



## XXVI Congresso AIOL

**San Michele all'Adige, 27 giugno - 1 luglio 2022**

Esperienze e approcci innovativi per la conoscenza e la salvaguardia degli  
ecosistemi acquatici

#### Comitato Scientifico

Caterina Bergami, *CNR-ISMAR, Bologna*  
Silvia Bianchelli, *Università Politecnica delle Marche, Ancona*  
Mauro Celussi, *Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS), Trieste*  
Diego Copetti, *CNR-IRSA, Brugherio (Monza-Brianza)*  
Domenico D'Alelio, *Stazione Zoologica Anton Dohrn, Napoli*  
Alessandra Pugnetti, *CNR-ISMAR, Venezia*  
Michela Rogora, *CNR-IRSA, Verbania*  
Nico Salmaso, *Fondazione E. Mach, Istituto Agrario di S. Michele all'Adige, S. Michele all'Adige (Trento)*  
Cecilia Teodora Satta, *Università degli Studi di Sassari*  
Monica Tolotti, *Fondazione E. Mach, Istituto Agrario di S. Michele all'Adige, S. Michele all'Adige (Trento)*

#### Comitato Organizzatore

*Fondazione E. Mach, Istituto Agrario di S. Michele all'Adige, Unità Idrobiologia*  
Adriano Boscaini  
Maria Cristina Bruno  
Leonardo Cerasino  
Ulrike Obertegger  
Nico Salmaso  
Monica Tolotti

## Indice

### Sommario

<b>Indice</b> .....	3
<b>Programma</b> .....	8
<b>INVITED SPEAKERS</b> .....	19
<b>Cristiana Callieri</b> .....	20
<b>Rita Giuffredi</b> .....	22
<b>Michael W. Lomas</b> .....	24
<b>Federico Marrone</b> .....	26
Dipartimento di Scienze e Tecnologie biologiche, chimiche e farmaceutiche, Università di Palermo .....	26
<b>Mariangela Ravaioli</b> .....	28
<b>Mario Sprovieri</b> .....	30
<b>COMUNICAZIONI ORALI</b> .....	32
<b>SESSIONE SPECIALE - Effetti della pandemia da SARS-CoV2 sugli ecosistemi acquatici – Chair: Jacopo Chiggiato, Giuseppe Scarcella, Michela Rogora</b> .....	33
Using machine learning to predict the effect of the 2020 COVID-19 lockdown on the biogeochemical properties of the Venice lagoon at selected sites .....	33
Evidence of Covid-19 lockdown effects on riverine dissolved organic matter dynamics provides a proof-of-concept for needed regulations of anthropogenic emissions. ....	33
Effects of the lockdown during Covid-19 Pandemic on the distribution of trace metals and PAH in the Venice Lagoon .....	34
Response of the Taranto Gulf (Ionian Sea, Italy) to the COVID-19 lockdown .....	35
COVID-19 lockdowns reveal the resilience of Adriatic Sea fisheries to forced fishing effort reduction .	35
Knowledge co-construction by citizens and researchers to create a SNAPSHOT of the marine environment during and after the Covid-19 lockdown .....	36
Underwater noise levels in the Northern Adriatic Sea during the COVID-19 pandemic period .....	36
COVID-19 lockdown affected atmospheric deposition and surface water chemistry over an Alpine area .....	37
The potential effects of COVID-19 lockdown and the following restrictions on the status of eight target stocks in the Adriatic Sea.....	38
<b>SESSIONE SPECIALE - Gli studi ecologici di lungo termine per la comprensione delle risposte degli ecosistemi acquatici agli impatti antropici e climatici – Chair: Giuseppe Denti, Silvia Pulina</b> .....	39
High altitude freshwaters: macroinvertebrates to the rescue.....	39
From metabarcoding time-series to plankton food webs.....	39
The European double heatwave in 2019: Chlorophyll-a response moderated by lake depth and trophic state .....	40

Do scientific dolphin watching influence cetacean's behaviour? The case study of the Levantine Aegean Sea (Eastern Mediterranean Sea).....	40
Lake oxygen and climate warming: the deep subalpine lakes in a global context.....	41
Long-term water temperature monitoring and the response of amphipod metabolic rate to climate change in Acquatina lagoon .....	41
Light transparency and chlorophyll-a influence the temporal and spatial differences of the under-ice microbiome .....	42
Synchronous trend signals of the water quality of Seveso, Olona and Lambro in half a century.....	42
Are phytoplankton a good indicator of climatic and anthropic impact? Hints from long term observations in the Gulf of Naples .....	43
Is plankton trophic structure a reliable indicator of the overall ecological efficiency? .....	43
Gli antichi strumenti della limnologia: dalla conservazione alla scoperta .....	44
Occurrence of cyanobacterial toxins in freshwaters of the Alpine region .....	45
Preliminary data on the effectiveness of fish passages from Toce River, the second largest tributary to Lago Maggiore .....	45
Diversity and distribution of dragonflies in Italy, with an updated checklist.....	46
Gaia Blu, the new multipurpose ocean research vessel of CNR.....	46
Building weighted networks for plankton communities from semi-quantitative data.....	47
The Italian chapter of the Marine Social Sciences Network: an opportunity to make a difference in the complex and complicated relationship between society and the sea in the Mediterranean basin. ....	47
Genetic differentiation between the wild and hatchery Marble trout ( <i>Salmo marmoratus</i> Cuvier 1829), and limited presence of released hatchery-produced individuals into the wild: a case study from Toce river (Piemonte, Italy).....	48
Plastic debris in freshwater systems worldwide .....	48
Vertical dispersion of microplastics in the marine environment. A modelling approach.....	50
<b>SESSIONE SPECIALE - Processi fisici e biogeochimici in ambienti marini e d'acqua dolce: misure e modelli –</b>	
Chair: Claudia Dresti, Diego Copetti, Andrea Fenocchi.....	52
Effectivity of hypolimnetic withdrawal on the restoration of Lake Varese.....	52
Modelling physical and ecological processes in medium-to-large deep European perialpine lakes: directions of past research and issues to address for the future.....	52
Long-term variability of the coastal ocean stratification in the Gulf of Naples: Two decades of monitoring the marine ecosystem at the LTER-MC site, between land and open Mediterranean Sea .	53
Multiple Stressor Effects on Ecosystem Function: Disentangling Effects of Eutrophication and Clogging on Nitrate Uptake.....	53
A simple model for predicting ice thickness in lakes.....	54
Resilience of plankton food webs to ocean warming .....	54
<b>SESSIONE SPECIALE - Laghi artificiali, stagni e lagune costiere del Mediterraneo: una risorsa a rischio –</b>	
Chair: Cecilia Teodora Satta, Federico Marrone .....	56
Trophic state and algal blooms in a southern Italy strategic multiple-uses reservoir (Lake Occhito) ....	56

The spreading of the global invader *Palaemon macrodactylus* Rathbun, 1902 and its interaction with congeneric native species in Venice lagoon (Italy)..... 56

**SESSIONE SPECIALE - Multidisciplinary and trans-ecodomain vision for the management and control of invasive alien species - Visione multidisciplinare e trans-ecodominio per la gestione e il controllo delle specie aliene invasive – Chair: Angela Boggero, Agnese Marchini .....**

**Chair: Angela Boggero, Agnese Marchini .....** 58

How hydrology and topography drive exotic plants in annual vegetation of mid-size lowland rivers... 58

LIFE PREDATOR: a new EU LIFE Nature & Biodiversity Project to PREvent, Detect, combAT the spread of *Silurus glanis* in south European lakes to protect biodiversity..... 58

The validation case on invasive crustaceans of the LifeWatch ERIC Internal Joint Initiative: state of the art and next steps forward. .... 59

Behavior of the invasive mosquitofish increases top-predator fry mortality: preliminary results..... 60

The initial spread of quagga mussel, *Dreissena bugensis* Andrusov, 1897, in Italy: molecular and morphological evidence in Lake Garda ..... 60

DNA metabarcoding as early warning and monitoring system for non-indigenous zooplankton species ..... 61

The effects of the alien aquatic plant *Alternanthera philoxeroides* on the freshwater communities of the Arno River in Florence ..... 61

Bio-pollution assessment of Lake Maggiore and its hydrographic system ..... 62

**SESSIONE SPECIALE - Il restauro degli ecosistemi: prevenire, arrestare ed invertire il degrado degli ecosistemi - Ecological Restoration: prevent, halt and reverse the degradation of ecosystems – Chair:**

**Silvia Bianchelli, Antonio Pusceddu .....** 63

Following the roadmap for the restoration of Mediterranean Macroalgal forests: a case study from the Central Adriatic Sea ..... 63

Displacement of hatchery trout in a small creek in Southern Switzerland: the role of water discharge 63

Moving waters: mitigating hydrological alterations while increasing hydropower production, a case study from the Italian Alps ..... 64

Bioreactor capacity of sea cucumber *Holothuria tubulosa* (Gmelin, 1788) under different scenarios of climate change..... 65

The challenge of setting restoration targets across the Mediterranean Sea under climate changes: the case study of macroalgal forests ..... 65

Restocking with wild caught farmed European eels: an alternative approach..... 66

**SESSIONE SPECIALE - Aquatic microbiomes and microbial pathogens across the One Health spectrum –**

**Chair: Grazia M. Quero, Ester M. Eckert .....** 67

Zooplankton influences extracellular DNA degradation and acquisition through natural transformation in freshwater microcosms ..... 67

Host-associated and environmental microbiomes in a Mediterranean gilthead sea bream fish farm .. 67

Improving environmental monitoring of Vibrionaceae in coastal ecosystem through amplicon sequencing..... 68

Popstars in the Adriatic Sea: seasonal dynamics of the most abundant prokaryotes at C1-LTER station, Gulf of Trieste ..... 68

Water masses age and origin drive the diversity of pelagic prokaryotes and dissolved organic matter dynamics: the Mediterranean Sea case .....	69
The sweet tooth of marine microbiomes: potential and expression patterns of prokaryotic glycosyl-hydrolases across the global ocean.....	69
Trends of fecal pollution along the coasts of Marche Region (Adriatic Sea) over a decade (2011-2021) .....	70
The role of intraspecific morpho-functional trait variability in marine phytoplankton responses to changing nutrient scenarios .....	70
<b>POSTER</b> .....	72
<b>SESSIONE SPECIALE - Gli studi ecologici di lungo termine per la comprensione delle risposte degli ecosistemi acquatici agli impatti antropici e climatici – Chair: Giuseppe Denti and Silvia Pulina.....</b>	73
A longitudinal study on bathing waters: bacterial investigation and <i>Ostreopsis</i> cf. <i>ovata</i> dynamics combined with environmental variables in a highly touristic area (Sardinia, western Mediterranean) from 2015 to 2021 .....	73
Effects of spring-summer water levels management on littoral macroinvertebrates of Lake Maggiore (NW, Italy).....	73
Multiannual zooplankton carbon and nitrogen stable isotopes for detecting changes in the Lake Maggiore (Italy) pelagic food web.....	74
High frequency monitoring (HFM) through in-situ sensors as a support to lake quality evaluation and management: insights from the INTERREG project SIMILE in Lake Maggiore .....	74
In-situ high resolution turbidity time series to describe storm resuspension events along the North-Western Adriatic shelf.....	75
<b>SESSIONE REGOLARE – Chair: Leonardo Cerasino, Maria Cristina Bruno.....</b>	76
The project “ROCK-ME: Geochemical response of Alpine Rock Glaciers to global warming: hydroecological consequences of trace element Export” .....	76
Environmental DNA as a tracer of the origin of sestonic organic matter in coastal systems .....	76
<b>SESSIONE SPECIALE - Laghi artificiali, stagni e lagune costiere del Mediterraneo: una risorsa a rischio – Chair: Cecilia Teodora Satta, Federico Marrone .....</b>	78
Use of otoliths for estimating age of <i>Mugil cephalus</i> L. destined to “bottarga” production in Tortoli lagoon (central western Sardinia, western Mediterranean) .....	78
A metagenetic study on intestinal microbial communities of grey mullets from a Mediterranean coastal lagoon (Santa Giusta, Sardinia, Italy) .....	78
Presence of microcystins in some reservoirs of Sardinia (western Mediterranean) in the period 2010-2021: preliminary results.....	79
The ancient irrigation system of the Palermo Plain (Sicily, Italy) as a substitute ecosystem: preliminary investigations on its aquatic flora.....	79
<b>SESSIONE SPECIALE – Multidisciplinary and trans-ecodomain vision for the management and control of invasive alien species - Visione multidisciplinare e trans-ecodominio per la gestione e il controllo delle specie aliene invasive – Chair: Angela Boggero, Agnese Marchini .....</b>	81
Potential impact of dreissenids species in relation to the first report of quagga mussel ( <i>Dreissena bugensis</i> ) at the end of winter 2022 in Lake Garda (Northern Italy). .....	81

Invasive hell: potential distributions of invasive gammarids overlap in central Europe but not in South European coastal regions .....	81
eDNA detection of autochthonous and invasive freshwater crayfish in Trentino .....	82
Distribution and impacts of the invasive amphipod <i>Dikerogammarus villosus</i> (Sowinsky, 1894) in the river Adda (South Adda Regional Park, Northern Italy).....	82
<b>SESSIONE SPECIALE - Il restauro degli ecosistemi: prevenire, arrestare ed invertire il degrado degli ecosistemi - Ecological Restoration: prevent, halt and reverse the degradation of ecosystems – Chair:</b>	
Silvia Bianchelli, Antonio Pusceddu .....	84
REST-ART: RESToration of Marine Forests on ARTificial Reefs.....	84
<b>SESSIONE SPECIALE - Aquatic microbiomes and microbial pathogens across the One Health spectrum –</b>	
Chair: Grazia Marina Quero, Ester Eckert .....	85
Insights into salinity tolerance from a <i>Chlamydomonas</i> strain .....	85
EVER-LAKE: Formation, evolution and fate of new proglacial lakes in the deglaciating Alps .....	85
Does the biodiversity of high-altitude aquatic prokaryotes reflect the expected “Windows of opportunity” in deglaciating Alpine catchments? .....	86
Microbial pathogen detection in freshwater biomonitoring by amplicon sequencing: range of potential applicability.....	86
<b>INDICE DEGLI AUTORI .....</b>	<b>88</b>

XXVI Congresso AIOL  
Associazione Italiana di Oceanologia e Limnologia  
27 giugno – 1 luglio 2022  
S. Michele all'Adige – Conferenza in Formato Ibrido

## Esperienze e approcci innovativi per la conoscenza e la salvaguardia degli ecosistemi acquatici



## Programma

I lavori congressuali saranno preceduti da una  
Short Summer School – Corso base di R  
Lunedì 27 giugno 14:00 - 18:00 e martedì 28 giugno 9:00 – 12:30  
Evento esclusivamente ONLINE:  
Il corso è organizzato con la collaborazione di Successione Ecologica  
<https://www.successionecologica.it/eventi/corso-base-di-r/>



### Martedì 28 giugno

#### ***Sala Conferenze, Palazzo Ricerca e Conoscenza (PRC)***

09.00 – 14.00 REGISTRAZIONE

14.00 – 14.45 CERIMONIA DI APERTURA

**14:45-15:30 RELAZIONE SU INVITO ONLINE:** Fabio Trincardi, Mario Sprovieri. **SNAPSHOT: A synoptic assessment of temporary-decreased human pressures on key Italian marine areas**

**Sessione speciale: Effetti della pandemia da SARS-CoV2 sugli ecosistemi acquatici.** CHAIR: Jacopo Chigiato, Giuseppe Scarcella, Michela Rogora

1. 15:30-15:45 **Carmen Ferra\***, Gianpaolo Coro, Anna Nora Tasseti, Enrico Nicola Armellon, Jacopo Pulcinella, Mario Sprovieri, Fabio Trincardi, Giuseppe Scarcella. COVID-19 lockdowns reveal the resilience of Adriatic Sea fisheries to forced fishing effort reduction.
2. 15:45-16:00. **ONLINE: Magda Di Leo**, Santina Giandomenico, Enza Quinci, Nadia Sabatino, Mario Sprovieri. Response of the Taranto Gulf (Ionian Sea, Italy) to the COVID-19 lockdown.
3. 16:00-16:15. **Michela Rogora**, Sandra Steingruber, Aldo Marchetto, Rosario Mosello, Paola Giacomotti, Arianna Orru', Gabriele A. Tartari, Rocco Tiberti. COVID-19 lockdown affected atmospheric deposition and surface water chemistry over an Alpine area.
4. 16:15-16:30. **Simona Retelletti Brogi**, Gianpiero Cossarini, Giancarlo Bachi, Cecilia Balestra, Elisa Camatti, Raffaella Casotti, Giovanni Checcucci, Simone Colella, Valtere Evangelista, Federico Falcini, Fedra Francocci, Toni Giorgino, Francesca Margiotta, Maurizio Ribera d'Alcalà, Mario Sprovieri, Stefano Vestri, Chiara Santinelli. Evidence of Covid-19 lockdown effects on riverine dissolved organic matter dynamics provides a proof-of-concept for needed regulations of anthropogenic emissions.

#### 16:30-16:45 COFFEE BREAK

5. 16:45-17:00. **ONLINE: Malek Belgacem\***, Fabrizio Aubry, Jacopo Chiggiato, Elisa Camatti, Francesco Acri, Marco Pansera, Giacomo Falchetta. Using machine learning to predict the effect of the 2020 COVID-19 lockdown on the biogeochemical properties of the Venice lagoon at selected sites.
6. 17:00-17:15 **ONLINE:** Petrizzo A., Barbanti A., Barfucci G., Bastianini M., Biagiotti I., Centurelli M., Chavanne R., Codarin A., Costantini I., Dadić V., Falceri F.M., Falkner R., Farella G., Felli M., Ferrarin C., Folegot T., Gallou R., Galvez D., Ghezzi M., Leonori I., Menegon S., Mihanović H., Muslim S., Pari A., Pari S., **Picciulin M.**, Pleslić G., Radulović M., Rako-Gospić N., Sabbatini D., Soldano G., Tegowski J., Vukadin P., Zdroik J. and F. Madricardo. Underwater noise levels in the Northern Adriatic Sea during the COVID-19 pandemic period.
7. 17:15-17:30. **ONLINE: Giuseppe Scarcella**, Silvia Angelini, Enrico Nicola Armelloni, Ilaria Costantini, Andrea De Felice, Stefano Guicciardi, Iole Leonori, Francesco Masnadi, Martina Scanu, Gianpaolo Coro. The potential effects of COVID-19 lockdown and the following restrictions on the status of eight target stocks in the Adriatic Sea.
8. 17:30-17:45. **ONLINE: Daniele Cassin**, Enza Quinci e Mario Sprovieri. Effects of the lockdown during Covid-19 Pandemic on the distribution of trace metals and PAH in the Venice Lagoon.
9. 17:45-18:00. **ONLINE:** Alba L'Astorina, **Rita Giuffredi**, Laura Criscuolo, Antonella Petrocelli. Knowledge co-construction by citizens and researchers to create a SNAPSHOT of the marine environment during and after the Covid-19 lockdown.

Mercoledì 29 giugno

*Sala Conferenze, Palazzo Ricerca e Conoscenza (PRC)*

**8:30-9:15. RELAZIONE SU INVITO ONLINE:** Mariangela Ravaioli. Presentation Volume LTER: The Italian network for long-term ecological research - The study of biodiversity and changes. Curators Capotondi L., Ravaioli M., Acosta A., Chiarini F., Lami A., Stanisci A., Leone Tarozzi L., Mazzocchi M.G.

**Alessandra Pugnetti - Remembering Giorgio Socal**

**Sessione speciale: Gli studi ecologici di lungo termine per la comprensione delle risposte degli ecosistemi acquatici agli impatti antropici e climatici.** CHAIR: Giuseppe Denti (ONLINE:) e Silvia Pulina

1. 9:15-9:30. **ONLINE: Gary Free**, Mariano Bresciani, Monica Pinardi, Stefan Simis, Xiaohan Liu, Clément Albergel and Claudia Giardino. The European double heatwave in 2019: Chlorophyll-a response moderated by lake depth and trophic state.
2. 9:30-9:45. **Ulrike Obertegger**. Light transparency and chlorophyll-a influence the temporal and spatial differences of the under-ice microbiome.
3. 9:45-10:00. **ONLINE: Barbara Leoni**, Veronica Nava, Claudia Dresti, Michela Rogora. Lake oxygen and climate warming: the deep subalpine lakes in a global context.
4. 10:00-10:15. **Angela Boggero**, Silvia Zaupa, Michela Rogora, Daniele Paganelli, Riccardo Fornaroli. High altitude freshwaters: macroinvertebrates to the rescue.
5. 10:15-10:30. **Domenico D'Alelio**, Daniele Bellardini, Giampaolo Zampicinini, Ferenc Jordan, Roberta Congestri, Luca Russo. From metabarcoding time-series to plankton food webs.

**10:30-10:45. COFFEE BREAK**

6. 10:45-11:00. **ONLINE: Adriana Zingone**, Lorenzo Longobardi, Laurent Dubroca, Francesca Margiotta, Diana Sarno. Are phytoplankton a good indicator of climatic and anthropic impact? Hints from long term observations in the Gulf of Naples.
7. 11:00-11:15. **ONLINE: Milad Shokri\***, Francesco Cozzoli, Ilaria Rosati, Fabio Vignes, Alberto Basset. Long-term water temperature monitoring and the response of amphipod metabolic rate to climate change in Acquatina lagoon.
8. 11:15-11:30. **ONLINE: Maurizio Ingrosso\***, Anastasia Miliou, Thodoris Tsimpids, Beatriz Tintorè, Paraskevi Nomikou, Giulia Cipriano, Roberto Carlucci, Francesca Cornelia Santacesaria, Pasquale Ricci. Do scientific dolphin watching influence cetacean's behaviour? The case study of the Levantine Aegean Sea (Eastern Mediterranean Sea).
9. 11:30-11:45. **ONLINE: Gianni Tartari**, Fabrizio Stefani, Valeria Mezzanotte, Alessandro Vittorio, Carlo Carrettini, Gianni Pampurini, Valeria Marchesi, Pietro Genoni. Synchronous trend signals of the water quality of Seveso, Olona and Lambro in half a century.

10. 11:45-11:50. POSTER: **Angela Boggero**, Silvia Zaupa, Daniele Paganelli, Michela Rogora, Marzia Ciampitiello, Lyudmila Kamburska. Effects of spring-summer water levels management on littoral macroinvertebrates of Lake Maggiore (NW, Italy).
11. 11:50-11:55. POSTER **Michela Rogora**, Tommaso Cancellario, Rossana Caroni, Lyudmila Kamburska, Andrea Lami, Dario Manca, Simona Musazzi, Rocco Tiberti. High frequency monitoring (HFM) through in-situ sensors as a support to lake quality evaluation and management: insights from the INTERREG project SIMILE in Lake Maggiore.
12. 11:55-12:00. POSTER Francesco Riminucci, Lucilla Capotondi, Mariangela Ravaioli, **Caterina Bergami**. In-situ high resolution turbidity time series to describe storm resuspension events along the North-Western Adriatic shelf.
13. 12:00: 12:05. **ONLINE**: POSTER **Anna Maria Bazzoni**, Valeria Manca, Paolo O. Fiori, Giovanni A. Mocchi, Maryam Motavalian, Stefano Muredda, Cristina Nigra, Renata Rossi, Cristina Russu, Maria Grazia Pintus. A longitudinal study on bathing waters: bacterial investigation and *Ostreopsis cf ovata* dynamics combined with environmental variables in a highly touristic area (Sardinia, western Mediterranean) from 2015 to 2021.
14. 12:05-12:10. **ONLINE**: POSTER **Rossana Caroni**, Roberta Piscia, Marina Manca. Multiannual zooplankton carbon and nitrogen stable isotopes for detecting changes in the Lake Maggiore (Italy) pelagic food web.

**Sessione speciale: Processi fisici e biogeochimici in ambienti marini e d'acqua dolce: misure e modelli.**

**CHAIR: Claudia Dresti; Diego Copetti; Andrea Fenocchi**

1. 12:15-12:40 OPENING TALK: **Andrea Fenocchi**, Claudia Dresti, Diego Copetti. Modelling physical and ecological processes in medium-to-large deep European perialpine lakes: directions of past research and issues to address for the future.

**Aula 6202 Palazzo Ricerca e Conoscenza (PRC)**

**SESSIONE regolare CHAIR: Maria Cristina Bruno, Leonardo Cerasino**

1. 9:15-9:30. **Tommaso Righi**, Emanuele Fasola, Mattia Iaia, Vanessa De Santis, Fabrizio Stefani and Pietro Volta. Genetic differentiation between the wild and hatchery Marble trout (*Salmo marmoratus* Cuvier 1829), and limited presence of released hatchery-produced individuals into the wild: a case study from Toce river (Piemonte, Italy).
2. 9:30-9:45 **Mattia Iaia** et al. Preliminary data on the effectiveness of fish passages from Toce River, the second largest tributary to Lago Maggiore.
3. 9:45-10:00. **Gianandrea La Porta**, Sönke Hardersen. Diversity and distribution of dragonflies in Italy, with an updated checklist.
4. 10:00-10:15. **Leonardo Cerasino**, Adriano Boscaini, Camilla Capelli, Fabio Lepori, Giorgio Franzini, Chiara Zampieri, Federica Giacomazzi, Rainer Kurmayer, Masa Zupancic, Tina Elersek, Nico Salmaso. Occurrence of cyanobacterial toxins in freshwaters of the Alpine region.
5. 10:15-10:30. **Daniele Bellardini\***, Luca Russo, Francesco Bolinesi, Luciano Bosso, Angela Buondonno, Ylenia Carotenuto, Rafaella Casotti, Maria Luisa Chiusano, Daniela Cianelli, Francesco Cipolletta, Gabriele Del Gaizo, Marta Furia, Priscilla Licandro, Olga Mangoni, Francesca Margiotta, Maria Grazia Mazzocchi, Marina Montresor, Isabella Percopo, Maria Saggiomo, Diana Sarno,

Simona Saviano, Jessica Vannini, and Domenico D'Alelio. Is plankton trophic structure a reliable indicator of the overall ecological efficiency?

**10:30-10:45. COFFEE BREAK**

6. 10:45-11:00. **ONLINE: Veronica Nava**, Julian Aherne, María B. Alfonso, Ana M. Antão-Geraldes, Katrin Attermeyer, Roberto Bao, Mireia Bartrons, Stella A. Berger, Marcin Biernaczyk, Raphael Bissen, Justin Brookes, David Brown, Giulia Candian, Miguel Cañedo-Argüelles, Moisés Canle, Camilla Capelli, Rafael Carballeira, José Luis Cereijo, Sakonvan Chawchai, Guangjie Chen, Søren T. Christensen, Kirsten S. Christoffersen, Elvira de Eyto, Jorge Delgado, Tyler Dornan, Jonathan P. Doubek, Julia Dusaucy, Oxana Erina, Zeynep Ersoy, Heidrun Feuchtmayr, Fabio Lepori, Maria Luce Frezzotti, Silvia Galafassi, David Gateuille, Vitor Gonçalves, Hans-Peter Grossart, David P. Hamilton, Ted Harris, Külli Kangur, Gökben Başaran Kankılıç, Rebecca Kessler, Christine Kiel, Edward M Krynak, Àngels Leiva-Presa Miguel Matias, Shin-ichiro S. Matsuzaki, Yvonne McElarney, Mark Mitchell, Beata Messyas, Musa Mlambo, Samuel N. Motitsoe, Caroline Owens, Deniz Özkundakci Solvig Pinnow, Agnieszka Pociecha, Pedro Raposeiro, Eva-Ingrid Rööm, Federica Rotta, Nico Salmaso, Facundo Scordo, Claver Sibomana, Daniel Siewert, Katarzyna Stepanowska, Chandra Sudeep, Ülkü Nihan Tavşanoğlu, Maria Tereshina, James Thompson, Monica Tolotti, Amanda Valois, Piet Verburg, Brian Wesolek, Gesa Weyhenmeyer, Naicheng Wu, Edyta Zawisza, Lauren Zink, Barbara Leoni. Plastic debris in freshwater systems worldwide.
7. 11:00-11:15. **ONLINE: Simone Zazzini**, Paolo Bello, Agnese Pini, Paolo Monti & Giovanni Leuzzi. Vertical dispersion of microplastics in the marine environment. A modelling approach.
8. 11:15-11:30. **ONLINE: Matteo Loschi**, Simone Libralato, Elisa Camatti, Fabrizio Bernardi Aubry, Domenico D'Alelio. Building weighted networks for plankton communities from semi-quantitative data.
9. 11:30-11:45. **ONLINE: Maria Vittoria Marra**, Elisa Baldrighi, Alberto Barausse, Antonio Calò, Domenico D'Alelio, Emanuela Dattolo, Cristina Mangano, Silvia Morgana, Antonella Petrocelli, Alessandra Pugnelli, Emma McKinley: The Italian chapter of the Marine Social Sciences Network: an opportunity to make a difference in the complex and complicated relationship between society and the sea in the Mediterranean basin.
10. 11:45-11:50 POSTER: **Viviana Di Tuccio**, Luca Russo, Gabriele Del Gaizo, Daniele Bellardini, Francesca Margiotta, Pasquale De Luca, Domenico D'Alelio and the NEREA team. Environmental DNA as a tracer of the origin of sestonic organic matter in coastal systems.
11. 11:50-11:55. POSTER. **ONLINE: Maria Cristina Bruno**, Monica Tolotti, Stefano Brighenti, Francesco Comiti, Lorenzo Brusetti, Andrea Fisher. The project "ROCK-ME: Geochemical response of Alpine Rock Glaciers to global warming: hydroecological consequences of trace element Export".

**12.40-14:30 PAUSA PRANZO (accesso mensa: 13:00-14:00)**

**Sala Conferenze, Palazzo Ricerca e Conoscenza (PRC)**

**14:30- 15:15 RELAZIONE SU INVITO ONLINE: Michael Lomas. Biology Trumps Ocean Warming: Adaptive Biogeochemistry in the Sargasso Sea**

**Sessione speciale: Processi fisici e biogeochimici in ambienti marini e d'acqua dolce: misure e modelli (cont.).** CHAIR: Claudia Dresti; Diego Copetti; Andrea Fenocchi

2. 15:15-15:30. **ONLINE: Claudia Dresti**, Michela Rogora, Diego Copetti, Fabio Buzzi, Andrea Beghi, Franca Pandolfi, Cristina Borlandelli, Davide Fortino, Giovanni Biccai, Daniele Magni, Alessandro Canziani, Andrea Fenocchi. Effectivity of hypolimnetic withdrawal on the restoration of Lake Varese.
3. 15:30-15:45. **ONLINE: Luca Russo**, Matteo Loschi, Daniele Bellardini, Roberta Congestri, Michael W. Lomas, Simone Libralato, Domenico D'Alelio. Resilience of plankton food webs to ocean warming.
4. 15:45-16:00. **ONLINE: Florian Kokoszka**, Baptiste Le Roux, Daniele Iudicone, Fabio Conversano, and Maurizio Ribera d'Alcalá. Long-term variability of the coastal ocean stratification in the Gulf of Naples: Two decades of monitoring the marine ecosystem at the LTER-MC site, between land and open Mediterranean Sea.
5. 16:00-16:15. **Julia Pasqualini**, Nergui Sunjidmaa, Daniel Graeber, Markus Weitere, Steffen Kummel, Niculina Musat, Zulma Lorena Duran, Alexander Bartush, Mario Brauns. Multiple Stressor Effects on Ecosystem Function: Disentangling Effects of Eutrophication and Clogging on Nitrate Uptake.
6. 16:15-16:30. Marta Fregona, Matti Leppäranta, Ivan Mammarella, **Sebastiano Piccolroaz**. A simple model for predicting ice thickness in lakes.

**16.30-16.45 COFFEE BREAK**

**16.45-18.00 ASSEMBLEA DEI SOCI**

Giovedì 30 giugno

**Sala Conferenze, Palazzo Ricerca e conoscenza (PRC)**

**8:30-9:15 RELAZIONE SU INVITO ONLINE: Federico Marrone: What we (don't) know about aquatic biodiversity. A plea for the reappraisal of the so-called "old-fashioned" approaches**

**Sessione speciale: Laghi artificiali, stagni e lagune costiere del Mediterraneo: una risorsa a rischio.** Chair: Cecilia Teodora Satta e Federico Marrone

1. 9:15-9:30. **ONLINE: Chiara Facca**, Francesco Cavraro, Piero Franzoi, Stefano Malavasi, Simone Redolfi Bristol. The spreading of the global invader *Palaemon macrodactylus* Rathbun, 1902 and its interaction with congeneric native species in Venice lagoon (Italy).
2. 9:30-9:45. **Diego Copetti**, Raffaella Matarrese, Licia Guzzella, Lucia Valsecch, Gianni Tartari, Marina Mingazzini, Maria Teresa Palumbo. Trophic state and algal blooms in a southern Italy strategic multiple-uses reservoir (Lake Occhito).
3. 9:45-9:50. **ONLINE: POSTER: Oriana Soru**, Paola Spanu, Efisio Sais, Tomasa Viridis, Maria Cristina Pinna, Maristella Putzu, Antonella Lugliè, Paola Buscarinu. Presence of microcystins in some reservoirs of Sardinia (western Mediterranean) in the period 2010-2021: preliminary results.
4. 9:50-9:55. **ONLINE: POSTER: Jacopo Culurgioni, Riccardo Diciotti\*\***, Laura Mura, Giovanna Chessa, Gabriele Sanna, Rosanna Floris, Francesco Chessa, Simonetto Serra, Marco Trentadue, Nicola Fois. Use of otoliths for estimating age of *Mugil cephalus* L. destined to "bottarga" production in Tortoli lagoon (central western Sardinia, western Mediterranean).
5. 9:55-10:00. **ONLINE: POSTER: Rosanna Floris**, Gabriele Sanna, Sonia Murgia, Greta Battaglia, Fabio De Pascale, Alessandro Vezzi, Nicola Fois. A metagenetic study on intestinal microbial communities of grey mullets from a Mediterranean coastal lagoon (Santa Giusta, Sardinia, Italy).
6. 10:00-10:05. **ONLINE: POSTER: Angelo Troia**, Mariano Vivacqua, Elisabetta Oddo, Tommaso La Mantia. The ancient irrigation system of the Palermo Plain (Sicily, Italy) as a substitute ecosystem: preliminary investigations on its aquatic flora.

**Sessione speciale: Multidisciplinary and trans-ecodomain vision for the management and control of invasive alien species - Visione multidisciplinare e trans-ecodominio per la gestione e il controllo delle specie aliene invasive.** CHAIR: Angela Boggero, Agnese Marchini

1. 10:05-10:20. **ONLINE: Cristina di Muri\***, Ilaria Rosati, Alberto Basset, Juan Miguel González-Aranda, Antoni Huguet-Vives, Nikos Minadakis, Antonio José Sáenz-Albanés, Lucia Vaira, Giorgio Mancinelli. The validation case on invasive crustaceans of the LifeWatch ERIC Internal Joint Initiative: state of the art and next steps forward.
2. 10:20-10:35. **ONLINE: Vanessa De Santis\***, Filip Ribeiro, Martin Cech, Cesare Puzzi, Gabriele Bovo, Alessandra Pucci, Bruno Aimone, Pietro Volta. LIFE PREDATOR: a new EU LIFE Nature & Biodiversity Project to PREvent, Detect, combAT the spread of SiluRus glanis in south European lakes to protect biodiversity.

**10.35-10.50 COFFEE BREAK**

3. 10:50-11:05. **ONLINE: Elena Tricarico**, Chiara Ceccarelli, Alberto Francesco Inghilesi, Lorenzo Lastrucci. The effects of the alien aquatic plant *Alternanthera philoxeroides* on the freshwater communities of the Arno River in Florence.
4. 11:05-11:20. **ONLINE: Anna Schroeder**, Alberto Pallavicini, David Stanković, Marco Pansera and Elisa Camatti. DNA metabarcoding as early warning and monitoring system for non-indigenous zooplankton species.
5. 11:20-11:35. **Nico Salmaso**, Francesca Ciutti, Cristina Cappelletti, Massimo Pindo, Adriano Boscaini. The initial spread of quagga mussel, *Dreissena bugensis* Andrusov, 1897, in Italy: molecular and morphological evidence in Lake Garda.
6. 11:35-11:50. **Daniele Paganelli**, Lyudmila Kamburska, Silvia Zaupa, Laura Garzoli, Angela Boggero. Bio-pollution assessment of Lake Maggiore and its hydrographic system.
7. 11:50-12:05. **Laura Saccardi**, Andrea Voccia, Maurizio Odicino, Jordi-René Mor and Pietro Volta. Behavior of the invasive mosquitofish increases top-predator fry mortality: preliminary results.
8. 12:05-12:20. Bolpagni Rossano, **Alice Dalla Vecchia**. How hydrology and topography drive exotic plants in annual vegetation of mid-size lowland rivers.
9. 12:20-12:25. POSTER: **Adriano Boscaini**, Cristina Cappelletti, Francesca Ciutti, Nico Salmaso. Potential impact of dreissenids species in relation to the first report of quagga mussel (*Dreissena bugensis*) at the end of winter 2022 in Lake Garda (Northern Italy).
10. 12:25-12:30. POSTER: **Daniele Paganelli**, Angela Cianci, Agnese Marchini. Distribution and impacts of the invasive amphipod *Dikerogammarus villosus* (Sowinsky, 1894) in the river Adda (South Adda Regional Park, Northern Italy).
11. 12:30-12:35. POSTER. **ONLINE: Tommaso Cancellario**, Alex Laini, Simone Guareschi. Invasive hell: potential distributions of invasive gammarids overlap in central Europe but not in South European coastal regions.
12. 12:35-12:40. POSTER. **ONLINE: Irene Lo Presti**, Lucia Zanovello, Matteo Girardi, Diego Micheletti, Giorgio Bertorelle, Heidi C. Hauffe, Maria Cristina Bruno. eDNA detection of autochthonous and invasive freshwater crayfish in Trentino.

**12.40-14.30 PAUSA PRANZO (accesso mensa: 13:00-14:00)**

**14.30-23.00 ESCURSIONE E CENA SOCIALE**

- 14.30-15.30 Trasferimento con bus al Lago di Tovel
- 15.30-15.45 Introduzione stazione LTER Lago di Tovel
- 15.45-17.00 Escursione
- 17.00-18.00 Rientro in FEM
- 19.00 Partenza per la cena (San Michele, 15 minuti a piedi da FEM)
- 19.30 Cena Sociale

Venerdì 1 luglio

**Sala Conferenze, Palazzo Ricerca e conoscenza (PRC)**

**8:30-9:15. RELAZIONE SU INVITO ONLINE: RITA GIUFFREDI. Moving across sectors, languages and boundaries: young people and women as agents of change in complex socio-ecological systems**

**SESSIONE regolare CHAIR: Maria Cristina Bruno, Leonardo Cerasino**

1. 9:15-9:30. **Leonardo Langone**, Fabio Trincardi. Gaia Blu, the new multipurpose ocean research vessel of CNR.
2. 9:30-9:45. **ONLINE: Roberto Bertoni**. Gli antichi strumenti della limnologia: dalla conservazione alla scoperta .

**Sessione speciale: Il restauro degli ecosistemi: prevenire, arrestare ed invertire il degrado degli ecosistemi - Ecological Restoration: prevent, halt and reverse the degradation of ecosystems. CHAIR: Silvia Bianchelli, Antonio Pusceddu**

1. 9:45-10:05. **OPENING ONLINE: Erika Fabbrizzi**, Sylvaine Giakoumi, Francesco De Leo, Laura Tamburello, Antonia Chiarore, Alberto Colletti, Marianna Coppola, Marco Munari, Luigi Musco, Fabio Rindi, Lucia Rizzo, Beatrice Savinelli, Giulio Franzitta, Daniele Grech, Emma Cebrian, Jana Verdura, Silvia Bianchelli, Luisa Mangialajo, Ina Nasto, Denada Sota, Sotiris Orfanidis, Nadia K. Papadopoulou, Roberto Danovaro, Simonetta Frascchetti. The challenge of setting restoration targets across the Mediterranean Sea under climate changes: the case study of macroalgal forests.
2. 10:05-10:20. **ONLINE: Cinzia Podda**, Francesco Palmas, Giovanna Chessa, Jacopo Culurgioni, Riccardo Diciotti, Nicola Fois, Andrea Sabatini. Restocking with wild caught farmed European eels: an alternative approach.
3. 10:20-10:35. **ONLINE: Claudia Ennas**, Viviana Pasquini, Pierantonio Addis, Antonio Pusceddu. Bioreactor capacity of sea cucumber *Holothuria tubulosa* (Gmelin, 1788) under different scenarios of climate change.

**10.35-10:50 COFFEE BREAK**

4. 10:50-11:05. **Silvia Bianchelli**, Simonetta Frascchetti, Francesco Martini, Marco Lo Martire, Fabio Rindi, Roberto Danovaro. Following the roadmap for the restoration of Mediterranean Macroalgal forests: a case study from the Central Adriatic Sea.
5. 11:05-11:20. **Stefano Brignone**, Vanessa De Santis, Tiziano Putelli, Christophe Molina, Armando Piccinini, Richard A. Carmichael, Pietro Volta. Displacement of hatchery trout in a small creek in Southern Switzerland: the role of water discharge.
6. 11:20-11:35. **ONLINE: Maria Cristina Bruno**, Francesca Vallefucio, Anna Casari, Larsen Stefano, Dallafior Valentina, Guido Zolezzi. Moving waters: mitigating hydrological alterations while increasing hydropower production, a case study from the Italian Alps.
7. 11:35-11:40 POSTER: **Jacopo Cimini**, Lorenzo Meroni, Valentina Asnaghi, Mariachiara Chiantore: REST-ART: RESToration of Marine Forests on ARTificial Reefs.

**11:40-12:25 RELAZIONE SU INVITO – PREMIO ALLA CARRIERA AIOL 2022 - ONLINE: C. CALLIERI: A 'life aquatic' with microbes: swimming through the last decades in microbial ecology with picocyanobacteria.**

**Sessione speciale: Aquatic microbiomes and microbial pathogens across the One Health spectrum.**

**CHAIR: Grazia Marina Quero, Ester Eckert**

1. 12:25-12:40. **Ester M. Eckert**, Francesco Riva, Emanuele Ferrari, Sara Borin, Andrea Di Cesare, Francesca Mapelli, Elena Crotti. Zooplankton influences extracellular DNA degradation and acquisition through natural transformation in freshwater microcosms.

**12.40-14.15 PAUSA PRANZO (accesso mensa: 13:00-14:00)**

2. 14:15-14:30. **Marco Basili\***, Grazia Marina Quero, Roberta Piredda, Giulia Maricchiolo, Simone Mirto, Elena Manini, Anne Mette Seyfarth, Marco Candela, Gian Marco Luna. Host-associated and environmental microbiomes in a Mediterranean gilthead sea bream fish farm.
3. 14:30-14:45. **ONLINE: Mauro Celussi**, Cecilia Balestra, Elisa Banchi, Viviana Fonti, Vincenzo Manna. Popstars in the Adriatic Sea: seasonal dynamics of the most abundant prokaryotes at C1-LTER station, Gulf of Trieste.
4. 14:45-15:00. **Vincenzo Manna\***, Elisa Banchi Mauro Celussi. The sweet tooth of marine microbiomes: potential and expression patterns of prokaryotic glycosyl-hydrolases across the global ocean.
5. 15:00-15:15. **Grazia Marina Quero**, Stefano Guicciardi, Pierluigi Penna, Gian Marco Luna. Trends of fecal pollution along the coasts of Marche Region (Adriatic Sea) over a decade (2011-2021).
6. 15:15-15:30. **Gian Marco Luna**, Grazia Marina Quero, Simona Retelletti Brogi, Chiara Santinelli. Water masses age and origin drive the diversity of pelagic prokaryotes and dissolved organic matter dynamics: the Mediterranean Sea case.
7. 15:30-15:45. **ONLINE: Elisa Banchi**, Vincenzo Manna, Viviana Fonti, Cinzia Fabbro, Mauro Celussi. Improving environmental monitoring of Vibrionaceae in coastal ecosystem through amplicon sequencing.
8. 15:45-15:50. **ONLINE: POSTER Maria Vittoria Tenci**, Marco Toffolon, Walter Bertoldi, Stefano Brighenti, Francesco Comiti, Luca Carturan, Maria Cristina Bruno, Leonardo Cerasino, Massimo Pindo, Monica Tolotti. EVER-LAKE: Formation, evolution and fate of new proglacial lakes in the deglaciating Alps.
9. 15:50-15:55. **ONLINE: POSTER: Sara Vettorazzo\*\***, Adriano Boscaini, Nico Salmaso. Microbial pathogen detection in freshwater biomonitoring by amplicon sequencing: range of potential applicability.
10. 15:55-16:00. **POSTER: Emma Bazzani\*\***, Chiara Lauritano, Olga Mangoni, Francesco Bolinesi, Maria Saggiomo. Insights into salinity tolerance from a *Chlamydomonas* strain.
11. 16:00-16:05. **POSTER Monica Tolotti**, Stefano Brighenti, Maria Cristina Bruno, Leonardo Cerasino, Massimo Pindo, Werner Tirlor, Davide Albanese. Does the biodiversity of high-altitude aquatic prokaryotes reflect the expected "Windows of opportunity" in deglaciating Alpine catchments?

**16:05-16:45 PREMIAZIONI GIOVANI RICERCATORI E CERIMONIA DI CHIUSURA**



\* partecipa al Premio Morabito per la migliore presentazione orale

\*\* partecipa al Premio Morabito per il miglior poster



## INVITED SPEAKERS

## Cristiana Callieri

CNR – IRSA MEG, Largo Tonolli 50, 28922 Verbania, Italia  
[cristiana.callieri@irsa.cnr.it](mailto:cristiana.callieri@irsa.cnr.it); <http://www.meg.irsa.cnr.it>



### Biosketch

I am senior research scientist associated at the Institute of Water Research (IRSA – CNR) of Verbania. I have been the leader scientist of the Aquatic Microbial Laboratory and responsible for the Radiochemistry Laboratory at the IRSA Institute. My research interests deal with the trophic interactions in the microbial food chain of subalpine, alpine and andine lakes in the frame of organic carbon cycle. In recent years, my research expanded towards the phylogeny, the ecophysiology and the biodiversity of freshwater picocyanobacteria in deep lakes and in the euxinic Black Sea. I devoted particular attention to morphological and physiological changes in picocyanobacteria populations triggered by climatic and environmental stressors, such as high PAR, UV radiation and predation. At the same time to enrich the knowledge of picocyanobacteria phylogeny (clade 5) and better

understand the evolutionary reconstruction of marine, euryhaline and freshwater species I isolated and purified around 100 *Synechococcus* and *Cyanobium* strains from lakes all over the world, and also from the Black Sea. At present, the collection of freshwater picocyanobacteria at IRSA Institute is one of the few in the world, enriched with strains isolated from other colleagues, and many of the strains have been sequenced for the whole genome. One of my latest research interest was to study the isolation of *Synechococcus* strains in the mesopelagic zone of the Black Sea. The in-depth study with laboratory experiments revealed the ability of those *Synechococcus* strains to survive in the mesopelagic zone by carrying out fermentation and to maintain the capacity for photosynthesis. I have also broadened my interests in the ecology and diversity of bacterioplankton, particularly Thaumarchaeota and CL500-11 lineage of phylum *Chloroflexi*, inhabiting the oxygenated hypolimnion. I directed and coordinated several national and international research projects, being responsible scientist for many international cooperation between CNR and the corresponding research organizations in Hungary, Czech Republic, Argentina, Bulgaria. I tutored several master and PhD theses in Italy and others European countries. I was external professor in Picoplankton Ecology courses at Parma University, and undertook courses for PhD students at the UNAM, Mexico. I am Associate Editor of the Journal of Limnology and I authored more than 200 journal publications and several book chapters on picocyanobacteria ecology.

### Selected publications

- Okazaki Y., Fujinaga S., Salcher M.M., Callieri C., Tanaka A., Kohzu A., Oyagi H., Tamaki H., Nakano S. 2021. Microdiversity and phylogeographic diversification of bacterioplankton in pelagic freshwater systems revealed by long-read amplicon sequencing. *Microbiome*, 9:24.
- Callieri C., Slabakova V., Dzhembekova N., Slabakova N., Peneva E., Cabello-Yeves P.J., Di Cesare A., Eckert EM., Bertoni R., Corno G., Salcher M.M., Kamburska L., Bertoni F., Moncheva S. 2019. The mesopelagic anoxic Black Sea as an unexpected habitat for *Synechococcus* challenges our understanding of global “deep red fluorescence”. *ISME J.* 10.1038/s41396-019-0378-z
- Okazaki Y., Salcher M., Callieri C., Nakano S. 2018. The broad habitat spectrum of the CL500-11 lineage (Phylum Chloroflexi), a dominant bacterioplankton in oxygenated hypolimnia of deep freshwater lakes. *Front. Microbiol.* 9: 2891. doi: 10.3389/fmicb.2018.02891
- Cabello-Yeves P.J., Picazo A., Camacho A., Callieri C., Rosselli R., Roda-Garcia J.J., Coutinho F.H., Rodriguez-Valera F. 2018. Ecological and genomic features of two widespread freshwater picocyanobacteria. *Environmental Microbiol.* 20: 3757-3771.
- Callieri C., M. Coci, G. Corno, M. Macek, B. Modenutti, E. Balseiro, R. Bertoni. 2013. Phylogenetic diversity of nonmarine picocyanobacteria. *FEMS Microbiol. Ecol.* 85: 293-301

- Callieri C., Cronberg G., Stockner J. 2012. Freshwater Picocyanobacteria: Single Cells, Microcolonies and Colonial Forms. In: Ecology of Cyanobacteria: Their Diversity in Time and Space. B. Whitton (Ed.). Second edition. Springer Publishers: 229-269.
- Callieri C., Lami A., Bertoni R. 2011. Microcolony formation by single-cell *Synechococcus* strains as a fast response to UV radiation. *Appl. Environ. Microbiol.* 77: 7533-7540.
- Callieri, C., Bertoni R., Corno G., Caravati E., Rasconi S., Contesini M. 2009. Bacteria, Archaea and Crenarchaeota in the epilimnion and hypolimnion of a deep holo-oligomictic lake. *Appl. Environ. Microbiol.*, 75 (22): 7298-7300.

### **A 'life aquatic' with microbes: swimming through the last decades in microbial ecology with picocyanobacteria**

Over the course of my career, aquatic microbial ecology came a long way. I believe that looking back to this history – not with nostalgia, but with the curiosity of the scientist – can help us move forward more mindfully, and better appreciate recent transformations in our understanding of microorganisms. With this lecture, then, I would like to retrace some of the most significant steps in the last decades in this field through my own research experience. Walking from molecular biology and its related 'omics' to their complex relations with biogeochemistry and ecology, exciting cognitive leaps have revealed an unexpected complexity to microbial worlds, one that we are still working hard to understand. To guide us through this history, I follow a group of microorganisms that accompanied me in my work: the tiny cyanobacteria, picosized cells who crucially shaped planet Earth as we know it, and who keep informing its transformations today. Starting from their long evolutionary history – and the ways we came to unfold them, I will then consider their ecological roles and implications, from communities to single-cells, and from lakes to one of the most surprising marine environments – the Black Sea: picocyanobacteria still have much to teach us!

## Rita Giuffredi

CNR IREA (Istituto per il Rilevamento Elettromagnetico dell'Ambiente), Milano

[giuffredi.r@irea.cnr.it](mailto:giuffredi.r@irea.cnr.it)



### Biosketch

Rita Giuffredi works in Milan at the Institute for Electromagnetic Sensing of the Environment of the National Research Council (IREA-CNR). After graduating in particle physics, she devoted to further develop her studies on science with a master's degree in science communication at SISSA in Trieste and a PhD focusing on narratives in EU research policy discourses, carried out at the University of Bologna. At the same time, she worked for four years at CERN (Geneva) as a science communicator within a European project for the development of new diagnostic tools based on technologies developed at high-energy physics colliders (PicoSEC-MCNet). Since 2018, she has been collaborating with the European H2020 project BlueMed CSA, which was in charge of coordinating and promoting the European initiative of

the same name on research and innovation for "Blue" growth in the Mediterranean area (BLUEMED Initiative - Research and Innovation for Blue Growth and Jobs in the Mediterranean area); she dealt with the aspects related to science communication, and public and youth engagement. She is also involved since 2021 in the BRIDGES project, oriented towards the emergence and critical discussion of scientists' narratives and experimenting hybrid, reflexive and transdisciplinary research practices, focusing on complex socio-ecological issues, and in particular on the case study of soil fertility. Her research interests mainly focus on knowledge production, research policies, the relationship between science and democracy and the public communication of science.

### Selected publications

- Giuffredi, R. (2021). Attraverso confini e all'interno di visioni: il progetto BRIDGES come esempio di approccio ibrido e transdisciplinare al lavoro di ricerca (in press). In A. L'Astorina & C. Mangia (Eds.), *Scienziati in affanno? Scienza, politica e società: l'approccio post-normale in teoria e nelle pratiche*. Edizioni CNR.
- Giuffredi, R., Criscuolo, L., De Lazzari, A., Fanelli, G., Giordano, R., Petrocelli, A., Portacci, G., Pugnetti, A., & L'Astorina, A. (2021). Knowledge Co-construction by Citizens and Researchers to Create a SNAPSHOT of the Marine Environment During and After the Covid-19 Lockdown. *Frontiers in Marine Science*, 8, 1580. <https://doi.org/10.3389/fmars.2021.718214>
- Cappelletto, M., Giuffredi, R., Kastanidi, E., Vassilopoulou, V., & L'Astorina, A. (2021). Grounding Ocean Ethics While Sharing Knowledge and Promoting Environmental Responsibility: Empowering Young Ambassadors as Agents of Change. *Frontiers in Marine Science*, 8 (September), 1–9. <https://doi.org/10.3389/fmars.2021.717789>
- L'Astorina, A., Giuffredi, R., & Grasso, V. (Eds.) (2020). *Comunicare Partecipare Collaborare. Teorie e buone pratiche negli enti di ricerca*. CNR Edizioni. <https://doi.org/10.26324/2020Ricomunicare>
- Cerroni, A., & Giuffredi, R. (2021). La Terza Missione dell'Università fra scienza, democrazia ed emancipazione umana - Lavori in corso. In V. Pellegrino & M. Massari (Eds.), *Scienze sociali ed emancipazione - Tra teorie e istituzioni del sapere*. Genova University Press (GUI). <https://gup.unige.it/scienze-sociali-ed-emancipazione>
- Chakraborty, A. and Giuffredi, R. (2019) Science and technology for the people? On the framing of innovation in policy discourses in India and in EU, *JCOM*, 18(03).
- Giuffredi, R., 2019. «... before it is too late»: contrazione della dimensione temporale e retorica dell'urgenza nei discorsi europei sulla ricerca. *Futuri*, 11, pp.23–31.
- Giuffredi, R., 2016. La transizione dall'«Europa della conoscenza» all'«Unione dell'innovazione» nella politica della ricerca europea. *PHYSIS Rivista Internazionale di Storia della Scienza*, LI(1–2), pp.187–200.
- Cerroni, A. & Giuffredi, R., 2015. L'orizzonte di Horizon 2020: il futuro europeo nelle politiche della ricerca. *Futuri*, 6, pp.31–41.

### **Moving across sectors, languages and boundaries: young people and women as agents of change in complex socio-ecological systems**

Marine environments are threatened globally by several phenomena – climate change, pollution, overfishing among others. In this evolving framework, hyper-specialised expert knowledge has shown its limits in ensuring a sustainable relationship, based on respect and gaining mutual benefit, between human populations and the oceans, and in proposing solutions to the challenges positioned at the interfaces among ecological systems, society and governance.

Faced with such complexity, part of the scientific community has questioned its own social role, methods and objectives, with the objective of forging new links not only with society at large, but also and simultaneously with ecological systems. Academic reflections proposed various models for fruitfully governing the complexity of socio-ecological systems, favouring the exchange and integration of knowledge and also attaching importance to values and non-rational aspects of negotiations between actors (Funtowicz & Ravetz, 1993; Gibbons et al., 1994; Jasanoff, 2004; Stephenson et al., 2021). One common aspect of these approaches is the need to broaden the range of social actors involved in defining and solving problems, in order to build socially robust, relevant, inclusive and ethically respectful knowledge, oriented towards shared future scenarios.

Among these actors, it is particularly necessary, especially in a democratic knowledge society, to involve citizenship in defining problems (Giuffredi et al., 2021), sharing knowledge and identifying shared solutions. In particular, some transversal categories, such as young people (Cappelletto et al., 2021) and women, are able to play a crucial role as agents of change, capable of moving across sectors, languages and boundaries, if they are given enough space and genuine empowerment. In this context, the work of the young Ambassadors of the Euro-Mediterranean BlueMed initiative will be specifically analysed, in the context of the other similar initiatives that have flourished in other basins, and the marine fieldwork storytelling realised through the “Donnammare” blog, within the SNAPSHOT project, will be presented.

## Michael W. Lomas

Bigelow Laboratory for Ocean Sciences, East Boothbay, ME, 04544, USA  
[mlomas@bigelow.org](mailto:mlomas@bigelow.org); <https://www.bigelow.org/about/people/mlomas.html>



### Biosketch

I am a marine biogeochemist with a broad interest in the role that phytoplankton diversity and physiology plays in mediating the key processes of the biological carbon pump, and associated macronutrient cycles. While all phytoplankton fix inorganic carbon, they are plants after all, different phytoplankton assemblages lead to different foodweb structures and ultimately different efficiencies of the biological carbon pump, as well as the flow of carbon and energy to higher trophic levels. Lomas' lab uses a combination of natural field observations, and field and laboratory manipulation experiments to study innate differences in phytoplankton physiology in the field and how different

phytoplankton groups respond to climate change, in particular ocean acidification.

### Selected publications

- Lomas, M.W., Bates, N.R., Johnson, R.J., Steinberg, D.K., Tanioka, T. 2022. Adaptive Biogeochemistry Leads to Counter-intuitive Carbon Export Response to Warming in the Sargasso Sea. *Nature Communications*, 13: 1211. DOI: 10.1038/s41467-022-28842-3.
- Tanioka, T., Matsumoto, K., Lomas, M.W. 2021. Drawdown of atmospheric pCO<sub>2</sub> via dynamic particle export stoichiometry in the ocean twilight zone. *Geophysical Research Letters*, 48: e2021GL094924.
- Lomas, M.W., Baer, S.E., Mougnot, C., Terpis, K.X., Lomas, D.A., Altabet, M.A., Martiny, A.C. 2021. Varying influence of phytoplankton biodiversity and stoichiometric plasticity on bulk particulate stoichiometry across ocean basins. *Communications: Earth and Environment*, 2:143. DOI:10.1038/s43247-021-00212-9.
- Martiny, A.C., Hagstrom, G.I., DeVries, T., Letscher, R.T., Britten, G.L., Garcia, C.A., Galbraith, E., Karl, D.M., Levin, S.L., Lomas, M.W., Moreno, A.R., Talmy, D., Wang, W., Matsumoto, K. 2022. Marine phytoplankton resilience may moderate oligotrophic ecosystem responses and biogeochemical feedbacks to climate change. *Limnology and Oceanography*, 67. DOI: doi.org/10.1002/lno.12029.
- Fawcett, S.E., Lomas, M.W., Ward, B.B., Sigman, D.M. 2014. The effect of summer-to-winter mixed layer deepening on eukaryotic new production in the Sargasso Sea. *Global Biogeochemical cycles*. DOI: 10.1002/2013GB004579.
- Martiny, A.C., Pham, C., Primeau, F., Vrugt, J., Levin, S., Lomas, M.W. 2013. Strong and reproducible latitudinal patterns in marine plankton elemental composition. *Nature Geoscience*, 6:279-283.

### Biology Trumps Ocean Warming: Adaptive Biogeochemistry in the Sargasso Sea

Ocean ecosystem models predict that warming and increased surface ocean stratification will trigger a series of ecosystem events, ultimately reducing the biological export of particulate carbon to the ocean interior. We present a nearly three-decade time series from the open ocean that documents a biological response to ocean warming and nutrient reductions wherein particulate carbon export is maintained, counter to expectations. Carbon export is maintained through a combination of phytoplankton community changes to favor cyanobacteria that have higher nutrient use efficiencies manifested in high cellular carbon-to-phosphorus ratios and enhanced shallow phosphorus recycling leading to increased nutrient use efficiency by the ecosystem. The role of cross trophic level interactions in further supporting carbon export remain to be resolved. These results suggest that surface ocean ecosystems may be more responsive and



adapt more rapidly to changes in the hydrographic system than is currently envisioned in earth ecosystem models, with positive consequences for ocean carbon uptake.

## Federico Marrone

Dipartimento di Scienze e Tecnologie biologiche, chimiche e farmaceutiche, Università di Palermo

[https://www.researchgate.net/profile/Federico\\_Marrone](https://www.researchgate.net/profile/Federico_Marrone);

<https://scholar.google.it/citations?user=7yrLNUMAAAAJ&hl=it>



### Biosketch

I am an associate professor at the University of Palermo, where I am the head of the “Laboratorio di biologia evolutivistica e delle popolazioni” and lecture within the Masters “Scienze della Natura”, “Biodiversità e biologia ambientale” and “Biologia della Conservazione”. My main research interest deals with the natural history of the fauna of west-Palaeartic inland waters, with a special focus on the systematics and phylogeography of diaptomid copepods. I am also interested in the monitoring of biological invasions in inland waters. I have authored more than 90 papers in international ranked journals, and I am currently Associate Editor of five journals indexed in

WoS and/or SCOPUS. I am a fellow of the “Associazione Italiana di Oceanologia e Limnologia”, the “Unione Zoologica Italiana”, the “Società Italiana di Scienze Naturali”, and the “Società Siciliana di Scienze Naturali”. I am co-responsible for “large branchiopod” and “calanoid copepod” crustaceans for the Checklist of Italian fauna.

### Selected publications

- Alfonso G., Stoch F. & F. Marrone, 2022. An annotated checklist and bibliography of the Diaptomidae (Copepoda, Calanoida) of Italy, Corsica, and the Maltese islands. *Journal of Limnology*, 80: 2019. <https://doi.org/10.4081/jlimnol.2021.2019>
- Vecchioni L., Arculeo M., Cottarelli V. & F. Marrone, 2021. Range-wide phylogeography and taxonomy of the marine rock pools dweller *Tigriopus fulvus* (Fischer, 1860) (Copepoda, Harpacticoida). *Zoologica Scripta*, 59: 839-857. <https://doi.org/10.1111/jzs.12457>
- Marrone F., Vecchioni L., Deidun A., Mabrouki Y, Arab A. & M. Arculeo, 2020. DNA taxonomy of the potamid freshwater crabs from Northern Africa (Decapoda, Potamidae). *Zoologica Scripta*, 49: 473–487. <https://doi.org/10.1111/zsc.12415>
- Marrone F., Nardi G., Cianfanelli S., Govedič M., Barra S.A., Arculeo M. & M. Bodon, 2019. Diversity and taxonomy of the genus *Unio* Philipsson in Italy, with the designation of a neotype for *Unio elongatulus* C. Pfeiffer (Mollusca, Bivalvia, Unionidae). *Zootaxa*, 4545: 339-374. <https://doi.org/10.11646/zootaxa.4545.3.2>
- Cottarelli V., Mura G., Ippolito G. & F. Marrone, 2017. *Chirocephalus sarpedonis* sp. nov. (Branchiopoda, Anostraca, Chirocephalidae) from Turkey questions the monophyly of the traditional *Chirocephalus* species-groups. *Hydrobiologia*, 801: 5–20. <http://dx.doi.org/10.1007/s10750-017-3271-7>
- Marrone F., Alfonso G., Naselli-Flores L. & F. Stoch, 2017. Diversity patterns and biogeography of Diaptomidae (Copepoda, Calanoida) in the Western Palearctic. *Hydrobiologia*, 800: 45-60. <http://dx.doi.org/10.1007/s10750-017-3216-1>
- Marrone F., Petrusek A., Alfonso G. & M. Arculeo, 2014. The diaptomid fauna of Israel (Copepoda, Calanoida, Diaptomidae), with notes on the systematics of *Arctodiaptomus similis* s.l. (Baird, 1859) and *Arctodiaptomus irregularis* Dimentman & Por, 1985 stat. rev. *Zoological Studies*, 53:74. <https://doi.org/10.1186/s40555-014-0074-7>
- Marrone F., Lo Brutto S., Hundsdoerfer A.K. & M. Arculeo, 2013. Overlooked cryptic endemism in copepods: systematics and natural history of the calanoid subgenus *Occidodiaptomus* Borutzky 1991 (Copepoda, Calanoida, Diaptomidae). *Molecular Phylogenetics and Evolution*, 66: 190-212. <http://dx.doi.org/10.1016/j.ympev.2012.09.016>

## **What we (don't) know about aquatic biodiversity. A plea for the reappraisal of the so-called "old-fashioned" approaches**

As stressed decades ago at the Convention of Biological Diversity held in Rio de Janeiro in 1992, "we cannot protect what we do not know": an adequate knowledge of the biological diversity and its distribution patterns is in fact essential for their management and long-term protection. This way, along with innovative approaches aimed at improving our knowledge about biodiversity, it is mandatory to think about the reliability of available information and about the existing trends in the exploration and description of biodiversity. Using inland water animal diversity as a case study, I will discuss some general patterns. Currently available information about species diversity, distribution and status is unevenly distributed among taxa and geographical areas, with some "more charismatic" taxa much better known than lesser ones, and areas located close to research centres much better known than more remote ones. Such gaps in knowledge are known as Linnean, Wallacean and Racovitzan shortfalls, and largely prevents an adequate conservation prioritization and nature management, not to mention biogeographical, phylogenetic, and ecological inferences.

The extent of such shortfalls is somehow surprising in Italy, a country with a long and respected history in taxonomy and faunal studies, and points out to a series of concurrent causes determining a "taxonomic impediment". These can be summarized in the scarce appeal of taxonomy in the era of -omics and environmental sciences, the ravaging (and poor application) of scientometric indexes hindering taxonomical and faunistic research, and the paucity of funds granted to their study. As a consequence, taxonomists can be considered an "endangered species", possibly on the verge of extinction, forecasting a grim future for biodiversity studies and conservation. Urgent measures are needed to invert this trend, based both on the involvement of amateur researchers through citizen science and social network initiatives and, most importantly, on the formation and support of a new generation of taxonomists.

## Mariangela Ravaioli

Istituto di Scienze Marine – Ismar-CNR, Bologna (<http://www.ismar.cnr.it/>)

[mariangela.ravaioli@bo.ismar.cnr.it](mailto:mariangela.ravaioli@bo.ismar.cnr.it)

[http://www.ismar.cnr.it/personale/ravaioli-mariangela/tt\\_cv\\_breve\\_view?idRicercatore=ravaioli-mariangela](http://www.ismar.cnr.it/personale/ravaioli-mariangela/tt_cv_breve_view?idRicercatore=ravaioli-mariangela)



### Biosketch

CNR Research Director - Research Associate at ISMAR-CNR Degree in Natural Sciences. Faculty of Mathematical, Physical and Natural Sciences of the University of Bologna (1976). She has been a researcher at the CNR since 1985, then Research Director at ISMAR-CNR. She is an expert in marine environmental geology, she has dealt in particular with biogeochemical processes and cycles in the marine and lake environment, sedimentation processes, pollution and the use of radioactive tracers, long-term in situ observation in the Italian and Antarctic seas. She was responsible and coordinator of numerous regional, national, and European research projects. She has been a member of Scientific Councils and Commissions including IGBP, PNRA, GOON, LTER, FISR-Vector, CROP, Women and Science, AGI.

She is involved in technology transfer. From 1994-2003 she was Director of F.F. of the Institute of Marine Geology of the CNR (now Ismar-CNR). From 2003-2015, she was in charge of the Marine Geology Office in Bologna. From 2009 to 2015 she was President of the Research Area of the CNR of Bologna. She is currently a Research Associate at Ismar-CNR. She is a member of the Environment and Gender Group of the Women and Science Association. Contact person for initiatives on Gender Equity for the Metropolitan City of Bologna. She is active in the dissemination of science in schools of all levels and with stakeholders, Author and co-author of numerous publications in national and international journals.

### Selected publications

- Riminucci F., Funari V., Ravaioli M., Capotondi L. (2022). Trace metals accumulation on modern sediments from Po river prodelta, North Adriatic Sea. *Marine Pollution Bulletin* 175 (2022) 113399 Volume 175, February 2022, 113399, pp 0-13.
- Grilli F., Accoroni S., F Acri, F Bernardi Aubry, C Bergami, M Cabrini, M. Ravaioli et al.- Seasonal and Interannual Trends of Oceanographic Parameters over 40 Years in the Northern Adriatic Sea in Relation to Nutrient Loadings Using the EMODnet Chemistry Data Portal. *Water* 12 (8), 2280 (2020)
- Barra E., Riminucci F., Dinelli E., Albertazzi S., Giordano P., Ravaioli M., et al.-Natural Versus Anthropic Influence on North Adriatic Coast Detected by Geochemical Analyses. *Applied Sciences* 10 (18), 6595 (2020)
- Giglio F., Romano S., Albertazzi S., Chiarini F., Ravaioli M., Ligi M., et al.- Sediment Dynamics of the Neretva Channel (Croatia Coast) Inferred by Chemical and Physical Proxies. *Applied Sciences* 10 (3), 807 (2020)
- Chiarini F., Ravaioli M., Capotondi L.- Interannual variability of vertical particle fluxes in the Ross Sea (Antarctica). *NATURE CONSERVATION-BULGARIA*, (34):417-440; 10.3897/natureconservation.34.30732 MAY 3 2019.
- Capotondi L., N. Mancin, V. Cesari, E. Dinelli, M. Ravaioli, F. Riminucci (2019). Recent agglutinated foraminifera from the North Adriatic Sea: What the agglutinated tests can tell. *Marine Micropaleontology*, 147, pp. 25-42, DOI: <https://doi.org/10.1016/j.marmicro.2019.01.006>.
- Ravaioli M., Chiarini F., Tarozzi L. Considerazioni su Cambiamenti climatici e biodiversità, Esempi di Studi e riflessioni di genere. In *AMBIENTE E CLIMA. Il presente per il futuro.* a cura di Cristina Mangia, Giuliana Rubbia, Mariangela Ravaioli, Sveva Avveduto, Patrizia Colella. Convegno Donne e Scienza-Lecce. (IRPPS Monografie) CNR-IRPPS e-Publishing: <http://www.irpps.cnr.it/e-pub/ojs/>. ISBN (online) 9788898822218 DOI: 10.14600/978-88-98822-21-8. pp. 297
- La Rete Italiana per la Ricerca Ecologica di Lungo Termine. *Lo studio della biodiversità e dei cambiamenti* (2021) a cura di Capotondi L., Ravaioli M., Acosta A., Chiarini F., Lami A., Stanisci A., Tarozzi L., Mazzocchi M.G. CNR-Edizioni,

Roma. DOI: 10.5281/zenodo.5570272. ISBN versione on-line: 978-88-8080-214-3, ISBN versione a stampa: 978-88-8080-208-2., 16 dicembre 2021.

**Presentation Volume LTER: The Italian network for long-term ecological research - The study of biodiversity and changes. Curators Capotondi L., Ravaioli M., Acosta A., Chiarini F., Lami A., Stanisci A., Leone Tarozzi L., Mazzocchi M.G.**

Ecology is the study of the interactions between organisms and the environment that hosts them. These are investigations complex and interdisciplinary scientific as ecosystems are characterized by numerous biotic and abiotic components that interact dynamically. Long Term Ecological Research (LTER) provides the basis scientific reference to distinguish the natural dynamics of ecological processes, which is manifested on long time intervals, from the effects of global trends such as climate change or factors local influence and disturbance. The availability of long series of ecological and biodiversity data allows, in addition, to evaluate the effectiveness of environmental protection and recovery actions, becoming a planning and verification tool in the management of resources and the territory. The LTER-Italy Network, which gathers 79 sites distributed throughout the national territory in which they are conducted long-term ecological research, is characterized by an extreme diversity of natural environments (eco-domains in the terrestrial, marine, inland and transitional waters) and is the context of trans-ecodomain and interdisciplinary studies for a holistic approach to understanding of the environment and its dynamics. This integrated approach is connected to basic, applied and technological sciences and the availability of long time series of ecological data on the Italian territory, allows to create a bridge between researchers, citizens, users and decision makers. This volume offers an updated overview of the various activities carried out by the LTER-Italy Network e of the results acquired during the first 15 years of its establishment. It is an overview that it ranges from historical and informative aspects to political and social ones, having as its fulcrum the research carried out in the countless observation sites and covering a broad spectrum of themes and approaches. This volume, the result of a great collective effort, is aimed at all those who are driven by interest in learn about the diversity and beauty of our environment, together with its many problems.

## Mario Sprovieri

CNR - IAS, Torretta Granitola, Via del Mare 3, 91021 Campobello di Mazara (TP), Italy  
[mario.sprovieri@cnr.it](mailto:mario.sprovieri@cnr.it); <http://www.ias.cnr.it>



### Biosketch

I am Director of Research at the Institute of Anthropic Impacts and Sustainability in the marine environment (IAS-CNR). I received a Ph.D. in Geochemistry (1997) from the University of Palermo. My research is mainly focused on: i) understanding the distribution and pathways of inorganic and organic pollutants in highly contaminated worldwide distributed marine coastal zones and open sea of the Mediterranean basin, ii) investigation of the dynamics of chemical tracers in the present Mediterranean basin and their interaction with lithosphere, atmosphere and biosphere, iii) understanding of natural variability and evolution of paleoclimate and palaeoceanography during the Cretaceous and late Neogene (by multi-proxy analysis of stable isotopes, trace metals, faunal assemblage distribution, etc). I was involved as Principal Investigator in the EUROCEANS, EARTHTIME, JERICO, PERSEUS and SESAME, GTSnext ITN EU, BLUEMED H2020, CIRCLES H2020, ABIOMMED DG/ENV,

SHAREMED INTERREG MED and as coordinator and principal researcher in several national and international programs focused on distribution of micro-pollutants in different coastal areas. He is coordinator of the project CISAS (FISR-MIUR), SOS Piattaforme & Impatti Offshore (MiTE), MARINE HAZARD (PON03) and other national research projects (PRIN2018, PNRA2019, etc.). I have served on many international science panels, on Committees of the CNR. He is co-author of several international science plans and co-author of over than 196 papers in peer-review journals in palaeoceanography, stratigraphy and environmental science. I am coordinating the Joint Programming Initiative (Oceans) action 'Science for Good Environmental Status' (2019-2023) with 14 participating EU countries and aiming to contribute to better understanding and achieving a Good Environmental Status (GES) in a more integrative way, towards a sustainable use of the seas and ocean and support to the Marine Strategy Framework Directive.

### Selected publications

- Coro, G., Tassetti, A. N., Armelloni, E. N., Pulcinella, J., Ferrà, C., Mario Sprovieri, M., Trincardi, F., Scarcella, G. COVID-19 lockdowns reveal the resilience of Adriatic Sea fisheries to forced fishing effort reduction. *Scientific Reports* (2022) 12:1052.
- Oliveri, E., Ausili, A., Barsanti, M., Conte, F., Delbono, I., Del Core, M., Giaramita, L., Passaro, S., Placenti, F., Quinci, E. M., Romano, Elena, R., Sabatino, N. Interferences between natural and anthropic hazards in marine-coastal environments: Assessing transport from land to the offshore systems in the Crotona basin (Ionian Sea). *Estuarine, Coastal and Shelf Science*, 271, (2022): 5: 107854
- Sprovieri, M., Cucco, A., Budillon, F., Salvaggio Manta, D., Trincardi, F., Passaro, S. Large-Scale Mercury Dispersion at Sea: Modelling a Multi-Hazard Case Study from Augusta Bay (Central Mediterranean Sea). *Int J Environ Res Public Health* (2022) 26;19(7):3956. <http://dx.doi.org/10.1016/j.scitotenv.2021.152412>
- Retelletti Brogi, S., Cossarini, G., Bachi, G., Balestra, C., Camatti, E., Casotti, R., Checcucci, G., Colella, S., Evangelista, V., Falcini, F., Francocci, F., Giorgino, T., Margiotta, F., Ribera d'Alcalà, M., Sprovieri, M., Vestri, S., Santinelli, C. Evidence of Covid-19 lockdown effects on riverine dissolved organic matter dynamics provides a proof-of-concept for needed regulations of anthropogenic emissions. *Science of the total Environment* 812 (2022) 152412.
- Traina, A., Ausili, A., Bonsignore, M., Fattorini, D., Gherardi, S., Gorbi, S. Quinci, E.M., Romano, E., Salvaggio Manta, D., Tranchida, G., Regoli, F., Mario Sprovieri, M. Organochlorines and Polycyclic Aromatic Hydrocarbons as fingerprint of exposure pathways from marine sediments to biota (2021). *Marine Pollution Bulletin*, 170.

Sprovieri, M., Ribera d'Alcalà, M., Roose, P., Drago, A., De Cauwer, K., Falcini, F., Lips, I., Maggi, C., Mauffret, A., Tronczynski, J., Zeri, C., Moretti, P.F. Science for Good Environmental Status: A European Joint Action to Support Marine Policy. *Sustainability* 2021, 13, 8664.

Bonsignore M., Salvagio Manta D.S., Barsanti M., Conte F., Delbono I., Horvat M., Quinci E.M., Schirone A., Shlyapnikov Y., Sprovieri M., Mercury isotope signatures in sediments and marine organisms as tracers of historical industrial pollution. (2020). *Chemosphere* (258)127435.

Denaro G., Salvagio Manta D., Borri A., Bonsignore M., Valenti D., Quinci E.M., Cucco A., Spagnolo B., Sprovieri M., De Gaetano A. HR3DHG version 1: Modeling the spatiotemporal dynamics of mercury in the Augusta Bay (southern Italy) (2020). *Geoscientific Model Development* (13)4. 2073-2093.

## **SNAPSHOT: A synoptic assessment of temporary-decreased human pressures on key Italian marine areas**

**Fabio Trincardi (1) & Mario Sprovieri (2)**

(1) Dipartimento Scienze del Sistema Terra e Tecnologie per l'Ambiente (DSSTTA-CNR), Piazzale Aldo Moro, 7 - 00185 Roma

(2) Istituto per lo studio degli Impatti Antropici e sostenibilità in ambiente Marino (IAS-CNR), Via del Mare, 3 - Torretta Granitola, Campobello di Mazara, Trapani

To contain the spread of the SARS-CoV2 coronavirus infection in most European Countries, Europe promoted a shut down of all non-essential economic activities while the population was induced to stay indoors. For about 2,5 months, Europe was forced into the grip of an unprecedented lockdown. This drastic limitation impacted the movement of people with an almost total halt of air and maritime transport. The lockdown took place in a very short time giving way to an unprecedented and unique experiment: significant reduction of many activities, both industry and services, was paralleled by intensification of a variety of measures to address the problems created by the pandemic. All this produced a significant and transitory modification of the anthropogenic impact on the environment, including the marine-coastal system, especially where anthropogenic pressure was most relevant before the lockdown (and after). The extent of this modification has been explored by a broad component of the Italian scientific community to characterize both the lockdown phase and the ensuing recovery and to produce a broad picture of the response of ecosystems; this activity provided key indications for future sustainable and effective management of the environment. The presentation shows the main conceptual approach and the key results of this research activity, still in progress. The results are clear for many variables (noise, fishing, fluxes of some of the nutrients to the ocean) though we recognise that quantifying the diminution of human pressure is not easy for all parameters in a conservative system that maintains the memory of previous cumulative impacts.



## COMUNICAZIONI ORALI

## SESSIONE SPECIALE - Effetti della pandemia da SARS-CoV2 sugli ecosistemi acquatici – Chair: Jacopo Chiggiato, Giuseppe Scarcella, Michela Rogora

### Using machine learning to predict the effect of the 2020 COVID-19 lockdown on the biogeochemical properties of the Venice lagoon at selected sites

**Malek Belgacem** (1) \*, Fabrizio Aubry (1), Jacopo Chiggiato (1), Elisa Camatti (1), Francesco Aciri (1), Marco Pansera (2), Giacomo Falchetta (3)

(1) ISMAR-CNR, Arsenale Tesa 104, Castello 2737/F, 30122 Venice, Italy

(2) Stazione Zoologica Anton Dohrn, Villa Comunale, 80121 Napoli, Italy

(3) CMCC@Ca'Foscari, Via della Libertà, 12, 30121 Venice, Italy

\* email corresponding author: [malek.belgacem@ve.ismar.cnr.it](mailto:malek.belgacem@ve.ismar.cnr.it)

Since March 2020, most governments worldwide have imposed lockdowns to limit the transmission of the Covid-19 disease, Italy included. Many types of outdoor activities (i.e., tourism, industries) were suspended, a large part of the population forced to stay home. As a consequence, the effect of the anthropogenic pressures on the environment was expected to be reduced during and after the lockdown period, albeit eventually temporary. The aim of this study is to identify signal/evidence, if any, of the impact of the lockdown in a peculiar environment such as the Lagoon of Venice, Italy, in particular, whether the outbreak has affected or not variations in the biogeochemical properties at two selected sites: San Giuliano and Palude della Rosa. These sites were chosen as sentinels of two markedly different areas of the Lagoon of Venice; the former located in a polluted industrial area, the latter in a relatively undisturbed lagoon site. We used Random Forest as machine learning regression algorithm to predict chlorophyll a, nitrate, ammonia, ammonium nitrate, phosphate, silicate measures of the year 2020 besides the phytoplankton diversity, to evaluate the water quality of the lagoon in a counterfactual scenario where no lockdown occurred. The results are based on a comparison between predicted and observed measurements during 2020 based on previous years variability. The model has shown a small variation between the predicted and the observed values of some parameters in both stations which means that the lockdown could have affected the lagoon ecosystem. To measure this impact, a percentage of change was calculated between the predicted and observed 2020. The model performance was accurate in predicting nitrate and nitrite levels ( $R^2 \geq 0.98$ ) unlike the other parameters ( $R^2 < 0.54$ ). The findings state that the predicted nitrate (absence of lockdown) would be slightly higher than the observed (lockdown) values by 3.2% starting during April 2020 in S. Giuliano, which could mean that there is less input of nitrate, while Palude della Rosa did not show much difference between the predicted and the observed nitrate, since it is less affected by the anthropogenic perturbations. Finally, to ensure that the generated counterfactuals are useful to predict the lockdown impact, we carry out a placebo test analysis.

### Evidence of Covid-19 lockdown effects on riverine dissolved organic matter dynamics provides a proof-of-concept for needed regulations of anthropogenic emissions.

**Simona Retelletti Brogi** (1)\*, Gianpiero Cossarini (2), Giancarlo Bachi (1), Cecilia Balestra (2), Elisa Camatti (3), Raffaella Casotti (4), Giovanni Checcucci (1), Simone Colella (5), Valtere Evangelista (1), Federico Falcini (5), Fedra Francocci (6), Toni Giorgino (7), Francesca Margiotta (4), Maurizio Ribera d'Alcalà (4), Mario Sprovieri (8), Stefano Vestri (1), Chiara Santinelli (1)

- (1) Istituto di Biofisica, CNR. Pisa, Italy.
  - (2) Istituto Nazionale di Oceanografia e Geofisica Sperimentale. Sgonico (TS), Italy.
  - (3) Istituto di Scienze Marine, CNR. Venezia, Italy.
  - (4) Stazione Zoologica Anton Dohrn. Napoli, Italy.
  - (5) Istituto di Scienze Marine, CNR. Roma, Italy.
  - (6) Istituto per lo studio degli impatti Antropici e Sostenibilità in ambiente marino, CNR. Roma, Italy.
  - (7) Istituto di Biofisica, CNR. Milano, Italy.
  - (8) Istituto per lo studio degli impatti Antropici e Sostenibilità in ambiente marino, CNR. Campobello di Mazara (TP), Italy.
- \* email corresponding author: [simona.retelletti@ibf.cnr.it](mailto:simona.retelletti@ibf.cnr.it)

The fast spread of SARS-CoV-2 virus in Italy resulted in a 3-months lockdown of the entire country. During this period, the effect of the relieved anthropogenic activities on the environment was plainly clear all over the country. Herein, we provide the first evidence of the lockdown effects on riverine dissolved organic matter (DOM) dynamics. The strong reduction in anthropogenic activities resulted in a marked decrease in dissolved organic carbon (DOC) concentration in the Arno River (-44%) and the coastal area affected by its input (-15%), compared to previous conditions. The DOM optical properties (absorption and fluorescence) showed a change in its quality, with a shift toward smaller and less aromatic molecules during the lockdown. The reduced human activity and the consequent change in DOM dynamics affected the abundance and annual dynamics of heterotrophic prokaryotes. The results of this study highlight the extent to which DOM dynamics in small rivers is affected by secondary and tertiary human activities as well as the quite short time scales to return to the impacted conditions. Our work also supports the importance of long-term research to disentangle the effects of casual events from the natural variability.

### Effects of the lockdown during Covid-19 Pandemic on the distribution of trace metals and PAH in the Venice Lagoon

**Daniele Cassin (1)\*, Enza Quinci (2) e Mario Sprovieri (2)**

- (1) CNR-ISMAR (Consiglio Nazionale delle Ricerche-Istituto di Scienze Marine), Castello 2737/f, 30121, Venezia
  - (2) CNR-IAS (Consiglio Nazionale delle Ricerche- Istituto per lo studio degli impatti Antropici e Sostenibilità), Via Della Vasca Navale - 00146 Roma
- \* email corresponding author: [daniele.cassin@cnr.it](mailto:daniele.cassin@cnr.it)

The lockdown imposed in Italy by the covid-19 pandemic in the early months of 2020 produced a significant decrease of the main anthropic activities present in the various environments, causing in turn a corresponding decrease in the production and emission of pollutants associated with these activities. Such situation generated by the emergency, despite its dramatic nature, represented a unique event gave the opportunity to evaluate both the effect of the drastic reduction of anthropogenic pressure on the environment and the processes with which the restart of the activities could restore the pre-lockdown conditions. This study represents a focus on the Venice lagoon, precious environment but always affected by the coexistence of multiple emission sources. For this purpose five selected stations were monitored for trace metals and PAH within one year. The results shown for some metals the prolonged lockdown led to the reduction of the concentration down to the background threshold. The restart of activities has resulted a return to concentrations comparable with those measured in previous years within six months. In particular, Cr and Cd marked an increase by a factor of 3. The PMF (Positive Matrix Factorization) approach was also used. From a preliminary analysis this statistical tool has shown that the increase in the concentration of the chemical species above can be attributed, for the dissolved component, from tributaries intake and atmospheric depositions, while for the particulate component, it was prevalent a sedimentological contribution, probably from resuspension. The concentrations of PAHs shown a good correlation with urban

and marine traffic trends. Furthermore, the fingerprinting analysis highlighted the clear prevalence of the atmospheric contribution on the composition of the analyzed samples.

### Response of the Taranto Gulf (Ionian Sea, Italy) to the COVID-19 lockdown

**Magda Di Leo** (1)\*, Santina Giandomenico (1), Enza Quinci (2), Nadia Sabatino (3), Mario Sprovieri (2)

(1) Istituto di Ricerca sulle Acque (IRSA-CNR), Via Roma 3, 74123, Taranto

(2) Istituto per lo studio degli Impatti Antropici e Sostenibilità in ambiente marino (IAS-CNR), Via del Mare 3, 91021 Torretta Granitola, Campobello di Mazara (TP)

(3) Istituto per lo studio degli Impatti Antropici e Sostenibilità in ambiente marino (IAS-CNR), ex Complesso Roosevelt, Lungomare Cristoforo Colombo, 4521, 90149 - Loc. Addaura – Palermo

\* email corresponding author: [magda.dileo@irsa.cnr.it](mailto:magda.dileo@irsa.cnr.it)

Following the Covid 19 pandemic, a total lockdown for social and economic activities was applied at global scale. This represented an unprecedented opportunity to explore dynamics and magnitude of the anthropic impact on the marine and coastal environment, which represents a major sink of human pollution. In this light, and as part of the SNAPSHOT project (a multidisciplinary research program dedicated to investigate the consequences of the lockdown on the Italian marine-coastal system, from May 2020 until June 2021), a number of selected sampling stations were analyzed, measuring contents of trace metals and organic compounds in seawater of the Taranto Gulf, which is an area of "high risk of environmental crisis". Evidence of a systematic increase (3 to 10 times with respect to the lockdown time) of PAHs (and their congeners used as fingerprint of sources), Cu, Cr, Ni and Zn, in the dissolved and particulate phase, were documented, extracting signals from the natural seasonal variability. This provided a unique chance to assess a nearly-natural background for this area and quantify the real anthropic impact (considering well-defined sources) on the marine environment. The local time-response of the contaminants dynamic was estimated and used to quantify the hysteresis of this semi-enclosed marine system.

### COVID-19 lockdowns reveal the resilience of Adriatic Sea fisheries to forced fishing effort reduction

**Carmen Ferrà** (1)\*, Gianpaolo Coro (2), Anna Nora Tassetti (1), Enrico Nicola Armelloni (1,3), Jacopo Pulcinella (1), Mario Sprovieri (4), Fabio Trincardi (5), Giuseppe Scarcella (1)

(1) Institute for Biological Resources and Marine Biotechnology (IRBIM), National Research Council of Italy (CNR), 60125, Ancona, 60125, Italy

(2) Institute of Information Science and Technologies (ISTI), National Research Council of Italy (CNR), Pisa, 56124, Italy

(3) University of Bologna, Department of Biological, Geological and Environmental Sciences, Bologna, 40126, Italy

(4) Institute of Anthropic Impacts and Sustainability in the Marine Environment (IAS), National Research Council of Italy (CNR), Torretta Granitola, 91021, Italy

(5) Department of Earth System Science and Environmental Technologies, National Research Council of Italy (CNR), Rome, 00185, Italy

\* email corresponding author: [carmen.ferravega@cnr.it](mailto:carmen.ferravega@cnr.it)

The COVID-19 pandemic provides a major opportunity to study fishing effort dynamics and to assess the response of the industry to standard and remedial actions. Knowing a fishing fleet's capacity to compensate for effort reduction (i.e., its resilience) allows differentiating governmental regulations by fleet, i.e., imposing stronger restrictions on the more resilient and weaker restrictions on the less resilient. In the present research, the response of the main fishing fleets of the Adriatic Sea to fishing hour reduction from 2015 to 2020 was measured. Fleet activity per gear type was inferred from monthly Automatic Identification System

data. Pattern recognition techniques were applied to study the fishing effort trends and barycentres by gear. The beneficial effects of the lockdowns on Adriatic endangered, threatened and protected (ETP) species were also estimated. Finally, fleet effort series were examined through a stock assessment model to demonstrate that every Adriatic fishing fleet generally behaves like a stock subject to significant stress, which was particularly highlighted by the pandemic. Our findings lend support to the notion that the Adriatic fleets can be compared to predators with medium-high resilience and a generally strong impact on ETP species.

### Knowledge co-construction by citizens and researchers to create a SNAPSHOT of the marine environment during and after the Covid-19 lockdown

Alba L'Astorina (1), **Rita Giuffredi** (1)\*, Laura Criscuolo (1), Antonella Petrocelli (2)

(1) Institute for Electromagnetic Sensing of the Environment (IREA), National Research Council of Italy (CNR), Milan, Italy  
(2) Institute for Water Research (IRSA), Talassografico "A. Cerruti", National Research Council of Italy (CNR), Taranto, Italy

\* Correspondence: Alba L'Astorina, Rita Giuffredi; [lastorina.a@irea.cnr.it](mailto:lastorina.a@irea.cnr.it), [giuffredi.r@irea.cnr.it](mailto:giuffredi.r@irea.cnr.it)

Lockdown measures adopted in Italy to contain the diffusion of Covid-19 inevitably altered the anthropogenic pressure on marine ecosystems. Public reactions were polarised around the surprise for a perceived quick natural recovery on one side, and of a generalised anxiety to restart economic activities on the other. The SNAPSHOT project, coordinated by the Italian National Research Council, was promoted to measure the effects of the unprecedented experimental conditions induced by the reduction of many anthropogenic pressures. The project was not conceived as a "traditional" scientific project but rather with a holistic, interdisciplinary approach, geared to combine scientific, economic and cultural observations to promote collective actions suitable to the governance of socio-ecological systems, reconciling respect for the environment with human activities and wellbeing, and thus grounding an ethical approach to marine resources. The project worked on one side to enrich scientific observations with the non-formal knowledge carried by the inhabitants of a set of coastal zones, thus empowering local populations; on the other to stimulate a reflection in the research community over the process of knowledge co-construction, its meaning, role and responsibility in the societal context. We present the perspective adopted by SNAPSHOT to build a responsible marine research project, inclusive both on the ground of involved actors and of knowledge sources, and comment the process- and community-related features, exploring limits and opportunities and proposing a set of recommendations, based on a preliminary review of our experience.

### Underwater noise levels in the Northern Adriatic Sea during the COVID-19 pandemic period

Antonio Petrizzo (1)\*, Andrea Barbanti (1), Giulia Barfucci (2), Mauro Bastianini (1), Iliaria Biagiotti (3), Michele Centurelli (3), Robert Chavanne (4), Antonio Codarin (2), Iliaria Costantini (3), Vlado Dadić (5), Francesco Marcello Falcieri (1), Raffaella Falkner (6), Giulio Farella (1), Mario Felli (7), Christian Ferrarin (1), Thomas Folegot (4), Roger Gallou (4), Daphnie Galvez (1), Mighol Ghezzi (1), Iole Leonori (3), Stefano Menegon (1), Hrvoje Mihanović (5), Stipe Muslim (5), Alice Pari (8), Sauro Pari (8), **Marta Picciulin** (1), Grgur Pleslić (6), Marko Radulović (6), Nikolina Rako-Gospić (6), Davide Sabbatini (8), Giulia Soldano (2), Jaroslav Tegowski (9), Predrag Vukadin (5), Jakub Zdroik (9), Fantina Madricardo (1)

(1) CNR-National Research Council, ISMAR - Institute of Marine Sciences in Venice, Castello 2737/f, 30122 Venice, Italy  
(2) ARPA FVG — Regional Environmental Protection Agency of Friuli Venezia Giulia, via Cairoli 14, 33057 Palmanova, Udine, Italy

- (3) CNR-National Research Council, IRBIM -Institute of Marine Biological Resources and Biotechnologies, SS Ancona, Largo Fiera della Pesca, 1 - 60125 Ancona, Italy  
(4) Quiet Oceans, Bâtiment Cap Ocean, Technopôle Brest-Iroise, 525 avenue Alexis de Rochon, 29280 Plouzané, France  
(5) Institute of Oceanography and Fisheries, Šetalište I. Meštrovića 63, 21000 Split, Croatia  
(6) Blue World Institute of Marine Research and Conservation, Kaštel 24, 51551 Veli Lošinj, Croatia  
(7) CNR-National Research Council, INM - Institute of Marine Engineering, via di Vallerano 139 – 00128 – Roma, Italy  
(8) Fondazione Cetacea Onlus, Viale Torino 7A, 47838 Riccione (RN), Italy  
(9) Institute of Oceanography, University of Gdańsk, Av. Marszałka Piłsudskiego 46, 81-378 Gdynia, Poland  
\*Corresponding author: [antonio.petrizzo@ve.ismar.cnr.it](mailto:antonio.petrizzo@ve.ismar.cnr.it)

Continuous underwater noise data have been recorded from March 2020 to June 2021 in the context of the Interreg Italy-Croatia SOUNDSCAPE project run in the Northern Adriatic Sea. Some of these data were collected during the COVID19 lockdown phase also thanks to the SNAPSHOT project. A network of nine stations ensured acoustic files collection 24h a day (48 kHz, 16 bit). Along the study period, an unprecedented drop in maritime mobility due to the COVID-19 pandemic was observed. Noise levels recorded pre (March 2020) and during (April 2020) the lockdown period are here compared to a post-lockdown situation (March 2021). During the lockdown phase, a clear noise reduction along the frequency spectrum up to 2.5 kHz was evident mostly on the Italian side of the study area: the Venice stations show the most prominent change, with a reduction of about 8 dB in the cumulative 63-2500 Hz frequency band at sea and an even more important noise level drop inside the lagoon. Less clear variations were found for the Croatian stations. Interestingly, high frequency noise levels remained almost constant in all the monitoring stations. This supports the hypothesis that the low-frequency variability was driven by the marine traffic decrease.

### COVID-19 lockdown affected atmospheric deposition and surface water chemistry over an Alpine area

**Michela Rogora** (1)\*, Sandra Steingruber (2), Aldo Marchetto (1), Rosario Mosello (1), Paola Giacomotti (1), Arianna Orrù (1), Gabriele A. Tartari (1), Rocco Tiberti (1,3)

- (1) National Research Council, Water Research Institute, Largo Tonolli 50, 28922 Verbania Pallanza (VB), Italy  
(2) Ufficio dell'Aria, del Clima e delle Energie Rinnovabili, Dipartimento del Territorio del Cantone Ticino, CH-6501 Bellinzona, Switzerland  
(3) Department of Earth and Environmental Sciences DSTA, University of Pavia, Via Ferrata 9, 27100 Pavia, Italy  
\* email corresponding author: [michela.rogora@cnr.it](mailto:michela.rogora@cnr.it)

The effects of COVID-19 lockdown on deposition and surface water chemistry in an area South of the Alps (Piedmont region, Italy, and Canton Ticino, Switzerland) were investigated by analyzing data from the Italian and Swiss long-term monitoring networks dealing with acidification and nitrogen enrichment of water bodies. Long-term data revealed that the deposition of S and N compounds in this area have stabilized since 2010; in 2020, however, deposition values were significantly below the average of the previous decade for both SO<sub>4</sub> and NO<sub>3</sub>, while the difference was rather limited for NH<sub>4</sub> deposition. The lower deposition values in 2020 can be related to the lower-than-average SO<sub>2</sub> and NO<sub>x</sub> air concentrations, consequent to the mobility restriction imposed by the lockdown. The lack of effects on NH<sub>4</sub> deposition can be explained by the fact that NH<sub>3</sub> emissions were not affected by the lockdown, being mainly related to agricultural activities. A widespread response to the decreased deposition of S and N compounds was observed in a group of pristine freshwater sites, with NO<sub>3</sub> concentrations in 2020 clearly below the long-term average. These results highlight the great potential of emission reduction policy in producing further improvements of water quality at sensitive sites.

## The potential effects of COVID-19 lockdown and the following restrictions on the status of eight target stocks in the Adriatic Sea

**Giuseppe Scarcella** (1)\*, Silvia Angelini (1,2), Enrico Nicola Armelloni (1,3), Ilaria Costantini (1), Andrea De Felice (1), Stefano Guicciardi (1), Iole Leonori (1), Francesco Masnadi (1,3), Martina Scanu (1,3), Gianpaolo Coro (4)

<sup>1</sup> (1) Institute for Biological Resources and Marine Biotechnology, National Research Council (CNR), Italy,

<sup>2</sup> (2) Fano Marine Center, Italy,

<sup>3</sup> (3) Department of Biological Sciences, Geological and Environmental, University of Bologna, Italy,

<sup>4</sup> (4) Istituto di Scienza e Tecnologie dell'informazione 'Alessandro Faedo' (ISTI), Italy....

\* email corresponding author: [giuseppe.scarcella@cnr.it](mailto:giuseppe.scarcella@cnr.it)

The COVID-19 pandemic had major impacts on the seafood supply chain, also reducing fishing activity. It is worth asking if fish stocks in the Mediterranean Sea, which in most cases has been in overfishing conditions for many years, may have benefitted from the reduction of the fishing pressure. The present work is the first attempt to make a quantitative evaluation of the impact of the COVID-19 related fishing effort reduction on the Mediterranean Sea fish stocks, focusing on the Adriatic Sea sub-areas. Eight commercially exploited target stocks were evaluated with a surplus production model, separately fitting the data for each stock until 2019 and until 2020. After reviewing the potential co-occurrence of environmental and management-related factors, we concluded that only in the case of the common sole can be detected an effective biomass improvement related to the pandemic restrictions, because it is the target of the only fishing fleet whose activity remained far lower than the expectation for the entire 2020. We conclude by remarking that effort management based on fishing days reduction has many flaws, and alternative instruments such as spatial management and harvest control rules based on output control may help to improve the condition of Adriatic fisheries.

## SESSIONE SPECIALE - Gli studi ecologici di lungo termine per la comprensione delle risposte degli ecosistemi acquatici agli impatti antropici e climatici – Chair: Giuseppe Denti, Silvia Pulina

### High altitude freshwaters: macroinvertebrates to the rescue

**Angela Boggero\***, Silvia Zaupa, Michela Rogora, Daniele Paganelli, Riccardo Fornaroli

CNR – Water Research Institute, Corso Tonolli 50, 28922 Verbania, Italy

\* email corresponding author: [angela.boggero@cnr.it](mailto:angela.boggero@cnr.it)

Biodiversity is of foremost importance both within the ICPWaters and National Emission Ceilings (NEC) Programmes, whose goals are the assessment of biological responses to reduced acidification compounds in mountain freshwaters following three goals defined by the UN 2030 Agenda (goals 6 on clean water, 13 on climate action, and 14 on life below water). Macroinvertebrates were sampled through an handle-net along the lake shores and in the outlet of each of the studied lakes in 2019 and 2020. Habitats were defined according to the EUNIS classification system: they include Permanent oligotrophic lakes (9 sites), and Surface temporary running waters (8 sites). Non-metric multidimensional scaling and Generalized Linear Models were applied to a data set including biodiversity metrics and the main environmental variables for both years. Results showed higher heterogeneity in 2020 than in 2019 based on their macroinvertebrate assemblages, even if diversity and richness decreased with altitude, decreasing pH and reactive phosphorous values. When focusing on EPT taxa and their richness, this increased with pH, and nutrient concentrations. The macroinvertebrate data collected with the aim of improving the environmental knowledge of mountain freshwaters, will allow to give an address to future national legislation.

### From metabarcoding time-series to plankton food webs

**Domenico D'Alelio** (1)\*, Daniele Bellardini (1), Giampaolo Zampicinini (1), Ferenc Jordan (1,2), Roberta Congestri (3), Luca Russo (1,4)

(1) Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, Villa Comunale, 80121 Naples, Italy

(2) Department of Chemistry, Life Sciences and Environmental Sustainability, University of Parma, Italy

(3) Laboratory of Biology of Algae, Department of Biology, University of Rome 'Tor Vergata', Via Cracovia 1 - 00133 Rome, Italy

(4) PhD Programme in Evolutionary Biology and Ecology, Department of Biology, University of Rome "Tor Vergata", Via della Ricerca Scientifica 1 - 00133 Rome, Italy

\* email corresponding author: [domenico.dalelio@szn.it](mailto:domenico.dalelio@szn.it)

The application of metabarcoding (metaB) in aquatic ecology is mostly based on inferring and studying co-occurrence networks, showing how plankton communities are affected by seasonal conditions and nutritional properties of the environment. Reflecting the 'multi-layered' nature of ecological communities by aggregating different kinds of trophic and non-trophic processes, co-occurrence networks are not direct evidence of trophic interactions, but they pave the way to assemble food web models by combining conceptual and mathematical approaches. In this study, we analyzed metaB time-series (including data from the long-term ecological research station MareChiara in the Gulf of Naples, Mediterranean Sea, Italy), to better describe the link between plankton diversity and food web structure. Specifically, we derived co-occurrence networks and converted them into conceptual models for food webs by identifying putative

trophic interactions therein, based on the biological information (i.e., body sizes and trophic habits) available for each planktonic organism detected by metaB. The resulting plankton food webs showed ecological properties resembling trophic processes, such as trophic hierarchy and modularity driven by dimensional differences between predator and prey. Thanks to the high taxonomic resolution of metaB analysis, we characterized trophic roles of planktonic organisms and identified the possible ecological implications.

### The European double heatwave in 2019: Chlorophyll-a response moderated by lake depth and trophic state

**Gary Free** (1)\*, Mariano Bresciani (1), Monica Pinardi (1), Stefan Simis (2), Xiaohan Liu (2), Clément Albergel (3) and Claudia Giardino (1)

(1) Institute for Electromagnetic Sensing of the Environment, National Research Council, Milan, 20133, Italy

(2) Plymouth Marine Laboratory, UK

(3) European Space Agency Climate Office, ECSAT, Harwell Campus, Didcot, Oxfordshire, United Kingdom

\* email corresponding author: [free.g@irea.cnr.it](mailto:free.g@irea.cnr.it)

In the summer of 2019, a widespread double heatwave event occurred in Europe. Such compounded weather events may have a significant impact on freshwater ecosystems. In order to examine this, we used data on satellite derived chlorophyll-a for 36 European lakes. Deep and medium depth lakes at higher latitudes were found to have a more synchronous chlorophyll-a increase with temperature, perhaps as a result of an improved light climate resulting from increased stratification. Many deep or northern lakes had a notable response to the heatwaves. Warmer southern shallow lakes were the most asynchronous, tending to show a greater response to subsequent low pressure or storm events than the heatwave itself. Chlorophyll-a peaks occurred typically 5 days after the peak of the heatwave for shallow lakes and for some shallow lakes the sequential cycle of several heatwaves and low pressure events was found to punctuate the seasonal pattern of chlorophyll-a. Notably, in several of these nutrient-rich lakes the response to the heatwave was dwarfed by large algal blooms occurring later during the typical cyanobacterial bloom period in early Autumn underlining the importance of timing and phenology in response to heatwaves.

### Do scientific dolphin watching influence cetacean's behaviour? The case study of the Levantine Aegean Sea (Eastern Mediterranean Sea)

**Maurizio Ingresso** (1)\*, Anastasia Miliou (2), Thodoris Tsimpids (2), Beatriz Tintorè (2), Paraskevi Nomikou (3), Giulia Cipriano (1), Roberto Carlucci (1), Francesca Cornelia Santacesaria (4), Pasquale Ricci (1)

(1) Università degli Studi di Bari, Via Orabona 4, 70125, Bari, Italy

(2) Archipelagos – Institute of Marine Research, P.O. Box 42, 83103, Pythagorio, Samos, Greece

(3) National Kapodistrian University of Athens, Zografou Campus, 15784, Athens, Greece

(4) Jonian Dolphin Conservation, Corso Vittorio Emanuele II 1, 74123, Taranto, Italy

\* email corresponding author: [maurizio.ingrosso94@gmail.com](mailto:maurizio.ingrosso94@gmail.com)

Although whale and dolphin watching is often carried out to raise awareness on cetaceans' conservation, their monitoring represents one of the main concerns mostly because repetitive approaches to pods could cause behavioural changes effects on short and long-term. To explore this phenomena data regarding cetaceans' responses to research boat approaches were collected between 2016 and 2021, during standardized vessel-based surveys carried out in the Levantine Aegean Sea (Eastern Mediterranean Sea). Surveys were carried out from different monitoring platforms: 2 sail boats and 2 motorboats. The response

to research boats were analysed for 3 different small odontocetes: *Tursiops truncatus*, *Stenella coeruleoalba* and *Delphinus delphis* (59, 65, 120 sightings, respectively). If no changes in behaviour occurred, responses were classified as neutral, otherwise as non-neutral. The response to research boats were analysed through a binomial Generalized Linear Model (GLM) in R environment (version 4.0.3, *stats* package). Only the common bottlenose dolphin showed statistically significant neutral response, (Frequency of Occurrence = 50, 85% of the total sightings of the species); while the striped dolphin and the short-beaked common dolphin did not show significant responses to boat approaches. In all cases, the different boat type did not influence the cetaceans' behaviour.

### Lake oxygen and climate warming: the deep subalpine lakes in a global context

**Barbara Leoni** (1)\*, Veronica Nava (1), Claudia Dresti (2), Michela Rogora (2)

(1) DISAT, Università degli studi di Milano – Bicocca, Piazza della Scienza 1 20126 Milano, Italy

(2) CNR, Water Research Institute (IRSA), Largo Tonolli, Verbania Pallanza, Italy

\* email corresponding author: [barbara.leoni@unimib.it](mailto:barbara.leoni@unimib.it)

The concentration of dissolved oxygen (DO) in aquatic systems influences nutrient biogeochemistry, biodiversity, the quality of drinking water, greenhouse gas emissions, and human health. In a context of global warming, concentrations of DO in lakes should decline with increasing water temperature due to reduced gas solubility, however, other mechanisms can also alter DO (e.g. rates of primary production and of heterotrophic respiration, strength and duration of thermal stratification). The deep subalpine lakes in Northern Italy have proved to be affected by climate change, in terms of increasing water temperature, aggrading stability of the water column and decreasing frequency and extent of deep water mixing. Further, owing to thermal regime changes, a recent decrease in the hypolimnetic oxygen content has been observed in oligo-mesotrophic lakes and an increase of the extent of anoxic conditions in meso-eutrophic ones. At the same time, the lakes showed an increase of epilimnetic DO as the algal production is promoted by favourable environmental condition. In this contribution, the long-term (40 years) trends in dissolved oxygen and temperature of two Italian lakes (L. Iseo and L. Maggiore), characterized by different trophic levels, will be discussed in relation to patterns observed and predicted at global level for lentic ecosystems (Jane et al. 2021).

### Long-term water temperature monitoring and the response of amphipod metabolic rate to climate change in Acquatina lagoon

**Milad Shokri** (1), Francesco Cozzoli (2), Ilaria Rosati (2), Fabio Vignes (1), Alberto Basset (1)

(1) Laboratory of Ecology, Department of Biological and Environmental Sciences and Technologies, University of Salento, S.P. Lecce-Monteroni, 73100 Lecce, Italy.

(2) Research Institute on Terrestrial Ecosystems (IRET – URT Lecce) - National Research Council of Italy (CNR), Campus Ecotekne, S.P. Lecce-Monteroni, 73100 Lecce, Italy.

\*email corresponding author: [milad.shokri@unisalento.it](mailto:milad.shokri@unisalento.it)

Climate change affects individual phenotypes, biotic and abiotic interactions, which have cascading impacts scale up to the ecosystem level. Considering long term ecological monitoring might reveal significant insights to changes in aquatic ecosystem functioning, we aimed to monitor the water temperature variations over a long term period, and evaluate the response of aquatic macroinvertebrate metabolic rate to climate change scenarios. To do so, the water temperature of a transitional water ecosystem: Acquatina, located on the southern coast of Apulia, has been monitored since 1985. Furthermore, we experimentally investigated the

response of individual standard metabolic rate of the amphipod *Gammarus insensibilis*, collected from Aquatina lagoon, across a temperature gradient covering the seasonal variation with a narrow temperature increase of 0.6 - 1.2 °C following the most conservative IPCC global warming scenario to year 2100. Overall, we have reported the water temperature variations and climate trend showing an increase of seasonal temperature over the last 3 decades. Furthermore, our experimental observation on the effect of temperature even the most conservative scenario i.e., 1.2° showed a significant increase of *G.insensibilis* metabolic rate individuals. Given the evidence of metabolic response of individuals to a marginal temperature increase, even the conservative climate change scenario might have significant implications on the population size structure and standing biomass.

### Light transparency and chlorophyll-a influence the temporal and spatial differences of the under-ice microbiome

**Ulrike Obertegger\***

Fondazione Edmund Mach, CRI, E. Mach 1, San Michele all'Adige (TN)

\* email corresponding author: [ulrike.obertegger@fmach.it](mailto:ulrike.obertegger@fmach.it)

Dynamics of under-ice community are barely understood. Here, bacterial communities of different layers (upper and lower euphotic layer, euphotic layer, hypolimnion) and years (2015, 2017–2021) of the LTER site Lake Tovel were investigated by Illumina sequencing of the 16S rRNA gene. Investigating under-ice conditions, the year 2017 showed highest under-ice light and chlorophyll-a while 2021 showed no under-ice light and lowest chlorophyll-a. Alpha- and beta-diversity of summer and under-ice hypolimnetic communities were similar. In non-metric multidimensional scaling (NMDS), summer and under-ice communities were different even though hypolimnetic communities were similar. Under-ice communities were not linked to layer differences implying that a spatial distinction under ice was less important than in summer, especially in years with little or no under-ice light. Most under-ice bacterial classes and ASVs showed direct and indirect dependencies on light availability and primary production. Similarly, light transparency and primary production were important in the NMDS with only under-ice communities. In the future, ice conditions with less snow cover might lead to bacterial communities similar to that of high-light years (2017, 2018, 2020).

### Synchronous trend signals of the water quality of Seveso, Olona and Lambro in half a century

**Gianni Tartari (1,2)\***, Fabrizio Stefani (1)\*, Valeria Mezzanotte (3), Alessandro Vittorio (3), Carlo Carrettini (2), Gianni Pampurini (2), Valeria Marchesi (4), Pietro Genoni (4)

(1) CNR-IRSA, via del Mulino 19, 20861 Brugherio (MB)

(2) Osservatorio per il Paesaggio Fiume Lambro Lucente, Via San Dionigi 90, 20139 Milano

(3) Università degli Studi di Milano Bicocca, Dipartimento di Scienze dell'ambiente e della Terra, Piazza della Scienza 2, 20126 Milano

(4) ARPA Lombardia, Via Rosellini 17, 2014 Milano

\* email: [gianni.tartari@irsa.cnr.it](mailto:gianni.tartari@irsa.cnr.it), [fabrizio.stefani@irsa.cnr.it](mailto:fabrizio.stefani@irsa.cnr.it)

Seveso, Olona and Lambro flow in a territory in which anthropization has reached an intensity that is almost unique in the European continent. The three rivers, which merge at Sant'Angelo Lodigiano, have been known for decades for their poor quality. For this reason, since the 1960s, they have been the subject of a huge number of studies and research. Through an accurate collection of scientific publications, reports and documents, starting from the beginning of the last century, it was possible to obtain historical data on the

chemical and biological quality of the three rivers. Data collected by Lombardy Regional Environmental Protection Agency (ARPA Lombardia) have been merged to create a database of aggregated data on an annual basis, called SOLAD (Seveso, Olona, Lambro Aggregated Database), which has come to cover more than half a century. The approximately 11,500 aggregated data, corresponding to approximately 90,000 chemical quality data, as well as several hundred biological quality data (homogeneously summarized by the IBE index), made it possible to describe the evolution of water quality over half a century (1970-2019) for thirteen river stretches (9 upstream of Milan and 4 downstream), synchronously and on a ten-year basis. The spatial gradient (North-South) is in agreement with the distribution of pressures while the evident synchronous temporal improvement in both chemical quality and biological quality in the entire basin, whose interpretation passes through the historical cycle of regulatory and management interventions, was even stronger than expected.

### Are phytoplankton a good indicator of climatic and anthropic impact? Hints from long term observations in the Gulf of Naples

**Adriana Zingone** (1)\*, Lorenzo Longobardi (1), Laurent Dubroca (2), Francesca Margiotta (1), Diana Sarno (1)

(1) Stazione Zoologica Anton Dohrn, Villa Comunale, 80121 Napoli, Italy

(2) IFREMER, Laboratoire Ressources Halieutiques de Port-en-Bessin, 14520, Port-en-Bessin-Huppain, France

\* email corresponding author: [zingone@szn.it](mailto:zingone@szn.it)

Phytoplankton are deemed to respond quickly to changes in environmental conditions, whereas their high spatial and temporal dynamics should prevent persistent impairments caused by impacts of climatic or anthropic origin. Time series of data can shed light on the response of phytoplankton assemblages to perturbations at different time scales. The analysis of a high-frequency oceanographic and biological dataset collected over more than 25 years at the LTER-MC site, in the Gulf of Naples, shows an impressive regularity in the annual occurrence and seasonal rhythms of phytoplankton species and remarkable stability of the species assemblages over the decades. This resistance despite anthropogenic and climatic impacts suggests that phytoplankton community structure may not be a good indicator of environmental change, although under continuous pressures stability may escalate into abrupt changes. In this respect, possible 'sentinels' can be traced in specific elements of the autotrophic compartment, such as the size structure of the communities, the occurrence of alien species, the frequency and intensity of seasonal blooms, and the abundance of potentially toxic species. All these aspects are relevant to ecosystem functioning and health and demonstrate the value of time series in the assessment and prediction of the environmental status.

## SESSIONE REGOLARE – Chair: Leonardo Cerasino, Maria Cristina Bruno

### Is plankton trophic structure a reliable indicator of the overall ecological efficiency?

**Daniele Bellardini** (1)\*, Luca Russo (1,2), Francesco Bolinesi (4), Luciano Bosso (3), Angela Buondonno (3), Ylenia Carotenuto (1), Raffaella Casotti (1), Maria Luisa Chiusano (3), Daniela Cianelli (3), Francesco Cipolletta (1,3), Gabriele Del Gaizo (1,3), Marta Furia (3), Priscilla Licandro (1), Olga Mangoni (4), Francesca

Margiotta (3), Maria Grazia Mazzocchi (1), Marina Montresor (3), Isabella Percopo (3), Maria Saggiomo (3), Diana Sarno (3), Simona Saviano (3), Jessica Vannini (1), and Domenico D'Alelio (1)

<sup>1</sup> (1) Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, Villa Comunale, 80121 Naples, Italy

<sup>2</sup> (2) PhD Program in Evolutionary Biology and Ecology, Department of Biology, University of Rome "Tor Vergata", Rome, Italy

<sup>3</sup> (3) Department of Research Infrastructures for Marine Biological Resources, Stazione Zoologica Anton Dohrn, Villa Comunale, 80121 Naples, Italy

<sup>4</sup> (4) Department of Biology, University of Naples Federico II, 80126 Naples, Italy

\* e-mail corresponding author: [daniele.bellardini@szn.it](mailto:daniele.bellardini@szn.it)

Plankton is the basis of pelagic food webs and is essential in supporting marine biodiversity and thus socio-economic activities, such as fisheries and aquaculture. It is therefore important to investigate the structure and functionality of plankton communities to understand ecosystem processes. In the frame of the FEAMP-IISPA program, we conducted sampling surveys along the coast of the Campania Region and analyzed planktonic communities in 22 sites characterized by different chemical, physical and biological conditions (e.g., coastal–offshore gradients and river discharges). The ability of plankton communities to sustain marine resources was characterized by analyzing the plankton trophic structure, i.e., the partitioning of biomass between trophic levels. Specifically, we grouped biomasses of all organisms (unicellular to metazoan organisms) into seven body size fractions and applied the normalized biomass size spectrum (NBSS) technique. This analysis is considered an indirect estimate of the efficiency of plankton in transferring matter and energy towards higher levels. Our results suggested that the plankton trophic structure is significantly largely influenced by change of the first trophic level, which in addition to phytoplankton, includes bacteria, protozoans and non-living matter. Therefore, complex dynamics underlie the structure of the planktonic food web which need to be elucidated by means of this approach and other tools.

## Gli antichi strumenti della limnologia: dalla conservazione alla scoperta

**Roberto Bertoni\***

CNR - IRSA MEG, Largo Tonolli 50, 28922 Verbania

\* e-mail corresponding author: [roberto.bertoni@irsa.cnr.it](mailto:roberto.bertoni@irsa.cnr.it)

Tra il 1500 e il 1600 gli studi di Copernico, Galileo e Newton hanno cambiato l'immagine dell'universo e avviato la rivoluzione scientifica, rinnovando le idee sulla scienza, sul lavoro scientifico, sui rapporti tra scienza e società, tra sapere scientifico e religione. È nato allora un nuovo tipo di sapere, basato sulla verifica sperimentale, che cessa di essere appannaggio del mago, del sacerdote o del dottore medievale interprete dei testi antichi. Il nuovo dotto è lo scienziato sperimentale che, per validare le teorie con esperimenti e misure, usa strumenti sempre più sofisticati che entrano nella scienza come mediatori di conoscenza.

Anche scienze tipicamente interdisciplinari come l'oceanoografia e la limnologia si sono sviluppate grazie a strumenti di indagine specifici o ereditati dalle diverse discipline coinvolte nel loro sviluppo. Questi antichi strumenti, oggi conservati nei musei, ci permettono di seguire i progressi dell'oceanoografia e della limnologia. In quest'ottica saranno illustrati alcuni strumenti conservati nella *Crypta Baldi*, museo degli antichi strumenti della limnologia.

Osservando l'evoluzione degli strumenti scientifici riaffiorano tra i ricercatori domande alle quali l'evoluzione tecnologica e la nostra capacità di utilizzarne i prodotti permetterà forse di dare risposte. Tra i visitatori nascono curiosità e consapevolezze utili a mostrare il ruolo e il valore della ricerca scientifica perché il museo può essere l'istituzione che rende possibile l'incontro tra scienza e società.

## Occurrence of cyanobacterial toxins in freshwaters of the Alpine region

**Leonardo Cerasino** (1)\*, Adriano Boscaini (1), Camilla Capelli (2), Fabio Lepori (2), Giorgio Franzini (3), Chiara Zampieri (3), Federica Giacomazzi (3), Rainer Kurmayer (4), Maša Zupančič (5), Tina Eleršek (5), Nico Salmaso (1)

(1) Research and Innovation Centre, Fondazione Edmund Mach (FEM), via E. Mach 1 - San Michele all'Adige, Italy.

(2) Institute of Earth Sciences, University of Applied Sciences and Arts of Southern Switzerland (SUPSI), Via Flora Ruchat-Roncati 15 - Mendrisio, Switzerland.

(3) Regional Environmental Agency of Veneto (ARPAV), Via Ospedale Civile 24 - Padova, Italy.

(4) Research Dep. of Limnology, University of Innsbruck, Mondsee Straße 9 - Mondsee, Austria.

(5) Department of Genetic Toxicology and Cancer Biology, National Institute of Biology (NIB), Večna pot 111 - Ljubljana, Slovenia.

\* email corresponding author: [leonardo.cerasino@fmach.it](mailto:leonardo.cerasino@fmach.it)

Different genera of freshwater cyanobacteria have the ability of producing toxic metabolites (cyanotoxins). Massive proliferation of these organisms can lead to harmful concentration of toxins in the water. An increase in frequency, magnitude and duration of harmful blooms has been documented globally in the last decades. It is therefore important to gather information about the occurrence of these contaminants in order to understand their geographical spread. The distribution of cyanotoxins in freshwater bodies of the alpine region was investigated in the frame of the "EcoAlps-Water" project, funded by the European Interreg Alpine Space Program. The sampling was conducted in lakes and rivers of Austria, Italy, Slovenia and Switzerland using uniform protocols. Both pelagic and benthic samples were sampled. Toxins' analysis was conducted in a reference laboratory (at the Fondazione Edmund Mach) using LC-MS/MS methodologies, able to distinguish the different classes of toxic compounds: hepatotoxic microcystins, neurotoxic anatoxins and saxitoxins, cytotoxic cylindrospermopsins. The investigation revealed the presence of cyanotoxins in the majority of investigated lakes, with microcystins being the most represented. Moreover, anatoxins were found in a few water bodies. In conclusion, cyanotoxins represent an additional risk that lakes of the Alpine Space region are facing. Constant attention to this issue must therefore be paid because global climatic changes and other local anthropogenic pressures can synergistically increase the risk of high cyanotoxins levels.

## Preliminary data on the effectiveness of fish passages from Toce River, the second largest tributary to Lago Maggiore

**Mattia Iaia** (1), Stefano Brignone (1), Armando Piccinini (2), Andrea Voccia (1), Tommaso Righi (1), Maurizio Odicino (1), Laura Saccardi (1), Vanessa De Santis (1), Tommaso Righi (1), Cesare Puzzi (3), Andrea Tersigni (3), Andrea Casoni (3), Pietro Volta (1)

(1) CNR-IRSA, Corso Tonolli 50, 28922, Pallanza

(2) Biomark, LLC 705 S. 8th St. Boise, ID 83702, USA

(3) G.R.A.I.A. srl, via Repubblica 1, 21020, Varano Borghi

\* email corresponding author: [iaiamarble90@gmail.com](mailto:iaiamarble90@gmail.com)

River fragmentation by dams and weirs is a major threat to riverine fish populations, as it prevents fish from migrating to spawn, feed or reach preferred habitats. The restoration of river connectivity mainly through the creation of fish passages or by-pass channels is one of the main goals of the EU environmental policies and it has been carried out since at least three decades supported by local, regional and European funds. Data on fish passages effectiveness are however scarce and most of them are not publicly and easily accessible. To assess the effectiveness of two fish passages realized in 2020 within the LIFE15NAT/IT/000823 IdroLIFE Project in correspondence of two dams located in the middle and upper reaches of the Toce River, antennas for the detection of Passive Integrated Transponders (PIT) tags have been settled within the two

fish passages. Across two years, 1923 fish belonging to 15 species were PIT tagged in the Toce River basin and, of these, 40 fish have been recorded by antennas. Among them, 72% were able to pass through the fish passage suggesting a good efficiency of the fish passages despite a low detection rate. Possible biases and implications of these preliminary results are discussed.

### Diversity and distribution of dragonflies in Italy, with an updated checklist

**Gianandrea La Porta\***, Sönke Hardersen

Società Italiana per lo Studio e la Conservazione delle Libellule ODV, via Elce di Sotto, 8 06123 Perugia

\* email corresponding author: [gianandrea.laporta@odonata.it](mailto:gianandrea.laporta@odonata.it)

Dragonflies, insects belonging to the order Odonata, occupy a trophic position as top or mid-level predators and are well-recognized indicators of environmental change, including effects of habitat fragmentation, environmental pollution, climate and land-use change. In fact, there is evidence that globally, species richness and abundance of dragonflies is related to both water and terrestrial quality. Odonata.it, the Italian Society for the Study and Conservation of Dragonflies, is an association that promotes research and activities to increase the knowledge on the biology and ecology of these insects and the protection of their habitats. Since 2009, the Society is collecting faunistic data on Italian dragonflies and is actively promoting a citizen science project. In 13 years, Odonata.it has provided important updates on the diversity and distribution of dragonflies in Italy and recently compiled a national checklist of 95 species, highlighting new and rediscovered species and an increase in Mediterranean species with a northward expansion. Also, a data set of more than 200,000 field records has been collected, revealing that citizen science is a powerful and robust method for entomological research. This approach is successful when conducted in combination with expert surveys, data validation, and a network of active odonatologists.

### Gaia Blu, the new multipurpose ocean research vessel of CNR

**Leonardo Langone\***, Fabio Trincardi

Consiglio Nazionale delle Ricerche, Piazzale Aldo Moro 7, 00185 Roma

\* e-mail corresponding author: [leonardo.langone@cnr.it](mailto:leonardo.langone@cnr.it)

In February 2022, Schmidt Ocean Institute, a private non-profit operating foundation, has donated its 82.9-meter research vessel, Falkor, to the Italian Consiglio Nazionale delle Ricerche (CNR), expanding the science agency's fleet of research vessels and continuing Falkor's legacy of conducting ocean science. Originally built in 1981 as a fishery protection vessel, the ship was acquired by Eric and Wendy Schmidt in 2009 when they founded Schmidt Ocean Institute. Following an extensive two-year refit, the ship was converted to the world's first year-round philanthropic research vessel made available for free to scientists. After a decade of remarkable discoveries and scientific research with Schmidt Ocean Institute, the research vessel will be reequipped by CNR with the latest technologies. The ship has been named Gaia Blu. This donation will foster collaboration with international research institutes and universities involved in studying the anthropogenically impacted Mediterranean basin. Gaia Blu will also offer a unique opportunity to CNR and the entire Italian scientific community to work on the world's ocean on a multi-year plan, within both European and other international projects.

### Building weighted networks for plankton communities from semi-quantitative data

**Matteo Loschi** (1,2)\*, Simone Libralato (2), Elisa Camatti (3), Fabrizio Bernardi Aubry (3), Domenico D'Alelio (4)

(1) Department of Life Sciences, University of Trieste, Via L. Giorgieri 10, 34127 Trieste, Italy

(2) National Institute of Oceanography and Applied Geophysics - OGS, Oceanography Division, ECHO Group, Via Beirut 2, 34151, Trieste, Italy

(3) ISMAR-CNR, Arsenale Tesa 104, Castello 2737/F, 30122 Venice, Italy

(4) Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, Villa Comunale, 80121 Naples, Italy

\* email corresponding author: [mloschi@ogs.it](mailto:mloschi@ogs.it)

Quantitative weighted network models are approaches widely used for understanding properties of the system. Although plankton community data in terms of composition and abundance are widely available, additional semi-quantitative ecological information are needed to build weighted networks. The goal of this study is the definition of an approach for developing quantitative networks from semi-quantitative data of plankton communities. The approach is based on a controlled iterative process that is used to develop synthetic networks that are then tested for realism using simple and general emerging properties by node and by the whole network as validating tests.

We used realistic ranges for metabolic parameters of plankton community and we have defined semi-quantitative indications of the strength of interactions between each taxa. An iterative MCMC approach was used by extracting random values for parameters from their range, through a uniform distribution, and assigning random quantitative values of diet proportions.

A large group of valid models (ensemble of 1000 networks) were obtained for two different years for the Venice lagoon as a case study. Whole network indicators were applied to valid models. Preliminary results indicate a stressed system, dominated by detritus fluxes, so with a low mean trophic level and a high efficiency.

### The Italian chapter of the Marine Social Sciences Network: an opportunity to make a difference in the complex and complicated relationship between society and the sea in the Mediterranean basin.

**Maria Vittoria Marra** (1)\*, Elisa Baldrighi (2), Alberto Barausse (3), Antonio Calò (4), Domenico D'Alelio (5), Emanuela Dattolo (5), Cristina Mangano (6), Silvia Morgana (7), Antonella Petrocelli (8), Alessandra Pugnetti (9), Emma McKinley (10)

(1) Coordinator of the Italian Chapter of the Marine Social Sciences Network, Galway Atlantaquaria, Seapoint Promenade, Salthill, H91 T2FD, Galway, Ireland

(2) Institute for Biological Resources and Marine Biotechnologies (IRBIM), Italian National Research Council (CNR), Ancona, Italy

(3) Department of Biology, University of Padova, Padova, Italy

(4) Department of Earth and Marine Sciences, University of Palermo, Via Archirafi 20-22, 90123, Palermo, Italy

(5) Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, Villa Comunale, 80121, Napoli, Italy

(6) Department of Integrative Marine Ecology (EMI), Stazione Zoologica Anton Dohrn Sicily Marine Centre, Lungomare Cristoforo Colombo (complesso Roosevelt) 90149 Palermo, Italy

(7) Institute for the Study of Anthropic Impact and Sustainability in the Marine Environment, National Research Council (IAS-CNR), Via della Vasca Navale, 00146 Roma, Italy

(8) Institute for Water Research (IRSA), National Research Council (CNR), via Roma 3, 74123 Taranto, Italy

(9) National Research Council, Institute of Marine Sciences, Arsenale Tesa 104, Castello 2737/F, I-30122 Venice, Italy

(10) Head of the Marine Social Sciences Network, School of Earth and Environment, Cardiff University, Park Place, CF10 3AT, Cardiff, United Kingdom

\* email corresponding author: [mariavittoriamarra@gmail.com](mailto:mariavittoriamarra@gmail.com)

Established in 2018, the Marine Social Sciences Network (MarSocSci) is a growing international community of researchers, policy-makers, practitioners and other stakeholders operating in the marine and coastal sector aimed at understanding the relationship between global society and the ocean, coasts and seas. Facilitating collaboration and dialogue across marine social sciences, economics, arts and humanities, MarSocSci seeks to promote the key role that social sciences can play in management and decision-making for our global seas and coastlines. The Network is rapidly expanding by initiating regional chapters focused on creating local synergies in the marine sector. Italy is the first country to establish a chapter in the Mediterranean Sea, where a social perspective is particularly important given the cultural richness across this shared basin. Considering its central position, Italy plays a strategic role in the management and conservation of the Mediterranean basin and all the consequent implications on the welfare of its coastal communities. Therefore, the MarSocSci Italian chapter has significant potential to initiate an effective dialogue among the actors involved in research and practice related to ocean literacy, blue economy, marine policy and public engagement at national and basin level that can contribute to sustainably change the management policies.

### Genetic differentiation between the wild and hatchery Marble trout (*Salmo marmoratus* Cuvier 1829), and limited presence of released hatchery-produced individuals into the wild: a case study from Toce river (Piemonte, Italy)

**Tommaso Righi** (1)\*, Emanuele Fasola (2), Mattia Iaia (1), Vanessa De Santis (1), Fabrizio Stefani (2), Pietro Volta (1)

(1) Water Research Institute - National Research Council (IRSA - CNR); Largo Tonolli, 50, 28922 Verbania Pallanza (VB), Italy

(2) Water Research Institute - National Research Council (IRSA - CNR); Via del Mulino, 19, 20861 Brugherio (MB), Italy

\* email corresponding author: [tommaso\\_righi@yahoo.com](mailto:tommaso_righi@yahoo.com)

Fish stocking, that is the introduction into wild populations of hatchery-produced fish, constitutes nowadays, the most common practice for fish stocks enhancement in rivers and lakes, typically performed by angling associations. The marble trout, *Salmo marmoratus* Cuvier 1829, a critically endangered subendemic salmonid in Northern Italy, and an iconic species for recreational fishing and conservation, has been object of intense aquaculture over the past several decades. Toce river is the second largest tributary of Lake Maggiore and is heavily stocked with hatchery trouts (*S. marmoratus*, *S. ghigii* and *S. trutta*) for fishery supplementation. To date, very limited information on marble trout population genetics inhabiting this basin is available. To fill this gap, molecular analysis based on mitochondrial (D-loop) and nuclear (12 microsatellites) markers on 405 samples was performed to characterize the wild and hatchery trout individuals and to investigate the effectiveness of stocking activities. Our results highlight a high level of introgression of non-native traits in both wild and hatchery samples. Significant differentiation between wild and domestic marble trout was also detected. Furthermore, the limited presence of domestic marble trout in the wild suggests a limited survival of these fish and the ineffectiveness of restocking activities to increase the stock.

### Plastic debris in freshwater systems worldwide

**Veronica Nava** (1)\*, Julian Aherne (2), María B. Alfonso (3), Ana M. Antão-Geraldes (4), Katrin Attermeyer (5,6), Roberto Bao (7), Mireia Bartrons (8), Stella A. Berger (9), Marcin Biernaczyk (10), Raphael Bissen (11), Justin Brookes (12), David Brown (13), Giulia Candian (1), Miguel Cañedo-Argüelles (14), Moisés Canle (7), Camilla Capelli (15), Rafael Carballeira (7), José Luis Cereijo (7), Sakonvan Chawchai (16), Guangjie Chen (17), Søren T. Christensen (18), Kirsten S. Christoffersen (19), Elvira de Eyto (20), Jorge Delgado (7), Tyler

Dornan (12), Jonathan P. Doubek (21), Julia Dusaucy (22), Oxana Erina (23), Zeynep Ersoy (24), Heidrun Feuchtmayr (25), Fabio Lepori (15), Maria Luce Frezzotti (1), Silvia Galafassi (26), David Gateuille (22), Vitor Gonçalves (27), Hans-Peter Grossart (9,28), David P. Hamilton (29), Ted Harris (30), Külli Kangur (31), Gökben Başaran Kankılıç (32), Rebecca Kessler (30), Christine Kiel (9), Edward M Krynak (33), Àngels Leiva-Presa (8), Miguel Matias (24), Shin-ichiro S. Matsuzaki (34), Yvonne McElarney (35), Mark Mitchell (36), Beata Messyasz (37), Musa Mlambo (38), Samuel N. Motitsoe (39), Caroline Owens (40), Deniz Özkundakci (41), Solvig Pinnow (9), Agnieszka Pocięcha (42), Pedro Raposeiro (27), Eva-Ingrid Rööm (43), Federica Rotta (15), Nico Salmaso (44), Facundo Scordo (33), Claver Sibomana (45), Daniel Siewert (46), Katarzyna Stepanowska (10), Chandra Sudeep (33), Ülkü Nihan Tavşanoğlu (47), Maria Tereshina (23), James Thompson (35), Monica Tolotti (44), Amanda Valois (48), Piet Verburg (48), Brian Wesolek (49), Gesa Weyhenmeyer (50), Naicheng Wu (51), Edyta Zawisza (52), Lauren Zink (53), Barbara Leoni (1)

- (1) University of Milano-Bicocca, Department of Earth and Environmental Sciences, Italy.
- (2) Trent University, School of Environment, Ontario, Canada.
- (3) Instituto Argentino de Oceanografía, Bahía Blanca, Argentina.
- (4) Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Bragança, Portugal.
- (5) WasserCluster Lunz - Biologische Station, Lunz am See, Lower Austria, Austria.
- (6) University of Vienna, Department of Functional and Evolutionary Ecology, Vienna, Austria.
- (7) University of A Coruña, A Coruña, Spain.
- (8) University of Vic - Central University of Catalonia, Biosciences Department, Vic, Spain.
- (9) Leibniz Institute of Freshwater Ecology and Inland Fisheries, Department of Plankton and Microbial Ecology Stechlin, Germany.
- (10) West Pomeranian University of Technology in Szczecin, Faculty of Food Science and Fisheries, Szczecin, Poland.
- (11) Chulalongkorn University, Department of Mining and Petroleum Engineering, Bangkok, Thailand.
- (12) The University of Adelaide, School of Biological Science North terrace, Adelaide, Australia.
- (13) Horizons Regional Council, Department of Environmental Data, Palmerston North, New Zealand.
- (14) FEHM Lab, Institute of Environmental Assessment and Water Research (IDAEA-CSIC), Jordi Girona, 18-26, 08034 Barcelona, Spain.
- (15) SUPSI, Institute of Earth Sciences, Mendrisio, Switzerland.
- (16) Chulalongkorn University, Department of Geology, Bangkok, Thailand 10330.
- (17) Yunnan Normal University, Faculty of Geography, Yunnan, China.
- (18) CPH Business Laboratory and Environment, Hillerød, Denmark.
- (19) University of Copenhagen, Department of Biology, Copenhagen, Denmark.
- (20) Marine Institute, Furnace, Newport, Co. Mayo.
- (21) Lake Superior State University, School of Natural Resources & Environment and Center for Freshwater Research and Education, Sault Sainte Marie, Michigan, USA.
- (22) Savoie Mont Blanc University, CNRS, Univ. Grenoble Alpes, EDYTEM, Chambéry, France.
- (23) Lomonosov Moscow State University, Department of Hydrobiology, Moscow, Russian Federation.
- (24) Universidade de Évora, MED - Mediterranean Institute for Agriculture, Environment and Development, Rui Nabeiro Biodiversity Chair, Évora, Portugal.
- (25) UK Centre for Ecology & Hydrology, Lake Ecosystems Group, Lancaster, United Kingdom.
- (26) Water Research Institute - National Research Council, Verbania, Italy.
- (27) Universidade dos Açores, Centro de Investigação em Biodiversidade e Recursos Genéticos - CIBIO, Ponta Delgada, Portugal.
- (28) Potsdam University, Institute for Biochemistry and Biology, Potsdam, Germany
- (29) Australian Rivers Institute, Griffith University, Brisbane, Queensland, Australia.
- (30) Kansas Biological Survey, University of Kansas, Lawrence, Kansas, USA.
- (31) Estonian University of Life Sciences, Centre for Limnology, Rannu, Tartumaa, Estonia.
- (32) Kırıkkale University, Faculty of Arts and Sciences, Biology Department, Kırıkkale, Turkey.
- (33) University of Nevada, Reno, Global Water Center, Reno, NV, USA.

- (34) National Institute for Environmental Studies, Biodiversity Division, Tsukuba, Ibaraki, Japan.
  - (35) Agri-Food & Biosciences Institute, Fisheries & Aquatic Ecosystems, Belfast, Northern Ireland.
  - (36) Horizons Regional Council, Department of Science and Innovation, Palmerston North, New Zealand.
  - (37) Adam Mickiewicz University, Institute of Environmental Biology, Department of Hydrobiology, Poznań, Poland.
  - (38) Albany Museum, Department of Freshwater Invertebrates, Grahamstown, Eastern Cape, South Africa.
  - (39) Rhodes University, Department of Zoology and Entomology, South Africa.
  - (40) University of California, Santa Barbara, Department of Ecology, Evolution, and Marine Biology, USA.
  - (41) Te Aka Mātuatua – School of Science, University of Waikato School of Science, Hamilton, New Zealand.
  - (42) Institute of Nature Conservation, Polish Academy of Sciences, Department of Freshwater Biology, Kraków, Poland.
  - (43) Estonian University of Life Sciences, Institute of Agricultural and Environmental Sciences, Chair of Hydrobiology and Fishery Kreutzwaldi, Tartumaa, Estonia.
  - (44) Research and Innovation Centre, Fondazione Edmund Mach, S. Michele all'Adige, Trento, Italy.
  - (45) Center for Research in Natural Sciences and Environment, Faculty of Sciences, University of Burundi, Bujumbura, Burundi.
  - (46) Wdecki Park Krajobrazowy, Osie, Poland.
  - (47) Çankırı Karatekin University, Department of Biology, Çankırı, Turkey.
  - (48) National Institute of Water and Atmospheric Research, Freshwater Ecology, Wellington, Wellington, New Zealand.
  - (49) Bay Mills Indian Community, Biological Services Department, Brimley Michigan, USA.
  - (50) Uppsala University, Dept. Ecology and Genetics/Limnology, Uppsala, Sweden.
  - (51) Department of Geography and Spatial Information Techniques, Center for Land and Marine Spatial Utilization and Governance Research, Ningbo University, Ningbo, China.
  - (52) Institute of Geological Sciences, Polish Academy of Sciences, Warsaw, Poland.
  - (53) University of Lethbridge, Department of Biological Sciences, Lethbridge, Alberta, Canada.
- \* email corresponding author: [veronica.nava@unimib.it](mailto:veronica.nava@unimib.it)

Plastic debris is widespread in freshwater ecosystems, but a rigorous assessment of its global distribution has been hindered by a lack of comprehensive and comparable data. We performed the first standardized global survey of lakes to assess the quantity and type of plastics (>250µm). We included 38 lakes located in 23 different countries distributed across five continents, spanning different environmental gradients and varying levels of anthropogenic stress. All samples were collected by horizontal trawling of a plankton net and subsequently treated with hydrogen peroxide. We identified 9425 plastic particles, which were classified based on shape, color, and size. Polymer identification was carried out using Raman micro-spectroscopy. Our results showed that the concentration of plastics spanned four orders of magnitude ( $10^{-3}$ - $10^1$  particles/m<sup>3</sup>). Fibers (49%) and fragments (41%) were the most frequently detected particles, suggesting a secondary origin of plastic contamination. The most commonly identified polymers were polyester (30%), polypropylene (20%), and polyethylene (16%), which are widely used in short life-cycle products and account for the majority of global plastic production. Further, we found that urban-related attributes of lakes/watersheds influenced the occurrence and type of plastics in lentic systems and larger and deeper lakes with higher retention times are accumulating plastic debris at higher concentrations.

### Vertical dispersion of microplastics in the marine environment. A modelling approach

**Simone Zazzini\***, Paolo Bello, Agnese Pini, Paolo Monti & Giovanni Leuzzi

University of Rome "La Sapienza", Faculty of Civil and Industrial Engineering, Department of Civil, Constructional and Environmental Engineering (DICEA), Via Eudossiana, 18 - 00184 Rome, Italy

\* email corresponding author: [simone.zazzini@uniroma1.it](mailto:simone.zazzini@uniroma1.it)

In order to study the water quality of the marine environment, it has to be analyzed the dispersion of microplastics (MP), as they became one of its major threads. So in this work, this problem has been tackle by means of a 3D Lagrangian Stochastic Model (LSM), developed by our research group. In this modelling framework, MPs are advected by the 3D currents, provided by the CMEMS database; they are dispersed by means of the 3D LSM, in which the vertical turbulent diffusivity is parameterized as a function of the mixed layer depth and the friction velocity. In addition, the characteristics of the particles are taken into account and a multivariate probability was calculated by combining the probability density functions of size, density and dimension; thus a discrete probability distribution of the mass and settling/rising velocity was obtained. This approach allows to assess the role of the different scale of turbulence and to highlight the importance of the characteristics of the particles in the dispersion in the water column. In general, particles lighter than seawater seem to remain confined close to the surface, on the contrary MPs heavier are supposed to accumulate on the bottom.

## SESSIONE SPECIALE - Processi fisici e biogeochimici in ambienti marini e d'acqua dolce: misure e modelli – Chair: Claudia Dresti, Diego Copetti, Andrea Fenocchi

### Effectivity of hypolimnetic withdrawal on the restoration of Lake Varese

**Claudia Dresti** (1)\*, Michela Rogora (1), Diego Copetti (2), Fabio Buzzi (3), Andrea Beghi (3), Franca Pandolfi (3), Cristina Borlandelli (3), Davide Fortino (3), Giovanni Biccai (3), Daniele Magni (4), Alessandro Canziani (5), Andrea Fenocchi (6)

(1) National Research Council of Italy, Water Research Institute (CNR-IRSA), L.go Tonolli 50, 28922 Verbania, Italy

(2) National Research Council of Italy, Water Research Institute (CNR-IRSA), Via del Mulino 19, 20861 Brugherio (MB), Italy

(3) ARPA, Agenzia Regionale per la Protezione dell'Ambiente della Lombardia, Via Ippolito Rosellini 17, 20124 Milano, Italy

(4) Direzione Generale Ambiente e Clima, Regione Lombardia, Piazza Città di Lombardia 1 20124 Milano (MI)

(5) Provincia di Varese, Piazza Libertà 1, 21100 Varese, Italy

(6) Department of Civil Engineering and Architecture, University of Pavia, Via Ferrata 3, 27100 Pavia, Italy

\* e-mail corresponding author: [claudia.dresti@irsa.cnr.it](mailto:claudia.dresti@irsa.cnr.it)

Lake Varese, a middle-sized monomictic subalpine lake in North-Western Italy, suffered from extended eutrophication in the second half of the XX century, due to uncontrolled delivery of untreated urban sewage. Pollution lasted till the end of the 1980s, when a sewage network around the lake was established. Due to the large accumulation of phosphorus and to the anoxia of the lake bottom, the lake still hasn't recovered, losing many of its uses. To accelerate the lake recovery, several restoration measures have been implemented since 2019 within the AQST "Salvaguardia e risanamento del lago di Varese" ("Accordo Quadro di Sviluppo Territoriale Salvaguardia e risanamento del lago di Varese") cooperative program, including hypolimnetic withdrawal. A detailed monitoring of the lake and of its outlet, which receives water from the hypolimnion after mixing with epilimnetic waters, was also performed. In this contribution, we will show the water quality observations gathered in the lake during the last two years, highlighting the effectiveness of the hypolimnetic withdrawal system, as well as showcasing the results of numerical simulations performed with a 1D coupled ecological-hydrodynamic model, which help isolating the role of the restoration measures on the water quality parameters, most importantly on the hypolimnetic phosphorus concentration.

### Modelling physical and ecological processes in medium-to-large deep European perialpine lakes: directions of past research and issues to address for the future

**Andrea Fenocchi** (1)\*, Claudia Dresti (2), Diego Copetti (3)

(1) Department of Civil Engineering and Architecture, University of Pavia, Via Ferrata 3, 27100 Pavia, Italy

(2) National Research Council of Italy, Water Research Institute (CNR-IRSA), L.go Tonolli 50, 28922 Verbania, Italy

(3) National Research Council of Italy, Water Research Institute (CNR-IRSA), Via del Mulino 19, 20861 Brugherio (MB), Italy

\* e-mail corresponding author: [andrea.fenocchi@unipv.it](mailto:andrea.fenocchi@unipv.it)

Through a review of modelling studies of both physical and ecological nature performed on medium-to-large deep European perialpine lakes, we have been able to identify the characters of past research which has

been performed on them during the last four decades. The evolution of topics and methodologies has been tracked down, as well as the geographical and morphometric distributions of investigated basins. An exponentially rising interest in quantitative modelling applications has been detected, linked to growing attention on the safeguard of water quality for multiple use and on the prediction of the effects of climate warming, as well as to the increasing availability, capabilities and ease of use of numerical modelling tools. Rising applications of spatially distributed three-dimensional hydrodynamic models and of coupled hydrodynamic-ecological models, as well as of artificial-intelligence techniques for ecological models, have been found. Further advancements in modelling efforts appear to be limited by field data availability and by the complexity and sometimes ephemeral validity of model calibration. A strong lack of modelling studies has also been detected for lakes in the Eastern Alps compared to those in the Western and Central Alps.

### Long-term variability of the coastal ocean stratification in the Gulf of Naples: Two decades of monitoring the marine ecosystem at the LTER-MC site, between land and open Mediterranean Sea

**Florian Kokoszka** (1)\*, Baptiste Le Roux (2), Daniele Iudicone (1), Fabio Conversano (1), and Maurizio Ribera d'Alcalà (1)

(1) Stazione Zoologica Anton Dohrn (Naples, Italy)

(2) Ecole Centrale de Nantes (Nantes, France)

\* email corresponding author: [florian.kokoszka@szn.it](mailto:florian.kokoszka@szn.it)

We analyze 20 years (2001-2020) of temperature and salinity profiles at the LTER-MC coastal station in the Gulf of Naples, Mediterranean Sea. Surface and bottom layer show increases of temperature (+0.01 and +0.03°C/year, 2005-2019); water-columns budgets (heat, freshwater) show pseudo-periodic oscillations every 3 to 5 years, and weak linear trends. Seasonal minimum of salinity occurs two months later than the runoff peak, pointing to the importance of horizontal circulation in regulating the inshore-offshore exchanges and the residence time of freshwater contribution. Inter-annual variations of the mixed layer depth (MLD) exhibit a shallowing (-1.27m/year during winter) and a shortened time span of the fully mixed water-column. A visible decadal shift in the external forcings suggests an influence of wintery wind stress in 2010-2019, that prevailed over dominant buoyancy fluxes in 2001-2009. Changes are visible in the large-scale indices of the North Atlantic and Western Mediterranean Oscillations and highlight the role of wind direction, offshore or inshore oriented, in disrupting the stratification driven by freshwater runoff. A random forest regression confirms that role and quantifies the MLD drivers importances. This allows for a reliable prediction of the stratification using external variables independent from the *in situ* observations.

### Multiple Stressor Effects on Ecosystem Function: Disentangling Effects of Eutrophication and Clogging on Nitrate Uptake.

**Julia Pasqualini**\*, Nergui Sunjidmaa, Daniel Graeber, Markus Weitere, Steffen Kummel, Niculina Musat, Zulma Lorena Duran, Alexander Bartush, Mario Brauns

Helmholtz-Centre for Environmental Research

\* email corresponding author: [julia.pasqualini@ufz.de](mailto:julia.pasqualini@ufz.de)

Streams face multiple environmental stressors induced by agricultural land use, which impact their capability to retain nutrients, such as nitrate. Here, the benthic and hyporheic zone act as important compartments of nitrate uptake, but may be impaired by multiple stress. We compared compartmental nitrate uptake subjected to eutrophication and fine sediment additions in a mesocosm experiment. We added an

isotopically enriched  $^{15}\text{N}$ - $\text{KNO}_3$  solution (20 atomic fraction (AF%)) for 24h to stream-side flumes, where phosphorous concentration and light intensity together with sediment grain size were manipulated. After the addition, sediment samples from the benthic and hyporheic compartments were collected and nitrate uptake rate was calculated based on temporal changes of organic matter AF%. In the reference treatment (gravel & low phosphorous and low light), the benthic and hyporheic zone contributed 93% and 7% to total uptake, respectively. Benthic uptake increased 10 times under eutrophic conditions and decreased 3 times with fine sediment addition, stressors interacted synergistically. Conversely, hyporheic uptake increased 10 times with fine sediment addition and 6 times under the eutrophic conditions. The interaction between both stressors was positive antagonistic. Concerning the benthic zone, the strong increase in nitrate uptake with the addition of phosphorous and light indicates phosphorous limitation under reference conditions due to nitrogen air deposition that alters the natural N:P ratio. Moreover, we detected low bioavailability for dissolved organic carbon entering the hyporheic zone, likely resulting in C limitation or C and P co-limitation of nitrate uptake.

### A simple model for predicting ice thickness in lakes

Marta Fregona (1), Matti Leppäranta (2), Ivan Mammarella (2), **Sebastiano Piccolroaz** (1)\*

(1) Department of Civil, Environmental and Mechanical Engineering, University of Trento, via Mesiano, 77, 38123, Trento

(2) Institute for Atmospheric and Earth System Research, University of Helsinki, Gustaf Hällströmin katu 2, 00014 Helsinki

\* email corresponding author: [s.piccolroaz@unitn.it](mailto:s.piccolroaz@unitn.it)

In lakes that freeze in winter the ice cover plays an important role for human activities and ecology. Being able to accurately predict ice-on and ice-off dates and ice thickness is therefore a relevant task, which becomes particularly intriguing when simple ice models can be used with relatively good predictive capabilities. Here we present an extension of the air2water model, originally developed to predict lake surface water temperature (LSWT), adding the possibility to simulate ice cover growth and decay. The new modelling framework preserves: i) the simplicity of the original air2water model (air temperature and precipitation being the only forcing variable), ii) its parsimony (only two additional model parameters) and iii) the physically based derivation of the equations (one for ice growth and the other for ice melting). The extended version of the air2water model is tested using long time series of observed LSWT and ice thickness (1960-2021) for several Finnish lakes with different climate and lake type conditions. The RMSE for daily LSWT is  $O(1)$  °C and that for ice thickness is  $O(1-10)$  cm. Similar performances are obtained when calibrating the model using both LSWT and ice thickness observations or only LSWT data, thus allowing its application to lakes without available ice observations.

### Resilience of plankton food webs to ocean warming

**Luca Russo** (1,2)\*, Matteo Loschi (3,4), Daniele Bellardini (2), Roberta Congestri (5), Michael W. Lomas (6), Simone Libralato (4), Domenico D'Alelio (2)

(1) Ph.D. Program in Evolutionary Biology and Ecology, Department of Biology, University of Rome 'Tor Vergata', Via della Ricerca scientifica 1 - 00133 Roma, Italy

(2) Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, Villa Comunale, 80121 Naples, Italy

(3) PhD Program in Environmental Life Sciences, University of Trieste, Piazzale Europa, 1, 34127, Trieste, Italy

(4) Department of Oceanography, National Institute of Oceanography and Applied Geophysics - OGS, Borgo Grotta Gigante 42/c - 34010 Sgonico (Trieste), Italy

(5) Laboratory of Biology of Algae, Department of Biology, University of Rome 'Tor Vergata', Via Cracovia 1 - 00133 Rome, Italy

(6) Bigelow Laboratory for Ocean Sciences, 60 Bigelow Drive - 04544 East Boothbay, ME, USA

\* email corresponding author: [luca.russo@students.uniroma2.eu](mailto:luca.russo@students.uniroma2.eu); [luca.russo@szn.it](mailto:luca.russo@szn.it)

Climate change is affecting plankton worldwide by reducing body sizes, altering metabolic pathways and modifying vital rates, with unpredictable effects on ecosystem functioning. In the Sargasso Sea (Bermuda Atlantic time-series), a negative relationship between temperature and net primary productivity was observed, but this change did not decrease the carbon export to the ocean interior, suggesting a reshuffling of trophic relationships involving plankton. To test this hypothesis, we carried out a long-term analysis (1994-2019) of plankton biomasses including microorganisms (i.e., bacteria, autotrophic, mixotrophic and heterotrophic protists), and five zooplankton size-classes (ranging 0.2 and >5 mm), and found contrasting trends, with some groups decreasing (i.e., phytoplankton) and other increasing (some zooplankton groups) in abundance suggesting trophic cascades, while the trend of the biomass vs body size distribution suggested that food web efficiency increased in time. Finally, we built food web models for each year of observation and produced a time-series of ecological networks: preliminary results indicate that, despite the primary production decrease, the plankton food web resulted resilient and adapted to the new regime by modifying the trophic network structure to improve the use of detritus as a food source and better exploit mixotrophy as a trophic strategy.

## SESSIONE SPECIALE - Laghi artificiali, stagni e lagune costiere del Mediterraneo: una risorsa a rischio – Chair: Cecilia Teodora Satta, Federico Marrone

### Trophic state and algal blooms in a southern Italy strategic multiple-uses reservoir (Lake Occhito)

**Diego Copetti** (1)\*, Raffaella Matarrese (2), Licia Guzzella (1), Lucia Valsecchi (1), Gianni Tartari (1), Marina Mingazzini (1), Maria Teresa Palumbo (1)

(1) IRSA-CNR Section of Brugherio, Via del Mulino, 19, 20861 Brugherio, Italy

(2) IRSA-CNR Section of Bari, Via De Blasio 5, 70132 Bari, BA, Italy

\* email corresponding author: [diego.copetti@irsa.cnr.it](mailto:diego.copetti@irsa.cnr.it)

Lake Occhito is a strategic multiple-uses reservoir located in south Italy. With a volume of about  $333 \times 10^6 \text{ m}^3$  it is one of the largest Italian reservoir used for the irrigation of the *Tavoliere di Puglia* agricultural area ( $\sim 600 \text{ km}^2$ ) and for the drinking supply of the of the Province of Foggia ( $600 \times 10^3$  inhabitants). The dam is built on the bed of the Fortore River (catchment area  $\sim 1000 \text{ km}^2$ ). The biogeochemical cycles in the lake are markedly influenced by the intense clay solid transport from the tributaries. The clay particles suspended in the lake tend to interact with the dissolved phosphates and to limit the primary production of the lake ecosystem. The lake therefore shows a trophic state lower than that expected based on the external phosphorus loads. In specific situations, however, this mechanism can jams and the lake ecosystem may sustain intense algal blooms. In this contribution we will present the results of research activities carried out during intense *P. rubescens* blooms. The paper integrates laboratory, in-situ and remote sensing measurements carried out in the catchment-reservoir-distribution network system.

### The spreading of the global invader *Palaemon macrodactylus* Rathbun, 1902 and its interaction with congeneric native species in Venice lagoon (Italy)

**Chiara Facca**\*, Francesco Cavraro, Piero Franzoi, Stefano Malavasi, Simone Redolfi Bristol

Dipartimento di Scienze Ambientali Informatica e Statistica, Università Ca' Foscari Venezia, via Torino 155, 30172, Venezia

\* email corresponding author: [facca@unive.it](mailto:facca@unive.it)

The decapod shrimp *Palaemon macrodactylus* Rathbun, 1902 is considered a global invader of estuarine and coastal areas thanks to its high euryhalinity and eurythermality, and to low oxygen consumption. Furthermore, its reproductive performance and aggressivity can further favour its spreading at the expense of native species. In the Venice lagoon, it was first recorded in 2012 and, from 2014, it has been collected in the entire basin, potentially overlapping its niche with that of native species, e.g. the congeneric *P. adspersus* Rathke, 1836 and *P. elegans* Rathke, 1836. In the Venice lagoon, the highest densities of *P. macrodactylus* were observed in confined sites, characterized by low salinities and long residence time, that are conditions favouring *P. elegans* presence. Laboratory experiments highlighted that *P. elegans* and *P. macrodactylus*, when competing for food can have similar behaviour at salinity 20, while *P. macrodactylus* can be significantly dominant at salinity 30. In term of reproduction, *P. macrodactylus* has the potentiality to spread better in mesohaline conditions, directly competing with *P. elegans* but apparently impacting less on *P. adspersus*.



Indeed, the reproductive performance of *P. adspersus* resulted to be similar to *P. macrodactylus* at salinity 20 and significantly better at salinity 30.

## SESSIONE SPECIALE - Multidisciplinary and trans-ecodomain vision for the management and control of invasive alien species - Visione multidisciplinare e trans-ecodominio per la gestione e il controllo delle specie aliene invasive – Chair: Angela Boggero, Agnese Marchini

### How hydrology and topography drive exotic plants in annual vegetation of mid-size lowland rivers

Rossano Bolpagni, **Alice Dalla Vecchia\***

Department of Chemistry, Life Sciences and Environmental Sustainability, University of Parma, Parco Area delle Scienze, 33/A, 43124 Parma

\* email corresponding author: [alice.dallavecchia@unipr.it](mailto:alice.dallavecchia@unipr.it)

Lowland rivers are among the most threatened ecosystems worldwide due to direct and indirect human impacts (e.g., water withdrawals, channelization, damming, pollution, exotic species invasion). A major hydrological effect is the loss of river dynamism that, in conjunction with the ongoing climate change, lead to drought and baseflow events that are increasingly intense and prolonged. All this strongly affects river plant community dynamics, especially of ephemeral communities that can establish on the seasonally exposed sediments. However, few data have been collected concerning this key component of riverbed primary producers so far. Furthermore, in these contexts the role of non-native species is expected to be relevant under varied levels of disturbance since river corridors have an extraordinary susceptibility to be invaded by exotic plants. To fill this knowledge gap and test the hypothesis that a progressive hydrological isolation may boost the accumulation and abundance of invasive plants in seasonally exposed sediments, a systematic investigation of annual river vegetation in three mid-size lowland tributaries (Ticino, Adda, Oglio rivers) of the River Po (northern Italy) was carried out. A total of 18 river stretches (six per river) and 108 (six per river stretch) vegetation units have been investigated collecting data from hydrologically comparable stretches along the upstream-downstream gradient. Native and exotic plant richness and diversity are (inversely) linked to the key river stretch features: average summer discharge, width, sediment texture and the elevation of marginal exposed sediments above the baseflow water level. Hydrology exerts a direct control on exotic plants not only as a dispersion vector, but also regulating the availability of habitat and the extent of phenological phases. Ecological flows, therefore, should not be primarily concerned with river aquatic domains, but should also take into consideration the contribution of emerging (periodically terrestrial) sediments to the overall balance of biodiversity and processes mediated by river courses.

### LIFE PREDATOR: a new EU LIFE Nature & Biodiversity Project to PREvent, Detect, combAT the spread of *Silurus glanis* in south European lakes to protect biodiversity

**Vanessa De Santis** (1)\*, Filip Ribeiro (2), Martin Cech (3), Cesare Puzzi (4), Gabriele Bovo (5), Alessandra Pucci (5), Bruno Aimone (6), Pietro Volta (1)

(1) Istituto di Ricerca Sulle Acque - Consiglio Nazionale delle Ricerche, Corso Tonolli 50, 28922, Verbania-Pallanza, Italy

(2) Faculdade de Ciências da Universidade de Lisboa, Campo grande C5 Piso 3, 1749016, Lisboa, Portugal

(3) Institute of Hydrobiology, Biology Centre of the Czech Academy of Sciences, Na Sádkách 7, 370 05 České Budějovice, Czech Republic

(4) G.R.A.I.A. Srl - Gestione e Ricerca Ambientale Ittica Acque, via Repubblica 1, 21020, Varano Borghi, Italy

(5) Città Metropolitana di Torino, corso Inghilterra 7, 10138, Torino, Italy

(6) Ente di Gestione delle aree protette delle Alpi Cozie, via Fransuà Fontan 1, 10050, Salbertrand, Italy

\* email corresponding author: [vanessa.desantis@irsa.cnr.it](mailto:vanessa.desantis@irsa.cnr.it)

The European catfish *Silurus glanis* L. is one of the most emblematic freshwater invasive fish in western and southern Europe. Being the largest freshwater fish in Europe and a voracious top predator, it constitutes a threat to the native fauna. Information on lacustrine populations where the species is thriving is scarce, limiting the efficacy of management measures in these systems. With a budget of € 2.85 m and a consortium of six partners from three countries, IRSA-CNR will lead the recently approved LIFE Predator project aimed at developing a multidisciplinary and transnational approach to control already established populations of *S. glanis*, prevent further spreading and future introductions in southern European lakes. The five-year project starting in autumn 2022, will develop and test on 50 lakes an early warning system based on eDNA and citizen science records and will test on 10 selected lakes the most effective and selective capture technics involving 230 anglers, which will be applied to reduce the abundance of catfish in 5 Natura 2000 sites. Massive raising awareness campaigns will be organised, and protocols and best practices will be transferred to at least 15 management authorities and a South European catfish Management Group (SEMG) will be created.

### The validation case on invasive crustaceans of the LifeWatch ERIC Internal Joint Initiative: state of the art and next steps forward.

**Cristina Di Muri** (1,2)\*, Ilaria Rosati (1,3), Alberto Basset (4,2), Juan Miguel González-Aranda (2), Antoni Huguet-Vives (2), Nikos Minadakis (2), Antonio José Sáenz-Albanés (2), Lucia Vaira (2), Giorgio Mancinelli (4,5,6)

(1) National Research Council (CNR), Research Institute on Terrestrial Ecosystems (IRET), Lecce, Italy

(2) LifeWatch ERIC, Seville, Spain

(3) LifeWatch Italy, Italy

(4) University of Salento, Department of Biological and Environmental Sciences and Technologies, Lecce, Italy

(5) National Research Council (CNR), Institute of Marine Biological Resources and Biotechnologies (IRBIM), Lesina, Italy

(6) National Interuniversity Consortium for Marine Sciences (CoNISMa), Roma, Italy

\* email corresponding author: [cristina.dimuri@iret.cnr.it](mailto:cristina.dimuri@iret.cnr.it)

LifeWatch ERIC, the European Research Infrastructure on biodiversity and ecosystems, launched in late 2019 an Internal Joint Initiative with five case studies on Non-indigenous and Invasive Species (NIS-IAS). Here, we describe the case study focused on two omnivorous and invasive crustaceans, i.e. *Callinectes sapidus* and *Procambarus clarkii*, and explore the procedures, resources, and web-services implemented to investigate their trophic impact on recipient food webs by using carbon and nitrogen stable isotope data obtained from the literature. The case study was designed to offer a number of e-tools to determine the spatially-explicit variability of the trophic position of the two invasive species and to model it as a function of relevant environmental predictors. The Crustaceans workflow is included in the Tesseract Virtual Research Environment (VRE), which ensures the integration (composability) of all the analytical services offered by LifeWatch ERIC. The workflow provides stakeholders a series of web services able to answer ecological questions concerning the trophic position of the species investigated and its variation in space by means of a user-friendly interface. The Crustaceans workflow has been tested using published datasets to provide an assessment of its reliability, to illustrate the functioning of the workflow, and verify the robustness of its outputs. The implementation of analytical functions within this case study represents a proof of concept for the constitution of open e-Science platforms focused on NIS-IAS based on a close collaboration between scientists and software developers. Our workflow has the potential to be used with a wide range of species, and can be further improved to support researchers in monitoring the impact of NIS-IAS; furthermore, it can

support policy-makers and stakeholders in the implementation of effective measures of management and control of the negative effects of bioinvasers in recipient environments.

### Behavior of the invasive mosquitofish increases top-predator fry mortality: preliminary results

**Laura Saccardi\***, Andrea Voccia, Maurizio Odicino, Jordi-René Mor and Pietro Volta

Water Research Institute (IRSA), Consiglio Nazionale delle Ricerche (CNR), Largo Tonolli 50, 28922, Verbania, Italy

\* email corresponding author: [laura.saccardi@irsa.cnr.it](mailto:laura.saccardi@irsa.cnr.it)

The non-native mosquitofish (*Gambusia holbrooki*), introduced in Italy in the early 20<sup>th</sup> century, is considered one of the 10 most invasive species worldwide. Its aggressive behavior has been reported as one trait favoring its invasiveness and causing the reduction of the abundance and/or richness of invertebrates, amphibians and fish species in freshwater habitats. However, some direct effects of their behavior have received less attention. In this study, we analyzed the interactions between mosquitofish and pike fry, a top predator that, in lakes, shows high aggressivity and similar habitat requirements to those of mosquitofish. We conducted a 5-day experiment investigating intra and interspecific interactions (activity, aggressive behavior and feeding competition) by video recording. Our results show that mosquitofish increase ~30% the mortality of pike. Its aggressive behavior occurs mainly by direct attacks on fins, as well as by increasing swimming activity. Surprisingly, mosquitofish voracity does not have an evident direct consequence on pike mortality. Our study highlights the importance of species behavior as a mechanism enhancing interspecific competition, in addition to trophic strategy.

### The initial spread of quagga mussel, *Dreissena bugensis* Andrusov, 1897, in Italy: molecular and morphological evidence in Lake Garda

**Nico Salmaso** (1)\*, Francesca Ciutti (2), Cristina Cappelletti (2), Massimo Pindo (1), Adriano Boscaini (1)

(1) Research and Innovation Centre, Fondazione Edmund Mach, via E. Mach 1, 38098, San Michele all'Adige, Italy

(2) Technology Transfer Centre, Fondazione Edmund Mach, via E. Mach 1, 38098, San Michele all'Adige, Italy

\* email corresponding author: [nico.salmaso@fmach.it](mailto:nico.salmaso@fmach.it)

The mollusc *Dreissena bugensis* Andrusov, also known with the common name of quagga mussel, is native of the northern Black Sea coast and is one of the most aggressive invaders in freshwater ecosystems. In this contribution, we report the first record of individuals of quagga mussel in Italy. Living organisms of this non-indigenous (NIS) species were collected in February and March 2022 in two stations located in the shallow (Bardolino) and deeper basins (Castelletto di Brenzone) of the lake. The maximum length of the individuals of quagga mussel was 12.9 (Bardolino) and 16.6 mm (Castelletto di Brenzone) ( $n = 66$ ). Individuals were identified using both shell morphological characterization and genetic analyses based on mitochondrial COI gene sequencing. With this new discovery, Lake Garda confirmed its pivotal role as a southern Alpine corridor for the introduction of non-indigenous species previously established at the northern border of the Alps. Considering its high colonization rate and compared with other invasion patterns observed in Europe and North America, it can be assumed that *D. bugensis* will soon establish itself with dominant populations throughout Lake Garda. At the same time, it can also be assumed that it will soon spread to other Italian water bodies.

## DNA metabarcoding as early warning and monitoring system for non-indigenous zooplankton species

**Anna Schroeder (1)\***, Alberto Pallavicini (1,2), David Stanković (3,4), Marco Pansera (2) and Elisa Camatti (5)

(1) University of Trieste, Department of Life Sciences, Via Licio Giorgieri 5, 34127, Trieste, Italy

(2) Stazione Zoologica Anton Dohrn, Villa Comunale, 80121, Naples, Italy

(3) Department of Organisms and Ecosystems Research, National Institute of Biology, Večna pot 111, 1000 Ljubljana, Slovenia

(4) Marine Biology Station Piran, National Institute of Biology, Fornace 41, 6330, Piran, Slovenia

(5) National Research Council, Institute of Marine Sciences (CNR ISMAR) Venice, Arsenale Tesa 104, Castello 2737/F, 30122, Venice, Italy

\* email corresponding author: [anna.schroeder@units.it](mailto:anna.schroeder@units.it)

The Venice Lagoon (VL), an ecosystem highly impacted by human activities, is a hotspot of maritime traffic which is massively increasing the risk of introducing invasive species via ballast water. Monitoring is a key element in understanding and controlling those invasions. In the past, taxonomic identification has always been performed through the analysis of morphological features by stereo microscopy. However, the suitability of morphological identification is reduced (i) by the single expertise of taxonomists, especially regarding consistency and comparability (ii) by the quality of preservation of specimens, as missing/damaged parts could prevent a successful identification, especially with regard to gelatinous organisms, and (iii) by the lack of diagnostic characters for immature (larval) stages. DNA metabarcoding, is a molecular tool for species identification from complex samples, that can be used for rapid, cost-effective, objective and efficient early-detection of NIS. Here we present studies performed in the last years in the VL applying DNA metabarcoding to assess the zooplanktonic biodiversity that permit us to detect several NIS that could not be detected by morphological identification. This tool was also applied to investigate on the feeding preferences of the invasive zooplanktivorous ctenophore *Mnemiopsis leidyi*, firstly recorded in 2016 in the VL, by comparing its gut content with the *in-situ* zooplankton community. This study indicated that the impact *Mnemiopsis* could have on the ecosystem functioning and services could be mostly due to the feeding pressure on meroplanktonic species such as mussels, clams, and crabs.

## The effects of the alien aquatic plant *Alternanthera philoxeroides* on the freshwater communities of the Arno River in Florence

**Elena Tricarico (1)\***, Chiara Ceccarelli (1), Alberto Francesco Inghilesi (1), Lorenzo Lastrucci (2)

(1) Dipartimento di Biologia, Università di Firenze, via Madonna del Piano 6, 50019, Sesto Fiorentino (FI)

(2) Museo di Storia Naturale - La Pira, Università di Firenze, Via La Pira 4, 50121, Firenze

\* email corresponding author: [elena.tricarico@unifi.it](mailto:elena.tricarico@unifi.it)

In 2007, the South American aquatic plant alligator weed *Alternanthera philoxeroides* (Amaranthaceae) was reported in the Arno River in Florence. Since then, it has been found spreading in the area. The present work aimed at assessing the effects caused by this species on plant and animal communities along the Arno River. In October 2015 and June 2016, four transects, two invaded and two non-invaded by the species, were sampled. Vegetation cover by different plant species and invertebrate communities sampled with a close-meshed net were evaluated. The results showed that *A. philoxeroides* can modify the local communities in a different way. Number and abundance of animal species, particularly alien or common native species, were higher in invaded transects; the presence of terrestrial species (e.g. spiders, insects) was also favoured, as *A. philoxeroides* forms dense mats from the bank to the water. On the contrary, plant communities were less diverse and rich in the invaded transects, characterised by few species. Further studies could better assess the long-term effects of *A. philoxeroides* on freshwater communities.

## Bio-pollution assessment of Lake Maggiore and its hydrographic system

**Daniele Paganelli\***, Lyudmila Kamburska, Silvia Zaupa, Laura Garzoli, Angela Boggero

National Research Council-Water Research Institute (CNR-IRSA), Corso Tonolli 50, 28922 Verbania, Italy

\* email corresponding author: [daniele.paganelli@irsa.cnr.it](mailto:daniele.paganelli@irsa.cnr.it)

A recent application of the Aquatic Species Invasiveness Screening Kit (AS-ISK) to the macrobenthic alien species of the hydrographic system of Lake Maggiore (NW Italy) indicated the presence of 7 species with high level of invasiveness and 3 of them were crayfish.

In a second step, focusing our attention to Lake Maggiore and to the 8 alien crayfish already present in Italy as target species for screening, we applied and compared two different risk screening tools, namely AS-ISK and Harmonia<sup>+</sup> to define the potential level of invasiveness of each crayfish present or not in the lake. Results highlighted that AS-ISK evaluated all crayfish as having a high risk of invasion, while Harmonia<sup>+</sup> classified 5 species with a medium level and 3 with a low level.

Finally, we qualitatively compared the potential level of invasiveness of crayfish with the Generic Impact Scoring System (GISS), an impact assessment tool developed to support the IUCN evaluation of alien species invasiveness.

Out of the 8 crayfish reported in Italy, 5 have not yet been reported in Lake Maggiore although they may represent a possible threat if introduced because they have the same level of invasiveness of other crayfish already present.

**SESSIONE SPECIALE - Il restauro degli ecosistemi: prevenire, arrestare ed invertire il degrado degli ecosistemi - Ecological Restoration: prevent, halt and reverse the degradation of ecosystems – Chair: Silvia Bianchelli, Antonio Pusceddu**

**Following the roadmap for the restoration of Mediterranean Macroalgal forests: a case study from the Central Adriatic Sea**

**Silvia Bianchelli (1)\***, Simonetta Frascchetti (2), Francesco Martini (1), Marco Lo Martire (1), Fabio Rindi (1), Roberto Danovaro (1,3)

(1) Università Politecnica delle Marche, Dipartimento di Scienze della Vita e dell'Ambiente, Ancona, Italy

(2) Università Federico II, Dipartimento di Biologia, Napoli, Italy

(3) Stazione Zoologica Anton Dohrn di Napoli, Napoli, Italy

\* email corresponding author: [silvia.bianchelli@univpm.it](mailto:silvia.bianchelli@univpm.it)

In the Mediterranean Sea, the algal forests composed by fuclean brown seaweeds *Cystoseira*, *Erikaria*, and *Gongolaria* form complex, productive and vulnerable shallow-water ecosystems. These forests are rapidly regressing with negative impact on the associated biodiversity and ecosystem functioning. Hence, active restoration emerges as the most promising strategy to rebuild disappeared forests. However, recent research indicates that the recovery of macroalgal forests requires synergistic interventions, starting with the mitigation of human impacts to restore the most degraded populations, since the viability of large restoration actions is compromised by ongoing human pressures (e.g., pollution, overgrazing, and climate change). A roadmap for Mediterranean macroalgal restoration was recently proposed to assist researchers and stakeholders in decision-making, considering the most effective methods in terms of cost and cost-effectiveness. Following this roadmap, we carried out a pilot restoration intervention of *Gongolaria barbata* along the Conero Riviera (Western-Central Adriatic Sea), selecting the most suitable sites to implement the restoration action with the adoption of different techniques. We measured the success by monitoring the effectiveness of the intervention, including the consideration of the associated biodiversity recovery, and estimating also the costs. The experiment is still going on and the first results confirms that under mitigated conditions, restoration is cost effective and successful.

**Displacement of hatchery trout in a small creek in Southern Switzerland: the role of water discharge**

**Stefano Brignone (1)\***, Vanessa De Santis (1), Tiziano Putelli (2), Christophe Molina (2), Armando Piccinini (3), Richard A. Carmichael (3), Pietro Volta (1)

(1) CNR-IRSA, Largo Tonolli 50, 28922 Verbania Pallanza, VB, Italy.

(2) Ufficio della caccia e della pesca, Repubblica e Cantone Ticino, Via F. Zorzi 13, 6500 Bellinzona

(3) Biomark, LLC 705 S. 8th St. Boise, ID 83702, USA.

\* email corresponding author: [stefano.brignone@irsa.cnr.it](mailto:stefano.brignone@irsa.cnr.it)

Fish stocking to enhance freshwater fisheries is a common practice in many countries. Little is known, however, on the effectiveness of these practices in small creeks in spite of the high efforts and investments required. The movement of subadult/adult hatchery brown trout, together with the one of wild individuals, was studied by passive telemetry in a small tributary of Lake Lugano (i.e., Laveggio creek, Ticino Cantone,

Switzerland). Both hatchery and wild fish were tagged with Passive Integrated Transponders (PIT) tags and released upstream and downstream a submersible monitoring antenna, anchored to the streambed in a pass-over orientation. The number of fish detected daily by the antenna (divided between fish released upstream and downstream the antenna) was analyzed in relation to the daily water discharge, to search for similar patterns in their fluctuation over time. Only the movement of fish released upstream the antenna displayed a significant relationship with water discharge, with the highest number of fish detected during periods of high-water flow, occurring after heavy rains. No significant relationship was found with fish released downstream the antenna. High-water discharge events were probably the main reason behind the steep decrease in hatchery trout abundance over time in our study site. Such events contributed to the poor effectiveness of restocking actions in this small tributary, providing further evidence against stocking strategies based on subadult/adult fish.

### Moving waters: mitigating hydrological alterations while increasing hydropower production, a case study from the Italian Alps

**Maria Cristina Bruno** (1)\*, Francesca Vallefucio (1,2), Anna Casari (2), Stefano Larsen (1), Valentina Dallafor (3), Guido Zolezzi (2)

(1) Research and Innovation Centre, Fondazione Edmund Mach, Via E. Mach 1, 38010 San Michele all'Adige, Italy

(2) Department of Civil, Environmental and Mechanical Engineering, University of Trento, Via Mesiano 77 38123 Trento, Italy

(3) Environmental Protection Agency of the Autonomous Province of Trento, Piazza Dante 15 38122 Trento, Italy

\* email corresponding author: [cristina.bruno@fmach.it](mailto:cristina.bruno@fmach.it)

We assessed the effect of a pronounced hydropeaking reduction on a 10-km reach in the upper course of the Noce Stream (NE Italian Alps). The water released by Cogolo-Peio storage hydropower created daily and subdaily hydropeaks, which increased the discharge from 1 to 7 m<sup>3</sup>sec<sup>-1</sup> in about 10 minutes. The mitigation measure, based on the diversion of water from the storage plant release channel directly into the intake of three small Run-of-the-River hydropower plants operating intermittently and in series, constructed in 2015, which released the hydropeaks downstream of the confluence with a major tributary. The application of a recently-proposed set of hydropeaking indicators, the hydraulic analysis of the propagation of the hydropeaking wave, together with the assessment of changes in biological data, allowed quantifying the effectiveness of hydropeaking mitigation. Although hydropeaking was largely mitigated, the macrobenthic communities did not show the taxonomic and functional recovery to a composition typical of more natural flow regimes. Conversely, the hyporheic communities showed an increase in diversity and abundance of interstitial taxa, especially those exclusive to the hyporheic zone. These effects were due to the positive (reduced shear stress and clogging) and negative (increased pollutants concentration) effects of the mitigation measures.

## Bioreactor capacity of sea cucumber *Holothuria tubulosa* (Gmelin, 1788) under different scenarios of climate change

**Claudia Ennas\***, Viviana Pasquini, Pierantonio Addis, Antonio Pusceddu

Università degli Studi di Cagliari, Dipartimento di Scienze della Vita e dell'Ambiente, Via T. Fiorelli 1, 09126 Cagliari

\*e-mail corresponding author: [c.ennas@unica.it](mailto:c.ennas@unica.it)

Climate change and eutrophication impair marine coastal ecosystems. The sea cucumber *Holothuria tubulosa* could be used as a bioremediator of eutrophicated sediments. We investigated quantity and biochemical composition of feces of *H. tubulosa* specimens exposed to temperature regimes varying from 14 to 29°C, either with acclimation or immediately after a sudden exposure to warmer temperatures (simulating heat peaks). Feces were analyzed in terms of protein, carbohydrate, and lipid contents, and their sum converted in C equivalents (biopolymeric C). Quantity and composition of feces produced in oligotrophic sediments after acclimation did not differ among temperatures. In eutrophic sediments, specimens acclimated at 20°C produced feces with protein and lipid contents higher than those at all other T. Specimens suddenly exposed to warmer T and fed with oligotrophic and eutrophic sediments produced C-enriched and C-depleted feces, respectively. Since *H. tubulosa* bioreactor capacity is enhanced only in eutrophic conditions (at 20°C) and the response to heat peaks is opposite in oligotrophic and eutrophic conditions, we conclude that the use of sea cucumbers as bioremediators of eutrophicated sediments would be calibrated under different T regimes and that heat peaks can alter sea cucumbers bioreactor capacity differently under different trophic conditions.

## The challenge of setting restoration targets across the Mediterranean Sea under climate changes: the case study of macroalgal forests

**Erika Fabbri** (1,2)\*, Sylvaine Giakoumi (2,3), Francesco De Leo (1), Laura Tamburello (2), Antonia Chiarore (2), Alberto Colletti (1), Marianna Coppola (1), Marco Munari (2), Luigi Musco (2,4), Fabio Rindi (5), Lucia Rizzo (2,6), Beatrice Savinelli (1), Giulio Franzitta (2), Daniele Grech (7), Emma Cebrian (8,9), Jana Verdura (10), Silvia Bianchelli (5), Luisa Mangialajo (10), Ina Nasto (11), Denada Sota (11), Sotiris Orfanidis (12), Nadia K. Papadopoulou (13), Roberto Danovaro (2,5), Simonetta Frascchetti (1,2)

(1) University of Naples Federico II, Via Cinthia, 80126, Naples, Italy

(2) Stazione Zoologica Anton Dohrn, Villa Comunale, 80122, Naples, Italy

(3) The University of Queensland, St Lucia, 4072, Brisbane, Australia

(4) University of Salento, Via Lecce-Monteroni, 73047, Lecce, Italy

(5) Università Politecnica delle Marche, Via Brecce Bianche, 60131, Ancona, Italy

(6) Institute of Sciences of Food Production, National Research Council, Via Lecce-Monteroni, 73100, Lecce, Italy

(7) IMC International Marine Centre, Via Domenico Millelire, 09170, Oristano, Italy

(8) University of Girona, Plaça de Sant Domènec 3, 17004, Girona, Spain

(9) Centre d'Estudis Avançats de Blanes, Consejo Superior de Investigaciones Científicas (CEAB-CSIC), Carrer Accés Cala Sant Francesc 14, 17300, Blanes, Spain

(10) Université Côte d'Azur, CNRS, UMR 7035 ECOSEAS, Av. Valrose, 06000, Nice, France

(11) University of Vlora "Ismail Qemali", Sheshi Pavaresia, Skelë, Rruga Kosova, 9401, Vlorë, Albania

(12) Fisheries Research Institute, Hellenic Agricultural Organization-Demeter, Nea Peramos, PS 64 007, Kavala, Greece

(13) Hellenic Centre for Marine Research (HCMR), IMBRIW, Crete P.O. Box 2214, 71003 Iraklion Crete, Greece

\* email corresponding author: [erika.fabbri@unina.it](mailto:erika.fabbri@unina.it)

The process of spatial prioritization has received scarce attention in marine restoration. However, considering where restoration activities will be undertaken is critical to guide restoration interventions. In this study, we assess the consequences of adopting different restoration targets and criteria on spatial restoration prioritization, at Mediterranean scale. We applied the decision-supporting tool Marxan, widely used in systematic conservation planning, on macroalgal forests since, in the last 20 years, forests loss has

been largely documented, with limited evidences of natural recovery. Spatial priorities were identified under six planning scenarios, considering three main restoration targets conceived to reflect the objectives of the EU Biodiversity Strategy for 2030.

Results show that the number of suitable sites for restoration is very limited at basin scale, and targets are only achieved when the recovery of 10% of regressing/extinct macroalgal forests is planned. Increasing targets translates in including unsuitable areas for restoration in Marxan solutions, amplifying the risk of ineffective efforts.

Our analysis supports macroalgal forests restoration and provides guiding principles and criteria to strengthen the effectiveness of restoration actions across habitats. The constraints in finding suitable areas for restoration are discussed, and recommendations to guide planning to support future restoration actions are also included.

### Restocking with wild caught farmed European eels: an alternative approach

**Cinzia Podda** (1)\*, Francesco Palmas (1), Giovanna Chessa (2), Jacopo Culurgioni (2), Riccardo Diciotti (2), Nicola Fois (2), Andrea Sabatini (1)

(1) University of Cagliari, Department of Life and Environmental Sciences, Via T. Fiorelli 1, 09126 Cagliari, Italy

(2) Agricultural Research Agency of Sardinia (Agris Sardegna) Fish Products Service, SS 291 Km 18,600, 07100 Sassari, Italy

\* email corresponding author: [cpodda@unica.it](mailto:cpodda@unica.it)

The critically endangered European eel *Anguilla anguilla* (L., 1758) needs conservation programs according to the EC Regulation 1100/2007 that, among recovery measures, include restocking. While restocking is commonly practiced using directly wild glass eels, we carried out a restocking experiment using farmed yellow eels starting from wild glass eels. Ca. 7500 glass eels from Pramaera river (Central-Eastern Sardinia) were raised from February to November 2018 in a commercial farm. Every two weeks, a subsample (50 eels) was analyzed (total length TL, total weight TW, health status). After nine months, the survival rate was 28% (2073 eels), with increasing of TL from  $6.34 \pm 0.66$  to  $17.29 \pm 4.24$  cm and TW from  $0.20 \pm 0.24$  to  $8.06 \pm 7.75$  g. 706 specimens were then released in the Ulassai river (Central-Eastern Sardinia), where the species was currently extinct; 136 eels (TL  $31.01 \pm 3.96$  cm, TW  $51.10 \pm 24.10$  g) were marked using PIT tags and monitored yearly until July 2021. After three years, recaptured eels (ca. 15%) showed a TL of  $52.4 \pm 3.94$  cm and TW of  $250.45 \pm 71.13$  g. Eels showed a good health status suggesting a good readjustment to the wild environment. Results suggest that restocking with farmed juvenile yellow eels (obtained from glass eels) may represent a valid alternative restocking approach.

## SESSIONE SPECIALE - Aquatic microbiomes and microbial pathogens across the One Health spectrum – Chair: Grazia M. Quero, Ester M. Eckert

### Zooplankton influences extracellular DNA degradation and acquisition through natural transformation in freshwater microcosms

**Ester M. Eckert** (1)\*, Francesco Riva (2), Emanuele Ferrari (1), Sara Borin (2), Andrea Di Cesare (1), Francesca Mapelli (2), Elena Crotti (2)

(1) Molecular Ecology Group, National Research Council of Italy - Water Research Institute (CNR-IRSA), Verbania, Italy

(2) Department of Food, Environmental and Nutritional Sciences (DeFENS), University of Milan, Milan, Italy

\* email corresponding author: [Estermaria.eckert@cnr.it](mailto:Estermaria.eckert@cnr.it)

Extracellular DNA (eDNA) is often stated as important for the spread of antibiotic resistance genes in freshwaters, but experimental data on the uptake of eDNA by environmental bacteria is scarce. To understand this process in the environment, the persistence and uptake of eDNA should be analyzed in a food-web context, i.e. considering interactions with higher organisms. Here I present data on the evaluation of the impact of zooplankton on eDNA degradation and acquisition, and frequency of natural transformation, using the environmental model organisms *Daphnia obtusa* and *Acinetobacter baylyi*. We conducted microcosm experiments with plasmidic and linear DNA adding *Daphnia* or its surrounding water and evaluated eDNA quantity, quality and transformation, and analysed the secreted proteins. The presence of *D. obtusa* resulted in proportional eDNA degradation, possibly by both animal and microbiota related enzymes. Consequently, there was a strong reduction in the natural transformation frequency of the bacterium *A. baylyi*. In contrast, *D. obtusa* released enzymes (surrounding water of *Daphnia*) increased transformation efficiency, probably due to changes in plasmid confirmation. These results strongly suggest that zooplankton and/or its microbiota reduce the quantity and change the quality of eDNA and thereby influence the spread of ARGs in freshwater.

### Host-associated and environmental microbiomes in a Mediterranean gilthead sea bream fish farm

**Marco Basili** (1,2)\*, Grazia Marina Quero (1), Roberta Piredda (3), Giulia Maricchiolo (4), Simone Mirto (5), Elena Manini (1), Anne Mette Seyfarth (6), Marco Candela (2), Gian Marco Luna (1)

(1) Institute of Marine Biological Resources and Biotechnologies, National Research Council (CNR-IRBIM), Ancona, Italy

(2) Alma Mater Studiorum—University of Bologna, Italy

(3) Department of Veterinary Medicine – University of Bari Aldo Moro, Valenzano (Bari), Italy

(4) Institute of Marine Biological Resources and Biotechnologies, National Research Council (CNR-IRBIM), Messina, Italy

(5) Institute of Anthropogenic Impacts and Sustainability in Marine Environment, National Research Council (IAS-CNR), Palermo, Italy

(6) Department of Global Surveillance, National Food Institute, Technical University of Denmark, Lyngby, Denmark

\* email corresponding author: [marco.basili@irbim.cnr.it](mailto:marco.basili@irbim.cnr.it)

Gilthead seabream is among the most important farmed fish species in the Mediterranean Sea. Several approaches are currently applied to assure a lower impact of diseases and a higher productivity, including the exploration of fish microbiome and its manipulation as a sustainable alternative to improve aquaculture practices. We explored the microbiome of farmed seabream to assess similarities and differences among microbial assemblages associated to different tissues, and compare them with those in the surrounding

environment. Seabream had distinct microbiomes according to the tissue and compared to the environment. Gut hosted the most diverse microbiome; different sets of dominant ASVs characterized environmental and fish samples. The similarity between fish and environmental microbiomes was higher in seawater than sediment, with highest similarity observed between gill and seawater, suggesting that gills are more closely interacting with the environment. We finally analyzed the potential connections occurring among microbiomes. These connections were relatively low among the host's tissues, in particular, between gut and the others fish-related microbiomes; other tissues (skin and gills), were found to be the most connected microbiomes. Our results suggest that seabream microbiomes reflect only partially those in their surrounding environment and that the host is the primary driver shaping seabream microbiome.

### Improving environmental monitoring of Vibrionaceae in coastal ecosystem through amplicon sequencing

**Elisa Banchi\***, Vincenzo Manna, Viviana Fonti, Cinzia Fabbro, Mauro Celussi

Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS), via Piccard 54, 34151 Trieste

\* email corresponding author: [ebanchi@ogs.it](mailto:ebanchi@ogs.it)

The Vibrionaceae family groups genetically and metabolically diverse bacteria thriving in all marine environments. They are important players in biogeochemical dynamics, and several species are well known pathogens. Here, we applied the phylogenetic placement coupled with a consensus-based approach using 16S rRNA gene amplicon sequencing, aiming to reach a reliable and fine-level Vibrionaceae characterization and identify the dynamics of blooming, ecologically important, and potentially pathogenic species in different sites of the northern Adriatic Sea. Water samples were collected monthly at an LTER site from 2018 to 2021, and in spring and summer of 2019 and 2020 at two sites affected by depurated sewage discharge. The 47 identified Vibrionaceae species represented generally below 1% of the sampled communities; blooms (up to ~11%) mainly formed by *Vibrio chagasii* and *V. owensii*, occurred in summer, linked to increasing temperature and particulate matter concentration. Pathogenic species were found in low abundance. Depuration plant samples were characterized by a lower abundance and diversity of species, highlighting that Vibrionaceae dynamics at sea are unlikely to be related to wastewater inputs. Our work represents a further step to improve the molecular approach based on short reads, toward a shared, updated, and curated phylogeny of the Vibrionaceae family.

### Popstars in the Adriatic Sea: seasonal dynamics of the most abundant prokaryotes at C1-LTER station, Gulf of Trieste

**Mauro Celussi\***, Cecilia Balestra, Elisa Banchi, Viviana Fonti, Vincenzo Manna

Istituto Nazionale di Oceanografia e di Geofisica Sperimentale - OGS, via Piccard 54, 34151 Trieste

\* email corresponding author: [mcelussi@ogs.it](mailto:mcelussi@ogs.it)

Planktonic marine microbial communities display dynamic abundance fluctuations over time, particularly in temperate environments. Such variations are driven by a plethora of biotic and abiotic drivers, especially at coastal sites. We analysed the temporal variations of planktonic prokaryotes at the C1-LTER station in the Gulf of Trieste for 3 years, aiming at depicting the seasonal dynamics of the most abundant oligotypes in surface and bottom (15m) layers.

As a first step, we identified the core microbiome, which was represented by 20-63% and 40-65% of the total prokaryotic diversity for the surface and bottom samples, respectively.

As a second step, we identified the seasonality of the most abundant oligotypes. Springtime was characterized by peaks in the relative abundance (RA) of the Flavobacteriaceae NS4 and NS5, and of several

genera within the Rhodobacteraceae. During summer the sampling site experienced blooms of cyanobacteria, with *Synechococcus* as the dominant genus, and of the Actinobacterium DS001. In Autumn, the genus *Actinomarina* of the Actinobacteria reached its highest RA; at the same time archaeal abundances (mostly *Nitrosopumilus*) started to rise, reaching their maxima during winter. In the coldest months also the sulfur oxidizer group SUP05 of the Gammaproteobacteria displayed the highest values.

### Water masses age and origin drive the diversity of pelagic prokaryotes and dissolved organic matter dynamics: the Mediterranean Sea case

**Gian Marco Luna (1)\***, Grazia Marina Quero (1), Simona Retelletti Brogi (2), Chiara Santinelli (2)

(1) Institute for Biological Resources and Marine Biotechnologies, National Research Council (IRBIM-CNR), Largo Fiera della Pesca 2, 60125, Ancona, Italy

(2) Biophysics Institute, National Research Council (IBF-CNR), Via G. Moruzzi, Pisa 56124, Italy

\* email corresponding author: [gianmarco.luna@cnr.it](mailto:gianmarco.luna@cnr.it)

The deep sea is among the largest, yet still poorly known, ecosystems on Earth. This knowledge gap is particularly evident for the deep Mediterranean Sea, characterized by peculiar conditions at meso- and bathypelagic depths, likely selecting for unique microbial assemblages. We collected seawater samples, from the surface to the bathypelagic layers, in basins of the Western Mediterranean Sea (Algero-Provençal Basin, Alboran Sea and Gulf of Lion) characterized by different trophic regimes, and described the composition of pelagic prokaryotic communities, the main physical-chemical variables, and the concentration and optical properties of dissolved organic matter (DOM). The main goal was to test the hypothesis that assemblages vary in the different water masses, and that they are structured by the quantity/quality of DOM. Communities were significantly different among layers (epi-, meso- and bathypelagic) and water masses. Richness and diversity (as Shannon index) increased significantly with depth, with highest richness in mesopelagic stations. Our data show that spatially separated microbial communities, belonging to different water masses, are associated with different DOM properties (different DOM quality), even if at similar DOC concentration, suggesting a different role played by communities in the DOM cycling, that needs to be further elucidated also in light of the changing conditions of the entire basin.

### The sweet tooth of marine microbiomes: potential and expression patterns of prokaryotic glycosyl-hydrolases across the global ocean

**Vincenzo Manna\***, Elisa Banchi, Mauro Celussi

Istituto Nazionale di Oceanografia e Geofisica Sperimentale – OGS, Via Auguste Piccard 54, 34151, Trieste

\* email corresponding author: [vmanna@ogs.it](mailto:vmanna@ogs.it)

Polysaccharides constitute a large fraction of the organic matter produced and degraded in the ocean, representing a pivotal nutritional source for heterotrophic microbes. Extracellular enzymes are the essential tool used by heterotrophic prokaryotes to access this resource. According to the foraging theory, extracellular enzymes should be cell-associated in dilute systems but secreted into the surrounding environment in diffusion-limited systems (e.g., organic particles). Aiming to characterise abundance and expression patterns of cell-associated and cell-free carbohydrate-degrading enzymes (glycosyl-hydrolases, GHs) across the global ocean, we queried the Tara Oceans metagenomic and metatranscriptomic datasets searching for prokaryotic GHs sequences. Distinguishing between secretory and non-secretory GHs, we aimed to assess the importance of microbial lifestyle for carbohydrate cycling in the ocean. Secretory GHs showed a clear latitudinal pattern, mostly evident for surface and deep chlorophyll maximum samples, with

higher abundance and expression observed in polar samples. According to GHs expression data, mesopelagic samples gathered in a distinct cluster, regardless of their climatic zone, significantly defined by secretory GHs involved in chitin degradation. These results indicate that a consistent fraction of carbohydrates cycling at high latitudes and in the mesopelagic ocean is channelled through dissolved exoenzymes, highlighting the importance of microscale carbon fluxes in these environments.

### Trends of fecal pollution along the coasts of Marche Region (Adriatic Sea) over a decade (2011-2021)

**Grazia Marina Quero\***, Stefano Guicciardi, Pierluigi Penna, Gian Marco Luna

CNR IRBIM, National Research Council – Institute of Marine Biological Resources and Biotechnologies, Largo Fiera della Pesca, 60125, Ancona (Italy)

\* email corresponding author: [grazia.quero@irbim.cnr.it](mailto:grazia.quero@irbim.cnr.it)

A general increase of fecal pollution has been reported worldwide over the last decades, with predictions suggesting a further rise by the end of this century in response to global change and increasing pressure on coasts. For these reasons, clarifying the trends and factors related to fecal pollution over relatively large spatial and temporal scales is of paramount importance. In this study, we retrospectively evaluated and analyzed Fecal Indicator Bacteria (FIB) abundance data along a coastal section of the Marche region – an area characterized by intense tourism, maritime traffic and industrial activities – over a decade (2011-2021) and related such data to precipitations levels, rivers' flow and drainage basins discharge, with the primary objectives of: i) assessing the temporal variation of the overall fecal contamination along the Marche Region coasts and ii) clarifying the possible factors explaining the fecal contamination.

In the light of climate change scenarios and considering the need to clarify environmental and human health under the One Health approach, our study represents a step forward the understanding of the future variability of fecal contamination and in designing effective management plans to limit microbial pollution in coastal waters.

### The role of intraspecific morpho-functional trait variability in marine phytoplankton responses to changing nutrient scenarios

**Silvia Pulina** (1)\*, Jorin Hamer (2), Giannina S. I. Hattich (2,3), Julia Romberg (2), Cecilia T. Satta (1), Birte Matthiessen (2)

(1) Aquatic ecology group, University of Sassari, Dipartimento di Architettura, Design e Urbanistica, via Piandanna 4, 07100 Sassari, Italy

(2) GEOMAR Helmholtz Centre for Ocean Research, Düsternbrooker Weg 20, 24105 Kiel, Germany

(3) Åbo Akademi University, Environmental and Marine Biology, Artillerigatan 6A, 20520 Åbo/Turku, Finland

\* email corresponding author: [pulinasi@uniss.it](mailto:pulinasi@uniss.it)

Nutrient limitation is expected to increase in the future ocean driven by intensified water column stratification due to increasing temperature. High variability in phytoplankton morphology at inter- and intra-specific level is a powerful strategy to cope with changing nutrient conditions. Nine genotypes of the diatom *Chaetoceros affinis* were incubated in the short-term at seven nitrate regimes to study the intraspecific morphological trait dynamics. Preliminary results suggest a significant intraspecific cell size and S/V variability of the diatom which can be explained by both plasticity of genotypes and to a larger extent by differences in mean trait values among genotypes. This significant variability allowed to group the cells into four morphotypes diverging in diameter size. Comparable intraspecific morphological variability of the diatom was also observed over a previous long-term experiment with a community consisting of *C. affinis* and the

coccolithophore *Emiliana huxleyi* with nine genotypes each, treated with three nitrate conditions. Here, plasticity played a more important role to explain morphological variability among the remaining *C. affinis* genotypes compared to the short-term. Results on the still ongoing analyses will be important to understand the potential importance of phytoplankton intraspecific phenotypic variability in changing environments which is still poorly studied.



# POSTER

## SESSIONE SPECIALE - Gli studi ecologici di lungo termine per la comprensione delle risposte degli ecosistemi acquatici agli impatti antropici e climatici – Chair: Giuseppe Denti and Silvia Pulina

A longitudinal study on bathing waters: bacterial investigation and *Ostreopsis cf. ovata* dynamics combined with environmental variables in a highly touristic area (Sardinia, western Mediterranean) from 2015 to 2021

**Anna Maria Bazzoni\***, Valeria Manca, Paolo O. Fiori, Giovanni A. Mocci, Maryam Motavalian, Stefano Muredda, Cristina Nigra, Renata Rossi, Cristina Russu, Maria Grazia Pintus

Regional Environmental Protection Agency of Sardinia (ARPAS), Via Rockefeller 58/60, 07100 SASSARI

\* email corresponding author: [ambazzoni@arpa.sardegna.it](mailto:ambazzoni@arpa.sardegna.it)

Most of coastal areas play a crucial role for many recreational activities. The protection and the safeguarding of water quality are the primary aim of principal European directives of bathing water policy (76/160/EEC; 2006/7/EC) in view of the consequences that has potential presence of pathogens on public health and the environment. This study was performed in bathing areas of northwest Sardinia (W Mediterranean Sea) and based on the results of a monitoring programme from 2015 to 2021, in accordance to Regulations currently in force. The aim was to obtain information about the water quality to prevent water-related outbreaks and protect the bathers' health. Presence of total Enterococci and *Escherichia coli* in the water surface, and *Ostreopsis cf. ovata* in the water column and on macroalgae, has been considered. Nutrients, physical parameters and environmental conditions were also examined. Based on the L-TERM monitoring results, critical situations have frequently been found always in the same sampling points, often as result of river flows or particular weather conditions. In most stations, problems occurred only sporadically, highlighting excellent water quality for bathing activities. The L-TERM study through an approach to different levels of the biological community was fundamental to marine environment quality evaluation.

Effects of spring-summer water levels management on littoral macroinvertebrates of Lake Maggiore (NW, Italy)

**Angela Boggero\***, Silvia Zaupa, Daniele Paganelli, Michela Rogora, Marzia Ciampitiello, Lyudmila Kamburska

CNR – Water Research Institute, Corso Tonolli 50, 28922 Verbania, Italy

\* email corresponding author: [angela.boggero@cnr.it](mailto:angela.boggero@cnr.it)

Lake Maggiore (North-west Italy) is one of the best studied lakes around the world, because it is an important water resource at the edge between the Alpine natural and the more industrial Po Plain areas. The lake is included within the LTER “Subalpine lakes” macrosite, with a long-term record of physical-chemical and biological data dating back to the '80s. Unfortunately, very scarce information is available on macroinvertebrates and on the recent and ongoing management of its water resource for flood control, water exploitation, and water safety purposes. The management, involving several and different stakeholders, is very complex, therefore, the INTERREG project Parchi VerbanoTicino (ID 481668) was launched to define feasible, and sustainable water management strategies useful to preserve water and terrestrial environments, the human welfare and the local economy. What impacts are induced by the management of spring-summer water levels on diversity of macroinvertebrates as a whole, and on

chironomids in particular? To answer this question a monitoring was performed in 2019-2021 in three protected natural areas characterised by sandy substrata, with different slopes and subjected to different water level scenarios. Changes in macroinvertebrate assemblage structure among sites, and in chironomid body size, biomass, and biodiversity are shown.

### Multiannual zooplankton carbon and nitrogen stable isotopes for detecting changes in the Lake Maggiore (Italy) pelagic food web

Rossana Caroni\*, Roberta Piscia, Marina Manca

CNR-IRSA sede di Verbania, Largo Tonolli 50, 28922, Verbania

\* email corresponding author: [rossana.caroni@irsa.cnr.it](mailto:rossana.caroni@irsa.cnr.it)

In this study, we have analysed decadal stable isotope ( $^{13}\text{C}$  and  $^{15}\text{N}$ ) data of pelagic crustacean zooplankton and environmental variables of Lake Maggiore (Italy). By performing decomposition of time series of zooplankton taxa  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  signatures, we detected marked seasonality and trends over the studied period. Zooplankton taxa and pooled samples (size fraction  $\geq 450\ \mu\text{m}$ ) showed  $\delta^{13}\text{C}\text{‰}$  values less depleted in summer and higher  $\delta^{15}\text{N}\text{‰}$  values in winter. Changing patterns in  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  zooplankton trends were related to chlorophyll *a* fluctuations and  $\text{NO}_3$  depletion occurred in the lake during recent years. The significant relationship between carbon isotopic signatures of both pooled zooplankton and *Daphnia* with water temperature was indicative of seasonality and of vertical distribution of the zooplankton taxa. More detailed insight into stable isotope signatures revealed niche differentiation between *Daphnia sp.*, Cyclopoids and *Diaphanosoma brachyurum*. Cyclopoids had restricted ranges of  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  and their  $\delta^{13}\text{C}$  signals were increasingly differentiated from that of *Daphnia* from winter to summer periods. The cladoceran *Diaphanosoma brachyurum* occurred with less negative  $\delta^{13}\text{C}$  signatures, likely due to its tendency to prefer warm months and to occupy superficial water layers of the lake.

### High frequency monitoring (HFM) through in-situ sensors as a support to lake quality evaluation and management: insights from the INTERREG project SIMILE in Lake Maggiore

Michela Rogora (1)\*, Tommaso Cancellario (1), Rossana Caroni (1), Lyudmila Kamburska (1), Andrea Lami (2), Dario Manca (1), Simona Musazzi (1), Rocco Tiberti (1,2)

(1) National Research Council, Water Research Institute, Largo Tonolli 50, 28922 Verbania Pallanza (VB), Italy

(2) Department of Earth and Environmental Sciences DSTA, University of Pavia, Via Ferrata 9, 27100 Pavia, Italy

\* email corresponding author: [michela.rogora@cnr.it](mailto:michela.rogora@cnr.it)

Lake Maggiore is a deep oligomictic lake belonging to the "Southern Alpine Lake" LTER site. Studies on physical, chemical and biological features of the lake have been performed continuously since the 1980s. The lake recovered from eutrophication thanks to the reduction of catchment loads and reached a stable oligotrophic status by the end of the 1990s. In the last decade, climate change became the main driving factor for the long-term evolution of the lake, affecting lake hydrodynamic, nutrient status and biological communities. A high frequency monitoring (HFM) system has been deployed in Lake Maggiore in 2020 within the cross-border cooperation project SIMILE (Integrated monitoring system for knowledge, protection and valorisation of the subalpine lakes and their ecosystems). The system consists of a buoy equipped with sensors for limnological variables (water temperature, pH, conductivity, dissolved oxygen) and algal pigments (chlorophyll, phycocyanin, phycoerythrin). First results revealed that HFM, used in conjunction with discrete chemical and biological monitoring, represents a useful tool to detect ecological changes, also in relation to

climate divers and may contribute to an improved evaluation of water quality. However, regular check and validation of the sensor readings through laboratory analyses are important to get reliable data.

### In-situ high resolution turbidity time series to describe storm resuspension events along the North-Western Adriatic shelf

Francesco Riminucci (1,2) \*, Lucilla Capotondi (1), Mariangela Ravaioli (1), **Caterina Bergami (1)**

(1) National Research Council of Italy (CNR) Institute of Marine Sciences (ISMAR), Bologna and Milano, Italy;

(2) PROAMBIENTE Consortium, Tecnopole Bologna CNR, Bologna, Italy

\* email corresponding author: [francesco.riminucci@bo.ismar.cnr.it](mailto:francesco.riminucci@bo.ismar.cnr.it)

Long-term data series (2012–2020) of physical and oceanographic parameters at the LTER-Italy research site “Delta del Po and Costa Romagnola” were analyzed to investigate the variability of surface turbidity along the North-Western Adriatic shelf. This shallow coastal ecosystem is characterized by high river runoff and by extremely variable wind and wave conditions; both these meteo-oceanographic forcings drive the local surface turbidity pattern. The data-set analyzed in this study combines superficial turbidity (optical backscatter) and salinity data acquired by the E1 buoy, one of the infrastructure active at this site, with meteorological, hydrographic, and wave data acquired by local stations of the ARPAE regional agency. The main and most intense turbidity events ( $NTU > 10$ ) recorded by the E1 station are mainly associated with storm events (wave height  $> 1.2$  m) primarily due to North-Easterly Bora winds and secondarily to Mistral and Sirocco winds from West-Northwest and South-West respectively. Although turbidity events along the coast south of the Po Delta are mainly due to suspended sediments brought by the river floods and by the wind-driven resuspension events, at the E1 site the high correlation between turbidity and wave height shows that the combined action of wind and waves represents the main forcing in this area.

## SESSIONE REGOLARE – Chair: Leonardo Cerasino, Maria Cristina Bruno

### The project “ROCK-ME: Geochemical response of Alpine Rock Glaciers to global warming: hydroecological consequences of trace element Export”

**Maria Cristina Bruno** (1)\*, Monica Tolotti (1), Stefano Brighenti (2), Francesco Comiti (2), Lorenzo Brusetti (2), Andrea Fisher (3)

(1) Research and Innovation Centre, Fondazione Edmund Mach, Via E. Mach 1, I-38010 San Michele all'Adige, Italy

(2) Faculty of Science and Technology, Free University of Bolzano/Bozen, Piazza Università 1, 39100 Bolzano, Italy

(3) Institute for Interdisciplinary Mountain Research, Austrian Academy of Sciences, Innrain 25, 6020 Innsbruck, Austria

\* email corresponding author: [cristina.bruno@fmach.it](mailto:cristina.bruno@fmach.it)

ROCK-ME is a 3-year project funded by the 4<sup>th</sup> Call of the EUREGIO Interregional Project Networks framework, started on April 1<sup>st</sup> 2022. The project addresses the effects of climate change on the degradation of mountain permafrost. Thawing rock glaciers (RG) are becoming major hydroecological drivers in numerous deglaciating Alpine catchments, as RG export cold waters often enriched in trace elements (TE). However, both the hydrological drivers and the ecological effects of TE enrichment on RG-fed streams and on the downstream river networks are almost entirely unknown. The research questions investigated by ROCK-ME are: 1) Thawing RG export higher loads of TE than glaciers, relict RG and groundwater springs; 2) TE in RG-streams mainly originate from bedrock weathering, and a smaller amount derives from past/present atmospheric deposition; 3) TE export and its ecological effects vary at multiple timescales in relation to seasonal and long-term dynamics of permafrost thawing; 4) TE bioaccumulate in the stream foodweb; 5) RG microbial communities influence TE bioavailability and toxicity; 6) thawing RG release heavy metal resistance genes. Three Alpine catchments with different proportions of glaciers and RG cover will be investigated with an integrated approach combining geomorphological/geochemical analysis, hydrological monitoring and modelling, ecological and genomic characterization.

### Environmental DNA as a tracer of the origin of sestonic organic matter in coastal systems

**Viviana Di Tuccio** (1)\*, Luca Russo (1,2), Gabriele Del Gaizo (1,3), Daniele Bellardini (1), Francesca Margiotta (3), Pasquale De Luca (3), Domenico D'Alelio (1) and the NEREA team (1,3)

(1) Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, Villa Comunale, 80121, Naples, Italy

(2) PhD Programme in Evolutionary Biology and Ecology, Department of Biology, University of Rome “Tor Vergata”, Rome, Italy

(3) Department of Research Infrastructures for Marine Biological Resources, Stazione Zoologica Anton Dohrn, Villa Comunale, 80121, Naples, Italy

\* email corresponding author: [viviana.dituccio@szn.it](mailto:viviana.dituccio@szn.it)

Environmental DNA (eDNA) study in aquatic sciences is becoming useful not only for biodiversity assessment but also for environmental management. During the project FEAMP-ISSPA, the augmented ocean observatory NEREA, and the programme ASSEMBLE+, we collected and analyzed eDNA from marine water samples in several sites and across an annual cycle in the Campania region (Italy) and used these data as tracers of the origin of sestonic organic matter in coastal systems (e.g., riverine vs. offshore). Water was sampled at different depths, ranging -800 and 0 m, from coastal stations and major river mouths to offshore stations and a deep submarine canyon. Metabarcoding (metaB) analysis targeted the ribosomal RNA (rRNA)

regions 12S and 18S, amplicon reads were classified based on public databases and arranged in libraries of operational taxonomic units (OTU), which were analyzed to derive biodiversity indices. Main differences were detected between eDNA libraries from different seasons and sites. The 12S rRNA marker allowed tracing the riverine origin of sestonic organic matter based on the dominance of DNA from terrestrial plants in the metaB data, in agreement with the copious amount of terrigenous material detected in parallel. Yet, deeper water samples showed a unique metaB fingerprint.

## SESSIONE SPECIALE - Laghi artificiali, stagni e lagune costiere del Mediterraneo: una risorsa a rischio – Chair: Cecilia Teodora Satta, Federico Marrone

### Use of otoliths for estimating age of *Mugil cephalus* L. destined to “bottarga” production in Tortolì lagoon (central western Sardinia, western Mediterranean)

Jacopo Culurgioni, **Riccardo Diciotti\***, Laura Mura, Giovanna Chessa, Gabriele Sanna, Rosanna Floris, Francesco Chessa, Simonetto Serra, Marco Trentadue, Nicola Fois

Agricultural Research Agency of Sardinia (Agris Sardegna) Fish Products Service, SS 291 Km 18,600, 07100 Sassari, Italy  
\* email corresponding author: [rdiciotti@agrisricerca.it](mailto:rdiciotti@agrisricerca.it). Jacopo Culurgioni and Riccardo Diciotti contributed equally to this work.

The flathead grey mullet *Mugil cephalus* Linnaeus, 1758 is particularly appreciated for dried, salted and compressed eggs (roe, “bottarga” in Italy) which are highly valuable delicacy in many Mediterranean countries. Sustainable management of the exploited local stocks is recommended, starting from basic information on population structure. During September 2020, 30 *M. cephalus* females from commercial fishery of Tortolì lagoon (central eastern Sardinia) were examined in the early stages of the bottarga production process. Biometric parameters total length (TL), total weight (TW), gonads weight (GW), gonadosomatic index (GSI), otoliths weight (OW) were measured. Each right otolith was examined *in toto* under binocular microscope in order to estimate fish ages by counting growth rings. The mean values±STD obtained were TL 61.06±6.31 cm, TW 2,703.13±796.47 g, GW 591.49±216.98 g, GSI 22.16±5.63, OW 0.11±0.03. The age estimated ranged from 4 to 9 years (mean 6.27±1.14), and the most frequent age class was 6 years. Positive correlations between age, TL ( $R^2=0.84$ ), and TW ( $R^2=0.78$ ) were observed. These preliminary data on population structure and growth rate of *M. cephalus* may represent useful basic information for the management of the fishery of this species.

### A metagenetic study on intestinal microbial communities of grey mullets from a Mediterranean coastal lagoon (Santa Giusta, Sardinia, Italy)

**Rosanna Floris** (1)\*, Gabriele Sanna (1), Sonia Murgia (1), Greta Battaglia (2), Fabio De Pascale (2), Alessandro Vezzi (2), Nicola Fois (1)

(1) AGRIS-Sardegna, Loc. Bonassai SS 291 km 18,6 – 07100 Sassari, Italy

(2) Dep. of Biology University of Padua, Via Ugo Bassi 58/B 35131 Padua, Italy.

\* email corresponding author: [rfloris@agrisricerca.it](mailto:rfloris@agrisricerca.it)

The objective of this study was to explore the diversity of gut microbial communities from 34 wild mullets inhabiting a brackishwater ecosystem (Santa Giusta Lagoon, Sardinia, Italy,) along four different seasons, using next generation sequencing (NGS). Amplicon sequencing of the V3-V4 hypervariable regions of the 16S rRNA gene was performed, yielding 2,292,589 quality filtered paired sequences. A total of 10,206 amplicon sequence variants (ASVs) were observed and used for the taxonomic assignment. The results indicated a high bacterial diversity (mean Shannon index: 4.74±1.12) and intestinal fish microbioma changes along the different seasons and between various fish species. Nine bacterial phyla were identified and the most abundant ones were: Proteobacteria (mean sequence abundance 36.9%±9.3), Actinobacteria (mean

sequence abundance  $19.6\% \pm 8.3$ ), Firmicutes (mean sequence abundance  $17.3\% \pm 16.5$ ). Bacteria belonging to the phyla Chloroflexi (up to 29.7%) were peculiar of autumn, Spirochaetota (up to 45.8%), Verrucomicrobiota (up to 23.95%), Fusobacteriota (up to 40.4%) and Cyanobacteria (up to 12.82%) were present only in winter while Bacteroidota characterized summer (up to 19.46%). The differentiation of intestinal microbioma in the various seasons was more evident at family level (27 identified bacterial families): the Brevinemataceae (Spirochaetota) (up to 45.8%) was dominant in winter, the Rhodocyclaceae (up to 47.7%) ( $\alpha$ -Proteobacteria) in autumn and the Staphylococcaceae (Firmicutes) (up to 35.8%) prevails in spring. This study confirms that intestinal bacterial communities of mullets are highly influenced by seasonal dynamics.

### Presence of microcystins in some reservoirs of Sardinia (western Mediterranean) in the period 2010-2021: preliminary results

**Oriana Soru (1)\***, Paola Spanu (1), Efisio Sais (1), Tomasa Viridis (1), Maria Cristina Pinna (1), Maristella Putzu (1), Antonella Lugliè (2), Paola Buscarinu (1)

(1) Ente Acque della Sardegna, viale Elmas, 116, 09122 Cagliari, Italy

(2) Dipartimento di Architettura, Design e Urbanistica, via Piandanna, 4, 07100 Sassari, Italy

\* email corresponding author: [soru.orian@gmail.com](mailto:soru.orian@gmail.com)

Most of the reservoirs of Sardinia is characterized by eutrophic conditions and frequent phenomena of algal blooms, caused by potentially toxic Cyanobacteria. *Microcystis*, *Planktothrix*, *Aphanizomenon*, *Dolichospermum* are the genera mainly responsible of these events. Sardinian reservoirs represent the main source of water supply and consequently they are subject to continuous monitoring for the water quality by the managing Regional Institution, the Ente Acque della Sardegna. Since 2010, microcystins monitoring has been carried out, by ELISA method and then, since 2012 also by LC-MS. That monitoring involved 28 reservoirs characterized by the presence of Cyanobacteria, obtaining significant results from 20 of them. Preliminary results from the 823 analyzed samples confirmed the toxicity of Cyanobacteria blooms, especially in presence of *Planktothrix agardhii-rubescens* group, *Dolichospermum flos-aquae*, *Aphanizomenon flos-aquae* and *Microcystis aeruginosa*. All the investigated MCs variants (MC-RR, MC-LR, dm MC-RR, dm MC-LR, MC-YR, MC-LA, MC-LW, MC-WR, MC-LF, MC-LY) were detected and MC-RR, MC-LR, dm MC-RR, dm MC-LR, MC-YR were the more important as abundance and frequency. These results suggest the importance of continuing and extending monitoring with detection of other cyanotoxins and isolation of species main responsible of blooms to obtain monospecific cultures for assessing toxicity at species-specific level.

### The ancient irrigation system of the Palermo Plain (Sicily, Italy) as a substitute ecosystem: preliminary investigations on its aquatic flora

**Angelo Troia (1)\***, Mariano Vivacqua (1), Elisabetta Oddo (1), Tommaso La Mantia (2)

(1) Department of Biological, Chemical and Pharmaceutical Sciences and Technologies—STEBICEF, University of Palermo, Via Archirafi 38, 90123 Palermo, Italy

(2) Department of Agricultural, Food and Forest Sciences—SAAF, University of Palermo, Viale delle Scienze, blg. 4, 90128 Palermo, Italy

\* email corresponding author: [angelo.troia@unipa.it](mailto:angelo.troia@unipa.it)

Many cities around the world are expanding, including in their perimeters green and blues spaces that could be crucial for the maintaining of biodiversity. Urban waterbodies are generally created to provide other services, but correctly managed they can provide also relevant ecosystem services. The Palermo Plain was

characterized, in the past centuries, by several wetlands that were progressively destroyed (or “reclaimed”). The ancient irrigation system, probably set during the Arab domination (IX-XI century A.D.), became a substitute ecosystem able to host a significant biodiversity. Our research focused on the remains of this system, scattered in the relictual green areas of the Plain, and especially on typical open cisterns, named (with a term of Arabic origin) “gebbie”; we checked the presence of strictly aquatic flora (vascular plants and charophytes), taking also into account some water parameters (conductivity, pH and hydroperiod) and the type of management of these water bodies. The floristic richness of these urban reservoirs appears to be generally low; however, they sometimes support rare species, or species otherwise disappeared from the Plain. If well managed, they have the potential to support a much greater biodiversity than they currently do; on the contrary, abandoned “gebbie” are the poorest ones.

## SESSIONE SPECIALE – Multidisciplinary and trans-ecodomain vision for the management and control of invasive alien species - Visione multidisciplinare e trans-ecodominio per la gestione e il controllo delle specie aliene invasive – Chair: Angela Boggero, Agnese Marchini

### Potential impact of dreissenids species in relation to the first report of quagga mussel (*Dreissena bugensis*) at the end of winter 2022 in Lake Garda (Northern Italy).

**Adriano Boscaini** (1)\*, Cristina Cappelletti (2), Francesca Ciutti (2), Nico Salmaso (1)

(1) Research and Innovation Centre, Fondazione Edmund Mach (FEM), Via E. Mach 1, 38098 S. Michele all'Adige (TN)

(2) Technology Transfer Centre, Fondazione Edmund Mach, via E. Mach 1, 38098, San Michele all'Adige, Italy

\* email corresponding author: [adriano.boscaini@fmach.it](mailto:adriano.boscaini@fmach.it)

Along with *Dreissena polymorpha* (zebra mussel), *Dreissena bugensis* (quagga mussel) is considered one of the most widespread and successful invasive species in Europe, Russia, and North America. The quagga mussel is a bivalve mollusc of the dreissenids family originating from the estuarine region of the rivers Dnieper and Southern Bug (Black Sea). The spread in Europe began after the 1940s and was associated with construction of canal-river systems. *D. polymorpha* was observed in Lake Garda since the end of the 1960s. In the last years, *D. bugensis* was found in the northern perialpine region and in late winter 2022 it was identified along the eastern shores of Lake Garda. Both species are defined as ecosystems engineers because they can strongly change the substrate structure, causing great economic damage in water pipes, potable water treatment plants, and port constructions. Moreover, they can affect resource availability for the other species. A few significant ecological differences between the two species suggest that the impact of quagga mussel could be even larger compared to that caused by zebra mussel. In this poster we will discuss the main expected ecological impacts following the introduction of quagga mussel into new aquatic habitats.

### Invasive hell: potential distributions of invasive gammarids overlap in central Europe but not in South European coastal regions

**Tommaso Cancellario** (1,2)\*, Alex Laini (3), Simone Guareschi (4,5)

(1) Department of Environmental Biology, University of Navarra, Irun Iarrea 1, E-31080 Pamplona, Spain

(2) National Research Council of Italy (CNR), Water Research Institute (IRSA), Molecular Ecology Group (MEG), Verbania Pallanza, Italy

(3) Department of Life Sciences and Systems Biology, University of Torino, Italy

(4) Geography and Environment, Loughborough University, LE11 3TU, United Kingdom

(5) Department of Conservation Biology, Doñana Biological Station (EBD - CSIC), 41092 Seville, Spain

\* email corresponding author: [tcancellari@alumni.unav.es](mailto:tcancellari@alumni.unav.es)

Freshwaters are mainly invaded by a non-random selection of taxa, among which Crustacean stand out with numerous successful examples. The amphipods *Dikerogammarus villosus* and *Dikerogammarus haemobaphes*, are emblematic examples of successful Ponto-Caspian invaders. However, the range of their potential ecological niche has not been explored yet. To fill this gap, we studied the current and future potential distributions in European Western Palearctic, considering two emission scenario magnitudes and

two time periods. Results underlined the suitability of large areas of Central Europe for both species and alerted for some potential expansions toward cold European regions. Moreover, *D. haemobaphes* may also further expand in western and southern European areas. However, scenarios of future climate changes do not support extra-expansions compared to the current potential distribution suggesting a reduction of the occupancy of highly suitable areas for both species. In addition, our outputs highlighted lowland areas at risk coupled with a significant association between human footprint and current suitability values for both amphipods. Therefore, surveys are recommended in aquatic ecosystems belonging to areas predicted as highly suitable for *D. villosus* and *D. haemobaphes*, as well as taxonomic/biomonitoring training helpful to detect their potential expansions and consequently allocate appropriate resources for monitoring and control.

### eDNA detection of autochthonous and invasive freshwater crayfish in Trentino

**Irene Lo Presti** (1,2), Lucia Zanovello (1,2,5), Matteo Girardi (2), Diego Micheletti (4), Giorgio Bertorelle (1), Heidi C. Hauffe (2), Maria Cristina Bruno (3)\*

(1) Dip. Scienze della vita e Biotecnologie, Università degli studi di Ferrara, Via Luigi Borsari 46, 44121 Ferrara, Italia

(2) Conservation Genomics Research Unit, Research and Innovation Centre, Fondazione E. Mach, Via E. Mach 1, 38098 S. Michele all'Adige (TN), Italy

(3) Hydrobiology Research Unit, Research and Innovation Centre, Fondazione E. Mach, Via E. Mach 1, 38098 S. Michele all'Adige (TN), Italy

(4) Unit of Computational Biology, Research and Innovation Centre, Fondazione E. Mach, Via E. Mach 1, 38098 S. Michele all'Adige (TN), Italy

(5) MUSE, Museo delle Scienze, Corso del Lavoro e della Scienza 3, 38122 Trento, Italia

\* email corresponding author: [cristina.bruno@fmach.it](mailto:cristina.bruno@fmach.it)

A major threat to biodiversity conservation is posed by invasive alien species (IAS). The global human-driven spread of these organisms reduces autochthonous species populations through resource competition and introduction of novel pathogens. Fast and efficient detection of invasive species is of fundamental importance for controlling their diffusion, and environmental DNA (eDNA) analysis is being developed to provide a cheaper and less time-consuming tool for early-detection. Our present aim was to test and apply a new eDNA protocol for monitoring white-clawed crayfish (*Austropotamobius pallipes*) populations in the Province of Trento, as well as the two invasive species known to be present in the Province: the red-swamp crayfish (*Procambarus clarkii*) and the spiny-cheek crayfish (*Faxonius limosus*). After filtering water samples from 14 sites across the study area, we extracted whole DNA using the DNeasy PowerWater Kit, and amplified a 360bp COI fragment with a single multi-species primer pair that allows discrimination of the three crayfish species, as well as *A. pallipes* mtDNA haplotypes. PCR products were sequenced with Illumina paired-end technology. Here we discuss the success of our method and present our preliminary results on freshwater crayfish detection using eDNA.

### Distribution and impacts of the invasive amphipod *Dikerogammarus villosus* (Sowinsky, 1894) in the river Adda (South Adda Regional Park, Northern Italy)

**Daniele Paganelli** (1,2)\*, Angela Cianci (1), Agnese Marchini (1)

(1) University of Pavia - Department of Earth and Environmental Sciences, Via S. Epifanio 14, 27100, Pavia, Italy

(2) National Research Council-Water Research Institute (CNR-IRSA), Corso Tonolli 50, 28922 Verbania, Italy

\* email corresponding author: [daniele.paganelli@unipv.it](mailto:daniele.paganelli@unipv.it)

In 2016, *Dikerogammarus villosus* (Sowinsky, 1894) (Crustacea, Amphipoda) was recorded for the first time in the river Adda, one of the main tributaries of the river Po. Since then, no scientific studies have been performed on it and therefore, in order to fill this gap, we investigated its distribution, population density, size classes distribution and biometry in the main course of the river, in the territory of the South Adda Regional Park. Furthermore, we defined its level of invasiveness using two different risk screening methods, in order to obtain a more comprehensive evaluation of its potential impacts: AS-ISK and Harmonia+. Finally, we compared the resulting invasiveness level with the output of the GISS method, also used by IUCN. Our data confirm that the invasive amphipod is well-established in the downstream part of the river Adda, and its distribution seems related to a different hydrodynamism. Interestingly, its level of invasiveness was evaluated as low level by Harmonia+ and high level by AS-ISK: this discrepancy is due to different evaluation of environmental and socio-economic impacts of a non-native species carried out by the two methods. Finally, we propose some possible actions to reduce the spreading rate of this invasive amphipod in this area.

**SESSIONE SPECIALE - Il restauro degli ecosistemi: prevenire, arrestare ed invertire il degrado degli ecosistemi - Ecological Restoration: prevent, halt and reverse the degradation of ecosystems – Chair: Silvia Bianchelli, Antonio Pusceddu**

**REST-ART: RESToration of Marine Forests on ARTificial Reefs**

**Jacopo Cimini\***, Lorenzo Meroni, Valentina Asnaghi, Mariachiara Chiantore

DISTAV, Università Degli Studi di Genova, Corso Europa 26, Genova, Italia.

\* email corresponding author: [jacopo.cimini1@gmail.com](mailto:jacopo.cimini1@gmail.com)

Healthy rocky coasts of the Mediterranean Sea are dominated by macroalgal forests formed by brown algae (i.e., *Cystoseira* sensu lato). These species provide important ecosystem services, contributing to coastal primary production and nutrient cycling, providing food, shelter, nurseries, and habitat for many vertebrate and invertebrate species. Moreover, latest studies highlight how three-dimensional complexity of macroalgal habitats may play an important role as nature-based coastal defense structures against erosion. Currently, most of the *Cystoseira* s.l. populations present in the Mediterranean basin are suffering a decline largely due to anthropic impacts, including coastline urbanization, habitat loss, overfishing, climate change and the increase of extreme climatic events (e.g., exceptional storms, floods, heat-waves). In the last years, a large effort for developing *Cystoseira* forests restoration has been implemented by EU projects (MERCES; Afrimed; ROCPOP LIFE). In light of the increasing threats caused by extreme climatic events, a need for infrastructures (e.g., piers, docks, protective walls) to protect the coastline has emerged. These bare substrates offer an opportunity for testing *Cystoseira* s.l. forestation in areas where the species were present but are very unlikely to naturally colonize those artificial reefs because of their very limited dispersal capacity. This will enhance ecological function and services provision to coastal users.

## SESSIONE SPECIALE - Aquatic microbiomes and microbial pathogens across the One Health spectrum – Chair: Grazia Marina Quero, Ester Eckert

### Insights into salinity tolerance from a *Chlamydomonas* strain

**Emma Bazzani** (1)\*, Chiara Lauritano (2), Olga Mangoni (3,4), Francesco Bolinesi (3), Maria Saggiomo (1)

(1) Research Infrastructure for Marine Biological Resources Department, Stazione Zoologica Anton Dohrn, Villa Comunale, 80121 Naples, Italy

(2) Ecosustainable Marine Biotechnology Department, Stazione Zoologica Anton Dohrn, Villa Comunale, 80121 Napoli, Italy

(3) Department of Biology, University of Naples Federico II, 80126 Naples, Italy

(4) Consorzio Nazionale Interuniversitario delle Scienze del Mare (CoNISMa), 00196 Rome, Italy

\* email corresponding author: [emma.bazzani@szn.it](mailto:emma.bazzani@szn.it)

Salinity is among the main drivers affecting the growth and distribution of photosynthetic organisms in their natural environment, especially in coastal areas, where run-off, rivers and land use have greater impact. As a consequence of climate change, the global salinity patterns are expected to vary, with strong implications on the distribution and composition of microalgal communities, which are the base of the food web.

In our project, we performed a comprehensive experiment exposing a microalga from the genus *Chlamydomonas* (*Chlamydomonas* sp CCMP225) to different concentrations of sea salts. The evaluation of the microalgal responses to this stressor will shed light on the morphological and physiological effects of salinity stress on green algae, allowing us to gain some insights on the possible effects of climate change on this group of organisms. Notably, our strain appeared to be exceptionally resistant to this kind of stress. In fact, even though the growth was considerably reduced under high salinity, the photosynthetic parameters were not substantially affected. These results could help to understand why some organisms are more favored than others under stressful conditions, and which characteristics give them extreme resilience and adaptability.

### EVER-LAKE: Formation, evolution and fate of new proglacial lakes in the deglaciating Alps

**Maria Vittoria Tenci** (1), Marco Toffolon (1), Walter Bertoldi (1), Stefano Brighenti (2), Francesco Comiti (2), Luca Carturan (3), Maria Cristina Bruno (4), Leonardo Cerasino (4), Massimo Pindo (4), Monica Tolotti (4)

(1) Università di Trento – Dipartimento di Ingegneria Civile, Ambientale e Meccanica, via Mesiano, 77 38123 Trento

(2) Università di Bolzano, piazza Università, 5 39100 Bolzano

(3) Università di Padova - Department of Land, Environment, Agriculture and Forestry, Viale Dell'Università, 16 - Legnaro (PD)

(4) Fondazione Edmund Mach - Centro Ricerca ed Innovazione, Via E. Mach, 1 38098 S. Michele all'Adige (TN)

\* email corresponding author: [mariavittoria.tenci@unitn.it](mailto:mariavittoria.tenci@unitn.it)

The Alpine deglaciation is one of the most evident effects of the ongoing climate change. Under glacier retreat, proglacial lakes are increasing both in number and in volume, thereby becoming important elements of the mountain landscape. An improved knowledge of the ecological characteristics of the newly forming lakes is crucial for the conservation of the Alpine biodiversity and habitats, to identify ecosystem services provided by these environments and to base coherent management strategies in the future iceless Alpine landscape. The “EVER-LAKE” PhD project will focus on a system of recently formed proglacial lakes in the Ortles-Cevedale Mountain group (Italy), with the aim to: (i) characterize the lake ecosystems from a physical, chemical and biological, point of view; (ii) understand the ecological development of proglacial lake

ecosystems with glacier retreat and build a conceptual model of their future evolution. Given the typically high water turbidity and the low biomass associated with these harsh habitats, biological communities will be characterized based on the metabarcoding of the 16S (prokaryotic) and 18S (eukaryotic) rRNA genes from eDNA samples. This approach will allow to obtain a broad overview of the taxonomical groups living in the lakes, while causing as less disturbance as possible.

### Does the biodiversity of high-altitude aquatic prokaryotes reflect the expected “Windows of opportunity” in deglaciating Alpine catchments?

**Monica Tolotti** (1)\*, Stefano Brighenti (2), Maria Cristina Bruno (1), Leonardo Cerasino (1), Massimo Pindo (1), Werner Tirlir (3), Davide Albanese (1)

(1) Research and Innovation Centre, Fondazione Edmund Mach, Via Mach 1, 38098 S. Michele all'Adige, Italy

(2) Faculty of Science and Technology, Free University of Bolzano/Bozen, Piazza Università 1, 39100 Bolzano, Italy

(3) Eco Research, Via Luigi Negrelli 13, 39100 Bolzano, Italy

\* email corresponding author: [monica.tolotti@fmach.it](mailto:monica.tolotti@fmach.it)

Alpine headwaters are threatened by the global warming that is accelerating the glacier melting and increasing the thermal and hydrological seasonal variability. Changing diversity and seasonal dynamics of aquatic communities reflect this variability and may have great implications for future integrity and functionality of Alpine freshwaters. Prokaryotes in Alpine streams have remained largely unexplored until recently, despite the recognition that microbial communities may have a disproportionate role in driving stream biodiversity, hydrochemistry, and metabolism. Organisms dwelling in glacial streams are expected to preferentially develop during Windows of opportunity (WOs), i.e. short periods of less harsh environmental conditions typically occurring in early summer and, especially, in late summer/autumn. While research demonstrated WO as favourable periods for biomass accrual, very little is known about parallel changes in biodiversity in both glacial and non-glacial streams. From June to September of 2017 and 2018 we investigated epilithic and sediment prokaryotic communities of streams fed by glaciers, rock glaciers and groundwater in two deglaciating Alpine catchments. We addressed the following questions: i) do WO drive seasonal changes in microbial diversity? ii) what are the major environmental drivers of prokaryotic diversity in different Alpine water types? iii) are WO changing under the impact of climate warming?

### Microbial pathogen detection in freshwater biomonitoring by amplicon sequencing: range of potential applicability

**Sara Vettorazzo** (1,2)\*, Adriano Boscaini (2), Nico Salmaso (2)

(1) Department of Cellular, Computational and Integrative Biology, University of Trento, Via Sommarive 9, 38123, Povo, Italy

(2) Research and Innovation Centre, Fondazione Edmund Mach, via E. Mach 1, 38098, San Michele all'Adige, Italy

\* email corresponding author: [sara.vettorazzo@studenti.unitn.it](mailto:sara.vettorazzo@studenti.unitn.it)

Pathogen detection is a key aspect to evaluate during freshwater biomonitoring. Studies leveraging high-throughput sequencing (HTS) technologies are providing new and cost-effective insights into the ecology of aquatic microbiomes and pathogen spread. In this work, environmental DNA samples collected from different small Alpine waterbodies and from Lake Garda were analysed by amplicon sequencing of 16S and 18S rRNA hypervariable regions. Bioinformatic analysis was based on the DADA2 pipeline and the amplicon sequence variants (ASVs) approach. Taxonomic assignments of potentially pathogenic bacteria and protists were performed by the naïve bayesian RDP classifier. In addition, a BLAST-based comparison was carried out. The analyses highlighted several limitations of metabarcoding, mainly linked to the limited taxonomic resolution that can be reached at the species level, and showed that amplicon sequencing can be suitable



only as a general first-step screening tool, to monitor particular potentially pathogenic genera (or families), pending a case-by-case evaluation of the experimental objectives. However, when more taxonomic accuracy is required, other HTS methods (e.g., whole genome analysis) can provide more resolution, up to the strain-level microbial detection.

## INDICE DEGLI AUTORI

Acri Francesco.....	33	Bolinesi Francesco .....	43, 85
Addis Pierantonio .....	65	Bolpagni Rossano.....	58
Aherne Julian .....	48	Borin Sara.....	67
Aimone Bruno.....	58	Borlandelli Cristina.....	52
Albanese Davide .....	86	Boscaini Adriano .....	45, 60, 81, 86
Albergel Clément .....	40	Bosso Luciano .....	43
Alfonso María B. ....	48	Bovo Gabriele .....	58
Angelini Silvia.....	38	Brauns Mario .....	53
Antão-Geraldes Ana M. ....	48	Bresciani Mariano .....	40
Armelloni Enrico Nicola .....	35, 38	Brighenti Stefano .....	76, 85, 86
Asnaghi Valentina .....	84	Brignone Stefano .....	45, 63
Attermeyer Katrin.....	48	Broggi Simona Retelletti .....	69
Aubry Fabrizio.....	33	Brookes Justin.....	48
Bachi Giancarlo .....	33	Brown David .....	48
Baldrighi Elisa.....	47	Bruno Maria Cristina.....	64, 76, 82, 85, 86
Balestra Cecilia .....	33, 68	Brusetti Lorenzo.....	76
Banchi Elisa .....	68, 69	Buondonno Angela .....	43
Bao Roberto.....	48	Buscarinu Paola .....	79
Barausse Alberto .....	47	Buzzi Fabio .....	52
Barbanti Andrea.....	36	Callieri Cristiana .....	20
Barfucci Giulia.....	36	Calò Antonio .....	47
Bartrons Mireia.....	48	Camatti Elisa .....	33, 47, 61
Bartush Alexander .....	53	Cancellario Tommaso .....	74, 81
Basili Marco .....	67	Candela Marco.....	67
Basset Alberto .....	41, 59	Candian Giulia.....	48
Bastianini Mauro .....	36	Cañedo-Argüelles Miguel.....	48
Battaglia Greta.....	78	Canle Moisés.....	48
Bazzani Emma.....	85	Canziani Alessandro.....	52
Bazzoni Anna Maria.....	73	Capelli Camilla.....	45, 48
Beghi Andrea .....	52	Capotondi Lucilla .....	75
Belgacem Malek .....	33	Cappelletti Cristina .....	60, 81
Bellardini Daniele.....	39, 43, 54, 76	Carballeira Rafael.....	48
Bello Paolo .....	50	Carlucci Roberto .....	40
Bergami Caterina .....	75	Carmichael Richard A.....	63
Berger Stella A. ....	48	Caroni Rossana .....	74
Bernardi Aubry Fabrizio .....	47	Carotenuto Ylenia .....	43
Bertoldi Walter .....	85	Carrettini Carlo .....	42
Bertoni Roberto .....	44	Carturan Luca.....	85
Bertorelle Giorgio .....	82	Casari Anna .....	64
Biagiotti Ilaria.....	36	Casoni Andrea.....	45
Bianchelli Silvia .....	63, 65	Casotti Raffaella .....	33, 43
Biccai Giovanni .....	52	Cassin Daniele.....	34
Biernaczyk Marcin .....	48	Cavraro Francesco .....	56
Bissen Raphael.....	48	Cebrian Emma.....	65
Boggero Angela.....	39, 62, 73	Ceccarelli Chiara .....	61

Cech Martin .....	58	De Santis Vanessa .....	45, 48, 58, 63
Celussi Mauro .....	68, 69	Del Gaizo Gabriele .....	43, 76
Centurelli Michele .....	36	Delgado Jorge .....	48
Cerasino Leonardo.....	45, 85, 86	Di Cesare Andrea .....	67
Cereijo José Luis.....	48	Di Leo Magda .....	35
Chavanne Robert .....	36	Di Muri Cristina .....	59
Chawchai Sakonvan.....	48	Di Tuccio Viviana.....	76
Checucci Giovanni.....	33	Diciotti Riccardo.....	66, 78
Chen Guangjie .....	48	Dornan Tyler .....	49
Chessa Francesco.....	78	Doubek Jonathan P.....	49
Chessa Giovanna.....	66, 78	Dresti Claudia.....	41, 52
Chiantore Mariachiara.....	84	Dubroca Laurent .....	43
Chiarore Antonia .....	65	Duran Zulma Lorena .....	53
Chiggiato Jacopo.....	33	Dusaucy Julia.....	49
Chiusano Maria Luisa.....	43	Eckert Ester M.....	67
Christensen Søren T.....	48	Eleršek Tina.....	45
Christoffersen Kirsten S.....	48	Elisa Banchi .....	68
Ciampitiello Marzia.....	73	Ennas Claudia.....	65
Cianci Angela .....	82	Erina Oxana.....	49
Cianelli Daniela .....	43	Ersoy Zeynep.....	49
Cimini Jacopo.....	84	Evangelista Valtere .....	33
Cipolletta Francesco .....	43	Fabbrizzi Erika .....	65
Cipriano Giulia .....	40	Fabbro Cinzia .....	68
Ciutti Francesca .....	60, 81	Facca Chiara.....	56
Codarin Antonio.....	36	Falchetta Giacomo.....	33
Colella Simone .....	33	Falcieri Francesco Marcello .....	36
Colletti Alberto .....	65	Falcini Federico .....	33
Comiti Francesco .....	76, 85	Falkner Raffaella .....	36
Congestri Roberta.....	39, 54	Farella Giulio.....	36
Conversano Fabio .....	53	Fasola Emanuele.....	48
Copetti Diego.....	52, 56	Felli Mario .....	36
Coppola Marianna .....	65	Fenocchi Andrea .....	52
Coro Gianpaolo.....	35, 38	Ferra Carmen .....	35
Cossarini Gianpiero.....	33	Ferrari Emanuele .....	67
Costantini Ilaria.....	36, 38	Ferrarin Christian .....	36
Cozzoli Francesco.....	41	Feuchtmayr Heidrun.....	49
Criscuolo Laura .....	36	Fiori Paolo O. ....	73
Crotti Elena .....	67	Fisher Andrea.....	76
Culurgioni Jacopo .....	66, 78	Floris Rosanna.....	78
D'Alelio Domenico .....	39, 44, 47, 54, 76	Fois Nicola.....	66, 78
Dadić Vlado.....	36	Folegot Thomas .....	36
Dalla Vecchia Alice.....	58	Fonti Viviana .....	68
Dallafior Valentina .....	64	Fornaroli Riccardo.....	39
Danovaro Roberto .....	63, 65	Fortino Davide .....	52
Dattolo Emanuela.....	47	Francocci Fedra.....	33
de Eyto Elvira .....	48	Franzini Giorgio.....	45
De Felice Andrea.....	38	Franzitta Giulio.....	65
De Leo Francesco.....	65	Franzoi Piero .....	56
De Luca Pasquale.....	76	Fraschetti Simonetta.....	63, 65
De Pascale Fabio .....	78	Free Gary .....	40

Fregona Marta .....	54	Lami Andrea .....	74
Frezzotti Maria Luce .....	49	Langone Leonardo .....	46
Furia Marta .....	43	Larsen Stefano .....	64
Galafassi Silvia .....	49	Lastrucci Lorenzo .....	61
Gallou Roger .....	36	Lauritano Chiara.....	85
Galvez Daphnie .....	36	Le Roux Baptiste .....	53
Garzoli Laura.....	62	Leiva-Presa Àngels .....	49
Gateuille David .....	49	Leoni Barbara.....	41, 49
Genoni Pietro.....	42	Leonori Iole.....	36, 38
Ghezzi Mighol .....	36	Lepori Fabio .....	45, 49
Giacomazzi Federica.....	45	Leppäranta Matti .....	54
Giacomotti Paola .....	37	Leuzzi Giovanni .....	50
Giakoumi Sylvaine .....	65	Libralato Simone .....	47, 54
Giardino Claudia .....	40	Licandro Priscilla .....	43
Giorgino Toni .....	33	Liu Xiaohan .....	40
Girardi Matteo.....	82	Lo Martire Marco.....	63
Giuffredi Rita .....	22, 36	Lo Presti Irene.....	82
Gonçalves Vitor.....	49	Lomas Michael W. ....	24, 54
González-Aranda Juan Miguel .....	59	Longobardi Lorenzo .....	43
Graeber Daniel.....	53	Loschi Matteo .....	47, 54
Grech Daniele .....	65	Lugliè Antonella .....	79
Grossart Hans-Peter .....	49	Luna Gian Marco.....	67, 69, 70
Guareschi Simone.....	81	Madricardo Fantina .....	36
Guicciardi Stefano.....	38, 70	Magni Daniele.....	52
Guzzella Licia.....	56	Malavasi Stefano .....	56
Hamer Jorin .....	70	Mammarella Ivan.....	54
Hamilton David P. ....	49	Manca Dario .....	74
Hardersen Sönke .....	46	Manca Marina.....	74
Harris Ted .....	49	Manca Valeria .....	73
Hattich Giannina S. I. ....	70	Mancinelli Giorgio.....	59
Hauffe Heidi C.....	82	Mangano Cristina.....	47
Huguet-Vives Antoni.....	59	Mangialajo Luisa .....	65
Iaia Mattia.....	45, 48	Mangoni Olga.....	43, 85
Inghilesi Alberto Francesco .....	61	Manini Elena .....	67
Ingresso Maurizio .....	40	Manna Vincenzo .....	68, 69
Iudicone Daniele.....	53	Mapelli Francesca .....	67
Jordan Ferenc .....	39	Marchesi Valeria .....	42
Kamburska Lyudmila .....	62, 73, 74	Marchetto Aldo.....	37
Kangur Külli.....	49	Marchini Agnese .....	82
Kankılıç Gökben Başaran .....	49	Margiotta Francesca .....	33, 43, 44, 76
Kessler Rebecca .....	49	Maricchiolo Giulia .....	67
Kiel Christine.....	49	Marra Maria Vittoria.....	47
Kokoszka Florian .....	53	Marrone Federico .....	26
Krynak Edward M .....	49	Martini Francesco .....	63
Kummel Steffen .....	53	Masnadi Francesco .....	38
Kurmayer Rainer.....	45	Matarrese Raffaella .....	56
L'Astorina Alba.....	36	Matias Miguel .....	49
La Mantia Tommaso .....	79	Matsuzaki Shin-ichiro S.....	49
La Porta Gianandrea .....	46	Matthiessen Birte .....	70
Laini Alex.....	81	Mazzocchi Maria Grazia.....	44

McElarney Yvonne .....	49	Pansera Marco .....	33, 61
McKinley Emma .....	47	Papadopoulou Nadia K. ....	65
Menegon Stefano .....	36	Pari Alice .....	36
Meroni Lorenzo .....	84	Pari Sauro.....	36
Messyasz Beata .....	49	Pasqualini Julia.....	53
Mezzanotte Valeria.....	42	Pasquini Viviana.....	65
Micheletti Diego .....	82	Penna Pierluigi .....	70
Mihanović Hrvoje .....	36	Percopo Isabella.....	44
Miliou Anastasia .....	40	Petrizzo Antonio .....	36
Minadakis Nikos.....	59	Petrocelli Antonella .....	36, 47
Mingazzini Marina .....	56	Piccinini Armando .....	45, 63
Mirto Simone.....	67	Picciulin Marta .....	36
Mitchell Mark .....	49	Piccolroaz Sebastiano .....	54
Mlambo Musa.....	49	Pinardi Monica.....	40
Mocci Giovanni A.....	73	Pindo Massimo .....	60, 85, 86
Molina Christophe .....	63	Pini Agnese .....	50
Monti Paolo .....	50	Pinna Maria Cristina.....	79
Montesor Marina .....	44	Pinnow Solvig.....	49
Mor Jordi-René .....	60	Pintus Maria Grazia.....	73
Morgana Silvia .....	47	Piredda Roberta .....	67
Mosello Rosario .....	37	Piscia Roberta .....	74
Motavalian Maryam .....	73	Pleslić Grgur .....	36
Motitsoe Samuel N .....	49	Pociecha Agnieszka.....	49
Munari Marco.....	65	Podda Cinzia .....	66
Mura Laura .....	78	Pucci Alessandra .....	58
Muredda Stefano.....	73	Pugnetti Alessandra.....	47
Murgia Sonia.....	78	Pulcinella Jacopo.....	35
Musat Niculina.....	53	Pulina Silvia .....	70
Musazzi Simona .....	74	Pusceddu Antonio.....	65
Musco Luigi.....	65	Putelli Tiziano.....	63
Muslim Stipe.....	36	Putzu Maristella .....	79
Nasto Ina.....	65	Puzzi Cesare .....	45, 58
Nava Veronica.....	41, 48	Quero Grazia Marina .....	67, 69, 70
NEREA team.....	76	Quinci Enza .....	34, 35
Nigra Cristina .....	73	Radulović Marko .....	36
Nomikou Paraskevi.....	40	Rako-Gospić Nikolina.....	36
Nora Tassetti Anna .....	35	Raposeiro Pedro .....	49
Obertegger Ulrike .....	42	Ravaioli Mariangela .....	28, 75
Oddo Elisabetta .....	79	Redolfi Bristol Simone .....	56
Odicino Maurizio .....	45, 60	Retelletti Brogi Simona .....	33
Orfanidis Sotiris .....	65	Ribeiro Filip .....	58
Orrù Arianna .....	37	Ribera d'Alcalà Maurizio.....	33, 53
Owens Caroline.....	49	Ricci Pasquale .....	40
Özkundakci Deniz .....	49	Righi Tommaso .....	45, 48
Paganelli Daniele .....	39, 62, 73, 82	Riminucci Francesco .....	75
Pallavicini Alberto .....	61	Rindi Fabio .....	63, 65
Palmas Francesco .....	66	Riva Francesco .....	67
Palumbo Maria Teresa.....	56	Rizzo Lucia.....	65
Pampurini Gianni.....	42	Rogora Michela .....	37, 39, 41, 52, 73, 74
Pandolfi Franca .....	52	Romberg Julia .....	70

Rõõm Eva-Ingrid .....	49	Tegowski Jaroslaw .....	36
Rosati Ilaria .....	41, 59	Tenci Maria Vittoria .....	85
Rossi Renata .....	73	Tereshina Maria .....	49
Rotta Federica .....	49	Tersigni Andrea .....	45
Russo Luca .....	39, 43, 54, 76	Thompson James .....	49
Russu Cristina .....	73	Tiberti Rocco .....	37, 74
Sabatini Andrea .....	66	Tintorè Beatriz .....	40
Sabatino Nadia.....	35	Tirler Werner .....	86
Sabbatini Davide.....	36	Toffolon Marco .....	85
Saccardi Laura.....	45, 60	Tolotti Monica.....	49, 76, 85, 86
Sáenz-Albanés Antonio José.....	59	Trentadue Marco .....	78
Saggiomo Maria.....	44, 85	Tricarico Elena .....	61
Sais Efisio .....	79	Trincardi Fabio .....	31, 35, 46
Salmaso Nico .....	45, 49, 60, 81, 86	Troia Angelo.....	79
Sanna Gabriele.....	78	Tsimpids Thodoris.....	40
Santacesaria Francesca Cornelia .....	40	Vaira Lucia.....	59
Santina Giandomenico .....	35	Vallefuoco Francesca .....	64
Santinelli Chiara.....	33, 69	Valois Amanda .....	49
Sarno Diana .....	43, 44	Valsecchi Lucia .....	56
Satta Cecilia T. ....	70	Vannini Jessica .....	44
Saviano Simona.....	44	Verburg Piet.....	49
Savinelli Beatrice .....	65	Verdura Jana .....	65
Scanu Martina.....	38	Vestri Stefano .....	33
Scarcella Giuseppe.....	35, 38	Vettorazzo Sara.....	86
Schroeder Anna .....	61	Vezi Alessandro .....	78
Scordo Facundo .....	49	Vignes Fabio.....	41
Serra Simonetto.....	78	Virdis Tomasa.....	79
Seyfarth Anne Mette .....	67	Vittorio Alessandro .....	42
Shokri Milad.....	41	Vivacqua Mariano.....	79
Sibomana Claver .....	49	Voccia Andrea .....	45, 60
Siewert Daniel.....	49	Volta Pietro .....	45, 48, 58, 60, 63
Simis Stefan .....	40	Vukadin Predrag .....	36
Soldano Giulia.....	36	Weitere Markus.....	53
Soru Oriana.....	79	Wesolek Brian.....	49
Sota Denada .....	65	Weyhenmeyer Gesa .....	49
Spanu Paola .....	79	Wu Naicheng.....	49
Sprovieri Mario .....	30, 33, 34, 35	Zampicinini Giampaolo .....	39
Stanković David .....	61	Zampieri Chiara.....	45
Stefani Fabrizio .....	42, 48	Zanovello Lucia .....	82
Steingruber Sandra.....	37	Zaupa Silvia .....	39, 62, 73
Stepanowska Katarzyna.....	49	Zawisza Edyta.....	49
Sudeep Chandra .....	49	Zazzini Simone .....	50
Sunjidmaa Nergui .....	53	Zdroik Jakub.....	36
Tamburello Laura.....	65	Zingone Adriana.....	43
Tartari Gabriele A. ....	37	Zink Lauren .....	49
Tartari Gianni.....	42, 56	Zolezzi Guido.....	64
Tavşanoğlu Ülkü Nihan .....	49	Zupančič Maša .....	45

---

***Il XXVI Congresso dell'AIOL è ospitato da:***

FONDAZIONE EDMUND MACH – SAN MICHELE ALL'ADIGE  
<https://www.fmach.it/>



---

***Il XXVI Congresso dell'AIOL è patrocinato da:***

PROVINCIA AUTONOMA DI TRENTO



FEDERAZIONE ITALIANA DI SCIENZE DELLA  
NATURA E DELL'AMBIENTE



---

***Il XXVI Congresso dell'AIOL è sponsorizzato da:***

[www.watec.it](http://www.watec.it)  
RT Environment SRL

