

XX Congresso

Associazione Italiana

di Oceanologia e

Limnologia

Lecce, 4-8 Luglio 2011



A.I.O.L.

LIBRO DEGLI ABSTRACT

XX Congresso



Associazione Italiana di
Oceanologia e Limnologia

LIBRO DEGLI ABSTRACT



Patrocinato da:

Di.S.Te.B.A.
Università del Salento
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Regione Puglia
Area Marina Protetta di Porto Cesareo
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Con il contributo di:

Di.S.Te.B.A.
Università del Salento
Regione Puglia
Azienda di Promozione Turistica di Lecce
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Banca Monte dei Paschi di Siena



UNIVERSITA'
DEL SALENTO



Dipartimento di Scienze e
Tecnologie Biologiche ed
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PROGRAMMA

XX Congresso Associazione Italiana Oceanologia e Limnologia

Lecce, 4-8 Luglio 2011
Hotel Tiziano

• Lunedì 4 Luglio

10.00	Apertura segreteria
15.00-15.30	Apertura del Congresso e saluti delle Autorita'
Chairperson:	R. Danovaro
15.30-16.00	Relazione a invito: <i>Impact of climate change on ocean physical and biological processes of relevance to fisheries.</i> J. Sarmiento et al. (University of Princeton)
16.30-16.45	V. Saggiomo, C. Balestra, F. Bignami, B. Buongiorno Nardelli, R. Casotti, O. Mangoni, F. Margiotta, S. Marullo, A. Passarelli, A. Pisano, C. Pizzi, M. Saggiomo, I. Santarpia, R. Santoleri. <i>Driving factors of coastal microbial dynamics along the Central-Southern Tyrrhenian Sea during TYR01 survey (Fall 2010).</i>
16.45-17.00	F. Margiotta, C. Balestra, F. Bignami, R. Casotti, S. Colella, R. Lavezza, O. Mangoni, S. Marullo, A. Passarelli, M. Saggiomo, I. Santarpia, C. Santinelli, G. Volpe. <i>Hydrochemical and biological features of coastal waters after a flooding event in the Gulf of Salerno as seen during TYR01 Survey (Tyrrhenian Sea).</i>
17.00-17.30	Pausa Caffè
17.30-17.45	A.M. Fragliasso, G. Fusco, G. Budillon. <i>Variabilità di mesoscala delle correnti lungo le coste calabro-campane (Febbraio-Settembre 2008) - Risultati preliminary.</i>
17.45-18.00	F. Foglini, F. Trincardi, E. Campiani, L. Langone. <i>The reshaping of the South West Adriatic Margin by pervasive dense shelf water cascading.</i>
18.00-18.15	G. Fusco, Y. Cotroneo, G. Budillon, G. Spezie. <i>Flussi di calore nel Mar di Ross e Weddel e loro interazione con i fenomeni climatici ENSO e Antarctic oscillation.</i>



- 18.15-18.30 **I. Rivetti, S. Frascetti, E. Zambianchi, F. Boero.** *Long-Term Evolution of the Mediterranean Water Column and biological response.*
- 18.30-18.45 **A. Russo, A. Coluccelli, M. Deserti, A. Valentini, A. Benetazzo, S. Carniel.** *Improving a forecasting hydrodynamic model in the Adriatic Sea.*
- 19.00-20.00 Cocktail di benvenuto**

• Martedì 5 Luglio

Chairperson: L. Airoidi

- 09.00-09.30 **Relazione a invito: Climatic Impacts and resilience of coastal ecosystems and fisheries. F. Micheli** (University of Stanford)
- 09.30-10.45 **A. Pusceddu, C. Corinaldesi, A. Dell'Anno, R. Danovaro.** *Inter-annual variability in prokaryotic and viral abundance in the Northern Adriatic Sea: links with changes in the trophic status?*
- 09.45-10.00 **C. Corinaldesi, A. Dell'Anno, E. Rastelli, R. Danovaro.** *Exploring the selective transfer of organic matter and microorganisms from the ocean surface to the atmosphere*
- 10.00-10.15 **C.T. Satta, S. Anglès, E. Garcés, J. Camp, B.M. Padedda, S. Pulina, N. Sechi, A. Lugliè.** *Dinoflagellate cyst assemblages in different areas of the Western Mediterranean Sea*

10.15-10.45 Pausa Caffè

- 10.45-11.45 **Relazione a invito: Environmental change blindness, “invisible present” and long-term ecological research: issues, opportunities and threats from LTER-ITALY freshwater and marine sites? A. Pugnetti** (CNR, ISMAR)

Contributi su **Stagni Temporanei Mediterranei**

11.30-13.00 Chairperson: O. Mangoni

- 11.30-11.35 **G. Belmonte.** *Coordinator of the project “Mediterranean temporary pools of Apulia”, founded by the Fondazione Casa di Risparmio di Puglia*

- 11.35-11.45 **A. Castorani** - President of Fondazione Ca.Ri.Puglia. "Ca.Ri.Puglia Foundation as research supporter"
- 11.45-12.00 **G. Alfonso, G. Belmonte**. *The faunal peculiarities of the Apulian temporary pools.*
- 12.00-12.15 **P. Ernandes, V. Zuccarello**. *Plants of the Mediterranean Temporary pools of Apulia.*
- 12.15-12.30 **F. Marrone, M. Korn, S. Turki, L. Naselli-Flores**. *Nuovi dati sulla fauna a "grandi branchiopodi" (branchiopoda: anostraca, notostraca, spinicaudata) delle acque temporanee della Tunisia*
- 12.30-12.45 **F. Stoch**. *State of knowledge on the fauna of the Italian temporary pools.*

12.45-14.15 Pausa Pranzo

Chairpersons: N. Salmaso

- 14.15-14.45 **Relazione a invito** Living the last segment: our falsified perception of the holocene biodiversity. **M. Taviani** (CNR, I-SMAR)
- 14.45-15.00 **D. Zeppilli, M. Canals, R. Danovaro**. *Biodiversity associated with pockmarks: extreme habitats contribute to increase gamma diversity in the deep sea.*
- 15.00-15.15 **M. Mea, S. Bianchelli, A. Pusceddu, R. Danovaro**. *Temporal variability of meiofaunal assemblages in deep-sea sediments of the NW Mediterranean Sea.*
- 15.15-15.30 **S. Miserocchi, L. Langone, C. Santinelli, M. Azzaro**. *Early diagenetic processes and organic carbon burial in deep sediments of the Mediterranean Sea.*
- 15.30-15.45 **T. Tesi, L. Langone, M.A. Goñi, R.A. Wheatcroft, S. Miserocchi, L. Bertotti**. *Compositional changes of sedimentary organic matter in prodeltaic sediments: a 9-yr time series analysis.*
- 15.45-16.00 **M. Giani, E. Arashkevich, D. Berto, G. Cerrati, R. Delfanti, A. Karageorgis, V. Kovacevic, E. Krasakopoulou, M. Lipizer, K. Pagou, F. Rampazzo, S. Mosharov, S. Salvi, M. Pujol Pay, T. Moutin, S. Tugrul**. *Particulate organic matter distribution in different areas of the Mediterranean and Black seas.*
- 16.15-16.30 **C. De Vittor, M. Lipizer, F. Tamberlich, C. Comici, C. Falconi, M. Giani**. *Temporal dynamic of particulate and dissolved organic matter in the Gulf of Trieste, Northern Adriatic Sea.*

16.30-16.30 Pausa Caffè

Chairpersons: L. Naselli-Flores

16.30-16.45 **Relazione a invito:** Lake Kivu: A lakeful of troubles...or an extraordinary site for limnological research? **Jean-Pierre Descy** (University of Namur)

16.45-17.00 **A. Oggioni, T. Kliment, G. Morabito, D. Manca.** *Le infrastrutture spaziali di dati negli studi limnologici ed ecologici*

17.00-17.15 **L. Cerasino, N. Salmaso.** *Cyanobacterial toxins profiling in the Italian Subalpine lakes.*

17.15-17.30 **G. Morabito, A. Oggioni.** *Variabilità ambientale a diverse scale spazio-temporali e risposta del fitoplancton: esempi da applicazioni di fluorimetria in vivo in alcuni laghi dell'Italia settentrionale.*

17.30-17.45 **N. Salmaso, L. Cerasino.** *Trophic gradients, climate change and cyanobacteria: what we expected and what we got – a lesson from Lake Garda.*

17.45-18.00 **D. Copetti, F. Salerno, E. Carraro, N. Guyennon, L. Valsecchi, E. C. Manfredi, G. Viviano, G. Tartari.** *Dinamica dei laghi tra cambiamenti a scala globale e locale: i casi di studio del Lago di Como e di Pusiano.*

18.00 – 20.00 Poster e degustazione prodotti tipici

• Mercoledì' 6 Luglio

Chairpersons: O. Mangoni

09.15-09.45 **Relazione a invito:** Do microbial coexistence and cooperation preserve diversity and productivity in aquatic systems? **G. Corno** (CNR, Palianza)

09.45-10.00 **C. Corinaldesi, G.M. Luna, A. Dell'Anno.** *Extracellular DNA pool fuels the metabolism of prokaryotes and represents a major archive of genetic diversity in deep-sea sediments of hypersaline anoxic basins.*

10.00-10.15 **M. Celussi, P. Del Negro, E. Crevatin, S. Fonda Umani.** *Long term variability in microbial degradation at a shallow coastal site: spectra and rates of extracellular enzyme activities in the Gulf of Trieste.*

- 10.15-10.30 **D. Giovannelli, M. Molari, G. d'Errico, E. Manini.** *Prokaryotic community structure variation in the deep sediments of the Mediterranean Sea and adjacent Atlantic Ocean.*
- 10.30-10.45 **M. Molari, E. Manini, A. Dell'Anno.** *Dark CO₂ fixation in benthic deep-sea ecosystems.*
- 10.45-11.00 **C. Corinaldesi, M. Tangherlini, A. Dell'Anno.** *Viral diversity and gene flow in deep-sea sediments.*
- 11.00-11.30 Pausa Caffè**
- 11.30-11.45 **Relazione a invito:** Bacterial and archaea diversity in nitrogen cycle: recent discoveries and future challenges. **M. Coci** (CNR, Pallanza)
- 11.45-12.00 **R. Bertoni, C. Callieri, L. Bracchini.** *Eterogeneità spaziale dei batteri e della sostanza organica in un grande lago subalpino, il Lago Maggiore.*
- 12.00-12.15 **D. D'Alelio** *Being one, no one and one hundred thousand: genetic divergence, recombination, selective sweeps and "epidemic" population structure in the freshwater cyanobacterium Planktothrix*
- 12.15-12.30 **G.M. Luna, A. Pusceddu, C. Corinaldesi, A. Dell'Anno, F. Ape, R. Danovaro.** *Impact of offshore mariculture on benthic microbial metabolism and biodiversity*
- 12.30-14.30 Pausa pranzo**
- Chairpersons: C. Corinaldesi
- 14.30-14.45 **E. Baldrighi, S. Aliani, E. Manini, A. Conversi.** *Small (≤ 10 Km) spatial-scale variability in the distribution and biodiversity patterns of deep macrobenthic communities along the north-west Sardinia slope: first results.*
- 14.45-15.00 **C. Gambi, A. Pusceddu, L. Benedetti-Cecchi, R. Danovaro.** *Patterns and drivers of benthic biodiversity in the deep Mediterranean Sea.*
- 15.00-15.15 **S. Bianchelli, C. Gambi, M. Mea, A. Pusceddu, R. Danovaro.** *Deep-sea nematode diversity in the Mediterranean Sea: habitat vs. regional variability.*
- 15.15-15.30 **L. Angeletti, G. Bavestrello, S. Canese, A. Ceregato, L. Rossi, M. Taviani.** *Marine life in Oyster Pit, a drowned dolina offshore the Gargano Promontory (south Adriatic Sea).*
- 15.30-15.45 **M. Sigovini, D. Tagliapietra, A. Volpi Ghirardini.** *Spatial scales of variability of the benthic community structure and*



15.45-16.00	<i>quality indices in coastal transitional ecosystems: the case study of the Venice Lagoon</i> P. Del Negro, T. Cibic, B. Cataletto, M. Celussi, C. Comici, S. Covelli, C. De Vittor, C. Fabbro, C. Falconi, A. Franzo, M. Giani, A. Karuza, G. Menchini, P. Simeoni. <i>Effect of contamination by hydrocarbons and heavy metals on transitional benthic ecosystem functioning</i>
16.00-16.15	V. Losi, M. Moreno, M. Grondona, L. Gaozza, M. Montefalcone, G. Albertelli. <i>Meiobenthic diversity in Ligurian Posidonia oceanica meadows</i>
16.15-16.45	Pausa Caffè
16.45-18.00	Tavola Rotonda – Donne e Ricerca, con A. Albini (Responsabile Ricerca Oncologica, IRCCS Multimedica), S. Castaldi (Università di Napoli) e L. Rossi (Università di Roma) (moderazione S. Fraschetti)
18.00-19.30	Assemblea Soci AIOL
20.30	Commemorazione di N. Della Croce e di F.M. Faranda. Cena Sociale (http://www.cortelicastro.it/)
	Spettacolo di pizzica

	• Giovedì 7 Luglio
Chairpersons:	A. Dell'Anno
09.15-09.45	Relazione a invito: Good riddance to bad luck: positive species interactions in an increasingly hostile world. F. Bulleri (Università di Pisa)
09.45-10.00	A. Terlizzi. <i>Large-scale human impacts and the limited effectiveness of Marine Protected Areas</i>
10.00-10.15	L. Airoidi, F. Bulleri. <i>Mitigating the impacts of marine urban infrastructures by managing opportunistic and invasive species: the experience of project THESEUS</i>
10.15-10.30	S. Bevilacqua, M.J. Anderson, K.I. Ugland, A. Terlizzi. <i>Taxonomic surrogates, compositional heterogeneity in marine benthic assemblages and the estimation of species richness</i>

- 10.30-10.45 **G. Gatti, M. Montefalcone, V. Parravicini, C.N. Bianchi, C. Morri, G. Albertelli.** *A Rapid Visual Assessment method (RVA) for monitoring coralligenous assemblages: a landscape approach*
- 10.45-11.00 **E. Calizza, P. Carlino, M.L. Costantini, L. Rossi.** *Effects of Posidonia oceanica meadow fragmentation on biodiversity organization: a study with stable isotopes.*
- 11.00-11.15 **S. Frascchetti, F. Micheli, L. Mangialajo, B. Hereu, E. Balasteros, E. Sala.** *Changes in beta diversity across the Mediterranean Sea*

11.15-11.45 Pausa Caffè

- 12.00-12.15 **S. Piraino, G. Aglieri, R. Caprioli, F. De Nitto, D. De Vito, C. Gravili, R. Lecci, A. Leone, C. Longo, G. Milisenda, S. Scorrano, F. Boero.** *Vectors of Change in Oceans and Seas Marine Life, Impact on Economic Sectors (VECTORS - 7th FP): interdisciplinary research into the arenas of sciences, policy, management and society.*
- 12.15-12.30 **F. Boero, C. Gravili, E. Prontera, P. D'Ambrosio, S. Piraino.** *Occhio alla medusa! La scienza dei cittadini.*
- 12.30-12.45 **C. Gravili, S. Piraino, F. Boero.** *Specie Non-Indigene (NIS) di Cnidari nel Mar Mediterraneo: riflesso di un problema globale?*

13.00-14.30 Pausa Pranzo

Contributi sulle Grotte Marine

Chairpersons: M. Milazzo

- 14.30-14.45 **M. Catra, G. Alongi, M. Cormaci, G. Furnari.** *Contributo alla conoscenza del macrofitobenthos degli ambienti di grotta: grotte dell'AMP "Plemmirio" (Siracusa) e dell'AMP "Isole Pelagie" (Stretto di Sicilia).*
- 14.45-15.00 **G. Guarnieri, S. Bevilacqua, A. Terlizzi, S. Frascchetti.** *Another example of habitat loss: the case of Mediterranean submarine caves.*
- 15.00-15.15 **C. Di Camillo, F. Betti, U. Pantaleo, A. Scinto, G. Bave-strello, C. Cerrano.** *Metodi di valutazione dell'impatto dell'attività subacquea in grotte marine sommerse.*
- 15.15-15.30 **M. Milazzo, A. Di Franco, M. Graziano, R. Chemello, A. Marchini.** *Valutazione della vulnerabilità alla frequentazione subacquea di grotte sommerse: applicazione in tre AMP italiane.*



15.30-15.45	A. Rosso, E. Di Martino, V. Di Martino. <i>Bryozoan biodiversity in selected submerged caves from three Marine Protected Areas in Italy.</i>
15.45-16.00	F. Di Stefano, P. Cimmino, G.F. Russo. <i>Analisi del tipo di frequentazione subacquea per la gestione delle grotte sottomarine.</i>
18.00-19.00	Premio AIOL alla Carriera Premio miglior pubblicazione giovani ricercatori AIOL Premio miglior poster del congresso AIOL Premio migliore comunicazione del congresso AIOL

• Venerdì 8 Luglio

Visite presso Ecotekne, Università del Salento

Visite guidate a Lecce, la città barocca, e lungo la costa del Salento

Escursioni e immersioni subacquee



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RELAZIONI A INVITO



GOOD RIDDANCE TO BAD LUCK: POSITIVE SPECIES INTERACTIONS IN AN INCREASINGLY HOSTILE WORLD

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Negative species interactions (i.e. competition and predation) have been traditionally viewed as the main force shaping community structure. However, in the last two decades, there has been growing recognition that positive species interactions (facilitation) underlie the structure and functioning of a plethora of natural systems. Within this context, research stimulated by the formulation of the stress-gradient hypothesis (SGH) has generated a wide consensus over an increased frequency of facilitative interactions with increasing levels of stress. In the marine environment, alterations of physical conditions, due to either global climate changes (e.g. pH, temperature, UV rays, intensity and temporal variance of extreme weather events) or localized human perturbations (e.g. organic and inorganic pollution, enhanced sediment deposition), can therefore be predicted to cause unprecedented changes in the sign and strength of species interactions. Will harsher environmental conditions promote the occurrence of positive species interactions? To which extent stress-tolerant species will be able to buffer susceptible species from adverse conditions? Will alterations in the biotic compartment (e.g. species loss and introduction) modify the effects of degraded physical conditions? Which will be the implications of altering the balance between negative and positive species interactions for ecosystem functioning? Answering these questions appears crucial to improve our ability to forecast the future of marine biodiversity in compounded scenarios of global climate changes and patchwork human influences. Very likely, a tight integration among different disciplines of marine science will be the fastest way forward to achieve this goal.

BACTERIAL AND ARCHEAL DIVERSITY IN NITROGEN CYCLE: RECENT DISCOVERIES AND FUTURE CHALLENGES

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Nitrogen is an essential component of all living organisms. A typical bacterial cell for example contains about 12-15% nitrogen by dry weight as components of proteins, amino-sugars, nucleic acids and several other constituents of the cell. In nature, the nitrogen occurs mainly in the lithosphere and as inert gas in the atmosphere. Only a small part is found in the biosphere either in reduced forms as ammonium-ammonia and amine groups or in many oxidized forms from nitric oxide to nitrates, covering a wide range of oxidation states. Reduction-oxidation reactions between the different stages of oxidation offer the potential of energy-generation by microorganisms. Our understanding of the nitrogen cycle is however far from complete with respect to the microorganisms that are involved: new processes and players in the cycle evolve and are just beginning to be investigated and understood. For example, the discovery of anaerobic ammonia oxidation (anammox) by bacteria belonging to Planctomycetales dates back to the early 1990's; the cultivation of mesophilic Archaea able of performing chemoautotrophic nitrification as Bacteria occurred only in 2005. Besides terrestrial, marine, estuarine and freshwater environments are differently investigated and known with respect to the nitrogen cycle.

Over the past hundred years, human activity has dramatically altered the global nitrogen cycle in several ways, for instance by increasing inputs of inorganic and organic nitrogen through severe fertilization, by releasing nitrogen oxides in the atmosphere by industrial combustion of fossil fuels, by acidifying soils, streams and lakes, etc... Consequentially, human activities are altering the tendency of the processes of the nitrogen cycle to balance each other in natural ecosystems. This suggests that important knowledge on the nitrogen cycle is still missing and, even more, that classical knowledge may need a reassessment, finally leading to a better understanding of the overall nitrogen cycle. In this perspective, studies on the microorganisms involved in the nitrogen cycle appeared to be noteworthy.

DO MICROBIAL COEXISTENCE AND COOPERATION PRESERVE DIVERSITY AND PRODUCTIVITY IN AQUATIC SYSTEMS?

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Potential competitors can raise their fitness, and their chances of ecological success, by developing common strategies to face sudden limitations. By applying artificial experimental systems it is possible to use microbes as model organisms to powerfully test ecological theories and draw back experimental trends to the natural environment. The interactions between microbial species common (and ecologically successful) in waters and occasional species belonging to the rare biosphere are often more complex than expected. Apparent cooperation, as well as necessary mutualism can be established between potentially competing bacterial species, for example in order to escape from predation (by co-aggregation, for the first time here presented as an anti-predator strategy) and concomitantly survive the uneven competition for resources in open waters. The result of the positive interaction between the two strain is the survival of both strains, even when ecological stressors could drive them to extinction when grown alone. Predator-prey interactions are highly impacted by the formation of co-aggregates: predators gain in terms of numbers and biomass when fed on mixed cultures, allowing speculations about the actual quality (and complementarity) of the different bacterial strains. The potential function of the co-aggregates composed by prey of different palatability as proxy of lake and marine-snow and thus as additional sources of nutrients in periods of food limitation, supports larger (predator) populations at higher trophic levels. Thanks to co-aggregates potential competitors survive to environmental stressors, incrementing their ecological relations. At the same time, the more complex prey population can support a higher predator population, resulting fundamental for the correct functioning of the trophic pyramid in limiting aquatic environments.



LAKE KIVU: A LAKEFUL OF TROUBLES ... OR AN EXTRAORDINARY SITE FOR LIMNOLOGICAL RESEARCH?

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Lake Kivu is, in several respects, one of the most extraordinary lakes in the world: aerobic life is limited to the top 60 m (often called the “biozone”), below which the temperature and salinity increase by steps. A major salinity step is located at a depth of 270 m, below which are trapped, due to the high hydrostatic pressure, extremely high amounts of gases, the most abundant being carbon dioxide and methane. This reminds of the “killer lakes”, Lake Nyos and Monoun (Cameroun) which presented sudden gas eruptions, responsible for the death of more than a thousand people from the surrounding villages, as well as of cattle and wildlife.

During the first decade of the years 2000, a great deal of new knowledge has accumulated on Lake Kivu, in particular thanks to projects run in parallel by Swiss and Belgian research teams. Eawag, in Switzerland, was mainly interested in measuring present gas concentrations and in investigating further the very peculiar physical structure of Lake Kivu, which had attracted international attention following the eruption of the volcano Nyiragongo in early 2002. What would happen if the lava flow that devastated part of the city of Goma reached the lake? Would the stratification of the lake be disturbed, triggering a massive eruption of another nature, releasing, among other gases, the carbon dioxide, threatening people and animals all around the lake? In addition to these natural risks, industrial methane harvesting has already begun, and may, if conducted at a large scale and with releases at inadequate depth, threaten ecosystem goods and services. Among these is the fishery, which is an affordable protein source for the local population. The main exploited species is a sardine introduced in the mid 1950s, *Limnothrissa miodon* or “sambaza”, endemic to Lake Tanganyika. Belgian limnological research led in the first part of the XXth century had shown that the pelagic zone supported large amounts of plankton, but no planktivore. The introduction of the *sambaza* has been widely considered as a great success from the fishery standpoint. By contrast, some scientists were less optimistic, and, based on observation of a dramatic zooplankton decrease, predicted the collapse of the sardine fishery. If such a collapse did not happen so far, as the annual yield has maintained itself as the fishing methods evolved, the sardine production has not met the expectations.

The research projects conducted from 2002 on the “biozone” of Lake Kivu aimed at understanding ecosystem function of this East African great lake. The presentation will be devoted to a summary of the ecological knowledge acquired on the lake and will address to what extent this knowledge can be applied to other great tropical lakes. Ongoing applied and fundamental research will also be considered.



CLIMATIC IMPACTS AND RESILIENCE OF COASTAL ECOSYSTEMS AND FISHERIES

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Marine and coastal ecosystems and human communities around the world are impacted by climate change, resulting in decreased ocean productivity, altered food web dynamics, habitat degradation, economic losses, and health and safety risks as a consequence of the changing and more variable climate. Climatic impacts occur both through altered physical conditions and variability, e.g., seawater temperature and sea level, and through a suite of chemical changes, including ocean acidification and hypoxia. In particular, time series analyses have highlighted declines in dissolved oxygen (DO) concentration in the ocean over the last several decades. In addition to these global trends of decreasing DO, hypoxic conditions have been documented at several coastal locations within the California Current region, most recently at Isla Natividad, Baja California Sur, Mexico, resulting in high mortality of ecologically and commercially important nearshore marine species and significant economic losses. The capacity of local ecosystems and associated human communities to adapt to these pressures depends on their resilience, that is the ability of ecosystems to absorb disturbance while retaining function and continuing to provide ecosystem services, and the ability of people to adapt to change in their environment by altering their behaviors and interactions. I will present and discuss results of an interdisciplinary research program investigating the current impacts of climate change on coastal marine ecosystems and human communities of the Pacific coast of Baja California, Mexico, and the influences of local and global feedbacks on the resilience and adaptive capacity of these systems.



**ENVIRONMENTAL CHANGE BLINDNESS, “INVISIBLE PRESENT” AND
LONG-TERM ECOLOGICAL RESEARCH: ISSUES, OPPORTUNITIES AND
THREATS FROM LTER-ITALY FRESHWATER AND MARINE SITES.**

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The psychological human trait called “change blindness” deals with the difficulties observers have in noticing large environmental changes, when they are not framed in the appropriate long-term recording context: at the time scale of decades humans are inclined to perceive the world as static, typically underestimating the degree of change that does occur. Processes acting over years are hidden and reside in what has been defined by Magnuson (1990) as the “invisible present”: this metaphor contains and represents the time scale within which our responsibilities for the planet are most evident. Long-Term Ecological Research (LTER), which focuses on multidecadal observations, provides the temporal context needed to avoid serious misjudgements in our attempts to understand and predict changes in the world around us and to manage our environment. LTER is also critical for testing ecological theories on community dynamics, variability and resilience, enhancing our capacity of forecasting and of managing resources. The study of ecosystems with a LTER perspective and a within- and across-system comparison approach, appears crucial in order to identify common patterns of variability and their links at different spatial and temporal scales.

Within this context we synthetically describe the LTER networks conceptual frame and we review the contribution to these issues of some Italian aquatic LTER sites, both marine and freshwater, taking into consideration examples from the activities carried out in the LTER-Italy network (LTER-Italy: www.lteritalia.it).

IMPACT OF CLIMATE CHANGE ON OCEAN PHYSICAL AND BIOLOGICAL PROCESSES OF RELEVANCE TO FISHERIES

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Cheung et al. (in press) have recently developed a combined empirical and mechanistic dynamic bioclimatic envelope model (DBEM) to predict the response of maximum fisheries catch potential to climate change in the Northeast Atlantic. The DBEM uses earth system model (ESM) projections of temperature, salinity, oxygen, and pH at the sea surface and ocean bottom, as well as surface advection fields and sea ice extent to predict the geographic and vertical shifts in relative abundance of exploited marine fish and invertebrate species. The ecophysiological response of the fish and invertebrates to changes in temperature, oxygen, and acidification is then estimated, and ESM simulations of primary production are used to calculate their maximum catch potential. The DBEM calculations have so far been done with only one ESM and only for the Northeast Atlantic. We here analyze the full global response in a large number of such ESM simulations to study the fundamental processes driving the response to future climate change, to determine the range in responses of the properties used to drive the DBEM, and to estimate how much uncertainty this variability between models introduces into the maximum catch potential estimates.

Cheung, W. L., J. Dunne, J. Sarmiento, and D. Pauly, in press. Integrating eco-physiology and plankton dynamics into projected changes in maximum fisheries catch potential under climate change in the Northeast Atlantic. *ICES Journal of Marine Science*

LIVING THE LAST SEGMENT: OUR FALSIFIED PERCEPTION OF THE HOLOCENE BIODIVERSITY

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Mankind originated sometimes in the Quaternary and its conscious approach to an organized, abstract and rational knowledge of the natural world enjoyed an exponential acceleration in the last segment of this era, the Holocene. In the stratigraphic nomenclature, the Holocene is the current epoch of the Quaternary whose conventional beginning is set at ca. 11700 ka. Science as a discipline itself was conceived just a handful of millennia ago, thus being a late Holocene invention. One side effect for 'scientific' humans of being themselves basically a Holocene accident is their widespread perception of the living world in such time span to be *the* representative standard scenario for life. This feeling is psychologically very deeply rooted and bears not trivial consequences in handling natural history issues, often contaminating and biasing our thinking. The geologist looks at the Holocene differently, considering it as unrepresentative of the Quaternary as a whole. In fact, the Quaternary is punctuated by many astronomically-paced glacial cycles with a rough duration of 100 ky each. The overwhelming cold mode is interrupted by interglacials, i.e. warm periods of variable intensity and short duration, ca. 10 ky. The Holocene, our time, is just but one such interglacial, actually the latest in order of time. The remaining 9/10ths of the last glacial period are climatically cold-temperate or cold, and the same holds true for the preceding glacial cycles in the Pleistocene. It is immediately intuitive that such climatic vagaries impinge drastically on living ecosystems, directing their organization, evolution and fate. The Mediterranean basin beautifully represents this situation in the ocean. Its marine history has experienced cyclic faunal turnovers from ecosystems enriched in or even dominated by cold water north-Atlantic elements to ecosystems bearing west-African (penultimate interglacial) warm or at least warm-temperate species (present interglacial, the Holocene). By large, scientists regard at our short-lived interglacial as the normal situation for the Mediterranean biodiversity to be, while diversions from this situation are disturbances and the presence of taxa in response of a different climatic situation is treated as an invasion. The 9/10ths rule would obviously implies that the modal Mediterranean biodiversity is in fact the cold one, known to us only in a fossil status, while the shorter warmer fluctuations, and their biological rearrangements, are to be accounted as somewhat ephemeral perturbations to this scheme.

COMUNICAZIONI ORALI

MITIGATING THE IMPACTS OF MARINE URBAN INFRASTRUCTURES BY MANAGING OPPORTUNISTIC AND INVASIVE SPECIES: THE EXPERIENCE OF PROJECT THESEUS

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Coastal landscapes are being transformed as a consequence of the increasing demand for infrastructures to sustain residential, commercial and tourist activities. Thus, intertidal and shallow marine habitats are largely being replaced by a variety of artificial substrata (e.g. breakwaters, seawalls, jetties). Understanding the ecological functioning of these artificial habitats is key to planning their design and management, in order to minimise their impacts and to improve their potential to contribute to marine biodiversity and ecosystem functioning. Nonetheless, little effort has been made to assess the role of human disturbances in shaping the structure of assemblages on marine artificial infrastructures.

We present recent results of experiments run through project THESEUS (FP7.2009-1, Contract 244104) to test the hypothesis that some of the impacts of globally expanding marine urban infrastructures, such as those related to the spread of opportunistic, and invasive species could be mitigated through ecologically-driven planning and management of disturbance (such as that related to long-term maintenance) to these structures. Maintenance caused a marked decrease in the cover of dominant space occupiers, such as mussels and oysters, and a significant enhancement of opportunistic and invasive forms, such as biofilm and macroalgae. These effects were particularly pronounced on sheltered substrata compared to exposed substrata. Experimental application of the disturbance at different times reduced or increased the magnitude of the impacts. We use these results to identify possible management strategies to inform the improvement of the ecological value of artificial marine infrastructures. We demonstrate that impact mitigation is a possible outcome of policies that consider the ecological features of built infrastructures and the fundamental value of controlling biodiversity in marine urban systems.



THE FAUNAL PECULIARITIES OF THE APULIAN TEMPORARY POOLS

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An extensive limnological study in all the Apulian territory, in part financed by the banking foundation *Fondazione Cassa di Risparmio di Puglia*, led to the identification of 191 lentic water bodies. Among them, 144 ponds are characterized by a temporary hydroperiod and 20 can be defined as Mediterranean Temporary Ponds according to the rules set by the Habitat Directive 92/43/CEE. The peculiar crustacean fauna of temporary pools has been studied. Large branchiopods are represented by 9 species: 5 Anostraca, 2 Notostraca, 2 Spinicaudata. Copepoda Calanoida are represented by 12 species mainly characterized by a Mediterranean chorotype. *Neolovenula alluadi*, found in 5 different sites, proved to be a new species for the Italian Fauna. Up to 5 coexisting Calanoida species were often detected synchronically in a single pond according to a well defined size separation this representing an exclusive case in Italy. Cyclopoida (10 species) and Cladocera (23 species) are still under investigation; therefore their checklists are still incomplete. *Diacyclops lubbocki* and *Cyclops divergens* are currently the most spread Cyclopoida in the region. Among Cladocera two species deserve to be remarked: *Daphnia similis* known in Italy only for the Apulian sites, and *Daphnia mediterranea* hereby reported for the first time in the Italian mainland. *Ceriodaphnia quadrangula*, *Daphnia chevreuxi* and *Pleuroxus letourneuxi* are the most common Cladocera in the Apulian temporary pools.

Most of pools relevant for their peculiar fauna, often do not correspond to the priority habitat Mediterranean Temporary Ponds, as defined by the Habitat Directive on the basis of plant association. These results open a discussion on the gaps of the Habitat Directive as an effective tool to indicate areas to be protected and might provide an useful support to the identification of new areas in Apulia deserving of preservation measures.

MARINE LIFE IN OYSTER PIT, A DROWNED DOLINA OFFSHORE THE GARGANO PROMONTORY (SOUTH ADRIATIC SEA)

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A submerged karst landscape has been recently identified between 50-105 m in the southern Adriatic Sea on the Apulian continental shelf ca. 10 km offshore the Gargano Promontory. The topography consists of relic erosive remnants and circular depressions interpreted as dolinas due to dissolution of carbonate rocks at times of lower-than-present sealevel in the late Pleistocene and successively drowned by the post-glacial sea level rise beginning ca. 12.5 kyrs BP. The deepest hole (ca. 20 m) is *Oyster pit* an almost perfectly circular depression located in 50 m water that has its bottom at 73 m. The area has been surveyed in detail twice, in 2008 and 2010 during CNR cruises ARCO and ARCADIA respectively, with the collection of a large number of geophysical, hydrological and biological data, as well as ROV images. Modern sessile organisms, mostly suspension feeders, often exploit palimpsest pebbles and brackish-lagoonal shells as attachment substrates. The most remarkable faunal feature of *Oyster Pit* is the massive presence of *Neopycnodonte cochlear* oyster banks and aggregations inhabiting its bottom and flanks often associated with sponges.

SMALL (≤ 10 Km) SPATIAL-SCALE VARIABILITY IN THE DISTRIBUTION AND BIODIVERSITY PATTERNS OF DEEP MACROBENTHIC COMMUNITIES ALONG THE NORTH-WEST SARDINIA SLOPE: FIRST RESULTS

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The understanding of spatial scale patterns of distribution, abundance and biodiversity of the deep-sea benthic communities has always been a challenge. Our recent investigations on deep-sea macrofaunal communities, performed on large (>100 km) spatial scale along the Mediterranean sea, confirm a significant decrease of benthic organism, both in abundance and biomass, with increasing depth and from West to East. It is accepted that a decrease in the nutrients input to the deep-sea floor is a likely reason for this decline.

In this study we focus on the role of food and sediment type vs. depth in shaping distribution and biodiversity variability of the deep-sea macrobenthos at the smaller (≤ 10 km) spatial scale. Macrobenthic community variability at this scale is in fact not known, yet this knowledge is essential to postulate a gradient with depth or longitude. Specific aims of this study are: i) to characterize the distribution, abundance, biomass and diversity of deep-sea macrobenthos, both along bathymetric and horizontal transects; ii) to explore the importance of food availability and sediment grain size in influencing macrofaunal communities at the small spatial scale; iii) to quantify how these variables contribute to shaping macrobenthic communities along spatial gradients. To achieve these aims, on October 2009 a total of 84 box-corer deployments were performed along a slope area off NW Sardinia (Mediterranean Sea), from the continental shelf break to the bathyal plain. Four box core replicates were collected at each of 7 increasing depths, from 600 to 2400m, every 300 m. The measurements were made along three parallel transects, ~ 1 km apart. This presentation will show our initial results.

ETEROGENEITÀ SPAZIALE DEI BATTERI E DELLA SOSTANZA ORGANICA IN UN GRANDE LAGO SUBALPINO, IL LAGO MAGGIORE

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I laghi presentano una ricca e dinamica eterogeneità temporale e spaziale evidente per gli organismi macroscopici. In anni recenti, tuttavia, si è evidenziato che anche i batteri ed il substrato da essi utilizzato sono presenti nell'ambiente con una eterogeneità spazio-temporale regolata da una serie complessa di fattori, che include i processi fisici che controllano il movimento delle masse d'acqua lacustri, la produttività della zona trofogenica, gli apporti alloctoni. Vengono qui presentati i risultati di una serie di misure effettuate nel Lago Maggiore in tre stazioni (nord, centro e sud), durante il periodo estivo, per confrontare l'eterogeneità verticale ed orizzontale dell'abbondanza, delle dimensioni cellulari e dell'attività del popolamento batterico eterotrofo insieme alla variazione del substrato organico, quest'ultimo qualitativamente caratterizzato valutandone la componente CDOM (Colored Dissolved Organic Matter). Dai primi risultati emerge che, in presenza di popolamenti batterici comparabili per abbondanza numerica, la loro attività è nel complesso minore nella stazione più a sud, ove la concentrazione di Carbonio Organico Totale (TOC) è più elevata, ed è massima nella stazione più a nord, caratterizzata da concentrazioni di TOC inferiori. Viene discussa anche l'importanza del CDOM nel determinare questo risultato. Accanto alla eterogeneità orizzontale dell'attività batterica si è evidenziata anche una eterogeneità verticale nell'attività specifica per cellula, rilevante soprattutto nella stazione più a nord, che è risultata maggiore alla massima profondità.

TAXONOMIC SURROGATES, COMPOSITIONAL HETEROGENEITY IN MARINE BENTHIC ASSEMBLAGES AND THE ESTIMATION OF SPECIES RICHNESS

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Understanding the dimension of biodiversity inhabiting a given geographical region has fascinated ecologists since a long time. However, the ongoing crisis of systematics and taxonomy hampers progresses in biodiversity exploration. Quantifying species richness at regional scale to set conservation areas, for instance, could be problematic in view of time-expensive taxonomic identifications and reduced available taxonomic expertise.

A common approach to quantify biodiversity, especially in large areas, is represented by species richness estimators, such as species-area curves. Although the accuracy of such tools is still under debate, recent developments allowed taking into account spatial heterogeneity of species distribution, improving their ability in providing reliable estimates of species number.

Species richness estimates based on species-area relationships, nevertheless, needs to rely on extensive sample collection carried out at fine taxonomic level. Current advance in the application of taxonomic surrogates showed that patterns of beta-diversity at species level could be effectively described considering family-level information. Since beta-diversity lay at the core of spatial patterns of species distribution, such findings seems to suggest that reliable estimates of species richness could be performed even using family-level data.

Here we provide a novel framework to extrapolate species richness in large areas from species-area curves based on extensive sampling at family level and on sample subsets at species level. Using six datasets of mollusc assemblages coming from the Atlantic, Pacific, and the Mediterranean, we showed that such an approach could allow reducing taxonomic identification efforts of 50%-75%.

Our results highlights the potential effectiveness of alternative approaches based on balancing the contribution of coarse and fine taxonomic taxonomy in providing accurate estimation of species richness, which could be of great help in biodiversity exploration and monitoring. Further investigations are needed to broaden the range of organisms and geographical regions, however, before any generalization of our findings is invoked.

DEEP-SEA NEMATODE DIVERSITY IN THE MEDITERRANEAN SEA: HABITAT VS. REGIONAL VARIABILITY

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Nematode diversity was investigated in different deep-sea habitats (canyons, open slopes, deep-water coral rubbles and bathyal plains) from three Mediterranean Sea regions (North-Western, Central and Eastern Mediterranean) spanning from 3.53° to 24.60° longitude E (>2000 km), at ca. 1000 m depth. Generally, local (α) diversity (either in terms of species richness and expected species number) decreased moving eastward. α diversity of nematodes did not vary significantly among different deep-sea habitats (canyons, open slopes, coral rubbles and bathyal plains) in most of the investigated regions, except for the North-Western Mediterranean, where the α diversity within the Cap de Creus canyon was significantly higher than in the adjacent open slopes. In all Mediterranean Sea regions, the composition of the nematode assemblages varied significantly among habitats as well as between sites within the same habitat. Average turnover (β) diversity between habitats was very high in all of the investigated deep-sea regions (59-90% dissimilarity), and resulted in high values of regional (γ) diversity, with the highest value (210 species) in the Central Mediterranean. Moreover, the turnover diversity among regions (δ diversity) was extremely high either between the North-Western and Central Mediterranean (81%) and between the Central and Eastern Mediterranean (89%), thus leading to a very high biogeographical (ϵ) diversity (280 species) in the deep Mediterranean sea. The results of the present study suggest that spatial variability in the composition of deep Mediterranean Sea nematode assemblages is more evident in terms of β and δ diversity rather than in terms of α diversity. This indicates that habitat may promote biodiversity even at very large spatial scales and that the Mediterranean sea as a whole represents a hot-spot of deep sea biodiversity also for meiofauna, and, more specifically for nematodes.



OCCHIO ALLA MEDUSA! LA SCIENZA DEI CITTADINI

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Gelatinous macrozooplankton blooms (mainly Cnidaria, Ctenophora, Thaliacea) are becoming a rule in the Mediterranean Sea. These massive events, however, are more perceived than documented, these phenomena easily escaping standard monitoring practices. An experiment in citizen science, promoted by the Mediterranean Commission (CIESM), asking citizens to deliver reports about their sighting of gelatinous macrozooplankton has evaluated for the first time the presence of such organisms over a vast spatial (the 8.500 km of the Italian coast) and temporal (the years 2009-2010) scales, showing that the species distribution is not homogeneous and that the presence of gelatinous macrozooplankton is massive in both years of observation. In 2010 the magazine Focus sponsored the campaign and opened a web page on it, reporting a weekly map of jellyfish presence along the Italian coast: Meteomedusa.

EFFECTS OF *POSIDONIA OCEANICA* MEADOW FRAGMENTATION ON BIODIVERSITY ORGANIZATION: A STUDY WITH STABLE ISOTOPES.

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Posidonia oceanica (L.) Delile meadows play a fundamental role on marine biodiversity organization and maintenance. Despite the causes are complex and still discussed, *P. oceanica* meadows are experiencing a fragmentation process, particularly on coastal areas. In this study we addressed the effect of meadow fragmentation on the abundance and diversity of the macrobenthonic associated fauna and on the trophic features of the community, in the coastal area of Tarquina (Vt), Italy (42°12'40"N 11°41'55"E).

Macroinvertebrate samples were collected using 20g autochthonous *P. oceanica* litterbags; six litterbags were placed in three different sampling sites: one site in an intact portion of the meadow (10000 leaves/m²), one at intermediate degree of fragmentation (5000 leaves/m²), and one in fragmented meadow (2000 leaves/m²). To test the importance of autochthonous detritus quality in defining habitat complexity and carrying capacity, also six 20g *Phragmites australis* leaf litterbags were placed in each site. Food webs structure were determined by correlative analysis of macroinvertebrate census data, corrected by $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values and by mixing models (e.g. IsoSource, Phillips and Gregg 2003); trophic niche was assessed by $\delta^{13}\text{C}$ range (CR).

Results showed a decrease of animal density and species richness along the fragmentation gradient, as expected, and an unexpected increase of trophic generalism, of community niche space and of trophic diversity of animals within the niche space. Moreover, we observed a shift from a food web based on both primary production and detritus, to a food web purely based on detritus as single basal resource in the fragmented portion of the meadow. Lastly, the use of both autochthonous and allochthonous leaf litters, despite significant differences in their attraction capacity, has proven useful for the complete taxonomical and functional characterization of the macrobenthonic community.

CONTRIBUTO ALLA CONOSCENZA DEL MACROFITOBENTHOS DEGLI AMBIENTI DI GROTTA: GROTTA DELL'AMP "PLEMMIRIO" (SIRACUSA) E DELL'AMP "ISOLE PELAGIE" (STRETTO DI SICILIA)

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I dati sul macrofitobenthos delle grotte marine sommerse delle coste italiane sono scarsi. Totalmente mancanti sono quelli circa eventuali danni alle comunità fitobentoniche causate dalla frequentazione da parte dei subacquei. Per approfondire le conoscenze sulla composizione floristica degli ambienti di grotta e sulle variazioni legate alla loro frequentazione, è stato effettuato lo studio di alcune grotte presenti nell'AMP "Plemmirio" e nell'AMP "Isole Pelagie".

Le grotte dell'AMP "Plemmirio" sono caratterizzate soprattutto da una prevalenza di *Peyssonnelia rubra* (Greville) J. Agardh, *Peyssonnelia squamaria* (S.G. Gmelin) Decaisne e *Flabellia petiolata* (Turra) Nizamuddin nella "Zona I" (imboccatura della grotta), mentre nel passaggio alla "Zona II" (avangrotta) la copertura vegetale si riduce notevolmente sino a scomparire del tutto nel giro di qualche metro. Nelle grotte dell'AMP "Isole Pelagie" le specie formano un manto vegetale a tratti frondoso-cespuglioso per la presenza di *Dictyota dichotoma* (Hudson) J.V. Lamouroux e *Halopteris filicina* (Grateloup) Kützing, che caratterizzano l'aspetto fisionomico del popolamento nella parte più esterna della zona I; poco più all'interno dominano *Palmophyllum crassum* (Naccari) Rabenhorst e *ErythroGLOSSUM sandrianum* (Kützing) Kylin. Nella zona II la copertura vegetale si riduce notevolmente senza tuttavia scomparire mai del tutto. Ciò a causa della conformazione delle grotte che essendo provviste di numerose aperture non presentano zone totalmente oscure.

Dalle osservazioni condotte, non sono stati rilevati segni di danneggiamento del manto vegetale a causa della frequentazione da parte dei visitatori. La presenza di frammenti di alghe calcaree rinvenuti fra i sedimenti del pavimento è da attribuire al *turnover* degli esemplari viventi sulle pareti, sul tetto e nelle zone limitrofe esterne alla grotta.

Da sottolineare che le grotte più frequentate sono risultate anche quelle con la più alta biodiversità. Ciò perché alcune caratteristiche delle grotte determinano allo stesso tempo: un'alta biodiversità, per le favorevoli condizioni di illuminazione, e una notevole frequentazione, per la facilità di accesso.

**LONG TERM VARIABILITY IN MICROBIAL DEGRADATION AT A SHALLOW
COASTAL SITE: SPECTRA AND RATES OF EXTRACELLULAR ENZYME
ACTIVITIES IN THE GULF OF TRIESTE**

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The degradation of organic matter along the water column is mediated by enzymes released into the environment by planktonic organisms. Variations in enzymes profiles (types and levels of activity) reflect the trophic status of the environment and could be caused by shifts in the dominant species or in the level of enzyme expression by the same species in response to changes in the spectrum of organic substrates.

To explore this issue, we examined the activity of 5 different hydrolytic enzymes (protease, α -glucosidase, β -glucosidase, alkaline phosphatase and lipase) along the water column at station C1, in the Gulf of Trieste (northern Adriatic Sea), from 2000 to 2005.

Most of the studied enzymes exhibited a pronounced seasonal variability with winter minima and maxima from April to October. During summer, alkaline phosphatase, lipase and protease reached the highest activity while the polysaccharide degradation prevailed in spring and autumn, associated to phytoplankton blooms. Notwithstanding the moderate interannual variability, as shown by similar average values, the spectrum of enzyme activities exhibited a very pronounced year by year change.

CYANOBACTERIAL TOXINS PROFILING IN THE ITALIAN SUBALPINE LAKES

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Cyanobacteria have a key role in all aquatic ecosystems. However, the presence of toxic strains of cyanobacteria can have negative impact on all water uses and can pose serious health risks for humans and animals. Toxic species belong mainly to the genera *Microcystis*, *Planktothrix* and *Anabaena*, which have the capability of producing toxic metabolites. Microcystins (MC) are the most abundant and dangerous toxins produced by cyanobacteria. They are cyclic peptides with hepatotoxic effect; they are also endowed with tumor promotion. In addition to MC, many other toxins are known, such as nodularins and the alkaloids anatoxins, saxitoxins and cylindrospermopsins. Although cyanobacteria are widespread in Italian lakes, very limited informations are available in the scientific literature about cyanotoxins distribution.

We have determined the degree of variability and diversity of cyanobacterial toxins in a group of lakes located in the Italian subalpine region (Lakes Garda, Maggiore, Como, Iseo, Lugano, Idro, Pusiano, Ledro and Levico) which are characterized by the presence of diverse populations of cyanobacteria. We set up an analytical method based on LC-MS technology for the screening of twenty-one cyclic peptides and thirteen alkaloids. The results of the survey showed that microcystins were constantly present in all water bodies although with very different concentrations. The highest values were recorded in summer periods in connection with the highest development of cyanobacterial biomass. The different lakes were characterized by different microcystins variants; this aspect is very important from a management point of view since among the 70 and more microcystins variants, toxicities values span over a 2 orders of magnitude range. Four variants of microcystins were by far the most represented in all lakes.

DINAMICA DEI LAGHI TRA CAMBIAMENTI A SCALA GLOBALE E LOCALE: I CASI DI STUDIO DEL LAGO DI COMO E DI PUSIANO

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Le dinamiche e l'evoluzione limnologica degli ambienti lacustri sono influenzate sia da pressioni locali (quali i carichi di nutrienti) sia da pressioni globali (cambiamenti climatici). Le due tipologie di pressione sono in realtà interconnesse. Un tipico esempio è il carico di nutrienti generato localmente, ma influenzato dall'intensità delle precipitazioni atmosferiche che risentono dell'influenza dei cambiamenti climatici a scala globale. La maggior parte dei processi biogeochimici che avvengono nei laghi è inoltre mediata dalla temperatura. Diversi autori sostengono in proposito che l'impatto del riscaldamento globale possa manifestarsi con effetti analoghi al processo di eutrofizzazione.

Un aspetto critico nella valutazione di quale dei due impatti, locale o globale, pesi maggiormente sull'ecologia di un lago è la capacità di distinguere i due segnali. A questo proposito risulta di particolare importanza la disponibilità di serie storiche coerenti e di adeguati strumenti statistici per l'analisi delle tendenze temporali. Un approccio parallelo all'analisi storica dei dati prevede l'utilizzo di modelli deterministici (process-based models) in grado di simulare le risposte fisiche, chimiche e biologiche dell'ecosistema lacustre alle diverse forzanti.

In questo lavoro si presentano alcuni risultati ottenuti da attività di ricerca svolte in due ambienti sub-alpini: il Lago di Pusiano e il Lago di Como. I due casi di studio si distinguono da un punto di vista morfometrico (di medie dimensioni il primo, grande e profondo il secondo) e per un diverso stato trofico (eutrofo il primo, mesotrofo il secondo). I due laghi sono invece sottoposti alle medesime forzanti meteo-climatiche e hanno "vissuto" una simile evoluzione trofica con un periodo di maggiore produttività a cavallo tra gli anni settanta e gli anni ottanta. I due ambienti rappresentano quindi due casi di studio rappresentativi per valutare le risposte ecosistemiche agli impatti globali e locali a cui sono sottoposti gli ambienti lacustri.

VIRAL DIVERSITY AND GENE FLOW IN DEEP-SEA SEDIMENTS

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Metagenomic analyses have shown that marine viral communities are incredibly diverse with an estimated viral diversity of 5000 genotypes in 200 liters of seawater and a million genotypes in one kilogram of coastal marine sediment. However, over 95% of marine viral sequences are not similar to previously described sequences suggesting that we have only begun to scratch the surface of marine viral diversity. Viral diversity in deep-sea sediments is still unknown. Since 1 kg of deep-sea sediment contains 10^{12} viruses, it potentially represents the larger source of viral genes. In our study, we analyzed the viromes of four deep-sea benthic ecosystems (including Black Sea, Atlantic and Arctic margins) by a Roche Life Sciences 454 Titanium sequencing platform in the framework of the GBMF's Marine Phage Initiative. Our results show that the number of known phages varies among ecosystems and over 90% of the sequences is unknown. In general, although the diversity of phages is similar to that of non-phages, the abundance of non-phages is much higher than the abundance of phages. This finding lets us hypothesize that eukaryotic viruses represent an important component of the deep virosphere.

EXPLORING THE SELECTIVE TRANSFER OF ORGANIC MATTER AND MICROORGANISMS FROM THE OCEAN SURFACE TO THE ATMOSPHERE

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Marine aerosol plays a crucial role in regulating the global climate, influencing the radiation balance of the Earth by scattering and absorbing solar radiations. Marine aerosol is constituted of diverse chemical compounds represented not only by inorganic components, but also by a very complex mixture of organic compounds. However, information on the composition of organic matter contained in marine aerosol is still very limited. Therefore, a more detailed characterisation of organic components transferred from the ocean surface to the atmosphere is crucial for a better comprehension of the role of marine aerosol in climate regulation.

In the present study we provided new insights on the composition of organic matter of marine aerosol by using an integrated approach based on biochemical, molecular and biological analyses carried out in field and experimental conditions during an oceanographic cruise in the North-Eastern Atlantic Ocean. In particular, natural aerosol, "artificial" aerosol generated during bubble-bursting experiments and seawater samples were collected for the analyses of carbohydrate, protein, lipid and DNA concentrations, as well as viral and prokaryotic abundances. Moreover, we carried out molecular fingerprinting (ARISA) and Real-Time PCR analyses (based on prokaryotic 16S rDNA genes). Our findings suggest that different organic compounds and specific prokaryotic genotypes can be selectively transferred from the ocean surface to the atmosphere, thus contributing to the formation of cloud condensation nuclei (CCN).

EXTRACELLULAR DNA POOL FUELS THE METABOLISM OF PROKARYOTES AND REPRESENTS A MAJOR ARCHIVE OF GENETIC DIVERSITY IN DEEP-SEA SEDIMENTS OF HYPERSALINE ANOXIC BASINS

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Deep-Hypersaline Anoxic Basins (DHABs) of the Mediterranean Sea are unique ecosystems characterized by nearly saturated salt concentrations, high hydrostatic pressure, absence of light, anoxia, and a sharp chemocline. Despite the extreme conditions, these ecosystems can sustain a high abundance, activity and diversity of microbial assemblages. However, available information on viral dynamics and their interactions with prokaryotic hosts is very limited but let us to hypothesize a major role of viral infection in the release of extracellular DNA. In this study, we investigated, for the first time, virus-prokaryote interactions in deep-sea sediments of the Medea basin which is the last discovered DHAB of the Mediterranean Sea. Moreover, here we also explored the ecological role of extracellular DNA, released by viral shunt, in sustaining prokaryotic metabolism and contributing to the prokaryotic genetic diversity. Our findings reveal that the sediments of Medea basin are hot-spots of viral infection of prokaryotic hosts which determine an extracellular DNA release $>10\text{mg DNA m}^{-2} \text{d}^{-1}$. A metagenetic approach, based on massive pyrosequencing analyses on prokaryotic 16S rDNA, revealed that extracellular DNA contains highly diversified gene sequences belonging to Bacteria and Archaea domains. A large fraction of gene sequences within the extracellular DNA pool were not shared with those contained in prokaryotic biomass. Overall, our results indicate that the extracellular DNA pool can contribute significantly to fuel prokaryotic metabolism and to enhance the whole genetic diversity in deep-sea sediments of this extreme ecosystem.

**BEING ONE, NO ONE AND ONE HUNDRED THOUSAND: GENETIC
DIVERGENCE, RECOMBINATION, SELECTIVE SWEEPS AND “EPIDEMIC”
POPULATION STRUCTURE IN THE FRESHWATER CYANOBACTERIUM
*PLANKTOTHRIX***

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The cyanobacterial genus *Planktothrix* produces massive and nuisance biomass accumulations in freshwater ecosystems, worldwide. The green-pigmented *Planktothrix agardhii* and the red-pigmented *P. rubescens* are the most known, studied and widely distributed morphospecies, while many rare taxa, such as the yellow pigmented *P. suspensa*, are still under-investigated.

I report a synthesis of an extensive study of characterization of *Planktothrix* spp. living in eight Italian sub-alpine lakes based on cultured strains. Overall, *P. rubescens* dominated Italian populations, *P. suspensa* was detected in one single lake and *P. agardhii* was virtually absent. Molecular analysis on neutrally-evolving *loci* indicated a high genetic diversity in Italian populations, due to both mutation and genetic recombination. The latter was highly frequent between *P. rubescens* and *P. suspensa*, but gene-transfer signals were also detected between the former species and *P. agardhii*, based on sequences present in public databases. Population biology approaches suggest that metapopulations of *Planktothrix* species should display a so-called “epidemic” structure characterized by i) free recombination amongst co-occurring clones and ii) fitter recombinant genotypes that occasionally increase rapidly in frequency to produce epidemic clones at local scale. This hypothesis was also supported by the analysis of adaptive *loci* (i.e. subject to vigorous selection pressures) on the same set of strains used for testing neutrally evolving *loci*. Interestingly, selective sweeps between different clonal populations were likely driven by their adaptability to hydrographical conditions, which was mirrored by the specific alleles borne at these adaptive *loci*.

In conclusion, the wide genetic fuzziness characterizing the genus *Planktothrix* roots upon the high evolutionary plasticity and complex ecological responses of its clonal populations, which could represent one, no one and one hundred thousand potential “species”, at the same time. Though enigmatically, this “multiple identity” should stand at the basis of the vast success of this cyanobacterium in most freshwater ecosystems, worldwide.

EFFECT OF CONTAMINATION BY HYDROCARBONS AND HEAVY METALS ON TRANSITIONAL BENTHIC ECOSYSTEM FUNCTIONING

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Sediment samples were collected in four sites along a salinity gradient (from 0.2 to 27.3) of the Aussa River (Marano lagoon, northern Adriatic, Italy) and a decreasing gradient of industrial contamination downstream (from St. A1 to St. A4). Benthic biodiversity (prokaryotes, primary producers, meiofauna, macrofauna) along with other structural and functional parameters were related to contamination. Meiofaunal abundance increased from 1005 ± 152 to >4000 ind. 10cm^{-2} downstream and the macrofaunal composition shifted from one exclusively composed of chironomid larvae to a typically lagoonal one. Due to low grazing pressure at St. A1 the benthic microalgal abundance exceeded $500,000$ cells cm^{-3} and seemed unaffected by contamination. Chlorophyceae and filamentous Cyanobacteria, not considered by traditional riverine biomonitoring (based solely on diatom indices), were abundant. Primary production was one order of magnitude higher in the freshwater impacted site than in the more saline one (7.20 and 0.60 $\mu\text{gC cm}^{-3} \text{h}^{-1}$, respectively). High organic enrichment (65 $\text{mgC g}_{\text{dry}}^{-1}$) at St. A2 probably caused the highest community respiration, estimated by O_2 microprofiles, along with the highest exoenzymatic activities (β -glucosidase, leucine aminopeptidase and lipase). In the contaminated sites an efficient ecosystem functioning, with high production and degradation rates, was ensured by an extremely active microbial community.

TEMPORAL DYNAMIC OF PARTICULATE AND DISSOLVED ORGANIC MATTER IN THE GULF OF TRIESTE, NORTHERN ADRIATIC SEA

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Many studies have shown that in the North Adriatic the low phosphorus availability determines high C/P and N/P ratios, both in dissolved and particulate matter; however the seasonal and interannual variability of the N and P pools bound to the organic fraction is still not well understood.

This paper focuses on the temporal dynamics of DOM and POM pools on a monthly and interannual (12 years) scale in a coastal site which is part of the Italian Long Term Ecological Research network. The results obtained show that DOM represents the prevailing fraction with respect to POM and that the organic fractions of nitrogen and phosphorus prevail over the inorganic ones. DOC shows a typical temporal evolution with winter minima and summer maxima, with higher seasonal variations in 1999 and 2005, and significantly lowers from 2006 to 2009. The relative minima were associated with the ingressions of high salinity waters from the central and southern Adriatic. Temporal variability in DON and DOP was not strongly correlated with that of DOC and showed a higher monthly variability. DOM - C:N:P ratio showed high temporal variability as well: values similar to Redfield ratio were measured in drought periods suggesting that the increase in the stoichiometric ratio has mainly an allochthonous origin.

In the particulate matter high temporal variability of carbon, nitrogen and phosphorus concentrations as well as of C/N, C/P and N/P ratios is observed. While carbon and nitrogen present a clear seasonal dynamic driven by temperature increase, the temporal evolution of phosphorus seems influenced by the combined effect of phytoplankton biomass dynamic, continental inputs and bottom resuspension. The highest deviation from Redfield ratio occur during phytoplankton blooms, whereas bottom resuspension events increase the concentration of PP and decrease significantly the C/P and C/N ratios.

METODI DI VALUTAZIONE DELL'IMPATTO DELL'ATTIVITÀ SUBACQUEA IN GROTTI MARINE SOMMERSE

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I subacquei che si immergono nelle grotte marine, in numero crescente negli ultimi anni, possono arrecare disturbo all'ambiente circostante sia modificando il comportamento naturale delle specie vagili sia attraverso l'impatto meccanico, che porta alla parziale o totale distruzione degli organismi sessili. Gli organismi bentonici presenti sulle pareti e sulle volte delle grotte sono principalmente poriferi, cnidari, briozoi e policheti tubicoli, molti dei quali secernono scheletri carbonatici la cui fragilità aumenta la possibilità di rottura. I sedimenti presenti sul fondo delle grotte, ricchi di scheletri carbonatici, rispecchiano le comunità sessili delle pareti delle grotte, e la loro analisi potrebbe permettere una valutazione dell'impatto dei subacquei.

Scopo di questo lavoro è la valutazione dell'impatto dei subacquei nell'ambiente di grotta tramite l'osservazione di alcuni organismi target presenti sulle pareti e la volta e il contemporaneo studio dei sedimenti depositati sul fondo. Questa ricerca è stata condotta in grotte frequentate e non all'interno di tre Aree Marine Protette - Capo Caccia, Pelagie e Plemmirio. La composizione percentuale della fauna e della flora presenti lungo le pareti e sulla volta delle grotte è stata determinata tramite il metodo conservativo dell'analisi di video-transetti e confrontata con gli organismi rinvenuti nei sedimenti.

I dati ottenuti mostrano che i sedimenti raccolti dal fondo di grotte frequentate contengono una quantità di frammenti di scheletri carbonatici dovuti ad un recente distacco superiore a quella delle grotte non accessibili, e che gli organismi eretti e ramificati, comunemente osservati nelle grotte non impattate, sono rari nelle grotte dove la presenza di subacquei è maggiore.

Sulla base di questi risultati proponiamo l'impiego di un semplice indice di qualità delle grotte, che tiene conto della presenza di specie vulnerabili – in particolare *Corallium rubrum*, briozoi eretti, policheti tubicoli e poriferi massivi o ramificati- della loro posizione all'interno della grotta e dell'elevazione rispetto al substrato.

ANALISI DEL TIPO DI FREQUENTAZIONE SUBACQUEA PER LA GESTIONE DELLE GROTTI SOTTOMARINE.

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Quella subacquea è ritenuta una delle attività maggiormente compatibili con gli scopi di conservazione e di educazione ambientale propri di un'area marina protetta (AMP). Obiettivo del lavoro è stata l'analisi sul tipo di frequentazione subacquea all'interno delle grotte sottomarine di due AMP ("Capo Caccia Isola Piana" e "Plemmirio"), attraverso la realizzazione di un'indagine che ha avuto lo scopo di produrre descrizioni riassuntive di carattere quantitativo, riguardanti la popolazione indagata.

Le attività sono state pianificate in più fasi, nel corso delle quali è stato preliminarmente elaborato un questionario, strutturato in cinque sezioni tematiche. I dati raccolti sono stati trattati attraverso analisi esplorative di tipo semplice, ricorrendo alle rappresentazioni delle distribuzioni tramite grafici e calcolando le opportune statistiche descrittive. Infine, sono state elaborate tavole di contingenza finalizzate a incrociare le variabili dell'analisi con le singole grotte.

I questionari sono stati somministrati nel periodo giugno-settembre 2010, ed il data set complessivo si è potuto basare su 209 di essi. Dalle risposte ottenute nelle varie sezioni del questionario, si può delineare un "profilo generale" del subacqueo appassionato di immersioni in grotta, prevalentemente di sesso maschile, di età dai 30 (66% del totale per età) ai 40 anni (48%), ad indicare che si tratta di un'attività sportiva non particolarmente diffusa tra i giovani, probabilmente perché, oltre a necessitare di esperienza, è anche alquanto costosa. Per quanto riguarda la percezione ambientale dovuta alla presenza dell'AMP, il risultato non è particolarmente evidente, il che sta a significare che la presenza dei subacquei nell'AMP non è determinata dalla presenza di grotte sottomarine e che queste non sono sufficientemente "valorizzate" come habitat peculiari dell'AMP. Sebbene lo studio statistico abbia confermato in maniera oggettiva numerosi aspetti dell'attività svolta nelle grotte sottomarine, sono emersi alcuni elementi aggiuntivi che hanno consentito di definire meglio le caratteristiche socio-demografiche dei sub. I dati raccolti possono altresì essere immediatamente utilizzati per definire elementi di pianificazione, d'incentivazione, di controllo e di valutazione d'impatto economico, di sicuro interesse anche per i gestori delle AMP.

PLANTS OF THE MEDITERRANEAN TEMPORARY POOLS OF APULIA

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Mediterranean temporary pools are temporary, very shallow water bodies (a few centimetres deep) existing only in winter or at the end of spring, with a semiaquatic Mediterranean vegetation consisting of therophytes and geophytes belonging to the *Isoeto-Nanojuncetea*.

Mediterranean temporary pools are included in the category of humid zones called "temporary wetlands" characterized from the alternation of flooding and drought. Temporary pools are classified among the most biologically and biogeographically interesting ecosystems in the Mediterranean region: the relevant floristic assemblages are mainly distributed in the western Mediterranean.

The temporary wet systems of the pools in the Thermo- and Mesomediterranean areas of Puglia region in South-Eastern Italy have been investigated; sampling have been carried out and classified by applying techniques of multivariate analysis to the data set.

Different types of ponds have been classified, with different morphological, hydro-ecological and geological characteristics; they can be referred to three main fresh to brackish waters habitat types: cupular pools, that are little karstic forms excavated in limestone, with a thin layer of soil; waterlogged soils, that are soils with low hydraulic conductivity, which tend to remain flooded; and dolines, that are natural topographic depressions of soil, linked to groundwaters. The most interesting aspects of these vegetation can be included in the *Isoëto-Nanojuncetea* class. On the basis of their remarkable floristic and coenologic originality, the analyzed systems find a proper placement in some of the most interesting European Habitats listed in the Annex I to the 92/43/EEC Directive: 3170 "Mediterranean temporary ponds", with a priority relevance. A new species related to these habitat have been described as endemic of Puglia.

This work extends the floristic and distributional knowledge of Mediterranean temporary pools in Puglia and provides new extended information about their conservation status in this region for the first time.

THE RESHAPING OF THE SOUTH WEST ADRIATIC MARGIN BY PERVASIVE DENSE SHELF WATER CASCADING

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The Southwest Adriatic Margin includes a steep and morphologically complex continental slope stretching about 400 km from the Pelagosa sill to the Otranto strait. The area has been investigated through multibeam surveys accompanied by high-resolution seismic stratigraphic surveys investigating glacial and post-glacial deposits. The margin is dissected by submarine slides, with head scars up to 10 km along the shelf edge and run-out distances of tens of km, an active fault system (the Gondola deformation belt), Bari Canyon and a set of shallowly incised and relatively straight canyons located further south.

After the end of the last glacial sea level low stand the North Adriatic shallow shelf became progressively drowned as a consequence of the eustatic rise. Through its progressive drowning, this region became a shallow shelf and one of the Mediterranean key sites for the formation of dense shelf waters through wind-forced winter cooling. The dense waters formed through this process move to the south, along the western side of the Adriatic, and reach the South Adriatic slope across which they cascade hugging the sea floor and generating a myriad of depositional and erosional effects such as: giant sediment drifts down to 1200m water depth, muddy and sandy sediment waves, comet marks against pre-existing slide blocks, furrow fields, large scours at the shelf edge and large erosional moats against major morphological barriers. All these features concur to a thorough “restyling” of the margin morphology interacting with markedly different pre-existing morphologies and sediment distribution. In this study we describe in detail the morphology of the margin, the distribution of active bedforms and the areas of dominant seafloor erosion to determine the extent to which bottom-hugging currents are effective in reshaping the margin morphology.

**VARIABILITÀ DI MESOSCALA DELLE CORRENTI LUNGO LE COSTE
CALABRO-CAMPANE (FEBBRAIO-SETTEMBRE 2008). RISULTATI
PRELIMINARI**

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Lo scopo di questo lavoro è analizzare le principali caratteristiche della dinamica delle correnti lungo le coste calabro-campane. La circolazione, in quest'area, è influenzata dalla presenza di tre diverse masse d'acqua, da una complessa batimetria e dalla presenza di una marcata variabilità stagionale. Tutti questi fattori, contribuiscono alla formazione di strutture molto particolari, legate al concatenarsi di più fattori. Per questo studio, sono stati utilizzati i dati acquisiti da Acoustic Doppler Current Profiler (ADCP) posizionati tra Monforte San Giorgio (Me) e Policastro Bussentino (Sa) nel periodo Febbraio-Settembre 2008. L'analisi dei dati raccolti ha evidenziato la prevalenza della componente zonale delle correnti in prossimità delle coste della Sicilia, della componente meridionale lungo le coste calabre e la presenza di onde interne a Nord dello Stretto di Messina. In particolare, questo tipo di struttura è presente solo in alcuni periodi e appare principalmente legato al forte contributo della marea ed alla stratificazione estiva che caratterizza quest'area. Al fine di individuare i principali periodi di variabilità delle correnti nella zona d'indagine, è stata utilizzata l'analisi wavelet, particolarmente adatta ai segnali di natura geofisica con caratteristiche non stazionarie, come quelli legati alla circolazione costiera. Attraverso questo tipo di indagine è stata evidenziata la presenza di oscillazioni inerziali che risultano particolarmente frequenti nell'area del Golfo di Sant'Eufemia.

CHANGES IN BETA DIVERSITY ACROSS THE MEDITERRANEAN SEA

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Beta-diversity has gained considerable value as a conservation tool, by representing either species turnover in space and time, variation in community structure within a given spatial and temporal extent, or ecological connectivity as defined by the difference between local diversity and the regional species pool. In general, loss of beta diversity has been viewed as a major threat to marine coastal assemblages, even though examples of either increase or decrease in beta diversity as a symptom of human impacts have been reported in the literature. Within the framework of a PEW project, we measured the abundance and biomass of subtidal rocky benthic assemblages and fish of 30 sites across the Mediterranean Sea, from Spain to Turkey, including very degraded locations, marine protected areas and remote areas far from evident sources of impact. Here, we analysed changes in beta diversity to assess if this diversity measure can be used to prioritize conservation efforts and evaluate the efficacy of protection actions. Results suggest that 1- effective protection restoring some components of the system (e.g. fish) not necessarily restore the entire ecosystem, thus stressing the need for more conservation and management efforts in addition to MPAs: effective no-take marine reserves can be considered an effective tool to restore fish populations, but the status of the other components of the system is also dependent on factors other than fishing. 2- benthic assemblages of *de facto* protected areas and well enforced MPAs generally shared higher beta diversity values compared to locations embedded within area featured by multiple stressors, however several exceptions were also observed. Human disturbance and conservation measures effects on marine assemblages can be very complex, limiting our ability to make predictions. Small-scale, site-specific features together with large-scale processes, and feedbacks between variability of multiple stressors and spatial variability of species and assemblages can be driving factors on community heterogeneity. Spatially explicit diversity measures such as beta diversity should be given full consideration but can respond differently in different context needing complementary measures to fully address the complexity of the marine system.

FLUSSI DI CALORE NEL MARE DI ROSS E WEDDELL E LORO INTERAZIONE CON I FENOMENI CLIMATICI ENSO E ANTARCTIC OSCILLATION

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In questo lavoro presentiamo un'analisi dei flussi di calore all'interfaccia aria-mare-ghiaccio nei Mari di Ross e di Weddell per il periodo dal 1958 al 2010. Le forzanti meteorologiche utilizzate per la stima dei flussi di calore sono fornite dall'ECMWF mentre le informazioni sulla copertura del ghiaccio sono fornite dal NIC-NCDC.

Le stime dei flussi di calore sono state analizzate al fine di valutarne la variabilità stagionale ed interannuale nelle aree investigate e le caratteristiche climatologiche in relazione agli indici climatici Southern Oscillation Index (SOI) e Southern Annular Mode index (SAMi) che sintetizzano rispettivamente i fenomeni El Niño Southern Oscillation (ENSO) e Antarctic Oscillation (AAO). Le mappe di correlazione, tra gli indici climatici e la distribuzione spaziale dei parametri in esame mostrano che il Mare di Ross e di Weddell interagiscono in maniera differente con la variabilità climatica polare ed extra polare. In particolare le stime dei flussi di calore delle due aree esaminate mostrano un comportamento sincrono o opposto a seconda dei periodi considerati. La spiegazione di questo comportamento potrebbe risiedere nell'effetto combinato dei due fenomeni ENSO ed AAO: infatti i periodi di comportamento opposto delle due aree sembrano essere legati alla presenza di significativi valori negativi del SOI, comunemente associati a 'El Niño', durante periodi di bassa intensità del SAMi. D'altro canto periodi di andamento sincrono dei flussi di calore nelle due aree sembrano collegati alla presenza di elevati valori del SAMi.

PATTERNS AND DRIVERS OF BENTHIC BIODIVERSITY IN THE DEEP MEDITERRANEAN SEA

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Understanding the biodiversity variability at different spatial scales and the drivers of these patterns is a crucial issue in ecological studies. This is particularly evident for the deep sea, the largest biome of the biosphere, where information on the spatial and temporal variability is almost completely lacking. We investigated the variability of nematode biodiversity (as species richness, turnover diversity and functional biodiversity) at different spatial scales (from local to macro-scale) in the Mediterranean Sea at 3000 m depth. The magnitude of spatial variability was compared with the one of temporal changes. We show that the spatial variability in biodiversity parameters was largest comparing sites at the macro-scale, but also that the spatial variability of faunal abundance and of structural diversity are not consistent. We also show that, when compared to spatial variability, temporal variability explained only a minor proportion of species richness variance. Nevertheless, temporal variability explained a major proportion of variance of species turnover. Data presented here let us hypothesizing that patterns of turnover diversity at the macroscale are most likely determined by dynamics of recruitment of species inhabiting a given deep-sea basin, whereas at smaller spatial scales patterns of variability were apparently related to species ingressions/export. Moreover changes in alpha and beta diversity are not correlated in the deep-sea sediments, but species turnover was correlated with functional diversity. Food quantity, quality and the diversity of the food sources accounted for a large portion of the observed variability (up to 100% at the macroscale) and are also the main drivers for the temporal variability of biodiversity. We conclude that changes in food availability, such as those expected as a consequence of climate change, might have a significant impact on the variability in the distribution of diversity in the deep-sea benthos.

A RAPID VISUAL ASSESSMENT METHOD (RVA) FOR MONITORING CORALLIGENOUS ASSEMBLAGES: A LANDSCAPE APPROACH

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Coralligenous assemblages include algae and invertebrates growing on a secondary hard substrate, generated mainly by the concretion of encrusting calcified red algae. This structurally complex bioconstruction develops only in the Mediterranean Sea and is protected under the European Directive 92/43/CE. Because of the operational restrictions imposed by SCUBA diving at high depths (20-50 m), the knowledge about coralligenous is still limited and standardized sampling protocols are lack. In this study, we assessed the state of the coralligenous shoals of Vado Ligure (Savona, NW Mediterranean) using a landscape approach with an innovative Rapid Visual Assessment method (RVA), based on underwater surveys along fixed routes coupled by video and photographic surveys. In each coralligenous shoal different landscapes were identified on the basis of geomorphologic characteristics. For each landscape benthic assemblages were investigated considering three layers: 1) the basal layer, composed by encrusting or with limited vertical growth organisms; 2) the intermediate layer, dominated by mounds or bush-shaped species with moderate vertical growth; 3) the upper layer, constituted by mounds or arborescent organisms with considerable vertical growth. Bionomic characterization of each layer took into account conspicuous species and those easily identifiable *in situ* and from photographic and video images, with particular regard to protected species. Descriptors chosen to assess the state of coralligenous assemblages in each landscape were: 1) basal layer bioconcretion thickness; 2) cover of encrusting species; 3) intermediate layer biodiversity; 4) abundance, high and cover of upper layer species. On the basis of the former descriptors, a quality score to each layer was defined and a total quality score for each landscape was computed. This new approach, focusing on landscape rather than on community aspects, optimized the sampling effort and provided an effective method for assessing the state of coralligenous assemblages.

PARTICULATE ORGANIC MATTER DISTRIBUTION IN DIFFERENT AREAS OF THE MEDITERRANEAN AND BLACK SEAS

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This study aims to investigate the variations of particulate organic matter (as C, N and P elements) from surface to deep waters in different sub-areas of the Mediterranean and Black Sea during two different seasonal periods: winter/spring and summer/autumn. The data were collected in the oceanographic cruises carried out during 2008 in the framework of the FP6 SESAME Project.

Horizontal maps allow to recognise the large availability of POC, PP and PN in the Black Sea, in comparison with all Mediterranean regional seas. They also reveal the existing spatial heterogeneity in the intermediate layers of the different sub-basins. Among the Mediterranean regional seas, the highest POC concentrations were found in the upper layers of Northern-Central Adriatic Sea and Northern-Central Aegean, with median values in the range 4-8 $\mu\text{mol C L}^{-1}$. Maxima were reached in the Northern Adriatic during Autumn after the fertilization following riverine discharges. In the Black Sea, POC concentrations ranged between 6 and 23 $\mu\text{mol C L}^{-1}$, with highest values in the North Western sector during Summer. High POC concentrations were also measured in the upper layer (0-25 m) of the Marmara Sea, both in winter and in summer, with median concentrations between 24 and 32 $\mu\text{mol C L}^{-1}$. The highest POC and PP concentrations are characteristic of the most productive seas under direct fluvial inputs: the Northern Adriatic, the Marmara Sea and the Black Sea.

In the open waters of all the different regional seas the exponential decrease of POC with increasing depth is evident in both seasonal periods. The vertical distribution of PP follows a similar pattern to that of POC but with a relatively stronger decrease with increasing depth. Concerning the deeper layers, the Western Mediterranean Deep Waters (WMDW) and Eastern Mediterranean Deep Waters (EMDW) have the lowest POC ($\leq 0.7\text{-}0.8 \mu\text{mol C L}^{-1}$), PN ($0.03\text{-}0.07 \mu\text{mol NL}^{-1}$) and PP concentrations ($\leq 0.002 \mu\text{mol PL}^{-1}$).

PROKARYOTIC COMMUNITY STRUCTURE VARIATION IN THE DEEP SEDIMENTS OF THE MEDITERRANEAN SEA AND ADJACENT ATLANTIC OCEAN

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A lack of works describing the deep-sea benthic prokaryotic community structure, especially to compare the relative contribution of the two prokaryotic domains (Bacteria and Archaea) and the quantitative relevance and ecological role of Archaea in the sediments of the deep-sea ecosystems is largely unknown. In the oceanic water column, the archaeal contribution to prokaryotic abundance varies among different regions, water masses and depths, and Crenarchaeota appear to be more variable in abundance than Euryarchaeota. In this study we investigate spatial distribution of prokaryotic abundance and community structure variation in relation with water depth, longitude and trophic conditions, identifying the relationships between prokaryotic community structure and activity and their implications in deep-sea ecosystem functioning. Our results, revealed by CAtalysed Reporter Deposition Fluorescence In Situ Hybridization (CARD-FISH), show that *Archaea* are a numerically important component of the deep benthic boundary layer prokaryotic assemblages and that do not show significant differences between investigated areas. A non-metric MDS analysis of the prokaryotic community structure among sampling areas and linear fitting of environmental and trophic descriptors show a good separation of the areas according to their ecological settings. The biopolymeric organic carbon and the proteins are among the factors that best explain the observed separation, also on basin scale. Results of the spatial distribution of archaeal community (Crenarchaea and Euryarchaea abundance) display a decreasing trend from 1200 at higher depth, while the percentage of euryarchaeota on total prokaryotic cells increase significantly with the depth of the investigated regions. This can be considered one of the most interesting results of this work. Their increase suggests an important contribution at the ecosystem functioning of the deep sea.

SPECIE NON-INDIGENE (NIS) DI CNIDARI NEL MAR MEDITERRANEO: RIFLESSO DI UN PROBLEMA GLOBALE ?

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Le introduzioni di Specie Non-Indigene (NIS) di Cnidari (Sifonofori esclusi) nel Mediterraneo sono documentate da una revisione della letteratura risalente ai primi anni dell'800, che ha portato alla stesura di una lista aggiornata di Cnidari NIS del bacino. In questo lavoro, sono riportate l'origine, la data ed la modalità di introduzione degli Cnidari NIS, insieme con informazioni relative alla loro biologia e zoogeografia. Sono state elencate 80 NIS, molte sono indo-pacifiche (64%), principalmente presenti nel bacino di Levante, ed il 36% sono atlantiche. Circa il 51% delle specie è stato segnalato solo poche volte, il 33% è stabile (largamente segnalato nel bacino), il 10% comprende specie altamente invasive, il 5% specie di dubbio *status* tassonomico, e l'1% specie criptogeniche.

La maggior parte delle NIS nel Mediterraneo orientale è entrata attraverso il Canale di Suez, mentre, nel Mediterraneo nord-occidentale e centrale, il traffico marittimo e l'espansione dell'areale naturale, attraverso lo Stretto di Gibilterra, costituiscono frequenti modalità di introduzione.

Le introduzioni attraverso il Canale di Suez e lo Stretto di Gibilterra sembrano essere le principali modalità di ingresso anche se, per una significativa parte delle NIS, la modalità di introduzione rimane ignota. La maggioranza delle NIS considerate qui sono ad affinità tropicale (51 specie su 80) e questa è una chiara conseguenza dello stabilirsi di nuove condizioni nel bacino, probabilmente dovute al riscaldamento globale.

L'impatto degli Cnidari NIS sugli ecosistemi mediterranei è noto solo per alcune specie, come per lo scifozoo *Rhopilema nomadica* nel bacino di Levante, mentre rimane probabilmente sottostimato per specie incospicue ma largamente segnalate, come l'idrozoo *Clytia hummelincki*.

ANOTHER EXAMPLE OF HABITAT LOSS: THE CASE OF MEDITERRANEAN SUBMARINE CAVES

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Submarine caves represent a common habitat in Mediterranean sea and one of the few deserving a generalized form of protection from EU initiatives, due to their uniqueness and vulnerability. Even if included in the list of habitats of Community Interest by the Habitats Directive (CODE 8330), caves are largely affected by diver frequentation unregulated even in MPAs. Although the potential effect deriving from scuba activities is widely recognized, there is a general lack of quantitative studies assessing the consequences of recreational activities within caves, seriously limiting our potential to plan threshold levels of diver frequentation in this habitat. Understanding their response to the putative disturbances of scuba divers is thus mandatory for their effective management and conservation. In the present study we have focused on different submarine caves in the NW Sardinia, inside an MPA where coexist regulated and not regulated caves, in order to quantify present impact on benthic assemblages deriving from divers and suggest indications to prevent further biodiversity loss. Photographic samplings were conducted after the period of maximum frequentation on a total of 4 caves within the MPA of Capo Caccia.

Results clearly show that diving frequentation can heavily affects caves' assemblages altering their patterns of distribution also decreasing their three dimensional structure. The tested impact is non-random since, taxa sensitive to the mechanical disturbance represented by direct physical contact of divers are significantly more abundant and homogeneously distributed in the fully protected cave than in the frequented ones. We demonstrate that intrinsic vulnerability of cave habitats, widely assumed but scarcely quantified, require the development of appropriate management measures that are not guarantee by generalized forms of protection. Management of caves crucially needs the establishment of ad hoc regulatory interventions leading to the long-term sustainable use of these unique habitats.

MEIOBENTHIC DIVERSITY IN LIGURIAN *POSIDONIA OCEANICA* MEADOWS

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Posidonia oceanica (L.) Delile (1813) is the most important and abundant seagrass in the Mediterranean Sea and its meadows are one of the most productive ecosystems and contribute to protect coastal areas. Seagrasses create complex trophic interactions among organisms of associated sediments. In particular, detritus deriving from the plant represents the most of the food available for benthic bacteria, macro and meiofaunal communities.

Descriptors commonly used to evaluate seagrass meadows health status are mainly related to the plant (e.g., phenological parameters) and/or to the meadow (e.g., structural parameters) and, therefore, are subjected to long-term response times. Conversely, early warning indicators would be able to rapidly detect environmental alterations to allow prompt management actions, in order to avoid an alteration hardly recoverable at the plant and/or the meadow level. Meiofauna is considered as a good bio-indicator with a rapid response to environmental variations, due to its main features (e.g., short life cycle, scarce mobility, presence/absence of tolerant/sensitive species).

Meiofauna in sediments colonized by *P. oceanica* in the Ligurian Sea (NW Mediterranean) was studied in order to evaluate the use of meiofaunal organisms as appropriate early warning indicator of environmental alterations. Meiofaunal community, with a particular attention to nematodes, grain size and organic matter in three meadows occurring in urbanized coastal areas were contrasted with those observed in three meadows located within Marine Protected Areas. Samplings were carried out in two distinct periods, at the beginning and at the end of the summer season, in order to individuate early changes in the meiofaunal community.

The meiofauna and the nematodes community structures highlighted differences among meadows not detectable by the other parameters, such as organic load and structural parameters (e.g. density). Meiofauna is, thus, proposed as appropriate biological quality elements (BQE) able to show early responses to environmental alterations.

IMPACT OF OFFSHORE MARICULTURE ON BENTHIC MICROBIAL METABOLISM AND BIODIVERSITY

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Mariculture activities are exponentially increasing in coastal oceans, having variable impacts on the surrounding environment. To provide insights about impacts on benthic microbial assemblages, we investigated prokaryotic and viral abundance, prokaryotic carbon production, aminopeptidase, β -glucosidase and alkaline phosphatase activities and bacterial diversity in four regions characterised by the presence of fish farms. These regions were spread across the entire Mediterranean Sea: Akrotiri Bay (Cyprus), Sounion Bay (Greece), Pachino Bay (Italy) and the Gulf of Alicante (Spain). At each region, all variables were measured in two habitats: sediments covered by beds of the seagrass *Posidonia oceanica* and non vegetated sediments. Generally, the presence of fish cages increased total prokaryotic and viral abundance, the virus-to-prokaryote (VPR) ratios, enzymatic activities and prokaryotic carbon production rates, indicating an overall stimulation of benthic microbial activities and an enhanced viral-mediated prokaryotic mortality. However, although uni- and multivariate analyses of variance identified significant differences between impact and control sediments, these differences were not consistent at all regions and habitats, suggesting region- and habitat-specific effects on benthic microbes. The analysis of bacterial diversity consistently revealed lower values of bacterial OTUs richness and evenness in all sediments below the fish cages. Cloning and sequencing of the bacterial 16S rRNA gene in non vegetated sediments showed the overall dominance of δ - and γ -proteobacteria, with an increase in δ -proteobacteria sulphate-reducers sequences (in particular *Desulforhopalus*, *Desulfocapsa* and *Desulfopila*) below the fish cages. We conclude that offshore mariculture can severely influence benthic prokaryotic and viral assemblages, by stimulating the overall prokaryotic metabolism, inducing shifts in bacterial community composition and enhancing the viral impact on prokaryotic assemblages.

HYDRO-CHEMICAL AND BIOLOGICAL FEATURES OF COASTAL WATERS AFTER A FLOODING EVENT IN THE GULF OF SALERNO AS SEEN DURING TYR01 SURVEY (TYRRHENIAN SEA)

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The main effect of global climate changes is the intensification of extreme events, including intense rain, and floods. Predictions point to an increased frequency of such events, whose impact on the marine ecosystems is unpredictable.

On November 8-10 2010, exceptionally rains caused the overflows of rivers Sele, Toglio, Tanagro, Sarno and Solofrana with consequent anomalous amounts of freshwater and terrigenous material poured into the Gulf of Salerno. The effects of such floods on the main physical, chemical and biological parameters were investigated in the framework of the oceanographic survey TYR01. The samplings were carried out on board of the R/V Urania from 16-20 November 2010. A thin layer of freshwater with salinities < 36 was observed up to 15 miles from the coastline. All chemical parameters (dissolved inorganic nutrients, total N and P, DOC, POC, TSM) showed increased values in this layer with respect to surrounding waters. Phytoplankton biomass and composition profited from this unexpected condition showing unusual values for the season: up to 4.5 mg m⁻³ of Chl *a* and a dominance of diatoms.

The data will be contextualized relative to previous surveys in the area and analyzed in terms of perturbation of abiotic environmental factors related to the flooding and their possible implications for the trophic characteristics of the area.

NUOVI DATI SULLA FAUNA A “GRANDI BRANCHIOPODI” (BRANCHIOPODA: ANOSTRACA, NOTOSTRACA, SPINICAUDATA) DELLE ACQUE TEMPORANEE DELLA TUNISIA

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Nonostante i primi studi sulla fauna a grandi branchiopodi (Anostraca, Notostraca e Spinicaudata) della Tunisia risalgano alla fine del XIX secolo, ad oggi non esiste un inventario completo ed aggiornato di questi organismi nella regione. Al fine di fornire un quadro organico e quanto più possibile completo, una serie di campagne di campionamento sono state condotte a partire dal 2004. Circa 240 corpi idrici temporanei, distribuiti in tutto il territorio Tunisino e nelle sue isole maggiori (Kerkennah e Djerba), sono stati campionati ripetutamente in inverno e primavera e sono stati raccolti dati sulla morfometria dei bacini e sulle principali caratteristiche fisiche e chimiche delle acque. Gli organismi raccolti sono stati identificati sulla base delle loro caratteristiche morfologiche. Le specie *Triops cancriformis* e *Triops mauritanicus simplex*, in assenza di dati morfologici affidabili che ne consentano l'identificazione, sono state separate comparando frammenti 12S e/o 16S di rDNA. La significatività dello sforzo di campionamento è stata valutata utilizzando il programma EstimateS 8.2 e le relazioni tra la distribuzione delle specie e le principali variabili ambientali sono state analizzate tramite CCA. In totale sono state identificate 14 specie suddivisibili in 3 gruppi ecologici principali: specie tipiche delle regioni steppiche e subdesertiche (*Tanymastigites perrieri*, *Triops granarius* e *Leptestheria mayeti*), specie tipiche delle regioni umide (*Chirocephalus diaphanus*, *Lepidurus apus lubbocki* e *Cyzicus tetracerus*) e specie alofile (*Artemia salina*, *Phallocryptus spinosus* e *Branchinecta media*). I Notostraci presentano peraltro una netta segregazione latitudinale, con *Lepidurus apus lubbocki* confinato nelle regioni più umide nel nord del paese e *Triops cancriformis*, *T. mauritanicus simplex* e *T. granarius* progressivamente distribuiti lungo un transetto nord-sud. Le specie *Branchinecta schaefferi* e *Streptocephalus torvicornis* non mostrano chiari pattern di distribuzione geografica e sono presenti dal Sahel alla piana di Medjerda e fino alla penisola di Cap Bonn nel nord della Tunisia. Sebbene le analisi effettuate dimostrino che lo sforzo di campionamento sin ora condotto possa considerarsi esaustivo per la regione, alcune specie nuove per la Tunisia potrebbero essere presenti in pozze temporanee, difficilmente raggiungibili, localizzate lungo i confini Algerino e Libico.

TEMPORAL VARIABILITY OF MEIOFAUNAL ASSEMBLAGES IN DEEP-SEA SEDIMENTS OF THE NW MEDITERRANEAN SEA

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In the last two decades, strong evidence is accumulating that the deep-sea environments are not as temporally stable as previously thought. Therefore, long-term studies are crucial to understand the diverse range of processes which occur in the deep sea. However, though quantitative studies of deep-sea fauna have been now conducted in almost all oceanic basins, most of these studies have been focused on the analysis of bathymetric gradients, not replicated in time. Therefore, it is still poorly known whether deep-sea assemblages display significant intra- or inter-annual variations, if these changes occur at all depths or are dependent on bathymetric gradients. The present picture we have on the abundance, biomass and diversity of deep-sea assemblages and of their relationships with food availability and other controlling factors is therefore likely constrained by the lack of sufficient information on the effect of variability at different temporal scales. In the present study we investigated on a regular temporal basis (biannual when possible) the intra- and inter-annual variability of meiofaunal abundance, biomass, number of higher taxa, community composition and nematode species and functional richness. Sediment samples were collected along the Catalan margin at depths from 1000 to 2400m in the Cap de Creus Canyon and in the adjacent continental slope during 6 oceanographic cruises carried out from April 2005 to October 2009. The analysis of the temporal changes revealed the presence of the highest variability of total meiofaunal abundance, biomass and diversity over the inter-annual temporal scale. These results undermine the till-to-now forgotten relevance of temporal variability in the deep sea and claim for the need of future studies accomplishing for temporal variability in the deep sea according to robust and rigorous hierarchical sampling strategies.

VALUTAZIONE DELLA VULNERABILITÀ ALLA FREQUENTAZIONE SUBACQUEA DI GROTTIE SOMMERSE: APPLICAZIONE IN TRE AMP ITALIANE

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Il turismo subacqueo è una delle più grandi forme di uso commerciale delle aree marine protette (AMP) in tutto il mondo, ma solo pochi studi sono stati condotti sull'impatto dell'attività subacquea nelle AMP. Tra i vari approcci utilizzati a questo scopo, uno di questi prevede la valutazione della vulnerabilità di un percorso alla frequentazione subacquea. Scopo del presente lavoro è stato quello di applicare un indice standardizzato per valutare il valore di vulnerabilità di 9 percorsi in ambiente di grotta, in 3 AMP italiane.

Ulteriore obiettivo di questo studio è stato quello di valutare le potenziali differenze nella percezione della vulnerabilità tra quattro categorie di stakeholders e fruitori di AMP (gestori di AMP, ricercatori, operatori diving ed turisti) e come queste possano influenzare la definizione dei livelli di vulnerabilità per i percorsi subacquei. Questo obiettivo è stato realizzato sviluppando 4 indici differenti "calibrati" sulla percezione di ciascuna categoria. Questa è stata valutata attraverso la somministrazione di questionari.

Dalle analisi emerge: 1) una elevata variabilità nei valori di vulnerabilità tra i differenti percorsi subacquei e 2) una assenza di differenza tra ricercatori, gestori di AMP e operatori diving in termini di percezione della vulnerabilità.

EARLY DIAGENETIC PROCESSES AND ORGANIC CARBON BURIAL IN DEEP SEDIMENTS OF THE MEDITERRANEAN SEA

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Early diagenesis refers to the combination of biological, chemical, and physical processes that occur during sediment burial. The early diagenetic processes in the upper sediment layers are generally most important in the benthic pelagic coupling and consequently reflect changes occurring in the pelagic processes. Sedimentary organic matter burial in marine sediment is an important reservoir and represents the predominant long term sink in the global biogeochemical cycle of organic carbon. Dissolved organic carbon (DOC) in pore waters plays a key role in the global carbon cycle, because it is involved in the remineralization and preservation of the sedimentary organic carbon as well as in the control of the sedimentary metal complexation.

During the TransMed cruises, in spring-summer 2007, bottom sediments were collected by using an oceanic boxcorer in 18 sites from deep plains along the Mediterranean Sea and Atlantic Ocean with the aim to estimate the mineralization and the burial rates of organic carbon.

DO, DOC and nutrients data in the pore waters together with the measurement of the respiratory electron transport system (ETS) activity in sediments will be presented and discussed.

The consumption rates of oxygen ranged from 0.8 mmol m⁻² d⁻¹ at station VKC (Atlantic Ocean) to 3.2 mmol m⁻² d⁻¹ at station V4C (Almeria-Oran area) corresponding to a carbon mineralization rate of 2.5 and 11.0 g C m⁻² y⁻¹, respectively. A good correlation was found between the estimates of SCOC and ETS activity. Organic carbon and total nitrogen contents mostly showed the highest values at the sedimentary interface, then they decreased downcore. In the western Mediterranean Sea, the averages of the surficial contents (0.64%), are slightly higher than those measured in the eastern Mediterranean Sea (0.55%) and in the Atlantic Ocean (0.44%). DOC exhibited concentrations ranging between 100 and 600 microM with different trends in the different stations. DOC concentrations in pore waters were generally elevated over bottom water values (up to an order of magnitude), implying that there was a net production of DOC within sediments as a result of remineralization processes.

DARK CO₂ FIXATION IN BENTHIC DEEP-SEA ECOSYSTEMS

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Recent findings provided evidence that dark CO₂ fixation (DCF) can be an important process for the functioning of the ocean interior, but its quantitative relevance and ecological significance in benthic deep-sea ecosystems are completely unknown. In this study we investigated rates of dark CO₂ fixation (by means of [¹⁴C]-bicarbonate incorporation experiments) together with rates of [³H]-leucine incorporation and prokaryotic abundance and biomass in surface sediments of a wide variety of deep-sea ecosystems. Our results revealed a fast and efficient incorporation of inorganic C into prokaryotic biomass, which was completely inhibited in the presence of specific antimicrobial compounds. Rates of bicarbonate incorporation in the deep-sea sediments investigated were 1-2 orders of magnitude higher than those reported for pelagic deep-sea systems and contributed to the whole prokaryotic carbon production for ca. 20%. The amount of inorganic C incorporated into prokaryotic biomass accounted up to 55% of the organic carbon flux reaching the seafloor, indicating that in these food limited ecosystems DCF can contribute for a large extent to sustain biomass production. Overall our findings indicate that, conversely to what expected, benthic deep-sea metabolism is not only dependent upon the supply of organic matter coming from the water column, but also upon *in situ* dark CO₂ fixation processes and as such highlight the importance to include this aspect for a better comprehension of the functioning of the deep food webs.

**VARIABILITÀ AMBIENTALE A DIVERSE SCALE SPAZIO-TEMPORALI E
RISPOSTA DEL FITOPLANKTON: ESEMPI DA APPLICAZIONI DI
FLUORIMETRIA *IN VIVO* IN ALCUNI LAGHI DELL'ITALIA
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La risposta del fitoplancton ai cambiamenti dell'ambiente fisico è molto rapida, in particolare per quanto riguarda variazioni nella frequenza del disturbo indotto dal mescolamento. Fino dai primi sviluppi della teoria del non-equilibrio, nell'ecologia del fitoplancton è stata sottolineata l'importanza di condurre osservazioni a scale temporali brevi, più adeguate a descrivere la dinamica dei popolamenti algali. Tuttavia, un campionamento intensivo è spesso difficile da realizzare ed è raro trovarne degli esempi in ambienti d'acqua dolce. In anni recenti l'introduzione di strumenti, come i fluorimetri di nuova concezione, in grado di tracciare la distribuzione di popolamenti algali con caratteristiche ecologiche e funzionali diverse, ha reso possibile investigare la dinamica del fitoplancton su ampie scale spaziali e/o brevi scale temporali.

A partire dal 2005, alcune campagne di misura sono state condotte dal CNR-ISE, in diversi ambienti lacustri dell'Italia settentrionale (Maggiore, Viverone, Candia, Pusiano), con lo scopo di analizzare sia la dinamica del fitoplancton a breve scala temporale, che l'eventuale eterogeneità della distribuzione spaziale. Nel caso del Lago Maggiore le misure hanno messo in luce l'esistenza di forti gradienti orizzontali nella concentrazione dei popolamenti fitoplanctonici, imputabili sia a diverse condizioni fisiche lungo l'asse maggiore del lago, che ad apporti di nutrienti algali localizzati in corrispondenza di alcuni dei tributari. Per quanto riguarda gli altri laghi, di dimensioni minori, si è osservata una maggiore omogeneità spaziale, sebbene i dati raccolti abbiano permesso di descrivere la risposta del fitoplancton alla variabilità fisica dell'ambiente e la dinamica delle successioni stagionali con un dettaglio elevato. Il presente contributo offrirà una panoramica delle relazioni osservate tra la variabilità negli ambienti lacustri studiati e la risposta delle comunità fitoplanctoniche a diverse scale temporali e spaziali.

LE INFRASTRUTTURE SPAZIALI DI DATI NEGLI STUDI LIMNOLOGICI ED ECOLOGICI

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Negli ultimi due decenni si è assistito, nell'ambito degli studi ambientali, a una maggiore diffusione di strumenti automatici per la raccolta di misure di campo. Questi strumenti possono infatti aumentare la risoluzione spaziale e temporale delle osservazioni, permettendo di rispondere all'esigenza per cui le brevi scale temporali e la tridimensionalità siano le vere scale di rappresentazione dei dati ecologici (Harris, 1985). Se si aggiunge la grande enfasi che oggi si dà agli strumenti di analisi e archiviazione geografica, indicati come linguaggi innovativi e multidisciplinari per visualizzare e provare le teorie ecologiche in 3 dimensioni (Butler, 2006). Si può comprendere come la creazione di un'infrastruttura che combini raccolta, archiviazione e distribuzione di dati ciascuno dei quali georiferibile, permetterebbe un miglioramento dell'accesso, della condivisione e del riutilizzo dei dati stessi.

Il lavoro che qui si presenta ha lo scopo di proporre un esempio di Infrastruttura Spaziale dei Dati (SDI), evidenziando potenzialità e problematiche, alla luce delle normative Europee in ambito distribuzione dei dati (INSPIRE 2007/2/CE) e delle esperienze fatte in seno a progetti nazionali (GIIDA) e europei (EnvEurope). Utilizzando come scenario d'uso gli studi limnologici, verrà:

1. fatta luce su alcuni servizi per l'archiviazione, l'interrogazione, l'elaborazione statistica e geostatistica, la visualizzazione e la distribuzione di dati meteo-idrologici, chimico-fisici e biologici;
2. posta l'attenzione sull'importanza della standardizzazione dei servizi per ottenere l'effettiva interoperatività dei dati raccolti.

**VECTORS OF CHANGE IN OCEANS AND SEAS MARINE LIFE, IMPACT ON
ECONOMIC SECTORS (VECTORS – 7th FP): INTERDISCIPLINARY
RESEARCH INTO THE ARENAS OF SCIENCES, POLICY, MANAGEMENT
AND SOCIETY**

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VECTORS is a multidisciplinary large-scale integrated European Project (2011-2015) supported within the Ocean of Tomorrow call of the European Commission Seventh Framework Programme, which aims to improve our understanding of how environmental and man-made factors are impacting marine ecosystems now and how they will do so in the future. The project will examine how these changes will affect the range of goods and services provided by the oceans, the ensuing socio-economic impacts and some of the measures that could be developed to mitigate or adapt to these changes. VECTORS will address a complex array of interests comprising areas of concern for marine life, biodiversity, sectoral interests, regional seas, and academic disciplines as well as the interests of stakeholders. The project will also ensure that the links and interactions between these areas of interest are explored, explained, modelled and communicated effectively to the relevant stakeholders. The VECTORS consortium is genuinely multidisciplinary and includes a mixture of natural scientists, some with knowledge of socio-economic aspects, and social scientists (environmental economists, policy and governance analysts and environmental law specialists) with interests in natural system functioning. VECTORS is therefore equipped to deliver the integrated interdisciplinary research required to achieve its objectives with maximal impact in the arenas of science, policy, management and society.

INTER-ANNUAL VARIABILITY IN PROKARYOTIC AND VIRAL ABUNDANCE IN THE NORTHERN ADRIATIC SEA: LINKS WITH CHANGES IN THE TROPHIC STATUS?

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Prone for several decades to eutrophication, the Northern Adriatic Sea is now experiencing a period of apparent oligotrophication. While changes in the grazing food chain and the benthic ecosystem have been documented, no information is available to date about changes in virus and prokaryotic abundance during this latter phase. To provide new insights on the till now neglected changes in the virus-prokaryote relationships occurred in the Northern Adriatic Sea as a possible consequence of changes in the trophic status, data of prokaryotic and viral abundance, virus to prokaryotic ratio, chlorophyll-a concentrations, temperature, salinity and dissolved oxygen concentrations measured during spring (March-May) in four consecutive years (2000-2003) were analysed. All investigated variables, with the exception of salinity, displayed significant inter-annual changes. The temporal modifications in the viral and prokaryotic abundance in the N Adriatic Sea offshore waters followed a continuous pattern, slightly deviating only in 2002. In particular, we identified a continuous increase of sea surface temperature which was associated with either an increase of prokaryotic abundance and a decrease of viral abundance. Multiple regression analysis revealed also that the observed temporal changes in the prokaryotic and viral abundances in the N Adriatic Sea were mostly explained by changes in dissolved oxygen (66% of total variance) and chlorophyll-a (24%) concentrations, whereas temperature and salinity variations explained altogether only 3% of the total variance, with only 10% of variance remaining fully unexplained. These results indicate that the functioning of the pelagic ecosystem of the Northern Adriatic Sea is strongly controlled by fluctuations in the major environmental characteristics and suggest that major changes in the trophic status may have severe effects on virus-prokaryote relationships.

LONG-TERM EVOLUTION OF THE MEDITERRANEAN WATER COLUMN AND BIOLOGICAL RESPONSE

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In recent times, several mass mortalities of benthic organisms occurred in the Mediterranean sea, due to sudden deepening of warm surface waters. The warmed layer tends to deepen, probably due to global warming, having dramatic effects on species that thrive below the warmer surface waters of the summer. Our hypothesis is that the warmer layer tends to become thicker in the recent years (as suggested by the biological response of long lived benthic organisms) and that the depth of the sharp shift between the warm surface layer and the rest of the water column tend to increase. To test this hypothesis we analyzed vertical profiles of temperature and density drawn from Mediterranean data banks (such as MEDAR/MEDATLAS), from Mediterranean long-term observatories (e.g. DYFAMED), from a hierarchy of models (from mixed layer to climate models). Representative depths in the temperature profile have been identified with specific algorithms (such as the split and merge technique, introduced by Pavlidis and Horowitz, 1974), namely the mixed layer depth and the thermocline base. The profile analysis was carried out over the whole Mediterranean Sea and regionally over individual subbasins. Sampling clearly represents a crucial issue in this kind of investigations, and even though a quantitative assessment would request data specifically collected for such a purpose, a deepening of the mixed layer depth at the end of the warm season and a prolongation of the seasonal summer behavior of the water column have been identified, in particular in the DYFAMED data base. These results confirm the importance of long-term modifications of the physical forcing on the time evolution of Mediterranean biota.

BRYOZOAN BIODIVERSITY IN SELECTED SUBMERGED CAVES FROM THREE MARINE PROTECTED AREAS IN ITALY

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The bryozoan biodiversity of underwater caves from the Mediterranean Sea is known mostly for some French and Spanish areas and single caves in restricted Italian localities.

The CoNISMa project MATTM_3AMP gave the opportunity to contribute new information about the bryozoan communities colonizing shallow underwater caves from three Marine Protected Areas (MPAs) from different geological, geographical, hidrological and human settings, namely the Pelagie (Sicily Strait), Plemmirio (SE coast of Sicily) and Capo Caccia (NW Sardinia) MPAs.

A total of 65 samples from ten caves have been studied. Bryozoans are obvious near the entrances but colonize cavities and crevices in all caves and even in their recessed ends. The total number of species amounts to 113 (22 cyclostomes, 1 ctenostome and 90 cheilostomes) belonging to 74 genera and 45 families. As expected, a large number of species is restricted to one or a few sites, sometimes from a single cave or area. A relatively small number seems to be widespread but only a few (less than a quarter) are shared by all MPAs.

The bryozoan total diversity and species composition differ in single caves and areas, mostly relating to cave extension, typology, setting and geological history. The Plemmirio MPA is the most diversified area and include the most speciose caves, whereas the Pelagie MPA shows the lowest species richness. The Capo Caccia MPA has intermediate values.

The study allowed to increase: a) the bryozoan biodiversity listed for the Italian seas, and b) the list of bryozoan species currently known as cave-dwellers, with the inclusion of both widespread species, previously considered as sciaphilic, and taxa with restricted distributions, whose geographical range is widened. Some taxa have been discovered which could represent introduced or, most likely, still undescribed species.

IMPROVING A FORECASTING HYDRODYNAMIC MODEL IN THE ADRIATIC SEA

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Since 2005 an Adriatic implementation of the Regional Ocean Modeling System (AdriaROMS; Chiggiato and Oddo, 2008) is being producing operational short-term forecasts (72 hours) of principal hydrodynamic properties (currents, sea level, temperature, salinity) of the Adriatic Sea on a daily basis. The main objective of AdriaROMS is to provide products useful for civil protection purposes (sea level forecasts, outputs to run other forecasting models as for saline wedge, oil spills and coastal erosion).

Air-sea fluxes are computed using forecasts produced by the COSMO-I7 operational atmospheric model (both AdriaROMS and COSMO-I7 are managed by the Hydro-Meteo-Clima Service – SIMC – of ARPA Emilia Romagna). At the open boundary (Otranto Strait), temperature, salinity and velocity are provided by the Mediterranean Forecasting System operational model managed by GNOO/INGV at Bologna, and main tidal components as derived from a tidal model are imposed.

In March 2011 a new AdriaROMS version has been implemented with several improvements including, among others, new ROMS version (3.4 vs. 3.0), increased horizontal resolution (2 km vs. 3-10 km), inverse barometer effect on sea level. The work has been carried out in the framework of the EU MICORE project (ARPA-SIMC being official partner), which aims to develop and demonstrate on-line tools for the reliable prediction of storm impacts in coastlines and to develop and enhance existing civil protection strategies. The use of a morphodynamic model is planned, and it would benefit from outputs of a coupled wave-current model; for this reason another version of ROMS coupled with the SWAN wave model is being implemented in the northern Adriatic Sea at higher horizontal resolution (0.5 km).

The systems will be described and results of data-model comparison will be showed.

DRIVING FACTORS OF COASTAL MICROBIAL DYNAMICS ALONG THE CENTRAL-SOUTHERN TYRRHENIAN SEA DURING TYR01 SURVEY (FALL 2010)

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The oceanographic survey TYR01 aimed at a biogeochemical characterization of coastal waters as related to river inputs and comparison with offshore stations in the Tyrrhenian Sea. The data will be fed into a regional algorithm for Case I and II waters along Campania and Latium coasts. Attention has been focused onto the contributions of main rivers to the coastal area (Sarno, Volturno, Garigliano, Tevere, Sele) and to the exchange and dilution mechanisms with offshore.

Samples have been collected along coast-to-offshore transects at 5 to 10 depths and analyzed for total inorganic nutrients, POC, Chla, liposoluble pigments by HPLC, photosynthetic parameters by PhytoPAM and bacteria concentration and composition by flow cytometry.

Preliminary results point to coast-to-offshore gradients of phytoplankton biomass with values up to 5.1 mg m⁻³ of Chla at coastal stations. Phytoplankton biomass and composition appear strongly ruled and localized by the river mouths except than in the Gulf of Naples, where high Chla concentrations are spread over the whole area. Pigment spectra analyses highlight different phytoplankton communities with diatoms dominating at coastal stations, and a higher diversity offshore and at oligotrophic stations. The PhytoPAM data show that in the upper mixed layer phytoplankton was low-light adapted and highly efficient in using the light available, as related to the low seasonal irradiances and strong mixing. Below the thermocline, instead, low photosynthetic performance (from rETRmax) was measured, probably due to limiting light conditions.

Bacteria concentrations were relatively low but showed different patterns as related to the percent of High vs Low Nucleic Acid subpopulations.

TROPHIC GRADIENTS, CLIMATE CHANGE AND CYANOBACTERIA: WHAT WE EXPECTED AND WHAT WE GOT – A LESSON FROM LAKE GARDA

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In this contribution we analyzed the impact of temporal trophic gradients on the phytoplankton community of Lake Garda. The station “Lago di Garda” was included in the Long Term Ecological Research network since 2007. We related the long-term development of phytoplankton and cyanobacteria to the fluctuations in the availability of nutrients at different temporal scales, from decadal temporal development to inter-annual changes. Estimation of parameters in linear models was carried out by applying Generalised Least Squares models (GLS). GLS allows estimation of unknown parameters in linear regression models even when assumptions are violated, i.e. when the variances of the observations are unequal, or when the data have a certain degree of serial correlation, as is usually the case in long-term ecological investigations. The development of cyanobacteria showed a strong dependence from the decadal development of phosphorus, with maximum correlation at a time lag of 1 year. Similarly, at the annual temporal scale, this algal group showed a strong dependence from the surface spring availability of TP, which, in turn, was related to deep mixing dynamics and winter climatic oscillations. Nevertheless, temporal trophic gradients showed a differential impact on the different groups of cyanobacteria. While the Oscillatoriales (in the whole range of temporal scales) and Chroococcales (decadal temporal scales) were closely linked to P fluctuations, the Nostocales (mainly *Anabaena lemmermannii*) appeared unaffected. Unexpectedly, this algal group increased its importance not only in Lake Garda, but also in other deep southern subalpine lakes just in the period coinciding with their oligotrophication (Maggiore, Como) or stabilization of nutrients (Garda, Iseo). These results suggest the need to change our present vision on the factors controlling the development of cyanobacteria, with important implications on water quality assessment criteria and lake management.

DINOFLAGELLATE CYST ASSEMBLAGES IN DIFFERENT AREAS OF THE WESTERN MEDITERRANEAN SEA.

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In the last decades, notable efforts have been dedicated to the deepening in the knowledge of the benthic phases of life cycles of dinoflagellate. In fact, studies on dinoflagellate cysts in the sediments are useful tools to integrate the information from the routine monitoring of the water column, at least for the presence of species that produce cysts. The sediment can be an excellent register for information on phytoplankton diversity in both time and space, and can allow the observation of species rarely or not detected in the water column. This type of study increases also the possibility to detect harmful species and may permit the evaluation of their potential proliferations.

This study reports data on dinoflagellate cyst assemblages observed in different types of coastal marine ecosystems of the Western Mediterranean Sea, i.e. harbours, enclosed bays and lagoons. The studied areas were Arenys de Mar harbour and the Ebre Delta Bays along Catalan coast (Spain), and two lagoons along western coast of Sardinia (Italy). Samplings were carried out from 2006 to 2010. Morphotypes were determined at species level when possible. Cyst assemblages showed high diversity at each sites. There were notable differences among morphotype compositions in the sites even if a number of morphotypes was common (e.g., *Scrippsiella* species). Some harmful species were detected and also species not recorded before in the water column in the respective sites. The presence of morphotypes not yet reported in literature was observed, some of them corresponding to new species.

SPATIAL SCALES OF VARIABILITY OF THE BENTHIC COMMUNITY STRUCTURE AND QUALITY INDICES IN COASTAL TRANSITIONAL ECOSYSTEMS: THE CASE STUDY OF THE VENICE LAGOON

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Coastal transitional ecosystems such as lagoons are characterized by high temporal and spatial variability of environmental conditions at multiple scales. In these severe and variable ecosystems it is difficult to separate the community response to anthropogenic stress from natural variation. Understanding the dependence of communities to environmental factors and the scales of variability plays a central role in quality assessment through biological indicators and indices.

We analyzed the macrozoobenthic communities of subtidal flats in the Venice Lagoon (Italy). The study is based on a three-year quantitative data set produced by the Water Authority of Venice, with 60 (in 2003 and 2007) to 180 (in 2002) sampling stations distributed over the lagoon. The community structure was analyzed through main synthetic macrodescriptors such as species richness, total abundance and biomass, and the multivariate analysis of the community composition matrices.

High interannual variability and spatial heterogeneity have been verified, particularly in terms of total abundance and biomass. The community structure has been significantly related to environmental factors, with species richness and community composition following a gradient from sea landwards, in relation to a composite ecocline, and mainly to seawater renewal and salinity. More complex spatial patterns at different scales have emerged, which can be only partially related to environmental variables. In particular, total abundance and biomass have smaller scales of variability than species richness and multivariate structure. Moreover, main taxonomic groups follow different spatial scales.

The community indices typically used in quality assessment are based essentially on the mathematical composition of synthetic macrodescriptors, such as species richness or abundance distribution among the species or indicator groups. Hence, indices based on different means to describe the community structure vary at different scales, reflecting the main factors and processes involved. The results of this study therefore have implications for the quality assessment of transitional ecosystems.

STATE OF KNOWLEDGE ON THE FAUNA OF THE ITALIAN TEMPORARY POOLS

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The species richness and distributional patterns of some taxonomic groups (Crustacea, Mollusca, Hexapoda and Amphibia) were assessed using the data stored in the database CKmap, integrated with recent literature and unpublished data especially from northeastern and southern Italy, including islands.

As every species inventory, most of our faunistic knowledge on temporary pools suffers of the so-called Wallacean shortfall, *i.e.* of the limited amount of data and of their uneven distribution. For example, most of the researches on microcrustaceans were concentrated on Alpine and northern Apenninic ponds and pools, karstic pools in northeastern Italy, Tyrrhenian coastal pools in residual woodlands in Latium. Recently, new researches were performed in poorly known areas (Sicily, Sardinia, Apulia, small islands and in a limited number of areas of other regions), while large gaps remain for several regions and landcover types. This uneven distribution of sampling sites prevents detecting hotspots of species richness, which are obscured by hotspots of sampling effort. Rarefaction curves together with non-parametric estimators were used to assess the degree of exhaustivity of species inventories in different areas; even the presumed well-known areas show inadequate sampling effort, especially for taxa with high dispersal power, like Odonata, Hydroadephaga, Hydrophiloidea.

The possibility of using a limited number of taxa as surrogates of overall species richness and hence conservation value of temporary pools, was explored in karstic areas of northeastern Italy. Unexpectedly, most of the taxa followed similar patterns of species richness; this may be due to the well known species-area relationship and to the length of the hydroperiod. Amphibians are good biodiversity indicators for the larger pools, while in small pools and puddles, Branchiopoda and Copepoda have a great value as surrogates. The well-studied Odonata and Coleoptera are poor indicators, showing low habitat preference and high species turnover found examining both short than long time-series.

LARGE-SCALE HUMAN IMPACTS AND THE LIMITED EFFECTIVENESS OF MARINE PROTECTED AREAS

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Marine Protected Areas (MPAs) can provide unique protection for critical areas and spatial escape for overexploited species and are regarded as an essential tools for the conservation of marine environments. However, the effectiveness of MPAs is greatly limited by several anthropogenic and natural impacts toward which they cannot offer any direct protection. Examples are represented by the spreading of exotic species, diffusion of chemicals and disease epidemics.

Here, I present four paradigmatic case studies of how human disturbances acting at scale larger than those encompassing by reserve boundaries can lead to failure in conservation plans. Specifically, I discuss 1- the effect of the dispersal of organotin compounds on the reproductive system of the gastropod prosobranchs inside Italian MPAs; 2- the changes in biodiversity patterns of macrofauna assemblages associated to *P. oceanica* meadows and in the structural properties of this priority habitat are dealt as a result of the presence of fish farms close to boundaries of a Natural Reserve; 3- the potential for invasive species to affect the conservation programs is addressed in light of recent studies that suggest the entry of pest metabolites in food webs with potential detrimental effects on the population dynamics of an endemic fish species; 4- finally, I focus on the detection of viral particles in the gonads and the brain of *D. labrax* collected in two no take-no access Marine Protected Areas in the Southern Italy. Results are discussed in relation to the need of implementing and standardize monitoring protocols under both non-protected and protected conditions in order to guarantee better and more efficient policies on conservation and management of the marine environment and its resources and prevent health impacts of environmental hazards.

COMPOSITIONAL CHANGES OF SEDIMENTARY ORGANIC MATTER IN PRODELTAIC SEDIMENTS: A 9-YR TIME SERIES ANALYSIS

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In Fall 2000, the Po River (Italy) experienced a 100-yr flood that resulted in a 1 to 25 cm-thick flood deposit in the adjacent central prodelta. In the following 9 years, prodeltaic sediments experienced numerous post-depositional perturbations including bioturbation, wave heights exceeding 5 m, sediment compaction, as well as periods of extremely high and low sediment supply. Cores collected in the central prodelta after the Fall 2000 flood and over the following 9 years represented an extraordinary opportunity to characterize the non-steady-state cycling of sedimentary organic matter in shallow marine sediments. The analysis was carried out on a 24 cm-thick event bed collected in the central Po prodelta after the flood. The internal architecture of this deposit was studied in detail using a combination of techniques, which included digital radiography and sediment texture analyses while biogeochemical analyses (organic carbon, total nitrogen, carbon stable isotopes, lignin phenols, cutin-derived products, benzoic acids, p-hydroxy benzenes, dicarboxylic acids, and fatty acids) were used to characterize the organic composition of freshly deposited sediments. The reoccupation of the coring site during follow up cruises allowed us to document sedimentological and biogeochemical changes through time. By selecting specific zones of the sedimentary column, which over specific time periods experienced intense and clear changes associated with the aforementioned post-depositional processes, we were able to discriminate the effect of these mechanisms on the ultimate fate of the organic carbon and test specific hypotheses regarding selective preservation of different classes of biomolecules.

BIODIVERSITY ASSOCIATED WITH POCKMARKS: EXTREME HABITATS CONTRIBUTE TO INCREASE GAMMA DIVERSITY IN THE DEEP SEA

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Pockmarks are craters of the seafloor, typically tens to hundreds of meters in diameter and meters to tens of meters deep, formed by subseafloor fluid expulsions (liquid/gaseous hydrocarbons and water). Pockmarks occur worldwide at all ocean depths, where they occasionally form pockmark fields that can potentially host a highly specialized benthic fauna able to exploit hydrocarbon releases. Individual pockmarks in the same field may display different levels of fluid emissions. Pockmarks at relatively shallow depths can be easily destroyed by human activities, such as bottom trawling. The sampling area is located in the continental slope of the Gulf of Lions, Western Mediterranean Sea, at water depths from 265 to 434 meters. We investigated the biodiversity associated to seafloor pockmarks, both with active gas emissions and inactive. Control sites were selected in sedimented seafloor beyond the influence of gas seepage, both within and outside the pockmark fields. We inspected the combined effect of i) seafloor heterogeneity, ii) variable levels of fluid (gas) emissions, and iii) trophic characteristics on meiofaunal assemblage structure and nematodes diversity. Sediments within the pockmark fields display lower meiofaunal abundance and biomass when compared with surrounding sediments not influenced by gas seepage. Although several higher taxa (e.g., Turbellaria, Tardigrada, Cumacea, Isopoda, Tanaidacea, Nemertina and Priapulida, which were present in control areas) were absent in the pockmarks, the richness of nematode species within all pockmarks was very high. About 25% of the total species encountered in deep-sea sediments of the investigated area was exclusively associated to pockmarks. We conclude that both active and inactive pockmarks provide a significant contribution to the regional (gamma) diversity of the continental slope in the Western Mediterranean Sea, so that the protection of these special and fragile habitats could be highly relevant to the conservation of deep-sea biodiversity.

POSTER

TEMPORARY WATERS IN APULIA (SOUTH-EASTERN ITALY): BIODIVERSITY AND ENVIRONMENTAL FEATURES

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The Mediterranean climate together with a karstic landscape, provides Apulia (south-eastern Italy) suitability for surface temporary waters. Very few studies have been addressed to check biological features of these peculiar environments in the region.

In the framework of a research project financed by the *Fondazione Cassa di Risparmio di Puglia* on the Apulian temporary waters, an extensive sampling has been carried out from autumn 2010 to winter 2011. “Mediterranean temporary ponds” (code 3170 of the Habitat Directive) were identified on the basis of the plant associations. Main human activities and threats to the habitat conservation were also identified for each site.

The study covered about 19,000 Km² of territory. A total of 141 temporary waters were detected and analysed. Twenty of them were recognized as “Mediterranean temporary ponds”, and some typical plant associations were characterized by the heterosporous pteridophyte *Isoetes japygia*, an endemic species of Apulia recently described.

Planktonic invertebrates were represented mainly by Crustacea. Among them *Neolovenula alluaudi* represents a new record for the Italian Fauna, *Daphnia mediterranea* proves to be a new records for the Italian mainland.

Even though Apulian temporary waters are region-wide spread, the “Mediterranean temporary ponds” are located only in the southernmost area of the region. A huge number of sites with a high number of Crustacea, some of which very rare, are not recognized as “Mediterranean temporary ponds”, but likewise they should deserve protection because they are in a bad condition mainly because of the urbanization and the intensive agricultural activities. These results open a discussion on the gap of the Habitat Directive to indicate areas deserving conservation and might provide an useful support to the designation of new protected areas in Apulia.

THE LAKES OF THE DUMRE AREA (ELBASAN): HYDROLOGICAL AND BIOLOGICAL TRAITS

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The Dumre area hosts a large number of karstic water bodies, mainly flooded by rainwater. They represent an important socio-economic resource to local people, as reservoirs, for irrigation, fishery. The heavy exploitation of waters and urbanization, together with the long water residence time, compromised the water quality of some of them. Other lakes are currently recognized as natural monuments and deserve conservation actions. Studies on the biodiversity of Dumre lakes are still lacking, while they would be extremely important as the autochthonous biological communities risk to be altered, or even destroyed before they are investigated. The aims of the present contribute are to evidence the gaps of knowledge in the biological studies regarding the Dumre lakes and to contribute to the filling this gap providing preliminary data on the zooplankton, an important section of the water ecosystems. The main hydrological features and a preliminary study of the zooplankton are here reported for 15 lakes out of the 104 which have been detected in the Dumre area. Finally, the study aims to give a first contribution to the knowledge of the biological peculiarities of the Dumre lakes, offering a point of discussion for the future management plans of these delicate habitats.

IMPLEMENTAZIONE DI UN ALGORITMO PER LA STIMA DELLO SPESSORE DEL GHIACCIO MARINO NELLE REGIONI ANTARTICHE

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Studi recenti hanno mostrato che nella regione Antartica l'estensione del ghiaccio marino ed il suo spessore non stanno andando incontro ad un significativo declino, come accade invece nell'Artico. Tuttavia, la variazione spaziale e temporale del ghiaccio marino intorno al continente antartico resta un fattore da monitorare attentamente, poiché nelle regioni polari le interazioni dinamiche e termodinamiche tra oceano ed atmosfera sono fortemente influenzate dalla presenza-assenza di ghiaccio marino e dalla profondità del suo spessore.

Dalle misure di temperatura di brillantezza, provenienti dai radiometri passivi a microonde SSM/I, è possibile ricavare con elevata accuratezza concentrazione ed estensione del ghiaccio marino, attraverso algoritmi testati e validati. Determinarne lo spessore è risultato, ad oggi, molto più complesso.

In questo lavoro viene presentato un nuovo algoritmo (SIT) in grado di stimare tale spessore, e la relativa copertura nevosa, a partire da misure telerilevate di temperatura di brillantezza SSM/I a differenti frequenze e polarizzazioni. Le stime ottenute sono state validate attraverso il confronto sia con i valori medi settimanali di spessore del ghiaccio marino forniti dal NIC-NCDC per l'anno campione 1994, sia con i dati in situ Aspect raccolti nel Mare di Ross (1995, 1998, 2002, 2003, 2004) e nel Mare di Weddell (1997). In entrambi i casi sono stati riscontrati valori di correlazione lineare molto elevati.

SIT è stato quindi utilizzato per stimare ed analizzare l'evoluzione dello spessore del ghiaccio marino nelle due regioni antartiche nel periodo 1992-2008. L'analisi ha mostrato per tutti gli anni oggetto di indagine un'ampia variabilità stagionale, in linea con l'evoluzione tipica annuale legata ai fenomeni di ispessimento e scioglimento del ghiaccio marino. Non sono stati evidenziati trend di crescita o decrescita significativi nel periodo considerato, anche se è stata riscontrata una leggera tendenza alla diminuzione dello spessore nel Mare di Ross e ad un incremento nel Mare di Weddell.

MICROBIAL COMMUNITY COMPOSITION AND DYNAMICS AS RELATED TO POLYUNSATURATED ALDEHYDES IN THE NORTHERN ADRIATIC SEA

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Polyunsaturated aldehydes (PUAs), produced by diatoms as secondary metabolites, are toxic for a variety of organisms including phytoplankton, grazers, invertebrates and bacteria. They also act as infochemicals and allelochemicals, shaping plankton communities and determining the fate and transfers along the pelagic food web. During a cruise in February 2008 in the northern Adriatic Sea we tested the effect of PUAs, octadienal and a mix of octadienal and heptadienal, on natural bacterial communities using on-deck incubations, flow cytometry, and MAR-CARD-FISH. In order to contextualize the experiment, picoplankton (autotrophic and heterotrophic) distribution and dynamics were also investigated using flow cytometry at 32 stations.

Synechococcus represented the most abundant group of autotrophic picoplankton, with an average of 4.29×10^4 cell ml⁻¹, while picoeukaryotes were on average 2.54×10^3 cell ml⁻¹ and heterotrophic bacteria 7.85×10^5 cell ml⁻¹. Picoeukaryotes and heterotrophic bacteria were mainly concentrated at surface and at Italian coastal stations, while cyanobacteria were more abundant in the northern and oligotrophic stations along Croatia. PUAs incubation showed little or no effect on total bacterial concentration. The most abundant groups were SAR11 and CFB (22% of total cells). The proportion of Alphaproteobacteria and the CFB showed dramatic changes after PUAs incubation (70% decrease in the Octa and 45 and 80% in the MIX treatment after 24 and 48h, 67% after 24h of mix incubation, Alfa and CFB respectively). Metabolic activity indicated a group-specific reaction to the PUAs inoculated, with Alphaproteobacteria the most affected group. Metabolic activity of all bacteria groups was negatively affected after 24h of MIX exposure while after 48h Roseobacter metabolic activity increased. Hence, PUAs appear to have a role in determining bacterial community composition and metabolic activity directly by favouring some bacterial groups, or indirectly, by slowing down some others and therefore in affecting the diversity and ecosystem functioning of the area.

“AQUA ALTA” – THE OCEANOGRAPHIC TOWER OF ISMAR-CNR: NEW MEASUREMENTS FROM AN UPGRADED TOOL.

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The oceanographic tower “Aqua Alta” of ISMAR-CNR is located 15 km offshore the coast of the Venice lagoon, in the Northern Adriatic Sea, at a depth of 16 m. The tower, operational since the early ‘70s, is the only scientific structure in Italy, and one of the very few in Europe, that can guest scientists on board for long periods and intensive campaigns in the middle of the sea. Besides, the tower allows also for a variety of long term automatic measurements. Its key-role has been recognized also by the fact that it is part of the International Long-Term network of Ecological Researches (<http://www.lter-europe.net/>).

Completed self-sufficient as far as power supply (diesel generator, photovoltaic and eolic generator), the tower is connected to land via two (radio linked) dedicated phone lines and, with the contribution of Magistrato alle Acque and Consorzio Venezia Nuova, now with a broadband Hyperlan bridge at high speed is one of the ISMAR LAN node. “Aqua Alta” is fully equipped with a series of instruments, devoted to meteorological, oceanographic and chemical parameters, that allow the acquisition of time series, currently among the longest ones in the world.

Among the rest, it currently hosts an AWR station (wind magnitude and direction, humidity, atmospheric pressure, rain, air and water temperature), an ADCP suitable for current and wave measurements, a CTD at 2 m depth (T, S, oxygen and turbidity), and five webcam (including two underwater) allowing remote video-surveillance and ecological monitoring. Results are currently validated and posted in RT at http://www.ismar.cnr.it/infrastructures/piattaforma-acqua-alta?set_language=en&cl=en.

Within the joint Project with the Veneto Region “SISOE”, the capabilities of the tower are being upgraded, with a second redundant hyperlink and real time display by hydrological devices. The structure is therefore playing a key-role in the new national network of observing system, being also particularly suitable for early warning activities such as algal bloom, oil spill or anoxia events detection.

PHYTOPLANKTON AND POLYCHAETE COMMUNITIES IN A FISH FARM IN ALGHERO BAY (NW SARDINIA, ITALY)

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During recent decades a rapid expansion of fish farming was developed in Mediterranean coastal waters, resulting in an increasing effort in marine coastal monitoring programs. Such amount of studies make available useful knowledge for an effective improvement of environmental and aquaculture activities.

In the present contribution, phytoplankton and polychaete infaunal communities, together with a set of environmental parameters, were investigated in a mariculture facility in Alghero Bay (NW Sardinia, Italy). Data were collected during two sampling times in summer 2010. Four stations were sampled in relation to prevailing direction of water currents in Alghero Bay (NW oriented): two of them, designated as impacted, were strictly close to the fish farm facility and the latter two, defined as control sites, were located 350 meters apart NW and NE respectively.

Analysis of similarities was performed on abundance of phytoplankton and polychaetes to test differences between time 1 and time 2 at control and impacted sites. Non-metric multidimensional scaling (nMDS) was used to produce two-dimensional ordinations. All multivariate analyses were done using the Bray-Curtis similarity index.

Preliminary results showed no significant differences among stations in phytoplankton abundance, whose values were very low throughout the summer ($< 75 \times 10^3$ cells l^{-1}), in agreement to the variations of environmental variables. Nevertheless, significant variation was detected between times of sampling. On the other hand, analysis of similarity revealed significant differences among polychaetes assemblages, however pairwise test and non-metric multidimensional scaling ordination did not highlight these differences.

RESTING VS ACTIVE STAGES IN PLANKTON DYNAMICS

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Marine coastal plankton undergoes seasonal fluctuations and interannual variations in its composition mainly justified with the alternance of active stages in the water column and resting stages (cysts) in the sediments. As a consequence, to fully understand the functioning of planktonic system in marine coastal areas we need to integrate information coming from pelagos and benthos into a *continuum* that could help us to quantify the transfer of biodiversity between these two domains. To achieve this goal we have set up at the confined coastal system of the Taranto Seas (southern Italy, Ionian Sea) an experimental design to gain information from the key elements in plankton dynamics.

We considered (in brackets the sampler used): active stages dynamics in the water column (Niskin bottles, plankton nets); cyst production (sediment traps); cyst accumulation (sediment cores); cyst germination (inverted traps, Niskin bottles very close to the sediment). The whole study was structured in two times, one in autumn mainly to observe the encystment dynamics, and one in the following spring, to observe the the excystment and its consequence on the water column. Different species showed different behaviours so justifying the unpredictability of confined coastal areas plankton dynamics.

FIORITURE DI *ANABAENA LEMMERMANNII* E FLUTTUAZIONI DI LIVELLO NEL LAGO MAGGIORE

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A partire dall'estate del 2005 si sono osservate fioriture del cianobattere *Anabaena lemmermannii* nel Lago Maggiore, un lago subalpino profondo con una concentrazione di fosforo totale PT $<10\mu\text{g L}^{-1}$. Negli anni delle fioriture si sono verificate fluttuazioni del livello del lago dovute all'interazione tra eventi climatici e gestione dei livelli lacustri. Per evidenziare una eventuale relazione causale tra fioriture e fluttuazioni di livello si è iniziata una ricerca volta a valutare gli apporti di nutrienti e carbonio organico dalle rive esposte ad essiccazione e successiva reidratazione a seguito di tali fluttuazioni. La stima del rilascio potenziale di fosforo inorganico (P) e di carbonio organico (C) dalle rive è stata effettuata esponendo substrati inerti per circa un mese a profondità sub-superficiale nel lago Maggiore, da aprile a ottobre 2010. Al recupero di tali substrati si misuravano P e C particellati su di essi accumulati. Si simulava poi un abbassamento del livello essiccando i substrati stessi che, successivamente, venivano reidratati come accade a seguito di una pioggia, per misurare il conseguente rilascio di carbonio e nutrienti. Le analisi hanno mostrato che, con l'avanzare della stagione, la sostanza organica che si accumula nella fascia litorale risulta relativamente più ricca in P, presentando un rapporto C:P tendente a diminuire. Mentre la percentuale di rilascio immediato è relativamente modesta per il C, il rilascio di P è molto più variabile ed elevato. Questo indica che la sequenza essiccazione-reidratazione libera rapidamente nell'ambiente il P accumulatosi sul litorale, rendendo disponibile anche una frazione del P (polifosfati organici ed inorganici, fosforo batterico) che sfugge all'ossidazione del materiale fresco. Questo "pulse" di P arriva a 25 mg P m^{-2} con un rapporto C/P di 4 e potrebbe essere un cofattore responsabile della fioritura di *A.lemmermannii* in condizioni di luce e di temperatura favorevoli.

ANALISI DEI PRINCIPALI PARAMETRI OCEANOGRAFICI IN RELAZIONE ALLE PROPRIETÀ OTTICHE DI 5 AREE MARINE LUNGO LE COSTE DELL'ITALIA MERIDIONALE. PRIMI RISULTATI.

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Nell'ambito del programma CLAM-PHYM (Coasts and Lake Assessment and Monitoring by PRISMA-HYperspectral Mission) è stata condotta una campagna oceanografica (27/08–13/09/2010) lungo le coste dell'Italia meridionale per analizzare le proprietà fisiche, chimiche, biologiche ed ottiche di alcune aree costiere. Le aree di campionamento sono: Golfo di Taranto, area di Policoro, baia di Cetraro, Golfo di Augusta e Golfo di Gela.

In ogni sito, sono stati collezionati profili di temperatura, salinità, torbidità, fluorescenza ed ossigeno disciolto. Sono state eseguite misure di riflettanza della superficie marina e lungo la colonna d'acqua con spettroradiometri iperspettrali. Sono stati inoltre raccolti campioni di acqua in superficie ed alla quota di 10 m per l'analisi dei nutrienti disciolti e per misurare le concentrazioni e gli spettri di assorbimento di clorofilla *a*, tripton, CDOM: tali sostanze sono definite otticamente attive in quanto interagiscono con la radiazione solare lungo la colonna d'acqua attraverso fenomeni di assorbimento e diffusione. I dati raccolti sono stati analizzati al fine di identificare la relazione bio-ottica tra le concentrazioni delle sostanze otticamente attive e gli spettri di riflettanza superficiale misurati in situ: tale relazione, se invertita, permette di mappare le loro concentrazioni dai dati da satellite.

I risultati preliminari hanno evidenziato una maggior attività biologica nell'area del golfo di Taranto e del Golfo di Gela con valori più elevati di clorofilla *a*, a-CDOM(440) e TSM. Queste aree sono infatti caratterizzate dalla presenza di importanti siti industriali e portuali. Il golfo di Gela, dove si sono riscontrate le maggiori concentrazioni di clorofilla *a* e CDOM, è inoltre caratterizzato dall'apporto di fiumi minori che contribuiscono ad aumentarne l'attività biologica. Ulteriori indagini saranno effettuate per verificare la correlazione tra le concentrazioni, gli spettri di riflettanza misurati in situ e le immagini satellitari, in modo da calibrare e validare le mappe di qualità dell'acqua ottenute da satellite.

TROPHIC EVOLUTION OF A COASTAL LAGOON (OLIVERI-TINDARI, SICILY): LOOKING AT THE RESPONSE OF PROKARYOTIC ABUNDANCE AND ACTIVITIES

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A Sicilian lagoon area, Oliveri-Tindari, including four ponds with different trophic conditions (Marinello, Mergolo, Porto, Verde), was studied during different multidisciplinary research programs: Cultural Heritage (February 1997 - March 98) and ARPA Sicily (June 2005 - May 2006). Prokaryotic abundance (PA), heterotrophic viable bacteria (VB), enzyme activities as indicators of organic matter decomposition (leucine aminopeptidase LAP, beta-glucosidase b-GLU, alkaline phosphatase AP), respiratory activity (R), Particulate Organic Carbon (POC) and Chlorophyll-*a* (Chl-*a*) were measured, together with temperature, salinity, dissolved oxygen, inorganic nutrients. The results of time-series were compared to monitor the trophic evolution of each pond, together with the prokaryotic abundances and activities response to the environmental changes. Considering the range of variation of annual mean values measured for each variable, from 1997-98 to 2005-06, temperature increased from 18.56 - 18.76 to 19.94 - 20.67°C, as well as dissolved oxygen (from 5.73 - 6.49 to 8.02 - 8.44 mg/l), phytoplankton biomass as Chl-*a* (from 0.38 - 5.51 to 1.34 - 15.90 µg/l), and POC (from 148.3 - 2232.1 to 537.8 - 8171.5 µgC/l), while, in Marinello and Mergolo only, nutrients decreased. Compared to 1997-98, lower values were observed in 2005-06 for PA ($5.2 - 8.5 \times 10^5$ vs $0.7 - 2.0 \times 10^5$ cells/ml), VB ($0.4 - 7.7 \times 10^4$ vs $0.4 - 2.0 \times 10^4$ CFU/100 ml), LAP (133.8 - 1210.8 vs 130.6 - 192.8 nmol/l/h), AP (117.0 - 415.0 vs 38.7 - 209.2 nmol/l/h) and R (0.9-5.5 vs 0.3 - 0.7 µgC/l/h). Conversely, b-GLU values followed well the inter-annual trophic trend, doubling from 1997-98 to 2005-06 from 4.5 - 22.8 to 8.8 - 45.1 nmol/l/h. Although enzyme activity patterns reflected spatially the trophic status, the opposite temporal trends showed by Chl-*a*, POC and prokaryotic variables suggested that allochthonous sources, rather than *in situ* microbial decomposition, played a key role in the trophic evolution of Oliveri-Tindari lagoon.

BATTERI ETERTROFI E INDICATORI DI CONTAMINAZIONE FECALE NEL MAR PICCOLO DI TARANTO: CAMPAGNE 1998 E 2008

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Il Mar Piccolo di Taranto rappresenta un braccio di mare incassato nell'entroterra, è strutturato in due insenature (I e II Seno) ed è influenzato dal considerevole sversamento di acque reflue dovute a scarichi urbani, industriali ed agricoli. Per tali motivi, può considerarsi una trappola di nutrienti con tendenza all'eutrofizzazione ed è particolarmente idoneo alla crescita dei molluschi bivalvi, tanto che almeno 1/5 del bacino risulta messo in coltura con impianti a mitili. Queste considerazioni non possono non sollecitare la necessità di un monitoraggio finalizzato alla valutazione dell'intero assetto microbiologico di tale ecosistema. In questo lavoro si presentano i risultati di due campagne di monitoraggio condotte nel I e II Seno a 10 anni di distanza l'una dall'altra nelle quali è stata valutata la qualità microbiologica delle acque e si è effettuata la caratterizzazione della componente batterica eterotrofa aerobia. Dal confronto dei dati ottenuti nelle due campagne è emerso che i valori di densità della flora batterica aerobia, nel tempo, sono diminuiti nel I Seno e aumentati nel II Seno. Da un punto di vista qualitativo nel I Seno è stato riscontrato un incremento dei generi *Aeromonas* (dal 10 al 21.4%), *Chromobacterium* e della famiglia delle *Enterobacteriaceae* (dal 2.9 al 16.7%) e una diminuzione dei batteri Gram positivi (dal 36.4 al 11.9%). Nel II Seno i generi *Aeromonas* e *Chromobacterium* sono rimasti invariati nel tempo mentre le *Enterobacteriaceae* sono aumentate (dal 6.2 al 25%). I valori medi dei coliformi totali si sono notevolmente ridotti sia nel I Seno (da 221 a 3 MPN/100mL) che nel II Seno (da 918 a 35 MPN/100mL). Un trend simile è stato registrato anche nel caso dei coliformi fecali. I dati ottenuti sono quindi importanti per valutare l'evoluzione, a lungo termine, dell'ecosistema indagato nonché per la comparazione con altri ecosistemi antropizzati.

RELAZIONI TRA SILICE BIOGENICA E OSCILLAZIONI CLIMATICHE NEL MARE DI ROSS (ANTARTIDE) DURANTE IL TARDO-QUATERNARIO

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La regione antartica rappresenta un sito ideale per l'indagine dei sedimenti silicei poichè in questa zona si trova circa il 75% del contenuto in silice biogenica dei sedimenti marini. L'accumulo è dovuto principalmente al maggiore grado di preservazione dei gusci silicei rispetto a quelli carbonatici in condizioni di acque fredde. La percentuale di silice biogena nel particolato marino, strettamente correlata ai *bloom* algali che si sviluppano in relazione ai processi stagionali di formazione e scioglimento dei ghiacci marini, permette di ricostruire la variabilità climatica nel tempo.

Il presente studio si basa sull'analisi di 12 *box core* prelevati in due diversi bacini, *Drygalski* e *Joides*, del Mare di Ross (Antartide) nell'ambito del progetto PNRA ABIOCLEAR (Cicli biogeochimici in Antartide – Ricostruzioni climatiche e paleoclimatiche mirato allo studio dei cicli biogeochimici del carbonio e della silice nell'Oceano Meridionale).

Il lavoro è basato sull'utilizzo integrato di profili ad alta risoluzione di diversi parametri sedimentologici, geochimici e fisici (contenuto in silice biogena, suscettività magnetica, porosità e contenuto d'acqua) che permette di effettuare ricostruzioni paleoambientali e ottenere informazioni sull'evoluzione climatica dell'area.

Specificatamente lo studio della componente biotica in relazione a quella abiotica nei sedimenti ha permesso di ricostruire le fasi di avanzata ed arretramento della calotta glaciale e quindi di documentare i cambiamenti climatici a diverse scale temporali.

Tali cambiamenti climatici, grazie alla correlazione con dati bibliografici della stessa area e con il profilo del rapporto D/H per il Mare di Ross su carote di ghiaccio, sono presumibilmente associabili all'*Antarctic Cold Reversal* (12.000 anni fa), all'Ottimo Climatico Olocenico (11.000-9.000 anni fa), alle brevi pulsazioni fredde corrispondenti agli eventi A e C documentati da Masson (2000) rispettivamente datate a 8.200 anni e a 2.000 anni e alla *Little Ice Age* (1.000–500 anni fa).

MACROFAUNA PROFONDA DEL MEDITERRANEO

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La composizione delle comunità macrobentoniche dei fondali molli profondi sono state studiate, da un punto di vista qualitativo, nell'ambito di diversi progetti di ricerca nazionali e internazionali che si svolgono dal 2005. Le difficoltà operative per il campionamento dei sedimenti profondi fanno sì che queste comunità in Mediterraneo siano poco studiate. L'obiettivo della ricerca è stato, quindi, quello di cercare di coprire, anche se in modo parziale, la mancanza di informazioni in merito. I campioni sono stati raccolti durante diverse campagne oceanografiche e con diverse metodologie: box-corer, multi-corer e benna tipo Van Veen. Sono stati setacciati a bordo con rete di maglia 0,5 mm. I siti campionati vanno dall'Adriatico meridionale all'Atlantico (al largo di Cadice) e corrispondono a profondità tra 85 e 4400 m. Nel complesso sono state campionate 96 stazioni, con 3 repliche per ciascuna.

In 62 stazioni (ca. 65% del totale) sono stati rinvenuti organismi appartenenti alla macrofauna, nelle aree del Canale di Sicilia e delle isole Eolie questa percentuale sale al 100%. In generale, il numero di organismi è molto basso e, di conseguenza, anche il numero di taxa. Si osserva una diminuzione di questo parametro con l'aumentare della profondità, ad eccezione della zona centrale del Canale di Sicilia, in corrispondenza delle frane sottomarine, e nell'area atlantica dove la tendenza è opposta. Le comunità, nel complesso, sono dominate dagli anellidi, in particolare policheti, ad eccezione della zona dell'Adriatico meridionale antistante Bari, dove nella scarpata dominano gli echinodermi e nell'area di frana dominano crostacei e sipunculidi.

COMUNITÀ BENTONICHE DELL'AREA COSTIERA DEL MAR TIRRENO

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Nel novembre del 2009 sono stati effettuati campionamenti di sedimento mediante benna Van Veen (capacità 75 l) nell'area costiera del Mar Tirreno, dal promontorio dell'Argentario fino all'isola di Ventotene, al fine di caratterizzare le comunità meio- e macrobentoniche in relazione alle principali forzanti ambientali (profondità, tessitura sedimentaria, potenziale influenza antropica) e trofiche (quantità e qualità del materiale organico sedimentario). Le 11 stazioni erano posizionate a quote comprese tra 60 e 145 m di profondità. 6 erano disposte sulla piattaforma continentale del margine toscano e laziale, in aree direttamente influenzate dalle dinamiche sedimentarie costiere e con prevalenza della frazione limo ($68\pm 6\%$ contro $25\pm 5\%$), mentre le restanti 5 erano poste in prossimità delle isole del Giglio, Ponza e Ventotene, caratterizzate da valori di classazione più elevati ($9,5\pm 7,7$ mm contro $2,6\pm 0,2$ mm delle stazioni di piattaforma). Le stazioni posizionate presso le isole mostravano una minore quantità di proteine sedimentarie, ma valori maggiori del rapporto clorofilla-a:feopigmenti, rispetto alle stazioni di piattaforma. Considerando la meiofauna, le stazioni settentrionali mostravano densità più elevate rispetto a quelle meridionali, principalmente a causa delle differenze tessiturali del sedimento (nematodi legati alla frazione fine e copepodi a quella più grossolana). Il numero dei taxa tendeva ad essere maggiore nel gruppo associato alle isole, in accordo con il miglior rapporto clorofilla-a:feopigmenti rilevato in tali stazioni. La minore abbondanza di organismi dipendeva verosimilmente dalla bassa concentrazione di proteine. Per quanto concerne la macrofauna non era evidente una regolazione univoca della densità dovuta a parametri geografici (latitudine, localizzazione in prossimità delle isole o della costa), tessiturali e alla disponibilità alimentare. Gli andamenti opposti riscontrati per le densità della macrofauna e della meiofauna suggerivano che il primo fattore di controllo della densità della macrofauna fosse la competizione con la meiofauna per le risorse e, verosimilmente, la pressione predatoria conosciuta come "meiofaunal bottlenek".

PRELIMINARY RESULTS FROM A BATHYMETRICAL AND SEISMOSTRATIGRAPHICAL SURVEY IN THE KONGSFJORDEN - SVALBARD ISLANDS

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During September 2010, an instrumented oceanographic array was deployed by CNR-ISMAR in the Kongsfjorden, a narrow fjord of the Svalbard archipelago. The Kongsfjorden is 20 km long and 4-10 km wide, elongated in SE–NW direction and the exchanges with the Arctic Ocean occur at the northwestern mouth along the western coast of the Spitsbergen island. This fjord is particularly suitable for exploring the possible impact of climate changes, because it is affected by Atlantic water influx (the northern branch of Gulf stream and the Arctic-type coastal water) and melting of tidal glaciers (Kongsvegen, Kronebreen, Blømstrandbreen), both being linked to global climate variability.

A seismic survey was performed in the inner part of the fjord and over 130 miles of Chirp subbottom profiles were acquired, with the purpose to describe the morpho-bathymetrical features and surficial seismo-stratigraphy. The bottom of the fjord is dominated by a widespread outcrop of bedrock. Several structures were detected, mainly related to relict sub-glacial and ice-scoured topography produced during the glacial re-advances of the Weichselian (20 ky BP) and again during the last major Holocene re-advance of the Little Ice Age. These features are several tens meter high above the sea bottom level, and in the southeastern part emerges as small islands separating the inner fjord into two parts.

The area located at the inner part of the fjord, close to the calving line, is characterized by the maximum sediment accumulation rate, and a thin (<10m) of coarse-grained sediment thickness can be observed, probably due to the interaction of the 3 proximal ice-tongues. The high-resolution seismic dataset allowed us to select the optimal site for the mooring deployment and in the next future sediment cores will be collected to investigate and discriminate the late Quaternary climatic events recorded in the sedimentary sequence.

VIRAL INFECTION AND DECAY IN BENTHIC DEEP-SEA ECOSYSTEMS

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Marine viruses represent a significant source of mortality for a wide range of organisms, and they influence the ecological processes and biogeochemical cycles of the oceans of the World. Integrating the viral component into global models of carbon cycling and nutrient regeneration is becoming a priority for an improved understanding of the functioning of marine ecosystems. Viral dynamics are the result of the balance between the rates of viral production and decay. However, while an increasing amount of information on viral production is becoming available from both pelagic and benthic systems, limited information is still available on the rates of viral decay. To provide new insights on viral dynamics, we carried out synoptic measurements of viral production and decay rates in a wide variety of benthic deep-sea ecosystems, spanning a broad range of bottom water temperatures and trophic conditions. The net viral production and decay rates were significantly correlated, but viral decay did not balance viral production at any of the benthic deep-sea sites investigated. We estimated that the carbon released by viral decay significantly contributed to the total C released by the viral shunt. Viruses non-infecting prokaryotes can also remain as a potential food source for benthic consumers, suggesting that viral decay can play an important role in benthic trophodynamic and biogeochemical cycles of the largest ecosystem of Earth.

**$\delta^{13}\text{C}$ RANGE TO STUDY EVOLUTIONARY TRAITS ASSOCIATION IN
PREDATOR-PREY RELATIONSHIP: NICHE WIDTH-MOBILITY-PREDATION
RISK.**

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We tested the hypothesis that prey generalism degree is associated to high mobility of individuals between trophic patches with the consequent increase in exposure to predator attacks (increase in predation risk).

Recent observations suggested that prey generalism could be assessed by Stable Isotopes Analysis, particularly by wide $\delta^{13}\text{C}$ ranges, and therefore it may be a useful tool in monodimensional niche width and predation pressure analysis.

Trophic patches consisting in *Alnus glutinosa* leaf substrate, principal component of allochthonous detritus from the examined biotope (Bracciano Lake, It) were offered in laboratory microcosm experiments to individuals of *Lymnaea auricularia* (Linnaeus 1758) (Gastropoda: Pulmonata). This freshwater snail is generally considered to be a trophic generalist species feeding on allochthonous POM and/or epilithon and autochthonous detritus, both characterized by different $\delta^{13}\text{C}$ content and therefore easily traceable from consumer stable isotopes analysis. To stimulate mobility, leaf patches were conditioned with 4 different fungal strains and no autochthonous substrate was offered. After 24h acclimation individuals were subjected to predation pressure. Two different experiments were set up: 1) real predation, by *Lepomis gibbosus* (Linnaeus 1758) (Centrarchidae) 2) simulated predation, manually collecting any individuals detected moving between patches.

Significantly lower $\delta^{13}\text{C}$ values and included in smaller ranges were observed in not preyed individuals, suggesting an higher specialism degree. Results showed that trophic generalism, mobility and predation risk can be associated traits and that Stable Isotopes Analysis may be a useful method in natural communities analysis.

REGIME CATABATICO E FLUSSI DI CALORE NELLA POLYNIA DI BAI TERRA NOVA, ANTARTIDE (1994-2009) – RISULTATI PRELIMINARI.

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Il Mare di Ross rappresenta un'ambiente oceanografico di particolare interesse scientifico essendo caratterizzato dalla presenza di persistenti aree libere dal ghiaccio, note come polynyas, di cui la più ricorrente è quella di Baia Terra Nova (BTN). La polynya di BTN gioca un ruolo importante nella variabilità termalina della colonna d'acqua dell'intera area del Mare di Ross. Gli scambi energetici all'interfaccia aria-mare nelle aree di polynya risultano essere una o due volte in ordine di grandezza maggiori rispetto agli scambi che avvengono nelle aree marine coperte dal ghiaccio.

In tale contesto, al fine di analizzare la variabilità delle forzanti atmosferiche alle differenti scale spaziali e temporali che influenzano la formazione e la dinamica della polynya di BTN, il presente lavoro concentra la sua attenzione, in una prima fase, sull'identificazione del regime catabatico che domina l'area stabilendo dei criteri oggettivi al fine di distinguere un evento catabatico da una normale intensificazione dei venti. I dati meteorologici utilizzati in questa fase sono stati acquisiti dalle AWS Eneide e Rita per il periodo dal 1994 al 2009. Nella seconda fase sono stati stimati i flussi di calore radiativi e turbolenti all'interfaccia aria-mare implementando le parametrizzazioni attualmente utilizzate nelle regioni polari in assenza di ghiaccio. È stato effettuato anche uno studio di sensitività sui flussi di calore turbolenti utilizzando differenti parametrizzazioni dei coefficienti di scambio turbolento. Infine per il periodo investigato è stata fornita una stima della produzione di ghiaccio marino e del trasporto di High Salinity Shelf Water all'interno della polynya di BTN.

**CONTRIBUTO ALLA CONOSCENZA DELLE DIATOMEE BENTONICHE
E DELLO STATO DI QUALITÀ AMBIENTALE DI CORSI D'ACQUA
DELL'AREA MEDITERRANEA: IL CASO DI STUDIO DEL RETICOLO
IDROGRAFICO DEL RIO MANNU DI PORTO TORRES
(SARDEGNA NORD-OCCIDENTALE).**

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Le comunità biotiche assumono un ruolo fondamentale nella definizione dello stato ecologico degli ecosistemi fluviali. Una spinta primaria nell'individuazione di strumenti di valutazione basati sulle componenti biotiche è stata data dalla Direttiva Europea Quadro in materia di acque (Water Framework Directive 2000/60/CE, WFD). Nell'ambito della flora acquatica delle acque lotiche, le Diatomee si rivelano particolarmente idonee nella valutazione di vari aspetti ecologici, poiché sono organismi tra i più sensibili alle condizioni ambientali. Il presente studio, svolto con finanziamento della Regione Autonoma della Sardegna, offre un contributo alla conoscenza delle Diatomee epilittiche ed epifittiche dei corsi d'acqua e alla sperimentazione del loro uso come indicatori nello specifico contesto geografico. Nel luglio 2010 e nel gennaio 2011 sono state condotte due campagne di campionamento in 11 stazioni fluviali su 6 corsi d'acqua del bacino del Rio Mannu di Porto Torres (Sardegna Nord-Occidentale). Sui campioni d'acqua sono state effettuate le analisi dei più significativi parametri fisico chimici e microbiologici (*Escherichia coli*). L'analisi microscopica ha permesso di identificare 167 taxa, perlopiù a distribuzione cosmopolita ma anche la presenza di altri di particolare interesse ecologico e biogeografico, come *Amphora paraveneta* e *Diploneis* sp. aff? modica. Sulla base dei dati ottenuti è stata definita la distribuzione nel reticolo idrografico in esame di *Diadesmis confervacea*, *Platessa Hustedtii* e *Navicula kotschy*, considerate specie esotiche a carattere invasivo. Inoltre, l'osservazione di *Navicula kotschy*, costituisce la prima segnalazione per i corsi d'acqua della regione.

Per le Diatomee osservate sono stati elaborati gli spettri ecologici relativi a pH, nutrienti, sostanza organica e grado di mineralizzazione del corpo idrico. Ulteriori valutazioni sono state effettuate mediante l'applicazione degli Indici EPI-D (Indice di Eutrofizzazione e/o Polluzione basato sulle Diatomee) ed NNS' (Navicula, Nitzschia e Surirella Index), che hanno rappresentato un strumento efficace nella definizione della qualità ambientale dei corsi d'acqua indagati.

ANALISI DI CORRENTE E PARAMETRI OCEANOGRAFICI IN UN SITO DELL'ADRIATICO SETTENTRIONALE (DICEMBRE 2005 - GIUGNO 2008)

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Dal 20 dicembre 2005 al 31 giugno 2008 una catena correntometrica è stata mantenuta in funzione in Adriatico Settentrionale (latitudine 44° 20' 24"N, longitudine 12° 44' 30"E) su un fondale profondo circa 40 m. Il correntometro utilizzato inizialmente era il modello RCM7 che è stato successivamente (dal 12 ottobre 2006) sostituito con un correntometro profilatore ADCP.

Dopo il recupero degli strumenti, i dati sono stati processati, controllati e sono state calcolate le medie orarie e giornaliere delle componenti della velocità.

Durante tutto il periodo di posa del "mooring" sono state effettuate campagne oceanografiche con cadenza bimestrale lungo due transetti orientati uno in direzione SW-NE e l'altro verso SE-NW intersecanti il mooring e costituiti da quattro stazioni di campionamento ciascuno, in cui sono stati registrati valori di temperatura, salinità, fluorescenza, torbidità e ossigeno disciolto lungo tutta la colonna d'acqua e prelevati campioni d'acqua per l'analisi dei sali nutritivi disciolti e della concentrazione di pigmenti clorofilliani.

Nell'arco del periodo considerato, la corrente superficiale è risultata mediamente diretta verso S-SE raggiungendo la massima intensità nel periodo invernale (segmento della WACC, Western Adriatic Coastal Current) con medie giornaliere anche oltre i 20 cm s⁻¹. La corrente di fondo è risultata generalmente più variabile, con una maggiore intensità nel primo ed ultimo anno di indagine.

Risultati interessanti sono invece ricavabili dall'analisi dei dati di temperatura in cui si è osservato un dicembre più caldo nel 2006 rispetto al 2005 e 2007, a seguito di un autunno più temperato. La salinità ha mostrato durante l'intero periodo di indagine una stratificazione alina tipica del versante italiano determinata dall'apporto di acque dolci principalmente dal fiume Po, il cui delta è situato a poche miglia a Nord del mooring. In particolare nel giugno 2008 si è osservata la salinità superficiale più bassa (intorno a 23 psu) dei tre anni di indagine dovuta ad una piena del fiume Po avvenuta pochi giorni prima del campionamento (circa 6015 m³ s⁻¹) e riscontrato anche nelle alte concentrazioni superficiali di nitrati (15-20 µmol l⁻¹) e ortosilicati (30-40 µmol l⁻¹).

CLIMATOLOGIC ANALYSIS OF MARINE AND ATMOSPHERIC VARIATIONS IN THE NORTHERN ADRIATIC SEA

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The northern 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. Being a shallow epicontinental basin with huge river runoff, such investigation is challenging because of the relevant high frequency variability of this sub-basin.

Thermohaline properties of over 13'000 oceanographic stations collected in the northern Adriatic Sea during the period 1970-2007 have been analyzed. Data were extracted by MEDAR/MEDATLAS2002 database (mainly for the first 20 years), while most data were collected by ISMAR-CNR (above all during the last 20 years). Data collected during the period 1970-1989 have been used to define the reference bimonthly climatologies. Bimonthly climatologies during the period 1990-2007 show sensible variations in respect to the reference. In particular, relevant variations (both negative and positive, according to the season) are evident in the surface haline field (at least partially explainable by variations of the Po river runoff), while very limited variations are detected at intermediate and bottom layers. Marine temperatures at surface show a strong warming from November to June, while the summer period does not exhibit relevant changes; the behavior is more variable at deeper layers.

Seasonal analysis of bio-chemical climatologies also show relevant variations, as a general chlorophyll-a reduction particularly evident in winter season. Statistical analysis of annual and seasonal time series of atmospheric data at selected locations around the northern Adriatic basin and Po river runoff reveals in several cases significant trends which can be related to the observed changes in marine fields.

MACROBENTHIC ASSEMBLAGES IN CAPROLACE AND FOGLIANO COASTAL LAKES (LATIUM, ITALY)

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Caprolace and Fogliano coastal Lakes are situated in the Circeo National Park (Lazio, Central Italy) and both of these transitional water systems are included in the Ramsar Convention. This study aims at evaluating the macrozoobenthic assemblages in the two coastal lakes to highlight the communities' ecological and compositional differences. Moreover, macrozoobenthic data were compared with previous studies (data collected in 2000) in order to supply useful information for the coastal lakes management.

Samplings of macrozoobenthos were carried out at 9 sampling sites: 5 in Caprolace Lake and 4 in Fogliano Lake. Replicate samples were collected in the period 2004-2006 (February, May, September, November) utilizing a Van Veen grab (0.1 m²).

A total of 110 taxa and 73 species were recorded: chironomid insects and annelids were the dominant taxonomic groups followed by molluscs, crustaceans and echinoderms. In particular, Caprolace is characterized by the highest number of species and taxa (94 taxa and 64 species): *Heteromastus filiformis*, *Leptochelia savignyi* and *Spio decoratus* are the most abundant marine species over the study period. In Fogliano Lake, macrozoobenthic assemblages (77 taxa and 51 species) are dominated by brackish species as *Chironomidae* gen. sp., *Abra segmentum*, *Corophium insidiosum* and *Heleobia stagnorum*. Cluster analysis and MDS performed using the PRIMER+ software confirmed the difference in macrozoobenthic assemblages of the two coastal lakes. Moreover, the one-way analysis of similarity (ANOSIM) demonstrated that these differences were statistically significant. Results of this study are in a partial agreement with the ones obtained in 2000; in particular, species richness of the two coastal lakes showed no variation, while some changes in species composition were found.

PRELIMINARY RESULTS OF THE OBAMA_2011 CRUISE

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A multi-disciplinary oceanographic cruise was carried out on the R/V Urania during late March-early April 2011 in the Southern Adriatic, Otranto Strait and in the cold-water coral province of S. Maria di Leuca to investigate environmental and ecological variations occurred in the deep ocean ecosystems connected to recent climate changes.

The cruise OBAMA_2011 was part of the experimental phase of two research projects: EC_HERMIONE (Hotspot Ecosystem Research and Man's Impact on European Seas) and PRIN_OBAMA (Offshore OBServatory for the long-term ecological research (L-TER) on the biodiversity And ecosystem Functioning of the deep Mediterranean SeA).

The aims of the two projects can be summarized as follows: a) evaluate the role of episodic events of dense shelf water spreading in the Southern Adriatic in transferring fresh organic matter to the deep benthic community; b) define if the dense water cascading events can produce the wide range of bedforms found on the continental slope or at its base; c) quantify the potential effects of global change and human impact on goods and services provided by deep marine ecosystems; d) investigate the role of viruses and predators on biodiversity of deep sea prokaryotes; e) define principles to create long-term ecological observatories; f) suggest offshore marine protected areas in the Italian seas.

During cruise OBAMA_2011, the following activities were performed: a) recovery, servicing and re-deployment of 2 instrumented moorings in Bari canyon; b) CTD and hydrocasts along transects normal to the continental slope; c) dilution experiments to assess deep sea microbial food web functioning; d) surface sediment sampling; e) Multibeam and Chirp survey; f) three deployments for a total of ~17 hours of an instrumented baited lander for observing the benthopelagic megafauna in coral and non-coral areas. Data collected in cruise OBAMA_2011 will be integrated with time-series of data by previous and ongoing research projects.

STUDIO ECO-TOSSICOLOGICO DEGLI EFFETTI DEGLI IDROCARBURI POLICICLICI AROMATICI (IPA) SULLA CATENA TROFICA MARINA.

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L'eco-tossicologia rappresenta un importante strumento integrativo dello studio del rischio ambientale.

Al fine di ottenere un quadro il più possibile completo e affidabile delle effetti della matrice indagata (inquinante), un buon approccio eco-tossicologico deve essere basato sull'utilizzo di una batteria di test che impiegano organismi appartenenti a differenti livelli trofici e che comprendano sia test di tossicità acuta sia cronica; difatti, l'uso di una singola specie per una corretta valutazione del livello di tossicità può risultare riduttivo soprattutto se rapportato alla complessità dell'ecosistema in studio.

In questo lavoro abbiamo valutato l'impatto, su organismi marini di vari livelli evolutivi e habitat, degli idrocarburi policiclici aromatici (Naftalene, Fenantrene, Antracene, Pirene e Benzo(a)Pirene) generalmente presenti in sedimenti marini di aree portuali interessate da contaminazione antropica.

Misure di mortalità sono state realizzate su batteri (Test Microtox) e su crostacei (*Daphnia magna* e *Artemia salina*), misure di spermio-, ed embriotossicità su echinodermi (riccio di mare, *Paracentrotus lividus*) e molluschi (cozza comune, *Mytilus galloprovincialis*), mentre test di resistenza e di inibizione della crescita sono stati realizzati, rispettivamente, su pesci (forma giovanili di *Dicentrarchus labrax*) e alghe (*Gracilaria dura*).

I dati ottenuti mostrano un omogeneità di risposta negli organismi tester evidenziando come la tossicità primaria delle sostanze testate sia maggiore per quelle a basso peso molecolare (es. Naftalene e Fenantrene) e minore per quello ad alto peso molecolare (es. Benzo(a)pirene) la cui tossicità secondaria aumenta notevolmente dopo le reazioni di bio-traformazione. La tossicità di tali sostanze si trova, pertanto, in diretta dipendenza della loro struttura, dal loro grado di solubilità e disponibilità nell'ambiente marino.

Seppur molti autori sottolineino come i dati ottenuti *in vitro* non siano sempre direttamente trasferibili alla condizione *in vivo*, i risultati ottenuti, il riferimento alla complessità sperimentale realizzata, ci forniscono una "finestra operativa" quanto mai reale della problematica affrontata.

SURFACE DISTRIBUTION OF PHYTOPLANKTON PIGMENTS ALONG A LONGITUDINAL TRANSECT FROM NEW ZEALAND TO THE CONTINENTAL SHELF OF THE ROSS SEA (ANTARCTICA)

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Surface distribution of phytoplankton pigments was investigated along a transect from New Zealand to the Ross Sea using ship of opportunity in the framework of the Italian National Program for Antarctica (PNRA) across different water masses separated by the main ACC fronts. The main objective was to investigate the change in biomass abundance and compositions of phytoplankton as related to the different water masses present and as a function of different ice coverage. The transect was sampled in January and February 2006, in December 2009 and January 2010 at 5 m depth using a water intake device sampling every 25 miles approximately (~90 stations sampled on each way).

Along the transect several hydrological fronts separated distinct water masses. These fronts play a pivotal role in driving the qualitative and quantitative distribution of phytoplankton assemblages and their functioning.

Phytoplankton biomass showed a clear latitudinal gradient with the most productive areas being the fronts (mainly the sACCf) and the Ross Sea. In general an inverse correlation was observed between Chl_a concentration and the diversity index H' , suggesting that a higher biomass is produced by a fewer species only. Northern to the Polar Front phytoplankton was highly heterogeneous and mainly represented by Prymnesiophytes, Dinoflagellates and Chrysophytes. Diatoms are, instead, dominant southern of the front.

Along the Antarctic margin in the Ross Sea, the ice coverage extension strongly affects phytoplankton composition. In areas extensively covered by ice, phytoplankton showed a higher pigment diversity as compared to areas free of ice, suggesting a positive action possibly through iron fertilization.

THE TYR01 COASTAL ZONE MARINE ECOSYSTEM FUNCTIONING EXPERIMENT AND IT CONTRIBUTION TO A NEW GENERATION OF MEDITERRANEAN OCEAN COLOR PRODUCTS

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The TYR01 cruise took place in the Tyrrhenian Sea from October 29 to November 22 2010 on board of the R/V Urania of the CNR. The experiment was the result of the cooperative effort of several Italian research Institutions: ISAC-CNR Roma, IBF-CNR Pisa, ENEA, Stazione Zoologica "A. Dohrn" Napoli, Università Partenope Napoli, Università di Napoli 'Federico II'.

The main objective was to define the environmental status of the open Tyrrhenian sea and Campania and Lazio coastal waters, in view of a definition of the Tyrrhenian GES (Good Environmental Status). In this context new instruments, including LIDAR, were tested to characterize chlorophyll, CDOM and TSM concentrations. The characterization of cross-shelf exchange dynamics, with particular focus on the advection/mixing mechanisms of river plumes, was also an objective of the experiment.

The adopted strategy included the acquisition of multi-spectral radiation profiles, CTD casts, biochemical and biological samples, *in situ* LIDAR marine data and specific experiments.

The *in situ* bio-optical dataset has been used to validate the MyOcean ocean colour chlorophyll products and the new merged Case1/case2 chlorophyll product for the open ocean and the coastal area. The new merged product provides more realistic chlorophyll estimates near the coast and in the transition zone without decreasing the quality of the open ocean estimates.

The data collected during the cruise contributed to evaluate the performance of satellite Particle Size Distribution (PSD) algorithms. PSD is an important measure since it provides significant information on the dominant phytoplankton functional types (PFTs) and influences particle sinking and carbon export. A PSD algorithm has been implemented in the Tyrrhenian Sea. Particles were divided into three main classes: 0.5–2 μm , 2–20 μm , 20–50 μm .

During the cruise, picoplankton-sized particles dominated offshore (> 60%) while nanoplankton-sized particles dominated near the coast (about 50%).

STRUTTURA DELLA COMUNITÀ BATTERIOPLANCTONICA IN TRE STAZIONI LUNGO UN TRANSETTO SARDEGNA – ISOLE BALEARI (CAMPAGNA OCEANOGRAFICA BIOFUN10)

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I campionamenti sono stati eseguiti lungo la colonna d'acqua di tre stazioni disposte lungo un transetto Sardegna-Isole Baleari (profondità max 2830m), durante la campagna oceanografica BIOFUN10 effettuata a bordo della N/O Urania (maggio 2010). I campioni sono stati prelevati adoperando bottiglie Niskin montate su Rosette munita di sonda multiparametrica (CTD-FI). Ciascun campione è stato analizzato per il contenuto in nutrienti (ortofosfati, nitrati, nitriti e ammoniaca). La stima dell'abbondanza batterica è stata determinata mediante conteggi vitali (CFU/ml) su Marine Agar e conteggi diretti (cell/ml) al microscopio ad epifluorescenza (DAPI). La *Fluorescent In Situ Hybridization* (FISH) è stata applicata per ottenere indicazioni preliminari sulla composizione della comunità batterioplanctonica. I campioni sono stati ibridati con le sonde oligonucleotidiche EUBmix (EUB338I + EUB338II + EUB338III) e ARCH915, entrambe marcate con fluorocromo Cy3, rispettivamente per Eubatteri ed Archeobatteri. La struttura della comunità batterica è stata studiata mediante la tecnica di fingerprinting ARISA (*Automated Ribosomal Intergenic Spacer Analysis*), previa estrazione del DNA totale.

Nel complesso, i conteggi vitali variavano tra $1,11 \pm 5,54 \times 10^2$ e $6,50 \pm 0,03 \times 10^3$ CFU/ml, mentre l'abbondanza batterica totale era compresa tra $1,23 \pm 0,20$ e $9,35 \pm 0,21 \times 10^5$ cell/ml. Sulla base dei risultati ottenuti dalla FISH, gli Eubatteri (range 17,7-62,6%) e gli Archeobatteri (range 1,5-84,4%) hanno mostrato un tipico andamento opposto, con una più elevata incidenza dei primi in superficie e dei secondi all'aumentare della profondità. Infine, la distribuzione e l'abbondanza relativa dei taxa individuati mediante ARISA si sono rivelate abbastanza eterogenee, permettendo di distinguere almeno sei cluster in cui i campioni vengono raggruppati principalmente per masse d'acqua, piuttosto che per stazione. Ciò suggerisce l'instaurarsi di comunità batterioplanctoniche specifiche che restano simili in strati uguali di stazioni differenti. Infine, l'analisi multivariata dell'intero data-set ha permesso di mettere in evidenza come le differenze fra le tre stazioni fossero dovute principalmente alle abbondanze, piuttosto che alla struttura delle comunità batteriche.

CARATTERIZZAZIONE DELLA COMUNITÀ BATTERICA ASSOCIATA A due PENNATULIDI MEDITERRANEI DEL MAR IONIO

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Per la loro abbondanza in ambiente marino, i batteri sono spesso i pionieri ed i principali colonizzatori di tutte le superfici di natura abiotica o biotica. Per la seconda tipologia, un esempio interessante è rappresentato dai coralli e dalle associazioni che essi instaurano con la comunità batterica simbiotica. I pennatulacei sono un gruppo di ottocoralli ancora poco studiato per questo aspetto. È sembrato, quindi, utile indagare sulla componente microbica dei due pennatulidi mediterranei *Pennatula phosphorea* Linnaeus, 1758 e *Pteroeides spinosum* (Ellis, 1764), rivolgendo l'attenzione anche alla potenziale attività antibiotica dei batteri ad essi associati.

La comunità microbica epibiotica delle due specie di invertebrati bentonici studiate, nonché quella presente nei sedimenti e dell'acqua circostante, è stata analizzata in via preliminare mediante due tecniche molecolari indipendenti dalla coltivazione (DGGE ed ARISA).

Le analisi hanno evidenziato differenze tra i campioni di tessuto, muco, acqua e sedimento (DGGE) e nella struttura della comunità batterica, non soltanto tra le matrici abiotiche e gli organismi, ma anche tra le due specie di pennatulidi e tra questi ed i campioni di muco (ARISA). I risultati dell'analisi DGGE permettono di presupporre un'associazione di tipo specie-specifica. In particolare, i dati dell'ARISA suggeriscono che possa sussistere una compartimentazione tra le comunità microbiche associate.

I 78 ceppi isolati da tessuti e muco dei pennatulidi sono stati testati per l'attività inibitoria verso sette microrganismi indicatori. I 12 ceppi attivi, identificati mediante sequenziamento del 16S rDNA, appartengono in massima parte al genere *Vibrio* (*Gammaproteobatteri*), mentre un solo ceppo appartiene al taxon dei *Firmicutes* (genere *Bacillus*).

Il presente studio fornisce prime informazioni sulle comunità microbiche associate a questo gruppo di ottocoralli poco studiato.

LONG-TERM PHYTOPLANKTON SIGNALS IN DIFFERENT SARDINIAN AQUATIC ECOSYSTEMS (MEDITERRANEAN SEA)

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It is generally accepted that long-term series of ecological data are essential in improving our ability to distinguish natural changes from those induced by human activities, at local and global scales. Moreover, they permit to establish baselines to which to refer to assess future changes. The potential of such long-term data series can be further enhanced if data collected on several types of ecosystems are compared to find common signals.

This study reports the temporal variation of phytoplankton and the main environmental parameters in three different aquatic ecosystems belonging to the Sardinian sites of the Italian Network of Long Term Ecological Researches (LTER-Italy): Cabras Lagoon, Gulf of Olbia and Temo Reservoir. The collection of data started in the middle of eighties (Temo Reservoir) and in the middle of nineties (Gulf of Olbia and Cabras Lagoon). Initially all the three ecosystems were classified as eutrophic and they are dominated by phytoplankton, as main primary producer. The objectives of this work are I) to assess the general tendencies of phytoplankton in each site and II) to compare the results of each site with the others to assess the eventual presence of common trends, in relation of those observed in the Mediterranean basin.

Chlorophyll *a* showed a tendency to decrement in the three studied sites in the last years. In addition, the presence of Cyanophyceae has increased in the Cabras Lagoon from 2001, dominating all the other classes in the last years. This change was accompanied by the reduction of the cellular size class, a tendency observed also in the Gulf of Olbia. The LTER approach has permitted to observe decrements of Chl *a* and cellular size also in other Mediterranean sites, indicating the necessity of a deeper analysis of these possible common trends on the basin scale.

QUANTITY AND BIOCHEMICAL COMPOSITION OF SEDIMENTARY ORGANIC MATTER OFF THE SOUTHERN COASTS OF THE SPITSBERGEN ISLAND (ARCTIC MARGIN)

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The seasonal formation of dense shelf water is a recurrent phenomenon along several areas of the European continental margins. The ecological effects of these events have been mostly investigated in the Gulf of Lions, the Adriatic Sea and the Aegean Sea (Pusceddu et al 2010 *Adv Oceanogr Limnol* 1, 67). Crossing the need for a better understanding of the various facets of the cascading of dense shelf waters along the European continental margin, an oceanographic cruise was carried out in July 2010 on board the R/V Jan Mayen and sediment samples were collected along a bathymetric transect crossing the continental margin off the southern coasts of the Spitsbergen island (Hornsund Bank, Svalbard). Sediments were analysed in terms of total phytopigment, protein, carbohydrate and lipid carbon. Protein, carbohydrate and lipid sedimentary contents increased significantly with water depth indicating the potential accumulation of biopolymeric (i.e. semi-labile) compounds in the deeper part of the margin. In contrast, total phytopigment sedimentary contents displayed a hump-shaped distribution with increasing water depth, with the highest values observed at 1125 m depth, where also the food quality of organic matter (in terms of the protein to carbohydrate ratio) reached the highest values. These preliminary results suggest that the continental margin under scrutiny is likely characterized by the presence of an active down-slope transport of organic matter from the adjacent continental shelf and pinpoint also that the organic material accumulated in the deeper part of the margin is characterized by a decreasing food quality.

FILTER FEEDING ORGANISMS AS SOURCE FOR THE ISOLATION OF BIOSURFACTANT-PRODUCING BACTERIA

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Many hydrocarbon-degrading bacteria are able to produce surfactants or emulsifiers, compounds which make easier the utilization of insoluble substances by cells. Biosurfactants have received increasing attention in recent years because of their many interface properties, and advantages over synthetic surfactants. To date, samples of contaminated water and soil have been the most used matrices for the isolation of potential biosurfactant-producing strains, whereas there is very little knowledge about the possible exploitation of biotic sources.

The aim of this study was to evaluate the possible use of benthic filter-feeding organisms at this purpose. The efficient filtration activities of these organisms make possible the accumulation and concentration of contaminants such as hydrocarbons, and bacterial biomass. Three different species of Polychaetes were studied: *Sabella spallanzanii*, *Branchiomma luctuosum* and *Megalomma claparedei*. Individuals were collected aseptically from the Lake of Faro (Messina, Italy). The homogenates obtained from samples were used to prepare enrichment cultures in mineral medium Bushnell Haas Broth and crude oil (1%) as a sole carbon source. After an incubation period of one month at 28°C, 71 strains were isolated and subjected to standard screening tests for biosurfactant production evaluation. Strains which showed a stable emulsion index (E24) \geq 50% were chosen to perform the extraction and preliminary characterization of the biosurfactant compounds by using thin layer chromatography (TLC). A total of 24 strains showed interesting yellow spots on TLC plate, suggesting the possible glycolipidic nature of the compounds. Biosurfactant producers were closely related to the genera *Joostella* sp., followed by *Pseudomonas* sp., *Cellulophaga* sp., *Cobetia* spp., *Cohaesibacter* sp. and *Pseudovibrio* sp.

Obtained results showed that it is possible isolating biosurfactant-producing strains from filter-feeding organisms. Moreover, bacterial genera that have never been mentioned in literature as biosurfactant producers are reported for the first time in this work.

PRESENZA DI DEEP-SEA ECOTYPE *THAUMARCHAEOTA* NEL LAGO MEROMITTICO SALMASTRO DI FARO (MESSINA – ITALIA)

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Il Lago di Faro è un lago salmastro di origine tettonica con una salinità che stagionalmente varia tra 34 e 38 ppt; esso rappresenta un raro esempio di bacino meromittico. Lo strato epilimnico aerobico ha una profondità massima di 15m ed in estate decresce significativamente a causa della scarsa affluenza di acqua di mare ossigenata proveniente dai canali che collegano il lago al mare. Inoltre, il limitato rimescolamento verticale delle acque garantisce la costante presenza di H₂S nell'ipolimnio. La natura del Lago di Faro e la presenza di un redoxcline ben definito fornisce una nicchia ottimale per lo sviluppo delle comunità procariotiche.

La presenza di *Crenarchaeota* mesofili marini ammonio-ossidanti (*Thaumarchaea*) è stata investigata alle profondità di 12m (oxic zone) e 20m (anoxic zone) mediante l'allestimento di librerie di cloni costruite sui geni che codificano per il 16S rRNA e sui geni funzionali amoA (ammonia monooxygenase) e accA (acetyl-coA carboxylase). L'analisi delle sequenze del gene 16S rRNA, ha evidenziato una rilevante presenza (68% degli OTUs) di sequenze affiliate a *Crenarchaeota* Marine Group I, soprattutto alla profondità di 12m. Il rimanente 32% delle sequenze è stato attribuito al phylum *Euryarchaeota* ed in particolare al genere *Methanohalophilus* (11%) ed all'ordine Thermoplasmatales (21%).

Dall'analisi delle librerie di cloni costruite sul gene *amoA*, accanto alla presenza dei due cladi Shallow Marine amoA (con i due sottogruppi A.1 e A.2) e Deep Marine amoA (B.1, B.2, B.3) (Yakimov et al., 2011), è stato individuato un nuovo folto gruppo di sequenze amoA che probabilmente costituiscono un terzo clade di sequenze prima d'ora mai ritrovato in ambiente mediterraneo. Anche per le sequenze dei cloni accA-like sono stati individuati due cladi filogeneticamente distinti: accA shallow ('Ecotype_2') e deep ('Ecotype_1a').

STUDIO ECO-TOSSICOLOGICO DELL'IMPATTO DEI PROCESSI DI BIOREMEDIATION IN AMBIENTI MARINI INQUINATI DA PETROLIO

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An ecotoxicological assessments of contaminated sea-water require an understanding of the impact of bioremediation techniques on marine ecosystem. To evaluate the ecotoxicological effects of biostimulation/bioremediation techniques on marine environments, ecotoxicological tests and experimentations of natural attenuation (only oil), biostimulation (addition of nutrients), bioaugmentation (addition of bacteria; addition of bacteria and nutrients) and bioremediation (addition of dispersant) were carried out on simulation systems (microcosms).

After 30 days of incubation, the ecotoxicological effects were evaluated by Microtox test, mortality of *Artemia salina* and spermiotoxicity and embriotoxicity on gametes of *Mitylus galloprovincialis* and *Paracentrotus lividus*. Quali-, quantitative hydrocarbons analysis (GC-MS) were also performed. Data obtained are in according to presence of pollutants and dynamic of oil biodegradation; moreover, data obtained show as bioaugmentation processes are the techniques more promising for the recovery and those that determinate a residual toxicity lower than seen in other system in studio.

IL MUCO DEI SABELLIDI (ANNELIDA, POLYCHAETA): IL SUO COINVOLGIMENTO NELLA DIFESA CHIMICA E NELLA RICOSTRUZIONE DEL TUBO

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Il muco è un complesso di proteine e polisaccaridi che formano un gel contenente più del 95% di acqua. Gli invertebrati utilizzano questa matrice come rivestimento della superficie esterna del corpo, per la locomozione, per minimizzare le forze d'attrito e la resistenza idrodinamica, per limitare le perdite di acqua. Questa secrezione può avere un ruolo importante nell'alimentazione e nella fecondazione, può rappresentare una sorta di matrice in cui le uova vengono ancorate e protette, può offrire protezione dall'essiccamento e dai raggi UV e contribuire all'inglobamento del sedimento. Nei policheti la produzione di muco costituisce una caratteristica chiave morfologica e funzionale che determina l'abilità di molte specie di sopravvivere nel loro ambiente. La complessa composizione del muco è correlata alle molteplici funzioni che esso svolge nelle varie specie: nutrimento, scambio gassoso, lubrificazione, costruzione del tubo. Il muco svolge anche una fondamentale funzione di difesa. Questa azione si esplica sia attraverso la formazione di una vera e propria barriera fisica alle invasioni e colonizzazioni microbiche, sia grazie al rilascio in questa matrice di sostanze tossiche o biologicamente attive che possono uccidere o inibire la crescita microbica. Nel presente studio abbiamo valutato l'attività antibatterica del muco prodotto da diverse specie della famiglia Sabellidae, nonché il ruolo di tale matrice nella ricostruzione del tubo dopo la rimozione degli animali dal tubo originale. Le specie indagate sono state: *Branchiomma luctuosum*, *Megalomma claparedei*, *Myxicola infundibulum*, *Sabella spallanzanii*. Le differenze osservate tra le specie indagate potrebbero essere connesse al differente ruolo svolto dal muco che in *B. luctuosum* è implicato prevalentemente nella costruzione del tubo, in *S. spallanzanii* è soprattutto connesso alla difesa chimica, mentre in *M. infundibulum* esso ricopre entrambi i ruoli. Infine, nel caso di *M. claparedei* il muco funge prevalentemente da bioadesivo per legare le varie particelle utilizzate per costruire il tubo.

**BIOACTIVE COMPOUNDS IN MARINE BIOMASSES: ANTIBACTERIAL
ACTIVITY IN THE LIPIDIC EXTRACTS OF *CLADOPHORA RUPESTRIS*
(CLADOPHORALES, CHLOROPHYTA)**

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Recent studies have shown that seaweeds are a good source of structurally novel secondary metabolites with antibacterial, antialgal, antifungal and antitumoral properties. Therefore, natural products from marine algae appear as a promising alternative valuable source of new compounds for drug development. It is also noteworthy that seaweeds often produce salt-stable antimicrobial compounds useful in the control of either fish or shellfish pathogens in aquaculture where the high-salt conditions might reduce antibiotic efficacy. In this investigation the antimicrobial activity of *Cladophora rupestris* (Linnaeus) Kützling lipidic extract was assayed and its chemical characterization was carried out by gas-chromatography and multinuclear and multidimensional NMR spectroscopy. The seaweed was collected in the Mar Piccolo of Taranto (northern Ionian Sea, Italy), washed, dried and powdered. The powdered material was subjected to Soxhlet extraction using chloroform/methanol (2:1, 55-60°C, 24 h). Five milligrams of extract were dissolved in ethanol and assayed for antimicrobial activity using the Kirby Bauer method (1966). Fatty acid composition was determined according to Budge and Parrish (2003). Analysis of fatty acid methyl esters was performed by gas-liquid chromatography. *Cladophora rupestris* lipidic extract showed a bacteriostatic activity against the two human pathogens *Enterococcus* sp. and *Streptococcus agalactiae* as well as all the tested *Vibrio* species (*Vibrio ordali*, *Vibrio fluvialis*, *Vibrio salmonicida*, *Vibrio vulnificus*, *Vibrio cholerae* non O-1, *Vibrio metschnikovii*). The ¹H NMR spectrum in CDCl₃ of algal lipid fraction showed the characteristic signals of saturated (SAFAs) and unsaturated fatty acids (UFAs) as well as other metabolites. The fatty acids profile of *C. rupestris* showed that palmitic acid methyl ester (16:0) was the predominant saturated fatty acids suggesting that it could be responsible of the observed antibacterial activity. These results are interesting considering the resistance against common antibiotics developed by bacteria and the need to control fish and shellfish diseases due to vibriosis.

VALUTAZIONE ECOTOSSICOLOGICA MEDIANTE BATTERI BIOLUMINESCENTI DELLE FOCI DELLA COSTA CROTONESE

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Il presente studio, di durata semestrale ed articolato in due campagne stagionali (inverno e primavera), si inquadra nell'ambito delle attività di controllo e monitoraggio condotte dall'ARPACAL in ottemperanza a quanto disposto dal D.Lgs. 152 e s.s. m.m. i.i. (Testo unico ambientale).

Lo scopo del lavoro è quello di valutare lo stato ecologico delle foci degli 8 corpi idrici superficiali presenti lungo la fascia costiera della Provincia di Crotona, mediante saggio biologico con *Vibrio fischeri* attraverso il confronto tra l'andamento della tossicità della campagna invernale (dicembre 2009/febbraio 2010) e di quella primaverile (marzo/giugno 2010).

Per ciascuna delle 8 foci sono state individuate 3 stazioni di campionamento: acqua centro foce, sedimento superficiale argine destro e sedimento superficiale argine sinistro.

I saggi ecotossicologici, condotti su 3 diverse matrici (sedimento centrifugato, colonna d'acqua ed elutriato di sedimento), sono stati eseguiti applicando i protocolli Microtox® Solid-Phase-Test e Basic Test.

Dall'analisi dei risultati non è stato possibile osservare un chiaro trend stagionale nell'andamento della tossicità.

A differenza della matrice acquosa che ha presentato valori di tossicità assente o lieve/media, le prove effettuate sulla fase solida mostrano una situazione generale di evidente tossicità, interessando la totalità dei campioni analizzati.

Ciò descriverebbe un'area fortemente compromessa per la probabile presenza di miscele di contaminanti biodisponibili e potenzialmente mobili verso la colonna d'acqua che tendono, però, ad accumularsi nel sedimento, luogo di raccolta e sorgente della maggior parte del carico inquinante in ogni ecosistema acquatico.

E' ragionevole presupporre che i contaminanti, verosimilmente presenti nei sedimenti in elevate concentrazioni restino legati al sedimento per la loro natura chimica, idrofobicità, adsorbimento e grado di complessazione con la sostanza organica.

DISTRIBUTIONAL PATTERNS OF MACROZOOBENTHIC ASSEMBLAGES IN THE GRADO-MARANO LAGOON (NORTHERN ADRIATIC SEA)

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Macrozoobenthic assemblages were examined in 41 sites, evenly distributed in the Grado-Marano Lagoon, sampled in May 2010. The research was aimed at evaluating the distribution of macrozoobenthos in the lagoonal area, also comparing the results with previous environmental studies on this topic.

A total of 118 taxa was recorded in the study area, annelids were the dominant taxonomic group followed by crustaceans, molluscs and echinoderms.

Cluster analyses showed marked differences in assemblage composition for the areas close to the continental coast (inner bank), intermediate areas and areas close to the inlets and the sea. The one-way analysis of similarity (ANOSIM) demonstrated that these differences were statistically significant. A gradient from the sea to the inner bank was identified by Correspondence Analysis as well. Along this gradient species richness and diversity decreased towards the inner bank, where the dominant species resulted to be typical inhabitants of lagoonal environment. Local abundance and evenness showed no correlation with the spatial distribution of the sampling sites. Moreover, there is no statistically significant difference between assemblage composition of the two sub-units (Grado and Marano) in which the lagoon is subdivided, and no correlation was demonstrated between community composition and granulometric composition of sediments. The results of this study showed some differences with previous researches (e.g. biodiversity distribution inside the lagoon's sub-units) and suggested that the observed pattern of macrozoobenthic assemblages is closely related to the hydrodynamics and water inflows characterizing the lagoon system.

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