



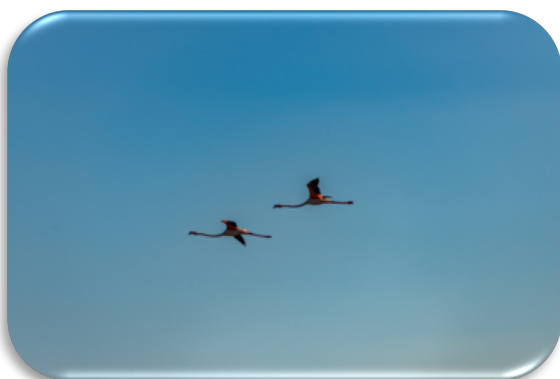
Fondazione  
di Sardegna



**A.I.O.L.**

ASSOCIAZIONE ITALIANA  
DI OCEANOLOGIA  
E LIMNOLOGIA

## XXIII Congresso Cagliari, 26-29 settembre, 2017



Con il patrocinio di:



## Programma generale del Congresso

MARTEDI'		MERCOLEDI'		GIOVEDI'		VENERDI'	
26-set-17		27-set-17		28-set-17		29-set-17	
		09.30-10.15 INVITED: VENAIL	09.30-10.15 INVITED: D'ALELIO	09.30-10.15 INVITED: D'ALELIO	09.30-10.15 INVITED: LUNA		
		10.15-10.35 TALK 006	10.15-10.35 TALK 016	10.15-10.35 TALK 016	10.15-10.35 TALK 026		
		10.35-10.55 TALK 007	10.35-10.55 TALK 017	10.35-10.55 TALK 017	10.35-10.55 TALK 027		
		10.55-11.20 COFFEE BREAK 002	10.55-11.20 COFFEE BREAK 004	10.55-11.20 COFFEE BREAK 004	10.55-11.20 COFFEE BREAK 006		
		11.20-11.40 TALK 008	11.20-11.40 TALK 018	11.20-11.40 TALK 018	11.20-11.40 TALK 028		
		11.40-12.00 TALK 009	11.40-12.00 TALK 019	11.40-12.00 TALK 019	11.40-12.00 TALK 029		
		12.00-12.20 TALK 010	12.00-12.20 TALK 020	12.00-12.20 TALK 020	12.00-12.20 TALK 030		
		12.20-12.40 TALK 011	12.20-12.40 TALK 021	12.20-12.40 TALK 021	12.20-12.40 TALK 030		
		12.40-13.00 TALK 012	12.40-13.00 TALK 022	12.40-13.00 TALK 022	12.20-13.00 AWARDS & CLOSING		
13.00-14.30	REGISTRAZIONE	13.00-15.00 PAUSA PRANZO		13.00-15.00 PAUSA PRANZO			
14.30-15.00	OPENING	15.00-16.30 FORUM		15.00-16.40 FORUM			
15.00-15.40	INVITED: GONZALEZ	THE LEGACY OF AQUATIC SCIENCES (F. ALVISI)		THE FUTURE OF AIOL (PRESIDENT & COUNCIL)			
15.40-16.00	TALK 001	16.30-17.00 COFFEE BREAK 003		16.20-16.50 COFFEE BREAK 005			
16.00-16.20	TALK 002	17.00-17.20 TALK 013		16.40-17.00 TALK 023			
16.20-16.50	COFFEE BREAK 001	17.20-17.40 TALK 014		17.00-17.20 TALK 024			
16.50-17.10	TALK 003	17.40-18.00 TALK 015		17.20-17.40 TALK 025			
17.10-17.30	TALK 004	18.00-19.30 ASSEMBLEA SOCI		POSTER			
17.30-17.50	TALK 005	20.30 CENA SOCIALE					
17.50-18.30	POSTER						
18.30-19.30	ICEBRAKER						

## Martedì 26 settembre 2017

13.00-14.30 Registrazione

14.30-15.00 Saluti delle Autorità e Apertura dei Lavori

**15.00-15.40 Clara Ruiz Gonzalez - Connecting microbial communities: The dispersal of taxa as a major factor shaping aquatic bacterioplankton assemblages [I001]**

**15.40-16.00 Salmaso N., Boscaini A., Cerasino L.** - Disentangling cyanobacterial diversity in a large perialpine lake using high-throughput sequencing and culture dependent approaches [C001]

**16.00-16.20 Alvisi F., Fazi S., Cibic T., Relitti F., Del Negro P.** - Influence of the Po River mouths on the microbial community of the prodelta benthic environment [C002]

16.20-16.50 Pausa Caffè

**16.50-17.10 Callieri C., Di Cesare A., Cabello Yeves P.J., Cristmas N., Salcher M., Sanchez-Baracaldo P.** - The genome of a freshwater planktonic *Synechococcus* strain reveals the potentiality to fix nitrogen [C003]

**17.10-17.30 Cardini U., Van Hoytema N., Bednarz V.N., Al-Rshaidat M.M.D., Wild C.** - Biological nitrogen fixation in the invasive seagrass *Halophila stipulacea* [C004]

**17.30-17.50 Bolinesi F., Arienzo M., Donadio C., Ferrara L., Trifuoggi M., Passarelli A., Saggiomo M., Stanislao C., Mangoni O.** - Temporal pattern of the phytoplankton community for assessing the trophic status of the coastal ecosystems (Gulf of Pozzuoli, Campania - Italy) [C005]

17.50-19.30 Poster & Aperitivo di benvenuto

## Mercoledì 27 settembre 2017

**09.30-10.15 Patrick Venail - Current state of freshwater phytoplankton diversity and ecosystem functioning research [I002]**

**10.15-10.35 Olita A., Capet A., Drago A., Gauci A., Sorgente R., Ribotti A., Sparnocchia S., Ruiz S., Pascua A.** - The use of sea gliders to study the sub-mesoscale phytoplankton biomass distribution and primary production in Mediterranean Sea [C006]

**10.35-10.55 Pulina S., Satta C.T., Padedda B.M., Sechi N., Lugliè A.** - Seasonal variations of phytoplankton size classes in relation to environmental variables in three Mediterranean coastal lagoons [C007]

10.55-11.20 Pausa Caffè

**11.20-11.40 Ricchi A., Falcieri F.M., Bonaldo D., Benetazzo A., Sclavo M., Barbariol F., Bonaldo D., Russo A., Coluccelli A., Carniel S.** - Modellizzare correttamente le aree di transizione per capire le dinamiche: l'esempio del sistema COAWST [C008]

**11.40-12.00 Sabatini A., Frau G., Palmas F., Solari P., Cogoni A., De Agostini A., Marignani M., Moccia D., Cau Al., Pusceddu A.** - Impacts of a not-indigenous invasive species (*Procambarus clarkii* Girard, 1852) on the ecological attributes of a managed saltmarsh (Stagno di Molentargius, Sardinia) [C009]

**12.00-12.20 Coluccia E., Deidda F., Lobina C., Deiana A.M., Salvadori S.** - Cytogenetic features of the invasive crayfish *Procambarus clarkii* (GIRARD, 1852) and comparison with other crustacean decapods [C010]

**12.20-12.40 Palmas F., Addis P., Sorgente R., Sabatini A., Olita A.** - Modelling the dispersal of red shrimp larvae from Sardinian seas: density and connectivity patterns [C011]

**12.40-13.00 Cau Al., Cannas R., Moccia D., Porcu C., Pusceddu A., Follesa M.C.** - Collaborative Fishery Research and short-term marine no-take areas boost resilience of European spiny lobsters to overfishing [C012]

13.00-15.00 Pausa Pranzo

15.00-16.30 Forum: The legacy of aquatic sciences (F. ALVISI)

16.30-17.00 Pausa Caffè

**17.00-17.20 Cuccu D., Mereu M., Agus B., Cannas R., Follesa M.C., Cau Al., Cau A.** - Sustainable management of Octopus fisheries in Sardinia [C013]

**17.20-17.40 Follesa M.C., Porcu C., Bellodi A., Cau Al., Mulas A., Marongiu M.F., Melis R., Cannas R.** - Evaluation of the status of demersal Chondrichthyan species in CW Mediterranean with focus on relatively rare species [C014]

**17.40-18.00 35 Pusceddu A., Cau Al., Moccia D., Mangoni O., Granata A., Guglielmo L.** - Particulate organic matter fluxes below the sea ice during pack ice melting (Tethys Bay, Ross Sea, Antarctica) [C015]

**18.00-19.30** Assemblea Soci

**20.30** Cena Sociale

### Giovedì 28 settembre 2017

**09.30-10.15** *Domenico D'Alelio* - Linking ecological to evolutionary processes in plankton observatory studies [I003]

**10.15-10.35** *Boggio E., Piscia R., Bettinetti R., Mazzoni M., Manca M.* - C and N isotopic signatures of zooplankton taxa in five small subalpine lakes along a trophic gradient [C016]

**10.35-10.55** *Spicciarelli R., Marchetto A.* - Limnological studies of Monticchio lakes (southern Italy): a historical overview [C017]

**10.55-11.20** Pausa Caffè

**11.20-11.40** *Marchetto A., Sforzi T.* - Do we need to identify diatoms to the species level for assessing lake biological quality? [C018]

**11.40-12.00** *Sabatini A., Podda C., Frau G., Serra M., Musu A., Cani V., Palmas F.* - Human-induced range contraction of endangered native freshwater fishes of Sardinia (Italy) [C019]

**12.00-12.20** *Orrù F., Borghero C., Buscarinu P.* - Fish communities in Sardinian artificial lakes: a first overview [C020]

**12.20-12.40** *Langone L., Lopes da Rocha M., Miserocchi S., Giordano P., Pellegrini C., Tesi T., Guerra R.* - Particle transfer along the modern mud-wedge of the Adriatic Sea by down-core sediment-bound metal distributions [C021]

**12.40-13.00** *Miserocchi S., Langone L., D'angelo A., Del Bianco F., Giglio F., Tesi T., Aliani S.* - Modern sediment distribution and composition within the Kongsfjorden, Svalbard Archipelago [C022]

**13.00-15.00** Pausa Pranzo

**15.00-16.40** Forum: The future of AIOL (Presidente & Consiglio)

**16.40-17.00** *Piredda R., Gaonkar C.C., Mordret S., Pargana K., Tomasino M.P., Montresor M., Kooistra W.H.C.F., Sarno D., Zingone A.* - Metabarcoding: a magnifier for protist studies in the sea [C023]

**17.00-17.20** *Kralj M., Čermelj B., Celio M., Lipizer M., Francé J., Mozetič P., Brunetti F., Giani M.* - Hypoxia in the gulf of Trieste: recent events and long term evolution [C024]

**17.20-17.40** *Copetti D., Salemo F., Valsecchi L., Viviano G., Buzzi F., Agostinelli C., Formenti R., Marieri A., Tartani G.* - Trend of phosphorus loads in Lake Pusiano in the period 1960-2015. Insights for the management of lake environments [C025]

**17.40-18.30** Poster

### Venerdì 29 settembre 2017

**09.30-10.15** *Gian Marco Luna* - Viruses in the dark, deep ocean [I004]

**10.15-10.35** *Brundu G., Farina S., Domenici P.* - Comparing the locomotory behavior of the wild and laboratory reared juvenile sea urchins (*Paracentrotus lividus* Lamark 1816) [C026]

**10.35-10.55** *Loi B., Guala I., Pires da Silva R., Brundu G., Baroli M., Farina S.* - Sea urchin fishery shifts potential reproductive contribution of population onto the shoulders of the young adults [C027]

**10.55-11.20** Pausa Caffè

**11.20-11.40** *Moccia D., Cau Al., Alvito A., Canese S., Cannas R., Follesa M.C.* - New extension and vulnerability of the "Sardinian Cold Water Coral province" [C028]

**11.40-12.00** *Carugati L., Lo Martire M., Gambi C., Danovaro R.* - Restoration of seagrass meadows in the Adriatic Sea [C029]

**12.00-12.20** *Cau Al., Alvito A., Moccia D., Canese S., Pusceddu A., Cannas R., Angiolillo M., Follesa M.C.* - Submarine canyons along the upper Sardinian slope (Central Western Mediterranean) as repositories for derelict fishing gears [C030]

**12.20-13.00** Consegna Premi e chiusura dei lavori

## Invited Speakers

**Clara Ruiz-González**, *Institut de Ciències del Mar (ICM-CSIC), Barcelona, Spain*

### **Connecting microbial communities: The dispersal of taxa as a major factor shaping aquatic bacterioplankton assemblages [I001]**

Bacteria are major players in marine and inland waters, but how variations in taxonomic composition impact their role in ecosystems remains unclear. This is partly because bacterial communities harbour thousands of taxa with very different lifestyles, persistence and dispersal capacities. Although the advent of sequencing technologies has fostered our understanding of the processes and factors shaping bacterial assemblages, there are still limitations among microbial ecology studies: e.g., most research is ecosystem-specific, neglecting the dispersal of microbes across different habitats or local communities. During the past years we have explored the biogeography of bacteria considering this potential connectivity among communities, unveiling a major role of microbial dispersal in fresh- and marine waters: we have shown that boreal lakes and rivers are strongly influenced by the transport of taxa from the surrounding terrestrial landscape, and that deep ocean communities seem largely structured by the sinking of surface microbes attached to particles. In addition, by modeling the spatial distribution of individual bacterial taxa, we have identified specific behaviors within aquatic prokaryotes, which can in turn be used to understand underlying processes linked to local selection or passive dispersal, or how environmental fluctuations regulate the relative abundances of generalist and specialist taxa across communities.



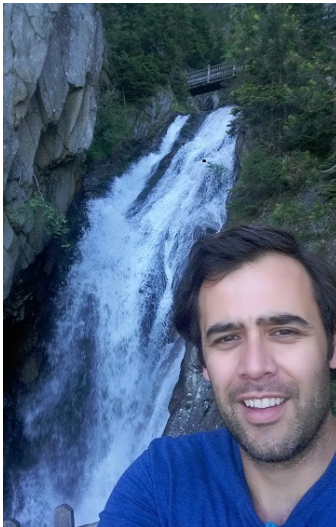
I am interested in understanding the links between bacterial diversity and function in aquatic ecosystems, as well as their implications for biogeochemical processes. During my scientific career I have tried to address questions related with this issue through different methods and approaches, such as single-cell techniques or Illumina sequencing, and working in ecosystems as different as rivers, wetlands, lakes, soils, estuaries and the ocean. I did my PhD at the Institut de Ciències del Mar (ICM-CSIC) in Barcelona (Spain, 2006-2011) under the supervision of Dr. J.M. Gasol and R. Simó, during which I applied tools and knowledge from the fields of microbial ecology, photobiology, and biogeochemistry to understand the role of solar radiation as a regulator of the uptake of organic carbon by marine bacterioplankton communities. The use of culture-independent techniques for studying the cell specific uptake of radiotracers by different microbial groups (e.g. MAR-CAR-FISH, flow cytometry cell sorting) allowed me to explore these interactions within

complex microbial communities in marine waters. During my postdoctoral experience, I moved my focus to freshwater bacterial communities, first at the University of Girona (Spain, 2011-2012) exploring the effects of dams on riverine bacteria, and during ca. three years across complex boreal aquatic networks from Quebec, as part of a project lead by Dr. Paul del Giorgio at the Université du Québec à Montréal (Canada, 2013-2015). There, the interpretation of high throughput sequencing data from a metacommunity perspective allowed me to better understand the mechanisms shaping the bacterial assemblages inhabiting heterogeneous landscapes where local microbial communities are linked by the movement of water in the landscape.

**Patrick Venail**, Ph.D., Dept. F.A. Forel, University of Geneva, Switzerland

### **Current state of freshwater phytoplankton diversity and ecosystem functioning research [I002]**

Freshwater biodiversity is under major threat by human driven activities. Despite being one of the most vulnerable ecosystems, we have little knowledge on the consequences of diversity loss in freshwater lotic systems. We performed a review of the existing literature linking phytoplankton diversity to ecosystem functioning in freshwater lakes and ponds. We found 23 studies including a total of 109 experiments that directly manipulated any aspect of phytoplankton diversity and measured its influence on ecosystem functioning. Taxonomy based metrics of diversity were by far dominant, accounting for 88% of the experiments manipulating phytoplankton diversity. Our revision revealed a plethora of ecosystem functions such as chlorophyll-a, biovolume, biomass and resource use efficiency on which the influence of diversity has been tested. Overall, half of the relationships between phytoplankton diversity and ecosystem functioning are linear positive and about another quarter are non-linear positive. Negative or complex impacts of phytoplankton diversity on ecosystem functioning accounted for 4% of the results only. Finally, no effect of diversity was observed in 23% of the experiments. Our results reveal that while not universal, losing phytoplankton diversity in freshwater lotic systems is detrimental for their overall functioning. More studies based on other measures of diversity such as functional or genetic diversity are urgently required to get a better picture of the importance of phytoplankton diversity on the functioning of freshwater lotic ecosystems.



He got his master's degree in Biodiversity, Evolution and Environment at the Université de Montpellier II (France) in 2006 and his PhD on Ecology and Evolution from the same institution in 2010. In 2011 the French Society of Ecology awarded him as the best young ecology researcher after his publication in *Nature* about testing the influence of dispersal on the diversity and functioning of experimental metacommunities. From 2010 to 2013 he worked as post-doc fellow, first at the Universidad de los Andes in Bogota (Colombia) and later at the School of Natural Resources and the Environment at the University of Michigan (USA) where he started using phytoplankton as an experimental model system. Since April 2013 he is a Senior Research and Teaching Assistant at the University of Geneva (Switzerland) in the Microbial Ecology group. His research focuses on understanding the diversity of life (biodiversity). His interests are at the interface between microbiology, ecology and evolution. Working with microorganisms (e.g., bacteria, microscopic algae) allows him exploring both ecological and evolutionary processes simultaneously. He has two major research axes. First, to explore the fundamentals of the diversification process and how the emerging diversity organizes into communities. Second, to evaluate and understand how changes in biological diversity influence the

functioning of ecological systems and the provisioning of ecosystem functions and services. To explore those topics, he has worked with a variety of organisms, both prokaryotic and eukaryotic, from terrestrial, marine and freshwater ecosystems. He has mostly worked under controlled laboratory conditions but has recently been involved in several fieldwork studies in Russia and Ecuador. Currently he is focused in lake systems and their provisioning of ecosystem services and into understanding the link between phytoplankton diversity and water quality.



**Domenico D'Alelio**, Dept. of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, Napoli, Italy

### **Linking ecological to evolutionary processes in plankton observatory studies [I003]**

The shape of ecological communities is the cumulative outcome of multifaceted and intersecting evolutionary progressions occurring at species level. Species evolve in consequence of contingent factors plus the relationships they establish with the environment and other co-occurring species. Reconstructing the history behind community assembly by explicitly considering species evolution and interactions is thus an essential step to fully comprehending the most intrinsic characteristics of communities and envisioning their adaptation to environmental changes. Such 'evolutionary ecology' approach is particularly suitable for studying plankton, a community of both rapidly evolving and strongly interconnected species. In this context, in situ observatories, i.e., relatively small geographic regions inspected with a Long Term Ecological Research approach, are among the best case studies. By means of LTER observation, reductionist and holistic approaches congregate, providing us with a synergistic perspective in the understanding of nature at different levels of complexity. In this paper, I report on such studies, which take advantage of diverse methodological approaches, unified by modeling and network science. The aim of my overview is documenting, discussing and integrating conceptually the main links between: i) species evolutionary history and biological features; ii) species life history and dynamics; iii) species interactions and community organization; and, ultimately, iv) community assembly and ecosystem functioning.



He got his master's degree cum laude in environmental sciences with specialization in oceanography at Parthenope Università di Napoli (Italy) on 2003 and his PhD degree in phytoplankton biology at Stazione Zoologica Anton Dohrn Napoli (Italy) on 2008. During his PhD studentship, he co-coordinated a work package of the European Commission Project SEED focusing on the ecology of Harmful Algal Blooms. On 2008-2009, he moved to Seconda Università di Napoli (Caserta, Italy), doing both academic lecturing on marine biology and scientific research on the ecology of benthic microcommunities thanks to an individual grant given by Accademia Nazionale dei Lincei (Rome, Italy). Between 2009 and 2012, he worked as a post-doc at Fondazione Edmund Mach (S. Michele all'Adige, Trento, Italy) and contributed in establishing a research line on the molecular ecology of freshwater harmful cyanobacteria in the frame of the ACE-SAP Project funded by the Province

of Trento. On 2013, he moved back to Stazione Zoologica, where he still works being part of the local team of the Italian Flagship Project Ritmare, with the main goal of integrating biological complexity within marine biogeochemical models by pursuing an end-to-end ecosystem perspective. The main scientific interest of Domenico D'Alelio is studying plankton ecology by explicitly considering the evolutionary histories of species and the interactions between them. In his career, he authored twenty peer-reviewed articles dealing with organismal biology, demography, community assembly and systems ecology and coordinated publications falling into fairly different methodological fields, from microbiology and molecular biology to statistics and modelling. In the very last years, he started applying network methods to plankton studies pertaining both ecological and evolutionary domains. The Gulf of Naples is the main case study to this respect, but he is also extending the above-mentioned approach to other systems (e.g., the Lagune of Venice). The main scientific achievements of Domenico D'Alelio are i) revealing supply-side ecological factors affecting population dynamics of phytoplankton lacking resting stages; ii) revealing alternative modes of population evolution in phytoplankton comparable to those present in pathogens; iii) quantifying the impact of plankton trophic-diversity on ecosystem functioning. Domenico D'Alelio is member of the Presidential Council of AIOL (2015-2017) and of the Science Communication working group of the Long Term Ecological Research Network in Italy. He is member of the Association for the Studies of Limnology and Oceanography (ASLO) since ten years. He is also a science communicator, writer and performer, with the main achievements being i) leading the organization of LTER Italy science bike-tours since 2015 and ii) being awarded of the ASLO Global Outreach Initiative 2016.

**Gian Marco Luna**, Istituto di Scienze Marine, CNR – ISMAR, Ancona (Italy)

### **Viruses in the dark, deep ocean [1004]**

Life in the largest ecosystem on the planet is dominated by microbes. In addition to cellular microbes, viruses constitute fundamental components of the deep sea biota, but the lack of viral isolates, coupled with the paucity of data on viral diversity, limits our knowledge about which viruses reside in the dark ocean, the phage/host interactions and the ecological role that viruses play. In this talk, I will summarize results of recent collaborative researches that investigated, by integrating culture-dependent and -independent approaches, the diversity, phage-host interaction and ecological role of deep-sea viruses. We assessed patterns in abundance and processes across the bathypelagic ocean, to demonstrate how important viruses are in the major pathways of carbon cycling. Also, we isolated and characterized the first phages from the deep sea, infecting one of the most abundant deep sea bacterium (*Alteromonas*), and mapped their genomes over a collection of oceanic viromes, to investigate their abundance across the ocean. Lastly, we produced a sequence dataset of 18 dsDNA viral-fraction bathypelagic metagenomes, to assess the diversity of populations, identify abundant and rare bathypelagic viruses, and make predictions of their hosts. Taken together, our results shed light on one of the most common phage/host interaction in the deep sea, provide the first laboratory models to better understand mechanisms of viral infection, and serve as foundational knowledge to comprehend more fully the ecological role by viruses in the deep ocean.



Gian Marco Luna is Research Scientist at the CNR-ISMAR (since 2011). Education: Laurea (110/110) in Marine Biology and Oceanography (2001), University of Ancona. Scholarship (2004) at the Marine Biological Laboratory, Woods Hole, USA. PhD in Marine Biology and Ecology (2005), Polytechnic University of Marche (Italy). Post-doc in Marine Microbial Ecology (2005-2010), Polytechnic University of Marche (Italy). FIRB Junior Researcher (2010-2011). His research focuses on marine microbiology and microbial ecology in coastal and deep-sea ecosystems, with main focus on the biodiversity, biogeochemical and ecological role of marine microbes. He is interested in understanding how microbial diversity and function change in relation to the main physical, chemical and biological drivers, and to explore the potential of metagenomics to study marine microbial communities. Other research interests address the ecology and fate of pathogenic bacteria of fecal origin in aquatic ecosystems, including mechanisms of antibiotic resistance. He participated, sometimes as Research Unit responsible, to more than 20 national and International research projects. Participated, also as Chief Scientist, to several oceanographic cruises in the Mediterranean Sea, the Atlantic and the Arctic Ocean, onboard Italian and European research vessels. He has carried out field activities in several aquaculture sites in Italy, Greece, Spain and Israeli, and in highly polluted lagoons and estuaries. He has attended >50 national and international conferences and workshops, also as Invited Speaker. Referee for more than 30 journals in the fields of environmental microbiology and aquatic microbial ecology. Member of the Editorial Board of the Journal of Limnology, and Review Editor for the journals *Frontiers in Public Health*, *Frontiers in Environmental Science*, and *Frontiers in Marine Science*. Evaluator of scientific proposals for several European countries and for the US. He has co-authored 47 publications on ISI journals.



## Comunicazioni

### [C001] Disentangling cyanobacterial diversity in a large perialpine lake using high-throughput sequencing and culture dependent approaches

Salmaso N.<sup>1</sup>, Boscaini A.<sup>1</sup>, Cerasino L.<sup>1</sup>

<sup>1</sup>Research and Innovation Centre, Fondazione Edmund Mach (FEM), San Michele all'Adige, Italy

In phytoplankton, a correct identification of cyanobacteria is of paramount importance, due to the ability of these organisms to produce a great variety of toxic compounds. Traditionally, the study of phytoplankton and cyanobacterial diversity in aquatic ecosystems was typically based on the microscopic examination of specimens and on the adoption of classical culture-dependent approaches and molecular techniques. Nevertheless, owing to the limitations of the traditional approaches, the number of cyanobacterial taxa can be severely underestimated and, in the case of microscopic observations, the correct identification compromised by taxonomic ambiguities and lack of a suitable number of diacritical features. In this contribution, we will evaluate the use of high-throughput sequencing (HTS; Illumina MiSeq) as a tool for the study of cyanobacterial diversity in a large and deep lake south of the Alps (Lake Garda). The analyses, based on gene marker amplification metagenomics (16S rRNA gene) were carried out on monthly samples collected during a two-years sampling campaign. The most abundant operational taxonomic units (OTUs) coincided with the most abundant taxa identified using traditional microscopic and culture dependent approaches based on molecular and phylogenetic analyses (e.g. *Tychonema*, *Planktothrix*, *Dolichospermum*, *Microcystis*). On the other hand, HTS allowed further identification of many abundant small *Synechococcales* and *Chroococcales*, and other rare large *Nostocales* never identified so far with traditional approaches. The concurrent metabolomic analyses confirmed the production of anatoxins and microcystins by the most abundant toxigenic taxa. While HTS approaches enable increasing the knowledge of microbial diversity, their use in the evaluation of target groups is not free of difficulties due, among the others, to the short length of 16S rRNA sequences.

### [C002] Influence of the Po River mouths on the microbial community of the prodelta benthic environment

Alvisi F.<sup>1</sup>, Fazi S.<sup>2</sup>, Cibic T.<sup>3</sup>, Relitti F.<sup>3</sup>, Del Negro P.<sup>3</sup>

<sup>1</sup>Consiglio Nazionale delle Ricerche, Istituto di Scienze Marine - ISMAR; <sup>2</sup>Consiglio Nazionale delle Ricerche, Istituto di Ricerca sulle Acque - IRSA; <sup>3</sup>Istituto Nazionale di Oceanografia e di Geofisica Sperimentale - OGS

Within the framework of the CNR flagship project RITMARE, the Po Prodelta Observation Cruise (POPo2014) carried out on the R/V OGS Explora between 2-8 October 2014 was aimed, among other goals, to understand to what extent sedimentary dynamics affect the microbial benthic community. In this work we will report on: 1) identification of prodeltaic areas most influenced by the recent influx of organic and inorganic matter obtained by lithological observation and analyses of short-lived radioisotopes (<sup>7</sup>Be and <sup>137</sup>Cs); 2) evaluation of the most recent sedimentary supply impact on microbial communities through sedimentological (density, porosity, water content, grain-size and lithology) and geochemical (TOC,  $\delta^{13}\text{C}$ , C/N) characterization, as well as 3) analysis of microbial community composition (CARD-FISH) in superficial (top 0-2cm) and sub-superficial (the underlying 2 cm) sediment layers. Inshore stations, in front of the main river mouths, showed a sedimentary record characterized by a sequence of 2-5 cm thick fine organic-rich dark graded sediment layers, topped by a thin oxidized surface layer, and maximum accumulation of recent riverine material. Shallower stations located among the main river mouths showed higher concentrations of sand. Offshore stations were characterized by a finer and homogeneous sedimentary record and a thicker oxidized surface layer. Microbial communities showed the highest abundance in front of the main river mouth (Busa Dritta). Differences between superficial and sub-superficial layers, both in term of bacterial abundance and percentage of specific bacterial clusters (e.g. *deltaproteobacteria*), were observed in sediments close to the river mouths whereas offshore sites did not show significant differences between the two layers. This suggest that deposition of fine organic-rich sediment in proximity of the river mouths could determine an increasing abundance of bacteria in surface sediments, as well as the occurrence of anoxic conditions in sub-surface layers resulting in a predominance of anaerobic metabolisms (e.g. sulfate-reducing *deltaproteobacteria*).

### [C003] The genome of a freshwater planktonic *Synechococcus* strain reveals the potentiality to fix nitrogen

Callieri C.<sup>1</sup>, Di Cesare A.<sup>1</sup>, J. Cabello Yeves P.<sup>2</sup>, Cristmas N.<sup>3</sup>, Salcher M.<sup>4</sup> Sanchez-Baracaldo P.<sup>3</sup>

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The non-heterocystous diazotrophic (N-fixing) unicellular cyanobacteria of small size have been recognized to be important in marine system and can contribute to the oceanic nitrogen fixation substantially. Certain *Synechococcus* strains showed nitrogenase activity only under anaerobic conditions, others are active also under microaerobic conditions, like the *Synechococcus* SF1, capable of photosynthesis and N fixation. The *Synechococcus* marine strains Miami BG43511 and BG43522 developed a kind of temporal regulation: N<sub>2</sub> fixation is performed during dark and photosynthesis during light. Nevertheless, there are no evidences of the existence of planktonic freshwater *Synechococcus* with the potentiality of N<sub>2</sub> fixation. We selected one *Synechococcus* strain isolated from a volcanic lake in central Italy, previously sequenced for the 16S DNA gene, we sequenced the entire genome focussing on the *nif*HDK operon genes. The presence of these genes indicate the potentiality to perform the nitrogen fixation. From the GC% content difference between the *nif* operon and the other genes it is possible to hypothesize a HGT for the gene acquisition. To evaluate if the genes could be active we carried out a laboratory experiment growing the strain in media with and without nitrogen and following its growth and RNA expression. *Synechococcus* LL was able to grow in both conditions but without fixing nitrogen, as *nif*HDK were not expressed. As the cultures without N bleached, losing their pigments, we hypothesize that *Synechococcus* could have used internal nitrogen reserve, instead of activating nitrogen fixation genes.

#### [C004] Biological nitrogen fixation in the invasive seagrass *Halophila stipulacea*

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The tropical seagrass *Halophila stipulacea* exhibits a limited capacity to use nitrate, but has a high uptake capacity and efficiency for ammonium. Consequently, N<sub>2</sub> fixation by associated prokaryotes (diazotrophs) may be important in providing ammonium needed for seagrass photosynthesis and growth. This association could provide a competitive advantage for *H. stipulacea* in relation to other seagrass species, but related knowledge is scarce. Here, we thus report measurements of net photosynthesis (O<sub>2</sub> fluxes) and N<sub>2</sub> fixation (acetylene reduction) associated with *H. stipulacea* from the Northern Red Sea over all four seasons of 2013. In parallel, we characterized the seagrass meadow areal extent, shoot and leaves density, and the leaf area index. Using this data, we quantified meadow net primary production and N<sub>2</sub> fixation and estimated the photo-metabolic N demand met by N<sub>2</sub> fixation at the community level. Results revealed a marked seasonality of meadow N<sub>2</sub> fixation, with rates ranging from 0.06 in winter to 4.60 mmol N m<sup>-2</sup> d<sup>-1</sup> in summer, i.e. an increase by two orders of magnitude. In summer, when dissolved nutrient concentrations in the water column were lowest and light intensity and temperature highest, there was a significant positive linear relationship between meadow net primary production and N<sub>2</sub> fixation, with the latter accounting for ca. 20 % of the photo-metabolic N demand. These findings suggest that N<sub>2</sub> fixation by associated diazotrophs can mitigate N limitation of *H. stipulacea* meadows under N scarcity. This trait may also favour the ongoing geographical expansion of *H. stipulacea*.

#### [C005] Temporal pattern of the phytoplankton community for assessing the trophic status of the coastal ecosystems (Gulf of Pozzuoli, Campania - Italy)

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The phytoplankton community responds quickly to environmental changes by varying biomass and functional diversity. This is the reason why phytoplankton observations are commonly used for the assessment of the health of marine ecosystems and trophic status in the context of the Descriptor 5 (Eutrophication) of the Marine Strategy Framework Directive (MSFD, 2008/56/EC). The Gulf of Pozzuoli (Campania, Italy) represents an area of high biodiversity. There, the submerged archeological park of Baia coexists with the former metallurgic plant of Bagnoli, which has been subjected to a strong industrial impact for about a century. The Gulf of Pozzuoli is affected by elevated anthropogenic loads which can have serious environmental impacts. Few studies have been conducted on this area to evaluate the temporal pattern of the phytoplankton community and its trophic status. Thus, we studied the distribution of the phytoplankton community in terms of the contributions of main phytoplankton functional groups. Sea water sampling started in May 2016 and ended in July 2017, along 5 transects positioned along a coastal-offshore alignment. The phytoplankton chemotaxonomic composition was correlated to salinity and nutrient concentration on different spatial and temporal scales. Pigment spectra of the phytoplankton community represent a valid approach for

the identification of an expedite and informative tool to assess water quality *sensu* MSFD. The study is part of a larger project for the environmental characterization of Gulf of Pozzuoli, including assays of heavy metals and polycyclic aromatic hydrocarbons and assessments of its ecotoxicological status.

**[C006] The use of sea gliders to study the sub-mesoscale phytoplankton biomass distribution and primary production in Mediterranean sea**

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Since 2013, the group of Oceanography of CNR-IAMC in Oristano is applying to the use of external facilities through the Trans-National Access program of two European projects (JERICO and JERICO-NEXT). This program allowed to access the use of sea gliders, equipped with bio-physical sensors, to investigate the spatial and temporal variability of biophysical parameters in areas of particular interest of the Mediterranean sea at the sub-mesoscale, with a special attention to algal biomass, primary production and their driving mechanisms. During the first experience in 2013 with the GABS proposal (Olita et al. 2014) for a research on the North Balearic Front area, the glider matched the onset of an early spring algal bloom across the front soon after a decrease in wind-driven turbulent convection and mixing (modeled). During the following FRIPP proposal in 2014 (Olita et al., 2017), bio-physical glider measurements in the Eastern Alboran Sea (AlborEx) allowed to observe the distribution of the deep chlorophyll maximum (DCM) across an intense density front. Here we applied a bio-optical model using PAR from Argo profiles collected simultaneously with glider data to estimate the primary production (PP). Integrated estimations of PP (1.3 g C m<sup>-2</sup>d<sup>-1</sup>) along the glider path are two to four times larger than those from satellite-based algorithms. In May-June 2017 we performed another long-lasting experiment (Glider-South proposal) sampling 3 times the transect between Malta and Tripoli, then showing its first promising results for this under-sampled Mediterranean area. Gliders, and more in general Autonomous Underwater Vehicles (AUV), showed their robustness and cost-effectiveness in sampling the sea at scales (and in marine conditions) sometimes prohibitive for ship-based samplings. Previous successful missions and new promising results suggest: 1) to plan other experiments/projects within the TNA programs of JERICO-NEXT and other EU projects; 2) to extend the already performed analyses (e.g. PP estimation) to a wider Mediterranean glider database.

**[C007] Seasonal variations of phytoplankton size classes in relation to environmental variables in three Mediterranean coastal lagoons**

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In this work we focused on the phytoplankton cell size structure in three eutrophic coastal lagoons (Calich, Santa Giusta and Corru S'Ittiri) located in the same geographic region (Sardinia, North Western Mediterranean Sea), but differing in geomorphology, catchment area, water temperature, water transparency, salinity and nutrient concentrations. Two cell size classes were considered: picophytoplankton (Pico, 0.2 - 2µm) and Utermöhl fraction of phytoplankton (UFP, > 2µm). The objectives of the study were to assess: i) which was the contribution of each cell size class to total phytoplankton abundance and biovolume, ii) how the phytoplankton abundance and biovolume of each cell size class responded to seasonal environmental variations, and iii) which environmental variables, among water temperature, water transparency, salinity, dissolved inorganic nitrogen, reactive phosphorus and reactive silica, affected significantly the seasonal dynamic of the two cell size classes (Redundancy Analysis). The major Pico contribution to total phytoplankton was in terms of density, with percentages > 70% in C. S'Ittiri and in S.Giusta (maximum in spring), and > 60% in Calich (maximum in winter). Instead, UTF dominated total phytoplankton biovolume. Maximum biovolume Pico contribution was observed in summer in Calich (0.25%) and S. Giusta (0.02%), and in autumn in C. S'Ittiri (0.05%). Temperature was the only one variable that positively influenced UTF and Pico abundance in all the site, but negatively UTF biovolume in Calich and S. Giusta. Salinity positively affected UTF and Pico abundance in Calich, and Pico abundance and biovolume in S. Giusta. UTF and Pico biovolume were negatively influenced by transparency and nutrients in C. S'Ittiri. Our results highlighted that, among the environmental variables investigated, temperature represented an important driver for both UTF and Pico. In contrast, salinity, transparency and nutrients were more important in relation to the cell size class and site considered.

# **[C008] Modellizzare correttamente le aree di transizione per capire le dinamiche: l'esempio del sistema COAWST**

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I crescenti impatti antropici e i cambiamenti climatici in atto rendono sempre più urgente lo studio delle acque interne (lacustri, lagunari o fluviali) e delle loro interazioni con l'ambiente limitrofo, con l'obiettivo di raggiungere una completa conoscenza degli ecosistemi marini e della fascia costiera. Gli strumenti di modellistica numerica applicati in ambito oceanografico hanno solitamente trascurato l'importanza delle acque interne e di transizione, descrivendole al loro solo parzialmente, come nel caso delle foci fluviali o di molte lagune costiere. In questo lavoro vengono descritte le potenzialità e alcune applicazioni del sistema modellistico COAWST (Coupled Ocean, Atmosphere, Wave and Sediment transport), un modello accoppiato stato dell'arte in grado di descrivere le dinamiche atmosferiche, oceaniche, ondose, di sedimenti, e biogeochimiche nelle aree di transizione. COAWST permette di descrivere in maniera consistente non solo i processi oceanici di mare aperto, ma anche le dinamiche costiere, incluse quelle fluviali e lagunari, con l'utilizzo di griglie annidate a risoluzione diversa (da diversi chilometri a pochi decimetri). Il lavoro presenta due casi di studio relativi al delta del fiume Po (Nord Adriatico) in cui le dinamiche deltizie sono investigate sotto l'influsso di diverse portate fluviali (condizioni estive con basse portate e di un evento inteso di piena invernale). Rispetto ad approcci classici, i risultati mostrano una migliorata rappresentazione della dinamica costiera, in particolare per l'evoluzione dei sedimenti nell'aria antistante la foce e la diffusione della *plume* nel bacino Nord Adriatico. Il lavoro apre nuovi scenari di applicazione di modelli integrati, utili per l'investigazione di processi fortemente dipendenti dalle acque interne (come ad esempio dispersione di inquinanti disciolti o particellati lungo il delta, fenomeni anossici, fioriture algali potenzialmente tossiche, etc.).

# **[C009] Impacts of a not-indigenous invasive species (*Procambarus clarkii* Girard, 1852) on the ecological attributes of a managed saltmarsh (Stagno di Molentargius, Sardinia)**

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The red-swamp crayfish *Procambarus clarkii*, native to NE Mexico and S USA, is among the most successful and invasive alien species that entered European freshwaters during the last 30 years. This species has expanded very rapidly thanks to early sexual maturity, rapid growth, large numbers of offspring, short life spans, high tolerance to drought and high temperatures. The Molentargius-Saline Regional Natural Park (Sardinia, Italy) is a managed saltmarsh, where, in 2004 a filtering ecosystem (ESF) has been established by removing all the existing vegetation and transplanting the macrophyte *Phragmites australis*, which remove undesirable substances by direct assimilation and provide a favorable habitat for the bacteria that transform pollutants. Since 2004, the number of plant taxa increased at an annual rate of ca. 14%, reaching in 2016 a total of 275 taxonomic units, of which 10 of conservation concern and 32 aliens. We investigated: 1) *P. clarkii* abundance in the ESF and its drainage channel, using baited traps; 2) sedimentary organic matter (OM) quantity and biochemical composition, along with the vegetation attributes and biodiversity of three invaded portions of the basin characterized by high, intermediate and low levels of shrimp abundance (1.5, 1 and 0 catch ind. day<sup>-1</sup> respectively). A total of 129 shrimps were sampled in 329 stations (LC<sub>med</sub>=40.79±6.98 mm; PT<sub>med</sub>=15.67±7.84 g), with the highest abundance occurring in emerging soft soils. Highest shrimp abundance was associated with the lowest OM contents and a decreasing proportion of proteins and carbohydrates, suggesting that *P. clarkii* can alter significantly the availability of food for other benthic consumers. *Phragmites australis*, the dominant plant, creates a quasi-continuous strip around the sub-basins. We report that the thickness of the plant strip is not related to *P. clarkii* density, concluding that the emerged vegetation is not a main factor regulating the presence and abundance of *P. clarkii* in the ESF or vice-versa. This study was supported by the Fondazione di Sardegna (year 2016) and Regione Sardegna (LR 7/2007) for the project: *Impact of Invasive Alien Species on Sardinian ecosystems*.

# **[C010] Cytogenetic features of the invasive crayfish *Procambarus clarkii* (GIRARD, 1852) and comparison with other crustacean decapods**

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The Louisiana crayfish *Procambarus clarkii* (Girard, 1852) is an invasive freshwater crustacean species present in several European countries. Within the last years, *P. clarkii* has been successfully established in various sites of Sardinian basins. Although their economic and ecological value, the cytogenetics of crustacean decapods is poorly studied. This is principally due to technical constraints in obtaining good chromosomal preparations as well as the features of the chromosome complement. In many species a high number (generally more than 100) of little sized chromosomes are present, and the highest number among Metazoa,  $2n=376$ , belongs to the Astacidae *Pacifastacus leniusculus trowbridgii*; as a result, different authors' data concerning the decapod karyotypes differ significantly. Moreover, modern molecular cytogenetic techniques, such as Fluorescence *In Situ* Hybridization, have been applied to a few species of decapods. With the aim to shed light on the data reported by different authors, here we examine the cytogenetic features of *P. clarkii*. Chromosome preparations were obtained by the air drying method from testicular and somatic tissues of males captured in Sardinian basins, C-banding and FISH were performed to localize the heterochromatin and ribosomal and telomeric sequences, respectively. Our results confirmed the  $2n=188$ , and pointed out the presence of A-T rich heterochromatic blocks. By FISH mapping, the major ribosomal genes were localized on four chromosome pairs and the telomeric repeat (TTAGG)<sub>n</sub>, besides the chromosomal ends, was detected in interstitial position of a large chromosome pair; the presence of two pairs of close ITS signals may be due to a telomeric association. Data obtained have been compared with other decapods with the aim to provide chromosome markers useful for cytotaxonomic analyses. This study was supported by the Fondazione di Sardegna (year 2016) and Regione Sardegna (LR 7/2007) for the project: Impact of Invasive Alien Species on Sardinian ecosystems.

**[C011] Modelling the dispersal of red shrimp larvae from Sardinian seas: density and connectivity patterns**

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*Aristaeomorpha foliacea* (Risso, 1827) is among the most exploited crustacean species, with traditional and economic significance for the deep-sea fishery of western and central Mediterranean countries. Despite its commercial importance little is known about its larval dispersal and migration patterns. To provide insights about the early life stage biology of this species, we evaluated 1) the potential larval dispersal around Sardinia; (2) the current knowledge of larval behavior, and 3) the connectivity patterns for stable spawning areas at the regional scale. Connectivity and three-dimensional (3D) dispersion of the larvae were assessed using Lagrangian simulations forced by a 3D regional ocean model. Biophysical simulations were run to track propagules released from known spawning areas. Passive transport (PT) and vertical migration (VM) scenarios were tested, each with two possible pelagic larval durations (PLDs) of 21 or 42 days. Dispersion of propagules in the PT and VM scenarios differed in terms of travelled distance, export out of the domain (larger for VM), and depth distribution (shallower and bimodal for VM). The mean dispersal distance ranged from a minimum of  $86 \pm 45$  km for PT21 to a maximum of  $230 \pm 120$  km for VM42. In terms of depth, VM scenarios show shallower distribution of the propagules (VM21=64% and VM42=58% above 500 m) than PT (PT21=58% and PT42=54%). Connectivity patterns among eight release areas and four predetermined Eco-Regions showed strong connectivity among the North-Western (NW), Western (W), and Southern (S) regions of Sardinia, whereas the Eastern region was more isolated. This finding, together with existing hypotheses of vertical migration likely occurring during first egg-larval phases, suggest that the VM scenarios are the most likely. Strong connectivity between the W and S sides of Sardinia and the relative isolation of the E side could have significant implications for the protection of this important resource.

**[C012] Collaborative Fishery Research and short-term marine no-take areas boost resilience of European spiny lobsters to overfishing**

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Declining fishery resources and relative services are a matter of fact, what is still under debate is if this trend can be reversed or not. Many Small-Scale Fisheries (SSF) from coastal areas showing declining catches and the absence of anytime soon possible recovery and, thus, do have a track record of being unsustainable. The fishery of the European spiny lobster *Palinurus elephas* (Fabr. 1787) has severely declined in the last 50 years in both the Mediterranean Sea and Atlantic Ocean. In European seas, current management options of this species include fishery effort restrictions and size limits on catches. Nevertheless, problems with compliance still persist, locally enhanced black market, as side effect. Outcomes from marine reserves establishment emphasized decadal recovery periods, with often hardly detectable fishery spillover benefits, partly ascribable to improper reserve enforcement or design. Using data collected through a Collaborative Fishery Research (CFR) project, we investigated variations in Catch-Per-Unit-Effort (CPUE) of European spiny lobster stocks both outside and inside three no-take areas established around Sardinia



(Tyrrhenian Sea) lasting five years and assisted by wild below-legal size juveniles restocking. We show that CPUE inside no-take areas increased significantly just after 2 years since their establishment, with two- to four-times higher CPUE. Moreover, we show also that a considerable fishery spillover effect ranging from >30% to >80% occurred after two / three years since no-take areas were established, which suggests the efficacy of reserves in promoting resilience of overfished lobster stock in surrounding fishing grounds. We conclude that combining CFR with the establishment of no take areas and the used of active restocking practices (using wild below-legal size juveniles) represents a reliable, highly efficient and dynamic short-term tool for boosting European spiny lobster resilience to local overfishing.

#### **[C013] Sustainable management of Octopus fisheries in Sardinia**

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Among the Italian regions, Sardinia is the largest producer of Octopus, mainly captured by small-scale fishery, in particular traps. This fishery is usually carried out in spring-summer within 50 m depth and allows catching *Octopus vulgaris* Cuvier, 1797 with a very low by-catch. Over the last few decades, in spite of the current legislation which imposes a minimum landing size and a limited number of traps, a decline in production level has been detected at the regional scale. In response to this decline and with the aim of achieving a sustainable management of *O. vulgaris* fishery, researchers and fishermen have carried out an experimental management in an area of central western Sardinia. Small specimens have been tagged and released at sea, and some artificial dens have been laid on the seabed of a no-take area with the aim to increase natural shelters and encourage mature females to spawn inside. The recapture of tagged specimens allowed to estimate in general, a large individual variability of daily growth rates (0.96-9.09 g day), with values in females (3.07-3.65 g day) higher than in males (2.08-2.98 g day). Theoretical straight distances travelled by recaptures ranged 9-5800 m in males and 9-1700 m in females, regardless of the days of freedom. However, considering that >80% of the animals were recaptured within 1 km from the release site, our results suggest a high site fidelity for the species. The effectiveness of the artificial dens for spawning was demonstrated by the presence of eggs and females in parental care and by the fact that all brooding-phases had taken place inside the dens. This result suggests that artificial habitats could represent a reliable option for the management of *O. vulgaris* stocks in the wild.

#### **[C014] Evaluation of the status of demersal Chondrichthyan species in CW Mediterranean with focus on relatively rare species**

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Overfishing and habitat degradation have profoundly altered marine animal populations, especially sharks and rays. Despite their important role as predators at the top of the food chain in marine ecosystems and the dramatic decline in abundance reported from many parts of the world's seas, data on their stock status remains still poor or non-existent. In this regard, the goal of this work is to assess the status of demersal Chondrichthyes in Sardinian waters, analyzing time series (1994–2015) trends of abundance, and assessing the current composition of catches in terms of species. A total of 25 demersal Chondrichthyes were detected. In contrast with features described worldwide, including the Mediterranean, our results showed a stable pattern or even increasing trend of Chondrichthyes abundance in Sardinia seas. The analysis conducted on the shelf and the slope highlighted a similar distribution pattern common to other Mediterranean areas, but with different abundance patterns.

In addition, given the problematic taxonomy affecting Chondrichthyes, historically linked to phenotypic similarity and/or individual variability, we focused our attention on a relatively rare species, the Norwegian skate *Dipturus nidarosiensis* (Storm, 1881), unknown until 2010 in the Mediterranean and currently object of wide discussion.

#### **[C015] Particulate organic matter fluxes below the sea ice during pack ice melting (Tethys Bay, Ross Sea, Antarctica)**

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During winter, the annual sea ice in Antarctica gets colonized by an abundant microbial community and huge amounts of particulate organic matter (POM) mostly derived from microalgae. This material is released in the water column during sea ice melting and is supposed to fuel higher trophic levels dwelling below the sea ice. As part of the project CEFA (Italian Antarctic Program), we investigated quantity and composition of POM released in the water column in November and December 2015 in Tethys Bay (Ross Sea) at 10 and 30 m depth. To shed light on the possible coupling between POM fluxes and their consumers, we investigated also the abundance and biochemical composition of two zooplankton taxa commonly encountered in the water column underneath sea ice: *Clione limacina* and *Limacina*

*helicina antarctica*. At 10-m depth, protein flux was characterized by a peak at the end of November and another one in mid-December, carbohydrate flux continuously decreased during the whole sampling period, and lipid flux peaked at the beginning of December. At 30-m depth, POM flux was much less variable (with exception for lipids which peaked at the beginning of November). Rates of POM export to 30-m depth were very high (up to 100%) till mid-November, then decreased continuously during the remaining sampling period, but the last few days. *L. helicina antarctica* and *C. limacina* abundance below the sea ice showed opposite temporal trends, with the former decreasing and the latter increasing during the study period. *C. limacina* was characterized by the dominance of lipids, whereas *L. helicina antarctica* showed a dominance of proteins. During the study period, their biochemical composition resembled that of POM, indicating that sea ice melting plays a major role in trophic successions of zooplankton in Antarctic coastal waters.

**[C016] C and N isotopic signatures of zooplankton taxa in five small subalpine lakes along a trophic gradient**

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Concern on stable isotopes analyses is increasing in freshwater ecology to better clarify ecosystems' functioning. By measuring carbon and nitrogen isotopic signatures, organism food sources and position level along food webs can be tracked, providing quantitative estimates of bi-dimensional niches. In order to verify the forcefulness of some general patterns of carbon and nitrogen stable isotope signatures in lakes of reduced size, we applied stable isotopes analysis to zooplankton community sampled in spring and summer in five small lakes located in the same subalpine region, within a trophic gradient (from oligotrophy to hyper-eutrophy). Seasonal changes in trophic position and food sources were analysed for the different zooplankton taxa to compare how and whether isotopic signatures and their seasonality are taxa specific. Carbon and nitrogen isotopic signatures were lake- and season- specific, depending on the depth/morphology and the trophic status of each lake, showing already-observed general trends, with some exceptions. Major variations in carbon signature were recorded in Lake Mergozzo and Lake Pusiano, the deepest lakes and with a larger volume, while minor variations appeared in Lake Endine, which has a reduced volume and depth. Carbon was generally less depleted in summer, with the exception of the shallowest Lake Comabbio and, in a lesser extent, of Lake Endine. Nitrogen enrichment was markedly higher in lakes Pusiano and Moro than in Mergozzo, decreasing in all cases in summer time, indicating a great variability of the trophic roles of zooplankton organisms.

**[C017] Limnological studies of Monticchio lakes (southern Italy): a historical overview**

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The Monticchio lakes are two maars located in the southwest portion of Vulture mountain, a Quaternary volcano. Today, this area is part of the Special Area of Conservation "Monte Vulture" (SAC IT9210210). Their main morphometric, physical and hydrodynamic characteristics, water chemistry, and plankton, hydrophytes and faunal diversity are described through a review of the studies, starting with the first detailed scientific study carried out on Lago Grande and Lago Piccolo of Monticchio at beginning of the twentieth century by Achille Forti, Alessandro Trotter and Giuseppe Stegagno. Since then, the area was strongly affected by human impact. During the years, other studies have considered in detail key aspects concerning water quality. A particular attention has been paid to eutrophication. Currently, these lakes have different trophic level: eutrophic or hypereutrophic for Lago Grande, and oligotrophic or mesotrophic for Lago Piccolo. In reference to the water thermal regime, the former lake is classified as dimictic, according to some authors, or warm monomictic, according to others. The latter is classified as biogenic meromictic. In over a hundred years, changes in the phytoplankton and zooplankton community structures have been particularly relevant, in particular in Lago Grande, contrasting with the high stability in diatom communities over millennia revealed by paleolimnological studies. Benthic community has not been studied, apart few samples analyzed by Forti in 1905. A multi-temporal analysis has revealed the loss of macrophyte species and their habitats. Between 1905 and 2010, 67% of the species in Lago Grande and 60% in Lago Piccolo disappeared. Due to the scientific interest and touristic importance, these lakes must continue to be the object of limnological studies in the future.

**[C018] Do we need to identify diatoms to the species level for assessing lake biological quality?**

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The Water Framework Directive asks to all Member States of the European Union to classify the ecological quality of significant water bodies on the basis of the biological communities they host. One of the biological communities that must be used for the ecological quality assessment is the periphytic community, mainly composed by diatoms. In Italy,

diatom-based lake quality assessment is performed using a specific index, named EPI-L, based on the method of weighted averages. For each species, a trophic score and an indicator weight were calculated using a data set of 80 lakes along a trophic gradient. The calibration data set includes 475 species, but only 109 were used in the calibration being found in at least 3 lakes. In order to reduce the complexity of the lake quality assessment, we calibrated a variant of EPI-L, using diatoms genera instead of species, and we compared the performance of these two variants in terms of correlation with the nutrient level and of different classification of each lake.

#### **[C019] Human-induced range contraction of endangered native freshwater fishes of Sardinia (Italy)**

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Freshwater fishes are highly vulnerable to anthropogenic stressors such as habitat pollution and fragmentation, restricted water resources and introduction of non-native species. All threats combines synergistically caused both distribution range contraction and occasional extinctions of the native species. Currently, in Sardinia the ichthyofauna comprises a total of 22 species (7 native and 15 non-native). Among those two fish species are categorized as critically endangered (CR, *Anguilla anguilla* Linnaeus, 1758 and *Salmo cettii* Rafinesque, 1810), and one (*Alosa fallax* Lacépède, 1803) as vulnerable (VU). A necessary first step to preserve them is to describe their spatial distribution and their habitat contraction to implement management and conservation strategies. This project is supported by the Regione Autonoma della Sardegna "Assessorato Della Difesa dell'Ambiente" (REP. 27002-1 del 18/12/2015). Occurrence data on endangered species distribution (802 sampling sites), covering two time periods (1<sup>st</sup>=1940-1970; 2<sup>nd</sup>=1990-2016), were mapped using a GIS software in order to visualize (1) the historical distribution and (2) compare the more recent with the historical data. The brown trout occurred in 81.6% of the investigated sites in the 1<sup>st</sup> and just 28,6% in the 2<sup>nd</sup> period. As consequence we observed an habitat range contraction of 78% and a displacements towards higher altitudes especially in the central-eastern part of Sardinia and in small isolated areas where temperature and flow regimens can sustain optimum ecological condition for the species. The European eel occurred in 92% and 41.7% of the sampled station in 1<sup>st</sup> and 2<sup>nd</sup> period respectively. The distribution map of the last thirty years shows that the European eel is distributed downstream many migratory barriers with very low presence upstream with an habitat contraction of 75%. The twait shad was historically reported in the rivers Coghinas, Barca, Cedrino, Temo, Tirso, Flumendosa, Picocca and Flumini Durci (occurrence 14.3%). Currently, is still present (occurrence <1%) in isolated and decreasing populations in some reservoirs, such as Flumendosa, Mulargia and Omodeo. The ongoing results deepen the knowledge about distribution patterns of endangered freshwater species and gives a basic background for improving the management strategies as recommended by the Annex II of the Habitats Directive 92/43/CEE.

#### **[C020] Fish communities in Sardinian artificial lakes: a first overview**

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The freshwater fish fauna of Sardinia Island is mainly characterized by a low number of native species and the absence of primary freshwater fishes. Sardinia has few major rivers and only one natural freshwater lake. Due to historical scarcity of water resources, since the early '900 more than 50 dams have been constructed. Reservoirs created by dams not only control floods and provide waters for the wellbeing of humans, but also represent new artificial habitats that have been rapidly occupied by freshwater fishes. This study aims to present a first inventory of the fish fauna of 23 main Sardinian artificial lakes, and to define their species composition. Data obtained from exploratory fishing surveys (2013-2016), made by the Regional Agency ENAS, have provided evidence for a total of 15 species, 11 of which are alien fishes. Cyprinidae is the most representative family (5 species) followed by Salmonidae. Since reservoirs became available, a continuous increase in the number of alien species has been observed as result of deliberate or accidental introductions and translocations. Every documented alien fish has become naturalized: introduced species seem to have found "vacant niches" in species-poor communities, which means that they adapts to food, space, spawning grounds, etc., which are not fully exploited by native species. Well-established populations have multiplied and spread across many water bodies (e.g. *Cyprinus carpio*, *Micropterus salmoides*). The weakness of Sardinia to freshwater fish invasions is expected to be exacerbated by changing climatic conditions, which could enhance the invasive potential of non-indigenous fishes that exhibit characteristics of *r*-selected species as well as a fair degree of ecological adaptability.

#### **[C021] Particle transfer along the modern mud-wedge of the Adriatic Sea by down-core sediment-bound metal distributions**

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In the marine environment, anthropogenic contaminants are mostly adsorbed onto the particulate matter, which mainly accumulates close to the source areas. Their concentrations and inventories gradually decline with increasing distance from the inputs. In many sedimentary systems, such as the Adriatic Sea, the magnitude of along-shelf particulate transport is much greater than the corresponding across-shelf component. In these systems, the river-borne contaminated material follows the dispersion pattern controlled by the main currents and accumulates when and where the energy of water mass decreases. Thus, the study of the contaminant fate can contribute to elucidate the depositional processes of river-borne material from the riverine source to the final sink into the sedimentary record. High Zn and Pb concentrations have been previously found in the northern Adriatic sector and related to anthropogenic influences. In this study, we used the vertical profiles of Pb and Zn, measured in <sup>210</sup>Pb-dated sediment cores collected along the modern mud wedge of the western Adriatic Sea, to reconstruct their historical evolution during the last century. The temporal trends of trace metals in the Adriatic sediments coincided with the industrial production activities and their past use. Our results showed that Zn and Pb concentrations started to increase from the World War I. The increasing contamination signal of these trace metals propagated southward as far as 450 km with a growing delay. A reduction of trace metals from mid-1980s was also observed, related to the implementation of stricter environmental regulations on chemical wastewaters. Based on the delay of propagation of the signal of the onset and decreasing shift of Zn and Pb recorded in sediment cores collected along the Po River dispersion system, a first estimate of ~10 years is provided for the mean transfer time of particles travelling from the Po River mouth to the Gargano subaqueous delta.

#### **[C022] Modern sediment distribution and composition within the Kongsfjorden, Svalbard Archipelago**

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The Kongsfjorden is 20 km long and 4-10 km wide glacially eroded fjord located in western Spitsbergen, Svalbard. Twelve short sediment cores were sampled in 2011 with the purpose to describe modern sediment distribution and composition. Core locations were chosen based on a high resolution seismic survey in order to delineate morpho-bathymetric features and surficial seismo-stratigraphy. The inner part of the fjord, close to the calving line of 3 ice tongues, is characterized by the maximum sediment thickness (up to 10m). Based on different seismic response, the investigated area was divided in 4 main categories: 1) acoustically well-laminated with continuous parallel reflectors; 2) parallel, irregular-transparent reflectors; 3) transparent-chaotic reflectors; 4) continuous, highly reflective. Cores were mainly composed by very fine muddy sediment, sometimes laminated. Sediment accumulation rates based on <sup>210</sup>Pb and <sup>137</sup>Cs depth profiles resulted in generally high sedimentation rates (>4 cm/y) near the glacier fronts, while sediment cores collected in the outer shelf showed more regular profiles and lower sedimentation rates (0.2-0.6 cm/y). Organic carbon content of surface sediments showed a spatial gradient with values decreasing towards the inner part of the fjord reflecting both higher accumulation rates and decrease of biological productivity from the open ocean towards the inner fjord. High Ca/Ti ratios from XRF core scanning in superficial sediment of the inner fjord demonstrate the deposition of Ca-rich sediments supplied by the catchment areas of Kronebreen and Kongsvegen glaciers. In the outer fjord, low Ca/Ti ratios reflect the influence of additional sources of sediment from other glaciers or small meltwater rivers. However, down core distribution of Ca/Ti ratio suggests the occurrence of past events during which the glacier influence extended further seaward. High Br/Cl ratios in hydrated marine sediments of the outer fjord reveal the presence of organic matter of marine origin.

#### **[C023] Metabarcoding: a magnifier for protist studies in the sea**

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Metabarcoding is a DNA-based approach that allows generating molecular data of natural communities in a fast, cheap, but sensitive way and is useful to shed light on microbial diversity. We provide examples of the methodological potential of the V4 region in the 18S rDNA to uncover species diversity in a metabarcoding dataset. The dataset includes 48 samples collected over the seasonal cycles across three years (2011-2013) at the LTER Mare Chiara station in the Gulf of Naples. The dynamics of protist communities, in terms of composition and abundance, revealed three main seasonal clusters (autumn-winter, spring-early summer end late summer). The same trend was identified based on the Dinophyta group. At the genus level, the results highlighted a high diversity and richness of *Chaetoceros*, the most abundant and widespread diatom genus in the world's seas, and revealed numerous new species previously



undescribed in GoN. In the genus *Leptocylindrus*, two populations were identified within *L. aporus*, with different temporal occurrence, which highlights the possibility of metabarcoding data to unveil cryptic or even intraspecific diversity. A number of harmful species were also detected for the first time in the Gulf of Naples, illustrating the relevance of the metabarcoding approach in monitoring aimed at the protection of human health. In conclusion, despite some biases, metabarcoding provides unprecedented insights in the biodiversity at LTER stations and is therefore useful for a wide range of academic and societal applications.

#### **[C024] Hypoxia in the gulf of Trieste: recent events and long term evolution**

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Seasonal summertime hypoxia has been observed in the North Adriatic since the 1970's, when a major increase in eutrophication was documented. Although oxygenation of bottom waters during the period August–November of the last two decades has increased in the area, recent data have revealed that hypoxia is again wide spreading in the Gulf of Trieste during summer. In this study, we evaluate the dissolved oxygen concentration in the bottom waters and its relationship with several environmental conditions. Physical and chemical data collected mostly on a regular monthly basis in three 30-years time-series stations were analyzed in order to detect trends and frequency of occurrence of hypoxia events in bottom waters. Preliminary results of the data analysis show a tendency toward increasing oxygen concentration in the bottom layer, however, during the summers of 2015 and 2016 two remarkable hypoxia events were observed in a marginal and relatively shallow area (17m) of the Gulf. Up to eight of the 28 sites monitored in the gulf during this period presented oxygen concentrations lower than 109  $\mu\text{M}$ , which is considered as 'mild hypoxia', while in two sites concentrations were even lower (below 63  $\mu\text{M}$ ). Hydrographic, chemical and biological data available for the area were analyzed, in order to evaluate the temporal and spatial extent of these hypoxia events, and to investigate the relationships with environmental drivers. High temperature and salinity at bottom indicated a pronounced water column stratification, which prevented the mixing of oxygen-rich surface water with oxygen-poor water at bottom. The oxygen consumption estimated in the area during the months of August and September indicates that the main contribution to oxygen depletion is attributed to benthic and plankton respiration, which exceeded the oxygen production. The high respiration rates estimated in the area are possibly favored by the increasing temperature trend in the bottom waters coupled with the enhanced organic matter production with the increasing riverine discharge.

#### **[C025] Trend of phosphorus loads in Lake Pusiano in the period 1960-2015. Insights for the management of lake environments**

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Lake Pusiano is a mid-sized subalpine Italian lake affected by long-term eutrophication problems. Using historical data and modelling approaches we reconstructed both the external phosphorus load (EPL) and the internal phosphorus load (IPL) for the periods 1960-2015 and 1972-2015 respectively. EPL reached its maximum in the 1980s with P values of about 21  $\text{t yr}^{-1}$  while currently it is close to 6  $\text{t yr}^{-1}$ . IPL was one order of magnitude less and ranged between 0.25  $\text{t yr}^{-1}$  (2015) and 3.6 (1985)  $\text{t yr}^{-1}$ . The strong reduction of the P load determined a marked decrease of both P (from 200 to 23  $\mu\text{g L}^{-1}$ ) and chlorophyll *a* (from 18 to 8  $\mu\text{g L}^{-1}$ ) concentrations in the lake. The process of eutrophication and subsequent recovery, however, showed hysteresis between P load and in-lake P content. In recent years, in particular, P concentrations (at winter overturn) seem to be independent from the P load. This has been related to modifications in the hydrological management of the lake, that favored P flush-out in fall, when the EPL is maximal. These modifications were originally planned to reduce the risk of floods but contributed to a marked decrease of the total P concentrations at winter overturn (23  $\mu\text{g L}^{-1}$ ), which recently resulted lower than target concentrations (30  $\mu\text{g L}^{-1}$ ) established by the Lombardy Region. The lake, nevertheless, suffers from the presence of the toxic cyanobacterium *Planktothrix rubescens*. Eradicating this species to further improve the lake water quality will likely require a supplementary abatement of the EPL.

#### **[C026] Comparing the locomotory behaviour of wild and laboratory-reared juvenile sea urchins (*Paracentrotus lividus* Lamark 1816)**

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The locomotor performance of Wild-harvested and Laboratory-reared juvenile individuals of sea urchin *Paracentrotus lividus* was compared in natural environment (Outdoors) and in laboratory-controlled (Indoors) conditions. Two landscape conditions were adopted Outdoors (i.e. Closed and Open). The Closed condition was set up covering the bottom with a white panel and enclosing it with a white annular panel, while Open was free of panels. The Indoor condition was set up using a cylindrical tank white tinted on the bottom and laterally, in line with the Closed treatment. Prior to the experiment, the animals were acclimated and maintained without feeding for 24 h. Sea urchins were individually placed in the center of a rough cylindrical stone and their movement was recorded with a time-lapse camera (5 sec intervals). Video images were analyzed to calculate the latency of locomotion, the average speed, the straightness-of-path and the locomotor direction. Wild animals resulted in a shorter latency ( $p < 0.001$ ) and higher speed ( $p < 0.001$ ) Outdoors than Indoors. Hence, Wild sea urchins are less reactive and move slower in the laboratory than in natural conditions. Both Wild and Laboratory-reared individuals, the environment influenced the straightness-of-path, with a more tortuous trajectory Indoors than Outdoors ( $p < 0.01$ ). Both Wild and Laboratory-reared sea urchins moved earlier when treated in Open ( $7.2 \pm 1$  sec, mean  $\pm$  SE) than in Closed ( $20.8 \pm 2.8$  sec) conditions ( $p < 0.001$ ). Mean directions were significantly different from random only for Open-Lab ( $p < 0.05$ ) and Open-Wild ( $p < 0.01$ ), while they did not differ from random in all other cases. Therefore, in nature, sea urchin movement is influenced by whether external cues (e.g. currents, odors, visual cues) are available (open condition) or not (closed condition). This study indicates that there are no differences in the locomotor performance in nature between Wild and Laboratory-reared sea urchins, with potential significance for restocking strategies.

**[C027] Sea urchin fishery shifts potential reproductive contribution of population onto the shoulders of the young adults**

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In this study, we compared the reproductive potential of two Sardinian *Paracentrotus lividus* populations subjected to different levels of fishing pressure: high (at Su Pallosu Bay) and low (at Tavolara-Punta Coda Cavallo). Reproductive potential was estimated through the gonadosomatic index during one year, in individuals larger than 30 mm, and the abundance and size-frequencies of fertile sea urchins. The gamete output per m<sup>2</sup> was assessed separately for the commercial-sized (>50 mm) and the undersized individuals with fertile gonads (40-50 mm). The population structures were specular, with high frequencies of urchins larger than 60 mm in the low-pressure zone whereas the undersized individuals were more frequent in the high-pressure zone. The reproductive potential of the fertile size classes changed significantly over time and between zones, progressing differently with an early spring spawning event in the high-pressure zone and two gamete depositions in early and late spring in the low-pressure zone. The multiple spawning events in the low-pressure zone determined a total gamete output two-fold higher than the high-pressure zone. However, the annual mean gamete output of population was similar in the two zones. In the high-pressure zone, the high density of the undersized individuals produced an amount of gametes similar to that of the commercial-size class in the low-pressure zone, thus balancing the smaller quantity of gametes produced by the commercial-sized individuals. In the high-pressure zone, the systematic removal of larger individuals does not seem to jeopardize the self-supporting capacity of the population, as the reproductive potential contribution depends more on the total density of fertile sea urchins than on their size. Findings suggest that, in highly fished zones, management measures should be addressed to guarantee high densities of the undersized sea urchins, which actually support the population survival, and to shed light on the source of the larval supply.

**[C028] New extension and vulnerability of the "Sardinian cold water coral province"**

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Using Remotely Operated Vehicle (ROV) surveys, we documented the occurrence and distribution of three banks of scleractinian Cold-Water Corals (CWC), two of them never documented before, encountered in three submarine canyons off Sardinia (NW Mediterranean Sea). We investigated also the composition of the associated megafaunal assemblages and the presence and typology of anthropogenic threats. We show that the three canyons were characterized by the presence of dense and healthy patches of small/medium *Madrepora oculata* colonies dwelling rocky walls and inclined silted bottoms. A few isolated colonies of *Lophelia pertusa* were also observed in one of the three canyons. We also documented a high megafaunal diversity within either living or death portions of the coral framework. Our results confirm that the Sardinian CWC province represents a biodiversity hotspot in the whole Mediterranean deep sea. Nonetheless, we also observed the presence of considerable anthropogenic impacts (fishing

gears and litter disposal). Our results extend the geographical framework of the recently discovered “Sardinian Cold Water Coral province”, increase the knowledge about deep water corals geographic distribution in the Mediterranean and suggest the need of urgent measures for conservation and governance of these Vulnerable Marine Ecosystems.

#### **[C029] Restoration of seagrass meadows in the Adriatic Sea**

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Seagrasses, a group of marine submerged angiosperms widely distributed along coastlines of the world, are characterized by high productivity and host a high biodiversity, providing great ecological and economic values to marine ecosystems. While seagrasses are recognized as priority subjects for conservation efforts, they are globally disappearing at an alarming rate. Restoration of seagrass ecosystems for improving coastal environmental quality has been recognized as crucial action to prevent further seagrass losses and facilitate recovery of goods and services that these ecosystems can provide to human well-being. Quantitative analysis on the performance of seagrass restoration is lacking and the processes influencing success or failure of restoration programs have not been systematically assessed. In 2002, a pilot experiment of seagrass transplanting has been carried out in Gabicce Mare (North-Western Adriatic Sea), an area of highly valuable natural resources (boarding a Site of Community Importance) and subjected to anthropogenic pressures (seasonal touristic activities and artificial structures: breakwaters). In the frame of the H2020 project MERCES (Marine Ecosystem Restoration in Changing European Seas) we aim to i) assess the long-term effect of seagrass restoration after 15 years from the first seagrass transplanting experiments, ii) evaluate the potential consequences of the relocation of breakwater structures on seagrasses meadows and associated meiobenthic biodiversity and iii) test the potential positive feedback between seagrass meadows and *Pinna nobilis* on restoration activities, benthic biodiversity and ecosystem functioning. We will combine data obtained from field work, historical aerial photography, sediment sampling and experimental plots. Here we present the preliminary results of the field surveys conducted during 2016-2017 in Gabicce Mare. Preliminary results confirm the presence of seagrass meadows of *Zostera marina*, *Nanozostera noltii* and *Cymodocea nodosa*, whereas green macroalgae, mussels and actinians are dominant outside the breakwater structures.

#### **[C030] Submarine canyons along the upper Sardinian slope (Central Western Mediterranean) as repositories for derelict fishing gears**

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By means of ROV surveys, we assessed the quantity, composition and bathymetric distribution of marine litter in 17 sites along the Sardinian continental margin (Central Western Mediterranean) at depths ranging from 100 to 480 m. None of the investigated sites was litter free, but the mean density of litter ( $0.0175 \pm 0.0022$  items m<sup>-2</sup>) was lower than that reported from other Tyrrhenian regions. The difference in the total litter density among sites was negligible, but the density of Derelict Fishing Gear (DFG) items (most of which ascribable to small scale fishery) was higher in submarine canyons than in other habitats. Our result suggest that submarine canyons (known to be highly vulnerable ecosystems) act as major repositories of DFGs, and, therefore, we anticipate the need of specific measures aimed at minimizing the loss and abandonment of DFGs in submarine canyons.

### Poster

- [P001] Beltrami M., Arpaia A., Rogora M., Giacomotti P., Orrù A., Tartari G. - Updating the successful recovery of the polluted Lake Orta: the last three years of limnological studies
- [P002] Bensi M., Langone L., Kovacevic V., Ursella L., Rebesco M., De Vittor C., Aliani S., Miserocchi S., Relitti F., Bazzaro M., Deponte D., Laterza R., Mansutti P., Lucchi R.G., Wåhlin A., Soltwedel T., Goszczko I., Skogseth R., Falck E., Nilsen F. - Dense water plumes SW off Spitsbergen Archipelago (Arctic) in 2014-2017
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## Poster

### [P001] Updating the successful recovery of the polluted Lake Orta: the last three years of limnological studies

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Lake Orta has been severely polluted since 1926 by industrial effluents high in Cu and ammonia. Cr, Ni, and Zn rich effluents from plating factories also contributed to pollution, and pH dropped below 4.0. More than 60 papers have documented the lake evolution and the sudden decline of plankton, benthos and fish. As a remedial action, the lake was limed from May 1989 to June 1990 with 10,900 tons of CaCO<sub>3</sub>, immediately raising the pH and decreasing the metal concentrations in the water column. Plankton and fish communities quickly rebounded, albeit as a poorly structured biological community. A new research, started in 2015 and still in progress, based on toxicity testing of the main tributaries and the lake water column, coupled with the chemical assessment of the water quality, aims to re-assess the lake conditions and to verify whether an improvement of this severely impacted environment is really taking place.

### [P002] Dense water plumes SW off Spitsbergen Archipelago (Arctic) in 2014-2017

M. Bensi<sup>1</sup>, Langone L.<sup>2</sup>, Kovacevic V.<sup>1</sup>, Ursella L.<sup>1</sup>, Rebesco M.<sup>1</sup>, De Vittor C.<sup>1</sup>, Aliani S.<sup>2</sup>, Miserocchi S.<sup>2</sup>, Relitti F.<sup>1,7</sup>, Bazzaro M.<sup>1</sup>, Deponte D.<sup>1</sup>, Laterza R.<sup>1</sup>, Mansutti P.<sup>1</sup>, Lucchi R. G.<sup>1</sup>, Wählin A.<sup>3</sup>, Soltwedel T.<sup>4</sup>, Goszczko I.<sup>5</sup>, Skogseth R.<sup>6</sup>, Falck E.<sup>6</sup>, Nilsen F.<sup>6</sup>

<sup>1</sup>OGS – Istituto Nazionale di Oceanografia e di Geofisica Sperimentale, Italy; <sup>2</sup>CNR-ISMAR – Consiglio Nazionale delle Ricerche-Istituto di Scienze Marine, Italy; <sup>3</sup>UGOT, University of Gothenburg, Sweden; <sup>4</sup>AWI, Alfred Wegener Institute for Polar and Marine Research, Germany; <sup>5</sup>IOPAS – Institute of Oceanology, Polish Academy of Sciences, Poland; <sup>6</sup>UNIS, University of Svalbard, Norway; <sup>7</sup>Università degli Studi di Trieste, Trieste, Italy. In the last decades, the Arctic region has gained a large interest because of climate changes and relevant effects on ice melting and global warming. Abrupt changes in the atmosphere are responsible for significant changes in ocean water masses and large-scale circulation patterns, which in turn affect the global climate. Studying ocean circulation and related processes along the south-western Spitsbergen slope (Svalbard Archipelago) is essential to describe the thermohaline circulation and the dense water formation (DWF) in the Arctic, and the way they contribute to the global thermohaline circulation. DWF processes in this region depend on: the rate of cooling and homogenisation of the Atlantic water along its northwards pathway, brine rejection phenomena, boundary convection on the Arctic Ocean shelves and slopes, and deep open-ocean convection in the central gyres of the Greenland and Iceland Seas. This study focuses on brine rejection, shelf convection and entrainment processes, which occur on the west Svalbard margin and in the Storfjorden during the winter season. Two short moorings (named S1 and ID2) were deployed ~1000m deep along the slope in 2014, to collect multiannual time-series in an area of potential interaction between the West Spitsbergen Current and the descending dense shelf plumes. Oceanographic cruises were carried out between 2014 and 2017 to integrate time-series with CTD casts. At S1 and ID2, time-series revealed a large thermohaline and current variability during the winter period, from October to April. Our data highlight the presence of a stable signal of Norwegian Sea Deep Water influenced by occasional intrusions of warmer (up to +2.7°C), saltier (up to ~35), and less dense (down to 27.98 kg m<sup>-3</sup>) water during fall-winter periods. Interestingly, such intrusions occur simultaneously at both sites, despite their distance (~170km), suggesting also that winter meteorological perturbations may play a role in triggering dense shelf plumes.

### [P003] Biodiversity loss in alternative states impairs ecosystem functioning and efficiency in the *Cystoseira* sp. meadows of the Mediterranean Sea

Bianchelli S.<sup>1</sup>, Buschi E.<sup>1,2</sup>, Danovaro R.<sup>1,2</sup>, Pusceddu A.<sup>3</sup>

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In the Mediterranean Sea, hard-bottom macroalgal meadows may switch to barrens grounds, as a result of sea urchins overgrazing. These are less-productive systems that display a very low if any resilience and represent an alternative state of the system. Previous studies reported low meiofaunal and nematode biodiversity levels in barren states across the Mediterranean Sea, as a result of habitat loss/fragmentation, associated also with a lower availability of trophic resources. In this study, we analyzed the relationship between biodiversity and ecosystem functioning in six areas of the Mediterranean Sea (Minorca, Sardinia, Capraia, Sicily islands, Croatia and Montenegro). All variables



related to ecosystemic functioning (meiofaunal biomass and degradation rates of organic matter), as well as those related to ecosystem efficiency (nematode to microbial biomass, microbial biomass to C decomposition rate, and meiofaunal biomass to predators' biomass ratios) showed lower values in barrens than in the *Cystoseira sp.* meadows, in all the study areas. The biodiversity of these systems was significantly and positively linked to their functioning. These results were consistent in all of the investigated areas, irrespectively of the barren extent and characteristics, suggesting that the degradation of biodiversity due to the loss of habitats provided by macroalgae meadows can cause a significant reduction of the ecosystem functioning. Since barren grounds are expanding rapidly along the Mediterranean Sea and meiofauna are a key trophic component in marine ecosystems, we suggest that the extension and persistence of barrens could also affect higher trophic levels.

#### **[P004] Molecular tools for the quantitative evaluation of *Tychonema bourrellyi* (Cyanobacteria) in large lakes**

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Cyanobacteria are of great interest in freshwater ecosystems, because they are able to produce toxins with potential negative impacts on public health, environment, and tourism economy. The cyanobacterium *Tychonema bourrellyi* has been recently identified in the large lakes south of the Alps (Garda, Iseo, Como and Maggiore) with populations able to produce neurotoxins, namely anatoxin-a (ATX) and homoanatoxin-a (HTX). A positive trend of ATX in Lake Garda was observed from 2009, and the increasing presence of this species in deep subalpine lakes raises serious concerns due to the possible impacts on the tourism economy and for the potential toxic effects, requiring therefore suitable methods of surveillance. Molecular tools offer the possibility to monitor toxigenic microorganisms reducing the assay time, improving the detection sensitivity and providing near-real time information for water quality management. In our study, a species specific method to quantify *T. bourrellyi* was developed with the SYBR Green I real time polymerase chain reaction technique (qPCR), designing new specific primers based on the analysis of highly specific region within the *rbcX* genes. The quantification of *T. bourrellyi* in unknown samples was achieved after calibration of the *rbcX* gene copy numbers with cell numbers estimated from microscopic analysis in a monoclonal culture of *T. bourrellyi* used as a standard. The method was validated by using *T. bourrellyi* densities estimated from microscopic analysis of environmental fresh water samples from Lake Garda. The cell concentrations determined by real time PCR showed a linear correlation with the cell concentrations determined from direct microscopic counts. The developed protocol represents, therefore, an accurate, economic and highly reproducible method to rapidly detect and quantify the toxic cyanobacterium *T. bourrellyi* enabling a long term monitoring population dynamics.

#### **[P005] Preserving and sharing data of deposits sand along the Western Sardinian Shelf**

Brambilla W.<sup>1</sup>, Conforti A.<sup>1</sup>, Carrara P.<sup>2</sup>, Lanucara S.<sup>2</sup>, Guerzoni S.<sup>3</sup>, De Falco G.<sup>1</sup>

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A critical component of Maritime Spatial Planning is the establishment of well-curated, federated Spatial Data Infrastructures (SDI) to provide a means to preserve and share geospatial data while promoting attribution and acknowledgement of its use. Objective of the work is to create a geospatial database of geomorphology, seismic and sedimentology data of Western Sardinian (Italy) marine sector, to share them and to promote planning actions in relation to the management of submerged sand deposits situated in the continental shelf, which can be used for beach nourishment. The work was realized through the integration of data and information collected during several projects. The available data consist of morphobathymetric data (multibeam) associated with the morphoacoustic data between -50 and -700 m and singlebeam surveys in low-depth coastal areas. Extensive coverage of high-resolution seismic profiles (Chirp 3.5 kHz) and hundreds of kilometres of sparker profiles were acquired along the continental shelf. Surface sediment sampling (Van Veen grab and box corer) and vibrocorer survey were performed. These data allowed the mapping, determination of the thickness and volumes of the submerged sand deposits and their sedimentological characterization. All data were organized by means of the software suite Geoinformation Enabling Toolkit StarterKit<sup>®</sup> (GET-IT), developed by researchers of the National Research Council for RITMARE project. GET-IT facilitates the creation of distributed nodes of an interoperable SDI and enables unskilled researchers from various scientific domains to create their own Open Geospatial Consortium (OGC) standard services for distributing geospatial data, observations and metadata of sensors and datasets. The products of the work are the creation of an information system of the sand reservoir along the Western Sardinian continental shelf through interoperable tools allowing the data storage in several levels of information, their sharing, and integrated management and analysis.

**[P006] Preserving and sharing geospatial data to enhance the sustainable management of biological resources in the Sinis MPA**

Brambilla W<sup>1</sup>, Coppa S<sup>1</sup>, Farina S<sup>2</sup>, Guerzoni S<sup>2</sup>, Massaro G<sup>3</sup>, Brundu R<sup>3</sup>, De Falco G<sup>1</sup>, Carrara P<sup>4</sup>, Lanucara S<sup>4</sup>, De Lucia A<sup>1</sup>.

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The Spatial Data Infrastructures (SDI) are a critical component of Maritime Spatial Planning to provide a means to preserve and share geospatial data. Objective of the work is to create a geospatial database to data repository and integration of abiotic/biotic variables, anthropogenic pressures, habitat and species distribution patterns by means of the software suite Geoinformation Enabling Toolkit StarterKit (GET-IT), developed by researchers of the National Research Council for RITMARE project. GET-IT facilitates the creation of distributed nodes of an interoperable SDI and enables unskilled researchers from various scientific domains to create their own Open Geospatial Consortium (OGC) standard services for distributing geospatial data, observations and metadata of sensors and datasets. Specifically, this work focuses on the case study of sea urchin fishery management in the "Penisola del Sinis – Isola di Mal di Ventre" Marine Protected Area (herein after "Sinis MPA"). This topic was a key example considering that: (1) *Paracentrotus lividus* is one of the most intensively exploited invertebrates in Sardinia and a key grazer able in shaping the structure of sublittoral assemblages; (2) there are more restrictive rules governing its exploitation inside the reserve even if the MPA is characterized by low levels of legal compliance and enforcement (3) there is wide availability of spatial and temporal data coming from three different institutions (i.e. Sinis MPA, IAMC-CNR, IMC). The products of the present work are the creation of an information system on the sea urchin resource through interoperable tools allowing the data storage in several levels of information, their sharing integrated management and analysis. This tool, facilitating the understanding of the ecological processes and offers an means to discuss with local stakeholders ways to increase the management effectiveness of biological resources and the individuation of possible policy solutions.

**[P007] Biodegradation of pharmaceutical micro-pollutants (ibuprofen) in the marine environment: a microcosm experiment**

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The main purpose of this study was to evaluate the biodegradation of ibuprofen by natural microbial populations. Industrial samples taken from two sections of a Biofilm Membrane Bio-Reactor (BF-MBR) waste water treatment system were considered. In order to evaluate the biodegradation capacity of the bacterial populations present in the industrial sample, experimental systems were developed, consisting of microcosms supplemented with mineral soil ONR7a, ibuprofen and sodium acetate and toluene (introduced into experimental systems at different concentrations) and used as biodegradation enhancement (Pollutants concentration was measured by GC-MS. In the samples collected in the BF-MBR system, the composition of the bacterial population was also analyzed (16S rDNA clone libraries). The obtained results evidenced how two dominant classes, related to Gammaproteobacteria and Flavobacteria, and a dominant genus, *Planktosalinus*, were present in the first section of the treatment system; in the second section the dominant classes were always Gammaproteobacteria and Flavobacteria, while the dominant genus was *Alcanivorax*. The presence of degrading hydrocarbon bacteria was found in both samples taken in the two sections of the treatment system; the presence of these genes was explained due to the actual nature of the sample, which was a mixture of bilge water and black waters from a passenger ship. From the obtained biodegradation data, a clear reduction in the pollutant (ibuprofen concentration) was observed. Approximately, after 7 days of incubation, a 50% reduction was in fact observed in microcosm systems with higher values of ONR7a, ibuprofen and toluene.

**[P008] Microbial assemblage in the Pasvik river (Arctic Norway): physiological characterization by Life Detector Chip (LDC) antibody microarray during two seasonal surveys**

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Polar ecosystems are areas very vulnerable to both natural or anthropogenic forcings. Knowledge of the microbial assemblage inhabiting these ecosystems can improve current understanding of their functioning and response to

environmental changes. Within the SPONGEPOP project funded by the 7th European Framework INTERACT programme, two seasonal surveys (May and July 2014) were performed at 9 different stations along the Pasvik river (Fennoscandia). An antibody microarray approach using Life Detector Chips (LDC) was applied to evaluate the benthic microbial community, its metabolic profiles and seasonal variations. Three different microchips were used, specific for the whole community, psychrophilic or cyanobacterial populations. LDC allowed a quick characterization of the benthic microbial community, revealing its great physiological versatility. Seasonal differences were found particularly at inner as well as outer stations. Whole community chip showed a microflora particularly active during the warmer months, as shown by the highest number of positive reactions. In May, high activity was found at the innermost stations, while in July no clear spatial trend was observed. Proteins were the most frequently metabolized compounds, followed by nucleotides and small molecules. High Shannon diversity indices (H) were found for the whole community at the innermost stations in May, while in July higher values at the outermost ones were reached. Psychrophiles reacted with high intensity with a great number of compounds at the outer stations during May; in this period, high H values characterized these microorganisms. In July, when temperature increased, their responses were sensibly reduced. Cyanobacteria showed a few number of positive responses, mostly at the inner stations of the river in May. In summer, only spots of reactivity against *Microcystis novacekii* and *M. aeruginosa* were detected.

#### [P009] Environmental and biological characteristics along a transect in Kongsfjorden (Svalbard Islands)

Caruso G.<sup>1</sup>, Madonna A.<sup>2</sup>, Bonamano S.<sup>2</sup>, Miserocchi S.<sup>3</sup>, Giglio F.<sup>3</sup>, Maimone G.<sup>1</sup>, Azzaro F.<sup>1</sup>, Decembrini F.<sup>1</sup>, La Ferla R.<sup>1</sup>, Piermattei V.<sup>2</sup>, Piazzolla D.<sup>2</sup>, Marcelli M.<sup>2</sup>, Azzaro M.<sup>1</sup>

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In the Kongsfjorden site (Svalbard Islands) glaciers retreat is one of the most evident signs of global warming. Such evidence has strong implications on the marine ecosystem. An oceanographic cruise was performed within the ARCA (ARctic: present Climatic change and past extreme events) Project in May 2016 to study the chemical-physical, biochemical and biological characteristics of superficial waters along a transect of 7 surface stations in inner Kongsfjorden until the Kronebreen glacier (stations 4-5-14-6-23-7 and 8, glacier). Station 4 was also sampled from surface to 100 m. The studied parameters were: temperature, salinity, dissolved oxygen, turbidity, nutrients, chlorophyll-a (Chl-a), Total Suspended Matter (TSM), chromophoric Dissolved Organic Matter (c-DOM) absorption, total bacterioplankton abundance and its respiring fraction, heterotrophic bacteria on Marine agar, extracellular enzymatic activity (leucine aminopeptidase - LAP, beta-glucosidase -GLU and alkaline phosphatase -AP). Temperature and salinity values decreased from station 4 to station 8 (near the glacier) and an opposite trend was observed for turbidity and nutrients values. TSM also peaked at station 8 while reduced concentrations of Chl-a characterized the surface waters. Ammonia, nitrite+nitrate and orthophosphate ranges were 0.45-1.44  $\mu\text{mol/l}$ , 0.12-5.60  $\mu\text{mol/l}$ , 0.10-0.48  $\mu\text{mol/l}$ , respectively. CDOM absorption slope values (range 275-295 nm) varied from 0.0077 to 0.0109  $\text{nm}^{-1}$ . Total and respiring bacterioplankton counts were in the magnitude order of  $10^6$  and  $10^4$  cells/ml respectively and of  $10^2$  Colony Forming Units/ml. Enzymatic activity patterns were in the order  $\text{AP} > \text{LAP} > \text{GLU}$ , with rates lower than 1.78, 1.25 and 0.25 nmol respectively. Temperature affected negatively nutrients, TSM and turbidity, positively GLU. AP was associated to the heterotrophic bacteria (Pearson  $r=0.59$ ). AP and c-DOM absorption spectra were significantly related ( $r=0.71$ ), as well as LAP and Chl-a ( $r=0.97$ ), suggesting fresh material stimulated enzymatic synthesis.

#### [P010] Variability in the silver eel (*Anguilla anguilla* Linnaeus, 1758) population from two Sardinian lagoons

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The European eel (*Anguilla anguilla*) stock has declined since the early 1970s caused by a number of factors, the relative importance of which is still debated (Bevacqua et al., 2007). The European Commission has proposed a regulation (COM 2005/472 final) to establish measures for the recovery of the stock with the aim of achieving an escapement to the sea of 40% of the adult silver eel biomass from each river basin. The silencing process corresponds to physiological and morphological changes that prepare the fish for the oceanic migration back to the Sargasso Sea where reproduction will take place (Durif et al., 2005); it occurs at different age and size (Tesch, 2003). The aim of this study was to describe the variability in the silver eel population from two Sardinian lagoons: Sa Praia and Porto Pino lagoons, located in the eastern and in the southern Sardinian coast, respectively. Samplings were conducted seasonally from winter 2015 to spring 2016, using 4 fyke nets per site. Each sampling lasted 10 days and the content of each fyke net was examined every 48 hours. Body length and weight, eye diameter and length of pectoral fin were

measured for each specimen analyzed. In both lagoons the average body length values are in line with the "pre-migrant" fraction as classified by Durif et al. (2009). In Porto Pino the percentage of silver eels longer than 50 cm, classified as the "migrant" fraction, is higher than in Sa Praia, probably due to environmental factors i.e. the constant marine features of the water measured in Porto Pino.

**[P011] Recovery of the red coral *Corallium rubrum* following simulated sediment resuspension events**

Da Ros Z.<sup>1</sup>, Dell'Anno A.<sup>1</sup>, Corinaldesi C.<sup>2</sup>, Lo Martire M.<sup>1</sup>, Cerrano C.<sup>1</sup>, Danovaro R.<sup>1,3</sup>

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Benthic suspension feeders are sensitive to sediment resuspension induced by natural forcings and anthropogenic activities (e.g. trawling, sediment dredging), but the magnitude of this impact needs to be clarified. In this study, we investigated the recovery of the red coral *Corallium rubrum* following simulated sediment resuspension events. Nubbins of the red coral (5-7 cm each) were exposed for 2 weeks to natural sediments (with a size < 125 µm and at concentrations 25 mg/L and 100 mg/L) collected in the surrounding environment where corals were obtained and continuously resuspended by means of a mechanical apparatus. During the experiment, polyps' activity, feeding rates and tissue integrity were analysed and compared to responses of un-exposed nubbins. Our findings revealed that continuous sediment resuspension determines a decrease of polyps' activity and feeding rates and a damage of coral tissues. However, the corals, once reported in clean conditions (i.e. seawater without sediment particles), were highly resilient. Overall results from this study provide new information on the impact of sediment resuspension on sessile organisms such as hard branching corals and pave the way for the definition of mitigation measures to minimise as much as possible the effects of anthropogenically-mediated sediment resuspension on benthic biota.

**[P012] Seasonal dynamic and distribution of the invasive species *Mnemiopsis leidyi* Agassiz (Ctenophora, Bolinopsidae) in three lagoons of the Gulf of Oristano (western Sardinia, Mediterranean Sea)**

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The invasive comb jelly *Mnemiopsis leidyi* is a lobate ctenophore native of coastal and estuarine waters in the temperate western Atlantic Ocean. Its high predatory ability on eggs and larvae of fish and shellfish is considered a potential threat for ecosystems and fisheries worldwide. Since the 1980s *M. leidyi* has colonized marine and transitional environments in Europe, and it was detected for the first time in Sardinia (S'Ena Arrubia lagoon) in 2015. In this work, the seasonal dynamic and distribution of *M. leidyi* were determined in three lagoons located in the same geographical area (Gulf of Oristano). Monthly samplings were conducted from October 2016 in S'Ena Arrubia, Santa Giusta and Cabras lagoons. *M. leidyi* samples were taken using an Apstein conic net (mesh size 200 µm) along three stretches of 100 m. In addition, the content of two fyke nets per site was examined after 24 hours of fishing. During each sampling, phytoplankton samples were collected and selected environmental variables were measured. *M. leidyi* was detected in S'Ena Arrubia from October to November 2016. The species disappeared in winter and spring months, until reappearing in July 2017. *M. leidyi* was observed throughout the study period in Cabras, whereas it has never been detected in Santa Giusta. The mean abundance and mean body size were 0.18 ctenophores m<sup>-3</sup> and 32.6 mm in S'Ena Arrubia, and 298.1 ctenophores m<sup>-3</sup> and 13.9 mm in Cabras. The differences in temporal and spatial distribution, mean abundances and sizes of specimens, reflected the dissimilarity of the three lagoons for salinity, nutrients and phytoplankton composition. Consistent with this, different management measures should be taken in each affected area in case of verified impacts of *M. leidyi* on ecological conditions and fisheries productivity.

**[P013] Benthic fluxes and early diagenetic processes in sediments of a drinking water reservoir (Ridracoli Dam, Forlì Italy)**

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The regeneration of nutrients and other chemical species in sediments are controlled by physical, chemical and biological factors and are related to the degradation of the sedimentary organic matter. The exchanges at the water-sediment interface play a fundamental role in the biogeochemical cycles, and can change the water composition. The aim of this study was to investigate the diffusive and dissolved benthic fluxes in the Ridracoli basin, an important drinking water reservoir. Sediments and water samples were collected in October 2015 and April 2016 at an experimental site, close to the Ridracoli dam. In situ benthic flux measurements of dissolved species ( $O_2$ , DIC, DOC,  $N-NO_3^-$ ,  $N-NO_2^-$ ,  $N-NH_4^{4+}$ ,  $P-PO_4^{3-}$ ,  $Si-Si(OH)_4$ ,  $H_2S$ , major and trace elements) were conducted using an automatic benthic chamber. Furthermore, undisturbed sediment cores were collected for analyses of TC, OC, TN,  $\delta^{13}C$ ,  $^{137}Cs$ , grain size and major and trace elements, as well as of the dissolved species in porewaters. Physico-chemical properties of the water column were measured, too. The diagenetic environment is characterized by high deposition rate of fine siliciclastic sediment, and high contents of fresh continental organic matter and Fe-Mn oxy-hydroxides. In October, a well-defined water stratification was detected and, consequently, anoxic conditions occurred near the bottom. Core sediments were always in anoxic conditions in both seasons. This study evidenced the occurrence of intense organic matter degradation processes throughout the sedimentary column, dissolved oxygen consumption near the water-sediment interface, reduction of Mn and Fe oxy-hydroxides, and dissolution of carbonates at sediment deeper depths. The accentuated stratification of the water column, the abundance of reactive organic matter and the anoxic environment near the bottom resulted in an important release of Fe, Mn, DIC,  $N-NH_4^{4+}$  and other associated elements. The situation became particularly critical in late summer, when the metal release could reduce the quality of the drinking water.

#### **[P014] Analysis of sea temperature in the Adriatic Sea: a century of data from 1913 to 2013**

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The Adriatic Sea can be considered the most sampled sub-basin of the Mediterranean Sea, so it represents an optimal area where to assess effects of climate change on water masses properties. Moreover, it is well established that temperature is an important regulator on the activity and growth of all aquatic organisms. Sea temperatures of over 14'000 oceanographic stations collected in the Adriatic Sea during the period 1913-2013 have been analyzed. Data were extracted by ATOS database (for the first 70 years), while most data were collected by ISMAR-CNR. Monthly climatologies during all the period show sensible variations. Temperatures at surface show a strong warming from June to August while on the bottom from August to September (almost 2 °C). A strong cooling is evident in winter period at the surface (mainly in January about 3°C) and from January to April on the bottom (about 2°C). The deepest part of the southern Adriatic (below 500m) clearly shows different dynamics. The South Adriatic Pit exhibits an evident warming from August to December ranging from about 13°C to 17 °C. In February and March, there is a slight cooling from 13°C to 12°C while in remaining months there are no significant variations. The dataset reveals how fast the response to climate change can be in the Adriatic compared to all the Mediterranean Sea and demonstrates the essential role of long dataset in the ocean.

#### **[P015] Diatom communities of the Casteldoria thermo-mineral spring (Northern Sardinia, Italy): first results**

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The thermo-mineral springs of Sardinia have been historically the subject of several geochemical studies. By contrast, their communities and ecological aspects are totally unknown, until now. The Casteldoria spring, located in the region of Anglona in northern Sardinia, is an interesting thermo-mineral spring of the Island, characterised by high temperature (72 °C at the point of emergence) and salinity (5 g L<sup>-1</sup>). The water emerges from granite sands and has a Na-Cl-Ca composition, with N<sub>2</sub> gas emissions, according to literature. The aim of this study was to document the diatom biodiversity of the spring by optical and scanning electron microscopy and to acquire first information about relationships between species and environmental variables. Samplings were conducted monthly for environmental variables (chemical, physical and nutrients) and seasonally for epilithic and epipellic diatoms, from May 2016 to April 2017. pH range was between 6.3 and 7.6, sodium between 1200 and 1439 mg L<sup>-1</sup>, sulfates between 88.7 and 100.8 mg L<sup>-1</sup>.



<sup>1</sup>, chlorides between 2530 and 3701 mg L<sup>-1</sup>, nitrates between 0.023 and 0.179 mg L<sup>-1</sup>, total phosphorus between 0.018 and 0.177 mg L<sup>-1</sup>, and reactive silica between 25.2 and 29.9 mg L<sup>-1</sup>. After a preliminary analysis of part of the samples collected, 142 taxa belonging to 51 genera were inventoried. The most abundant taxa (relative abundance > 5%) were *Aulacoseira ambigua*, *A. granulata*, *Amphora* sp., *Nitzschia frustulum*, *N. microcephala*, *N. sp.*, *Pinnularia jocolata* and *Stephanodiscus neoastrea*. These species have a cosmopolitan distribution with the exception of *P. jocolata*, present mainly in tropical environments at high temperatures of South America. The most abundant and frequent taxa (relative abundance of 1.5 to > 5%) mostly prefer brackish to saline waters (eg *Nitzschia clausii*), high nutrient content (eg *Achnanthes exiguum*) and medium-high content of organic matter (eg *Melosira varians*).

**[P016] B-N-methylamino-L-alanine and microcystins concentrations in relation to Cyanobacteria abundance in eutrophic Mediterranean artificial lake: the case study of Lake Bidighinzu (Sardinia, Italy)**

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In Sardinia, water for drinking derives primarily from reservoirs, the majority of which is eutrophic. Cyanobacteria are the dominant group in the phytoplankton, especially in the summer-autumn period, the most critical seasons for the quality and the uses of water. Recently, a relationship between the trophic state, cyanobacteria abundance and microcystins (MCs), the most frequent cyanotoxins recognised worldwide, was assessed for Sardinian reservoirs. Sardinia represents also a genetic isolate, characterized by a higher frequency than expected of the rate of Amyotrophic Lateral Sclerosis and of genetic mutations involved in different neuropathological conditions. β-N-methylamino-L-alanine (BMAA) production is a potent not yet well investigated neurotoxin, produced by Cyanobacteria, involved in the Amyotrophic Lateral Sclerosis/Parkinsonism dementia complex. This study investigated on the relationships among environmental variables (14), Cyanobacteria, and BMAA and MCs in a hypereutrophic reservoir, Lake Bidighinzu (North-Western Sardinia, Italy) whose waters are mainly used for drinking. Enzyme Linked Immunosorbent Assay (ELISA) for determination of BMAA and MCs were used in surface and subsurface water, collected weekly from March to October 2014. BMAA and MCs positives were found in almost all the samples (n = 22). MCs > 1 µg l<sup>-1</sup>, the World Health Organization limit for MCs in drinking water, was registered in correspondence of *Cyanocapsa* sp. bloom (about 5 \* 10<sup>8</sup> cells l<sup>-1</sup>) in September and in October. BMAA maximum was found in correspondence of *Dolichospermum flos-aquae* bloom (> 6 \* 10<sup>7</sup> cells l<sup>-1</sup>) in June. A redundancy analysis separated the cyanotoxins and relative toxic species of Cyanobacteria into two main groups: *Dolichospermum* species (related to BMAA and most important nutrients), and *Microcystis* species (related to MCs and DO). Our results offer a first estimation of concentrations of BMAA and a further report on MCs and relationship with Cyanobacteria assemblages and trophic state of Bidighinzu Lake.

**[P017] Ecology of biotic communities of thermal springs: early studies on Cyanobacteria in Sardinia (Italy)**

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The ecology of thermal springs is still poorly studied compared to other types of freshwater ecosystems, despite their importance as hot-spots of biological diversity and their socio-economic value. The thermal springs communities are composed of a relatively small number of species with a cosmopolitical geographic distribution, genetically differentiated and isolated on the local scale. Eight thermal springs (Casteldoria, Caddas 1, Caddas 2, Oddini, San Saturnino, Abbarghente, S. Giovanni Su Anzu, San Martino), belonging to five hydrographic basins, were investigated, with the main aim of studying, for the first time in Sardinia, some aspects of the ecology of their living communities, considering in particular the Cyanobacteria, one of the main groups of microorganisms inhabiting these ecosystems. Water samples for chemical, physical and nutrients determination and Cyanobacteria were sampled in summer 2016 and winter 2017. Cyanobacteria were collected from different substrates: rock and pebbles (epilithic), macrophytes (epiphytic) and fine sediment (epipelagic). The number of taxa varied from 8 (S. Giovanni su Anzu) to 15 (San Saturnino). The percent species composition revealed that the most important species were *Leptolyngbya thermalis*, *Leptolyngbya laminosa* and *Oscillatoria* sp. in San Saturnino; *Oscillatoria* sp., *L. thermalis* and *Planktothrix* sp. in Abbarghente; *L. laminosa*, *L. thermalis* and *Lyngbya* sp. in Fordongianus (Caddas 1 and 2); *L. thermalis*, *Oscillatoria* spp. and *Lyngbya* spp. in Casteldoria, San Martino and Oddini; *L. thermalis*, *Oscillatoria* sp. and *Synechococcus* sp. in S. Giovanni su Anzu. The presence of species potentially toxic, such as *Mastigocladus laminosus*, *Lyngbya nigra* and *Cyanosarcina* sp., were found in Abbarghente, Caddas 1, S. Giovanni Su Anzu, San Martino and San Saturnino. Our preliminary results indicate an unexpected biodiversity of the investigated thermal springs and highlight the

importance of further in deep studies to construct a robust ecological knowledge of these peculiar ecosystems for supporting their management and protection.

**[P018] Small-scale distribution of meiofauna and biopolymeric C in subtidal sandy sediments (Mediterranean Sea)**

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We investigated the small-scale variation in the abundance and taxa composition of meiofauna, along with the quantity and biochemical composition of organic matter (OM) in subtidal sandy sediments. We tested the null hypothesis that abundance and composition of the meiofaunal community, and the OM quantity and composition do not vary within a surface of 1 m<sup>2</sup>. Sediment samples for meiofauna and OM analyses were collected at 50-cm depth from a surface delimited by a 1×1 m frame, divided into 3×3 quadrat sub-frames. From each of the 9 sub-frames 3 replicates were collected using manual corers. The frame was parallel to the coastline to include in the experiment the potential influence of micro-hydrodynamic forcing, assumed to be proportional to the distance from the shore. OM quantity (biopolymeric C) and biochemical composition (proteins, carbohydrates, lipids and phytopigments), and the abundance of meiofauna were quite homogenous within the frame. The meiofaunal community composition varied significantly within the frame and exhibited an apparent gradient associated with the distance from the shore, and hence with the level of micro-hydrodynamic conditions. We report also that the composition of the meiofaunal abundance and community composition are tightly related with the sedimentary lipid contents. Our results suggest that, within 1 m<sup>2</sup> in subtidal sandy sediments, 3 replicates are sufficient to assess correctly OM quantity and composition and meiofauna abundance, but inadequate, because of the significant variability in meiofaunal composition at a finer scale (<1m<sup>2</sup>), to provide a sufficiently representative assessment of meiofauna taxonomic composition. The relationship between meiofaunal community composition and the lipid sedimentary contents suggest the need of further studies aimed at identifying origin and composition of the lipid components of sedimentary OM.

**[P019] Forecasting the fate of possible oil dispersions from oil platforms and assessing the related hazard and environmental risk: the "SOS-Piattaforme" project**

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The Italian Ministry of the Environment, Land and Sea (MATTM) has appointed CNR (CNR-DTA, with a main role for the CNR-IAMC in Oristano) for monitoring oil rigs in the Italian seas (along the southern Sicily and in the Adriatic Sea) and providing among the other products: a daily bulletin of possible oil dispersions; hazard, vulnerability and risk maps for the area around the platforms; a tool to support Authorities (Ministry itself and the Coast Guard) in managing actual emergencies in case of real oil slicks. In order to satisfy the above cited deliverables, a modeling system was built based on 3D Eulerian hydrodynamical models (on which CNR-IAMC in Oristano has long lasting experience) providing forcing fields for a Lagrangian community model for oil spill dispersions and slick evolution (oil transport and transformation) named MEDSLIK-II. Hydrodynamical numerical modeling is based on two different approaches, finite elements and finite differences, respectively more suitable for coastal (in virtue of a finer resolution) or open waters. Both are nested at boundaries with coarser models and forced at surface with forecast fields provided by meteorological models (Skiron, Athens University; Bolam, CNR-ISAC). Numerical oil trajectories will be validated by observational experiments conducted with drifter buoys. Such modeling system automatically and daily provides (through a restricted-access web portal, <http://www.seaforecast.cnr.it/forecast?q=user>) the output of the numerical simulations of potential oil dispersions from oil rigs. Aside the operational use of the system, the numerical outputs are stored in netcdf format and used to compute statistics of the slick distributions. Such statistics provide an estimation of the hazard, assessed by two different indexes. The indexes constitute the basic informative layer on which the environmental risk will be assessed, once opportunely combined with coastal vulnerability and sensitivity layers.

**[P020] A straightforward approach to assess the impact and linkage between land uses and trophic status of inland water ecosystems in Sardinia, Western Mediterranean**

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This work aims at developing a straightforward methodology for an in-depth evaluation of linkages between watershed land uses and lentic inland waters, such as lakes and lagoons, as a cause of water eutrophication. The proposed methodology integrates multi-resolution, multi-scale and multi-source geospatial data as Corine Land Cover (CLC), decadal agricultural census data, demographic and ground-based expert knowledge at basin level over relevant economic watersheds in Western Mediterranean island of Sardinia (Italy). The evaluation, carried out through geospatial and multivariate analysis, integrated factors such as land uses, habitat structure, biodiversity and degree of anthropization and eventually, summarized the whole in several thematic environmental sustainability indicators. The methodology underwent to a first order calibration and validation that have foreseen the use of data collected from 21 water bodies selected among several lakes and lagoons. Though preliminary, first results have given satisfactory assessment of inland water trophic state along investigated areas. Good correlation has indeed been observed among environmental sustainability indicators and concentration of total phosphorus, main limiting nutrient factor in investigated reservoirs, chlorophyll *a* and phytoplankton biomass. The watershed pressure evaluation assessed by means of such indicators, agreed with the trophic classification obtained from independent OECD probabilistic model developed the same series of data. The application of the proposed method in Sardinia demonstrated to be have high degree of up-scalability potential. Other tests are indeed planned to be implemented across other European areas for more robust and reliable validation.

**[P021] Potential impact of bottom trawling activities on sedimentary organic matter in the Gulf of Castellammare (Sicily)**

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Bottom trawling has been identified as one of the main drivers of sedimentary dynamics in deep environments, resuspending surface sediments and eroding the seafloor. Although the impacts of trawling in deep-sea sediment properties and the resulting impairment of the ecosystem functioning have been previously inferred, the repercussions of this constant erosion with depth on the bioavailability of organic matter still need to be addressed. Sediment dry bulk density, grain size, 210Pb concentrations, and organic biomarkers (proteins, lipids, carbohydrates, and phytopigments) were analyzed in triplicate sediment cores retrieved in trawled and untrawled sites from the Gulf of Castellammare, Sicily. The trawled site was severely eroded, as shown by the high dry bulk density and depleted excess 210Pb concentrations, whereas the excess 210Pb profile at the untrawled site revealed a 6 cm thick surface mixed layer derived from bioturbation overlaying softer sediments that had accumulated at an average rate of 0.15 cm/yr. At the untrawled site, lipids, carbohydrates, and phytopigments concentrations decreased with depth, characteristic of organic matter consumption by benthic communities. Fresh organic matter (lipids, proteins, and phytopigments) concentrations in the uppermost layer were comparable in both trawled and untrawled sites, likely due to similar inputs of pelagic organic matter prior to the sampling period. However, organic biomarkers became significantly depleted in depth at the trawled site as a consequence of the continuous erosion caused by trawling. These results reveal that trawling-induced sediment resuspension and erosion in the Gulf of Castellammare have removed significant amounts of organic matter which have led to a high dependence on the pelagic settling of organic matter to maintain the ecosystem functioning in trawling grounds.

**[P022] Temporal pattern of planktonic fungi in the LTER MareChiara station**

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Fungi are important functional players in marine ecosystems where they are involved in decomposition of organic matter, cycling of nutrients and as pathogens. However, fungi have so far been neglected compared to other groups. Temporal dynamics of fungal communities' diversity and relationship with environmental variables were investigated by high-throughput sequencing of the V4 region of 18S rDNA gene on 48 surface water samples, collected over three years (2011-2013) at the LTER Mare Chiara station in the Gulf of Naples (Tyrrhenian Sea, Mediterranean Sea). The analyses resulted in a total of 58,396 sequences related to fungi, corresponding to more than 150 different taxa. Fungal diversity covered the phyla Ascomycota, Basidiomycota, and Chytridiomycota, the latter resulting as the dominant phylum. Several sequences matched those of marine fungal isolates representing a wide range of niches from saprotrophs to animal and algal parasites. The temporal dynamics of plankton fungal communities showed recurrent patterns defined by three main seasonal clusters: i) autumn-winter (November -January), ii) spring-early summer (March-June), iii) late summer (July-October). Preliminary exploration carried out on a subset of environmental data, using BIO-ENV analysis, selected two parameters that were significantly related to the temporal shifts: temperature, which is a proxy for the seasonal cycle, and nitrates, most probably related to the presence of fungal groups able to use them as source of nitrogen. Interestingly, no significant relation with salinity was found, suggesting the presence of halotolerant groups. In conclusion, this molecular approach revealed that fungi are rare in pelagic environments; however, relative abundance does not reflect ecological importance. This study emphasised the need to better understand fungal niche diversification and functional roles in the marine coastal ecosystems, in order to include this component in the context of the overall pelagic ecosystem functioning and services.

**[P023] River flood impact on diversity and functioning of benthic prokaryotes in the Po river prodelta (Italy): ecological significance and climate change-related considerations**

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Climate change is expected to increase the future occurrence of extreme events, both in terms of magnitude and frequency. Such events include river floods, which are important structuring forces in prodelta and coastal ecosystems, and can affect their functioning also by potentially shaping prokaryotic diversity and metabolism. The Po river is the largest Italian tributary transporting annually tons of water and suspended matter to the adjacent Northern Adriatic Sea, and its prodelta system typically experiences two discharge peaks per years, that ensure a supply and deposition of land-derived organic carbon as well as numerous pollutants (e.g., heavy metals, PAHs, PCBs) in the coastal ocean. However, these events are changing in frequency and intensity as a consequence of climate change effects on the Po river hydrographic basin. In this work, an event-response surface sediment sampling was carried out in the Po river prodelta after 3 flood events of different entities, in June ("moderate") and December 2013 ("low"), and December 2014 ("high discharge"). Samples were analyzed for the determination of biodiversity and community composition, together with a panel of environmental variables and pollutants. Moreover, collected data are casted in the perspective of coastal circulation patterns and river plume dynamics, modeled by means of a state of the art hydrodynamic model (COAWST modeling suite). Different climate change related scenarios of possible ecological impacts driven by extreme events in the area are therefore drawn, with the aim also of estimating the sediment microbial responses to future changes in the river discharge rates.

**[P024] Monitoring CO<sub>2</sub> leakage at Carbon Capture and Storage sites using stable carbon isotopes in phytoplankton**

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Carbon capture and storage technology (CCS) is expected to play a key role in climate change mitigation strategies by reducing CO<sub>2</sub> emissions into atmosphere from fossil fuel combustion. Although a well-engineered storage site is not expected to leak, the risk of failure of CO<sub>2</sub> containment and the subsequent environmental impact is a major issue for the acceptance of this approach. This study aims at the evaluation of carbon isotopic analysis as a tool for effective early warning of CO<sub>2</sub> migration from CCS, since different carbon sources have specific  $\delta^{13}\text{C}$  (usually lower values in anthropogenic emissions than in natural CO<sub>2</sub>). Three culture experiments were conducted within 2L-photobioreactors under controlled conditions (light, temperature, pH, salinity and pCO<sub>2</sub>). In each experiment, the diatom *Thalassiosira* sp. was grown in two different media: one prepared with natural seawater and the other with artificial seawater,

whose carbonate system derived from anthropogenic CO<sub>2</sub>. Both media were equally supplemented with nutrients (silicates, nitrates and phosphates), metals and vitamins. Daily variations of  $\delta^{13}\text{C}$  in dissolved inorganic carbon (DIC) and in algae were analysed in order to study the phytoplankton response. According to our preliminary results (first two experiments), differences exist in diatom response between natural and anthropogenic conditions. In natural medium, the diatom  $\delta^{13}\text{C}$  values did not show important deviations from the starting value ( $-24.4 \pm 0.3\text{‰}$ ), whereas in the anthropogenic CO<sub>2</sub> system, algae carbon isotopic signature became more negative (until  $-44.4 \pm 0.9\text{‰}$ ) due to the exposure to lower  $\delta^{13}\text{C}$  DIC values ( $-44.7 \pm 0.8\text{‰}$ ). The tested microalgae integrated the different source of inorganic carbon in a short period after the exposure to the artificial seawater medium, reflecting in different carbon isotopic values with respect to the natural system.

**[P025] Sostanza organica disciolta cromoforica (CDOM) come strumento predittivo per valutare la dinamica della DOM in lagune Mediterranee**

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La materia organica disciolta (DOM) svolge un'importante ruolo nel ciclo del carbonio. La conoscenza della sua dinamica rappresenta quindi un passo fondamentale nella comprensione dei processi biogeochimici in ambienti acquatici. Oltre il 90% di DOM è costituita da carbonio organico disciolto (DOC), di cui la materia cromoforica (CDOM) rappresenta una importante frazione, per cui il suo bilancio viene analiticamente misurato come contenuto di DOC/CDOM. Considerando il DOC un indicatore trofico per sistemi lagunari, in questo studio ipotizziamo che le proprietà ottiche (coefficienti di assorbimento, slope spettrali e SUVA<sub>254</sub>) della DOM possono essere considerate variabili predittive della qualità delle acque lagunari, indipendentemente dalle dinamiche spaziali e temporali del DOC. A tal proposito, abbiamo preso in esame due sistemi lagunari Mediterranei, il sistema Lagune-Golfo di Oristano (LGO) e la laguna di Varano (LV), caratterizzati da differenti condizioni ambientali e pressioni antropiche. La strategia di campionamento ha tenuto conto dei gradienti spaziali e temporali delle variabili in questione. Il forte gradiente salino, da <1 (siti fluviali) a >50 (laguna di Mistras), osservato nel sistema LGO influenza la distribuzione DOC/CDOM, come evidenziato dalle negative correlazioni tra la salinità e i coefficienti di assorbimento a<sub>280</sub> e a<sub>350</sub>, indicando una forte influenza terrigena nei siti prossimi a input fluviali, con livelli minimi nei siti distanti da input fluviali. Al contrario, in LV la salinità è risultata omogeneamente distribuita, indicando un buon mescolamento di acque dolci e marine, e correlata positivamente con le concentrazioni di DOC/CDOM molto più basse di quelle riscontrate nella laguna di Cabras del sistema LGO. Nonostante le marcate differenze osservate tra le due aree di studio, la dinamica spaziale e temporale delle variabili trofiche e ottiche ha evidenziato una costante e lineare correlazione tra DOC e CDOM, supportando l'ipotesi che il CDOM può essere una efficace variabile predittiva per la stima del DOC.