Provincia di Lecco

A.I.O.L.

Comune di Lecco

XXVIII Congresso AIOL

Lecco 24 – 28 Giugno 2024

Acqua: elemento vitale, risorsa essenziale
Condividere le conoscenze per affrontare il cambiamento

Abstract Book

CNR IRSA

UNIVERSITÀ DI PAVIA

UNIVERSITAS STUDIORUM INSUBRIAE

UNIVERSITÀ DEGLI STUDI DI MILANO BICOCCA

istituto per il rilevamento elettromagnetico dell'ambiente

effs european federation for freshwater sciences

SIL International Society of Limnology

EuCliPa.IT
Associazione Italiana del Patto per il Clima

electromec
Divisione Ecosistemi

biological · biophysical · engineering

bbe moldaenke

ISOIL INDUSTRIA
Le soluzioni che contano

ARPA LOMBARDIA
Agenzia Regionale per la Protezione dell'Ambiente

Regione Lombardia

Questo volume raccoglie i contributi presentati al XXVIII Congresso dell'Associazione Italiana di Oceanologia e Limnologia (AIOL), tenutosi a Lecco dal 24 al 28 Giugno 2024.

Comitato Scientifico:

- Martina Austoni, CNR-IRSA, Verbania
- Alessandro Bellino, Università degli Studi di Salerno
- Silvia Bianchelli, Università Politecnica delle Marche, Ancona
- Domenico D'Alelio, Stazione Zoologica Anton Dohrn, Napoli
- Andrea Fenocchi, Università degli Studi di Pavia
- Vincenzo Manna, OGS, Trieste
- Michela Rogora, CNR-IRSA, Verbania
- Cecilia Teodora Satta, Università degli Studi di Sassari
- Monica Tolotti, Fondazione Edmund Mach, S. Michele all'Adige (Trento)

Comitato Organizzatore:

CNR-IRSA, Brugherio

- Diego Copetti
- Stefania Erba
- Stefano Tasselli
- Lucia Valsecchi

CNR-IRSA, Verbania

- Martina Austoni
- Giulia Cesarini
- Claudia Dresti
- Michela Rogora

CNR-IREA, Milano

- Mariano Bresciani

Università degli Studi di Pavia

- Paolo Dezuanni
- Andrea Fenocchi
- Daniele Paganelli
- Nicolò Pella

Università degli Studi di Milano-Bicocca

- Barbara Leoni

Università degli Studi dell'Insubria

- Ginevra Boldrocchi

ARPA Lombardia

- Fabio Buzzi

INDICE

RELAZIONI A INVITO. *Plenary Lectures*	**8**
Ana Cristina Cardoso. *European Alien Species Information Network at the interface between science and policy*	**9**
Stefano Fenoglio. *L'Uomo come specie fluviale*	**10**
Nikolas Galli. *Using the water scarcity lens to observe, understand and improve (un)sustainable water use*	**11**
Agnese Marchini. *Comunicare le scienze acquatiche al pubblico con l'arte performativa*	**12**
Nico Salmaso. *Current status and perspectives in the application of metagenomics to advance knowledge of the taxonomy and functionality of microbial communities*	**13**
Salvatrice Vizzini. *Coastal blue carbon ecosystems: role, threats and perspectives*	**14**

Sessione Speciale 1 ***Harmful microalgae in aquatic ecosystems: new approaches and challenges for research and monitoring*** **Chair: Cecilia Teodora Satta, Antonella Lugliè, Nico Salmaso**	
PRESENTAZIONI ORALI	**15**
Giorgia Ravera*, Monica Cangini, Samuela Capellacci, Sonia Dall'Ara, Giuseppe Prioli, Mauro Marini, Elena Manini, Antonella Penna, Silvia Casabianca. *Monitoring of harmful dinoflagellate Dinophysis spp. occurrence in mussel farms in the Northwestern Adriatic Sea through an innovative molecular qPCR assay*	16
Mara Simonazzi*, Tânia K. Shishido, Endrews Delbaje, Matti Wahlsten, David P. Fewer, Kaarina Sivonen, Laura Pezzolesi, Rossella Pistocchi. *Underrated cyanobacteria from drinking waters: expand the knowledge about a less-studied cyanobacterial genus by integrating biochemical, toxicological and genomic analyses*	17
Riccardo Bentivogli*, Laura Pezzolesi, Elisa Costanzini, Nicolè Caputo, Beatrice M.S. Giambastiani, Sonia Silvestri. *Laboratory application of a hyperspectral optical sensor for phytoplankton community analysis*	18
Sara Vettorazzo*, Adriano Boscaini, Leonardo Cerasino, Nico Salmaso. *From small water bodies to lakes: Exploring the diversity of freshwater bacteria and cyanobacteria in an Alpine Biosphere Reserve*	19
Elisabetta Canuti*, Martina Austoni. *Characterization of phytoplankton composition in Lake Maggiore: Integrating chemotaxonomy for enhanced cyanobacteria detection*	20
POSTER	**21**
Adriano Boscaini*, Sabrina Pozzi, Silvia Costaraoss, Leonardo Cerasino, Nico Salmaso. *Expansion of cyanobacteria outbreaks in the Alpine region: first report of an intense Microcystis bloom in Lake Serraia*	22
Oriana Soru*, Rosa Borghero, Antonella Lugliè, Paola Buscarinu. *Toxic cyanobacteria and algal blooms in Sardinian reservoirs*	23
Martina Austoni*, Adriano Boscaini, Fabio Buzzi, Leonardo Cerasino, Giorgio Franzini, Federica Giacomazzi, Manuela Marchesi, Chiara Zampieri, Nico Salmaso. *Recent spread of Raphidiopsis raciborskii in the lake district south of the Alps*	24

Sessione Speciale 2 ***The capabilities, promise and challenges of remote sensing for water monitoring: using Earth observations for marine and freshwater applications research*** **Chair: Mariano Bresciani**	
PRESENTAZIONI ORALI	**25**
OPENING: Ilaria Cazzaniga. *Earth Observation applications for water quality monitoring in diverse environments, from inland waters to the oceans: opportunities, challenges and uncertainties*	**26**
Mariano Bresciani*, Alessandro Quirino Scotti, Monica Pinardi, Andrea Lami, Andrea Beghi, Nicola Ghirardi, Paolo Villa. *Monitoring primary producers in Lake Varese using multisensor satellite data*	27
Rossana Caroni*, Anna Joelle Greife, Mariano Bresciani, Claudia Giardino, Giulio Tellina, Monica Pinardi. *Examining global trends in shallow lakes using satellite derived data from the Climate Change Initiative Lakes_cci project*	28
Marina Amadori*, Mariano Bresciani, Giacomo De Carolis, Francesca De Santi, Gianfranco Fornaro, Claudia Giardino, Lorenzo Giovannini, Sebastiano Piccolroaz, Marco Toffolon, Giulia Valerio, Virginia Zamparelli. *Integration of satellite Synthetic Aperture Radar data with optical imagery and numerical models for investigating wind, waves and currents at the lakes surface*	29

Federica Braga*, Gian Marco Scarpa, Giorgia Manfè, Giuliano Lorenzetti, Luca Zaggia. *Spatio-temporal patterns of milky waters in the Lagoon of Venice*	30
Nicola Ghirardi*, Mariano Bresciani, Monica Pinardi, Daniele Nizzoli, Pierluigi Viaroli. *Assessing the role of pit lakes in riverine landscape rehabilitation via multi-source satellite data*	31
POSTER	**32**
Maria Cristina Bruno*, Jose Barquin, Laura Concostrina Zubiri, Luca Gallitelli, Micael Jonsson, Morgan Hughes, Monika Laux, Giorgio Pace, Massimiliano Scalici, Ralf Schulz, Stefano Larsen. *The BIODIVERSA + RIPARIANET project: Prioritising riparian ecotones to sustain and connect multiple biodiversity and functional components in river networks*	33

Sessione Speciale 3 ***Time Series Insights: from Aquatic Research to Policy and Public engagement*** **Chair: Carola Murano, Diego Copetti, Michela Rogora**	
PRESENTAZIONI ORALI	**34**
OPENING: Caterina Bergami. ***How to enhance the impact of research products through effective management and sharing practices***	**35**
Ulrike Obertegger*, Stefano Corradini, Leonardo Cerasino, Linda C. Weiss. *Mixing drives hypolimnetic dissolved oxygen, but what about CO_2? Case study mountain Lake Tovel*	36
Stefano Tasselli*, Claudio Roscioli, Licia Guzzella. *DDT in Lake Maggiore: still a reason of concern?*	37
Michela Rogora*, Angela Boggero, Giulia Cesarini, Riccardo Fornaroli, Lyudmila Kamburska, Simona Musazzi, Aldo Marchetto, Silvia Zaupa. *Long-term data as an invaluable tool for the monitoring and assessment of high-altitude lakes ecological status*	38
Diego Copetti*, Lucia Valsecchi, Gianni Tartari, Michela Rogora, Claudia Dresti, Andrea Fenocchi, Nicolò Pella, Paolo Dezuanni, Elisa Carena, Chiara Agostinelli, Fabio Buzzi. *Long-term (1972-2023) limnological evolution of Lake Pusiano: research and management insights*	39
Vincenzo Manna*, Elisa Banchi, Viviana Fonti, Mauro Celussi. *Lighting up heterotrophy: seasonality and environmental preferences of photoheterotrophic prokaryotes in the northern Mediterranean Sea*	40
Lucia Valsecchi*, Licia Guzzella, Stefano Tasselli, Cristina Borlandelli, Erika Lorenzi, Clara Bravi, Palumbo Maria Teresa, Branchi Marco, Laura Marziali. *Sediment flushing procedures in Lombardy reservoirs: Chemical and Ecotoxicological evaluation*	41
Flavia Dory*, Veronica Nava, Morena Spreafico, Valentina Soler, Barbara Leoni. *Long-term changes in Lake Iseo, Italy: Unravel the complex pathways by which climate change and nutrient variation affect the phytoplankton community*	42
POSTER	**43**
Lucia Valsecchi*, Elisa Carena, Chiara Agostinelli, Fabio Buzzi, Martina Austoni, Diego Copetti. *Evolution of phytoplankton community over the last 50 years in the lake of Pusiano*	44
Domenico D'Alelio*, Carola Murano, Luca Russo. *Mapping topic evolution across the 40-years old Long-Term Ecological Research MareChiara in the Gulf of Naples (Italy)*	45

Sessione Speciale 4 ***Science, Policy and Citizens efforts to tackle aquatic invasive and non-native species*** **Chair: Lyudmila Kamburska, Angela Boggero**	
PRESENTAZIONI ORALI	**46**
Angela Boggero*, Tommaso Cancellario, Giulia Cesarini, Lyudmila Kamburska, Imanol Miqueleiz, Antonín Kouba, Eric R. Larson, Francisco J. Oficialdegui, Elena Tricarico, Sergio Bedmar, Riccardo Fornaroli. *Research perspectives from a worldwide bibliographic review on invasive crayfish*	47
Rosa Zullo*, Rosaria Lauceri, Alberto Zullo, Luigi Sorrentino, Denise Schiavetta, Angela Boggero, Silvia Zaupa, Lyudmila Kamburska, Maria Oliviero. *New active biopolymers and chitosan-based films from invasive crayfish*	48
Marco Uttieri*, Ylenia Carotenuto, Alessandra de Olazabal, Iole Di Capua, Alenka Goruppi, Valentina Tirelli. *Pseudodiaptomus marinus: history of its recent spreading in the Mediterranean Sea and neighbouring areas*	49
Ylenia Carotenuto*, Iole di Capua, Marco Pansera, Elisa Camatti, Valentina Tirelli, Marco Uttieri. *Development and mortality of the non-indigenous copepod Pseudodiaptomus marinus over single and multiple generation experiments: a pilot study*	50

POSTER	**51**
Sebastiana Di Dio*, Salvatore Coco, Jasmine Ferrario, Agnese Marchini. *Selectivity of eco-sustainable and artificial substrates on the recruitment of fouling species in the natural environment*	52
Lyudmila Kamburska*, Denise Schiavetta, Giulia Cesarini, Marco Orlandi, Silvia Zaupa, Angela Boggero. *Co-occurrence of North American crayfish in northwestern Italian lakes*	53
Paula Moretti*, Daniele Paganelli, Agnese Marchini. *Using invasive amphipod species (Ptilohyale littoralis) as a case study for evaluating risk assessment*	54
Daniele Paganelli*, Adriana Bellati, Andrea Gazzola, Francesco Bracco Daniele Pellitteri-Rosa. *Impacts, potential benefits and eradication feasibility of aquatic alien species in an integral natural state reserve*	55

Sessione Speciale 5 ***Integrated approaches with hydrodynamics and hydrology: models and measurements*** **Chair: Andrea Fenocchi, Diego Copetti, Claudia Dresti, Nicolò Pella, Paolo Dezuanni**	
PRESENTAZIONI ORALI	**56**
Paolo Dezuanni*, Diego Copetti, Claudia Dresti, Nicolò Pella, Michela Rogora, Fabio Buzzi, Edoardo Cavallini, Daniele Nizzoli, Andrea Fenocchi. *Multi-decadal evaluation of nutrient loads flowing into the Italian deep subalpine lakes through their main tributaries*	57
Nicolò Pella*, Andrea Fenocchi, Adrián López-Ballesteros, Claudia Dresti, Diego Copetti, Fabio Buzzi, Javier Senent-Aparicio. *Assessment of nutrient loads and in-lake concentrations for Lake Pusiano and its catchment during the 2021-2023 drought*	58
Andrea Fenocchi*, Nicolò Pella, Diego Copetti, Fabio Buzzi, Daniele Magni, Nico Salmaso, Claudia Dresti. *Using process-based coupled ecological-hydrodynamic models to support regional lake water quality protection planning in Northern Italy*	59
Simona Saviano, Florian Kokoszka, Vincenzo Botte, Fabio Conversano, Daniele Iudicone, Daniela Cianelli*. *Connectivity patterns in a Mediterranean coastal area: a multiannual analysis*	60
POSTER	**61**
Claudia Dresti*, Michela Rogora, Fabio Buzzi, Andrea Beghi, Daniele Magni, Alessandro Canziani, Andrea Fenocchi. *An assessment of the present and future effectiveness of hypolimnetic withdrawal for the restoration of eutrophic Lake Varese (Northern Italy) through a modelling approach*	62
Marina Amadori*, Marco Toffolon, Mariano Bresciani, Claudia Giardino, Abolfazl Irani Rahaghi, Daniel Odermatt, James Runnalls, Mortimer Werther, Damien Bouffard. *ALPLAKES, an open-source online tool for real-time modelling of lakes in the Alps*	63
Isabella D'Ambra, Simona Saviano, Louise Merquiol, Maria Grazia Mazzocchi, Maria Assunta Ambrosio, Daniele Iudicone, Vincenzo Botte, Daniela Cianelli*. *Tracking movements of Pelagia noctiluca medusae by combining modeling and stable isotope approaches*	64

Sessione Speciale 6 ***Biodiversity and Habitat in fluvial ecosystems*** **Chair: Stefania Erba, Silvia Quadroni**	
PRESENTAZIONI ORALI	**65**
OPENING: Andrea Buffagni*, Marcello Cazzola, Simona Cislaghi, Simone Cardoni, Fabrizio Stefani, Stefania Erba, Carlo Belfiore. *Uno sguardo allo scrigno degli Efemerotteri italiani: idee per il futuro prossimo*	**66**
Alberto Doretto*, Niccolò Talluto, Giuseppe Crosa, Paolo Espa, Livia Servanzi, Silvia Quadroni. *A new biomonitoring index for evaluating the effects of sediment flushing operations in alpine streams*	67
Silvia Quadroni*, Stefania Erba, Marcello Cazzola, Simona Cislaghi, Andrea Buffagni. *Flow-related habitat variability of Mediterranean rivers and its effect on ecological status assessment: A 70-year perspective for benthic macroinvertebrates of a Sardinian river system (Southwestern Italy)*	68
Mattia Iaia*, Silvia Quadroni, Stefano Brignone, Vanessa De Santis, Tommaso Righi, Daniele Tamborini, Andrea Tersigni, Armando Piccinini, Cesare Puzzi, Roberta Bettinetti, Pietro Volta. *Assessment of the effectiveness and efficiency of two fish passages in the Toce River*	69
Simona Cislaghi*, Simone Cardoni, Marcello Cazzola, Stefania Erba, Andrea Buffagni. *Digitization, barcoding and microscope slides: coupling old-fashioned and innovative habits for biodiversity studies*	70
Stefania Erba*, Marcello Cazzola, Giuseppe Pappagallo, Marco Barcella, Emanuele Barca, Simona Cislaghi, Andrea Buffagni. *The importance of integrating Habitats Directive and Water Framework Directive approaches in habitat assessment*	71

Magdalena Vanek*, Andreas Hilpold, Roberta Bottarin, Matteo Anderle, Elia Guariento, Thomas Marsoner, Chiara Paniccia, Julia Plunger, Johannes Rüdisser, Julia Seeber, Alberto Scotti, Francesca Vallefuoco, Ulrike Tappeiner. *Biodiversity Monitoring South Tyrol: A multi-taxon long-term monitoring scheme in an Alpine region*	72
Alessandro Bellino*, Abdullah A. Saber, Daniela Baldantoni. *Lotic ecosystems as important but tricky refugia for charophytes in warm climates – implications for biodiversity and conservation*	73
Antonella Carosi*, Francesca Lorenzoni, Lucio Di Matteo, Daniela Valigi, Corrado Cencetti, Carlo Cardellini, Stefano Casadei, David Cappelletti, Massimo Lorenzoni. *The role of the New Fish Community Ecological Status Index (NISECI) in the definition of the Ecological Flows for the upper Tiber River basin (Umbria, central Italy)*	74
Anna Marino*, Silvia Bertolotti, Manuela Macrì, Francesca Bona, Silvia Bonetta, Elisa Falasco, Marco Minella, Stefano Fenoglio. *Water quality and water quantity are two sides of the same coin? A case study of a northwest Alpine river under water stress and the impacts of wastewater treatment plant discharges on benthic communities*	75
Raffaella Balestrini*, Andrea Buffagni, Marcello Cazzola, Stefania Erba. *The role of habitat and local hydromorphology in the ecological quality of Mediterranean agricultural rivers: the case of the "Tavoliere delle Puglie"*	76
POSTER	**77**
Silvia Quadroni*, Paolo Espa, Livia Servanzi, Giuseppe Crosa, Giuseppe Roberto Pisaturo, Giulia Stradiotti, Maurizio Righetti, Niccolò Talluto, Alberto Doretto. *FluEMMA – An interdisciplinary project to investigate ecological, hydro-morphological and management aspects of sediment flushing operations from Alpine reservoirs*	78
Cristina Cappelletti*, Nico Salmaso, Adriano Boscaini, Massimo Manfrini, Filippo Faccenda, Francesca Ciutti. *Identification of reliable metrics to assess the effects of trout farming on biological water quality in Alpine rivers (Trentino Province): integration of morphological and DNA metabarcoding approaches*	79
Monica Tolotti*, Afredo Maule, Stefano Brighenti, Giulio Voto, Maria Cristina Bruno. *Do dissolved heavy metals enter the food webs of alpine streams?*	80
Magdalena Vanek*, Jan Martini, Stefano Brighenti, Thea Schwingshackl, Francesca Vallefuoco, Alberto Scotti, Valeria Lencioni, Roberta Bottarin. *Rock glacier springs: cool habitats for species on the edge*	81

Sessione Speciale 8 ***From macro to nano: a world of plastic concerns*** **Chair: Veronica Nava, Silvia Galafassi, Giulia Cesarini**	
PRESENTAZIONI ORALI	**82**
Gilberto Binda*, Luka Šupraha, Margarida Costa, Eva Leu, Luca Nizzetto. *Plastic as a carrier of algal species: proof of concept, environmental relevance and potential*	83
Veronica Nava*, Sudeep Chandra, Barbara Leoni. *Plastisphere effects on ecosystem traits: from biodiversity to metabolism*	84
Giulia Cesarini*, Massimiliano Scalici. *Comprehensive assessment of plastic impacts in river ecosystems: a multi-level approach*	85
Silvia Galafassi*, Raffaella Sabatino, Andrea Di Cesare, Roberta Piscia, Simona Musazzi, Gianluca Corno, Pietro Volta, Rosa Zullo. *Assessing degradation and biofilm formation on disposable food containers of various materials in a lake environment*	86
Beatrice Luzi*, Rosa Zullo, Pedro Marcelo Pozzo, Marco Carnevale Miino, Alberto Pietro Damiano Baltrocchi, Elena Cristina Rada, Vincenzo Torretta, Silvia Galafassi. *Quantification of microfiber release for recycling in circular economy: Experimental insight from the ProPla project*	87
POSTER	**88**
Benedetta Villa*, Roberta Bettinetti. *Quantification of microplastics using two staining techniques: Nile Red and Rose Bengal*	89
Federica Rotta*, Barbara Leoni, Fabio Lepori, Agnese Marchini, Camilla Capelli. *Does lake stratification influence microplastics fate? A case study in Lake Lugano*	90
Veronica Nava*, Mona Abbasi, Oloyede Adekolurejo, Patrick Aurich, Nans Barthélémy, Berenike Bick, Bryan Burri, Marco J. Cabrerizo, Geoffrey Cairola, Teofana Chonova, Mathilde Cour, Vanessa De Santis, Flavia Dory, Annemieke M. Drost, Baptiste Fatras, Lena Fehlinger, Aida Figler, Dariusz Halabowski, Daniel Harvey, Ellinor Jakobsson, Benjamin Misteli, Laureen Mori-Bazzano, Valentin Moser, Julia Pasqualini, Federica Rotta, Bianca Schmid-Paech, Camille Touchet, Konstantinos Vaziourakis, Víctor Manzanares-Vázquez, Dar Jaffer Yousuf, Julia Gostyńska. *The PhytoPlastic project: large-scale collaboration exploring the plastisphere across European lakes*	91

Francesca Vallefuoco*, Dahms T.J. Heinrich, Magdalena Vanek, Roberta Bottarin. *A transversal study for the identification and reduction of microplastics in freshwater ecosystems in South Tyrol: The PlasticFree Project*	92
Giulia Cesarini*, Michela Rogora, Silvia Galafassi. *First evidence of microplastics occurrence in LTER high-mountain lakes in the Western Alps*	93
Chiara Magnabosco*, Monica Passananti, Roberta Piscia, Silvia Galafassi. BIOPLACE: Impact of degradation products of BIOdegradable PLAstics on biogeochemical Cycles and freshwater Environments	94
Carola Murano*, Tecla Bentivoglio, Serena Anselmi, Leonilde Roselli, Iole Di Capua, Monia Renzi, Antonio Terlizzi. *Exploring nanoplastic uptake: Insights from field and laboratory experiments in the Gulf of Naples*	95

Sessione Speciale 9 ***Science outreach and citizen science*** **Chair: Domenico D'Alelio, Daniele Paganelli**	
PRESENTAZIONI ORALI	**96**
OPENING: Domenico D'Alelio*, Daniele De Luca, Daniele Bellardini, Rosalia Calicchio, Anja Raggio, Pasquale De Luca, Marco Signore, Iole Di Capua, Emanuela Dattolo. *The ocean is not just water. Augmenting the common perception of marine biodiversity by integrating community-based monitoring and edutainment in coastal peripheries*	**97**
Daniele Paganelli*, Lucrezia Cilenti, Giorgio Mancinelli, Salvatrice Vizzini, Pere Abelló, Abdulghani H. Abdulghani, Michel Bariche, Sergio Bedmar, Jamila Ben Souissi, Gianni Brundu, Sabrina Etourneau, Silvia Falco, Branko Glamuzina, Elvis Kamberi, Mohamed H. Kara, George Katselis, Kosmas Kevrekidis, Evangelos Konstantinidis, Sami M. Ibrahim, Verònica López, Youness Mabrouki, Olivera Markovic, Sinan Mavruk, Abdulrraziq Miftah, Sahar Mehanna, Ragia Moussa, Costas Perdikaris, Angel Pérez-Ruzafa, Ana Pesic, Patricia Prado, Argyrios Sapounidis, Massimiliano Scalici, Fouzi Abdelkhaleq Taybi, Francesco Tiralongo, Aylin Ulman, Agnese Marchini. *The TROPHYC project: the use of scientific knowledge and local ecological knowledge to assess the impact of the Atlantic blue crab Callinectes sapidus (Rathbun 1896) in the Mediterranean Sea*	98
Raffaella Bullo*, Silvia Bianchelli. *PCSI – Plastic Crime Scene Investigation. The Citizen Science Approach to Microplastic Monitoring*	99
Alessandro Lagrotteria*, Samuele Roccatello, Cristina Scalvini, Chiara Andrà, Alberto Doretto. *Citizen science for river biomonitoring: a new approach for implementing traditional monitoring*	100
Bruna Gumiero*, Marco Cossu, Francesco Di Grazia, Alessandra Casali, Cristian Di Stefano. *Monitoring Riparian Vegetation in Citizen Science*	101
POSTER	**102**
Chiara Vitillo, Bruna Gumiero*, Francesco Di Grazia, Alessio Polvani, Cristina Capineri, Steven Loiselle, Fabrizio Monaci, Stefano Loppi. *Monitoraggio dei macroinvertebrati fatto dai cittadini (progetto CS4rivers)*	103
Elisabetta Canuti*. *Open-source CTD with Enhanced Accessibility and Novel Pulse-Amplitude Modulated Fluorescence Sensor for Oceanographic Research: OCEAN-PULSE project*	104

Sessione Regolare **Chair: Alessandro Bellino**	
PRESENTAZIONI ORALI	**105**
Rita Varchetta*, Elisa Banchi, Alessandro Vezzi, Donata Canu, Mauro Celussi. *Hydrolytic enzymes fingerprints in surface and deep-sea prokaryotic communities in the Ross Sea (Southern Ocean)*	106
Ginevra Boldrocchi*, Benedetta Villa, Carlotta Santolini, Damiano Monticelli, Cristina Corti, Gilberto Binda, Maristella Mastore, Giulio Magni, Jan Pachner, Giulia Liguori, Angelica Zanoletti, Roberta Bettinetti. *Assessing chemical contamination of Adriatic Sea (Eastern Mediterranean Sea) using zooplankton as bioindicator organisms*	107
Roberta Piscia*, Marina Manca, Rossana Caroni, Piero Guilizzoni, Roberta Bettinetti. *Zooplankton taxa repository of DDTtot and sumPCB14: Seasonal and decadal variations in Lake Maggiore*	108
POSTER	**109**
Francesca Ciutti*, Saúl Blanco, Ulrike Obertegger, Marco Bertoli, Elisabetta Pizzul, Paolo Pastorino, Marino Prearo, Cristina Cappelletti. *Exploring benthic diatom diversity in a high-altitude lake*	110
Flavia Dory*, Veronica Nava, Linda Nedbalovà, Morena Spreafico, Valentina Soler, Barbara Leoni. *Spanning the gap between autotrophs and cryoconite holes: a morphological approach reveals the diversity of microalgae and Cyanobacteria in Northern Victoria Land, Antarctica*	111

RELAZIONI A INVITO

Plenary Lectures

Ana Cristina Cardoso
European Commission, Joint Research Centre (JRC), 21027 Ispra, Italy.
ana-cristina.cardoso@ec.europa.eu

Ana Cristina Cardoso studied marine biology, concluding a 'Licenciatura' (long cycle academic degree) in marine biology and fisheries, and a Ph.D. in marine biology. She is since 1995 a scientific officer at the European Commission, Joint Research Centre (JRC). She has contributed and coordinated several research and science-policy projects in the fields of freshwater, marine ecology and biodiversity. Since 2012, she coordinates the European Alien Species Information Network (EASIN), an initiative of the JRC, and carries out research and scientific support to EU policy on the thematic of biodiversity and alien species.

European Alien Species Information Network at the interface between science and policy

The European Alien Species Information Network (EASIN) was launched in 2012 by the European Commission to facilitate the exploration of alien species (AS) information and assist the implementation of European policies on biodiversity. Since then, EASIN has been appointed as the official information system under Art. 25 of the invasive alien species (IAS) Regulation 1143/2014/EU. EASIN fosters transnational collaborations with the scientific community and European Union (EU) Member States (MS) and gathers and harmonizes data from research organizations and competent authorities, to provide centralized access to scientific information and spatial data on about 14,000 AS occurring in Europe. It also provides the EU early warning system allowing EU MS to notify the Commission and inform the other MS on the early detection of IAS of Union concern and the measures applied for their rapid eradication or management. This presentation provides an overview on EASIN activities, its role interfacing between citizens, scientific and policy communities through concrete examples. It will highlight how EASIN connect with work streams of the EU common implementation strategy to ensure integration of science in policy implementation through direct interaction with MS national appointed experts in processes coordinated by relevant environment authorities.

Stefano Fenoglio

Università degli Studi di Torino, DBIOS

stefano.fenoglio@unito.it; https://www.researchgate.net/profile/Stefano-Fenoglio

Professore ordinario presso l'Università degli Studi di Torino - DBIOS e cofondatore del Centro per lo Studio dei Fiumi Alpini (ALPSTREAM/Parco del Monviso). La sua passione per i fiumi nasce nell'infanzia e lo porta ad una Laurea in Scienze Naturali e al successivo Dottorato di Ricerca in Scienze Ambientali. Zoologo, la sua intera vita professionale è stata dedicata ai fiumi, ed in particolare allo studio della loro biodiversità e del loro rapporto con l'Uomo.
E' autore di circa centocinquanta pubblicazioni scientifiche, due libri di testo universitari ed un saggio dal titolo: Uomini e Fiumi, storia di un'amicizia finita male, edito da Rizzoli nel 2023.

L'Uomo come specie fluviale

Pur non avendo branchie né pinne, noi siamo una specie fluviale. I fiumi hanno permesso la nascita delle nostre società così come le conosciamo, hanno accompagnato la nostra crescita culturale agevolando la differenziazione del lavoro e degli interessi, hanno modellato il nostro paesaggio interiore oltre che plasmato quello esteriore. Agricoltura, commercio, insediamenti stabili che poi si sono accresciuti sino a diventare grandi città, trasporti, scoperte tecnologiche: tutto questo e molto altro ancora è nato sulle rive di un fiume. Attualmente, più della metà della popolazione mondiale vive ancora a meno di tre chilometri di distanza da un grande fiume e innumerevoli sono gli esempi che testimoniano l'antichità di questo nostro rapporto. Tutelare la biodiversità dei fiumi, preservarne il corretto funzionamento ecologico, adottare strumenti di gestione sostenibile delle loro acque: queste sono le sfide più pressanti che ci pone il cambiamento climatico globale. Noi dipendiamo dai fiumi adesso come 8.000 anni fa, solo che purtroppo non ce ne rendiamo più conto.

Nikolas Galli
Department of Civil and Environmental Engineering, Politecnico di Milano, Milano, Italy
nikolas.galli@polimi.it; www.glob3science.polimi.it

I received my MSc degree in Environmental and Land Planning Engineering in 2019 at Politecnico di Milano (Italy). I then spent six months in Paraguay, where I worked on mapping water resources and participative planning of rural-urban development in the Chaco area. I am now a postdoctoral researcher in the Glob3science group at Politecnico di Milano, after obtaining my PhD in February 2023 the same group, with a thesis on the use of water scarcity metrics to explore conflictual instances of water use and design synergistic water use strategies. My main research interests are agro-hydrological modeling of water-energy-food nexus-based problems and solutions, conflictual aspects of water resources availability and management, and the public health implications of unsustainable food system practices, including deforestation, forest fragmentation, the livestock revolution and agricultural intensification.

Using the water scarcity lens to observe, understand and improve (un)sustainable water use

Water is at the core of the main current global and regional challenges: how human systems interact with the hydrological cycle contributes to shaping sustainable development. Hydrosocial interactions are often expected to ignite when the availability of water is impacted in relation to its multisectoral utilization. Water scarcity can be a quantitative representation of these interactions, to better understand existing situations of water competition and other hydrosocial processes, and to imagine and design water use synergies. I will examine the multifaceted aspects of water scarcity through different studies we have done in Politecnico di Milano, addressing for instance the role of water, and the water-food nexus, in violent conflicts, the impact of extractive activities on water resources, water access and food security, as well as the possibility of reversing the propagation paradigm of water scarcity to contribute designing hydrologically sustainable development strategies.

Agnese Marchini

Department of Earth and Environmental Sciences, University of Pavia
https://unipv.unifind.cineca.it/individual?uri=http%3A%2F%2Firises.unipv.it%2Fresource%2Fperson%2F661655

Laureata in Scienze Biologiche nel 2000, Agnese Marchini ha conseguito il Dottorato in Ecologia Sperimentale nel 2004 presso l'Università di Pavia, proseguendo con post-doc presso le Università di Ferrara e Pavia. Dal 2023 è professore ordinario di Ecologia all'Università di Pavia dove riveste incarichi di coordinamento didattico, comunicazione e internazionalizzazione. La sua ricerca riguarda principalmente le invasioni biologiche acquatiche, considerando diversi aspetti della problematica inclusi quelli gestionali, e partecipando a gruppi di lavoro internazionali sul tema, tra cui il gruppo di lavoro sulle introduzioni e il trasferimento di organismi marini (WGITMO) dell'ICES, il comitato editoriale del database AquaNIS, e il gruppo di lavoro sulle specie aliene invasive (WGIAS) della DG Ambiente della Commissione Europea. Autrice o coautrice di novanta articoli pubblicati su riviste scientifiche internazionali, nel 2024 è entrata nella classifica mondiale dei 'Best Scientist' nella categoria 'Ecology and Evolution'. Le sue ricerche sono state riportate su >100 articoli divulgativi (magazine, giornali, radio), e partecipa attivamente a varie iniziative di divulgazione al pubblico (documentari, mostre, seminari e laboratori partecipativi).

Comunicare le scienze acquatiche al pubblico con l'arte performativa

Gli ecosistemi acquatici sono una inestimabile fonte di risorse per l'umanità, eppure sono poco familiari alla maggior parte della popolazione, che spesso si limita a una loro superficiale fruizione turistica. Cambiamenti climatici e attività antropiche rappresentano gravi minacce a questi ecosistemi, ma la loro trattazione semplicistica da parte dei media non aiuta alla comprensione dei meccanismi e in questo modo ostacola l'approvazione delle politiche ambientali. Per cambiare questo paradigma è necessario adottare nuovi strumenti educativi e processi di comunicazione.
Questa presentazione cercherà di evidenziare i vantaggi dell'approccio teatrale come canale di veicolazione di contenuti, ed in particolare del teatro fisico, mezzo di comunicazione efficace e immediato perché svincolato da un testo e fruibile anche da chi non ha cultura teatrale. Verrà riportata l'esperienza di un caso di studio specifico: uno spettacolo teatrale fisico/acrobatico che tratta le principali minacce ambientali per l'oceano, in cui l'impatto sulla presa di consapevolezza del pubblico è stato misurato con specifici metodi di valutazione. I risultati dell'esperienza suggeriscono come le arti performative possano rappresentare approcci innovativi alla comunicazione di tematiche complesse e al cambiamento sociale, creando una connessione emotiva che sembra favorire l'acquisizione di nuovi valori e stimolare nuovi approfondimenti.

Nico Salmaso
Fondazione Edmund Mach, San Michele all'Adige (TN)
Scopus Author ID: 6603847332; ORCID https://orcid.org/0000-0001-6057-3642; Google Scholar Profile: Nico Salmaso
nico.salmaso@fmach.it

Nico Salmaso obtained a degree in Natural Sciences at the University of Padua and a PhD in Ecology at the University of Parma. He is currently a senior researcher and head of the Hydrobiology Unit at the Fondazione Edmund Mach, Istituto Agrario di S. Michele all'Adige. His research interests encompass microbial ecology, including both prokaryotes and eukaryotic microalgae, as well as the effects of eutrophication, climate change, and other anthropogenic stressors on the biodiversity, abundance, and phenology of aquatic communities. Specific investigations are focused on the biodiversity and ecology of toxigenic cyanobacteria and the identification and impact of cyanotoxins. The detection of toxigenic cyanobacteria is achieved using culture-dependent (isolated strains) and culture-independent (metagenomic) approaches. He is the responsible of the LTER station "Lago di Garda." President of AIOL from 2020 to 2023. He coordinated the project Eco-AlpsWater (2018-2022), funded by the Alpine Space program, which involved 12 European institutions and 6 countries in the study of microbial diversity through the analysis of environmental DNA from over 50 lakes and rivers across the Alps. Currently, his research interests are also implemented within projects funded by the EU Horizon program and PNRR. He has organized three summer schools on the application of "omics" approaches in the study of aquatic ecosystems. The results of the research were disseminated in numerous seminars, courses, and congresses. He is the author of over 100 papers published in refereed journals.

Current status and perspectives in the application of metagenomics to advance knowledge of the taxonomy and functionality of microbial communities

In the limnological and oceanographic disciplines, the last decade has seen one of the most significant changes in approaches to the study of prokaryotic and eukaryotic microorganisms. Traditional methods based on culture-based techniques and morphological analysis have been increasingly complemented by various high-throughput sequencing (HTS) technologies, which are able to directly analyse genetic material extracted from environmental samples and provide a comprehensive snapshot of the microbial community. While metabarcoding is rapidly expanding its application to virtually all aquatic life, its use is limited to the identification of taxonomic repertoires or selected individual genes of functional value. Conversely, metagenomics has been applied to the study of prokaryotic communities and, more rarely, micro-eukaryotic organisms. The characterisation of species at the genomic level allows the functional characterisation of microbial communities, inferring the metabolic pathways and processes that drive ecosystem dynamics. Specific examples include the discovery of new potential metabolic processes relevant to human health (including the biosynthesis of emerging cyanotoxins) or genes involved in antibiotic resistance or the biosynthesis of a wide range of bioactive molecules. In addition to reviewing the present state of HTS approaches, this review will provide concrete examples of the application of HTS to potentially harmful cyanobacteria.

Salvatrice Vizzini
Dipartimento di Scienze della Terra e del Mare-DiSTeM & Centro di Sostenibilità e Transizione Ecologica-CSTE, Università degli Studi di Palermo, Palermo, Italy
Consorzio Nazionale Interuniversitario per le Scienze del Mare-CoNISMa, Roma, Italy
https://www.unipa.it/persone/docenti/v/salvatrice.vizzini

I am Full Professor of Ecology at the University of Palermo. I graduated at the University of Palermo in Biological Sciences where I also obtained a PhD in Animal Biology. I teach Marine Biology and Ecology to bachelor and master students. I have been studying the ecology of coastal marine ecosystems since 2002. I am interested in the evaluation of trophic structure and food web properties as indicators of changes due to climate change, biological invasion, pollution, and in the assessment of the origin and fate of nutrients and contaminants in coastal marine ecosystems. More recently, I have been working on blue carbon coastal ecosystems, providers of an important ecosystem service, such as climate regulation, and delivering additional benefits to society (support to biodiversity, provision of food, coastal protection, fisheries enhancement). I am currently studying the factors affecting carbon sequestration, the effects of anthropic pressure and strategies to recover degraded vegetated ecosystems also in light of their potential as a nature-based solution to contrast climate change.

Coastal blue carbon ecosystems: role, threats and perspectives

The role of vegetated coastal ecosystems as carbon sinks within the global ocean carbon cycle has received increasing attention over the last fifteen years. The term blue carbon (BC) was first proposed in 2009 to define the CO_2 sequestered and stored in the form of organic carbon in sediments of seagrasses, saltmarshes and mangroves. Hence, other than providing multiple services, including biodiversity enhancement and coastal protection, BC ecosystems are natural carbon sinks and act as hot spots for carbon burial. Here I present an overview of the peculiar features of the BC ecosystems, from distribution to global stocks, then focusing on the dominant BC ecosystem of the Mediterranean Sea, seagrass meadows, and how their BC role is affected by climate change and other stressors. Emphasis will be given to the importance of conservation and restoration of BC ecosystems, as viable nature-based solutions to mitigate climate change and contribute to meet the goals of sustainable development.

Sessione Speciale 1

Harmful microalgae in aquatic ecosystems: new approaches and challenges for research and monitoring

Chair: Cecilia Teodora Satta, Antonella Lugliè, Nico Salmaso

PRESENTAZIONI ORALI

Monitoring of harmful dinoflagellate *Dinophysis* spp. occurrence in mussel farms in the Northwestern Adriatic Sea through an innovative molecular qPCR assay

Giorgia Ravera (1,2)*, Monica Cangini (3), Samuela Capellacci (2,4,5), Sonia Dall'Ara (3), Giuseppe Prioli (6), Mauro Marini (7), Elena Manini (7), Antonella Penna (2,4,5), Silvia Casabianca (2,4,5)

(1) Department of Pure and Applied Sciences, University of Urbino, Campus Enrico Mattei, Via Ca le Suore, 2/4, 61029, Urbino, Italy
(2) CoNISMa, National Inter-University Consortium for Marine Sciences, Piazzale Flaminio, 6, 00184, Roma, Italy
(3) Fondazione Centro Ricerche Marine, Italian National Reference Laboratory for Marine Biotoxins, Viale A. Vespucci, 2, 47042 Cesenatico, Italy
(4) Department of Biomolecular Sciences, University of Urbino, Campus Enrico Mattei, Via Ca le Suore, 2/4 61029, Urbino, Italy
(5) Fano Marine Center, The Inter-Institute Center for Research on Marine Biodiversity, Resources and Biotechnologies (FMC), Viale Adriatico, 1, 61032 Fano, Italy
(6) M.A.R.E. S.c. a r.l., Via E. Toti, 2, 47841 Cattolica, Italy
(7) National Research Council (CNR), Institute for Biological Resources and Marine Biotechnologies (IRBIM), Via Largo Fiera della Pesca, 2, 60125, Ancona, Italy

* email corresponding author: g.ravera@campus.uniurb.it

ABSTRACT

The dinoflagellate *Dinophysis* spp. is a cosmopolitan genus of marine phytoplankton able of producing lipophilic toxins that accumulate in shellfish tissues and cause Diarrheic Shellfish Poisoning syndrome. In the Northwestern Adriatic Sea, mussel farming is a strategic activity where DSP is a major concern, and therefore seawater and seafood are regularly monitored. Light microscopy is currently the official approach, but it can take a long time and requires a high level of expertise. This study aimed to evaluate the use of a qPCR-based assay to faster quantify *Dinophysis* spp. abundance. Individual cells of *Dinophysis* spp. from different sampling sites were isolated and analysed by qPCR, the average number of rDNA copy number per cell was $1.21 \times 10^4 \pm 1.81 \times 10^3$. Then, *Dinophysis* spp. seawater abundance was determined using both traditional microscopy and qPCR assay. The detection limit of the qPCR assay was 10 copies of rDNA per well. Estimates by these two methods showed a positive correlation (Spearman rs = 0.57, p-value < 0.001) and qPCR was found to be more efficient than microscopy counts with a ratio of 2.24. Advantages of the qPCR method include rapidity, sensitivity and efficiency, suggesting a potential role in phytoplankton monitoring plans.

Underrated cyanobacteria from drinking waters: expand the knowledge about a less-studied cyanobacterial genus by integrating biochemical, toxicological and genomic analyses

Mara Simonazzi*(1), Tânia K. Shishido(2), Endrews Delbaje(3), Matti Wahlsten(2), David P. Fewer(2), Kaarina Sivonen(2), Laura Pezzolesi(1), Rossella Pistocchi(1)

(1) Department of Biological, Geological and Environmental Sciences (BiGeA), University of Bologna, Via Sant'Alberto 163, 48123 Ravenna, Italy
(2) Department of Microbiology, Faculty of Agriculture and Forestry, Viikinkaari 9, University of Helsinki, Helsinki, Finland

* email corresponding author: mara.simonazzi2@unibo.it

ABSTRACT

Cyanobacteria are photosynthetic prokaryotes abundant in freshwaters, including those destined to human use. They may form harmful blooms, often accompanied by toxic metabolites (cyanotoxins). Only few genera have been extensively studied, while others, equally widespread, remain less-investigated (e.g., as of May 2024: 9,457 vs 221 hits in Scopus for "*Microcystis*" and "*Limnothrix*, respectively). The aim of the present work was to explore the hidden features of a *Limnothrix* cf. *redekei* isolate from an Italian shallow drinking water reservoir, using a multidisciplinary approach. After 18 days of cultivation, *L*. cf. *redekei* showed higher biomass productivity than other *Limnothrix* spp. (6.5 vs 1.9 mg L^{-1} day^{-1}), with a high protein content (38-52%dw). The isolate shared high genomic similarities with the only 10 published *Limnothrix* genomes (size 4.4 Mb, GC 55%.), despite their different origin. Two regions encoding a cyanobactin and a polyketide were identified, but not those for cyanotoxins. UPLC-QTOF analyses confirmed the production of the cyanobactin, while no polyketide was identified. Bioassay-guided approach using *Artemia* sp. revealed a highly toxic fraction among those obtained from *Limnothrix* aqueous extracts. More efforts are needed to clarify the nature of the observed toxicity and to explore the potential risks associated with this less-investigated cyanobacterium.

Laboratory Application of a Hyperspectral Optical Sensor for Phytoplankton Community Analysis

Riccardo Bentivogli (1)*, Laura Pezzolesi (1,2), Elisa Costanzini (1), Nicolè Caputo (2,3), Beatrice M.S. Giambastiani (1,2), Sonia Silvestri (1)

(1) Department of Biological, Geological and Environmental Sciences, University of Bologna, Via Sant'Alberto 163, 48123, Ravenna, Italy
(2) Interdepartmental Centre for Research in Environmental Sciences, University of Bologna, Via Sant'Alberto 163, 48123, Ravenna, Italy
(3) Marine and Freshwater Research Centre (MFRC), Atlantic Technological University (ATU), Dublin Road, Galway City, Republic of Ireland

* email corresponding author: riccardo.bentivogli4@unibo.it

ABSTRACT
The continuous increase of satellite sensors for ocean observation presents an opportunity to gather detailed information from aquatic ecosystems. Hyperspectral optical sensors, particularly, hold promise in analyzing phytoplankton species composition. This study explores the potential of a nano-hyperspec sensor for analyzing different microalgal groups. Laboratory-measured remote sensing reflectance (Rrs) of five monospecific phytoplankton cultures and their mixed at different concentrations were examined, including both harmful (*Alexandrium minutum* and *Chattonella* sp.) and non-toxic species (*Phaeodactylum tricornutum*, *Synechococcus* sp., and *Heterocapsa* sp.). Through various analyses such as spectral fourth-derivative analysis, similarity indices, PCA, spectral indexes and unmixing technique, characteristic features distinguishing taxonomic groups were investigated, as well as the relationship between Rrs and algal biomass, measured as chlorophyll-a concentration, cell density and biovolume. Our findings reveal distinct spectral signatures for each algal group, with variations in peaks locations related to the different pigments composition; relative reflectance intensities across concentrations indicate how Rrs signature is overall characteristic enabling the discrimination of the different species. Additionally, promising results have been achieved in unmixing techniques for distinguishing among different algal spectra in mixed samples. By establishing an integrated phytoplankton monitoring methodology, these results could lay the foundation for future satellite applications for aquatic monitoring.

From small water bodies to lakes: Exploring the diversity of freshwater bacteria and cyanobacteria in an Alpine Biosphere Reserve

Sara Vettorazzo[1,2*], Adriano Boscaini[1], Leonardo Cerasino[1], Nico Salmaso[1,2]
1 Hydrobiology Unit, Research and Innovation Centre, Fondazione Edmund Mach, S. Michele all'Adige 38098, Italy
2 NBFC, National Biodiversity Future Centre, Palermo 90133, Italy

* email corresponding author: sara.vettorazzo@fmach.it

ABSTRACT

Small water bodies hide high biodiversity but are often understudied in the Alpine region. We characterized the planktic and benthic bacterial communities, as well as the water chemistry and cyanotoxin content, of a wide physiographic range of 19 freshwater bodies within an Alpine Biosphere Reserve, including ponds, pasture ponds, peat bogs, lake ponds, shallow lakes, and lakes. We collected both water and surface sediment samples, followed by metabarcoding analysis (V3-V4 16S rRNA gene). We investigated the changes in biodiversity and the distribution of unique and shared amplicon sequence variants (ASVs) between water and sediment habitats, and across freshwater typologies. We found that pelagic and benthic habitats harboured unique bacterial communities with significant differences in their taxonomic compositions. Planktic communities showed greater heterogeneity than benthic ones, exhibiting interesting taxonomic differences related to freshwater typologies. A particular focus was given to potentially harmful cyanobacteria, which were generally distributed at low abundances in water and sediment habitats. As a result, only a few water samples (mainly lakes and shallow lakes) showed low concentrations of cyanotoxins. Overall, our results provided essential insights into the bacterial and cyanobacterial ecology of understudied environments such as ponds and pasture ponds.

Characterization of Phytoplankton Composition in Lake Maggiore: Integrating Chemotaxonomy for Enhanced Cyanobacteria Detection

Elisabetta Canuti (1)*, Martina Austoni (2)

(1) European Commission, Joint Research Centre, Ispra, Italy
(2) CNR-IRSA, Verbania, Italy

* email corresponding author: elisabetta.canuti@ec.europa.eu

ABSTRACT

This study examines phytoplankton composition in Lake Maggiore, emphasizing cyanobacteria detection via distinctive pigment compositions. While microscopy remains the preferred method for phytoplankton identification, alternative methods such as remote sensing and pigment-based classification offer greater spatio-temporal coverage and reduced resource requirements. Chemotaxonomy, which uses chemical markers to infer taxonomic information, is valuable when combined with other data forms to establish a phytoplankton community classification system. Between May and September 2023, five pilot campaigns were performed on Lake Maggiore aimed at validating in-situ radiometric measurements and developing algorithms for satellite data validation. The campaigns included 27 stations with Total Chlorophyll-a (TChl-a) values ranging from 1.13 to 6.9 mg/m³. Measurements of Suspended Particulate Matter (SPM), yellow substance, absorption coefficients of pigments, detritus, surface temperature and Secchi disk are collected at each station. Phytoplankton pigment composition was analyzed using High Performance Liquid Chromatography (HPLC). The dataset, applying biomarker pigment classification, was examined using the CHEMTAX approach for phytoplankton classification. Results were compared with supervised analyses such as Principal Component Analysis (PCA) and Cluster Analysis (CA). Microscopic analysis verified the results of both chemotaxonomy and statistical analyses based on the HPLC dataset. Insights from inherent optical properties and hydrogeological data were also integrated.

Sessione Speciale 1

Harmful microalgae in aquatic ecosystems: new approaches and challenges for research and monitoring

Chair: Cecilia Teodora Satta, Antonella Lugliè, Nico Salmaso

POSTER

Expansion of cyanobacteria outbreaks in the Alpine region: first report of an intense *Microcystis* bloom in Lake Serraia

Adriano Boscaini (1)*, Sabrina Pozzi (2), Silvia Costaraoss (2), Leonardo Cerasino (1), Nico Salmaso (1)

(1) Research and Innovation Centre, Fondazione Edmund Mach, via E. Mach 1, 38098 San Michele all'Adige, Italy
(2) Provincial Agency for Environmental Protection of Trento, Piazza Vittoria 5, 38122 Trento, Italy

* email corresponding author: adriano.boscaini@fmach.it

ABSTRACT

Lake Serraia is a small eutrophic dimictic lake located in the town of Baselga di Pinè, in the Province of Trento. The lake has an average depth of 7 m and a maximum depth of 18 m and is mainly used for recreational activities. During the last decade, summer blooms of non-toxigenic populations of *Dolichospermum* spp. were documented over the entire lake. Conversely, at the end of August 2023, an intense toxigenic bloom of *Microcystis aeruginosa* developed over several weeks, resulting in a bathing ban by the local authorities. Besides the usual monitoring for the control of bathing waters, a few opportunistic samples were collected for microscopical examinations, toxins analyses using LC-MS techniques, and strain isolation and cultivation. In the areas where the surface scums developed, the MC-LR and MC-RR congeners of microcystins showed concentrations of 200 µg L^{-1} and 42 µg L^{-1}, respectively. The bloom episodes documented in Lake Serraia are part of a more general increasing trend of cyanobacterial outbreaks actively documented in the southern Alpine region. Besides persisting high trophic status, as in Lake Serraia, the causes were also connected to the general increasing temperature trends at the global and local levels.

Toxic cyanobacteria and algal blooms in Sardinian reservoirs

Oriana Soru [(1)] *, Rosa Borghero [(1)], AntonellaLugliè [(2)], PaolaBuscarinu [(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.oriana@gmail.com

ABSTRACT

In recent decades, the synergistic effect of global warming and eutrophication has favoured cyanobacterial blooms in freshwater ecosystems. The consequent widespread presence of cyanotoxins represents an emergency for human healt hand requires adequate management tools. Sardinia, the second largest island in the Mediterranean, is also the Italian region with both the highest number of reservoirs and the largest volume of potential accumulation of freshwater, also intended for drinking use. Most of the reservoirs are managed by the ENAS (Sardinia Water Authority) which has been monitoring microcystins (MCs) and cylindrospermopsin (Cyl) by ELISA method (Microcystins ADDA-ELISA Microtiter Plate and Cylindrospermopsin ELISA Microtiter Plate Abraxis kit). From 2017, results have been supported by annual intercalibration tests organized by Eurofins Abraxis with the MCs and Cyl proficiency testing program for drinking and recreational water. The research is currently also aimed at other toxins (e.g. anatoxins). This contribution reports results that have been obtained analyzing more than 1000 samples for phytoplankton and cyanotoxins (MCs and Cyl) from 28 reservoirs since 2004. MCs exceeded the limit of 1.0 µg/l (D.Lgs. 2023, n.18) in 90 samples from 15 reservoirs. Since 2010 Cyl were detected in 140 samples from 12 reservoirs, with a maximum of 1.63 µg/l.

Recent spread of *Raphidiopsis raciborskii* in the lake district south of the Alps

Martina Austoni (1)*, Adriano Boscaini (2), Fabio Buzzi (3), Leonardo Cerasino (2), Giorgio Franzini (4), Federica Giacomazzi (4), Manuela Marchesi (3), Chiara Zampieri (4), Nico Salmaso (2,5)

(1) CNR Istituto di Ricerca Sulle Acque (IRSA), Largo Tonolli 50, 28925 Verbania, Italy
(2) Research and Innovation Centre, Fondazione Edmund Mach, Via E. Mach 1, 38098 San Michele all'Adige, Italy
(3) ARPA Lombardia, Settore Monitoraggi Ambientali Dipartimento di Lecco, Via 1° Maggio, 23848 Oggiono, Italy
(4) ARPA Veneto- ARPAV, Servizio Laboratorio Provinciale di Verona, Via Dominutti 8, 37135 Verona, Italy
(5) NBFC, National Biodiversity Future Center, Piazza Marina 61, 90133 Palermo, Italy

*email corresponding author: martina.austoni@cnr.it

ABSTRACT

Changing climate conditions and human-induced eutrophication could lead to an increase in harmful cyanobacterial blooms in freshwater environments. Furthermore, climate change may affect the geographic distribution of potentially toxigenic species and cyanobacteria, leading to the appearance of new threats in previously unexposed areas. Recently, the toxic cyanobacterium *Raphidiopsis raciborskii*, known for forming blooms, has increased its presence particularly in temperate regions. The objective of this work is to expand the knowledge about the distribution of *R. raciborskii* in Northern Italy. Specifically, we will include new observations recorded during the last decade based on investigations carried out in the framework of scientific and government monitoring, as well as large biogeographical surveys carried out on the whole Alpine Space area (Project Eco-AlpsWater). The detection of *R. raciboskii* in Northern Italy highlights the importance of an attentive monitoring of freshwater quality and the implementation of measures to prevent the spread of harmful organisms.

Sessione Speciale 2

The capabilities, promise and challenges of remote sensing for water monitoring: using Earth observations for marine and freshwater applications research

Chair: Mariano Bresciani

PRESENTAZIONI ORALI

Earth Observation applications for water quality monitoring in diverse environments, from inland waters to the oceans: opportunities, challenges and uncertainties.

Ilaria Cazzaniga (1)*

(1) European Commission, Joint Research Centre, via Fermi 2749 - 21027 Ispra (VA)
* email corresponding author: Ilaria.Cazzaniga@ec.europa.eu

ABSTRACT

Optical remote sensing offers a great opportunity for synoptic, long-time, global and high-frequent monitoring of water bodies at different scales. Ideally, it valuably supports, among others, the observation of Essential Climate Variables (ECV), the quantification of Sustainable Development Goals (SDG) indicators and real-time monitoring systems for any surface water body, from inland waters to the oceans.

However, the applications of optical remote sensing techniques in water monitoring are challenged or limited by different factors, which vary depending on the water bodies characteristics, the water optical properties, the spatial and temporal scales, and the boundary conditions. The atmospheric correction, i.e. the removal of the signal coming from the atmosphere and other disturbances, and the derivation of biophysical variables are particularly tricky over water. They are even more challenging in optically-complex waters (as coastal and inland waters usually are) and in small water bodies. Providing uncertainty estimates associated to remote sensing data also requires a constant effort by the remote sensing community and agencies to carry out validation activities.

In this work, an overview of the current opportunities and challenges of optical remote sensing applications is provided for diverse environments. Challenges and requirements in uncertainty estimate and validation activities are also presented.

Monitoring primary producers in Lake Varese using multisensor satellite data

Mariano Bresciani (1)*, Alessandro Quirino Scotti (1), Monica Pinardi (1), Andrea Lami (2), Andrea Beghi (3), Nicola Ghirardi (1) Paolo Villa (1)

(1) Istituto per il Rilevamento Elettromagnetico dell'Ambiente, Consiglio Nazionale delle Ricerche (IREA-CNR), via Corti 12, 20133, Milano
(2) Istituto di Ricerca Sulle Acque, Consiglio Nazionale delle Ricerche (IRSA-CNR), Largo Tonolli 50, 28922, Verbania Pallanza (VB)
(3) Agenzia Regionale per la Protezione dell'Ambiente della Lombardia, Regione Lombardia, 21100 Varese

* email corresponding author: bresciani.m@irea.cnr.it

ABSTRACT

Due to the excessive eutrophication that has occurred in Lake Varese over the last few decades, the local management authorities have embarked on a rehabilitation plan that includes intensive monitoring activities (AQST Lake Varese). In addition to in situ sampling and a buoy equipped with instruments for continuous measurements, monitoring is carried out by satellite images (Sentinel-2) to study the spatial and temporal dynamics of primary producers (phytoplankton and macrophytes). Chlorophyll-a concentration maps of the euphotic zone, for the period 2019-2023, have been obtained by applying algorithms parameterised with the specific optical properties of the lake, and show high concentrations in autumn due to the surface accumulation of cyanobacteria, also mapped by the PRISMA hyperspectral sensor. The covered area, conditions and seasonal evolution of macrophytes - floating plants and helophytes – were quantified from WAVI (a spectral proxy for canopy density) maps in the period 2016-2023. The results show the overgrowth of invasive hydrophytes during the spring-summer of last years in the south-western part of the lake. In addition, high spatial resolution (2 m) IKONOS, WorldView-2/3 imagery was used for retrospective mapping (2001-2023) of helophyte. The results highlighted the retreat of the common reed in particular near to the Bardello tributary.

Examining global trends in shallow lakes using satellite derived data from the Climate Change Initiative Lakes_cci project

Rossana Caroni[1], Anna Joelle Greife[1], Mariano Bresciani[1], Claudia Giardino[1], Giulio Tellina[1], Monica Pinardi[1]

[1]CNR – IREA, Institute for Electromagnetic Sensing of the Environmental, Via A. Corti 12, 20133 Milan, Italy

* email corresponding author: caroni.r@irea.cnr.it

ABSTRACT

The Lakes_cci (Climate Change Initiative) project provides global and consistent satellite observations of Lakes essential climate variables (ECVs): Lake Water Level and Extent, Surface Water Temperature, Ice Cover and Water-Leaving Reflectance (LWLR), capturing both the physical state of lakes and their biogeochemical response to physico-chemical and climatic drivers. Data generated in the project contains products for the period 1992-2020 (v2.0.2), producing data of appropriate quality for climate studies. The Lakes_cci dataset includes 2024 lakes worldwide, covering a wide range of hydro-morphological and ecological characteristics. From this dataset, we selected a subset of shallow lakes (average depth <3m; n=352) distributed globally, in order to investigate long-term timeseries/trends of Chlorophyll-a and Turbidity derived from LWLR. The results will be discussed in relation to lake and catchment characteristics acquired by the HydroLAKES dataset, as well as climatic and demographic variables in order to investigate relationships between water quality trends in shallow lakes and their main environmental and anthropogenic drivers during the last two decades.
Shallow lakes and wetlands dominate inland waters and provide many ecological services, being particularly important in carbon storage and biodiversity. Because of their large surface-to-volume ratios, they are prone to environmental changes influenced by nutrient loading and pollutants and are sensitive to climate change.

Integration of satellite Synthetic Aperture Radar data with optical imagery and numerical models for investigating wind, waves and currents at the lakes surface

Marina Amadori(1)*, Mariano Bresciani(1), Giacomo De Carolis(1), Francesca De Santi(2), Gianfranco Fornaro(1), Claudia Giardino(1), Lorenzo Giovannini(3), Sebastiano Piccolroaz(3), Marco Toffolon(3), Giulia Valerio(4), Virginia Zamparelli(1)

(1) Istituto per il Rilevamento Elettromagnetico dell'Ambiente (IREA), Consiglio Nazionale delle Ricerche (CNR)
(2) Istituto di Matematica Applicata e Tecnologie Informatiche (IMATI), Consiglio Nazionale delle Ricerche (CNR)
(3) Dipartimento di Ingegneria Civile, Ambientale e Meccanica (DICAM), Università di Trento;
(4) Dipartimento di Ingegneria Civile Ambiente Territorio Architettura e Matematica (DICATAM), Università degli Studi di Brescia

* email corresponding author: amadori.m@irea.cnr.it

ABSTRACT

The water quality and the overall ecological state of a lake depend on the mixing dynamics and transport processes. The use of hydrodynamic numerical models for resolve the physics behind water motion is a practice in limnological investigations to overcome the existing measurement limitations. However, feeding the models with initial and boundary conditions, as well as calibrating and validating them, requires spatially distributed information. Water velocity is typically measured by in-situ sensors at fixed locations or on boats or through drifters. All these tools provide time series with high temporal but limited spatial resolution. Similar limitations affect the measurement of the meteorological conditions and surface wind waves, which have important effects on the development of surface mixing. In marine and coastal environments, such limitations are overcome by the use of Synthetic Aperture Radar (SAR) data for the retrieval of spatially resolved information on wind, waves and water currents at the water surface. We present the results of a pioneering study on Lake Garda, Italy, where spaceborne SAR data are combined with optical imagery of suspended sediments and surface water temperature to reconstruct surface motion. The information obtained from satellite products is then integrated with numerical models for retrieving fields of wind speed and surface velocity for the first time in a medium-sized lake.

Spatio-temporal patterns of milky waters in the Lagoon of Venice

Federica Braga (1)*, Gian Marco Scarpa (1), Giorgia Manfè (1), Giuliano Lorenzetti (1), Luca Zaggia (2)

(1) Istituto di Scienze Marine - Consiglio Nazionale delle Ricerche, Castello 2737/F, 30122 Venezia
(2) Istituto di Geoscienze e Georisorse - Consiglio Nazionale delle Ricerche, Via Gradenigo 6, 35131 Padova

* email corresponding author: federica.braga@cnr.it

ABSTRACT

The presence of milky waters, observed as water-color anomalies in satellite images, derives from a perturbation of the sulfur cycle in hypo-anoxic conditions. This study developed a methodology to map and monitor the presence of milky water patterns in the Lagoon of Venice using Landsat 8 and Sentinel-2 data and was applied for the period 2013-2021. Exploiting the peculiar optical properties of milky waters, a classification algorithm was implemented to detect sulfur enriched waters and distinguish them from other water targets such as submerged vegetation, bare substrates, phytoplankton bloom and suspended sediment. The results showed the occurrence of several events in 2013 and in the period between 2015-2017, while no evident phenomena were observed in 2014 and 2019. A considerable reduction in the number and extension of milky waters occurred in the 2018-2021 period. The analysis showed that they were mainly visible in July and August, with some minor patches in June. Moreover, the occurrence of milky water was associated with dense coverage of macrophytes, notably *Ulva spp*. The long-term dynamics of milky waters provides valuable information for monitoring water quality and for supporting the assessment of their ecological impact and socio-economic consequences in transitional sites.

Assessing the role of pit lakes in riverine landscape rehabilitation via multi-source satellite data

Nicola Ghirardi (1,2)*, Mariano Bresciani (2), Monica Pinardi (2), Daniele Nizzoli (3), Pierluigi Viaroli (3)

(1) CNR - Institute of BioEconomy, Via Madonna del Piano 10, 50019 Sesto Fiorentino, Italy
(2) CNR - Institute for Electromagnetic Sensing of the Environmental, Via A. Corti 12, 20133 Milan, Italy
(3) Department of Chemistry, Life Sciences and Environmental Sustainability, University of Parma, Parco Area delle Scienze 33/A, 43124 Parma, Italy

* email corresponding author: nicola.ghirardi@cnr.it

ABSTRACT

Since the 1950s, an intense quarrying activity led to the formation of several pit lakes (PLs) which now dot floodplains and urbanized regions globally. Recently, a renewed interest in PLs has grown as tools for riverine landscape rehabilitation. The primary aim of this study was to quantify the number, distribution, and major physical/optical characteristics of PLs in the Po River basin, in order to assess their relevance and suitability for ecological restoration purposes. To achieve this aim, multi-source satellite imagery (Landsat, Sentinel-2, and PRISMA) was employed for PLs identification and analysis of their water quality parameters. The results show that 1580 PLs are present in the Po River basin, and their number and the total area have increased from 1990 to 2021. PLs currently account for 63.5 km^2 surface area, an average water volume of 378 × 106 m^3 and for a removal of 26.6 mg N m^{-2} d^{-1} via denitrification. Therefore, PLs can potentially contribute ecosystem services, e.g., water provisioning and nitrogen cycle regulation, and can be exploited for rehabilitating the riverscape. In this context, remote sensing is a very reliable tool for quantifying and analysing PLs in a vast area such as the Po River basin.

Sessione Speciale 2

The capabilities, promise and challenges of remote sensing for water monitoring: using Earth observations for marine and freshwater applications research

Chair: Mariano Bresciani

POSTER

The BIODIVERSA + RIPARIANET project: Prioritising riparian ecotones to sustain and connect multiple biodiversity and functional components in river networks

Maria Cristina Bruno (1, 8)*, Jose Barquin (2), Laura Concostrina Zubiri (2), Luca Gallitelli (3), Micael Jonsson (4), Morgan Hughes (4), Monika Laux (5), Giorgio Pace (6, 7), Massimiliano Scalici (3, 8), Ralf Schulz (5), Stefano Larsen (1, 8)

(1) Research and Innovation Centre, Fondazione Edmund Mach, Via Mach 1, 38098 S. Michele all'Adige (TN), Italy
(2) IHCantabria, Instituto de Hidráulica Ambiental, Universidad de Cantabria, C/ Isabel Torres, 15 – PCTCAN, 39011 Santander, Cantabria, Spain
(3) University of Roma Tre, Department of Sciences, Viale Guglielmo Marconi 446, 00146 Rome, Italy
(4) Department of Ecology and Environmental Science, Umeå University, SE-90187 Umeå, Sweden
(5) Institute for Environmental Sciences, RPTU – University of Kaiserslautern-Landau, Fortstraße 7 Gebäude, I76829 Landau, Germany
(6) Centre of Molecular and Environmental Biology (CBMA) / Aquatic Research Network (ARNET) Associate Laboratory, Department of Biology, University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal
7) Institute of Science and Innovation for Bio-Sustainability (IB-S), University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal
(8) National Biodiversity Future Center (NBFC), Università di Palermo, Piazza Marina 61, 90133 Palermo, Italy

* email corresponding author: cristina.bruno@fmach.it

ABSTRACT

The development of approaches optimizing the spatial conservation of natural stream-riparian networks represent a flagship example of biodiversity protection in the EU. The Biodiversa+ RIPARIANET project will leverage the increasing resolution of remote sensing information to provide practitioners with evidence-based guidance and approaches to biodiversity conservation. The key question is how to remotely assess riparian integrity and identify areas which provide effective connectivity allowing species biodiversity and ecosystem functions to persist through meta-ecological processes. We are investigating riparian networks within six river basins in Europe, along a longitudinal/climatic gradient. In 2023, we have gathered local needs and interests from key stakeholders and satellite imagery and GIS environmental data for all basins, and we will use these data to model riparian and river ecosystems functions and to identify ecological hotspots through a GIS-based multi-criteria approach. Starting in May 2024, we will collect field data to assess multiple biodiversity and stressors at the local scale, and scale-up this information to the network scale using geostatistical tools and advanced modelling. This knowledge will result in a decision-support tools allowing decision-makers at local and EU levels to identify protection gaps and ecological hotspots along riparian networks, based on multiple biodiversity, functional and connectivity criteria.

Sessione Speciale 3

Time Series Insights: from Aquatic Research to Policy and Public engagement

Chair: Carola Murano, Diego Copetti, Michela Rogora

PRESENTAZIONI ORALI

How to enhance the impact of research products through effective management and sharing practices

Caterina Bergami (1)*

(1) Istituto di Scienze Marine ISMAR-CNR, Via Roberto Cozzi, 53, 20126, Milano

* email corresponding author: caterina.bergami@cnr.it

ABSTRACT

In the era of data-driven research, the effective management and sharing of research products are crucial for advancing scientific knowledge and fostering collaboration. Sharing research products not only promotes transparency and reproducibility but also enables researchers to build upon existing findings, fostering discoverability. Throughout the various phases of research workflow, from design and data collection to analysis and dissemination, the accessibility of research products deeply influences the overall impact of the research. Moreover, proper curation of time series ensures that datasets are organized, annotated, and preserved in a manner that maximizes their usability and longevity. The presentation will examine the pivotal role of effective management and sharing practices in amplifying the impact of scientific research. It will explore key aspects of data curation and research products dissemination, showcasing their significance in enhancing the visibility, reproducibility, and utility of all research outcomes, from the research idea to the dissemination of the results. By providing practical examples and actionable insights, the presentation aims to empower researchers to strategically leverage their scientific discoveries, thereby maximizing their influence within the scientific community, the policy makers, and the general public.

Mixing drives hypolimnetic dissolved oxygen, but what about CO_2? Case study mountain Lake Tovel

Ulrike Obertegger (1)*, Stefano Corradini (2) Leonardo Cerasino (1) Linda C. Weiss (3)

(1) Fondazione Edmund Mach, Research and Innovation Centre, Hydrobiology Research Unit, 38010-San Michele all'Adige, Italy
(2) Fondazione Edmund Mach, Technology Transfer Centre, Agrometeorology and Informatics Unit, 38010-San Michele all'Adige, Italy
(3) Department of Animal Ecology, Evolution and Biodiversity, Ruhr-University Bochum, 44801- Bochum, Germany

* email corresponding author: ulrike.obertegger@fmach.it

ABSTRACT

Climate warming impacts biogeochemical cycles in lakes. Capitalizing on long-term monthly data (1995–2022) of oligotrophic mountain Lake Tovel, it has been shown that longer autumn mixing driven by later ice-in led to Lake Tovel's shift from monomixis to dimixis. However, how did this ecosystem shift impact the lake's CO_2 emissions? Here, we calculated surface CO_2 concentrations and flux by applying geochemical relationships and the thin boundary layer approach. The air–water CO_2 flux (µmol CO_2 m^{-2} d^{-1}) showed a period of lowest ($mean_{1995–2010}$: 6.4 ± 0.7), highest ($mean_{2011–2017}$: 35.7 ± 2.1), and intermediate emissions ($mean_{2018–2022}$: 19.3 ± 4.7). The recent decline in surface CO_2 concentrations from the year 2018 onwards was attributed to increased stratification that offset lake autumn mixing and thus led to the observed decline. Regression results and the overlap between temporal trend patterns indicated that surface CO_2 concentrations of Lake Tovel were positively influenced by external (loading of allochthonous carbon) and internal (lake autumn mixing) factors. These results help us to better understand the carbon cycle in mountain lakes in a changing climate.

DDT in Lake Maggiore: still a reason of concern?

Stefano Tasselli (1)*, Claudio Roscioli (1), Licia Guzzella (1)

(1) Consiglio Nazionale delle Ricerche – Istituto di Ricerca Sulle Acque (CNR-IRSA), Via del Mulino 19, Brugherio (MB), 20861, Italy

* email corresponding author: stefano.tasselli@irsa.cnr.it

ABSTRACT

DDT was employed in Italy until 1978 as an insecticide in agriculture. Due to its persistence and toxicity, DDT was classified as a POP in 2001 and as a priority substance in 2013. DDT is persistent and shows a high bioaccumulation potential due to its lipophilicity and slow elimination rates with a possible biomagnification through the food chain. DDT contamination was firstly detected in Lake Maggiore in 1996, with high levels measured in several fish species, beyond the legal limit for edible fish. The source of the pollution was then identified in a chemical plant, which produced and discharged DDT into a tributary of River Toce, one of the major affluents of Lake Maggiore. In 1998 started the first monitoring program to assess the level of DDT contamination in the lake, revealing that the contamination spread all over the lacustrine environment. Until now, different matrices have been investigated every year in order to follow the evolution over time of this contamination. Here we summarize results obtained from the analysis of DDT in lake sediment cores, tributaries sediments, fish and macroinvertebrates in the last twenty years to understand the evolution of DDT pollution and to assess the actual level of contamination.

Long-term data as an invaluable tool for the monitoring and assessment of high-altitude lakes ecological status

Michela Rogora (1)*, Angela Boggero (1), Giulia Cesarini (1), Riccardo Fornaroli (1), Lyudmila Kamburska (1, 2), Simona Musazzi (1), Aldo Marchetto (1, 2), Silvia Zaupa (1)

(1) National Research Council – Water Research Institute (CNR-IRSA), L.go Tonolli 50, 28922 Verbania Pallanza, Italy
(2) NBFC, National Biodiversity Future Center, Piazza Marina 61, Palermo 90133, Italy

* email corresponding author: michela.rogora@irsa.cnr.it

ABSTRACT

High mountain lakes are particularly sensitive to environmental stressors, including the deposition of atmospheric pollutants and climate change. They provide ideal sites to assess the effects of acidification and other air pollution related impacts, as well as the recovery following reduction in pollutant emission and deposition. HMLs are also considered sentinels of climate change, being mountain areas hotspots of climate-related losses. To assess these impacts, time series of physical, chemical, and biological data, collected with standard methodologies, are fundamental. We present an example of long-term data (since the 1980s) collection, analysis and sharing for two LTER mountain lake sites, lakes Paione Inferiore and Superiore (IT09-004-A and IT09-003-A). These lakes partly recovered from acidification, as shown by chemical and biological indicators (pH, alkalinity, epilithic diatoms) in response to decreasing deposition of acidifying compounds; however, they are still sensitive and their water quality and biological assemblages are presently affected by nutrient inputs, including nitrogen, and climate-related drivers, such as increasing water temperature, lake level fluctuations, decreasing ice and snow cover in the catchment. Our results demonstrate that selecting responsive chemical and biological indicators, to be regularly assessed in time, is crucial to support sustainable management and conservation strategies for these fragile ecosystems.

Long-term (1972-2023) limnological evolution of Lake Pusiano: research and management insights

Diego Copetti (1)*, Lucia Valsecchi(1), Gianni Tartari(1), Michela Rogora (2), Claudia Dresti (2), Andrea Fenocchi (2,3), Nicolò Pella (2,3), Paolo Dezuanni (2,3), Elisa Carena (4), Chiara Agostinelli (4), Fabio Buzzi (4)

(1) CNR – Water Research Institute, Via del Mulino 19, 20861 Brugherio, MB, Italy;
(2) CNR – Water Research Institute, Largo Tonolli 50, 28922 Verbania Pallanza, Italy
(3) Department of Civil Engineering and Architecture, University of Pavia, Via Adolfo Ferrata 3, 27100 Pavia, Italy;
(4) ARPA Lombardia, Dipartimento di Lecco, Via 1° Maggio 21/B, 23848 Oggiono, LC, Italy

* email corresponding author: diego.copetti@irsa.cnr.it

ABSTRACT

The first limnological data of Lake Pusiano (a mid-size monomictic subalpine lake) date back to 1972. Since then, the lake ecosystem has been subject to variations in both local and global anthropogenic pressures. This contribution provides an overview of the limnological evolution of the lake in the period 1972-2023. The dataset used in this study consists of historical data collected by CNR–Water Research Institute and ARPA Lombardia, supplemented by a joint field campaign currently underway. Phosphorus concentrations in the lake reached a maximum in the mid-1980s, with about 200 µg P L^{-1} at winter overturn. Subsequently, phosphorus concentrations declined in response to policies activated to reduce both phosphorus content in detergents and phosphorus loads from the catchment. Since 2014, phosphorus concentrations at winter overturn have been fluctuating between 19 and 33 µg P L^{-1}, underlining a current meso-eutrophic condition. The interannual variations of phosphorus concentrations at winter mixing appear to be mainly related to the amount of rainfall in the previous year. The joint effect of high phosphorus concentrations at winter overturn and global atmospheric warming is probably at the base of intense algal blooms which can occur in the lake even in winter (e.g., early January).

Lighting up heterotrophy: seasonality and environmental preferences of photoheterotrophic prokaryotes in the northern Mediterranean Sea

Vincenzo Manna[1,2], Elisa Banchi[1,2], Viviana Fonti[1], Mauro Celussi[1,2]

(1) Istituto Nazionale di Oceanografia e Geofisica Sperimentale – OGS, Trieste
(2) NBFC, National Biodiversity Future Center, Palermo

* email corresponding author: vmanna@ogs.it

ABSTRACT

The ability to supplement heterotrophic metabolism with light-driven energy production is widespread in microbial communities inhabiting the sunlit portion of the ocean. Besides facultative heterotrophs (i.e. cyanobacteria), photoheterotrophic microbes can use either bacteriochlorophyll (Bchl*a*)-driven light harvesting or proteorhodopsins (PRs), a photon-driven proton pump, to obtain energy from light. Despite the importance of these processes for organic matter biogeochemistry, their temporal patterns are seldom investigated. Leveraging on published data to identify Bchl*a*- and PRs-bearing prokaryotic taxa at fine taxonomic resolution, we investigated seasonal patterns and environmental preferences of photoheterotrophic prokaryotes in a 3-year time series of 16S rRNA amplicon sequencing in the northern Adriatic Sea. Bchl*a*-bearing genera (e.g. Planktomarina, HIMB11 and Luminiphilus) showed relative abundance peaks (~20%) in spring that were significantly associated with photoperiod lengthening and higher chlorophyll *a* concentrations. Taxa containing PRs (e.g., members of the SAR11 and SAR86 clades) reached peaks of ~12% relative abundance in fall and winter and preferred oligotrophic conditions. Among the Bchl*a*-bearing genera, we detected different abundance patterns in response to organic matter availability, suggesting the existence of a gradient in the contribution of light-driven energy production to their metabolic balance. Our results suggest that PRs- and Bchl*a*-driven photoheterotrophy occupies different temporal and ecological niches, shedding light on this widespread metabolic trait in temperate coastal environments.

Sediment flushing procedures in Lombardy reservoirs: Chemical and Ecotoxicological evaluation

Lucia Valsecchi[1] , Licia Guzzella[1], Stefano Tasselli[1], Cristina Borlandelli[2], Erika Lorenzi[2], Clara Bravi[3], Palumbo Maria Teresa [1], Branchi Marco[1],Laura Marziali[1]

(1) CNR – Water Research Institute, Via del Mulino 19, 20861 Brugherio, MB, Italy;

(2) Lombardy Regional Environmental Protection Agency, Via Rosellini, 17, I-20124 Milano, Italy

(3) Lombardy Region, Piazza Città di Lombardia, 1, I-20124 Milano, Italy

* email corresponding author: lucia.valsecchi@irsa.cnr.it

ABSTRACT

Reservoirs have become crucial for both hydropower generation and water storage, but sediment accumulation poses significant challenges, reducing the reservoir storage capacity and accumulating contaminants of both natural and anthropogenic origin, such as trace metals, which may impair water quality. In Northern Italy, especially in Lombardy Region, sediments are removed by flushing, i.e. allowing the accumulated sediment to flow downstream. These operations determine an initial physical-mechanical impact on the downstream river ecosystem, but they can also enhance the release of accumulated contaminants, affecting water quality and biotic communities at long term. Our aim was to evaluate the potential impacts of flushing in the Liro River (SO), by collecting sediments upstream and downstream the dam, before and after a flushing event. Our evaluation considered an integrated approach of both chemical analyses of sediments and ecotoxicological test batteries. Results showed slight ecotoxicological effects, which were mirrored by low concentrations of contaminants in sediments. This approach may be the basis for the definition of protocols for a sustainable management of sediments in reservoirs.

Long-term changes in Lake Iseo, Italy: Unravel the complex pathways by which climate change and nutrient variation affect the phytoplankton community

Flavia Dory (1)*, Veronica Nava (1), Morena Spreafico (1), Valentina Soler (1), Barbara Leoni (1)*

(1) University of Milano-Bicocca, Department of Earth and Environmental Sciences, Piazza della Scienza 1, Milan, Italy.

* email corresponding author: barbara.leoni@unimib.it and flavia.dory@unimib.it

ABSTRACT

Deep lakes are particularly exposed to the double threat posed by climate change through increased temperature and its effect on nutrient cycling. These threats are a serious issue for phytoplankton communities. However, the complex implications of these two factors on water quality and ecosystem functioning remain largely unresolved. Given these gaps, we investigated the pathways by which temperature and nutrients regulate the lake phytoplankton communities. We used 22 years of observational data to understand the respective significance of temperature and nutrients in shaping both the diversity and biovolume of phytoplankton in a deep perialpine lake. Between 1993 and 2021, we observed a decline in the lake's physicochemical quality in the water column and an increase in water temperature. As a consequence of water warming, we observed a severe modification of nutrient cycling, reflected by the overall increase in nutrient concentrations. The interaction between temperature and nutrients and the deterioration of the physicochemical parameters of the lake led to a remarkable taxonomical and functional reorganization of the phytoplankton community. This study shows that in the next years, phytoplankton in deep subalpine lakes will undergo drastic changes, and that total mixing events might act as tipping points for community transformation.

Sessione Speciale 3

Time Series Insights: from Aquatic Research to Policy and Public engagement

Chair: Carola Murano, Diego Copetti, Michela Rogora

POSTER

Evolution of phytoplankton community over the last 50 years in the lake of Pusiano.

Lucia Valsecchi(1)*, Elisa Carena (2), Chiara Agostinelli (2), Fabio Buzzi (2), Austoni Martina (3), Diego Copetti (1)

(1) CNR – Water Research Institute, Via del Mulino 19, 20861 Brugherio, MB, Italy;
(2) ARPA Lombardia, Dipartimento di Lecco, Via 1° Maggio 21/B, 23848 Oggiono, LC, Italy
(3 CNR – Water Research Institute, Largo Tonolli 50, 28922 Verbania Pallanza, Italy

* email corresponding author: lucia.valsecchi@irsa.cnr.it

ABSTRACT

The first information on the phytoplankton community of Lake Pusiano dates back to 1967 and highlighted the presence of only two species of Cyanobacteria. This group in a subsequent investigation has shown an increasing importance until the early 2000s where they represented up to 90% of the total biomass. In those years, extensive blooms were reported due to the presence of Planktothrix rubescens, which especially in 2002, reached high values of biomass, limiting the growth of other algal species (and therefore biodiversity), representing at least 45% for almost the whole year. Subsequent redevelopment works, which have brought total phosphorus concentrations from 200 µg of P L-1 in the 80s to 19 and 33 µg of P L-1 in 2014, and climate change, which has raised temperatures especially in the summer, seem to have affected the species, favoring the increase in algal biodiversity.
This paper aims to provide an overview of the phytoplankton evolution of the lake over the last 50 years, using a joint dataset of CNR - Water Research Institute and ARPA Lombardia and a joint field campaign currently underway. In addition, it would like to indicate what may be the chemical-physical variables that have influenced its evolution.

Mapping topic evolution across the 40-years old Long-Term Ecological Research MareChiara in the Gulf of Naples (Italy)

Domenico D'Alelio (1,2)*, Carola Murano (1,2), Luca Russo (1)

(1) Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, Villa Comunale, 80121 Naples, Italy
(2) NBFC, National Biodiversity Future Center, Piazza Marina 61, 90133, Palermo, Italy

* email corresponding author: domenico.dalelio@szn.it

ABSTRACT

The forty-year Long-Term Ecological Research MareChiara (LTER-MC) started on the 26th of January 1984, with a fortnightly oceanographic sampling until 1991 and, after a three-year interruption, with a weekly sampling, up to date. LTER-MC produced >150 publications cited by thousands of other studies. We analyzed the whole LTER-MC literature corpus using a semantic approach based on topic modeling, a machine-driven procedure to identify and map topics and their interactions within the scientific production. Understanding the causes behind the evolution of scientific topics, their emergence, splitting, hybridization, or merging within a scientific community, represents an important step in science policy, e.g., to manage collaborative research and bring it into the future. Across different topics, mainly represented by studies on Natural History, Biodiversity, Phenology, Life Cycles, and Community Ecology, the LTER-MC work expanded our knowledge of planktonic organisms, describing in detail their lifestyles and delineating their many relationships with environmental conditions. In presenting our results, we discuss strengths, weaknesses, opportunities, and threats connected to the overall scientific dimension of LTER-MC, envisioning potential implementation plans for the upcoming decades, considering the need for a stronger science-policy integration, following the United Nations Decade of Ocean Science for Sustainable Development.

Sessione Speciale 4

Science, Policy and Citizens efforts to tackle aquatic invasive and non-native species

Chair: Lyudmila Kamburska, Angela Boggero

PRESENTAZIONI ORALI

Research perspectives from a worldwide bibliographic review on invasive crayfish

Angela Boggero (1)*, Tommaso Cancellario (2), Giulia Cesarini (1), Lyudmila Kamburska (1,3), Imanol Miqueleiz (4), Antonín Kouba (5), Eric R. Larson (6), Francisco J. Oficialdegui (5), Elena Tricarico (7), Sergio Bedmar (8), Riccardo Fornaroli (9)

(1)National Research Council - Water Research Institute (CNR-IRSA), Corso Tonolli 50, 28922, Verbania Pallanza, Italy
(2)Balearic Biodiversity Centre, Department of Biology, University of the Balearic Islands, 07122, Palma, Spain
(3)National Biodiversity Future Center (NBFC), Piazza Marina 61, 90133, Palermo, Italy
(4)Cornell University, College of Agriculture and Life Sciences, Department of Natural Resources and the Environment, 226 Mann Drive, 14850 Ithaca, NY, USA
(5)University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters, South Bohemian Research Centre of Aquaculture and Biodiversity of Hydrocenoses, Zátiší 728/II, 389 25, Vodňany, Czech Republic
(6)University of Illinois, Department of Natural Resources and Environmental Sciences, 1102 South Goodwin Avenue, Urbana, 61801 Illinois, USA
(7)University of Florence, Department of Biology, via Madonna del Piano 6, 50019, Sesto Fiorentino (FI), Italy
(8)Doñana Biological Station (EBD-CSIC), Department of Conservation Biology, Americo Vespucci 26, 41092, Seville, Spain
(9)University of Milano-Bicocca, Department of Earth and Environmental Sciences, Piazza della scienza 1, 20126, Milano, Italy

* email corresponding author: angela.boggero@cnr.it

ABSTRACT

Invasive crayfish are a major threat to biodiversity, ecosystem functioning and services. Figuring out which research have been conducted in the field so far and on which topics to provide responses to research, management, and conservation issues, is essential. We used Web of Science as a search engine to retrieve all papers from 1990 to 2023 (period of increasing knowledge on biological invasions) that meet our search criteria. Keywords such as 'crayfish', 'alien', 'non-native', 'invasive', 'introduced' and 'freshwater' were selected. Through this bibliometric search and the exhaustive analysis of the abstracts and keywords primarily, we intended to respond the following questions:

1. What are the main research topics considered up to the present on invasive crayfish worldwide?
2. What is our degree of knowledge about invasive crayfish?
3. What are the future activities we need to focus on to limit and/or prevent crayfish expansion?

From a total of 883 papers, the main topics investigated (ecology, general biology, and management), the study's purpose (influence/interaction, taxonomic interaction level, investigated habitat) and what is on the horizon for biological invasions have been acquired. These findings will be shared among researchers and water managers to address existing gaps and to enhance water management.

New active biopolymers and chitosan-based films from invasive crayfish

Rosa Zullo (1)*, Rosaria Lauceri (1), Alberto Zullo (2), Luigi Sorrentino (3), Denise Schiavetta (4), Angela Boggero (1), Silvia Zaupa (1), Lyudmila Kamburska (1, 5), Maria Oliviero (3)

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

(2) Department of Sciences and Technologies, University of Sannio, Via De Sanctis, 82100, Benevento, Italy.

(3) National Research Council – Institute for Polymers, Composites and Biomaterials (CNR-IPCB), Piazzale E. Fermi 1, Portici (NA), Italy

(4) Università del Piemonte Orientale – Dept. of Science, Technology and Innovation (DISIT), Viale Michel 11, 15121 Alessandria, Italy

(5) National Biodiversity Future Center (NBFC), 90133 Palermo, Italy

* email corresponding author: rosa.zullo@cnr.it

ABSTRACT

Freshwater crayfish are critical for both native species and the food industry. Thus, new active biopolymers and biodegradable films from the invasive crayfish *Faxonius limosus* were developed to assess its potential usefulness in the food industry contributing to both economic and environmental sustainability. Chitin from crayfish shells was extracted, converted into chitosan to prepare chitosan-based films. We characterized the thermal, spectroscopic, barrier properties and superficial microscopic structure of the produced biomaterials. Crayfish chitosan films showed improved thermal stability, mechanical and water vapor barrier properties, and surface smoothness compared to commercial chitosan-based films. In addition, to avoid the use of organic solvent and to preserve and exploit the natural antioxidant property of astaxanthin of the crayfish shell, a chemical process to retain the carotenoid during chitosan production was attempted. 2,2-diphenyl-1-picrylhydrazyl (DPPH) assays showed that astaxanthin-deprived crayfish biopolymers exhibited antioxidant activities: the astaxanthin greatly enhanced the antioxidant properties of crayfish chitin and chitosan, while had almost no effect on the film antioxidant properties. Therefore, the products obtained from *F. limosus* are qualified to be incorporated in functional foods and active packaging to reduce food lipid oxidation, also contributing to the reduction of shell waste, thus strengthening the containment strategies of invasive species.

Pseudodiaptomus marinus: history of its recent spreading in the Mediterranean Sea and neighbouring areas

Marco Uttieri (1,2)*, Ylenia Carotenuto (1), Alessandra de Olazabal (3), Iole Di Capua (1,2), Alenka Goruppi (2,3), Valentina Tirelli (2,3)

(1) Stazione Zoologica Anton Dohrn, Villa Comunale, 80121 Napoli
(2) NBFC, National Biodiversity Future Center, Piazza Marina 61, 90133 Palermo
(3) Istituto Nazionale di Oceanografia e di Geofisica Sperimentale, via A. Piccard 54, 34151 Trieste

* email corresponding author: marco.uttieri@szn.it

ABSTRACT

Pseudodiaptomus marinus Sato, 1913 is a calanoid copepod native to the Indo-Pacific region. Following its first record in the Adriatic Sea in 2007, it has become an emergent non-indigenous species in the Mediterranean Sea and neighbouring waters. In this contribution, we provide an overview of the introduction of *P. marinus* in the investigated areas, which highlights the rapid spread of this copepod over space and time. With particular reference to Italian waters, *P. marinus* occurs in the coastal areas of the Ligurian Sea, the Tyrrhenian Sea, the Ionian Sea and the Adriatic Sea. The resulting distribution map is based on both literature reports and original data. The picture drawn provides new insights into the invasion ecology of *P. marinus*, demonstrating its remarkable ability to adapt to extremely diverse environments over a wide haline and temperature range, as well as the possibility of being introduced by numerous vectors. The resulting scenario also allows speculations on the realistic future further spread of *P. marinus* and the potential expansion of its distribution range.

Development and mortality of the non-indigenous copepod *Pseudodiaptomus marinus* over single and multiple generation experiments: a pilot study

Ylenia Carotenuto (1)*, Iole di Capua (1,2), Marco Pansera (3), Elisa Camatti (4), Valentina Tirelli (2,5), Marco Uttieri (1,2)

(1) Stazione Zoologica Anton Dohrn, Villa Comunale, 80121, Napoli
(2) NBFC, National Biodiversity Future Center, Piazza Marina 61, 90133 Palermo
(3) CNR Istituto Scienze Polari, Spianata S. Ranieri 86, 98122 Messina
(4) CNR Istituto di Biofisica Unità Operativa di Pisa, Via G. Moruzzi 1, Pisa
(5) Istituto Nazionale di Oceanografia e di Geofisica Sperimentale, via A. Piccard 54, 34151 Trieste

* email corresponding author: ylenia.carotenuto@szn.it

ABSTRACT

The copepod *Pseudodiaptomus marinus* Sato, 1913, native to the Indo-Pacific region and now an emergent non-indigenous species in the Mediterranean Sea and neighbouring waters, is an egg-carrying calanoid living in coastal lagoons and estuaries having sharp salinity and temperature ranges. However, very little is known on the factors affecting development and mortality rates from egg hatching to adulthood. As food quality is one of the key factors affecting copepod development and mortality across multiple generations, a pilot laboratory experiment was conducted to identify the optimal phytoplankton diet to support *P. marinus* development over one single generation. Hatched nauplii were fed a monoalgal diet of *Isochrysis galbana* (Prymnesiophyceae), *Rhinomonas reticulata* (Cryptophyceae), *Rhodomonas baltica* (Cryptophyceae) or *Prorocentrum minimum* (Dinophyceae), until adulthood. The diets supporting the highest survivorship to adults were, then, used for the cultivation of *P. marinus* through multiple generations. The results showed that *P. marinus* is amenable to long-term cultivation with comparatively similar mortality and developmental rates of other calanoid species. The results of this study will help to acquire a deeper awareness of the relevant traits potentially enabling *P. marinus* to colonize habitats with very contrasting environmental conditions.

Sessione Speciale 4

Science, Policy and Citizens efforts to tackle aquatic invasive and non-native species

Chair: Lyudmila Kamburska, Angela Boggero

POSTER

Selectivity of eco-sustainable and artificial substrates on the recruitment of fouling species in the natural environment

S. Di Dio[1,*], S. Coco[1], J. Ferrario[1], A. Marchini[1]

[1]Department of Earth and Environmental Science, University of Pavia, Pavia, Italy

*Email corresponding author: salvatore.coco01@universitadipavia.it

Abstract

Settlement substrate and surface topography play a key role in larval settlement, influencing community composition. Two-dimensional artificial substrates are peculiar to harbors, where they have been shown to facilitate the settlement of opportunistic and non-indigenous species (NIS). In contrast, complex three-dimensional natural substrates are known to enhance local biodiversity. This study tests the performance of different substrates in recruiting sessile marine organisms and specifically NIS, with the aim of identifying possible alternative materials to be used in port design. The experiment was conducted at Palmaria Island (Gulf of La Spezia, Ligurian Sea) from April to September 2023. A total of 16 experimental units were deployed vertically at a depth of about 1 meter, each composed of four different substrates (dimension 14x14 cm), both natural (wood – W, and cork - C) and artificial (polyvinyl chloride – PVC, and nonwoven polypropylene geotextile - PP). The results obtained from this experiment reveal that the artificial substrates (PP and PVC) show higher NIS diversity than the natural substrates tested (C and W). This suggests that natural substrates could be more resistant to NIS settlement, providing new perspectives for materials to be used in ports.

Co-occurrence of North American crayfish in northwestern Italian lakes

Lyudmila Kamburska (1,2)*, Denise Schiavetta(3), Giulia Cesarini (1), Marco Orlandi (1), Silvia Zaupa (4), Angela Boggero (1)

(1) National Research Council, Water Research Institute (CNR-IRSA), Corso Tonolli 50, 28922, Verbania, Italy
(2) National Biodiversity Future Center (NBFC), Piazza Marina 61, 90133, Palermo, Italy
(3) Università degli Studi del Piemonte Orientale, via Duomo 6, 13100, Vercelli, Italy
(4) National Research Council, Water Research Institute (CNR-IRSA), 74123 Taranto, Italy

* email corresponding author: lyudmila.kamburska@irsa.cnr.it

ABSTRACT

Invasive crayfish are widespread in the Italian lakes, but their distribution and impact remain poorly understood. We carried out a multi-year study to assess the coexistence of *Faxonius limosus*, *Pacifastacus leniusculus* and *Procambarus clarkii* in lakes Maggiore, Mergozzo and Orta. We caught crayfish using traps across different littoral habitats (piers, beaches, reed beds) to better depict their spread. Morphological traits (body length and weight, cephalotorax length/width), Catches Per Unit Effort (CPUE), sex ratio and how they differ among the species and between the lakes were discussed. *Faxonius limosus* is so far diffused in the three lakes: it coexists with *P. clarkii* and *P. leniusculus* in Lake Maggiore, and with *P. clarkii* in Lake Orta, but it is still the unique in lake Mergozzo. While *F.limosus* dominated in Lake Maggiore, *P. clarkii* is the most abundant in lake Orta. Both, *F.limosus and P.clarkii* manifested highest body length and weights in lake Maggiore in respect to other lakes. At present, *P. leniusculus* was observed only in the Swiss part of Lake Maggiore, overlapping with the other crayfish species. Despite the steady spreading in northwestern Italian lakes, the invasive crayfish suffered with the unprecedented heatwaves in 2023 and with most likely pathogen threats.

Using Invasive Amphipod Species (*Ptilohyale littoralis*) as a Case Study for Evaluating Risk Assessment

Paula Moretti (1-2)*; Daniele Paganelli (1) Agnese Marchini (1)

(1) Department of Earth and Environmental Sciences, University of Pavia
(2) Department of Animal Biology, University of Campinas

* email corresponding author: paulamoretti@live.com

ABSTRACT

Aquatic invasions are significant drivers of biodiversity loss in marine environments, underscoring the critical need for effective risk assessment tools to mitigate their impact. This study employs AS-ISK v2.4 to evaluate the invasive amphipod *Ptilohyale littoralis* and its potential effects on different risk areas in Brazil. Furthermore, it explores how different approaches to accessing knowledge can shape outcomes. Initially, the study relied on existing knowledge about the taxon, ecology, and economic impacts. Subsequently, it was complemented by additional data, including supplementary experiments. The study considered regions further south than where it was initially recorded in Brazil, where conditions are similar to the species' original habitat, and northern areas with different abiotic factors. The findings highlight a substantial risk across multiple perspectives, emphasizing the urgent need for proactive monitoring and management, particularly southern regions likely to become future establishment zones. From a biodiversity perspective, the study underscores the significance of experimental research and understanding species ecology, especially for a certain groups lacking direct economic value. While AS-ISK v2.4 proves invaluable in identifying high-risk species, its effectiveness is contingent upon supplementary information. Implementing standardized monitoring protocols in potential introduction zones could significantly bolster early detection and management efforts.

Impacts, Potential Benefits and Eradication Feasibility of Aquatic Alien Species in an Integral Natural State Reserve

Daniele Paganelli (1)*, Adriana Bellati (2), Andrea Gazzola (1), Francesco Bracco (1) and Daniele Pellitteri-Rosa (1)

1 Department of Earth and Environmental Science, University of Pavia, Via Ferrata 1, 27100 Pavia, Italy;
2 Department of Ecological and Biological Sciences, University of Tuscia, Largo dell' Università snc, 01100 Viterbo
* Correspondence: daniele.paganelli@unipv.it

ABSTRACT

Riverine wetlands are stepping-stone environments for the protection of local biodiversity, but they are particularly vulnerable to biological invasions. In order to take action against biological invasions, it is crucial to assess the impacts of alien species. However, it is also important to assess the potential benefits on ecosystem services that alien species could have. Once it has been verified that negative impacts are higher than potential benefits, it is important to propose feasible actions to contrast them. In this study, we assessed eight freshwater alien species recorded in an integral protected wetland using the Invasive Species Effects Assessment Tool (INSEAT) to quantify their negative impacts and potential benefits on ecosystem services. Moreover, for each species, we evaluated the feasibility of the main eradication techniques currently proposed in the literature using the Non-Native Risk Management scheme
(NNRM), with the final aim of suggesting effective actions for their management. The INSEAT results indicated that all the assessed species had more impacts than benefits while NNRM provided useful indications on the best practical conservation actions to use for reducing the density, and therefore, the negative impacts on ecosystem services and the local biodiversity of the assessed alien species.

Sessione Speciale 5

Integrated approaches with hydrodynamics and hydrology: models and measurements

Chair: Andrea Fenocchi, Diego Copetti, Claudia Dresti, Nicolò Pella, Paolo Dezuanni

PRESENTAZIONI ORALI

Multi-decadal evaluation of nutrient loads flowing into the Italian deep subalpine lakes through their main tributaries

Paolo Dezuanni (1,2), Diego Copetti (3), Claudia Dresti (2), Nicolò Pella (1,2), Michela Rogora (2), Fabio Buzzi (4), Edoardo Cavallini (5), Daniele Nizzoli (5), Andrea Fenocchi (1,2)

(1) Dipartimento di Ingegneria Civile e Architettura, Università di Pavia, Via Ferrata 3, 27100 Pavia, Italia
(2) Consiglio Nazionale delle Ricerche, Istituto di Ricerca sulle Acque (CNR-IRSA), Largo Tonolli 50, 28922 Verbania, Italia
(3) Consiglio Nazionale delle Ricerche, Istituto di Ricerca sulle Acque (CNR-IRSA), Via del Mulino 19, 20861 Brugherio (MB), Italia
(4) ARPA Lombardia, Dipartimento di Lecco, Via 1° Maggio 21/B, 23848 Oggiono (LC), Italia
(5) Dipartimento di Scienze Chimiche, della Vita e della Sostenibilità Ambientale, Università di Parma, Parco Area Delle Scienze 11/A, 43124 Parma, Italia

* e-mail corresponding author: paolo.dezuanni@unipv.it

ABSTRACT
The Italian large deep subalpine lakes (LDLs: lakes Maggiore, Como, Iseo, Idro and Garda) are among the sites where eutrophication was first studied, especially in the 1980s, when these basins experienced eutrophic conditions. The establishment of wastewater treatment plants and the reduction of phosphorus in detergents following national regulations reduced the external loads to the LDLs. The success of these measures varied among lakes, owing to different and efforts in pollution reduction and sewer implementation in the watersheds. Governmental authorities are presently concerned with reaching higher water quality standards for the LDLs, following the European Water Framework Directive (WFD). However, these can only be achieved through a continuous effort on external load reduction, being in-lake interventions unfeasible due to the large dimensions of these lakes. In this context, knowledge on present and past external loads is essential. However, also thanks to the WFD monitoring requirements, monthly nutrient concentration series ranging 15 – 40 years are now available for all the main tributaries of the LDLs. These, combined with daily discharge data, allow estimating extended nutrient load series. In this study we assess the external loads released to the LDLs from their major tributaries, evaluate trends and discuss the differences among watersheds.

Assessment of nutrient loads and in-lake concentrations for Lake Pusiano and its catchment during the 2021-2023 drought

Nicolò Pella (1,2)*, Andrea Fenocchi (1,2), Adrián López-Ballesteros (3), Claudia Dresti (2), Diego Copetti (4), Fabio Buzzi (5), Javier Senent-Aparicio (3)

(1) Department of Civil Engineering and Architecture, University of Pavia, Via Adolfo Ferrata 3, 27100 Pavia, Italy
(2) CNR, Water Research Institute (CNR-IRSA), Largo Vittorio Tonolli 50, 28922 Verbania, Italy
(3) Department of Civil Engineering, Universidad Católica San Antonio de Murcia, Campus de los Jerónimos, 30107 Guadalupe, Spain
(4) CNR, Water Research Institute (CNR-IRSA), Via del Mulino 19, 20861 Brugherio (MB), Italy
(5) ARPA Lombardia, Dipartimento di Lecco, Via 1° Maggio 21/B, 23848 Oggiono (LC), Italy

* email corresponding author: nicolo.pella01@universitadipavia.it

ABSTRACT

Eutrophication still affects lakes in Northern Italy. The main cause is pollution from anthropogenic activities, with climate change playing a negative synergistic role. External nutrient loads to lakes widely vary among years and their estimation is always subject to uncertainties due to data availability and frequency of samplings, as well as the presence of multiple point and non-point sources. The aim of this study is to evaluate the magnitude and variability of nutrient loads to Lake Pusiano triggered by the rainfall from its watershed. A eco-hydrological model of the Pusiano catchment was set up with the SWAT+ (Soil & Water Assessment Tool) model, calibrating it with daily discharges and seasonal nutrient data on the main tributary (River Lambro) available from ARPA Lombardia. Simulated nutrient loads were used as input for a one-dimensional coupled ecological-hydrodynamic model of Lake Pusiano developed using the QWET (QGIS Water Ecosystem Tool) software. Both models were calibrated over 2007-2020. Finally, the drought period which affected Northern Italy in 2021-2023 was simulated with SWAT+ and QWET, evaluating both the nutrient loads reaching the lake and the lacustrine ecosystem response to such critical conditions. The impact of the heavy rainfalls at the end of 2023 was also estimated.

Using process-based coupled ecological-hydrodynamic models to support regional lake water quality protection planning in Northern Italy

Andrea Fenocchi (1,2)*, Nicolò Pella (1,2), Diego Copetti (3), Fabio Buzzi (4), Daniele Magni (5), Nico Salmaso (6,7), Claudia Dresti (2)

(1) Department of Civil Engineering and Architecture, University of Pavia, Via Adolfo Ferrata 3, 27100 Pavia, Italy
(2) National Research Council, Water Research Institute (CNR-IRSA), Largo Vittorio Tonolli 50, 28922 Verbania, Italy
(3) National Research Council, Water Research Institute (CNR-IRSA), Via del Mulino 19, 20861 Brugherio (MB), Italy
(4) ARPA Lombardia, Dipartimento di Lecco, Via 1° Maggio 21/B, 23848 Oggiono (LC), Italy
(5) Regione Lombardia, Direzione Generale Ambiente e Clima, Piazza Città di Lombardia 1, 20124 Milano, Italy
(6) Fondazione Edmund Mach, Research and Innovation Centre, Via Edmund Mach 1, 38098 San Michele all'Adige (TN), Italy
(7) National Biodiversity Future Center (NBFC), Piazza Marina 61, 90133 Palermo, Italy

* e-mail corresponding author: andrea.fenocchi@unipv.it

ABSTRACT

In this contribution, we present an application of the process-based coupled ecological-hydrodynamic model QWET over 9 lakes in Northern Italy (Alserio, Annone Est, Annone Ovest, Como, Endine, Garda, Iseo, Idro, Pusiano). The regional water quality protection plan for these lakes is based on limit depth-averaged total phosphorus concentrations at spring mixing. These concentrations have been previously used to determine threshold external loads through Vollenweider-OECD steady-state empirical models, which have also been employed to estimate in-lake concentrations following external load reductions. However, such approaches have several limitations and have often produced inaccurate results. Process-based coupled ecological-hydrodynamic models offer much wider possibilities, yet their application has been up to now restricted to individual lakes due to calibration effort and data availability burdens. Here, by developing a simplified model structure, adopting automatic calibration and employing data from public monitoring, we made a regional-scale application possible. Models were calibrated over past observations, simulating then nutrient reduction scenarios for the future decades. The advantages over empirical models were identified, determining the strengths and limits of the employed simplified approach over lakes with different features. Model results highlight that for the water quality improvement of these lakes, external load reduction from their watersheds is still central.

Connectivity patterns in a Mediterranean coastal area: a multiannual analysis

Simona Saviano (1), Florian Kokoszka (2), Vincenzo Botte (3), Fabio Conversano (1), Daniele Iudicone (3), Daniela Cianelli (1)*

(1) Stazione Zoologica di Napoli Anton Dohrn, Department of Research Infrastructures for Marine Research, Naples, Italy;
(2) Consiglio Nazionale delle Ricerche – Istituto di Scienze Marine, Naples, 80133, Italy;
(3) Stazione Zoologica di Napoli Anton Dohrn, Department of Integrative Marine Ecology, Naples, Italy;

* email corresponding author: daniela.cianelli@szn.it

ABSTRACT

Quantifying the connectivity in coastal areas allows understanding the spatio-temporal scales of transport processes as well as the dispersion patterns between different locations. This is crucial in densely urbanized areas, such as the Campania Region (Mediterranean Sea - Southern Italy) where highly polluted rivers, marine protected areas and sites of cultural interest are present. We here estimate the connectivity patterns, through the analysis of the surface dynamics, for the period January 2013 - December 2017, representing the variability of the study area. The coastal connectivity associated to the surface flows is studied using particle tracking based on a regional ocean modelling system (ROMS). The numerical simulations have been performed for the Tyrrhenian Sea and downscaled for the Campania coastal area to cover high resolution temporal scales. The Lagrangian transport tool, forced with the ROMS velocity fields, provides trajectories of virtual particles, released from coastal sites into the model domain. Results highlight the role of local current in affecting particles destinations and the relevant effect of the seasonal variability of the area. The coastal connectivity patterns allow to clarify the effect of physical forcings occurring in the surface layers and the spatial distribution of different particles (i.e., plankton, larvae, microplastics).

Sessione Speciale 5

Integrated approaches with hydrodynamics and hydrology: models and measurements

Chair: Andrea Fenocchi, Diego Copetti, Claudia Dresti, Nicolò Pella, Paolo Dezuanni

POSTER

An assessment of the present and future effectiveness of hypolimnetic withdrawal for the restoration of eutrophic Lake Varese (Northern Italy) through a modelling approach

Claudia Dresti (1), Michela Rogora (1), Fabio Buzzi (2), Andrea Beghi (2), Daniele Magni (3), Alessandro Canziani (4), Andrea Fenocchi (1,5)

(1) National Research Council, Water Research Institute (CNR-IRSA), Largo Tonolli 50, 28922 Verbania, Italy.
(2) Agenzia Regionale per la Protezione dell'Ambiente della Lombardia (ARPA Lombardia), Via Ippolito Rosellini 17, 20124 Milano, Italy
(3) Regione Lombardia, Direzione Generale Ambiente e Clima, Piazza Città di Lombardia 1, 20124 Milano, Italy.
(4) Provincia di Varese, Piazza Libertà 1, 21100 Varese, Italy.
(5) University of Pavia, Department of Civil Engineering and Architecture, Via Ferrata 3, 27100 Pavia, Italy.

* e-mail corresponding author: claudia.dresti@irsa.cnr.it

ABSTRACT

Hypolimnetic withdrawal, employed as a restoration strategy in eutrophic lakes alongside external nutrient input reduction, aims at mitigating internal phosphorus (P) loads by removing anoxic nutrient-rich bottom waters. This study focuses on evaluating the impact of hypolimnetic withdrawal on the water quality of Lake Varese, a subalpine mid-sized lake in North-Western Italy. Historically, the lake experienced extensive eutrophication due to untreated urban sewage discharge in the second half of the 20th century. Over the years, various restoration measures have been implemented, including hypolimnetic withdrawal. Since 2020, a systematic annual withdrawal has been performed inside a cooperative agreement for the protection and management of the lake. Using data collected from 2019 to 2021, a one-dimensional ecological-hydrodynamic coupled model (General Lake Model/Aquatic EcoDynamics – GLM/AED2) was calibrated and applied to Lake Varese to forecast its evolution under various scenarios. Model simulations of 2020-2021, with and without hypolimnetic withdrawal, demonstrated the withdrawal effectiveness in reducing hypolimnetic P concentrations. Future simulations (2023-2085) under climate change scenarios assessed the long-term impact of withdrawal and of possible external nutrient load reductions. Results suggest that the withdrawal increases hypolimnetic temperatures, potentially leading to reduced water-column stability and stratification in autumn. This may ultimately decrease P concentrations in the lake.

ALPLAKES, an open-source online tool for real-time modelling of lakes in the Alps

Marina Amadori (1), Marco Toffolon (2), Mariano Bresciani (1), Claudia Giardino (1), Abolfazl Irani Rahaghi (3),Daniel Odermatt (3), James Runnalls (3), Mortimer Werther (3), Damien Bouffard (3)

(1) Istituto per il Rilevamento Elettromagnetico dell'Ambiente (IREA), CNR, Milano, Italia
(2) Dipartimento di Ingegneria Civile, Ambientale e Meccanica, Università degli Studi di Trento, Italia
(3) Eawag, Swiss Federal Institute of Aquatic Science and Technology, Surface Waters – Research and Management, Switzerland

* email corresponding author: amadori.m@irea.cnr.it

ABSTRACT

Understanding the complex dynamics of water temperature and transport processes in lakes is crucial for numerous environmental and societal applications, including ecosystem management, water quality assessment, and recreational planning. Traditional methods of monitoring and modeling these dynamics often rely on labor-intensive field measurements and computationally intensive simulations with limited real-time capabilities. In light of increasing environmental concerns and supported by advances in computational capabilities and web technologies, we developed a tool that models lake dynamics and provides the results through an accessible, user-friendly web interface for public and scientific use. The proposed online tool offers a web-based visualization that provides users with near-instantaneous updates on lake conditions and forecasts about the future evolution of 12 alpine and peri-alpine lakes located in Italy and Switzerland. This online tool was developed within the AlpLakes project, funded by the European Space Agency (ESA) and consolidates a collaborative effort among experts of physical limnology, remote sensing, numerical modelling, and software engineering, towards a new generation of online tools to inform the public and support research on lake dynamics.

Tracking movements of *Pelagia noctiluca* medusae by combining modeling and stable isotope approaches

Isabella D'Ambra (1), Simona Saviano (2), Louise Merquiol (1), Maria Grazia Mazzocchi (1), Maria Assunta Ambrosio (2), Daniele Iudicone (1), Vincenzo Botte (1), Daniela Cianelli (2)*

(1) Stazione Zoologica di Napoli Anton Dohrn, Department of Integrative Marine Ecology, Naples, Italy;
(2) Stazione Zoologica di Napoli Anton Dohrn, Department of Research Infrastructures for Marine Research, Naples, Italy;

* email corresponding author: daniela.cianelli@szn.it

ABSTRACT

True jellyfish (Cnidaria, Scyphozoa) often appear in unexpected large aggregations along the coasts, where they interfere with human activities (tourism, fisheries, power plants). Therefore, tracking their movements and predicting their outbreaks is crucial for several economic activities but are challenged by their fragile bodies and ephemeral appearance.
We here combined modeling and stable isotope (SI) approaches to define the patterns of outbreaks of the scyphomedusa *Pelagia noctiluca* in the Gulf of Naples (GoN). Carbon and nitrogen SIs of medusae collected during outbreaks on 6 March, 3-5 June, 24 July and 20 November 2019 did not reflect the SIs of their potential prey collected within the GoN, but rather those found in pelagic zones. This mismatch was corroborated by particle tracking simulations performed using a regional ocean modeling system (ROMS), which allowed to reconstruct the trajectories of individuals up to 20 days before collection. Numerical results suggested that medusae were driven from offshore towards the coastal areas of the GoN by the surface dynamics of the southern Tyrrhenian Sea and wind regimes promoting the entry of water – and medusae - into the GoN. In addition, local dynamics characterized by slow advection favoured the permanence of *P. nocticula* within the GoN.

Sessione Speciale 6

Biodiversity and Habitat in fluvial ecosystems

Chair: Stefania Erba, Silvia Quadroni

PRESENTAZIONI ORALI

Uno sguardo allo scrigno degli Efemerotteri italiani: idee per il futuro prossimo

Andrea Buffagni (1,2)*, Marcello Cazzola (1), Simona Cislaghi (1), Simone Cardoni (3), Fabrizio Stefani (1), Stefania Erba (1), Carlo Belfiore (4)

(1) CNR-IRSA Water Research Institute, Via del Mulino 19, 20861 Brugherio (MB), Italy
(2) National Biodiversity Future Center (NBFC), Piazza Marina 61, 90133 Palermo, Italy
(3) CNR-IRSA Water Research Institute, Via Roma 3, 74123 Taranto, Italy
(4) DEB, Department of Biological and Ecological Sciences - Tuscia University, Largo dell'Università snc, 01100 Viterbo, Italy

* corresponding author – andrea.buffagni@irsa.cnr.it

ABSTRACT
Negli ultimi venticinque anni, il principio che un'informazione non accurata potesse determinare significativi errori di interpretazione ha in qualche modo ostacolato lo sviluppo delle conoscenze tassonomiche sugli Efemerotteri italiani. Anche la compilazione di taxalist a livello di specie si è rivelata un compito arduo per vaste aree italiane, a causa dell'incertezza nell'attribuzione tassonomica per molti generi. La necessità di nuove raccolte in ambienti naturali soggetti a drastici cambiamenti, la difficoltà di reperire gli adulti, insieme alla necessità di integrare approcci metodologici complementari (genetica e morfologia) rendono oggi molto impegnativo approcciare in modo organico l'ordine degli Efemerotteri. Nel contesto del National Biodiversity Future Center (NBFC), abbiamo avviato analisi biomolecolari e i primi risultati sembrano indicare che parte della variabilità morfologica fino ad oggi ritenuta intraspecifica vada invece riconsiderata in chiave interspecifica. Nell'ottica di giungere ad aggiornamenti tassonomici, è importante definire il quadro esistente (morfospecie), integrarlo con i risultati dei nuovi approcci e derivare un quadro di sintesi coerente con lo scenario più ampio (i.e. europeo). In questa presentazione, descriviamo i punti salienti dell'attività in corso, fornendo un contributo sull'attuale situazione degli Efemerotteri italiani, considerando sia le criticità alla base del concetto di specie, sia la natura incrementale della conoscenza scientifica.

A new biomonitoring index for evaluating the effects of sediment flushing operations in alpine streams

Alberto Doretto[1,2*], Niccolò Talluto[1], Giuseppe Crosa[3], Paolo Espa[3], Livia Servanzi[3], Silvia Quadroni[3]

(1) Dipartimento per lo Sviluppo Sostenibile e la Transizione Ecologica, Università del Piemonte Orientale, Piazza S. Eusebio 5, Vercelli, Italia
(2) ALPSTREAM – Alpine Stream Research Center, Ostana, Italia
(3) Dipartimento di Scienze Teoriche e Applicate, Università degli Studi dell'Insubria, Via JH Dunant 3, Varese, Italia

* email corresponding author: alberto.doretto@uniupo.it

ABSTRACT

Sediment flushing operations are one of the main hydro-morphological alterations associated with dams in alpine rivers because of the acute flux and an intense deposition of fine sediment on the riverbed. Although their negative effects on aquatic biota have been widely documented, specific biomonitoring indices related to this type of disturbance are still rare. In this contribution, the Siltation Index for LoTic EcoSystems (SILTES) is proposed and tested for assessing the impacts of fine sedimentation based on benthic macroinvertebrate communities. SILTES is a multi-metric index that varies from 0 (most impacted condition) and 1 (pristine condition) and combines both taxonomic and functional metrics: the total taxon richness, EPT richness and the abundance of macroinvertebrates preferring coarse mineral substrates and fast-flowing water. The validity of SILTES index was tested using data from independent case studies on sediment flushing operations in the Cottian and Rhaetian Alps. Our results show that SILTES index is generally more suitable than other indices in detecting the impacts of fine sediment deposition associated with flushing operations. These findings provide thus useful tools for biomonitoring the effects of man-induced siltation in streams and contribute to improve our diagnostic ability concerning stressor-specific alterations.

Flow-related habitat variability of Mediterranean rivers and its effect on ecological status assessment: A 70-year perspective for benthic macroinvertebrates of a Sardinian river system (Southwestern Italy)

Silvia Quadroni (1)*, Stefania Erba (2), Marcello Cazzola (2), Simona Cislaghi (2), Andrea Buffagni (2,3)

(1) Department of Theoretical and Applied Sciences, University of Insubria, 21100 Varese, Italy
(2) Water Research Institute, National Research Council (CNR-IRSA), 20861 Brugherio MB, Italy
(3) National Biodiversity Future Center (NBFC), 90133 Palermo, Italy

* email corresponding author: silvia.quadroni@uninsubria.it

ABSTRACT

In this study, we focused on the impact of temporal streamflow variation of Mediterranean rivers on the definition of reference conditions and ecological status assessment based on benthic macroinvertebrate communities. Starting from streamflow timeseries (71 years long) of two typical Sardinian rivers reaches (Southwestern Italy) and using empirical relationships, we investigated the temporal variability of the lentic-lotic character and of the biological metrics used to define the ecological status of Italian rivers (the multi-metric STAR_ICM index and its sub-metrics). We also compared the result of the application of dynamic *vs* fixed reference conditions for ecological status classification. The lentic-lotic character of Sardinian rivers fluctuates over time from lotic conditions in winter to extremely lentic conditions in summer, with significant variations from one year to another. All the considered biological metrics vary consequently over time, with a significant reduction in the summer months due to droughts/ low flows, and display a higher variability in pool than in riffle. If dynamic instead of fixed reference conditions are used to calculate the STAR_ICMi, quality classification shifts towards better ecological status, proving the strong impact of ignoring the effects of the natural habitat variability of Mediterranean rivers when assessing their ecological status.

Assessment of the effectiveness and efficiency of two fish passages in the Toce River

Mattia Iaia (1,2) *, Silvia Quadroni (2), Stefano Brignone (1,3), Vanessa De Santis (1), Tommaso Righi (4), Daniele Tamborini (5), Andrea Tersigni (5), Armando Piccinini (6), Cesare Puzzi (5), Roberta Bettinetti (2), Pietro Volta (1)

(1) CNR-IRSA, Corso Tonolli 50, 28922, Pallanza
(2) Università degli Studi dell'Insubria, Via Valleggio 11, 22100, Como
(3) Università di Torino, Via Verdi 8, 10124, Torino
(4) Università Politecnica delle Marche, Piazza Roma 22, 60121, Ancona
(5) G.R.A.I.A. srl, Viale Repubblica 1, 21020, Varno Borghi
(6) Biomark, LLC 705 S. 8ph St. Boise, ID 83702, USA

* email corresponding author: mattia.iaia@irsa.cnr.it

ABSTRACT

River fragmentation is one of the main threats to freshwater fish. Fish passages are mitigation tools that water resource managers and stakeholders increasingly use to restore river connectivity. However, their effectiveness and efficiency must be adequately assessed to determine the mitigation effect. Moreover, although numerous, current methods and metrics used for such an assessment could reveal, in some cases, inadequate. In this study, two vertical slot fishways, built along the Toce River (a tributary of Lake Maggiore, northern Italy) within the IdroLIFE project (LIFE15NAT/IT/000823), were monitored from 1th April 2021 to 14th March 2022 using two radio PIT-tag antennas located at the inlet and outlet of each fishway. A total of 2672 fish, including native species (e.g., *Salmo marmoratus* and *Cottus gobio*), as well as non-native species, were tagged at 30 sites along the Toce River. Despite this large tagging effort, only 70 fish were recorded in the fishways during the monitoring period, mainly corresponding to specimens tagged in the fishway proximity. Here, we discuss the effectiveness and efficiency of the two fish passages in relation to water flow, time of the year, and fish biological features (e.g., fish species, size, age).

Digitization, barcoding and microscope slides: coupling old-fashioned and innovative habits for biodiversity studies

Simona Cislaghi (1)°, Simone Cardoni (1), Marcello Cazzola (1), Stefania Erba (1), Andrea Buffagni (1, 2)*

(1) CNR-IRSA, Water Research Institute, Italy
(2) National Biodiversity Future Center (NBFC), 90133 Palermo, Italy

° presenting author – simona.cislaghi@irsa.cnr.it
* corresponding author – andrea.buffagni@irsa.cnr.it

ABSTRACT

Natural science collections and field data have traditionally been crucial to address scientific research topics. In the last decades, developments in digital image and in gene sequences acquisition through DNA barcoding have considerably increased the information that can be obtained from physical specimens, whether preserved in a collection or gathered in the environment. In this regard, integrated approaches to scientific research are gaining ground to combine diverse aspects relating to biological data, such as genomes and morphological characteristics. This contribution sets out the salient points of a methodological approach, including practical-operational aspects, developed to obtain combined genetic and detailed morphological information on biological specimens, specifically on Ephemeroptera taxa. A conservative approach has been devised to obtain the gene sequence of the specimen while keeping its morphological parts intact. The approach consists of different steps from sampling to permanent slides preparation and DNA sequencing. Two collections, one 'physical' (e.g. the specimen and its parts) and one 'digital' (e.g. the images), are created from the different steps. The elements of the two collections are used in the definition of taxonomic units through the identification of diagnostic characters in combination with DNA barcoding analysis (COI standard marker).

The importance of integrating Habitats Directive and Water Framework Directive approaches in habitat assessment

Stefania Erba[*1], Marcello Cazzola[1], Giuseppe Pappagallo[2], Marco Barcella[1,2], Emanuele Barca[2], Simona Cislaghi[1], Andrea Buffagni[1]

1 Water Research Institute, National Research Council (CNR-IRSA), via del Mulino 19, 20861 Brugherio (MB) – IT
2 Water Research Institute, National Research Council (CNR-IRSA), Via F. De Blasio, 5 70132 Bari (BA) – IT

* email corresponding author and presenting author: stefania.erba@irsa.cnr.it

ABSTRACT

The protection and restoration of riverine habitats is still a central issue of environmental policies and management actions. Habitats Directive (HD, 92/43/EEC) and Water Framework Directive (WFD, EC/2000/60) are keystones of Europe's nature conservation and environmental enhancement policies. Despite the ambitious targets of these directives a vast array of multiple stressors at large spatial scales is known to limit the effect of river restoration. This contribution describes how aspects related to WFD monitoring could be integrated into HD monitoring. The study has been carried out in three rivers in Puglia (South Italy) in the context of the MIA project (M.I.A. RETE-NATURA 2000, B35F21002450001). The presence of the HD habitats 3250, 3280 and 3290 has been investigated. A set of WFD related characteristics has been included in the survey scheme to acquire information at both wider and local spatial scales e.g. land-use, habitat quality, substratum and flow type, habitat mosaic and morphological alteration. The different spatial and environmental gradients identified by multivariate analysis will be related to the presence of the habitats. It is expected that the obtained results can guide the assessment of features significant for habitat conservation in the studied environments.

Biodiversity Monitoring South Tyrol: A multi-taxon long-term monitoring scheme in an Alpine region

Magdalena Vanek (1)*, Andreas Hilpold (1), Roberta Bottarin (1), Matteo Anderle (1), Elia Guariento (1), Thomas Marsoner (1), Chiara Paniccia (1), Julia Plunger (1), Johannes Rüdisser (2), Julia Seeber (1,2), Alberto Scotti (1,3), Francesca Vallefuoco (1), Ulrike Tappeiner (1,2)

(1) Institute for Alpine Environment, Eurac Research, Viale Druso 1, I-39100 Bolzano, Italy

(2) Department of Ecology, University of Innsbruck, Technikerstrasse 25/Sternwartestrasse 15, A-6020, Innsbruck, Austria

(3) APEM Ltd, Stockport, United Kingdom (current affiliation)

* email corresponding author: Magdalena.Vanek@eurac.edu

ABSTRACT

The Biodiversity Monitoring South Tyrol (BMS) addresses the critical need for comprehensive biological datasets to evaluate conservation efforts in mountainous and protected regions, recognized as global biodiversity hotspots. With standardized protocols, BMS surveys freshwater macroinvertebrates, soil fauna, vascular plants, bryophytes, orthopterans, butterflies, birds and bats across different spatial scales. Covering diverse habitats from near-natural to anthropogenically altered areas, BMS monitors 120 aquatic and 320 terrestrial sites, spanning 7,400 km^2 of the Autonomous Province of Bolzano. For the stream monitoring, 12 stream types were identified, including 24 reference points, sampled every year (2 sites per 12 stream types), and 24 additional sites, resampled every four years. Consequently, the sampling design offers insights into spatial and temporal variations in benthic macroinvertebrate diversity. Substrate types and river categories influence taxonomic distribution, with microhabitat niches supporting specific taxa. Overall, differing substrate availability at patch level is highly important for the distribution and composition of benthic macroinvertebrate assemblages in different types of mountainous streams. BMS data informs conservation strategies, aids in spatial planning, and contributes to ecological indicator development, essential for assessing climate change impacts on mountain ecosystems. This integrated approach bridges research and policy, supporting biodiversity conservation in South Tyrol and beyond.

Lotic ecosystems as important but tricky refugia for charophytes in warm climates – implications for biodiversity and conservation

Alessandro Bellino (1)*, Abdullah A. Saber (2), Daniela Baldantoni (1)

(1) Department of Chemistry and Biology "Adolfo Zambelli", University of Salerno, Via Giovanni Paolo II 132, Fisciano (SA) 84084, Italy
(2) Department of Botany, Faculty of Sciences, Ain Shams University, Abbassia Square, Cairo 11566, Egypt

* email corresponding author: abellino@unisa.it

ABSTRACT

Charophytes are an ecological and evolutionary important group of macroalgae characterizing the benthic vegetation of lakes and wetlands, where they exert crucial control over community and ecosystem dynamics. In spite of their widespread distribution, they are amongst the most endangered macrophytes in aquatic ecosystems, threatened by habitat loss and various forms of environmental alterations. The increasing ephemeral nature of many water bodies in Mediterranean and warmer climates further restricts the range of suitable habitats and acts as an environmental filter affecting biodiversity. In this context, lotic environments may represent suitable refugia, but their highly dynamical nature poses further challenges for the persistence of charophyte populations.
With a view to investigate the ecological niche breadth of charophytes and the role of lotic refugia on their distribution and diversity, the present research investigated 23 populations belonging to the genera *Chara*, *Nitella* and *Tolypella* from southern Italy and northern Egypt. Results show that charophytes increasingly colonize lotic ecosystems in warmer climates, with morphological adaptations to mechanical stresses, but also that populations are likely to undergo local extinction events, dramatically shaping metapopulation dynamics. By shedding light on charophyte ecology, our findings contribute to understanding their dynamics and devising suitable conservation strategies.

The role of the New Fish Community Ecological Status Index (NISECI) in the definition of the Ecological Flows for the upper Tiber River basin (Umbria, central Italy)

Antonella Carosi (1)*, Francesca Lorenzoni (1), Lucio Di Matteo (2), Daniela Valigi (2), Corrado Cencetti (2), Carlo Cardellini (2), Stefano Casadei (3), David Cappelletti (1), Massimo Lorenzoni (1)

(1) Dipartimento di Chimica, Biologia e Biotecnologie, Università di Perugia, Via Elce di Sotto 8, 06123, Perugia
(2) Dipartimento di Fisica e Geologia, Università di Perugia, Via Pascoli s.n.c., 06123, Perugia
(3) Dipartimento di Ingegneria Civile ed Ambientale, Università di Perugia, Via G. Duranti, 93, 06125, Perugia

* email corresponding author: antonella.carosi@unipg.it

ABSTRACT

The estimation of Ecological Flows (EF) is essential in rivers to achieve the objectives defined by the Water Framework Directive (WFD) 2000/60/EC. The fish fauna is able to respond to the annual flow variability, assuming the role of a biological quality element. Based on these assumptions, we applied the New Index of the Ecological Status of Fish Communities (NISECI) as a criterion to define the transition from the Minimum Vital Flow (MVF), currently in force, to the EF, as required by the WFD. With this aim, we defined the NISECI values of 24 river reaches located on the Tiber River basin hydrographic network, and we performed the physico-chemical characterization. For summer flow rates (lean season), we considered the EF equal to the MVF in the sites where the WFD objective had already been achieved. In the other cases, we foresaw an increase in flow rate, depending on the deviation from the Good Ecological Status, and considering the need to guarantee the diluting power of the river. According to this approach, we based the modulation of the amount, quality, and timing of water discharge contemplated by the EF concept on the natural flow duration curves calculated for the Tiber River basin.

Water quality and water quantity are two sides of the same coin? A case study of a northwest Alpine river under water stress and the impacts of wastewater treatment plant discharges on benthic communities

Anna Marino[1,3,*], Silvia Bertolotti[2], Manuela Macrì[1], Francesca Bona[1,3], Silvia Bonetta[1], Elisa Falasco[1,3], Marco Minella[2], Stefano Fenoglio[1,3]

1 Department of Life Sciences and Systems Biology, University of Torino, Via Accademia Albertina 13, 10123 Turin, Italy

2 Department of Chemistry, University of Torino, Via Pietro Giuria 5, 10125 Turin, Italy

3 Alpine Stream Research Center (ALPSTREAM), 12030 Ostana, Italy

* email corresponding author: anna.marino@unito.it

ABSTRACT

In the context of global climate change, the occurrence of droughts in streams of alpine origin is a recent phenomenon, whose impact is still poorly investigated. Regarding the relationship between rivers and climate change, most studies focused on aspects linked to water 'quantity' neglecting those related to water 'quality'. In this study, we adopted a multi-disciplinary approach to investigate the response of an Alpine river (Stura di Lanzo, NW Italy) to the severe drought conditions that occurred in the year 2022. It was hypothesized that reduced water flow could worsen the effects of wastewater treatment plant (WWTP) discharges, increasing chemical pollution and altering microbial and benthic communities. Chemical variables, bacterial indicators, pathogens, benthic communities as macroinvertebrates and diatoms, were monitored monthly upstream and downstream of a WWTP. Results showed higher nutrient and bacterial concentrations downstream, correlating with water scarcity. Benthic communities responded accordingly, particularly during low-flow conditions. Understanding these impacts is crucial for planning effective management strategies as drought events are projected to increase in Europe.

The role of habitat and local hydromorphology in the ecological quality of Mediterranean agricultural rivers: the case of the "Tavoliere delle Puglie"

Raffaella Balestrini*, Andrea Buffagni, Marcello Cazzola, Stefania Erba

Water Research Institute, National Research Council (CNR-IRSA), via del Mulino 19, 20861 Brugherio (MB) – IT

* email corresponding author and presenting author: raffaella.balestrini@irsa.cnr.it

ABSTRACT

Despite more than 20 years of policies to counter water quality deterioration, nutrient enrichment remains one of the main causes of water quality degradation in Europe. According to the latest environmental report published by ISPRA in 2020, 57% and 80% of Italian rivers and lakes, respectively, do not achieve good ecological status. Among the southern regions, Apulia is the one most affected by agriculture pressure, a human activity considered one of the main causes of the deterioration of both surface and groundwater. More than 50% of the river water bodies monitored in Apulia over the last four years are eutrophic or at risk of eutrophication. Hydromorphological and habitat characteristics are environmental factors that can control the processes governing nutrient retention on which the self-purification capacity of aquatic ecosystems depends. This paper describes the results of a study aimed at identifying the environmental factors that determine the spatial variability of nitrate concentrations in 23 river stretches monitored by ARPA Puglia in the Tavoliere. A wide range of explanatory variables was selected, with particular emphasis on two main aspects: i) land use in the catchment and riparian areas, ii) hydromorphological and habitat characteristics of the river reaches.

Sessione Speciale 6

Biodiversity and Habitat in fluvial ecosystems

Chair: Stefania Erba, Silvia Quadroni

POSTER

FluEMMA – An interdisciplinary project to investigate ecological, hydro-morphological and management aspects of sediment flushing operations from Alpine reservoirs

Silvia Quadroni (1)*, Paolo Espa (1), Livia Servanzi (1), Giuseppe Crosa (1), Giuseppe Roberto Pisaturo (2), Giulia Stradiotti (2), Maurizio Righetti (2), Niccolò Talluto (3), Alberto Doretto (3)

(1) University of Insubria, Via JH Dunant 3, 21100 Varese, Italy
(2) Free University of Bozen-Bolzano, Faculty of Engineering, Universitätsplatz 5, 39100 Bolzano, Italy
(3) University of Eastern Piedmont, Piazza S. Eusebio 5, 13100 Vercelli, Italy

* email corresponding author: silvia.quadroni@uninsubria.it

ABSTRACT

Sediment flushing operations are expected to increase in frequency in alpine rivers in the next future to recover reservoir capacity with unpredictable effects on the aquatic biota and ecosystem integrity. There is therefore an urgent demand for practices and science-based management criteria to make these operations sustainable to fulfil the human demand of water without impairing the biodiversity and ecosystem services provided by rivers. Yet, our ability to quantify and mitigate the negative effects of these operations is still limited by the lack of uniformity in normative and technical guidelines as well as specific eco-hydraulics and biomonitoring tools. The FluEMMA project aims to fill these knowledge and methodological gaps through (i) the identification and validation of the best biomonitoring metrics based on benthic macroinvertebrate communities to correctly assess the impacts of these operations, and (ii) the investigation of management alternatives for reducing the impacts associated with sediment flushing operations and promoting the post-flushing recovery of both physical habitat and benthic macroinvertebrate communities. The performance of more eco-sustainable flushing operations will allow maintaining both the current level of hydropower production and good levels of the ecological quality of rivers.

Identification of reliable metrics to assess the effects of trout farming on biological water quality in Alpine rivers (Trentino Province): integration of morphological and DNA metabarcoding approaches

Cristina Cappelletti (1)*, Nico Salmaso (2,3), Adriano Boscaini (2), Massimo Manfrini (4), Filippo Faccenda (1), Francesca Ciutti (1)

(1) Fondazione Edmund Mach, Technology Transfer Center, Via Edmund Mach 1, 38098 San Michele all'Adige (TN), Italy
(2) Fondazione Edmund Mach, Research and Innovation Center, Via Edmund Mach 1, 38098 San Michele all'Adige (TN), Italy
(3) NBFC, National Biodiversity Future Center, Palermo, Italy
(4) O.P. ASTRO, Producer Organisation Astro Associazione Troticoltori Trentini, Via Galileo Galilei 43 z.i., 38015 Lavis (TN), Italy

* email corresponding author: cristina.cappelletti@fmach.it

ABSTRACT
Fish farming can affect the quality of receiving watercourses through nutrients, organic matter, and suspended solids enrichment as well as through the release of drugs and chemicals. Trentino Province is one of the most important producers of salmonids in Italy, with about 60 farms, mainly producing rainbow trout (*Onchorhynchus mykiss*). The Filiera ASTRO's Project "*Competitività e Sostenibilità dell'Acquacoltura di Montagna"* (supply chain contract) funded by MASAF (Ministero dell'agricoltura, della sovranità alimentare e delle foreste) aims to improve the sustainability and economic value of mountain aquaculture. Within this framework, biological and chemical analysis will be carried out in water courses upstream and downstream of trout farms' effluents. Biological monitoring of macroinvertebrate and periphyton communities (with a focus on diatoms) will be carried out via both morphological and molecular (environmental DNA - eDNA) approaches. Specific aquaculture impacts and efficacy of mitigation measures (e.g. filters, sedimentation tanks) will be assessed by applying both established and candidate water quality metrics. The latter will be used to obtain or confirm environmental certification of good practice, thus providing a cost-effective and reliable tool for better management of sustainable aquaculture.

Do dissolved heavy metals enter the food webs of alpine streams?

Monica Tolotti (1,2)*, Afredo Maule (1), Stefano Brighenti (3), Giulio Voto (4), Maria Cristina Bruno (1,2)

(1) Research and Innovation Centre, Fondazione Edmund Mach, Via Mach 1, 38098 S. Michele all'Adige, Italy
(2) NBFC, National Biodiversity Future Center, Palermo 90133, Italy
(3) Competence Centre for Mountain Innovation Ecosystems, Free University of Bolzano/Bozen, Piazza Università 1, 39100 Bolzano, Italy
(4) Eco Research, Via Luigi Negrelli 13, 39100 Bolzano, Italy

* email corresponding author: monica.tolotti@fmach.it

ABSTRACT

The Euregio project "ROCK-ME": Geochemical response of Alpine Rock Glaciers to global warming" investigates the origin, export, and ecological effects of trace elements in river networks affected by rock glacier thawing and glacier retreat. Permafrost degradation and glacier recession can cause elevate export of solutes, including heavy metals, into river networks while the contribution from groundwater is often negligible. However, the ecological effects remain understudied. We assessed if and how trace element enrichment causes biomagnification processes in the aquatic organisms by characterizing the foodwebs of different stream types (intact and relict rock glaciers, and reference spring draining an area without periglacial landforms/glaciers/permafrost) with $\delta^{13}C$ and $\delta^{15}N$ isotopic ratios analysis and measuring the content of trace elements in each component of the foodweb. The investigation was conducted in 2022 in two catchments in South-Tyrol: Lazaun and Madritsch/Madriccio Valleys. The analysed matrices were: CPOM, FPOM, epilithic biofilms, bryophytes, and benthic invertebrates of different taxa characterized and grouped by feeding habit (omnivore, carnivore, herbivore, detritivore). The same trace elements were measured in the water of each stream type. As expected, most of the biomagnification occurred in streams originating from intact rock glaciers.

Rock glacier springs: cool habitats for species on the edge

Magdalena Vanek (1)*, Jan Martini (1,2), Stefano Brighenti (3), Thea Schwingshackl (1,2), Francesca Vallefuoco (1), Alberto Scotti (1,4), Valeria Lencioni (5) & Roberta Bottarin (1)

(1) Institute for Alpine Environment, Eurac Research, Viale Druso 1, I-39100 Bolzano, Italy
(2) Department of Ecology, University of Innsbruck, Technikerstrasse 25/Sternwartestrasse 15, A-6020, Innsbruck, Austria
(3) Competence Centre for Mountain Innovation Ecosystems, Free University of Bozen-Bolzano, Bozen/Bolzano, Italy
(4) APEM Ltd, Stockport, United Kingdom (current affiliation)
(5) Climate and Ecology Unit, Research and Museum Collections Office, MUSE-Museo delle Scienze, Trento, Italy

* email corresponding author: Magdalena.Vanek@eurac.edu

ABSTRACT

Glacier loss due to climate change poses a significant threat to aquatic biodiversity, especially in mountainous regions. Streams originating from rock glaciers, known as "icy seeps," may serve as refuges for cold-adapted organisms, preserving cold waters even in warming climates. However, the extent of this refuge function requires further validation. Our study in the Eastern Italian Alps examined biotic and abiotic parameters of icy seeps, glacier springs, and non-glacial springs during late summer 2021. We found that icy seeps displayed intermediate meltwater contributions with low water temperatures, and elevated trace elements, resembling glacier springs. Yet, they also exhibited low discharge and turbidity akin to spring brooks. Macroinvertebrate community composition in icy seeps correlated strongly with chemical harshness gradients, indicating their importance for certain species. Despite similarities with glacier springs, icy seeps hosted declining, threatened species, highlighting their conservation value. Protecting these habitats is crucial amid ongoing climate warming and water scarcity threats. Overall, our findings underscore the importance of icy seeps as cool habitats for species vulnerable to climate change-induced warming and drying in mountainous regions.

Sessione Speciale 8

From macro to nano: a world of plastic concerns

Chair: Veronica Nava, Silvia Galafassi, Giulia Cesarini

PRESENTAZIONI ORALI

Plastic as a carrier of algal species: proof of concept, environmental relevance and potential implications

Gilberto Binda (1, 2)*, Luka Šupraha (1), Margarida Costa (1), Eva Leu (3), Luca Nizzetto (1, 4)

1 Norwegian Institute for Water Research (NIVA), Økernveien 94, 0579 Oslo, Norway
2 Department of Science and High Technology, University of Insubria, Via Valleggio 11, 22100 Como, Italy
3 Akvaplan-niva, Fram Centre, 9296 Tromsø, Norway
4 RECETOX, Masaryk University, Kamenice 753/5, 625 00 Brno, Czech Republic

* email corresponding author: gilberto.binda@niva.no

ABSTRACT

The presence of plastics in water ecosystems raises concerns about the potential ecotoxicological effects. However, other environmental and ecological implications have been overlooked: plastic can in fact host a biofilm community and facilitate the dispersal of microalgae in waters, potentially affecting the natural community assembling and the availability of nutrients. Here, we investigated the likelihood of plastic fragments being colonized by algal species and the potential effects in a pilot, laboratory-based study. We initially exposed a simulated algal community of 5 pelagic species commonly found in freshwaters to both pristine and biofouled (with other 2 benthic algal species) polypropylene fragments. In these experiments, we observed changes in the algal community composition and significant chemical alterations driven by the biofouled plastics, while the presence of plastic only did not show any significant difference in comparison to the control. This indicates a key role of the biofilm on plastic, leading to competitive interactions between the biofilm and the pelagic communities. Environmental relevance is currently being assessed by the formation of biofilms on different plastic types using natural benthic and pelagic communities isolated from ponds and lakes. This will frame the environmental relevance of plastic as a carrier of algal species.

Plastisphere effects on ecosystem traits: from biodiversity to metabolism

Veronica Nava (1)*, Sudeep Chandra (2), Barbara Leoni (1)

(1) University of Milano-Bicocca, Piazza della Scienza 1, 20126, Milano (MI), Italy
(2) Global Water Center and Biology Department, University of Nevada, 1664 N. Virginia, Reno, NV 89557-0314, United States

* email corresponding author: veronica.nava@unimib.it

ABSTRACT

While plastic pollution is increasingly recognized as an emerging threat to freshwater ecosystems, few studies quantify the impact of plastics and their associated communities ('plastisphere') on ecosystem traits, ranging from biodiversity and functional traits to metabolic functions. It has been suspected that the impacts on ecosystems may depend on their state, but cross-studies comparing ecosystem responses are rare in the published literature. In this presentation, we aim to quantify the influence of biofouled plastics on some ecological processes in different aquatic systems across geographical regions and varying trophic statuses. We conducted a series of semi-natural experiments to understand metabolic changes, evaluate biodiversity traits, and scale our findings to comprehend the potentially broader influence plastics can have on governing water quality traits and ecological state of freshwater systems. Our results demonstrate that plastic surfaces function as habitats for a community of biologically active organisms that play pivotal roles in essential ecosystem processes, such as ecosystem metabolism (rate of respiration and production). We observed alterations in nutrient cycling and shifts towards heterotrophy or autotrophy depending on environmental conditions. These findings show that plastics can have larger effects than expected, impacting system metabolism and influencing biogeochemical cycles.

Comprehensive assessment of plastic impacts in river ecosystems: a multi-level approach

Giulia Cesarini (1,2)*, Massimiliano Scalici (2,3)

(1) National Research Council – Water Research Institute (CNR-IRSA), Corso Tonolli 50, 28922 Verbania, Italy
(2) Department of Sciences, University of Roma Tre, Viale G. Marconi 446, 00146 Rome, Italy
(3) National Biodiversity Future Center (NBFC), Università di Palermo, Piazza Marina 61, 90133 Palermo, Italy

* email corresponding author: giulia.cesarini@irsa.cnr.it

ABSTRACT

Plastics pose a significant threat to aquatic habitats globally, prompting considerable attention from scientists. Although rivers are identified as primary sources of plastics to seas and oceans, freshwater environments have received comparatively less attention. Exposure to environmental factors fragments plastics into smaller particles, ranging from macro- to nanoplastics. This PhD project aimed to enhance understanding of plastics' behaviour in riverine ecosystems through a multi-level approach, spanning from the ecosystem to organism level and analysing different plastic sizes at each level. The first objective was to assess the transport of floating macroplastics in riverine ecosystems using a standardized methodology and suggest enhancements for further plastic investigations. The second objective aimed to gather field data on the role of riparian zones in the distribution of macro- and mesoplastics. The third objective focused to investigate the accumulation of microplastics and additives in freshwater bivalves, specifically *Anodonta cygnea*. Lastly, the fourth objective aimed to explore the teratogenic effects of nanoplastics on freshwater organisms under realistic exposure conditions. In conclusion, this PhD project contributes to understanding plastic pollution in freshwater environments, examining impacts from the ecosystem to individual levels and underscoring the detrimental effects of plastics of all sizes.

Assessing Degradation and Biofilm Formation on Disposable Food Containers of various materials in a Lake Environment

Silvia Galafassi (1,2)*, Raffaella Sabatino (1,2), Andrea Di Cesare (1,2), Roberta Piscia (1), Simona Musazzi (1), Gianluca Corno (1,2), Pietro Volta (1), Rosa Zullo (1)

(1) Water Research Institute, National Research Council, Largo Tonolli 50, 28922 Verbania, Italy
(2) NBFC, National Biodiversity Future Center, Palermo 90133, Italy

* email corresponding author: silvia.galafassi@cnr.it

ABSTRACT

Microplastic particles are persistent micropollutants that pose a danger to ecosystems and their biodiversity, both through their direct toxic action and by creating a distinct ecological niche that can host a different assortment of microorganisms. In this regard, the presented study explores the changes that occur during the exposition to the surface waters of Lake Maggiore of commercially available food containers, including conventional materials like polypropylene (PP) and polyethylene terephthalate (PET), as well as innovative biodegradable (Mater-Bi) and natural materials (wood and cellulose). After 43 days of environmental exposure, spectral changes, as revealed by FT-IR spectroscopy in PET and Mater-Bi, along with alterations in thermal properties of all human-made materials, already indicated the occurrence of a degradation process. Despite similar bacterial richness, the biofilms on PET, PP, and Mater-Bi differed significantly from those on both natural materials and the planktonic community. The communities on human-made materials showed a higher proportion of potential pathogens, with PET and PP exhibiting increased abundances of antibiotic resistance genes. Overall, these findings stress the need for dedicated strategies to curb the spread of human-made polymers in freshwaters, including innovative materials that, due to their biodegradable properties, might be perceived as less hazardous for the environment.

Quantification of Microfiber Release for Recycling in Circular Economy: Experimental Insight from the ProPla project

Beatrice Luzi (1)*, Rosa Zullo (1), Pedro Marcelo Pozzo (1), Marco Carnevale Miino (2), Alberto Pietro Damiano Baltrocchi (2), Elena Cristina Rada (2), Vincenzo Torretta (2), Silvia Galafassi (1,3)

(1) Water Research Institute, National Research Council, Largo Tonolli 50, 28920 Verbania, Italy
(2) Department of Theoretical and Applied Sciences, University of Insubria, via J.H. Dunant 3, 21100 Varese, Italy
(3) NBFC, National Biodiversity Future Center, Palermo 90133, Italy

*email corresponding author: beatrice.luzi@irsa.cnr.it

ABSTRACT

Microfibers (MFs) are widespread environmental pollutants[1,2,3], often predominantly made of polyethylene terephthalate (PET), one of the most used polymers in the textile industry. Domestic laundering has been identified as a major source, with each wash estimated to release thousands to millions of MFs[4,5], that can be directly discharged into the environment or bypass wastewater treatment plants[5]. Though they are widely studied nowadays, still little is known about their environmental fate and recyclability.
In this scenario, the ProPla project seeks to upcycle PET MFs (microPET) by bioconverting into amino acids or other high-value compounds using an engineered *Escherichia coli* strain. This strain will colonize the larval gut microbiota of the saprophagous insect *Hermetia illucens*, making it capable of utilizing PET as food source, turning a harmful contaminant into a resource.
To achieve this goal, the quantity of microPET released from domestic laundry, typically discarded and likely to contribute to environmental pollution, was quantified[6]. Both washing and drying processes were considered, including testing a domestic microfiber retention device for washing machines. These tests, along with a market survey to assess everyday textile composition, enabled an overall evaluation of the recoverable fibers quantity. Subsequently, fibers separation protocols were developed to isolate PET[7] for its bioconversion.

1. Acharya, S., Rumi, S. S., Hu, Y., & Abidi, N. (2021). Microfibers from synthetic textiles as a major source of microplastics in the environment: A review. Textile Research Journal, 91(17–18), 2136–2156. https://doi.org/10.1177/0040517521991244

2. Mathalon, A., & Hill, P. (2014). Microplastic fibers in the intertidal ecosystem surrounding Halifax Harbor, Nova Scotia. Marine Pollution Bulletin, 81(1), 69–79. https://doi.org/10.1016/j.marpolbul.2014.02.018

3. Remy, F., Collard, F., Gilbert, B., Compère, P., Eppe, G., & Lepoint, G. (2015). When Microplastic Is Not Plastic: The Ingestion of Artificial Cellulose Fibers by Macrofauna Living in Seagrass Macrophytodetritus. Environmental Science & Technology, 49(18), 11158–11166. https://doi.org/10.1021/acs.est.5b02005

4. Browne, M. A., Crump, P., Niven, S. J., Teuten, E., Tonkin, A., Galloway, T., & Thompson, R. (2011). Accumulation of Microplastic on Shorelines Woldwide: Sources and Sinks. Environmental Science & Technology, 45(21), 9175–9179. https://doi.org/10.1021/es201811s

5. Erdle, L. M., Nouri Parto, D., Sweetnam, D., & Rochman, C. M. (2021). Washing Machine Filters Reduce Microfiber Emissions: Evidence From a Community-Scale Pilot in Parry Sound, Ontario. Frontiers in Marine Science, 8, 777865. https://doi.org/10.3389/fmars.2021.777865

6. Zambrano, M. C., Pawlak, J. J., Daystar, J., Ankeny, M., Cheng, J. J., & Venditti, R. A. (2019). Microfibers generated from the laundering of cotton, rayon and polyester based fabrics and their aquatic biodegradation. Marine Pollution Bulletin, 142, 394–407. https://doi.org/10.1016/j.marpolbul.2019.02.062

7. Burat, F., Güney, A., & Olgaç Kangal, M. (2009). Selective separation of virgin and post-consumer polymers (PET and PVC) by flotation method. Waste Management, 29(6), 1807–1813. https://doi.org/10.1016/j.wasman.2008.12.018

Sessione Speciale 8

From macro to nano: a world of plastic concerns

Chair: Veronica Nava, Silvia Galafassi, Giulia Cesarini

POSTER

Quantification of microplastics using two staining techniques: Nile Red and Rose Bengal

Benedetta Villa (1)* & Roberta Bettinetti (2)

(1) Department of Science and High Technology, University of Insubria, Via Valleggio 11, Como, Italy
(2) Department of Human Sciences, Innovation and Territory, University of Insubria, Via Valleggio 11, Como, Italy
*Corresponding author: bvilla3@studenti.uninsubria.it

ABSTRACT
The quantification of microplastics is still problematic due to the lack of a standard method. There is a huge need of a comparable method to understand the unseen impact on the environment. The aim of this work is to present a possible way to quantify microplastics at microscope using the known dye Nile Red and moreover, exceed the limits of this dye with Rose Bengal. Nile Red is a suitable simple method to decrease the number of particles that need confirmation by analytical techniques such as FTIR or Raman spectroscopies, but in some cases its affinity for biogenic material can lead to false positives. For this reason, in this work samples were split in two aliquots, which were stained with Nile Red and Rose Bengal; Rose Bengal displays more affinity towards the biogenic material in the sample and the comparison between both can improve visual inspection and the final quantification. The entire process of quantification was conducted using a digital microscope with a resolution of 1 µm, which greatly improves the detection of each particle compared to optical microscopes.

Does lake stratification influence microplastics fate? A case study in Lake Lugano

Federica Rotta (1, 2)*, Barbara Leoni (3), Fabio Lepori (4), Agnese Marchini (1), Camilla Capelli (2)

(1) University of Pavia, Department of Earth and Environmental Sciences, Via Ferrata 1, 27100, Pavia, Italy
(2) University of Applied Sciences and Arts of Southern Switzerland, Institute of Earth Sciences, Via Flora Ruchat-Roncati 15, 6850, Mendrisio, Switzerland
(3) University of Milano-Bicocca, Department of Earth and Environmental Sciences, Piazza della Scienza 1, 20126, Milano, Italy
(4) Etat de Vaud, Avenue de Valmont 30b, 1014, Lausanne, Switzerland

* email corresponding author: federica.rotta@supsi.ch

ABSTRACT

Microplastics (MPs) are widespread pollutants of freshwater environments. However, research has mainly investigated plastics occurrence in lakes, while little is known about MP fate in these ecosystems. Here we present results from an ongoing research promoted and funded by the International Commission for the Protection of Italia-Swiss Waters (CIPAIS), which aims to understand MP distribution and behaviour in Lake Lugano's watershed. Recent surveys have reported high concentrations of these pollutants in its surface and subsurface waters. In this study we provide novel data on MP (size range 5-0.1mm) fate in relation to the thermal stratification of the lake. Environmental samples were collected from the epilimnion (0-10m), metalimnion (10-20m) and hypolimnion (20-80m) of the water column using nets, in order to evaluate MP concentrations within each layer and in relation to the thermocline depth. Additionally, sediment traps were seasonally deployed at 20m depth in order to quantify changes in MP sedimentation rate over the year. Our results show that MP vertical distribution and sedimentation flux were highly variable, changing through seasons. The presence and depth of the thermocline was found to be relevant, accumulating potentially harmful concentrations of MPs in the euphotic zone (0-20m) during the thermal stratification of the lake.

The PhytoPlastic project: large-scale collaboration exploring the plastisphere across European lakes

Veronica Nava (1)*, Mona Abbasi (2), Oloyede Adekolurejo (3,4), Patrick Aurich (5), Nans Barthélémy (6), Berenike Bick (2), Bryan Burri (7), Marco J. Cabrerizo (8), Geoffrey Cairola (9), Teofana Chonova (10), Mathilde Cour (11), Vanessa De Santis (12), Flavia Dory (1), Annemieke M. Drost (13, 14), Baptiste Fatras (9), Lena Fehlinger (15), Aida Figler (16), Dariusz Halabowski (17), Daniel Harvey (18), Ellinor Jakobsson (2), Benjamin Misteli (19), Laureen Mori-Bazzano (7), Valentin Moser (20,21), Julia Pasqualini (5), Federica Rotta (22,23), Bianca Schmid-Paech (24), Camille Touchet (6), Konstantinos Vaziourakis (2), Víctor Manzanares-Vázquez (25), Dar Jaffer Yousuf (26), Julia Gostyńska (27)

(1) University of Milano-Bicocca, Piazza della Scienza 1, 20126 Milano (MI), Italy
(2) Department of Ecology and Genetics/Limnology, Uppsala University, Uppsala, Sweden
(3) School of Biology, University of Leeds, Leeds, United Kingdom
(4) Department of Biology, Adeyemi Federal University of Education, Ondo, Nigeria
(5) Helmholtz-Centre for Environmental Research, UFZ, 39114 Magdeburg, Germany
(6) Université Claude Bernard Lyon 1, LEHNA UMR 5023, CNRS, ENTPE, F-69622, Villeurbanne, France
(7) Université de Genève, Département Forel, Geneva, Switzerland
(8) University of Granada, Campus Fuentenueva s/n, 18071, Granada, Spain
(9) ENSEGID engineering school, 33600, Pessac, France
(10) Department Environmental Chemistry, Eawag: Swiss Federal Institute of Aquatic Science and Technology, Zurich, Switzerland
(11) Independent researcher
(12) Water Research Institute - National Research Council of Italy, Verbania, Italy
(13) NIOO-KNAW, Wageningen, the Netherlands
(14) Institute for Biodiversity and Ecosystem Dynamics, University of Amsterdam, Amsterdam, the Netherlands
(15) University of Vic UVic-UCC, Department of Biosciences, GEA Research Group, Carrer de la Laura 13, 08500 Vic, Spain
(16) Semmelweis University, Department of Bioinformatics, Budapest, Hungary
(17) University of Lodz, Faculty of Biology and Environmental Protection, Department of Ecology and Vertebrate Zoology, Lodz, Poland
(18) UK Centre of Ecology & Hydrology, Lancaster University, Lancaster/Newcastle, United Kingdom,
(19) WasserCluster Lunz, Lunz, Austria
(20) Community Ecology, Swiss Federal Institute for Forest, Snow and Landscape Research WSL, Birmensdorf, Switzerland
(21) Department of Aquatic Ecology, Swiss Federal Institute of Aquatic Science and Technology Eawag, Dübendorf, Switzerland, Zurich, Switzerland
(22) University of Applied Sciences and Arts of Southern Switzerland, Via Flora Ruchat-Roncati 15, CH-6850, Mendrisio, Switzerland
(23) University of Pavia, Via Ferrata 1, 27100, Pavia, Italy
(24) Weihenstephan-Triesdorf University of Applied Science, Germany
(25) Department of Research and Development, Coccosphere Environmental Analysis, Málaga, Spain
(26) Leibniz- Institute of Freshwater Ecology and Inland Fisheries, IGB Berlin
(27) Adam Mickiewicz University in Poznan, Institute of Environmental Biology, Department of Hydrobiology, Poznan, Poland

* email corresponding author: veronica.nava@unimib.it

ABSTRACT

The presence of plastics in freshwater ecosystems is now widely recognized, with substantial variations in concentrations and types. A growing body of literature acknowledges that plastics can serve as a substrate for biofilm growth, facilitating the colonization of diverse organisms and thus creating what is known as the 'plastisphere'. Within this community, microalgae represent an important component; however, few studies have focused on the photoautotrophic aspect of the plastisphere. Here, we present the preliminary results of the 4th collaborative FreshProject "PhytoPlastic". The project investigates the temporal establishment of microalgae on different plastic polymers in lakes across a wide geographical scale. We incubated two plastic polymers (low density polyethylene and polyethylene terephthalate) and a glass substrate (as a control) in 14 lakes across Europe. To assess the temporal and seasonal development of colonization, samples were collected in each season after 3, 7, 15, and 30 days. For each substrate, we quantified photoautotrophic biomass by estimating chlorophyll *a* and ash-free dry mass. This project represents the first coordinated experiment conducted on a large spatial scale to investigate the interaction between microalgae and plastic. Beyond its scientific contributions, the project fosters collaboration among early-career researchers in freshwater sciences and lays the groundwork for future partnerships.

A transversal study for the identification and reduction of microplastics in freshwater ecosystems in South Tyrol: The PlasticFree Project

Francesca Vallefuoco[1*], Dahms T.J. Heinrich[1], Magdalena Vanek[1], & Roberta Bottarin[1]

(1) Institute for Alpine Environment, Eurac Research, Bozen/Bolzano, Italy

* email corresponding author: francesca.vallefuoco@eurac.edu

ABSTRACT

Microplastics (MPs) are ubiquitous and persistent pollutants, posing significant environmental and public health concerns due to their role as vectors for toxicants and the adverse effects of their accumulation in ecosystems. Despite their recognized impact, European standardized protocols and legislation for the quantification of MPs in freshwater environments are still under development. The PlasticFree project aims to fill this gap by (i) conducting a comprehensive assessment of the distribution of MPs in the Province of Bolzano/Bozen; (ii) developing the most appropriate sampling and analytical methods for alpine waterbodies. Focusing on different environmental compartments, including surface water, riverbank and interstitial sediments, macroinvertebrates, and fish. The project aims to identify and quantify different forms of MPs in aquatic ecosystems. A total of 16 different sites across the South Tyrol province will be investigated over multiple seasons to determine any seasonal and annual variations of MP loads. Additionally, the project aims to reduce MPs pollution from sewage treatment plants, by implementing innovative prototypes and testing them through a BACI approach. This interdisciplinary study promotes cooperation between public administrations, research institutes, and private companies, recognizing the importance of research and innovation in managing this emerging contaminant.

First evidence of microplastics occurrence in LTER high-mountain lakes in the Western Alps

Giulia Cesarini (1)*, Michela Rogora (1), Silvia Galafassi (1)

(1) CNR Istituto di Ricerca Sulle Acque (IRSA), L.go Tonolli 50, 28925 Verbania

* email corresponding author: giulia.cesarini@irsa.cnr.it

ABSTRACT

Microplastic pollution has become of global concern in all types of ecosystems, from aquatic to terrestrial ones. Until now, data regarding the microplastics occurrence in remote ecosystems such as high-mountain lakes (HMLs) are scarce. However, these ecosystems are recognized indicators of global change and considered particularly sensitive to air pollutants. In this study microplastics (< 5 mm) were investigated in two HMLs, lakes Paione Inferiore (PAI) and Paione Superiore (PAS), belonging to the LTER (Long-Term Ecological Research) network, and their final outlet, in the framework of the LIFE project MODERn NEC. The two lakes and the outlet showed comparable levels of microplastic abundance. The size range varied from 111 to 5000 µm, with a trend of increasing size from PAS to the outlet. Fibers (>89%) were the predominant shape in all sites, compared to fragments (<12%), with black and blue being the most prevalent colours. PET and polyester were the most common identified polymers. Initial findings indicated the presence of microplastics in HMLs, with potential sources including medium to long-range atmospheric transport and local tourism. Further research is needed to clarify the sources and effects of microplastics on aquatic food webs in these key ecosystems.

BIOPLACE: Impact of degradation products of BIOdegradable PLAstics on biogeochemical Cycles and freshwater Environments

Chiara Magnabosco (1)*, Monica Passananti (2), Roberta Piscia (1),Silvia Galafassi (1)

(1) Centro Nazionale delle Ricerche – Istituto di Ricerca sulle Acque (IRSA-CNR), Via Tonolli 50, 28922, Verbania-Pallanza, Italy
(2) Università degli Studi di Torino,Via Pietro Giuria 5, 10125, Torino, Italy

* email corresponding author: chiara.magnabosco@irsa.cnr.it

ABSTRACT

To reduce the ecological impacts of plastic pollution, the use of biodegradable plastics (BDP) is increasingly spreading as alternative materials (1,2,3,4). In the environment, BDP are degraded by abiotic and biotic factors, resulting in the release of degradation products (DP), including potential toxic additives and polymers (1,5). BIOPLACE project studies the potential impact of DP on freshwater environments. Abiotic degradation experiments will be performed to evaluate chemical release of both bio-based and petroleum-based BDP in laboratory and water samples collected from different freshwater environments. DP-BDP obtained will be used to investigate their potential effects on freshwater biota. Experiments will be done to test their possible influence on microbial communities and assessing their acute and chronic toxicity on microalgae and zooplankton. Indeed, these organisms play important roles in aquatic food webs, environmental biodiversityand carbon and nitrogen biogeochemical cycles. In this contest, DP-BDP can be a source of carbon and nitrogen, influencing the biogeochemical cycles. Microcosm experiments, the analysis of the consumption kinetics of the DP-BDP, the microbial community composition and its proteome will be used to verify this aspect. Finally, this project will provide important data about the BDP ecological impact for possible new regulatory directives.

References:

1. X. Yan,Q. Chen, Z. Zhang, Y. Fu, Z. Huo, Y. Wu, H. Shi (2023). Chemical features and biological effects of degradation products of biodegradable plastics in simulated small waterbody environment. *Science of The Total Environment*, 904, 166829.
2. M. Capolupo, A. Rafiq, I. Coralli, T. Alessandro, P. Valbonesi, D. Fabbri, E. Fabbri (2023). Bioplastic leachates characterization and impacts on early larval stages and adult mussel cellular, biochemical and physiological responses. *Environmental Pollution*, 319, 120951.
3. V. Kaing, Z. Guo, T. Sok, D. Kodikara, F. Breider, C. Yoshimura (2024). Photodegradation of biodegradable plastics in aquatic environments: Current understanding and challenges. *Science of The Total Environment,*911,168539.
4. C.Campanale, S. Galafassi, F. Di Pippo, I. Pojar, C. Massarelli, V. F. Uricchio (2024). A critical review of biodegradable plastic mulch films in agriculture: Definitions, scientific background and potential impacts. *Trends in Analytical Chemistry*, 170, 117391.
5. T. Ahmed, M. Shahid, F. Azeem, I. Rasul, A. A. Shah, M. Noman, A. Hameed, N. Manzoor, I. Manzoor (2018). Biodegradation of plastics: current scenario and future prospects for environmental safety. *Environmental science and pollution research*, 25:7287-7298.

Exploring Nanoplastic Uptake: Insights from Field and Laboratory Experiments in the Gulf of Naples

Carola Murano[1,2*], Tecla Bentivoglio[3], Serena Anselmi[3], Leonilde Roselli[4], Iole Di Capua[4], Monia Renzi[5], Antonio Terlizzi[1,2,4]

[1] Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, Naples, Italy
[2] NBFC, National Biodiversity Future Center, Piazza Marina 61, 90133 Palermo, Italy
[3] Bioscience Research Center, Via Aurelia Vecchia, 32, 58015 Orbetello, Italy
[4] Department of Research Infrastructures for marine biological resources, Stazione Zoologica Anton Dohrn, Naples, Italy
[5] Department of Life Sciences, University of Trieste, Via Licio Giorgieri, 34127 Trieste, Italy

* email corresponding author: carola.murano@szn.it

ABSTRACT

Plastic pollution, particularly microplastics (1 µm - 5 mm) and nanoplastics (<1 µm), poses a significant environmental challenge to marine ecosystem. There is mounting concern that nanoplastics, due to their tiny size, might be more widespread and potentially more harmful than larger plastic particles. This study aims to assess the biomagnification of nanoplastics along the marine food webs in the Gulf of Naples, focusing on phytoplankton and zooplankton communities, *Engraulis encrasicolus* and *Scomber colias* specimens. Before starting the analysis of natural samples collected in the Gulf of Naples, a positive control case study was performed in which specimens of phytoplankton and zooplankton were exposed to fluorescent polystyrene nanoplastics (PS-NPs, 100 nm) at different concentrations (0.01, 0.2, 2, 5, 10 mg/L) for 24h, under controlled laboratory conditions. Optical microscopy, fluorimetry, and Raman spectroscopy confirmed nanoplastic internalization in both phytoplankton and zooplankton, with a dose-dependent uptake rate. These findings enhance our understanding of polystyrene nanoplastic toxicokinetics in marine plankton communities, suggesting their potential as biosensors for detecting emerging stressors and nanoplastic accumulation.

Sessione Speciale 9
Science outreach and citizen science

Chair: Domenico D'Alelio, Daniele Paganelli

PRESENTAZIONI ORALI

The ocean is not just water. Augmenting the common perception of marine biodiversity by integrating community-based monitoring and edutainment in coastal peripheries

Domenico D'Alelio (1,2)*, Daniele De Luca (1,3), Daniele Bellardini (1,4), Rosalia Calicchio (5,6), Anja Raggio (1), Pasquale De Luca (1), Marco Signore (1), Iole Di Capua (1,2), Emanuela Dattolo (1,2)

(1) Stazione Zoologica Anton Dohrn, Villa Comunale, 80121 Naples, Italy
(2) NBFC, National Biodiversity Future Center, Piazza Marina 61, 90133, Palermo, Italy
(3) Università della Tuscia, Viterbo, Italy
(4) Università degli Studi di Genova, Corso Europa 26, 16132 Genova, Italy
(5) Università degli Studi di Napoli Parthenope, Centro Direzionale, isola C4, 80143 Napoli, Italy
(6) ASD Cilento a Vela – Cilento Sailing, Marina di Camerota, 84059, Camerota, Italy

* email corresponding author: domenico.dalelio@szn.it

ABSTRACT

The innate capacity to observe natural phenomena, e.g., ocean color changes and alternations of luxuriant and poor waters, drove our social evolution. In the modern era, science should help society re-discover biodiversity-humanity links, promote sustainable lifestyles, and establish a scientific-cultural enlightenment boosted by social interactions. Herein, we present Reknotting Marine Biodiversity, a project to involve citizens in the co-design, creation, and running of community-based monitoring and educational entertainment (i.e., in a single word, 'edutainment') to augment the common perception of marine biodiversity in coastal peripheries. In our first public campaign, we taught sailors carrying out marine biodiversity surveys using the environmental DNA metabarcoding technique, and we collaborated with them by integrating sailing school camps and marine biology classes under an edutainment perspective. Sailors became promoters of ocean literacy, helping scientists establish multi-stakeholder partnerships with local policy-makers and economic operators. These trans-disciplinary initiatives falling into the boundaries of citizen science can impact the scientific, social, political, and economic dimensions at a regional level, making local biodiversity heritage visible, reinforcing the sense of place, and catalyzing the reaching of Sustainable Development Goals targets.

The TROPHYC project: the use of scientific knowledge and local ecological knowledge to assess the impact of the Atlantic blue crab *Callinectes sapidus* (Rathbun 1896) in the Mediterranean Sea

Daniele Paganelli (1)*, Lucrezia Cilenti (2), Giorgio Mancinelli (3), Salvatrice Vizzini (4), Pere Abelló (31), Abdulghani H. Abdulghani (10), Michel Bariche (32), Sergio Bedmar (11), Jamila Ben Souissi (18), Gianni Brundu (17), Sabrina Etourneau (21), Silvia Falco (12), Branko Glamuzina (5), Elvis Kamberi (19), Mohamed H. Kara (22), George Katselis (24), Kosmas Kevrekidis (6), Evangelos Konstantinidis (25), Sami M. Ibrahim (23), Verònica López (8), Youness Mabrouki (14), Olivera Markovic (33), Sinan Mavruk (34), Abdulrraziq Miftah (16), Sahar Mehanna (9), Ragia Moussa (30), Costas Perdikaris (25), Angel Pérez-Ruzafa (13), Ana Pesic (33), Patricia Prado (7, 8), Argyrios Sapounidis (20), Massimiliano Scalici (27, 28), Fouzi Abdelkhaleq Taybi (15), Francesco Tiralongo (29), Aylin Ulman (26), Agnese Marchini (1)

(1) Department of Earth and Environmental Sciences, University of Pavia, Via Sant'Epifanio 14, 27100, Pavia
(2) Institute of Sciences of food Production (ISPA), Via Michele Protano, 71121 Foggia
(3) Department of Biological and Environmental Sciences and Technologies (DiSTeBA), University of Salento, Lecce, Italy S.P. 6, Lecce - Monteroni - Lecce (LE)
(4) Department of Earth and Marine Sciences, University of Palermo, CoNISMa, Via Archirafi 18, 90123 Palermo, Italy
(5) University of Dubrovnik, Ćira Carića 4, 20000 Dubrovnik, Croatia
(6) Decentralized Administration of Macedonia Thrace, Navarinou 28-Karaoli & Dimitriou, 551 31 Kalamaria, Thessaloniki, Greece
(7) Instituto de Investigación en Medio Ambiente y Ciencia Marina (IMEDMAR-UCV), Universidad Católica de Valencia SVM, C/Explanada del Puerto S/n, 03710, Calpe, Alicante, Spain
(8) Institut d'Estudis Professionals Aqüícoles i Ambientals de Catalunya (IEPAAC), 43540 La Ràpita, Tarragona, Spain
(9) National Institute of Oceanography and Fisheries NIOF, Fisheries Division, Egypt
(10) Department of Marine Resources, Omar Al-Moukhtar University, El Bayda, Libya
(11) Department of Conservation Biology, Doñana Biological Station (EBD-CSIC), Americo Vespucio 26, 41092, Seville, Spain
(12) Instituto de Investigación para la Gestión Integrada de Zonas Costeras (IGIC), Universitat Politècnica de València, C/Paranimf 1, 46730, Gandía, Valencia, Spain
(13) Departamento de Ecología e Hidrología, Facultad de Biología Universidad de Murcia, Campus de Excelencia Internacional MareNostrum, 30100, Murcia, Spain.
(14) Sidi Mohamed Ben Abdellah of fez, Biotechnology, Conservation and Valorisation of Natural Resources Laboratory, Fez. B.P. 1796, 30003, Fez, Morocco
(15) University Mohammed Premier of Oujda, Faculté Pluridisciplinaire de Nador, Équipe de Recherche en Biologie et Biotechnologie Appliquées, B.P 300, 62700 Selouane, Morocco, Oujda, Morocco
(16) Omar Al-Mukhtar University, Department of Biology, Faculty of Education, Al-Bayda, Libya
(17) International Marine Centre - IMC Foundation, Loc. Sa Mardini 09170, Torregrande, Oristano, Italy
(18) National Institute of Agronomy of Tunisia, Biodiversity, Biotechnology and Climate Change Laboratory (LR11ES09) University Tunis El Manar, Tunis, Tunisia
(19) Agricultural University of Tirana, St. Paisi Vodica 1025, Tirana, Albania
(20) Hellenic Agricultural Organization Dimitra - Fisheries Research Institute, Nea Peramos, Kavala, 64007, Greece
(21) Corsican Regional Council, Service of the Biguglia lagoonNatural Reserve, Furiani, France
(22) Université d'Annaba - Laboratoire Bioressources Marines, BP 230 Oued Kouba, Annaba – Algérie
(23) College of Natural Resources and Environmental Sciences, Tobruk University, Tobruk, Libya
(24) University of Patras, Nea ktiria 30200, Mesolonghi, Greece
(25) Region of Epirus, Regional Unit of Thesprotia, Department of Fisheries, 46100 Igoumenitsa, Greece
(26) Mersea Marine Consulting, Tuzla Mah. 531 Sokak Apt. 4. D.2. Fethiye, Turkey 48300
(27) Department of Sciences, University Roma Tre, viale Guglielmo Marconi 446, 00146 Rome, Italy
(28) National Biodiversity Future Center (NBFC), University of Palermo, Piazza della Marina 61, 90133 Palermo, Italy

(29) Department of Biological, Geological and Environmental Sciences, University of Catania, Via Androne 81, 95124 Catania, Italy
(30) Invertebrate Aquaculture Laboratory, AquacultureDepartment, National Institute of Oceanographyand Fisheries, NIOF, Cairo, Egyp
(31) Institut de Ciències del Mar (ICM-CSIC), passeig Marítim de la Barceloneta 37, 08003 Barcelona, Spain
(32) Biology Department, American University of Beirut, Beirut 1107 2020, Lebanon
(33) University of Montenegro - Institute of marine biology, Put I Bokeljske brigade 68, Kotor, Montenegro 85330.
(34) Cukurova University, Fisheries Faculty, 01330, Balcalı, Adana, Türkiye

* email corresponding author: daniele.paganelli@unipv.it

ABSTRACT

The recent increase of the Atlantic blue crab *Callinectes sapidus* (Rathbun 1896) is a clear example of a weak or absent management of non-native marine populations in the Mediterranean Sea. In 2023, to increase the knowledge on the biology, trophic ecology, invasion history and impacts of *C. sapidus*, the TROPHYC project was launched involving a network of 43 data contributors among researchers and private companies in all the Mediterranean Sea. A questionnaire of 24 questions was sent to the network to collect information on the context-specific data on the spatial and temporal occurrence of *C. sapidus* in target areas, to assess which environmental, economic, social, and cultural values are perceived to be endangered by its invasion, and to explore mitigation and adaptation options. Therefore, the information obtained using the local ecological knowledge (LEK) was integrated in a conventional risk screening tool (AS-ISK). Despite few differences in the evaluation obtained from LEK, *C. sapidus* was ranked as a species with high level of invasiveness in all the assessment areas.
The integration of these two approaches will be useful for an advanced resolution of the ecological and socio-economical complexity of the impacts of *C. sapidus* in the Mediterranean Sea.

PCSI – Plastic Crime Scene Investigation. The Citizen Science Approach to Microplastic Monitoring

Raffaella Bullo (1) (2) (3)*, Silvia Bianchelli (1)(4)

(1) Dipartimento di Scienze della Vita e dell'Ambiente - Università Politecnica delle Marche, Via Brecce Bianche, 60131 Ancona.

(2) Dipartimento Conservazione Animali Marini e Public Engagement, Stazione Zoologica Anton Dohrn, via Gregorio Allegri 1,00189 Roma.

(3) CIRCE srl, Vie dei Coronari 155, 00186 Roma

(4) National Biodiversity Future Center, Palermo.

* e-mail corresponding author: r.bullo@pm.univpm.it

ABSTRACT

Plastic pollution in oceans has gained public attention thanks to scientific knowledge advancement and media coverage. While society is becoming aware, the focus prevails mainly on macroplastics. Public awareness of microplastic pollution remains low. Recent studies have shown that visually demonstrating the extent of pollution could increase public knowledge and influence risk perception. "PCSI—Plastic Crime Scene Investigation" is dedicated to assessing a methodology for the quality-quantitative analysis of microplastics in seawater surfaces and beaches through a Citizen Science approach. It engages civil society in scientific research and offers a robust data set that can be compared with that of other scientific and governance bodies. To make the sea-surface activities inclusive, a prototype called *Kythara* was developed and calibrated against the Manta Trawl Net, the device used in the MSFD protocols. *Kythara* was applied to assess the microplastic presence in 6 areas along the Roman coast, 3 protected and 3 unprotected areas. A communication plan was developed to involve citizens, local administrations, and stakeholders to create a local network. The project demonstrated that Citizen Science can be effective in collecting solid scientific data, raising social awareness of scientific themes, and involving all segments of society in tackling environmental challenges.

Citizen science for river biomonitoring: a new approach for implementing traditional monitoring

Alessandro Lagrotteria [1*], Samuele Roccatello [2], Cristina Scalvini [2], Chiara Andrà [2], Alberto Doretto [2,3]

1. Department of Life Sciences and Systems Biology, University of Turin, Via Accademia Albertina 13, 10123 Torino, Italy

2. Department for the Sustainable Development and Ecological Transition, University of Eastern Piedmont, Piazza S. Eusebio 5, 13100 Vercelli, Italy

3. ALPSTREAM - Alpine Stream Research Center, 12030 Ostana, Italy

* email corresponding author: lagrotterialessandro@live.it

ABSTRACT

Citizen Science is increasingly utilized for environmental monitoring and educational purposes. For lotic ecosystems, this approach could be used for implementing those obtained with traditional methods and gaining even more data on local biodiversity. An interdisciplinary study, conducted from January to June 2024 in Piedmont (Northwestern Italy), was carried out to implement data on stream macroinvertebrates collected by the Regional Agency for the Protection of the Environment (ARPA) with those obtained by citizen scientists. Benthic macroinvertebrates were collected using a Surber net by researchers from almost 10 sampling stations situated in the lowland sections of rivers and agricultural ditches. Volunteers, mostly with a non-science background, identified organisms using simplified dichotomous keys specially developed for this study. Based on the data collected, several biodiversity and biomonitoring indices were calculated by citizen scientists. Preliminary results highlight significant differences in the taxonomy composition of macroinvertebrate communities between ARPA and Citizen Science sites, with only some shared taxa. Local richness (α diversity) showed minimal variation, but substantial differences were observed in β- and γ diversity. These findings underscore the importance of Citizen Science raising awareness of environmental issues but also for river monitoring and data collection in support of conventional methods.

Monitoring Riparian Vegetation in Citizen Science

Bruna Gumiero [(1, 2)*], Marco Cossu[(2)], Francesco Di Grazia [(3)], Alessandra Casali [(2)], Cristian Di Stefano [(2)]

(1) Università di Bologna, Dipartimento di Chimica Industriale "Toso Montanari" via Gobetti 45, 40129 Bologna
(2) ISPRA The Italian National Institute for Environmental Protection and Research, Via Vitaliano Brancati, 48 - 00144 Roma
(3) DBCF, University of Siena DBFC via Aldo Moro, 2 53100 Siena

* email corresponding author: bruna.gumiero@unibo.it *www.osservatoriocitizenscience.org*

ABSTRACT

The literature emphasizes the vital role of native riparian vegetation in maintaining healthy river ecosystems, offering essential services like habitat provision, food sources, and flood control. However, citizens often overlook the importance of riparian vegetation, viewing it as hazardous or unsightly. To address this gap, a methodology called "RiVe" has been developed for Citizen Science activities. RiVe aims to empower individuals from all backgrounds to assess riparian forest quality through user-friendly techniques. This methodology involves monitoring vegetation structures and observing twelve target species, serving as indicators of habitat health. The process includes training citizen scientists, collecting data on riparian vegetation, and analysing the collected information. By incorporating both environmental monitoring and social dimensions like awareness and education, RiVe seeks to advance scientific understanding of riparian vegetation's functions in society. Ultimately, the analysis of collected data will provide insights into riparian habitat health and human impacts, contributing to informed conservation efforts. Finally, the RiVe method can be usefully integrated into remote sensing analyses. The results of an integrated analysis between RiVe and the QBR-GIS Index which uses remote data will be presented.

Sessione Speciale 9
Science outreach and citizen science

Chair: Domenico D'Alelio, Daniele Paganelli

POSTER

Monitoraggio dei macroinvertebrati fatto dai cittadini (progetto CS4rivers)

Chiara Vitillo (1)*, Bruna Gumiero (1,2), Francesco Di Grazia(1), Alessio Polvani(1), Cristina Capineri (1), Steven Loiselle (1), Fabrizio Monaci(1), Stefano Loppi(1)

(1) *Department of Life Sciences, University of Siena, NBFC, National Biodiversity Future Center, Palermo 90133, Italy*

(2) *University of Bologna, Dept of Industrial chemistry "Toso Montanari" via Gobetti 45, 40129 Bologna, Italy*

* email corresponding author: vitillo2@student.unisi.it

ABSTRACT

In the framework of the CS4rivers project, a participatory monitoring project for assessing habitat quality and biodiversity of riverine ecosystems, a new simplified method for monitoring freshwater quality using macroinvertebrates is under development. The methodology is called IBS (Simplified Biotic Index), being a simplified version of the well-known IBE (Extended Biotic Index). The latter is based on a double entry matrix, in the rows the groups with decreasing sensitivity, in the columns the total number of taxa. In IBS protocol citizens are trained by experts to identify different sensitive groups. Regarding the identification of the total number of taxa, a collaboration is created between citizens and experts through the exchange of photos following a specific protocol. For the first two years, a full data check by experts is planned to verify the data quality collected by citizens, and hence both the validity of the method and its feasibility. A pilot study involving students and 4 groups of citizens is ongoing from September 2023 at 7 sites along the basin of the river Idice. At the same time, monitoring by citizens started in May 2024 in 13 stations in the Ombrone river basin.

Open-source CTD with Enhanced Accessibility and Novel Pulse-Amplitude Modulated Fluorescence Sensor for Oceanographic Research: OCEAN-PULSE project

Elisabetta Canuti (1)*

(1) European Commission, Joint Research Centre, Ispra, Italy

* email corresponding author: elisabetta.canuti@ec.europa.eu

Abstract

Understanding and monitoring the physical and chemical properties of the oceans is of key scientific importance. Factors such as temperature, salinity, and depth (CTD) provide insights into ocean circulation, heat storage, and the distribution of marine life. Additionally, the assessment of primary productivity and of phytoplankton, which can be assessed through PAM (Pulse-Amplitude Modulated) fluorescence measurements, are fundamental in comprehending the global carbon cycle
and the health of the marine ecosystems. In this context, the aim of the Open-source CTD with Enhanced Accessibility and Novel Pulse-Amplitude Modulated Fluorescence Sensor for Oceanographic Research, OCEAN-PULSE, is the development of an open source CTD with integrated PAM, thus providing significant advantages with respect of traditional CTD instruments equipped with these sensors. Commercial CTDs are often prohibitively expensive. By democratizing access through open-source design, OCEAN-PULSE enables global participation in ocean studies,
aligning with UN Sustainable Development Goals and EU policies. The project's core objectives include sharing detailed plans for constructing the open CTD, creating a low-cost instrument using off-the-shelf components, and integrating PAM sensors for enhanced research capabilities. Additionally, OCEAN-PULSE will be compared with commercial counterparts in field campaigns, validating its efficacy in real-world settings. Expected outcomes include open-source hardware and software and cost-effective instrumentation.

Sessione Regolare

Chair: Alessandro Bellino

PRESENTAZIONI ORALI

Hydrolytic enzymes fingerprints in surface and deep-sea prokaryotic communities in the Ross Sea (Southern Ocean)

Rita Varchetta (1,2,3)*, Elisa Banchi (2,3), Alessandro Vezzi (4), Donata Canu (2,3), Mauro Celussi (2,3)

(1) Department of Earth and Marine sciences, University of Palermo, Via Archirafi 22 90123, Palermo, Italy
(2) NBFC (National Biodiversity Future Center,Palermo, Italy) Piazza Marina 61 90133 Palermo, Italy
(3) National Institute of Oceanography and Applied Geophysics—OGS, Trieste, Italy
(4) University of Padua, Via U. Bassi 58/B, 35131 Padua, Italy

* email corresponding author: rvarchetta@ogs.it

ABSTRACT

The Ross Sea is characterized by a significant export of particulate organic carbon (POC) to the deep-water layers, reaching up to 50% of surface primary production. This phenomenon is dependent on mineralization processes performed by prokaryotic communities through a complex set of hydrolytic enzymes.

In this study, we used a metagenomic approach to explore the genetic repertoire of free-living and total prokaryotic communities living in the surface and in the deep-water masses of the Ross Sea. We focused on the genes involved in the production of exoenzymes such as glycosyl hydrolases (GH), proteases and lipases.

The samples were collected during the XXXII Italian expedition to Antarctica, in three stations along a coast-offshore transect, in surface and bottom (from 550 to 1065 m depth) layers. Then, the DNA samples were collected for metagenomic analysis in unfiltered (total) and 1-µm-filtered (free living microbes) water.

Our results indicate that deep-sea microbes in this environment harbour the potential to quickly exploit the pulses of a broad spectrum of organic substrates carried to the mesopelagic by the intense export flux of primary production. In progress analyses will further shed light on the preferred foraging strategies by free-living and particle-attached prokaryotes.

Assessing Chemical Contamination of Adriatic Sea (Eastern Mediterranean Sea) Using Zooplankton as Bioindicator Organisms

Ginevra Boldrocchi (1,2)*, Benedetta Villa (1,2), Carlotta Santolini (1), Damiano Monticelli (3), Cristina Corti (3), Gilberto Binda (3,4), Maristella Mastore (5), Giulio Magni (2), Jan Pachner (2), Giulia Liguori (2), Angelica Zanoletti (6), Roberta Bettinetti (1)

1 Department of Human Sciences, Innovation and Territory, University of Insubria, Via Valleggio 11, Como, Italy
2 One Ocean Foundation, Via Gesù 10, 20121 Milan, Italy
3 Department of Science and High Technology, University of Insubria, Via Valleggio 11, Como, Italy
4 Norwegian Institute for Water Research (NIVA), Økernveien 94, 0579 Oslo, Norway
5 Department of Theoretical and Applied Sciences, University of Insubria, 21100 Varese, Italy
6 Fondazione Centro Velico Caprera E.T.S., Via Cornelio Tacito 6, 20137 Milan, Italy
*Corresponding author: ginevra.boldrocchi@uninsubria.it,

ABSTRACT

The Adriatic Sea is considered particularly vulnerable to marine pollution due to its riverine inputs and human activities. Despite zooplankton has been intensively used as bioindicators of pollution worldwide, this basin still presents limited available information on the ecotoxicology of these organisms. Therefore, in this study, the levels of PCBs, DDT and 15 trace elements (TEs) have been measured in zooplankton from 46 locations from the Adriatic Sea. PCBs and DDT showed a mean of 31.1 ± 29.6 ng g^{-1} dw and 3.1 ± 2.7 ng g^{-1} dw respectively. While both contaminants have decreased since the 1970s, few hotspots of PCB contamination have been identified in the central-eastern Adriatic. With regards to DDT, most samples were below 5 ng g^{-1} dw suggesting a low contamination.
Data on TEs pointed out some hotspots, with the highest Metal Pollution Index values detected in the Gulf of Venice (Co, Ni, Cu, Pb, Cr), Tremiti (Co, Ni, Hg, Pb, Cr), Lastovo Island (Cu, Zn, As, Se, Cd), Taranto (Ni, Zn, Hg, Cr), and offshore Corfu Island (Co, Ni, Cu, Zn, Pb, Cr). Mercury, Cd and Pb levels have decreased in the last 40 years and most of TE levels (besides Cu) are lower than renowned worldwide contaminated areas. Overall, the levels of pollution found in the Adriatic zooplankton suggest a general improvement of the marine ecosystem.

Zooplankton taxa repository of DDT_{tot} and sumPCB_{14}: Seasonal and decadal variations in Lake Maggiore

Roberta Piscia (1)*, Marina Manca (1), Rossana Caroni (2), Piero Guilizzoni (1), Roberta Bettinetti (3)

(1) Water Research Institute, National Research Council, Largo Tonolli 50, 28922 Verbania, Italy
(2) Institute for Electromagnetic Sensing of the Environment, National Research Council, Via Bassini, 15, 20133 Milano, Italy
(3) Department of Human Sciences, Innovation for the Territory, University of Insubria, Via Valleggio 11, Como, Italy

* email corresponding author: roberta.piscia@cnr.it

ABSTRACT

Persistent organic pollutants (DDTs and PCBs) were analysed in the pelagic zooplankton organisms preyed by fish (size fraction ≥ 450µm) since 2009, in the framework of the monitoring program in Lake Maggiore. We evaluated taxa specific repositories of DDT_{tot} and sumPCB_{14} (14 congeners), their seasonal variation, their changes over the period 2009–2021 and the potential contribution of different taxa in transferring toxicants to whitefish, based on the Ivlev's Electivity Index. The repository of both POPs was generally higher in spring. We detected a decrease in the zooplankton DDT_{tot} repository over the last six years driven by a decline of Standing Stock Biomass, while for sumPCB_{14} repository the difference with the previous period was not significant. *Daphnia* and cyclopoids have been the major contributors to the repository. However, when the whitefish selectivity index was applied, the role of carnivorous *Bythotrephes* resulted more important to the detriment of cyclopoids, particularly in summer and winter. Our results are important for the elaboration of predictive models on the transfer of POPs along the food chain, highlighting not only the importance of freshwater zooplankton in *toto*, but also that different taxa can have different roles.

Sessione Regolare

Chair: Alessandro Bellino

POSTER

Exploring benthic diatom diversity in a high-altitude lake

Francesca Ciutti (1)*, Saúl Blanco (2), Ulrike Obertegger (3), Marco Bertoli (4), Elisabetta Pizzul (4), Paolo Pastorino (5), Marino Prearo (5), Cristina Cappelletti (1)

(1) Fondazione Edmund Mach, Technology Transfer Center, Via Edmund Mach 1, 38098 San Michele all'Adige (TN), Italy
(2) Universidad de León, Departamento de Biodiversidad y Gestión Ambiental,Facultad de Ciencias Biológicas y Ambientales, Campus de Vegazana s/n,24071 León, Spain
(3) Fondazione Edmund Mach, Research and Innovation Centre, Via Edmund Mach 1, 38098 San Michele all'Adige (TN), Italy
(4) Department of Life Sciences, University of Trieste, Via L. Giorgieri 10, 34127 Trieste, Italy
(5) Istituto Zooprofilattico Sperimentale del Piemonte, Liguria e Valle d'Aosta, Via Bologna 148, 10154 Torino, Italy

* email corresponding author: francesca.ciutti@fmach.it

ABSTRACT

High-altitude lakes have been studied intensively over the last decades as they are considered excellent sentinels of environmental change. Upper Lake Balma (altitude: 2212 m a.s.l.; surface area: 0.82 ha; maximum depth: 2.77 m) has been recently investigated for some biological units (fish and invertebrates), trophic conditions (nutrient concentrations) and microplastic occurrence. Here, we studied benthic algae, namely diatoms, in seven littoral areas of different periods. Preliminary result of the morphological analysis revealed the presence of 120 taxa, belonging to 9 orders, 21 families and 37 genera. The genera with a higher number of species were *Eunotia* (16 species), *Psammothidium* (14), and *Pinnularia* (8). *Fragilaria* cf. *nanana* Lange-Bertalot is the dominant species in all samples (max 81% of relative abundance). Some taxa need an in-depth study, as they may refer to new species. (i.e. small Araphids; *Geissleria* sp., *Adlafia* sp., *Humidophila* sp.).
High-throughput sequencing (rbcl gene; Diat.barcode, version 10 database) revealed 618 amplicon sequencing variants (ASVs). Of these ASVs, only 16 species were found both with microscopy and sequencing, and 41 species were specific for sequencing. With sequencing, many ASVs were not assigned to species level.

Spanning the gap between autotrophs and cryoconite holes: a morphological approach reveals the diversity of microalgae and Cyanobacteria in Northern Victoria Land, Antarctica

Flavia Dory (1)*, Veronica Nava (1), Linda Nedbalovà (2), Morena Spreafico (1), Valentina Soler (1), and Barbara Leoni (1)*

(1) University of Milano-Bicocca, Department of Earth and Environmental Sciences, Piazza della Scienza 1, Milan, Italy.
(2) Charles University, Faculty of Science, Department of Ecology, Viničná 7, 128 44 Prague 2, Czech Republic.Affiliazione 2 (Università/Ente, indirizzo, CAP, città…)
(3) National Research Council of Italy, Institute of Polar Sciences, Via Cozzi 53, Milan, Italy

* email corresponding author: barbara.leoni@unimib.it and flavia.dory@unimib.it

ABSTRACT

The Antarctica continent carries the greatest diversity of lacustrine environments on the planet, including glaciers, and is one of the regions of the world most threatened by climate change. Among the microhabitats covering the glacier's surface, cryoconite holes are supraglacial depressions containing water and microbe-mineral aggregates. The autotrophic component of cryoconite plays a central role in the functioning of the cryoconite ecosystem, however, the knowledge of phototroph organisms in these glacial habitats remains largely incomplete. Given these gaps, we provided a highly comprehensive morphological description of the diversity of Cyanobacteria and microalgae taxa obtained from cryoconite holes sampled across different glacial locations in Northern Victoria Land, East Antarctica. Our study revealed that cryoconite holes encompass a remarkably high diversity of Cyanobacteria and microalgae in terms of taxonomy, biomass, and morphotypes. The results highlight the importance of photoautotrophs in playing a key role in the cryoconite ecosystem and suggest their potential to lower the ice albedo of Antarctic glaciers. This work paves the way for further research on the taxonomy of photoautotrophs in extreme environments.