stress, such as drought, and extreme values of salinity and temperature. In this respect, climatic change impact on agriculture fostered the sustainable production of algal biomass. For this reason, the ability of the Rhodophycean Hypnea cornuta and Spyridia filamentosa to settle on artificial substrata was tested in the Mar Piccolo of Taranto. Results were encouraging for further experiments aiming to the production of extracting biomasses.

Biotic control of in-stream nutrient retention in nitrogen-rich springs (Po Valley, Northern Italy)

Balestrini, R.; Delconte, C. A.; Palumbo, M. T.; Buffagni, A.

Ecological Engineering

Agriculture is a major contributor of nutrients to surface waters in large parts of the world and affects hydromorphological conditions of rivers eventually altering their ecological status. Increasing attention has been given to those aspects of river functioning which refer to the processes able to modulate the concentration of nutrients exported downstream. This study aimed to evaluate the nutrient retention in agricultural groundwater-fed lowland streams, also known as "fontanili", contaminated by elevated nitrate loadings. We used the nutrient spiraling method to assess ammonium (NH_4) and phosphate (PO_4) retention in two fontanili reaches, that significantly differed in presence/absence of aquatic macrophytes and tree canopy in the riparian zone. The results indicate that the overall nutrient retention was higher in the macrophyte-rich than in the unvegetated stream channel. The metric better reflecting the biological removal (i.e. the uptake velocity – Vf) was 9.8-fold and 4.4-fold higher, respectively for NH_4 and PO_4, in the vegetated than in the unvegetated reach. Temperature was an important driver of nutrient retention in vegetated condition, while discharge explained most variation of the uptake length of both nutrients in the reach where macrophytes were lacking. The role of the autotrophic compartment was further highlighted by the positive association between the uptake velocity (Vf- NH_4 and Vf- PO_4) and the gross primary production. The relationships observed between some retention metrics and the relative nutrient availability suggest that primary producers strongly controlled NH_4 retention despite the extremely high N:P water ratio. The median NH_4 uptake rate at the macrophyte-rich spring (30.5 $\mu gm^{-2}\ min^{-1}$) was 5.5 fold higher than that at the unvegetated one, and was in the range reported for pristine streams. A few simple management actions are suggested that might be helpful to mitigate nitrogen and phosphorous pollution in the hydraulic networks of the Po Plain

Body size shifts in aquatic and terrestrial urban communities

Merckx T., Souffreau C., Kaiser A., Baardsen L.F., Backeljau T., Bonte D., Brans K.I., Cours M., Dahirel M., Debortoli N., De Wolf K., Engelen J.M.T., Fontaneto D., Gianulca A.T., Govaert L., Hendrickx F., Higuti J., Lens L., Martens K., Matheve H., Matthysen E., Piano E., Sablon R., Shon I., Van Doninck, De Meester L. & Van Dyck H.

Nature

Body size is intrinsically linked to metabolic rate and life-history traits, and is a crucial determinant of food webs and community dynamics1,2. The increased temperatures associated with the urban-heat-island effect result in increased metabolic costs and are expected to drive shifts to smaller body sizes3. Urban environments are, however, also characterized by substantial habitat fragmentation4, which favours mobile species. Here, using a replicated, spatially nested sampling design across ten animal taxonomic groups, we show that urban communities generally consist of smaller species. In addition, although we show urban warming for three habitat types and associated reduced community-weighted mean body sizes for four taxa, three taxa display a shift to larger species along the urbanization gradients. Our results show that the general trend towards smaller-sized species is overruled by filtering for larger species when there is positive covariation between size and dispersal, a process that can mitigate the low connectivity of ecological resources in urban settings5. We thus demonstrate that the urban-heat-island effect and urban habitat fragmentation are associated with contrasting community-level shifts in body size that critically depend on the association between body size and dispersal. Because body size determines the structure and dynamics of ecological networks1, such shifts may affect urban ecosystem function.

Characteristics of meiofauna in extreme marine ecosystems: a review

Zeppilli D., Leduc D., Fontanier C., Fontaneto D., Fuchs S., Gooday A.J., Goineau A., Ingels J., Ivanenko V.N., Kristensen R.M., Cardoso Neves R., Sanchez Santos N., Sandulli R., Sarrazin J., Sørensen M.V., Tasiemski A., Vanreusel A., Autret M., Bourdonnay L., Claireaux M., Coquillé V., De Wever L., Rachel D., Marchant J., Toomey L. & Fernandes D.

Marine Biodiversity

Extreme marine environments cover more than 50% of the Earth's surface and offer many opportunities for investigating the biological responses and adaptations of organisms to stressful life conditions. Extreme marine environments are sometimes associated with ephemeral and unstable ecosystems, but can host abundant, often endemic and well-adapted meiofaunal species. In this review, we present an integrated view of the biodiversity, ecology and physiological responses of marine meiofauna inhabiting several extreme marine environments (mangroves, submarine caves, Polar ecosystems, hypersaline areas, hypoxic/anoxic environments, hydrothermal vents, cold seeps, carcasses/sunken woods, deep-sea canyons, deep hypersaline anoxic basins [DHABs] and hadal zones). Foraminiferans, nematodes and copepods are abundant in almost all of these habitats and are dominant in deep-sea ecosystems. The presence and dominance of some other taxa that are normally less common may be typical of certain extreme conditions. Kinorhynchs are particularly well

adapted to cold seeps and other environments that experience drastic changes in salinity, rotifers are well represented in polar ecosystems and loriciferans seem to be the only metazoan able to survive multiple stressors in DHABs. As well as natural processes, human activities may generate stressful conditions, including deoxygenation, acidification and rises in temperature. The behaviour and physiology of different meiofaunal taxa, such as some foraminiferans, nematode and copepod species, can provide vital information on how organisms may respond to these challenges and can provide a warning signal of anthropogenic impacts. From an evolutionary perspective, the discovery of new meiofauna taxa from extreme environments very often sheds light on phylogenetic relationships, while understanding how meiofaunal organisms are able to survive or even flourish in these conditions can explain evolutionary pathways. Finally, there are multiple potential economic benefits to be gained from ecological, biological, physiological and evolutionary studies of meiofauna in extreme environments. Despite all the advantages offered by meiofauna studies from extreme environments, there is still an urgent need to foster meiofauna research in terms of composition, ecology, biology and physiology focusing on extreme environments.

Climate change, migration and displacement of populations: a special issue

Salerno Franco

International journal of climate change strategies and management

Assessing the nature and scale of migration that is directly attributable to climate change in the decades ahead is far from straightforward. The interconnectedness of the various drivers of migration, and the complex interactions of climate change with those drivers, make it difficult to attribute specific environmental impacts (Chang Seng and Birkmann, 2011). In the past few decades, potential linkages and implications of climate change on human mobility have taken hold in the literature (Black et al., 2011; Felli and Castree, 2012; Upadhyay et al., 2015). It is becoming clearer that one single factor is rarely a sufficient reason for migrating. Migration causes are usually multi-faceted, with climate change adding to already increasing levels and complexities of population mobility (de Sherbinin et al., 2011; Felli and Castree, 2012; Chang Seng and Birkmann, 2011; Hugo, 2011).

Climatic effects on vertical mixing and deep-water oxygen content in the subalpine lakes in Italy

Rogora M., Buzzi F., Dresti C., Leoni B., Lepori F., Mosello R., Patelli M., Salmaso N.

Hydrobiologia

Deep lakes south of the Alps (DSL: Maggiore, Lugano, Como, Iseo and Garda) are characterised by varying trophic states and dissolved oxygen (DO) concentrations. Some of these lakes experience anoxic conditions in deep waters. We hypothesised that the increase in temperature and water-column stability observed in these lakes during recent decades influenced the deep-water DO concentration. In particular, we tested whether the thermal regime of the lakes and the depth of mixing affect oxygen replenishment during winter-spring

turnover. To this aim, we analysed long-term trends and seasonal variability of oxygen levels in the DSL during 1992-2016. We included in our analysis the effects of environmental variables, such as winter air temperature and atmospheric modes of variability. Our results showed a recent decrease in the deep-water oxygen content in lakes Maggiore, Como and Garda and an increase of the extent of anoxic conditions in lakes Lugano and Iseo. Our results suggest that, beside cultural eutrophication, rising environmental pressures, such as global warming, can influence the future trends of the oxygen levels and ecological states of deep lakes

Cnidarian Interaction with Microbial Communities: From Aid to Animal's Health to Rejection Responses

Stabili L.; Parisi M. G.; Parrinello D.; Cammarata M.

Marine Drugs

The phylum Cnidaria is an ancient branch in the tree of metazoans. Several species exert a remarkable longevity, suggesting the existence of a developed and consistent defense mechanism of the innate immunity capable to overcome the potential repeated exposure to microbial pathogenic agents. Increasing evidence indicates that the innate immune system in Cnidarians is not only involved in the disruption of harmful microorganisms, but also is 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. Sometimes, the shifts in the normal microbiota may be used as early bio-indicators of both environmental changes and/or animal disease. Here the Cnidarians relationships with microbial communities and the potential biotechnological applications are summarized and discussed.

Comparative genomics of bdelloid rotifers: Insights from desiccating and nondesiccating species

Nowell R.W., Almeida P., Wilson C.G., Smith T.P., Fontaneto D., Crisp A., Micklem G., Tunnacliffe A., Boschetti C. & Barraclough T.G.

PLoS Biology

Bdelloid rotifers are a class of microscopic invertebrates that have existed for millions of years apparently without sex or meiosis. They inhabit a variety of temporary and permanent freshwater habitats globally, and many species are remarkably tolerant of desiccation. Bdelloids offer an opportunity to better understand the evolution of sex and recombination, but previous work has emphasised desiccation as the cause of several unusual genomic features in this group. Here, we present high-quality whole-genome sequences of 3 bdelloid species: Rotaria macrura and R. magnacalcarata, which are both desiccation intolerant, and Adineta ricciae, which is desiccation tolerant. In combination with the published assembly of A. vaga, which is also desiccation tolerant, we apply a comparative genomics approach to evaluate the potential effects of desiccation tolerance and asexuality on genome evolution in bdelloids. We find that ancestral tetraploidy is conserved among all 4 bdelloid species, but

homologous divergence in obligately aquatic Rotaria genomes is unexpectedly low. This finding is contrary to current models regarding the role of desiccation in shaping bdelloid genomes. In addition, we find that homologous regions in A. ricciae are largely collinear and do not form palindromic repeats as observed in the published A. vaga assembly. Consequently, several features interpreted as genomic evidence for long-term ameiotic evolution are not general to all bdelloid species, even within the same genus. Finally, we substantiate previous findings of high levels of horizontally transferred nonmetazoan genes in both desiccating and nondesiccating bdelloid species and show that this unusual feature is not shared by other animal phyla, even those with desiccation-tolerant representatives. These comparisons call into question the proposed role of desiccation in mediating horizontal genetic transfer.

Comparison between kinetics of autochthonous marine bacteria in activated sludge and granular sludge systems at different salinity and SRTs

Santo Fabio Corsino, Marco Capodici, Francesca Di Pippo, Valter Tandoi, Michele Torregrossa

Water research

Biological nutrient removal performances and kinetics of autochthonous marine biomass in forms of activated sludge and aerobic granular sludge were investigated under different salinity and sludge retention time (SRT). Both the biomasses, cultivated from a fish-canning wastewater, were subjected to stepwise increases in salinity (þ2 $g_{NaCl}\ L^{-1}$), from 30 $g_{NaCl}\ L^{-1}$ up to 50 $g_{NaCl}\ L^{-1}$ with the aim to evaluate the maximum potential in withstanding salinity by the autochthonous marine biomass. Microbial marine species belonging to the genus of Cryomorphaceae and of Rhodobacteraceae were found dominant in both the systems at the maximum salinity tested (50 $g_{NaCl}\ L^{-1}$). The organic carbon was removed with a yield of approximately 98%, irrespective of the salinity. Similarly, nitrogen removal occurred via nitritation-denitritation and was not affected by salinity. The ammonium utilization rate and the nitrite utilization rate were approximately of 3.60 $mg_{NH4\text{-}N}\ g_{VSS}^{-1}h^{-1}$ and 10.0 $mg_{NO2\text{-}N}\ g_{VSS}^{-1}h^{-1}$, respectively, indicating a high activity of nitrifying and denitrifying bacteria. The granulation process did not provide significant improvements in the nutrients removal process likely due to the stepwise salinity increase strategy. Biomass activity and performances resulted affected by long SRT (27 days) due to salt accumulation within the activated sludge flocs and granules. In contrast, a lower SRT (14 days) favoured the discharge of the granules and flocs with higher inert content, thereby enhancing the biomass renewing. The obtained results demonstrated that the use of autochthonous-halophilic bacteria represents a valuable solution for the treatment of high-strength carbon and nitrogen saline wastewater in a wide range of salinity. Besides, the stepwise increase in salinity and the operation at low SRT enabled high metabolic activity and to avoid excessive accumulation of salt within the biomass aggregates, limiting their physical destructuration due to the increase in loosely-bound exopolymers.

Comparison of different types of landfill leachate treatments by employment of nontarget screening to identify residual refractory organics and principal component analysis

C. Pastore, E. Barca, G. Del Moro, C. Di Iaconi, M. Loos, H.P. Singer, G. Mascolo

Science of the Total Environment

Three different chemical oxidation processes were investigated in terms of their capability to degrade organic chemical components of real mature landfill-leachate in combination with biological treatment run in a Sequencing Batch Biofilter Granular Reactor (SBBGR). H_2O_2, H_2O_2 + UV and O_3 were integrated with SBBGR and respective effluents were analyzed and comparedwith the effluent obtained frombiological SBBGR treatment alone. In agreementwith their respective oxidative power, conventional bulk parameters (residual COD, TOC, Ntot, TSS) determined from the resulting effluents evidenced the following efficacy ranking for degradation: SBBGR/O_3 > SBBGR/UV+ H_2O_2 > SBBGR/ H_2O_2 > SBBGR. Amore detailed characterization of the organic compounds was subsequently carried out for the four treated streams. For this, effluents were first subjected to a sample preparation step, allowing for a classification in terms of acidic, basic, strongly acidic and strongly basic compounds, and finally to analysis by liquid chromatography/high resolution mass spectrometry (LC/ HR-MS). This classification, combined with further data post-processing (non-target screening, Venn Diagram, tridimensional plot and Principal Component Analysis), evidenced that the SBBGR/ H_2O_2 process is comparable to the pure biological oxidation. In contrast, SBBGR/O_3 and SBBGR/UV+ H_2O_2 not only resulted in a very different residual composition as compared to SBBGR and SBBGR/ H_2O_2, but also differ significantly from each other. In fact, and despite of the SBBGR/O_3 being the most efficient process, this treatment remained chemically more similar to SBBGR/ H_2O_2 than to SBBGR/UV + H_2O_2. This finding may be attributable to different mechanism of degradation involved with the use of UV radiation. Apart from these treatment differences, a series of recalcitrant compounds was determined in all of the four treatments and partly identified as hetero-poly-aromatic species (humic acids-like species).

Control strategy for filamentous sludge bulking: Bench-scale test and full-scale application

Fan N., Wang R., Qi R., Gao Y., Rossetti S., Tandoi V., Yang M.

Chemosphere

Sludge bulking caused by the overgrowth of filamentous bacteria, especially Microthrix parvicella, has been observed in WWTPs worldwide during low-temperature periods. In this study, the impacts of sludge load on the in situ growth of M. parvicella and sludge settleability were first evaluated at 15 °C over a period of 500 d using a bench-scale anaerobic-anoxic-aerobic reactor fed with raw sewage from a full-scale WWTP. When the reactor was operated at a sludge load of 0.07 ± 0.015 kg Chemical Oxygen Demand (COD) (kg MLSS·d)$^{-1}$ for 120 d, the sludge volume index (SVI) increased gradually from 85 mL g^{-1} to 157 mL g^{-1}, and the abundance of M. parvicella quantified by qPCR and FISH methods also increased from 0.42% to 4.63% and 1.56%-13.59%, respectively. When the sludge load was further reduced to

0.04 ± 0.004 kg COD (kg MLSS·d)$^{-1}$, the SVI value varied in a narrow range of 135-164 mL g^{-1} over a duration of 280 d, while the M. parvicella abundance increased to the maximum values of 10.13% (qPCR) and 18.53% (FISH), respectively. When the sludge load was increased to 0.12 ± 0.016 kg COD (kg MLSS·d)$^{-1}$, filamentous abundance and SVI were reduced to 1.06% (qPCR) and 105 mL g^{-1} within 100 d, suggesting that it might be possible to control the growth of M. parvicella by keeping the sludge load above 0.1 kg COD (kg MLSS·d)$^{-1}$. The feasibility of the strategy was further validated in the same WWTP. It was found that the SVI and filamentous abundance in winter were successfully controlled for two successive years at below 120 mL g^{-1} and 7% (FISH), respectively, when the sludge load was maintained at 0.14 ± 0.04 kg COD (kg MLSS·d)$^{-1}$ by adjusting sludge discharge, proving that this sludge-load-based strategy could be an efficient approach to control filamentous bulking

Could the extreme meteorological events in Lake Maggiore watershed determine a climate-driven eutrophication process?

Morabito G., Rogora M., Austoni M., Ciampittiello M.

Hydrobiologia

Lake Maggiore has reached a stable oligotrophic status after a recovery process from mesotrophy that began in the early 1980s. However, the most recent phytoplankton and water chemistry data seem to indicate that various changes are taking place, including a slight increase in TP values, and almost regular blooms have occurred since 2005. Meteoclimatic data collected over the last few decades in the Lake Maggiore watershed highlight an increase in the frequency of extreme rainfall events. Here, for the period 2000-2013, we analyse the relationships between the phytoplankton dynamics and selected extreme precipitation events, in order to evaluate the possible role of rainfall in affecting the nutrient availability and phytoplankton dynamics. Among the algal groups, cyanobacteria showed the strongest relationship with the precipitation pattern, particularly on a short-term temporal scale. Our results support the hypothesis that rainfall may lead to a short-term increase in nutrients that stimulate the growth of phytoplankton and the development of blooms in summer, when epilimnetic waters are usually nutrient depleted. The almost regular cyanobacterial blooms recorded in Lake Maggiore since 2005 can be interpreted as a response to changing precipitation patterns and therefore as a sign of climate-induced eutrophication

Coupling the water footprint accounting of crops and in-stream monitoring activities at the catchment scale

Ersilia D'Ambrosio, Anna Maria De Girolamo, Maria Cristina Rulli

MethodsX

In this work, a simple approach for calibrating the water footprint (WF) accounting of crops with in-stream measurements at the catchment scale was developed. The green and blue components of the WF were evaluated by performing a soil-water balance at a 10-day time-interval. The surface runoff was calibrated based on continuous streamflow measurements. Meanwhile, the grey component of the WF related to nitrogen use was quantified by means of

the results from the in-stream monitoring activities. The methodology can be applied to any catchment where soil, land use, weather, agricultural practices, nitrogen balance and stream data are available. This methodological approach can support local authorities in the decision-making process for effective agricultural policy setting and water planning. The WF accounting for an agricultural catchment is coupled with surface-water monitoring results The green and blue WF are assessed by performing a soil-water balance Surface runoff and grey water accounts are based on in-stream monitoring activities

ddPCR applied on CPR samples reveals long-term occurrence and spread of antibiotic resistance genes and class 1 integrons carrying bacteria in the marine plankton community

Di Cesare A., Petrin S., Fontaneto D., Losasso C., Eckert E., Tassistro G., Borello A., Ricci A., Wilson W., Pruzzo C. & Vezzulli L.

Environmental Microbiology Reports

Antibiotic resistance is a rising threat for human health. Although in clinical settings and terrestrial environments the rise of antibiotic resistant bacteria is well documented, their dissemination and spread in the marine environment, covering almost two-thirds of the Earth's surface, is still poorly understood. In this study, the presence and abundance of sulphonamide resistance gene (sul2) and class 1 integron-integrase gene (intI1), used as markers for the occurrence and spread of antibiotic resistance genes since the beginning of the antibiotic era, were investigated. Twenty-nine archived formalin-fixed samples, collected by the Continuous Plankton Recorder (CPR) survey in the Atlantic Ocean and North Sea from 1970 to 2011, were analysed using Droplet Digital PCR (ddPCR) applied for the first time on CPR samples. The two marker genes were present in a large fraction of the samples (48% for sul2 and 76% for intI1). In contrast, results from Real-Time PCR performed on the same samples greatly underestimate their occurrence (21% for sul2 and 52% for intI1). Overall, besides providing successful use of ddPCR for the molecular analysis of CPR samples, this study reveals long-term occurrence and spread of sul2 gene and class 1 integrons in the plankton-associated bacterial communities in the ocean.

Dealing with Uncertainty in Decision-Making for Drinking Water Supply Systems Exposed to Extreme Events

Pagano Alessandro, Pluchinotta Irene, Giordano Raffaele, Petrangeli Anna Bruna, Fratino Umberto, Vurro Michele

Water resources management

The availability and the quality of drinking water are key requirements for the well-being and the safety of a community, both in ordinary conditions and in case of disasters. Providing safe drinking water in emergency contributes to limit the intensity and the duration of crises, and is thus one of the main concerns for decision-makers, who operate under significant uncertainty. The present work proposes a Decision Support System for the emergency management of drinking water supply systems, integrating: i) a vulnerability assessment model

based on Bayesian Belief Networks with the related uncertainty assessment model; ii) a model for impact, and related uncertainty assessment, based on Bayesian Belief Networks. The results of these models are jointly analyzed, providing decision-makers with a ranking of the priority of intervention. A GIS interface (G-Net) is developed to manage both input spatial information and results. The methodology is implemented in L'Aquila case study, discussing the potentialities associated to the use of the tool dealing with information and data uncertainty.

Deconvolution models for a better understanding of natural microbial communities enumerated by flow-cytometry

Corno G. and Callieri C.

Cytometry Part A

The application of flow cytometry is well-established for the characterization of aquatic microbial communities in natural systems. The manuscript by Amalfitano et al. (this issue, page 194; DOI: cyto.a.23304) presents an attractive approach to dredge the cytometric fingerprinting of planktonic microorganisms.The presented bioinformatics tool is likely suitable for automation and could considerably increase the potential of flow cytometry for microbiological studies in environment, as the time of analysis will be shortened and cohesive microbial populations will be detected through an operator-independent procedure. For this reason, when broadly applied by microbial ecologists, the deconvolution model proposed by Amalfitano and coworkers (this issue) could represent a fundamental step toward a correct flow-cytometric assessment of microbial numbers and morphological distribution, promoting a significant advance in deeper understanding the microbial dynamics of aquatic systems.

Deconvolution model to resolve cytometric microbial community patterns in flowing waters

Amalfitano Stefano, Fazi Stefano, Ejarque Elisabet, Freixa Anna, Romani Anna M., Butturini Andrea

Cytometry. Part A

Flow cytometry is suitable to discriminate and quantify aquatic microbial cells within a spectrum of fluorescence and light scatter signals. Using fixed gating and operational settings, we developed a finite distribution mixture model, followed by the Voronoi tessellation, to resolve bivariate cytometric profiles into cohesive subgroups of events. This procedure was applied to outline recurrent patterns and quantitative changes of the aquatic microbial community along a river hydrologic continuum. We found five major subgroups within each of the commonly retrieved populations of cells with Low and High content of Nucleic Acids (namely, LNA, and HNA cells). Moreover, the advanced analysis allowed assessing changes of community patterns perturbed by a wastewater feed. Our approach for cytometric data deconvolution confirmed that flow cytometry could represent a prime candidate technology for assessing microbial community patterns in flowing waters. (c) 2017 International Society for Advancement of Cytometry

Degradation of a fluoroquinolone antibiotic in an urbanized stretch of the River Tiber

Anna Barra Caracciolo, Paola Grenni, Jasmin Rauseo, Nicoletta Ademollo, Martina Cardoni, Ludovica Rolando, Luisa Patrolecco.

Microchemical Journal

The widespread detection of antibiotics in terrestrial and aquatic systems has engendered significant scientific and regulatory concern. Overall, knowledge concerning the ecotoxicology and sub-lethal effects in water is scarce, but some experimental studies show that antibiotics can induce pathogen resistance and they can also have detrimental effects on natural microbial communities and their key functions. The main aim of this study was to investigate the occurrence of the biodegradation and photodegradation processes of the fluoroquinolone ciprofloxacin (CIP) in the River Tiber waters, in a stretch highly impacted from human pressure. Two set of microcosms consisting of river water containing the natural microbial community and treated with 500 μg/L of CIP in absence or presence of UV-light were performed. Moreover, some microcosms were filled with river water previously sterilized and then treated with the antibiotic. The combined experimental set made it possible to evaluate if the antibiotic CIP could be photodegraded and/or biodegraded. CIP residual concentrations were measured over time by using HPLC coupled to fluorescence detection (FLD) and

the effects of the antibiotic on the natural microbial community were assessed in terms of live cell abundance. The key role of light in CIP disappearance was confirmed, but also its biodegradation in natural river water was demonstrated. In fact, differently from other experiments we found a higher degradation rate (DT50= 10.4 d), in presence of both light and the natural river bacterial populations than in the same sterilized river water (DT50 = 18.4 d). Moreover, even in the dark, a partial CIP biodegradation was also observed (DT50 = 177 d). The overall results were supported by the increase in live cell numbers with the decrease of CIP concentrations both in the dark and light condition.

Diatom diversity in headwaters influenced by permafrost thawing: First evidence from the Central Italian Alps

Rotta Federica, Cerasino Leonardo, Occhipinti-Ambrogi Anna, Rogora Michela, Seppi Roberto, Tolotti Monica

Advances in Oceanography and Limnology

Glacier melting and permafrost thawing are the most evident effects of the current climate change that is strongly affecting high mountain areas, including the European Alps. As the thawing rate of subsurface ice is lower than for glacier ice, it is expected that, while glaciers retreat, an increasing number of Alpine headwaters will become more influenced by permafrost degradation during the 21st century. Despite the expected change in the relative importance of glacier and permafrost in determining Alpine hydrology, studies addressing effects of permafrost thawing on chemical and, especially, biological features of adjacent surface waters are still scarce. The present study contributes to characterise the epilithic and epiphytic

diatom diversity in a set of permafrost-fed headwaters in three sub-catchments differing in bedrock Ethology of the Italian Central Alps (Trentino Alto-Adige) in relation to water chemistry and habitat features. In addition, it explores chemical and biological differences between permafrost-fed streams and headwaters with no direct contact to permafrost, namely glacier-fed (kryal) and precipitation-/groundwater-fed (rhithral) streams. Permafrost-fed waters showed higher electrical conductivity and enhanced ion concentrations than glacier- and precipitation-fed waters, while concentration of trace elements (e.g. Sr, Ni, Zn, As) were more irregularly distributed among waters of different origin, though they showed a tendency to reach higher levels in permafrost-fed waters. Diatom species richness and diversity were lower in permafrost-fed headwaters, and were principally related to water pH and trace metal concentrations. Epiphytic diatom assemblages were more diverse than epilithic ones, independently from the water origin, while differences in species composition were not sufficient to unequivocally identify a typical diatom composition for the different water types considered in this study

Disinfection of urban wastewater by a new photo-Fenton like process using Cu-iminodisuccinic acid complex as catalyst at neutral pH

Fiorentino A., Cucciniello R., Di Cesare A., Fontaneto D., Prete P., Rizzo L., Corno G. & Proto A.

Water Research

Photo-Fenton process is among the most effective advanced oxidation processes (AOPs) in urban wastewater treatment and disinfection, but its application as tertiary treatment at full scale has not been a feasible/attractive option so far because optimum conditions are typically achieved under acidic pH. In this work a new photo Fenton like process (UV-C/H_2O_2/IDS-Cu) using iminodisuccinic acid (IDS)-Cu complex as catalyst, was compared to other processes (UV-C/H H_2O_2/Cu, UV-C/ H_2O_2/Fe, H H_2O_2 and UV-C) in urban wastewater disinfection. Since this is the first time that IDS-Cu complex was isolated and used as catalyst, preliminary tests to evaluate the mineralization of a model compound (phenol, 25 mg L^{-1} initial concentration) in water by UV-C/ H_2O_2/IDS-Cu were carried out. Almost complete mineralization of phenol (95%) was observed after 60 min treatment, being the process more effective than all other investigated AOPs (Fenton and photo-Fenton processes). This process was also proven to be more effective in the inactivation of E. coli (complete inactivation (3.5 log units) in 10 min) at natural pH (7.8 ± 0.5) in real wastewater, than the other processes investigated. Unlike of what observed for E. coli inactivation, the investigated processes only partially inactivated total bacterial population (from 18% for UV-C to 43% for UV-C/ H_2O_2/Cu), according to flow cytometry measurements. In particular, Cu based photo-Fenton processes resulted in the higher percentage of inactivated total cells, thus being consistent with the results of E. coli inactivation. It is worthy to note that, as H_2O_2 was decreased, UV-C/ H_2O_2/Cu-IDS was more effective than UV-C/ H_2O_2/Cu process. Moreover, the formation of small and large clusters decreased in the presence of Cu and Cu-IDS complex, and process efficiency improved accordingly; these results show that Cu based AOPs can more effectively disaggregate clusters, thus making disinfection process more effective than Fe based AOPs.

Distribution patterns of organic pollutants and microbial processes in marine sediments across a gradient of anthropogenic impact

Zoppini A, Ademollo N, Patrolecco L, Langone L, Lungarini S, Dellisanti W, Amalfitano S.

Environmental pollution

Marine sediments are part of the hydrological cycle and the ultimate storage compartment of land derived organic matter, including pollutants. Since relevant microbially-driven processes occurring at benthic level may affect the quality of the overall aquatic system, the necessity for incorporating information about microbial communities functioning for ecosystem modelling is arising. The aim of this field study was to explore the links occurring between sediment contamination patterns by three selected class of organic pollutants (Polycyclic Aromatic Hydrocarbons, PAHs, Nonylphenols, NPs, Bisphenol A, BPA) and major microbial properties (Prokaryotic Biomass, PB; total living biomass, C-ATP; Prokaryotic C Production rate, PCP; Community Respiration rate, CR) across a gradient of anthropogenic pollution. Sediments were sampled from 34 sites selected along 700 km of the western coastline of the Adriatic Sea. Organic contamination was moderate (PAHs <830 ng g_1; NPs <350 ng g_1; BPA <38 ng g_1) and decreased southward. The amount of PAHs-associated carbon (C-PAHs) increased significantly with sediment organic carbon (OC), along with microbial functional rates. The negative relation between PCP/CR ratio and OC indicated the shift toward oxidative processes in response to organic pollution and potential toxicity, estimated as Toxic Equivalents (TEQs). Our outcomes showed that sediment organic contamination and benthic microbial processes can be intimately linked, with potential repercussions on CO_2 emission rates and C-cycling within the detritus-based trophic web

Dynamical Drivers of the Local Wind Regime in a Himalayan Valley

Potter E.R., Orr A., Willis I.C., Bannister D., Salerno F.

Journal of geophysical research

Understanding the local valley wind regimes in the Hindu-Kush Karakoram Himalaya is vital for future predictions of the glacio-hydro-meteorological system. Here the Weather Research and Forecasting model is employed at a resolution of 1 km to investigate the forces driving the local valley wind regime in a river basin in the Nepalese Himalaya, during July 2013 and January 2014. Comparing with observations shows that the model represents the diurnal cycle of the winds well, with strong daytime up-valley winds and weak nighttime winds in both months. A momentum budget analysis of the model output shows that in the summer run the physical drivers of the near-surface valley wind also have a clear diurnal cycle, and are dominated by the pressure gradient, advection, and turbulent vertical mixing, as well as a nonphysical numerical diffusion term. By contrast, the drivers in the winter run have a less consistent diurnal cycle. In both months, the pressure gradient, advection, numerical diffusion, and Coriolis terms dominate up to 5,000 m above the ground. The drivers are extremely variable over the valley, and also influenced by the presence of glaciers. When glaciers are removed from the model in the summer run, the wind continues further up the valley, indicating how the local valley winds might respond to future glacier shrinkage. The spatial variability of

the drivers over both months is consistent with the complex topography in the basin, which must therefore be well represented in weather and regional climate models to generate accurate outputs.

Ecohydrology for water, biodiversity, ecosystem services, and resilience in Africa

Zalewski Maciej, Fazi Stefano, Wolanski Eric

Ecohydrology & Hydrobiology

Africa is a continent of great natural resources, societal potential, and beauty. The rapid growth of population of people and cattle in sub-Saharan Africa has dramatically increased the pressure on the environmental resources, reducing their resilience and sustainability. To reverse this negative trend, ecohydrology needs to be implemented and this must start with a transfer of knowledge of ecohydrology, not only on a theoretical level but also in practical applications. Ecohydrology is about engineering a harmony between environment and society, ie it is a problem-solving science. It proposes low-cost, nature-based solutions. It often starts with the creation of demonstration sites, such as farmers' education centre in Asella, Ethiopia

Ecological and genomic features of two widespread freshwater picocyanobacteria

Pedro J. Cabello-Yeves, Antonio Picazo, Antonio Camacho, Cristiana Callieri, Riccardo Rosselli, Juan J. Roda-Garcia, Felipe H. Coutinho, Francisco Rodriguez-Valera

Environmental Microbiology

We present two genomes of widespread freshwater picocyanobacteria isolated by extinction dilution from a Spanish oligotrophic reservoir. Based on microscopy and genomic properties, both picocyanobacteria were tentatively designated Synechococcus lacustris Tous, formerly described as a metagenome assembled genome (MAG) from the same habitat, and Cyanobium usitatum Tous, described here for the first time. Both strains were purified in unicyanobacterial cultures, and their genomes were sequenced. They are broadly distributed in freshwater systems; the first seems to be a specialist on temperate reservoirs (Tous, Amadorio, Dexter, Lake Lanier, Sparkling), and the second appears to also be abundant in cold environments including ice-covered lakes such as Lake Baikal, Lake Erie or the brackish Baltic Sea. Having complete genomes provided access to the flexible genome that does not assemble in MAGs. We found several genomic islands in both genomes, within which there were genes for nitrogen acquisition, transporters for a wide set of compounds and biosynthesis of phycobilisomes in both strains. Some of these regions of low coverage in metagenomes also included antimicrobial compounds, transposases and phage defence systems, including a novel type III CRISPR-Cas phage defence system that was only detected in Synechococcus lacustris Tous

Ecological effects of antibiotics on natural ecosystems: A review

Grenni P, Ancona V, Barra Caracciolo A

Microchemical journal

Among the different pharmaceuticals present in soil and water ecosystems as micro-contaminants, considerable attention has been paid to antibiotics, since their increasing use and the consequent development of multi-resistant bacteria pose serious risks to human and veterinary health. Moreover, once they have entered the environment, antibiotics can affect natural microbial communities. The latter play a key role in fundamental ecological processes, most importantly the maintenance of soil and water quality. In fact, they are involved in biogeochemical cycling and organic contaminant degradation thanks to their large reservoir of genetic diversity and metabolic capability. When antibiotics occur in the environment, they can hamper microbial community structure and functioning in different ways and have both direct (short-term) and indirect (long-term) effects on microbial communities. The short-term ones are bactericide and bacteriostatic actions with a consequent disappearance of some microbial populations and their ecological functioning. The indirect impact includes the development of antibiotic resistant bacteria and in some cases bacterial strains able to degrade them by metabolic or co-metabolic processes. Biodegradation makes it possible to completely remove a toxic compound from the environment if it is mineralized. Several factors can influence the significance of such direct and indirect effects, including the antibiotic's concentration, the exposure time, the receiving ecosystem (e.g. soil or water) and the co-occurrence of other antibiotics and/or other contaminants. This review describes the current state of knowledge regarding the effects of antibiotics on natural microbial communities in soil and water ecosystems

Effect-based and chemical analytical methods to monitor estrogens under the European Water Framework Directive

Koenemann Sarah, Kase Robert, Simon Eszter, Swart Kees, Buchinger Sebastian, Schluesener Michael, Hollert Henner, Escher Beate I., Werner Inge, Ait-Aissa Selim, Vermeirssen Etienne, Dulio Valeria, Valsecchi Sara, Polesello Stefano, Behnisch Peter, Javurkova Barbora, Perceval Olivier, Di Paolo Carolina, Olbrich Daniel, Sychrova Eliska, Schlichting Rita, Leborgne Lomig, Clara Manfred, Scheffknecht Christoph, Marneffe Yves, Chalon Carole, Tusil Petr, Soldan Premysl, von Danwitz Brigitte, Schwaiger Julia, San Martin Becares Maria Isabel, Bersani Francesca, Hilscherova Klara, Reifferscheid Georg, Ternes Thomas, Carere Mario

TrAC. Trends in analytical chemistry

The European Decision EU 2015/495 included three steroidal estrogens, estrone, 17 beta-estradiol and 17 alpha-ethinyl estradiol, in the "watch-list" of the Water Framework Directive (WFD). As consequence, these substances have to be chemically monitored at the level of their environmental quality standards, which can be challenging. This project aimed to identify reliable effect-based methods (EBMs) for screening of endocrine disrupting compounds, to harmonise monitoring and data interpretation methods, and to contribute to the current WFD review process. Water and wastewater samples were collected across Europe and analysed

using chemical analyses and EBMs. The results showed that 17 beta-estradiol equivalents were comparable among methods, while results can vary between methods based on the relative potencies for individual substances. Further, derived 17 beta-estradiol equivalents were highly correlated with LC-MS/MS analyses. This study shows that the inclusion of effect-based screening methods into monitoring programmes for estrogens in surface waterbodies would be a valuable complement to chemical analysis.

Effect of formulated diets on the proximate composition and fatty acid profiles of sea urchin Paracentrotus lividus gonad

Prato Ermelinda, Chiantore Mariachiara, Kelly Maeve S., Hughes Adam D., James Philip, Ferranti Maria Paola, Biandolino Francesca, Parlapiano Isabella, Sicuro Benedetto, Fanelli Giovanni

Aquaculture international

Three formulated diets were tested to evaluate their effects on gonad quality in Paracentrotus lividus. Experiments were conducted in parallel by the Consiglio Nazionale delle Ricerche (CNR) of Taranto (trial 1) and the University of Genoa (trial 2), in land-based systems. In both trials, somatic and gonadsomatic index (GSI) were measured and the nutritional profile of the sea urchins has determined significant variations in the biochemical composition. Sea urchins fed the experimental diets contained higher levels of nutrients (protein and lipid and carbohydrate) compared to wild sea urchins. However, total polyunsaturated fatty acids (PUFAs), especially EPA and DHA, and the n-3/n-6 ratio were lower in urchins fed with formulated diets. In both trials, sea urchins fed with diet 2 (SABS) showed a similar profile with PUFAs higher than SAFAs and MUFAs, the highest UNS/SAT ratio, although the highest n3/n6 ratio was observed in the group fed diet 3 (CNR).

Atherogenicity, thrombogenicity, and hypocholesterolemic/hypercholesterolemic indices showed the best values in sea urchins fed diet 2 in both trials.

Effects of Apirolio Addition and Alfalfa and Compost Treatments on the Natural Microbial Community of a Historically PCB-Contaminated Soil

Di Lenola M, Barra Caracciolo A, Grenni P, Rauseo J, Ancona V, Uricchio V F, Laudicina V A, Massacci A.

Water, air and soil pollution

Polychlorinated biphenyls (PCBs) are ubiquitous and persistent organic pollutants generated exclusively from human sources and found in the environment as several congeners (e.g. Apirolio, produced in Italy and used for electrical transformers). To evaluate the ability of the natural microbial community of historically PCB-contaminated soil to transform or degrade PCBs after fresh contamination through the addition of Apirolio, a microcosm experiment was conducted in a greenhouse for approximately 8 months. Compost and Medicago sativa (alfalfa) were additionally used in the microcosms to stimulate microbial PCB degradation. Chemical analyses were performed to evaluate PCB concentrations in the soil and plant tissue. Changes in the microbial community under the different experimental conditions were evaluated in

terms of total abundance, viability, diversity, and activity. Interestingly, the addition of Apirolio did not negatively affect the microbial community but did stimulate the degradation of the freshly added PCBs. The plant and compost copresence did not substantially increase PCB degradation, but it increased the microbial abundance and activity and the occurrence of α-Proteobacteria and fungi.

Effects of short- and long-term exposures to copper on lethal and reproductive endpoints of the harpacticoid copepod Tigriopus fulvus

Biandolino Francesca, Parlapiano Isabella, Faraponova Olga, Prato Ermelinda

Ecotoxicology and environmental safety

The long-term exposure provides a realistic measurement of the effects of toxicants on aquatic organisms. The harpacticoid copepod Tigriopus fulvus has a wide geographical distribution and is considered as an ideal model organism for ecotoxicological studies for its good sensitivity to different toxicants. In this study, acute, sub-chronic and chronic toxicity tests based on lethal and reproductive responses of Tigriopus fulvus to copper were performed. The number of moults during larval development was chosen as an endpoint for sub-chronic test. Sex ratio, inhibitory effect on larval development, hatching time, fecundity, brood number, nauplii/brood, total newborn production, etc, were calculated in the chronic test (28d). Lethal effect of copper to nauplii showed the LC50-48h of 310 ± 72µgCu/L (mean ± sd). It was observed a significant inhibition of larval development at sublethal copper concentrations, after 4 and 7 d. After 4d, the EC50 value obtained for the endpoint in "moult naupliar reduction" was of 55.8 ± 2.5µgCu/L (mean ± sd). The EC50 for the inhibition of naupliar development into copepodite stage, was of 21.7 ± 4.4µgCu/L (mean ± sd), after 7 days. Among the different traits tested, copper did not affect sex ratio and growth, while fecundity and total nauplii production were the most sensitive endpoints. The reproductive endpoints offer the advantage of being detectable at very low pollutant concentrations.

Efficacy of methanogenic biomass acclimation in mesophilic anaerobic digestion of ultrasound pre-treated sludge Environmental Technology

Gagliano M.C., Gallipoli A., Rossetti S., Braguglia C.M.

Environmental Technology

Methanogenic biomass plays a key role with regard to methane production during anaerobic bioconversion of organic substrates. In this study, the effect of two different acclimated inocula on digestion performances was investigated by means of anaerobic batch tests on untreated and sonicated waste-activated sludge. Organics solubilization and removal kinetics, the abundance and physiological conditions of archaeal cells on ultimate methane yield were evaluated. The simultaneous presence of Methanosarcina and Methanosaeta in the archaeal biomass, the higher initial archaeal cells relative abundance and their occurrence in the aggregated forms were the main factors positively affecting the conversion into methane. The presence of the acclimated inoculum at the start-up influenced positively the methane improvement due to sonication, and the methane-specific production increased from

0.335 ± 0.03 to 0.420 ± 0.05 $Nm^3/kg\ VS_{fed}$. Moreover, the better physiological state of methanogens permitted to appreciate the effect of hydrolysis improvement by ultrasound pretreatment.

Energy recovery capacity evaluation within innovative biological wastewater treatment process

Valentina Piergrossi, Marco De Sanctis, Silvia Chimienti, Claudio Di Iaconi

Energy Conversion and Management

Experimental study we present is a full-scale energy recovery system able to extract, by means of a water source heat pump, the leftover thermal bioenergy available in a Sequencing Batch Biofilter Granular Reactor (SBBGR) within the wastewater treatment process. Heat pump compressor engine was powered by a 5.1 kW Photovoltaic plant, thermal energy being recovered is accumulated by two phase change materials tanks (PCM) for heat and cold latent energy storage whose capacity is 0.3 and 0.5m^3 respectively, thermal energy excess was dissipated through evaporator and condenser devices.

Thermal energy extracted from SBBGR ranged from 0 to 14.5 kWh as function of environmental temperature and temperature set point of SBBGR. It was largely affected by environmental temperature during radiation and no deterioration of SBBGR performances were recorded during energy extraction even at lowest temperature set point (i.e. 15 °C).

Results obtained demonstrated that SBBGR technology, thanks to its particular process scheme, allows wastewater heat extraction within the treatment process operation, making it actually the only wastewater treatment system able to exchange energy at low temperature (15 °C) without prejudice to treatment performances and, at the same time, to operate a thermal regulation of the treatment reactors, integrating the optimization of thermo-dependent biological processes with energy recovery systems.

Enhancing anaerobic treatment of domestic wastewater: State of the art, innovative technologies and future perspectives

Stazi Valentina, Tomei Maria Concetta

Science of the total environment

Recent concerns over public health, environmental protection, and resource recovery have induced to look at domestic wastewater more as a resource than as a waste. Anaerobic treatment, owing to attractive advantages of energy saving, biogas recovery and lower sludge production, has been suggested as an alternative technology to the traditional practice of aerobic wastewater treatment, which is energy intensive, produces high excess of sludge, and fails to recover the potential resources available in wastewater. Sewage treatment by high-rate anaerobic processes has been widely reported over the last decades as an attractive method for providing a good quality effluent. Among the available high-rate anaerobic technologies, membrane bioreactors feature many advantages over aerobic treatment and conventional anaerobic systems, since high treatment efficiency, high quality effluent,

pathogens retention and recycling of nutrients, were generally achieved. The objective of this paper is to review the currently available knowledge on anaerobic domestic wastewater treatment for the mostly applied high-rate systems and membrane bioreactors, presenting benefits and drawbacks, and focusing on the most promising emerging technologies, which need more investigation for their scale-up.

Environmental filtering and phylogenetic clustering correlate with the distribution patterns of cryptic protist species

Singer D., Kosakyan A., Seppey C.V.W., Pillonel A., Fernandez L.D., Fontaneto D., Mitchell E.A.D. & Lara E.

Ecology

The community composition of any group of organisms should theoretically be determined by a combination of assembly processes including resource partitioning, competition, environmental filtering, and phylogenetic legacy. Environmental DNA studies have revealed a huge diversity of protists in all environments, raising questions about the ecological significance of such diversity and the degree to which they obey to the same rules as macroscopic organisms. The fast-growing cultivable protist species on which hypotheses are usually experimentally tested represent only a minority of the protist diversity. Addressing these questions for the lesser known majority can only be inferred through observational studies. We conducted an environmental DNA survey of the genus Nebela, a group of closely related testate (shelled) amoeba species, in different habitats within Sphagnum-dominated peatlands. Identification based on the mitochondrial cytochrome c oxidase 1 gene, allowed species-level resolution as well as phylogenetic reconstruction. Community composition varied strongly across habitats and associated environmental gradients. Species showed little overlap in their realized niche, suggesting resource partitioning, and a strong influence of environmental filtering driving community composition. Furthermore, phylogenetic clustering was observed in the most nitrogen-poor samples, supporting phylogenetic inheritance of adaptations in the group of N. guttata. This study showed that the studied free-living unicellular eukaryotes follow to community assembly rules similar to those known to determine plant and animal communities; the same may be true for much of the huge functional and taxonomic diversity of protists.

Evolutionary toxicology as a tool to assess the ecotoxicological risk in freshwater ecosystems

Rusconi M., Bettinetti R., Polesello S., Stefani F.

Water

Borrowing the approaches of population genetics, evolutionary toxicology was particularly useful in assessing the transgenerational effects of a substance at sublethal concentrations, as well as evaluating genetic variation in populations exposed to pollutants. Starting from assays in controlled conditions, in recent years this approach has also found successful applications multi-stressed natural systems. It is also able to exploit the huge amount of data

provided by Next Generation Sequencing (NGS) techniques. Similarly, the focus has shifted from effects on the overall genetic variability, the so-called "genetic erosion", to selective effects induced by contaminants at more specific pathways. In the aquatic context, effects are usually assessed on non-model species, preferably native fish or macroinvertebrates. Here we provide a review of current trends in this specific discipline, with a focus on population genetics and genomics approaches. In addition, we demonstrate the potential usefulness of predictive simulation and Bayesian techniques. A focused collection of field and laboratory studies is discussed to demonstrate the effectiveness of this approach, covering a range of molecular markers, different endpoints of genetic variation, and different classes of chemical contaminants. Moreover, guidelines for a future implementation of evolutionary perspective into Ecological Risk Assessment are provided.

Fish assemblages in deep Italian subalpine lakes: history and present status with an emphasis on non-native species

Volta P., Jeppesen E., Sala P., Galafassi S., Foglini C., Puzzi C., Winfield I.J.

Hydrobiologia

We provide a comprehensive overview of the status of fish assemblages in eight Italian subalpine lakes using multiple data sources: historical records, standardised sampling and fishery catch statistics. Thirty-four fish species were recorded, twenty of which are native, seven introduced historically and another seven introduced recently. The number of fish species in individual lakes has increased by between 25 and 65% from 1855 to the present, with the increase being higher in the larger lakes. Non-native species contributed between 4.0 and 71.5% to standardised catches by numbers and between 4.8 and 65.1% by biomass. Roach Rutilus rutilus and pumpkinseed Lepomis gibbosus dominated electrofishing and benthic catches by number, while open-water catches were dominated by the coregonids European whitefish Coregonus lavaretus and gangfish Coregonus macrophthalmus. In terms of biomass, electrofishing catches were dominated by crucian carp Carassius carassius, largemouth bass Micropterus salmoides and wels catfish Silurus glanis, benthic catches were dominated by roach, European whitefish and crucian carp, and open-water catches by coregonids. Commercial fisheries are important ecosystem services provided by subalpine lakes, with their harvests now dominated by non-native species. To deliver effective biodiversity conservation and ecosystem services provision, the prioritisation of targets and interventions of management of non-native species is needed.

Free LNAPL Volume Estimation by Pancake Model and Vertical Equilibrium Model: Comparison of Results, Limitations, and Critical Points

Frollini Eleonora, Petitta Marco

Geofluids

Light nonaqueous phase liquids (LNAPLs), due to their low solubility, dissolve slowly, acting as a long-term source of water contamination, and consequently they represent an important environmental issue. In the subsoil, more than 99% of spilled LNAPL remains as adsorbed and

free phase; therefore, the volume estimation of free phase, obtained in this case through two different conceptual models (Pancake Model and Vertical Equilibrium Model), is considered a fundamental step for a correct site remediation. According to the first model, the LNAPL floating on the water table and its saturation is up to 100%; instead, according to the second one, the LNAPL can penetrate below the water table and the coexistence of LNAPL, water, and air in the pore fraction, leads to a lower LNAPL saturation, variable with the depth. Actually, in subsoil LNAPL and water saturations vary with depth due to the influence of capillarity, leading to the inaccuracy of Pancake Model assumption. Despite the evident limitation of Pancake Model, both models were applied, coupled with area calculations with Thiessen polygons and grid at regular mesh, to roughly estimate the free LNAPL volume existing in a contaminated site. The volume estimation carried out, considering the LNAPL type and its features, the soil type, and relative effective porosity, provides estimates of volumes having differences up to thousands of cubic meters. The results analysis shows that this estimation has several critical points such as area definition and the lack of site-specific data (e.g., porosity). Indeed, the sensitivity analysis for porosity shows that a reduction of this parameter provides a 20% reduction of estimated volume.

Gene expression and genotoxicity in Manila clam (Ruditapes philippinarum) modulated by sediment contamination and lagoon dynamics in the Po river delta

Stefani F., Casatta N., Ferrarin C., Izzotti A., Maicu F., Viganò L.

Marine environmental research

The lagoons of the Po River delta are potentially exposed to complex mixtures of contaminants, nevertheless, there is a substantial lack of information about the biological effects of these contaminants in the Po delta lagoons. These environments are highly dynamic and the interactions between chemical and environmental stressors could prevent the proper identification of biological effects and their causes. In this study, we aimed to disentangle such interactions focusing on Manila clams, previously exposed to six lagoons of the Po delta, adopting three complementary tools: a) the detailed description via modelling techniques of lagoon dynamics for salinity and water temperature; b) the response sensitivity of a number of target genes (ahr, cyp4, ρ-gst, σ-gst, hsp22, hsp70, hsp90, ikb, dbh, ach, cat, Mn-sod, Cu/Zn-sod, cyp-a, flp, grx, TrxP) investigated in clam digestive glands by Real Time PCR; and c) the relevance of DNA adducts determined in clams as markers of exposure to genotoxic chemicals. The lagoons showed specific dynamics, and two of them (Marinetta and Canarin) could induce osmotic stress. A group of genes (ahr, cyp4, Mn-sod, σ-gst, hsp-22, cyp-a, TrxP) seemed to be associated with overall lagoon characteristics as may be described by salinity and its variations. Lagoon modelling and a second group of genes (hsp70, hsp90, cat, ikb, ach, grx, Cu/Zn-sod) also suggested that moderate increases of river discharge may imply worse exposure conditions. Oxidative stress seemed to be associated with such events but it was slightly evident also under normal exposure conditions. DNA adduct formation was mainly associated with overwhelmed antioxidant defences (e.g. low Cu/Zn-sod) or seemingly with their lack of response in due time. In Po delta lagoons, Manila clam can be affected by chemical

and environmental factors which can contribute to induce oxidative stress, DNA adduct formation and, ultimately, to affect clam condition and health.

Genome analysis of the freshwater planktonic Vulcanococcus limneticus sp. nov. reveals horizontal transfer of nitrogenase operon and alternative pathways of nitrogen utilization.

Di Cesare A., Cabello-Yeves P.J., Chrismas N.A.M., Sánchez-Baracaldo P., Salcher M.M., Callieri C.

BMC Genomics

Background: Many cyanobacteria are capable of fixing atmospheric nitrogen, playing a crucial role in biogeochemical cycling. Little is known about freshwater unicellular cyanobacteria Synechococcus spp. at the genomic level, despite being recognised of considerable ecological importance in aquatic ecosystems. So far, it has not been shown whether these unicellular picocyanobacteria have the potential for nitrogen fixation. Here, we present the draft-genome of the new pink-pigmented Synechococcus-like strain Vulcanococcus limneticus. sp. nov., isolated from the volcanic Lake Albano (Central Italy).

Results: The novel species Vulcanococcus limneticus sp. nov. falls inside the sub-cluster 5.2, close to the estuarine/marine strains in a maximum-likelihood phylogenetic tree generated with 259 marker genes with representatives from marine, brackish, euryhaline and freshwater habitats. V.limneticus sp. nov. possesses a complete nitrogenase and nif operon. In an experimental setup under nitrogen limiting and non-limiting conditions, growth was observed in both cases. However, the nitrogenase genes (nifHDK) were not transcribed, i.e., V.limneticus sp. nov. did not fix nitrogen, but instead degraded the phycobilisomes to produce sufficient amounts of ammonia. Moreover, the strain encoded many other pathways to incorporate ammonia, nitrate and sulphate, which are energetically less expensive for the cell than fixing nitrogen. The association of the nif operon to a genomic island, the relatively high amount of mobile genetic elements (52 transposases) and the lower observed GC content of V.limneticus sp. nov. nif operon (60.54%) compared to the average of the strain (68.35%) support the theory that this planktonic strain may have obtained, at some point of its evolution, the nif operon by horizontal gene transfer (HGT) from a filamentous or heterocystous cyanobacterium.

Conclusions: In this study, we describe the novel species Vulcanococcus limneticus sp. nov., which possesses a complete nif operon for nitrogen fixation. The finding that in our experimental conditions V.limneticus sp. nov. did not express the nifHDK genes led us to reconsider the actual ecological meaning of these accessory genes located in genomic island that have possibly been acquired via HGT.

Geophysical and hydrological data assimilation to monitor water content dynamics in the rocky unsaturated zone

De Carlo L., Berardi M., Vurro M., Caputo M.C.

Environmental monitoring and assessment

In recent years, geophysics is increasingly used to study the flow and transport processes in the vadose zone. Particularly, when the vadose zone is made up of rocks, it is difficult to install sensors in the subsurface to measure hydrological state variables directly. In these cases, the electrical resistivity tomography (ERT) represents a useful tool to monitor the hydrodynamics of the infiltration and to estimate hydraulic parameters and state variables, such as hydraulic conductivity and water content. We propose an integrated approach aimed at predicting water content dynamics in calcarenite, a sedimentary carbonatic porous rock. The uncoupled hydrogeophysical approach proposed consists in 4D ERT monitoring conducted during an infiltrometer test under falling head conditions. Capacitance probes were installed to measure water content at different depths to validate the estimations derived from ERT. A numerical procedure, based on a data assimilation technique, was accomplished by combining the model (i.e., Richards' equation) with the observations in order to provide reliable water content estimations. We have used a new data assimilation method that is easy to implement, based on the ensemble Kalman filter coupled with Brownian bridges. This approach is particularly suitable for strongly non-linear models, such as Richards' equation, in order to take into account both the model uncertainty and the observation errors. The proposed data assimilation approach was tested for the first time on field data. A reasonable agreement was found between observations and predictions confirming the ability of the integrated approach to predict water content dynamics in the rocky subsoil.

Happy birthday Hydrobiologia! 70 years young and still growing

Fontaneto D., Thomaz S.M., Naselli-Florse L. & Martens K.

Hydrobiologia

Hydrobiologia started its existence in March 1948 by publishing a first volume of 476 pages, and already then focused on the biology and ecology of aquatic organisms. After 70 years, the focus of the journal is still similar, but the diversity of approaches increased during the seven decades of its existence. To celebrate the 70 years of Hydrobiologia, we here address some emerging trends in the history of publications in Hydrobiologia.

Hydrological Conditions and Phytoplankton Community in the Lesina Lagoon (Southern Adriatic Sea, Mediterranean)

Caroppo C., Roselli L., Di Leo A.

Environmental science and pollution research

The Lesina Lagoon (Southern Adriatic Sea, Mediterranean) is a coastal lagoon located in a highly intensified farming and tourist area. A monthly sampling was carried out in 1998 in five stations, representative of different hydrological features, in order to analyse phytoplankton composition and its relation to environmental parameters. Our results showed high spatial variability of abiotic variables. Phytoplankton abundances and biomass trends showed marked seasonality, with annual peaks occurring in late winter-early spring and summer periods. Phytoplankton blooms were due to the diatom Thalassiosira pseudonana and the dinoflagellate Prorocentrum cordatum. Statistical analyses showed that salinity and nutrients were the main

factors affecting phytoplankton abundance and biomass. Phytoplankton dynamics was associated both to seasonality and the hydrodynamic regime of the system. Moreover, chemical-physical data were analysed together with those collected in the same stations in 2007, to compare their dynamics under different hydrological regimes. The two periods corresponded to the closure and opening, respectively, of canals connecting the lagoon to the sea. In general, abiotic variables (salinity, dissolved oxygen, pH, nitrate, phosphate and silicate concentrations) were significantly affected by the hydrodynamic regime. These data could provide a useful basis to complement the knowledge gained through current monitoring within the framework of the European Directives, as well as to implement conservation and management strategies of these transitional waters.

Identifying a reliable method for estimating suspended sediment load in a temporary river system

De Girolamo A. M., Di Pillo R., Lo Porto A., Todisco M. T., Barca E.

Catena

Sampling strategies and methods used for estimating load can lead to large uncertainties in suspended sediment transport quantification, especially in rivers with high variability in streamflow. The aim of this paper is to evaluate suspended sediment load, using a number of direct estimation techniques, in order to find a suitable method for temporary river systems and to assess the uncertainty associated with load estimation, due to the specific method applied. One year of continuous measurement of flow, and discrete sampling (n=216) of suspended sediment concentrations, taken from 2010 to 2011 in the Celone River (SE, Italy), were used to estimate annual load. Averaging, ratio and regression estimator methods were applied to the entire dataset, and to subsets of data, to calculate the load. The results show a wide range of values, from 220 to 1123 t km^{-2} yr^{-1}, with respect to the applied suspended sediment load estimation techniques. Averaging methods resulted biased. Sediment rating curves underestimated load, while, if the back-transformation bias correction was used, load was overestimated. The ratio methods generally overestimate load. Increased precision and accuracy was achieved through applying data stratification, based on flow regime and seasonality. After applying three different flow regime stratifications, the annual load ranged from 240 to 606 t km^{-2} yr^{-1} and, using seasonal stratification, from 258 to 974 t km^{-2} yr^{-1}. It seems that ratio estimator methods, and the regression equations applied to the stratification on a flow regime basis, are more suitable for estimating load in temporary, flashy streams.

Identificazione delle Contaminazioni di Falda con Tecniche Biomolecolari: La Contaminazione da Nitrati e L'individuazione della Fonte. Prima azione pilota in Puglia

Angelantonio Calabrese, Claudia Campanale, Vito Felice Uricchio, Massimo Blonda

L' ACQUA

Le scoperte della biologia molecolare negli ultimi 20 anni hanno portato allo sviluppo di nuovi metodi di ricerca di microrganismi basati sull'identificazione di sequenze di geni specifici. La

diagnosi molecolare si è rivelata, in generale, più sensibile e più specifica rispetto ai metodi di coltura tradizionali richiedendo meno tempo per l'identificazione. Il sequenziamento genico dei frammenti amplificati consente, inoltre, di identificare i tipi batterici presenti e di eseguire studi epidemiologici molecolari e analisi filogenetiche. L'azione pilota svolta sul territorio della regione Puglia è stata finalizzata all'individuazione delle potenziali fonti di contaminazione di nitrati, distinguendo l'origine da concimi minerali, letame, rifiuti urbani, fanghi di depurazione, ecc. Utilizzando l'approccio biomolecolare, le indagini sono state condotte su 23 pozzi identificati nella regione sulla base dei risultati del monitoraggio della concentrazione di nitrati condotta nel periodo 2008-2014. In tali pozzi, infatti, erano stati registrati superamenti dei limiti normativi (50 mg/L, D.Lgs. n.152/06).

Identifying sediment source areas in a Mediterranean watershed using the SWAT model

Ricci G.F., De Girolamo A.M., Abdelwahab O.M.M., Gentile F.

Land degradation & development

This study aims to evaluate the suitability of the Soil and Water Assessment Tool model in simulating runoff and sediment loss in the Carapelle (SE Italy), a typical Mediterranean watershed, where continuous measurements of streamflow and sediment concentration were collected over a 5-year period, on a half-hour timescale, processed on a daily timescale. After sensitivity analysis, the model was calibrated and validated for runoff and sediment. Statistics show generally satisfactory efficiency. To further improve sediment simulation performance, we used a seasonal calibration scheme, in which data recorded in the dry and wet seasons were used to calibrate sediments separately, on a seasonal basis. We also tested the model's capability in identifying the major sediment source zones and river segments where there is sediment deposition. On the basin scale, the average water yield (186 mm) corresponds to 27% of the total rainfall (686 mm), and average annual sediment load was estimated to be 6.8 t ha^{-1} $year^{-1}$. On the subbasin scale, a gradient of sediment yield was found that is characterised by a large difference among the upper (7 to 13 t ha^{-1} $year^{-1}$), central, and lower parts (<1 t ha^{-1} $year^{-1}$) of the study area. Conversely, deposition in channel flow has its highest values in the central part of the watershed, where there is an alluvial plain. Winter wheat and olive land use are the major source areas, in terms of sediment. This study confirms that the Mediterranean watershed is a fragile ecosystem, and measures are needed to mitigate soil depletion

Impact of magnetite nanoparticles on the syntrophic dechlorination of 1,2-dichlorloethane

Leitão Patrícia, Leitão Patrícia, Leitão Patrícia, Aulenta Federico, Rossetti Simona, Nouws Henri P.A., Danko Anthony S.

Science of the total environment

In anaerobic environments microorganisms exchange electrons with community members and with soil and groundwater compounds. Interspecies electron transfer (IET) occurs by several

mechanisms: diffusion of redox compounds or direct contact between cells. This latter mechanism may be facilitated by the presence of conductive nanoparticles (NP), possibly serving as electron conduits among microorganisms. Our study examined the effect of magnetite (Fe_3O_4) NP on the dechlorination of 1,2-dichloroethane (1,2-DCA) by a mixed-culture. The addition of NP (170 mg L^{-1} total Fe) enhanced the acetate-driven reductive dechlorination of 1,2-DCA to harmless ethene (via reductive dihaloelimination) up to 3.3-times (2.3 eq L^{-1} d^{-1} vs. 0.7 eq L^{-1} d^{-1}), while decreasing the lag time by 0.8 times (23 days) when compared to unamended (magnetite-free) microcosms. Dechlorination activity was correlated with the abundance of Dehalococcoides mccartyi, which accounted up to 50% of total bacteria as quantified by CARD-FISH analysis, pointing to a key role of this microorganism in the process. Given the widespread abundance of conductive minerals in the environment, the results of this study may provide new insights into the fate of 1,2-DCA and suggest new tools for its remediation by linking biogeochemical mechanisms.

Impact of summer monsoon on the elevation-dependence of meteorological variables in the south of central Himalaya

Yang Kun, Guyennon Nicolas, Ouyang Lin, Ouyang Lin, Tian Lide, Tartari Gianni, Salerno Franco

International journal of climatology

The South Asian summer monsoon brings abundant precipitation and associated latent heat release to the south of central Himalaya, and alters hydrothermal conditions of this region. This study explored the impact of South Asian summer monsoon on the elevation-dependence of meteorological variables along the south slope of Mt. Everest in the central Himalaya, which is crucial to modelling the glacio-hydrological processes in this elevated region. The data were collected at five stations deployed at 2660-5600 m above sea level (asl) along the slope during 2007-2011. Major findings are the following: The amount of precipitation during the monsoon season usually decreases with elevation but it is relatively uniform between 3600 and 5000 m asl. This uniform profile may be attributed to the monsoon-terrain-land interactions, particularly to the retard effect of glacier cooling on daytime upvalley wind; Cloud shielding effects cause lower solar radiation and higher downward longwave radiation in the monsoon than in the other seasons. In particular, higher elevations have more clouds in the afternoon, resulting in an abnormal elevation-dependence of solar radiation (i.e. higher elevations receive less solar radiation); Strong daytime upvalley wind and moist convection homogenizes the vertical distributions of air mass along the slope, causing a constant lapse rate of both surface air temperature and dew-point temperature (representing humidity) during typical monsoon months, but this phenomenon is not found in the other seasons. These findings provide critical guidance for extrapolating the meteorological variables from lower to higher elevations in this region.

Influence of a prepared diet and a macroalga (Ulva sp.) on the growth, nutritional and sensory qualities of gonads of the sea urchin Paracentrotus lividus

Prato Ermelinda, Fanelli Giovanni, Angioni Alberto, Biandolino Francesca, Parlapiano Isabella, Papa Loredana, Denti Giuseppe, Secci Marco, Chiantore Mariachiara, Kelly Maeve S., Ferranti Maria Paola, Addis Piero

Aquaculture

This study evaluated the growth of the purple sea urchin Paracentrotus lividus, fed with two diets, in sea- and land-based systems compared to wild populations. The experiments investigated the effects of the feeding regimes on gonad yield, nutritional traits and overall quality. Sea-based trials were performed by the CNR of Taranto (Trial S), whereas land-based trials were performed in the facilities of the University of Cagliari (Trial L). Urchins fed with a laboratory prepared pelletized diet (P), and a mix diet PU (50% of P-Diet and 50% of fresh Ulva sp.) were compared to wild urchins (W). In both trials the experimental diets supported a gonad growth when compared to wild population ($p < .05$). Sensory characteristics, assessed by 6 panel experts for each trial, highlighted significant differences in gonad colour and taste in both trials, while only in Trial S for texture ($p < .05$). The changes in the biochemical composition of sea urchins' gonads caused significant variations in the nutritional profile. Sea urchins fed with the experimental diets contained higher levels of total protein and lipids and PUFAs than wild sea urchins, although EPA, DHA and n-3/n-6 ratio, were lower in urchins fed with artificial diets. In Trial L, total free amino acids showed an increase respect to W gonads ($p < .05$), whereas in Trial S, total free amino acids showed a decrease only in sea urchin fed with P-Diet ($p < .05$). The results presented in this study provide evidence of the good performance of the formulated diet assuming its application for the development of Mediterranean echinoculture.

Innovative Techniques for Enhancing and Monitoring Microbial Activities for In Situ Remediation of Contaminated Sites

Grenni P, Barra Caracciolo A, Franzetti A, Alberti L

SETAC globe

The accidental spills of contaminants such as hydrocarbons and chlorinated solvents can contaminate soil and water, raising concern because they are recalcitrant compounds and toxic for ecosystems and human health. In situ remediation techniques, in particular those involving microbial communities, represent an economically and environmentally sustainable strategy for reducing the contamination and understanding the responses of biological targets to these pollutants. The development of new tools and technologies for monitoring in situ and enhancing microbial activity is crucial for advancing the remediation of contaminated sites. In order to make this technology more profitable and successful, it is important to include an interdisciplinary involvement of scientists of different discipline (e.g. hydrogeologists, microbiologists, chemists and ecotoxicologists).

Insights into the CuO nanoparticle ecotoxicity with suitable marine model species

Rotini A., Gallo A., Parlapiano I., Berducci M. T., Boni R., Tosti E., Prato E., Maggi C., Cicero A. M., Migliore L., Manfra L.

Ecotoxicology and environmental safety

Metal oxide nanoparticles, among them copper oxide nanoparticles (CuO NPs), are widely used in different applications (e.g. batteries, gas sensors, superconductors, plastics and metallic coatings), increasing their potential release in the environment. In aquatic matrix, the behavior of CuO NPs may strongly change, depending on their surface charge and some physical-chemical characteristics of the medium (e.g. ionic strength, salinity, pH and natural organic matter content). Ecotoxicity of CuO NPs to aquatic organisms was mainly studied on freshwater species, few tests being performed on marine biota.

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

Patricia Sánchez-Baracaldo, Giorgio Bianchini, Andrea Di Cesare, Cristiana Callieri and Nathan A. M. Chrismas

Frontiers In Microbiology

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 clade of non-marine picocyanobacteria consisting of Cyanobium, Synechococcus and marine Sub-cluster 5.2; this clade itself is sister to marine Synechococcus and Prochlorococcus. The most basal lineage within the Syn/Pro clade, Sub-Cluster 5.3, includes marine and freshwater strains. Relaxed molecular clock (SSU, LSU) analyses show that while ancestors of the Syn/Pro clade 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 clade 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.

Integrating "hard" and "soft" infrastructural resilience assessment for water distribution systems

Pagano Alessandro, Pluchinotta Irene, Giordano Raffaele, Fratino Umberto

Complexity

Cities are highly dynamic systems, whose resilience is affected by the interconnectedness between "hard" and "soft" infrastructures. "Hard infrastructures" are the functional networks with physical elements providing goods or services. "Soft infrastructures" (culture, governance, and social patterns) encompass the social networks, make the hard infrastructures work, and are vital for understanding the consequences of disasters and the effectiveness of emergency management. Although the dynamic interactions between such infrastructures are highly complex in the case of the occurrence of hazardous events, it is fundamental to analyze them. The reliability of hard infrastructures during emergency management contributes to keep alive the social capital, while the community, its networks, and its own resilience influence the service provided by infrastructural systems. Resilience-thinking frameworks overcome the limits of the traditional engineering-oriented approaches, accounting for complexity of socio-technical-organizational networks, bridging the static and dynamic components of disasters across pre- and postevent contexts. The present work develops an integrated approach to operatively assess resilience for the hard and soft infrastructural systems, aiming at modeling the complexity of their interaction by adopting a graph theory-based approach and social network analysis. The developed approach has been experimentally implemented for assessing the integrated resilience of the hard/soft infrastructures during the L'Aquila 2009 earthquake.

Kinetic study of two-step mesophilic anaerobic-aerobic waste sludge digestion: Focus on biopolymer fate

Mosca Angelucci D., Di Cesare S.M., Tomei M.C.

Process safety and environmental protection

Kinetics of the sequential anaerobic-aerobic digestion operated under mesophilic conditions on waste activated sludge of a full-scale wastewater treatment plant was investigated. Special focus was given to the fate of proteins and carbohydrates, given the influence of biopolymers on dewatering properties of the sludge. Kinetic tests were performed to characterize the suspended solid degradation and the trend of biopolymers in both digestion steps. Volatile solid degradation rates were 0.93 and 0.52 $kg_{VS}m^{-3}$ d^{-1} in anaerobic and aerobic conditions, respectively. Different models (1st order, Michaelis-Menten, Valentini and Contois) have been compared for VS degradation: Contois equation provided the best data fitting (correlation coefficients >=0.99). Evolution of biopolymers during two-step process exhibited a similar pattern: during the anaerobic phase, an increase of about one order of magnitude was observed for carbohydrates and of 100% for proteins, while in the aerobic bioreactor both decreased of 29 and 73%, respectively. Data from kinetic tests were employed to model the biopolymer patterns taking into account their production from the hydrolysis of particulate organic substrate and their biodegradation in the different anaerobic and aerobic reaction

environments. Michaelis-Menten equation gave satisfactory predictions of the biopolymer fate with correlation coefficients ranging from 0.92 to 0.97, for both carbohydrates and proteins.

Lack of host specificity of copepod crustaceans associated with mushroom corals in the Red Sea

Ivanenko V.N., Hoeksema B., Nikitin M.A., Mudrova S.V., Martínez A., Rimskaya-Korsakova N., Berumen M.L. & Fontaneto D.

Molecular Phylogenetics & Evolution

The radiation of symbiotic copepods (Crustacea: Copepoda) living in association with stony corals (Cnidaria: Scleractinia) is considered host-specific and linked to the phylogenetic diversification of their hosts. However, symbiotic copepods are poorly investigated, occurrence records are mostly anecdotal, and no explicit analysis exists regarding their relationship with the hosts. Here, we analysed the occurrence of symbiotic copepods on different co-occurring and phylogenetically closely related scleractinian corals. We used an innovative approach of DNA extraction from single microscopic specimens that preserves the shape of the organisms for integrative morphological studies. The rationale of the study involved: (i) sampling of mushroom corals (Fungiidae) belonging to 13 species and eight genera on different reefs along the Saudi coastline in the Red Sea, (ii) extraction of all the associated copepods, (iii) morphological screening and identification of copepod species, (iv) use of DNA taxonomy on mitochondrial and nuclear markers to determine species boundaries for morphologically unknown copepod species, (v) reconstruction of phylogenies to understand their evolutionary relationships, and (vi) analysis of the ecological drivers of the occurrence, diversity and host specificity of the copepods. The seven species of coral-associated copepods, all new to science, did not show any statistically significant evidence of host-specificity or other pattern of ecological association. We thus suggest that, contrary to most assumptions and previous anecdotal evidence on this coral-copepod host-symbiont system, the association between copepods and their host corals is rather labile, not strict, and not phylogenetically constrained, changing our perception on evolutionary patterns and processes in symbiotic copepods.

Large and deep perialpine lakes: a paleolimnological perspective for the advance of ecosystem science

Tolotti M., Dubois N., Milan M., Perga M.-E., Straile D., Lami A.

Hydrobiologia

The present paper aims at reviewing general knowledge of large European perialpine lakes as provided by sediment studies, and at outlining the contribution, from several lines of evidence, of modern paleolimnology in both interpreting past lake ecological evolution and forecasting lake responses to future human impacts. A literature survey mainly based on papers published in international journals indexed on ISI-Wos and Scopus from 1975 to April 2017 has been conducted on the 20 perialpine lakes with zmax >= 100 m and lake area >= 10 km^2, and on 4 shallower perialpine lakes representing hotspots of extensive neo- and paleo-limnological research. By pinpointing temporal and spatial differences in paleolimnological studies

conducted in the Alpine countries, the review identifies knowledge gaps in the perialpine area, and shows how sediment-based reconstructions represent a powerful tool, in mutual support with limnological surveys, to help predicting future scenarios through the "past-forward" principle, which consists in reconstructing past lake responses to conditions comparable to those to come. The most recent methodological developments of sediment studies show the potential to cope with the increasing ecosystem variability induced by climate change, and to produce innovative and crucial information for tuning future management and sustainable use of Alpine waters.

Lewis-Bronsted acid catalysed ethanolysis of the organic fraction of municipal solid waste for efficient production of biofuels

di Bitonto Luigi, Antonopoulou Georgia, Braguglia Camilla, Campanale Claudia, Gallipoli Agata, Lyberatos Gerasimos, Ntaikou Ioanna, Pastore Carlo

Bioresource technology

A combined Lewis-Bronsted acid ethanolysis of sugars was thoroughly investigated with the aim of producing ethyl levulinate (EL) in a single step. Ethanolysis carried out at 453 K for 4 h using H_2SO_4 (1 wt%) and $AlCl_3$-6HO(30 mol % with respect to sugars) produced a yield of 60 mol % of EL respect to glucose and starch. Such optimised conditions were positively applied directly on different food waste, preliminarily characterised and found to be mainly composed by simple (10-15%) and relatively complex sugars (20-60%), besides proteins (6-10%) and lipids (4-10%), even in their wet form. The catalytic system resulted robust enough to the point that the copresence of proteins, lignin, lipids and mineral salts not only did not negatively affect the overall reactivity, but resulted efficiently converted into soluble species, and specifically, into other liquid biofuels of different nature.

Life-history strategies in zooplankton promote coexistence of competitors in extreme environments with high metal content

Aranguiz-Acuna A., Perez-Portilla P, de La Fuente A. & Fontaneto D.

Scientific Reports

The toxicity of pollutants on aquatic communities is determined by the specific sensitivities and by the ecological relationships between species, although the role of ecological interactions on the specific sensitivity to pollutants is complex. We tested the effect of exposure to copper on the life-history strategies of two coexisting rotifer species of the genus Brachionus from Inca-Coya lagoon, an isolated water body located in Atacama Desert. The experiments looked at differences in the response to the stress by chemical pollution mimicking field conditions of copper exposure, levels of food, and salinity, between single-species cultures and coexisting species. Under single species cultures, B. 'Nevada' had lower densities, growth rates, and resting eggs production than B. quadridentatus; when in competition, B. 'Nevada' performed better than B. quadridentatus in most life-history traits. B. 'Nevada' was a copper-tolerant species, which outcompeted B. quadridentatus, more copper-sensitive, with higher levels of copper. Species-specific responses to environmental

conditions and pollution, plus differential relationships between population density and production of resting eggs, resulted in reduced niche overlap between species, allowing stabilized coexistence. The extreme environmental conditions and the isolation of the Inca-Coya lagoon, make it an excellent model to understand the adaption of aquatic organisms to stressed environments.

Linear and evolutionary polynomial regression models to forecast coastal dynamics: Comparison and reliability assessment

Delia Evelina Bruno, Emanuele Barca, Rodrigo Mikosz Goncalves, heithor Alexandre de Araujo Queiroz, Luigi Berardi, Giuseppe Passarella

Geomorphology

In this paper, the Evolutionary Polynomial Regression data modelling strategy has been applied to study small scale, short-term coastal morphodynamics, given its capability for treating a wide database of known information, non-linearly. Simple linear and multilinear regression models were also applied to achieve a balance between the computational load and reliability of estimations of the three models. In fact, even though it is easy to imagine that the more complex the model, the more the prediction improves, sometimes a "slight" worsening of estimations can be accepted in exchange for the time saved in data organization and computational load. The models' outcomes were validated through a detailed statistical, error analysis, which revealed a slightly better estimation of the polynomial model with respect to the multilinear model, as expected. On the other hand, even though the data organization was identical for the two models, the multilinear one required a simpler simulation setting and a faster run time. Finally, the most reliable evolutionary polynomial regression model was used in order to make some conjecture about the uncertainty increase with the extension of extrapolation time of the estimation. The overlapping rate between the confidence band of the mean of the known coast position and the prediction band of the estimated position can be a good index of the weakness in producing reliable estimations when the extrapolation time increases too much. The proposed models and tests have been applied to a coastal sector located nearby Torre Colimena in the Apulia region, south Italy.

Long-term anaerobic digestion of food waste at semi-pilot scale: Relationship between microbial community structure and process performances

Tonanzi Barbara, Gallipoli Agata, Gianico Andrea, Montecchio Daniele, Pagliaccia Pamela, Di Carlo Marco, Rossetti Simona, Braguglia Camilla M.

Biomass & bioenergy

Stability and performance of long term semi-continuous Anaerobic Digestion of food waste at semi-pilot scale is here evaluated based on the integration of multiple lines of evidence. In order to elucidate the main microbial components, the core microbiome dynamics were assessed by high-throughput 16 S rRNA gene sequencing over the reactor operation together with the data related to the AD performances. The experimental reactor, after a successful

start-up, was operated for more than 200 days at a moderate OLR (Organic Loading Rate) of 1.6 +/- 0.4 g VS L(-1)d(-1). The availability of readily biodegradable substrate, in particular carbohydrates, favored the fermentative functional redundancy of bacteria promoting the rapid accumulation of acetate first, and propionate afterwards, due to limited methanogenesis. The prolonged operation, despite the moderate OLR, nurtured propionate accumulation, because H-2 concentration exceeded the level capable to render the reaction endergonic, hampering the propionate uptake process. The application of a Pulsed Feeding strategy increased the hydrogenotrophic Methanomicrobiales favoring the consumption of propionate most likely through hydrogen utilization.

Long-term change in the trophic status and mixing regime of a deep volcanic lake (Lake Bolsena, Central Italy)

Mosello R., Bruni P., Rogora M., Tartari G., Dresti C.

Limnologica

Lake Bolsena, the fourth Italian lake for volume (9.2×10^9 m^3), must be considered as highly sensitive to eutrophication for its extremely long water renewal time. In this paper, temperature and chemical characteristics of the lake measured in the period 2003-2017 are used to discuss the mixing pattern and the variation in the oxygen and algal nutrient concentrations, as indicators of the trophic level. In the analysed period the lake showed oligomictic characteristics, reaching the full overturn, with homogenization of the chemical profile over the whole water column, only in 4 out of the 15 considered years. A regular decrease of oxygen and increase of phosphorus concentrations in the deepest layers has been observed in the non-circulating multi-year periods. The mean total phosphorus concentration showed a regular increase, reaching values close to 16 $\mu g\ P\ L^{-1}$ in early spring 2017, mostly because of the urban discharge from the watershed, not adequately collected from an existing sewage pipe. Chemical and mixing patterns are discussed in relation with a previous study, carried out in 1966-1971, confirming the recent increase of phosphorus concentrations and the lower frequency of full circulation. The progressive deterioration of lake water quality indicates the need of prompt actions to reduce the external nutrient load and of further studies on the physical and biological characteristics of the lake, still strongly missing.

Long-term changes (1990-2015) in the atmospheric deposition and runoff water chemistry of sulphate, inorganic nitrogen and acidity for forested catchments in Europe in relation to changes in emissions and hydrometeorological conditions.

Vuorenmaa J., Augustaitis A., Beudert B., Bochenek W., Clarke N., De Wit H. A., Dirnböck T., Frey J., Hakola H., Kleemola S., Kobler J., Krám P., Lindroos A., Lundin L., Löfgren S., Marchetto A., Pecka T., Schulte-Bisping H., Skotak K., Srybny A., Szpikowski J., Ukonmaanaho L., Vana M., Åkerblom S., Forsius M.

Science of the Total Environment

The international Long-Term Ecological Research Network (ILTER) encompasses hundreds of long-term research/monitoring sites located in awide array of ecosystems that can help us understand environmental change across the globe.We evaluated long-term trends (1990–2015) for bulk deposition, throughfall and runoff water chemistry and fluxes, and climatic variables in 25 forested catchments in Europe belonging to the UNECE International Cooperative Programme on IntegratedMonitoring of Air Pollution Effects on Ecosystems (ICP IM).Many of the IMsites form part of themonitoring infrastructures of this larger ILTER network. Trendswere evaluated for monthly concentrations of non-marine (anthropogenic fraction, denoted as x) sulphate (xSO_4) and base cations x(Ca+Mg), hydrogen ion (H^+), inorganic N (NO_3 and NH_4) and ANC (Acid Neutralising Capacity) and their respective fluxes into and out of the catchments and for monthly precipitation, runoff and air temperature. A significant decrease of xSO_4 deposition resulted in decreases in concentrations and fluxes of xSO_4 in runoff, being significant at 90% and 60% of the sites, respectively. Bulk deposition of NO_3 and NH_4 decreased significantly at 60–80% (concentrations) and 40–60% (fluxes) of the sites. Concentrations and fluxes of NO_3 in runoff decreased at 73% and 63% of the sites, respectively, and NO_3 concentrations decreased significantly at 50% of the sites. Thus, the LTER/ICP IM network confirms the positive effects of the emission reductions in Europe. Air temperature increased significantly at 61% of the sites, while trends for precipitation and runoffwere rarely significant. The sitespecific variation of xSO_4 concentrations in runoff wasmost strongly explained by deposition. Climatic variables and deposition explained the variation of inorganic N concentrations in runoff at single sites poorly, and as yet there are no clear signs of a consistent deposition-driven or climate-driven increase in inorganic N exports in the catchments.

Long-term population dynamics: Theory and reality in a peatland ecosystem.

Connor S. E., Colombaroli D., Confortini F., Gobet E., Ilyashuk B. P., Ilyashuk E. A., Van Leeuwen J. F. N., Lamentowicz M., Van Der Knaap W. O., Malysheva E., Marchetto A., Margalitadze N., Mazei Y., Mitchell E. A. D., Payne R. J., Ammann B.

Journal of Ecology

Population dynamics is a field rich in theory and poor in long-term observational data. Finding sources of long-term data is critical as ecosystems around the globe continue to change in ways that current theories and models have failed to predict. Here we show how long-term ecological data can improve our understanding about palaeo-population change in response to external environmental factors, antecedent conditions and community diversity. We examined a radiometrically dated sediment core from the Didachara Mire in the mountains of south-western Georgia (Caucasus) and analysed multiple biological proxies (pollen, fern spores, non-pollen palynomorphs, charcoal, diatoms, chrysophyte cysts, midges, mites and testate amoebae). Numerical techniques, including multivariate ordination, rarefaction, independent splitting and trait analysis, were used to assess the major drivers of changes in community diversity and population stability. Integrated multi-proxy analyses are very rare in the Caucasus, making this a unique record of long-term ecological change in a global biodiversity hotspot. Population changes in the terrestrial community coincided primarily with external environmental changes, while populations within the peatland community were affected by

both internal and external drivers at different times. In general, our observations accord with theoretical predictions that population increases lead to greater stability and declines lead to instability. Random variation and interspecific competition explain population dynamics that diverged from predictions. Population change and diversity trends were positively correlated in all taxonomic groups, suggesting that population-level instability is greater in more diverse communities, even though diverse communities are themselves more stable. There is a continuing need to confront population theory with long-term data to test the predictive success of theoretical frameworks, thereby improving their ability to predict future change

Mapping phytoplankton blooms in deep subalpine lakes from Sentinel-2A and Landsat-8

Mariano Bresciani, Ilaria Cazzaniga, Martina Austoni, Tommaso Sforzi, Fabio Buzzi, Giuseppe Morabito, Claudia Giardino

Hydrobiologia

For effective lakes' management, high-frequent water quality data on a synoptic scale is essential. The aim of this study is to test the suitability of the latest generation of satellite sensors to provide information on lake water quality parameters for the five largest Italian subalpine lakes. In situ data of phytoplankton composition, chlorophyll-a (chl-a) concentration and water reflectance were used in synergy with satellite observations to map some algal blooms in 2016. Chl-a concentration maps were derived from satellite data by applying a bio-optical model to satellite data, previously corrected for atmospheric effects. Results were compared with in situ data, showing good agreement. The shape and magnitude of water reflectance from different satellite data were consistent. Output chl-a concentration maps, show the distribution within each lake during blooming events, suggesting a synoptic view is required for these events monitoring. Maps show the dynamic of bloom events with concentration increasing from 2 up to 7 mg m^{-3} and dropping again to initial value in less than 20 days. Latest generation sensors showed to be valuable tools for lakes monitoring, thanks to frequent, free of charge data availability over long time periods.

Mass-transfer impact on solute mobility in porous media: A new mobile-immobile model

Costantino Masciopinto, Giuseppe Passarella

Journal of Contaminant Hydrology

The theory for modeling non-equilibrium solute transport in porous media is still based on approximations to a model proposed by Lapidus and Amundson in 1952 that has not been updated. This Mobile–Immobile Model (MIM) is based on the definition of a mass-transfer coefficient (α), which has been proven subject to some severe limitations. Measurements at both laboratory and field scales have demonstrated the scale-dependency of α values. This means that the MIM theory fails in real applications, since α is not constant, as defined in the kinetic model theory, but is a time-residence (or distance) dependent coefficient. Multi-rate

mass-transfer models have been proposed in recent literature to capture real-world solute transport with a multiple mass transfer. In this study, we propose a novel model, which implements the analytical solution of Fick's second law of diffusion directly in the nonequilibrium advection/dispersion equation of solute transport in porous media. New model solutions properly fitted data collected during tracer tests carried out at the CNR-IRSA Laboratory (Bari, Italy) in a horizontal sandbox, 2 m of length, by using sodium chloride as the conservative tracer. Selected breakthrough curves at specific positions were used to validate the proposed model solution and estimate both conventional and proposed coefficients of mass transfer. Results have shown a decreasing trend of α from 0.09 to 0.04 h^{-1} after about 1.2 m of filtration for the investigated sand, whereas new solutions provide two scale-invariant tracer coefficients of rate of tracer mass-transfer (0.004 ± 0.005 h^{-1}) and of tracer time delay (1.19 ± 0.01). The proposed model performs very well, since it provides a readily solved analytical solution with respect to the conventional MIM. Results of the proposed MIM are very similar to those provided by the conventional MIM. The new model solution can be implemented in particle tracking or random walk software in order to solve two-dimensional nonequilibrium solute transport in groundwater.

Mechanism of daytime strong winds on the northern slopes of Himalayas, near Mount Everest: Observation and simulation

Sun F., Ma Y., Hu Z., Li M., Tartari G., Salerno F., Gerken T., Bonasoni P., Cristofanelli P., Vuillermoz E.

Journal of applied meteorology and climatology

The seasonal variability of strong afternoon winds in a northern Himalayan valley and their relationship with the synoptic circulation were examined using in situ meteorological data from March 2006 to February 2007 and numerical simulations. Meteorological observations were focused on the lower Rongbuk valley, on the north side of the Himalayas (4270 m MSL), where a wind profile radar was available. In the monsoon season (21 May-4 October), the strong afternoon wind was southeasterly, whereas it was southwesterly in the nonmonsoon season. Numerical simulations were performed using the Weather Research and Forecasting Model to investigate the mechanism causing these afternoon strong winds. The study found that during the nonmonsoon season the strong winds are produced by downward momentum transport from the westerly winds aloft, whereas those during the monsoon season are driven by the inflow into the Arun Valley east of Mount Everest. The air in the Arun Valley was found to be colder than that of the surroundings during the daytime, and there was a horizontal pressure gradient from the Arun Valley to Qomolangma Station (QOMS), China Academy of Sciences, at the 5200-m level. This explains the formation of the strong afternoon southeasterly wind over QOMS in the monsoon season. In the nonmonsoon season, the colder air from Arun Valley is confined below the ridge by westerly winds associated with the subtropical jet.

Mechanisms linking active rock glaciers and impounded surface water formation in high-mountain areas

Colombo N., Sambuelli L., Comina C., Colombero C., Giardino M., Gruber S., Viviano G., Vittori Antisari L., Salerno F.

Earth Surface Processes and Landforms

The seasonal variability of strong afternoon winds in a northern Himalayan valley and their relationship with the synoptic circulation were examined using in situ meteorological data from March 2006 to February 2007 and numerical simulations. Meteorological observations were focused on the lower Rongbuk valley, on the north side of the Himalayas (4270 m MSL), where a wind profile radar was available. In the monsoon season (21 May-4 October), the strong afternoon wind was southeasterly, whereas it was southwesterly in the nonmonsoon season. Numerical simulations were performed using the Weather Research and Forecasting Model to investigate the mechanism causing these afternoon strong winds. The study found that during the nonmonsoon season the strong winds are produced by downward momentum transport from the westerly winds aloft, whereas those during the monsoon season are driven by the inflow into the Arun Valley east of Mount Everest. The air in the Arun Valley was found to be colder than that of the surroundings during the daytime, and there was a horizontal pressure gradient from the Arun Valley to Qomolangma Station (QOMS), China Academy of Sciences, at the 5200-m level. This explains the formation of the strong afternoon southeasterly wind over QOMS in the monsoon season. In the nonmonsoon season, the colder air from Arun Valley is confined below the ridge by westerly winds associated with the subtropical jet.

Metadata to the database on fish distribution in Italian lakes and reservoirs

Pietro Volta & Silvia Galafassi

Freshwater Metadata Journal

The database comprises the distribution of freshwater fish species in 28 Italian lakes. Data were obtained between 2007 and 2014 from standardised (CEN based) samplings with benthic and mesopelagic multi-mesh gillnets. The database offers a detailed description of the biodiversity of fish communities in the Italian regions of Piedmont, Lombardy, Trentino-Alto Adige and Sardinia including both natural lakes and reservoirs.

Microbial community changes in a chlorinated solvents polluted aquifer over the field scale treatment with poly-3-hydroxybutyrate as amendment

Matturro B., Pierro L., Frascadore E., Papini M.P., Rossetti S.

Frontiers in Microbiology

This study investigated the organohalide-respiring bacteria (OHRB) and the supporting microbial populations operating in a pilot scale plant employing poly-3-hydroxybutyrate (PHB),

a biodegradable polymer produced by bacteria from waste streams, for the in situ bioremediation of groundwater contaminated by chlorinated solvents. The bioremediation was performed in ground treatment units, including PHB reactors as slow release source of electron donors, where groundwater extracted from the wells flows through before the re-infiltration to the low permeability zones of the aquifer. The coupling of the biological treatment with groundwater recirculation allowed to drastically reducing the contamination level and the remediation time by efficiently stimulating the growth of autochthonous OHRB and enhancing the mobilization of the pollutants. Quantitative PCR performed along the external treatment unit showed that the PHB reactor may efficiently act as an external incubator to growing Dehalococcoides mccartyi, known to be capable of fully converting chlorinated ethenes to innocuous end-products. The slow release source of electron donors for the bioremediation process allowed the establishment of a stable population of D. mccartyi, mainly carrying bvcA and vcrA genes which are implicated in the metabolic conversion of vinyl chloride to harmless ethene. Next generation sequencing was performed to analyze the phylogenetic diversity of the groundwater microbiome before and after the bioremediation treatment and allowed the identification of the microorganisms working closely with organohalide-respiring bacteria

Microbial electrochemical technologies: maturing but not mature

Aulenta F., Puig S., Harnisch F.

Microbial biotechnology

It started more than 100 years ago (Potter, 1911). As most, if not all, important developments, its discovery was triggered by mere curiosity. Obviously, what we are referring to is a field of science and engineering that is now summarized under the umbrella of microbial electrochemical technologies (MET). MET are based on the interfacing of microbiology and electrochemistry. Primary MET are based on the wiring of microbial metabolism to solid-state electrodes, via a process typically referred to as extracellular electron transfer (EET). Until recently, EET remained a scientific curiosity. However, advances in the physiology, phylogeny and even biochemistry of so-called 'electroactive' bacteria have gained deeper insights and shown that electroactives are more abundant and important than considered, so far.

Microbiomes of gall-inducing copepod crustaceans from the corals Stylophora pistillata (Scleractinia) and Gorgonia ventalina (Alcyonacea)

Shelyakin P.V., Garushyants S.K., Nikitin M.A., Moudrova S.V., Berumen M., Speksnijder A.G.C.L., Hoeksema B.W., Fontaneto D., Gelfand M.S. & Ivanenko V.N.

Scientific Reports

Corals harbor complex and diverse microbial communities that strongly impact host fitness and resistance to diseases, but these microbes themselves can be influenced by stresses, like those caused by the presence of macroscopic symbionts. In addition to directly influencing the host, symbionts may transmit pathogenic microbial communities. We analyzed two coral gall-forming copepod systems by using 16S rRNA gene metagenomic sequencing: (1) the sea fan Gorgonia ventalina with copepods of the genus Sphaerippe from the Caribbean and (2) the

scleractinian coral Stylophora pistillata with copepods of the genus Spaniomolgus from the Saudi Arabian part of the Red Sea. We show that bacterial communities in these two systems were substantially different with Actinobacteria, Alphaproteobacteria, and Betaproteobacteria more prevalent in samples from Gorgonia ventalina, and Gammaproteobacteria in Stylophora pistillata. In Stylophora pistillata, normal coral microbiomes were enriched with the common coral symbiont Endozoicomonas and some unclassified bacteria, while copepod and gall-tissue microbiomes were highly enriched with the family ME2 (Oceanospirillales) or Rhodobacteraceae. In Gorgonia ventalina, no bacterial group had significantly different prevalence in the normal coral tissues, copepods, and injured tissues. The total microbiome composition of polyps injured by copepods was different. Contrary to our expectations, the microbial community composition of the injured gall tissues was not directly affected by the microbiome of the gall-forming symbiont copepods.

Microbiome profiling in extremely acidic soils affected by hydrothermal fluids: the case of the Solfatara Crater (Campi Flegrei, southern Italy)

Simona Crognale, Stefania Venturi, Franco Tassi, Simona Rossetti, Heba Rashed, Jacopo Cabassi, Francesco Capecchiacci, Barbara Nisi, Orlando Vaselli, Hilary G. Morrison, Mitchell L. Sogin and Stefano Fazi

FEMS microbiology, ecology

An integrated geochemical and microbiological investigation of soils from the Solfatara Crater (Campi Flegrei, southern Italy) demonstrated that interstitial soil gases dominated by CO_2 and other typical hydrothermal gaseous species (e.g. H_2S, CH_4, ethane, benzene, alkenes and S-bearing organic compounds) influenced the composition of microbial communities. The relatively high concentrations of hydrothermal fluids permeating the soil produced acidic conditions and whitish deposits that characterize the Solfatara Crater floor. Archaea and Bacteria showed almost equal cell abundance (up to 3.2 × 107 and 4.2 × 107 cell/g, respectively) with relatively low levels of biodiversity and equitability in sites characterized by elevated temperatures (up to 70◦C), very low pH values (up to 2.2) and reducing conditions. In these sites, high-throughput sequencing showed the marked selection of microorganisms, mainly affiliated with the genera Thermoplasma, Ferroplasma and Acidithiobacillus. A relatively high biodiversity and concomitant distinctive structure of the microbial community were observed in soils poorly affected by fumarolic emissions that were oxic and rich in organic matter.

Microplastics increase impact of treated wastewater on freshwater microbial community

Eckert E.M., Di Cesare A., Kettner M.T., Arias-Andrés M., Fontaneto D., Grossart H.-P., Corno G.

Environmental Pollution

Plastic pollution is a major global concern with several million microplastic particles entering every day freshwater ecosystems via wastewater discharge. Microplastic particles stimulate

biofilm formation (plastisphere) throughout the water column and have the potential to affect microbial community structure if they accumulate in pelagic waters, especially enhancing the proliferation of biohazardous bacteria. To test this scenario, we simulated the inflow of treated wastewater into a temperate lake using a continuous culture system with a gradient of concentration of microplastic particles. We followed the effect of microplastics on the microbial community structure and on the occurrence of integrase 1 (int1), a marker associated with mobile genetic elements known as a proxy for anthropogenic effects on the spread of antimicrobial resistance genes. The abundance of int1 increased in the plastisphere with increasing microplastic particle concentration, but not in the water surrounding the microplastic particles. Likewise, the microbial community on microplastic was more similar to the original wastewater community with increasing microplastic concentrations. Our results show that microplastic particles indeed promote persistence of typical indicators of microbial anthropogenic pollution in natural waters, and substantiate that their removal from treated wastewater should be prioritised.

Modelling soil erosion in a Mediterranean watershed: Comparison between SWAT and AnnAGNPS models

Abdelwahab O.M.M., Ricci G.F., De Girolamo A.M., Gentile F.

Environmental research

In this study, the simulations generated by two of the most widely used hydrological basin-scale models, the Annualized Agricultural Non-Point Source (AnnAGNPS) and the Soil and Water Assessment Tool (SWAT), were compared in a Mediterranean watershed, the Carapelle (Apulia, Southern Italy). Input data requirements, time and efforts needed for input preparation, strength and weakness points of each model, ease of use and limitations were evaluated in order to give information to users. Models were calibrated and validated at monthly time scale for hydrology and sediment load using a four year period of observations (streamflow and suspended sediment concentrations). In the driest year, the specific sediment load measured at the outlet was 0.89 t ha^{-1} yr^{-1}, while the simulated values were 0.83 t ha^{-1} yr^{-1} and 1.99 t ha^{-1} yr^{-1} for SWAT and AnnAGNPS, respectively. In the wettest year, the specific measured sediment load was 7.45 t ha^{-1} yr^{-1}, and the simulated values were 8.27 t ha^{-1} yr^{-1} and 6.23 t ha^{-1} yr^{-1} for SWAT and AnnAGNPS, respectively. Both models showed from fair to a very good correlation between observed and simulated streamflow and satisfactory for sediment load. Results showed that most of the basin is under moderate (1.4-10 t ha^{-1} yr^{-1}) and high-risk erosion (> 10 t ha^{-1} yr^{-1}). The sediment yield predicted by the SWAT and AnnAGNPS models were compared with estimates of soil erosion simulated by models for Europe (PESERA and RUSLE2015). The average gross erosion estimated by the RUSLE2015 model (12.5 t ha^{-1} yr^{-1}) resulted comparable with the average specific sediment yield estimated by SWAT (8.8 t ha^{-1} yr^{-1}) and AnnAGNPS (5.6 t ha^{-1} yr^{-1}), while it was found that the average soil erosion estimated by PESERA is lower than the other estimates (1.2 t ha^{-1} yr^{-1}).

Mitonuclear discordance as a confounding factor in the DNA taxonomy of monogonont rotifers

Obertegger U., Cieplinski A., Fontaneto D. & Papakostas S.

Zoologica Scripta

Discordance between mitochondrial and nuclear phylogenies is being increasingly recognized in animals and may confound DNA-based taxonomy. This is especially relevant for taxa whose microscopic size often challenges any effort to distinguish between cryptic species without the assistance of molecular data. Regarding mitonuclear discordance, two strikingly contrasting scenarios have been recently demonstrated in the monogonont rotifers of the genus Brachionus. While strict mitonuclear concordance was observed in the marine B. plicatilis species complex, widespread hybridization-driven mitonuclear discordance was revealed in the freshwater B. calyciflorus species complex. Here, we investigated the frequency of occurrence and the potential drivers of mitonuclear discordance in three additional freshwater monogonont rotifer taxa, and assessed its potential impact on the reliability of DNA taxonomy results based on commonly used single markers. We studied the cryptic species complexes of Keratella cochlearis, Polyarthra dolichoptera and Synchaeta pectinata. Phylogenetic reconstructions were based on the mitochondrial barcoding marker cytochrome c oxidase subunit I gene and the nuclear internal transcribed spacer 1 locus, which currently represent the two most typical genetic markers used in rotifer DNA taxonomy. Species were delimited according to each marker separately using a combination of tree-based coalescent, distance-based and allele-sharing-based approaches. Mitonuclear discordance was observed in all species complexes with incomplete lineage sorting and unresolved phylogenetic reconstructions recognized as the likely drivers. Evidence from additional sources, such as morphology and ecology, is thus advisable for deciding between often contrasting mitochondrial and nuclear species scenarios in these organisms.

Non-enzymatic portable optical sensors for microcystin-LR.

Larisa Lvova, Carla Guanais Gonçalves, Luca Prodi, Marco Lombardo, Nelsi Zaccheroni, Emanuela Viaggiu, Roberta Congestri, Licia Guzzella, Fiorenzo Pozzoni, Corrado Di Natale and Roberto Paolesse.

Chemical Communication

We present here the development of an all-solid-state optical sensor based on phenyl-substituted diaza-18-crown-6 hydroxyquinoline (DCHQ-Ph) for the indirect selective detection of microcystin-LR (MC-LR), reaching a very low detection limit of 0.05 lg L^{-1}, well below the World Health Organisation (WHO) guideline value (1 lg L^{-1}) in potable water. We demonstrate the potential applicability of the developed method in fast and low-cost water toxicity estimation.

Non-native Fish Occurrence and Biomass in 1943 Western Palearctic Lakes and Reservoirs and their Abiotic and Biotic Correlates.

Carolina Trochine, Sandra Brucet, Christine Argillier, Ignasi Arranz, Meryem Beklioglu, Lluís Benejam, Teresa Ferreira, Trygve Hesthagen, Kerstin Holmgren, Erik Jeppesen, Fiona Kelly, Teet Krause, Martti Rask, Pietro Volta, Ian J. Winfield, Thomas Mehner

Ecosystems

Invasion of non-native species is considered a major threat to global biodiversity. Here we present a comprehensive overview of the occurrence, richness and biomass contribution of non-native fish species in 1943 standing water bodies from 14 countries of the Western Palearctic, based on standardised fish catches by multi-mesh gillnetting. We expected strong geographical gradients to emerge in the occurrence of non-natives. We further hypothesised that the contribution by non-natives to the local fish community biomass was correlated with local richness and the trophic level of native and non-native species. Non-native fish species occurred in 304 of 1943 water bodies (16%). If the average number of occupied water bodies per country was weighted by number of water bodies per country, the grand mean occurrence of non-natives in Western Palearctic water bodies was 10%. Exotic (non-native to the Palearctic) and translocated (non-native only to parts of the Palearctic) species were found in 164 (8.4%) or 235 (12.1%) of the water bodies, respectively. The occurrence and local richness of non-native fish species increased with temperature, precipitation and lake area and were substantially higher in reservoirs than in natural lakes. High local biomass contributions of non-native species were strongly correlated with low richness of native species and high richness of non-native species, whereas the trophic level of the fish species had only a weak effect. Single non-native species rarely dominated community biomass, but high biomass contributions and thus strong community and ecosystem impacts can be expected if several non-native species accumulate in a water body.

Organic Fraction of Municipal Solid Waste Recovery by Conversion into Added-Value Polyhydroxyalkanoates and Biogas

Valentino F.; Gottardo M.; Micolucci F.; Pavan P.; Bolzonella D.; Rossetti S.; Majone M.

ACS sustainable chemistry & engineering

The integrated-multistage process proposed herein is a practical example of a biorefinery platform in which the organic fraction of municipal solid waste (OFMSW) is used as a valued source for polyhydroxyalkanoates (PHA) and biogas production. Technical and economical feasibilities of this approach have been demonstrated at pilot-scale, providing a possible upgrade to traditional biowaste management practices, presently based on anaerobic digestion (AD). A pH-controlled OFMSW fermentation stage produced a liquid VFA-rich stream with a high VFA/CODSOL ratio (0.90 COD/COD) that was easily used in the following aerobic stages for biomass and PHA production. The solid fraction was valorized into biogas through AD, obtaining energy and minimizing secondary flux waste generation. The reliable biomass enrichment was demonstrated by a stable feast-famine regime and supported by microbial

community analysis. The selected consortium accumulated PHA up to 55% wt. Compared to the traditional AD process in an urban scenario of 900000 AE, the integrated approach for OFMSW valorization is preferable, and it is characterized by an electrical energy production of 85.7 MWh/d and 1.976 t/d as PHA productivity. The proposed process was also evaluated as economically sustainable if the PHA is marketed from 0.90 €/kg as the minimum threshold to a higher market price.

Oxidation of azo and anthraquinonic dyes by peroxymonosulphate activated by UV light.

Michele Pagano, Ruggiero Ciannarella, Vito Locaputo, Giuseppe Mascolo, and Angela Volpe.

Journal of environmental science and health. Part A

The photochemical degradation of two azo and two anthraquinonic dyes was performed using potassium peroxymonosulphate (Oxone®) activated by UV radiation. The fast decolourization of all dyes was observed within 6 min of UV irradiation, with corresponding dye decays higher than 80%. The kinetic rate constants of the dyes' decay were determined, along with the energetic efficiency of the photochemical treatment, taking into account the influence of a few anions commonly present in real wastewaters (i.e., chloride, nitrate, carbonate/bicarbonate and phosphate ions). Chloride and carbonate/bicarbonate ions enhanced dye degradation, whereas phosphate ions exerted an inhibitory effect, and nitrates did not have a predictable influence. The dye decolourization was not associated with efficient mineralization, as suggested by the lack of a significant total organic carbon (TOC) decrease, as well as by the low concentrations of a few detected low molecular weight by-products, including nitrate ions, formaldehyde and organic acids. High molecular weight by-products were also detected by mass spectrometry analysis. The investigated process may be proposed as a convenient pre-treatment to help dye degradation in wastewater during combined treatment methods.

Performance of passive sampling with low-density polyethylene membranes for the estimation of freely dissolved DDx concentrations in lake environments.

Raffaella Borrelli, A. Patricia Tcaciuc, Iason Verginelli, Renato Baciocchi, Licia Guzzella, Pietro Cesti, Luciano Zaninetta, Philip M. Gschwend.

Chemosphere

Laboratory and field studies were used to evaluate the performance of low-density polyethylene (PE) passive samplers for assessing the freely dissolved concentrations of DDT and its degradates (DDD and DDE, together referred to as DDx) in an Italian lake environment. We tested commercially available 25 mm thick PE sheets as well as specially synthesized, 10 mm thick PE films which equilibrated with their surroundings more quickly. We measured PE-water partitioning coefficients (Kpew) of the 10 μm thick PE films, finding good correspondence with previously reported values for thicker PE. Use of the 10 μmPE for ex situ

sampling of a lake sediment containing DDx in laboratory tumbling experiments showed repeatability of ±15% (= standard deviation/mean). Next, we deployed replicate 10 μm and 25 μmPE samplers (N = 4 for 10 d and for 30 d) in the water and sediment of a lake located in northern Italy; the results showed dissolved DDx concentrations in the picogram/L range in porewater and the bottom water. Values deduced from 10 mm thick PE films compared well (95% of all comparison pairs matched within a factor of 5) with those obtained using PE films of 25 mm thickness when dissolved DDx concentrations were estimated using performance reference compound (PRC) corrections, whether left at the bed-water interface for 10 or 30 days. These results demonstrated the potential of this sampling method to provide estimation of the truly dissolved DDx concentrations, and thereby the mobile and bioavailable fractions in both surface waters and sediment beds.

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

Pawel Krzeminski, Maria Concetta Tomei, Popi Karaolia, Alette Langenhoff, C. Marisa R. Almeida, Ewa Felis, Fanny Gritten, Henrik Rasmus Andersen, Telma Fernandes, Celia M. Manaia, Luigi Rizzo, Despo Fatta-Kassinos.

Science of the Total Environment

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.

Persistence of antibiotic resistance genes in large subalpine lakes: the role of anthropogenic pollution and ecological interactions

Eckert E.M., Di Cesare A., Coci M., Corno G.

Hydrobiologia

The spread of antibiotic-resistant bacteria is a threatening risk for human health at a global scale. Improved knowledge on the cycle of antibiotic resistance spread between human and the environment is a major requirement for the management of the current crisis. Compared to the well-studied cycle in clinical settings much less is known about the factor allowing their persistence in the environment. In fact, lakes and rivers exposed to high anthropogenic impact seem to become long-term reservoirs for resistance genes. The presence of antibiotic resistance genes (ARGs) within the resident microbiome of large subalpine lakes (i.e. Lake Geneva, Lake Maggiore) has recently been investigated in both the water column and the sediment. These studies suggest a correlation between the abundance of some ARGs and the anthropogenic impact. Within the system, however, abiotic factors and the food-web structure determine the survival of specific bacterial genotypes and thus the resistance genes they harbour. Thus, a growing body of work suggests an important role of ecological interactions in the persistence or elimination of such genes from the environment. This article reviews the current literature regarding the presence of ARGs in subalpine lakes, the impact of anthropogenic pollution on their appearance and the potential role of various ecological interactions on their persistence in the system.

Persistence of meromixis and its effects on redox conditions and trophic status in Lake Idro (Southern Alps, Italy)

Viaroli P., Azzoni R., Bartoli M., Iacumin P., Longhi D., Mosello R., Rogora M., Rossetti G., Salmaso N., Nizzoli D.

Hydrobiologia

This paper reports a study of oxygen and redox conditions, trophic status, and phytoplankton community in the meromictic Lake Idro (Italy) from 2010 to 2014. The sequence of causes and effects of meromixis are also evaluated by comparing recent research with studies conducted from the late 1960s to the mid-1990s. In the last half century, Lake Idro was steadily meromictic due to solutes which accumulated in its deep waters, along with both dissolved nutrients and chemically reduced substances produced by the anaerobic microbial metabolism. These substances were retained in bottom waters and made unavailable to upper layers until stratification broke. Mixing episodes occurred in 2005-2006 altering stratification, and oxygen and nutrient distribution within the lake. The potential full overturn effects were also evaluated as potential oxygen consumption due to the oxidation of reduced substances to forecast possible oxygen exhaustion and collapse of biological communities. Finally, meromixis is discussed as a potential threat for deep perialpine lakes using Lake Idro as a reference to comparatively evaluate the present status and possible future trends.

Persistence of the antibiotic sulfamethoxazole in river water alone or in the co-presence of ciprofloxacin.

Luisa Patrolecco, Jasmin Rauseo, Nicoletta Ademollo, Paola Grenni, Martina Cardoni, Caterina Levantesi, Maria Laura Luprano, Anna Barra Caracciolo

Science of the Total Environment

Sulfamethoxazole and ciprofloxacin are among the most prescribed antibiotics and are frequently detected in surface water ecosystems. The aim of this study was to assess the role of a riverine natural microbial community in sulfamethoxazole (SMX) degradation in presence and absence of ciprofloxacin (CIP). River samples were collected from a stretch of the Tiber River highly impacted by human pressure. An experimental set up was performed varying some abiotic (dark/UV-light) and biotic (presence/absence of microorganisms) conditions that can affect antibiotic degradation.

The residual concentrations of SMX and CIP were measured (HPLC-MS or HPLC-UV/FLD) and the effects on the natural microbial community were assessed in terms of microbial number (N. live cells/mL) and structure (Fluorescence In Situ Hybridization - FISH). Finally, the occurrence of the antibiotic resistance sul1 gene was also verified using quantitative PCR (qPCR).

In 28 days, in the presence of both UV-light and microorganisms SMX disappeared (bLOD). SMX decreased partially in the dark (24%) and a slightly higher depletion was found in sterile river water and UV-light (30%). However, only in the presence of the microbial populations and in dark conditions, SMX disappeared subsequently at days 60. In the co-presence of CIP and light, SMX was more persistent (50%) than when alone. The depletion of CIP was not negatively influenced by SMX occurrence. The antibiotics did not negatively affect the microbial numbers. The FISH analysis showed that some bacterial populations were initially inhibited by the presence of the antibiotics, but at the end of the experiment, a general increase in most groups was observed together with an increase in the copy numbers of the sul1 gene. Therefore, the antibiotics at the dose of 500 μg/L did not have biocide effects on the natural microbial community and, instead, promoted some resistant natural bacterial populations able to degrade them.

Phyto-dehydration of confined sludge: a sustainable approach for the management of polluted ponds

Dario Liberati, Paolo Sconocchia, Anna Ricci, Giovanni Gigliotti, Chiara Tacconi, Paola Grenni, Sara Tariciotti, Anna Barra Caracciolo, Angelo Massacci, Alessandra Lagomarsino, Paolo De Angelis

Journal of Soils and Sediments

Leaf transpiration drives many of the processes involved in phyto-technologies, and it can represent a useful mechanism to remove water from different kind of storage basins presenting inorganic, organic or microbiological contamination (phyto-dehydration), with the aim to reduce the risk of environmental contamination. In this framework, a mesocosm-scale

trial was carried out to test the capacity of different helophyte species to reduce the excess of water in an artificial pond filled with oversaturated sludge.

The sludge derives from the digestion of pig slurries, presents high levels of zinc and copper and for most of the year is covered by a water layer of about 20 cm due to rainfalls. This layout (water layer over the sludge) was reproduced inside the mesocosms, where four helophyte species (Phragmites australis and a mix of Carex acutiformis, Iris pseudacorus and Juncus effusus) were planted on floating frames. Plant growth and functionality were monitored for one year, along with their water consumption capacity; the vegetation impact on sludge chemistry, sludge microbial community and sludge greenhouse gases emission/uptake were also evaluated. The sensitivity of the phyto-dehydration system to the reduction of water level occurring during summer in the pond was investigated reducing the water input to the mesocosms.

P. australis and C. acutiformis successfully established in the mesocosms, while a significant mortality was recorded for I. psudacorus and J. effusus. Once established, plants were able to grow in the mesocosms, and no metal toxicity effect was observed on photosynthesis rates that were comparable with values reported for natural stands of the species. Plants significantly increased (from 24 to 63%, depending on the species) the amount of water lost by the mesocosms and counteracted the reduction of sludge organic carbon that could lead to a mobilization of the heavy metals bound to organic matter: furthermore, plants decreased the rates of mesocosm greenhouse gas emission and reduced the sludge pathogen (Enterobacteriaceae) occurrence. Water limitations reversibly reduced the water consumption and CO_2 uptake capacity of the mesocosms.

The results of this study demonstrated that the water balance of a sludge/water system can be effectively modified through the phyto-dehydration approach, increasing significantly the amount of water lost. Although the low tolerance of two species to the sludge/water environment after plantation needs to be further investigated, this phyto-technology can represent a promising approach to manage the excess of water in polluted ponds.

Photocatalytic Degradation of Diclofenac by Hydroxyapatite-TiO_2 Composite Material: Identification of Transformation Products and Assessment of Toxicity

Murgolo Sapia, Moreira Irina S., Piccirillo Clara, Castro Paula M. L., Ventrella Gianrocco, Cocozza Claudio, Mascolo Giuseppe

Materials

Diclofenac (DCF) is one of the most detected pharmaceuticals in environmental water matrices and is known to be recalcitrant to conventional wastewater treatment plants. In this study, degradation of DCF was performed in water by photolysis and photocatalysis using a new synthetized photocatalyst based on hydroxyapatite and TiO_2 (HApTi). A degradation of 95% of the target compound was achieved in 24 h by a photocatalytic treatment employing the HApTi catalyst in comparison to only 60% removal by the photolytic process. The investigation of photo-transformation products was performed by means of UPLC-QTOF/MS/MS, and for 14 detected compounds in samples collected during treatment with HApTi, the chemical structure

was proposed. The determination of transformation product (TP) toxicity was performed by using different assays: Daphnia magna acute toxicity test, Toxi-ChromoTest, and Lactuca sativa and Solanum lycopersicum germination inhibition test. Overall, the toxicity of the samples obtained from the photocatalytic experiment with HApTi decreased at the end of the treatment, showing the potential applicability of the catalyst for the removal of diclofenac and the detoxification of water matrices.

Plankton dynamics across the freshwater, transitional and marine research sites of the LTER-Italy Network. Patterns, fluctuations, drivers

Giuseppe Morabito, Maria Grazia Mazzocchi, Nico Salmaso, Adriana Zingone, Caterina Bergami, Giovanna Flaim, Stefano Accoroni, Alberto Basset, Mauro Bastianini, Genuario Belmonte, Fabrizio Bernardi Aubry, Isabella Bertani, Mariano Bresciani, Fabio Buzzi, Marina Cabrini, Elisa Camatti, Carmela Caroppo, Bruno Cataletto, Michela Castellano, Paola Del Negro, Alessandra de Olazabal, Iole Di Capua, Antonia Concetta Elia, Daniela Fornasaro, Marina Giallain, Federica Grilli, Barbara Leoni, Marina Lipizer, Lorenzo Longobardi, Alessandro Ludovisi, Antonella Lugliè, Marina Manca, Francesca Margiotta, Maria Antonietta Mariani, Mauro Marini, Mara Marzocchi, Ulrike Obertegger, Alessandro Oggioni, Bachisio Mario Padedda, Marco Pansera, Roberta Piscia, Paolo Povero, Silvia Pulina, Tiziana Romagnoli, Ilaria Rosati, Giampaolo Rossetti, Fernando Rubino, Diana Sarno, Cecilia Teodora Satta, Nicola Sechi, Elena Stanca, Valentina Tirelli, Cecilia Totti, Alessandra Pugnetti

Science of the total environment

A first synoptic and trans-domain overviewof plankton dynamics was conducted across the aquatic sites belonging to the Italian Long-Term Ecological Research Network (LTER-Italy). Based on published studies, checked and complemented with unpublished information, we investigated phytoplankton and zooplankton annual dynamics and long-term changes across domains: from the large subalpine lakes to mountain lakes and artificial lakes, from lagoons to marine coastal ecosystems. This study permitted identifying common and unique environmental drivers and ecological functional processes controlling seasonal and long-termtemporal course. The most relevant patterns of plankton seasonal succession were revealed, showing that the driving factors were nutrient availability, stratification regime, and freshwater inflow. Phytoplankton and mesozooplankton displayed a wide interannual variability at most sites. Unidirectional or linear long-term trends were rarely detected but all sites were impacted across the years by at least one, but in many case several major stressor(s): nutrient inputs, meteo-climatic variability at the local and regional scale, and direct human activities at specific sites. Different climatic and anthropic forcings frequently co-occurred, whereby the responses of plankton communities were the result of this environmental complexity. Overall, the LTER investigations are providing an unparalleled framework of knowledge to evaluate changes in the aquatic pelagic systems and management options

Planktonic and periphytic bdelloid rotifers from Thailand reveal a species assemblage with a combination of cosmopolitan, tropical, and yet undescribed species

Jaturapruek R., Fontaneto D., Meksuwan P., Pholpunthin P. & Maiphae S.

Systematics & Biodiversity

The dispersal pattern of microorganisms has been a debated topic in the last decade, because for microscopic organisms with dispersing stages, biogeographic barriers may not exist and geographic distances may have little effect on the probability of their occurrence. In this study we tested whether a group of microscopic animals, the bdelloid rotifers, sampled in a tropical country, could indeed be cosmopolitan, strictly tropical, and/or have endemic species. We sampled freshwater habitats throughout Thailand in dry and rainy seasons between 2014 and 2016, focusing on permanent water bodies, where the prevalence of species producing resting stages acting as propagules for dispersal should be minimal and thus dispersal limitation should exist, with several species being narrowly distributed. We used traditional morphological identification, geometric morphometric analyses on the shape and size of the jaws, and DNA taxonomy to identify species and to quantify the morphological and genetic distances of Thai samples in comparison with data on bdelloids from other areas in the world. We found a total of 12 species of planktonic and periphytic bdelloid rotifers, and all approaches we used, qualitative and quantitative, confirmed a group of nine potentially cosmopolitan species already known from other continents, one tropical oriental species, and two new species with a potentially narrow geographic distribution, one of which we here formally describe. We thus support the idea that for microscopic animals the moderate endemicity hypothesis suggested for protists may also hold true: most of the species we found indeed have a wide geographic distribution, but other species with narrower distributions do exist.

Polycyclic aromatic hydrocarbons in a bakery indoor air: trends, dynamics, and dispersion.

Pierina Ielpo, Maria Rosaria Taurino, Riccardo Buccolieri, Claudia Marcella Placentino, Francesco Gallone, Valeria Ancona, Silvana Di Sabatino.

Environmental Science and Pollution Research

Indoor air pollution assessment in work environments remains challenging due to a combination of logistic reasons and availability of costly instrumentation for data acquisition and post-processing. Existing literature focuses on energy production environments, hospitals, and less so on food production spaces. Studies on indoor air quality in bakeries are scarce or even absent. Motivated by this, the present study investigates indoor air quality in a bakery located in Bari province in South Italy, using a combination of approaches including analytical chemistry analyses and computational fluid dynamics to reconstruct the air ventilation in response to air temperature gradients within the working environment. PM2.5 indoor samplings were collected every 6 h from 7 to 19 April 2013 in the proximity of two bakery ovens powered by gas and wood, respectively. For each sampling day, 4 PM2.5 samples were

collected: from 3:00 to 9:00 h (first), from 9:00 to 13:30 h (second), from 14:00 to 21:00 h (third), and from 21:00 to 3:00 h (fourth). In total, 40 samples were collected. On each sample, several polycyclic aromatic hydrocarbons (PAHs) were determined such as benzo[a]anthracene (228), benzo[b]fluoranthene (252), benzo[k]fluoranthene (252), benzo[a]pyrene (252), benzo[g,h,i]perylene (276), indeno[1,2,3-cd]pyrene (276), and dibenzo[a,h]anthracene (278), the main compounds of 16 priority US Environmental Protection Agency (US-EPA) PAHs in particulate phase. The PAH mean concentrations showed higher values during the first (from 3:00 to 9:00 h) and fourth (from 21:00 to 3:00 h) sampling intervals than the other two with benzo[a]pyrene mean values exceeding the Italian law limit of 1 ng/m3. Taking into account benzo[a]pyrene mean concentration for the first interval and the first plus the second one, which are the hours with the largest working activity, we have estimated that the baker and co-workers are exposed to a cancer risk of 4.3 × 10−7 and 5.8 × 10−7, respectively (these values are lower than US-EPA recommended guideline of 10−6). Our study was complemented by numerical analyses using state-of-the-art computational fluid dynamics to reconstruct at high resolution air movement from the various working places, i.e., the bakery and the selling area which were connected via a door. The numerical simulations were possible given that surface temperature using infrared thermography as well as air temperature was continuously recorded throughout the sampling acquisition. The use of this approach allowed us to estimate the transport and diffusion of benzo[a]pyrene from one area to the other thus complementing the point sampling information. Computational fluid dynamic simulation results confirm the presence of benzo[a]pyrene in the laboratory as obtained from the measurements and suggests its presence in the sales' area of the bakery with concentrations similar those found in the laboratory.

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

Antonella Petrocelli, Boris Antolić, Luca Bolognini, Ester Cecere, Ivan Cvitković, Marija Despalatović, Annalisa Falace, Stefania Finotto, Ljiljana Iveša, Vesna Mačić, Mauro Marini, Martina Orlando-Bonaca, Fernando Rubino, Benedetta Trabucco, Ante Žuljević

Marine pollution bulletin

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.

Predicting new snow density in the Italian Alps: A variability analysis based on 10 years of measurements.

Mauro Valt, Nicolas Guyennon, Franco Salerno, Anna B. Petrangeli, Rosamaria Salvatori, Paola Cianfarra, Emanuele Romano.

Hydrological Processes

Despite its strong impact on the time evolution of the snowpack, current estimation of new snow density (ρ_{hn}) is usually accomplished either by using local empirical techniques or by assuming a constant snow density. Faced with the lack of an estimation model of ρ_{hn} valid for a wide spatial scale and supported by a suitable number of observations, this study aims to develop simple monthly linear regression models at scale of the entire Italian Alpine chain based on 12,112 snowfall observations at 122 stations, using only air temperature as predictor. Moreover, the remaining variance is investigated in both time and space, also considering some qualitative features of the snowfall events. The daily ρhn measurements present a mean value of 115 kg m^{-3} (105 and 159 kg m^{-3} for dry and wet conditions, respectively). The mean air temperature of the 24 hr preceding the snowfall event has been found to be the best predictor of the ρhn, within 31% of uncertainty. The analysis of associated residues allows supporting the idea that the adoption of a more local approach than the one analysed here is not able to substantially increase the predictive capabilities of the model. In fact, the main factor explaining the remaining variance over the air temperature is the wind, but in a complex orography, as mountain regions are, supplying realistic local wind fields is particularly challenging. Therefore, we conclude that using only the daily mean temperature as predictor is a good choice for estimating daily new snow density at scale of Italian Alpine chain, as well as at more regional scale.

Produzione di serie storiche con il telerilevamento satellitare: uno strumento innovativo per la gestione sostenibile della molluschicoltura?

Caroppo C., Portacci G., Giordano L.

Biologia marina mediterranea

Global aquaculture production in increasing over the last years, but official statistics frequently under-report the real data due to the illegal farming and the unregulated market. Recent advances in remote sensing technology allow us to view aquaculture and fishery practices from space. Here, we used remote sensing to count mussel culture plans in the First Inlet of Mar Piccolo of Taranto from 1988 to 2015. The results evidenced the unreliability of officially reported statistics and provide the first example of mussel culture production

Prokaryoplankton and phytoplankton community compositions in five large deep perialpine lakes

Hernandez-Aviles J.S., Callieri C., Bertoni R., Morabito G., Leoni B., Lepori F., Buzzi F., Salmaso N.

Hydrobiologia

Phytoplankton (PCC) and prokaryoplankton community compositions were studied in five perialpine lakes (Garda, Maggiore, Como, Iseo, and Lugano) of different trophic conditions and mixing regimes, using inverted microscopy and CARD-FISH technique. The aim of this research was to assess, for the first time in these lakes, the relationships among PCC, bacteria, and archaea, and the effects of environmental drivers. We observed a clear difference of PCC compositions in spring and summer. All the lakes showed Bacillariophyta dominating in spring, whereas in summer, there were remarkable differences of PCC. Prokaryoplankton composition showed more pronounced differences in the vertical profile than those between spring and summer. The oligomictic lakes showed a uniform vertical gradient of prokaryotes in spring, while in the meromictic lakes, their abundances were incremented with depth. In summer, the prokaryotic community changed, and niche differentiation occurred in almost all lakes. In conclusion, our study showed a general pattern, common to all the lakes, of a first appearance of the large-sized "opportunistic" bacteria in spring, followed by ultramicrobacteria, less vulnerable to predation in summer. Significant correlations between a few PCC and bacterial groups were found, thus elucidating that functional interactions can be the key to understand plankton successions.

Purification of Galactose binding lectin from the mucus of Sabella spallanzanii (Gmelin, 1791) and interaction of arsenic with bacterial agglutinating activity

Dara M.; Benenati G.; Parisi M. G.; Piazzese D.; Stabili L.; Cammarata M.

Invertebrate Survival Journal

Lectins are present in almost all living organisms and are involved in several biological processes, including immune responses. In the present study, a galactose binding lectin (SsGBL) exhibiting an apparent MW of 43 kDa has been characterized and purified from the mucus of the polichaete Sabella spallanzanii by using both affinity chromatography and high-pressure liquid chromatographic methods. Its agglutinating activity towards rabbit erythrocytes was significantly modified by the addition of calcium or EDTA. The activity was optimal at temperature values comprised between 4 °C and 37 °C, was partially retained after exposure at 50 °C, and was depleted at 90 °C. The SsGBL was able to agglutinate bacteria. The strongest activity was observed towards V. alginolyticus and E. coli, by contrast SsGBL at lesser extent agglutinated the Gram positive Micrococcus lysodeikticus, suggesting its possible involvement in host pathogen interactions. Chemical analysis of animal tissues shows high concentrations of arsenic, in the branchial crown of animals (Bio Accumulation Factor: 1,869) respect to sea water. We then investigated the arsenic effect and according to the branchial crown accumulation the mucus bacterial agglutinating activity results show that the presence of arsenic determines a modification but not complete inhibition also at the higher used concentration (BAF ranging from 200 to 20,000), whereas methylmercury totally depletes the mucus agglutinant activity.

Quantifying Debris Thickness of Debris-Covered Glaciers in the Everest Region of Nepal Through Inversion of a Subdebris Melt Model

Rounce D.R., King O., McCarthy M., Shean D.E., Salerno F.

Journal of geophysical research

Debris-covered glaciers are ubiquitous in the Himalaya, and supraglacial debris significantly alters how glaciers respond to climate forcing. Estimating debris thickness at the glacier scale, however, remains a challenge. This study inverts a subdebris melt model to estimate debris thickness for three glaciers in the Everest region from digital elevation model difference-derived elevation change. Flux divergences are estimated from ice thickness and surface velocity data. Monte Carlo simulations are used to incorporate the uncertainties associated with debris properties, flux divergence, and elevation change. On Ngozumpa Glacier, surface lowering data from 2010 to 2012 and 2012 to 2014 are used to calibrate and validate the method, respectively. The debris thickness estimates are consistent with existing in situ measurements. The method performs well over both actively flowing and stagnant parts of the glacier and is able to accurately estimate thicker debris (>0.5 m). Uncertainties associated with the thermal conductivity and elevation change contribute the most to uncertainties of the debris thickness estimates. The surface lowering associated with ice cliffs and supraglacial ponds was found to significantly reduce debris thickness, especially for thicker debris. The method is also applied to Khumbu and Imja-Lhotse Shar Glaciers to highlight its potential for regional application.

Quantifying impacts of climate variability and human activities on the streamflow of an Alpine river

Saidi H., Dresti C., Manca D., Ciampittiello M.

Environmental earth sciences

In this study, we present a review of the current state-of-the-art research on streamflow alteration assessment, and examine the impact of climate variability and human activities on the natural streamflow of a tributary of Lake Maggiore (north-western Italy). The recent concept of climate elasticity of streamflow was used to indicate in which parameters the streamflow is more sensitive. First, a statistically identified change point was used to define the base period. Methods including hydrological sensitivity, climate elasticity and hydrological modelling then allowed us to estimate the anthropogenic and climatic effects on streamflow and to have an idea of the complicated non-linear relationship among streamflow, precipitation and temperature. Our results suggest that climate variability accounted for 85% of the decrease in streamflow. The remaining change could result from land cover-use change. The climate elasticity method used in this study could predict streamflow for future climatic change scenarios.

Rainfall as primary driver of discharge and solute export from rock glaciers: The Col d' Olen Rock Glacier in the NW Italian Alps

Nicola Colombo, Stephan Gruber, Maria Martin, Mery Malandrino, Andrea Magnani, Danilo Godone, Michele Freppaz, Simona Fratianni, Franco Salerno

Science of the total environment

Three hypotheses exist to explain how meteorological variables drive the amount and concentration of solute-enriched water from rock glaciers: Warm periods cause increased subsurface ice melt, which releases solutes; rain periods and the melt of long-lasting snow enhance dilution of rock-glacier outflows; and percolation of rain through rock glaciers facilitates the export of solutes, causing an opposite effect as that described in hypothesis . This lack of detailed understanding likely exists because suitable studies of meteorological variables, hydrologic processes and chemical characteristics of water bodies downstream from rock glaciers are unavailable. In this study, a rock-glacier pond in the North-Western Italian Alps was studied on a weekly basis for the ice-free seasons 2014 and 2015 by observing the meteorological variables (air temperature, snowmelt, rainfall) assumed to drive the export of solute-enriched waters from the rock glacier and the hydrochemical response of the pond (water temperature as a proxy of rock-glacier discharge, stable water isotopes, major ions and selected trace elements). An intra-seasonal pattern of increasing solute export associated with higher rock-glacier discharge was found. Specifically, rainfall, after the winter snowpack depletion and prolonged periods of atmospheric temperature above 0 °C, was found to be the primary driver of solute export from the rock glacier during the ice-free season. This occurs likely through the flushing of isotopically- and geochemically-enriched icemelt, causing concomitant increases in the rock-glacier discharge and the solute export (SO_4^{2-}, Mg^{2+}, Ca^{2+}, Ni, Mn, Co). Moreover, flushing of microbially-active sediments can cause increases in NO_3^- export.

Remediation of internal phosphorus loads with modified clays, influence of fluvial suspended particulate matter and response of the benthic macroinvertebrate community.

Hongbin Yin, Grant B. Douglas, Yongjiu Cai, Cheng Liu, Diego Copetti

Science of The Total Environment

Clay-based phosphorus (P) sorbents have been increasingly used as geoengineering materials for the management sediment-derived internal P loading in eutrophic lakes. However, the long-term behavior of these sorbents has remained elusive along with their response to burial under suspended particulate matter (SPM), and their effect on macroinvertebrate communities occupying dynamic regions at the sediment-water interface of shallow and turbid lakes. In this study, field mesocosm experiments were undertaken in Lake Chaohu, China, to study the effects of the application of lanthanum-modified bentonite (LMB) and thermally-modified calcium-rich attapulgite (TCAP) on sediment internal P loading and to assess their influence on macroinvertebrate community structure. A complementary laboratory core incubation study was also undertaken to investigate the effects of SPM deposition on LMB and TCAP

performance. In the field, both LMB and TCAP effectively intercepted P released from sediment for up to five months. A P fractionation analysis indicated that LMB and TCAP application results in a substantial increase in inert P fractions in sediment. Laboratory studies indicated that deposition of SPM may increase in mobile P both in the upper sediment and across the new post-SPM deposition sediment-water interface. Importantly, a comparison of sediment chemical extractions and estimated P fluxes suggests that chemically-defined forms of P in the sediment may be used as a proxy to estimate the net sediment P flux. Significantly, the surficial application of either LMB or TCAP did not cause negative effects on macroinvertebrate communities. This study indicates that to sustain a low P flux across the sediment-water interface in shallow, turbid lakes, repeat dosing of geoengineering materials, temporally aligned to the deposition of fluvial SPM, may be required.

Retrospective analysis: a validation procedure for the redesign of an environmental monitoring network

Emanuele Barca, Delia E. Bruno, Aimé Lay-Ekuakille, Sabino Maggi, Giuseppe Passarella

Measurement

Monitoring networks are essential tools for the effective management of vulnerable or limited environmental resources. Cost and logistics constraints often suggest to reduce the number of monitoring sites while minimizing the loss of information determined by these changes. The problem can be rigorously addressed through the optimization of one or more objective functions that rep- resent the managerial goals associated to the network. However, the use of objective functions is based on assumptions that in practical cases can be inaccurate. To overcome this problem, we have developed a retrospective analysis procedure that validates the degree of acceptability of the optimal reduced configuration at a local and global level. The procedure has been applied to a case study in Apulia, Italy, finding that the optimal reduced network was unable to recover the measured values of the monitored parameter of two discarded locations, making it unable to accomplish its monitoring goals.

Review: Impacts of permafrost degradation on inorganic chemistry of surface fresh water

Colombo N., Salerno F., Gruber S., Freppaz M., Williams M., Fratianni S., Giardino M.

Global and planetary change

Average atmospheric temperature has increased globally over the last decades and, as a response, the cryosphere is changing (Fountain et al., 2012). Permafrost, a component of the cryosphere, is widespread in the Arctic and Antarctica, and in cold mountains, including densely populated areas of the European Alps and Asian mountain ranges (Gruber, 2012). Permafrost interacts with climate (Walter Anthony et al., 2006; Schuur et al., 2015), hydrology (e.g., Liljedahl et al., 2016), ecosystems (Jorgenson et al., 2001; Vonk et al., 2015) and human systems (Nelson et al., 2002; Harris et al., 2009). Recent reviews have focused on the impacts of permafrost warming and degradation on river biogeochemistry (Frey and McClelland, 2009)

and aquatic ecosystems (Vonk et al., 2015) in the Arctic. Notwithstanding, local and regional modifications of water hydrochemistry due to permafrost degradation have been reported from many locations, globally. Given the sparsity of data available, understanding and analysing permafrost degradation impacts on inorganic chemistry of surface fresh water will benefit from identifying common patterns in existing studies. The present review thus aims to distil insight gained across differing permafrost environments and configurations globally. Following a brief background section, we distinguish three typical example configurations of permafrost thaw. For those, we review impacts of permafrost degradation on major ions (e.g., Ca^{2+}, Mg^{2+}, SO_4^{2-}, NO_3^-) and on trace elements (e.g., Ni, Mn, Al, Hg, Pb).

Screening and risk management solutions for steroidal estrogens in surface and wastewater.

R. Kase, B. Javurkova, E. Simon, K. Swart, S. Buchinger, S. Könemann, B.I. Escher, M. Carere, V. Dulio, S. Ait-Aissa, H. Hollert, S. Valsecchi, S. Polesello, P. Behnisch, C. di Paolo, D. Olbrich, E. Sychrova, M. Gundlach, R. Schlichting, L. Leborgne, M. Clara, C. Scheffknecht, Y. Marneffe, C. Chalon, P. Tusil, P. Soldan, B. von Danwitz, J. Schwaiger, A. Moran Palao, F. Bersani, O. Perceval, C. Kienle, E. Vermeirssen, K. Hilscherova, G. Reifferscheid, I. Werner

Trends in Analytical Chemistry

In 2015, the European Commission included three steroidal estrogens in the so-called "watch list" of the EU WFD. Monitoring these compounds is challenging, however, because analytical detection limits are often too high to monitor the proposed environmental quality criteria. To test the suitability of alternative effect-based methods for monitoring steroidal estrogens, water samples were collected across Europe and analysed using five in vitro effect-based and three chemical analytical methods. Steroidal estrogen concentrations were below analytical detection limits in < 40% of samples, while effect-based methods were able to quantify estrogenicity in all samples. Results of a chemical mixture risk assessment correlated highly with effect-based estrogenic activities. We conclude that the application of effect-based methods for WFD surface water monitoring allows the sensitive detection of steroidal estrogens and estrogen mixtures, and allows an ecotoxicological risk assessment using appropriate effect-based trigger values.

Screening of Three Echinoderm Species as New Opportunity for Drug Discovery: Their Bioactivities and Antimicrobial Properties

Stabili L.; Acquaviva M. I.; Cavallo R. A.; Gerardi C.; Narracci M.; Pagliara P.

Evidence-Based Complementary and Alternative Medicine

Echinoderms are a renewable resource with an economic value due to their increasing demand as food and/or source of bioactive molecules exerting antitumor, antiviral, anticoagulant, antioxidant, and antimicrobial activities. In this framework, the present study is aimed at investigating the antibacterial, antioxidant, and hemolytic activities in the three Echinoderm species Echinaster sepositus, Arbacia lixula, and Sphaerechinus granularis. The sea star E.

sepositus showed lysozyme-like activity (mean diameter of lysis of 13.4 +/- 0.2 mm), an antimicrobial activity against the human emerging pathogens Staphylococcus aureus, Pseudomonas aeruginosa, and Candida famata, and a strong lytic activity (100 +/- 0.05%) towards the human red blood cells. Furthermore A. lixula and E. sepositus had the highest antioxidant activity (1792.75 +/- 233.7 and 1765.65 +/- 484.58 nmolTE/mL, resp.). From toxicological assays, it was shown that E. sepositus was not toxic towards HeLa cells and Vibrio fischeri, encouraging the exploitation of this species in the pharmaceutical field. Therefore, our findings have implications due to the ongoing explosion of antibiotic-resistant infections because of the new opportunistic pathogens and the need to discover antibacterial agents with new modes of action. Also the recorded antioxidant activity taking into account the need to find natural antioxidants useful for human health is intriguing.

Seeking alternative stable states in a deep lake.

Bruel Rosalie, Marchetto Aldo, Bernard Anaelle, Lami Andrea, Sabatier Pierre, Frossard Victor, Perga Marie

Freshwater Biology

Hysteresis linked to alternative stable states may explain delays in water quality recovery despite reduced nutrient loadings in shallow lakes. Because deep lakes are assumed to be less prone to critical transitions, similar delays are attributed to the confounding effects of additional environmental disturbances, such as climate warming. Herein, we hypothesized that the lack of evidence of nutrient-driven alternative stable states in a deep lake arises from the fact that the nutrient threshold that causes the critical transition is lower than the nutrient threshold in shallow lakes. Thereby, it might have been crossed much earlier in the lake history. To test this hypothesis, we focused on the palaeo-ecological trajectory of Lake Varese, which is a deep, hyper-eutrophicated peri-alpine lake undergoing restoration. Proxies for drivers (diatoms and pigments) and responses (cladocera), as well as a repeatable analysis, were used to identify transitions and to distinguish hysteretic delays from those of the ecosystems responding to additional constraints over the past century. Our results suggest spatial heterogeneity in the ecological response. The littoral habitats changed abruptly and prematurely at a low nutrient enrichment threshold, causing a shift that met many criteria of a flickering-type critical transition. Soon after the littoral shift, a striking increase in the lake phosphorous concentration was recorded and drove the pelagic assemblage towards a new state. This transition was abrupt, and the pelagic communities exhibited limited evidence of recovery; however, we found no evidence of hysteresis. Therefore, the modern ecological trajectory of the pelagic communities is currently driven by climate warming. This detailed analysis allowed us to go beyond the general pattern that links ecological responses to drivers and suggest that a non-linear transition 37 following eutrophication can take place in a deep lake synchronously with linear transitions. Instead of triggering a new regime shift, climate warming, to which pelagic habitats are more sensitive than littoral ones, has driven the lake further from its safe operating space.

Sensitivity of WRF-Chem model to land surface schemes: Assessment in a severe dust outbreak episode in the Central Mediterranean (Apulia Region).

Umberto Rizza, Mario Marcello Miglietta, Cristina Mangia, Pierina Ielpo, Mauro Morichetti, Chiara Iachini, Simone Virgili, Giorgio Passerini.

Atmospheric Research

The Weather Research and Forecasting model with online coupled chemistry (WRF-Chem) is applied to simulate a severe Saharan dust outbreak event that took place over Southern Italy in March 2016. Numerical experiments have been performed applying a physics-based dust emission model, with soil properties generated from three different Land Surface Models, namely Noah, RUC and Noah-MP. The model performance in reproducing the severe desert dust outbreak is analysed using an observational dataset of aerosol and desert dust features that includes optical properties from satellite and ground-based sun-photometers, and in-situ particulate matter mass concentration (PM) data. The results reveal that the combination of the dust emission model with the RUC Land Surface Model significantly over-predicts the emitted mineral dust; on the other side, the combination with Noah or Noah-MP Land Surface Model (LSM) gives better results, especially for the daily averaged PM_{10}.

Sludge cake and biofilm formation as valuable tools in wastewater treatment by coupling Integrated Fixed-film Activated Sludge (IFAS) with Self Forming Dynamic Membrane BioReactors (SFD-MBR).

Pompilio Vergine, Carlo Salerno, Giovanni Berardi, Alfieri Pollice.

Bioresource Technology

Two lab-scale Self Forming Dynamic Membrane BioReactors (SFD-MBR), equipped with 50 μm nylon meshes were set up and operated for the treatment of real municipal wastewater. Plastic carriers were added in one of the two bioreactors to generate a combination of the Integrated Fixed-film Activated Sludge (IFAS) and the SFDMBR technologies. Overall, the two systems performed very well, achieving excellent effluent quality under steady state conditions and showing good resilience to extreme organic loading conditions. Continuous air scouring and periodical mesh cleaning by jet rinsing with tap water were effective in maintaining stable and high productivity (membrane flux around 67 Lm2 h-1) over a period of 140 days. The application of the IFAS process resulted in lower production of excess sludge and improved denitrification. On the other hand, under the tested conditions the combined IFAS-SFD-MBR showed a higher tendency to mesh clogging with respect to the SFDMBR.

Spatial and temporal trends of target organic and inorganic micropollutants in Lake Maggiore and Lake Lugano (Italian-Swiss water bodies): contamination in sediments and biota.

Licia Maria Guzzella, Stefano Novati, Nadia Casatta, Claudio Roscioli, Lucia Valsecchi, Andrea Binelli, Marco Parolini, Nicola Solcà, Roberta Bettinetti, Marina Manca, Michela Mazzoni, Roberta Piscia, Pietro Volta, Aldo Marchetto, Andrea Lami, Laura Marziali.

Hydrobiologia

DDx, PCBs, PBDEs, Hg, and As contamination in sediments and aquatic organisms of different trophic levels (zooplankton, mussel, fish) were analyzed in Lake Maggiore and Lake Lugano, two large deep perialpine lakes. In the period 2001–2015, we analyzed the spatial and temporal trends of the considered pollutants to detect potential contamination sources and to compare concentrations with Sediment Quality Guidelines (SQGs) or existing Quality Standards (QSs). DDx and Hg contamination deriving from past industrial activities in the Pallanza Basin still exceeded SQGs in sediments and QSs in fish, with potential risks for the ecosystem. Banned in Europe in 1985, PCBs showed low residual values, while recent PBDE peaks resulted in the exceedance of the QSs for biota in both lakes, probably due to current industrial activities. Arsenic mainly derives from geochemical origin. The analysis of the biomagnification of toxicants in a pelagic food chain in Lake Maggiore (zooplankton–fish) according to a stable isotope approach is also presented, according to both the Trophic Magnification Factor and the Trophic Level adjusted BioMagnification Factor: the importance of seasonality and a Hg > DDx ≈ PBDEs biomagnification capacity were observed. Low PCB bioaccumulation was detected in biota, probably because equilibrium was not reached yet in young fish.

Species and hybrids in the genus Diaphanosoma Fischer, 1850 (Crustacea: Branchiopoda: Cladocera)

Liu P., Xu L., Xu S., Martinez A., Chen H., Cheng D., Dumont H.J., Han B.-P. & Fontaneto D.

Molecular Phylogenetics & Evolution

Cladocerans are well-studied planktonic crustaceans, especially those of the genus Daphnia in which interesting evolutionary questions have been addressed on speciation processes. The aim of the present study is to demonstrate that other genera of cladocerans show similar levels of cryptic diversity, intraspecific gene flow, and thus become useful model systems for comparison. In order to do so, we chose the genus Diaphanosoma, widespread in tropical and temperate areas. We started with a survey of species diversity in the genus Diaphanosoma in Asia using a morphological approach, then obtained sequences from a mitochondrial and a nuclear marker from multiple individuals of different species, performed tests on DNA taxonomy and molecular phylogenies, and assessed the role of hybridization in explaining the cases of mitonuclear discordance. The results are that cryptic diversity occurs in Diaphanosoma, and mitonuclear discordance was found in about 6% of the sequenced animals.

Past hybridization is supported as the most likely explanation for the discordance: no evidence was found of first generation hybrids with heterozygous sequences. Our analysis on patterns of genetic diversity in Diaphanosoma supports similarities and differences with what is known in Daphnia.

Soil properties and trace elements distribution along an altitudinal gradient on the southern slope of Mt. Everest, Nepal

Magnani A., Ajmone-Marsan F., D'Amico M., Balestrini R., Viviano G., Salerno F., Freppaz M.

Catena

The absence of significant local inputs of pollution makes remote mountain ecosystems suitable to assess the atmospheric deposition of contaminants, such as trace elements, which can derive from both natural and anthropogenic sources. The Himalayan range is a potential target for the atmospheric deposition of pollutants because of the regional monsoon climate and the presence of contaminant source regions in its vicinity (e.g. Kathmandu Valley). Studies of elevation gradients of trace elements in topsoils and soil profiles in the Himalaya are very limited. The main goal of this study was to determine the distribution of trace elements (Co, Cd, Cu, Zn, Cr, Pb, Ni, and Mn) in soils on the southern slope of Mt. Everest as a function of elevation, soil depth, and pedogenic properties. Trace elements were measured in 30 topsoils along an altitudinal gradient (3570-5320 m a.s.l.) and in 11 different soil profiles opened under different land uses and topographical settings. The contents of Co, Zn, Cr, and Ni in the topsoil were found positively correlated with the altitude, and on average reached a peak at 4900-5000 m a.s.l. The results showed a limited contamination, similar to the one measured in soils from other high mountain regions. Differently from the expectations, both soil depth and organic carbon, which significantly decreased with the altitude, were not found significant factors controlling the altitudinal distribution of trace elements. Pedogenic processes were associated with different depth trends of trace metals along the elevation gradient, with depletion in surface and accumulation in illuvial horizons where podzolization was active; at higher altitude, a weaker leaching resulted in higher surface concentrations.

Spatial and temporal dynamics of primary producers in shallow lakes as seen from space: Intra-annual observations from Sentinel-2A

Pinardi Monica, Bresciani Mariano, Villa Paolo, Cazzaniga Ilaria, Laini Alex, Toth Viktor, Fadel Ali, Austoni Martina, Lami Andrea, Giardino Claudia

Limnologica

Under the current high anthropic pressure and climate change scenarios, a trend towards increasing changes in the trophic status of shallow lakes, and the development of opportunistic floating species is to be expected. This raises the need for monitoring and management actions to prevent widespread environmentally negative effects (e.g., anoxia). An efficient approach to monitoring water quality and primary producers in inland waters is to integrate in situ with remote sensing data. In this work, satellite multispectral data acquired by Sentinel-2 A are

used to assess the intra-annual spatial and temporal dynamics of phytoplankton abundance, in terms of chlorophyll-a (Chl-a) concentration and macrophyte Leaf Area Index (LAI) in a shallow eutrophic fluvial lake system (Mantua Lakes, Italy). Chl-a concentrations and LAI were derived from Sentinel-2 A data by applying a semi-empirical band ratio algorithm combined with a bio-optical model (BOMBER) for the former (Chl-a), and a semi-empirical model for the latter (LAI). These products were validated against in situ data (rRMSE = 20% for both products; R-2 = 0.93 for Chl-a; R-2 = 0.83 for LAI). Phytoplankton maps showed a marked intra-annual spatial and temporal variability, generally revealing a Chl-a concentration gradient from lotic to lentic waters. Air temperature was the main driver of Chl-a concentration, followed by water discharge and precipitation. The macrophyte LAI followed aquatic plant growth seasonally, and was independent of the hydro-meteorological data. Allochthonous and invasive macrophyte species (such as Nelumbo nucifera and Ludwigia hexapetala) had higher LAI compared than the Mantua Lakes' autochthonous floating-leaved species (e.g., Trapa natans and Nuphar lutea). Maps of the abundance of primary producers can be used to follow the temporal and spatial evolution of different communities and support management actions, e.g., by identifying potential algal bloom hotspots, or the optimal timing for measures to control invasive species overgrowth.

Stable isotope stratigraphy of travertine sequences from channel deposits at hierapolis of Phrygia (Denizli, Turkey)

Fayek Asmaa, Brilli Mauro, Guyennon Nicolas, Giustini Francesca, Voltaggio Mario

Alpine and Mediterranean Quaternary

Travertine sequences from petrified channels used in antiquity as water supply canals in the city of Hierapolis (Denizli, Turkey) for irrigation and domestic use were sampled and analyzed for stable isotopes composition. Data records from two channels show composite quasi-periodic variations. Radium-226 activity was measured to calculate temporal constrains; one of the channels, 182cm thick, deposited in 790±71 years, whereas the other, 644cm thick, in 995±71 years. Isotope data, studied through spectral and cross-spectral analysis, indicate that the different oscillation frequencies may be related to surface temperature and rainfall pulses.

Studio comparativo del contenuto lipidico e del profilo degli acidi grassi di holothuria tubulosa e h. Polii

F. Biandolino, I. Parlapiano, G. Denti, G. Fanelli, V. Russo, E. Prato

Biologia Marina Mediterranea

Total lipids and fatty acids of four tissues (external and internal body wall, longitudinal muscle and gonad) of Holothuria tubulosa (Gmelin, 1788) and H. polii Delle Chiaje, 1824, from Ionian Sea, were evaluated. Highest lipids % were found in H. polii in the most part of tissues, except for external body wall. H. tubulosa was characterized by highest proportion of polyunsaturated fatty acids, except for gonad, while, H. polii showed an uniform distribution of fatty acids class in the investigated tissues.

Tardigrada and Rotifera from moss microhabitats on a disappearing Ugandan glacier with the description of a new species of water bear

Zawierucha K., Gąsiorek P., Buda J., Uetake J., Janko K. & Fontaneto D.

Zootaxa

Glaciers and ice sheets are a peculiar biome with characteristic abiotic and biotic components. Mountain glaciers are predicted to decrease their volume and even to melt away within a few decades. Despite the threat of a disappearing biome, the diversity and the role of microscopic animals as consumers at higher trophic levels in the glacial biome still remain largely unknown. In this study, we report data on tardigrades and rotifers found in glacial mosses on Mount Stanley, Uganda, and describe a new tardigrade species. Adropion afroglacialis sp. nov. differs from the most similar species by having granulation on the cuticle, absence of cuticular bars under the claws, and a different macroplacoid length sequence. We also provide a morphological diagnosis for another unknown tardigrade species of the genus Hypsibius. The rotifers belonged to the families Philodinidae and Habrotrochidae. In addition, we discuss the diversity of microinvertebrates and potential role of tardigrades and rotifers on mountain glaciers as top consumers. As for any organism living apparently exclusively in glacial habitats on tropical glaciers, their extinction in the near future is inevitable, possibly before we can even discover their existence.

The 1D Richards' equation in two layered soils: a Filippov approach to treat discontinuities

Marco Berardi, Fabio Difonzo, Michele Vurro, Luciano Lopez

Advances in Water Resources

The infiltration process into the soil is generally modeled by the Richards' partial differential equation (PDE). In this paper a new approach for modeling the infiltration process through the interface of two different soils is proposed, where the interface is seen as a discontinuity surface defined by suitable state variables. Thus, the original 1D Richards' PDE, enriched by a particular choice of the boundary conditions, is first approximated by means of a time semidiscretization, that is by means of the transversal method of lines (TMOL). In such a way a sequence of discontinuous initial value problems, described by a sequence of second order differential systems in the space variable, is derived. Then, Filippov theory on discontinuous dynamical systems may be applied in order to study the relevant dynamics of the problem. The numerical integration of the semidiscretized differential system will be performed by using a one-step method, which employs an event driven procedure to locate the discontinuity surface and to adequately change the vector field.

The ANT-BIOFILM Project (PNRA): Biological Colonization of Antarctic coastal sites and Biotechnological prospecting

G Caruso, M Azzaro, O Dell'Acqua, A Lo Giudice, S Fazi, C Caroppo, F Azzaro, R La Ferla, G Maimone, P Laganà, F Marinelli, F Berini, GL Marcone, G Pichon, M Chiantore

Biologia Marina Mediterranea

This note describes the design and set up of artificial structures for the study of biological colonization within the two years ANT-Biofilm project funded by the National Programme of Antarctic Research (PNRA), focusing on the activities performed from the experimental concept to the bioprospecting of bacteria with biotechnological potential.

The bioelectric well: A novel approach for in situ treatment of hydrocarbon-contaminated groundwater

Palma Enza, Daghio Matteo, Franzetti Andrea, Petrangeli Papini Marco, Aulenta Federico

Microbial biotechnology

Groundwater contamination by petroleum hydrocarbons (PHs) is a widespread problem which poses serious environmental and health concerns. Recently, microbial electrochemical technologies (MET) have attracted considerable attention for remediation applications, having the potential to overcome some of the limiting factors of conventional in situ bioremediation systems. So far, field-scale application of MET has been largely hindered by the limited availability of scalable system configurations. Here, we describe the 'bioelectric well' a bioelectrochemical reactor configuration, which can be installed directly within groundwater wells and can be applied for in situ treatment of organic contaminants, such as PHs. A laboratory-scale prototype of the bioelectric well has been set up and operated in continuous-flow regime with phenol as the model contaminant. The best performance was obtained when the system was inoculated with refinery sludge and the anode potentiostatically controlled at +0.2 V versus SHE. Under this condition, the influent phenol (25 mg l^{-1}) was nearly completely (99.5 ± 0.4%) removed, with an average degradation rate of 59 ± 3 mg l^{-1} d and a coulombic efficiency of 104 ± 4%. Microbial community analysis revealed a remarkable enrichment of Geobacter species on the surface of the graphite anode, clearly pointing to a direct involvement of this electro-active bacterium in the current-generating and phenol-oxidizing process.

The biogeochemical vertical structure renders a meromictic volcanic lake a trap for geogenic CO_2 (Lake Averno, Italy).

Franco Tassi, Stefano Fazi, Simona Rossetti, Paolo Pratesi, Marco Ceccotti, Jacopo Cabassi, Francesco Capecchiacci, Stefania Venturi, Orlando Vaselli.

PLoS ONE

Volcanic lakes are characterized by physicochemical favorable conditions for the development of reservoirs of C-bearing greenhouse gases that can be dispersed to air during occasional rollover events. By combining a microbiological and geochemical approach, we showed that the chemistry of the CO_2- and CH_4-rich gas reservoir hosted within the meromictic Lake Averno (Campi Flegrei, southern Italy) are related to the microbial niche differentiation along the vertical water column. The simultaneous occurrence of diverse functional groups of microbes operating under different conditions suggests that these habitats harbor complex microbial consortia that impact on the production and consumption of greenhouse gases. In the epilimnion, the activity of aerobic methanotrophic bacteria and photosynthetic biota, together with CO_2 dissolution at relatively high pH, enhanced CO_2- and CH_4 consumption, which also occurred in the hypolimnion. Moreover, results from computations carried out to evaluate the dependence of the lake stability on the CO_2/CH_4 ratios, suggested that the water density vertical gradient was mainly controlled by salinity and temperature, whereas the effect of dissolved gases was minor, excepting if extremely high increases of CH_4 are admitted. Therefore, biological processes, controlling the composition of CO_2 and CH_4, contributed to stabilize the lake stratification of the lake. Overall, Lake Averno, and supposedly the numerous worldwide distributed volcanic lakes having similar features (namely bio-activity lakes), acts as a sink for the CO_2 supplied from the hydrothermal/magmatic system, displaying a significant influence on the local carbon budget.

The Broad Habitat Spectrum of the CL500-11 Lineage (Phylum Chloroflexi), a Dominant Bacterioplankton in Oxygenated Hypolimnia of Deep Freshwater Lakes

Okazaki Yusuke, Saicher Michaels M., Callieri Cristiana, Nakano Shin-ichi

Frontiers in microbiology

CL500-11 (phylum Chloroflexi) is one of the most ubiquitous and abundant bacterioplankton lineages in deep freshwater lakes inhabiting the oxygenated hypolimnion. While metagenomics predicted possible eco-physiological characteristics of this uncultured lineage, no consensus on their ecology has so far been reached, partly because their niche is not clearly understood due to a limited number of quantitative field observations. This study investigated the abundance and distribution of CL500-11 in seven deep perialpine lakes using catalyzed reporter deposition-fluorescence in situ hybridization (CARD-FISH). Samples were taken vertically (5-12 depths in each lake) and temporally (in two lakes) at the deepest point of the lakes located in Switzerland, Italy, and Austria with varying depth, trophic state, mixing regime, and water retention time. The results showed a dominance of CL500-11 in all the lakes; their proportion to total prokaryotes ranged from 4.3% (Mondsee) to 24.3% (Lake Garda) and their abundance ranged from 0.65 x 10^5 (Mondsee) to 1.77 x 10^5 (Lake Garda) cells mL(-1). By summarizing available information on CL500-11 occurrence to date, we demonstrated their broad habitat spectrum, ranging from ultra-oligotrophic to mesoeutrophic lakes, while low abundances or complete absence was observed in lakes with shallow depth, low pH, and/or short water retention time (<1 year). Together with available metagenomic and geochemical evidences from literatures, here we reviewed potential substrates supporting growth of CL500-11. Overall, the present study further endorsed ubiquity and quantitative significance

of CL500-11 in deep freshwater systems and narrowed the focus on their physiological characteristics and ecological importance.

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

Cristiana Callieri, Violeta Slabakova, Nina Dzhembekova, Nataliya Slabakova, Elisaveta Peneva, Pedro J. Cabello-Yeves, Andrea Di Cesare, Ester M. Eckert, Roberto Bertoni, Gianluca Corno, Michaela M. Salcher, Lyudmila Kamburska, Filippo Bertoni, Snejana Moncheva

ISME Journal

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 characterized by a poorly understood fluorescence signal called "deep red fluorescence", a chlorophyll a-like signal found in deep dark oceanic waters. In two cruises, we repeatedly found up to 103 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 photosynthesize 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 present state of Lake Bracciano: hope and despair.

David Rossi, Emanuele Romano, Nicolas Guyennon, Martina Rainaldi, Stefano Ghergo, Alessandro Mecali, Daniele Parrone, Sara Taviani, Antonio Scala, Emanuele Perugini.

Rendiconti Lincei. Scienze Fisiche e Naturali

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.

The reuse of reclaimed water for irrigation around the Mediterranean Rim: a step towards a more virtuous cycle?

Ait-Mouheb N., Bahri A., Thayer B.B., Benyahia B., Bourrie G., Cherki B., Condom N., Declercq R., Gunes A., Heran M., Kitir N., Molle B., Patureau D., Pollice A., Rapaport A., Renault P., Riahi K., Romagny B., Sari T., Sinfort C., Steyer J.-P., Talozi S., Topcuoglu B., Turan M., Wery N., Yildirim E., Harmand J.

Regional environmental change

Climate change and a growing population around the Mediterranean Rim are increasing the need for water and, consequently, the pressure on resources in terms of both quantity and quality. High-quality water should be primarily reserved to drinking water while reclaimed water is an alternative for other usages. A review of situations in Tunisia, Jordan, France, and Italy involving the use of reclaimed water highlights the disparity in national regulations governing this alternative water resource and in its management. On the first hand, the use of recycled water for irrigation can have an adverse impact on public health and the environment, depending on treatment and irrigation practices. On the other hand, it may also represent a new source of water: wastewater should no longer be considered as waste but, rather, as a new resource to be handled in a circular economy-type loop. Current scientific knowledge in agronomic and environmental sciences, as well as in the economic and social sciences, can be integrated and used to lower the associated risk through the effective management of irrigation using recycled water and to address the following questions: (i) How can the time-varying nutrient needs of crops be managed to operate safe environmental reuse within an adapted risk assessment framework? (ii) What socio-economic models can render this integrated approach sustainable? (iii) What treatment systems and irrigation technology can be used to support these ideas and with what information? (iv) What changes in the regulations are needed?

Time-lapse Mise-á-la-Masse measurements and modeling for tracer test monitoring in a shallow aquifer.

Maria Teresa Perri, Pantaleone De Vita, Rita Masciale, Ivan Portoghese, Giovanni Battista Chirico, Giorgio Cassiani

Journal of Hydrology

The main goal of this study is to evaluate the reliability of the Mise-á-la-Masse (MALM) technique associated with saline tracer tests for the characterization of groundwater flow direction and velocity. The experimental site is located in the upper part of the Alento River alluvial plain (Campania Region, Southern Italy). In this paper we present the hydrogeological setting, the experimental setup and the relevant field results. Subsequently, we compare those data against the simulated results obtained with a 3D resistivity model of the test area, coupled with a model describing the Advection – Dispersion equation for continuous tracer injection. In particular, we calculate a series of 3D forward solutions starting from a reference model, all derived from electrical tomography results, but taking into consideration different values of mean flow velocity and directions. Each electrical resistivity 3D model is used to produce synthetic voltage maps for MALM surveys. Finally, the synthetic MALM voltage maps are compared with the ones measured in the field in order to assess the information content of the MALM dataset with respect to the groundwater field characteristics. The results demonstrate that the information content of the MALM data is sufficient to define important characteristics of the aquifer geometry and properties. This work shows how a combination of three-dimensional time-lapse modeling of flow, tracer transport and electrical current can substantially contribute towards a quantitative interpretation of MALM measurements during a saline tracer test. This approach can thus revive the use of MALM as a practical, low cost field technique for tracer test monitoring and aquifer hydrodynamic characterization.

Trophic structure and microbial activity in a spawning area of Engraulis encrasicolus

Zaccone R, Azzaro M, Azzaro F, Caruso G, Caroppo C, Decembrini F, Diociaiuti T, Fonda Umani S, Leonardi M, Maimone G, Monticelli L, Paranhos R, Placenti F, Cuttitta A, Patti B, La Ferla R

Estuarine, Coastal and Shelf Science

The abundance, biomass and size-structure of planktonic populations, and the microbial metabolic processes were studied in the Sicily Channel, one of the most important spawning areas in the Mediterranean for anchovy (Engraulis encrasicolus), a pelagic species of commercial interest. Results showed that prokaryotes contribute for the 83% of total carbon biomass. Microphytoplankton abundances and biomasses were dominated by autotrophic nanoflagellates and dinoflagellates (36 identified species) and contribute 11% of total biomass. The microzooplanktonic biomass showed its maximum at the surface or subsurface and its contribution was low (4%). The study highlights the prevalence of pico-sized fractions within the whole phytoplankton biomass expressed as chlorophyll content, suggesting the importance of picophytoplankton in sustaining the microbial food web in an oligotrophic area. Autotrophic production exceeded oxidation by respiration; at the same time, prokaryotic activities and eggs distribution co-varied with temperature, even if the microbial activities were quite depressed, indicating that ecosystem functioning was active at low trophic levels and confirming the general oligotrophy of the Sicily Channel. The results obtained confirmed that the area acted as a nursery for small fish and both autotrophic and heterotrophic processes supported by microorganisms were in synergy.

Trophic transfer of persistent organic pollutants through a pelagic food web: The case of Lake Como (Northern Italy)

Mazzoni Michela, Boggio Emanuela, Manca Marina, Piscia Roberta, Quadroni Silvia, Bellasi Arianna, Bettinetti Roberta

Science of the total environment

Despite DDT and PCB having been banned for about 40 years, they are still detectable in the environment. In the present research we specifically investigated the trophic transfer of these organochlorine contaminants (OC) through a pelagic food web of a deep lake in Northern Italy (Lake Como) over time. Zooplankton and fish were sampled each season of a year and OC concentrations and the carbon and nitrogen isotopic ratios were measured. By using stable isotopes, the direct trophic relationship between pelagic zooplankton and zooplanktivorous fish was confirmed for Alosa agone only in summer. Based on this result, the biomagnification factor normalized on the trophic level (BMFTL) for organic contaminants was calculated. BMFTL values were within the range 0.9-1.9 for DDT isomers and 1.6-4.9 for some PCB congeners (PCB 95, PCB 101, PCB 149, PCB 153, PCB 138 - present both in zooplankton and in fish and representing >60% of the PCB contamination), confirming the biomagnification of these compounds in one of the two zooplanktivorous fish species of the lake. (C) 2018 Elsevier B.V. All rights reserved.

Towards energy self-sufficiency and integral material recovery in waste water treatment plants: Assessment of upgrading options

Giorgio Bertanza, Matteo Canato, Giuseppe Laera.

Journal of Cleaner Production

Wastewater treatment facilities are increasingly being considered as centralized installations where various resources can be recovered from the sewage. Novel technological solutions are already available for achieving this goal. However, their application to upgrade existing plants can be far more challenging than building new dedicated plants. While the scientific literature is generally focused on testing and comparing the recovery options, this work was aimed at giving a holistic evaluation of the actual impacts of upgrading existing facilities. Commercially available systems were considered for retrofitting two plants of different size (50,000 and 500,000 population equivalents) and achieving either energy self-sufficiency or material recovery. Based on mass and energy balances, a detailed evaluation of technical, social, economic, and administrative aspects was carried out. Environmental aspects were also included, adopting a simplified approach. It turned out that energy self-sufficiency (external energy supply reduced down to about 10% of the total need) is not far away to be achieved, with moderate techno-economic implications, especially when the plant is already equipped with primary sedimentation and anaerobic digestion. Integral recovery of treated effluent, sludge and nitrogen can also be pursued in large facilities, while several potential criticalities arise for medium-sized plants. The adopted procedure evidenced critical aspects that are often disregarded in the decision process: this may suggest where to address efforts in evaluating real situations.

Urbanization and climate change impacts on surface water quality: Enhancing the resilience by reducing impervious surfaces.

Salerno Franco, Viviano Gaetano, Tartari Gianni.

Water Research

Climate change and urbanization are key factors affecting the future of water quality in urbanized catchments. The work reported in this paper is an evaluation of the combined and relative impact of climate change and urbanization on the water quality of receiving water bodies in the context of a highly urbanized watershed served by a combined sewer system (CSS) in northern Italy. The impact is determined by an integrated modelling study involving two years of field campaigns. The results obtained from the case study show that impervious urban surfaces and rainfall intensity are significant predictors of combined sewer overflows (CSOs) and consequently of the water quality of the receiving water body. Scenarios for the year 2100 demonstrate that climate change combined with increasing urbanization is likely to lead to severe worsening of river water quality due to a doubling of the total phosphorus load from CSOs compared to the current load. Reduction in imperviousness was found to be a suitable strategy to adapt to these scenarios by limiting the construction of new impervious areas and decreasing the existing areas by only 15%. This information can be further utilized to develop future designs, which in turn should make these systems more resilient to future changes in climate and urbanization.

Water quality and total microbial load: A double-threshold identification procedure intended for space applications

Amalfitano S.; Levantesi C.; Garrelly L.; Giacosa D.; Bersani F.; Rossetti S.

Frontiers in microbiology

During longer-lasting future space missions, water renewal by ground-loaded supplies will become increasingly expensive and unmanageable for months. Space exploration by self-sufficient spacecrafts is thus demanding the development of culture-independent microbiological methods for in-flight water monitoring to counteract possible contamination risks. In this study, we aimed at evaluating total microbial load data assessed by selected early-warning techniques with current or promising perspectives for space applications (i.e., HPC, ATP-metry, qPCR, flow cytometry), through the analysis of water sources with constitutively different contamination levels (i.e., chlorinated and unchlorinated tap waters, groundwaters, river waters, wastewaters). Using a data-driven double-threshold identification procedure, we presented new reference values of water quality based on the assessment of the total microbial load. Our approach is suitable to provide an immediate alert of microbial load peaks, thus enhancing the crew responsiveness in case of unexpected events due to water contamination and treatment failure. Finally, the backbone dataset could help in managing water quality and monitoring issues for both space and Earth-based applications.

Water-table and discharge changes associated with the 2016–2017 seismic sequence in central Italy: hydrogeological data and a conceptual model for fractured carbonate aquifers.

Marco Petitta, Lucia Mastrorillo, Elisabetta Preziosi, Francesca Banzato, Marino Domenico Barberio, Andrea Billi, Costanza Cambi, Gaetano De Luca, Giuseppe Di Carlo, Diego Di Curzio, Cristina Di Salvo, Torquato Nanni, Stefano Palpacelli, Sergio Rusi, Michele Saroli, Marco Tallini, Alberto Tazioli, Daniela Valigi, Paola Vivalda, Carlo Doglioni.

Hydrogeology Journal

A seismic sequence in central Italy from August 2016 to January 2017 affected groundwater dynamics in fractured carbonate aquifers. Changes in spring discharge, water-table position, and streamflow were recorded for several months following nine Mw 5.0–6.5 seismic events. Data from 22 measurement sites, located within 100 km of the epicentral zones, were analyzed. The intensity of the induced changes were correlated with seismic magnitude and distance to epicenters. The additional post-seismic discharge from rivers and springs was found to be higher than 9 m^3/s, totaling more than 0.1 km^3 of groundwater release over 6 months. This huge and unexpected contribution increased streamflow in narrow mountainous valleys to previously unmeasured peak values. Analogously to the L'Aquila 2009 postearthquake phenomenon, these hydrogeological changes might reflect an increase of bulk hydraulic conductivity at the aquifer scale, which would increase hydraulic heads in the discharge zones and lower them in some recharge areas. The observed changes may also be partly due to other mechanisms, such as shaking and/or squeezing effects related to intense subsidence in the core of the affected area, where effects had maximum extent, or breaching of hydraulic barriers.

The aquifer recharge: An overview of the legislative and planning aspect

De Giglio O., Caggiano G., Apollonio F., Marzella A., Brigida S., Ranieri E, Lucentini L., Uricchio V.F., Montagna M.T.

Annali di Igiene

In most regions of the world, safeguarding groundwater resources is a serious issue, particularly in coastal areas where groundwater is the main water source for drinking, irrigation and industry. Water availability depends on climate, topography and geology. The aim of this paper is to evaluate aquifer recharge as a possible strategy to relieve water resource scarcity. Natural aquifer recharge is defined as the downward flow of water reaching the water table, increasing the groundwater reservoir. Hydro-meteorological factors (rainfall, evapotranspiration and runoff) may alter natural recharge processes. Artificial aquifer recharge is a process by which surface water is introduced with artificial systems underground to fill an aquifer. As a consequence of global warming that has increased the frequency and severity of natural disasters like the drought, the impacts of climate change and seasonality, the artificial recharge has been considered as a viable option. Different direct and indirect techniques can be used, and the choice depends on the hydrologic characteristics of a specific area. In Italy, Legislative Decree no. 152/06 plans artificial aquifer recharge as an additional

measure in water management, and Decree no. 100/2016 establishes quantitative and qualitative conditions for recharge. Many projects examine aquifer recharge, such us WADIS-MAR in the southern Mediterranean region, WARBO in Italy and municipal wastewater treatment project in Apulia, a southern Italian region. However, aside from groundwater recharge, the community must foster a spirit of cooperation to manage groundwater as a sustainable resource.

Why we need sustainable networks bridging countries, disciplines, cultures and generations for aquatic biomonitoring 2.0: A perspective derived from the DNAqua-Net COST Action

Leese F., Bouchez A., Abarenkov K., Altermatt F., Borja A., Bruce K., Ekrem T., Čiampor Jr F., Čiamporová-Zatovičová Z., Costa F.O., Duarte S., Elbrecht V., Fontaneto D., Geiger M.F., Hering D., Kahlert M., Kalamujić Stroil B., Kelly M., Keskin E., Liska I., Mergen P., Meissner K., Pawlowski J., Penev L., Reyjol Y., Rotter A., Steinke D., Vitecek S., Zimmermann J., Weigand A.M.

Advances in Ecological Research

Aquatic biomonitoring has become an essential task in Europe and many other regions as a consequence of strong anthropogenic pressures affecting the health of lakes, rivers, oceans and groundwater. A typical assessment of the environmental quality status, such as it is required by European but also North American and other legislation, relies on matching the composition of assemblages of organisms identified using morphological criteria present in aquatic ecosystems to those expected in the absence of anthropogenic pressures. Through decade-long and difficult intercalibration exercises among networks of regulators and scientists in European countries, a pragmatic biomonitoring approach was developed and adopted, which now produces invaluable information. Nonetheless, this approach is based on several hundred different protocols, making it susceptible to issues with comparability, scale and resolution. Furthermore, data acquisition is often slow due to a lack of taxonomic experts for many taxa and regions and time-consuming morphological identification of organisms. High-throughput genetic screening methods such as (e)DNA metabarcoding have been proposed as a possible solution to these shortcomings. Such "next-generation biomonitoring", also termed "biomonitoring 2.0", has many advantages over the traditional approach in terms of speed, comparability and costs. It also creates the potential to include new bioindicators and thereby further improves the assessment of aquatic ecosystem health. However, several major conceptual and technological challenges still hinder its implementation into legal and regulatory frameworks. Academic scientists sometimes tend to overlook legal or socioeconomic constraints, which regulators have to consider on a regular basis. Moreover, quantification of species abundance or biomass remains a significant bottleneck to releasing the full potential of these approaches. Here, we highlight the main challenges for next-generation aquatic biomonitoring and outline principles and good practices to address these with an emphasis on bridging traditional disciplinary boundaries between academics, regulators, stakeholders and industry.

Zurich Statement on Future Actions on Per - and Polyfluoroalkyl Substances (PFASs)

Ritscher Amelie, Wang Zhanyun, Scheringer Martin, Boucher Justin M., Ahrens Lutz, Berger Urs, Bintein Sylvain, Bopp Stephanie K., Borg Daniel, Buser Andreas M., Cousins Ian, DeWitt Jamie, Fletcher Tony, Green Christopher, Herzke Dorte, Higgins Christopher, Huang Jun, Hung Hayley, Knepper Thomas, Lau Christopher S., Leinala Eeva, Lindstrom Andrew B., Liu Jinxia, Miller Mark, Ohno Koichi, Perkola Noora, Shi Yali, Haug Line Smastuen, Trier Xenia, Valsecchi Sara, van der Jagt Katinka, Vierke Lena

Environmental health perspectives

Per - and polyfluoroalkyl substances (PFASs) are man-made chemicals that contain at least one perfluoroalkyl moiety, -CnF2n-. To date, over 4,000 unique PFASs have been used in technical applications and consumer products, and some of them have been detected globally in human and wildlife biomonitoring studies. Because of their extraordinary persistence, human and environmental exposure to PFASs will be a long-term source of concern. Some PFASs such as perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) have been investigated extensively and thus regulated, but for many other PFASs, knowledge about their current uses and hazards is still very limited or missing entirely. To address this problem and prepare an action plan for the assessment and management of PFASs in the coming years, a group of more than 50 international scientists and regulators held a two-day workshop in November, 2017. The group identified both the respective needs of and common goals shared by the scientific and the policy communities, made recommendations for cooperative actions, and outlined how the science-policy interface regarding PFASs can be strengthened using new approaches for assessing and managing highly persistent chemicals such as PFASs.

Monografie / Contributi in volumi

Atmospheric deposition in European Forests in 2016.

Marchetto A., Waldner P., Verstraeten A.

Forest Condition in Europe 2018. Technical Report of ICP Forests. Report under the UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP). vol. BFW-Dokumentation 25/2018 pp. 1 - 92. A. Michel, W. Seidling, A.K. Prescher (eds.). Vienna, Austria: BFW Bundesforschungszentrum für Wald, 2018.

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 pathway: wet deposition of compounds dissolved in rain and snow and dry deposition of particulate matter through gravity or filtration, for example by 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 2016, the chemical composition of atmospheric deposition was measured in 250 level II permanent plots. In this report, we focus on acidifying, buffering, and eutrophying compounds. High deposition of nitrate deposition was mainly found in Central Europe (Germany, Denmark and the Netherlands), while for ammonium they were also found in Northern Italy. The area of high deposition is smaller for sulphate, including some plots in Germany, and Poland. High values are also measured in the Netherlands, but they are partially due to deposition of marine aerosol, and they are less evident after sea-salt correction. High deposition in Southern Italy may be related to local human sources and to volcanic contribution. 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 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.

Soil biodiversity and European woody agroecosystem

Grenni P., Fernández-López M., Mercado-Blanco J. (Eds),

COST Action FP1305 BioLink-Linking belowground biodiversity and ecosystem function in European forests, Proceedings of the 2018 Annual Meeting - Granada, 14-16 March 2018

Il Lago di Tovel: memorie, documenti e sedimenti.

Canale M., M. Gentilini, P. Guilizzoni, M. Manca. (a cura di).

CNR Edizioni, ISBN: 978 88 8080 306 5

Il lago di Tovel si trova in Trentino, sulla destra orografica della val di Non, incastonato tra le cime delle Dolomiti di Brenta. Il caratteristico fenomeno dell'arrossamento delle acque lo ha reso famoso nel mondo e terreno di ricerca per molti eminenti studiosi di limnologia nel corso del Novecento.

Le fonti documentarie e i reperti naturali relativi a questo caratteristico specchio d'acqua, conservati dall'Istituto per lo Studio degli Ecosistemi del CNR, hanno permesso di ricostruire le campagne di studio svolte a Tovel tra il 1938 e il 1940. Da quell'epoca la ricerca non si è mai interrotta, proseguendo anche dopo la fine del fenomeno dell'arrossamento (1964).

Nel libro viene pubblicato anche il diario delle campagne condotte da Edgardo Baldi, che ci restituisce una vera e propria "istantanea" del suo metodo e modus operandi. La modernità del suo approccio, che prevedeva l'utilizzo di materiale cartografico e fotografico, e persino di un laboratorio per l'osservazione di campioni in vivo, ha permesso la raccolta di una documentazione scientifica di straordinario valore e la costituzione del Museo del Placton dell'Istituto.

Echinodermata: The Complex Immune System in Echinoderms

L. Courtney Smith; Vincenzo Arizza; Megan A. Barela Hudgell; Gianpaolo Barone; Andrea G. Bodnar; Katherine M. Buckley; Vincenzo Cunsolo; Nolwenn M. Dheilly; Nicola Franchi; Sebastian D. Fugmann; Ryohei Furukawa; Jose Garcia-Arraras; John H. Henson; Taku Hibino; Zoe H. Irons; Chun Li; Cheng Man Lun; Audrey J. Majeske; Matan Oren; Patrizia Pagliara; Annalisa Pinsino; David A. Raftos; Jonathan P. Rast; Bakary Samasa; Domenico Schillaci; Catherine S. Schrankel; Loredana Stabili; Klara Stensväg; Elisse Sutton

In Advances in Comparative Immunology

The Echinodermata is an ancient phylum of benthic marine invertebrates with a dispersal stage planktonic larva. These animals have innate immune systems as characterized by clearance of foreign particles including microbes from the body cavity of both larvae and adults, and allograft tissue rejection in adults. Immune responsiveness is mediated by a variety of adult coelomocytes and larval mesenchyme cells. Echinoderm diseases from a range of pathogens can lead to mass die-offs and impact aquaculture, but from which some individuals can recover. Genome sequences of several echinoderms have identified genes with immune function including expanded families of Toll-like receptors, NOD-like receptors, scavenger receptors with cysteine rich domains, plus signaling pathways, and cytokines. The set of transcription factors that regulate proliferation and differentiation of the cellular immune system are conserved and indicate the ancestral origins of hematopoiesis. Both larval and adult echinoderms are in constant contact with potential pathogens in sea waterseawater and they respond to infection by phagocytosis and encapsulation and employ proteins that function in immune detection and response. Anti-pathogen responses include activation of the SpTransformer genes, a complement system, and the production of many types of antimicrobial peptides. Echinoderms have homologues of the recombinase activating genes plus all associated genes that function in vertebrates for immunoglobulin gene family rearrangement, although their gene targets are unknown. The echinoderm immune system has been

characterized as unexpectedly complex, robust, and flexible. Many echinoderms have very long life spans that correlate with an excellent capacity for cell damage repair. In many marine ecosystems, echinoderms are keystone predators and herbivores and therefore are species that can serve as optimal sentinels of environmental health. Coelomocytes can be employed in sensor systems to test for the presence of marine pollutants. When Elie Metchnikoff inserted a rose prickle into a larval sea star and observed chemotaxis, phagocytosis, and encapsulation by the mesenchyme cells, not only did he initiate the field of immunology, but also that of comparative immunology in which the echinoderms have been an important part

Elucidating Local Food Production to Identify the Principles and Challenges of Sustainable Agriculture

Oren Shelef, Jesu´s D. Fernández-Bayo, Yonatan Sher, Valeria Ancona, Heather Slinn, and Yigal Achmon

In: Sustainable Food Systems from Agriculture to Industry – Improving Production and Processing, Edited by C.M: Galanakis, Elsevier Academic Press

I Sea-Futuring tours nei Cammini LTER

L'Astorina A, Pelusi A, Petrocelli A, Portacci G, Rubino F

In I Cammini della Rete LTER-Italia. Il racconto dell'ecologia in cammino, 2018 Roma: CNR Edizioni

Microbial Communities

Cristiana Callieri, Ester M. Eckert, Andrea Di Cesare, Filippo Bertoni

in Encyclopedia of Aquatic Ecology

Aquatic microbial community can be defined as an assemblage of co-occurring, and potentially interacting, microbes, present in a defined habitat in space and time. Despite the small size, microorganisms are key elements for the ecological dynamics of the biosphere. They are not only the most diffused life forms; they are also characterized by an incredible functional and genetic diversity, contributing fundamentally to the biogeochemical processes on Earth.

In this chapter, we describe the main ecological characteristics of aquatic microbial communities. We begin from microbial lifestyles in freshwater and marine habitat, considering then the diversity and functions of prokaryotes, eukaryotes, and viruses, to end with an analysis of the intrinsic and extrinsic community drivers.

Since planetary biogeochemical transformations are the emergent results of accumulated processes working at microscale, we conclude the chapter with an opening to novel molecular and single-cell approaches that promise to shed light on micro-scale interactions.

Naproxen in the Environment

Grenni P, Bagnis S, Comber S

in Naproxen-Chemistry, Clinical aspects and Effects, 2018,Nova Science Publishers

Active pharmaceuticals ingredients (APIs) are necessary for the wellness and health of humans and animals. Nevertheless, because they have biological activity also on non-target organisms, they might cause environmental side effects worth to be considered. In fact, during the last 25 years the occurrence of APIs in natural environments such as surface water, groundwater, soil, etc. has been increasingly reported in the scientific literature. As a consequence, these molecules are included in the category of the "contaminants of emerging concern", which encompasses contaminants that can be detected at low (µg-ng) concentrations but whose effects on the environment are not well defined. Despite the potential for harmful ecological and human health effects these emerging contaminants are not covered by the current law for the quality of surface or ground waters, and an urgent need for scientific sound information is necessary for the assessment of their environmental risk. The nonsteroidal anti-inflammatory drug Naproxen is a polar compound that has been detected in concentrations ranging from ng to µg per litre in surface waters and in wastewater treatment plant effluents. This pharmaceutical is absorbed by the organism after intake and is subject to metabolic transformations. However, a significant fraction of the original substance is excreted un-metabolized by the human organism via urine or faeces and is thus emitted in its active form into raw sewage and sewage sludge. The presence of Naproxen in surface water is due to its incomplete removal in WWTPs or the direct discharge of untreated wastewaters into rivers. This API has resulted ready biodegradable in aerobic conditions, but owing to its large human consumption it is continuously discharge in large concentrations which leads to the phenomenon known as pseudo-persistency and its occurrence at concentrations higher than other more persistent APIs. This aspect is important in the light of the recently found evidence of possible detrimental effects on natural bacterial populations at realistic concentrations, which cannot exclude negative effects on bacteria key for the ecosystem functioning. In this chapter the occurrence of Naproxen in different aquatic environments, its environmental fate and the typical pseudo-persistency, as well as its effects on different ecosystems will be discussed.

The use of treated wastewater for crop irrigation

Alfieri Pollice, Ramy Saliba, Antonio Lonigro

in Water management for sustainable agriculture, 2018, Burleigh Dodds Science Publishing Limited

Reuse of treated wastewater is an established practice in many countries, and also untreated streams are commonly used in several developing countries lacking collection and sanitation services. Worldwide, about 7.1 billion m3/year (5% of treated wastewater and 0.18% of water consumption) are reused mainly for irrigation (about 50%) and industrial purposes (about 20%) (Lazarova, 2017; GWI, 2009). These figures show that despite the increased environmental awareness and the understanding that water is a limited resource in many regions of the planet, relevant improvements are still needed in order to achieve sustainable

growth in terms of water utilization. These aspects were highlighted in the definition of the Sustainable Development Goals, where water reuse is clearly included as a practice requiring specific attention (UN, 2015).

The shortage of water and the increasing need for food due to the expanding world population and for irrigation water, both in respect to sufficient quality and quantity (SDG 6), render reuse an indispensable practice. Wastewater treatment and reuse offer important environmental and economic advantages, independent of the cost of both practices. As half of the global water bodies are seriously contaminated by untreated wastewater, wastewater treatment and reuse promotes environmental security by alleviating the pollution of freshwater resources while providing more water for irrigation (UNEP, 2010). Wastewater reuse in irrigation is considered extremely important for agriculture as a guarantee for food and environmental security. First, it constitutes a continuous and stable supply especially during peak water requirement periods. It also allows the recovery of nutrients, resulting in a reduction of chemical fertilizer inputs, and finally contributing to decrease the level of nutrients in natural water bodies (Singh et al., 2011; Ajonina et al., 2012; Ribas et al., 2010).

As the use of reclaimed water may provide sufficient flexibility to allow water authorities to respond to short and long term needs and reliability of water supplies, the foundation of water reuse is built upon three principles (Asano, 2002): i) providing reliable treatment of wastewater to meet quality requirements for the end-use application; ii) protecting public health; and iii) gaining public acceptance. Therefore, to address the water crisis it is rather indispensable that water engineers and social scientists work together (Garcia and Pargament, 2015).

Contributi nell'ambito di Convegni

M.C. Tomei, D. Mosca Angelucci, V. Stazi, A.J. Daugulis

A continuous two-phase bioreactor for effective decontamination of industrial wastewater and valuable component recovery.

World Water Congress & Exhibition of the International Water Association (IWA), Tokyo Japan, 16-21/09/2018

Barra Caracciolo A., Grenni P., Patrolecco L., Di Lenola M., Ademollo N., Rauseo J., Plutzer J., Monostory K., Sperlàgh B.

A joint research between pharmacology and environmental science to assess pharmaceutical occurrence in river ecosystems.

XVI Hungarian- Italian Symposium on Spectrochemistry: Technological innovation for water science and sustainable aquatic biodiversity. (Budapest, Hungary

Barra Caracciolo A, Dejana L, Fajardo C, Grenni P, Martin M, Mengs G, Sánchez-Fortún S, Lettieri T, Saccà ML, Medlin L,

A new fluorescent oligonucleotide probe for in situ identification of Microcystis Aeruginosa in freshwater

XVI Hungarian-Italian Symposium on Spectrochemistry, Technological Innovation for water science and sustainable aquatic biodiversity. Budapest, 3-6 October 2018.

Spada L., Calò M. Cardellicchio N., Di Leo a., Facella P., Giandomenico S., Perrotta G.

"A New LIFE for Mar Piccolo" Project: preliminary results for "ex ante" activities.

XVII Congresso Nazionale di Chimica dell'Ambiente e dei Beni Culturali, Genova, 24-27/06/2018

Petrangeli Papini M., Majone M., Arjmand F., Pierro L., Sagliaschi M., Sucato S., Bartsch E., Alesi E., Rossetti S., Matturro B.

A new process for the in situ remediation of aged low-k DNAPL source zone by enhances mobilization and bioremediation

7th European Bioremediation (EBC-VII) and 11th International Society for Environmental Biotechnology (ISEB 2018) Joint Conference, June 25-28, Chania (Greece)

De Sanctis M., Chimienti S., Sgaramella G., Piergrossi V., Di Iaconi C.

An advanced wastewater treatment system for reducing sludge producing in water line.

Proceedings of the IWA SMICE 2018 Conference, (Sludge Management in Circular Economy), 23-25 May 2018, Rome, Italy

Rauseo, J., Spataro, F., Ademollo, N., Pescatore, T., Patrolecco L.

Antibiotics and endocrine disrupting compounds in wastewater treatment plants and in receiving water bodies around the city of Rome (Italy).

SETAC Europe 28th Annual Meeting

Spataro F, Rauseo J, Ademollo N, Pescatore T, Patrolecco L.

Antibiotics and endocrine disrupting compounds (EDCs) in the Tiber river (Rome, Italy).

XVI Hungarian- Italian Symposium on Spectrochemistry: Technological innovation for water science and sustainable aquatic biodiversity. (Budapest, Hungary)

Mariani L, Donati E, Grenni P, Patrolecco L, Rauseo J, Barra Caraccciolo A

Application of the Vibrio fischeri acute toxicity test to assess the environmental impact of spoil materials containing the surfactant sodium lauryl ether sulphate

SETAC Europe 28th Annual Meeting, Roma, 13-17/05/2018

Preziosi Elisabetta, Frollini Eleonora, Parrone Daniele, Ghergo Stefano, Rossi David, Amalfitano Stefano, Melita Marco, Zoppini Annamaria

Arsenic, iron, manganese mobilisation in groundwater and microbial communities properties at a landfill facility

EGU General Assembly 2018, Vienna, 08/04/2018-13/04/2018

Crognale S, Zecchin S, Amalfitano S, Casentini B, Fazi S, Corsini A, Cavalca L, Rossetti S.

Arsenic-related microorganisms in aquatic environments: distribution and exploitation in bioremediation

BIOFILMS 8, 27-29 maggio 2018, Aarhus, Danimarca

Grenni P., Rauseo J., Spataro F., Cardoni M., Di Lenola M., Patrolecco L., Zacchini M., Pietrini F., Di Baccio D., Ademollo N., Barra Caracciolo A.

Assessment of sulfamethoxazole persistence in river water samples in presence or absence of the Lemna minor aquatic plant.

XVI Hungarian- Italian Symposium on Spectrochemistry: Technological innovation for water science and sustainable aquatic biodiversity. (Budapest, Hungary

Rauseo J, Cardoni M, Patrolecco L, Ademollo N, Di Lenola M, Pescatore T, Spataro F, Barra Caracciolo A, Grenni P

Assessment of the natural microbial community in a cattle manure-amended soil in presence/absence of the antibiotic sulfamethoxazole

3rd Conference on Ecology of Soil Microorganisms, Helsinki, 17-21 Giugno 2018

Cardoni M, Di Lenola M, Ancona V, Aimola G, Grenni P, Barra Caracciolo A

Assessment of the microbial community in poplar rhizosphere of a heavy metal contaminated soil

Soil biodiversity and European woody agroecosystems, Granada (Spain), 14-15 Marzo 2018

Cardoni M, Barra Caracciolo A, Ademollo N, Di Giulio A, Grenni P, Pescatore T, Rauseo J, Patrolecco L

Biodegradability of the anionic surfactant sodium lauryl ether sulphate used as the main component in two foaming agents for tunnelling process

SETAC Europe 28th Annual Meeting, Roma, 13-17/05/2018

Di Gregorio L, Congestri R., Tandoi V., Rossetti S., Neu T.R., Di Pippo F.

Biofilm control in cooling towers: the effect of biodispersants on freshwater biofilms developed in flow lanes

Biofilms 8, May 27-29, Aarhus, Denmark

Barca, Emanuele; Vessia, Giovanna.

Comparison of some machine learning methods for assessing the percentage of soil organic carbon.

20th EGU General Assembly, EGU2018, Proceedings 4-13 April, 2018 in Vienna.

Cavallo R. A., De Giglio O., Montagna M.T., Acquaviva M.I., Stabili L., Marcella Narracci

Dalle acque sotterranee alle acque marino costiere: Vibrio water-borne diseases.

51° Congresso Nazionale SiTI. Ottobre 17-20 2018, Riva del Garda(TN).

Rauseo, J., Barra Caracciolo, A., Ademollo, N., Cardoni, M., Di Lenola, M., Gaze, W.H., Stanton I.C., Grenni, P., Pescatore, T., Spataro, F., Patrolecco, L.

Degradation of the sulfamethoxazole antibiotic in an agricultural soil.

38th International Symposium on Halogenated Persistent Organic Pollutants & 10th International PCB Workshop, 26-31 August 2018, Kraków, Poland.

Patrolecco L., Ademollo, N., Pescatore, T., Rauseo, J., Spataro, F.

Determination of anionic surfactants by Pressurized Liquid Extraction (PLE) followed by the modified Methylene Blue Active Substances (MBAS) method in spoil material from excavation processes

SETAC Europe 28th Annual Meeting

Maria Teresa Palumbo 1, Agnese Lai 2, Marina Mingazzini 1, Mauro Majone 2 and Federico Aulenta 3

Detoxification efficiency during bioelectrochemical treatment of groundwater contaminated by cahs: an ecotoxicological evaluation

7th European Bioremediation Conference & 11th ISEB Conference, Chania, Greece, 25 - 28/06/2018

Rauseo J, Ademollo N, Barra Caracciolo A, Di Giulio A, Pescatore T, Mininni G, Patrolecco L

Distribution and persistence of anionic surfactants in leachate and conditioned soil: mesocosm study for EPB-TMB applications

SETAC Europe 28th Annual Meeting, Roma, 13-17/05/2018

Michele Rinaldi, Antonio Troccoli, Angelo Pio De Santis, Salvatore Antonio Colecchia, Emanuele Barca.

Durum Wheat Yield and Quality in a No-Tillage Experiment.

XLVII Convegno della Società Italiana di Agronomia (SIA) Marsala 12 – 14/09/2018.

Ademollo, N., Corsolini, S., Rauseo, J., Casentini, B., Amalfitano, S, Zoppini A, Valsecchi S, Polesello S, Spataro F, Pescatore T, Patrolecco L.

Dynamics of legacy and emerging pollutants in fjord ecosystems of the high Arctic: Svalbard (Norway) and NE Greenland.

38th International Symposium on Halogenated Persistent Organic Pollutants & 10th International PCB Workshop, 26-31 August 2018, Kraków,

Anna Barra Caracciolo, Paola Grenni, Emanuela Galli, Jasmine Rauseo, Nicoletta Ademollo, Maria Ludovica Saccà, Maria Teresa Palumbo, Valerio Giorgio Muzzini, Enrica Donati, Ines Lacchetti, Anita Di Giulio, Paola M. B. Gucci, Eleonora Beccaloni, Luisa Patrolecco

Ecotoxicity evaluation of soil conditioned with foaming products by a bioassay battery.

7th European Bioremediation Conference & 11th ISEB Conference, Chania, Greece, 25-28 /06/ 2018

I. Lacchetti, P.M.B. Gucci, P. Grenni, L. Patrolecco, M. Cardoni, M. Di Lenola, J. Rauseo, E. Galli, V.G. Muzzini, E. Donati, A. Finizio, P. Fumagalli, A. Barra Caracciolo

Ecotoxicological assessment of spoil material produced in mechanized excavation

SETAC Europe 28th Annual Meeting, Roma Italia, 13-17/05/2018

Dejana L, Di Lenola M, Cardoni M, Grenni P, Mitton FM, Patrolecco L, Ademollo N, Gonzales M, Miglioranza KSB, Barra Caracciolo A

Effects of DDE on a soil natural microbial community in presence/absence of the Solanum lycopersicum plant

Soil biodiversity and European woody agroecosystems, Granada (Spain), 14-15 Marzo 2018

Palumbo M.T., Mingazzini M.

Effects of light wavelengths on growth and biomass production of two green algae in culture systems using LED illumination.

5th International Symposium on Green Chemistry and Circular Economy. Skiathos (GR), Sept. 2018

Cardoni M, Mitton FM, Di Lenola M, Patrolecco L, Ademollo N, Gonzalez M, Miglioranza KSB, Grenni P, Barra Caracciolo A

Effects of plant growth and organic carbon addition on DDE degradation in soil

SETAC Europe 28th Annual Meeting, Roma, 13-17/05/2018

G. Mascolo1, S. Murgolo1, S. Franz2, E. Falletta3, H. Arab2, M. Bestetti2,

Employment of TiO_2 Meshes Electrochemical Photocatalysis for the Degradation of Emerging Organic Pollutants in Wastewater Effluents

XVII Congresso Nazionale di Chimica dell'ambiente e dei Beni Culturali, Genova, 24-27/06/2018

Petrangeli Papini M., Arjmand F., Ciampi P., Esposito C., Birnstingl J., Carboni M., Goria P., Rossetti S., Matturro B., Bacchi M., Foglietto P.

Enhancing in situ bioremediation by injection of colloidal activated carbon for the remediation of a chlorinated solvent plume

7th European Bioremediation (EBC-VII) and 11th International Society for Environmental Biotechnology (ISEB 2018) Joint Conference, June 25-28, Chania (Greece).

Petrangeli Papini M., Arjmand F., Ciampi P., Esposito C., Birnstingl J., Carboni M., Goria P., Rossetti S., Matturro B., Bacchi M., Foglietto P.

Enhancement of Biological Reductive Dechlorination by in situ Adsorption onto Colloidal Activated Carbon: from the Lab to the Full Scale Application

Setac Europe 28th Annual Meeting 13-17 May 2018, Rome (Italy).

De Sanctis M., Chimienti S., Sgaramella G, Pastore C., Piergrossi V., Di Iaconi C.

Energetic valorisation of Posidonia oceanica residues by an enhanced anaerobic digestion process.

Proceedings of the 6th International Conference on Sustainable Solid Waste Management, Naxos Island, Greece, 13–16 June 2018

Grenni P, Patrolecco L, Pescatore T, Spataro F, Ademollo A, Cardoni M, Di Lenola M, Barra Caracciolo A

Environmental assessment of foaming agent persistence in conditioned soil for EPB-TBM tunnelling

SETAC Europe 28th Annual Meeting, Roma, 13-17/05/2018

Finizio A., Grenni P., Patrolecco L., Galli E., Muzzini V.G., Fumagalli P., Rizzi C., Barra Caracciolo A.

Environmental risk assessment of sodium laureth sulphate (SLES) contained in conditioning agents used in mechanized tunnelling

Conservazione, ripristino ed adattamento degli ecosistemi nell'Antropocene, Cagliari, 12-14/09/2018

Felipe de Jesús Villalobos-Delgado, Adrián Bonilla-Petriciolet, Carlo Pastore, Luigi di Bitonto

Estudio de extracción de lípidos para el aprovechamiento de biomasas de plantas de tratamiento de agua y su utilización en la obtención de biocombustibles

AMIDIQ – La Ingenieria Quimica como motor de la innovacion, San José del Cabo, 1-4 Maggio 2018

Rolando L., Barra Caracciolo A., Ortega-Calvo J.J.

Evaluation of the swimming behavior and tactic response to atrazine of the Pseudomonas sp. strain ADP

SETAC Europe 28th Annual Meeting, Roma, 13-17/05/2018

Sebastiani D, Vilardi G, Di Giulio A, Miliziano S, Di Palma L, Barra Caracciolo A, Grenni P, Patrolecco L

Expeditious test for on-site monitoring activity in mechanized tunnelling applications

SETAC Europe 28th Annual Meeting, Roma, 13-17/05/2018

Crognale S, Amalfitano S, Casentini B, Fazi S, Petruccioli M, Rossetti S.

Exploitation of biological As(III)-oxidation in water treatment systems: potentialities and microbiome profiling in bioreactors

XV Congress of the Italian Federation of Life Sciences (FISV), 18-21 September 2018, Roma, Italia

Carlo Pastore, Luigi di Bitonto

Exploitation of the chemical potential of sewage sludge through Ethanolysis

SMICE 2018 - Sludge Management In Circular Economy, Roma, 23-25 Maggio 2017

Luigi di Bitonto, Carlo Pastore

FAMEs, Estolides and Methyl-10-Hydroxystearate from Sewage scum: a sustainable route to valorise a waste

SMICE 2018 – Sludge Management In Circular Economy, Roma, 23-25 Maggio 2017

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

First detection of Prorocentrum cf. shikokuense bloom in the Mediterranean Sea.

Riunione Annuale del Gruppo di Algologia della Società Italiana di Botanica, Catania, 16-17/11/2018

Ancona V, Barra Caracciolo A, Borello D, Campanale C, De Caprariis B, Grenni P, Basile A, Uricchio VF

Gasification treatments of poplar biomass produced in contaminated area recovered by plant assisted bioremediation

13th Conference on Sustainable Development of Energy, Water and Environment Systems, Palermo, 30/09/18-04/10/18

De Sanctis M., Chimienti S., Piergrossi V., Luprano M.L., Levantesi C., Di Iaconi C.

Granular technology for wastewater reclamation in agriculture.

Proceedings of the IWA Biofilms: Granular Sludge Conference 2018. 18-22 March, Delft, Netherlands

Ancona V, Grenni P, Campanale C, Barra Caracciolo A, Cardoni M, Aimola G, Di Lenola M, Bagnuolo G, Mascolo G, Uricchio VF,

Green remediation of a PCB polluted soil by poplar assisted bioremediation

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

Ancona V, Barra Caracciolo A, Campanale C, Grenni P, Di Lenola M, Cardoni M, Rascio I, Mascolo G, Massacci A, Uricchio VF,

Heavy metal phytoremediation of poplar clone in a contaminated soil in southern Italy

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

Barra Caracciolo A, Dejana L, Grenni P, Martin M, Mengs G, Saccà ML, Congestri R, Viaggiu E, Medlin L

Identification of cyanobacteria in surface water by fluorescence in-situ hybridization techniques

First Scientific Symposium- Health and Climate Change Symposium, Roma, 3-5/12/2018

L. Stabili, M.I. Acquaviva, E. Cecere, A. Giangrande, M. Narracci, A. Petrocelli, R.A. Cavallo

Il progetto REMEDIA-LIFE e l'impiego di macroalghe come biorimediatori: sfruttamento delle loro biomasse per fini biotecnologici

49° Congresso della Società Italiana di Biologia Marina, Cesenatico (FC), 4-8 giugno 2018

Frollini E., Parrone D., Ghergo S., Rossi D., Zoppini A., Melita M., Amalfitano S., Preziosi E.

Impact of waste management facilities on groundwater: Is the environmental isotope analysis an added value?

XVIII Giornata Mondiale dell'acqua, poster, Accademia Nazionale dei Lincei, 2018, Roma

Zoppini A, Melita M, Casentini B, Laratta B, Pescatore T, De Girolamo AM

In situ observations of temporary rivers dry sediments: chemical quality and microbial properties

XIX Conference of the Iberian Association of Limnology Inland waters and XXI century challenges: from scientific knowledge to environmental management, Coimbra, Portuga, 24 - 29 June 2018

T. Cibic, S. Fazi, L. Pin, L. Viganò, A. Zoppini, R. Zonta, P. Del Negro.

Influence of natural and anthropogenic disturbances on benthic communities in four lagoons of the po delta system: focus on microbial assemblages.

EGU General Assembly 2018, Vienna, 08/04/2018-13/04/2018

Cibic T, Asioli A, Fazi S, Auriemma R, Franzo A, Nasi F, Ferrante L, Viganò L, Zoppini A, Zonta R, Del Negro P.

Influence of natural and anthropogenic disturbance on benthic communities in four lagoons of the Po delta system.

8th European Coastal Lagoons Symposium, 20-23 March 2018 - Athens, Greece

Nogues I, Barra Caracciolo A, Grenni P, Bustamante MA

Influence of soil organic amendments on the phenolic contents in rosemary (Rosmarinus officinalis L.) plants

SETAC Europe 28th Annual Meeting, Roma, 13-17/05/2018

Blonda M., Calabrese A., Cardellicchio A, Casale B., Dentamaro G., Di Lecce V., Dimucci A, Guaragnella C., Matrino D., Palagachev D., Petruzzelli D., Politi T., Rizzi M., Sarcina V., Uricchio V.F.

Innovative Methodology for Detecting of Possible Harmful Compounds for Wastewater Treatment the MAUI Project

2018 Workshop on Metrology for Industry 4.0 and IoT, MetroInd 4.0 and IoT 2018 – 6 August 2018

Antonio Lo Porto

Knowledge gaps and Research needs for an improved implementation of the Water Framework Directive.

European Commission, DG Environment, Workshop on the Status of implementation of the Water Framework Directive, Brussels, 7 February 2018

Luigi di Bitonto, Vito Locaputo, Carlo Pastore

Liquid fuel from sewage sludge through direct acid ethanolysis

NAXOS 2018-6th International Conference on Sustainable Solid Waste Management, Naxos, 13-16 Giugno 2018

Micheli C, Cecere E, Cibic T, De Cecco L, Petrocelli A, Pignatelli V, Portacci G, Rubino F, Borfecchia F.

Mapping biomass of macroalgae in the Mar Piccolo of Taranto (Southern Italy) by means of high resolution satellite remote sensing.

2nd Conference Mapping water bodies from space. ESA-ESFRIN Frascati, Roma, 27-28 marzo 2018

Angelantonio Calabrese, Massimo Blonda, Antonio Casale, Barbara Casale, Roberto Mauro, Antonietta Dimucci, Diego Matrino, Vincenzo Sarcina, Vito Felice Uricchio

MAUI: a new system for monitoring possible harmfull compounds imput at wastwater treatment systems

European Waste Water Management, 17-18 July 2018, Manchester United Footbal Stadium, Manchester, UK

A. Lay-Ekuakille, P. Visconti, S. Maggi, D. E. Bruno, and G. Passarella

Metrological Aspects in Approximate Computing: Fourier Transform in Polluted Water Spectroscopy

MetroSea 2018 IEEE International Workshop on Metrology for the Sea, Bari, 08-10/10/2018

Passatore L, Massacci A, Guerriero E, Benedetti P, Nogues I, Grenni P, Rauseo J, Di Lenola M, Barra Caracciolo A,

Microcosm experiment to assess the effectiveness of a Populus clone to enhance PCB biodegradation in a historically contaminated soil

SETAC Europe 28th Annual Meeting, Roma, 13-17/05/2018

Crognale S, Amalfitano S, Casentini B, Fazi S, Petruccioli M, Rossetti S.

Microorganisms and arsenic: exploitation of microbially-mediated processes for water treatment

7th European Bioremediation Conference (EBC-VII) and the 11th International Society for Environmental Biotechnology conference (ISEB 2018), 24-28 June 2018, Chania (Greece).

Tonanzi B., Braguglia C.M., Gallipoli A., Gianico A., Pagliaccia P., Rossetti S.

Microbial population dynamics in biowaste mesophilic anaerobic digestion: the impact of sewage sludge addition

SMICE 2018, 23-25 May, Rome, Italy

Crognale S, Petruccioli M, Rossetti S.

Microorganisms in arsenic-contaminated aquatic environments: distribution, metabolic potential and exploitation in bioremediation

Cortona Procarioti 2018, 17-19 May 2018, Cortona, Italia

Ricci G.F., Jeong J., De Girolamo A.M.3, Gentile F.

Modelling management practices to reduce soil erosion in an agricultural watershed in Southern Europe

2018 International SWAT Conference, Brussel, September 17-21, 2018

Stefano Ghergo, Elisabetta Preziosi, Maurizio Guerra, Nicoletta Calace, Nicolas Guyennon, Marco Marcaccio, Stefano Menichetti, Emanuele Romano

National Guidelines for Groundwater Quality Trend and Trend Reversal Assessment: Overview and Procedures Implementation

XVIII Giornata mondiale dell' acqua. La previsione idrogeologica sulla risorsa acqua, Accademia dei Lincei, 22/03/2018

Frollini Eleonora, Parrone Daniele, Ghergo Stefano, Preziosi Elisabetta

Natural background level assessment in groundwater: application of the Italian national guideline

EGU General Assembly 2018, Vienna, 08/04/2018-13/04/2018

Angelantonio Calabrese, Massimo Blonda, Barbara Casale, Vito Felice Uricchio, Roberto Mauro, Diego Matrino, Antonietta Dimucci and Vincenzo Sarcina

New Alert System for Monitoring Wastewater Compounds Harmful for the Treatment: Maui

3rd EWaS International Conference Insights on the Water-Energy-Food Nexus, 27-30 June 2018, Lefkada Island, Greece

S. Murgolo1, J. Müller 2, Uwe Hübner2, J. E. Drewes2, G. Mascolo1

Non-target screening in treated wastewater reuse: a new tool for process evaluation ?

XENOVAC II - Challenges and Solutions related to Xenobiotics and Antimicrobial Resistance in the Framework of Urban WasteWater Reuse: Towards a Blue Circle Society, Limassol, Cyprus, 10-12/10/2018

Barra Caracciolo A, Dejana L, Fajardo C, Grenni P, Martin M, Lettieri T, Mengs G, Saccà ML, Medlin L

Oligonucleotide probes for fluorescence in-situ identification of cyanobacterial cells in surface waters

SETAC Europe 28th Annual Meeting, Roma, 13-17/05/2018

Mosca Angelucci Domenica, Stazi Valentina, Tomei M. Concetta

On-site treatment of dye-bath wastewater with a two-stage polymer extraction and biological regeneration process.

10th IWA Eastern European Young Water Professionals Conference, Zagreb, Croatia, 10-11 maggio 2018

Patrolecco L, Rauseo J, Gaze WH, Ademollo N, Cardoni M, Di Lenola M, Grenni P, Spataro F, Barra Caracciolo A

Persistence of the sulfamethoxazole antibiotic in a digestate-amended agricultural soil

SETAC Europe 28th Annual Meeting, Roma, 13-17/05/2018

Rauseo J, Patrolecco L, Gaze WH, Stanton IC, Ademollo N, Cardoni M, Di Lenola M, Grenni P, Pescatore T, Spataro F, Barra Caracciolo A.

Persistence of sulfamethoxazole in manure amended soils.

XVI Hungarian- Italian Symposium on Spectrochemistry: Technological innovation for water science and sustainable aquatic biodiversity

Ancona V, Massarelli C, Grenni P, Galeone C, Vurro M, Uricchio VF, Barra Caracciolo A,

Pesticides contamination in aquatic ecosystems: ecological assessment for reducing environmental impacts and risks on human health

XVI Hungarian-Italian Symposium on Spectrochemistry, Technological Innovation for water science and sustainable aquatic biodiversity. Budapest, 3-6 October 2018,

Rauseo, J., Spataro F, Ademollo N, Pescatore T, Patrolecco L.

Pharmaceuticals and endocrine disrupting compounds (EDCs) in the Tiber River (Rome, Italy).

38th International Symposium on Halogenated Persistent Organic Pollutants & 10th International PCB Workshop, 26-31 August 2018, Kraków, Poland.

Ancona V, Barra Caracciolo A, Grenni P, Borello D, Falconi M, Basile A, Massacci A, Uricchio VF

Plant-assisted bioremediation to recover multi-contaminated areas and provide biomass for renewable energy production

SETAC Europe 28th Annual Meeting, Roma, 13-17/05/2018

Crognale S., Fazi S., Amalfitano S., Casentini B., Rossetti S.

Popolazioni batteriche nelle acque del viterbese e in biofiltri

Convegno arsenico nell'ambiente. Azioni di mitigazione per la protezione della salute umana. 23 Marzo 2018, Milano

Finizio A, Grenni P, Patrolecco L, Galli E, Muzzini VG, Donati E, Lacchetti I, Barra Caracciolo A

Preliminary environmental risk assessment of sodium lauryl ether sulphate contained in foaming agents used in mechanized tunnelling

SETAC Europe 28th Annual Meeting, Roma, 13-17/05/2018

Ermelinda Prato, Francesca Biandolino, Isabella Parlapiano, Loredana Papa, Giovanni Fanelli

Quality assessment of scallop Mymachlamys varia as a valuable source of bioactive compunds from the Italian Mediterranean coasts

World Aquaculture Society 2018, Las Vegas, 16-25/02/2018

Rubino Fernando, Fanelli Giovanni

Relocation of Pinna nobilis (Mollusca, Bivalvia), an important component of best practices to maintain biodiversity in endangered marine coastal areas

EGU General Assembly, Vienna, 8/4/2018-13/4/2018

De Sanctis M., Levantesi C., Luprano M., Chimienti S., Piergrossi V., Di Iaconi C.

Removal of pathogens and antibiotic resistance genes by a multi barrier system for wastewater reuse.

Proceedings of the IWA World Water Congress & Exhibition16 – 21 Septemeber 2018, Tokio, Giappone

Antonio Lo Porto

Research & Innovation for improved WFD implementation

EU-WFD Common Implementation Strategy, Strategic Coordination Group Workshop, Brussels, 8 February 2018

Barra Caracciolo A, **Grenni P**, *Cardoni M, Di Lenola M, Campanale C, Garbini GL, Aimola G, Uricchio VF, Fernandez Lopez M, Ancona V*

Rhizosphere microbial community of poplar plants involved in PCB phyto-assisted bioremediation

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

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River Basin Management: how to deal with Pollutants of Emerging Concern?

Water JPI Conference on the theme "Emerging Pollutants in Freshwater Ecosystems", Helsinki, Finland, 6–7 June 2018

Flavio Borfecchia, Fernando Rubino, Tamara Cibic, Carmela Caroppo, Ester Cecere, Luigi De Cecco, Elena di Poi, Antonella Petrocelli, Vito Pignatelli, and Carla Micheli

Satellite Mapping of Macro-algae and Phytoplankton communities in the Mar Piccolo of Taranto (Ionian Sea, southern Italy), a confined marine basin heavily impacted by anthropogenic activities

European Geosciences Union General Assembly 2018, Vienna, 8-13 aprile 2018

Raffaele Di Pillo, Anna Maria De Girolamo, Maria Teresa Todisco

Sediment Production and Source Areas Identificaiton in A Temporary River: A Physical-Based Multi-Scale Approach (Celone, Puglia, Se Italy)

XXXVI Convegno Nazionale di Idraulica e Costruzioni Idrauliche, Ancona, 12-14 Settembre 2018

Caroppo C., Portacci G.

Shellfish farming in Taranto: tradition, problems and opportunities

Erasmus+ project S.T.E.P.S.: Seas, Tourism, Environment, Protection, Sustainability - Sea Future: beetween innovation and tradition, Taranto, 17 maggio 2018

Barra Caracciolo A, Grenni P, Beccaloni E, Patrolecco L,

Site-specific protocol to assess the environmental compatibility of spoil materials produced by EPB-TBM

SETAC Europe 28th Annual Meeting, Roma, 13-17/05/2018

Barra Caracciolo A, Ancona V, Grenni P, Cardoni M, Di Lenola M, Campanale C, Garbini GL, Lopez MF, Aimola G, Uricchio VF

Soil microbial community associated to a poplar-assisted bioremediation study.

SETAC Europe 28th Annual Meeting, Roma, 13-17/05/2018

Antonio Lo Porto

Structure and Activities of the China EU Water Platform

Water JPI Workshop - Strategy for International Cooperation (19/09/2018, Vienna)

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., Pichon G., Chiantore M.

Substrate colonization in the Ross Sea, Antarctica: the ANT-BIOFILM Project

POLAR 2018, Davos (Switzerland), 15/06/2018-26/06/2018

Salerno C., Berardi G., Pollice A.

Substrate stress response of MBR activated sludge for wastewater treatment as detected through a metaproteomic approach.

Proceedings of the EFB International conference "Microbial stress: from systems to molecules and back", Kinsale, Co. Cork (Ireland), European Federation of Biotechnology, 23-25 April 2018.

Rauseo J., Patrolecco L., Ademollo, N., Grenni, P., Cardoni, M., Rolando L., Levantesi, C., Luprano, M.L., Barra Caracciolo, A.

Sulfamethoxazole degradation in river water microcosms and effect on natural microbial community

SETAC Europe 28th Annual Meeting, Roma, 13-17/05/2018

Massimo Blonda, Angelantonio Calabrese, Raffaele Palumbo and Elvira Giorgio

Sulphide Biooxidation in Activated Sludge Diffusion Process: Microbiological and Biochemical Effects

3rd EWaS International Conference Insights on the Water-Energy-Food Nexus 27-30 June 2018, Lefkada Island, Greece

Gentile F., D'Ambrosio E., Spanò M., Abdelwahab O.M.M., Lonigro A., Ricci G.F., Romano G., Calabrese A., Pappagallo G., De Girolamo A.M.

Territorial Analysis and Hydrological Modeling of the Canale d'Aiedda Basin

EurAgEng 2018 Conference, Wageningen, the Netherlands, 8 – 12 July 2018

Passatore L, Barra Caracciolo A, Di Lenola M, Grenni P, Nogues I, Guerriero E, Benedetti P, Massacci A

Test on poplar clone Monviso growing in a historically PCB contaminated soil

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

Piergrossi V., De Sanctis M., Chimienti S., Sgaramella G., Di Iaconi

Thermal energy recovery from municipal wastewater treatment by an innovative hybrid energy recovering system.

IWA World Water Congress & Exhibition16 – 21 september 2018, Tokio, Giappone

Marco Berardi, Fabio Difonzo, Michele Vurro

Transversal method of lines for a smart modelling of percolation through unsaturated zone

XVIII Giornata mondiale dell'acqua", Accademia dei Lincei, 22 marzo 2018,

Palumbo M.T., Mingazzini M., Lai A., Aulenta F.

Toxicity Reduction Evaluation of groundwater bioremediation using the algal toxicity test.

5th International Symposium on Green Chemistry and Circular Economy. Skiathos (GR), Sept. 2018

Anna Maria Stellacci, Daniela De Benedetto, Rita Leogrande, Carolina Vitti, Mirko Castellini, Emanuele Barca.

Use Of Mixed Effects Models Accounting For Residual Spatial Correlation To Analyze Soil Properties Variation In A Field Irrigated With Treated Municipal Wastewater.

XLVII Convegno della Società Italiana di Agronomia (SIA) Marsala 12 – 14/09/2018.

Angelantonio Calabrese, Vito Felice Uricchio, Massimo Blonda & Claudia Campanale

Use of Molecular Techniques for Identification the Kind of Nitrate Contamination in Groundwater

6th Annual International Forum on Water 16-19 July 2018 Athens, Greece

Calò M., Cardellicchio N., Di Leo A., Giandomenico S., Grassi G., Spada L.

Use of moss bags for metals monitoring in a protected Nature Park: preliminary results.

XVII Congresso Nazionale di Chimica dell'Ambiente e dei Beni Culturali, Genova, 24-27/06/2018

Mariani L, Donati E, Patrolecco L, Rauseo J, Rolando L, Barra Caracciolo A, Grenni P.

Use of the Vibrio fischeri aquatic ecotoxicity test for evaluating residual concentrations of the anionic surfactant sodium lauril ether sulphate in excavated soil elutriates.

XVI Hungarian- Italian Symposium on Spectrochemistry: Technological innovation for water science and sustainable aquatic biodiversity. (Budapest, Hungary)

Georgia Antonopoulou, Ioanna Ntaikou, Maria Alexandropoulou, Asimina Tremouli, Carlo Pastore, Luigi di Bitonto, Symeon Bebelis, Gerasimos Lyberatos

Using household food waste as a source of energy in a single-chamber microbial fuel cell

NAXOS 2018-6th International Conference on Sustainable Solid Waste Management, Naxos, 13-16 Giugno 201

Martina Cardoni, Paola Grenni, Anna Barra Caracciolo, Hanan Elhaes, Hanan S. Ibrahim, Medhat A. Ibrahim

Water hyacinth microspheres to remediate freshwater from metal contamination

XVI Hungarian-Italian Symposium on Spectrochemistry, Technological Innovation for water science and sustainable aquatic biodiversity. Budapest, 3-6 October 2018

Antonio Lo Porto

Water Management and Climate Change: possible EU-China cooperation

China-EU Water Platform, Qingdao International Water Conference, Qingdao, 26-28 June 2018

Rapporti di Progetto

Elisabetta Preziosi, Stefano Ghergo, Eleonora Frollini, Daniele Parrone, Annamaria Zoppini, Stefano Amalfitano, Marco Melita, Nicoletta Ademollo, Giuseppe Mascolo, Domenico Mastroianni, Francesca Falconi, Ruggero Ciannarella, Giancarlo Ciotoli, Alessandra Sciarra

Attività per la supervisione scientifica dell'adeguamento della rete di monitoraggio, campionamenti e analisi nel sito relativo alla discarica di rifiuti non pericolosi della Società MAD s.r.l. in località Cerreto nel comune di Roccasecca

Elisabetta Preziosi, Stefano Ghergo, Eleonora Frollini, Daniele Parrone, Annamaria Zoppini, Stefano Amalfitano, Marco Melita, Giuseppe Mascolo, Domenico Mastroianni, Francesca Falconi, Ruggero Ciannarella

Indagini per la definizione dei valori di fondo geochimico naturale degli elementi previsti dal D.lgs. 152/06 (all. 5 tab. 2), relativamente all'impianto di gestione rifiuti non pericolosi (T.M.B.), sito in località Casale Bussi nel Comune di Viterbo

Elisabetta Preziosi, Stefano Ghergo, Eleonora Frollini, Daniele Parrone, Annamaria Zoppini, Stefano Amalfitano, Marco Melita, Giuseppe Mascolo, Domenico Mastroianni, Francesca Falconi, Ruggero Ciannarella

Indagini per la definizione dei valori di fondo geochimico naturale degli elementi previsti dal D.lgs. 152/06 (all. 5 tab. 2), relativamente alla discarica per rifiuti non pericolosi sita in località Le Fornaci nel Comune di Viterbo

Girolamo Belardi, Daniela Guglietta, Francesca Trapasso, Daniele Passeri, Stefano Ubaldini, Rosamaria Salvatori, Barbara Casentini, Shalini Dhyani, Nihar Sahoo, Paras Pujari, Parikshit Verma

Integrated multidisciplinary approach for reusing mining waste as resource

Pollice A., Vergine P., Pappagallo G.

MEPROWARE Novel methodology for the promotion of treated wastewater reuse for Mediterranean crops improvements. Deliverable 1.1 – Water Monitoring Protocol. WaterWorks2014

Vergine P., Salerno C., Pappagallo G., Berardi G., Pollice A.

MEPROWARE Novel methodology for the promotion of treated wastewater reuse for Mediterranean crops improvements. Deliverable 1.2 - Water Quality Characterization. WaterWorks2014

De Vito R., Vergine P., Pollice A.

MEPROWARE Novel methodology for the promotion of treated wastewater reuse for Mediterranean crops improvements. Deliverable 4.2 – Economic and Environmental Impacts of Water Reuse WaterWorks2014.

N. Cardellicchio, A. Di Leo, S. Giandomenico, L. Spada, M. Calò.

Monitoraggio chimico e chimico-fisico (ex-ante) dei livelli di inquinanti all'interno del sito da bonificare nell'ambito del progetto Life4MarPiccolo.

Manuali tecnici / Linee Guida

Stefano Mariani, Giovanni Braca, Emanuele Romano, Barbara Lastoria, Martina Bussettini

Linee Guida sugli Indicatori di Siccità e Scarsità Idrica da utilizzare nelle attività degli Osservatori Permanenti per gli Utilizzi Idrici - Stato Attuale e Prospettive Future

Attività editoriale

Notiziario dei Metodi Analitici & IRSA News [ISSN 2465-017X]

Il Notiziario dei Metodi Analitici pubblicato per la prima volta nel 1995, come diretta emanazione del più vecchio notiziario "Metodi analitici per le acque" (il primo numero risale al gennaio del 1981), continua la sua vita nella nuova veste di pubblicazione telematica.

Alla storica sezione dedicata all'Analitica, nata con lo scopo di fornire un contributo alla divulgazione ed al trasferimento dei risultati di studi riguardanti l'aggiornamento dei metodi ufficiali di analisi degli inquinanti nelle acque, si affianca una sezione IRSA News che raccoglie contributi che testimoniano interessi ed attività attuali dell'Istituto che si ritiene opportuno divulgare.

Direttore responsabile: **Giuseppe Mascolo**

Comitato di Redazione: **L. Campanella, L. Guzzella, S. Polesello, L. Patrolecco, S. Valsecchi**

Segreteria di Redazione: **S. Ghergo**

1/2018

1. *Determinazione dei residui di prodotti fitosanitari in acqua, superficiale e sotterranea, tramite estrazione in fase solida (SPE) e analisi gas cromatografica (parte a) e cromatografia liquida con rivelatore di massa (parte b)*

2. *Determinazione di antiparassitari in acque destinate a consumo umano mediante SPME-GC/MS-MS*

3. *Determinazione di idrocarburi policiclici aromatici (IPA) in acque destinate a consumo umano mediante SPME-GC/MS-MS*

4. *Linee guida per la valutazione delle tendenze ascendenti e d'inversione degli inquinanti nelle acque sotterranee (D.M. 6 luglio 2016)*

5. *Progetto "FRAME" JPI Water dell'UE, sul riutilizzo indiretto delle acque reflue a scopo potabile*

I Progetti

Elenco dei Progetti attivi

Life4MarPiccolo

A New Life for Mar Piccolo

Responsabile: **A. Di Leo**

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.

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.*

Personale coinvolto: **A. Di Leo S. Giandomenico, L. Spada**

Periodo di validità: **2016-2020**

JPI FRAME

A novel Framework to Assess and Manage contaminants of Emerging concern in indirect potable reuse

Responsabile: **Stefano Polesello**

Under the umbrella of the European research initiative "Water JPI (Joint Programming Initiative „Water Challenges for a Changing World")" leading European scientists, engineers and practitioners from seven institutes in four countries (Germany, Italy, France and Norway) closely worked together to develop new strategies to minimize the impacts of a broad range of chemical and biological contaminants when reusing treated municipal wastewater via subsurface treatment to augment drinking water resources coordinated by the German Federal Institute of Hydrology (BfG). The project's main aim was to provide sufficient quantities of safe drinking water, while preserving ecosystems and human health. The practice of recycling treated municipal wastewater effluents to augment drinking water supplies is defined as "indirect potable reuse".

FRAME addresses important aspects in the context of producing high quality water from recycled water

- *i) removal of emerging water contaminants by various treatment processes,*
- *ii) detection and removal of transformation products formed by microbial and chemical reactions of the emerging chemicals,*
- *iii) inactivation of viruses and other pathogens,*
- *iv) removal of antibiotic-resistant bacteria,*
- *v) use of bioassays and biomarkers to detect effects caused by specific pollutants and mixtures of pollutants,*
- *vi) quantifying the reduction of environmental and human health risks,*
- *vii) costs, non-monetary benefits and potential drawbacks of several treatment strategies.*

FRAME is testing several treatment combinations including ozonation and advanced oxidation processes coupled with a new process of sequential biologically active filtration. Modelling transport and fate of emerging contaminants and their transformation products through various treatment combinations will provide guidance in assessing the efficiency of mitigation strategies. The FRAME concept will influence European and national regulations related to wastewater and indirect potable reuse. It will be primarily validated at water reclamation facilities in Braunschweig, Germany and Spain.

Personale coinvolto: **S. Polesello, S. Valsecchi, M. Rusconi, G. Mascolo, S. Murgolo**

Periodo di validità: **2015-2018**

ACWAPUR

Accelerated Water Purification during Artificial Recharge of Aquifers - A Tool to Restore Drinking Water Re-Sources

Responsabile: **Caterina Levantesi**

Il progetto ACWAPUR mira a dimostrare, in scala di laboratorio e reale, il potenziale delle barriere tecnologiche da applicare nei processi di ricarica artificiale delle falde (Artificial Recharge of Aquifer) per la protezione degli acquiferi dalla contaminazione. Se confermato,

l'aumento delle capacità di depurazione dei sistemi ARoA ottenuto con le barriere, consentirebbe di superare una delle maggiori criticità legate alla diffusione di queste tecniche incentivandone l'utilizzo e l'applicazione. Il progetto italiano è in particolare finalizzato alla selezione delle strategie più efficaci per favorire la rimozione della contaminazione di origine biologica (patogeni ed antibiotico resistenza). In ACWAPUR, per la prima volta, l'analisi dei fenomeni coinvolti nella riduzione della carica microbica e dell'antibiotico resistenza sarà finalizzato alla selezione di condizioni ottimali per promuovere i processi naturali d'igienizzazione nelle barriere. Rispetto alle tecniche di disinfezione comunemente utilizzate (e.g. clorazione, UV, ultrafiltrazione), le barriere hanno il vantaggio di operare in situ promuovendo processi naturali, senza richiesta di energia e con un minimo impatto sull'ambiente.

Personale coinvolto: **Amalfitano Stefano, Zoppini Annamaria, Luprano MariaLaura, Melita Marco**

Periodo di validità: 2016-2018

Accordo con Commissario Straordinario per gli interventi urgenti di bonifica, ambientalizzazione e riqualificazione di Taranto

Responsabile: **Vito Felice Uricchio**

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.

Attività di interesse comune propedeutiche alla realizzazione degli interventi per la bonifica, ambientalizzazione e riqualificazione del Mar piccolo di Taranto

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.

Azioni sull'ecosistema dell'Area di Crisi Ambientale di Taranto

Ambiente terrestre - *Questa azione si compone di numerosi Task che mirano, come precedentemente detto, allo studio integrato del territorio in esame (ambiente terrestre), 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 km^2). 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*

AFORED - Ambiente, Formazione, Ricerca, Educazione

L'ambiente vissuto ed esperito non è sinonimo solo di luogo fisico, ma si sostanzia delle relazioni sociali e culturali che in esso si generano. L'approccio interdisciplinare è, dunque, prerogativa essenziale di tale attività. Il progetto di formazione si serve di modelli educativi capaci di agevolare una sempre maggiore sinergia fra il tradizionale modo di intendere i percorsi di istruzione e la formazione evidence based sul campo, in modo da favorire la diretta partecipazione dello studente e stimolando l'interesse verso una conoscenza critica e consapevole delle problematiche ambientali presenti nell'Area Vasta di Taranto, alla luce dei dati raccolti dal Commissario Straordinario. Comunque anche di studenti in fase di scelta del percorso universitario. Affinché gli interventi posti in essere dal Governo, attraverso il lavoro del Commissario Straordinario, siano efficacemente e ampiamente compresi dagli attori istituzionali e sociali, nonché dall'intera cittadinanza, in modo da favorire una reale partecipazione di ciascuno al processo di ri-progettazione del proprio territorio e della propria storia e di "risanamento" sociale, economico, istituzionale oltre che ambientale dell'Area Vasta di Taranto, è necessaria l'implementazione di "processi informativi, educativi e riflessivi" per gli esponenti del mondo istituzionale, di quello imprenditoriale, dell'associazionismo e dell'intera cittadinanza. Di qui la costituzione di una attività che raccoglie e coordina tutti quegli interventi e strumenti in grado di consentire un'adeguata e attenta comunicazione scientifica, istituzionale e divulgativa del lavoro svolto dal Commissario Straordinario in concomitanza con il CNR-IRSA.

Personale coinvolto: **V. Ancona, C. Massarelli, V.N. Palmisano, N. Lopez, C. Campanale, A. Calabrese, S. Brigida, A. Basile, C. Galeone, B. Casale, M. Tumulo, D. Losacco, R. Mauro, R. Lamaddalena**

Periodo di validità: **2015-2020**

Invasi

Accordo di collaborazione art. 15, L. 241/90 tra Regione Lombardia e CNR-IRSA per lo sviluppo di attività inerenti la gestione delle acque superficiali e degli invasi

Responsabile: **Laura Marziali**

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. Questo progetto consentirà di validare l'approccio mediante applicazione del protocollo su casi reali.

Personale coinvolto: **Laura Marziali, Licia Guzzella, Lucia Valsecchi, Stefano Tasselli**

Periodo di validità: **2018-2019**

ERICA

Analisi di PFAS in percolati di discarica

Responsabile: **Sara Valsecchi**

Convenzione tra societa' Erica srl e CNR-IRSA. L'attività del progetto consiste nell'analisi di composti perfluorurati (PFAS) in percolati di discarica sottoposti a sperimentazione di abbattimento mediante carboni attivi in impianto pilota. È prevista inoltre un'attività di intercalibrazione con altri enti pubblici e privati coinvolti nelle attività di misura dei PFAS.

Personale coinvolto: **Stefano Polesello, Sara Valsecchi, Francesca Cappelli**

Periodo di validità: **2018**

ARPAV CARAVAGGIO

Responsabile: **Andrea Buffagni**

Qualora siano permanenti e significative, le alterazioni idromorfologiche, di grande impatto nei fiumi europei, possono portare ad una designazione formale dei corpi idrici come "fortemente modificati" (HMWB) ai sensi della Direttiva Quadro sulle Acque (WFD). Le conoscenze attuali che riguardano la relazione causa-effetto tra pressioni antropiche e comunità acquatiche sono scarsamente approfondite nel contesto di tali corpi idrici, le cui alterazioni sono estese e, spesso, molteplici. Ne consegue la difficoltà, da parte degli enti gestori, di definire delle misure concrete atte a migliorarne il potenziale ecologico e, al contempo, di impostare dei monitoraggi mirati a rilevare risposte biologiche coerenti con la realtà delle alterazioni presenti su tali corpi idrici.

Il progetto, finanziato da ARPA/Regione Veneto, è focalizzato sui corpi idrici fluviali fortemente modificati del Bacino Scolante della Laguna di Venezia (BSL). In ambito BSL, il contesto analizzato è relativo a corpi idrici arginati o che presentano importanti rinforzi di sponda a contatto con l'alveo. Il progetto ha visto svolgersi un'attività sperimentale dedicata che ha previsto il campionamento e l'identificazione degli organismi macrobentonici e la raccolta di informazioni idromorfologiche e di habitat, principalmente tramite applicazione del metodo CARAVAGGIO. Sulla base dei dati raccolti, ci si propone di fornire elementi di approfondimento per:

- *Definizione del Massimo e del Buono Potenziale Ecologico (MEP e GEP) in ambito BSL.*
- *Affinamento e validazione del sistema di classificazione per i corpi idrici fluviali fortemente modificati del bacino scolante della laguna veneta, eventualmente estendibile al di fuori del BSL;*
- *Descrizione delle principali alterazioni di habitat e individuazione di possibili misure di risanamento.*

Personale coinvolto: **Stefania Erba, Marcello Cazzola, Raffaella Balestrini, Laura Verzino, Laura Terranova**

Periodo di validità: **2016-2018**

Atmospheric deposition, soils and surface waters at an alpine tundra catchment in NW Italian Alps: implications for N and C biogeochemical cycles

Responsabile: **Raffaella Balestrini**

Mountain ecosystems, in particular the alpine tundra, located above treeline, are highly vulnerable to changes in climate, pollutants and nutrient input. Short growing season, extremely low air temperatures, and often snow-covered soils, all contribute in reducing the ability of these ecosystems to face alterations that affect their physical structure and biological communities. Results from a number of studies have suggested that high elevation ecosystems are more susceptible to ecological impacts from N deposition than forest or grassland ecosystems at lower altitudes. The general aim of the project is to integrate the role of atmospheric deposition in the long-term monitoring of biogeochemical cycles in the LTER (Long-Term Ecological Researches) station Angelo Mosso, located at 2901 m s.l.m. close to the Monte Rosa Massif (4634 m) in NW-Italy. We will compute the total atmospheric fluxes, by monitoring the snowpack, the summer precipitation and the dry deposition. Furthermore, we aim to investigate the sources and processing of atmospheric nitrogen species as well as their geographic origin by using the isotopic techniques (N-isotopes and δ2H and δ18O water molecule) and the backward trajectories analysis.

Personale coinvolto: **Raffaella Balestrini, Carlo Delconte**

Periodo di validità: **2018-2020**

Accordo FF.OO.

Attività di tutela ambientale: programma di monitoraggio dei siti inquinati della regione Puglia

Responsabile: **Vito Felice Uricchio**

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.

Personale coinvolto: **V.F. Uricchio, C. Massarelli, N. Palmisano, N. Lopez**

Periodo di validità: **2003-2019**

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

Responsabile: **Vito Felice Uricchio**

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.

Personale coinvolto: **V.F. Uricchio, V. Ancona, A. Basile, A. Calabrese, A. Volpe, C. Massarelli, C. Campanale, B. Casale**

Periodo di validità: **2017-2018**

BATA

Bacterial-assisted Adsorption Technology for Arsenic removal from water

Responsabile: **Simona Rossetti**

Il progetto è mirato allo studio dei processi di rimozione di arsenico da acque destinate al consumo umano mediante ossidazione biologica di As(III) (tramite l'isolamento e/o l'arricchimento di specie arsenito-ossidanti da acque naturali contaminate) e successiva rimozione della forma ossidata As(V) su opportuni materiali adsorbenti. Lo studio è effettuato sia in biofiltri in scala di laboratorio che in un impianto pilota basato sul trattamento chimico-fisico mediante ZVI o materiali ossi-idrossidi di ferro e lantanio.

Partecipanti: **Barbara Casentini, Stefano Amalfitano, Stefano Fazi, Simona Crognale**

Periodo di validità: **2015-2018**

BEvERAGE

BioElectrochemical RemediAtion of Groundwater plumEs

Responsabile: **Federico Aulenta**

Groundwater resources are highly vulnerable to contamination. Heavy metals, chlorinated solvents and petroleum hydrocarbons are relevant pollutants in Europe and in the USA. In Lombardy, about 70% of the sites ranked for the Region Plan of Contaminated Sites are affected by hexavalent chromium and/or aliphatic chlorinated solvents and/or petroleum hydrocarbons in groundwater and/or soil.

In situ remediation techniques, which do not need groundwater to be pumped out, are becoming more and more popular, as they have shown to be cheaper and quicker than pump and treat systems. Among these, bioremediation has a significant role, for its general sustainability in terms of environmental impact and costs. For both organic and inorganic pollutants, bioremediation is based on contaminant transformation to harmless species; however, while organics can be mineralized, most inorganics change their oxidation state, hopefully reducing their toxicity and mobility in the environment.

In order to promote the growth and metabolism of microorganisms that are involved in the bioremediation process, suitable electron donors/acceptors have to be supplied. Lab- to full-scale applications have shown that anaerobic processes can work for both hexavalent chromium and aliphatic chlorinated solvents, while aerobic bioremediation is preferred for petroleum hydrocarbons. Therefore engineered bioremediation processes are typically based on the continual addition of chemicals (e.g., hydrogen gas, lactate, long-lasting biodegradable organic substrates, air, oxygen gas, oxygen-releasing compounds, etc.), which can be affected by difficulty in dosage estimate, deliver frequency, heterogeneity in distribution, etc. In bioelectrochemical systems (BES), the electron transfer is continuously promoted/controlled in term of current or voltage application between the bioelectrodes, close to which electrochemically active microorganisms are located with the role of catalyst. BES has great promise in bioremediation as they are inexpensive, self-regenerating and sustainable.

The remediation processes that will be studied in this project are in situ BES treatments for chromium (VI), aliphatic chlorinated hydrocarbons, petroleum hydrocarbons and mixed groundwater pollution. Lab tests will be performed in order to select the proper "electro-active" microbial consortia and to investigate the effects of the different electrodes' materials, geometry, and operating conditions on the kinetics of the processes, taking into account the typical groundwater composition and contamination.

The research involves three Universities and one Research Institute, namely Politecnico di Milano - Dipartimento di Ingegneria Civile e Ambientale (POLIMI), Università di Roma Sapienza – Dipartimento di Chimica (UNIRMS), Università degli Studi di Milano Bicocca - Dipartimento di Scienze dell'Ambiente e del Territorio e di Scienze della Terra (UNIMIB), and Istituto per la Ricerca sulle Acque - Consiglio Nazionale delle Ricerche (IRSA-CNR), covering the different expertise that are needed.

Personale coinvolto: **Federico Aulenta, Carolina Cruz Viggi, Enza Palma**

Periodo di validità: **2016-2018**

Soluzioni Verdi

Biorimedio fitoassistito: una strategia verde per il recupero di aree contaminate e la valorizzazione di biomassa

Responsabile: **Vito Felice Uricchio**

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.

- *Attività: Utilizzo di tecniche di biorimedio fitoassistito finalizzate alla decontaminazione di aree multicontaminate e Trattamenti tecnologici per la valorizzazione della biomassa legnosa prodotta da interventi di biorimedio.*
  Responsabile scientifico: **Valeria Ancona**
  Personale coinvolto: **C. Campanale, G. Aimola, D. Losacco, C. Galeone, V. Uricchio**
- *Attività: Messa a punto di metodi per l'identificazione di microorganismi coinvolti nella decontaminazione*
  Responsabile scientifico: **Anna Barra Caracciolo**
  Personale coinvolto: **P. Grenni, G. Garbini, L. Rolando**

Periodo di validità: **2017-2020**

BIOWYSE

Biocontamination Integrated cOntrol Wet sYstem for Space Exploration

Responsabile: **Simona Rossetti**

Il progetto è finalizzato alla messa a punto di un sistema integrato di prevenzione, trattamento e monitoraggio della contaminazione microbiologica in acque destinate al consumo umano a bordo delle stazioni spaziali internazionali (ISS). Il progetto vede la partecipazione di European Science Foundation (Francia), Thales Alenia Space Italia, SMAT S.p.A. (Società Metropolitana Acque Torino), Università di Firenze (Italia), GL Biocontrol (Francia), AquiSense Technologies (Gran Bretagna) e Liewenthal Electronics (Estonia).

Partecipanti: **Caterina Levantesi, Stefano Amalfitano, Barbara Casentini, Diego Copetti, Fabrizio Stefani**

Periodo di validità: **2016-2019**

Bracco

Responsabile: **Claudio Di Iaconi**

Sono ormai numerose le attività industriali, anche economicamente rilevanti (industria conciaria, tessile, olearia, della carta, del petrolio, farmaceutica, ecc.), che producono effluenti liquidi di difficile trattabilità. Una delle principali criticità del trattamento è costituita dalla presenza di composti recalcitranti e xenobiotici, anche ad elevate concentrazioni, la cui rimozione è fonte di crescente preoccupazione per gli eventuali effetti inibitori e/o tossici sui microorganismi comunemente presenti negli impianti di trattamento. La presenza di tali inquinanti richiede, inoltre, ulteriori stadi di affinamento con conseguente aumento della complessità dello schema di trattamento. In tale contesto, l'Istituto ha svolto un'attività di ricerca mirata alla semplificazione e all'efficientizzazione degli schemi di trattamento mediante la combinazione di tecniche biologiche e processi di ossidazione avanzati. Tale attività ha portato allo sviluppo di un nuovo processo basato sull'integrazione della degradazione biologica con il trattamento chimico ossidativo all'interno di un sistema biologico realizzato ad hoc. Il processo sviluppato consente di ridurre drasticamente la complessità dello schema di trattamento, la produzione di residui solidi ed i costi di trattamento. Da alcuni anni è attiva una proficua collaborazione con la società Bracco Imaging spa, leader mondiale nella sintesi di composti per la diagnostica per immagini, la quale ha finanziato diversi progetti per testare il processo sviluppato per il trattamento degli effluenti prodotti nei loro siti produttivi.

Personale coinvolto: **Marco De Sanctis, Domenico Bellifemine, Silvia Chimienti, Giuseppe Sgaramella**

Periodo di validità: **2012-2019**

PLANETARY HEALTH

Cambiamenti climatici e salute nella vision "Planetary Health"

Responsabile: **Stefano Polesello**

Il progetto è finalizzato a produrre informazioni scientifiche originali, funzionali per impostare, condurre e seguire le azioni a supporto delle decisioni in tema di salute relativamente alla presidenza italiana del G7 (2017) sia per quanto riguarda la componente salute del vertice dei Capi di Stato di maggio 2017, che per quanto riguarda il settore sanitario nelle sue varie

formulazioni, culminanti nella riunione ministeriale di novembre 2017, focalizzate, in particolare, a definire e proporre una Strategia di mitigazione degli effetti dei cambiamenti climatici (CC) sulla salute dell'uomo e del pianeta, secondo la vision Planetary Health. Le attività di ricerca specifiche condotte nel progetto sul piano nazionale, saranno finalizzate ad approfondire le conoscenze per l'analisi di impatto e vulnerabilità delle aree fragili del paese - con particolare attenzione agli effetti indiretti di impatti ambientali sulla salute - per la formulazione di una strategia di prevenzione e mitigazione degli effetti negativi dei CC, e per la valutazione dell'efficacia delle strategie, nel contesto nazionale, anche al fine di proporre l'Italia come paese pilota a livello internazionale per la valutazione d'impatto dei cambiamenti climatici.

Personale coinvolto: **S. Valsecchi, F. Cappelli**

Periodo di validità: **2017-2018**

CAVE

Cave 2018 – Attività con Carabinieri del NOE

Responsabile: **Vito Felice Uricchio**

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.

Personale coinvolto: **C. Massarelli, V.N. Palmisano**

Periodo di validità: **2017-2020**

ANT-Biofilm

Colonizzazione microbica di ambienti bentonici in Antartide: risposte di abbondanze, diversità e attività microbiche ed insediamento larvale a disturbi naturali o antropici e ricerca di metaboliti secondari

Responsabile: **Stefano Fazi**

Lo scopo dello studio è quello di valutare in diversi siti di Baia Terra Nova (Tethys Bay e Road Bay), gli effetti potenziali causati da perturbazioni naturali o antropiche, quali contaminanti o acqua di scioglimento di ghiacciai, sul biofilm che si sviluppa su substrati artificiali a diversi livelli biologici (batteri, microalghe e comunità larvali). Durante due estati australi consecutive saranno effettuate due diverse attività sperimentali, considerando: il biofilm su substrati artificiali esposti a biofouling in siti influenzati da diverso impatto antropico, salinità, profondità.

Personale coinvolto: **Stefano Fazi, Carmela Caroppo**

Periodo di validità: **2017-2018**

Commissario straordinario per la realizzazione degli interventi necessari all'adeguamento e alla normativa vigente delle discariche abusive presenti sul territorio nazionale

Responsabile: **Vito Felice Uricchio**

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.

Personale coinvolto: **V. Ancona, D. Montecchio, A.M. Basile**

Periodo di validità: **2017-2020**

IdroLIFE

Conservation and management of freshwater fauna of EU interest within the ecological corridors of Verbano Cusio Ossola.

IdroLIFE si propone di migliorare lo stato di conservazione di specie ittiche ed astacicole di interesse comunitario (All. II Direttiva Habitat) attraverso interventi concreti di conservazione sulle specie nei Siti Natura 2000 del Verbano Cusio Ossola e di ripristino della percorribilità fluviale del Fiume Toce e del Torrente San Bernardino. Gli aspetti sui quali IdroLIFE intende agire sono, quindi, di natura faunistica (attività di riproduzione e di ripopolamento delle specie target, controllo di specie esotiche invasive), ambientale (interventi di deframmentazione), e di pianificazione (adozione di un Piano di Conservazione a ivello provinciale). Gli obiettivi specifici di IdroLIFE sono così riassumibili:

Ristabilire la continuità dei corridoi acquatici del VCO, più precisamente del Fiume Toce, attraverso la sua deframmentazione dal Lago Maggiore fino al primo ostacolo naturale invalicabile per una lunghezza di circa 60 Km intervenendo su 5 ostacoli, e del Torrente San Bernardino, dal Lago Maggiore al SIC Val Grande intervenendo su 1 ostacolo. Realizzare un incubatoio di proprietà pubblica finalizzato ad azioni di conservazione delle specie target di progetto (dimensionato per una produzione annua di 40.000 esemplari di Trota marmorata, 500 di Scazzone, 2500 di Pigo e Savetta). Migliorare lo stato di conservazione della popolazione di Trota marmorata nella ZPS IT1140017 "Fiume Toce", di Pigo e Savetta nella ZPS IT1140013 "Lago di Mergozzo e Mont'Orfano" e di Scazzone e Vairone nel SIC IT1140011" Val Grande", attraverso attività di ripopolamento. Migliorare lo stato di

conservazione e la distribuzione del Gambero d'acqua dolce nel SIC IT1140011 "Val Grande", attraverso la formazione e insediamento di nuove colonie in 4 aree vocate. Ridurre e controllare la diffusione di specie esotiche invasive (siluro, pesce gatto, acerina, persico sole, carassio, salmonidi esotici) nei Siti Natura 2000 della Provincia del VCO. Concepire, condividere e adottare una legislazione quadro per la conservazione delle specie target a livello provinciale e nei Siti Rete Natura 2000, attraverso la realizzazione e adozione di un Piano di Conservazione, che includa misure specifiche per evitare la diffusione delle specie esotiche invasive. Sensibilizzare cittadini e i portatori di interesse riguardo all'importanza del mantenimento della biodiversità acquatica. Realizzare attività di educazione ambientale, attraverso il coinvolgimento di bambini, giovani e adulti, la produzione di un filmato educativo e di una app smartphone per l'insegnamento scolastico. LIFE 15 NAT/IT/000823

Personale coinvolto: **Pietro Volta, Agatina Salanitro, Marina Ferrara, Igorio Cerutti, Paolo Sala, Roberta Piscia**

Periodo di Validità: **2016-2020**

SFD MBR

Convenzione tra SERECO S.r.l., Acquedotto Pugliese S.p.A. e IRSA CNR per la verifica della tecnologia innovativa Self-Forming Dynamic Membrane Bioreactor.

Responsabile: **Alfieri Pollice**

Realizzazione, installazione e verifica delle performance di un impianto pilota basato sull'integrazione della tecnologia FDG (Filtro a Dischi a Gravità) con i processi di trattamento biologico. L'obiettivo è di verificare, in scala significativa e presso un depuratore municipale, l'efficacia del processo Self Forming Dynamic Membrane Bioreactor, già oggetto di sperimentazioni in scala da banco. Coordinamento della attività di progettazione e verifica dei processi di un nuovo sistema integrato di depurazione biologica e separazione solido/liquido delle acque reflue anche ai fini del riutilizzo degli effluenti.

Personale coinvolto: **A. Pollice, P. Vergine, C. Salerno, G. Berardi, G. Pappagallo**

Periodo di validità: **2016-2018**

Dal Mare all'Orta, riapre nel bacino del Ticino l'ultima via ai laghi ancora chiusa alla migrazione Ittica

Fondazione Cariplo ha finanziato questo progetto finalizzato al ripristino della funzionalità ecologica del corridoio acquatico del Torrente Strona che mette in comunicazione il Lago d'Orta con il bacino del Lago Maggiore e del Fiume Po. Il progetto ha l'obiettivo di rendere percorribile tutto il tratto di torrente Strona a partire dall'abitato di Gravellona Toce fino quello di Omegna, sulle rive del Lago d'Orta. Il contesto del progetto è quello di migliorare lo stato ecologico del corso d'acqua e dello stesso lago d'Orta, già oggetto di un altro imponente progetto di riqualificazione ecologica (progetto IttiOrta).

Personale coinvolto: **Volta Pietro, Paolo Sala, Roberta Piscia, Monica Beltrami, Marina Ferrara, Agatina Salanitro**

Periodo di validità: **2017-2020**

MISCELE

Definizione di un approccio metodologico alla valutazione degli effetti combinati delle sostanze chimiche

Responsabile: **Paola Grenni, Anna Barra Caracciolo**

Il Progetto tra MATTM e IRSA-CNR ha lo scopo di definire degli approcci metodologici idonei alla valutazione degli effetti combinati (es. cumulativi, sinergici) delle sostanze chimiche sull'ambiente, con particolare riferimento agli ecosistemi acquatici. Tale obiettivo sarà realizzato analizzando quanto ad oggi sviluppato in ambito europeo ed internazionale, selezionando ed applicando alcuni modelli previsionali con dati sia teorici, che di monitoraggio. Il Progetto viene realizzato grazie anche alla collaborazione con l'Università di Milano Bicocca e alla costituzione di un apposito Gruppo di lavoro. Accordo di collaborazione Ministero dell'Ambiente e della Tutela del Territorio e del Mare e Istituto di Ricerca Sulle Acque- Prot. N. 26130 del 20.11.72018 – DVA-MATTM

Periodo di validità: **2018-2019**

DESERT

Responsabile: **Salvatore Camposeo**

Nei prossimi decenni una grande percentuale della popolazione mondiale vivrà in aree con scarsità idrica e scarsa qualità dell' acqua a causa dei cambiamenti climatici e dell' aumento della pressione demografica, quindi l' agricoltura dovrà affrontare la sfida di soddisfare la crescente domanda di cibo derivante dal tasso di crescita previsto della popolazione. Nella regione mediterranea, l' agricoltura irrigua contribuisce al 75% della produzione finale. La salinizzazione secondaria da acqua d'irrigazione è un problema crescente in tutto il mondo poiché una frazione sempre maggiore di terreno agricolo è impattata da essa. Nell'ambito della Call 2014 Water Works 2014-Eranet cofound del programma Horizon 2020, è stato proposto il progetto DESERT.

L'obiettivo generale del progetto è di sviluppare e sperimentare innovazioni sostenibili, tecnologiche e gestionali, che promuovano sul territorio, regionale, nazionale ed internazionale, il riuso di acque non convenzionali in agricoltura. La diffusione di tale pratica avverrà attraverso l'utilizzo di tecnologie che consentiranno di mettere a disposizione del settore primario risorse alternative che riducono al minimo gli impatti agronomici ed ambientali. Le innovazioni proposte riguardano:

- *la sperimentazione di tecnologie sostenibili e a basso costo di trattamento delle acque reflue urbane mediante l'uso di energie alternative;*
- *realizzazione di un sistema innovativo di monitoraggio in continuo delle acque a fini irrigui e gestione intelligente dei nutrienti;*

- *la definizione di protocolli per il calcolo di indici sintetici di qualità del suolo.*

Il progetto di durata triennale prevede, in particolare, la messa a punto di un prototipo di trattamento a basso costo delle acque reflue urbane per il riuso in agricoltura, che include trattamenti successivi attraverso filtrazione, ultrafiltrazione ed osmosi inversa per la rimozione dei sali. Il fabbisogno energetico dell'intero processo di trattamento sarà fornito da energia solare e le acque prodotte saranno utilizzate per fertirrigare due importanti specie arboree da frutto, olivo e mandorlo, presso le strutture sperimentali del DiSAAT dell'Università di Bari. Inoltre, sarà realizzato un sistema hardware & software innovativo per la gestione dei nutrienti in agricoltura attraverso il monitoraggio continuo dei nutrienti delle acque e, quindi, per la gestione della fertirrigazione. La maggiore disponibilità idrica derivante da fonti alternative da un lato scoraggerà lo sfruttamento e il conseguente deterioramento delle risorse idriche sotto-superficiali e dall'altro consentirà la sua valorizzazione per un riuso sostenibile in agricoltura.

Personale coinvolto: **Emanuele Barca**

Periodo di validità: **2017-2019**

VASES

Determinazione tassonomica di campioni macroalgali e classificazione dello stato ecologico mediante l'applicazione dell'indice MaQI

Responsabile: **Antonella Petrocelli**

Oggetto della convenzione è stata la valutazione dello stato ecologico di 27 corpi idrici di transizione in Sardegna tramite l'applicazione dell'indice MaQI, in ottemperanza alla Water Framework Directive (2000/60/CE).

A tal fine, facendo seguito ad un accordo già stipulato nel 2016, in primavera (maggio 2018) e autunno (ottobre 2018), si è provveduto alla valutazione della: 1. composizione specifica, in termini di componente fitobentonica, dei campioni raccolti, 2. biomassa (peso fresco sgocciolato in g) delle specie presenti, 3. composizione percentuale delle comunità, 4. presenza di specie non-indigene.

Personale coinvolto: **Antonella Petrocelli, Ester Cecere, Giuseppe Portacci**

Periodo di validità: **2018**

DiFoInFo

Responsabile: **Fabrizio Stefani**

Lo scenario progettuale nasce dallo studio di fattibilità "100 Fontanili dall'Adda al Ticino" all'interno del quale l'area del sud-est milanese è emersa come area strategica prioritaria per attuare gli interventi. Sono state considerate le esigenze ecologiche delle specie e degli habitat di riferimento, sono state abbozzate le modalità gestionali più opportune e le necessità di interventi strutturali su teste ed aste dei fontanili, orientando le scelte di intervento su aree nella disponibilità agli Enti proponenti. Il progetto sinteticamente prevede: il coordinamento

tecnico amministrativo delle azioni, la pulizia, la riqualificazione e rinaturalizzazione delle teste e delle aste dei fontanili, la realizzazione di interventi di miglioramento forestale delle fasce ripariali, azioni di comunicazione e sensibilizzazione, nonché un piano di monitoraggio della funzionalità ecologica e ambientale pre-post intervento. Il capofila del progetto è il Consorzio di Bonifica Est Ticino Villoresi. I partner sono: il Dipartimento di Scienze Agrarie e Ambientali. Produzione, territorio, agro energie (DISAA) dell'Università degli Studi Milano, l'IRSA-CNR, Legambiente Lombardia Onlus, il comune di Pantigliate, il comune di Peschiera Borromeo, il comune di Rodano ed il comune di Vignate.

Personale coinvolto: **Fabrizio Stefani, Laura Marziali**

Periodo di validità: **2016-2019**

Montedoglio

Diga di Montedoglio sul Fiume Tevere: attività per l'analisi della qualità chimico-fisica e microbiologica dei sedimenti nel bacino d'invaso

Responsabile: **Stefano Fazi**

L'Ente Acque Umbre Toscane (EAUT), il Centro Interuniversitario Per l'Ambiente (CIPLA) dell'Università degli Studi di Perugia e l'Istituto di Ricerca sulla Acque del Consiglio Nazionale delle Ricerche (IRSA-CNR) hanno stipulato una convenzione per lo svolgimento di attività di monitoraggio e ricerca al fine di mettere a punto strategie gestionali.

Personale coinvolto: **Stefano Fazi, Stefano Amalfitano, Carolina Cruz Viggi, Domenico Mastroianni, Francesca Falconi**

Periodo di validità: **2017-2018**

ARCTICDOC

DOC fractionation: dynamic of POPs and trace metals, emerging contaminants and cryopelagic community

Responsabile: **Nicoletta Ademollo, Luisa Patrolecco**

Le finalità del progetto riguardano le dinamiche che regolano gli scambi gassosi nelle interfacce aria/neve-ghiaccio/ acqua, il destino dei contaminanti in acqua e le risposte funzionali e strutturali della comunità microbica in funzione dei cambiamenti climatici. Particolare attenzione è rivolta alla comprensione del destino del materiale rilasciato nella colonna d'acqua a seguito dello scioglimento della neve-ghiaccio, attraverso indagini sul comportamento della sostanza organica, dei contaminanti e delle attività biologiche associate in funzione della stagionalità. Studio delle dinamiche che regolano il comportamento della sostanza organica, dei contaminanti e delle attività biologiche in funzione della stagionalità nel Mare Polare Artico. A tal fine sono svolte attività di campionamento e analisi di contaminanti organici prioritari (IPA, PCB, nonilfenoli), emergenti (composti perfluorinati-PFAS, residui farmaceutici), analisi microbiologiche e applicazione di tecniche di ultrafiltrazione a flusso tangenziale di campioni di acqua di mare (Mare Polare Artico -Isole Svalbard, Norvegia).

Personale coinvolto: **Jasmin Rauseo, Tanita Pescatore, Francesca Spataro**

Periodo di validità: **2016-2019**

Dry-flux

Responsabile: **Annamaria Zoppini**

The CO_2 emissions from dry freshwater systems represent a so far overlooked process in the global carbon cycle. Recent research indicates that drying and rewetting of freshwater sediments creates hot spots of carbon mineralization and thus CO_2 emissions, which are probably relevant on a global scale (Gómez-Gener et al., 2016; Reverey et al., 2016; Von Schiller et al., 2014). However, existing knowledge is scarce and mainly based on regional studies from e.g. U.S.A. (Gallo et al., 2014) or Spain (Gómez-Gener et al., 2016), investigating specific systems (either lotic or lentic), though underlying biogeochemical processes are assumed to be globally valid (Reverey et al., 2016).

Habitats with exposed sediments include ephemeral rivers and ponds as well as shallow sediments of lakes and reservoirs with large water level fluctuations. We hypothesize that CO_2 emissions from these sites is higher under dry conditions compared to the flooded phase and relevant on a global scale. To test this hypothesis we want to quantify CO_2 emissions from dry sediments in different types of dry habitats all over the globe. The CO_2 flux shall be measured by a simple static closed chamber approach. These flux measurements will be accompanied by a number of basic measurements (like temperature, sediment moisture, etc.) and site data to assess potential regulating factors. If data allow, we would also check the importance of CH_4 and N_2O emissions from dry sediments. We would like to generate a global dataset with the help of a number of selected international collaborators. The collection and interpretation of the dataset shall lead to a joint publication.

The IRSA contribution consisted to analyse 5 sediments of the temporary rivers within the Candelaro river Basin for physico-chemical characteristics, microbial communities properties and CO_2 flux of dry sediment and soil by automatic CO_2 analyser.

Personale coinvolto: **A. Zoppini, A.M. De Girolamo, M. Melita, F. Falconi, L. Patrolecco, N. Ademollo, B. Casentini**

Periodo di validità: **2017-2020**

IttiOrta

Ecologial restoration of Lake Orta.

Il ripristino ecologico dei corpi idrici è un elemento essenziale delle politihe ambientali nazionali ed europee. La WFD 2000/60/CE impone dealine stringenti per riportare al buono stato ecologico i laghi. In quexto progetto, cofinanziato dal demanio lacuale del Lago d'Orta, il CNR promuove una serie di attività di monitoraggio dello stato chimico fisico del Lago e di ripopolamento con le specie chiave utilizzate quali indicatori di buona qualità ambientale ai sensi delle normative attuali.

Personale coinvolto: **Pietro Volta, Silvia Galafassi, Roberta Piscia, Michela Rogora, Monica Beltrami**

Periodo di validità: **2016-2020**

Autostrade - Galleria Santa Lucia

Espletamento di attività tecnico – scientifiche volte alla caratteriz-zazione ecotossicologica in corso d'opera dei materiali da scavo derivanti dallo scavo meccanizzato della galleria Santa Lucia dell'autostrada A1 Barberino del Mugello–Calenzano

Responsabile: **Luisa Patrolecco**

IRSA-CNR/Autostrade per l'Italia SpA. Esecuzione di un'attività sperimentale volta alla valutazione di conformità ambientale dei materiali di scavo che si originano in corso d'opera (durata 24-36 mesi) dallo scavo meccanizzato per la costruzione della Galleria Santa Lucia, Barberino del Mugello, in ottemperanza a quanto indicato nel Piano di Utilizzo Terre (PUT). Coordinamento della sperimentazione iniziata a marzo 2017, in coincidenza con l'inizio dello scavo per la realizzazione della galleria e volta alla determinazione chimica del contenuto di tensioattivi anionici e alla valutazione di ecotossicità, utilizzando il batterio luminescente Vibrio fischeri, su elutriati prodotti delle terre e rocce che deriveranno dallo scavo stesso. Responsabili scientifici attività di laboratorio: Anna Barra Caracciolo, Paola Grenni

Personale coinvolto: **Anna Barra Caracciolo, Paola Grenni, Nicoletta Ademollo, Jasmin Rauseo, Francesca Spataro, Livia Mariani, Tanita Pescatore, Ludovica Rolando, Laura Dejana**

Periodo di validità: **2017-2020**

DNAqua-Net

EU COST Action CA15219 - Developing new genetic tools for bioassessment of aquatic ecosystems in Europe

Responsabile: **Stefano Fazi, Diego Fontaneto**

The goal of DNAqua-Net is to nucleate a group of researchers across disciplines with the task to identify gold-standard genomic tools and novel eco-genomic indices and metrics for routine application for biodiversity assessments and biomonitoring of European water bodies. Furthermore, DNAqua-Net provides a platform for training of the next generation of European researchers preparing them for the new technologies. Jointly with water managers, politicians and other stakeholders, the group develops a conceptual framework for the standard application of eco-genomic tools as part of legally binding assessments.

Personale coinvolto: **Stefano Fazi, Diego Fontaneto, Angela Boggero**

EU-MACS

EUropean MArket for Climate Services

Responsabile: **R. Giordano**

Horizon 2020 - Fighting and adapting to climate change. Project ref. 730500. Il progetto EU-MACS mira ad analizzare e valutare, a livello europeo, il potenziale mercato dei servizi climatici, analizzando barriere, opportunità, caratteristiche tecniche, scientifiche, legali, amministrative e socioeconomiche. L'IRSA contribuisce al progetto fornendo expertise in tema di gestione risorse idriche e adattamento ai cambiamenti climatici. In particolare, le attività svolte sono orientate all'analisi delle reti sociali ed istituzionali interessate alla gestione dei rischi collegati al clima.

Personale coinvolto. **R. Giordano, I. Portoghese, R. Matarrese**

Periodo di validità. **2016-2018**

FONTANAPULIA

FOtocatalizzatori NanosTrutturati e RAdiazioNe UV per un'Acqua più PULItA.

Responsabile: **G. Mascolo**

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.

Personale coinvolto: **S. Murgolo, R. Ciannarella, G. Bagnuolo**

Periodo di attività: **2018-2019**

Bilaterale CNR-CSIR

Improved Safe Management of Arsenic-rich Waste Generated from Arsenic Removal Plant.

Responsabile: **Barbara Casentini**

Arsenic (As) concentration in distributed drinking water exceeding the proposed safe limit of 10 µg/L (WHO) are often registered in South East Asia, especially West Bengal region, and some countries in Europe, Italy included. In India groundwater arsenic contamination was first reported from the state of West Bengal in 1983. The problem of arsenic contamination in ground water is known to have affected a population of about 50 million in different districts of India. Consumption of ground water with As >50 µg/L (Indian limit) in certain wells over a prolonged period of time has resulted in serious health hazards, especially among the rural and semi-urban population in these regions. Until 2010, in Italy more than one million of people were still drinking water with As >10 µg/L (EU limit)). In Italy it is not allowed anymore to distribute drinking water containing above 10 µg As/L since 2013. Therefore, many water treatment plants have been recently installed.

Given the increased application of arsenic removal technologies in response to more stringent regulations it can be expected that greater quantities of As-bearing waste will be generated. Up-to-date most successfully implemented removal technologies are coagulation and co-precipitation with addition of Al and Fe salts; sorption on filters (Activated Alumina, Granular Iron Hydroxides, Iron Coated Sand and Ion Exchange Resin); membrane filtration (Reverse Osmosis). Currently the disposal of arsenic rich sludge generated from the treatment processes includes landfilling, stabilization, cow dung mining, passive aeration, pond disposal and soil application. Management of As-rich sludge is one of the issues that has received little attention from vendors of the technologies and also from the users, especially in low income countries. Solid arsenic concentration in Iron filters varies greatly and reported range is 1-80,000 mg/kg. Usually, concentration is higher than 200 mg/m3. New frontiers in As-treatment technologies tend to commercialize filters with increasing adsorption capacity (>50 mgAs/gFe). So, there is a strong demand for development of environmentally safe and effective disposal methods for arsenic contaminated sludge out of water treatment system.

Evaluation of As-sludge leaching potential is often performed using chemical leaching procedures [Toxic Characteristic Leaching Procedure (TCLP) and Waste Extraction Test (WET)]. The crucial parameters to properly assess leaching behavior in actual landfill conditions were proved to be solution properties, test duration, experimental headspace and biotic processes.

In Italy waste produced by water treatment are disposed according to EU Directive 99/31/EC transposed into the National DM 27/9/2010 very recently modified by DM 24/6/2015. Waste produced by any water treatment plants are coded as CER 19 09 and classified as not hazardous. They can be directly disposed in landfill if compliant to the leaching test (As <200 µg/L as eluted by 1:10 solid/water on solid dry weight basis).

While landfills are commonly used for disposal of sludge and represent the main practice in Europe, in India rapid urbanization has made it increasingly difficult to find suitable landfill sites. Often, it is disposed of nearby rivers or low laying areas, which is likely to pollute surface and groundwaters. There is need to find more environmental friendly sludge disposal solutions for a long-term strategy. A possible feasible solution to reduce landfill or even improper disposal appears to be recycling of the sludge and use it for beneficial purposes.

Personale coinvolto: **Andrea Gianico, Stefano Fazi**

Periodo di validità: **2016-2018**

Autostrade PLUS

Incarico per l'espletamento di attività tecnico-scientifiche su additivi per lo scavo meccanizzato della Galleria Santa Lucia

Responsabile: **Anna Barra Caracciolo**

Il progetto ha come obiettivo quello di eseguire una sperimentazione di laboratorio in microcosmi contenenti due terreni provenienti da uno scavo di una galleria con EPB-TBM nella quale vengono effettuate determinazioni analitiche del tensioattivo anionico SLES, principale componente del nuovo prodotto commerciale da testare, per valutare sia la sua biodegradabilità che gli eventuali effetti ecotossici del terreno trattato a diversi tempi dal condizionamento (simulando la maturazione dei terreni nel sito di scavo).

Responsabile Scientifico attività di laboratorio: Luisa Patrolecco, Paola Grenni

Personale coinvolto: **Nicoletta Ademollo, Martina Di Lenola, Jasmin Rauseo, Martina Cardoni, Francesca Spataro, Ludovica Rolando, Tanita Pescatore, Livia Mariani**

Periodo di validità: **2018**

CASALE BUSSI

Indagine per la definizione dei valori di fondo geochimico naturale dei parametri inorganici previsti dal D.lgs. 152/06 (all. 5 tab. 2) relativamente ad un impianto di gestione rifiuti non pericolosi (T.M.B.), sito in località Casale Bussi nel territorio del Comune di

Responsabile: **E. Preziosi**

L'indagine riguarda un sito nel Comune di Viterbo (VT) dove è localizzato un impianto per la gestione di rifiuti non pericolosi (TMB) autorizzato alla Società ECOLOGIA VITERBO S.r.l. e comprenderà attività conoscitive nell'ambito della geologia, idrogeologia e geochimica.

In particolare l'attività di indagine sarà finalizzata alla definizione dei valori di fondo geochimico naturale dei parametri inorganici previsti dalla tabella 2 dell'allegato 5 del D.lgs 152/06, con particolare riferimento ad arsenico, fluoruri, ferro, manganese, nichel, che hanno presentato in passato concentrazioni maggiori delle relative CSC.

Personale coinvolto: **E. Preziosi, S. Ghergo, A. Zoppini, S. Amalfitano, D. Mastroianni, E. Frollini, D. Parrone, M. Melita, F. Falconi**

Periodo di validità: **2017-2018**

Indagini sulle sostanze pericolose nell' ecosistema del Lago Maggiore

Responsabile: **Licia Guzzella**

Il programma di indagini è stato formulato sulla base delle linee di azione della CIPAIS per il Lago Maggiore, per soddisfare l'obiettivo specifico di conoscenza teso a verificare la concentrazione di microinquinanti e/o sostanze pericolose emergenti rilevabili nelle acque

comuni e nei diversi comparti dell'ecosistema, prestando attenzione ad evitare sovrapposizioni con le attività istituzionali degli Enti preposti al monitoraggio ambientale. In particolare questo programma di indagini si articola su tre linee:

1) continuare la naturale e necessaria implementazione delle serie storiche e delle conoscenze acquisite nell'arco di 16 anni grazie ai finanziamenti della CIPAIS su alcuni parametri di valutazione (DDT e Mercurio);

2) introdurre nuove analisi relative a composti di recente introduzione (NBFR) da analizzare sulla fauna ittica e sui sedimenti dell'ecosistema, già individuati nel Lago e/o nel suo bacino imbrifero attraverso studi indipendenti;

3) intensificare il monitoraggio biologico del fiume Toce, in relazione ai possibili rischi di contaminazione legati all'avvio della bonifica del sito di interesse nazionale di Pieve Vergonte, prevista entro la fine del 2016.

Personale coinvolto: **Licia Guzzella, Laura Marziali, Lucia Valsecchi, Claudio Roscioli**

Periodo di validità: **2016-2021**

IProPBio

Integrated Process and Product Design for Sustainable Biorefineries

Responsabile: **Pastore C.**

Bio-based economy in Europe involves 22 million people and turns over roughly 2.4 billion €. The full realization of its huge potential, however, requires expert knowledge and synergy of different competencies. In particular, key questions and bottlenecks awaiting clear answers are:

- *How to design and integrate flexible and product-tailored processes for the available biomass feedstocks?*
- *How to integrate chemical and biochemical routes into sustainable biorefining of the given feedstocks?*
- *How to relate the biomass extraction and separation processes with the properties of the desired products and the sustainable utilization of the depleted matrices?*
- *How the production processes can be integrated into closed loop production?*

The overall goal of IProPBio is to exchange complementary theoretical and experimental knowledge of research Staff while looking for innovative answers to such important questions. IProPBio is divided in 4 research oriented work packages plus two supporting packages for internal knowledge sharing and results dissemination. Alternative feedstock and high-value products characterization; thermodynamic data analysis and properties prediction; alternative technological flowsheets for economic and eco-compatible conversion of waste biomass into high value products; mass and energy integration studies to reduce wastes and enhance the profitability; life cycle assessment to determine the net contribution of the best designs to environmental pollution, are the main issues approached in the work packages.

IPropBio will significantly impact:

- *the competitiveness of EU bioeconomy*

- *participants' potential and new carrier perspectives*
- *exchange and transfer of high-quality multidisciplinary knowledge, advanced expertise, research and innovation between academic and non-academic participants in EU member states and third countries through the dissemination of the results achieved to target groups and the general public*

Personale coinvolto: **Pastore C., di Bitonto L.**

Periodo Validità: **2017-2020**

SERV_FORFIRE

Integrated services and approaches for assessing effects of climate change and extreme events for fire and post fire risk prevention (JPI Climate project)

Responsabile: **A. Lo Porto**

One of the main objectives of SERV_FORFIRE is to improve the quality of services and approaches for assessing effects of climate change on fire and post fire risk in order to define suitable strategies for prevention and mitigation actions. 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 climatic time scales. Fire Risk and Post Fire Risk estimation procedures will be developed and setup accordingly. The project will develop and deliver specific climate monitoring products to help to evaluate the impacts of climate, climate variability and climate change over vegetation, estimation of fire and post fire risk, mitigation strategies and will help to better understand the challenges over different key areas, either due to the participation of countries in different geographic regions spanning from Mediterranean to Northern and Arctic EU or linked to sectors of primary interest as rural areas and agriculture, fire in the wildland urban- interface, citizen health.

Personale coinvolto: **A. Lo Porto, A.M. De Girolamo**

Periodo di validità: **2017-2020**

Accordo bilaterale CNR - MTA

Interdisciplinary collaboration between pharmacology and environmental sciences to assess drug occurrence in the environment by using advanced spectrochemistry and analytical methods

Responsabile: **Anna Barra Caracciolo**

The environmental impact of pharmaceuticals and their metabolic products has been the subject of extensive research all over the world. Most pharmaceuticals can reach the environment, primarily in natural water, through human consumption and excretion or through improper disposal and are often eliminated ineffectively by wastewater treatment plants. Once in the water, they can have subtle effects on ecosystem biota and on humans through use of contaminated drinkable water. Italian and Hungarian researchers involved in this project have

a longstanding experience in dealing with this problem. The collaboration aims to assess in a holistic approach the environmental and health impacts of pharmaceutical mixtures on the water ecosystems in order to update and to rationalize monitoring plans for evaluating pharmaceutical contamination. For this purpose, experts in various fields (analytical chemistry, pharmacology, toxicology, microbiology) have been collaborating in a common research on this topic.

Personale coinvolto: **Paola Grenni, Luisa Patrolecco, Nicoletta Ademollo, Martina Di Lenola, Francesca Falconi, Domenico Mastroianni, Jasmin Rauseo**

Periodo di validità: **2016-2018**

Interventi per esplorazione dei fenomeni carsici

Responsabile: **Mario Parise (IRPI)**

La Regione Puglia nell'ambito delle sue attività istituzionali ha deciso di avviare una attività di studio di alcuni fenomeni carsici di particolare rilievo. In particolare nella L.R. 30/12/2013, n. 45, l'art. 45 "Interventi per esplorazione dei fenomeni carsici" riporta che la Regione Puglia ha istituito uno stanziamento di 100.000 € per l'anno 2014 per "finanziare attività esplorative di fenomeni carsici di recente rinvenimento, in particolare per quelli che presentano rilevante interesse scientifico, per estensione, tipologia e morfologia, perché diretto prevalentemente alla verifica della qualità e quantità delle acque sotterranee". La stessa Regione ha individuato il CNR-IRPI, per il quale il responsabile scientifico è il dott. Mario Parise, quale coordinatore dell'esecuzione delle attività.

L'IRSA svolgerà attività di monitoraggio di campo che, come ben noto, fornisce indicazioni utili sull'andamento dei percorsi preferenziali del flusso idrico nelle fessure del sottosuolo. In particolare il monitoraggio delle acque sarà svolto in ambiente ipogeo; questo monitoraggio è un'attività difficile ma necessaria per la piena comprensione delle cavità sotterranee e del loro funzionamento idraulico ed idrogeologico. Le attività sono finalizzate alla predisposizione di uno studio modellistico capace di valutare il bilancio idrologico sotterraneo, dopo aver definito il bacino di alimentazione dell'area di studio, nonché il relativo deflusso verso il mare.

Personale coinvolto: **Michele Vurro, Costantino Masciopinto, Serena Liso**

Periodo di validità: **2015-2018**

Ledvance

Attività Sperimentali finalizzate alla ricognizione della qualità delle correnti acquose in entrata/uscita dal trattamento acque di processo c/o Ledvance per l'individuazione di una configurazione ottimale per la loro depurazione.

Responsabili: **C. Di Iaconi, G. Mascolo**

Al fine di poter proporre rimedi/miglioramenti adeguati alla filiera di trattamento delle acque reflue dello stabilimento della Ledvance S.p.A., è stata eseguita una breve attività volta alla

ricognizione della qualità delle correnti che entrano ed escono dal trattamento nonché alla verifica sperimentale (su scala da banco) di trattamenti aggiuntivi volti al miglioramento delle caratteristiche di degradabilità del refluo al fine di migliorare la qualità dell'effluente finale. Tale attività hanno riguardato:

- *i) la misurazione del pH dell'effluente dello stadio di trattamento primario al fine di valutare se vi sono delle oscillazioni di pH,*
- *ii) ii) la caratterizzazione della concentrazione del COD, azoto ammoniacale, azoto ossidato (nitroso e nitrico) ed altri parametri tecnologici rilevanti ai fini della caratterizzazione delle varie coppie di reflui e della valutazione dell'efficienza dello stadio biologico per la rimozione del COD e dell'azoto,*
- *iii) iii) la caratterizzazione della concentrazione di tensioattivi non ionici nelle varie coppie di reflui al fine di valutare l'efficienza di rimozione dei tensioattivi nello stadio biologico e le oscillazioni della concentrazione in ingresso allo stadio biologico,*
- *iv) iv) test di degradazione con vari sistemi di ossidazione avanzata (ozono/acqua ossigenata, ozono a pH alcalino, radiazioni ultraviolette/acqua ossigenata) su ciascuna coppia di effluenti al fine di valutare l'opportunità di inserire uno stadio di trattamento di ossidazione avanzata in alternativa o in combinazione dello stadio biologico aerobico.*

Personale coinvolto: **M. De Sanctis, R. Ciannarella**

Periodo di attività: **2018**

Biolink

Linking belowground biodiversity and ecosystem function in European forests

Responsabile: **Anna Barra Caracciolo**

European forests are of immense importance to both society and the environment, providing a range of products and ecosystem services many of which are threatened by climate change. Our understanding of forest diversity, especially belowground, is currently limited and spread over distinct trophic levels. Little is known about the redundancy and functional diversity in forest soils. The aim of the project is to create a forum where current understanding of functional belowground biodiversity at different scales and trophic levels in European forests can guide the development of prescriptions for sustainable forest and tree crop management.

Personale coinvolto: **Paola Grenni, Martina Di Lenola, Martina Cardoni**

Periodo di validità: **2014-2018**

Mangiafanghi

Responsabile: **Claudio Di Iaconi**

La gestione dei fanghi di depurazione rappresenta attualmente una delle maggiori criticità del ciclo di trattamento delle acque di scarico. Infatti, sebbene il volume dei fanghi prodotti da un

depuratore di reflui urbani rappresenti solo l'1-2% del volume delle acque reflue che affluisce all'impianto, il suo trattamento e smaltimento finale può arrivare ad incidere fino al 60% sui costi della depurazione.

Pertanto, la problematica sopra riportata costringe a considerare con sempre maggiore attenzione nuovi sistemi/strategie che siano in grado di ridurre la produzione dei fanghi di supero

L'obiettivo del progetto Mangiafanghi, finanziato dalla Regione Puglia (FSC 2007/2013, Programma regionale a sostegno della specializzazione intelligente e della sostenibilità sociale ed ambientale. Intervento "Cluster tecnologici regionali"), è la valutazione su scala dimostrativa della sostenibilità economica ed ambientale di una nuova tecnologia (nota con l'acronimo SBBGR – Sequencing Batch Biofilter Granular Reactor) sviluppata dall'IRSA-CNR. Tale sistema è in grado di ridurre, rispetto alle tecnologie di depurazione convenzionali, la produzione di fango fino al 80%.

L'obiettivo finale verrà raggiunto attraverso:

1) *la progettazione, la realizzazione, la conduzione e la gestione di un dimostratore di impianto SBBGR da 3.500 abitanti equivalenti da installare presso il depuratore dell'agglomerato di Putignano;*
2) *Il monitoraggio e l'ottimizzazione delle prestazioni del dimostratore in termini di rimozione degli inquinanti convenzionali ed emergenti, produzione fanghi ed emissione di sostanze odorigene;*
3) *la valutazione del ciclo di vita della soluzione innovativa proposta*

Personale coinvolto: **Marco De Sanctis, Giuseppe Mascolo, Angela Volpe, Silvia Chimienti, Valerio Guido Altieri, Domenico Bellifemine, Ruggiero Ciannarella, Sgaramella Giuseppe**.

Periodo di validità: **2016-2018**

Metodi predittivi per lo studio del flusso preferenziale nella zona insatura in rocce porose e fratturate

Responsabile: **Maria Clementina Caputo**

L'acqua si infiltra in superficie e attraversa la zona insatura secondo vari meccanismi. Può muoversi rapidamente, seguendo percorsi di flusso preferenziali verticali, lateralmente lungo discontinuità litologiche, stratigrafiche, tettoniche oppure più lentamente in modo diffuso attraversando suoli o rocce. L'acqua, quindi, si muove nel sottosuolo come flusso in parte diffuso e in parte preferenziale. Tale suddivisione ha un grande impatto sugli ecosistemi, sull'agricoltura e sulle risorse idriche poiché determina la quantità dell'acqua e la velocità con cui si distribuisce tra superficie, zona insatura e falda. Ad esempio, quando l'infiltrazione si verifica su terreni estremamente secchi, la componente di flusso preferenziale che contribuisce alla ricarica diventa predominante a scapito di quella che, attraversando il suolo, gli conferisce l'umidità necessaria per le piante. Prevedere il percorso, la velocità e le modalità con cui l'acqua si muove, quindi, è fondamentale per molte questioni idrologiche quali:

- *ricarica degli acquiferi, in quanto i flussi preferenziali sono in grado di veicolare notevoli quantità di acqua influenzando fortemente l' efficacia del processo di ricarica;*
- *trasporto di contaminanti, in quanto la previsione dei flussi di acqua, tempi di trasporto, quantità di contaminante trasportato, insieme alle dinamiche delle reazioni chimiche sono tutti aspetti estremamente sensibili ai flussi preferenziali;*
- *effetti dei cambiamenti climatici sulla disponibilità e qualità dell' acqua, in quanto i flussi preferenziali sono influenzati dall'intensità, frequenza e durata degli eventi meteorici eccezionali, condizionando la relazione quantitativa tra infiltrazione preferenziale e diffusa, connessa ad eventi episodici o continui.*

Personale coinvolto: **Maria Clementina Caputo, Lorenzo De Carlo, Rita Masciale**

Periodo di validità: **2016-2018**

Microplasma

Micro and maCRO PLAStic pollution Monitoring with Advanced technologies

Responsabile: **Vito Felice Uricchio**

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).

Personale coinvolto: **C. Campanale, C. Massarelli**

Periodo di validità: **2017-2020**

MATTM

Ministero dell'Ambiente e della Tutela del Territorio e del Mare

Responsabile: **Vito Felice Uricchio**

Il 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).

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***).*

Periodo di validità: **2017-2018**

MAUI

Monitoraggio continuo per le Acque reflue Urbane ed Industriali per l'eco-industria – Regione Lombardia

Responsabile: **Vito Felice Uricchio**

Il progetto è centrato sulla realizzazione di tecniche per il campionamento in continuo delle acque reflue urbane ed industriale ed alla identificazione di processo/prodotto trasferibile alla compagine industriale e finalizzato alla riduzione/monitoraggio dei costi del servizio. Obiettivo generale del progetto è la realizzazione di un prodotto/processo finalizzato alla verifica in tempo reale/monitoraggio delle emissioni in fogna civili ed industriali. Il risultato previsto dal progetto è essenzialmente legato alla produzione di software e di norme tecniche operative; è frutto di collaborazione decennale tra Aziende ed Enti di ricerca e prevede cooperazione continua tra i proponenti. Con maggiore dettaglio nell'ambito del progetto è previsto lo sviluppo di un sistema di trattamento dei dati provenienti dai sensori (sia in acqua che in vapore) idonei a fornire dati di tipo analitico chimico/fisico secondo quanto richiesto dalla normativa italiana ed europea relativa al campo di applicazione delle acque reflue destinate allo smaltimento in fogna. La stessa metodica, opportunamente validata in sede progettuale, potrà esse utilizzata per dati relativi processivi tipo industriale che utilizzano soluzioni acquose di vari elementi. Partendo dall'acquisizione di informazioni di dettaglio sull'andamento della qualità e quantità di refluo che transita in un tratto fognario indisturbato è stato individuato un set di parametri minimo e ottimale per la descrizione degli eventi che tipicamente caratterizzano il funzionamento di un sistema di collettamento reflui (variazioni di portate e carico, scarichi anomali, eventi meteorologici eccezionali). Sulla base dei dati raccolti dal monitoraggio chimico/fisico si effettua l'analisi integrata dei parametri e delle informazioni disponibili, concorrendo a sviluppare conoscenza utile a comporre un quadro completo sulla composizione dei reflui individuando anche la presenza di inter correlazione tra i diversi parametri, le diverse relazioni tra i parametri e gli eventi. Metodiche primarie si riferiscono ad applicazioni di Reti Neurali Artificiali, di sistemi Intelligenza Artificiale con risoluzione numerica di sistemi complessi ed approssimati di equazioni (pattern recognition, simiglianza,

etc.). Il progetto mira alla realizzazione di un sensore innovativo in grado di riconoscere episodi di contaminazione attraverso l'identificazione di specifici pattern.

Personale coinvolto: **A. Calabrese, M. Blonda, L.M. Guzzella, S. Polesello, S.M. Valsecchi**

Periodo di validità: **2017-2019**

NAIAD

NAture Insurance value: Assessment and Demonstration

Responsabile: **R. Giordano**

Descrizione. Progetto H2020 Grant Agreement No 730497. Il progetto è incentrato sullo sviluppo di approcci basati sull'impiego di Nature Based Solutions (NBS) finalizzati alla riduzione di rischi connessi ad eventi estremi, quali soprattutto inondazioni e siccità. NAIAD mira ad implementare approcci interdisciplinari finalizzati a:

1) *conoscere e massimizzare i servizi ecosistemici associati a tali soluzioni;*
2) *migliorare la conoscenza e supportare l'accettabilità di NBS da parte di stakeholder locali.*

Il progetto si basa sull'analisi di una serie di casi studio in Europa, differenti per scala geografica e tipo di rischio, attraverso cui definire modelli tecnici ed economici validi e replicabili in altre realtà. L'IRSA ha responsabilità scientifica del WP3 ' Social risk Assessment and Institutional framework'.

Personale coinvolto. **R. Giordano, A. Pagano**

Periodo di validità. **2017-2019**

NETSIGN

Network innovativo di sensori avanzati per il monitoraggio ambientale

Responsabile: **Vito Felice Uricchio**

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.

Personale coinvolto: **C. Massarrelli**

Periodo di validità: **2017-2020**

MEPROWARE

Novel methodology for the promotion of treated wastewater reuse for Mediterranean crops improvements

Responsabile: **Alfieri Pollice**

Il progetto propone una metodologia per favorire l'effettiva applicazione delle pratiche di riutilizzo irriguo dei reflui depurati nei paesi del Mediterraneo. Attività: Preparazione della proposta progettuale, definizione e coordinamento del progetto internazionale (Spagna, Portogallo e Italia), coordinamento delle attività sulla caratterizzazione delle acque destinate al riutilizzo irriguo e delle attività sulle valutazioni socio-economiche e coinvolgimento degli stakeholder. Bando Eranet/JPI Water Waterworks2014

Personale coinvolto: **A. Pollice, R. Giordano, P. Vergine, C. Salerno, G. Berardi, G. Pappagallo**

Periodo di validità: **2016-2018**

Optimized Nutrients Recovery from Wastewater Treatment Sludge

Responsabile: **Maria Concetta Tomei**

Il progetto è focalizzato sul recupero di nutrienti (soprattutto fosforo) da fanghi prodotti nella depurazione di reflui urbani mediante precipitazione quale prodotto ad alto valore aggiunto (struvite). Il fosforo scarseggia a livello globale per cui si rendono necessarie strategie di recupero da varie fonti e in varie forme. La struvite (ortofosfato di P e Mg), è considerato un buon fertilizzante. E' stato effettuato uno studio per l'implementazione della rimozione biologica del fosforo allo schema attuale di processo a fanghi attivi del depuratore di Nosedo, il principale sito di trattamento delle acque reflue della città di Milano. La possibilità di integrare un comparto anaerobico in testa al processo biologico è stata analizzata attraverso delle simulazioni eseguite con il software di calcolo ASCAM (Activated Sludge Computer Aided Modelling). Le simulazioni, applicate ad un unico modulo dell'impianto, sono state condotte in stato stazionario e forniscono una prima valutazione delle caratteristiche dimensionali della nuova configurazione impiantistica al variare delle condizioni operative. I risultati conseguiti saranno alla base di uno studio successivo in cui sarà considerata la variabilità temporale dell'influente in termini di portata e concentrazioni caratteristiche (analisi dinamica).

Personale coinvolto: **M. C. Tomei, V. Stazi, D. Mosca Angelucci**

Periodo di validità: **2015-2018**

PESFOR-W

Payments for Ecosystem Services (Forests for Water)

Responsabile: **A. Lo Porto**

The PESFOR-W COST Action will consolidate learning from existing woodlands for water PES (Payment for Ecosystem Services) 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.

Personale coinvolto: **A. Lo Porto**

Periodo di validità: **2017-2020**

LIFE-PHOENIX

Perfluorinated compounds HOlistic ENvironmental Interistitutional eXperience

Responsabile: **Stefano Polesello**

The LIFE PHOENIX project aims to apply and demonstrate an innovative and holistic approach to manage important cases of pollution from mobile and persistent chemicals at regional scale. After 16 months of activities the project achieves some of the first goals, such as the establishment of a Permanent Regional Commission on PFAS problem together with a scientific-technical expert Committee which exchanges information with project partners. The development of a forecast tool to predict PMOC diffusion, and in this specific case PFAS, on rivers and groundwater for the risk assessment, which represents one of key goals of the LIFE PHOENIX project, necessary to implement the data warehouse and will be proposed as forecast tool, as well as the development of early warning systems by cellular biomarkers are in progress. Pilot Plant for phytodepuration completed its demonstration phase and the chemical analyses, necessary to validate the system, are almost completed. First year of monitoring in agricultural areas has been concluded. Water, soil, agricultural products and resident animals have been collected in ten areas impacted by PFAS at different levels on a monthly base both in the irrigation and non-irrigation seasons. Method of analysis for all these matrices have been developed and validated and the analysis of hundreds of collected samples is currently in progress. Materials for communication and dissemination to general audiences have been prepared, while dissemination activities to the scientific community has been carried out by participation in congresses and by scientific networking website.

Personale coinvolto: **Stefano Polesello, Sara Valsecchi, Francesca Cappelli, Claudia Ferrario**

Periodo di validità: **2017-2020**

PerFORM WATER 2030

Platform for Integrated Operation Research and Management of Public Water towards 2030

Responsabile: **Licia Guzzella**

PerFORM WATER 2030 intends to create a long-term experimental platform for research, development and validation of innovative technologies, processes and decision-making tools, in order to assure an increasingly efficient management of the public urban water. The project aims to support water utility managers, so that they can act as key players and promoters of

innovation in the water sector. The project will take place in various wastewater treatment plants managed by CAP Group in the Metropolitan City of Milan and it will focus on 4 main thematic areas:

Water: The key aspects of this thematic area are the monitoring of drinking water quality and the optimization of distribution networks, the monitoring and removal of emerging contaminants, the monitoring and reduction of gaseous emissions into atmosphere, the optimization of wastewater treatment processes.

Biosolid valorization: The planning and activation of measures to reduce the quantity of sludge produced during the purification phase is envisaged. This line of action also includes an action aimed at thermally exploiting the sludge, recovering energy and raw materials from purification activities.

Recovery of energy and materials: This thematic area is addressed to the recovery of materials and energy in wastewater treatment plants, the upgrade of biogas to biomethane and the optimization of anaerobic digestion.

Economic and social issues: An extensive assessment of the economic and social acceptance of new technologies is carried out by involving stakeholders and by an advanced analysis of costs and pricing strategies for the water service.

PerFORM WATER 2030 project is funded within the framework of the European Regional Development Fund 2014-2020 and the Lombardy Region call "Accordi per la Ricerca e l'Innovazione".

Personale coinvolto: **Licia Guzzella, Laura Marziali, Stefano Polesello, Sara Valsecchi, Lucia Valsecchi Maria Teresa Palumbo, Francesca Cappelli, Stefano Tasselli, Claudio Roscioli**

Periodo di validità: **2018-2021**

Polieco

Responsabile: **Claudio Di Iaconi**

Il progetto mira a favorire il riciclo e recupero dei beni a base di polietilene al termine del loro ciclo di vita attraverso la riduzione del consumo di acqua e quantitativo di fango prodotto nella fase di lavaggio. Il progetto riguarda la valutazione dell'applicazione del sistema SBBGR (Sequencing Batch Biofilter Granular Reactor), sviluppato dell'IRSA-CNR, per il trattamento delle acque di lavaggio dei beni e/o rifiuti a base di polietilene al fine di ridurre il quantitativo di fanghi che solitamente viene prodotto durante la depurazione di tali acque. Il sistema SBBGR è in grado di ridurre fino al'80% il quantitativo di fango che solitamente si produce negli impianti di depurazione tradizionali. Il trattamento mediante SBBGR verrà potenziato anche chimicamente al fine di migliorare la qualità dell'effluente (e consentire agevolmente il suo riutilizzo) e del fango finale.

Personale coinvolto: **Marco De Sanctis, Domenico Bellifemine, Valerio Guido Altieri**

Periodo di validità: **2018-2019**

CISA-HMF

Produzione di Idrossi-Metil Furfurale (HMF) da biomasse di scarto e/o materie prime seconde agroalimentari

Responsabile: **Carlo Pastore**

Un nuovo processo di valorizzazione sarà testato ed applicato su scala pilota per la conversione in idrossimetilfurfurale (HMF) dei carboidrati più o meno complessi (anche di natura cellulosica) presenti negli scarti agroindustriali e nei rifiuti solidi urbani. Sin dal 2004, il Laboratorio Nazionale delle Energie Rinnovabili (NREL) del Dipartimento di Energia degli U.S. (DOE) ha diffuso una lista di 12 molecole di potenziale interesse mondiale ed ottenibili per trasformazione termochimica dei carboidrati. In questa lista sono riportati anche l'acido levulinico e l'acido 2,5-Furan dicarbossilico (FDCA), entrambi derivabili da HMF. Sebbene la sua sintesi sia stata ampiamente studiata, e quand'anche fossero stati individuati dei metodi di sintesi efficaci, spesso questi erano anche caratterizzati da serie limitazioni, quali l'elevato impatto ambientale associato: uso di catalizzatori a base di cromo e stagno, di solventi cancerogeni, di liquidi ionici a base di sali di ammonio o di imidazolio, di fatto efficaci e convenienti, posponevano però un grave problema di smaltimento dei residui. In questa attività collaborativa si testeranno tecnologie semplici e condizioni relativamente blande già verificate in scala laboratorio, anche su matrici reali complesse ad elevato contenuto di carboidrati. L'efficiente conversione dei carboidrati di mirati scarti agroindustriali e FORSU in HMF, produrrebbe due immediati benefici: la riduzione dei relativi attuali costi di produzione della molecola target, per una più ampia disponibilità ed economicità della risorsa di partenza adoperata e la concomitante gestione sostenibile di rifiuti da smaltire.

Personale coinvolto: **Pastore C., di Bitonto L., Locaputo V., Menegatti S.**

Periodo di validità: **2017-2018**

Programma di monitoraggio dei residui dei prodotti fitosanitari nei corpi idrici superficiali e sotterranei pugliesi e definizione delle relative reti di monitoraggio

Responsabile: **Vito Felice Uricchio**

Il presente Programma ha come obiettivo la definizione della rete di 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 l'articolazione del Programma è volta, in linea con la strategia comunitaria e nazionale e con gli indirizzi tecnico–scientifici di ISPRA, 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. In particolare, è necessario tenere conto delle sostanze nell'ambiente e delle loro proprietà ecotossicologiche.

Personale coinvolto: **C. Massarelli, M. Vurro, V. Ancona, V.N. Palmisano**

Periodo di validità: **2017-2018**

Programma di monitoraggio di acque sotterranee con tecniche biomolecolari fonti di inquinamento da nitrati

Responsabile: **Vito Felice Uricchio**

La presente azione pilota è finalizzata all'individuazione delle potenziali fonti di contaminazione distinguendo l'origine del nitrato da fertilizzanti minerali, effluenti zootecnici, reflui urbani, fanghi di depurazione, etc.

Di conseguenza gli obiettivi prioritari della presente azione sono:

- *identificazione con maggiore certezza 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;*
- *possibilità di ispirare azioni di mitigazione più 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.*

Personale coinvolto: **A. Calabrese, C. Campanale, C. Ancona.**

Periodo di validità: **2017-2020**

ARPA-Diossine

Programma di ricerca per la messa a punto di idonee metodiche analitiche sviluppando al massimo le prestazioni ottenibili con strumentazione quali spettrometria di massa in bassa risoluzione (LR) e spettrometria di massa interfacciata a cromatografia liquida.

Responsabile: **G. Mascolo**

Con il presente progetto l'ARPA Puglia, in riferimento ai D.M. 56/2009 e 260/2010 nei quali sono riportati gli standard di qualità per le sostanze chimiche dell'elenco di priorità, di cui alle tabelle 1/A, 2/A e 3/A degli stessi Decreti, nonché per gli altri inquinanti non appartenenti all'elenco di priorità, di cui alle tabelle 1/B, 2/B e 3/B degli stessi Decreti, ha inteso verificare e mettere a punto idonee metodiche analitiche sviluppando al massimo le prestazioni ottenibili con la strumentazione della spettrometria di massa in bassa risoluzione relativamente al

monitoraggio della presenza di alcuni inquinanti, tra cui i Difenileteribromati, le Diossine, i Furani e i PCB diossina simili in matrici ambientali quali acque, sedimenti e top-soil.

Personale coinvolto: **R. Ciannarella, G. Bagnuolo**

Periodo di validità: **2014-2019**

Protezione delle Oloturie

Responsabile: **Ester Cecere**

Con il Decreto Ministeriale 27 febbraio 2018 "Divieto della pesca delle Oloturie", pubblicato nella Gazzetta Ufficiale della Repubblica Italiana n. 88 del 16.4.2018. il Ministero delle politiche agricole alimentari e forestali (MIPAAF) ha vietato la pesca, la detenzione e lo sbarco delle oloturie, Echinodermi comunemente noti come "cetrioli di mare", presenti nel Mar Mediterraneo con numerose specie. Le ragioni del divieto sono da ricercare nella pesca incontrollata di questi organismi marini che vengono esportati nei Paesi orientali dove rappresentano un alimento "di lusso" nella cucina tradizionale. Ma i "cetrioli di mare" svolgono un ruolo ecologico troppo importante e il depauperamento delle popolazioni di oloturie comporta il rischio di sconvolgere gli equilibri degli ecosistemi marini costieri.

I ricercatori del CNR-IRSA hanno significativamente contribuito a questo importante risultato fornendo al MIPAAF il supporto scientifico necessario ad emanare questa norma.

Già nel 2016, a seguito di un grosso sequestro di oloturie, le considerazioni scientifiche fornite dalla Sede di Taranto avevano supportato il Tribunale di Taranto nel denunciare che "la pesca abusiva di tonnellate di esemplari di oloturie, asportando totalmente dai fondali marini tale specie, causa un grave danno alla biodiversità presente nei tratti di mare interessati, nonché l'alterazione grave ed irreversibile dell'ecosistema marino".

In particolare, è stato evidenziato il ruolo ecologico delle oloturie: sono dei detritivori che ingeriscono il sedimento e si nutrono delle particelle di materiale organico (microalghe, batteri, ecc.) in esso contenuto, fungendo da biorimediatori naturali, capaci di assimilare e abbattere i batteri, compresi quelli potenzialmente patogeni, e di fornire alle popolazioni rivierasche un servizio "eco-friendly" di depurazione degli inquinanti batterici presenti nell'ambiente marino. Inoltre, i "cetrioli di mare" svolgono nell'ecosistema marino altre importanti funzioni quali, ad esempio, contribuire ad impedire l'insorgere di crisi anossiche e a favorire l'insediamento delle fanerogame marine, Posidonia oceanica e Cymodocea nodosa, importantissime specie degli ambienti marini e salmastri.

È stato così sottolineato che la pesca eccessiva ed indiscriminata di oloturie può compromettere la stabilità dell'ecosistema di riferimento che viene reso, quindi, più vulnerabile alle varie pressioni cui è sottoposto, antropiche e non. In aggiunta, si può determinare la perdita di numerosissimi "servizi" resi agli ecosistemi stessi.

Personale coinvolto: **Ester Cecere, Loredana Stabili**

Periodo di validità: **2015-2018**

Recepimento del Regolamento EC 1143/2014

Responsabile: **Antonella Petrocelli**

Nell'ambito del Gruppo "Specie alloctone" della Società Italiana di Biologia Marina (SIBM) per conto di ISPRA è stato condotto l'esercizio di prioritizzazione delle specie non-indigene di macroalghe presenti nei mari italiani e di horizon scanning di quelle non ancora segnalate, ma che potrebbero ben presto essere introdotte, al fine di rispondere alla richiesta della Commissione Europea di elaborare un elenco nazionale e unionale di specie aliene, con particolare riferimento a quelle invasive, per consentire una più corretta formulazione della normativa comunitaria.

Personale coinvolto: **Antonella Petrocelli, Ester Cecere**

Periodo di validità: **2018**

Aereoporti

Redazione di un Piano di gestione della rete idropotabile per gli Aeroporti di Roma

Responsabile: **Maria Concetta Tomei**

Il progetto è focalizzato sulla redazione di un piano di gestione della rete idropotabile per gli aeroporti di Roma che ha l'obiettivo, mediante l'adozione di idonee strategie di prevenzione e controllo, di assicurare ai diversi utilizzatori gli standard di qualità dell'acqua distribuita con elevate garanzie di protezione da eventi di contaminazione di natura fisica, chimica, microbiologica, radiologica. L'attività è stata completata per l'Aeroporto di Fiumicino ed i risultati sono riportati in un primo report, a cui seguirà un secondo documento per lo scalo di Ciampino.

Personale coinvolto: **M. C. Tomei, B. Casentini, A. Sbrilli**

Periodo di validità: **2016-2018**

REMEDIA Life

REmediation of Marine Environment and Development of Innovative Aquaculture: exploitaiton of edible/not edible biomass

Responsabile. **L. Stabili**

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. 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. (codice progetto LIFE16 ENV/IT/000343)

Personale coinvolto: **M.I. Acquaviva, R.A. Cavallo, E. Cecere, A. Petrocelli, G. Portacci, M. Narracci, L. Stabili**

Periodo di validità: **2017-2021**

RES-URBIS

REsources from URban BIo-waSte

Responsabile: **Carlo Pastore**

RES URBIS aims at making it possible to convert several types of urban bio-waste into valuable bio-based products, in an integrated single biowaste biorefinery and by using one main technology chain. This goal will be pursued through:

- *collection and analysis of data on urban biowaste production and present management systems in four territorial clusters that have been selected in different countries and have different characteristics.*
- *well-targeted experimental activity to solve a number of open technical issues (both process- and product-related), by using the appropriate combination of innovative and catalogue-proven technologies.*
- *market analysis whitin several economic scenarios and business models for full exploitation of bio-based products (including a path forward to fill regulatory gaps).*

Urban bio-waste include the organic fraction of municipal solid waste (from households, restaurants, caterers and retail premises), excess sludge from urban wastewater treatment, garden and parks waste, selected waste from food-processing (if better recycling options in the food chain are not available), other selected waste streams, i.e. baby nappies. Bio-based products include polyhydroxyalkanoate (PHA) and related PHA-based bioplastics as well as ancillary productions: biosolvents (to be used in PHA extraction) and fibers (to be used for PHA biocomposites). Territorial and economic analyses will be done either considering the ex-novo implementation of the biowaste biorefinery or its integration into existing wastewater treatment or anaerobic digestion plants, with reference to clusters and for different production size. The economic analysis will be based on a portfolio of PHA-based bioplastics, which will be produced at pilot scale and tested for applications: - Biodegradable commodity film - Packaging interlayer film - Speciality durables

Personale coinvolto: **Pastore C., di Bitonto L., Rossetti S.**

Periodo di validità: **2017-2019**

BioNet – PTP

Rete di laboratori per la ricerca in proteomica e gnomica clinica: Biodiversità per la valorizzazione e sicurezza delle produzioni alimentari tipiche pugliesi.

Responsabile: **R.A. Cavallo**

Il progetto BioNet-PTP è strategico per il Sistema Puglia in quanto si propone, sulla base dell'implementazione di strumentazione e biotecnologie avanzate, di organizzare e potenziare una rete di laboratori pubblici distribuiti in tutta la Regione con specifiche competenze nella raccolta sistematica, caratterizzazione, analisi, conservazione e valorizzazione delle biodiversità microbica e vegetale finalizzata all'innovazione tecnologica e relativo trasferimento al sistema agro-alimentare pugliese, con particolare riferimento ai prodotti tipici. Tale progetto permetterà inoltre di unire in modo sinergico alte competenze chimiche e biologico-molecolari nell'ambito della biologia vegetale, della microbiologia, della qualità, sicurezza e tecnologie alimentari, della bioinformatica, al fine di occuparsi quindi dello studio e del monitoraggio della biodiversità per la valorizzazione e sicurezza delle produzioni tipiche pugliesi a supporto del settore agro-alimentare pugliese. Grazie a questo monitoraggio e analisi costante della biodiversità microbica e vegetale autoctona si potrà garantire la sicurezza e promuovere le produzioni tipiche pugliesi e si potranno sviluppare applicazioni industriali di nuova generazione per:

- *i) la verifica e la certificazione della qualità delle produzioni agricole e dei processi di trasformazione dei prodotti stessi nelle filiere agro-alimentari,*
- *ii) la tracciabilità dei prodotti,*
- *iii) la sicurezza alimentare dei prodotti e dei processi di trasformazione (per esempio microorganismi patogeni, micotossine e allergeni),*
- *iv) la garanzia di preservare la qualità organolettiche dei prodotti tipici legati ad un particolare zona produttiva territoriale,*
- *v) lo sviluppo di nuove tecnologie per il miglioramento e/o l'ottimizzazione dei processi produttivi, basate sulla conoscenza delle basi molecolari della biodiversità genotipica e fenotipica di organismi autoctoni di interesse agro-alimentare (filiera viti-vinicola, lattiero-casearia, cerealicola con prodotti da forno, carni e vegetali fermentati).*

Personale coinvolto: **R.A. Cavallo, M.I. Acquaviva, E. Cecere, A. Petrocelli, M. Narracci, L. Stabili, C. Caroppo, E. Prato, A. Di Leo**

Periodo di validità: **2016-2021**

RiPinTA

Ricollocazione di Pinna nobilis nei mari di Taranto

Responsabile: **Fernando Rubino**

L'Autorità Portuale di Taranto ha avviato la realizzazione di una serie di opere di ampliamento e modernizzazione del Porto di Taranto. Nell'ambito dell'Intervento "Piastra Portuale di Taranto" è stata realizzata di una "Vasca di colmata" per accogliere i fanghi provenienti dai dragaggi necessari per l'approfondimento dei fondali del IV Sporgente e della Darsena Ovest.

Durante le operazioni di messa in sicurezza della fauna ittica presente nella vasca di colmata, nel corso del monitoraggio compiuto tra febbraio e aprile 2016, sono stati censiti oltre 1.200 esemplari di Pinna nobilis (L. 1758). Questo mollusco è una specie che richiede una particolare conservazione. Ciò ha determinato la necessità di progettare e realizzare un intervento urgente di messa in sicurezza degli esemplari presenti nella vasca di colmata mediante la loro ricollocazione in altro sito idoneo. In relazione a tale intervento di spostamento è stato messo a punto un progetto di ricerca che mira a valutare l'efficacia dell'intervento tramite la valutazione della mortalità e dei possibili impatti sull'ambiente marino nella zona di reimpianto.

Personale coinvolto: **Fernando Rubino, Giovanni Fanelli, Giuseppe Denti, Vincenzo De Palmis**

Periodo di validità: **2016-2018**

SMIRES

Science and Management of Intermittent Rivers and Ephemeral Streams (EU COST-SMIRES CA 15113)

Responsabile: **Annamaria Zoppini**

More than half of the global river network is composed of intermittent rivers and ephemeral streams (IRES), which are expanding in response to climate change and increasing water demands. After years of obscurity, the science of IRES has bloomed recently and it is now recognised that IRES support a unique high diversity, provide essential ecosystems services and are functionally part of river networks and groundwater systems. However, they still lack protective and adequate management, jeopardizing the water resource at the global scale. This Action will bring together hydrologists, biogeochemists, ecologists, environmental economists, social researchers and stakeholders from 14 different countries to develop a research network for synthesising the fragmented and recent knowledge on IRES, improving our understanding of IRES ecology, and translating this into science-based, sustainable management of river networks. This Action is organized within 6 Working Groups to address:

1. The occurrence, distribution, drivers and hydrological trends of IRES;

2. The effects of flow alterations on IRES functions and ecosystem services;

3. The interaction of aquatic and terrestrial biogeochemical processes;

4. Biomonitoring the ecological status of IRES;

5. Synergies in IRES research at the European scale, data assemblage and sharing;

6. IRES management and advocacy training.

Personale coinvolto: **A. Zoppini, A.M. De Girolamo**

Periodo di validità: **2016-2019**

WATER ALLIANCE

Screening Target and non-target di inquinanti emergenti nelle acque di falda

Responsabile: **Sara Valsecchi**

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.

Personale coinvolto: **Stefano Polesello, Sara Valsecchi, Francesca Cappelli**

Periodo di validità: **2018-2019**

Sistema di monitoraggio ambientale integrato nel territorio della Città di Barletta - Analisi di fattibilità degli interventi di messa in sicurezza e bonifica

Responsabile: **Vito Felice Uricchio**

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.

Personale coinvolto: **V.F. Uricchio, V. Ancona, A. Calabrese, A. Volpe, C. Massarelli, C. Campanale, B. Casale, A.M. Basile, D. De Paola**

Periodo di validità: **2017-2019**

SLIDERAIL

Responsabile: **Michele Vurro**

Il progetto mira alla progettazione ed alla realizzazione di un sistema innovativo che consente, in tempo reale, il monitoraggio conoscitivo e di allerta dei fenomeni franosi. Il progetto sarà in grado di fornire utili indicazioni per la previsione ed il controllo di eventi legati a frane lungo le linee ferroviarie integrando un sistema di acquisizione dati 3D per la diagnostica dell'infrastruttura ferroviaria installato a bordo veicolo con tecnologie osservative provenienti da piattaforme remote, calibrate con dati acquisiti in situ da sofisticati sistemi di misura dell'umidità del suolo e contenuto d'acqua negli strati più profondi. La soluzione comprenderà inoltre un sistema di allertamento preventivo che, grazie all'integrazione di procedure di analisi e modellazione dei dati rilevati, sarà in grado di fornire agli Enti preposti un adeguato supporto nelle attività di previsione e monitoraggio dei fenomeni di dissesto, nella valutazione dell'effettivo livello di suscettibilità idrogeologica associabile a ciascun versante e nell'attivazione delle misure di prevenzione.

Personale coinvolto: **Michele Vurro, Maria Clementina Caputo, Lorenzo De Carlo, Rita Masciale, Marco Berardi, Raffaella Matarrese, Francesco De Benedictis**

Periodo di validità: **2017-2018**

SWaRM-Net

Smart Technologies per il recupero e la produzione di energia negli impianti di depurazione

Responsabile: **Maria Concetta Tomei**

Il progetto è focalizzato sulla progettazione e sperimentazione di soluzioni impiantistiche innovative per la progettazione e la gestione degli impianti di trattamento delle acque reflue caratterizzate da ridotti consumi e recuperi energetici. Si propone inoltre di investigare processi che in parallelo alla funzione depurativa siano in grado di produrre energia ossia di trasformare il rifiuto in risorsa.

Il programma della attività prevede:

- *Definizione di strategie di intervento per il recupero di energia negli impianti di depurazione al fine di giungere all'autosufficienza energetica*
- *Sviluppo di un processo bioelettrochimico (basato sulla tecnologia delle MFC/MEC) che permetta di rimuovere e valorizzare la sostanza organica delle acque reflue e/o dei fanghi di depurazione*
- *Sviluppo e verifica dell'applicabilità del processo combinato trattamento reflui-produzione di biocombustibili con impiego di microalghe*
- *Definizione di strategie di controllo di processo che, mediante impiego di sensoristica innovativa, consentano di conseguire elevate efficienze di rimozione e ottimizzare il risparmio energetico.*

Personale coinvolto: **M. C. Tomei, V. Stazi, F. Aulenta, S. Fazi, C. Pastore**

Periodo di validità: **2016-2019**

SWaRM-Net

Smart Technologies per il trattamento di reflui e acque di pioggia per il riuso

Responsabile: **Maria Concetta Tomei**

In coerenza con le definizioni della Direttiva Quadro sulle Acque 2000/60/CE, il progetto persegue gli obiettivi di salvaguardia, tutela e miglioramento della qualità ambientale dei corpi idrici, nonché l'utilizzazione accorta e razionale delle risorse naturali basata su una gestione non solo sostenibile, ma adattabile alle circostanze che si presentano anche a seguito dei cambiamenti globali.

L'attività è volta a promuovere il riutilizzo di acque reflue depurate e di acque di pioggia. A tale scopo si prevede la progettazione e la sperimentazione di soluzioni impiantistiche innovative per il trattamento delle acque reflue in grado di produrre effluenti idonei al riuso e la realizzazione di green infrastructures finalizzate all'autodepurazione e al riutilizzo irriguo delle acque di pioggia.

Ulteriore obiettivo è il controllo in tempo reale della qualità microbiologica delle acque naturali e da impianti di trattamento al fine del riutilizzo, garantendo la saluta umana e quella dell'ambiente. L'approccio prevede lo sviluppo di metodi innovativi da utilizzare con tecnologie avanzate per la potenziale automazione delle analisi. Lo scopo è quello di ottimizzare le conoscenze già acquisite in laboratorio per ottenere metodi veloci (15-20 minuti dal campionamento), precisi, a basso costo, adatti a personale non specializzato.

Personale coinvolto: **M. C. Tomei, A. Zoppini, C. Di Iaconi**

Periodo di validità: **2016-2019**

SWaRM-Net

Smart Water Resource Management – Networks

Responsabile: **Vito Felice Uricchio**

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.

Personale coinvolto: **M.C. Tomei, E. Romano, M. Vurro, G. Tartari, A.B. Pentrangeli, C. Massarelli, V. Ancona, R. Lamaddalena, R. Giordano, M Ianigro**

Periodo di validità: **2015-2019**

Sorical - Invaso artificiale sul fiume Alaco - Studio limnologico

Responsabile: **Aldo Marchetto**

L'invaso sul fiume Alaco si trova in un'area seminaturale, prevalentemente boscata, con una pressione antropica minima. Tuttavia, nel passato sono stati rilevate brevi fioriture algali, messe in relazione con il carico interno di nutrienti dovuto ai momenti di anossia delle acque profonde. Uno studio limnologico svolto tra il 2015 e il 2017 ha permesso di mettere in luce le cause del fenomeno e di definire una strategia di gestione per limitarne gli effetti. Con questo nuovo studio biennale si vuole verificare l'efficacia delle misure di gestione adottate, anche in funzione della variabilità meteorologica interannuale che influenza sia le quantità di acqua disponibile che la stabilità della stratificazione dell'invaso.

Sulla base di analisi chimiche delle acque e della analisi qualitativa e quantitativa delle popolazioni fitoplantoniche, è stata ricostruita la dinamica stagionale del fitoplancton, in relazione ai fattori fisici e chimici che ne controllano lo sviluppo, come la temperatura, la stabilità della stratificazione e la disponibilità di nutrienti e sono stati forniti suggerimenti gestionali per mitigare il rischio di nuove fioriture e definire i fattori che ne determinano l'innesco.

Personale coinvolto: **Aldo Marchetto, Giuseppe Morabito, Gabriele Tartari**

Periodo di validità: **2018**

CyanoAlert

Space Based Cyanobacteria Information & Services

Responsabile: **C. Caroppo**

The project CyanoAlert is funded by the European Union's Horizon 2020 research and innovation programme (grant agreement No 730141). It will be a global service for the environmental authorities and commercial sector, concerned by health risks and quality of water resources. The proposed project will deliver a fully automated application for assessing toxin producing cyanobacteria and microalgal blooms in water resources globally, using ground-breaking Copernicus Earth Observation technology. The service foresees a dual dissemination system that provides user-specific information for monitoring and reporting purposes to customers, and a free and open information service for the public based on mobile telecommunication. European SMEs will partner with users in the environmental authority and commercial sector, in order to establish a sustainable supply chain, based on a sound business model, to bring this innovative service to market.

Personale coinvolto: **C. Caroppo, G. Alabiso, V. De Palmis, G. Portacci**

Periodo di validità: **2016-2020**

INTEGRON

Squaring the cycle: the INTEgration of GROundwater processes in Nutrient budgets for a basin-oriented remediation strategy

Responsabile: **Balestrini Raffaella**

The general aim of this project is to integrate the role of groundwater as sink or source of nutrients (N and P) in river basin mass balances. Most studies are unable to integrate groundwater N contamination data in the global N models at the watershed scale, and the same applies to P dynamics, with an even higher degree of uncertainty. Groundwater features must be understood as they provide information on the timing of nutrient transfer from and to the surface and on the main sources and transformations in different geographical areas. Long term projection of the evolution of N and P concentrations in surface water cannot be developed unless groundwater is included in the model.

Nutrient budgets at watershed scale, inventory of sources, N and P dynamics in aquifers (water residence time, storage zones, paths) and nutrient upwelling timing and quantity will be studied in two key sub-basins of the Po river, the Adda and the Ticino basins, in their sub-lacual sector. These basins are characterized by groundwater upwelling in the —springs belt‖ and by a strong river hydrological alteration due to multiple water use. However, the three basins strongly differ for crops, fertilizer applications and livestock density, likely resulting in a gradient of nutrient surplus and a consequent different impact on surface and groundwater quality. Nutrient cycling will be investigated also in relation to the type and amount of

irrigation, with the aim to understand how this affects groundwater upwelling, N and P mobilization and retention, river water quality and ecosystem functioning. The comparison between the calculated nutrient surplus and the load exported by rivers at the closing section will allow to quantify the amount retained within the basin that could be denitrified (in the case of N) or leached to groundwater. Hydrochemical data, coupled to aquifer characteristics, will allow to evaluate the present status of the nutrient contamination and to estimate the amounts stored in the reservoirs. In the higher plain, groundwater dating will allow to infer the residence time of nutrients in groundwater and to estimate the timing for groundwater recovery following the remedial actions undertaken at watershed level. Finally, in the lower plain, the factors promoting denitrification and its capability to permanently remove the N excess, and those enhancing the P mobilization or retention will be investigated. Dissemination activities will play a key role in the project. Through a Social Network Analysis, the main groups of stakeholders (as the actors/groups likely to be affected or that can influence the project) will be identified and involved at an early stage. Using innovative communication instruments such as the social media, results will be made available for the scientific and the social communities to comment in real time.

The project addresses the need to restore and preserve good water quality status for future generations, one of the key challenges faced by water resources managers, having to cope also with the changes in water availability due to climatic change and the increasing demand from multiple users. By integrating the role of groundwater as a sink or source for nutrients, the project will investigate the ecosystem services provided by this compartment, identify the main present and future criticalities, and evaluate the potential and time frame for a natural attenuation of the contamination.

Personale coinvolto: **R. Balestrini, C. Delconte, A. Buffagni**

Periodo di validità: **2016-2019**

START

START Cluster

Responsabile: **Vito Felice Uricchio**

L'obiettivo generale del progetto, che focalizza i propri studi sull'area costiera pugliese e i principali porti della regione, consiste nella progettazione e nello sviluppo di strumenti informatizzati e servizi specifici per la sicurezza ambientale e marittima, per la gestione integrata delle infrastrutture portuali e per la valutazione dei fenomeni di erosione costiera, eventi estremi e inondazione. In particolare lo sviluppo di un tale approccio integrato permetterà: l'implementazione di un sistema di early warning e rapid mapping per le coste e i porti per far fronte ad eventi estremi lungo le coste pugliesi, come inondazioni nei tratti costieri, mareggiate all'imboccatura dei porti e tracimazione delle onde in corrispondenza dei moli; la valutazione della vulnerabilità all'erosione costiera e all'inondazione delle coste pugliesi; la progettazione di un sistema di supporto alle decisioni per la gestione integrata delle aree portuali. Le attività di monitoraggio e pianificazione costiera e portuale, alla luce della caratterizzazione del tratto costiero pugliese, risultano di fondamentale importanza sia per rispondere alle emergenze costiere, sia per gli studi di dinamica costiera e la progettazione di opere di difesa dai fenomeni erosivi, sia nel contesto della pianificazione urbana e

paesaggistica. Il progetto si propone di adottare un approccio olistico e interdisciplinare che consenta di fornire maggiori informazioni sui fenomeni erosivi, di individuare le possibili cause, di attivare allerte a seguito di fenomeni estremi e di supportare la pianificazione di interventi sulla costa e sui porti per i prossimi decenni. Dal punto di vista settoriale, il progetto START mira a integrare diversi ambiti strategici andando a creare sinergie tra impresa, enti di ricerca e spin-off universitari, società di consulenza, utenti del mare, centri di competenza e reti di laboratori. Dal punto di visto tecnologico e scientifico, le conoscenze della ricerca applicata in ambito marino-costiero sono rese fruibili agli utenti mediante le più moderne tecnologie digitali.

Personale coinvolto: **C. Massarelli**

Periodo di validità: **2017-2018**

WaterWorks2014

Stepping up EU research and innovation cooperation in the water area

Responsabile: **A. Lo Porto**

WaterWorks 2014 (WW2014) è il primo progetto ERA-NET Cofund lanciato dalla JPI Water nell'ambito del programma Horizon 2020. Lo scopo principale del progetto è sviluppare azioni di ricerca e innovazione transdisciplinari e transnazionali nel settore dell'acqua, a livello europeo. L'obiettivo specifico di WaterWorks2014 è integrare le agende strategiche di diverse agenzie di finanziamento europee nei campi della ricerca e innovazione nel settore dell'acqua e dell'ambiente.

Personale coinvolto: **A. Lo Porto, M. Vurro**

Periodo di validità: **2014-2019**

Studio di Alta Specializzazione sullo studio quali-quantitativo del sistema "Sorgente Tara"

Responsabile: **Michele Vurro**

Oggetto della convenzione è lo 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. Lo studio prevede attività sperimentali e modellistiche consistenti in misure di portata dell'emergenza puntuale della sorgente lungo il canale derivatore e nella camera di presa, Ricostruzione dell'attuale superficie piezometrica mediante rete di pozzi da campionare previa livellazione topografica di dettaglio, ricostruzione storica dei livelli piezometrici e analisi delle variazioni nel tempo, campagne di misura della salinità da realizzarsi lungo il canale derivatore e nella camera di presa, indagini geochimica delle acque sotterranee finalizzata a valutare il grado di miscelazione tra le acque del sistema sorgente Tara e quelle dell'acquifero superficiale e Indagini geofisiche per la definizione del modello concettuale idro-geofisico. Dalla raccolta deli dati esistenti verrà implementato un modello numerico previsionale in grado di valutare gli effetti dell'aumento dei prelievi sulla porzione costiera dell'acquifero superficiale.

Personale coinvolto: **Michele Vurro, Ivan Portoghese, Maria Clementina Caputo, Lorenzo De Carlo, Rita Masciale, Raffaella Matarrese, Francesco De Benedictis**

Periodo di validità: **2015-2018**

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

Responsabile: **Luisa Patrolecco**

IRSA-CNR/Italferr S.p.A. - Sperimentazione in scala di laboratorio per la valutazione ecotossciologica complessiva, in funzione del tempo di maturazione, di diverse tipologie di terreno prelevate in zona di scavo per la realizzazione della galleria Irpinia-Orsara (linea ferroviaria Napoli-Bari) e condizionate con agenti schiumogeni selezionati in base alla tipologia di terreno scavato, utilizzando parametri di condizionamento che simulino la situazione reale di scavo. Per queste valutazioni, ci si avvale di determinazioni chimiche (concentrazione schiumogeni nei terreni e negli elutriati prodotti dai terreni stessi) e ecotossicologiche con organismi test del comparto sia acquatico che terrestre. Responsabili scientifici attività di laboratorio: Anna Barra Caracciolo, Paola Grenni

Personale coinvolto: **Anna Barra Caracciolo, Paola Grenni, Nicoletta Ademollo, Jasmin Rauseo, Francesca Spataro, Livia Mariani, Tanita Pescatore, Ludovica Rolando**

Periodo di validità: **2018-2020**

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

Responsabile: **Luisa Patrolecco**

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organismi test del comparto sia acquatico che terrestre. Responsabili scientifici attività di laboratorio: Anna Barra Caracciolo, Paola Grenni

Personale coinvolto: **Anna Barra Caracciolo, Paola Grenni, Nicoletta Ademollo, Jasmin Rauseo, Francesca Spataro, Livia Mariani, Tanita Pescatore, Ludovica Rolando**

Periodo di validità: **2018-2020**

Sviluppo di tecnologie innovative per la rimozione di composti xenobiotici dalle acque di scarico

Responsabile: **Maria Concetta Tomei**

Il progetto si propone di sviluppare tecnologie innovative per la rimozione di composti xenobiotici (di difficile biodegradabilità dalle acque di scarico e verificarne l' applicabilità per i composti di maggior rilevanza in termini di pericolosità ambientale.

L'attività sperimentale è stata focalizzata sui reattori-TPPB (Two Phase Partitioning Bioreactors) il cui principio di funzionamento è basato sull' impiego di un solvente organico, praticamente insolubile in acqua e biocompatibile con la biomassa, che, per le sue caratteristiche di immiscibilità, dà luogo ad una fase stratificata sulla fase acquosa contenente i microrganismi. Il solvente è in grado di solubilizzare elevate quantità del composto (tenuto conto anche della natura idrofobica di molti inquinanti organici) che si distribuisce, in funzione del coefficiente di partizione, tra la fase acquosa e la fase solvente. In questo modo, anche se al reattore vengono alimentate elevate quantità di composto, i microrganismi sono esposti a ridotti livelli di concentrazione. Inoltre, il substrato fornito alla biomassa è determinato unicamente dai processi metabolici infatti, quando il substrato viene consumato nella fase acquosa, la necessità di ristabilire l' equilibrio termodinamico nel sistema causa il trasferimento del composto xenobiotico dalla fase solvente alla fase acquosa in modo ottimale in quanto direttamente dipendente dalla cinetica di biodegradazione. In alternativa la solvente possono essere utilizzati polimeri commerciali quale fase di partizione in quanto presentano il vantaggio di essere completamente biocompatibili con la biomassa e non sono soggetti a fenomeni di biodegradazione parallela. La sperimentazione relativa ai reattori TPPBs si è concentrata, pertanto sull' impiego di polimeri quale fase di partizione. Le prove sono state condotte su reattori sequenziale di laboratorio utilizzato in modalità convenzionale e TPPB mediante aggiunta di polimeri in forma granulare. È stato sperimentato con successo anche l'impiego in alternativa ai polimeri di pneumatici in forma sminuzzata. Di recente è stato messo a punto un prototipo C-TPPB operante con tubi polimerici che consente il funzionamento in continuo ed è idoneo per il trattamento di reflui contenenti ad elevato carico organico e componenti inorganici tossici per le biomasse.

Quali composti target sono stati testati fenoli sostituiti.

Sono state anche eseguite prove di rigenerazione del polimero usato sia con il metodo classico di estrazione con solvente che con un processo di biorigenerazione ossia con tempi di contatto prolungati con la stessa biomassa operante nel sistema.

Personale coinvolto: **M. C. Tomei, D. Mosca Angelucci, V. Stazi**

Periodo di validità: **2016-2020**

M4W

Sviluppo e applicazione di soluzioni integrate tecnologiche e gestionali per il trattamento delle acque reflue e il riutilizzo efficiente in agricoltura, adattato alle esigenze dei Paesi dell'Africa mediterranea

Responsabile: **Vito Felice Uricchio**

MADFORWATER è un progetto di ricerca e innovazione finanziato dal programma Horizon 2020 dell'Unione Europea e coordinato dall'Università di Bologna. L'obiettivo generale di MADFORWATER è sviluppare una serie integrata di strumenti tecnologici e gestionali per il miglioramento del trattamento delle acque reflue, il riutilizzo delle acque reflue trattate per l'irrigazione e l'efficienza idrica in agricoltura, con lo scopo di ridurre la vulnerabilità dell'acqua in bacini selezionati in Egitto, Marocco e Tunisia.

Il progetto si occupa principalmente dell'integrazione dell'offerta (trattamento delle acque reflue), della domanda (riutilizzo dell'acqua in agricoltura) e del conseguente adattamento delle soluzioni proposte al contesto locale. Prevede inoltre un approccio partecipativo e multidisciplinare per la progettazione di tecnologie e soluzioni gestionali, raggiunto attraverso un quadro di cooperazione internazionale caratterizzato da una consolidata collaborazione tra i partner UE e Paesi dell'Africa mediterranea e un forte dialogo tra il consorzio e numerosi stakeholder internazionali al fine di massimizzare l'adeguatezza delle soluzioni proposte in relazione al contesto locale e di conseguenza ottimizzare l'impatto a lungo termine previsto delle tecnologie MADFORWATER, e delle strategie di gestione delle risorse idriche e politiche.

Personale coinvolto: **Roberta Lamaddalena**

Periodo di validità: **2017-2020**

SMART4action

Sustainable Monitoring and Reporting to Inform Forest and Environmental Awareness and Protection

Responsabile: **Aldo Marchetto**

Più del 30% del territorio italiano è coperto da foreste. Esse rappresentano una grande risorsa economica rinnovabile e offrono servizi ecosistemici di enorme importanza, come la protezione idrogeologica del territorio, la conservazione della biodiversità, l'accumulo nella biomassa del diossido di carbonio.

Negli ultimi decenni, la crescita e lo stato di salute delle foreste sono stati influenzati dai cambiamenti globali in atto, come l'aumento della temperatura, il cambiamento dei regimi di precipitazione, l'aumento dei livelli atmosferici di ozono e della deposizione di azoto.

Il progetto LIFE SMART4Action si propone di ridisegnare le reti nazionali di monitoraggio forestale e i metodi di interazione con il pubblico, per assicurarne la sostenibilità finanziaria nonostante i tagli di bilancio senza perderne la validità scientifica.

L'analisi delle serie temporali di dati pregressi delle reti di monitoraggio, la validazione di nuove modalità di monitoraggio e l'analisi geospaziale hanno permesso di ottimizzare il numero di siti di monitoraggio, la frequenza e la distribuzione delle attività e di massimizzare le informazioni raccolte. Infine, l'IRSA ha anche sviluppato meccanismi per aumentare nel pubblico la consapevolezza dell'importanza del patrimonio forestale e delle reti di monitoraggio, come applicazioni internet e per smartphone per informare i cittadini e coinvolgerli nelle attività di monitoraggio, e ha messo a disposizione i dati raccolti attraverso servizi standard geospaziali.

Personale coinvolto: **Aldo Marchetto, Michela Rogora, Gabriele Tartari, Arianna Orrù, Paola Giacomotti, Agatina Salanitro**

Periodo di validità: **2014-2018**

WE-MET

Sustainable wastewater treatment coupled to energy recovery with microbial electrochemical technologies (ERANET-MED)

Responsabile: **Federico Aulenta**

In Mediterranean countries, around 1% of municipal electricity consumption is attributed to wastewater treatment (WWT) plants. Thereof, the main share is owed to the aeration of the activated sludge tanks. Recent studies have experimentally demonstrated that the energy content of influent municipal wastewaters is typically over 10 times greater than the energy required to run the plants. This clearly demonstrates that the energy content of raw wastewater is substantial and should accordingly be regarded as a valuable energy resource rather than a waste to simply dispose of. If the energy contained wastewater is harnessed (even only partially), it could help the water industries become self-sufficient in energy or even net-providers.

In this context, the WE-MET project will devise the use of Microbial Electrochemical Technologies (MET), possibly integrated with other technologies, as a groundbreaking approach to recover energy trapped in wastewater while simultaneously cleaning up the wastewater. Overall, using MET will therefore offer a net environmental benefit from wastewater treatment and an economic and environmental upside of using a waste stream for high value energy recovery.

To reach these ambitious objectives, the WE-MET Project brings together a multidisciplinary team of scientists from Universities and Research Institutions, as well as industrial partners (i.e., a SME with expertise in industrial engineering). The WE-MET's pathway to impact combines both fundamental science and upscaling activities, in order to facilitate the development of technologies which are technically effective and sustainable and also to reach out end-users and stakeholders. This will be possible also with the help and support of an influential Advisory Board composed of policy making institutions (Ministries of environment), professionals (wastewater treatment companies) as well as international representatives of scientific associations.

Personale coinvolto: **Federico Aulenta, Carolina Cruz Viggi, Daniele Montecchio, Carlo Pastore**

Periodo di validità: **2016-2019**

TECO (EU INCO)

Technological Eco - Innovations for the Quality Control and the Decontamination of Polluted Waters and Soils

Responsabile: **A. Lo Porto**

The project TECO has been approved within the EU cross action with India dedicated to support research and innovation partnership. The impact of industrial development on the environment has been often severe and many times dramatically destructive. Today the most advanced technologies based on a better understanding of natural processes and the discovery of new materials and analytical techniques can help to recover critical situations linked to the overexploitation of natural resources. TECO project is funded by the European Union - Delegation of the European Union to India in collaboration with the EuropeAid Cooperation Office - and is dedicated to the implementation of EU-India exchange of experts and innovators in the field of technological eco-innovation applied to the pollution of soils and waters and to the improvement of their quality.

Personale coinvolto: **A. Lo Porto, A. Barra Caracciolo, P. Grenni, C. Braguglia**

Periodo di validità: **2014-2018**

T.E.S.A.

Tecnologie innovative per l'affinamento Economico e Sostenibile delle Acque reflue depurate rivenienti dagli impianti di depurazione di Taranto Bellavista e Gennarini

Responsabile: **Alfieri Pollice**

Il progetto si propone di verificare sul campo alcune tecnologie di affinamento delle acque depurate innovative efficienti e a basso impatto economico, con particolare riferimento ai sistemi di filtrazione superficiale. (Bando Innolabs, POR Puglia FESR-FSE 2014-2020 Asse I, Azione 1.4b).

Personale coinvolto: **A. Pollice, P. Vergine, C. Salerno, G. Berardi**

Periodo di validità: **2018-2020**

THERBIOR

Thermal Energy Recovery from a novel sequencing batch BIOfilter granular Reactor

Responsabile: **Claudio Di Iaconi**

THERBIOR focuses on the development, implementation and diffusion of technologies to improve energy efficiency in wastewater treatment plants using a solar-assisted heat pump

(SHP) system, applicable Europe-wide but centered on the Mediterranean region. The THERBIOR project aims to provide a solution for the tourism sector, which is characterized by intense seasonal water demand and wastewater discharge. The integration of a highly efficient heat exchanger coupled to a SHP with a pioneering Sequencing Batch Biofilter Granular Reactor (SBBGR), which is already installed at the Water Research Institute (CNR-IRSA, Italy), creates new value through reuse and repurposing. This technology should produce benefits for local populations in the form of wastewater management, giving people access to clean water, and thus contributing to societal well-being through better human health as a result of better water quality. The main goal is to reuse the heat from the novel SBBGR reactor in an air-conditioning system, backed up by Phase -Change Material (PCM) storage, capable of covering the cooling/heating (CH) and domestic hot water (DHW) demand of an experimental test laboratory (ETL); this was constructed during the first part of the project at the CNR-IRSA site. After obtaining satisfactory results from the developed prototype, we will analyze this innovative application's viability for incorporation into Almeria's (Spain) and Bari's (Italy) tourist facility network. The main goal is to evaluate how much energy it is possible to gain from a specific urban wastewater network to reduce energy consumption (coming from fossil fuels) for CH purposes in tourist buildings located in the cities. THERBIOR project is cofunded by EC within Era-Net Cofund WaterWorks 2014.

Personale coinvolto: **Marco De Sanctis, Valentina Piergrossi, Angela Volpe, Valerio Guido Altieri, Domenico Bellifemine, Ruggiero Ciannarella, Sgaramella Giuseppe**.

Periodo di validità: **2018-2019**

TRAFANDE

TRAttamento FANghi da Depurazione

Responsabile: **Claudio Di Iaconi**

Il progetto si inquadra nella tematica della riduzione dei fanghi di depurazione, la cui gestione rappresenta, oggigiorno, una delle maggiori criticità dell'intero ciclo di trattamento delle acque di scarico urbane. Infatti, sebbene il volume dei fanghi prodotti da un depuratore di reflui urbani rappresenti circa il 2%% del volume delle acque che affluisce all'impianto, il suo trattamento e smaltimento finale può arrivare ad incidere fino al 60% sui costi della depurazione. Pertanto, tra i gestori degli impianti di depurazione di acque reflue vi è attualmente un forte interesse verso soluzioni tecnologiche in grado di minimizzare la produzione dei fanghi da avviare allo smaltimento. Gli approcci attualmente disponibili per la riduzione dei fanghi della depurazione si dividono in due grandi gruppi: quelli che agiscono sulla linea acque e quelli che, invece, vanno ad intervenire sulla linea fanghi del depuratore. I primi affrontano il problema fanghi all'origine, riducendo il quantitativo da inviare alla linea fanghi del depuratore, mentre i secondi cercano di ridurne i volumi dopo la loro formazione. Il presente progetto si inserisce nell'ambito dei sistemi innovativi appartenenti al secondo gruppo. In particolare, il progetto ha l'obiettivo di testare su scala dimostrativa l'inserimento di uno stadio di idrolisi termica sulla linea fanghi prima della digestione anaerobica e l'inserimento a valle del sistema di disidratazione di uno stadio di essiccazione e pirogassificazione. Tale approccio è in grado di ridurre il quantitativo di fanghi prodotti fino al'85%.

Trafande è un progetto finanziato dal POR Puglia FESR FSE 2014-2010, Asse I. – Azione 1.4, "Intervanti di promozione di nuovi mercati per l'innovazione" – Intervento denominato OpenLabs.

Personale coinvolto: **Marco De Sanctis, Domenico Bellifemine**

Periodo di validità: **2017-2018**

UPPARK

UPPark! Strategie di rete per il parco Terra delle Gravine

Responsabile: **A. Di Leo**

Il Parco Naturale Regionale "Terra delle "Gravine", con una superficie complessiva di 25.000 ettari, è la più estesa area protetta regionale: il parco si estende sul territorio di 13 comuni della Provincia di Taranto (Ginosa, Laterza, Castellaneta, Mottola, Massafra, Palagiano, Palagianello, Statte, Crispiano, Martina Franca, Montemesola, Grottaglie e San Marzano) e su quello del comune brindisino di Villa Castelli.

Questo enorme territorio è stato compreso nel Parco Naturale Regionale "Terra delle "Gravine", costituito ex lege nel 2005, con l'evidente intento, seppur non dichiarato, di mettere assieme i territori della "pietra scavata" che hanno dato vita ai villaggi rupestri e quelli della "pietra costruita", quei "thòlos" da cui discendono i trulli della Murgia.

Non esiste altrove, in tutta l'Europa occidentale, un'area con un'analoga concentrazione di insediamenti rupestri e di siti archeologici, con ricchezze naturalistiche e fenomeni carsici di simile rilevanza, con un paragonabile patrimonio di biodiversità.

È un vasto territorio in cui sono altresì comprese aree a fortissima antropizzazione, si pensi alla Gravina di Statte ubicata a pochi chilometri dalla zona industriale di Taranto, che per questo motivo devono essere tutelate e valorizzate con maggiore attenzione.

Per questo il Progetto "UPPark! Strategie di rete per il Parco Terra delle Gravine" prevede, oltre all'esecuzione di diverse attività per valorizzare il Parco, rendendolo pienamente fruibile ai cittadini, anche una serie di interventi per la valutazione del rischio chimico, la prevenzione e la riduzione dei rischi ambientali nell'area del parco, al fine di preservare, per le generazioni future, l'integrità dei questo straordinario ecosistema, un vero e proprio santuario della biodiversità.

Personale coinvolto: **A. Di Leo, S. Giandomenico, L. Spada**

Periodo di validità: **2016-2019**

ECO-LOOP

Uso sostenibile delle acque reflue in agricoltura.

Responsabile: **Alfieri Pollice**

Il progetto ha come obiettivo la ricerca, lo sviluppo, la prototipazione e il test (in scenari reali) di una piattaforma elettronica e informatica basata su sensori che si configura come strumento

di supporto all'utilizzo delle acque reflue affinate per scopi irrigui. L'IRSA si occuperà del monitoraggio delle attività sperimentali sul riuso irriguo.

Personale coinvolto: **A. Pollice, P. Vergine, C. Salerno, G. Berardi**

Periodo di validità: **2018-2020**

VIOLA

Valori di fondo negli acquiferi pugliesi

Responsabili: **Giuseppe Passarella, Elisabetta Preziosi**

Ricognizione normativa, campionamento, misure qualitative e quantitative in campo, analisi chimiche e microbiologiche, interpretazione dei dati, disseminazione dei risultati per la definizione ed applicazione del protocollo per la determinazione dei valori di fondo naturali (VFN) per alcuni parametri di interesse (Fe, Mn, Nitrati, Cloruri, solfati, ecc.)

Valutazione delle aree maggiormente a rischio di superamento di soglie definite;

Individuazione di indicatori innovativi per la valutazione dello stato delle acque sotterranee utilizzando tecniche microbiologiche.

Personale coinvolto: **S. Amalfitano, F. Falconi, S. Ghergo, S. Maggi, R. Masciale, C. Masciopinto, D. Mastroianni, G. Passarella, E. Preziosi, M. Vurro, A. Zoppini**

Periodo di validità: **2018-2020**

PerBio

Valutazione della perdita di biodiversità nelle acque interne minori lombarde

Responsabile: **Fabrizio Stefani**

L'idea progettuale nasce della nostra diretta osservazione del declino della biodiversità negli ultimi decenni nel sistema idrico minore della Lombardia, con la conseguente riduzione o perdita di importanti servizi ecosistemici. L'obiettivo primario del progetto, finanziato da Cariplo, è quello di creare un database sul trend temporale della biodiversità dei corsi d'acqua minori della provincia di Milano, suffragato dal confronto fra informazioni storiche (a partire dal 1960) e campagne di monitoraggio che svolgeremo ad hoc per completare la conoscenza del quadro attuale. Gli obiettivi specifici sono:

1) *l'individuazione delle aree di maggior declino e dei possibili fattori alla base del fenomeno;*
2) *il confronto e l'aggiornamento delle informazioni, sempre più necessario in relazione alla riduzione dei monitoraggi naturalistici avvenuta con la riorganizzazione degli enti amministrativi locali.*

Il database potrà essere reso disponibile da Fondazione CARIPLO sulla piattaforma UBI GREEN e inserito nella piattaforma "big-data" dell'Osservatorio Regionale della Biodiversità della Regione Lombardia. Esso costituirà un elemento conoscitivo imprescindibile per progettare

ripristini naturalistici delle aree planiziali veramente efficaci, ai quali noi stessi stiamo partecipando nell'ambito dei progetti Cariplo 100 fontanili, DiFoInFo, Volare.

Personale coinvolto: **Fabrizio Stefani, Laura Marziali**

Periodo di validità: **2018-2019**

AZeRO antibiotici

Valutazione della Presenza di Antibiotici nei Reflui Zootecnici e nel Digestato di Impianti a Biogas: Studio di Strategie per la loro Rimozione

Responsabile: **Anna Barra Caracciolo**

Il progetto interdisciplinare, in linea con la sostenibilità ambientale, la Green Economy e la salvaguardia della salute dell'uomo e degli ecosistemi, coinvolge competenze di Chimica analitica ambientale e delle fermentazioni, Ecologia Microbica ed Ecologia degli ecosistemi ruminali. Con il progetto si studieranno fattori e condizioni per la rimozione di residui di antibiotici ad uso veterinario (es. sulfametossazolo e l'enrofloxacina) che si ritrovano nei reflui zootecnici a causa della loro presenza nelle deiezioni animali. Poiché i reflui zootecnici sono sempre più spesso utilizzati per alimentare impianti a biogas in un ciclo virtuoso di valorizzazione degli scarti e sottoprodotti, gli studi saranno rivolti alle cinetiche di degradazione degli antibiotici sia in presenza (aerobiosi) che in assenza di ossigeno (anaerobiosi). In tal senso saranno considerati parametri e fattori che ne possano migliorare la degradazione. Lo scopo dell'attività progettuale, in collaborazione con il laboratorio di Biomasse e Biotecnologie per l'Energia dell'ENEA Casaccia, è ottenere conoscenze atte a rendere più sostenibili sia la filiera zootecnica che le produzioni energetiche localizzate presso gli allevamenti, contribuendo a valorizzare economicamente e qualitativamente il compost, un prodotto commerciale ottenibile dal digestato in uscita dagli impianti a biogas. La presenza di antibiotici nel compost infatti causa contaminazione del suolo con effetti biocidi su alcune popolazioni microbiche naturali, nonché con il rischio di trasmissione di eventuali geni di resistenza all'uomo e agli animali.

Personale coinvolto: **N. Ademollo, P. Grenni, L. Patrolecco, J. Rauseo, F. Spataro, L. Rolando, T. Pescatore, L. Mariani, V. Mazzurco Mitrania, Andrea Visca**

Periodo di validità: **2018-2020**

I-ZEB

Verso Edifici Intelligenti a Energia Zero per la crescita della città intelligente

Responsabile: **Laura Marziali**

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.

Personale coinvolto: **Laura Marziali, Diego Copetti, Franco Salerno, Licia Guzzella, Francesco Talarico, Lucia Valsecchi, Stefano Novati, Nicolas Guyennon, Gianni Tartari, Cristina Frana**

Periodo di validità: **2016-2018**

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