

# World Conference on Marine Biodiversity.

11 - 15 November 2008

**Valencia Spain**

City of Arts and Sciences



# Tuesday November 11

## Parallel sessions

### Morning

#### Red sea auditorium

##### Session 3.2 What lived in the oceans? Shifting baselines in time and space.

Chairs : Bo Poulsen; Loren McClenachan; Andrew A. Rosenberg; Matthew McKenzie.

12:00 12:15 RETREAT OF COLD-TEMPERATE SPECIES IN THE MEDITERRANEAN SEA (REPORT FROM THE CIESM WORKSHOP ON MEDITERRANEAN INDICATORS OF GLOBAL WARMING, HELGOLAND)

Boero, Ferdinando. Dipartimento di Scienze e Tecnologie Biologiche e Ambientali, Università del Salento, Italy.

Mediterranean temperature regimes identify three "cold areas" (Gulf of Lions, Northern Adriatic, Northern Aegean) where species of cold-water affinity thrive, even at shallow depths. The tropicalization and meridionalization of the Mediterranean Sea favours species of warm-water affinity, radically changing the biota, giving the impression of an increase in biodiversity. A less explored effect of global warming, however, is the impact of rising temperatures on species of cold water affinity. In the recent past, for instance, an abnormal deepening of the summer thermocline caused a mass mortality of sea fans throughout the Northern part of the Western Mediterranean. Such evident phenomena are probably just a symptom of the impact of global warming on Mediterranean biodiversity. The arrival of new species is more easily recorded than the disappearance of other species, especially if these are inconspicuous, as most species are. A careful analysis of the status of Mediterranean cold-water species is leading to the identification of putative extinct species that are not being recorded since at least one century. These might be the so far undetected victims of global warming.

12:15 12:30 FISHING AND JELLYFISH ERADICATE FISH 180 YEARS AGO.

Poulsen, Bo, Department of Environmental, Social and Spatial change, Roskilde University,  
MacKenzie, Brian R., National Institute of Aquatic Resources (DTU-Aqua), Technical University of Denmark and University of Aarhus, Copenhagen, Denmark.

Poulsen Bo, Department of Environmental, Social and Spatial Change, Roskilde University, Denmark.

Sustainable fish populations require both healthy ecosystems in which they can live and grow, and protection from overfishing. A rare historical example from the Limfjord, Denmark in the first half of the 19th century allows diagnosis of the chronology of how the vulnerability of a herring (*Clupea harengus*) population to ecosystem variability was increased by effects of fishing on the population and food web interactions within the ecosystem. Both the population and fishery collapsed when several years of destructive fishing methods were followed by an extreme climatic-hydrographic event that affected herring survival and changed food web structure (jellyfish invasion). Changes in trophic interactions were facilitated by fishing, which had reduced the abundance of jellyfish food competitors (herring) to low levels. Lowering the risks of future collapses of fish populations and of trophic re-organisations to less desirable configurations requires low exploitation rates that buffer against environmental variability and measures to support well-functioning and structured ecosystems.

12:30 - 12:45 CLIMATE INFLUENCE ON THE BARENTS AND WHITE SEA ECOSYSTEMS.

Lajus, Dmitry, Ichthyology and hydrobiology, St.Petersburg state university, Russian federation.

Alekseeva, Yaroslava, P.P. Shirshov Institute of Oceanology, Russian Academy of Sciences, Moscow, Russian Federation.

Lajus Julia, Center for Environmental and Technological History, European University at St. Petersburg, St. Petersburg, Russian Federation.

Barents and White seas is a northeastern boundary of distribution range for many boreal Atlantic species. Thus this region represents a convenient model for studying climate effects on ecosystems. In this study supported by HMAP programme we summarize numerous historical information on changes of distribution range and population abundance of species from various groups during last four centuries, especially since the end of the 19th c. The longest time series on Atlantic salmon showed increase of their abundance in warmer periods. In warm periods unusual appearance of arctic mammals (white whale, harp seal) along Barents Sea coast was repeatedly reported. Also, in warm periods, in particular, in 1930s, warm-water pelagic fish and invertebrate species were moving with warm currents into Barents Sea significantly shifting their range and some of them entered the White Sea. In the White Sea the climate influences abundance of stickleback, one of the key species of coastal ecosystem. Therefore historical data show significant changes in composition and abundance of all components of biota in the Barents and White Sea in periods with pronounced temperature changes.

12:45 – 13:00 LONG-TERM CHANGES IN STONY CORAL ASSEMBLAGES OFF JAKARTA (1920 - 2005).

Van der Meij, Sancia; Hoeksema Bert, Zoology, National Museum Auditorium of Natural History Naturalis, The Netherlands.

Current social and economic developments in tropical regions include accelerated urbanization in coastal areas that increase pressure on species-rich coral reef ecosystems. High sedimentation rates, nutrient loading and chemical contamination, as well as physical destruction associated with human exploitation, increasingly degrade and destroy coral reefs. For the recognition of global change signals and human impact on marine ecosystems, a solid historical baseline is needed. This research gives insight in the ecological changes in Jakarta Bay and the adjacent Thousand Islands archipelago (Kepulauan Seribu) between 1920 and 2005. The long-term presence of research infrastructure allowed extensive surveys in the area since the 1920s. Historical zoological collections resulting from these studies (mostly stony corals and mollusks) are still accessible in The Netherlands. The availability of data from 1920 (natural history collections, note books, nautical maps) to 2005 (fieldwork data) offers the opportunity to detect local changes in Indonesia's marine fauna. Depauperation of Jakarta Bay's reefs include an 80% loss in species for the reefs closest to shore. The offshore coral assemblages merely showed shifts in species composition.

13:00 - 13:15 AOTEAROA / NEW ZEALAND; AN IDEAL TEST OF THE EFFECTS OF HUMAN IMPACTS SINCE FIRST ARRIVAL ON MARINE ECOSYSTEMS

Macdiarmid, Alison, Benthic fisheries & ecology, National Institute of Water & Atmospheric Research, New Zealand.

A problem in identifying the scale of human impacts on marine ecosystems over long time periods (1-10s of millennia) is they have co-occurred with major shifts in climate. As there are no modern coastal marine ecosystems unaffected by human activity, to clarify the effects of humans we need to identify a landmass and adjacent marine ecosystem where humans are known to have settled relatively recently, the land and marine ecosystems are isolated from other areas inhabited by humans, there is access to sufficiently detailed archaeological, historical and contemporary data sources on the state of the marine ecosystem, the climate variation over the period of human occupation is modest and well described, the non-climate physical drivers are well described and the timing and magnitude of major removals from the marine ecosystem are known. Here we report on one area, Aotearoa/New Zealand, that meets these criteria and describe the initial stages of a project that seeks to describe the magnitude and timing of changes to a large marine shelf ecosystem from pristine to heavily impacted over a period of just 700 years.

13:15 – 13:30 TIMES OF CHANGE: A SPATIO - TEMPORAL ANALYSIS OF ROCKY SHORE COMMUNITIES IN FALSE BAY, SOUTH AFRICA

Mead, Angela; Tunley, K., Griffiths, C. L. and Rouault, M. Marine Biology Research Centre, Zoology, University of Cape Town, South Africa.

Twenty years of change within intertidal community structure was investigated in a Bay, located along an Eastern Boundary upwelling system, on the West coast of South Africa. Ten sites in the west of the Bay were surveyed in 1987 and 2008/2009. Biomass data for macro-algae and macro-fauna located on the high, mid and low-shore were analysed using a multivariate tool. Significant dissimilarities were detected in community assemblages. Most notably, the cold water kelp, *Ecklonia maxima* and the predominantly cold water introduced mussel, *Mytilus galloprovincialis*, appeared in the Bay. The warm water indigenous mussel, *Perna perna*, disappeared. Detected community shifts were considered in parallel with trends in anthropogenic forcing factors, over the same time period. Marine pollution and exploitation were ruled out as anthropogenic forcing factors. Trends in sea surface temperature, based on AVHRR and in-situ data, demonstrate a temperature depression along the west coast,

inclusive of the west side of the Bay. The importance of shifts in wind regimes and upwelling patterns, indicative of global climate change, are discussed with respect to the changes detected. It is proposed that a combination of marine introductions, climate change and competition have significantly altered the intertidal communities in the Bay. Further experimental evidence is required to test this proposal.

# Tuesday, November 11

## Parallel Sessions

### Morning

#### Museum auditorium

##### Session 1.10 Patterns and drivers in the distribution of marine biodiversity: in homage to John Gray.

Chairs : Paul Somerfield and Richard Warwick.

12:00 – 12:15 ALL ANIMALS ARE EQUAL, BUT SOME ANIMALS ARE MORE EQUAL THAN OTHERS.

Warwick, Richard: Somerfield Paul J, Plymouth Marine Laboratory, United Kingdom.

If the number of animal species is to be used as a measure of 'biodiversity' then we need to know whether animal phyla are consistently subdivided in such a way that each species represents an equal division of life's diversity. It is widely assumed, intuitively, that the traditional Linnean classification of marine animals is inconsistent between different major groups. We demonstrate formally that this is the case. For this exercise we use a consistent taxonomic hierarchy for all phyla within a relatively large region, the UK. The value of average taxonomic distinctness  $\Delta^+$  is shown to vary considerably between phyla. There is a highly significant relationship between the number of species within a phylum, and the average distance through the taxonomic hierarchy between those species. Larger phyla are broken up into relatively small units at higher taxonomic levels. Interestingly, this occurs independently of the perceived taxonomic difficulty within phyla. Species number is therefore a poor unit of currency for evaluating biodiversity.

12:15 – 12:30 ARE MARINE BENTHIC COMMUNITIES ASSEMBLED AT RANDOM FROM REGIONAL SPECIES POOLS.

Somerfield Paul, Plymouth Marine Laboratory, United Kingdom.

Local species diversity may be determined by processes operating locally, or by regional processes such as environmental structuring or history. Classical theory focusing on competition predicts that the species combining to form communities will be less similar to each other than if they are assembled at random from a regional species pool. Theory focusing on environmental structuring predicts that species will be more similar to each other than expected by chance. Using data held in the MarBEF database, little or no evidence is found for species lists of whole faunas at any scale being random subsets of species lists at larger scales. Species tend to be more closely related to each other than would be expected if they were assembled at random, implying that regional processes determine the assembly of communities. Focusing on polychaetes, there is a much stronger tendency for local composition to be a random subset from regional pools at all scales. Thus it is not possible to determine whether local polychaete diversity is independent of both local and regional processes, or determined by a combination of both.

12:30 – 12:45 TOWARDS MARINE MACROECOLOGY: BUILDING ON JOHN GRAY'S LEGACY.

Webb, Tom, Department of animal & plant sciences, University of Sheffield, UK.

For those of us with one wet and one dry foot, the division between 'mainstream' (i.e. terrestrial) and marine ecology is a constant frustration. John Gray's legacy is to all ecologists, however, as he pursued the broad questions that are relevant in all systems: what drives the distribution of biodiversity? In this spirit, I discuss the mutual benefits of developing a science of marine macroecology. Macroecology is the study of the distribution and abundance of organisms at large scales; new databases are finally allowing realisation of the vast potential of marine systems to contribute to this research effort. I present a macroecological analysis of the European macrobenthos, emphasizing similarities with terrestrial patterns (e.g. right-skewed species-occupancy distributions), the potential to go beyond what is possible in analyses of birds (e.g. extending analyses of phylogenetic patterns of abundance from within-Order to cross-Class), and the opportunity to test new theories (e.g. statistical sampling theories of species-abundance distributions). Finally, I discuss how macroecology's role in predicting and understanding responses to global change can help us to understand the distribution of marine diversity.

12:45 – 13:00      SPATIAL SCALING IN BENTHIC ECOLOGY.

Ellis, Joanne; Schneider David, Crydium Ltd, St John's. Canada.

Using modern computer based search engines we were able to assemble, review, and document the rise of the concept of scale in benthic ecology. In the early literature the term appears to have been most commonly used to verbally qualify a result as being found at a particular spatial scale. However we document a shift from verbal expression to quantitative methods that explicitly incorporate scale into the design of the study. Examples include the development of nested multi-scale studies and experiments conducted over large spatio-temporal scales at the level of estuary or region. We also review novel methods for assessing scale effects in benthic ecosystems. First the use of gradient or correlative study designs have been developed in order to assess spatial and temporal heterogeneity in benthic ecosystems. These designs recommend nesting small-scale experiments within a broad-scale correlative framework. Secondly, we assess the development of statistical analytical techniques to analyze spatial data and formal mathematical techniques for scaling functional relationships. We believe that the design and analytical advances identified provide a framework for ecologists to address pressing large-scale questions.

13:00 – 13:15      LATITUDINAL PATTERNS IN BENTHIC INVERTEBRATE DIVERSITY ON EUROPEAN CONTINENTAL SHELVES: INSIGHTS FROM THE MARBEF DATABASE.

Renaud Paul, Research Akvaplan-niva, Norway; Bjørgesæter Anders, Biology, University of Oslo, Oslo, Norway; Karakassis, Ioannis, Biology, University of Crete, Heraklion; Kedra Monika, Institute of Oceanography PAS, Sopot, Poland; Kendall Michael, Plymouth Marine Laboratory, Plymouth, UK; Labrune Céline, Laboratoire d'Océanographie Biologique, Université Pierre et Marie Curie, Banyuls-sur-mer, France; Lampadariou Nikolaos, Hellenic Centre for Marine Research, Heraklion, Greece; Somerfield Paul, Plymouth Marine Laboratory Plymouth, UK; Webb Thomas Webb, Animal & Plant Sciences, University of Sheffield, Sheffield, UK.; Vanden Berghe Edward, OBIS, Rutgers University, New Brunswick, NJ, USA; Claus Simon, Vlaams Instituut voor de Zee, Oostende, Belgium.

Latitudinal clines in species diversity in limnic and terrestrial habitats have been noted for well over a century and are consistent across many taxonomic groups, but recent studies in marine systems over the past 2-3 decades have yielded equivocal results. We conducted initial analyses of the MarBEF (EU Network of Excellence for Marine Biodiversity and Ecosystem Function) data base to test for trends in local and regional diversity over the latitudinal extent of European continental-shelf waters (36-81 °N). Soft-sediment benthic macrofauna exhibit little evidence of a latitudinal cline in local ( $\alpha$ -) diversity measures. Relationships with depth were relatively strong and complex. Statistically significant latitudinal trends were small and positive, suggesting a modest increase in diversity with latitude once depth covariates have been removed. These results are consistent regardless of whether subsets of the database were used, replicates were pooled, or component taxonomical groups were evaluated separately. Local and regional diversity measures were significantly and positively correlated. Scientific cooperation through data sharing can be a powerful tool with which to address fundamental ecological and evolutionary questions relating to large-scale patterns and processes.

13:15 – 13:30      HABITAT VARIATION, SPECIES DIVERSITY AND ECOLOGICAL FUNCTIONING IN A MARINE SYSTEM

Hewitt, Judi; Thrush Simon, Hamilton. National Institute of Water and Atmospheric Research, New Zealand. Dayton, Paul. SCRIPPS. USA.

The expectation that long-term, broad-scale changes in the relative abundance of species, homogenization of habitats and decreases in diversity will affect ecosystem function has led to an increasing number of studies on functional diversity and composition. Such studies rarely consider the effect of habitat variation, despite the strong link between habitat and species diversity in many systems. In this study we examine the link between functional composition and habitat variation in two locations with different regional species pools. We found similar functional traits occurring in the two locations, but differences between habitats within the locations. High evenness within traits was apparent (across both locations and habitats) reflecting the potential for the maintenance of function with the loss of individual species. Between-habitat differences in functional traits were driven by differences in organism densities rather than the presence/absence of individual traits, emphasizing the importance of density shifts in driving function. Furthermore, the importance of habitat variation to functional composition and diversity suggests that habitat heterogeneity should be explicitly included within studies trying to predict the effect of species loss on ecosystem function.

## Parallel Sessions

### Morning

## Polivalente Room

### **Session 1.9 The Coral Triangle: patterns and processes in marine species richness and habitat diversity**

Chairs: Bert W. Hoeksema; Michael N. Dawson; Gustav Paulay; Annadel Cabanban.

12:00 – 12:15      USE OF PRESENCE/ABSENCE DATA TO INDICATE CUMULATIVE SPECIES RANGE OVERLAPS IN THE CORAL TRIANGLE.

Hoeksema, Bert, Zoology, National Museum Auditorium of Natural History Naturalis, The Netherlands.

The ranges of many marine species overlap in the Coral Triangle. The centre's boundaries are not exactly known, because many species ranges have not been determined accurately. Due to different evolutionary pasts and various ecological requirements, it is unlikely that species show the exact same ranges. A majority shows widespread ranges that are entirely Indo-West Pacific. Most other species have restricted ranges in and around the centre. Some rare species may show disjunctive or fragmented distribution ranges, but this may result from incomplete sampling. Furthermore, different presentation methods are used to indicate species ranges: just locality data, distribution outlines, or hatched areas of occupancy. Another problem in determining species diversity patterns is that many species are not well known. Therefore, in order to get more insight in the position of the Coral Triangle, it is proposed to use selected species groups for which taxonomic revisions are available. By using model taxa, reliable data sets can be obtained on species presence or absence.

12:15 – 12:30      ECOLOGY AND EVOLUTION IN MARINE LAKES ACROSS THE INDO-WEST PACIFIC.

Dawson, Michael; Martin Laura, School of Natural Sciences, University of California, Merced, USA.  
Bell Lori; Patris Sharon, Coral Reef Research Foundation, Koror, Palau.

Marine lakes are bodies of seawater entirely surrounded by land. They exhibit great variety in shapes, sizes, distances from the sea, and can be described in terms of water column characteristics and biotic complements which may differ due to dissimilar physical connections with the sea. Marine lakes are 'habitat islands' that exhibit biogeographic, ecological, and evolutionary characteristics of 'true islands' (with varying degrees of isolation), mainland fragments, or otherwise patchily distributed habitat. They present situations rare in their clarity for studying the ecology and evolution of taxa in many marine phyla. We present comparative phenotypic, phylogeographic, and biogeographic analyses of species and communities in marine lakes of Berau (N. Indonesia), Palau, and West Papua (E. Indonesia). Many marine lakes are colonized independently from the same ancestral populations, providing opportunities to examine the combined stochastic and deterministic effects of genetic drift, genomic canalization or genetic lines of least resistance, and altered adaptive landscapes. Patterns of phenotypic evolution and community assembly are repeated in multiple taxa, in multiple regions. In marine lakes, the tape of life has been run again and again.

12:30 – 12:45      WHAT MOLECULAR GENETIC MARKERS CAN TELL ABOUT EVOLUTION IN THE CORAL TRIANGLE.

Kochzius, Marc, University of Bremen, Biotechnology and Molecular Genetics, Germany.

The world's greatest diversity of marine shallow water species can be found in the Indo-Malay Archipelago, also called Coral Triangle. This high diversity can be explained by several theories, which fall into three main categories: centre-of-evolutionary-radiation from where new species disperse, centre-of-overlap of the Indian and Pacific Oceans biota, and centre-of-accumulation of species that originated in peripheral areas. Genetic studies on several taxa have shown a phylogenetic break between the Indian and Pacific Ocean, supporting the view of speciation in separated ocean basins. However, detailed studies on the genetic population structure of marine biota in the centre of marine biodiversity are rather rare, even though such information is important to understand evolutionary and ecological processes in the Coral Triangle. This presentation aims to provide a status quo of what is known about the genetic structure of coral reef biota in the Coral Triangle, which general pattern can be observed, and which conclusions can be drawn regarding the evolution of species in the region. Recent studies have shown a complex genetic population structure in many species, which can be attributed to the geological history and prevailing current regimes in the Coral Triangle. The genetic population structures are characterized by restricted gene flow between some sites and panmixing between others. The major observed genetic differentiation between the Indian Ocean and Western Pacific is most probably due to historical isolation by sea level changes, whereas current oceanographic conditions facilitate connectivity along the Indonesian Through flow on the one hand and separation at sometimes very small scales on the other hand. These factors cause vicariance between populations, which can lead to allopatric speciation, suggesting that the Indo-Malay Archipelago is a centre-of-evolutionary-radiation.

12:45 – 13:00 MARINE HOTSPOTS REVISITED: AMPHIPODS AS MODEL ORGANISMS IN THE ASSESSMENT OF CORAL REEF BIODIVERSITY.

Thomas, James, Oceanography, Nova Oceanographic Center, USA.

There is growing consensus among scientists that coral reefs are globally threatened and that decades of efforts to protect and manage reefs have largely failed to slow or reverse declines in diversity and habitat structure. Many marine conservation efforts employ "hotspot" paradigms to identify areas that subsequently become focal points for conservation and protection. Emerging research using model organisms suggests such "hotspot-based" approaches may not accurately assess diversity levels in coral reefs and their use in marine resource management must be reconsidered. An alternative predictive model based on cladistic biogeography of endocommensal coral reef amphipod crustaceans suggests that areas of exceptional diversity may result from accumulations of taxa into certain areas rather than dispersal out of supposed centers of origin. This model both confirms areas of high diversity and infers where similar situations may occur in other reef systems thus contradicting the reigning paradigms of vicariance and dispersal commonly used in marine conservation efforts. It is essential that accurate information on the quality and level of diversity in reef organisms be utilized in forward-looking coral reef research and conservation efforts.

13:00 – 13:15 MARINE KEY BIODIVERSITY AREAS IN THE PHILIPPINE HOTSPOT.

Ambal, Ruth Grace, Sheila Vergara. Biodiversity Analysis Synthesis and Monitoring Unit, Conservation International – Philippines, Philippines.

The Philippines may lay claim to a staggering percentage of all tropical marine biodiversity at the same time lay the same claim to the largest collection of threats to both marine species and habitats. Despite these challenges, partnerships and networks among marine experts in the country have organized efforts to identify and document the process of selecting marine key biodiversity areas (MKBAs) using selection criteria based on the principles of vulnerability and irreplaceability that were further refined by the presence of trigger species and manageability criteria. This paper presents the results of the first iteration of the Philippine MKBA selection.

13:15 – 13:30 ASPECTS OF DISTRIBUTION OF CORAL REEF DAMSELFISHES ALONG THE EGYPTIAN COASTS OF THE GULF OF SUEZ AND THE RED SEA PROPER.

Ebeid, Maha, Environment, The National Institute of Oceanography and Fisheries, Egypt.

The distribution of damselfishes on fifteen sites along the Egyptian coasts of the Gulf of Suez and the northern Red Sea proper was investigated. 25 species of damselfishes were counted on three 100m long and 5m wide transects on the reef-edge. The percentage cover of benthic components was also measured using three 10m long line-transects. The study revealed marked differences in the environmental conditions between the Gulf of Suez and the Red Sea proper. These differences have lead to variations in reef structure and fish communities from north to

south. Reef structure and damselfish communities of the northern Gulf of Suez are different from those of the southern Gulf which in turn are different from those of the Red Sea proper. The Red Sea proper had higher abundance and diversity of damselfishes than the Gulf of Suez. Planktivorous damselfishes were more abundant in the Red Sea proper, while herbivores were more abundant in the Gulf of Suez. Branching coral cover correlated significantly positively with the abundance of damselfishes. Reef morphology had greater influence on damselfish biodiversity than benthic composition.

## Parallel sessions

# Afternoon

## Red sea auditorium

### Session 1.3 Deep-sea and extreme environments: temporal and spatial patterns among species and ecosystems

Chairs : Pedro Martinez Arbizu; Andrew Gooday; Ana Colaco; Adrian Glover; Stefanie Keller.

15:00 – 15:15 BIODIVERSITY AND ECOSYSTEM FUNCTION IN THE ABYSS: SOURCE AND SINKS, GLOBAL WARMING AND IRON FERTILIZATION.

Smith Craig; DeLeo Fabio; Benardino Angelo; Sweetman Andrew, Oceanography, University of Hawaii at Manoa, USA.

Martinez Pedro, DZMB, Forschungsinstitut Senckenberg, Wilhelmshaven, Germany.

The abyss covers 54% of the Earth and yet the processes driving abyssal biodiversity and ecosystem function remain poorly evaluated. We synthesize developments in biodiversity and ecosystem function and explore how the abyss will respond to climate change and iron fertilization. It is postulated that abyssal biodiversity is driven by "slope-abyss source-sink" processes; we use hydrodynamic data and models to suggest that this hypothesis cannot explain abundance/diversity patterns in the vast Pacific which contains most of the abyss. Many aspects of abyssal ecosystem structure and function are strongly modulated by the quantity and quality of particulate organic carbon (POC) sinking from the surface ocean. Because deep POC flux is controlled by upper-ocean biogeochemistry, climatic and anthropogenic alterations of ocean biogeochemistry will propagate rapidly to abyssal habitats. Using data from synchronous studies of POC flux and ecosystem properties, we make quantitative predictions of changes in abyssal ecosystem structure and function expected from climate change and iron fertilization. These changes are profound and must be considered in assessments of environmental impacts of global warming and iron fertilization of the oceans.

15:15 – 15:30 GLOBAL PATTERNS OF ABYSSAL BIODIVERSITY.

Martínez Arbizu, Pedro, German Center of Marine Biodiversity Research, Senckenberg Research Institut, Germany.

Census of the Diversity of Abyssal Marine Life "CeDAMar" is an international program designed to study benthic biodiversity at greatest oceanic depths. The present contribution will review what is known about global biodiversity patterns in the abyss.

15:30 – 15:45 LONG-TERM RADICAL CHANGES IN DEEP-SEA ECOSYSTEMS - RESULTS FROM THE PORCUPINE ABYSSAL PLAIN SUSTAINED OBSERVATORY.

Billet, David; Lampitt R.S.; Bett BJ; Gooday AJ, Ocean Biogeochemistry and Ecosystems, National Oceanography Centre, Southampton, UK.

Kalogeropoulou V, Lampadariou L, Hellenic Centre for Marine Research, Heraklion, Crete, Greece.

Martínez Arbizu P, Senckenberg Institute, German Centre for Marine Biodiversity, Wilhelmshaven, Germany.

Paterson GLJ, Department of Zoology, The Natural History Museum Auditorium, London, UK.

Reid W, School of Marine Science and Technology, Newcastle University, Newcastle, UK.

Salter I, Ocean Biogeochemistry and Ecosystems, National Oceanography Centre, Southampton, UK.

Soto EH, Facultad de Ciencias del Mar y de Recursos Naturales, Universidad de Valparaíso, Viña del Mar, Chile.

Vanreusel A, Marine Biology Section, University of Ghent, Ghent, Belgium.

Wolff GA, Department of Earth and Ocean Sciences, University of Liverpool, Liverpool, UK.



Time series sampling from 1989 to 2005 on the Porcupine Abyssal Plain, NE Atlantic Ocean, 4850 m, has shown that abyssal communities change radically in abundance with time. Changes are seen in all size components of the benthic community, but are most apparent in the invertebrate megafauna. Some species have changed in abundance by over three orders of magnitude. Total megafaunal biomass, however, does not vary significantly. The increases in abundance in megafauna are of small, gelatinous species. They have a radical effect on how organic matter is processed at the sediment surface (because of their large numbers and high rate of activity) but do not lead to large-scale changes in biomass. Some elements of the macrofaunal and meiofaunal components, in contrast, show a smaller response in terms of abundance, and are likely to have a concomitant increase in biomass. The faunal changes may be related to variations in the downward flux of organic matter. Some rare species can become super-abundant with time posing questions about the functional significance of the many rare species in deep-sea ecosystems.

15:45 – 16:00      ECOLOGICAL CONNECTIVITY AMONG SEAMOUNTS: COMBINING HYDRODYNAMIC DISPERSAL MODELLING AND OCEANSCAPE GENETICS TO EVALUATE MARINE PROTECTED AREA DESIGN IN AUSTRALIA.

England, Phillip: Gunasekera Rasanthi, Marine & Atmospheric Research, CSIRO, AUSTRALIA.

Miller Keren, University of Tasmania, University of Tasmania, Hobart, Australia.

Slawinski Dirk, Marine & Atmospheric Research, CSIRO, Perth, Australia.

Audzijonyte Asta, MBARI, Moss Landing, USA.

One of the world's largest networks of temperate marine protected areas (MPA) has recently been established in south eastern Australia. These MPAs were in part designed to protect the many deepwater seamounts in the region under threat from trawl fishing. A large programme of biological dredge sampling and acoustic seafloor mapping provided an ideal opportunity to investigate spatial patterns of benthic seamount biodiversity at community and population levels. We used hydrodynamic modelling based on particle tracking in three dimensions to predict likely spatiotemporal patterns of larval dispersal in south eastern Australia. To test these predictions against observed, realised patterns of dispersal and connectivity we developed microsatellites to investigate fine-scale population structure among seamounts in three benthic invertebrates: two deep water corals and a decapod crustacean. Spatial individual-based simulation modelling parameterised with particle dispersal-based estimates of dispersal was also used to interpret observed population structure. We discuss our findings with reference to the likely adequacy of MPA size and spacing from the point of view of marine connectivity and marine biodiversity conservation in the deep sea.

## Parallel Sessions

## Afternoon

## Museum auditorium

### Session 1.10 Patterns and drivers in the distribution of marine biodiversity: in homage to John Gray

Chairs : Paul Somerfield and Richard Warwick.

15:00 – 15:15      HOW MANY HABITATS ARE THERE IN THE SEA (AND WHERE)?

Fraschetti, Simonetta: Terlizzi Antonio; Boero Ferdinando, Department of Biological Environmental Science and Technology, Laboratory of Zoology and Marine Biology, Italy.

Current policies of habitat conservation, recovery, and management are strongly biased in favour of terrestrial systems, being poorly applicable to marine environments. A sound habitat classification, leading to spatially explicit accounts on the distribution of marine habitats and communities, is crucial to identify conservation priorities aimed at preventing habitat loss. The ten major European marine habitat classifications have been here revised, and their major differences have been formally tested in terms of multivariate dissimilarity. Mediterranean-based classifications resulted rather uniform, their habitats forming a separate cluster from the rest of European ones;

these differences might be due to either distinct ecological features, or to divergences in the way habitats are classified. Either too vague or too detailed classifications, leading to cumbersome appreciations of biodiversity at habitat level, fail to provide proper tools for the conservation and management of marine environments. Different species assemblages can inhabit the same habitat type, representing the well-known natural variability that, at large scale, should not affect the appreciation of habitat distribution. An attempt at providing an unambiguous tool for the evaluation of biodiversity at habitat level is also presented.

15:15 – 15:30      DISTRIBUTION PATTERNS OF SESSILE EPIFAUNA IN THE EASTERN ENGLISH CHANNEL: COMPARISON OF 1972-1976 TO 2004-2007.

Dauvin, Jean-Claude, Foveau, Aurelie; Marine Station Wilmereux, Lille 1 University, France.

Desroy, Nicolas. Saint-Malo Station. IFREMER. France.

Dewarumez, Jean-Marie; Sandrine, Alizier; Cabrioch, Louis. Marine Biological Station. CNRS. France

The hydrodynamics in the eastern English Channel create marked sediment gradients from west to east and offshore towards the coast, and generate sediment transport. In strong current areas, pebbles and gravel dominate. They are covered by an important amount of sessile epifauna often neglected in benthic research. Nevertheless, epifauna is sensible to bottom perturbations (sand accumulation and fishery activities), and thus could be good surrogate for assessing changes in response to climatic and anthropogenic stress. By using methods for estimating species richness and rare species, like those developed by J.S. Gray, or for determining species distribution patterns, the role of sessile epifauna in marine biodiversity can be revealed. Diversity patterns at the scale of the whole eastern basin and temporal changes over the last three decades show sedimentary modifications, especially in the area around the Dover Strait. In addition, comparing the Cabrioch study done in the 1970s and our study completed in the early 2000s reveals faunal enrichment that is discussed in relation to differences in the techniques used in these studies and changes due to edaphic and climatic modifications.

15:30 – 15:45      NUMBERS AND DENSITY OF SPECIES ARE NOT THE SAME MEASURES OF BIODIVERSITY ON ROCKY SHORES ALONG THE COAST OF NEW SOUTH WALES

Underwood, Anthony. Centre for Research on Ecological Impacts of Coastal Cities, University of Sydney, Australia

Chapman, Maura G. Centre for Research on Ecological Impacts of Coastal Cities, University of Sydney, Australia

Cole, Victoria J. Department of Zoology and Entomology, Rhodes University, South Africa

Palomo, Gabriela. Museo Argentino de Ciencias Naturales, Buenos Aires

Sampling in two winters revealed increased numbers of species on rocky shores with increasing distance from north to south across 415 km of the coast of New South Wales, Australia. There was no such trend during summers. The latitudinal increase in species was due to sessile and mobile fauna. Encrusting and foliose algae did not contribute. Seasonal differences were mostly due to changing numbers of species between seasons. The numbers of species per sample-unit always increased with distance from north to south in both seasons and both years when grain-size of sampling was quadrats (scattered < 1 m apart) or sites on the shore (20 – 30 m apart). Species-density was therefore unreliable as an estimate of diversity along the coast, because it revealed spurious trends in summer. Analyses of densities, dispersions, frequencies of occurrences and multivariate dissimilarities of the organisms did not explain why species' densities showed a trend along the coast. Comparisons of diversity where species are not censused, but must be sampled, are made difficult by the dispersions of individual taxa across sample-units.

15:45 – 16:00      BIODIVERSITY IN ONE OCEAN.

O'Dor Ronald, Census of Marine Life, Consortium for Ocean Leadership, USA.

The history of life is written in the ocean, and the history of the ocean is written in DNA. The Census of Marine Life has demonstrated that we can track the relationships of man and the ocean back over 10,000 years, and that DNA Barcodes from 10,000 species in a single drop of seawater can be distinguished in hours. We now have the tools to unravel the relationships of hundreds of phyla to track this history back billions of years. These Census technologies mean that the ocean is no longer opaque or unknowable. The secrets of the largest component of the biosphere are knowable.

## Parallel Sessions

# Morning

## Polivalente Room

### Session 1.9 The Coral Triangle: patterns and processes in marine species richness and habitat diversity.

Chairs : Bert W. Hoeksema; Michael N. Dawson; Gustav Paulay; Annadel Cabanban.

#### 15:00 – 15:15 CORAL REEF CONDITION CHANGES IN THE SOUTHWESTERN CUBA.

Alcolado, Pedro M.; Hernández-Muñoz Darlenys; Busutil Linnet, Departamento de Ecología Marina, Instituto de Oceanología, Cuba.

Caballero Hansel, Departamento de Exposiciones Biológicas, Acuario Nacional de Cuba, Cuba.

Perera Susana, Departamento de Planificación de Áreas Marinas, Centro Nacional de Áreas Protegidas, La Habana, Cuba.

Hidalgo Gema, Departamento de Biología Marina, Instituto de Oceanología, La Habana, Cuba.

An ecological assessment (AGRRA) was carried out at the Batabanó Gulf (Cuba) on 2001 providing a baseline for further comparisons. A recent AGRRA assessment (2007) evaluated the impact of unprecedented frequent and intense cyclones since 2001. In the reef crest sites live coral cover reduction varied from no-change to 21%, while average coral diameter reduction varied from 16 cm to 40 cm. In forereef sites the reduction of cover varied from no-change to 14%, while diameter reduction varied from no-change to 26%. However, where little or no-change in cover and diameter was observed, great shifts occurred in species dominance. The population density of the sea-urchin *Diadema antillarum* remained negligible in the south of the gulf, while it increased significantly at the eastern Cayo Palomo reef crest. The previous significantly higher coral cover of this site reflects that hurricanes were not harmful stressors in the past.

#### 15:15 – 15:30 THE SPONGE FAUNA OF INDONESIAN MARINE LAKES AND MANGROVES.

Becking, Leontine; de Voogd Nicole J. Zoology, National Museum of Natural History, The Netherlands.

Marine lakes are land-locked salt water bodies that are thought to have been formed in the Holocene and have maintained a marine character ever since through a network of submarine connections to the sea. The marine flora and fauna of these lakes is sparsely documented, although as a result of the relative isolation from the open sea, the marine lakes are expected to harbor endemic subspecies, and new species. The objective of the present study was to document the composition of the sponge assemblages of seven marine lakes in Indonesia: three located in East Kalimantan, on the islands of Kakaban and Maratua, and four located in Raja Ampat, Papua, on the islands of Mansuar and Gam. We subsequently related the variation in species composition to habitat variables and compared the lake's composition to that of coastal mangroves adjacent to the lakes in order to establish true lake-endemics. We will present preliminary results on the sponge diversity of the Indonesian marine lakes and mangrove systems.

#### 15:30 – 15:45 RELATING SPONGE SPECIES TRAITS TO ENVIRONMENTAL VARIABLES IN INDONESIAN CORAL REEF SPONGE ASSEMBLAGES.

De Voogd, Nicole, Zoology, National Museum of Natural History, The Netherlands.

Cleary Daniel F.R., Biology, CESAM - Centro de Estudos do Ambiente e do Mar, Aveiro, Portugal.

Coral reefs in Indonesia are seriously threatened by human activities. Indonesian reefs are among the most diverse in the world, which should make them a primary target for research, protection and management. Proper conservation and management of marine biodiversity hotspots such as Indonesian coral reefs requires accurate baseline knowledge of the constituent species and environmental variables that structure these communities. There is now overwhelming evidence that global ecological changes have altered coral reef community states and driven reductions in species richness. In addition to relating species to environmental variables, a key question is to what extent evolved biological traits are associated with given environmental conditions. Very few coral reefs are located close enough to large cities to study the influence of large urban populations on reef assemblages. An exception is the Thousand Islands reef complex to the north of Jakarta, the capital city of Indonesia, and one of

the largest conurbations in the world. In the present study, we indicate that environmental conditions and sponge species traits interact to determine the composition of sponges across an Indonesian coral reef complex.

## COFFEE BREAK

### Parallel sessions

## Morning

### Red sea auditorium

#### Session 1.11 The taxonomic component of marine biodiversity

Chairs : Geoff Boxshall; Christos Arvanitidis.

16:30 – 16:45 THE MARBEF TAXONOMY CLEARING SYSTEM - A MODEL SYSTEM FOR DELIVERING DEMAND-LED TAXONOMY.

Boxhall, Geoff, Zoology, The Natural History Museum Auditorium, UK.

MarBEF established a Taxonomy Clearing System in order to: 1. Facilitate integration between the taxonomists and ecologists within the MarBEF network. 2. Provide an effective interface helping to match supply and demand for taxonomy within MarBEF. The Taxonomy Clearing System had a small budget to provide financial support to meet these objectives and solicited proposals every six months. Funding was requested for a wide variety of tasks but was always driven by demand from within the network. Tasks included the description of new marine species, the production of a fully georeferenced database of Pycnogonida and Brachiopoda species, updating of the global database on planktonic copepods and harmonising of the SAHFOS zooplankton nomenclature with that of ERMS, the delivery of specialist training in the identification of planktonic copepods, tintinnids, polychaetes, Komokiaceans, nematodes and ostracods, participation in training workshops on zooplankton, penaeid decapods, mysids, deep-sea copepods, and meiofaunal copepods, and the identification of problematic taxa such as deep-sea tanaids and copepods parasitic on polychaetes. By the end of the programme the dominance of requests for taxonomic training was very marked – suggesting a shortage of taxonomic skills.

16:45 – 17:00 DNA BARCODING OF OCEANIC PLANKTONIC OSTRACODA: SPECIES RECOGNITION AND DISCOVERY

Angel, Martin, OBE, National Oceanography Centre, UK.

Nigro Lisa; Bucklin Ann, Department of Marine Science, University of Connecticut, Groton CT 06340, USA;

Planktonic ostracods are numerically important in nearly all pelagic environments of the deep ocean, but are generally overlooked. During cruises to the Sargasso Sea (April 2006) and Tropical Eastern Atlantic (November 2007), species of planktonic ostracods were picked out live from mesoplankton samples collected from depths down to 5,000 m at nine stations. Identified specimens were submitted for DNA sequencing at sea, and a DNA barcode was determined for the 650 base-pair region of the mitochondrial cytochrome oxidase I (i.e. the mtCOI gene, which has proven useful in discriminating species of other marine crustaceans). MtCOI sequences were determined for >61 species of ostracods. Patterns of variation in this gene portion show low intraspecific variation (1% to 3%) but high interspecific variation (15% to 26%). Generally the results demonstrate the effectiveness of the mtCOI as an accurate and reliable tool for taxonomic identification of known ostracod species. However, it does not resolved phylogenetic relationships above the genus level and, in some genera, the species do not cluster together with any tree-building algorithm.

17:00 - 17:15      CRYPTIC SPECIATION IN MARINE OLIGOCHAETES REVEALED BY DNA DATA.

Erséus, Christier, Department of Zoology, Göteborg University, Sweden.

Oligochaetes are a group of segmented worms (Annelida) especially abundant in littoral and estuarine habitats of coastal regions throughout the world. Many morphologically recognized species have been reported to have wide geographical ranges, including patterns of circumtropical distribution. The genetic variation in such forms, however, indicate that the species diversity among marine oligochaetes is greatly underestimated. This presentation will give examples of ongoing studies of mitochondrial and nuclear gene sequences in such animals, revealing extensive cryptic speciation on local as well as global scales.

17:15 - 17:30      BARCODING BONES – A SECOND POPULATION OF *OSEDAX MUCOFLORIS* IDENTIFIED BY DNA FROM BONES FOUND IN A SHRIMP TRAWL.

Dahlgren, Thomas; Wiklund Helena, Department of Zoology, Göteborg University, Sweden; Glover Adrian, Natural History Museum Auditorium, London.

A barcode approach was used to investigate four large whale vertebrae collected in a shrimp trawl in the North East Atlantic. Sequencing of bone tissue showed that the bones were from a sperm whale, the third time the species is recorded in Swedish waters. A survey of the bone surfaces and collection of DNA samples from any cavities found, disclosed four individuals of *Osedax mucofloris* representing the only known naturally occurring population of that species. Population genetic analysis of the data indicates a close connection to the previously known populations at experimentally sunk whale falls, deep divergence of *Osedax mucofloris* haplotypes and a very high effective population size in the Skagerrak and the surrounding shallow seas.

17:30 - 17:45      MARINE INVENTORIES AND DNA BARCODING.

Sundberg, Per, Zoology, University of Gothenburg, Sweden.

The Swedish Taxonomy Initiative is currently undertaking marine inventories in its effort to catalogue the Swedish fauna. Marine fauna consists of many phyla, which poses problems when it comes to identifying the collected specimens. Since it is impossible to have experts covering all possible taxa on board the ship, one often has to rely on post identification of preserved material. For many taxonomic groups this makes identification difficult or in some cases impossible. It is therefore common in marine monitoring programmes to see that animals are only identified to phylum. This will of course give an inaccurate measurement of biodiversity, and will also risk hiding changes in the faunal composition. I discuss whether DNA barcoding could be used for identifying species in preserved bulk samples, and show example of how it can work. I furthermore discuss potential problems with barcoding marine invertebrates

17:45 - 18:00      ANNELID BIODIVERSITY AT EPHEMERAL CHEMOSYNTHETIC HABITATS.

Wiklund, Helena, Department of Zoology / Systematics and Biodiversity, Göteborg University, Sweden.  
Glover Adrian G, Zoology Department, The Natural History Museum Auditorium, London, United Kingdom.  
Smith Craig R, Department of Oceanography, University of Hawaii, Honolulu (USA).  
Dahlgren Thomas G, Department of Zoology / Systematics and Biodiversity, Göteborg University, Sweden.

The Skagerrak sea of the Swedish west coast is one of the most studied marine areas in the world, with at least 10 marine laboratories working in the area. Nevertheless, recent studies on newly discovered habitats such as sunken whale carcasses have revealed many new species associated with ephemeral bacterial mat communities. In this study we present new annelid species found at shallow-water whale-falls, organically-enriched sediment taken beneath fish farms, and in sunken wood-fall experiments. Molecular phylogeny analyses suggest that these annelids, specialized on ephemeral chemosynthetic habitats, are in fact closely related to littoral, sediment-dwelling annelids. A combined molecular and morphological approach has revealed a remarkable adaptive radiation of closely-related species within a complex, bacterial mat community. This radiation event is comparable to that which has occurred in other annelid groups at deep-sea chemosynthetic environments, and calls into question the theory that diverse chemosynthetic communities are only found in deep-water.

18:00 - 18:15      MORE THAN MEETS THE EYE: CRYPTIC SPECIATION IN HIPPOTHOID BRYOZOANS.

Hughes, Roger, School of Biological Sciences, Bangor University, U.K.

A total of 86 species or higher taxa were identified from the Mombasa Port survey. They consisted of 86 native species, with the most being recorded from 27 families and 14 genera of the classes Gastropoda and 25 bivalvia. 51 are noted under the OBIS database with ITIS recognition.

18:15 – 18:30     BIODIVERSITY OF DECAPOD CRUSTACEANS OF THE GERMAN SECTOR OF THE SOUTHERN NORTH SEA. -CHANGES IN SPACE AND TIME.

Sonnewald, Moritz, Marine Zoology co. Dr. M. Tuerkay, Senckenberg Research Institute, Germany.

The research area of this long term study covers the whole German sector of the southern North Sea. Epibenthic mega- and macrofauna was collected with a beam trawl during several expeditions with the German RV's Gauss, Valdivia, and Senckenberg in the period between 1986 and 2007, paying special attention to the decapod crustaceans, but the accompanying fauna was also recorded. The decapods were identified to species either on board the research vessel, sexed and counted and/or later in the home lab. The composition of the fauna was recorded and mapped in correlation with environmental data, recorded directly at the sample sites, such as depth, salinity, water temperature and accompanying benthic fauna. As a result the immigration of warm temperate species into this eastern North Sea region could be documented. It is anticipated that the species composition of this taxocoenosis will undergo dramatic changes in future in consequence of the global warming affecting also the sea water temperatures. This study is considered as a step forward in regular observation of such changes and will be repeated in future at regular intervals.

## Parallel Sessions

# Afternoon

## Museum auditorium

### Session 2.2 Biodiversity & Ecosystem Shifts: Viewed from the Bottom Up

Chairs : John R. Dolan; Wiebe Kooistra.

16:30 – 16:45     THE EVOLUTION OF COMPLEX MARINE EUKARYOTES AND THEIR IMPACT ON THE EARTH SYSTEM.

De Vargas, Colomban, Evolution du Plancton et Paléo-Océans, Station Biologique de Roscoff, France.  
Kooistra Wiebe, Marine Botany, Stazione Zoologica Anton Dohrn, Naples, Italy.

By evolving the nucleus –and consequently the active system of membranes connecting the genome to the exterior world- marine eukaryotes have greatly increased both the genetic and phenotypic complexity of biota and their modes of interactions with the Earth system. Phagocytosis, sex, and symbiosis are the first-order consequences of eukaryogenesis. The intracellular fabrications of nanoscale, organic and/or inorganic structures with catalytic roles in the physical and/or chemical performance of the cell are relatively simpler processes which, however, appear to be major forces in planetary biogeochemistry. Driven by the latest molecular phylogenetic data on eukaryotic macro- and micro-evolutions, we discuss here the timing, taxonomy/biodiversity, biological function, and ecological impact of silicate and carbonate biomineralization in marine eukaryotes. Despite being highly polyphyletic and plurifunctional, both types of biomineralization potentially rely on a suite of common cellular processes and can happen in related taxa. The successive re-inventions of eukaryotic silicate and carbonate biomineralizations have clearly imprinted Earth geochemistry. The less visible eukaryotic production of extracellular organic structures, often precursors of inorganic “skeletons”, may also have fundamentally impacted global ocean carbon cycling, and participated to the ever growing influence of eukaryotes on the shaping of the biosphere.

16:45 – 17:00     MAJOR DIFFERENCES OF BACTERIAL DIVERSITY AND ACTIVITY INSIDE AND OUTSIDE OF A NATURAL IRON-FERTILIZED PHYTOPLANKTON BLOOM IN THE SOUTHERN OCEAN

West, Nyree, Laboratoire d'Océanographie Biologique, Observatoire Océanologique de Banyuls, Banyuls sur Mer, France

The response of heterotrophic bacterial activity and diversity to a phytoplankton bloom induced by natural iron fertilization in the Southern Ocean (Kerguelen plateau) was investigated in January-February 2005. In the core of the bloom, rates of bacterial heterotrophic production ([<sup>3</sup>H] leucine incorporation) and respiration exceeded

those in surrounding high nutrient low chlorophyll (HNLC) waters by factors of 6 and 5, respectively. Based on 16S rDNA clone libraries, striking differences in the bacterial community structure within and outside the phytoplankton bloom were observed. In surface waters in the core of the phytoplankton bloom, the dominant operationally taxonomic units (OTU) were the Roseobacter NAC11-7 cluster, SAR92 and a CFB cluster related to the agg58 group, whereas in HNLC waters, SAR11, Roseobacter RCA and Polaribacter dominated. Using site-specific probes for fluorescence in situ hybridization and microautoradiography (MICRO-FISH) we observed contrasting dynamics in terms of the abundance and the relative contribution of these bacterial groups to bulk leucine incorporation. These results indicate that the Kerguelen bloom is associated with a specialized bacterial community that mediates the cycling of carbon and probably iron.

17:00 – 17:15      CONCEPTS AND DEFINITIONS IN MARINE BIODIVERSITY RESEARCH: WHERE DO MICROBES FIT THE BIODIVERSITY-FUNCTIONING DEBATE?

Gasol, Josep M., Biologia Marina i Oceanografia, Institut de Ciències del Mar-CSIC, Spain.  
Jürgens Klaus, Institut für Ostseeforschung Warnemünde, Rostock, Germany.

We will discuss how different concepts commonly used in the marine biodiversity-functioning literature can be applied to microbes. For this, we will have to dwell into what are the limitations that the methods we use carry, and we will discuss whether microbial biodiversity can be determined or not, what are the recommendations that we suggest depending on the methodologies used, and how can we approach theoretically the diversity-functioning debate from the point of view of the microbes. A special effort will be done to convey the message that since the species concept might not be applicable to most marine microbes, we will have to use other units of diversity to describe the variability in any given community.

17:15 – 17:30      ADVANCING UNDERSTANDING OF BIOGEOGRAPHY-DIVERSITY RELATIONSHIPS OF MICROORGANISMS IN THE NORTH SEA.

Sapp Melanie; Parker Ruth; Schratzberger Michaela, Ecosystem and Environment, Cefas Laboratory, UK.

Spatial scaling is an essential basis for understanding scales at which organisms interact with one another and with their environment. Large scale patterns of faunal distribution are thought to be influenced by physical environmental factors whereas smaller scale spatial heterogeneity is maintained by species-specific life history characteristics, quantity and quality of food sources, and local disturbances including both natural and man-induced events. It is still not clear which environmental parameters control the diversity and community structure of sedimentary microorganisms mediating important ecosystem processes. In this study, multi-scale patterns were elucidated at the Oyster Ground, North Sea (54°4'N/4°E) and related to biotic (e.g. multicellular organisms) and abiotic parameters (e.g. quality and quantity of carbon sources in the sediment) to establish the relationship between the distribution of both bacterial and archaeal communities and their environment. Similarities of community fingerprints at various spatial scales are discussed in the light of habitat heterogeneity.

17:30 – 17:45      COASTAL DEVELOPMENT AFFECTS DIVERSITY AND ECOLOGICAL PROCESSES OF KELP EPIFAUNA.

Marzinelli, Ezequiel; Coleman Ross; Underwood Antony; Blockley David, Centre for Research on Ecological Impacts of Coastal Cities, University of Sydney, Australia.

Urbanization of coastal habitats, particularly increased numbers of pier-pilings, jetties and seawalls along shorelines, is a global issue. Modification of marine habitats from coastal development affects diversity and abundances of organisms by altering physical and biological factors. Epibiota on man-made structures differ from those on natural habitats, but they have received considerably less attention. To understand the consequences of changes in the structure of these assemblages on ecosystem functioning, it is therefore necessary first to determine which ecological processes are being affected. In Sydney Harbour, pier-pilings support different assemblages of bryozoans on kelp from those on rocky reefs. Further, abundances of invasive species were much greater on kelp on pilings than on reefs. We tested models about differences between these habitats on the effects of physical factors (e.g. shade) and/or biological interactions (e.g. disturbance/predation) on ecological processes, such as recruitment, growth and mortality. Manipulative experiments to determine which processes regulate patterns of diversity and abundances of kelp epifauna in modified habitats will be discussed and how these relate to ecosystem functioning will be identified.

17:45 – 18:00      REGIME SHIFTS AND SPECIES LISTS: CHANGES IN THE BLACK SEA REFLECTED IN SPECIES RECORD OF THE MICROZOOPLANKTON.

Dolan John, Microbial d'Océanographie, Univ Paris 6-CNRS, Station Zoologique, France.

The Black Sea has undergone major changes from the 1960's to the present. Tintinnid ciliates of the microzooplankton have been studied in the Black Sea for over 130 years. Using historical records, a time line was constructed for each species and apparent changes in species inventories documented. The number of species recorded increased steadily from the 1870's to the mid-1960's. From the 1960's to the 1990's, with the installation of the Iron Gates dam of the Danube River and eutrophication, the frequency of new species records declined but with no apparent species losses. The 1990's to the present saw the rise and fall of the comb jelly and the collapse and recovery of the anchovy fishery, a period with increases in the number of new species and apparent losses of resident species. It appears that abrupt changes in planktonic ecosystems may be detectable with a very crude metric of community composition - lists of species.

#### 18:00 – 18:15 AN INTEGRATED MICROBIAL OBSERVATORY IN THE NW MEDITERRANEAN SEA

Lebaron, Philippe; Obernosterer, Ingrid; Intertaglia, Laurent; Laboratoire ARAGO, University Pierre et Marie Curie - Paris Universit s, Banyuls-sur-mer. France  
Gasol, Josep; PEDROS-ALIO, Carlos. Departament de Biologia i Oceanografia. Institut de Ci ncies del Mar – CMIMA. Barcelona. Spain.

Microbial Observatories are important for the discovery of unknown microorganisms and for the characterization of novel biochemical, metabolic, physiological, genomic, and other properties and processes of newly described or poorly understood microbes and microbial assemblages. An integrated Microbial Observatory has been developed on the Catalan coast of the Mediterranean sea in 2005 and is presently shared by two institutes in France and in Spain. Three sampling stations located at different depths are monitored to (i) understand the cell biology and biogeochemical activities of the major bacterioplankton groups, (ii) discover undescribed microorganisms and microbial consortia from diverse habitats and, (iii) characterize the properties and activities of newly described and poorly understood microbes and microbial communities. The ecology of a few key phylogenetic groups is currently investigated, a few new bacterial species and algae group have been described and a collection of environmental microorganisms has been developed.

#### 18:15 – 18:30 BACTERIAL COMMUNITIES ON COPEPOD FAECAL PELLETS: BIODIVERSITY, FACTORS AND FUNCTIONS.

De Troch, Marleen; Cnudde Clio; Willems Anne; Vanreusel Ann, Marine Biology, Ghent University, Belgium.

Copepod faecal pellets should not be considered as waste products since they form a unique substrate for bacteria. The bacterial communities colonizing these pellets governs their re-use. Systematic removal of pellets of benthic copepods (order Harpacticoida) in lab experiments resulted in an increased production of smaller pellets. The consumed food source (different diatoms) is deterministic for the amount of faecal pellets produced but also for the bacterial diversity on the pellets. Freeze-dried diatoms as food resulted into a more diverse bacterial community in comparison to a diet of fresh diatoms. The age of the faecal pellets is also crucial for the bacterial composition. Trophic upgrading is vital for grazers and bacteria have an important bottom-up control on grazers. On the other hand, grazers modify the diversity of the bacterial communities dependent on their need, illustrating a clear top-down control. In conclusion, the food transit through the digestive track of harpacticoid copepods causes a major change in the composition of the food associated micro-organisms. In this way, the production of faecal pellets guarantees an enrichment of bacteria in the environment.

#### Parallel Sessions

### Afternoon

#### Polivalent Room.

#### Session 1.10 Patterns and drivers in the distribution of marine biodiversity: in homage to John Gray

Chairs : Paul Somerfield and Richard Warwick.



16:30 – 16:45 BENTHOS CHARACTERISATION AND LINKS WITH CLIMATE DRIVERS OF THE NORWEGIAN CONTINENTAL SHELF AND EUROPEAN ARCTIC.

Bremner, Julie, Institute of Biology, University of Oslo, Norway.

Cusson Mathieu, Département des sciences fondamentales, Université du Québec à Chicoutimi, Chicotimini, Canada.

Renaud Paul, Akvaplan-niva AS, Tromsø, Norway.

Gray John, Institute of Biology, University of Oslo, Oslo, Norway.

This study describes patterns of abundance, diversity and assemblage structure of benthic macrofauna from the North Sea to the Kara Strait, including Svalbard and Franz Josef Land regions. Recent measurements in the Arctic coastal environment indicate these regions are presently undergoing rapid environmental change and, according to global circulation models, this rate of change is expected to increase over the next decades. In this context, it has become imperative to document assemblages in the Arctic and surrounding regions in order to track potential changes in the benthic compartment and gain a better understanding of the impact of the main drivers (e.g. productivity, SST, salinity) on the benthos and on benthic-pelagic connections. The objective of this study is to characterise and model, at various scales, the relationships between benthos diversity and climate drivers of the Norwegian continental shelf and other European Arctic regions using existing datasets. The datasets include over 100 stations spread across the region and, for many of these, repeated sampling over a decade.

16:45 – 17:00 ADDITIVE PARTITIONING OF BENTHIC MACRO-INVERTEBRATE DIVERSITY IN THE BALTIC SEA- NORTH SEA TRANSITION.

Josefson Alf, Marine Ecology, National Environmental Research Institute, University of Aarhus, Denmark.

Knowledge of how diversity changes across spatial scales is important for conservation of biodiversity. Following the concept of additive partitioning, species richness, of benthic invertebrates, was examined across three different nested scales, the cm, m and km scale in the estuarine Baltic Sea – North Sea transition area. The material used was 638 samples with 329 species from 64 sites in 7 regions; the latter defined by salinity and geographical location. Results were compared to a null model (Crist et al. 2003), randomly assigning species-individuals between samples. Beta-diversity between regions was much higher than expected, while richness was less than expected at smaller scales. Results show that regions, mainly characterised by different salinity regimes, largely determined the richness of this fauna in the area. The expected positive effect of salinity on richness was, thus, mainly apparent on the largest scale and not so much at the smaller (i.e. alpha) scales. At the sample scale, richness seemed more determined by abundance distribution of common species in each region. Conservation of diversity in this area requires a large scale approach.

17:00- 17:15 THE GRAY ZONE: RELATIONSHIPS BETWEEN HABITAT LOSS AND MARINE DIVERSITY AND THEIR APPLICATIONS IN CONSERVATION.

Airolidi, Laura; Balata David, Dipartimento Biologia Evoluzionistica Sperimentale, University of Bologna, Italy.

Beck Michael W., The Nature Conservancy and Institute of Marine Sciences, University of California, Santa Cruz, California, USA.

Structurally complex habitats are becoming rarer across temperate marine environments; indeed the coastal and marine world is getting flatter. In some cases marine habitats are lost entirely (e.g., wetlands are filled), but in many cases the loss is a gradual transition from a more complex to a less complex habitat (i.e., a change from canopy-forming to turf forming algae). We explore the multiple ways habitat loss affects marine species diversity, and propose a conceptual model that identifies the main interactions and feedbacks between these processes. The loss of habitat structure generally leads to lower abundances (biomasses) and often to declines in species richness. There is often also a suite of colonizing species that prosper from these transitions. These sets of expanding species can amplify the changes to the system, cause variable effects on species richness and other components of diversity, feed back to affect the various components of habitat loss (e.g. maintain new environmental conditions) and prevent the recovery of the system. Less well studied are the effects on between-habitat diversity and functional diversity. We argue that we need to understand these latter changes to better manage and conserve the structure and function of ecosystems and the diverse services that humans continue to expect from them. Calling for more of the approaches and thinking that John Gray championed we discuss how this work can focus efforts in research, conservation, restoration and management.

17:15 – 17:30 FAUNA ON MACROPHYTES: DIVERSITY PATTERNS AT DIFFERENT SCALES AND HABITATS.

Christie Hartvig, Department of marine biodiversity, Norwegian Institute for Water Research, Norway.

Recent studies on a number of different macrophyte systems have revealed high diversity of associated fauna on kelps, seaweeds and seagrasses. A common pattern is that these plants are inhabited by particularly high densities of amphipods, gastropods and other mobile fauna, mainly in densities beyond 100 000 individuals per m<sup>2</sup>. The fauna species distribution differs between the different species of macrophytes. However, the fauna diversity (species composition) associated with a specific macrophyte species does not change much at regional scale. Thus, the differences in fauna composition between the different macrophytes are consistent over large areas. Fauna diversity depends on habitat architecture and at micro-spatial scale along the vertical parts of the erect plants. The high functional redundancy in both plants and associated animals is probably important for the macrophyte system stability. The stability and diversity of fauna associated to macrophytes are found to be threatened by overgrazing and eutrophication.

**17:30 – 17:45 BENTHOS OF THE ARGENTINIAN CONTINENTAL SHELF: FAUNAL ASSEMBLAGES, SPECIES DISTRIBUTION AND RICHNESS ALONG A LATITUDINAL GRADIENT.**

Bremec, Claudia Silvia; Schejter Laura; Gilberto Diego; Souto Valeria, Lab. Bentos, Instituto Nacional de Investigación y Desarrollo Pesquero, Mar del Plata, Argentina.  
Acha Eduardo Marcelo, Ecología Pesquera-Plancton, CONICET-INIDEP.  
Mianzan Hermes, Ecología Pesquera-Plancton, CONICET-INIDEP.

The aim of this study was to assess benthic species composition and richness considering their spatial distribution and density, according to a latitudinal gradient in the Argentine Sea. The study area is located between 37°-44°S and 80-130m depth, with homogeneous soft bottoms. The epibenthos is dominated by *Zygochlamys patagonica* and associated invertebrates. We studied material from 167 samples obtained during 2007. In the case of Porifera, Hydrozoa (taxonomic resolution difficult) and scallop epibionts, we used previous information. A total of 129 species were registered in the study area, 90 of which were identified in our samples. Sponges and hydroids reached a total of 19 and epibionts 20 species. Most of the species were widely distributed, some showed disrupted or rare presence. Sample diversity estimates do not show a latitudinal gradient. Differences in structure of the conspicuous assemblage along the latitudinal range are attributed to variable density of the taxa. We emphasize the subantarctic origin of the fauna, related with the highly productive waters at the shelf break frontal system. This study was partially financed by Inidep, Pict15080 and 1553, Conicet5009.

**17:45 – 18:00 WHICH FACTORS CAUSE BENTHIC DIVERSITY IN A LOW SALINITY MARINE ENVIRONMENT?**

Glockzin, Michael; Zettler Michael L., Biological oceanography, Leibniz Institute for Baltic Sea Research Warnemünde (IOW), Germany.

The brackish water environment of the Baltic Sea is dominated by a strong gradient of salinity and with salinity the benthic diversity as well decreases – salinity is regarded as the master factor regulating benthic diversity in brackish habitats. But here consistently small patches of comparatively higher or lower benthic diversity do emerge – namely in areas where either environmental factors or anthropogenic impacts influencing the benthic habitat change drastically over short spatial distances. Hence, spatial diversity in ecological factors creates diversity among benthic colonization and community structures. Through multivariate and geostatistical modeling we show the possibility to determine environmental key factors and predict thereby induced benthic colonization areas and community structures inside the broad scheme of a brackish water habitat. Our work is based upon quantitative macrozoobenthic abundance data collected over a period of 4 years, making it the most comprehensive study performed in this respect in the Southern Baltic Sea up to date - it clearly demonstrates the need to analyze species' relationships in gradient systems such as the Baltic Sea and provides a tool to predict natural and anthropogenic forced changes in species distribution.

**18:00 – 18:15 FROM THE DATABASE TO THE SHORE: SPATIAL PATTERNS OF INTERTIDAL BIODIVERSITY.**

Blight, Andrew; Johnson Mark; Allock Louise; Maggs Christie School of Biological Sciences, Queen's University Belfast, United Kingdom.

The UK has a potentially rich database of species records that could be used to test hypotheses regarding intertidal biodiversity. Doubts over variation in data quality may, however, restrict such analyses. As part of a wider project we compared data from a number of UK biodiversity datasets summarized in 10 km grid squares with fixed effort field survey data, paying particular attention to algae and molluscs. There was a significant positive relationship between the data from field surveys and that of the database, implying that the 10 km grid square information is informative. Across scales, diverse assemblages of algae were found to support the most

diverse assemblages of molluscs. These local patterns exist within a background of large-scale gradients in species diversity. The larger scale patterns will be analysed with particular attention to the potential effects of habitat heterogeneity and changes in latitude and longitude.

18:15 – 18:30      STRUCTURE AND DIVERSITY OF SHALLOW SOFT-BOTTOM BENTHIC MACROFAUNA IN THE GULF OF LIONS (NW MEDITERRANEAN).

Labruno, Celine, Laboratoire d'Océanographie Biologique de Banyuls-sur-Mer, Observatoire Océanologique de Banyuls-sur-Mer, France.

Grémare Antoine, UMR 5085, Station Biologique d'Arcachon, Arcachon, France.

Amoroux Jean-Michel, Laboratoire d'Océanographie Biologique de Banyuls-sur-Mer, Observatoire Océanologique de Banyuls-sur-Mer, Banyuls-sur-mer, France.

Sardà Rafael; Gil João; Taboada Sergi, Centre d'Estudis Avançats de Blanes, CSIC, Blanes, Spain.

Samples of soft-sediment macrobenthos from 92 sites between 10 and 50 m depth were used to assess (1) the main soft-bottom macrofauna communities in the Gulf of Lions, (2) the different components of the diversity of benthic macrofauna in this area, and (3) the relevance of the use of major taxonomic groups as surrogates for the analysis of the structure and diversity of total macrofauna. Three main communities were identified by cluster analysis and associated procedures. Alpha-diversity indices were in accordance with those reported for similar communities in the Mediterranean. Conversely, the beta-diversity value was higher than the few other data available in the literature for marine soft-bottom macrofauna. The total number of species in the studied area estimated by the "Total Species accumulation curve" (TS) method was 2319, which was only 10% higher than the number obtained by extrapolation of the species-area curve. Our results show that the choice of an optimal surrogate for total macrofauna depends on the characteristic of the macrofauna to be studied. Moreover, this choice is also dependent on the environment to be studied.

## Wednesday, November 12.

### Parallel sessions

### Morning

### Red sea Auditorium

#### Session 1.1 Marine Biodiversity in Polar Regions

Chairs: Paul Renaud; Angelika Brandt; Michael Stoddart)

10:30 10:45      TESTING OLD TERRESTRIAL PARADIGMS IN ARCTIC MARINE ENVIRONMENT

Weslawski, Jan – Marcin; Włodarska-Kowalczyk, Maria; Legeżyńska, Joanna; Ecology, Institute of Oceanology Polish Academy of Sciences, Poland

Kedra, Monika, Ecology, Institute of Oceanology PAS, Poland

Since the time of Darwin and Wallace, through the mid XX century zoogeography of Ekman, several important paradigms about Arctic were formulated and went into the textbooks of ecology. As the terrestrial paradigms were useful in functional ecology and biodiversity conservation, we wanted to test them for applicability in marine

invertebrates, in the context of present climate change. As a testing ground we have used extensive collections of soft bottom macrofauna in four fjordic basins, of two different Arctic fjords (Hornsund and Kongsfjorden). The selected hypothesis were: 1) Low number of species in Arctic is compensated with the great number of animals in individual population (or Arctic species populations are more numerous compared to their boreal cousins) 2) Individuals are competing for space – given space is occupied either with higher number of species represented by few individuals or high number of individuals of few species. 3) Animals living in the cold grow larger and live longer compared to their boreal cousins 4) Larger species use more space on the expense of smaller taxa (biodiversity is higher in biota dominated by small animals). As our data shown often trends opposite to the paradigms presented above, we are trying to explain specifics of Arctic fjords by their young evolutionary age, strong disturbances and state of unsaturated niches.

10:45 11:00        BIODIVERSITY, BIOGEOGRAPHY AND FIRST RESULTS ON THE ECOLOGY OF THE DEEP SOUTHERN OCEAN BENTHOS

Brandt, Angelika, Zoological Museum Auditorium, University of Hamburg, Germany

Three recent ANDEEP expeditions collected organisms and environmental data at 40 stations between 748-6348 m water depth, increasing known biodiversity substantially and discovering many new species. Evidence is emerging that Southern Ocean deep-water faunas are linked to both adjacent shelf and other ocean basin assemblages. This linkage is complex and varies between taxa. Even though we are only beginning to understand the patterns and scale of Southern Ocean biodiversity, we now want to understand some forces that drive biodiversity and biogeographic patterns. We want to understand the function of biodiversity, the role of rare and abundant species. ANDEEP-SYSTCO (ANTarctic benthic DEEP-sea biodiversity: colonisation history and recent community patterns – SYSTem COupling) is an ambitious programme and designed to study processes in different realms of the biosphere in Antarctica and uncover how these systems are linked to each other (atmospheric-pelagic-benthic coupling processes). SYSTCO will help to close another gap in our knowledge of the Southern Ocean deep sea, the functioning of these communities. Samples will be taken during ANDEEP-SYSTCO between 28.11.2007 and 4.2.2008 and preliminary will be presented.

11:00 11:15        DIVERSITY AND DISTRIBUTION PATTERNS OF AMPHIPOD CRUSTACEANS IN OLD (ANTARCTIC) AND YOUNG (ARCTIC) POLAR ENVIRONMENTS.

Jazdzewska, Anna, Laboratory of Polar Biology and Oceanobiology, Inst. of Ecology & Environmental Protection, University of Lodz, Poland

Legezyńska, Joanna; Wesławski, Jan marcin; Department of Marine Ecology, Institute of Oceanology PAS, Poland

Jazdzewski, Krzysztof, Laboratory of Polar Biology and Oceanobiology, University of Lodz, Poland

Extensive collections of amphipods from two similar polar fjords – Admiralty Bay (Antarctic) and Hornsund (Arctic) were compared. Due to the long term studies in both basins the species lists are probably nearly complete, encompassing over 140 species from 38 families in Admiralty Bay and over 70 species from 26 families in Hornsund. Dominant species in both basins are the following: *Gondogeneia antarctica*, *Hippomedon kergueleni*, *Waldeckia obesa*, *Heterophoxus videns* and *Urothoe oniscoides* in Admiralty Bay and *Quasimelita formosa*, *Quasimelita quadrispinosa*, *Arrhis phyllonyx*, *Monoculodes packardii*, and *Ampelisca eschrichtii* in Hornsund. Their role in benthic communities (functional groups) were discussed. The observed differences in amphipod diversity, estimated with the taxonomic distinctness index, are probably caused by much longer isolation (over 20 million years) of the Antarctic environment versus short (less than 1 million years) polar history of the Arctic. The higher heterogeneity of Antarctic shelf habitats may be another reason.

11:15 11:30        BIOGEOGRAPHY OF THE SOUTHERN OCEAN: A GLOBAL PERSPECTIVE ON DEEP MACROBENTHIC DISTRIBUTIONS

Kaiser, Stephanie, Zoological Museum Auditorium, University of Hamburg, Germany

How species are distributed in space and time enhances our understanding of current and historical processes driving dispersal and speciation. Biogeographic studies on Southern Ocean (SO) fauna have focussed on very few shelf taxa. Yet, by far the largest environment is the deep sea comprising ~80% of the SO seabed. The SO is unusual, with unparalleled shelf-abyss connectivity. Furthermore Antarctic Bottom Water generated there flows into all other deep-sea areas, thus leading to great potential for interchange of Antarctic and global deep-sea faunas. The first comprehensive study on SO deep-sea biogeography is presented using isopods as a model group. Data were collated across literature and recent expeditions recording isopods. Distributions were analysed across taxonomic and bathymetric levels (shelf, slope, deep sea) to assess centres of richness and

endemism and faunal affinities to other ocean basins. Focus is then directed at a crucial biogeographic junction of the Scotia arc to interpret finer-scale patterns. The study will illustrate that to make giant leaps in understanding biogeography, we must look across scales in space and taxonomy and not just at the 'big' picture.

11:30 11:45 HIGH SPECIES RICHNESS IN AGGREGATIONS OF THE POLYCHAETE *FILOGRANA IMPLEXA* IN A SUBARCTIC TIDAL RAPID IN NORTHERN NORWAY

Gulliksen, Bjørn, Department of Aquatic BioSciences, Norwegian College of Fishery Science, Norway  
Haanes, Hallvard, Dep of Basic Sciences and Aquatic Medicine, The Norwegian School of Veterinary Science, Norway

Decreasing species richness of marine macrobenthic invertebrates from the tropics to the arctic is commonly suggested, but also opposed in reports comparing biodiversity of similar soft bottom habitats from different latitudes. Recent studies also indicate that biogenic habitats in northern latitudes like *Lophelia*-reefs (common along the Norwegian coast) and Carbonate reefs (SW Greenland) contain high species richness compared to calcareous structures at lower latitudes. Other but less known biogenic structures common in northern latitudes are the aggregations of the serpulid polychaete *Filograna implexa* Berkely, 1827, calcareous tubes forming "mini-reefs" with several levels of structure and a diameter up to half a metre. We have recorded 4663 individual invertebrates belonging to 99 species (61 solitary, 38 colonial) within such aggregations of *Filograna* constituting a total volume of only 4,4 litres (8 aggregations of different size) from a subarctic tidal rapid (Rystrømmen, Tromsø, Norway). The number of species in each aggregation was positively related to its size and indicated that the high species diversity is due to the structural heterogeneity of the aggregations, which may create microhabitats and protect against predation.

11:45 12:00 FIRST ACROSS-REALM BIODIVERSITY COMPENDIUM FOR A POLAR LOCALITY: THE SOUTH ORKNEY ISLANDS, ANTARCTICA

Barnes, David; Griffiths, Huw, Biological Sciences, British Antarctic Survey, UK  
Kaiser, Stefanie, Biozentrum Grindel and Zoological Museum Auditorium, University of Hamburg, Germany  
Linse, Katrin, Biological Sciences, British Antarctic Survey, UK

How rich are polar localities compared to those elsewhere and how does this vary across realms, e.g. on the land or in the sea? Comprehensive species lists of all realms exist for many tropical and temperate localities, especially for islands or countries, but to our knowledge not one has been established for a polar locality. This is true especially for the Antarctic where the impoverished terrestrial and fresh-water fauna is fairly well established for many islands. Studies across realms have taken place from research stations and scientific cruises to the South Orkney Islands (SOI) for about a century, and these islands must be one of the better-studied polar localities. Here we present and compare marine, intertidal, fresh-water, terrestrial and parasite levels of species richness. Many of these species are Southern Ocean/Antarctic endemics but for the islands' age and isolation, surprisingly few are endemic to SOI. In the sea we compare richness across pelagic and benthic environments, bathymetry and taxa. We explore rates of species accumulation and how these differ across Antarctic localities, model taxa and, in the sea, with depth.

12:00 12:15 BIODIVERSITY IN COASTAL ARCTIC BEAUFORT SEA

Iken, Katrin; School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, USA  
Konar, Brenda. School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, USA  
Schonberg, Susan. University of Texas at Austin.

In the coastal Alaskan Arctic, isolated boulders fields provide rare colonisable hard substrate for macroalgae and sessile epibenthic macrofauna amidst the usually soft bottom environment. Two such isolated boulder fields separated by approximately 100 km were compared for species composition and diversity in 2005. Overall species composition between both fields was very similar for macroalgae and invertebrates but species abundances varied considerably for some species, especially among the invertebrates. These differences may contribute to our understanding of large-scale versus local dispersal patterns and community dynamics.

12:15 12:30 DOES CLIMATE CHANGE INFLUENCE BIODIVERSITY OF MESOZOOPLANKTON FROM THE EUROPEAN ARCTIC MARGINAL ICE ZONE?

Blachowiak-Samolyk, Katarzyna; Kwasniewski, Slawek; Marine Ecology Department, Institute of Oceanology of Polish Academy of Sciences, Poland

Hop, Haakon; Falk-Petersen, Stig; Norwegian Polar Institute, Norway

The Marginal Ice Zone (MIZ) is one of the most important and dynamic features in the Arctic. The ongoing warming of Arctic regions will lead to a northward retreat of the sea ice, and to an earlier opening of huge areas in spring. Zooplankton, as a one of the most important prey of commercially important fishes, play a vital role in MIZ of the Arctic ecosystem. Presented study integrates vast mesozooplankton data from, environmentally sensitive, MIZ of the Barents Sea (May 1999), Fram Strait (May and August 2003) and northern Svalbard waters (August 2003). Comparison of Atlantic (warm) vs. Arctic (cold) zooplankton communities will be provided with use of common biodiversity measures. One of the leading result of the study indicates increasing number of species in deep zooplankton of Fram Strait contrary to shallow waters zooplankton of the Barents Sea. The distribution of typical temperate water meso- and bathypelagic zooplankters reflects the pattern of Atlantic water circulation, which enters the Arctic Ocean north of Svalbard and extends to the east as a cyclonic boundary current along the Eurasian continental.

12:30 12:45 BIOGEOGRAPHY OF THE MAGELLAN - ANTARCTIC ECHINOIDS. FORECASTS FOR ITS EVOLUTION

David, Bruno, Biogeosciences, University of Burgundy, France

In the context of global warming, the relationships between South America and Antarctic benthic fauna are of particular interest. Indeed, southward migrations of cold temperate fauna can be expected as the Magellanic area is largely in connection with the Antarctic Peninsula via South Georgia and South Sandwich islands and via ridges surrounding the Scotia Sea. Biogeographic comparisons of echinoid fauna have allowed to settle links between South American and Polar biomes in the area of the Weddell quadrant. The data analyzed cover more than 150 years of exploration, up to the most recent cruises. Comparisons have been done considering several sub-regions (South Shetlands, Peninsula, Weddell Sea, Tierra del Fuego, South Argentina...). They involve analyses of raw distribution data of the whole echinoid fauna, but also take in consideration more specific aspects such as reproductive strategies, feeding habits, or phylogeny. All these aspects allow to set hypotheses for the evolution of the echinoid fauna in the forthcoming decades, particularly regarding what group(s) would be more prone to migration/extinction processes as enhanced by the global warming.

12:45 13:00 BIODIVERSITY, BIOGEOGRAPHIC STRUCTURE AND QUANTITATIVE DISTRIBUTION OF BRYOZOANS IN THE CHUKCHI SEA AS A COMPONENT OF ECOSYSTEM OF THE SEA

Denisenko, Nina, Marine research department, Zoological Institute of the Russian Academy of Sciences, Russia

Bryozoan fauna of the Chukchi Sea has not been the focus of many investigations. In contrary to 126 species marked in the Russian publications until 2001, our species list includes 188 species. 52 species were added after analyzing of international publications and 10 species were found for first time in the samples collected in 2004-2005. Construction of prognostic model demonstrates the possibility of an increasing of genus and species richness of bryozoans in the Chukchi Sea. Clusterization procedure of similarity indexes calculated on comparison of species composition at the stations determines two faunal groups: one of them is located in the Bering Strait and in the eastern part of the sea, the second - in the western part of the sea, in the Gerald trough and near the Wrangell Island. The Chukchi Sea bryozoan fauna is more similar to the Bering Sea fauna than to the fauna of the Arctic Seas. Influence of the Pacific water masses influence on biogeographic structure too. The most number of bryozoan species are the Pacific boreal-arctic species and wide spread boreal-arctic species. Shares of the Arctic and boreal pacific species are approximately equal and the boreal forms predominate the arctic species (12.5 and 10.9 % correspondently). The most diverse fauna is registered in the Bering Strait and near capes on hard bottom on depth 20-50 m. Variations of biomass values of the sessile organisms correspond to distribution of gravel and pebble in the sea and. Bryozoans biomass varies from 0.5 to 92.0 g/m<sup>2</sup>.

13:00 13:15 ANTARCTIC BENTHIC DIVERSITY: LOCAL TO REGIONAL PATTERNS, AND RELATIONSHIPS WITH PRODUCTIVITY

Glover, Adrian; Nealova, Lenka, Zoology Department, The Natural History Museum Auditorium, UK  
Mincks, Sarah, Institute of Marine Science, University of Alaska, USA  
Sumida, Paulo, Instituto Oceanografico, University of Sao Paulo, Brazil  
Smith, Craig, Department of Oceanography, University of Hawaii, USA

The recent multi-disciplinary 'FOODBANCS' study on the West Antarctic Peninsula (WAP) continental shelf has shown for the first time how benthic food quality and availability is tightly coupled to both seasonal and inter-annual surface water production. Low rates of bacterially-mediated remineralization of organic carbon flux are

thought to create a rich sediment 'food bank' of bioavailable material, supporting detritivores throughout the lean winter months. Here we present the first biodiversity data from the FOODBANCS study sites for the polychaete assemblage, which represents approximately 70% of the macrofauna by abundance. A strong cross-shelf gradient was observed, with a positive correlation between productivity (as measured by sediment food quality) and species diversity. Locally, high levels of dominance were observed, with up to 70% of the polychaetes in some samples represented by a single species of spionid. Local diversity on the Antarctic shelf is significantly lower than for the deep-sea. However, our analyses suggest that at a regional level, habitat heterogeneity may drive relatively high beta-diversity on the Antarctic shelf.

13:15 13:30 EPIBENTHIC MEGAFaUNA IN THE NORTHERN BERING AND CHUKCHI SEAS, ARCTIC

Mincks, Sarah; Bluhm, Bodil; Iken, Katrin; Iken, Katrin; Institute of Marine Science, University of Alaska, Fairbanks, USA

Sirenko, Boris, Zoological Institute, Russian Academy of Sciences, Russia

Epibenthic megafaunal invertebrate communities were studied in the Northern Bering and Chukchi Seas from beam trawl hauls at a total of 29 stations during one cruise in 2004 and two cruises in 2007. Gross abundance and biomass estimates ranged from 370 to 73,000 individuals per 1000m<sup>2</sup> and from 1.6 to 73kg wet weight per 1000m<sup>2</sup>, respectively. Biomass was particularly high in Herald Canyon and in the Bering Strait area. Echinoderms, especially ophiurids (*Ophiura sarsi*), various sea stars and sea urchins (*Strongylocentrotus droebachiensis*) had by far the highest biomass (and often abundance) values at most stations. Crustaceans, especially crabs (*Chionoecetes opilio* and *Hyas coarctatus*) and shrimps (*Argis* lar and others) dominated in terms of abundance at some stations. Other dominant groups included gastropods and cnidarians. Megafaunal species richness ranged from 16 to 53 per station with mollusks and crustaceans contributing most to overall species richness. Multi-dimensional scaling techniques, based on species relative biomass, grouped the stations primarily by substrate type rather than by water masses. Several northern range extensions were recorded during the 2004 expedition.

## Museo Auditorium

### Session 3.1 Assessing the consequences of large-scale biodiversity change

Chairs: Boris Worm; Heike K. Lotze

10:30 10:45 CONSEQUENCES OF DEPLETING LARGE PREDATORS IN OCEAN FOOD WEBS

Worm, Boris, Biology Department, Dalhousie University, Canada

Declining abundance and diversity of large predators, such as tuna, billfish, sharks, and large groundfish is a pervasive aspect of marine biodiversity change. Here I attempt to quantify the general magnitude of change in marine predator abundance and diversity and to trace the wider ecosystem consequences. Large-scale observational and experimental evidence suggests that top-down effects of marine predators can lead to a fundamental reorganization of marine food webs. While changes can cascade through multiple consumer levels, attenuation of such effects at the zooplankton level may be typical in the ocean. New empirical evidence also supports the idea that the depletion of large predators can 'flip' ecosystems into alternative states. These novel findings, when taken together, suggest oceanic top-down control is more prevalent than has been appreciated. This underscores the need to consider potentially complex ecosystem effects of exploiting marine predators and the importance to maintain these species above thresholds of ecological extinction.

10:45 11:00 ECOSYSTEM CONSEQUENCES OF HISTORICAL BIODIVERSITY CHANGES IN COASTAL WATERS

Lotze, Heike, Biology Department, Dalhousie University, Canada

Coastal ecosystems have been influenced by multiple human impacts throughout history. Only recently, however, have we started to quantify the magnitude of historical changes in marine animal populations and their supporting ecosystems. Here, I investigate the consequences of long-term biodiversity changes for ecosystem structure and functioning, the services these systems provide for human well-being, and the recovery potential of depleted

populations. Large declines and shifts in marine biodiversity have altered the fundamental species composition of coastal ecosystems. These changes translate into altered food-web structure, habitat availability, and filtration capacity, leading to quantifiable losses in fisheries production, water quality control, and coastal protection. The recovery of populations depends on the magnitude and time-span of past depletion as well as on life-history parameters. I will contrast cases where multiple human impacts have impaired recovery, with those where management actions have enabled species and ecosystem functions to recover.

11:00 11:15      IMPACTS OF HISTORICAL DEGRADATION ON ECOSYSTEM STRUCTURE IN MARINE FOOD WEBS

Coll Monton, Marta, Biology Department, Dalhousie University, Canada

Marine ecosystems have been subjected to anthropogenic influences for thousands of years possibly leading to increasing ecological degradation of marine food webs. Historical degradation may have resulted in a reduction of higher trophic levels, simplification of food-web structure, and changes in productivity. Here we quantify and compare marine food-web properties across different historical time periods. We assembled feeding networks for multiple study regions and used two different modeling approaches: stochastic and mass-balance modeling. Differences in food-web structure and emerging properties across sites and time periods were explored with non-parametric ANOSIM and SIMPER procedures (PRIMER) based on multi-dimensional scaling (MDS) of the Bray-Curtis dissimilarity index. A meta-analysis was performed to test for differences among study sites. Results indicate strong similarities in food-web structure in early time periods (pre-human, hunter-gatherer and agricultural periods), but significant differences compared with later time periods including local and regional markets and early and late global periods. In the latter group, ecosystems showed higher degradation with time in terms of overexploitation of higher trophic levels, simplification of food-web structure and changes in productivity allocation.

11:15 11:30      RANGE CONTRACTION AND FRAGMENTATION IN LARGE, HIGHLY MOBILE PELAGIC FISHES

Tittensor, Derek; Worm, Boris; Biology, Dalhousie University, Canada

Tunas and billfishes are large, often highly migratory pelagic predators. Several species have experienced substantial depletions in abundance since the onset of industrialised fishing (e.g. Myers & Worm 2003). Yet it remains unclear whether there have been corresponding changes in range sizes and connectedness. We examined global Japanese longlining log-book data from the 1960s to the 1990s to determine what, if any, changes have occurred in the range distributions of these species during this period. We compare our results to characteristic patterns of range contraction and fragmentation in terrestrial systems under human impact, and consider the likely consequences of such changes.

11:30 11:45      DECLINES IN HIGHER TROPHIC LEVEL FISH DECREASE COASTAL RESISTANCE TO EUTROPHICATION

Eriksson, Britas Klemens, Department of Marine Benthic Ecology and Evolution, University of Groningen, The Netherlands

Ljunggren, Lars; Sandström, Alfred; Institute of Coastal Research, Swedish Board of Fisheries, Sweden

Johansson, Gustav, The Foundation of Uppland, Sweden

Mattila, Johanna, Husö Biological Station and the Department of Biology, Åbo Akademi University, Finland

Rubach, Anja, Institute of Botany, University of Cologne, Germany

Räberg, Sonja, Department of Botany, Stockholm University, Sweden

Snickars, Martin, Husö Biological Station and the Department of Biology, Åbo Akademi University, Finland

Sieben, Katrin, Department of Marine Benthic Ecology and Evolution, University of Groningen, The Netherlands

Coastal eutrophication and exploitation of higher trophic levels of marine fish are parallel processes that we need to consider jointly. In the Baltic Sea, blooms of opportunistic filamentous algae from increased nutrient loads and strong local declines of coastal predatory fish are challenging nuisances for coastal management. Using field-data from nine areas covering a 700 km coastline, we found that the trophic composition of the fish community correlated strongly with the large-scale distribution of bloom-forming macroalgae. Areas with depleted top-predator communities displayed massive increases in smaller bodied fish and high covers of ephemeral algae. Additional small-scale field experiments demonstrated that exclusions of larger predatory fish and enrichment with agricultural nutrient fertilizer had similar effects; both factors doubled the net production of opportunistic macroalgae. This shows that coastal fish community composition and nutrient availability both are important in the development of macroalgal blooms. Our results suggest that regional declines of larger piscivorous fish may



decrease coastal resistance to eutrophication by releasing top-down control on algal production, generating high covers of opportunistic filamentous algae.

11:45 12:00 CONSEQUENCES OF BIODIVERSITY CHANGES FOR ECOSYSTEM FUNCTIONING:  
COMBINING LONG-TERM OBSERVATIONS, EXPERIMENTS AND MODELLING.

Hawkins, Steve, College of Natural Sciences, Bangor University, UK  
Mieszkowska, Nova, Marine biodiversity and climate change, Marine Biological Association of the UK, UK  
Moore, Pippa, School of Biological Sciences, University of Plymouth, UK  
Poloczanska, Elvira, Marine and Atmospheric Research, CSIRO, Australia  
Sugden, Heather, College of Natural Sciences, Bangor University, UK  
Burrows, Michael T., Ecology Department, Scottish Association for Marine Science, UK

Major shifts in distribution of rocky shore species have been recorded in recent years. The extent of poleward movement is idiosyncratic and dependant upon life history characteristics, dispersal capability and habitat requirements. Models have been developed predicting likely assemblage composition based on future environmental scenarios. We take quantitative and qualitative forecasts to explore the functional consequences of changes in differences in identity and species richness of Gastropod grazers and foundation species such as barnacles for ecosystem functioning. The balance of primary producers and secondary consumers and import and export of production from shores is predicted to change along wave action gradients and with latitude in a warming world.

12:00 12:15 INTERACTIVE EFFECTS OF RED AND WHITE NOISE PROCESSES ON MARINE COASTAL  
BIODIVERSITY: IMPLICATIONS FOR PREDICTING CHANGES IN STRUCTURE AND FUNCTION OF COASTAL  
SYSTEMS

Benedetti-Cecchi, Lisandro; Tamburello, Laura; Bertocci, Iacopo; Maggi, Elena; Vaselli, Stefano; Bulleri, Fabio;  
Department of Biology, University of Pisa, Italy

Increasing levels of autocorrelation and accelerating rates of change in ecological drivers are distinctive features of current environmental modifications. Autocorrelated processes display a negative relationship between variance and the scale of observation (red noise), while processes changing abruptly in space or time have large variance also at small scales (e.g. white noise). We used a combination of long-term observations and large-scale field experiments to test the hypothesis that disturbances characterized by different scales of variability (as determined by their spectral coefficients) affect marine coastal biodiversity interactively. Observational data originated from our own work and from publically available resources. Experiments were repeated in three habitats (intertidal and subtidal algal stands and seagrasses) and consisted in disturbing algal canopies and entire assemblages along transects in factorial combinations, to simulate realistic spatial red and white noise processes, respectively. Statistical models that included interactions among predictor variables generally explained a larger amount of variability in response variables than additive models. These results indicate that the effects of environmental drivers operating at different scales cannot be predicted by examining each driver in isolation.

12:15 12:30 MECHANISMS & PARADIGMS UNDERPINNING CLIMATE-DRIVEN SHIFTS IN MARINE  
BIOGEOGRAPHY.

Mieszkowska, Nova, Marine Biodiversity and Climate Change, Marine Biological Association of the UK, UK  
Burrows, Mike, Scottish Association for Marine Science, Scotland  
Hawkins, Steve, University of Bangor, UK

Long-term datasets of the abundance and distribution of rocky intertidal species along the European coastline have demonstrated large biogeographical range shifts in species of both boreal and lusitanian origin since the onset of rapid climate warming in the 1980s. These changes are up to 10 times greater than shifts observed for terrestrial species, are species-specific, and are likely to be accelerating. Brown's abundant centre distribution theory has been much criticised in recent years, however, this theory holds true for European intertidal invertebrates and we identify physical and environmental parameters that are likely to be driving this relationship. In conjunction with abundance/distribution analyses, we use time-series data of population dynamics, recruitment and reproductive cycles close to northern range limits to determine the dynamics of macro-ecological patterns and identify mechanisms setting geographic limits. In combination, these data provide a toolbox with which to forecast future climate-driven changes in marine communities.

12:30 12:45 CLIMATE ENVELOPE MODELS TO PREDICT THE GEOGRAPHICAL DISTRIBUTIONS OF THE ENDEMIC MEDITERRANEAN ICHTHYOFAUNA UNDER CLIMATE WARMING SCENARIOS

Ben Rais Lasram, Frida, Unité de Recherche Ecosystèmes et Ressources Aquatiques, Institut National Agronomique de Tunisie, Tunisia

Marine fish communities are changing drastically in response to climate change. This is even more critical in semi-closed areas such as the Mediterranean, a hotspot of endemism. The ability to predict the extension or the contraction of endemic species ranges is therefore highly desirable because they are of primary importance in biodiversity conservation. Climate envelope models have become relevant tools for such an issue: they use the current distributions of species to deduce their climatic requirements. Based on these requirements, future distributions can be predicted under climate changes. In this study, we provide a comparison of different methods for predicting fish geographic distributions in the Mediterranean (multiple regressions, regression trees and learning methods): we (1) model the distributions of the 79 Mediterranean endemic fishes as a function of monthly temperatures, (2) predict the future distributions according to the IPCC scenarios and (3) identify the winner and the loser species according to the gains or the gaps in their predicted distributions. To our knowledge, this is the first study to address the effects of global warming on the endemic Mediterranean ichthyofauna.

12:45 13:00 PREDICTING LARGE SCALE CHANGES IN KELP FOREST – SEA URCHIN DISTRIBUTIONS AND POSSIBLE ECOLOGICAL CONSEQUENCES

Rinde, Eli; Norderhaug, Kjell Magnus; Christie, Hartvig; Bekkby, Trine; Biodiversity and Eutrophication in Marine Environments, Norwegian Institute for Water Research (NIVA), Norway

In temperate and rocky coastal areas, productive and species rich kelp systems have been transformed to low productive and species poor barren grounds at large spatial scales. Along the Norwegian coast, this phenomenon occurs between 64-71°N, where large kelp areas have been transformed to barren grounds for more than 3 decades. Recent investigations indicate a gradual recovery of the barren grounds in the southern area. Utilising detailed spatial data sets in predictive habitat modelling, combined with knowledge of the main physical factors that control the distribution of kelp forests and barren grounds, we have developed probability maps of the distribution of these two distinct stages. Further, by assessing the spatial extent of the two stages of the ecosystem, and the temporal changes in their distribution, we have estimated the associated changes in ecosystem structure and functioning, such as kelp standing stock and primary production. Implications for diversity of benthic plants and animals will also be discussed.

13:00 13:15 CHANGES IN PLANKTON DYNAMICS AND BIODIVERSITY IN THE OLIGOTROPHIC BAY OF CALVI (CORSICA, NORTHWESTERN MEDITERRANEAN): RESPONSE TO CLIMATE CHANGE

Goffart, Anne; Hecq, Jean-Henri, Oceanology, University of Liège, Belgium

The development of the winter-spring phytoplankton bloom is investigated in the Bay of Calvi (Corsica, Ligurian Sea, Northwestern Mediterranean) since 1979. A drastic reduction of phytoplankton biomass is evidenced over the last three decades. Changes in phytoplankton dynamics and biodiversity are discussed in relation to long-term changes in wind stress, NAO conditions and environmental conditions. As a consequence, time-series results enlighten that the entire food web dynamics is affected and that ecosystem resilience is threatened.

13:15 13:30 PATTERNS OF CHANGE AT COMMUNITY LEVEL: TROPHIC SHIFTS AND TAXONOMIC DISTINCTNESS AT SEAGRASS BEDS MACROBENTHIC COMMUNITIES INVADED BY SEaweEDS

Deudero, Salud, Biology, Universitat Illes Balears, Spain

Invasive seaweeds *Caulerpa racemosa* and *Caulerpa taxifolia* colonise wide areas of *Posidonia oceanica* seagrass beds at the Balearic Islands (Western Mediterranean). Patterns of change in macrobenthic communities are discussed along with trophic shifts at the community level.

## Polivalente Auditorium

### Session 2.5 Marine bioinvasions and ecosystem functioning

Chairs: Sergej Olenin; Anna Occhipinti Ambrogi; Stephan Gollasch

10:45 11:00 CLIMATIC REGULATION OF INVASION IMPACTS ON NATIVE DIVERSITY AND ECOSYSTEM FUNCTIONING

Queiros, Ana; Kaiser, Michel Joseph; Hiddink, Jan Geert; Coastal Resource Ecology and Management, School of Ocean Sciences, College of Environmental Sciences, Bangor University, UK  
Nogueira Cabral, Enrique, Instituto de Oceanografia, Faculdade de Ciencias, Universidade de Lisboa, Portugal

Invasive ecosystem engineers are high impact species because they modulate resources and contribute disproportionately to ecosystem functioning. These invasions can lead to changes in native diversity that relate to invasive species' trade-offs between competitive ability and abiotic stress tolerance. We investigated how climate regulates invasion impacts on biodiversity and ecosystem functioning, through changes in functional importance of invasive species. Abundance distributions of the invasive bioturbating clam *Ruditapes philippinarum* were determined at four sites across a latitudinal temperature gradient in Europe. Species richness increased with the oxygenation depth of superficial sediments, which was explained by higher densities of *R. philippinarum*. This relationship was stronger when climatic conditions were optimal for the invasive, and when bioturbation contributed more to sediment oxygenation relative to environmental processes. Experimental manipulation of community evenness, and richness, across temperature treatments corroborated the functional importance of this species in invaded communities. Bioturbation was enhanced where the species was present, and dominant, and when temperature was optimal for *R. philippinarum*. This study provides evidence for climatic regulation of biodiversity and ecosystem functioning relationships through changes in species functional importance.

11:00 11:15 THE ROLE OF INTRODUCED PONTO-CASPIAN CRUSTACEANS IN THE ESTUARINE SYSTEMS OF THE BALTIC

Razinkovas, Arturas; Gasiunaite, Zita; Lesutiene, Jurate; Coastal Research & Planning Institute, Klaipeda University, Lithuania  
Berezina, Nadezhda, Laboratory of Freshwater and Experimental Hydrobiology, Zoological Institute RAS, Russia

The role of Ponto-Caspian crustaceans (mysid and gammarid species) was assessed in two estuarine habitats in the Baltic – Curonian lagoon and the Neva estuary. Based on the gut content analysis (Curonian lagoon and Neva estuary) and stable isotope analysis (Curonian lagoon) the role of introduced mysid (*Paramysis lacustris* and *Limnopsis benedeni* in the Curonian lagoon) and gammarid species (*Pontogammarus robustoides* and *Pontogammarus crassus* in the Curonian lagoon and Neva estuary) in the littoral zone were assessed. Differences between the stable isotope and gut content analysis based approach were discussed. The results point toward high ontogenetic diet differences among the species, but no significant seasonal variation. Compiled ECOPATH food web model was used to assess energy and matter flows in both ecosystems and the quantitative role of the introduced crustaceans. Niche overlap between native and introduced species was calculated as well as ecotrophic efficiency of main food items to evaluate the ecosystem role. A possibility to reconstruct pre-invasion foodweb is discussed.

11:15 11:30 SEBI2010 SUBINDICATOR "CUMULATIVE NUMBER OF MARINE ALIEN SPECIES IN EUROPE SINCE 1900"

Zenetos, Argyro, Institute of Marine Biological Resources, Hellenic Centre for Marine Research, Greece  
Josefsson, Melanie, Swedish Environmental Protection Agency, Sweden  
Baldursson, Snorri, Icelandic Institute of Natural History, Iceland  
Larsson, Tor-Bjorn, EEA, Denmark

The potential threat that alien species pose to biological diversity can be illustrated in the cumulative number of alien species. The indicator 'Cumulative number of marine alien species in Europe since 1900' is developed by the SEBI2010 WG5 and shows the cumulative number of alien species established in Europe from 1900 onwards using 10-year intervals. Trends are illustrated for all of Europe, but can be broken down to individual Large Marine Ecosystem (LME) or countries as well as per selected taxonomic groups. A simple information system has been developed in the Hellenic Centre for Marine Research (HCMR) to serve developing this indicator. This is the most immediately available information (monthly updated) that indeed highlights the (potential) pressure from alien species. The rate of alien species establishment has clearly increased steeply during the recent decades (and the pathways are well known). Short term changes may be difficult to discern in the trend. In future, it is envisaged to combine this information with a subset of 'European worst invasive alien species' (from 1990); including additional layers of information on impact and distribution.

11:30 11:45      The impact of the introduction of the two ascidians: *Aplidium argus* and *Aplidium nordmanni* on the native Mediterranean species, *Aplidium conicum*

Chebbi, Nadia, Halieutic, National agronomic institute of Tunis, Tunisia

Mastrototaro, Francesco, zoologu, University of Bary, Italy

Missaoui, Hechmi, halieutic, National agronomic institute of Tunis, Tunisia

The ascidian *Aplidium conicum*, Mediterranean native species, had abundant in Tunisian coast up to nowadays. These species present more variability: two types of colours: white and orange and live in variable depth. *A. conicum* is invaded in his environment by two species *Aplidium argus* and *Aplidium nordmanni*, atlanto-mediterranean species, but more abundant in the Atlantic than the north Mediterranean. These two species, habitually of cold water, are recorded for the first time in Tunisian coast (south Mediterranean) in the gulf of Tunis and the gulf of Hammamet. The presence of these species is probably the consequence of phenomenon like the global warming that tends to homogenize the water between the two parts of Mediterranean north and south. In the other hand, the increase of navy traffic allowed the put in of this species in south Mediterranean particularly in Tunisian coast favourable environment of her development. In this paper we demonstrate the impact of the introduction of these two species in the Tunisian coast on the native Mediterranean species (comparison of abundances, spatial and temporal distributions).

11:45 12:00      IMPACT OF NATIVE AND INVASIVE ALGAL WRACK ON MACROFAUNAL ASSEMBLAGES IN SANDY BEACHES

Rodil, Iván; Olavaria, Celia; Lastra, Mariano; Jesús, España; Ecología y Biología Animal, Universidad de Vigo, Spain

Many sandy beaches worldwide receive large amounts of drift seaweed, i.e. wrack, from offshore algal beds and closer rocky shores. Algal wrack has been reported as a key resource (food and/or refuge) on sandy beaches affecting biodiversity and abundance of intertidal organisms including shorebirds. Despite the importance of wrack in structuring intertidal assemblages, the role of type of wrack and its location on the shore has not been explored experimentally to date. Manipulation of two species of brown seaweeds, i.e. artificial wrack patches made up of the native *Saccorhiza polyschides* and the invasive species *Sargassum muticum*, was carried out to test hypotheses about influences on macrofaunal assemblages inhabiting exposed sandy beaches. Results pointed out that a change in the type of wrack entering a beach may alter the macrofaunal assemblages. Macrofauna abundance, diversity and number of species varied significantly between both types of wrack, although this pattern was not consistent between heights on the shore over time. Data also provided evidences that nutritional content and microclimatic conditions of different types of wrack might affect macrofaunal assemblages.

12:00 12:15      PHYLOGEOGRAPHY, LIFE-HISTORY AND ECOLOGY OF THE GLOBAL MARINE INVADER *MICROCOSMUS SQUAMIGER* (ASCIDIACEA)

Rius, Marc; Pascual, Marta; Department de Biologia Animal, Universitat de Barcelona, Spain

Marshall, Dustin J., Centre of Marine Studies, The University of Queensland, Australia

Griffiths, Charles L.; Branco, George M.; Centre of Invasion Biology, Zoology Department, University of Invasion Biology, Zoology Department, South Africa

Pineda, Mari Carmen, Departamet de Biologia animal, Univrsitat de Barcelona, Spain

Turon, Xavier, Centre for Advanced Studies of Blanes, CSIC, Spain

The solitary ascidian *Microcosmus squamiger* is nowadays widely distributed around the world. Both inside and outside of harbours, and in aquaculture facilities, this species can colonise all available substrata forming monospecific beds. We undertook a phylogeographic genetic study using worldwide samples and concluded that *M. squamiger* is native to Australia and has expanded through shipping to other continents. We conducted a life cycle study and found that *M. squamiger* populations are annual and that their abundance and reproductive maturity peak in summer. In the laboratory we found that embryos developed between 15 and 25°C, that larvae have a swimming time of a few hours and that settlement occurs preferably between 20 and 25°C. Larvae exhibited geotactic but not phototactic behaviour. Experiments involving *M. squamiger* and *Styela plicata* suggested that population dynamics of native and invasive species are ruled by interactions occurring during the early phases of their life-history. Our multidisciplinary study highlights the need of a combined approach to gain knowledge of biological parameters of relevance to effectively implement management plans in areas where this species might become a pest.

12:15 12:30      FITTING THE INVASION HISTORY OF THE ALIEN XENOSTROBUS SECURIS (MOLLUSCA, MYTILIDAE) IN RIA OF VIGO (NW SPAIN)

Pascual, Santiago, Ecology And Marine Biodiversity (Ecobiomar), Investigaciones Marinas (CSIC), Spain  
Posada, David, Genetica, FACULTAD DE CIENCIAS. UNIVERSIDAD DE VIGO, Spain  
Villalba, Antonio; Abollo, Elvira; CENTRO DE INVESTIGACIÓN MARIÑAS (XUNTA DE GALICIA), Spain  
Nombela, Miguel Angel, Edafologia y estratigrafía, FACULTAD DE CIENCIAS. UNIVERSIDAD DE VIGO, Spain  
Gonzalez, Angel F.; Garcia, Muel E.; Guerra, Angel; Ecobiomar, INSTITUTO DE INVESTIGACIONES MARINAS (CSIC), Spain

Biological analysis and environmental characterization of the non-indigenous invasive species *Xenostrobus securis* was undertaken in the Ria of Vigo. This study included genetic identification and traceability, parasites, species abundance, biomass distribution, and sediment composition of substrata type per site. Genetic results suggest two temporally-spaced events of colonization of *X. securis* in the Ria of Vigo. This pigmy-mussel has a very patchy distribution, being more abundant in brackish sites with fine sediments and high organic matter content. Nevertheless, the results indicated an absence of preference in substrate utilization, which may be due to a passive retention through tidal cycle and flow circulation constraints operating to explain the spatial pattern distribution of the observed aggregated populations of *X. securis* in the Ria de Vigo. Furthermore, field observations also indicate the use of exploited oysters as substrata for settlement of *X. securis*. A three-year study of ecological observations in the field allows us to fit a starting point of ecosystem invasion of the pigmy mussel *X. securis* in Galician estuarine waters.

12:30 12:45      KAMCHATKA CRAB (PARALIRHODES CAMTSCHATICUS) IN THE BARENTS SEA: A REVIEW OF THE STATUS AND IMPACT ON THE ECOSYSTEM

Sokolov, Vasily, Laboratory of commercial invertebrates, Russian Federal Research Institute of Fisheries and Oceanography (VNIRO), Russia  
Spiridonov, Vassily, Laboratory of coastal ecosystems, P.P. Shirshov Institute of Oceanology of the Russian Academy of Sciences, Russia

A review of the extensive literature on the Kamchatka crab *Paralithodes camtschaticus* intentionally introduced in the Barents Sea in the 1960s is presented. The following topics are discussed: establishing and growth of the Kamchatka crab population in the new environment, contemporary limits of distribution, reproduction, life history and migrations, habitat preferences of particular age groups, feeding and impact on the ecosystem, differences between native and introduced populations. Between 1980 and 2001 the largest in the world West Kamchatka population was one order of magnitude more abundant than the Barents Sea population and reached of about 137 million specimens. Therefore, the Barents Sea population will most probably grow for some time. Thus the stock of Kamchatka crab only in the Russian zone of the Barents Sea in 2003-2005 was estimated as approximately 100 million specimens, including 40-50 million mature specimens (Sokolov, Miljutin, 2008). The analysis of dynamics of Kamchatka crab annual stocks and distributions in the Barents Sea indicates that the acclimatization theory developed for short-living species is not appropriate for understanding the processes in the artificially established population of Kamchatka crab.

12:45 13:00      THE PROMINENCE OF NATIVE BLUE MUSSELS AS ECOSYSTEM ENGINEERS IN THE INTERTIDAL FLATS OF THE WADDEN SEA IS REPLACED BY ALIEN OYSTERS: STATUS QUO OF SYSTEM CHANGE

Markert, Alexandra; Esser, Wiebeke; Werham, Achim; Dept. for Marine Research, Senckenberg Institute, Germany

10 years after first record of the non-indigenous Pacific oyster *Crassostrea gigas* in the Wadden Sea of Lower Saxony (Southern German Bight) most of the intertidal blue mussel beds (*Mytilus edulis*) transformed into massive oyster reefs. Since 2003 the alien species spread out exponentially. *M. edulis* withstood extinction, integrated to the reefs and even managed to recover from formerly decreasing stocks. The ecological role of blue mussel beds, (I) providing hard substrate and (II) refuge to epibenthic species and (III) promoting the settlement of endobenthic species through the enrichment of sediments with organic matter, has been transferred to oyster reefs. Diversity, abundance and biomass of the macrofauna in the new habitat increased. Furthermore, blue mussel beds were an essential food source for wader and migratory birds which first stayed off the reefs. Meanwhile, oystercatchers (*Haematopus ostralegus*) learned to forage on oysters whereas curlews (*Numenius arquata*) feed on associated fauna in the reef. The change from non-persistent mussel beds to stable reefs supports new invasions as most recently observed by the Asian crab *Hemigrapsus penicillatus*.

13:00 13:15 DIFFERENT FOOD WEB STRUCTURE COULD LEAD TO DIFFERENT RESPONSE OF AN INVADER, A CASE STUDY ON MNEMIOPSIS LEIDYI

Javidpour, Jamileh; Sommer, Frank; Sommer, Ulrico; Food web, Leibniz Institute of Marine Sciences, Germany

We have examined how different food web structure could affect an invader impact. In the first mesocosm experiment we examined whether phytoplankton densities could affect Mnemiopsis feeding rate. Predation of the ctenophore on copepodite stage of *Acartia tonsa* was calculated under 3 concentrations of phytoplankton (0, low, high). For the second experiment we manipulated two different food web structures. One food web was Diatom-Artemia-Mnemiopsis and the other Ciliates-Artemia-Mnemiopsis. Our preliminary results from the first experiment show that increasing phytoplankton concentration decreases feeding rate of Mnemiopsis. This is probably due to mechanical damage on feeding sensors of Mnemiopsis by diatom chains. The result of the second experiment suggests that changes in the food web could facilitate invader impact.

13:15 13:30 PATTERNS AND IMPACTS OF MARINE BIOINVASIONS IN SOUTH AFRICA

Griffiths, Charles, Zoology, University of Cape Town, South Africa

Approximately 22 marine invasive species are currently confirmed from South Africa, with a further 18 cryptogenic. More than half the confirmed species were first identified since 2000 and most are restricted to harbours, sheltered lagoons and estuaries. Only five have significant ecological or economic impacts. The Japanese oyster *Crassostrea gigas*, recently established in three Cape estuaries, can be harvested, but poses little threat to indigenous species. The ascidian *Ciona intestinalis* causes significant mortality by smothering farmed mussels on suspended ropes. The European shore crab *Carcinus maenas* appears unable to establish on the wave-exposed open coast, but poses a major threat to lagoonal aquaculture sites. The barnacle *Balanus glandula* occurs in dense inter-tidal beds in the Cape, where it changes community structure. The Mediterranean mussel *Mytilus galloprovincialis* is now the dominant rocky shore organism along 1 500 km of coastline from Namibia to the Eastern Cape. And has profound ecological impacts, including competition with indigenous mussels and limpets for primary rock space, provision of increased habitat for infaunal species and increased food availability to terrestrial predators, particularly Oystercatchers and humans.

## **Lunch**

## **Red sea auditorium**

### **Session 1.1 Marine Biodiversity in Polar Regions**

Chairs: Paul Renaud; Angelika Brandt; Michael Stoddart

15:00 15:15 SCAR-MARBIN: INSIGHTS IN ANTARCTIC BIODIVERSITY PATTERNS USING

Danis, Bruno. SCAR Marine Biodiversity Information Network. Royal Belgian Institute of Natural Sciences. Belgium

CAML sister-project SCAR-MarBIN (SCAR Marine Biodiversity Information Network, [www.scarmarbin.be](http://www.scarmarbin.be)) compiles and manages the existing and new information (generated by CAML) on Antarctic marine biodiversity by establishing and supporting a distributed system of interoperable databases. Although still largely incomplete, the information made freely available through the web portal can already be used to gain insights in Biodiversity patterns in the Antarctic, which already challenge current views on this ecosystem origins. Merged with new database capacities from the Arctic Ocean Diversity (ArcOD) project, bi-polar analyses become also possible. The presentation will show how the data can be used and integrated using new web technologies and unprecedented datamass, and will call for more commitment from the scientific community to publish raw data.

15:15 15:30 ZOOPLANKTON DYNAMICS IN THE EUROPEAN ARCTIC CORRIDOR IN A TIME OF CLIMATE CHANGE - ARE THERE EVIDENCES OF PELAGIC ECOSYSTEM REGIME SHIFT?

Kwasniewski, Slawomir; Olszewska, Anna; Department of Marine Ecology, Institute of Oceanology Polish Academy of Sciences, Poland  
Wold, Anette; Falk-Petersen, Stig; Hop, Haakon; Norwegian Polar Institute, Norway

Mesozooplankton was investigated thoroughly in Kongsfjorden (79°N 12°E, in the European Arctic Corridor) and the adjacent shelf and slope within the research program MariClim, funded by the Norwegian Research Council. This study was accompanied by parallel investigations of oceanographic and marine biological parameters. Mesozooplankton was sampled at nine permanent stations in spring, summer and autumn of 2006 and 2007. Samples were taken from the entire water column in the fjord and on the shelf, and down to 1100 m at the slope, in discrete layers, with Multi Plankton Sampler Type Midi or from the upper 100 m with WP3 net. We will discuss the mesozooplankton community structure (including assessment of the community biodiversity) and its dynamics (spatial and temporal variability in abundance and biomass). Mesozooplankton characteristics will be analyzed by descriptive and nonparametric statistics, in relation to available ecosystem parameters. In addition, the mesozooplankton biological dynamics will be put into context of the long term zooplankton variability, as observed in Kongsfjorden at the Long-Term Biodiversity Research study site, maintained since 1996 within the EU BIOMARE research Program.

15:30 15:45 COASTAL FISH ASSEMBLAGES OFFTERRE ADELIE (EAST ANTARCTICA): ROLE OF ICEBERG SCOURING, GLACIER AND INNERSHELF DEPRESSION

Koubbi, Philippe, Laboratoire d'Océanographie de Villefranche, Université Paris VI, France  
Eléaume, Marc, Département Milieux et Peuplements Aquatiques, MNHN, France  
Gutt, Julian, AWI, Germany

Remotely Operated Vehicle explorations in the coastal zone of Terre Adélie was to describe megabenthic and fish assemblages between 20 and 218 m. The area of investigation offered a variety of environmental conditions such as depressions, islands with sheltered and exposed areas as well as the Astrolabe Glacier. Fish assemblages change with depth and degree of perturbations due to iceberg scouring. Most of the 13 species observed down to 218 m are known to be associated with stressed habitats. Others are indicators of a more stable ecosystem as they are living, as an example, in glass sponges. Among these areas, particular attentions are given to the innershell depressions and to the cliffs of the Astrolabe glacier tongue. As an example, proofs of spawning of *Trematomus hansonii* near the glacier were gathered. What might happen in case of glacier collapse which will increase icebergs disturbance and offer more perturbed habitats?

15:45 16:00 BENTHIC MACRO- AND MEGAFAUNA IN THE CENTAL ARCTIC CANADA BASIN

Bluhm, Bodil; Iken, Katrin; University of Alaska Fairbanks, School of Fisheries and Ocean Sciences, USA  
MacDonald, Ian, Texas A&M University, USA  
Gagaev, Sergey, Zoological Institute, Russian Academy of Sciences, Russia  
Strong, Sarah, Texas A&M University, USA

Benthic macro- and megafauna was sampled in the Arctic Canada Basin in July 2005 at depths ranging from 817 to 3880m. Macrofauna was collected by 33 box cores at 11 stations. Mean macrofauna abundance per station ranged from 89-5149 individuals m<sup>-2</sup> with the highest concentrations on the upper Chukchi Sea slope and the lowest in the Canada Basin proper. Mean infaunal biomass ranged from <0.1 to 27 g wet weight m<sup>-2</sup> with the same geographical trend. Abundance, biomass and Shannon diversity decreased with depth, although diversity peaked at mid-depths. Polychaetes were most abundant and also dominated the biomass. Station groups 'abyss', 'slope' and 'Chukchi Cap' had different faunal compositions. Megafauna was quantified at 8 stations from digital images taken with a down-looking camera. Mean megafauna abundance ranged from 1.4 to 62 individuals m<sup>-2</sup> and was highest at a sub-circular feature on the Chukchi Plateau located in 900m water depth, 1200m in diameter and ca. 40m below the surrounding seabed. Holothurians, *Kolga hyalina*, were the single-most abundant taxon at this station.

## Museum auditorium

**Session 1.3 Deep-sea and extreme environments: temporal and spatial patterns among species and ecosystems**

Chairs : Pedro Martinez Arbizu; Andrew Gooday; Ana Colaco; Adrian Glover; Stefanie Keller.

15:00 15:15 COMMUNITY DYNAMICS ON A HIGH TEMPERATURE HYDROTHERMAL EDIFICE: A DECADEAL STUDY

Cuvelier, Daphne; Gunasekera, Rasanthi, Department of Oceanography and Fisheries, University of the Azores, Portugal

Millar, Karen, University of Tasmania, Australia

Slawinski, Dirk, Marine & Atmospheric Research, CSIRO, Australia

Audzijonyte, Asta, MBARI, USA

Eiffel Tower is a well defined and active hydrothermal edifice of the Lucky Strike vent field (Mid Atlantic Ridge), situated south of the Azores at a depth of 1690m. Since its discovery in 1993, considerable imagery data have been gathered during scientific cruises, spanning 12 years of vent development. The edifice is dominated by extensive mussel-beds of *Bathymodiolus azoricus*. In association with these mussel-beds live alvinocaridid shrimps, bythograeid crabs and other less conspicuous species. Four faunal assemblages and two types of substratum were distinguished based on high-definition photographs and video imagery, and mapped on topographic templates. Colonization patterns were evaluated in relation to habitat characteristics like fluid exits and structure orientation. First results reveal several interesting patterns; e.g. the degree of colonisation remains almost equal (ca. 50%) over the years. The relative proportion of the assemblages however does change. Other remarkable temporal features are the hydrothermal activity that extends towards the periphery, the increase of bacterial cover and the decrease of large mussels. Contrarily to the rapid dynamics on edifices from the Pacific, the rate of change in the communities observed here is clearly inferior.

15:15 15:30 GLOBAL DISTRIBUTIONAL PATTERNS OF POLYCHAETA AND FIRST INSIGHTS INTO COSMOPOLITANISM

Ebbe, Brigitte. DZMB. Senckenberg Institute. Germany.

Schueler, Myriam. Zoology. Ruhr University of Bochum. Bochum.

Data from the first comprehensive assessment of biodiversity in the deep Southern Ocean, the CeDAMar project ANDEEP, revealed very different degrees of endemism versus global distribution among different taxa. Polychaetes were found to be much more widely distributed than, e.g., peracarid crustaceans such as isopods. While there are indications that differing distributional patterns are linked to reproductive mechanisms, the question remains whether at least some species known to be cosmopolitan are complexes of cryptic species. Molecular genetic methods revealed that in some taxa, e.g., foraminifera, there are indeed true cosmopolitans, most of them possibly originating from the Southern Ocean and carried northwards by ocean currents. During the recent follow-up project SYSTCO, run jointly by the Census of Marine Life field projects CeDAMar and CAML, samples were taken from stations in different current regimes and water bodies. Based on first results from the SYSTCO expedition, benthic faunal composition will be interpreted with regard to nutrient flux from the water column to the deep-sea floor. The influence of nutrient fluxes on biogeographic distribution patterns will be assessed to gain further insights on processes driving biodiversity in the deep sea.

15:30 15:45 DIVERSE SILICEOUS SPONGE FAUNAS LINKED WITH BENTHIC BIODIVERSITY IN THE SOUTHERN OCEAN DEEP-SEA

Janussen, Dorte. Marine Evertebraten I. Forschungsinstitut und NaturMuseum Auditorium Senckenberg. Germany.

Plotkin, Alexander S. St. Petersburg State University, Russia

Sponges play an important role in the marine benthic ecology by providing habitats for a variety of other organisms and harbouring a great biodiversity, ranging from microbial to meio-, macro- and megafaunal communities. Rich associations of Porifera are thus linked with high benthic diversity and abundance of other animal phyla. This is obvious in the Southern Ocean, e. g. on Kapp Norwegia shelf, where extraordinarily high sponge abundance and biomass are correlated with diverse associations of especially crustaceans, polychaetes and echinoderms. From bathyal to abyssal depths, the largely endemic Antarctic shelf sponge fauna is gradually replaced by cosmopolitan taxa of increasingly patchy distribution, but often of higher diversity than on the shelf. The Southern Ocean bathyal is characterized by the richest sponge associations, including both shallow and deep water taxa. With their structuring properties and large body size of many Antarctic siliceous sponges, both Hexactinellida and Demospongiae, these diverse taxa play a crucial role for the colonization of deep-sea bottoms by other animals. Factors inhibiting sponge occurrence, such as lack of hard substrates or many clay particles in the bottom water, are likely to be limiting also for the richness and diversity of entire benthic communities.



15:45 16:00      LARGE, ENIGMATIC FORAMINIFERAN-LIKE PROTISTS: DIVERSITY AND VERTICAL DISTRIBUTION IN SEDIMENTS OF AN ABYSSAL POLYMETALLIC NODULE FIELD (CLARION-CLIPPERTON FRACTURE ZONE, NE PACIFIC)

Radziejewska, Teresa. Department of Palaeoceanology. University of Szczecin. Poland  
Kamenskaya, Olga. P.P.Shirshov Institute of Oceanology Russian Academy of Sciences. Moscow. Russia.  
Gooday, Andrew J. National Oceanography Centre. Southampton. United Kingdom.  
Radziejewska, Teresa. Department of Palaeoceanology. University of Szczecin. Poland

Komokiaceans, xenophyophores, and similar large (millimetre- to centimetre-sized) testate protists resembling Foraminifera are a ubiquitous and often dominant component of abyssal macrofaunal assemblages. Yet they are often overlooked and many forms are undescribed, often at the genus or higher taxon level. As a result, they represent a major source of unknown biodiversity in the deep sea. We studied the diversity and vertical distribution of these delicate, often-fragmentary organisms in sediment samples (0-6 cm layer) collected from 3 sites in the eastern part of the Clarion-Clipperton polymetallic nodule field (sub-equatorial NE Pacific) during the 1997 cruise of Interoceanmetal Joint Organization (IOM). A total of 68 morphotypes was recorded (10-44 per station), indicating an extremely diverse assemblage. Although most morphotypes were found in the upper 1.5 cm, deeper sediment layers also supported fairly diverse assemblages. A few species attached to nodule surfaces have been described previously, but ours is the first study of these protists in sediments from an abyssal nodule field. It contributes to our baseline knowledge of abyssal communities in an area targeted for future commercial nodule mining operations.

## Polivalente auditorium

### **Session 4.1 Biodiversity and bioprospecting: Ecological roles of marine natural products and biotechnological applications**

Chairs: Adrianna Ianora; Angelo Fontana

15:00 15:15      CHEMICAL WARFARE IN PLANKTON COMMUNITIES

Fontana, Angelo; d'Ippolito, Giuliana; Cutignano, Adele; Lamari, Nadia; Functional Biosynthesis, CNR - Istituto di Chimica Biomolecolare, Italy.  
Barreiro, Aldo, Facultad de Ciencias, Universidad de Vigo, Spain  
Romano, Giovanna; Montresor, Marina; Ianora, Adriana; Stazione Zoologica "A. Dohrn", Italy

Ingestion of diatoms can induce reproductive failure in dominant zooplankton grazers with consequences on recruitment and cohort size of the next copepod generation. The effect has been initially associated to production of specific metabolites, such polyunsaturated aldehydes (PUAs), of low acute toxicity to adult predators but which depress viability of copepod gametes and offspring the major grazers, the copepods. However, independent studies have recently showed that the ecological scenario is much more complex than we believe. At the moment, it seems that inhibitory activity of microalgae does not correlate with a single class of products but rather is dependent on a multi-component cellular response triggered by enzymatic synthesis of complex mixture of toxic and pro-apoptotic phycooxylipins (PHOXYs). Production of PHOXYs and PUAs is biochemically disjointed and a single algal strain or species that was previously not found to be a PUA producer may still have deleterious effects on copepods because of activation of other LOX pathways. Production of these reactive chemical species may thus explain the discrepancy in past laboratory and field results.

15:15 15:30      BIOACTIVE MARINE NATURAL PRODUCTS THAT ARE PROMISING DRUG LEADS AND CELL BIOLOGY TOOLS

Andersen, Raymond. Chemistry. University of British Columbia. Vancouver. Canada.

The secondary metabolites found in marine invertebrates represent an extremely rich source of novel chemical diversity for academic drug discovery and chemical biology programs. Among the invertebrates, marine sponges continue to be the most prolific source of new marine natural products. Our group at UBC has amassed a sizable

library of crude extracts from marine sponges collected in many of the world's oceans. In collaboration with biologists at UBC, this crude extract library has been screened for activity in a variety of cell-based and pure enzyme assays designed to identify promising lead compounds for the development of drugs. The cell-based assays invented by our collaborators screen for antimetabolic agents, anti invasion/antiangiogenic agents as well as agonists and antagonists of the cannabinoid receptors. Pure enzymes are used to screen for activators/inhibitors of the lipid phosphatase SHIP, PI3kinase, IDO, and inhibitors of hepatitis C, SARS and West Nile viral proteases. Bioassay guided fractionation and spectroscopic analysis is used to identify the structures of compounds active in these assays. Chemical synthesis is used by our group to probe the SAR for new pharmacophores and to provide material for in vivo testing in animal models. A number of promising drug leads for treatment of cancer and inflammation, including pelorol, exigamine A, ceratamines, and the hemiasterlins, and cell biology tools, such as the spirastrellolides, neopetrosiamide A, and papuamides, have been discovered in this program. The lecture will illustrate the importance of marine biodiversity to our academic drug discovery/chemical biology research.

#### 15:30 15:45 GENOMIC MINING FOR ELUCIDATION OF NOVEL BIOSYNTHETIC PATHWAYS FOR BIOACTIVE NATURAL PRODUCTS IN MICROALGAE

Cembella, Allan. Division of Biosciences. Alfred Wegener Institute for Polar and Marine Research. Bremerhaven. Germany

John, Uwe; Jaekisch, Nina, Yang, Ines; Tillmann, Urban; Krock, Bernd; Stucken, Karina; Section of Ecological Chemistry. Alfred Wegener Institute for Polar and Marine Research. Bremerhaven. Germany.

Vásquez, Mónica. Departamento de Genética Molecular y Microbiología. Pontificia Universidad Católica de Chile, Laboratorio de Ecología Microbiana y Toxicología Ambiental. Santiago. Chile

Gloeckner, Gernot. Fritz Lipmann Institute for Age Research Jena, Germany

Microalgae are a rich source of secondary metabolites, including phycotoxins and unknown allelochemicals associated with harmful algal blooms (HABs). The known phycotoxins comprise a wide variety of guanidine derivatives, secondary amino acids, peptides, cyclic imines and linear and macrocyclic polyether toxins. Various hypotheses regarding the in situ ecological significance of phycotoxins have been advanced, e.g. chemical defence, yet relatively little is known about the genetic regulation of biosynthetic pathways. Dinoflagellates are perhaps the richest and most diverse source of toxic polyether compounds, but they pose severe challenges for whole genomic sequencing. The "expressed sequence tag" (EST) approach has, however, proven promising for gene hunting. The relative simplicity of cyanobacterial genomes allows for complete genome sequencing. Studies with labeled precursors suggest that dinoflagellates and cyanobacteria share certain biosynthetic pathways such as for the tetrahydropurine neurotoxins (saxitoxin group). Genomic databases have been screened to identify genes that may be involved in toxin production and cell regulation and growth. Identification and cloning of polyketide biosynthetic genes found in genomic and cDNA libraries provides the first steps for programmed synthesis of novel bioactive compounds.

#### 15:45 16:00 NEW ALKALOIDS FROM TWO MEDITERRANEAN CNIDARIANS

Thomas, Olivier; Cachet, Nadja; Chemistry, Université de Nice Sophia Antipolis - LCMB UMR6001 CNRS, France

Culioli, Gerald; Mokri, Redouane. Chemistry. Université du Sud Toulon Var. Toulon. France.

Perez, Thierry. Chemistry. Centre d'Océanologie de Marseille - DIMAR. Marseille. France.

Mehiri, Mohamed. Chemistry. Université de Nice Sophia Antipolis - LCMB UMR6001 CNRS, France.

This work is part of the French ECIMAR program aimed at describing the bio and chemodiversities of Mediterranean marine invertebrates. Among the marine environment marine sponges are the most studied organisms looking for bioactive marine natural products. Nevertheless the extensive chemical studies of two well known Mediterranean cnidarians, the sea anemone *Parazoanthus axinellae* and the orange coral *Astrodes calycularis*, led to the identification of new alkaloids as major components. The isolation and structural elucidation of these new metabolites will be described as well as chemical total syntheses of the major compounds. Spatial and temporal variations in the production of these metabolites have also been observed.

## Coffee break

### Session 1.1 Marine Biodiversity in Polar Regions (Paul Renaud; Angelika Brandt; Michael Stoddart)

16:30 16:45        ECTOSYMBIOSIS ON CIDAROIDS, A CRITICAL FACTOR IN ESTABLISHING LOCAL BENTHIC BIODIVERSITY IN DEEP WEDDELL SEA.

Rigaud, Thierry, Université de Bourgogne, UMR CNRS de Bourgogne, France  
De Ridder, Chantal; Hétériér, Vincent; Biologie Marine, Université Libre de Bruxelles, Belgium  
David, Bruno, UMR CNRS Biogéosciences, Université de Bourgogne, France

In deep marine environments, competition for hard substrates is a critical factor in the distribution and diversity of benthic organisms. In this context, the occurrence of biotic substrates in addition to mineral substrates may change the characteristics of sessile fauna. We tested this hypothesis in different localities of the Weddell Sea (Antarctica), by studying the contribution of ectosymbionts installed on the spines of cidaroids (echinoids). Presence of cidaroids promoted a higher total specific richness, increased sessile species abundance, but did not change the diversity. Analyses of species distribution suggested that the cidaroids are a favorable habitat for sessile organisms, compared to stones, but are colonized by relatively specialist sessile species, leaving the unfavorable stone habitat to more generalist species. Therefore, our study highlights the role of some living organisms, such as cidaroids, as key species increasing Antarctic benthic deep sea biodiversity, through the niche they provide to symbiotic species.

16:45 17:00        MARINE MICROPLANKTON BIODIVERSITY CHANGES OF ARCTIC IN "FEVER". BENEFIT OR DISASTER?

Wiktor, Jozef; Piwosz, Katarzyna; Hapter, Ryszard. Marine Ecology Department, Institute of Oceanology PAS, Poland.

"Traditional" model of pelagic ecosystem assume one feast of lipid rich diatom spring bloom as a main nutritional event for arctic pelagic and benthic communities. believed since beginning of Polar research. Among others, warming of Arctic has consequences in productivity of pelagic ecosystems. Field semi simultaneous experiment in Hornsund-fjord on the border between Arctic and Atlantic domain – cold scenario and Kongsfjorden –influenced by warm Atlantic waters fjord, was carried out. Hornsund microplankton dominated was by diatoms and another autotrophs while warm Kongsfjorden dominated was by small flagellates and mixo and heterotrophic ones. "Quantity" of taxonomic composition reflected – as was expected – quantity of biomass and primary production

17:00 17:15        SYSTEMATICS AND BIOGEOGRAPHY OF ANTARCTIC DEEP-SEA GROMIIDS

Rothe, Nina; Gooday, A.J.; Hughes, J.A.; DEEPSEAS Benthic Biology Group, Zoological Institute of Russian Academy of Sciences, Russia  
Pawlowski, J.; Fahrni, J.; Department of Zoology and Animal Biology, University of Geneva, Switzerland  
Aranda da Silva, A., Centro de Estudos do Ambiente e do Mar, Universidade de Aveiro, Portugal  
Pearce, R.B., Paleocceanography and Paleoclimate, National Oceanography Centre, Southampton, UK

Gromiids (Supergroup Rhizaria; genus *Gromia*) are large protists related to, but distinct from, the Foraminifera. Until recently, they were known mainly from a single, cosmopolitan shallow-water species, *Gromia oviformis*. Morphologically, *Gromia* species are characterized by 1) their simple, organic-walled tests, which range from spherical to grape-shaped, sausage-shaped or lobate in form, 2) the presence of an oral capsule and 3) a distinctive "honeycomb membrane" layer in the test wall. With the exception of an early record from a deep Norwegian fjord, the first report of deep-sea *Gromia* stems from the Oman (*Gromia sphaerica*) and Pakistan (*Gromia pyriformis*) margins of the Arabian Sea, where gromiids were discovered in 1994, living at bathyal depths. Here, we present the first report of gromiids from bathyal and abyssal depths in the Weddell Sea, Antarctica. The systematic description of thirteen previously undescribed species is based on a combination of morphological and molecular criteria. *Gromia* species are characterized by their test morphology and presence of a distinct oral capsule. Three species were identified as gromiids based on the presence of a "honeycomb membrane" layer, as well as on the phylogenetic analysis of partial SSU rDNA sequences. The new species are smaller (length from 0.4 to 4.4 mm) than *G. sphaerica* (4.7 to 38 mm), but reach a larger average size than *G. pyriformis* (< 1.0 mm). The Weddell Sea samples include novel morphotypes, including one in which the organic test is enclosed within an agglutinated case, so far a unique feature among gromiids. Other species show previously undescribed wall structures, including a polygonal surface pattern of thickened sections of wall with a layer of illite clay particles attached to the wall surface. This study has considerably increased our knowledge of the morphological and taxonomic diversity of this fascinating and potentially ecologically important group of deep-sea protists.

17:15 17:30 ICELAND'S ISOPOD HIGHLIGHTS - HOW RIDGE STRUCTURES INFLUENCE DISTRIBUTION AND DIVERSITY OF DESMOSOMATIDAE SARS, 1897

Brix, Saskia, Senckenberg Forschungsinstitut und NaturMuseum Auditorium, Deutsches Zentrum für marine Biodiversitätsforschung, Germany  
Svavarsson, Jörundur, Institute of Biology, University of Iceland, Finland

The distribution and diversity of Desmosomatidae Sars, 1897 were examined in Icelandic waters, where the large Greenland-Iceland-Faeroe Ridge (GIF Ridge) crosses the North Atlantic. In all 34 species were found, belonging to 21 genera. Most of the species were restricted to either northern (10) or southern (14) side of the GIF Ridge. Five species were found on both sides of the Ridge (*Eugerdia globiceps*, *Eugerdia reticulata*, *Oecidiobranchus hansenii*, *Nannoniscus profundus* and *Pseudomesus brevicornis*). Five species (*Desmosoma latipes*, *Eugerdella armata*, *Eugerdia tenuimana*, *Prochelator lateralis* and *Pseudergella hessleri*) cross the Ridge but barely so and seem to have their distributional limits towards colder waters just north of the Ridge) or southern limits towards warmer waters just south of the Ridge. These species are mostly restricted to a certain water mass. Many of the species are apparently limited towards north by the physical presence of the Ridge. Many species have the upper limits of their bathymetrical distribution well above the saddle depths of the Ridge and these species have apparently their distribution limited to either north or south by the temperature.

17:30 17:45 ZOOGEOGRAPHIC INFERENCES OF THE ANTARCTIC AND SUBANTARCTIC PYCNOGONIDS

Soler-Membrives, Anna; Munilla, Tomás; Biología Animal, Biología Vegetal y Ecología, Universitat Autònoma de Barcelona

This study contains the current list of the austral pycnogonids and their depth and distribution zone. 264 species have been recorded to date. They account for 19.6 % of the 1344 species recorded worldwide thus far. One hundred and six species are endemic to Antarctic waters, 62 to the Subantarctic, 63 are common in both regions and 55 are circumpolar. The richest genus is *Nymphon*, with 67 species. Forty seven synonymies are detected. We compare the variation of species between the years 2000 and 2007. The increase in expeditions is directly related to the increase in the circumpolarity of the species and to the decrease in their zonal endemism. The Benthic Insular Refuge Hypothesis is proposed as an explanation for the southern distribution of the present Pycnogonid fauna, coming from the Scotia Arc.

17:45 18:00 MOLECULAR PHYLOGENY AND TIME DIVERGENCE ESTIMATION BETWEEN LINEAGES OF THE GENUS NACELLA (PATELLOGASTROPODA: NACELLIDAE) IN THE SOUTHERN OCEAN.

González Wevar, Claudio Alejandro, Departamento de Ciencias Ecológicas, Universidad de Chile, Instituto de Ecología y Biodiversidad, Chile  
Nakano, Tomoyuki, Department of Geology and Palaeontology, National Museum Auditorium of Nature and Science, Japan  
Juan Iván, Cañete, Departamento de Recursos Naturales, Universidad de Magallanes, Chile  
Elie, Poulin, Departamento de Ciencias Ecológicas, Universidad de Chile, Chile

The origin and diversification of the antarctic marine benthic fauna is of great interest on evolutionary biology since they have been subjected to several macroevolutionary forces such as extinctions, tectonics and extreme climatic change. The genus *Nacella* is a dominant invertebrate group in Antarctic and Subantarctic regions and constitute a good candidate for molecular analysis. Currently, *Nacella* is composed of 14 species with one in Antarctica, seven in the Magellanic region, one in Central Chile and other four inhabiting subantarctic islands. Phylogenetic reconstructions based on two mitochondrial markers (COI and CytB) were performed using different methods MP and MCMC. We also used a relaxed bayesian method for multilocus data to estimate the times among the lineages of *Nacella*. Molecular analyses showed that *Nacella* correspond a monophyletic group with an Australasian origin. It appear that its origin and diversification are more recent (~ 12 MYA) than the expected under the hypothesis of vicariant evolution of the Southern Ocean fauna (~ 25 MYA). The extreme levels of genetic similarities between the Magellanic species suggest a recent pleistocenic diversification.

18:00 18:15 LESS-KNOWN GROUPS IN THE ARCTIC GLACIAL FJORDS: SIPUNCULAN FAUNA CASE STUDY

Kedra, Monika, Department of Marine Ecology, Institute of Oceanology Polish Academy of Sciences, Poland

The biodiversity of Sipuncula in the high latitudes is rather low but in arctic fjords Sipuncula are often specified among dominant taxa. They may comprise over 10 % of total macrobenthic abundance and may contribute to more than 80 % of total biomass but usually they are identified only to the phylum level. Occurring locally in such high amounts they may play an important role in bioturbation of the sediments and as a food source for higher trophic levels. The main aim was to study patterns of the taxonomic composition, diversity and distribution of sipunculan fauna in arctic fjords of Spitsbergen. A large collection of samples (1186 specimens, 256 stations) at depths ranging from 40m to 2553m was taken in 10 fjords in east and west coast of Spitsbergen. The sipunculan densities varied from 10 to 840 specimen per m<sup>2</sup>. Due to their important role in the ecosystem a need to include sipunculans in routine macrobenthic surveys must be emphasized. Despite their bad reputation of the 'difficult group' every effort should be taken to increase the level of taxonomic expertise in this group in all marine ecological labs involved in benthic studies. The project was co-funded by the Arctic Ocean Diversity (ArcOD) minigrant.

18:15 18:30 CENSUS OF ANTARCTIC MARINE LIFE (CAML)

Victoria A. Wadley, Michael D. Stoddart; Australian Antarctic Division, Hobart, Australia

The Census of Antarctic Marine Life (CAML) recently completed the fieldwork for the biggest ever biodiversity survey in Antarctica, coordinating projects on 18 major research voyages during the International Polar Year. Given the escalating cost of fuel, it will be difficult to repeat this sampling effort. After analysis of the samples in museums and universities around the world, the data are being shared through the Marine Biodiversity Information Network of the Scientific Committee on Antarctic Research (SCAR-MarBIN). This will leave a significant legacy for the International Polar Year, providing access to the data needed to improve our overall understanding of marine biodiversity and its role in the Southern Ocean ecosystem. The census is now in the data integration and synthesis phase. In October, a workshop at Duke University, North Carolina, used case studies to explore the mapping and visualisation potential of the data. Comparisons between Antarctic and Arctic ecosystems were the subject of an associated workshop entitled 'Polar Synthesis Macroscope'. This refers to using a 'zoom' function to examine biodiversity data at different spatial scales. A large amount of work still remains to be completed and much of the data analysis will extend well beyond the end of CAML in 2010.

### **Session 2.3 Ecosystem Functioning and Biodiversity Science in the Deep sea**

Chairs: Inge Jonckheere; Françoise Gaill; Eva Ramirez-Llodra; Michail Yakimov; Christian Stenseth; Lisandro Benedetti-Cecchi

16:30 16:45 TROPHIC DIVERSITY AND ECOSYSTEM FUNCTION IN HIGH-STRESS CONTINENTAL MARGIN ECOSYSTEMS.

Levin, Lisa, Scripps Institution of Oceanography, UC San Diego, EE.UU.

Topographic, tectonic, oceanographic and terrestrial influences generate extensive heterogeneity on continental margins. The resulting habitats include a broad range of photosynthesis- and chemosynthesis-based ecosystems. Here I explore for several of these ecosystems (oxygen minima, methane seeps, non-reducing slope) the influence of gradients in 2 stressors, oxygen and sulfide, on trophic diversity. Trophic pathways are examined with C and N stable isotope data and trophic niche diversity is defined in isotope space. There are strong relationships among stress, trophic diversity, and community properties (abundance, composition) that have key consequences for ecosystem functions such as biomass production, bioturbation, carbon processing and burial. The implications of trophic diversity-function relationships in these systems for broader continental margin functions and services, and under current scenarios of climate change, are to be discussed.

16:45 17:00 RELATIONSHIP BETWEEN BENTHIC BIODIVERSITY AND DEEP-SEA ECOSYSTEM FUNCTIONING: A MULTILAYER APPROACH

Danovaro, Roberto; Pusceddu, Antonio; Department of Marine Sciences, Polytechnic University of Marche, Italy

We present a large-scale study on deep-sea sediments that relates benthic biodiversity of prokaryotes, meiofaunal and macrofauna to several independent indicators of ecosystem functioning and efficiency. We show that deep-sea ecosystem functioning is related to deep-sea biodiversity and that ecosystem efficiency is linked to functional

biodiversity. These results suggest that a higher biodiversity supports higher rates of ecosystem processes and an increased efficiency with which these processes are performed. The relationships presented here, being consistent across a wide range of deep-sea ecosystems, suggest that mutually positive functional interactions (ecological facilitation) can be common in the largest biome of our biosphere and indicate that interactions among species occur also across different Kingdoms and life forms. This study provides scientific evidence of the intimately connections among all forms of biodiversity and suggests that conservation of deep-sea biodiversity as a whole is a priority for a sustainable functioning of the worlds' oceans.

17:00 17:15      DIVERSITY AND COLONIZATION PROCESSES OF OSEDAX SPECIES ON WHALE FALLS

Pradillon, Florence; Kawab, Maseru; Noda, Chilkayo; Fujikura, Katsunori; Fujiwara, Yoshihiro; Extremobiosphere Research Center, Japan Agency for Marine-Earth Science and Technology, Japan

Sunken whale carcasses are believed to have acted as evolutionary stepping-stones for the colonization of deep chemosynthetic environments because of the zoological and ecological affinities observed between communities developing in these extreme environments. Siboglinid polychaetes are one of the major family found in chemosynthetic environments where they survive using symbiosis. At whale falls, they are represented by the *Osedax* genus, a highly specialized taxa feeding on bones. This genus appears to be world-wide distributed, but dispersal and colonization processes remain unknown. We investigated *Osedax* diversity on a sperm whale carcass sunken at 950 meters off Japan coast, in the Pacific Ocean. Seven species were identified using molecular data. Among early colonists, 2 species are also reported from carcasses in the East Pacific, more than 5000 km away. Later colonists, on the other hand, are all new species, and may have a more local distribution. Therefore, in addition to ecological preferences, different dispersal strategies may also explain succession patterns. Observation of embryonic development and larvae will also be presented and discussed in this regard.

17:15 17:30      COLONISATION EXPERIMENTS IN CHEMOSYNTHETIC ECOSYSTEMS IN THE DEEP-SEA: BIOLOGICAL AND ECOLOGICAL ASPECTS

Gaudron, Sylvie, UMR 7138, University of Pierre et Marie Curie

Chemosynthetic ecosystems in the deep-sea are new type of ecosystems where communities of organisms live in extreme environment dependant either on sulphur and methane or both. The key question is how these organisms are colonising these ecosystems? Which species arrive first? Which is the functioning of this newly formed community structure and depending on which environmental factors? We have deployed for one year since 2006 a series of identical colonisation devices ranged from 1700 to 2400m depth, within Europe from the Nordic Sea (Haakon Mosby Mud Volcano), the Mid-Atlantic (MoMar), to the Mediterranean (Nil deep-sea fan brines). During this period, microbial to metazoan communities have established. Colonisation devices were filled separately with different substrate (mineral or organic) and were then recovered during several cruises in 2007. Identification of fauna has been undertaken by using various techniques (MEB, TEM and Fluorescent hybridization in situ. Environmental parameters such as sulphide and temperature were also recorded during both deployment and recovering of the colonisation devices. A comparison in biodiversity of newly established species depending on substrate and on environmental parameters will be exposed.

17:30 17:45      THE TROPHODYNAMIC ROLE AND COLONISATION CAPACITY OF NEMATODE COMMUNITIES IN DIFFERENT ARCTIC DEEP-SEA ENVIRONMENTS

Guillini, Katja, Biology, University of Ghent (Ugent), Belgium  
Van Oevelen, Dick, Department of Ecosystem Studies, NIOO-CEME, The Netherlands  
Schewe, Ingo; Soltwedel, Thomas; Alfred Wegener Institute, Germany  
Vanreusel, Ann, Biology, University of Ghent, Belgium

Up to 30% of the photosynthetic derived organic matter sinks out of the surface waters and serves directly or indirectly as food for benthic organisms. This holds true for most of the deep-sea floor. There are however so called "extreme environments" where the benthos additionally or mainly profits from chemosynthetically derived energy. This is the case in hydrothermal vents and cold seeps where bacteria oxidise reduced elements. Invertebrates may feed on these bacteria directly or harbour them as endosymbionts. Meiofauna represents an important and very diverse group of inhabitants of the deep-sea floor. Within the meiofauna, Nematoda are the most abundant taxon, generally dominating in biomass and densities. Therefore they are expected to play an important role in the transfer of carbon. However there is still very little known about their trophodynamic role in the ecology of deep-sea environments. During this study in situ colonisation enrichment experiments as well as ex situ enrichment experiments were performed. This was done at the Hausgarten site and at the Håkon Mosby Mud Volcano in order to study the reaction on organic carbon input and the uptake of potential <sup>13</sup>C labeled food sources (diatoms and bacteria) based on stable isotope and fatty acid analyses.

17:45:18:00 EVIDENCES THAT SOME OF THE SYMBIOTIC MUSSELS ASSOCIATED WITH  
CHEMOSYNTHETIC ORGANIC SUBSTRATES ARE UBIQUITOUS

Lorion, Julien; Duperron, Sebastián; Samadi, Sarah; Systematic Adaptation Evolution, University Pierre and Marie Curie, France

Bathymodiolinae (Bivalvia: Mytilidae) have been thoroughly studied in hydrothermal vents and cold seeps where it was shown that they have symbiotic relationships with chemosynthetic bacteria. Other species from this family inhabit less known reducing ecosystems such as the bones of large marine mammals but also woods and other plant material. Whale bones are rich in lipids whereas woods are rich in cellulose and lignin. Despite of this disparity, both the decay of lipids and lignin produce dihydrogen sulphide. Species inhabiting such environment also have chemosynthetic symbionts that are mostly thiotrophic bacteria. We explored the diversity of Bathymodiolinae mussels from sunken plant material collected by trawling in the South West Pacific and examined their symbionts. We also used colonization devices to sample and examine specimens from other organic substrates such as whale bones or feathers that are less easy to localize at the deep-sea floor. This survey shows that some species are ubiquitous and are able to live on both sunken woods and whales bones. The role of the thiotrophic symbiosis with regard to that ubiquity will be discussed.

18:00 18:15 CONNECTIVITY IN AN OCEANIC SEAMOUNTS SYSTEM: COMPARATIVE  
PHYLOGEOGRAPHY OF GASTROPODS WITH CONTRASTED REPRODUCTIVE STRATEGIES

Castelin, Magalie; Samadi, Sarah; Bouchet, Philippe; Systematic Adaptation Evolution, Museum Auditorium National d'Histoire Naturelle, France

Marine benthic invertebrates possess a species-specific mode of larval development. Species with planktotrophic development have larvae that spend an extended period of time in the water column, and it is commonly accepted that such species have higher levels of dispersal and gene flow than species with non-planktotrophic development. Because of the accretionary growth of the gastropod shell, it is possible to infer the mode of larval development of a species from the morphology of its protoconch, which is ideally retained at the top of the adult shell. For these reasons, gastropods are a good model to test connectivity between seamounts. Earlier studies have suggested that trapped water circulation generated by seamounts ("Taylor's column") may locally increase speciation rate by breaking up species in small isolated populations. We have compared the genetic structure of benthic gastropod species covering several larval developments, living on seamounts near New Caledonia. Based on COI sequences, our results confirm the intuitive correlation between genetic connectivity and mode of development. Taylor's columns effects, if present, would impact recruitment at spatio-temporal scales that are irrelevant to evolution process.

18:15 18:30 SIBOGLINIDAE IN THE GULF OF CADIZ - WHERE AND WHY

Hilário, Ana, CESAM, University of Aveiro, Portugal  
Cunha, Marina, Dep. Biología, University of Aveiro, Portugal

Siboglinids are tube-dwelling annelids that inhabit marine reducing habitats such as anoxic mud bottoms, seeps and hydrothermal vents. As adults, they lack a functional digestive system and rely on chemoautotrophic microbial endosymbionts. Three subgroups constitute the Siboglinidae: Frenulata, Monilifera and Vestimentifera. Because they are keystone species in hydrothermal vents and cold seeps habitats, vestimentiferans have, in general, been better studied. The discovery of chemosynthetic-based communities dominated by frenulates in several mud volcanoes in the Gulf of Cadiz, and the possibility to explore these habitats through several research programmes has been an excellent opportunity to extend our knowledge on this understudied group of siboglinids. Molecular and morphological analyses of specimens collected from several mud volcanoes showed that there are at least 12 different species. The distribution of these species reflects both bathymetric patterns and sulphide profiles of the different mud volcanoes where they occur. Colonisation devices with different settlement substrates were deployed in several mud volcanoes to study the dynamics of early colonisation and the cues that trigger the larval settlement of these species.

## Polivalente auditorium

#### **Session 4.1 Biodiversity and bioprospecting: Ecological roles of marine natural products and biotechnological applications**

Chairs: Adrianna Ianora; Angelo Fontana

16:30 16:45 A NEW BIOMATERIAL FROM SPONGES: BIOSILICA (SUSTAINABLE PRODUCTION WITH VERSATILE APPLICATIONS)

Müller, Werner EG; Schöder, Heinz C. Abteilung Angewandte Molekularbiologie. Institut für Physiologische Chemie, Universität. Germany.

Biosilicification is an evolutionary old and widespread type of biomineralization both in unicellular and multicellular organisms including sponges, diatoms, radiolaria, choanoflagellates, and higher plants. In the last few years combined efforts in molecular biology, cell biology, and inorganic and analytical chemistry allowed first insights in the molecular mechanisms by which these organisms form an astonishing structural variety of siliceous structures not reached by chemical methods. The skeletal elements of two classes of sponges, Demospongiae and Hexactinellida, the siliceous spicules, consist of glassy amorphous silica (biosilica). The demosponges exhibit the unique ability to synthesize biosilica using a novel group of enzymes which have been termed silicateins. Silicateins have been isolated, cloned and sequenced both from marine sponges and freshwater sponges. The recombinant silicateins (protected by patents worldwide [W.E.G. Müller and H.C. Schröder]) are of high interest and potential importance for a variety of medical and technical applications, e.g. surface modification of glasses and other materials including biomaterials, the preparation of resins, insulators, mesoporous molecular sieves and catalysts. In addition, biomimetic approaches have been undertaken to exploit the biosynthetic potential of the natural biosilicification mechanisms.

16:45 17:00 THE EFFECTS OF DIATOM POLYUNSATURATED ALDEHYDES ON PLANKTON BIODIVERSITY AND FUNCTIONING

Casotti, Raffaella; Balestra, Cecilia; Functional Ecology and Evolution Laboratory. Stazione Zoologica A. Dohrn. Napoli. Italy.

Ribale, François. School of Oceanography. University of Washington. Seattle. USA.

Bastianini, Mauro. CNR-Istituto Biologia del Mare. Venice. Italy.

Gasol, Josep M; Alonso-Sáez, Laura. Departament de Biologia Marina i Oceanografia. Institut de Ciències del Mar-CMIMA, CSIC. Barcelona. Spain.

Lebaron, Philippe; Intertaglia, Laurent. Observatoire Océanologique de Banyuls. Banyuls-sur-mer. France.

Vidoudez, Charles; Pohnert, Georg. Friedrich Schiller Universität. Jena. Germany.

Miralto, Antonio. Functional Ecology and Evolution Laboratory. Stazione Zoologica A. Dohrn. Napoli. Italy.

Polyunsaturated aldehydes (PUAs) are secondary metabolites produced by some species of marine diatoms from degradation of polyunsaturated fatty acids (PUFAs) and are used as chemical defense against their predators. PUAs trigger cell death also in many phytoplankton and bacteria in the laboratory and also appear to represent stress signals within diatom populations. When inoculated into a natural bacterial community, the compounds appear to selectively affect or slow down the metabolism of certain groups of bacteria when compared to others, suggesting that they are able to influence bacterial community composition and therefore biodiversity. However, PUAs are only released when cell membrane integrity is disrupted, as occurs during grazing by predators. Evidence is accumulating, though, that phytoplankton may die by active or passive cell death (necrosis or apoptosis) and lysis, thereby releasing PUAs independent from grazing. Hence, the impact of diatoms on biodiversity and the functioning of plankton ecosystems may have been previously underestimated. This presentation aims at reviewing the present state-of-the-art on PUAs production and their effects on plankton and proposes an ecological interpretation of their role on biodiversity and cell metabolism.

17:00 17 15 NEW PERSPECTIVE SPECIES OF MOLLUSKS FOR MARICULTURE IN THE BLACK SEA (UKRAINIAN COST)

Vyalova, Oksana; Scherban, Svetlana; Borodina, Aleksandra. Animal physiology and biochemistry. Institute of biology of the southern seas. Sevastopol. Crimea. Ukraine.

Results of acclimatization of triploid and diploid forms of oyster spats, which were original of French, are reported. Young mollusks were introduced into the Black sea (Ukrainian coast). Data have shown the high rates of survival and growth, rapid increases of biomass and contents of protein, lipids, carotenoids. The oyster is an exotic sea



food for Ukrainian people. Now a few of living oysters are imported from Europe and very expensive. We hope that the oysters which have been brought up in the Black sea, will allow to vary and to enrich a dietary ration of common Ukrainians. The organization of marine firms will allow to decide the social problems of local population, there are new workplaces, employment, tourist industry, restaurant business and so on in this region. New alien-species *Anadara inaequalis* is a perspective mussels of mariculture in this region too. It is widely used as a sea food in the countries of the Eastern Asia. Mollusks has much bioactive substances and antioxidants. It is possible to use *Anadara* as a sea food, and as the medical treatments of cancer and cardiovascular diseases.

17:15 17 30        SECONDARY METABOLISM OF THE SPONGE GROUP HOMOSCLEROMORPHA :  
DIVERSITY AND VARIATION OF ITS EXPRESSION IN RELATION TO BIOTIC AND ABIOTIC FACTORS

Ivanisevic, Julijana. Oceanology. Marine Station Endoume, Oceanology Center of Marseille, University of Mediterranean. France.

Thomas, Olivier. Chemistry. University of Nice Sophia Antipolis. Nice. France.

Ereskovsky, Alexander. Oceanology. Marine Station Endoume, Oceanology Center of Marseille, University of Mediterranean. France.

Pérez, Thierry. Oceanology. Marine Station Endoume, Oceanology Center of Marseille, University of Mediterranean. France.

In the Mediterranean, *Homoscleromorpha* species are dwellers of sciaphilic hard substrate communities with a visible strong out competing ability. This small sponge clade, which seems to be a distinct lineage from other sponges, is of particular interest because it shares specific characters with the Eumetazoa. The systematics of this group is challenging and requires fine cytological studies to distinguish sibling species. We developed a chemical fingerprint approach which, applied to 10 Mediterranean *Homoscleromorpha* species, appeared as a rapid and efficient tool to contribute to taxonomical and phylogenetic studies. Potential chemotaxonomic markers are proposed from the species to the *Homoscleromorpha* level. A rapid assessment of the bioactivity revealed a correlation between the sponge natural toxicity and the cell diversity that each sponge harbors into their tissue. The time series analysis of a target species gave an insight into seasonal fluctuations of the predominant secondary metabolites. Among them, an increasing production of a new long chain unsaturated fatty acid has been observed during the summer, and correlated with a high reproductive effort. We discuss the potential antifouling properties of this fatty acid.

17:30 17 45        OCEAN BIODIVERSITY AS A RESERVOIR FOR PHARMACEUTICALS AND RESEARCH  
MODELS

Boeuf, Gilles. Laboratoire Arago. University Pierre & Marie Curie, Paris6/CNRS. Banyuls-sur-mer. France.

Oceans and seas today make up the largest volume offered to life, covering almost 71 % of the Earth surface. Roughly 275 000 species have been described as coming from marine environments, yet this only represents some 15 % of all currently known species. However marine biomass can be enormous: marine bacteria represent more than 10 % of all organic carbon on the planet. Life appeared in the ancestral ocean 3 800 million years ago and various key evolutionary events have occurred there: the appearance of the nuclear membrane and cell nucleus; the "pluricellularity"; the capture of bacteria and their transformation into organelles; and sexuality. Among the 33 phyla existing today on Earth, 12 have never left the ocean and live exclusively in marine environments. From such a biodiversity, humans exploit 157.5 million metric tons (Mt, data 2005) a year for food: 94.5 Mt fisheries and 63 Mt aquaculture. However humans also take advantage of marine biodiversity for other reasons: ancestral characters and organisational and behavioural patterns make marine organisms an excellent reservoir for identifying and extracting pharmaceuticals (> 5 000 today: anti-cancers, antibiotics, antivirals, anti-fungi, immunostimulators, immunosuppressives, growth factors, bone regenerators, etc...), molecular tools (polymerases, fluorescent proteins, etc...) and cosmetic molecules as well as offering pertinent "models" for basic and applied research. A few marine species used as "models" set the base for major advances in the life sciences as recognized by several Nobel Laureates: discovery of phagocytosis; anaphylactic shock; nervous influx transmission; memory molecular mechanisms, cyclins and cancer mechanisms; eye organisation; neurotransmitter membrane receptors; origin of the specific immune system, etc... Marine models are very useful to understand the origin and functioning of important life mechanisms, including in humans and to develop new applications for efficient disease treatments. Relationships between the ocean and public health are physical, chemical, biological and physiological. The oceans supply mankind with renewable living resources, threatened today. Marine organisms, ecosystems and biodiversity deserve more study and protection, and much better management is required for sustainable exploitation of marine resources..

# THURSDAY, 13 November.

## Morning

### Red sed auditorium

#### Session 1.5 Open ocean pelagic and benthopelagic diversity: patterns and monitoring

Chairs : Odd Aksel Bergstad; Ann Bucklin; Tone Falkenhaus; Uwe Piatkowski.

10:30 -10:45 PELAGIC BIODIVERSITY AND CLIMATE CHANGE.

Beaugrand, Gregory. Centre National de la Recherche Scientifique (CNRS), Laboratoire d'Océanologie et de Géosciences, CNRS UMR LOG 8187, Station Marine,. Université des Sciences et Technologies de Lille B.P. 80. 62930 Wimereux , France

Edwards, Martin; Lindley, John A. Sir Alister Hardy Foundation for Ocean Science, Citadel Hill The Hoe. Plymouth PL1 2PB, England

Climate change, attributed in least in part to anthropogenic activity, is unambiguous and its effects have been detected in many functional units of the Earth System. This study presents new analyses of sea surface temperature changes and show that climate change is affecting pelagic biodiversity of the North Atlantic Ocean and adjacent seas. Changes are seen from phytoplankton to zooplankton to fish leading to the modification in the dominance of species and the structure, the diversity and the functioning of marine ecosystems. Biological changes ranging from phenological to biogeographical shifts have changed significantly to contribute to abrupt ecosystem shifts in some regions of the Atlantic. These alterations reflect a transition and in some cases adaptations of pelagic ecosystems to a warmer temperature regime. Mechanisms are complex because they are nonlinear exhibiting tipping points and varying in space and time. The sensitivity of certain ecosystems in the North Atlantic to temperature changes is high, indicating that a small temperature modification at critical thresholds can trigger sustained ecosystem shifts. Implications of these changes for biogeochemical cycles are discussed. Our results have some consequences for fish management because they suggest that the carrying capacity of ecosystems will be modified by climate change. If warming continues as rates projected by the Intergovernmental Panel on Climate Change, the North Sea carrying capacity will not be able to sustain commercially exploitable cod stock.

10:45 – 11:00 BIODIVERSITY AND ECOLOGICAL NICHES OF DEEP-SEA COPEPODS: VERTICAL PARTITIONING, DIETARY PREFERENCES AND DIFFERENT TROPHIC LEVELS MINIMIZE INTERSPECIFIC COMPETITION.

Auel Holger; Laakmann Silke, Marine Zoology (FB 2), University of Bremen, Germany.

Biodiversity, abundance, and vertical distribution of deep-sea copepods (Euchaetidae, Aetideidae) were studied in Arctic Fram Strait during 1996-2006. Field data were combined with trophic biomarkers (fatty acids, stable isotopes) to characterize ecological niches of four *Paraeuchaeta* and seven aetideids. An enigmatic feature of meso- & bathypelagic communities is the sympatric co-occurrence of several congeners. This raises the question what mechanisms effectively minimize interspecific competition and sustain a high biodiversity in the deep-sea pelagial despite food limitation and in the absence of physical barriers. Within both families, congeners usually inhabit discrete depth layers, thus vertically partitioning the water column. Representatives occurring at the same depth differ in diet, feeding behaviour and trophic level. *Paraeuchaeta* species also differed in reproductive strategies. Larger eggs and smaller clutch size in bathypelagic species indicate a more lecithotrophic development as an adaptation to food limitation. Comparative studies in the Atlantic help identifying general patterns of biodiversity and niche separation in deep-sea zooplankton. Our time series also indicates changes in zooplankton community composition over the last decade down to the mesopelagic zone as a result of global warming.

11:00 – 11:15      NEW FLAVORS OF GELATA: BIODIVERSITY OF DEEP-SEA AND OPEN-OCEAN CTENOPHORES, SIPHONOPHORES, AND MEDUSAE.

Haddock Steven, MBARI, USA.

Dunn C.W., Ecol.Evol.Biology, Brown Univ, Providence, USA.

Pugh P.R., National Oceanographic Centre, Southampton / U.K.

G.R. Harbison, Biology, WHOI, Woods Hole, USA.

Helm R.R., Eckerd College, St. Petersburg, USA.

Raskoff K.A., Biology, Monterey Peninsula College, Monterey, USA.

The diversity of gelatinous zooplankton is difficult to estimate for several reasons. Samples are hard to obtain and collect, and diagnostic characters may not survive preservation. We have used a variety of methods in an attempt to circumvent these problems, including submersible collection and molecular phylogenetic analyses. Even with limited geographic coverage, our samples indicate that undescribed species form a significant fraction of the overall diversity of each group. Although the species richness of these phyla may not be on par with arthropods or polychaetes, the number of undescribed higher level groups is surprisingly large. There is also potential for much larger diversity given the number of cosmopolitan species that are likely to include cryptic species. Because the deep ocean water-column constitutes more than 90% of the living space on the planet, even uncommon species can add up to vast numbers. Thus an accurate baseline of marine fauna, critical for detecting ecological change, requires substantial effort toward determining the true diversity of the gelatinous components.

11:15 – 11:30      ANALYSIS OF MARINE HOLOZOOPLANKTON SPECIES DIVERSITY USING DNA BARCODES.

Bucklin Ann; Jennings Robert; Ortman Brian; Nigro Lisa, Department of Marine Sciences, University of Connecticut, USA.

Copley Nancy, Department of Biology, Woods Hole oceanographic Institution, Woods Hole, USA.

Wiebe Peter, Department of Biology, Woods Hole Oceanographic Institution, USA, New England.

DNA barcodes (i.e., short sequences for species recognition and discovery) provide an accurate means of identifying and discriminating known species, and will allow development of molecular approaches to rapid species identification. DNA barcodes, usually partial sequences for the mitochondrial cytochrome oxidase I (mtCOI) gene, have now been determined for more than 1,500 known species representing all major groups of holozooplankton assemblage, which include ~7,000 described species in 15 phyla. The growing DNA barcode database provides links between the species name, DNA sequence, and morphological characters. DNA barcodes are useful to identify individual specimens, reveal cryptic species, describe biogeographical distribution, discover new species, and characterize species diversity through environmental sequencing. In the not-too-distant future, DNA barcodes may be used in automated taxonomic analysis of known species in zooplankton samples, thus freeing experts to focus on the identification and description of new species.

11:30 – 11:45      DISTRIBUTION OF PELAGIC SHRIMPS (DECAPODA) ON THE MID-ATLANTIC RIDGE.

Falkenhaus Tone; Hansen Hege Ø, Plankton Research group, Institute of Marine Research, Norway.

Vereshchaka Alexander, Shirshov Institute of Oceanology, Russia.

Willassen Endre, The Natural History Collections, University of Bergen, Bergen, Norway.

Christiansen Marit E., Natural History Museum Auditorium, University of Oslo, Oslo, Norway.

Decapod shrimps comprise a significant part of the micronekton biomass in the mesopelagic zone of the oceans. The accumulated information on their distribution, migration and life histories suggests that pelagic shrimps play important roles in the vertical transport of organic matter in the oceanic system. In this paper we report on species compositions and vertical distributions of pelagic shrimps relative to a mid-ocean ridge system. Pelagic shrimps were sampled at 17 positions along the northern Mid-Atlantic Ridge (MAR; Iceland to the Azores) on a survey conducted as a part of the Census of Marine Life field project MAR-ECO. Depth stratified sampling revealed information on vertical distributions from surface down to 3000 m. 45 species of pelagic decapods shrimps belonging to 16 genera were identified. The major biogeographic divergence in the studied area was found at the Subpolar Front (SPF), which marked the boundary for the distribution of several species. An increase of species richness was found towards lower latitudes and the highest diversity of pelagic shrimps was usually found in the 700-1500 m stratum. Elevated abundance of pelagic shrimps was observed in the region of the SPF. Biomass per volume of pelagic shrimps was highest in the upper mesopelagic zone (200-700 m) north of the SPF. South of the SPF the biomass maximum was observed at 700-2300 m depth. Factors influencing distributions of the observed species assemblages along the Mid-Atlantic Ridge are discussed.

11:45 – 12:00      COMPARATIVE BIODIVERSITY OF MYCTOPHIDAE IN PELAGIC ZONE OF THE TROPICAL OCEAN

Tsarin Sergey, Biophysical ecology, Institute of Biology of the Southern Seas (IBSS), National Academy of Sciences of Ukraine, Ukraine.

Beloivanenko Tamara, Ichthyology, Institute of Biology of the Southern Seas (IBSS), National Academy of Sciences of Ukraine.

Biodiversity is important index of ecosystem and environment state. Very often biodiversity is study on the example of separate taxonomic groups. We studied myctophid taxocenosis of the night sound scattering layers (SSL). Differences of Myctophidae biodiversity in epipelagic zone of the Tropical Atlantic and the Indian Ocean were found. The greater number of species was found in the species composition of myctophid taxocenosis of SSL in the Tropical Indian Ocean in comparative with the Tropical Atlantic Ocean. (Up to 30 species was found simultaneously, against 10-15). In the Atlantic Ocean were found mainly taxocenosis of powerful jet current. In the Indian Ocean were found only taxocenosis, which related to certain water masses, usually limited closed circulations. Probably, this phenomenon is related to the frequent (half-year) changing of current direction in the Indian Ocean in depending on direction of monsoons. As a rule the life cycle of myctophids makes up half-year or multiple its. Obviously, taxocenosis, which are related directly to the jet current, does not have a time for the development and biodiversity in them less than in water mass.

12:00 – 12:15      PLANKTON DIVERSITY IN THE TROPICAL COASTAL WATERS OF KODIAKKARAI (POINT CALIMERE), INDIA.

Perumal Pachiappan, RAJKUMAR Mayalagu; Natarajan, Centre of Advanced Study in Marine Biology, ANNAMALAI UNIVERSITY, India.

The results of an investigation carried out on the phyto and zooplankton vis-à-vis hydrography at the coastal waters of Kodiakkarai (Southeast coast of India - Lat. 10° 16' 20 N; Long. 79° 49' 51 E), during September 2006 to August 2007 are reported. The concentration ranges of salinity (‰) and oxygen (ml l<sup>-1</sup>) were: 26-35 and 3.15-5.24 respectively. The ranges (µM) of nitrate, nitrite, phosphate, silicate and ammonia were: 3.54-7.05; 0.28-0.98; 0.26-2.82; 19.96-53.39 and 0.02-0.85 respectively. A total of 105 species of phytoplankton (diatoms predominated) and 121 forms of zooplankton (copepods predominated) were recorded. The density and diversity (bits/ind.) ranges of phyto and zooplankton were: 7,862 - 81,355 (cells l<sup>-1</sup>); 2.34-3.89 and 12,474-86,145 (org./l); 3.67-4.03 respectively. Higher values of density and diversity were found during post-monsoon and summer seasons and which showed positive correlation with salinity. The occurrence of most of the zooplankton showed a distinct seasonal pattern which was closely associated with the species-specific environmental conditions. The spatio-temporal variations in the distribution of plankton are discussed in relation to various hydrographical parameters/ previous reports of tropical and temperate ecosystems.

12:15 – 12:30      THE USE OF MICROARRAY FOR MONITORING SPATIAL AND TEMPORAL CHANGES IN BIODIVERSITY IN THE PICOPLANKTONIC.

Medlin Linda; Gescher Christine; Metfies katja, Department of biological oceanography, Alfred Wegener Institute, Germany.

The island of Helgoland has a long history in marine research and phytoplankton dynamics. In 1962, the Helgoland Roads time-series was established. For the phytoplankton community, only the > 20µM size fraction is identified on a daily basis. For picoplanktonic groups, light microscopy can not differentiate taxa or species. Molecular analyses of the picoplanktonic community have revealed frequent changes on a weekly and monthly basis, but a high congruence on a yearly basis. In this study phytoplankton field samples were taken at Helgoland in the North Sea from 2004 to 2006 in regularly intervals. The phyto- and especially picoplanktonic community compositions were successfully analyzed with the PHYTOPLANKTON CHIP for these three years. A few taxa were abundant all the time, whereas others were rare.

12:30 – 12:45      INFLUENCE OF THE MID ATLANTIC RIDGE ON THE DISTRIBUTION AND ABUNDANCE OF EUPHAUSIIDS IN THE OPEN ATLANTIC OCEAN.

Letessier Tom; Brierley Andrew, School of Biology, University of St Andrews, UK.

In the North Atlantic, patterns of near surface distribution and abundance of euphausiids are well known from the Continuous Plankton Recorder (CPR), but data for deeper depth horizons and more extremes of latitude have, until recently, been sparse. This has made it difficult to infer the impact - if any - of the Mid Atlantic Ridge (MAR)

on euphausiid distribution and abundance. Here we use a rapidly-expanding data set arising from recent CoML-aligned cruises to the MAR (including MAR-ECO and ECOMAR) in conjunction with data from other sampling programmes (including the UK's Marine Productivity programme) in a Generalized Additive Model framework to explore latitudinal patterns of variability in euphausiid distribution on, and at either side of, the MAR. We consider the roles of fracture zones and fronts overlying the ridge in demarcation of productivity biomes (as per Longhurst), and explore the roles of various physical and biological drivers on regional euphausiid biodiversity. Finally we consider how predicted environmental change might impact euphausiids in the vicinity of the MAR in the short- to medium-term future.

12:45 – 13:00      RELATIONSHIPS IN HOLOZOOPLANKTON, GENETIC AND MORPHOLOGICAL DIVERSITY, EXAMPLES FROM CHAETOGNATHA.

Pierrot-Bults Annelies, Marine Plankton, Zoological Museum Auditorium Amsterdam, University of Amsterdam, The Netherlands.

Jennings Robert, University of Massachusetts, Boston, USA.

Pelagic systems are the largest on earth and are composed of taxa with vast ranges of distribution. Genetic (using mtCOI) and morphologic diversity of Chaetognaths will be discussed looking into Eukrohnia species relationships, diversity, and phylogeography. For this study material from different locations has been used e.g. Arctic, Antarctic, North Atlantic, South-east Atlantic and South Pacific.

13:00 – 13:15      DIVERSITY HOTSPOTS OF SHARKS, RAYS AND CHIMAERAS IN THE SOUTHWEST ATLANTIC.

Lucifora Luis; García Verónica, Biology, Dalhousie University, Canada.

Menni Roberto, División Zoología Vertebrados, Museo de La Plata and Consejo Nacional de Investigaciones Científicas y Técnicas, La Plata, Argentina.

Recognizing large scale patterns and hotspots of biodiversity is fundamental to set priority areas for conservation. Chondrichthyan fishes – sharks, rays and chimaeras – are among the most threatened marine organisms in the world, and yet the geographic distribution of chondrichthyan diversity at large scales is unknown. Here, the distribution of chondrichthyan species of the southwest Atlantic (between 22 and 57°S, from 20 to 1100 m depth) was mapped onto a 1°-by-1°-cell grid, using data from four research cruises between 1966 and 1978 – before development of major fisheries in the area. Reported catches of chondrichthyans by trawl fisheries were overlaid with diversity patterns to assess areas of risk. Species density peaked off central Argentina between 38 and 44°S; these hotspots of biodiversity coincided largely with highly productive and transitional zoogeographic areas. The highest extractions of chondrichthyans by fisheries (1245-2477 annual tonnes) occurred in the cells with the highest biodiversity. Given the high overlap between diversity hotspots and catches of chondrichthyans, protected areas covering these hotspots could be useful to conserve chondrichthyan diversity.

13:15 -13:30      GLOBAL PATTERNS OF RICHNESS AND THE ECOLOGICAL CONSEQUENCES OF DECLINE FOR OCEANIC PREDATORY FISHES.

Boyce Daniel, Biology, Dalhousie University, Canada.

Tunas and billfishes are important economically and ecologically, but have declined greatly in abundance since the commencement of industrialized fishing in the open oceans. A prerequisite for effective management will be determining the environmental factors affecting the large-scale distribution patterns of these species as well as quantifying the ecosystem effects of declining abundances. Here, I use a statistical modeling approach to predict global patterns of species richness from the individual temperature tolerances of 18 species of tuna and billfish. Predicted patterns of tuna and billfish richness were positively correlated with diversity patterns derived from empirical fisheries data and peaked at intermediate latitudes in a manner similar to other open ocean marine taxa. Further, in order to gauge potential trophic impacts of oceanic predatory fish declines, large-scale time trends for several mesopelagic prey fish species were estimated. Initial model results provide evidence of increasing abundance in these taxa, in accordance with a top-down hypothesis. These findings provide further evidence that oceanic ecosystems possess a unique biological structure and highlight the importance of predatory fishes in structuring open ocean ecosystems.

## Morning

## Auditorium museum

### Session 1.8 Marine biogeography and comparative phylogeography: joining paleontologists, taxonomists, ecologists and geneticists

Chairs : Anne Chenuil; Filipe Alberto.

10:30 – 10:45 SHUFFLING OF NATIVE GENETIC DIVERSITY IN INTRODUCED SPECIES: FROM EVIDENCES TO CONSEQUENCES.

VIARD Frédérique, Adaptation & Diversité en Milieu Marin (UMR 7144 CNRS UPMC), Station Biologique de Roscoff, France.

Human-mediated species introductions around the world are an important facet of the global change. Biological invasions have been observed at an increasing rate since the end of the 19th century with major threats for biodiversity and ecosystem stability. Numerous conceptual frameworks and methodological outlines have been developed for the study of biological invasions. In particular an increasing number of studies have been concerned with the genetic diversity of invaders: how genetically diverse are those species? Did they suffer from founder events? What is the correlation between genetic diversity and invasion success? By using examples drawn from genetic analyses of marine invertebrates (e.g. *Cyclope neritea*) and macrophytes (e.g. *Undaria pinnatifida*), I will show that successful introductions often rely on recurrent introductions of large numbers of individuals (i.e. no or limited founder effects). Consequently, human-mediated introductions may promote a regional re-shuffling of the genetic diversity observed within the native range of the species. Such processes can have important consequences on the ability of introduced populations to adapt to future environmental changes.

10:45 – 11:00 WHAT CAN COMPARATIVE PHYLOGEOGRAPHIES TELL US ABOUT SOUTHERN AFRICA'S DYNAMIC OCEANIC PAST?

Von der Heyden Sophie, Evolutionary Genomics Group, Department of Botany and Zoology, Stellenbosch University, South Africa.

South Africa is the meeting point of two great and dynamic oceanic currents, with the associated coastline comprising a number of highly variable bioregions that affect the distribution and abundance of marine species. In order to understand the patterns of population structure and gene flow along the 3500 kms of South African coastline, species with large geographical ranges and differing life history characteristics (i.e. broadcast spawning, brooding and live bearing) were sequenced for both mtDNA and nuclear genes. Organisms included molluscs, crustaceans, echinoderms and fishes. Cape Agulhas plays an important role in limiting gene flow between the east and west coast for many species. Other barriers to gene flow were also detected, but differ between even closely related groups of organisms and are probably linked to life history and environmental requirements. Coalescent analyses were utilised in order to analyse demographic changes for all species concerned. Understanding the patterns and processes influencing population structuring will influence not only the management practices of exploited marine species, but will contribute to the management and conservation of the entire southern African coast.

11:00 -11:15 CONCORDANT PHYLOGEOGRAPHIC PATTERNS AMONG VARIOUS SPECIES SUGGEST ANCIENT ORIGIN OF THE 30°S MARINE BIOGEOGRAPHIC TRANSITION.

Faugeron Sylvain; Brante Antonio; Castilla Juan Carlos; Fernandez Miriam; Navarrete Sergio; Poulin Elie, Ecología, Facultad Ciencias Biológicas. Pontificia Universidad Católica de Chile, Chile.  
Cárdenas Leyla, Departamento de Ecología, Universidad Austral, Valdivia, Chile.  
Haye Pilar, CEAZA, Universidad Católica del Norte, Coquimbo, Chile.  
Valero Myriam; Viard Frédérique, UMR7144, CNRS, Roscoff, France.  
Wares John, Department of Genetics, State University of Georgia, Athens, USA.

The distribution pattern of coastal marine species shows in Chile 3 main biogeographic provinces: the Magellan Province, the Peruvian Province and an Intermediate Area in between. Two biogeographic transitions separate these provinces at 42°S and 30°S. The 42°S limits the distribution of most taxa and corresponds to major

environmental discontinuities. In contrast, the 30°S is more controversial as it is not observed for many taxa and the geographic location does not correspond to a clear environmental transition. In order to investigate the origin of this biogeographic transition, phylogeographic studies were engaged in several taxa which distribution crosses this transition zone. For 6 out of these 10 species, a deep genetic discontinuity was observed around 30°S, suggesting an ancient origin of the biogeographic transition (estimated at up to 4.5 million years). The remaining species that do not show such a discontinuity correspond to highly dispersive species and/or species that suffered more recent demographic expansion. These results are contrasted with current patterns of recruitments, reproductive out-put, and local adaptation that suggest the influence of present-day ecological factors in maintaining the phylogeographic discontinuity.

11:15 – 11:30 SCANNING THE GENOME OF THE PACIFIC CUPPED OYSTER, *CRASSOSTREA GIGAS*, FOR ADAPTIVE DIFFERENTIATION DURING GEOGRAPHIC RANGE EXPANSION.

Rohfritsch Audrey; Boudry Pierre, Laboratoire de génétique et pathologie, Ifremer, France.

Bierne Nicolas, Laboratoire Biologie Intégrative, ISEM, Sète, France.

Heurtebise Serge, Laboratoire génétique et pathologie, Ifremer, Plouzane, France.

Lapegue Sylvie, Laboratoire génétique et pathologie, Ifremer, La Tremblade, France.

*Crassostrea gigas* is endemic to Japan, but has been introduced and translocated for aquaculture purpose into several European countries. Our project aims at identifying the characteristics of such a flourishing species (chance and/or global change or good adaptation ability). Therefore we developed a population genomics approach, known as “genome scan”. It corresponds to the study of numerous loci spread through the genome, in order to quantify the part of the genome affected by a molecular signature that takes the form of a valley of diversity centred on the selected mutation (selective sweep) and/or the form of an unexpected level of population differentiation. The genome scan is performed with AFLPs (Amplified Fragment Length Polymorphisms). We are genotyping different “colonizing” populations in Europe, and a “native” population (Japan). Equilibrium models are then used to evaluate outliers to help focus research on genomic regions of interest. In addition, we are mapping on a reference population the candidate outliers and quantifying the part of the genome affected by a loss of diversity. We present and discuss here the first results.

11:30 – 11:45 SPATIAL VARIATION OF THE STRIPED SEABREAM (*LITHOGNATHUS MORMYRUS*) USING A COMBINATION OF GENETIC, ECOLOGICAL AND LIFE-HISTORY APPROACHES.

Sala Bozano Maria; Mariani Stefano, School of Biological & Environmental Science, University College Dublin, Ireland.

Kermaier Valerio, Unit of Evolutionary Biology/Systematic Zoology, University of Postdam, Postdam, Germany.

The geographic structure of populations results from the interplay amongst several factors, such as gene flow, life history variation, ecology, or isolation by behavioural, genetic, or geographical barriers. In recent years a large number of studies have focused on genetic markers to unravel the geographical structuring of a vast number of organisms, but only a few of them have effectively integrated both genetic and ecological approaches. In the present study we used genetic and ecological analysis to examine population structuring in a marine teleost, *Lithognathus mormyrus*, across different locations along a Mediterranean-Atlantic transect. Microsatellite and mitochondrial control region screening, parasitic load, life history and ecological traits (sex ratio, weight-at-length, size- and age-at-sex change, growth rate, feeding habits) are employed to describe spatial patterns in this species. Our results reveal a high degree of congruence between ecological and genetic descriptors of present-day connectivity, and identify in the Oran-Almeria front the main barrier to effective migration in striped seabream. This study shows that a truly multidisciplinary approach is required to describe and understand thoroughly the biogeographic structure of marine populations.

11:45 – 12:00 USING MOLECULAR DATA TO INTERPRET ECOLOGICAL GRADIENTS: AN INTERFACE BETWEEN GENETICS AND ECOLOGY.

Vasileiadou Katerina; Sarropoulou Elena; Tsiggenopoulos Kostas, IMBG, HCMR, Crete.

Reizopoulou Sofia; Simboura Nomiki, Oceanography, HCMR, Athens, Greece.

Nicolaidou, Artemis, Biology, University of Athens, Athens, Greece.

Orfanidis Sotiris; Fisheries Research Institute, National Agricultural Research Foundation, Kavala, Greece.

Kotoulas Giorgios; Arvanitidis Christos, IMBG, HCMR, Heraklion, Greece.

Until lately, ecology and population genetics disciplines were used separately in the community studies. An approach that has not been applied widely is testing the ecological theory with the use of molecular data deriving

from multispecies assemblages. A first attempt to compare faunal patterns from polychaete lagoonal taxocommunities with those resulting from molecular data from the same species, is presented in the current study. For this purpose, mtDNA of the most abundant polychaetes from some Greek lagoons were used. Species and genetic diversity patterns were produced by non-metric multidimensional scale (MDS) analysis, whilst 2nd stage MDS analysis was used in order to compare those patterns.

12:00 – 12:15      COMPARATIVE PHYLOGEOGRAPHY OF THREE FUCUS SPECIES (HETEROKONTOPHYTA; FUCACEAE) WITH CONTRASTING MATING SYSTEMS AND HABITATS.

Hoarau Galice; Coyer James; Hogerdijk Bas, Marine Benthic Ecology and Evolution, CEES, University of Groningen, Netherlands.

Costa Joana; Serrao Ester, CCMAR-CIMAR, University of Algarve, Faro, Portugal.

Billard Emmanuelle; Valero Myriam, Evolution et Génétique des Populations Marines, Station Biologique de Roscoff, Roscoff, France.

Johannesson Kerstin, Marine Ecology, Tjärnö Marine Biological Laboratory, Strömstad, Sweden.

Stam Wytze, MarBEF, University of Groningen, Haren, The Netherlands.

The Last Glacial Maximum (20-18 kya) dramatically affected extant distributions of virtually all northern European biota. For marine species, recent studies on northeastern Atlantic taxa suggest a Pleistocene refugium around the Iberian Peninsula, the English Channel/Brittany area, and the southwestern coast of Ireland. Species of the brown algal genus *Fucus* (Heterokontophyta; Fucaceae) dominate the intertidal biomass of northern Atlantic shorelines with a distinct zonation pattern. Locations of refugia and post-glacial recolonization pathways were examined using a highly variable mitochondrial intergenic spacer in *F. vesiculosus* (dioecious, mid intertidal) and *F. spiralis* (hermaphroditic, high intertidal) and compared with similar data previously obtained for *F. serratus* (dioecious, low intertidal to subtidal). Implications of the differences in mating system and habitat for the phylogeography and historical demography are discussed.

12:15 – 12:30      GENETIC AND BACTERIAL DIVERSITY OF THE ENDANGERED SPONGE SPONGIA AGARICINA.

Noyer Charlotte, Molecular Biology, Integrin Advanced Biosystems, Scotland, UK.

Becerro Mikel A.; Uriz Maria Jesus, Aquatic Ecology, Center for Advanced Studies of Blanes (CEAB, CSIC), Blanes, Spain.

McKenzie Douglas, Integrin Advanced Ecosystems, Oban Argyll, Scotland.

Understanding biodiversity is a major challenge in ecology. Sponges can hold a large diversity of bacterial endobionts and natural products. Whether this bacterial and chemical diversity is related and a function of the sponge genetic diversity is unknown. We are investigating these relationships in the endangered Mediterranean sponge *Spongia agaricina*. Here, we quantified sponge and bacterial diversity in multiple sponge populations from the Mediterranean and Portugal using microsatellite markers, Denaturing Gradient Gel Electrophoresis, and qPCR. We found evidence for significant allelic variation in microsatellite loci and significant genetic differentiation between sponge populations, which are isolated by distance. We also found a great bacterial diversity that significantly varied between populations. Our results show for the first time a relationship between the diversity of the sponge and its associated bacterial community at a geographic scale. Further research will test whether variation in natural products occurs at the same scale and will shed light on the true nature of these relationships. This research is part of a PhD funded by the European Union BIOCAPITAL grant.

12:30 – 12:45      WHY IS THERE A BIOGEOGRAPHIC TRANSITION AT 30°S ALONG THE CHILEAN COAST? A PHYLOGEOGRAPHIC STUDY OF THE KELP LESSONIA NIGRESCENS.

Tellier, Florence, Station Biologique de Roscoff / Center for Advanced Studies of Ecology and Biodiversity, LIA DIAMS. CNRS-UPMC / Pontificia Universidad Catolica de Chile. France/Chile.

Valero, Myriam. Station Biologique de Roscoff, LIA DIAMS. CNRS-UPMC. Roscoff. France

Faugeron, Sylvain. Center for Advanced Studies of Ecology and Biodiversity, LIA DIAMS. Pontificia Universidad Catolica de Chile. Santiago. Chile.

Along the Chilean coast, three biogeographic regions have been defined, with two transition zones at 30-33°S and 40-42°S. In contrast to the 40-42°S transition zone, the significance of the 30-33°S transition zone is controversial, as it does not coincide with any clear ecological barrier and there is no convincing explanation for



the origin of this transition zone. The aim of this study is to determine if the 30-33°S zone coincides with genetic changes in the kelp *Lessonia nigrescens* continuously distributed along the coast. We used a phylogeographic approach based on a comparison of three different DNA markers: mitochondrial (ATP8S), nuclear (ITS) and chloroplastic (Rubisco spacer). The markers agreed to show the existence of two highly divergent clades, occurring on each side of the 30°S biogeographic transition zone. These possible cryptic species never co-occur in populations (even in the contact zone between the two clades), suggesting a complete reproductive isolation. In this contact zone characterized by a mosaic of populations of the two clades, transplantation experiments have been performed in order to discuss the existence of an ecological barrier.

12:45 – 13:00      ORIGIN OF SOUTHERN HEMISPHERE MYTILUS (MOLLUSCA, BIVALVIA) POPULATIONS: CONTRASTING PATTERNS INFERRED FROM MITOCHONDRIAL AND NUCLEAR DNA.

Gerard Karin, Center d'Océanologie de Marseille, Université de la Méditerranée, France.

Bierne Nicolas, CNRS, Sète, France.

Borsa Philippe, IRD, Noumea, New Caledonia.

Chenuil Anne; Féral Jean-Pierre, Centre d'Océanologie de Marseille, CNRS, Marseille, France.

Smooth-shelled mussels (*Mytilus* spp.) are antitropically distributed. In the Northern Hemisphere, the *M. edulis* species complex includes *M. edulis*, *M. galloprovincialis* and *M. trossulus*, which are genetically well differentiated. In the Southern Hemisphere, morphological characters, allozymes and intron length polymorphisms, suggested that *Mytilus* spp. populations from South America and Kerguelen Islands were related to *M. edulis* and those from Australasia to *M. galloprovincialis*. On the other hand, a phylogeny of the 16S rDNA mitochondrial locus (16S) demonstrated a clear distinctiveness of southern mussels and suggested their relationships with Mediterranean *M. galloprovincialis*. Here, we analysed the faster evolving locus cytochrome oxidase subunit I (COI). The divergence between haplotypes of southern and northern populations, was confirmed with more support. A strong genetic structure was detected among southern samples. This southern differentiation was partly explained by recent introduction of northern mussels. However, three genetic entities were also revealed among southern endemics populations: 1) South America and Kerguelen Island, 2) Tasmania, 3) New Zealand. The apparent cyto-nuclear discordance suggests two alternative biogeographic scenarios that imply either one or two trans-equatorial migrations.

13:00 – 13:15      DISTRIBUTIONAL AND DEMOGRAPHIC CONSEQUENCES OF PLEISTOCENE GLACIATIONS FOR A MARINE DEMERSAL FISH.

Larmuseau Maarten, Biology, Katholieke Universiteit Leuven- Laboratory of Animal Diversity and Systematics, Belgium.

Van Houdt Jeoren K.J., Biology, Royal Museum Auditorium of Middle Africa, Tervuren, Belgium.

Hellemans Bart, Biology, Katholieke Universiteit Leuven-Laboratory of Animal Diversity and Systematics, Leuven, Belgium.

Guelinckx Jef, Biology, Katholieke Universiteit Leuven-Laboratory of Aquatic Ecology and Evolutionary Biology, Leuven, Belgium.

Volckaert Filip A.M., Biology, Katholieke Universiteit Leuven-Laboratory of Animal Diversity and Systematics, Leuven, Belgium.

The Pleistocene glaciations were the most significant historical event during the evolutionary lifespan of most extant species. However, little is known about the consequences of the ice ages on the distribution and demography of marine animals of the Northeastern Atlantic. Because of reduced levels of contemporary gene flow, a marine demersal fish, the sand goby (*Pomatoschistus minutus*; Gobiidae, Teleostei) has been chosen for a phylogeographic study using cytochrome b sequences and eight microsatellites. Because of the absence of a fossil record, only ecological and taxonomical information could be used to calibrate the for gobies typically high evolutionary clock. Reciprocal monophyly occurred between the Mediterranean and Atlantic populations with a divergence dated in the Middle-Pleistocene. The Atlantic Clade contains an Iberian and North Atlantic (NA) Group, from which only the latter did contribute to the most recent postglacial distribution expansion. The historical demography of the Mediterranean Clade was mainly influenced by Middle Pleistocene glaciations in contrast to the two Atlantic ESUs who show for the first time evidence for a recent, most likely post-LGM, expansion.

13:15 -13:30      RECONSTRUCTING THE EVOLUTIONARY AND DEMOGRAPHIC HISTORY OF TWO KELP SPECIES.

Valero Myriam; Destombe Christophe; Daguin Claire; Oppligez Valeria; Lamy Thomas, UMR CNRS-UPMC 7144, Station Biologique de Roscoff, France.

Both historical and contemporary natural processes have a profound influence on the distribution of individuals within a species' range and, as a consequence, on the distribution of the genetic diversity. In this study, we propose to use tools of population genetics to investigate dynamics of dispersal and colonisation including global change and human effect in two brown seaweeds with contrasting (annual vs perennial) life histories. The kelp, *Laminaria digitata* is the dominant species along the Brittany coast where it is harvested for its high quality alginates. Its species range appears to be changing under the effect of the climatic changes and/or anthropogenic pressures. In the southern limit of its range, *L. digitata* populations are regressing in favour of the annual kelp species *Saccorhiza polyschides*. The historical approach (phylogeography) reveals that one of the main refugia occurred in Brittany where both species coexisted in the past. The contemporary approach shows for both species that habitat discontinuity has a major effect on genetic diversity and gene flow suggesting that maladaptation at range limits is probably mainly due to drift (small population size).

## Morning

### Polivalente room

#### Session 2.5 Marine bioinvasions and ecosystem functioning

Chairs : Sergej Olenin; Anna Occhipinti Ambrogio; Stephan Gollasch.

10:30 – 10:45      PATTERNS AND IMPACTS OF BIOINVASIONS IN EUROPEAN COASTAL SEAS

Olenin, Sergej. Didziulis, Viktoras Coastal Research and Planning Institute. Klaipeda University. Klaipeda. Lithuania.

Galil, Bella. National Institute of Oceanography. Haifa. Israel.

Gollasch, Stephan. GoConsult. Hamburg. Germany.

Minchin, Dan. Marine Organism Investigations. Ballina Killaloe, Co Clare. Ireland.

Panov, Vadim. Faculty of Geography. St. Petersburg University. Russia.

Cowx, Ian, Nunn. Andy D. International Fisheries Institute. University of Hull. UK.

Gherardi, Francesca. Tricarico, Elena. Dip. Biologia Animale e Genetica. Universita' degli Studi di Firenze. Italy.

Miossec, Laurence. IFREMER. La Tremblade. France.

Occhipinti Ambrogio, Anna. Dip. Ecologia del Territorio. Università degli Studi di Pavia. Italy.

We analyzed regional differences in the patterns of biological invasions in various European regional seas. There are nearly 1070 alien species introduced either into Europe from elsewhere (e.g. the Americas, SE East Asia) or from one European biogeographical region to another (e.g. from the Caspian Sea to the NW European seas). At the European scale the most important pathways are ships' ballast water and hull fouling (30 % of all introduction events), marine and inland canals (24 %), aquaculture and stocking practices (20 %). Other pathways (e.g. ornamental, leisure activities, biocontrol) and introduction events where pathways remain unknown constitute about 25%. Primary and secondary anthropogenic pathways may overlap and together with natural factors can greatly facilitate the spread of non-native aquatic biota. Also the importance of pathways varies within different European regions. The impacts of invasive species depend on the phase of invasion and on the spatial scale, being most visible in small invaded areas and "diluted" at the larger scale. The paper is based on the results of the recent EU funded research projects DAISIE, IMPASSE, ALARM and MARBEF.

10:45 – 11:00      GLOBAL CHANGE AND ALIEN SPECIES IN THE MEDITERRANEAN SEA

Occhipinti Ambrogio, Anna. Dip. Ecologia del Territorio. Università degli Studi di Pavia. Italy.

Galil, Bella. National Institute of Oceanography. Haifa. Israel

Occhipinti Ambrogio, Anna. Dip. Ecologia del Territorio. Università degli Studi di Pavia. Italy

More than 600 alien marine metazoan species have been recorded in the Mediterranean Sea, and many have established durable populations. In the past two decades on average about 10 alien species new to the Mediterranean have been recorded annually. The majority of aliens are thermophilic species originating from the

Indo-Pacific or Indian Oceans, which have entered the Mediterranean through the Suez Canal. While Erythrean aliens were pouring into the Levantine basin, alien shellfish and their "associates" were introduced into the European coast of the Mediterranean through the massive importation of alien shellfish in the 1960s - 1980s. The increasing role of the Mediterranean as a hub of international commercial shipping have contributed to the resurgence of shipping-derived introductions since the 1960s. Data gleaned from a recently assembled database of alien species in the Mediterranean allow examination of the possible impacts of global change and environmental management options either in place or soon to be. It is likely that the rising sea water surface temperature (SST) will favour the thermophilic aliens reproduction, growth, and survival, and provides them with a distinct advantage over native temperate Mediterranean taxa. Both processes - rising SST and the influx of thermophilic aliens - may impact the already teetering fisheries, mariculture, and tourism through proliferation of alien parasitic, noxious and poisonous species, displacement of commercially-important native species, or through alteration of the food web and by causing phase shift in coastal ecosystems and changing seascape patterns. These processes pose a challenge to the environmental ethics and policies of the peri-Mediterranean countries.

11:00 - 11:15      HOW DO CHANGES IN PREDATOR DIVERSITY AFFECT ECOSYSTEM FUNCTIONING?

O'Connor, Nessa. School of Biology and Environmental Science. University of College Dublin. Ireland.

It is known that the rate of species loss is increasing on a global scale and predators are most at risk from human-induced extinction. The effects of losing predators are difficult to predict because different combinations of species can interact in unpredictable ways, making it difficult to identify general relationships. In recent years, studies in marine systems have led the way, providing improved designs of experiments testing for effects of species diversity on ecosystem functioning and advancing our understanding of the role of multiple predators. Predator identity and density are emerging as important factors determining the effects of predator diversity per se. Predictions are further complicated by density dependant intra-guild interactions among predators. Mounting evidence suggests that using a traditional food web model approach may not be useful in this context because predators cannot be classed into a single functional group and their roles may vary when present at different densities. Predictions of the effects of loss of predators should, therefore, be based on detailed knowledge of a system and sound experimental evidence, not from observations or generalised models.

## LUNCH

## AFTERNOON

### Red sed Auditorium

#### **Session 2.1 Coastal marine benthic biodiversity and ecosystem process under uncertain environmental futures**

Chairs : Martin Solan; Dave Paterson; Dave Raffaelli; Piran Whit.

15:00 -15:15      BIODIVERSITY EFFECTS ON ECOSYSTEM FUNCTIONING: HOW RELEVANT ARE EXPERIMENTS TO THE REAL WORLD?

Duffy J. Emmett, The College of William and Mary, Virginia Institute of Marine Science, 23062-1346.

Theory and experiments have made significant progress in illuminating the influence of changing biodiversity on ecosystem functioning (BEF) in recent years. But controversy continues regarding the relevance of BEF experiments to the complex ecosystems and large spatial and temporal scales of interest in conservation and management. Here I address some of the persistent criticisms of experimental BEF research and argue that they have often been overstated. Contrary to some suggestions, many putative artifacts attributed to BEF experiments render their conclusions conservative. Like other areas of ecological theory, BEF speaks to broad general patterns, rather than to species-level applied conservation problems. Nevertheless, insights from BEF experiments conducted to date are likely to underestimate rather than overestimate the importance of biodiversity to ecosystem

functioning and service provision in the real world. Managing ecosystems to promote biodiversity can have important benefits, utilitarian and otherwise.

#### 15:15 – 15:30 HOW DO THE STRENGTH AND IMPORTANCE OF POSITIVE INTERACTIONS CHANGE WITH ENVIRONMENTAL STRESS?

Johnson Gareth; Hiddink Jan Geert; Kaiser Michel Joseph, Coastal Resource Ecology and Management, School of Ocean Sciences, College of Environmental Sciences, Bangor University, Wales.  
Ramsay Kisten, Countryside Council of Wales, Bangor, Wales.

Human-induced environmental change is predicted to alter levels of biodiversity at all scales. Positive interspecific interactions could help mediate species loss by ameliorating environmental stress. This study examines how the importance of facilitation via biomodification changes with stress in intertidal communities. Abundances of two bioengineers and the strength of the stress they ameliorate were manipulated in situ. Natural benthic communities were exposed to three densities of *Arenicola marina* at three levels of anoxic stress and three densities of *Limacina conchilega* at three different current speeds. Bioirrigation by *A. marina* and increased sediment stability caused by *L. conchilega* were more important in more stressful treatments. Species richness was also significantly higher in high stress treatments when bioengineers were present. Hence, positive interactions through biomodification are relatively more important in high stress systems. This study shows that bioengineers play an important role in stressed communities, allowing species to survive in environments that would not otherwise have been tolerable. In the face of global environmental change, facilitative interactions will become more important and may buffer species loss to a degree.

#### 15:30 -15:45 DEAD ZONES: A MAJOR BLOW FOR BIODIVERSITY IN SHALLOW COASTAL SEAS

Riedel, Bettina. Stachowitsch, Michael. Department of Marine Biology. University of Vienna. Austria.  
Zuschin, Martin. Department of Paleontology. University of Vienna. Austria.  
Haselmair, Alexandra. Department of Marine Biology. University of Vienna. Austria.

No other environmental parameter crucial to shallow coastal ecosystems worldwide has changed as dramatically as dissolved oxygen (DO). Presently, nearly 200 hypoxic (<2 ml l<sup>-1</sup>) and anoxic (no oxygen) areas, so-called "dead zones", have been identified around the globe, impacting coastal waters and estuaries from the molecular to the ecosystem level. Fuelled by ongoing eutrophication and global warming (i.e. increased thermal stratification) this large-scale loss of biodiversity can change structurally complex and diverse benthic and pelagic communities to far simpler, depauperated ones. The Northern Adriatic Sea, characterized by epifaunal communities that form dense multi-species aggregations or bioherms, serves as a model for repeated seasonal low DO events. Here, this has led to a series of benthic mortalities whose extent and severity appear to be increasing. To date, the onset and extent of such collapses is difficult to predict: benthic mortality events often run their course within a few days, hindering full documentation in the field. Using a specially developed underwater-chamber – equipped with camera, flashes and a sensor array – we have for the first time experimentally recreated small-scale anoxias in situ that successfully mimic the forcing conditions present during large-scale anoxic scenarios. Our approach fully documents the complex, community-level processes and interactions expected in the natural environment, such as concurrent behavioural reactions on natural substrates, intra- and interspecific interactions (e.g. unexpected predatory interactions), and mortality sequences. The aim is to identify indicator species for oxygen crises and to better evaluate the status and stability of benthic systems here and elsewhere.

#### 15:45 – 16:00 EFFECTS OF AQUATIC PLANT SPECIES RICHNESS ON BENTHIC ECOSYSTEM STRUCTURE AND FUNCTION.

Boström Christoffer; Gustafsson Camilla; Salo Tiina, Environmental and Marine Biology, Åbo Akademi University, Finland.

Effects of plant diversity on ecosystem functioning has been extensively studied in terrestrial systems, however analogous marine experiments are rare. The mixed Baltic Sea angiosperm assemblages (>10 species) provide excellent model systems for plant manipulations simulating non-random species loss. We present results from five field experiments designed to test for effects of plant species richness and composition on intratrophic (primary production, competition, biomass allocation: above-ground vs. below ground) and intertrophic (sediment micro- and macrofauna and leaf fauna) patterns and processes. In two 3.5 mo experiments, monocultures and mixtures of the four dominating plants were planted in a replacement design based on (a) standardized plot density (17 treatments) and (b) biomass (7 treatments). Effects of plant richness on leaf fauna, was tested in two 1 week experiments (7 treatments) and by sampling artificial seagrass in established plant cultures. Plants showed species

and treatment specific differences in growth strategy and high morphological plasticity. Results also indicate minor effects of plant richness on infaunal communities, while epifaunal responses were species specific with strong temporal variation. Plant richness correlated negatively with epifaunal diversity.

## Auditorium museum

### Session 1.4 Discoveries from integrated data systems

Chairs: Ward Appeltans; Mark J. Costello; Edward Vanden Berghe.

15: 00 – 15:15 ANALYSIS OF SPECIES RICHNESS PATTERNS AS APPARENT FROM OBIS DATA.

Vanden Berghe, Edward, OBIS, USA.

The Ocean Biogeographic Information System (OBIS, <http://www.iobis.org>) integrates data from a vast number of individual databases/datasets, and contains now about 14 million distribution records from 250 datasets. This integration necessitates the strict application of controlled vocabularies to assure that content of the different sources is properly interpreted. For taxonomy, two databases have been recently attained sufficient completeness to be usefully deployed in such quality control: the World Register of Marine Species (WoRMS, <http://www.marinespecies.org>) and the Interim Register of Marine and Non-Marine Genera (IRMNG, <http://irmng.csiro.gov.au>). Both automated and manual clean-up was done on the OBIS taxonomic names as they were supplied to the system by its data providers; the manual method was only performed on a relatively small group (rays and sharks). Statistics were calculated on the number of names strings that ultimately resolved to the same correctly spelled name, and to the currently accepted name. General trends of diversity were calculated on the raw names, the cleaned-up names and the accepted names, and the resulting maps compared with each other.

15:15 – 15:30 OCEANLIFE: A SCALABLE INFORMATION INTEGRATION FRAMEWORK FOR MARINE BIODIVERSITY AND ECOLOGY.

Stocks Karen; Condit Chris; Qian Xufei; Gupta Amarnath, San Diego Supercomputer Center, University of California, San Diego, USA.

The OceanLife project has been developing data integration technologies for use in a variety of biological sciences, including marine biodiversity studies. Its open-source data mediator, which will be described in the presentation, provides a generic and extensible approach for integrating and accessing data of a variety of types, including those commonly used for biodiversity point data and marine environmental data. The mediator is currently being extended to handle time-series data, particularly spatiotemporal information. New collaborators interested in using these tools in their data systems are welcome. Contrasting our experience in developing the system for marine biodiversity (in particular for OBIS, seamount ecology, and marine protected area science) with our development for molecular biology and neurobiology highlights particular challenges facing marine biodiversity informatics: 1) a lack of funding and especially expertise for implementing new technologies in existing production systems, leading to stalled prototypes and a proliferation of home-grown solutions that make post-hoc interoperability difficult; 2) the need for biodiversity systems to support much more flexible data querying, browsing, and pruning than many other application areas; and 3) a lack of widely-adopted data formats and controlled vocabularies, particularly formal ontologies, that limits interoperability.

15:30 -15:45 ADVANCING MARINE HABITAT CLASSIFICATIONS THROUGH A NEW GLOBAL TERRAIN MAP TO INTEGRATE ECOLOGY IN BIODIVERSITY DATA SYSTEMS.

Costello Mark, EcoServe and University of Auckland, Ireland.

Including ecology in biodiversity data systems requires classifications of habitat terms to provide standard definitions and hierarchical relationships. In addition to data systems such as the Ocean Biogeographic Information System (OBIS), a wide range of intergovernmental, conservation and fishery organizations (e.g. IUCN, WWF, TNC, UNESCO, FAO, IOC, ICES, GEOSS) require classifications of marine habitats and ecosystems to enable comparisons between areas and to organize information in maps and reports. However, all of the terms used to describe habitats are concepts whose definition is context dependant. For example, the habitat of a benthic invertebrate is very different in spatial scale to that for a parasite, plankton, tuna or whale. An ecosystem can be physiographically defined as a lagoon, seamount, estuary, abyssal plain, or entire ocean. Different sampling methods will define different regions, such as satellite images of ocean colour, acoustic maps of the

seabed, in-situ sampling of water or sediment cores, and maps derived from analyses of species distributions that may define biogeographic regions. To date, biogeographic boundaries have been more defined by expert opinions than analyses of species distribution data. This presentation reviews classifications in use regionally and globally (EUNIS, Australian, LME, MEOW, Longhurst's, IHO sea and oceans, Exclusive Economic Zones). A physical 'habitat' classification based on a Geographical Information System analysis of the best available globally integrated bathymetry will be reported here for the first time, and present and future options, including pelagic, benthic and hierarchical systems, for data management in OBIS and GEOSS are outlined.

15:45 – 16:00      LARGE-SCALE PATTERNS IN HARPACTICOID COPEPOD DIVERSITY AND DISTRIBUTION.

Garlitska Lesya, Ecology of Marginal Communities, Odessa Branch, Institute of Biology of Southern Seas, NASU, Ukraine.

Chertoprud Elena; Azovsky Andrey, Dept of Hydrobiology, Biological Faculty, Moscow State University, Moscow, Russia.

Kondar Daria, Coastal Ecology Laboratory, Shirshov Institute of Oceanology, RAS, Moscow, Russia.

Using an extensive collection of both original and published data from more than 200 sources, the data base of the marine benthic harpacticoid species is compiled. Up to date, the base includes (after removing the synonyms) more than 1720 species and covers the Arctic, North and Central Atlantic Oceans as well as the European enclosed seas. Analysis of the species composition similarity between 25 regions shows that five large groups could be distinguished: Polar (central Arctic basin, Laptev, East Siberian, Chukchi and Beaufort seas), Sub-arctic (North, Baltic, White, Barents and Kara seas, N-E and N-W Atlantics), Mediterranean, Ponto-Caspian (Black, Azov, Caspian and Aral seas) and Central W Atlantic (including Caribbean Sea and Gulf of Mexico). Central E Atlantic fauna is rather solitary and has a high degree of "endemism". Plankton, phytal and non-specific benthic species are the most widely distributed while interstitial and sand-dwelling forms usually have more restricted occurrence. The data on most the regions are still incomplete, and these results should be treated as rather preliminary. Thus, further cooperative efforts are necessary to obtain the more comprehensive dataset.

## Polivalente room

### Session 3.3 Fish and fisheries: genes to global market

Chairs : Reinhold Hanel; Mikko Heino.

15: 00 – 15:15      EFFECT OF RECENT CLIMATIC CHANGES ON ABUNDANCE OF SOLE, SOLEA SOLEA, IN THE KATTEGAT AND BELT SEA.

MacKenzie Brian; Else Nielsen, National Institute for Aquatic Resources, Technical University of Denmark, Denmark.

Sole populations are found in the Black Sea, Mediterranean Sea and as far north as Denmark. Commercial fisheries landings of sole in the Kattegat have increased 2-3 fold during 1952-2007. Here we use 4 research surveys to investigate whether abundances have increased and therefore are reflected in commercial landings data, or whether the increase is primarily due to changes in fishery-related factors (e. g., effort). The four surveys cover different time periods from 1957-present. Sole abundance has increased in research surveys, and much of the inter- and multi-annual variability in abundance was related to temperature fluctuations: warm years appear to lead to higher production and/or survival of young soles. The effect of temperature on sole in this area is consistent with expectations based on the geographic range of the species and also increases in abundance of several "southern" species (e. g., anchovy, *Engraulis encrasicolus*, and red mullet, *Mullus surmuletus*) seen in these waters during the past 10-15 years. Recent warm temperatures appear to be leading to a change in fish biodiversity in the Kattegat.

15:15 – 15:30      GENETIC VARIATION AT SNP LOCI ACROSS WILD POPULATIONS OF THE EUROPEAN SEA BASS.

Souche Erika; Hellemans Bart, Biology, Katholieke Universiteit Leuven- Laboratory of Animal Diversity and Systematics, Belgium.

Bargelloni Luca, Public Health, Comparative Pathology, and Veterinary Hygiene, University of Padova, Padova, Italy.

Guinand Bruno, Institut des Sciences de l'Evolution CNRS-Université de Montpellier 2, Montpellier, France.

Bonhomme François, Institut des Sciences de l'Evolution CNRS-Université de Montpellier 2, Montpellier, France.

Volckaert Filip, Biology, Katholieke Universiteit Leuven-Laboratory of Animal Diversity and Systematics, Leuven, Belgium.

The European sea bass (*Dicentrarchus labrax*) is an economically important marine species in Europe, living in the Atlantic Ocean and throughout the Mediterranean Sea. Atlantic and Mediterranean sea bass populations have been shown to be genetically diverse using microsatellite markers, generally located in non coding regions and supposedly neutral. Twenty-four natural populations from all over the Atlantic Ocean and the Mediterranean Sea have been screened for Single Nucleotide Polymorphisms (SNPs) both in coding and non coding regions. We want to understand how neutral and adaptive variation has shaped population variation. A total of 63 SNPs reasonably spread over the genome have been selected for genotyping. Among them 49 SNPs are located in annotated Expressed Sequence Tags, 23 being in amino acid sequences and 8 being non synonymous. The last 14 SNPs were developed from non coding genomic sequences (BAC end sequences) and are thus expected to be neutral. The results confirm the known neutral differences in genetic structure and point to a small number of SNP loci under selection.

15:30 -15:45      EXPLOITATION-DRIVEN EVOLUTION AND MARINE BIODIVERSITY.

Heino Mikko, Department of Biology, University of Bergen, Norway.

Dieckmann Ulf, Evolution and Ecology Program, International Institute for Applied Systems Analysis, Laxenburg, Austria.

Life-history diversity can be envisaged as spanning from "slow lane" life histories (implying late maturation, a long life span, slow growth to a potentially large body size, and a low potential rate of population increase) to "fast track" life histories (early maturation, a short life span, fast body growth to a moderate asymptotic size, and a high potential rate of population increase). Slow-lane life histories are viable only when mortality after recruitment is low. Consequently, modern fishing practices, which have greatly increased overall mortality levels in many marine fishes, are disadvantaging slow-lane life-history strategies and instead favour fast-track strategies, as evidenced by a worldwide range of well-documented changes in exploited fish communities. Similar changes, however, are also expected within species and populations: when heritable life-history variation exists, high and selective mortality usually favors the fast-track variants, causing the evolutionary truncation of natural life-history diversity. We present recent progress in documenting and understanding exploitation-driven evolution and its consequences, and discuss how management measures might be adapted to tackle this challenge.

15:45 – 16:00      LIVING ON THE EDGE – ISOLATED POPULATIONS OF A SMALL PELAGIC COLDWATER MARINE FISH SPECIES TRAPPED IN THE NORTHERN MEDITERRANEAN.

Hanel Reinhold, Debes Paul, Marine Ecology, Leibniz Institute of Marine Sciences, Germany.

Apart from the growing evidence of range shifts of marine fish species, extirpations and even extinctions are predicted but not yet observed consequences of actual climate change. Especially small pelagic fish species, generally characterised by large effective population sizes and a high potential for gene flow, quickly respond to changes in physical oceanographic conditions and have shown large population fluctuations and extirpations over glacial timescales. We present a range-wide phylogeographic survey of European Sprat (*Sprattus sprattus*) based on a 530 bp sequence of the mitochondrial control region that proves the existence of genetically isolated populations in northern Mediterranean basins. We conclude that these populations -characterized by a significantly reduced genetic diversity- remain isolated because of their inability to maintain gene flow under the present physical oceanographic conditions. Our results demonstrate the effect of glacially induced changes in physical oceanographic conditions on a cold adapted small pelagic fish species trapped in a geographically confined area at its southernmost distribution limit and for the first time identify distinct and highly vulnerable populations on the climate-change-induced edge of survival.

**COFFEE BREAK**

# Red sed auditorium

## Session 2.1 Coastal marine benthic biodiversity and ecosystem process under uncertain environmental futures

Chairs : Martin Solan; Dave Paterson; Dave Raffaelli; Piran Whit.

16:30 – 16:45 THE ROLE OF MACROFAUNA IN THE FUNCTIONING OF A SEA FLOOR: IS THERE ANY SEASONAL, DENSITY OR FUNCTIONAL IDENTITY EFFECT?

Braeckmand Ulrike; Vincx Magda, Marine Ecology, Ghent University, Belgium.  
Provoost Pieter, Ecosystem studies, NIOO-CEME, Yerseke, The Netherlands.  
Gribsholt Britta, Department of Biology, Marine Biological Laboratory, Helsingør, Denmark.  
Middelburg Jack; Soetaert Karlina, Ecosystem studies, NIOO-CEME, Yerseke, The Netherlands.  
Vangansbeke Dirk, Vanaverbeke Jan, Marine Biology, Ghent University, Ghent, Belgium.

To assess the effects of density declines and species loss on benthic ecosystem functioning, we investigated the importance of three different functional groups of macrobenthos in the benthic processes of the Belgian Continental Shelf. As macrobenthic activity depends on temperature and food availability, we performed two mesocosm experiments: before sedimentation of the phytoplankton bloom and after. Single – species treatments of key-species belonging to three different functional groups (*Abra alba*, *Lanice conchilega* and *Nephtys* sp.) were added to microcosms at three density levels (average natural - lower - very low) to account for possible density declines. Oxygen and nutrient fluxes as well as bioturbation were measured. Both before and after phytoplankton bloom, *L. conchilega* had more pronounced influences on benthic respiration and nutrient release than *A. alba* and *Nephtys* sp.. *A. alba* appeared to be a more effective bioturbator than *Nephtys* sp.. Moreover, ecosystem functioning (as benthic respiration, nutrient fluxes and bioturbation) seems to be related to animal densities. Therefore, a decrease in densities (due to anthropogenic or natural disturbances) may have implications for ecosystem functioning rates at the study area.

16:45 – 17:00 MARINE BIODIVERSITY-ECOSYSTEM PROCESSES UNDER UNCERTAIN ENVIRONMENTAL FUTURES.

Bulling Mark; Hicks Natalie; Solan Martin, Oceanlab, University of Aberdeen, Scotland.  
Paterson David, Gatty Marine Laboratory, University of St. Andrews, Fife, Scotland.  
Raffaelli Dave, Environment Department, University of York, York, England.

The biological composition and richness of most of the Earth's major ecosystems are being dramatically transformed by anthropogenic activity. Marine environments are particularly vulnerable to such changes. Extensive use has been made of experiments involving randomly assembled communities with varying numbers of species to assess the effect of biodiversity loss on ecosystem processes. However, few of these studies have incorporated the extinction driver as an integrated part of the experimental design. Therefore the relationships found between biodiversity loss and the effects on ecosystem processes have lacked real world context. Here, we investigate empirically the effect of current and two likely future scenarios of temperature and atmospheric CO<sub>2</sub> levels on the relationships between species richness and ecosystem processes in a benthic marine system. Communities of varying richness levels of functionally contrasting macrofaunal species are exposed to factorial combinations of temperature and CO<sub>2</sub> levels in a mesocosm experiment, and levels of bioturbation and nutrient flux measured as ecosystem processes.

17:00 – 17:15 THRESHOLDS OF HYPOXIA FOR MARINE BENTHIC COMMUNITIES.

Vaquer-Sunyer Raquel; Duarte Carlos, Coastal Ecology, IMEDEA, Spain.

Hypoxia is a mounting problem affecting the world's coastal waters with severe consequences for marine life, including death and catastrophic changes. Hypoxia is forecasted to increase due to the combined effects of the continued spread of coastal eutrophication and global warming. A broad comparative analysis across a range of contrasting marine benthic communities showed that hypoxia thresholds vary greatly across marine taxa, and that the conventional definition of 2 mg O<sub>2</sub> L<sup>-1</sup> to designate waters as hypoxic is well below the empirical sublethal and lethal O<sub>2</sub> thresholds for most groups tested. These results imply that the number and area of coastal



ecosystems affected by hypoxia and the future extent of hypoxia impacts on marine life have been grossly underestimated.

17:15 – 17:30     INTERTIDAL ENVIRONMENTAL STRESS GRADIENTS AND SEAWEED CANOPIES AS DETERMINANTS OF SPECIES DIVERSITY IN TROPHIC GROUPS.

Scrosati Ricardo; Van Genne Barbara; Watt Courtney, Department of Biology, Saint Francis Xavier University, Canada.

Using rocky intertidal species and habitats from Atlantic Canada, we investigated the effects of environmental stress gradients and seaweed canopies on the species diversity of major trophic groups: primary producers, filter feeders, herbivores, and carnivores. We investigated vertical gradients of intertidal elevation and horizontal gradients of exposure to wave action and winter ice scour in two contrasting coasts in Nova Scotia: the Gulf of St. Lawrence and the open Atlantic. Basal species (primary producers and filter feeders) were always more species-rich than herbivores and carnivores. Across the vertical and horizontal gradients, trophic groups generally increased in diversity from the most stressful habitats (high elevations and exposed areas) to habitats with relatively benign conditions (low elevations and sheltered areas). The rate of change in species diversity, however, was higher for basal species than for the upper trophic levels across these gradients. We also show how the abundance of fucoid seaweed canopies was related to the diversity of understory trophic groups across the stress gradients. We discuss these patterns in relation to the ecological theory on environmental stress models and ecosystem engineers.

17:30 – 17:45     COMPARISON OF BIODIVERSITY AND TROPHODYNAMIC FUNCTION OF COASTAL FOOD WEBS ALONG THE EUROPEAN COAST - A NETWORK ANALYSIS APPROACH.

Asmus Harald; Asmus Ragnhild, Coastal Ecology, Alfred Wegener Institute, Germany.  
Sokolowski Adam; Wolowicz Maciej, Institute of Oceanography, University of Gdansk, 81-378 Gdynia, Poland.  
Razinkovas Arturas; Gasiunaitė Zita; Lesutienė Jurate, Coastal Research and Planning Institute, University of Klaipėda, LT 92294 Klaipėda, Lithuania.  
Van Oevelen Dick; Hummel Herman, Centre for Estuarine and Coastal Ecology, Netherlands Institute of Ecology 4401 NT Yerseke, The Netherlands.  
Cardigos Frederico; Colaço Ana; Serrão Santos Ricardo, DOP - University of the Azores, University of the Azores, 9901 612 Horta, Portugal.  
Richard Pierre; Niquil Nathalie, Centre de Recherche sur les Écosystèmes Marins et Aquacanoles (CRELA), France.  
Gremare Antoine; Carlier Antoine, Observatoire Océanologique de Banyuls, Laboratoire d'Océanographie Biologique, F66651 Banyuls-sur-Mer, France.

Food webs of different European coastal systems from the Baltic Sea, North Sea, The Atlantic and the Mediterranean Sea have been analysed by means of network analysis. All systems showed large differences in species composition and species diversity as well as in biomass and productivity. Standing stocks, diets of the various faunal components and the rate of flow between the compartments in the model were based on empirical data. The models depict the biomass of each compartment, carbon flow between the compartments, imports and exports, as well as an energy budget for each. Benthic communities contribute by different percentages to the cycling. The carbon flow of each system is highly dependent on the community structure. The trophic structure and the energetic transfer along the trophic pyramid is compared between the systems and its relation to biodiversity is discussed. Comparing several dimensionless system level indices calculated for the different marine and estuarine ecosystems, transfer of energy and most system level indices are highly variable between the coastal ecosystems. Some system level indices, such as average path length, average residence time, Finn cycling index, average mutual information and the different connection indices were distinctly correlated with biodiversity. Flow diversity and food web connectance was closely related to biodiversity, but depends to a large degree on the presence of dominant species. This study revealed the correlation between the diversity of coastal systems and their trophodynamic function. The role of biodiversity for energy flow and stability of coastal systems is discussed based on the results of this study.

17:45 – 18:00     EFFECTS OF BIODIVERSITY AND HABITAT STRUCTURE ON ECOSYSTEM PROCESSES.

Godbold Jasmin; Solan Martin, Oceanlab, University of Aberdeen, Scotland.  
Bulling Mark, Environment Department, University of York, York, England.

Habitat fragmentation and homogenisation are expected to substantially affect global biodiversity over the next century, but their effects on ecosystem processes are still unclear. Manipulative experiments explicitly testing the relationship between biodiversity and ecosystem processes have largely been carried out in isolated, homogenous environments that do not incorporate structural heterogeneity. Here we experimentally investigated the effects of biodiversity, faunal movement and habitat heterogeneity on bioturbation and nutrient generation in marine benthic communities. Communities were established within a multi-patch mesocosm system, in which patches were either isolated or connected by corridors. Our results show that bioturbation intensity and nutrient generation are enhanced in more diverse systems, but that the magnitude of effect is underpinned by the presence of a dominant species. Moreover, increasing the openness of the system and allowing fauna to move and select patches, positively affected both bioturbation and nutrient generation. Collectively our findings suggest that the effects of species loss are likely to be more dramatic in fragmented habitats and that some ecosystem processes are best maintained by retaining habitat heterogeneity.

18:00 – 18:15      ECOSYSTEM ENGINEERING EFFECTS ON BIODIVERSITY.

Bouma Tjeerd, E. Cacabelos, F.G. Brun; Ysebaert, T. Netherlands Institute of Ecology (NIOO-KNAW) Centre for Estuarine and Marine Ecology . Yerseke. The Netherlands.  
Folkard, A. Department of Geography. Lancaster Environment Centre. Lancaster University. UK.  
Reise, K. Alfred Wegener Institute (AWI) for Polar and Marine Research. Wadden Sea Station Sylt. Germany.  
Olenin, S. Coastal Research and Planning Institute. Klaipeda University. Klaipeda, Lithuania

Within MarBEF RMP D-4-4.2-2, we have studied in a broad range of ecosystems the role of native and/or invasive ecosystem engineers on biodiversity. The MarBEF RMP enabled its members to carry out joined experiments, and to discuss concepts. Our presentation will provide an overview of the latest findings of our RMP, as are currently being published in a special issue. In addition to this overview, we will show the results of a series of flume studies, in which we tried to unravel the mechanisms by which ecosystem engineers affect biodiversity. The flume studies clearly show that ecosystem engineering effects on biodiversity is strongly determined by local hydrodynamics. The latter may offer an explanation for the contrasting effects of ecosystem engineers on biodiversity that have been reported in the literature. The conditional outcome depending on hydrodynamic forcing may explain why it is so difficult to derive general assembly rules that ascribe the effect of ecosystem engineers on biodiversity.

18:15 – 18:30      BIODIVERSITY, TRAIT DYNAMICS AND ECOSYSTEM PROCESSES UNDER GRADUAL AND CATASTROPHIC DISTURBANCE: A MODEL ANALYSIS

Matthijs, Vos; Soetaert, Karlina, Heip, Carlo; Middelburg, Jack. Ecosystem Studies. Netherlands Institute of Ecology, CEME. Yerseke. The Netherlands  
Herman, Peter. Spatial Ecology. Netherlands Institute of Ecology, CEME. Yerseke. The Netherlands

We use a mechanistic model to show how species traits and diversity shape major ecosystem functions, under both gradual and catastrophic disturbance. We focus on successional patterns in marine benthic communities and evaluate how species extinctions modify ecosystem functioning.

## Auditorium museum

### Session 1.4 Discoveries from integrated data systems

Chairs : Ward Appeltans; Mark J. Costello; Edward Vanden Berghe.

16:30 – 16:45      COMPARISON OF THE PERFORMANCES OF TWO BIOTIC INDICES BASED ON A SOFT-BOTTOM MACROZOOBENTHOS PAN-EUROPEAN DATABASE.

Grémare Antoine, Station Marine d'Arcachon, University Bordeaux 1, France.

The pan-European MacroBen database was used to compare the performances of AMBI and BQIES, two of the main biotic indices recently proposed within the European Water Framework Directive. A total of 18287 stations were selected and later divided into four subareas: Celtic-Biscay Shelf, Mediterranean, North Sea and

Norwegian+Barents Seas. BQI ES500.05 were computed for 767 taxa, which account for 98.7% of the total abundances in the database. Heterogeneities in ES500.05 between subareas suggest that species can present different sensitivity/tolerance levels in different geographical areas. There were only poor negative correlations between (1) AMBI Ecological Groups and ES500.05 and (2) AMBI and BQIES. Low values of AMBI were sometimes associated with low values of BQIES resulting in the attribution of different Ecological Quality status (EcoQ). This was caused by the dominance of species classified as sensitive by AMBI and as tolerant by BQIES. These most important species and we underline the need for a clarification of their sensitivity/tolerance levels. It is also concluded that the use of a specific scale of conversion into EcoQ is necessary in each homogeneous habitat.

16:45 – 17:00 OBIS-SEAMAP: DEVELOPING A BIOGEOGRAPHIC RESEARCH DATA COMMONS FOR THE ECOLOGICAL STUDIES OF MARINE MAMMALS, SEABIRDS, AND SEA TURTLES.

Halpin Patrick, Duke University Marine Lab, Duke University, USA.

Our ability to understand, conserve, and manage the planet's marine biodiversity is fundamentally limited by the availability of relevant taxonomic, distribution, and abundance data. The OVBIS-SEAMAP initiative has developed an expanding geo-database of marine mammal, seabird, and sea turtle distribution and abundance data globally. The OBIS-SEAMAP information system is intended to support research into the ecology and management of these important marine megavertebrates and augment public understanding of the ecology of marine megavertebrates by: (1) facilitating studies of impacts on threatened species, (2) testing hypotheses about biogeographic and biodiversity models, and (3) supporting modeling efforts to predict distributional changes in response to environmental change. This system takes advantage of recent technological advances in Geographic Information Systems (GIS), Internet data standards, and content management systems to stimulate a novel community-based approach to the development of a data commons for biogeographic and conservation research. To date, the global OBIS-SEAMAP database includes >2.5 million observation records from more than 200 datasets, spanning 73 yr (1935 to 2008) provided by a growing international network of data providers

17:00 – 17:15 DATA INTEGRATION AND INTEROPERABILITY IN THE BIOLOGICAL AND CHEMICAL OCEANOGRAPHY DATA MANAGEMENT SYSTEM AND CMARZ.

Wiebe Peter; Groman, Robert; Allison, Dicky; Biology, Woods Hole Oceanographic Institution, USA.  
Chandler, Cynthia; Glover, David. Marine Chemistry & Geochemistry. Woods Hole Oceanographic Institution, USA.

The Biological and Chemical Oceanography Data Management Office (BCO-DMO) serves investigators conducting marine chemical and ecological research. BCO-DMO provides open access to data and information developed in the course of scientific research in short and intermediate time frames. In a related effort, the Census of Marine Zooplankton (CMarZ, see [www.cmarz.org](http://www.cmarz.org)) is working toward a taxonomically comprehensive assessment of biodiversity of animal plankton throughout the world oceans. The taxonomic focus is on the holozooplankton that drift with ocean currents throughout their lives. To support the data management and web-serving requirements of these projects, a MySQL database for the requisite metadata has been developed. Also, policies and procedures were needed to ensure that high quality data are easily discoverable and retrievable, and to allow a high degree of interoperability with other data systems. In addition to a text-based, tabular interface to existing data, the University of Minnesota's MapServer interface provides geospatial access to our data sets. MapServer also provides Open Geospatial Consortium standards-based interoperability to the database by supporting the Web Mapping Service and Web Feature Service protocols.

17:15 – 17:30 OBIS FOR BEGINNERS.

Grassle J. Frederick; Vanden Berghe Edward, Marine and coastal sciences, Institute of Marine and Coastal Sciences, Rutgers, The State University of New Jersey, USA.

Often marine biological data are the result of projects with a limited temporal and spatial cover. Taken in isolation, datasets resulting from these projects are only of limited use in the interpretation of large scale phenomena. More specifically, they fail to inform on a scale commensurate with the information needed to address major conservation and management issues such as the effects of global change, invasive species, harmful algal blooms, and the loss of biodiversity. Individual studies are restricted in the amount of data they can generate; but by combining the results from many studies, massive databases can be created that make possible broad-scale analyses. The Ocean Biogeographic Information System (OBIS, <http://www.iobis.org>), the data integration component of the Census of Marine Life (CoML, <http://www.coml.org>), assesses and explains the diversity and distribution of marine life through a network of linked databases, integrating data from a vast number of sources, with the assistance of a global network of Regional OBIS Nodes. It is ideally placed to inform

decision makers on global environmental issues that threaten the health of the world oceans, and thus the safety of mankind. The system, now eight years old, has 14 million biogeographical records, extracted from 250 datasets, documenting distribution of more than 80,000 species. The present web portal is available since 2004. A new portal is in development, using a different tool set. This will facilitate new functionality including Ocean Geospatial Consortium compliant web services. Examples of products based on these will be given.

## Polivante room

### **Session 3.3 Fish and fisheries: genes to global market**

Chairs : Reinhold Hanel; Mikko Heino.

16:30 – 16:45 SEASCAPE GENETICS IN ANTARCTIC FISH: UNCOUPLING OF PHYSICAL AND BIOLOGICAL PROCESSES.

Carvalho Gary; Rock Jennifer, School of Biological Sciences, Environment Centre Wales, Bangor University, UK.  
Young Emma; Murphy E; Meredith Mike; Thorpe S; Belchier Mark; Collins M; Everson I; Rodhouse Paul, British Antarctic Survey, Cambridge, UK.  
Hutchinson Bill; School of Biological Sciences, University of Hull, Hull, UK.  
Hauser Lorenz, University of Washington, Seattle, USA.

Molecular genetic markers provide informative tools for estimating larval connections between marine populations. Similarly, physical oceanographic models can simulate larval movements in relation to hydrographic variability. Although the dynamics of larval dispersal and population connectivity has a rich history, there are relatively few studies that generate physical predictions in conjunction with empirical tests of population differentiation. Our research examines the influence of oceanographic processes and life history variation on gene flow in two contrasting Antarctic marine fish: *Champsocephalus gunnari* and *Notothenia rossii*. These species are broadly sympatric in much of their distribution, but differ in aspects of life history that are expected to strongly affect their dispersal capabilities. We employ oceanographic models including (1) OCCAM and (2) a high resolution model (using POLCOMS) to predict larval transport around Antarctica as well as finer scale cross-shelf transport and retention around South Georgia. Using mtDNA and microsatellite markers, we examine historic and contemporary gene flow. Here we present data from large scale oceanographic models in combination with evidence for inter-specific variation in mitochondrial and nuclear gene flow at the circumpolar level.

16:45 – 17:00 RECENT CHANGES IN NORTHERN ADRIATIC ICTHYOFAUNA: EXPERIENCES FROM SLOVENIA.

Mavric Borut; Lipej Lovrenc, Marine Biology Station Piran, National Institute of Biology, Slovenia.

During the last decade a plethora of fish species were confirmed in Slovenian sea for the very first time and beside that some unusual fish species, considered to be rare, were recorded in the area as well. This may be attributed to several factors, however an increase in the research effort and the adoption of new techniques are the most important. Some species are Lessepsian migrants (*Terapon theraps*), while other could be related to the phenomena of meridionalisation (*Balistes carolinensis*, *Coris julis*, *Pteroplatytrigon violacea*). Recently adopted non-destructive techniques, such as visual census, underwater filming and the use of narcotics, enabled the recording of some apparently »rare« benthic fish species in the Mediterranean Sea (*Gobius roulei*, *Apletodon incognitus*, *Millerigobius macrocephalus*). There are also some new findings of bigger fishes associated with the better prospection. This is the case of some shark and ray species (*Carcharhinus plumbeus*, *Cetorhinus maximus*, *Pteromylaeus bovinus*) and some peculiar teleosts (*Mola mola*, *Ranzania laevis*, *Luvarus imperialis*).

17:00 – 17:15 THE DISTRIBUTION AND RELATIONSHIPS BETWEEN HAKE (*MERLUCCIIUS MERLUCCIIUS* LINNAEUS, 1758) AND COD (*MERLANGIUS MERLANGIUS* LINNAEUS, 1758) IN THE SEA OF MARMARA (1990-1995).

Demirel Nazil; Yuksek Ahsen; Okus Erdogan; Uysal Ayhan; Demirel Nazil, Physical Oceanography and Marine Biology, Institute of Marine Sciences and Management, University of Istanbul, 90 212 4400000 / 26034.

This study was carried out in 34 trolling stations in the Sea of Marmara in years 1992-1995, fish stocks and distribution has been investigated using trawling gear and the effect of physico-chemical conditions monitored. The fishes were separated from trawl material and distributions, stock size and conditions were investigated. Five years period, Hake *Merluccius merluccius* Linneaus, 1758 biomass was highest in all areas in all seasons (summer and winter) in years 1990-1996 and their percentage to the total economical demersal fish stocks was around 50-60 % annually. Cod was following the Hake, especially their stock size has been gradually increased by years and their percentage was around 15-20 %.

## Friday November 14.

### Parallel Sessions

### Morning

### Red Sea Auditorium

#### **Session 2.4. Broad Scale Patterns And Sources Of Variation In Biodiversity-Ecosystem Functioning Relationships**

Chairs: Magda Vincx; Katja Philippart; Tasman Crowe; Steve Hawkins; Lisandro Benedetti-Cecchi

10:30 10:45      MONITORING LARGE SCALE MARINE ECOSYSTEM CHANGES – STRATEGY AND ITS APPLICATION

Shirayma, Yoshihisa, Seto Marine Biological Laboratory, Field Science Education and Research Center, Japan

There are varieties of threats to the marine ecosystem, e.g. human disturbance of the habitat, climate change, ocean acidification. Most these impacts are not limited to a local scale, but potentially affects on marine ecosystem in the global scale. To understand such large scale impacts and potential ecosystem change on the function and structure of marine biodiversity, it is prerequisite to prepare a strategic monitoring program to reveal long-term large-scale ecosystem change. Such program can serve however not only to the scientific community but also to other units of the human society, e.g. policy makers. For example, change of global scale biogeography of marine species will emphasize impact of climate change on marine ecosystem, and urge the policy maker to find the best solution among trade-off relationships among conservation of marine biodiversity and industrial development in the coastal lands. In this presentation, I will introduce some activities pursuing global scale long term marine ecosystem monitoring, and discuss about the benefits of such program in various points of view.

10:45 11:00      DISCRIMINATING BEF RELATIONSHIPS FROM EMPIRICAL STUDIES

Paterson, David; School of Biology, University St Andrews, Scotland  
Benedetti-Cecchi, Lisandro; Dipartimento di Scienze dell 'Uomo e dell 'Ambiente, University Pisa, Italy

This paper will consider the current empirical efforts being made in the investigation of the biodiversity ecosystem function relationship. Recent attempts have been made to bridge the gap between controlled laboratory studies and the more complex approach of manipulation of the natural environment. The paper will examine recent advances in the BEF debate and consider the advantages and disadvantages of using natural systems. The

implications of logistic restraints, system heterogeneity, replication (statistical power and context) and scale will be addressed using examples from the literature and recent studies across Europe.

11:00 11:15      RELATIONSHIPS BETWEEN BIODIVERSITY AND THE STABILITY AND FUNCTIONING OF MARINE ECOSYSTEMS: EXPERIMENTAL COMPARISONS AMONG HABITATS AT A EUROPEAN SCALE

Crowe, Tasman, School of Biology and Environmental Science, University College Dublin, Ireland

Benedetti Cecchi, Lisandro; Bulleri, Fabio; Dipartimento di Biologia, Italy

Cusson, Mathieu, Université du Québec à Chicoutimi, Canada

Jenkins, Stuart, School of Ocean Sciences, Bangor University, UK

Aspden, Rebecca; Paterson, David. School of Biology. University of St. Andrews. St. Andrews. Scotland.

Terrados, Jorge. Instituto Mediterráneo de Estudios Avanzados (CSIC-UIB). Esporles. Spain.

Marine taxa vary considerably in their influence on ecosystem functioning. Consequences of loss of marine biodiversity are therefore difficult to predict without extensive empirical research. BIOFUSE ([www.marbef.org/projects/biofuse](http://www.marbef.org/projects/biofuse)) aimed to compare impacts of biodiversity loss on stability and functioning of a range of European marine ecosystems. Key structural species were removed to test effects on the resistance and resilience to disturbance of the structure and functioning of ecosystems in three habitats. Preliminary findings varied among habitats and locations. On 7 of 8 rocky shores, removal of canopy algae affected ecosystem structure, but physical disturbance did not affect measures of structure or function. On sedimentary shores, loss of *Arenicola marina* had no measurable effect on community diversity or a range of functional variables, regardless of disturbance by organic enrichment. In seagrass beds, changes in concentrations and fluxes of nutrients and oxygen caused by organic enrichment were not affected by the loss of *Zostera noltii* in Germany or by the loss of *Cymodocea nodosa* in Mallorca. Combining these findings with existing experimental data will enable assessment of the generality of effects of loss of marine biodiversity on ecosystem functioning.

11:15 11:30      PAN-EUROPEAN PATTERNS IN MARINE PROPAGATION

Philippart, Catharina, Marine Ecology, Royal NIOZ, The Netherlands

Amaral, Ana, Universidade do Algarve, Portugal

Van Bleijswijk, Judith, Biological Oceanography, Royal NIOZ, The Netherlands

In the MarPACE (Marine Propagation Along the Coasts of Europe) project, we aimed to identify the intensity, timing, and temporal extent of production and (primary) settlement of pelagic propagules of benthic plants and animals along large-scale Pan-European transects representing spatial gradients in environmental conditions such as seawater temperature, isolation and seasonality. Studied species comprise both floral and faunal key organisms (e.g. ranging from biofilm communities to bivalve post-larvae). Both representatives of the rocky shore and the soft-sediment communities were studied. During this presentation, we will present our overall hypothesis and the first results of our simultaneous biweekly standardized sampling of pelagic and (to a lesser extent) benthic propagules in European waters, including stations in the North-East Atlantic (Azores), the Iberian upwelling margin (Faro, Porto), the Mediterranean Sea (Lecce, Palma de Mallorca, Banyuls-sur-Mer), the English Channel (Roscoff, Ostend), the Wadden Sea (Texel, Sylt), the German Bight (Helgoland) and the Baltic Sea (Sopot), from December 2006 up to December 2007. Additionally, we will discuss if and, if so, how our results may contribute to the research questions related to consequences of climate change for large-scale distributions of marine communities.

11:30 11:45      PATCH HETEROGENEITY AND DISPERSAL LIMITATION CAUSE A NEGATIVE CORRELATION BETWEEN REALIZED LOCAL DIVERSITY AND COMMUNITY PRODUCTIVITY

Matthiessen, Birte, Marine Ecology, Institute of Marine Sciences (IfM-GEOMAR), Germany

The relationship between biodiversity and ecosystem functioning (BDEF) has been widely investigated irrespective of local and regional processes allowing for stable species coexistence. Theory predicts that patch heterogeneity can allow for regional coexistence by species sorting, and dispersal can allow for local coexistence by source-sink dynamics. This in turn can have profound consequences for the predictability of the BDEF. In experimental metacommunities with marine benthic microalgae we manipulated dispersal rate and light intensity to test the predictions that patch heterogeneity locally causes a negative, and regionally (i.e. beta diversity) a positive BDEF. Our results show that realized local and regional diversity was significantly higher in heterogeneous compared to homogeneous metacommunities. In the heterogeneous metacommunities realized local diversity and beta-diversity decreased with increasing dispersal rate. Local diversity also decreased with increasing light intensity. In contrast, local biomass increased with increasing dispersal rate and light intensity. Regional biomass production did not change. Hence, locally diversity correlated negatively with biomass production. Comparing carrying capacities of

the single species from monocultures with the communities reveal that the most productive species was competitively superior only in high light intensities. However, source sink dynamics maintained this species throughout the whole region and thereby decreased local diversity and increased local productivity.

11:45 12:00      COMPLEX POSITIVE CONNECTIONS BETWEEN FUNCTIONAL GROUPS ARE REVEALED BY NEURAL NETWORK ANALYSIS OF ECOLOGICAL TIME-SERIES

Thrush, Simon; Coco, Giovanni; Hewitt, Judi; Coastal Ecosystems, National Institute of Water and Atmospheric Research, New Zealand

The relationships between functional linkages within communities and community dynamics are fundamental to biodiversity-stability relationships. By teasing apart the 'hidden layers' within artificial neural networks (ANNs), we developed webs defining how functional groups influence each others temporal dynamics. ANNs were based on 15 years of bimonthly monitoring of macrobenthic communities on three intertidal sandflats in Manukau Harbour (New Zealand). Sites differed in web topology, and diversity, with the site dominated by one functional group exhibiting only a few strong links, the lowest  $\alpha$ -,  $\beta$ - and  $\gamma$  diversity and the highest temporal stability in  $\alpha$ -diversity. However, positive interactions between functional groups, non-concordant with harbour-wide or site-specific environmental variables, always dominated the interaction webs. The increased number of links we observed with increased temporal variation of species richness within functional groups and overall diversity supports the insurance hypothesis. While our findings suggest there may be no consistent model characterizing the topology of temporal interactions between functional groups, decreasing diversity is likely to decouple interactions between functional groups and decrease ecosystem functionality.

12:00 12:15      SPECIES DIVERSITY PATTERNS ON ROCKY SHORES IN UK AND IRELAND: THE INFLUENCE OF PELAGIC PRIMARY PRODUCTIVITY AND TEMPERATURE

Burrows, Michael; Harv, Robin; Robb, Linda; Poloczanska, Elvira; Ecology, Scottish Association for Marine Science, UK

Moore, Pippa; Leaper, Rebecca; Marine Biological Association of the United Kingdom, UK

Kendall, Michael, Plymouth Marine Laboratory, UK

Simkanin, Christina; Department of Life Sciences, Galway-Mayo Institute of Technology, Ireland

Anne Marie, Power, Martin Ryan Institute, National University of Ireland –Galway, Ireland

Davenport, John; Myers, Alan; Zoology, Ecology and Plant Science, University College Cork, Ireland

Mc Grath, David, Department of Life Sciences, Galway-Mayo Institute of Technology, Ireland

Hawkins, Stephen, School of Ocean Sciences, Bangor University, UK

Rocky shore species were recorded at 682 sites around Ireland and the UK between 2002 and 2006. Present-day distributions were compared with those in 1950-60s to assess climate-related changes in abundance and geographical limits. Multivariate analysis of community data from Scottish sites showed that change in community composition along wave exposure gradients explained the largest fraction of variance. The next largest portion was associated with species diversity, mostly positively with macroalgae, and negatively with filter feeders (mussels and barnacles). This measure of species diversity was negatively related to pelagic primary productivity from satellite data. To extend this analysis to the whole of the UK and Ireland, we identified a smaller proxy set of species that predicted overall species diversity. The abundance of 21 species predicted this measure very well ( $R^2=0.86$ ). Predicted diversity was negatively related to within-region productivity patterns, with big differences in overall diversity among regions correlated positively with sea surface temperature in February. We propose that productivity-induced high abundance of filter feeders may have a negative impact on the diversity of intertidal macroalgae and associated species.

12:15 12:30      THE EFFECT OF INCREASED RAINFALL ON MEIOFAUNA ASSEMBLAGES: IS THERE A UNIFORM RESPONSE TO ENVIRONMENTAL PERTURBATION?

Ferrero, Timothy; Barnes, Natalie; Zoology, The Natural History Museum Auditorium, UK

Adão, Helena; Portugal, Rute. Biology Department, University of Evora, Portugal

Compinas-Bezerra, Tania; Van Gansbeke, Dirk; Steyaert, Maaike; Vanaverbeke, Jan. Department of Biology, Ghent University, Belgium

Dgras, Aleksander; Urba-Malinga, Barbara. Department of Fisheries Oceanography and Marine Ecology, Polish Sea Fisheries Institute, Poland

Kuhnert, Jutta; Veit-Köhler, Gritta. German Centre for Marine Biodiversity Research, Senckenberg Research Institute, Germany  
Lampadariou, Nikolaos, Institute of Oceanography, Hellenic Centre for Marine Research, Greece  
Schratzberger, Michaela, Lowestoft Laboratory, Centre for Environment, Fisheries & Aquaculture Science, UK  
Whomerley, Paul, Burnham Laboratory, Centre for Environment, Fisheries & Aquaculture Science

Sandy beaches represent a dynamic interface between the marine, terrestrial and groundwater systems which may be rapidly influenced by rainfall events. The meiofauna of beach sediments are responsive to changes in salinity, drying and periods of emergence and may be ideal organisms for modelling the direct effects of climate change. Recent research suggests that patterns of rainfall over Europe have changed over the 20th century influenced by human activities, with northern Europe becoming wetter and southern Europe drier. Models also indicate that rainfall events may change in frequency and intensity. We will describe and present results from the largest fully standardised and replicated field experiment ever undertaken in meiofaunal ecology; a recently completed MarBEF/Manuela study undertaken at four European locations in Belgium, Poland, Portugal and Crete. The study aimed to examine whether meiofaunal assemblages would respond in a universal manner to an environmental perturbation, modelled experimentally through artificial rainfall events. Such responses have often been assumed, but results have often been contradictory and a greater understanding of meiofaunal responses to disturbance is central to developing predictive models for the future.

#### 12:30 12:45 BIODIVERSITY PATTERNS OF MARINE INVERTEBRATE METACOMMUNITIES IN THE MEDITERRANEAN SEA.

Moritz, Charlotte; Loeuille, Nicolas; Guarini, Jean-Marc; Biological Oceanography, UPMC Univ Paris 06 CNRS, France  
Guizie, Katell, Biological oceanography, UPMC Univ Paris 06 CNRS, France

A dynamic metacommunity model was designed to link processes governing interactions between benthic invertebrate populations and their environment. It combined in the same approach the landscape, hydrological environment and metacommunity complexities. Our objective was to understand how a structure in coastal marine communities and metacommunities emerges from interacting population dynamics. It is now used to investigate underlying processes that structure metacommunities in the Mediterranean Sea. Coastal benthic ecosystems were considered as a mosaic of habitats with different types of substrates described by a typical community of interacting organisms. The connectivity between communities was ensured by a stochastic larval dispersal in the water column. The model is based on simple population dynamics, incorporating discrete synchronized recruitment. Interactions (competition, predation, mutualism) were determined by the metacommunity trophic structure. The oligotrophy, supposed to be a strong structuring factor, was introduced by limiting growth parameters. Simulations have shown that interactions stabilised the dynamics and that the level of connectivity controlled the density levels, suggesting that oligotrophy might not be the only factor to explain the high diversity-low biomass Mediterranean patterns as it was observed.

#### 12:45 13:00 GLOBAL TRENDS IN INTERTIDAL MACROALGAL BIODIVERSITY

Konar, Brenda; Chenelot, Heloise, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, USA  
Cruz, Juan, Universidad Simon Bolivar, Venezuela  
Edwards, Matt, San Diego State University, USA  
Iken, Katrin, University of Alaska Fairbanks, USA  
Lindstrom, Sandra, University of British Columbia, Canada  
Milne, Rebecca, Huntsman Marine Science Centre, Canada  
Miloslavich, Patricia, Universidad Simón Bolívar, Venezuela  
Pohle, Gerhard, Huntsman Marine Science Centre, Canada  
Riosmena-Rodriguez, Rafael, Universidad Autonoma de Baja California Sur, Mexico  
Saunders, Gary, University of New Brunswick, Fredericton, Canada

Within the last decade the need for nearshore biodiversity studies on a large spatial or even global scale has become increasingly obvious but studies are lacking, partly because comparisons can be hampered by the use of different methods. For a comparative biodiversity assessment on various spatial and temporal scales, a unified approach is preferred. NaGISA, the nearshore component of the Census of Marine Life (CoML), was established to examine biodiversity in macroalgal and seagrass communities on a global scale. Here, we present our first attempt to compare intertidal macroalgal communities sampled at various sites around the world using the NaGISA protocols. All sites had rocky substrates and were considered typical for each region. We used multivariate analyses to examine spatial trends in macroalgal community structure based on species composition (and higher taxonomic levels) and biomass. These types of analyses allow us to compare macroalgal diversity levels on latitudinal and longitudinal scales in an attempt to discern whether clear large-scale patterns exist.



13:00 13:15      SPATIAL PATTERNS AND TEMPORAL VARIATIONS IN MACROBENTHOS COMPOSITION  
IN THE SOUTHERN BALTIC SEA AND POSSIBLE IMPACT ON ECOSYSTEM FUNCTIONING

Schiedek, Doris; Arctic Environment, National Environmental Research Institute, University of Aarhus, Denmark  
Zettler, Michael L; Glockzin, Michael. Biological Oceanography, Baltic Sea Research Institute, Germany

The Baltic Sea is a young non-tidal ecosystem with highly variable hydrographical conditions (e.g. salinity, oxygen) and increased human impact (e.g. pollution, climate change). Based on historic data reaching back 80 years and more recent monitoring data covering a period of 15 years a group of about 25 macrobenthic taxa was identified as being the most important species in the southern Baltic Sea. These species not only represent different taxonomic groups but also specific functional guilds. Their distribution is not uniform and varies temporal with possible consequences for ecosystem functioning. Their presence/absence could interact with important ecosystem functions such as benthic-pelagic matter transport and fluxes. The bivalve *Arctica islandica*, widely distributed in the high saline areas of the southern Baltic, showed increased occurrence in 1996–2006 compared to 1950–1970. In the Arkona basin a 3–10-fold increase in abundance of the six most important species since the 1920s has been observed in 2001–2004 probably caused by eutrophication. It will also be discussed if other factors such as changes in temperature regime may have an impact on species' distribution.

13:15 13:30      ON LINKING ECOSYSTEM STRUCTURE AND FUNCTION IN THE INTERTIDAL.

Bendell, Leah, Biological Sciences, Simon Fraser University, Canada

On the west coast of British Columbia, Canada, the diversity of the intertidal benthic community is changing in response to increased pressures from shellfish aquaculture and invasive species. How these changes in community structure are affecting ecosystem function is not known. To address this concern, 18 beaches (9 under pressure due to Manila clam farming and 9 reference) were compared with respect to benthic community structure and ecosystem function attributes (amounts of silt, carbon, nitrogen, phosphorus and iron in surface sediments). Parallel field mesocosms studies (n=12) were conducted in which intertidal species were manipulated to match community composition as determined from the field sampling. Geochemical attributes as measured for the 18 beaches were also determined for the 12 mesocosms. Farmed beaches were distinct from reference beaches with respect to amounts of accumulated silt, carbon and iron. As well, the geochemical behaviour of iron and phosphorus was altered in those mesocosms where clams were the dominant benthic species present versus mesocosms where a more diverse community was present. These findings demonstrate how community structure can influence basic sediment geochemistry and have important implications on how we manage our intertidal regions with respect to anthropogenic disturbances such as intensive shellfish farming.

## Museum Auditorium

### Session 4.3 Conserving Marine Biodiversity: Making Policy, Management Tools, and Scientific Knowledge Work Together

Chairs: Jake Rice; Heye Rumohr

10:30 10:45      MARINE BIODIVERSITY: THE SCIENCE NEEDED TO SUPPORT THE CURRENT POLICY  
AGENDA

Rice, Jake. Fisheries and Oceans. Government of Canada. Ottawa. Canada.

Since WSSD in 2002, there has been a rapid escalation of international policy agreements and instruments regarding conservation, sustainable use, and equitable sharing of benefits from biodiversity. Initially the policy focus was terrestrial, but since 2006, marine biodiversity has become a major consideration as well. This shifts the science-policy dialogue on marine biodiversity in some important ways. One is from calling attention to the importance of marine biodiversity to finding a balance between needs for conservation of biodiversity and sustainable use, particularly for food security. A second is from research based on our woefully incomplete knowledge of marine biodiversity to application to what we do know to marine policy and management of human activities in the sea. These dialogues between experts in marine biodiversity science and experts in marine policy and management have particular importance, and pressures, because there are several time sensitive accountabilities coming due in 2010, 2012, and 2015, and the marine community will be hard-pressed to document prior commitments have been met. The paper will summarize the history of these policy commitments

and the implicit assumptions that they make about both our knowledge of marine biodiversity and capacities to manage. It will focus particularly on the possible contradiction that most policy and management instruments are designed for managing individual industry sectors (fishing, undersea mining, shipping, etc), yet conservation of biodiversity makes integrated management planning and decision-making an imperative. In doing so, it will set the stage for the contributions to the theme session on Biodiversity and Policy. The contributions then will highlight the ways that various experts, disciplines, and States are coming to grips with these challenges.

10:45 11:00      SCIENTIFIC CRITERIA FOR CONSERVATION AND SUSTAINABLE USAGE OF MARINE BIODIVERSITY IN CANADA'S OCEANS: THE CANADIAN HEALTHY OCEANS NETWORK

Snelgrove, Paul, Schneider, David. Ocean Sciences Centre, Memorial University of Newfoundland, Canada  
Archambault, Philippe, Institut de Sciences de la Mer (ISMER), Université du Québec à Rimouski, Canada  
Juniper, Kim; Tunnicliffe, Verena. School of Earth & Ocean Sciences and Department of Biology, University of Victoria, Canada  
Lawton, Peter; McKindsey, Chris; Pepin, Pierre. Department of Fisheries & Oceans, Government of Canada, Canada  
Metaxas, Anna, Oceanography Department, Dalhousie University, Canada

The new Canadian Healthy Oceans Network will unite researchers to provide scientific criteria to guide policy for conservation and sustainable use of marine biodiversity resources in Canada's three oceans. Theme Marine Biodiversity will address biodiversity in relation to habitat diversity. Specifically, we will test hypotheses that link functional and species biodiversity to habitat diversity. Theme Ecosystem Function will determine how ecosystem function and health are linked to biodiversity and natural and anthropogenic sources of disturbance. Specifically we aim to understand the role of biodiversity in marine ecosystem services by linking biodiversity and ecosystem function measures, and provide predictive models and tools to minimize anthropogenic impacts. Theme Population Connectivity will address how dispersal influences patterns of diversity, resilience, and source/sink dynamics of species and communities. Specific goals are to evaluate the role of larval dispersal in regional source-sink species dynamics using existing management areas as model systems and compare different metrics of larval dispersal to estimate metapopulation connectivity. We will synthesize the outcomes of each of these themes across the Network to identify approaches to bridge science and policy.

11:00 11:15      CONFOUNDING EFFECTS OF MPAS: THE NEED FOR EXPERIMENTAL MANAGEMENT

Kaiser, Michel, School of Ocean Sciences, Bangor University, UK  
Stewart, Gavin; Pullin, Andrew; School of Environment and Natural Resources, Bangor University, Wales

Marine protected areas (MPAs) are spatially defined areas where anthropogenic impacts on marine biota are restricted and thereby provide a refuge for species of commercial and conservation importance. Here, we use systematic review methodology to synthesize uncollated data regarding the impact of marine reserves (no-take areas) in temperate waters. We found large differences in the density, biomass and species richness between no-take areas and adjacent exploited areas but habitat effects could not be distinguished from reserve effects. The deficiencies in the current evidence-base can only be overcome by a large scale coordinated experimental approach to the implementation of a network of MPAs. This should incorporate Before-after-control-impact-pairs, standardized methods for parameter estimation, agreed protocols for assessing spillover effects and fishing effort. Large numbers of reserves (>30) require monitoring if even large effects are to be detected, and related to reserve and species covariates. The increasing international commitments towards the establishment of a networks of MPAs provides a unique opportunity to assess their effectiveness, but this can only be achieved if they are designed to achieve clear and quantifiable objectives.

11:15 11:30      PRACTICAL APPLICATION OF SCIENTIFIC CRITERIA FOR SELECTION OF MARINE PROTECTED AREAS

Hiscock, Keith, Jackson, Emma; Langmead, Olivia; Marine Biodiversity & Conservation Science Programme, Marine Biological Association, UK

This presentation investigates how scientifically-based criteria for mpa selection can be applied, especially bearing in mind the often sparse survey data available to inform them. It will address classifying the character of locations through the EUNIS system, identifying 'Nationally Important Marine Features' and identifying marine biodiversity 'hotspots'. In many cases, comparison of areas can be done using the 'lowest common denominator', for instance, physiographic (landscape) units. However, ideally, physical and biological survey data should be able to discriminate to at least EUNIS level 4 biotopes to be meaningful, therefore requiring in situ survey. If rare species or species that are in decline or threatened with decline are being taken into account, careful searching in areas

will be needed. Such requirements are prejudiced by withdrawal of conservation agencies from field survey by experienced biologists and over-reliance on acoustic survey methods.

11:30 11:45 CONSERVATION OF BIODIVERSITY IN URBANIZED ESTUARIES BENEFITS FROM INNOVATIVE COLLABORATIONS BETWEEN SCIENCE AND MANAGEMENT

Chapman, Maura G., Centre for Research on Ecological Impacts of Coastal Cities, The University of Sydney, Australia

Urbanization of marine habitats have largely focussed on contamination, with loss, alteration and fragmentation of habitats largely ignored. Coastal urbanization is predicted to be a major growth area and intertidal habitats will be most affected, replaced by built structures, such as seawalls. Intertidal habitats are under pressure from impacts on land and water and their loss affect many specialist taxa. Despite increasing numbers of built habitat on shorelines, there is generally little concern about their impacts from those who design them, who licence or regulate them, or who commission them. Yet they seldom provide suitable habitat for the organisms they displace. Conservation is increasingly being focussed not only on protected areas, but on environments subjected to human influences, including cities. I will describe innovative approaches to re-engineering built structures in Sydney Harbour (Australia) to enhance their value as habitat. These are based on strong collaborations among engineers, developers, managers and ecologists to bring together engineering expertise, ecological understanding and policy requirements to conserve biodiversity. From this research, new approaches to conservation, that are logistically feasible, inexpensive, ecologically sound and widely applicable, are suggested.

11:45 12:00 BIOLOGICAL VALUATION: GUIDELINES FOR A TRANSPARENT AND GENERALLY APPLICABLE PROTOCOL FOR THE MARINE ENVIRONMENT

Degraer, Steven; Derous, Sofie; Rabaut, Marijn; Vincx, Magda. Marine Biology Section, Biology Department, Ghent University, Belgium

Courtens, Wouter; Stienen, Eric W.M; Paelinckx, Desiré. Institute of Nature and Forestry Research, Belgium  
Deckers, Pieter; Deneudt, Klaas; Hostens, Kris; Moulaert, Ine; Flanders Marine Institute, Belgium  
Roff, John C., Environmental Science, Acadia University, Canada  
Van Lancker, Vera; Verfaillie, Els; Renard Centre of Marine Geology, Ghent University, Belgium  
Degraer, Steven, Marine Biology Section, Biology Department, Ghent University, Belgium

Policy makers and marine managers request reliable and meaningful biological baseline maps to be able to make well-deliberated choices concerning sustainable use and conservation in the marine environment. Biological valuation maps aim at the compilation of all available biological and ecological information for a selected study area and allocate an integrated biological value to subzones. They can therefore be used as baseline maps for future spatial planning at sea. This paper gives guidelines on the practical application of the concept of marine biological valuation to a study area. All steps in the valuation protocol are described, starting from the selection of the valuation criteria over the determination of the appropriate assessment questions and practical algorithms to evaluate the criteria to the final scoring of all assessment questions. The marine biological valuation protocol is illustrated using a hypothetical study area.

12:00 12:15 PICKING A WAY FORWARD: FITTING TRADITIONAL SHELLFISH GATHERING INTO A MARINE PROTECTED AREA

Johnson, Mark, School of Biological Sciences, Queen's University Belfast, UK

Traditional hand gathering of shellfish is a highly visible activity that presents particular problems for managing coastal protected areas. Individual harvesters act informally and independently, harvesting both for personal consumption and commercially. The visibility of harvesters suggests to casual observers a lack of policing of activity in the protected area. The long standing nature of the activity can make conservation legislation difficult to apply and novel forms of regulation are contentious. An analysis of winkle picking in Strangford Lough (Northern Ireland) suggests that hand gathering could be promoted in a sustainable manner. An important part of this approach would be to make better use of the unrecognized synergies between fisheries, public health and conservation legislation.

12:15 12:30 ARTIFICIAL NEURAL NETWORKS AS A TOOL FOR MODELLING AZOREAN FISHERIES

Gil, Fabíola, Department of Agricultural Sciences, University of Azores, Portugal  
Pinho, Mário; Dentinho, Tomaz; Department of Oceanography and Fisheries, University of Azores, Portugal

We used artificial neural networks to model the catch/effort employed in the blackspot seabream fishery in selected fishing ports of the Azores Archipelago. These artificial neural networks were compared with traditional regression tools and were used to design, test and evaluate alternative management strategies. The dependent variables were the red seabream CPUE (calculated from the mobile average of effort and captures and mobile average of the red seabream captures). The explanatory variables were captures of juveniles, mobile average of other captures, seasonality, yearly environmental variations, accumulated captures in the 4 previous trimesters and the two previous years, and the mobile average of effort (number of red seabream-targeted outings per month). The output is the long-term relation between effort and captures with then is used to estimate the private and free access supply functions and to simulate the effect of alternative policies on employment, income and sustainability of the stock.

12:30 12:45      INFORMING TARGETS BY COMMUNICATING CLIMATE CHANGE SCIENCE TO POLICY MAKERS: THE MARINE CLIMATE CHANGE IMPACTS PARTNERSHIP.

Frost, Matthew, Marine Environmental Change Network, Marine Biological Association of the UK, UK  
Dye, Stephen; Buckley, Paul; MCCIP Secretariat, CEFAS, UK

There are numerous policy targets and objectives such as meeting 'good ecological and chemical status' by 2015 (WFD), 'achieve or maintain good environmental status' by 2020 (MSD) and reduce rate of or halt biodiversity loss by 2010 (CBD & Malahide declaration respectively). However, it is only when we understand the baseline condition of marine ecosystems that we can truly measure progress in reaching objectives. One major factor, which will affect ecosystem state (and hence baseline condition), will be the impact of long-term anthropogenically driven climate change. For the UK, the lack of available information for stakeholders on marine climate impacts led to the creation of the Marine Climate Change Impacts Partnership (MCCIP) in mid-2005. MCCIP was set up specifically 'to facilitate the transfer of high quality evidence on marine climate change impacts, and related advice, to policy advisors and decision-makers'. The MECN, as a key science partner, works with MCCIP in providing climate information, and MCCIP is now seen as a key tool for environmental managers in the UK as well as a potential model that can be applied elsewhere.

12:45 13:00      BIOMARES, A LIFE PROJECT TO RESTORE AND MANAGE THE BIODIVERSITY OF LUIZ SALDANHA MARINE PARK

Cunha, Alexandra; Erzini, Karim; Serrao, Ester; CCMAR, Edificio 7, University of Algarve, Portugal  
Gonçalves, Emanuel, ISPA, Portugal  
Henriques, Miguel, PNA, ICNB, Portugal  
Henriques, Victor, IPIMAR, INRB, Portugal  
Marbá, Núria; Duarte, Carlos; IMEDEA, CSIC, Spain

Luiz Saldanha a Marine Park and Nature 2000 site is considered to be THE hot spot for Portuguese marine biodiversity. The LIFE-BIOMARES project aimed at the restoration and management of the biodiversity of the area and implemented several conservation tasks. One of the most challenging is the restoration of the seagrass prairies that were completely destroyed by fisheries and recreational boating. It includes the transplanting of seagrasses from donor populations, and the germination and plantation of seagrass seeds to maintain the genetic diversity of the transplanted area. The most popular action was the establishment of environmental friendly moorings, to integrate recreational use of the area with environmental protection. Several actions of information and environmental education about the marine park and the project are also in action. For compensating for fishermen loss of fisheries ground and to increase the knowledge of the habitats of the park, the cartography of the park and the surrounding area is being made. This project is an excellent example of how MPAs implementation can be supported by the EU environmental policies.

13:00 13:15      MOBIDIC - MONITORING INTERTIDAL BIODIVERSITY WITH SCHOOLS

Sousa Pinto, Isabel; Vieira, Raquel, Coastal Biodiversity Laboratory, Centre for Marine and Environmental Research, Portugal

To detect changes and to forecast how communities will develop there is the need of series of biodiversity data that span for a long period of time, and over a wide geographic range. The intertidal zone offers great educational and scientific opportunities for young students to learn more about marine life. The MoBiDiC is an intertidal Biodiversity Monitoring Programme, that started in Portugal and that involves Cimar, a Marine Research Centre from University of Porto and ten basic and secondary schools. Each participating school is responsible for the collection of periodic data at a particular beach with the help of researchers from Cimar. The data: e.g. species lists, abundances, temperature and salinity and the presence of garbage or sources of pollution, is

recorded in a database that is online. The student can compare their data with data from other schools, other years and so on. The program, that is part of Marbef Outreach, is now being extended to partners in other countries, aiming at having possibilities of comparing data and experiences, and have exchange of students and teachers from different European countries.

#### 13:15 13:30 GRAVEL SEEDING - A SUITABLE TECHNIQUE FOR RESTORATION OF THE SEABED FOLLOWING MARINE AGGREGATE DREDGING?

Cooper, Keith: Ware, Suzanne; Vanstaen, Koen; Barry, Jon. Marine Ecology Team, CEFAS, UK

Remediation and restoration of offshore marine habitats is a relatively new concept with attempts in European regions largely being instigated by requirements of various European strategic directives. The purpose of this experiment was to investigate the practicality and effectiveness of gravel seeding as a potential restorative method that could be applied at marine aggregate extraction sites following cessation of dredging. Zone 2, a relinquished area within aggregate extraction Area 408 (offshore Humber), was chosen as the experimental site as there is some evidence for persistence of sand which may have resulted from screening operations at this site. Two, 4000 tonne, cargoes were dredged, using a commercial suction hopper trailer dredger, from within an active zone of Area 408 and deposited within the Treatment box. A baseline survey and 3 post-deposition monitoring surveys, using a combination of acoustic, video and grab sampling techniques, were undertaken in order to assess the effectiveness of gravel seeding in restoring physical and biological attributes at the treatment site. Results suggested that the gravel seeding technique was not only practically feasible but was also successful in terms of returning both the physical and biological attributes at the treatment site to a state more representative of gravelly substrata in the wider, un-impacted environment.

## Polivalente Auditorium

### Session 4.4 Emerging paradigms in coastal research and related management and policy implications

Chairs: Natarajan Ishwaran; Patricio Bernal; Jerry Melillo; Maria-Lourdes Palomares

#### 10:30 10:45 HUMAN IMPACTS ON COASTAL AND SHELF ECOSYSTEMS: SMALL SCALE FISHERIES AS A PROBLEM AND A SOLUTION

Pauly, Daniel, Fisheries Centre, University of British Columbia, Canada

Humans have become a major geological and hydrological force, as can be seen on the terrestrial side of coastal areas and deeper inland, where agriculture and other human activities have deeply modified terrestrial ecosystems, and reduced their biodiversity. Marine ecosystems and their biodiversity are also strongly impacted, particularly coastal waters and adjacent shelves. Most of these impacts are generated, or at least aggravated, by coastal fisheries. Thus, the historic catches of the mainly small-scale fisheries exploiting coastal zones should provide a measure of the impact these very fisheries are having. However, small-scale fisheries catches are not, or very badly, covered in the catch statistics of most countries, and literally disappear in international fisheries statistics. This can be remedied by a deliberate program of historic reconstruction such as conducted by the Sea Around Us Project. Results so far indicate that the catches of artisanal fisheries are much higher than is commonly assumed, though, in many cases, they have declined in the past few decades. Most of the declines appear to have been due to overfishing of inshore waters, aggravated by competition between small-scale and industrial fisheries. Also, these fisheries now rely on a different array of species, indicating that coastal species diversity has also been affected, and not only their abundance. The catch reconstruction process involves a wide range of resources (books, grey literature, online databases, etc.) and disciplines (fisheries science, rural economics, maritime anthropology, etc.) and thus serve as focal point for a consilient approach to both fisheries, and the biodiversity they depend on, and threaten. These reconstructions may also help in re-conceptualizing small-scale coastal fisheries from the marginal activities that they now are, to a revitalized sector, compatible with the maintenance of coastal biodiversity, and, via exclusive access privilege, free from the burden of competition with fuel- and subsidy-guzzling industrial fisheries.

#### 10:45 11:00 SQUEEZED OUT: SANDY BEACHES AS THREATENED FUNCTIONAL ECOSYSTEMS

Schoeman, Dave; Smit, AJ; Scharler, Ursula; Muir, Dave; Govender, Natasha; Harris, Linda; School of Biological and Conservation Sciences, University of KwaZulu-Natal, South Africa  
Nel, Ronel. Department of Zoology. Nelson Mandela Metropolitan University. Port Elizabeth. South Africa

Sandy beaches are dominant features of most of the world's ocean coastlines, are invaluable recreational assets for society, and have been iconic symbols of nature's indomitability. Yet beaches of the twenty-first century are increasingly trapped between burgeoning coastal urbanization and the rising sea, a phenomenon, known as 'coastal squeeze'. Beaches are also starved of sediment inputs by anthropogenic disruption of sediment-transport processes, with the result that they are slowly eroding. The consequences of these impacts are not immediately clear because beaches are among the most poorly understood of marine ecosystems. For example, process-orientated, integrated studies of the ecology of whole beach systems have been extremely rare. Nevertheless, beaches accommodate unique biodiversity, which probably contributes to important coastal ecosystem services such as the filtration of seawater, the assimilation of particulate organic matter, the remineralisation of organic nutrients, and the transfer of resultant products to higher trophic levels in adjacent systems. In this paper, we focus on beaches from the South African east coast to illustrate how integrated studies of beach ecosystem function might inform priorities for beach conservation.

#### 11:00 11:15 POLICY IMPLICATIONS FOR THE NORTHERN BENGUELA UPWELLING SYSTEM UNDER DIFFERENT CLIMATE CHANGE SCENARIOS

Heymans, Sheila, Ecology, Scottish Association for Marine Science, Scotland  
Christensen, Villy; Sumalia, Rashid; Fisheries Centre, UBC, Canada

The Benguela upwelling system is one of the most productive ecosystems in the world, driven by the perennial, southwesterly winds. The upwelled water reduces sea surface temperature (SST) and increase the nutrient content of the coastal waters. Hake recruitment is dependent on low surface temperatures and nutrients, while anchovy catches are favoured by the breakdown of the Lüderitz upwelling cell, which acts as a barrier to the import of recruits from the south. Changes in the ecosystem between 1956 and 2000 are correlated to sea surface temperature and wind stress. The effects of the possible increase in SST due to climate change on the function of the ecosystem and commercial gain possible from the ecosystem were simulated. In addition, alternative policy options available to fisheries managers were explored under the different climate change scenarios. Scenarios such as optimizing the discounted profit from the fisheries in the ecosystem, maximizing the jobs that can be provided by the fisheries, maximizing a measure of ecosystem status, and analyzing tradeoffs of these.

#### 11:15 11:30 RECOVERY OR DECLINE OF THE NORTHWESTERN BLACK SEA?

Langmead, Olivia; McQuatters-Gollop, Abigail; Marine Institute, University of Plymouth, UK  
Mee, Laurence, Scottish Association for Marine Sciences (SAMS), Dunstaffnage Marine Laboratory, UK

During recent decades anthropogenic activities have dramatically impacted the Black Sea ecosystem. High levels of riverine nutrient input during 1970-80s caused eutrophic conditions leading to collapse of benthic habitats on the northwestern shelf. Intense fishing pressure depleted stocks and the introduction of exotic species caused further ecosystem changes. Economic collapse of surrounding socialist republics in the 1990s resulted in decreased nutrient loading and ecosystem recovery has begun; but under rapidly changing economic and political conditions future recovery is uncertain. Here we use a multidisciplinary approach to integrate information from socioeconomic and ecological systems to identify the main threats to ecosystem integrity. The Driver-Pressure-State-Impact-Response framework was used to construct a conceptual model explicitly mapping ecosystem impacts of socioeconomic drivers. Findings indicate that variations in policy have significant consequences for ecosystem health, and recovery is directly linked to socioeconomic choices through levels of natural resource exploitation. This work is discussed in the context of the European Commission's recently published Marine Strategy Directive with emphasis on the role of international cooperation and multilateral environmental agreements in achieving a sustainable future for the region.

#### 11:30 11:45 SEALIFEBASE: IMPLEMENTING A FISHBASE-LIKE SYSTEM FOR MARINE ORGANISMS

Palomares, Maria Lourdes, Fisheries Centre, University of British Columbia, Canada  
Garilao, Cristina; Bailly, Nicolas; Laxamana, Elijah; The SeaLifeBase Project, The WorldFish Center Philippine Office, Philippines.

Patterned after FishBase, the most comprehensive online database on the world's fish, the SealifeBase Project attempts to produce the leading information system for the world's marine organisms (about 200,000 species).

Conceptualized by Dr. Daniel Pauly and managed by Dr. M.L.D. Palomares of the Fisheries Center, University of British Columbia, Canada, the project has teamed up with the WorldFish Center to produce the system using the FishBase database structure and web design as a template. This paper describes how the team behind SeaLifeBase was able to publicly offer the database (with over 90,000 species, of which about half would have some key information encoded) online after just three years of development. It also discusses the issues encountered with respect to encoding data, adapting the FishBase database structure to capture information specific for non-fish organisms, and updating the FishBase web design to effectively implement and maintain one set of code for both websites.

11:45 12:00      CORAL REEF DEPENDENCY AND VALUATION IN LINGAYEN GULF: IMPLICATIONS FOR POLICY

Trinidad, Annabelle; Geronimo, Rollan; Alino, Porfirio; Marine Science Institute, University of the Philippines, Philippines

The coral reefs of Lingayen Gulf are among the best studied reefs in the Philippines while Lingayen Gulf itself has benefited from various academic and donor-funded initiatives in coastal management. Yet, arresting the continued degradation of coral reefs and the threats posed by human activities persist. In the towns of Anda, Bolinao, Bani, and Alaminos, collectively known as ABBA, live coral cover has declined precipitously or has been classified as being either fair (i.e., 25% to 50% live coral cover) to "poor" (i.e., 0% to 25% live coral cover). Ironically, coral reefs provide significant production to the region's municipal fisheries. From 1983 to 1985, reef fish comprised 17% to 33% of the total landed catch of municipal fishers in Pangasinan while the siganid fishery, from fries to adults, is an economic base of many coastal communities. Other than destructive fishing, aquaculture structures built close to reef areas and the increasing frequency of fish kill occurrences threaten the overall environment. Coral reef interaction indices were computed for the ABBA municipalities for fishery, aquaculture and tourism. For fishery, the index is affected by the type of gears used, species composition, and the area of operation. For aquaculture, the index is computed by ascertaining the distance of aquaculture structures to coral reefs while the tourism index is affected by the type of activity tourists indulge in. Based on a survey conducted from the period August to September 2006, the resulting indices yield a high value for aquaculture, i.e. .80 to .90 for three of the four municipalities indicating that aquaculture cages and pens are situated very near or at coral reef areas.

12:00 12:15      SEAHORSE FISHERY IN BRAZIL

Oliveira, Tacyana; Rosa, Irecê; Departamento de Sistemática e Ecologia, Universidade Federal da Paraíba, Brazil

Brazil holds a prominent position in the global seahorse trade, which is essentially based on the continuous removal of individuals from wild populations. This study aimed to identify the major sources of seahorses traded live or in dried form in the country. Information on the seahorse fishery was gathered through field work conducted at 65 Brazilian coastal localities, between January 2001 and November 2005. The live trade was generally conducted by self-taught divers or artisanal fishers, while the main sources of specimens traded in dried form were the incidental captures in shrimp trawls (SE-S region), industrial fish nets (SE-S) and lobster nets (N-NE). Although not discarded, and dried on board specifically for commercial purposes, seahorse specimens were officially treated as bycatch, and did not enter official statistics. Nevertheless, our results indicated that, in volume, the dried trade accounted for the bulk of the removal of seahorses from the wild in Brazil. There is an urgent need to develop regulations and public policies to address the interfaces between commercial trawling and marine conservation in Brazil.

12:15 12:30      SHIFTING BASELINE ON EXPLOITED FISHERY RESOURCES, THE FISHERS' SIDE OF THE STORY

Tesfamichael, Dawit; Pauly, Daniel; Pitcher, Tony; Fisheries Centre, University of British Columbia, Canada

A semi structured questionnaire with entries for the spatial and temporal catch and effort data was used to interview a total of more than 400 fishers from Eritrea, Sudan and Yemen in the Red Sea. The result showed that on average the best catch ever recalled by fishers (kg/day/crew) declined 8.7 to 2 times, the rate being higher in recent years. The size of the largest fish ever caught has declined drastically over the last 50 years by up to 3 times (*Scomberomorus commerson* in Yemen). The number of species believed to be depleted or rare in the catch is higher for older fishers than the younger; so is the number of fishing grounds. The result also showed as fishers started to acquire more technologically "advanced" equipment they started to go further from the coast especially after 1970, the time huge aid work was available in the region. Interview helped to acquire information from

fishers' memory in these less data areas and also understand the perception of the fishers which is crucial part for a successful marine biodiversity management.

12:30 12:45        MAINSTREAMING MARINE SCIENTIFIC KNOWLEDGE INTO POLICY-MAKING:  
EXPERIENCES AND PROSPECTS.

Arico, Salvatore. Salvatore Arico, Man and the Biosphere Programme, United Nations Educational Scientific and Cultural Organization

Luis Valdes, Intergovernmental Oceanographic Commission

The presentation will introduce the intergovernmental scientific cooperation and policy framework to which the findings of marine scientific research can contribute. The presentation will have a two-fold focus. Reference will be made to the coastal marine sites that are part of the World Network of Biosphere Reserves under UNESCO's Man and the Biosphere (MAB) Programme, as well as other sites recognized under the intergovernmental umbrella. These sites can be considered as *in situ* laboratories where biodiversity, social, economic and cultural conditions interact in shaping ecosystem structure, ecological services, human impacts and societal benefits. Moreover, the presentation will introduce the Ocean Sciences Programme of the Intergovernmental Oceanographic Commission (IOC), with particular reference to its coastal research element. The IOC provides an intergovernmental platform for international scientific cooperation and for transferring the findings of research to decision- and policy-makers. The presentation will suggest ways for promoting the dialogue between science and policy and propose options for linking current and planned scientific efforts focusing on coastal research with the UNESCO MAB Programme and the IOC.

**Lunch**

## **Red Sea Auditorium**

### **Session 2.4. Broad Scale Patterns And Sources Of Variation In Biodiversity-Ecosystem Functioning Relationships**

Chairs: Magda Vincx; Katja Philippart; Tasman Crowe; Steve Hawkins; Lisandro Benedetti-Cecchi

15:00 15:15        DIVERSITY-STABILITY RELATIONSHIPS IN MARINE SYSTEMS - EVIDENCE FROM  
TARGETTED SAMPLING AND COMPARISON WITH OUTCOMES OF META-ANALYSIS

Cusson, Mathieu. Département des sciences fondamentales. Université du Québec à Chicoutimi. Chicoutimi. Canada.

Crowe, Tasman. School of Biology and Environmental Science. University College Dublin. Dublin. Ireland.

Benedetti-Cecchi, Lisandro. Dipartimento di Biologia. Pisa. Italy.

The causes of the biodiversity loss and its consequences for the functioning and stability of ecosystems are the current focus of intense research activity BIOFUSE, a subproject within MARBEF, includes tests of diversity-stability relationships using both a sampling programme on rocky shores using a standard methodology (45 sites within Europe, 2 years; 5 dates) and a meta-analysis of 28 existing data sets that cover various spatial and temporal scales in a range of benthic habitats. We used these data to test the hypothesis that the stability of species richness and assemblage structure were a function of the mean number of taxa (averages taken over time and space) at a site. Results of the sampling programme indicated no relationships between diversity and stability, whilst the meta-analysis revealed larger temporal fluctuations in species richness (but not assemblage structure) at the more diverse sites. These results indicated that the mean-variance scaling relationship is an important mechanism driving fluctuations in diversity. The different outcomes of the meta-analysis and the sampling programme have important implications for future analyses of BEF relationships.

15:15 15:30        BEAM TRAWLING, BENTHIC DIVERSITY AND ECOSYSTEM FUNCTIONING IN TEMPERATE  
SOFT BOTTOM HABITATS

Rabaut, Marijn; Degraer, Steven; Vincx, Magda; Biology Department- Marine Biology Section, Ghent University (Ugent), Belgium



This research focuses on degradation of benthic habitats from destructive fishing practices. The ecosystem-engineer *Lanice conchilega* is used as a proxy to test beam-trawl impacts on soft-bottom habitats in the North Sea. Therefore, different experiments were performed, of which the results are presented here. During mesocosm experiments, different beam trawl regimes were simulated in dense *L. conchilega* patches. Mortality was high for all regimes, but only after several subsequent beam-trawl passages; *L. conchilega* is thus relatively resistant to fishing pressure. However, an intertidal one-off experimental trawling showed significant community impacts ( $p=0.001$ ), due to the response of highly dominant species. Analyses of macrofaunal long-term data from a shallow fine-sediment bottom proved these dominant species to be strongly dependent on *L. conchilega*; this tube-builder shapes the community composition by expanding the realized niche of species that otherwise occur in low densities. In situ measurements of *Lanice* aggregations (e.g. elevation  $p<0.0001$ ) allowed qualifying them as reefs. Finally, the reef-functions for *Solea solea* are being investigated. The presented work characterizes variation in BEF relationships and improves our capacity to assess consequences of anthropogenic threats.

15:30 15:45 BIOGEOGRAPHIC VARIATION IN  $\delta^{13}\text{C}$  AND  $\delta^{15}\text{N}$  VALUES OF MYTILUS SPP. AND MACOMA BALTHICA ALONG THE EUROPEAN COAST

Magni, Paolo, CNR, National Research Council, IAMC, Institute for Coastal Marine Environment, Italy

In order to assess biogeographic variation in isotopic composition of dominant marine bivalves,  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values of *Mytilus* spp. and *Macoma balthica*, and their potential food sources, were studied along the European coast in spring and autumn 2004. Baltic Sea, North Sea and Atlantic Sea regions, characterized by strong differences in (benthic) biodiversity, were compared. *Mytilus* spp. showed more depleted  $\delta^{13}\text{C}$  values than *M. balthica*, most evident in the Baltic Sea in spring, where also particulate organic matter and macroalgae  $\delta^{13}\text{C}$  values were found to be depleted. This suggested differences in food sources among the two species, consistent with the wider spectrum of food items known for *M. balthica*. No differences in  $\delta^{15}\text{N}$  values between *Mytilus* spp. and *M. balthica*, however, indicated the same trophic level within a food web. Moreover, enriched  $\delta^{15}\text{N}$  values, up to 2 trophic levels higher, were found at some stations for both bivalves, as an indication of local eutrophic conditions. The results suggest similar pathways in energy flow from primary producers to bivalves, irrespective of biogeographic differences related to environmental conditions and biodiversity levels.

15:45 16:00 THE NEED FOR THE INCORPORATION OF PHYLOGENY IN THE MEASUREMENT OF BIOLOGICAL DIVERSITY, WITH SPECIAL REFERENCE TO ECOSYSTEM FUNCTIONING RESEARCH.

King, Ian, Department of Nematology, University of California, Riverside, USA

Defining and measuring biodiversity is an important research area in biology, with very interesting theoretical and applied aspects, as it serves as the underpinning of other research. Numerous definitions have been proposed, and these definitions of biodiversity influence how it is measured. From the still commonly used measure of species diversity through higher taxon diversity, molecular measures, ecological measures and indicator taxa, these measures have as their fundamental shortcoming a lack of an explicit consideration of the evolutionary context represented by phylogenies. Attempts have been made to incorporate phylogenetic considerations into measuring biodiversity, but more hypothesis-driven research need to be done. A specific case study of how this added emphasis on phylogeny-based biodiversity measurement can influence the way in which research can be directed and hypotheses can be generated is presented. The elucidation of the relationship of biodiversity to ecosystem functioning is a very timely concern, as global biodiversity is being lost regardless of metric of biodiversity that is used.

**Session 4.3 Conserving Marine Biodiversity: Making Policy, Management Tools, and Scientific Knowledge Work Together**

Chairs: Jake Rice; Heye Rumohr

15:00 15:15 WORKING TOGETHER TO PROTECT BIODIVERSITY OF PACIFIC SALMON STOCKS IN BRITISH COLUMBIA

Gallagher, Patricia, Centre for Coastal Studies, Simon Fraser University, Canada  
Orr, Craig, Watershed Watch Salmon Society, Coquitlam, British Columbia, Canada

In recent years there has been a significant loss of biodiversity for all six species of Pacific salmon in British Columbia. In addition to habitat loss and overharvesting, salmon are being impacted by climate change, unfavourable ocean conditions, aquaculture, urbanization, and other stressors. Management for the future

sustainability of salmon stocks has become increasingly complex and this is compounded by the shift to an ecosystem-based approach by government agencies that must also take into account the balance of the social and cultural with the economic values of wild salmon. As these changes evolve new governance models are developing involving partnerships among diverse groups of stakeholders including governments at federal, provincial and local scales, First Nations, industry, community, natural and social scientists, and non-governmental organizations. There is a trend to more collaborative and local decision-making and this is reflected in a number of examples of initiatives including the development and implementation of a Canadian Wild Salmon Policy, an inter-sectoral committee for watershed management, a regional management board, an industry-NGO agreement on salmon aquaculture, and a cross-sectoral roundtable on integrated salmon management.

15:15 15:30 MARINE RESERVES AS A TOOL FOR FISHERY MANAGEMENT: SPEAR-FISHING CLOSURE BENEFITS TO ARTISANAL FISHERY

Rocklin, Delphine, Tomasini; Jean-Antoine; Mouillot, David. Ecolag UMR 5119 - CC 093, Université Montpellier II, France

Culioli, Jean-Michel. Office de l'Environnement de la Corse. Bonifacio. France.

Pelletier, Dominique. EMH, IFREMER. Nantes. France.

As marine stocks strongly decrease, a challenging issue is to preserve marine biodiversity while sustaining fisheries. Marine Protected Areas have often proved their efficiency to increase fish stocks locally but their ability to sustain artisanal fisheries facing recreational fishing pressure has not been yet demonstrated. In 1999, 15 % of the Bonifacio Strait Natural Reserve area was closed to spear-fishing. Using artisanal fishery catches data available from 2000 to 2007, we evaluated the effect of this closure upon species assemblage. Gathering species together according to their sensitivity to spear-fishing, we found that i) the abundance of strongly targeted species doubled, ii) occasionally targeted species increased of about 50% and iii) no differences were found for untargeted ones. We then developed a synthetic indicator accounting on species sensitivity to a human pressure, such as spear-fishing, to reveal the protection effect on impacted assemblage. As the reserve effect does not affect the whole fish assemblage, but principally recreational targeted species, it indirectly highlights the impact of recreational fishing and the effectiveness of such marine reserve policy for sustaining coastal artisanal fisheries.

15:30 15:45 SAYA DE MALHA – AN INVISIBLE ISLAND IN THE INDIAN OCEAN. THE PROBLEM OF ESTABLISHING A SHALLOW WATER MARINE PROTECTED AREA IN THE HIGH SEAS

Vortsepneva, Elena; Tomasini, Jean-Antoine; Tzetlin, Elena ; Biological faculty, Moscow State University, Russia  
Ambsdorf, Jens. Lighthouse Foundation. Hamburg. Germany.

Vassily, Spidridonov. P.P. Shirshov Institute of Oceanology of Russian Academy of Sciences; Moscow and WWF Russia.

Saya de Malha Bank, a submerged atoll in the western Indian Ocean was often visited by Russian scientific and fishing expeditions in the 1970-80s which accumulated a considerable material. A review on the biology and ecology of Saya de Malha based on the Russian and other publications, unpublished reports. The information collected up to date indicates certain level of the biota endemism which make it the area of particular ecological and biological importance in need of protection. Bank is one of a few shallow water areas outside the zones of national jurisdiction. Historically habitat damaging practices of fishing and collecting were not uncommon on Saya de Malha and there is no guarantee that antropogenic threats for coral, seagrass and other benthic habitats are no longer actual. Furthermore, the High Seas fishing and the impact of climate change on coral communities bring to the agenda the issues of establishing an international monitoring in the area. While there are still no agreed legal mechanisms for establishing international marine protected areas in the High Sea several options for development, protective management on Saya de Maha are discussed.

15:45 16:00 PLANNING OF THE MARINE AREAS IN NEED OF PROTECTION IN RUSSIA'S SECTOR OF THE ARCTIC

Spiridonov, Vassily, Laboratory of Coastal Ecosystems, P.P. Shirshov Institute of Oceanology of the Russian Academy of Sciences, Russia

Gavrilo, Maria, Geography of Polar Regions, Arctic and Antarctic Research Institute, Russia

Nikolaeva, Natalya, Russian Bird Conservation Union, Russia

Ivanov, Andrey, Geography Faculty, M.V. Lomonosov Moscow State University, Russia

Makarov, Anton, Russia

The presentation describes a project aimed at planning the system of marine protected areas and other areas with special nature management regime in the Arctic. The selected areas should secure conservation of marine biological diversity in the quickly changing conditions: decreasing ice coverage of the Arctic and other manifestations of the global climate change; possible intensification of traffic along the Northern Sea Route; development of extraction and transportation of hydrocarbons in the shelf area; increasing accessibility of remote areas and development of tourism. As a framework for assessment and planning physiographic regionalization has been applied to the part of the North Polar Ocean traditionally studied and used by USSR/ Russia. At the current stage the first version of the Atlas of potential MPAs and other special management nature areas in the Russian Arctic is prepared and made available in the electronic format. Currently no areas in need of protection has been identified in the Deep Water High Arctic physiographical provinces and the provinces of northern parts of Siberian seas. With decreasing summer ice cover and raising interest to prospecting of hydrocarbon and mineral resources on the seafloor of the Arctic Basin it is time to begin the process of assessment and selection of areas which represent the principal ecosystems of the High Arctic.

## Coffee break

### Session 1.7 Biodiversity of Deep Continental Margins: Local to Global Patterns and Processes

Chair: Myriam Sibuet

16:30 16:45 BIODIVERSITY AS A FUNCTION OF TROPHIC CONDITIONS ON CONTINENTAL MARGINS – THE NORTHERN GULF OF MEXICO

Rowe, Gilbert, Marine Biology, Texas A&M University at Galveston, USA

Budgets of sea-floor standing stocks and cycling of organic carbon at seven sites across a 3 km depth gradient in the NE Gulf of Mexico have been used to compare biodiversity patterns as a function of trophic conditions. Although total carbon biomass and associated fluxes decline precipitously with increasing depth, alpha diversity follows a parabolic pattern, with a maximum at mid-slope depths. This pattern is accentuated by the shallow-water (500 m) low in  $E(s=100)$ , a product of the dominance by a single species of amphipod in the gigantic Mississippi Trough. Beta diversity, however, varied by group across the entire range of food availability, each group having its own distinct depth- or food-related pattern. The decline in stocks and respiration with depth were more abrupt in the larger forms (fishes and megafauna), resulting in an increase in the relative predominance of smaller sizes (bacteria and meiofauna) at depth.

16:45 17:00 HOTSPOTS AND PATTERNS OF BIODIVERSITY IN DEEP-SEA SEDIMENTS ALONG EUROPEAN MARGINS

Dell'Anno, Antonio; Gambi, Cristina; Bianchelli, Silvia; Mea, Marianna; Zeppilli, Daniela; Corinaldesi, Cinzia; Pusceddu, Antonio; Danovaro, Roberto; Department of Marine Sciences, Polytechnic University of Marche, Italy

Continental margins can be considered as hotspots of biodiversity. We investigated the spatial patterns of biodiversity along these ecosystems comparing open slopes, landslides, canyons and deep sea corals. We also calculated the turnover ( $\beta$ ) diversity at different depths within the same habitat, among different habitats and different spatial scales comparing more than 60 deep-sea sites from North-East Atlantic ocean to the Mediterranean Sea and covering wide latitudinal and longitudinal gradients. Our results indicate that the turnover of diversity in deep-sea sediments is extremely high i) at different depths within the same habitat, ii) between different habitats (open slope vs canyon, open slope vs landslide). Results will be discussed in order to investigate the factors controlling the patterns and hotspots of benthic biodiversity along the European margins.

17:00 17:15 EXPLORING DECAPOD DIVERSITY ALONG AUSTRALIA'S WESTERN CONTINENTAL MARGIN (12° S – 35° S)

Mc Callum, Anna. Zoology. University of Melbourne. Melbourne. Australia

Poore, Gary. Sciences. Museum Auditorium Victoria. Melbourne. Australia

Williams, Alan. CSIRO Marine and Atmospheric Research. Hobart. Australia

Australia's continental margins are expansive and largely unexplored. In efforts to manage resource use while preserving biodiversity, oceans have been divided into biogeographic provinces based on the distribution of fishes and geophysical surrogates. It is of interest to test how well this characterisation represents patterns of

invertebrate diversity. Surveys of Australia's western continental margin (~100 to 1000 m depths) were undertaken in 2005 and 2007 by CSIRO Marine and Atmospheric research in conjunction with museum taxonomists from around Australia. Sampling was completed at a total of 195 stations within 26 latitudinal sites between 12 ° and 35 ° S. The species composition and distributional patterns of decapod crustaceans were investigated by Museum Victoria with the aim of testing hypotheses on taxonomic surrogacy and the biogeography of Australia's biodiversity. Decapods are useful in this context as they have a diverse and relatively well documented taxonomy in Australia, and feature strongly in biogeographic debates.

#### 17:15 17:30 LARGE SCALE PATTERNS IN THE DIVERSITY AND COMMUNITY STRUCTURE OF DEEP-SEA NEMATODES

Vanreusel, Ann; Vanaverbeke, Jan; Raes, Maarten; Bezerra, Tania; Van Gaeve, Saskia; Ingels, Jeroen; Merckx, Bea. Marine Biology, University Ghent, Belgium

Gambi, Cristina; Danovaro, Roberto. Polytechnic University of Marche, Via Brecce Bianche, 60131, Ancona, Italy.

Fonseca, Gustavo. Alfred Wegener Institute for Polar and Marine Research, Deep-Sea Research Group, Am Handelshafen 12 (Co, ABC), D-27570 Bremerhaven, Germany

Radziejewska, Teresa. Department of Oceanography, Agricultural University, Kazimierza Krolewicza 4, 71-550 Szczecin.

Muthumbi, Agnes. University of Nairobi, School of Biological sciences PO Box 30197 Kenya

Lampadariou, Nikos. Hellenic Centre for Marine Research, Crete, Greece.

Milyutina, Maria; Milyutin, Dmitry; Portnova, Daria. P.P. Shirshov Institute of Oceanology, Russian Academy of Sciences, 36, Nakhimovskiy Prospekt, 117218 Moscow, Russia

Esteves André; Da Silva, Maria Cristina; Venekey, Virag; Veronica Genevois. Universidade Federal de Pernambuco - UFPE, Departamento de Zoologia, Laboratório de Meiofauna Recife-PE, Brazil

Netto, Sergio. Laboratório de Ciências Marinhas, Universidade do Sul de Santa Catarina (UNISUL), Av. Colombo Sales 84, Laguna, Santa Catarina, 88790-000, Brazil

Tchesunov, Alexey. Dept. Invertebrate Zoology, Biological Faculty, Moscow State University, Vorobyovy Gory, Moscow 119 991, Russia.

Gad, Gunnar. AG Zoosystematik & Morphologie, CVO Universität, Oldenburg 26111, Germany

Ferrero, Tim. Natural History Museum Department of Zoology, Cromwell Road, London SW7 5BD, UK

Baban, Ingle. Biological Oceanography Division, National Institute of Oceanography, Dona Paula, Panaji, Goa, 403004

Galstova, Valentina; Zeppilli, Daniela; Pape, Ellen; Santos, Giovanni.

Nematodes represent the most abundant metazoan group in deep-sea sediments. In general, their relative importance in the benthos and their diversity increase with water depth from the continental shelf to mid slope depths to the abyssal plain. However, this high biodiversity is not well understood yet, especially when local diversity estimates are extrapolated to regional or even global scales. In the framework of the Census of Marine life projects CoMarge and CEDAMAR more than 60 datasets collected worldwide were analysed in order to unravel large scale patterns in deep-sea nematode diversity, distribution and community composition. Both community composition and density showed a tight correlation with ocean surface productivity. On the other hand, the expected unimodal distribution of diversity in relation to water depth was not general. Different ocean basins showed clear differences in regional diversity estimates with higher values in the South-West Atlantic and Indian Oceans compared to North-East Atlantic or the Mediterranean Sea. Habitat heterogeneity contributed significantly to the total diversity. Cold water coral rubble and manganese nodule areas are particularly interesting hot spots of nematode biodiversity.

#### 17:30 17:45 HETEROGENEITY OF MACROFAUNAL COMMUNITIES AT LOCAL SCALE IN THE GULF OF GUINEA

Galeron, Joelle, Environnement Profond, IFREMER, Centre de Brest, France

Menot, Lenaick, Institut Océanographique, France

The BIOZAIRE programme developed an integrated study of the benthic ecosystems on the Congo-Angola margin where a very active pockmark field was discovered at 3150m depth in the vicinity of the Congo submarine system. The links between the chemosynthesis based ecosystem and the surrounding detritus based ecosystem was investigated by comparing the macrofaunal communities and the sediment characteristics in the pockmark field and along two transects around the active area. The macrofaunal communities of the two systems were clearly distinct in terms of density, composition, and vertical distribution. In the chemosynthetic ecosystem, macrofauna associated to megafaunal clusters showed a great variability, linked to the great variability in sediment physico-chemical parameters. This spatial heterogeneity in habitat characteristics likely enhances the diversity of macrobenthic communities at the scale of the pockmark. Further than 250m from the active area, macrofaunal

communities were less abundant, and had a structure typical of sediment abyssal communities. No gradient was observed along the two transects, indicating that the influence of methane seeps on the surrounding area is very limited.

17:45 18:00 THE MID-SLOPE DEPTH PEAK IN BENTHIC DIVERSITY: ITS COMMONALITY AND POTENTIAL CAUSES

Menot, Lenaick; Sibuet, Myriam; INSTITUT OCEANOGRAPHIQUE, France  
Carney, Robert, LSU, USA  
Rowe, Gilbert, TAMUG, USA  
Levin, Lisa, SIO, USA  
Sellanes, Javier, UCN, Chile  
Ramos, Ana, IEO, Spain  
Ramil, Francisco, Universidad de Vigo, Spain  
Vanreusel, Ann, Ghent University, Belgium  
Narayanaswamy, Bhavani, SAMS, UK  
Ingole, Baban, NIO, India  
Billett, David; Hughes, Alan; Gooday, Andrew; NOCS, UK  
Galerón, Joëlle, Ifremer, France

The 25-years old statement that within-habitat diversity is higher at bathyal depths than either on the shelf or in the abyss remains a challenging theory in ecology. The commonality and causes of this mid-slope diversity peak are among the key questions addressed by COMARGE (Continental Margin Ecosystems on a worldwide scale), a field project of the Census of Marine Life. In order to address this question, we have gathered about 15 cross-margin datasets from the Arctic, Atlantic, Pacific, Indian, Southern Oceans and the Gulf of Mexico, each spanning a depth range of 1000 m up to 4000 m. Together they encompass a wide range of geological settings (active vs passive margins), hydrological properties (including oxygen minimum zones), productivity regimes and taxonomic groups (protists to fish). A unimodal relationship of species diversity along depth gradients was the most common pattern. This unimodal pattern was particularly evident when a dataset included samples from the shelf, upper slope communities were submitted to disturbance and/or there was an ecotone between two bathyal communities. The potential processes underlying the observed pattern are discussed.

18:00 18:15 GLOBAL GENERALITY OF BATHYMETRIC ZONATION ON CONTINENTAL MARGINS

Carney, Robert, Dept Oceanography, Louisiana State University, USA

Bathymetric zonation or depth-related change in species composition is a characteristic of distributions on continental margins. Within well-studied regions the patterns are reproducible, predictable, and directional. Various explanations as to the cause of zonation have been proposed. Some proposed mechanisms are physiological and some ecological. When zones are compared at multiple locations through out the world ocean including detritus-fueled and chemosynthetic fauna, there is some indication of common patterns. Zonation is ubiquitous, but the rates vary by region and taxa. The presence of zonation within chemosynthetic communities can be interpreted as being independent of food influx and possibly indicative of a hydrostatic pressure effect. A better resolution of cause will require large-scale sampling following a specific design proposed herein.

18:15 18:30 MEGABENTHOS BIODIVERSITY IN ATLANTIC CONTINENTAL MARGINS OFF WEST AFRICA

Ramos, Ana; Centro Oceanográfico de Vigo, Instituto Español de Oceanografía, Spain  
Ramil, Fran; González-Porto, Marcos; de Matos-Pita, Susana S.; Soto; Faculdade de Ciencias do Mar, Universidade de Vigo, Spain  
Balguerías, Eduardo, Subdirección, Instituto Español de Oceanografía, Spain  
Hernández, Eva, Centro Oceanográfico de Canarias, Instituto Español de Oceanografía, Spain  
Salmerón, Francisca, Centro Oceanográfico de Málaga, Instituto Español de Oceanografía, Spain  
García-Isach, Eva; Burgos, Candelaria; Estación Marina de Cádiz, Instituto Español de Oceanografía, Spain  
Sánz, José Luis; Tello, Olvido; Centro Oceanográfico de Madrid, Instituto Español de Oceanografía, Spain  
Cristobo, Javier; Centro Oceanográfico de Gijón, Instituto Español de Oceanografía, Spain  
Faraj, Abdelmalek, Institut de la Recherche Halieutique, Casablanca  
Mesfoui, Hakim, Institut de la Recherche Halieutique, Morocco  
Holtzhausen, Hannes, Ministry of Fisheries and Marine Resources, Namibia

Although deep benthic megafauna of North Atlantic have been well studied (Levin & Gooday, 2003) and some works published about benthic invertebrate from Morocco and Namibia, global knowledge about composition and biodiversity of benthic communities along African continental margin is still quite poor. From 2004 to 2008 seven joint prospection surveys were carried out in deep waters of Morocco, Mauritania and Namibia on board O/V "Vizconde de Eza". 586 stations were accomplished between 400 and 2,000 meters depth in the three countries EEZ. Hauls (one hour trawling real time) were carried out with a commercial Lofoten trawl gear, using the swept-area method and following a stratified random sampling procedure. In each station total invertebrates catch were separated into morphospecies, counted and weighted. Data of megabenthos are analyzed in order to establish the distribution of species densities, the communities composition and the comparison of biodiversity distribution patterns Northern and Southern of Atlantic African continental margins. Densities and diversity seem to be highest in Morocco, which present the highest habitat heterogeneity too. The highest biomass (wet weight) was found off Tanger, Cape Ghir and between cape Bojador and Dakhla. In the northern sector the community was dominated by filter-feeders, mainly Demospongia; off Cape Ghir by deposit-feeders, mainly Holothuroidea, and in the southern sector by filter-feeders again, mainly Hexactinellida in this case. Suspension-feeders were very scarce and seems to disappear Southern of Cape Boujador, being nearly absent in Sahara, Mauritania and Namibia slopes. In Mauritania and Namibian waters megabenthic assemblages are dominated by deposit-feeders, mainly Holothuroidea (88% of total biomass in Namibia and up to 92% in Mauritania). Mean biomass was highest in Namibia (414 kg/st), intermediate in Mauritania (160 kg/st), and lowest in central and northern Moroccan margin (95 kg/st) and Sahara (68 kg/st); nevertheless, diversity shows decreasing figures from Sahara (36 sp/st), Mauritania (27 sp/st) and Namibia (only 17 sp/st). Mean values of richness, densities and mainly biomass increases with depth in Morocco and Sahara margins, showing a strong "jump" down 1,500 m. Possible hypotheses to explain these geographical and bathymetric differences in relation to environmental variables, including geomorphologic and oceanographic characteristics, are discussed in this presentation.

## Museum Auditorium

### Session 4.2 Societal and Economic Benefits of Marine Biodiversity

Chairs: Juan Carlos Castilla; Lalit P. Chaudhari; Narendra Kumar Choudhary; Stefan Gelcich; Annette Kimmich; Carolyn Scheurle; Michalis Skourtos, Alyne Delaney; Poul Holm; Melanie Auste

16:30 16:45      INTEGRATING VALUATION METHODOLOGIES AT EUROPEAN CASE STUDY SITES

Austen, Melanie, Biodiversity and Sustainable Ecosystems, Plymouth Marine Laboratory, UK  
Delaney, Alyne E, Innovative Fisheries Management, North Sea Centre, Denmark  
Mangi, Beaumont, N. J. Plymouth Marine Laboratory, UK  
Holm, Poul; Marboe, A. Department of Environmental, Social and Spatial Change, Roskilde University, Denmark  
Atkins, J.; Burdon, D; Institute of Estuarine & Coastal Studies, University of Hull,  
Davis, C, Department of Earth and Ocean Sciences, University of Liverpool, UK  
Degraer, S; Deroos Marine Biology Section, Biology Department, Ghent University, Belgium  
Dentinho, S. T; Ressurreição, A. Department of Oceanography and Fisheries, University of Azores, Portugal  
Jones, G. Edwards; Kaiser, M. School of Ocean Sciences, Bangor University, UK  
Zarzycki, T, Department of Experimental Ecology of Marine Organisms, Institute of Oceanography, University of Gdansk, Poland

Determining the 'value' (monetary or non-monetary) of marine biodiversity is a route to assessing its socio-economic importance. Few valuation studies of marine biodiversity exist and these have mostly focussed on specialist or charismatic habitats such as coral-reefs and wetlands or on taxa such as fish with obvious market value. We have examined the importance of marine biodiversity both in terms of in its own right and its delivery of goods and services through the relationship of biodiversity with ecosystem functioning. Within the EU Marine Biodiversity Network of Excellence MarBEF, a variety of valuation methodologies have been developed specifically for coastal marine biodiversity and applied to case-study areas across Europe from the Azores to the Baltic. These include direct and indirect economic valuation (e.g. gas and climate regulation, waste management, contingent valuation), socio-cultural valuation (discourse analysis), and biological (intrinsic) valuation. Here we will present the results (currently being synthesised and assessed) highlighting similarities and differences in the values obtained through these different approaches and in the different case-study sites; and discuss the utility of these methodologies for policy and management.

16:45 17:00 FIRST STEPS IN ASSIGNING VALUE TO NEW ZEALAND'S COASTAL ENVIRONMENT

Livingston, Mary; Beaumont, Jennifer; MacDiarmid, Alison; Oliver, Megan; Livingston, Mary;  
Science, Ministry of Fisheries, New Zealand

An estimated 65,000 marine species and associated habitats deliver a wide range of ecosystem services that sustain substantial fishing, aquaculture and tourism industries in New Zealand waters. In a political environment that manages its budget on the basis of risk and threat to assets, we are challenged to assign economic importance and value to different aspects of our coastline. Because of its isolated position in the SW Pacific, and its diverse seascape, New Zealand has a relatively high proportion of endemic species. Offshore habitats such as seamounts sustain fragile slow growing animal communities that are vulnerable to fishing and other extraction activities. Inshore habitats are vulnerable to these and competing pressures from recreational activities, urban development, aquaculture, the threat of species incursions from shipping traffic and environmental forcing linked to changes associated with climate change. As a step towards assigning value to New Zealand's marine environment and identifying areas at greatest risk, 230 unique maps of environmental information ranging from species occurrences to marine mammal breeding areas and habitat distribution around the coastline were developed and analysed using a Geographic Information System. Layers to map socio-economic and cultural values were also developed. The utility of the maps for conservation planning, research planning, risk management, and as a tool for assigning value to the marine environment is discussed.

17:00 17:15 SOCIOCULTURAL VALUATION OF MARINE BIODIVERSITY: A CASE STUDY FROM THE ISLES OF SCILLY

Delaney, Alyne, Environment, Society, and Spatial Change, Roskilde University, Denmark  
Marchioni, Meredith, Florida International University, USA  
Meek, David, University of Georgia, USA

Little research has been conducted on the socio-cultural valuation of biodiversity. Using the Isles of Scilly as an innovative case study, the paper presents the use of q-method to elicit data concerning the relationship between marine biodiversity and ecosystem services. One method of ensuring the integration of social, economic and environmental demands and pressures, as required by the Ecosystem Approach, is to utilize the concept of ecosystem goods and services. The Isles of Scilly data provide a strong and unique opportunity for resource managers to develop strategies that address the concerns and values of all stakeholders. While much variation exists between the socio-cultural groups, there is a commonly held importance for the many species that exist on the Isles of Scilly and thus a concern for the area's proper management. Furthermore, the data illustrates a need for greater emphasis to be placed on educating the public about the importance of marine biodiversity. Understanding the interconnections between these perspectives is essential for policy makers and project managers, if an ecosystem approach is to synthesize ecological and socio-cultural data.

17:15 17:30 ECONOMIC VALUATION OF SPECIES LOSS IN THE OPEN SEA: A CASE STUDY FROM THE AZORES

Ressurreição, Adriana, Department of Oceanography and Fisheries, University of Azores, Portugal  
Gibbons, James, School of the Environment & Natural Resources, Bangor University, UK  
Dentinho, Tomaz, Department of Agrarian Sciences, University of Azores, Portugal  
Kaiser, Michael, School of Ocean Science, Bangor University, UK  
Santos, Ricardo, Department of Oceanography and Fisheries, University of Azores, Portugal

The economic valuation of environmental goods and services is becoming widespread, but to date relatively little analysis has been undertaken on marine systems. This study helps to fill that gap and has three major aims: (i) design and test a framework to value the benefits associated with changes on marine biodiversity; (ii) identify differences in economic valuation of marine biodiversity of different society sectors and (iii) examine the variability in economic valuation of different levels of changes on marine biodiversity. A contingent valuation survey was undertaken with a face to face format in two Azorean islands using species richness of five marine taxa (sea mammals, fish, algae, sea birds and invertebrates) as a proxy of marine biodiversity. Two questionnaires were applied, each with a different level of biodiversity loss- 10% or 25% from the status quo- and respondents were randomly given one of the two alternatives. Socio-demographic variables were able to explain significant variation in valuation, but the results suggest that respondents did not differentiate between different levels of species loss. This finding has significant implications for conservation policy.

17:30 17:45 ECONOMIC VALUATION OF MARINE ENVIRONMENTAL DAMAGES: ASSESSMENT OF NON-USE VALUE LOSSES INVOLVED WITH THE PRESTIGE OIL SPILL BY MEANS OF VALUE TRANSFER

Ding, Helen, Sustainability Indicators and Environmental Valuation Programme, Fondazione ENI Enrico Mattei (FEEM), Italy  
Nunes, Paulo A.L.D., Department of Economics, University of Venice and Fondazione ENI Enrico Mattei (FEEM), Venice

One of the major man-made disasters responsible of marine environmental damages is oil spill. The empirical evidence has shown that an oil spill involves significant monetary losses to local economy (e.g. fishery production) and important damages to the marine environment (e.g. ecosystem functioning). Economists explore the use of a set of non-market valuation tools so as to capture the total welfare loss. All in all, this is a time-consuming and costly approach. Therefore, we propose to apply value transfer methods by exploring past economic valuation studies. We pay particular attention to the assessment of non-use value losses caused by one recent and European largest oil spill: the Prestige. This approach will be anchored on two economic valuation studies: the Exxon Valdez oil spill in Alaska (1989) and an hypothetical oil spill in the Belgian coast (ex ante). Methodological procedures, econometric specification and estimation results are presented. Finally, the results are analysed from the policy-design perspective.

17:45 18:00 SEAGRASS ECOSYSTEMS OF EAST ASIA: THE 'S' FACTOR IN COASTAL BIODIVERSITY CONSERVATION IN TROPICAL ASIA-PACIFIC

Fortes, Miguel, Marine Plants, Marine Science Institute CS, Philippines

Research undertaken in Southeast Asia since 1996 have shown that seagrasses may rival coral reefs and mangroves in productivity and economic value. In the Philippines alone, 2008 data show that seagrass beds in the western part of the country occupy at least 27,282 sq. km (coral reefs in the entire country cover an area of 27,000 sq. km). At current total economic value (TEV), this translates to US\$ 3.2 Billion per year. However, anthropogenic pressure accounts for 20-60% of seagrass loss in the region. For the first time, a seagrass species (*Halophila beccarii*) has been identified by IUCN as a 'vulnerable' species in Asia-Pacific, while a few others, included in the watch list. The threats to seagrass prompted governments to initiate efforts to link research with policies in order to conserve seagrass biodiversity. Benefits derived from the four Seagrass Demonstration Sites in the South China Sea are showing that with enhanced awareness on seagrass, livelihood and local governance could be improved. Results of the present study pose as a major challenge to regional biodiversity conservation planning. However, the consequences of decisions involved in the application of the concept have not yet been tested.

18:00 18:15 CIVIL SOCIETY'S CONTRIBUTION TO CONSERVING MARINE BIODIVERSITY THROUGH THE ECONOMIC VALUATION OF MARINE PROTECTED AREAS

Gelcich, Stefan, Ecologia, Pontificia Universidad Catolica, Chile

Guidelines agreed upon in the Johannesburg summit on sustainable development have seen an increase in interest for using marine protected areas (MPAs) as a biodiversity conservation tool. However, even when local communities have been consulted, the implementation of MPAs has led to opposition from stakeholder groups. To deal with this problem, researchers have argued that MPAs must encourage the participation of civil society into all decisions, from design to day-to-day management. This study looks into the contribution which civil society, mainly small-scale fishers and the general population/stakeholders could play in the conservation of marine biodiversity along the Chilean coast. The study uses economic valuation models to understand civil societies priorities in generating MPAs. It uses choice experiments to understand stakeholders willingness to pay for different MPA attributes. Results suggest stakeholders are willing to pay for the development of MPAs. However, these values differ between stakeholders, with important consequences for establishing MPA networks. The presentation ends showing how empirical data on valuation can guide local councils, artisanal fishers and academics to establish unique grassroots marine biodiversity conservation models in developing countries.

18:15 18:30 CULTURAL VALUES AND CONSERVATION STRATEGIES - SOCIO-CULTURAL CONTRIBUTION TO MARINE ECOSYSTEM GOODS AND SERVICES

Marboe, Anne Husum, Department of Environmental, Social and Spatial Change, Roskilde University, Denmark

Based on a case study in the Wadden Sea this paper examines local cultural impact on management plans and implementation of national and international protection and conservation regimes in the marine environment. Cultural values are fundamental for conservation targets and significantly influential in the process of design, management and decisions on conservation, protection and restoration of marine biodiversity. The paper answers



the question how cultural values influence the process. Values are difficult to grasp. How can we know more about them? Data are collected from local, national and international sources from the 1970s to the present on nature protection and conservation management and legislation in the Wadden Sea. Understanding value systems is important to make management strategies effective and to prevent political discussions about nature and the value of nature that are often stretched between exploitation and conservation strategies. Communities living close to and related to the sea often connect special identity to marine ecosystems that have played a significant role in the economic or cultural definition of the community.

## Saturday, November 15.

### Parallel sessions

### *Morning*

### Red sea auditorium

#### **Session 1.6 Biodiversity, Biogeography, and Vulnerability of Deep-Water Seamount and Chemosynthetic Ecosystems (Tim Shank; Paul A. Tyler)**

10:30 10:45 SHAPING NEW PARADIGMS FOR SEAMOUNT BIODIVERSITY AND ASSESSMENTS OF THE VULNERABILITY OF SEAMOUNT HABITATS TO ANTHROPOGENIC DISTURBANCE: THE CONTRIBUTION OF THE CENSEAM PROJECT

Rowden Ashley, Benthic Fisheries and Ecology, National Institute of Water & Atmospheric Research, New Zealand

In 2005, researchers of the Global Census of Marine Life on Seamounts (CenSeam) began to address two core questions: What factors drive community composition and diversity on seamounts, including any differences between seamounts and other habitat types? and What are the impacts of human activities on seamount community structure and function? To answer these questions on large spatial scales researchers first had to devise and implement tools/methods to overcome problems inherent in the types/quality of data available. To date a number of groundbreaking studies have been conducted which have begun to challenge some of the paradigms that existed at the inception of the project e.g., that seamounts are centres of endemism, as well as providing new insight into the forces that shape patterns of biodiversity on seamounts. Investigations of the vulnerability of seamount communities to fishing and mining activities have also been conducted, and the results already used to inform environmental management of seamounts in international waters. A review of CenSeam-related studies will be presented and advances in our understanding of biodiversity maintenance and implications for conservation/management discussed.

10:45 11:00 ARE SEAMOUNTS UNIQUE AND SPECIAL SNOWFLAKES: LESSONS FROM NORTHEAST PACIFIC SEAMOUNTS

McClain Craig; Barry Jim; Loundsten Lonny, N/A, Monterey Bay Aquarium Research Institute, USA.

The 'lore' of seamounts suggests they are unique and rugged ocean habitats hosting highly diverse and endemic faunas with high biomass. Much attention is given to the proposition that seamounts possess highly endemic faunas reflecting hydrographic/topographic features leading to genetic isolation-similar to terrestrial islands. Those who challenge this idea propose instead that seamounts are oases, centers of high biomass that support increased species diversity. Alternatively, seamounts may acquire heightened biodiversity through the presence of coral and sponge fields, promoting local species coexistence through increased habitat complexity. High biodiversity may

also reflect rapid habitat turnover associated with abiotic/biotic parameters encountered across the flanks and summits of the seamount. Many of these ideas contrast sharply. Here, I evaluate the evolutionary/ecological role of seamounts and their importance to the surrounding deep-sea ecosystem utilizing data gathered from Davidson Seamount off the central California coast combined with a 20+ year dataset of nearby slope faunas. Overall, little evidence exists for seamount isolation rather Davidson appears to be an integral component of the deep-sea system potentially serving as source of larvae to surrounding areas.

11:00 11:15 PHYLOGEOGRAPHIC PATTERNS OF DEEP-SEA CORALS ON NORTH PACIFIC SEAMOUNTS

Baco-Taylor Amy, Associated Scientists at Woods Hole, USA.

Armando Sanchez Juan, Departamento Ciencias Biologicas-Facultad de Ciencias, Universidad de los Andes, Bogota, Columbia.

Cairos Stephen, Smithsonian Institution, Washington, D.C., USA.

Corals are a key component of the fauna of deep-sea hard substrate habitats and are of interest as habitat-forming organisms for invertebrates and fishes. They are the dominant taxon and the most diverse invertebrate group on seamounts. Deep-sea corals are generally long-lived and slow growing with potentially limited recruitment, making them particularly unlikely to recover from anthropogenic impacts. The threats to seamounts make their study time-critical, with corals making an ideal model organism for research into the biology, ecology and vulnerability of seamount fauna. However, a global deficiency of scientific expertise in morphological taxonomy has been cited as a significant impediment to our understanding of deep-sea coral diversity, coral biogeography, and seamount ecology. Molecular genetic methods can be used to overcome this impediment and more rapidly assess species diversity in archived specimen collections. However, these methods have not yet been widely applied to deep-sea corals. Here we compare levels of interspecific and intraspecific genetic variation for six genes in two octocoral taxa, the Family Paragorgiidae and the primnoid genus *Narella*. All specimens were concurrently examined morphologically for species identifications. Using the most variable of these genes, the phylogeographic patterns of both taxa on North Pacific seamounts are presented.

11:15 11:30 IN-SITU SPAWNING OBSERVATIONS OF CALYPTOGENA BIVALVES USING THE LONG-TERM DEEP-SEA OBSERVATORY

Katsunori, Fujikura; Fujiwara, Yoshihiro; Furushima, Yasuo; Maruyama, Tadashi; Hiroyuki, Yamamoto.

Extremobiosphere Research Center. Japan Agency for Marine-Earth Science and Technology (JAMSTEC).

Yokosuka. Japan.

Amaki, Kasumi. College of Bioresource Sciences. Nihon University. Fujisawa. Japan.

Barry, James. Benthic Biology and Ecology. Monterey Bay Aquarium Research Institute (MBARI). Moss Landing. USA.

Iwase, Ryoichi. Marine Technology Center. Japan Agency for Marine-Earth Science and Technology (JAMSTEC). Yokosuka. Japan.

Vesicomyid bivalves are a common taxon at deep-sea vents and seeps. In spite of successful fertilization is one of the most important factor in the life-history of aquatic animals, our knowledge of the reproduction of most deep-sea animals including vesicomyid bivalves limited due to the logistic difficulties of deep-sea investigations. To understand reproductive biology and ecology of deep-sea organisms, the in-situ long-term deep-sea observatory composed by TV camera, CTD, and a current meter was deployed at the Off Hatsushima Island seep site in Sagami Bay, Japan. We could get detail reproductive data, such as spawning behavior, frequency and spawning cues of the *Calymene* bivalves using this observatory for 1 year. Male spawning was triggered by a rise in water temperature of 0.1- 0.2 °C. Female spawning by egg release into the water column was always preceded by male spawning and decreasing near-bottom current speeds. These results demonstrate the utility of long-term observatories for studies of deep-sea reproductive biology, particularly for species characterized by rare, episodic spawning events.

11:30 11:45 HYDROTHERMAL FLUID FLUX DRIVES DIVERSITY OF DEEP-SEA HYDROTHERMAL VENT MEIOFAUNA

Gollner Sabine; Kekely Julia; Riemer Barbara; Bright Monika, Marine Biology, University of Vienna, Austria.

Le Bris Nadine, Environnement Profond, Ifremer, Plouzané, France.

Catastrophic volcanic eruptions, tectonic disturbances, and hydrothermal fluid emissions with variable flux rates form transient environments at the midocean ridge system, the largest volcanic mountain chain on Earth. We

studied meiobenthos at hydrothermal vents along a gradient of vent flux and their well-characterized megafaunal habitats to explore and discuss meiobenthic diversity and its underlying ecological and evolutionary processes. The vent communities were dominated by hard substrate generalists also living on bare basalt with ambient deep-sea temperatures in the axial summit collapse trough. One third of species were vent endemics but occurred over a wide range of physico-chemical conditions. Species richness and diversity clearly increased with decreasing vent flux from black smoker chimneys hosting alvinellid polychaetes (S: 3-7, H'loge: 0.18 – 0.46), to tubeworm aggregations with moderate emissions (S: 9 – 24; H'loge: 0.44 – 2.00), and to mussel assemblages at low emissions (S: 28 – 32; H'loge: 2.34 – 2.62). These data suggest that with an increase of temperature and toxic hydrogen sulfide, a decrease of species being able to cope with these extreme conditions and thus a less diverse community will be found.

11:45 12:00 UNRAVELING THE EVOLUTION OF CHEMOSYMBIOTIC MYTILIDS: A MORPHOLOGICAL PERSPECTIVE

Genio Luciana, Earth and Biosphere Institute - School of Earth & Environment, University of Leeds, UK.  
Kiel Steffen, Institute of geosciences –paleontology, Christian-Albrechts-University Kiel, Kiel, Germany.  
Cunha Marina R., CESAM – Centro de Estudos do Ambiente e do Mar, Departamento de Biologia, Universidade de Aveiro, Aveiro, Portugal.  
Grahame John; Little Crispin T.S., Earth & Biosphere Institute, University of Leeds, Leeds, UK.

Since the discovery of hydrothermal vents three decades ago, chemosymbiotic mussels have been of particular interest to marine biologists, especially because of their symbiotic relationships with bacteria. To date, more than 20 mytilid species have been described at hydrothermal vents, cold seeps, wood- and whale-falls, and several genetically distinct groups have been identified. Diversification of chemosymbiotic mytilids and their ecological success in these extreme environments are a combined result of their feeding and reproductive adaptations. Despite the extensive studies on the biology of chemosymbiotic mussels, many questions remain unanswered regarding their evolutionary history. So far, our knowledge comes from a number of molecular studies, which suggest a stepping stone evolution from wood- and whale-fall to seep and vent environments. Morphological analyses of these mytilid genera are almost absent and are necessary to improve mytilid systematics, as well as the taxonomic classification of fossil taxa. This study aims to investigate the potential use of early ontogenetic features, shell microstructure and mineralogy for phylogenetic analyses and evolutionary studies of chemosymbiotic mytilids.

12:00 12:15 PHYLOGEOGRAPHY AND POPULATION GENETICS OF VENT/SEEP ANIMALS IN THE WESTERN PACIFIC

Watanabe Hiromi, Extremobiosphere Research Center, Japan Agency for Marine-Earth Science and Technology, Japan.  
Murakami Sohki; Yorisue Takefumi; Kojima Shigeaki, Marine Ecosystems Dynamics Division, Ocean Research Institute, University of Tokyo, Tokyo, Japan.  
Miyazaki Jun-Ichi, Faculty of Education and Human Science, University of Yamanashi, Kofu, Japan.

In the western Pacific, hydrothermal vent fields are distributed in backarc basins and island arcs, and these have different geological backgrounds from mid oceanic ridges in the Atlantic and eastern Pacific. In this presentation, we will review the phylogeography and population genetics of invertebrates in chemosynthesis-based biological communities in western Pacific and introduce commonalities. Some gastropods and barnacles are genetically different between the northern and southern hemisphere, and most of their gene flow seems to be limited in a single backarc basin, probably due to the limited larval dispersal in backarc basins. At the methane seeps in Sagami Bay, the Nankai Trough, Kagoshima Bay, low genetic diversities were estimated in all the examined populations of tubeworms, clams and shrimps, while relatively high diversities were estimated from other populations of the same species at other vent fields. Population genetic diversity may reflect some environmental difference in vent/seep sites in the western Pacific.

12:15 12:30 COMPARATIVE PHYLOGEOGRAPHY OF DEEP-SEA HYDROTHERMAL VENT SPECIES ALONG THE EAST PACIFIC RISE

Plouviez Sophie; Daguin Claire; Virad Frédérique; Lallier François; Jollivet Didier, UMR7144 UPMC CNRS, Station Biologique de Roscoff, France

Deep-sea hydrothermal vents are widely distributed along oceanic ridges throughout the globe. Venting is caused by deep-sea water infiltration into the oceanic basaltic crust where it is overheated and charged of metallic elements. The hot uplifted fluid (around 350°C) is mixed to the cold and well-oxygenated bottom sea-water and

precipitated to form large sulfide edifices. Hydrothermal vent species are strictly associated with these sulfidic emissions as their nutritional needs only rely on chemolithoautotrophic bacteria. Deep-sea hydrothermal vent sites are highly fragmented and often separated by hundreds of kilometres with a rapid and highly variable turn-over both in time and space, which implies good dispersal capacities in order to (re)colonize new habitats. Dispersal is mainly restricted to the sea bottom layer along the ridge axis. Consequently, breaks that offset ridge axis (like transform faults) could disrupt gene flow and thus may promote genetic breaks, geographic structure of populations and, ultimately speciation. Here, we compared several phylogeographic patterns from different gastropod and polychaete species in order to test the possibility of vicariant processes and propose a global history of colonisation of vent species along the East Pacific Rise (EPR). First coalescence results using sequences of the Cytochrome Oxidase I mitochondrial gene indicated low geographic structure in nearly all studied species. Most networks displayed a star-like structure of same age, suggesting a recent demographic expansion. Breaks to gene flow are detected at different latitudes and often shared between groups of species and could be attributed to putative vicariant events.

12:30 12:45 POPULATION DYNAMICS AND DISPERSAL OF "COLD SEEP" CLAMS (BIVALVIA: VESICOMYIDAE): FACTORS DEFINING SPATIAL CONNECTIVITY

Audzijonyte Asta; Vrijenhoek Robert, Molecular Biology, Monterey Bay Aquarium Research Institute, USA

Recent evidence suggests that chemosynthetic "cold seep" ecosystems are likely to be widespread along most continental margins. Yet, little is known about these ecosystems, as they are hard to locate, and because recent deep-sea research has been largely directed towards hydrothermal vent investigations. A defining characteristic of biological communities, including those in "cold seeps," is the scales over which its constituent species are connected in space and time. We used molecular approaches to study dispersal rates and demographic dynamics of "cold seep" vesicomyid clams from the eastern Pacific, with a particular focus on the Monterey Bay, California. Genetic structure was inferred using a range of nuclear-coding genes and individual-based statistical analyses. Patterns of genetic structuring and estimated dispersal rates were interpreted in the light of knowledge on predominant ocean current vectors, larvae dispersal capabilities, and longevity of the "cold seep" habitats.

## Museum Auditorium

### Session 1.2 Recent discoveries in Marine Biodiversity

Chairs: Graham Shimmield; Bhavani Narayanaswamy

10:30 10:45 HUNTING HIGH AND LOW – LÉVY-LIKE SCALING LAWS OF MARINE PREDATOR SEARCH BEHAVIOUR

Sims, David, Marine Ecology, Marine Biological Association Laboratory, UK

Comparing several dimensionless system level indices calculated for the different marine and estuarine ecosystems, transfer of energy and most system level indices are highly variable between the coastal ecosystems. Some system level indices, such as average path length, average residence time, Finn cycling index, average mutual information and the different connection indices were distinctly correlated with biodiversity. Flow diversity and food web connectance was closely related to biodiversity, but depends to a large degree on the presence of dominant species. This study revealed the correlation between the diversity of coastal systems and their trophodynamic function. The role of biodiversity for energy flow and stability of coastal systems is discussed based on the results of this study.

10:45 11:00 LIFE UNDER THE FORMER ANTARCTIC LARSEN A/B ICE SHELF: A WHITE SPOT AND ITS BIODIVERSITY-CHANGE

Gutt Julian, Marine Animal Ecology, Alfred Wegner Institute, Germany.  
Heilmayer Olaf, National Oceanography Centre, Southampton, UK.  
Isla Enrique, Institut de Ciències del Mar, Barcelona, Spain.  
Langer Stephanie, Alfred Wegener Institute, Bremerhaven, Germany.  
Lehnert Linn Sophie, Research and Technology Centre (FTZ), Buesum, Germany.  
Scheidat Meike, Wageningen IMARES, Texel, The Netherlands.

Seiler Jan, School of Ocean Sciences, University of Wales, Bangor, UK.  
Kock Karl-Hermann, The Federal Centre of Fisheries, Hamburg, Germany.

More than 33% of Antarctica's shelf is covered by ice shelves. Thus, under ice shelf habitats are the norm rather than an exception, however, it is one of the least known habitats on earth. Over the past 40 years atmospheric warming caused ice shelves at the northern part of the Antarctic Peninsula to disintegrate almost completely, with the largest being Larsen A/B which collapsed in 1996 and 2002, respectively. During a CAML-Polarstern expedition in 2006/07 integrated ecological study was carried out for the first time in such a habitat. Results show a specific benthic fauna which can still be attributed to the old ice-covered situation and give first hints on a biodiversity shift as a result of low-pace response. Observations in the water column showed local concentrations of pelagic key species: krill and Antarctic silverfish. As a consequence, Crabeater seals and Minky whales live in relatively high abundances in this area. In contrast, penguins were rare since they are locally tied to their rookeries, which exist not far away but not in the formerly ice shelf covered areas.

11:00 11:15 OVER A HALF-CENTURY STUDY ON MESOZOOPLANKTON COMMUNITY IN THE GULF OF RIGA (BALTIC SEA)

Põllupüü Maria, Department of Ecodynamics, Estonian Marine Institute of the University of Tartu, Estonia.  
Möllmann Christian, Institute for Hydrobiology and Fisheries Science, University of Hamburg, Hamburg, Germany.  
Simm Mart; Ojaveer Henn . Estonian Marine Institute, University of Tartu, Tallin, Estonia.

Mesozooplankton studies were initiated in the shallow NE Gulf of Riga since the late 1940s in association with larval herring investigations. Involving initially only May-July, the weekly sampling was extended since the early 1970 over the almost whole ice-free season. The current paper examines multi-annual trends in the abundance and biomass of more abundant zooplankton species/taxa. Major shifts in the zooplankton community dynamics appear to have taken place in the mid-second half of the 1980s, evidenced by reversal of decreasing trend in the abundance and biomass of the calanoid copepods (*Eurytemora affinis* and *Acartia* spp.) and start of decline of cladoceran abundance (essentially *Bosmina coregoni maritima*). In the next decades, some of the further zooplankton community changes could be attributed to the invasion of several alien species (*Marenzelleria neglecta*, *Cercopagis pengoi*, *Evadne anonyx*), re-appearance of the arctic copepod *Limnocalanus macrurus* and more frequent occurrence of freshwater cladocerans *Leptodora kindtii* and *Diaphanosoma* spp. The observed changes will be analysed in relation to the variability of major local environmental factors, incl., water temperature, ice coverage, nutrient concentration and riverine freshwater inflow.

11:15 11:30 ASSESSING TEMPERATE BENTHIC MEIOFAUNAL DIVERSITY USING 454 METAGENETICS

Creer Simon; Fonseca, Vera; Carvalho, Gary. School of Biological Sciences, Environment Centre Wales, Bangor University, UK  
Lunt, Dave. Department of Biological Sciences. University of Hull. Hull. UK.  
Power, Deborah. CCMAR. University of Algarve. Faro. Portugal.  
Thomas, Kelly. Hubbard Center for Genome Studies. University of New Hampshire. USA.  
Lamshead, John. Department of Zoology. Natural History Museum Auditorium. London. UK.

Benthic meiofauna are an ecologically important, ubiquitous and diverse guild comprised of between 50-90% nematodes. Despite their abundance and ecological importance, a current estimate of global nematode diversity remains speculative. This knowledge gap results from the small size and morphological conservativeness of nematodes that can cause significant problems in species identification. In order to solve the biodiversity identification issue, molecular DNA "barcodes" are now being used to assist species identification and molecular appraisals of accepted marine nematode morphospecies are uncovering the occurrence of cryptic species. Here, we test a metagenetic approach to estimate molecular operational taxonomic unit (MOTU) diversity at a range of spatial scales between northern Scotland and southern Portugal. Replicated meiofaunal sampling (n=3) of approximately 16 sandy sediment sites around the UK and Europe (total n=48) was performed prior to mass decantation, video imaging, individual/whole community DNA extraction, 18S PCR and combinations of chain termination and massively parallel 454 sequencing. The MOTU diversity estimates are compared with data derived from morphological taxonomy to assess the effectiveness of metagenetic approaches in the high-throughput assessment of marine meiofaunal communities.

11:30 11:45 CRYPTIC DIVERSITY OF BATHYAL HYDROIDS FROM THE GULF OF CADIZ (NE ATLANTIC)

J. Moura Carlos; Cunha Marina R., Departamento de Biologia, Universidade de Aveiro, Portugal.  
Medel Maria D., Departamento de Fisiología y Biología Animal, Universidad de Sevilla, Sevilla, Spain.

Harris David J. Centro de Investigação em Biodiversidade e Recursos Genéticos, Universidad do Porto, Porto, Portugal.

Rogers Alex D., Institute of Zoology, Zoological Society of London, London, United Kingdom

About 60 hydroid species (15 families) have been recovered from dead scleractinean stands, carbonate chimneys' fields and mud volcanoes (230-2194 m depths) during 10 oceanographic campaigns carried out since 2000 in the Gulf of Cadiz. One new species, genus and family were already described, the known bathymetrical ranges of many species extended, and 8 other new species discovered. The 16S RNA gene has been sequenced to revise taxonomy and complement identification. It allowed detection of cryptic diversity and other taxonomic inconsistencies including cases of conspecificity and congenerity. In terms of ecology, the diversity and abundance of the hydroids at the study sites is apparently influenced by local hydrodynamics, availability of hard substrata, habitat heterogeneity, depth and seepage activity. Several collected species have broad geographical distributions and it is likely that some may have adapted to live in the mild seepage environments of the Gulf of Cadiz, taking advantage from the high rates of microbial production. Genetic diversity is higher than expected and the number of species recorded from these mud volcanoes contrasts with the rare reports of Hydrozoa from other cold seeps.

11:45 12:00 DIVERSITY, DENSITY AND MORPHOMETRY OF A *ERRINA ASPERA* FACIES IN THE MESSINA STRAIT

Salvati Eva; Angiolillo Michela; Giusti Micaela; Greco Silverstro; Canese Simonepietro, Habitat and Biodiversity Protection, Central Institute for Marine Research (ICRAM), Italy

*Errina aspera* is the only calcareous skeleton hydrozoan of Mediterranean, the presence of which is restricted to the Strait of Messina. The rareness makes this species the only Mediterranean hydrozoan mentioned in the IUCN red list. Because of its rareness and of the environmental conditions in which it lives (deep waters with strong currents), information about this species are incomplete and approximate. During the sampling activities for the project "Monitoring the marine biodiversity along Calabrian coasts", affiliated in the framework of "Census of marine life", high resolution photographs data about the massive assemblages of *E. aspera* were collected. The aim of this work is to describe the *Errina aspera* facies present in the middle of the Strait of Messina. A R.O.V. equipped with a high definition camera and two parallel lasers pointers provided us with 30 pictures to elaborate qualitative and quantitative data. Information concerning species composition of the assemblage (random point count methodology), density (n° of colonies/m<sup>2</sup>) and macroscopic morphometric measurements (height, width and n° of apices for colony) have been calculated using CPCe software.

12:00 12:15 SOFT-SHELLED FORAMINIFERA ALONG A DEPTHS OXIC - ANOXIC INTERFACE SOFT-SHELLED FORAMINIFERA ALONG A DEPTHS OXIC - ANOXIC INTERFAC FROM AN ACTIVE GAS SEEPAGE AREA (THE BLACK SEA) SOFT-SHELLED FORAMINIFERA ALONG A DEPTHS OXIC - ANOXIC INTERFACE FROM AN ACTIVE GAS SEEPAGE AREA (THE BLACK SEA) SOFT-SHELLED FORAMINIFERA ALONG A DEPTHS OXIC - ANOXIC INTERFACE SOFT-SHELLED FORAMINIFERA ALONG A DEPTHS OXIC - ANOXIC INTERFACE FROM AN ACTIVE GAS SEEPAGE AREA (THE BLACK SEA)

Anikyeyeva Oksana; Sergeeva Nelly, Department of Ecology of Benthos, Institute of Biology of the Southern Seas, Ukraine.

Gooday Andrew, Ocean Biogeochemistry and Ecosystems, National Oceanography Centre, Southampton, Southampton, United Kingdom.

Meiobenthic fauna in the Black sea oxic-anoxic zone (below 150-200 m) is numerous, specific and diverse. On our preliminary results, 15 high-level taxons were identified in active gas seepage area. Nematoda and Foraminifera were the dominant groups. Foraminifera presented by considerable number of soft-shelled species and one calcareous species *Ammonia tepida*. We found about 30 species of the soft-shelled monothalamous foraminifers on the depths 120 – 240 m. Most of them (21 species) belong to Allogromiidae family, another – to Saccamminidae. Two species of allogromiids refer to *Tinogullmia* genus (one of them was mentioned before by Sergeeva, Anikeeva, Gooday, 2005). One new species that was not noticed before, makes part of *Vellaria* genus, and others are representatives of the 7 new genera of Allogromiidae family. Some of them we registered in the Black Sea earlier (Sergeeva, Anikeeva, 2006). We have also determined that 1 saccamminid species belonged to *Psammophaga* genus. The rest of saccamminids refer to the 2 new genera. We described one of the soft-shelled foraminifera as a new genus and species for science *Goodayia rostellatum*.

12:15 12:30 THE INTERNATIONAL CENSUS OF MARINE MICROBES AND THE ENCYCLOPEDIA OF LIFE: BRIDGING THE GAP BETWEEN THE MOLECULAR AND THE TRADITIONAL

Thessen Anne; Amaral-Zettler L.; Patterson D.J., Biodiversity Informatics, Marine Biological Laboratory, USA.

Protists provide a unique opportunity to study biogeography and diversity of marine microbes through a combination of legacy data and modern molecular surveys. There are two projects focused on the compilation, analysis and delivery of these data, the International Census of Marine Microbes (ICoMM; [icomm.mbl.edu](http://icomm.mbl.edu)) and the Encyclopedia of Life (EOL; [www.eol.org](http://www.eol.org)). ICoMM is one of 14 ocean realm projects in the Census of Marine Life program that seeks to document the diversity, distribution and abundance of microbial life in the oceans. This project will include the development of a list of all marine protists. The EOL is a collaborative effort to aggregate all known data on every named and known species (including protists) and deliver this data in a personalized format via the internet. Both projects will serve as a global resource for biological information that can be used by audiences with a wide variety of expertise. The compilation of data and application of new technology will allow for large-scale protistan diversity studies that can lead to new insight into microbial biodiversity and biogeography.

12:30 12:45 CENSUS OF MARINE LIFE: EXPERIMENTAL DESIGN AND PERSPECTIVES IN THE INTERPRETATION OF RESULTS

Palomo, Maria Gabriela, Laboratorio de Ecosistemas Costeros, Museo Argentino de Ciencias Naturales, Argentina.

Big messages from the census of marine life emphasized the idea of increasing knowledge, the idea of interconnection of the oceans and the idea of the increase of changing. This last idea is particularly difficult to measure, since we do not know the rate of the changes, nor the rate of the increase. The goal of this presentation is to evaluate what we know about increases and changes and what we can do about them. We used data from a NaGISA site at 38° S, in a rocky shore community at Mar del Plata, Argentina performed in 2006, 2007 and 2008 to evaluate these goals. Also data performed in 1966 in the same site was used. NaGISA experimental design includes an annual sampling of one site within the area, with three intertidal levels, and five replicates in each level. Samples of macroalga, and macrofauna were taken only in patches with macroalga. Interpretation of results could be a hard work if we want to elaborate general conclusions. However, the CoML is the opportunity to discuss and improve our knowledge about them.

12:45 13:00 BENTHIC INVERTEBRATE BIODIVERSITY AND BIOGEOGRAPHY PATTERNS OF SOUTH AFRICA

Lange Louise, Zoology, Marine Biology Research Centre, South Africa.

The offshore benthic environment of South Africa consists of unconsolidated sediments. This study aims to determine the benthic invertebrate biodiversity and biogeography of this poorly known environment. Samples were taken along the South and West coasts as by-catch trawl samples. Over 300 trawls were examined, ranging in depths between 30 m and 600 m. The Indian Ocean along the South coast supports a wide variety of benthic invertebrates, approximately 300 species, with echinoderms (35 %), anomura (20 %), hydrozoans (16%) and opisthobranchs (10 %) constituting the highest biomass in this region. On the west coast, the cold Atlantic Ocean supports a much lower benthic biodiversity, in the region of a 140 species with porifera (82 %) being the bulk contributor to the overall biomass. The anomura (7 %) and macrura (4 %) were the second and third highest contributors to biomass in this cold region. The benthic community structure is currently being determined for the offshore areas and samples are being analyzed both spatially and statistically. The results of this study and new benthic biomes will be presented at the conference.

## Poster A

### Session 1.1 Marine Biodiversity in Polar Regions

Chairs: Paul Renaud; Angelika Brandt; Michael Stoddart

THE BIODIVERSITY OF SEA ICE COMMUNITIES IN THE BALTIC SEA

Majaneva, Markus; Rintala, Janne-Markus; Tvärminne Zoological Station, University of Helsinki, Finland  
Piisilä, Maria; Fewer, David; Blomster, Jaanika; Department of Biological and Environmental Sciences, University of Helsinki, Finland

The Baltic Sea is the world's largest brackish water basin, which freezes annually from October to May. The species richness in the Baltic is affected by the low salinity of the water (2-15‰). We assessed the biodiversity of eukaryotic sea ice communities and the surrounding water in the Baltic by sequencing small-subunit ribosomal RNA gene clone libraries. Total of 1312 partial and 555 full-length 18S genes were sequenced. 120 OTUs were found using 95% sequence similarity. Coverage varied between 89 to 95 % in different samples and the Shannon diversity index was 1.9–2.5 in water and 2.0–3.2 in ice samples. Sequencing of total RNA from one ice sample indicated that majority of the organisms present in the sea ice are active. The results show that the eukaryotic sea ice communities in the Baltic Sea are diverse compared to winter time water communities. This suggests that the biodiversity of eukaryotes in the Baltic Sea is underappreciated if only measured from the water and that ice communities may be important in the over-wintering of microscopic algae and protists.

#### REGIONAL ASSESSMENT OF KNOWN BIODIVERSITY: THE GULF OF MEXICO EFFORT

Felder, Darryl L., Biology, University of Louisiana – Lafayette, USA  
Camp, David K, NMNH Associate, Smithsonian Institution, USA  
Tunnell, Jr, John W., Harte Research Institute for Gulf of Mexico Studies, Texas A&M University - Corpus Christi, USA

An attempt to compile an updated taxonomic inventory for the entire Gulf of Mexico (GMx) has been completed. We define boundaries for the GMx, geographically and ecologically. Full taxonomic coverage was attempted, and required 140 expert contributors, representing 80 institutions in 15 countries. The effort listed 15,315 species of 40 phyla inhabiting the 1.5 million km<sup>2</sup> GMx (the most comprehensive account to date for a large marine ecosystem); 1,253 species are potentially endemic to the GMx and 552 are apparently nonindigenous. Estimated coverage is near 80 percent of macrobiota that actually exists, with this estimate varying widely across phylogenetic groups. Molecular studies reveal undescribed taxa among even common forms, some long overlooked. Taxonomic descriptions and revisions lag far behind molecularly based efforts for most groups; unjustifiable lumping of taxa in some recent revisions frustrates efforts. Targeted sampling programs in and adjacent to the GMx, continued molecular study, rigor in consensus taxonomy, and thorough studies of existing archives are needed for credible and timely understanding of taxonomic diversity [supported under the Harte Institute for GMx Studies, US NSF grants DEB-0315995 and EF-0531603].

#### BENTHIC HYDROIDS FROM THE ROSS SEA AND THE BALLENY ISLANDS (ANTARCTICA) COLLECTED BY THE NEW ZEALAND ANTARCTIC EXPEDITION BIOROSS 2004 WITH RV TANGAROA

Peña Cantero, Álvaro Luis, Unidad de Biodiversidad y Evolución de Cnidarios, Instituto Cavanilles de Biodiversidad y Biología Evolutiva, Spain

During the New Zealand Antarctic expedition BioRoss 2004, with RV Tangaroa, a survey to study the biodiversity of marine communities on the Ross Sea shelf and the seamounts around the Balleny Islands (Antarctica) was carried out. Amongst the numerous benthic samples an important collection of hydroids was present. Samples were obtained employing several sampling gears (Van Veen grab, Agassiz trawl, epibenthic sled and rock dredge). A total of 67 species has been recorded, belonging to the subclasses Anthoathecata and Leptothecata. Anthoathecates are represented by just nine species belonging to the families Bougainvillidae, Tubulariidae, Candelabridae, Clathrozoellidae, Hydractinidae and Eudendriidae. The last being the best represented with four species of Eudendrium. The 58 leptothecate species belong to the families Campanulinidae, Lafoeidae, Haleciidae, Halopterididae, Kirchenpaueriidae, Sertulariidae and Campanulariidae. Sertulariidae is by far the most diversified family with 27 species (40%), followed by Kirchenpaueriidae with eight (12%) and Haleciidae with seven species (10%). At the generic level, the predominant genera are Symplectoscyphus with 13 species (20%), Staurotheca with nine (13%), Oswaldella with eight (12%) and Halecium with six species (10%).

#### SPATIAL PATTERNS OF BENTHIC DIVERSITY IN MOLLUSCS FROM WEST ANTARCTICA

Troncoso, Jesús, Ecología y Biología Animal, Facultad de Ciencias del Mar - UVIGO -, Campus Vigo

Despite several works have documented patterns of diversity in deep-sea organisms, trends of diversity and processes responsible for such trends still remain unclear. So far, very few studies have document the effects of several variables such as latitude and longitude in deep-sea organisms in Antarctic region. Here, we explored the spatial patterns of diversity of benthic gastropods and bivalves, and their relationships with depth, longitude and



latitude in an extensive region about 2200 km long and 500 km wide from the South Shetland Islands to the Bellingshausen Sea in West Antarctica. A total of 134 species from 54 stations was recorded. The number of rare species was large with almost a half of species represented by 1 or 2 individuals (41%) and most species (62%) restricted to 1 or 2 sites. Species richness (i.e. alpha diversity) and beta diversity (measured as Whittaker's and Bray-Curtis similarity indices) were low, but highly variable among zones. The partial Mantel test revealed that similarity among sites increased with the decrease of depth differences, but not with horizontal separation.

#### BACTERIAL ASSEMBLAGES IN THE SEA ICE OF THE NORTHERNMOST BALTIC SEA, THE BOTHNIAN BAY

Leskinen, Elina; Rouvinen, Vilma; Tuomainen, Jaana; of Biological and Environmental Sciences, University of Helsinki, Finland

Vähä, Ville, Department of Biology, University of Oulu, Finland

Kaartokallio, Hermann, Department of Biology, Finnish Institute of Marine Research, Finland

We have investigated the bacterial assemblages in the ice cover of the northernmost Baltic Sea, the Bothnian Bay. The area is characterized by low salinity (2-3 ppt) and is annually covered by ice for 5-6 months. During winter river waters accumulate under the ice forming a fresh water layer that spreads tens of kilometers from river mouths. The ice is thus very different compared with the ice cover of oceanic waters. Molecular analysis (PCR, TGGE and 16S rDNA sequence analyses) revealed a bacterial community with several  $\beta$ -Proteobacteria and a Bacteroidetes taxon earlier found in melt pools on polar sea ice. Another group of bacteria consisted of Firmicutes,  $\beta$ -Proteobacteria and  $\beta$ -Proteobacteria, which are associated with the decomposition of DOM in the Baltic Sea. The third group were fresh water bacteria belonging to  $\beta$ -Proteobacteria, Actinobacteria and Planctomycetes. The bacterial assemblage in the sea ice of Bothnian Bay was mostly cosmopolitan in its origin. Contrary to the ice bacterial community found in the Baltic Sea Proper with slightly higher salinity (5-6ppt), there was a striking dominance of fresh water taxa in the Bothnian Bay.

#### PATTERNS OF POLYCHAETE DIVERSITY IN TWO POLAR REGIONS - TAXONOMIC DISTINCTNESS AND FUNCTIONAL GROUPS APPROACH

Monika Kedra, Pabis, Krzysztof, Jacek Sicinski, Sławomira Gromisz, Maria Włodarska-Kowalczyk; Laboratory of Polar Biology and Oceanobiology, Ecology and Environmental Protection, Poland

Rich and diversified extensive polychaete collections from two polar fiords are compared. Admiralty Bay in the Antarctic (63°S) and Arctic fiord Hornsund (77°N) have been selected for the Arctic & Antarctic Fiord Taxa Biodiversity Inventory (AATBI) within the frame of IPY. The benthos diversity of Admiralty Bay is also the subject of Admiralty Bay Benthos Diversity Data Base (ABBED), the Census of Antarctic Marine Life connected, project. Large collections from both fiords are available. Both collections are representative and show almost complete lists of polychaete species: 140 in Admiralty Bay, 110 in Hornsund. The aim of the study is to compare patterns of diversity from two polar regions. The comparison of polychaete taxonomic distinctness is taken into consideration. This may be a measure of evolutionary pattern of polychaete fauna of both, the old (Antarctica) and the young (Arctic) polar ecosystems. Additionally, an attempt of functional groups (seven feeding types and four mobility types) comparative analysis and description in these two areas will be presented.

#### ZOOPLANKTON BIODIVERSITY IN AN ARCTIC FJORD (KONGSFJORDEN, SVALBARD)

Olśzewska, Anna; Kwasniewski, Sławomir; Department of Marine Ecology, Institute of Oceanology Polish Academy of Sciences, Poland

Falk-Petersen, Stig; Wold, Anette; Hop, Haakon; Norwegian Polar Institute, Norway

Within the MariClim project (Marine ecosystem consequences of climate induced changes in water masses of West-Spitsbergen) founded by the Norwegian Research Council, zooplankton was investigated at nine stations in Kongsfjorden and neighboring shelf and slope, in spring, summer and autumn in 2006 and 2007. Sampling was with Multi Plankton Sampler Type Midi in discrete layers, and with WP-3 net from upper 100 m. Zooplankton biodiversity will be described with focus on mesozooplankton and copepod taxa. Results from the two years of study will be compared with historical data from this region (Fram Strait and the European Arctic Corridor). The increasing occurrence of boreal taxa (*Acartia clausi*, *Temora longicornis*, *Evadne nordmanni*) in the area of Kongsfjorden raises the question whether this is a consequence of increased Atlantic water input in the time of climate change or just a result of increased sampling effort.

#### TOWARDS A COMPREHENSIVE INVENTORY OF THE SOUTHERN OCEAN BIODIVERSITY

De Broker, Claude; Danis, Bruno; Department of Invertebrates, Royal Belgian Institute of Natural Sciences, Belgium

In the framework of the Census of Antarctic Marine Life, the Antarctic Marine Biodiversity Information Network SCAR-MarBIN is establishing a Register of Antarctic Marine Species (RAMS), providing accurate and complete taxonomic and distribution data openly accessible online. RAMS aims at compiling and managing an authoritative taxonomic list of species occurring in the Antarctic marine environment, to establish a standard reference for marine biodiversity research, conservation and sustainable management. RAMS in turn contributes to some larger taxonomy initiatives such as the World Register of Marine Species. Species-level information is of basic importance and species scientific name is an inescapable and standardized field to link various kinds of data from different databases. Relying on literature information as well as on new records from CAML cruises and Museum Auditorium collections, world-renowned specialists contribute to establish up-to-date and dynamic classification of the various taxonomic groups, accurate species lists and occurrence data. The Register of Antarctic Marine Species constitutes the first attempt to complete the inventory of the Southern Ocean biodiversity from micro-organisms to whales, contributing to establish a sound benchmark to assess future biodiversity changes.

#### THE CENSUS OF ANTARCTIC MARINE LIFE; A MAJOR IPY INITIATIVE

Stoddart, Michael, Department of the Environment, Water, Heritage and Arts, Australian Antarctic Division, Australia

In this study, status of coral reefs and marine sponges of the northern Persian Gulf, (Kish Island and Nayband Bay as target areas) were assessed. Result indicated that, mean percentage cover of living hard corals ( $\pm$  SE) were about  $11.8 \pm 0.6$  in Kish Island and  $31.2 \pm 0.6$  in Nayband Bay. We identified about 30 species of hard corals in whole studied areas, which were belonged to 15 genera and 7 families. Among them family of Faviids with about 7 genera and 13 species were the most diverse and families of Acroporidae and Poritidae were the most abundant hard. We observed a few evidence of Yellow band disease just in Kish Island that particularly infected *Acropora clathrata*. Also about 0.5 to 2.5 percent of hard corals were being bleached in two studied areas.

#### WHITE SEA BIOLOGICAL STATION: 50 YEARS OF BIODIVERSITY RESEARCH

Sukhotin, Alexey; Primakov, Igor; Subhotin, Alexey; White Sea Biological Station, Zoological Institute of Russian Academy of Sciences, Russia

Berger, Victor; Naumov, Andrew; White Sea Biological Station, Zoological Institute, Russia  
Flyachinskaya, Liudmila, White Sea Biological Station, Zoological Institute, Russia

The White Sea Biological Station "Kartesh" (WSBS) is a marine stationary located near the North Polar Circle in the Chupa Inlet of the Kandalaksha Bay of the White Sea. It was founded in 1957 as a permanent stationary to study biodiversity, life cycles and long-term and seasonal changes in populations and communities of the White Sea organisms. A comprehensive database, which includes about 1000 species of the White Sea benthic organisms, has been created. It covers 950 intertidal and subtidal stations covering the whole White Sea area. Since 1957 the Station performs monitoring of hydrological parameters and plankton communities. Such a long series of observations allows to estimate seasonal and long-term trends in the structure of the White Sea pelagic ecosystems, and to make predictions in the light of global climate change. Recently the new approaches in biodiversity research have been developed at the WSBS. They include studies of meroplankton and computer modeling of microobjects, which allowed to identify the new species for the White Sea fauna.

#### **Session 1.3. Deep-sea and extreme environments: temporal and spatial patterns among species and ecosystems**

Chairs: Pedro Martinez Arbizu; Andrew Gooday; Ana Colaco; Adrian Glover; Stefanie Keller

#### BIODIVERSITY AND BIOGEOGRAPHY OF ABYSSO-BENTHIC FISHES OF THE SOUTH-EASTERN ATLANTIC

Schneider, Matthias, Ichthyology-Marine Zoology, Senckenberg Research Institute and Natural History Museum, Auditórium, Germany

Most studies of deep-sea fish communities conducted in the Atlantic so far focussed on the northern hemisphere, in particular on assemblages on continental slopes and seamounts. Our knowledge of the deep dwelling, abyssal ichthyofauna in general and that of the Southeastern Atlantic in particular remains fragmentary. During the RV 'Meteor' expeditions 'DIVA I' and 'DIVA II' abyssal-benthic fish communities of the deep basins of the Southeastern Atlantic were investigated using a 3.5 m Agassiz trawl. The water depths varied between 5052 m and 5497 m. Demersal fish communities of the Guinea, Angola and Cape basin were dominated by macrourids of the genus *Coryphaenoides*, ipnopsids (*Bathymicrops*, *Bathypterois*) and ophiids (*Abyssobrotula*). Differences in community composition, abundance, biomass, and mean size of dominant species among the basins are presented. Species compositions and biodiversity patterns are discussed with regard to basin-related productivity and latitudinal gradients. Some species were recorded for the first time from the South-eastern Atlantic. The geographical distribution of selected species is revised, based on results from the RV 'Meteor' expeditions and an extensive study of various Museum Auditorium collections.

#### MACROBENTHIC COMMUNITIES ON SUB-ARCTIC BOTTOMS

Dos Santos, Eric; Svavarsson, Jörundur; Department of Biology, University of Iceland, Iceland  
Ragnarsson, Stefán, Marine Research Institute, Iceland  
Tendal, Ole, Zoological Museum Auditorium, University of Copenhagen, Denmark

The expansion of fishing pressure into deeper waters of the sub-Arctic and Arctic creates a need for more investigation of habitat-forming megabenthos on a range of hard to soft bottoms. Benthic communities of the sub-Arctic northwest of Iceland were documented during a BIOICE cruise using underwater photography techniques. Sampling occurred at eight stations in the depth range of 240 – 375 m. All animals larger than 1 cm (diameter or length) were identified to highest taxonomic level possible. Main bottom types could be distinguished on the basis of visual examination of the photographs. Based on the number of individuals and species, a significant difference in community structure between communities on bottoms of different type was shown. Hard bottom sub-Arctic communities were dominated mainly by poriferans, especially *Tetilla* spp., *Haliclona* spp., and *Polymastia* spp. Epibenthos on soft bottoms was less diverse but at sites where small (<5 cm) rocks were present in high number, density of ascidians overcame that of all other present taxa. Accordingly, the epifauna had a pronounced hard bottom character despite the prevalence of soft substrate.

#### BIODIVERSITY OF NEMATODE ASSEMBLAGES FROM A UNIQUE SHALLOW WATER SUBMARINE CAVE WITH CHARACTERISTICS SIMILAR TO THE DEEP-SEA

Lampadariou, Nikolaos, Oceanography, Greece  
Chevaldonné, Pedro, DIMAR, Station Marine d'Endoume, Centre d'Océanologie de Marseille, Rue de la Batterie des Lions, France  
Janssen, Annika, DZMB, Forschungsinstitut Senckenberg, Germany

The abundance and biodiversity of nematode assemblages was investigated from a shallow (18-24 m) submarine cave in the Mediterranean. Due to its descending floor, the cave shows the unique characteristic of cold and dense water entrapment in its inner part, resulting in stable (ca. 13-15°C) temperatures throughout the year. Three zones were sampled: the entrance, with a direct influence from the open sea, the central part where weak water mixing and dim light is still observed (ca. 50 m from entrance), and the inner completely dark and isolated part (ca. 100 m from entrance). The nematode communities from these three habitats were significantly different from each other with the inner-cave community displaying the largest dissimilarities. In all zones, non-selective deposit feeders were significantly more abundant. However, high numbers of a large predator, were encountered in the inner part. The community at the inner part was more uniformly distributed with several species being equally important. In contrast, the central and outer parts were highly dominated (> 40%) by one single species of the genus *Sabatieria*.

#### LARGE, ENIGMATIC FORAMINIFERAN-LIKE PROTISTS: DIVERSITY AND VERTICAL DISTRIBUTION IN SEDIMENTS OF AN ABYSSAL POLYMETALLIC NODULE FIELD (CLARION-CLIPPERTON FRACTURE ZONE, NE PACIFIC)

Kamenskaya, Olga, laboratory of deep-sea fauna, P.P.Shirshov Institute of Oceanology Russian Academy of Sciences, Russia  
Gooday, Andrew, National Oceanography Centre, UK  
Radziejewska, Teresa, Department of Palaeoceanology, University of Szczecin, Poland

Komokiaceans, xenophyophores, and similar large (millimetre- to centimetre-sized) testate protists resembling Foraminifera are a ubiquitous and often dominant component of abyssal macrofaunal assemblages. Yet they are

often overlooked and many species are undescribed, often at the genus or higher taxon level. As a result, they represent a major source of unknown biodiversity in the deep sea. We studied the diversity and vertical distribution of these delicate, often-fragmentary organisms in sediment samples (0-6 cm layer) collected from 3 sites in the eastern part of the Clarion-Clipperton polymetallic nodule field (sub-equatorial NE Pacific) during the 1997 cruise of InterOceanmetal Joint Organization (IOM). A total of 68 morphotypes was recorded (10-44 per station), indicating an extremely diverse assemblage. Although most morphotypes were found in the upper 1.5 cm, deeper sediment layers also supported fairly diverse komokiacean assemblages. A few species attached to nodule surfaces have been described previously, but ours is the first study of these protists in sediments from an abyssal nodule field. It contributes to our baseline knowledge of abyssal communities in an area targeted for future commercial nodule mining operations.

#### DIVERSITY AND LARGE-SCALE BIOGEOGRAPHY OF PARAMESOCHRIDAE (COPEPODA, HARPACTICOIDA) IN SOUTH ATLANTIC AND ANTARCTIC ABYSSAL PLAINS

Gheerardyn, Hendrik, Biology Department - Marine Biology Section, Ghent University, Belgium  
Veit-Köhler, Gritta, German Centre for Marine Biodiversity Research, Senckenberg Research Institute, Germany

Within the framework of the international project CeDAMar, the deep-sea campaigns DIVA and ANDEEP in 2000, 2002 and 2005 to the southern Atlantic Ocean (Guinea, Angola and Cape Basin) and the Southern Ocean (Weddell and Scotia Sea) yielded meiofauna samples from 21 stations. At depths down to 5655 m, a total of 512 cores from 83 hauls were collected. In the present study, all 310 adult Paramesochridae Lang, 1944 (Copepoda, Harpacticoida) were analyzed at the taxonomic-morphological level. They belonged to 19 species and four genera (*Kliopsyllus* Kunz, 1962, *Leptopsyllus* T. Scott, 1894, *Paramesochra* T. Scott, 1892 and *Scottopsyllus* Kunz, 1962). Eleven species were restricted to single regions, whereas the others showed a much wider distribution. For example, the two known species, *K. andeep* Veit-Köhler, 2004 and *K. diva* Veit-Köhler, 2005, were both collected from Guinea, Angola and Weddell Abyssal Plain, and *K. new sp. 1* occurred in all three West-African basins. For the first time, this study provides insights into the large-scale biogeography of deep-sea harpacticoids and indicates that distribution ranges might span across South Atlantic and Antarctic abyssal plains.

#### POLYCHAETE MORPHOLOGICAL AND GENETIC DIVERSITY IN THE EQUATORIAL PACIFIC

Paterson, Gordon; Glover, Adrian; Zoology, Natural History Museum Auditorium, UK  
Smith, Craig; Atimara, Iris; Oceanography, University of Hawaii, USA  
Foster, Peter; Dyall, Pat; Zoology, Natural History Museum Auditorium, UK  
Galeron, Joelle; Menot, Lenaik; DOP, IFREMER, France  
Boeggemann, Markus, University Osnabruck, Germany

Both morphological and molecular methods were used to assess species diversity and distributions within the Clipperton Clarion Fracture Zone manganese nodule fields in the Pacific. The aim of the study was to provide biogeographic information to inform management plans for the sustainable exploitation of manganese nodules from this region. The species studied came from five polychaete families - Cirratulidae, Glyceridae, Lumbrineridae, Spionidae and Syllidae. This poster will present the latest results.

#### DIVERSITY BEYOND THE SPECIES RICHNESS? HOW TO DEAL WITH LESS ABUNDANT TAXA OF THE DEEP SEA - LIKE LORICIFERA?

Gad, Gunnar, Deutsches Zentrum für Marine Biodiversitätsforschung (DZMB), Forschungsinstitut Senckenberg, Germany

There is no doubt that the most abundant taxa of deep-sea meiofauna are Nematoda (88-90%) and Harpacticoida (8-9%). It is therefore no surprise that most studies of deep-sea meiofauna diversity deal with these two taxa. Other animal groups like Loricifera seem to have such a low distribution that it is hardly worth mentioning. The investigation of Loricifera from North Atlantic deep-sea basins revealed that this group in average makes up no more than 0.2-0.3% of the total deep-sea meiofauna in the analysed samples (DIVA-1 in 2000 and DIVA-2 in 2005). Remarkably, they are present with a few specimens in each sample, despite this low abundance. However, in a few cases Loricifera suddenly start being the second most abundant taxon of the meiofauna! Reasons for this may be found in their life cycles. The number of different life history stages of deep-sea Loricifera is impressive and their complex life cycles are surprising in response to small-scale changes of environmental conditions. Instead of dealing exclusively with species numbers, also the variety of life history stages of deep-sea Loricifera can be used for aims of biodiversity research.

## SHALLOW MARINE CAVES AS MESOCOSMS OF THE DEEP-SEA: THE "3PP CAVE" EXAMPLE

Chevaldonné, Pierre; Pérez, Thierry; Boury-Esnault, Nicole; Harmelin, Jean-Georges; Lejeusne, Christophe; Zibrowius, Helmut; Vacelet, Jean; Chevaldonné, DIMAR, Centre d'Océanologie de Marseille, Aix-Marseille Université, France  
Lampadariou, Nikolaos; Martínez Arbizu, Pedro; Hellenic Centre for Marine Research, Greece  
Janessen, Annika, DZMB, Forschungsinstitut Senckenberg, Germany

Shallow marine caves share ecological features with the deep sea: darkness, oligotrophy, reduced water circulation. Significant faunistic ties exist between caves and the deep sea. However, a unique cave from the French Mediterranean presents yet another similarity. Due to its descending floor, the cave traps cold and dense water in its inner parts. As a result, the temperature of the cave remains stable and low (ca. 13-15°C, i.e. the Mediterranean deep-sea temperature) throughout the year. Known to scientists since the early 1990's, the cave has provided many surprises: a population of deep-sea hexactinellid sponges, carnivorous sponges, and several other deep-sea taxa. The 3PP cave also acts as a shelter from the warming of the Mediterranean, for some stenothermal species. Cave temperature, and the main biotic features (sponges, mysids) are monitored through time. This natural mesocosm of the deep Mediterranean, accessible by divers (25 m), has been the focus of recent efforts coordinated by the DEEPSETS RMP (MARBEF), focusing on the cave floor. Harpacticoid copepods and nematodes show striking similarities (quantitatively and qualitatively) with meiofaunal patterns of abyssal deep-sea sediment.

### **Session 1.10. Patterns and drivers in the distribution of marine biodiversity: in homage to John Gray**

Chairs: Paul Somerfield and Richard Warwick

## MACROECOLOGICAL PATTERNS IN DIVERSITY OF MARINE BENTHIC CILIATES: DO MICROBS HAVE MACROECOLOGY?

Azovsky, Andrey, Moscow State University, Russia  
Mazei, Yuri, Penza State Pedagogic University, Russia

The data on occurrences of over 1300 species of marine benthic ciliates compiled from more than 220 sources are used for studying world-wide distribution and diversity of the group. No clear geographical correlates are found in faunistic composition, especially on genera or families levels. Regional endemism is much lower than for macroorganisms. Regional-scale diversity depends neither on total area nor coastline length and does not show any latitudinal gradients. At the same time, it highly correlates with investigation effort expended in the region and (negatively) with average salinity. Local-scale diversity does not correlate with regional diversity and does not show any latitudinal trends. Moreover, region-averaged local diversity values demonstrate striking world-wide resemblance (120-140 species per site). By contrast, the point diversity (average number of species per station) turns to be positively related with absolute latitude, while the beta-diversity demonstrates the opposite trend. We suggest that marine benthic ciliates demonstrate many macroecological patterns that consistently contradict the regularities commonly obtained for macroorganisms. Thus, even if ciliates have macroecology, it is very specific and quite differs from those for macroorganisms.

## THE DIVERSITY OF HARPACTICOIDA (COPEPODA) UNDER AND AWAY FROM A FISH FARM

Mateja, Grego, National Institute of Biology, Slovenia  
Marleen, De Troch, Ghent University, Belgium  
Janez, Forte; Alenka, Malej, National Institute of Biology, Slovenia

Fish farming is one of the anthropogenic drivers of change of meiofauna communities worldwide. The meiofauna and in particular harpacticoid copepod diversity were studied along 2 transects within a 100 m distance from the fish farm in the shallow Bay of Piran (North Adriatic) during 2 seasons. Most of the variance between the samples at the higher taxa level was due to changes in kinorhynch and harpacticoid copepod abundances. Copepod abundance increased away from cage and a shift in species composition was detected. Under cages *Bulbamphiascus* n. sp. 1 accounted for the majority of the abundance in spring and summer. This dominant genus was represented by high numbers of CV copepodites under the cage. In control samples (100 m from cage) the species richness was significantly higher. Other species (e.g. *Stenhelia* sp) showed an increased abundance away from cages. The distribution of individual biomass of copepod communities tended to larger copepods under

cage. The present study focuses not only on structural diversity (species number), but also on functional diversity (species identity) and its importance for ecosystem functioning of a muddy bottom.

**THE IMPACTS OF THE DEMERSAL HAKE TRAWL FISHERY ON BENTHIC BIODIVERSITY IN SOUTHERN AFRICA**  
Atkinson, Lara; Field, John, University of Cape Town, South Africa

The South African commercial trawl fishery originated in the early 1900s and targets the highly sought-after gadoid hake species *Merluccius capensis* and *M. paradoxus* in a near continuous band between 300 and 800 m depth from the west to the south-east coasts of South Africa. The transboundary nature of the hake stocks between South Africa and Namibia, where an equally large hake fishery exists, has encouraged joint research and management cooperation between the two countries, for the demersal trawl fishery. The hake fishery is the largest and most lucrative of South Africa's fisheries and was awarded the environmentally sustainable Marine Stewardship Council certification in 2004. The impact of trawling on the benthic environment has however been identified as a major risk to the sustainability of this fishery. The fishery is currently under review for re-certification of this award and requires investigation of potential benthic impacts. Elsewhere studies have shown that demersal fishing gear can impact significantly on benthic biodiversity, however, such effects have never been examined in southern Africa. The aim of this study is to quantify the impacts of the demersal trawl fishery on abundance, biomass and diversity of benthic macrofauna and epifauna in soft bottom habitats along the southern Benguela region. Benthic macrofauna and epifauna were sampled in areas of light vs. intense fishing activity (note: no trawl grounds in this region are afforded any protection from fishing activities hence the necessity to compare light vs. intensely fished areas) at four sites and analysed for significant differences using multivariate techniques (PRIMER). Environmental variables (depth, salinity, temperature, sediment type and organic content) were evaluated, with no significant differences between light vs. intensely trawled areas resulting at each of the four sites. Results strongly indicate that the disturbance induced by demersal fishing contributes towards changes in benthic macrofauna and epifauna community compositions. Whilst no significant differences in diversity indices are evident in macrofauna communities, the species present in heavily trawled areas are significantly different from those in lightly trawled areas. The epifauna communities appear to be severely impacted by trawl-induced disturbance. The implications of these results, and future studies of ecosystem functioning, are discussed.

**Session 1.11. The taxonomic component of marine biodiversity**

Chairs: Geoff Boxshall; Christos Arvanitidis

**MORPHOMETRIC ANALYSIS OF THE GENUS *TERSCHELLINGIA* DE MAN, 1888 (NEMATODA, LINHOMOEIDAE) WITH DISCUSSION OF THE DIAGNOSTIC FEATURES AND IDENTIFICATION KEY TO THE SPECIES**

Armenteros, Maickel; Ruiz-Abierno, Alexei; Ecology, University of Havana, Cuba  
Vincx, Magda; Decraemer, Wilfrida; marine biology section, University of Ghent, Belgium

The cosmopolitan genus *Terschellingia* (Nematoda, Linhomoeidae) is a problematic taxon. Its species show high morphological plasticity, possess few diagnostic characters and identification keys are lacking. A revision of the genus was carried out based on data from the literature and from light and electronic microscopy. The diagnosis of genus was emended. Of the current 37 nominal species, 15 are considered as valid species based on characters related to amphidial fovea, cephalic and cervical setae, shape of oesophageal bulb, spicular apparatus and tail shape. Tabular and pictorial keys were provided based on these characters. The sympatric species: *T. communis*, *T. goubaultae*, and *T. longicaudata* were redescribed based on recently collected Cuban specimens. They showed relatively large differences in body size in comparison with the holotypes, suggesting variation due to local environment. The highest intraspecific variation pertains for the cosmopolitan species *T. longicaudata*, suggesting that morphological plasticity enhanced adaptation to environmental conditions. The notable taxonomic inflation within the genus (13 inquirenda species, 9 junior synonyms), probably also present in other highly specious genera of marine nematodes, leads to overestimation of the alpha-diversity.

**GREEN NON-MOTILE PICOPLANKTON, PHYLOGENY, PIGMENTS AND FINE-STRUCTURE.**

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Jouenne, Fabien, Station Biologique de Roscoff, France  
Johnsen, Geir, Norwegian University of Science and Technology, Norway  
Legall, Florence; Vault, Daniel; Station Biologique de Roscoff, France

The chlorophyte class Prasinophyceae contains a number of pico sized species. Phylogenetic studies have shown the class is polyphyletic and it has been redefined several times since its erection by Chadeaud in the 1970's. We present pigment, nuclear SSU rDNA and fine-structure data of new non-motile members of the class. Many small coccoid species such as Pycnococcus, Prasinococcus and Prasinoderma has been ascribed to the class and was confined within the order Mamiellales because of their pigments. New evidence has shown that they may constitute an additional group of green algae containing prasinoxanthin and MgDVP not related to the Mamiellales. Other small non-motile species including Picocystis salinaris form a clade of their own and a new taxon embracing these species needs to be erected.

#### A REFERENCE DNA BARCODE LIBRARY FOR DECAPODA REVEALS PRIORITY GROUPS FOR TAXONOMIC AND SYSTEMATIC FOCUS.

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Costa, Filipe, Departamento de Biología, Universidade do Minho, Portugal  
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Contemporary biodiversity assessments are mainly based on morphological characters, but the collapse of taxonomic expertise combined with the limitations of morphological taxonomy demands new approaches for biodiversity research. DNA barcoding has been suggested as a solution to this problem and the creation of a well-annotated reference library is a critical starting component for establishing DNA-based identification tools. Decapoda crustaceans are a dominant group of megabenthic invertebrates but little is known about genetic variation on sufficiently large geographic and bathymetric scales. We analysed cytochrome oxidase I (COI) and 16S sequences for decapods collected in the Northeastern Atlantic Ocean and in the Mediterranean Sea and compared the molecular data with field-based morphological identifications, and additional bioinformatic sequence sources. Results suggest that COI provides effective species-level discrimination for nearly all putative species. Some groups showed taxonomic inconsistencies that may reveal the existence of cryptic species, incongruence of identification criteria, or insufficient resolution of COI and 16S. We intend to use other mitochondrial and nuclear markers to clarify possible ambiguities in taxonomic boundaries and help reconstruct phylogenies for most pertinent families.

#### POLYCHAETE ASSEMBLAGE AROUND A SEWAGE OUTFALL IN A WESTERN MEDITERRANEAN SOFT-BOTTOM BEACH.

Royo García, Miguel; Torres-Gavilá, Javier; Tiena Medialdea, José; Valero Hervás, Mario; Ciencias del Mar, Instituto De Investigación En Medio Ambiente Y Ciencia Marina. Universidad Católica De Valencia, Spain

This study analyzes the structure, composition and distribution of the polychaetes community under the influence of a sewage outfall. It is located in the infralittoral coastal zone of a sandy beach characterized by a soft slope. Analyses of water column revealed the presence of a homogeneous mass of water, with the exception of the surroundings of the sewage outfall, where typical information of urban waste water were obtained. Eighty five species belonging to thirty families of polychaetes were identified. Nephtys hombergii and Onuphis eremita were the most dominant species. The analysis of the trophic groups showed the highest abundances of carnivorous and omnivorous, followed by the surface and sub-surface deposit feeders. The effect of sewage on the distribution of the fauna appeared to be restricted to the southeast of the outfall, where the highest values of abundance, specific richness and organic matter content were found. A possible explanation to the polychaetes' distribution is the direction of the predominant current in the zone of study (NE-SW). Finally, we present a species card. It includes taxonomic and ecological data of polychaeta fauna.

#### RHOPALIOPHORAN JELLYFISH (CNIDARIA: CUBOZOA, SCYPHOZOA, STAUROZOA). ARE TRADITIONAL MORPHOLOGICAL APPROACHES STILL VALID TO ACCESS THEIR BIODIVERSITY?

Morandini, Andre, NUPEM/UFRJ, Brazil

The number of rhopaliphoran species has changed little since the beginning of the 1900's. The number of new species described has increased some 30% after Haeckel and Mayer monographs. Most of these species came from deep waters or unexplored areas, some are small and inconspicuous, and others are based on sessile polyp stages. For some time, the group had experienced a process of "synonymization", in which several species (with minor morphological differences) were treated as a single wide distributed one. More recently, new techniques (molecular biology) are calling the attention of researchers for the distinction of rhopaliphoran species based on

DNA sequence data. But the most striking and intriguing aspect of this new insight is that, when observing these species carefully, researchers can still find some significant morphological differences. Inspection of type specimens and old collected material is a good source of additional morphological data for certain species. It is advocated that comparative morphology is still a good tool for the differentiation of species, and with support of molecular biology, we will know better the diversity and test hypothesis of evolutionary traits within the group.

## SCALIDOPHORA OF THE GULF OF MEXICO

Shirley, Thomas, Harte Research Institute for Gulf of Mexico Studies, Texas A&M University-Corpus Christi, USA

A recently completed all-species inventory of the Gulf of Mexico (GMx) revealed that knowledge of Scalidophora (phyla Priapulida, Kinorhyncha and Loriciphera) is scant; studies of these phyla might provide a fertile area for taxonomic discoveries and biodiversity increases. Large numbers (506 specimens) of loriciferans from 40 sampling locations, in 298 to 2959 m depth, were identified only to phylum, but may represent as many as six species. Similarly, only one kinorhynch species has been reported from the GMx. Large numbers (>800) of kinorhynchs have been collected from several faunal surveys, but have been sorted only into five genera. Other species of kinorhynchs from nearshore and estuarine areas have been identified only to phylum or genus. A single species of priapulid, cf. *Tubiluchus corallicola*, has been collected abundantly (to 1200 .m-2) from numerous locations with coarser sediments in the southeastern GMx. An undescribed, macrofaunal priapulid was collected in the southern GMx. The Scalidophora are a poorly studied taxon in the GMx that should provide many new species and noteworthy range extensions [supported under the Harte Research Institute for GMx Studies].

## MOLLUSCAN BIODIVERSITY OF THE GULF OF MEXICO

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Rosenberg, Gary, Department of Malacology, Academy of Natural Sciences of Philadelphia, USA

An all-species biotic resume of the Gulf of Mexico (GMx) has recently been completed. Eighteen authors from 15 institutions in five countries compiled a well-documented yet conservative checklist of 2455 marine mollusk species, including updated taxonomy, habitat, depth, and distribution within the boundaries of the GMx as defined in this project. This is the most comprehensive effort to date in documenting GMx mollusks. Nine apparently introduced species were recorded and 259 species are currently considered endemic (10.5% endemism). The southeast quadrant (including the Florida Keys, NW Cuba and NE Yucatan Peninsula) showed the highest diversity and SW the lowest, but most sampling effort has been in the SE and least in the SW. Discovery of new species is still common, with about 9% having been described in the last 20 years. Sampling of micromollusks and nudibranchs, as well as deepwater species is still poor in many areas, therefore continuing discovery of new species and GMx occurrences of species from neighboring waters are expected [supported under the Harte Research Institute for GMx Studies].

## TAXONOMY OF EUROPEAN PEA CRABS (CRUSTACEA, DECAPODA, BRACHYURA, PINOTHERIDAE)- TRADITIONAL TOWARDS MODERN MORPHOLOGICAL METHODS

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European Pea Crabs are very small crabs that live commensally inside bivalves or sea squirts. They pass through different morphotypes in their life cycle and have a conspicuous sexual dimorphism. Thus, the taxonomy of Pinnotheridae is quite challenging. On European coasts, two species are widely accepted species are recognised: *Pinnotheres pisum* (LINNÉ 1767) and *Nepinnotheres pinnotheres* (LINNÉ 1767). A third species, *Pinnotheres pectunculi* HESSE 1872 is only known from one bivalve host species from its type locality Roscoff (France). Because it is very similar to *Pinnotheres pisum*, some authors still doubt its status as a valid species. Even more problematic are two further species described as living in ascidians: *Pinnotheres ascidicola* HESSE 1872 (European Atlantic coast) and *Pinnotheres marioni* GOURRET 1884 (Mediterranean). Since their first record, these inhabitants of sea squirts were rarely mentioned and never carefully compared with other European species. My investigations include a careful analysis of characters by Scanning Electron and Confocal Microscopy. These modern morphological methods enlight the understanding of structures in a way that may have surprised the Pinnotherids' first authors.

## BIODIVERSITY OF IBERIAN PYCNOGONIDS PROJECT: PRELIMINARY RESULTS



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This work pretends to realise a monograph of Iberian Pycnogonids related to FAUNA IBERICA VIII research project. The basis of this subproject are not only the already known publications and collections from the main researcher and others, but also future reviews of collections from other universities and public institutions. This work will consist in a taxonomical and ecological study of Iberian species, including descriptions, drawings, photographs, keys of identification and geographical and bathymetrical distributions of each species. The data bank will be exposed at the Internet page of Fauna Ibérica. Actually, the iberian pycnogonids are well studied at infralittoral level, but there are few studies at deep waters, mainly in the Mediterranean Sea, where only 5 specimens are found below 100 m. The only records of deep samples were collected in the Gibraltar waters by BALGIM French expedition, between 131 and 2100m, which recorded 20 different species, two of them new for the science (Stock, 1987). Moreover, the Spanish FAUNA I cruise (mainly on the Atlantic waters of Andalucía region), found 18 species, a new European citation and another two new species up to 500m (Munilla, 1993a). Up to date, a total of 51 species represented by 10000 specimens have been collected in the Iberian and Balearic waters in 442 stations approximately. Forty species belong to the Atlantic, 30 to the Mediterranean Sea and 20 are common in both waters. A total of 1340 species have been catalogued all over the world.

## **Session 2.2 Biodiversity & Ecosystem Shifts: Viewed from the Bottom Up**

Chairs: John R. Dolan; Wiebe Kooistra

### **LINKING ENVIRONMENTAL PARAMETERS AND CHANGES IN ACTIVE DIAZOTROPHIC COMMUNITY STRUCTURE TO NITROGENASE ACTIVITY PATTERNS IN COASTAL MICROBIAL MATS**

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Microbial mats on intertidal sandy beaches often function as pioneer systems; allowing a succession of higher plants and thus influencing the morphodynamics of the ecosystem. Biodiversity of coastal microbial mats and their functioning with regard to nitrogen fixation were investigated using the acetylene reduction assay to record nitrogenase activity as well as denaturing gradient gel electrophoresis and quantitative PCR to access bacterial diversity and changes of nifH-gene expression over time. Moreover, factors controlling nitrogenase activity, e.g., the tidal cycle and concentration of key nutrients, have been evaluated. The mat higher up in the littoral zone showed several nitrogenase activity-maxima between sunset and sunrise and harboured a variety of diazotrophic proteobacteria and cyanobacteria. Active diazotrophic community changed over a diel cycle and was related to changes in nitrogenase activity. In contrast, the mat situated close to the low water mark was mainly composed of non-heterocystous cyanobacteria with *Lyngbya aestuarii* being the most dominant diazotroph. Accordingly, a night time-maximum of nitrogenase activity was recorded. Diazotrophic diversity and daily integrated nitrogenase activity of the two mats were similar.

### **DIATOM EVOLUTION**

Kooistra, Wiebe, Marine Botany, Stazione Zoologica Anton Dohrn, Italy

Diatoms constitute a major lineage of photosynthetic eukaryotes. Their hallmark is the silica cell wall (frustule). Diatoms are ubiquitous in the plankton and benthos of marine and freshwater habitats, and their contribution to global productivity and nutrient cycling is significant. In molecular phylogenies the centric diatoms constitute a paraphyletic group whereas pennates are monophyletic. Marine planktonic diatoms are found predominantly in the centrals though a few pennates have managed to become important as well. Frustule elements are preserved in various concentrations and in various states, and often in all their resplendence, over millions of years. Centrals first appear in the Jurassic, and pennates appear in the Late Cretaceous. Insight in why they became so abundant and diverse in marine ecosystems would be valuable to climatologists trying to discover if there are any historical analogues for the current Earth system, with atmospheric CO<sub>2</sub> now at levels unknown since the mid-Tertiary and an ocean pH that within a few centuries may be lower than at any time since the end of the Carboniferous.

### **ENVIRONMENTAL CONDITION, LIFE CYCLES AND ENDOGENOUS CLOCKS IN PHYTOPLANKTON DYNAMIC. EVIDENCES FROM EXPERIMENTAL OBSERVATIONS IN THE NW ADRIATIC SEA**

Bastianini, Mauro; Bernardi Aubry, Fabricio; ISMAR Istituto di Scienze Marine, CNR Consiglio Nazionale delle Ricerche, Italy  
Solidoro, Cosimo; Bandelj, Vinko; Istituto Nazionale di Oceanografia e di Geofisica Sperimentale, OGS, Italy

Ecological theory and numerical models assume the existence of relations between species succession and environmental conditions. This aspects have important implications in the studies concerning the possibility of using information on presence-absence of given species as indicators of ecological status. However, the research of experimental evidence in support of these assumptions is elusive. Life cycles and 'internal clocks' might be as important as the environmental conditions in regulating structure and dynamic of plankton community. Here we present analysis from two different datasets from the north Adriatic basin. Our analysis suggests that life cycles and 'internal clocks' might be as important as the environmental conditions in regulating structure and dynamic of plankton community. While environmental conditions can explain variability of total abundances, the importance of time (life cycle) grows larger and larger when moving to groups or species level. As a consequence robust patterns in biological structure (seasonality) do persist in spite of large variations in environmental conditions, whereas environmental conditions by themselves hardly explain large fractions of the variability observed in plankton communities.

### **Session 2.3 Ecosystem Functioning and Biodiversity Science in the Deep sea**

Chairs: Inge Jonckheere; Françoise Gaill; Eva Ramirez-Llodra; Michail Yakimov; Christian Stenseth; Lisandro Benedetti-Cecchi

#### **THE ESF EURODEEP PROGRAMME- ECOSYSTEM FUNCTIONING AND BIODIVERSITY IN THE DEEP SEA**

Jonckheere, Inge, LESC, European Science Foundation (ESF), France

The deep sea as the largest environment on the planet, is the least well known and one of the least studied. It contains extremely large, continuous habitats such as the millions of km<sup>2</sup> of abyssal plains and the 65,000 km long mid-oceanic ridge system. At the same time, it encloses relatively small localised geological features such as canyons, seamounts, deep-water coral reefs, hydrothermal vents and fluid seepages on mud volcanoes, pockmarks, which support unique microbial and faunal communities. What little we know about deep-sea ecosystems supports the hypothesis that more species occur in the deep sea than anywhere else on Earth. As much as 90% of species collected in a typical abyssal sediment sample are new to science. EuroDEEP is a European Collaborative Research Programme (EUROCORES) in deep sea biodiversity science that brings together more than 25 research groups from 10 countries. After the Call for Proposals, four multidisciplinary collaborative research projects have been launched in the EuroDEEP programme framework in June 2007. EuroDEEP aims at the exploration and identification of the different deep-sea habitats, assessing both the abiotic and biotic processes that sustain and maintain deep-sea communities in order to interpret variations of biodiversity within and between deep-sea habitats and the interactions of the biota with the ecosystems in which they live. The resulting scientific data are a prerequisite for the sustainable use and the development of management and conservation options aiming at the sustainable use of marine resources that will benefit society as a whole. The EuroDEEP programme fosters pan-European collaborative research, networking and training as well as dissemination of scientific results and activities developed in the frame of the programme.

#### **NEW INSIGHTS ON RIMICARIS EXOCULATA BACTERIAL ECTOSYMBIOSIS: A MOULT CYCLE RELATED PERSPECTIVE**

Corbari, Laure; Compère, Philippe; University of Liège Lab. morphologie fonctionnelle et évolutive - Morphologie Ultrastructurale, University of Liège, Belgium

Cambron-Bonavita, Marie-Anne, 2Laboratoire de Microbiologie et Biotechnologie des Extrêmophiles, Ifremer, France

Long, Gary J., Department of Chemistry, Missouri University of Science and Technology, USA

Grandjean, Fernande, Department of Physics, University of Liège, Belgium

Zbinden, Magail; Gaill, Françoise; UMR CNRS 7138 Systématique, Adaptation et Evolution, University Pierre et Marie Curie, France

The *Rimicaris exoculata* shrimp is considered as the primary consumer dominating the fauna of Mid-Atlantic Ridge (MAR) hydrothermal vent ecosystems. In their gill chambers, these shrimps harbour an important ectosymbiotic community of chemoautotrophic bacteria associated with iron oxide deposits. The periodic bacterial re-colonisation of the gill chamber and the deposition of mineral have been related to the stages of the moult cycle and to the external colour exhibited by the shrimps, providing at least a relative time scale for the development of the bacterial symbiotic community. Bacteria and mineral were characterised in shrimps of different moult stages from two vent fields, Rainbow (36° 14.0' N) and TAG (26° 08.0' N), by use of light microscopy, electron microscopy (SEM, TEM, STEM), X-ray microanalysis (EDX) and Mössbauer spectroscopy. This multidisciplinary approach has revealed the rapid development of the bacterial community in 5 successive steps that end at formation of a thick mineral crust of heavy iron oxide concretions that consist in nanoparticles of two-line ferrihydrite intermixed with minor ligands (Silica, Ca, Mg-phosphate). Observations of the bacteria-mineral interactions suggest the biogenic origin of the iron oxide deposits.

#### EXPLORING PATTERNS OF BIODIVERSITY, FUNCTION AND EXTERNAL FORCING IN A GULF OF MAINE LANDSCAPE

Ellis, Sara; Incze, Lewis; Wolff, Nicholas; Gulf of Maine Area Census of Marine Life, University of Southern Maine, USA

Auster, Peter, University of Connecticut, USA

Lawton, Peter, St. Andrews Biological Station, Canada

We are using a landscape ecology approach and high-resolution multi-beam mapping to partition the environment of Stellwagen Bank (southwestern Gulf of Maine) and its immediate surroundings into habitat types determined by depth and bottom substrate characteristics. Additional characteristics (such as light and bottom stress) are used as modifiers, rather than subdividing the habitats into finer classifications. All space is divided into 30 x 30 m "cells" that represent opportunities for observation, experimentation and replication, though the vast majority remains unsampled. We are populating the landscape/cells with data from photographic, benthic grab, trawl, water column, model and satellite databases. A model of ocean circulation is used to determine seasonally averaged regions of input and output to and from the system (e.g., nutrients, particulate material and planktonic organisms) over various periods of time (days to months). Seasonally migrating biomass (fish, mammals, birds) provides inputs to the system that are subsidized elsewhere; likewise some of the local seasonal growth moves off the bank. Our objective is an assessment of ecosystem services provided by the bank (locally and exported), and the local and external drivers of those services. Even in a comparatively well-studied system, data and information density is low, which greatly constrains calculations. EAM (Ecosystem Approaches to Management) must consider multiple, nested levels of detail that allow for study and management across multiple size scales. We are using Stellwagen Bank as a mid-sized (2,200 km<sup>2</sup>) pilot study of biodiversity, function and larger ecosystem linkages to evaluate model performance and future information needs.

#### THE STRUCTURAL AND FUNCTIONAL BIODIVERSITY OF THE MEIOFAUNA IN RELATION TO GEOCHEMICAL CONDITIONS ON THE DARWIN MUD VOLCANO IN THE GULF OF CADIZ

Pape, Ellen; Bezerra; Vanreusel, Ann; Tania Nara; Marine Biology Section, Ghent University, Belgium

Heeschen, Katja, Geochemistry research Group, National Oceanography Centre, UK

Moodley, Leon, Ecosystem Studies, Centre for estuarine and marine ecology (NIOO-KNAW), Netherlands

As all cold seeps, mud volcanoes (MV) are characterized by strong gradients and a high variability in biogeochemical conditions in the sediment on a relatively small scale. The Darwin mud volcano in the Gulf of Cadiz (1100 m) was sampled for meiofauna and pore water geochemistry (nutrients, sulphide, methane amongst others) along a gradient from the centre of an active area on the rim of the crater towards the slope. The combined analysis of meiofaunal community structure and geochemistry on the same cores allows unraveling fine scale variation in the micro- and macrohabitats and its associated fauna. More specifically, we were able to get a better understanding of changes in meiofaunal community structure (1) from the MV centre towards the edge in relation to increasing cover of hemipelagic sediment on top of mud breccia and (2) from the sediment surface to the deeper sediment layers in relation to vertical geochemical sediment profiles. Besides community analysis, we investigated whether the meiofauna relies upon thiotrophically, methanotrophically or photosynthetically derived food sources by applying fatty acid analysis and compound-specific stable isotope analysis.

#### ARE DEEP SEA COMMUNITIES CONTROLLED BY SURFACE WATER PRODUCTIVITY: A TALE OF TWO SEAS?

Jeffreys, Rachel; Lavaleye, Marc; Duineveld, Gerard; Marine Ecology, NIOZ, Netherlands

Phytoplankton blooms provide the sole source of energy viz. particulate fluxes to the majority of deep sea communities. These communities are reliant on biogenic fluxes for growth, reproduction and recruitment. Productivity exerts controls on biodiversity and ecosystem function, with peaks in biodiversity occurring at intermediate water depths (~3000m). Environmental forcing has led to long term changes in community composition at the Porcupine Abyssal Plain and Pacific. In this study we aim to assess the role of productivity in biodiversity and ecosystem functioning in an abyssal (3000m) and continental slope (1200m) setting at two contrasting sites: the oligotrophic W. Mediterranean and the more eutrophic Galicia Bank. The approach will involve: (1) the use of stable isotopes and biomarkers to assess the quality and origin of the food source (2) biomarkers with both bulk and compound specific isotope analysis in order to assess the response of the fauna to the food source. We hypothesise that: (1) biodiversity will peak at abyssal sites and at Galicia Bank (2) productivity exerts greater control on ecosystem function at Galicia Bank. Preliminary results are presented.

#### **Session 2.4. Broad Scale Patterns And Sources Of Variation In Biodiversity-Ecosystem Functioning Relationships**

Chairs: Magda Vincx; Katja Philippart; Tasman Crowe; Steve Hawkins; Lisandro Benedetti-Cecchi

##### **THE IMPACT OF SEABED DISTURBANCE ON THE DIVERSITY OF MEIOFAUNA COMMUNITIES ? LINKING FIELD AND LABORATORY OBSERVATIONS.**

Schratzberger Michaela, Lowestoft Laboratory, Centre for Environment, Fisheries and Aquaculture Science, United Kingdom.

Lampadariou Nikolaos, Institute of Oceanography, Hellenic Centre for Marine Research, Iraklion, Greece.

Somerfield Paul, Plymouth Marine Laboratory, Plymouth, United Kingdom.

Vandepitte Leen, Flanders Marine Institute, Oostende, Belgium.

Vanden Berghe Edward, Rutgers University, Institute of Marine and Coastal, New Brunswick, USA.

Broad Scale Patterns And Sources Of Variation In Biodiversity-Ecosystem Functioning Relationships.

##### **CHANGES IN BENTHIC DIVERSITY AND ECOSYSTEM FUNCTION IN RESPONSE TO ORGANIC ENRICHMENT FROM FISH FARMING.**

Papageorgiou Nafsika, Kalantzi Ioanna; Apostolaki Eugenia; Sevastou Katerina; Karakassis Ioannis, Biology Department, University of Crete, Crete.

The benthic enrichment gradient was studied in four Mediterranean areas affected by fish farms. In every area the macrofauna species composition, abundance and biomass was determined at 6 sampling stations and a series of diversity metrics were calculated. For better understanding of the environmental change, in addition to the biotic indices, a number of geochemical variables (redox potential, labile and refractory organic matter, MD, sulfide concentration, Phosphorus concentration etc) and ecosystem processes (oxygen consumption, mineralization of nitrogen) were measured for every gradient. The nonparametric rank correlation analysis between all possible pairs of diversity, geochemical and ecosystem function variables in the data set showed a large number of significant positive or negative correlations. Furthermore, in order to study the combined effect of changes in sediment geochemistry and biodiversity metrics we used multiple stepwise regression using ecosystem function descriptors (O<sub>2</sub> consumption, N mineralization) as dependent variables. This analysis resulted in multiple regression models explaining a large proportion (60-90%) of the variability of the data. Our results indicate that ecosystem function changes considerably in response to both geochemical variables and biodiversity metrics.

##### **NEMATODE SIZE AND SHAPE FROM THE SHELF TO THE DEEP SEA: ADAPTATIONS TO BENTHIC ECOSYSTEM FUNCTIONING.**

Vanaverbeke Jan; Franco Maria; Steyaert Maaïke, Marine Biology Section, Ghent University, Belgium.

Lampadariou Nikolaos, Hellenic Centre for Marine Research, Heraklion, Greece.

Muthumbi Agnes, Department of Zoology, University of Nairobi, Nairobi, Kenya.

Vandepitte Leen; Vanden Berghe Edward, VLIZ, Oostende, Belgium,

Soetaert Karlina, NIOO-CEME, Yerseke, The Netherlands.

We investigated changes in nematode biomass, length and width from the shelf to the deep sea. While previous research indicated that food input and sediment grain size were important factors to explain nematode individual biomass, our results (based on more shelf data than ever before) indicate that sediment grain size is not. Food input is indeed an important factor, since it is at the basis of all biogeochemical processes. Mineralisation causes vertical oxygen gradients leading to adaptations in nematode width and length to optimize nematode survival in oxygen stressed sediments. In sediments where mineralisation is fast, shorter nematodes are dominant. Being short allows for a combination of maintained mobility and a faster reproduction needed to sustain the nematode populations in food poor habitats. A further decrease in length is always coupled with an increase in width irrespective of geographical area or depth. The increase in width allows for the storage of reserve substances and decreases the risk of being preyed upon. Therefore, nematode size and shape are influenced by ecosystem functioning rather than physical constraints and food input as such.

#### MARINE BIOFILM BACTERIA DEVELOPING ON TEST PANELS DYED BY SOME ANTIFOULING PAINTS IN THE MARINA OF IZMIR BAY, TURKEY.

Kacar Asli; Cihangir Bulent, Microbiology, Marine Sciences and Technology, Turkey.  
Kocuyigit Ali; Ozdemir Guven, Microbiology, Science Faculty, Izmir, Turkey.

Marine biofouling is a natural process which imposes important economical losses on many man-related activities such as marine transport. In this study, we have examined isolation of bacteria from the initial stage of biofilm that formed on coated with four different marine paints (triazine diamine, fluorine, zinc-oxide, copper-oxide) and one rustproof paint test panels that had been exposed to natural seawater in the marina of the Izmir Bay. The first results of the study were shown that there was bacterial growth on all test panels and was significant differences between panels when the viable counts compared. Twenty-six strains were isolated and 15 selected bacterial strains were identified. Phylogenetic analysis using 16S rDNA sequences indicated that the 15 strains belonged to 5 different genus (*Alteromonas*, *Pseudoalteromonas*, *Vibrio*, *Klebsiella*, *Exiguobacterium*)

#### ANTHROPOGENIC DISTURBANCE OF DEEP-SEA MEGABENTHIC ASSEMBLAGES: A STUDY WITH REMOTELY-OPERATED VEHICLES IN THE FAROE-SHETLAND CHANNEL, NE ATLANTIC.

Jones Daniel, Ocean Biogeochemistry and Ecosystems, National Oceanography Centre, Southampton, UK.

The effects of local-scale anthropogenic disturbance from seabed drilling on epibenthic megafaunal abundance, diversity and assemblage pattern were examined in three Faroe-Shetland Channel hydrocarbon fields at 420 m (Schiehallion), 508 m (Foinaven) and 600 m (Laggan) water depth with a range of disturbance regimes and faunal assemblages associated with water temperature. Remotely Operated Vehicle video allowed high-resolution assessment of assemblage patterns and disturbance extent. Disturbance was high within 50 m of the drill site where spoil was clearly visible on the seabed, with depressed abundances (individuals ha<sup>-1</sup>: Foinaven 1900; Schiehallion 2178; Laggan 244) and diversity ( $H' = 1.75$  Foinaven; 1.12 Schiehallion; 1.68 Laggan) from smothering effects. These effects extended to around 100 m from the drill site, although this varied with current regime and nature of drilling activity. Further from the drill site megafaunal assemblages were similar to background with increased diversity ( $H' = 2.02$  Foinaven; 1.77 Schiehallion; 1.98 Laggan) and abundance (individuals ha<sup>-1</sup>: Foinaven 16484; Schiehallion 5477; Laggan 9982). Responses of megafaunal assemblages were complex, controlled by differing effects to individual species often based on their motility.

#### THE RELATIONSHIP BETWEEN BIODIVERSITY AND FUNCTIONING OF SOFT SEDIMENT ECOSYSTEMS WITH VARIABLE REGIMES OF DISTURBANCE.

Aspden Rebecca, School of Biology, University St Andrews, Scotland.  
Paterson David, University St Andrews, Scotland.  
Rossi Francesca, Netherlands Institute of Ecology, Centre for Estuarine and Marine Ecology, Department of Ecosystems Studies, Netherlands.

The data presented here is an output of BIOFUSE, a MarBEF Theme 2 RMP. The composition (and biodiversity) of infaunal assemblages were manipulated within 2 soft sediment systems (Scotland and the Netherlands). Variable mesh sizes were buried within the sediment to produce infaunal assemblages of different diversity and structure within the test areas. These systems were monitored in order to observe how ecosystem properties changed as a function of these altered assemblages in response to varying levels of environmental stress, in this case organic enrichment. The level of enrichment or mesh size had no effect on the properties of the sediments, highlighting the resilience of these systems to disturbance and changes in diversity. This experiment is currently on going and further analysis is yet to be done. This data will be included in the final poster presentation.

## EFFECT OF BIODIVERSITY ON THE STABILITY OF MARINE COMMUNITIES - EVIDENCE FROM META-ANALYSIS OF EXPERIMENTAL STUDIES.

Bulleri Fabio; Cusson Mathieu; Benedetti-Cecchi Lisandro, Dipartimento di Biologia, Università di Pisa, Italy.  
Kotta Jonne, Estonian Marine Institute, Tallinn, Estonia.

Crowe Tasman Peter, Department of Zoology, University College Dublin, Dublin, Ireland.

Understanding the role of biodiversity on the stability of ecosystems is key for the conservation of marine systems. One of the major objectives of BIOFUSE, a Responsive Mode Project of MARBEF ([www.marbef.org/projects/biofuse](http://www.marbef.org/projects/biofuse)), was that of assessing the consequences of biodiversity loss and disturbance on marine communities. This issue was tackled by means of a meta-analytical approach. Datasets were collated from studies involving the manipulation of diversity at various trophic levels (canopy algae, grazers or predators) or disturbance and carried out in various natural habitats (rocky intertidal and subtidal; sedimentary bottoms), in mesocosms and laboratory. Comparison of different responses variables (e.g. diversity indices; biomass; respiration; production) among regions/habitats were done using response log response ratio ( $\text{Irr} = \ln(X_e/X_c)$ ) between experimental plots ( $X_e$ : stressed habitats or manipulated communities) and controls ( $X_c$ : non stressed habitats or untouched communities). Results of this study, along with those of manipulative experiments undertaken by BIOFUSE members in different systems and regions across Europe, allow us to draw general conclusions on the role of diversity on the functioning of marine ecosystems.

## EXPERIMENTAL EVALUATION OF THE ROLE OF SEAGRASSES IN THE RESISTANCE AND RESILIENCE OF SEDIMENT FUNCTIONING TO ORGANIC MATTER LOADING.

Terrados Jorge, Ecology and Marine Resources, IMEDEA (CSIC-UIB) Instituto avanzado de estudios avanzados, Spain.

Asmus Raghild, Alfred Wegener Institute for Polar and Marine Research, Sylt, Germany.

Kotta Jonne, Marine Biology, Estonian Marine Institute, University of Tartu, Tallinn, Estonia.

Seagrasses are key species in the maintenance of the diversity of shallow coastal sediment communities and their participation in the flow of carbon and nutrients of the communities is highly significant. The loss of seagrasses may have major effects on the stability and functioning of shallow coastal ecosystems. Integrated research was performed in three different localities across Europe to evaluate the role of seagrasses in the resistance and resilience of sediment functioning to disturbance. The addition of organic matter (as a source of disturbance) and/or the deletion of the seagrass were haphazardly applied to replicated 2500 cm<sup>2</sup> seagrass plots following a factorial experimental design and the net flux of oxygen across the sediment/water interphase under natural light conditions (as a measure of sediment functioning) was measured in each plot at 4/5-week intervals during summer, the period of maximum vegetative development of European seagrasses. Our results show that the response of sediment functioning to disturbance was not affected by the presence of the seagrass. However, in the Wadden Sea site, disturbance caused seagrass loss and dramatic changes in oxygen flux rates.

## NOVEL IN-SITU TECHNIQUES FOR LINKING BIOLOGICAL ACTIVITY TO SEDIMENT FUNCTION.

Teal Lorna, Oceanlab, University of Aberdeen, Scotland.

Parker Ruth, CEFAS, Lowestoft, England.

Fones Gary, SEES, University of Plymouth, Plymouth England.

Solan Martin, Oceanlab, University of Aberdeen, Newburgh, Scotland.

In order to link biological activity to ecosystem processes in the sediment, simultaneous in-situ measurements of both biology and sediment chemistry conditions are required. A novel in-situ technique has been developed for measuring sediment redox conditions alongside biological activity (bioturbation) by combining DGT gels and time-lapse sediment profile imaging (t-SPI). The SPI including the gels (g-SPI) was deployed at two sites within the North Sea (Oyster ground and Dogger Bank) that support different biological communities. The profile images show higher biological activity at the Oyster ground than the Dogger Bank. The DGT profiles further suggest that background diagenetic processes are more highly affected by biological activity at the Oyster ground than the Dogger. The method was validated by taking gels from cores retrieved at the same sites, the common method used for DGT. Ongoing work is combining the g-SPI technique with tracking sediment particles in order to link in-situ sediment reworking rates to observed redox conditions. The link between biology and chemistry provides a key step towards determining the function of macrofauna in relation to reaction rates within the sediment.

## RECRUITMENT OF BENTHIC COMMUNITIES ON ARTIFICIAL PANELS LOCATED OVER VEGETATED SUBSTRATES (POSIDONIA OCEANICA MEADOWS) AND SANDY BOTTOMS.

Cabanellas-Reboredo Miguel; Deudero Salud, Biology, University of Balearic Islands, Spain.  
Hendriks Iris Eline, Litoral Ecology, IMEDEA (CSIC-UIB), Spain.

Settlement and subsequent recruitment of littoral fouling communities were studied through the use of artificial panels deployed over *Posidonia oceanica* (L.) Delile meadows and sandy bottoms in a Marine Protected Area (MPA) of Palma Bay (Balearic Islands, eastern Mediterranean). The fouling community was measured both quantitatively and qualitatively every two weeks and three months for one year (February 2007 to February 2008). Community composition was significantly different between bottom and top surface of the settlement panels. The temporal difference and the succession of the community recruited, generated large differences between artificial panels sampled every two weeks and three months. Additionally, we found differences in the fouling community between artificial panels located over *P. oceanica* and sandy bottoms. Recruitment peaks determined by favourable conditions could be observed of certain species. Our study not only provides information about settlement and recruitment processes and the larval pool over *P. oceanica* meadows. Moreover, this study is a contribution to the Marine Propagation Along the Coast of Europe (MarPace) Pan-European project providing information with the European complementary studies to clarify the impact of the global change.

### **Session 3.1 Assessing the consequences of large-scale biodiversity change**

Chairs: Boris Worm; Heike K. Lotze

#### **ASSESSING THE CONSEQUENCES OF DIVERSITY CHANGES IN FISH COMMUNITIES: AN EXPERIMENTAL APPROACH**

Sieben, Katrin; Eriksson, Britas Klemens; Department of Marine Benthic Ecology and Evolution, University of Groningen, Netherlands

In the last decades fish communities have undergone large scale changes in abundance, diversity and community structure. This has resulted in changed trophic relations - food web structure - in many marine ecosystems, which have altered the strength of top-down control. Fishes are relatively flexible in their trophic position in food webs ranging from herbivores to top-predators and often shift in their diet between different trophic levels during their life history. Thus, predictions about consequences of changes in trophic relations due to changes in fish communities require a detailed understanding of their functional role in the food web. Therefore, we set up a field experiment in the Baltic Sea to investigate how top-down control on invertebrate communities depends on fish community structure, including mono- and in mixed cultures of omnivorous and carnivorous fish feeding on different trophic levels. We suggest that effects of fish community structure and diversity on adjacent trophic levels depend strongly on the fish identity - and that the functional role of each fish species in the food web determines the strength of top down control.

#### **STATISTICAL MODEL FOR THE PREDICTION OF FISHERY-INDUCED CHANGES IN BIODIVERSITY OF SARDINIAN DEMERSAL ASSEMBLAGES**

Locci, Ivan; Follesa, Maria Cristina; Pesci, Paola; Sabatini, Andrea; Cau, Angelo; Department of Animal Biology and Ecology, University of Cagliari, Italy

Marine biodiversity is considered as a key factor for ecosystem functioning. While it is well proved that the commercial fishing affects overall biomass, size and species structure of demersal fish communities, few studies considered effects of fishery on species diversity. In the present contribution a Shannon's entropy ( $H'$ ) temporal trend were simulated using a multiple linear regression, in order to investigate about the relationships between fishing effort and species diversity. We considered demersal assemblages, related to red shrimp, in specific locations of Sardinian seas (Central-Western Mediterranean), which have recently undergoes increase in fishing pressure. Data come from annual MEDITS trawl surveys carried out from 1994 to 2004, concomitant to a progressive Sardinian fleet renewal.  $H'$  was considered as response variable, while biodiversity components and different fishing effort expressions were incorporated and tested as potential explanatory variables. The best model ( $R^2 = 28.58\%$ ; F-test p-value = 0.0017) incorporate species richness and fishing effort expressed as number of boats per trawling area. Chi-square test display a significant relationship between  $H'$  observed and predicted data, highlighting a high dependence of biodiversity on fishing effort.

BIOGEOGRAPHICAL DISTRIBUTION PATTERNS OF POLYCHAETE SPECIES FROM THE CONTINENTAL SHELF (0-200 M) IN THE NORTH EASTERN ATLANTIC OCEAN, FROM THE SOUTH OF SPAIN (GIBRALTAR STRAIT) TO THE NORTH OF NORWAY (36 -70° N)

Quiroz Martinez, Benjamín; Schmitt, François G.; Dauvin, Jean-Claude; Dewarumez, Jean-Marie; Laboratoire d'Océanologie et de Géosciences, Station Marine de Wimereux, Université de Lille 1, France  
Salas-de-León, David-Alberto, Unidad Académica de Geología Marina y Ambiental, Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México, Mexico

Polychaetes colonize a large range of soft and hard marine sediment habitats from intertidal to the hadal zones, and are considered to be good surrogates to identify the main environmental conditions that control the structure and functioning of benthic communities. On the other hand, an important focus for biodiversity studies has been to test the existence of latitudinal or bathymetric gradients in the gamma diversity of soft-sediment biota, including polychaetes. Our aim is to characterise the biodiversity and biogeographical distribution patterns of polychaete species from the continental shelf (0-200 m) in the North Eastern Atlantic Ocean, from the south of Spain (Gibraltar Strait) to the North of Norway (36 -70° N). The patterns are examined in relation to both main stresses, i.e. hydrodynamics and hydro-climatic gradients. Analysis methods come from statistical physics (i.e. entropic analysis, multivariate extremes and multifractal analysis). These approaches try to draw the diversity pattern of this marine invertebrate group on a large biogeographical scale to identify the main factors structuring these patterns, and to identify transitional zones between the distinguished faunal species contingents of the north-eastern coastal north-eastern coastal Atlantic.

HOW TO MODEL LARGE-SCALE HABITAT CHANGES USING EELGRASS (*ZOSTERA MARINA*) MEADOWS AS A CASE STUDY

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Erikstad, Lars, Department of Landscape Ecology, Norwegian Institute for Nature Research, Norway  
Bakkestuen, Vegar, Museum Auditorium of Natural History, University of Oslo, Norway  
Isæus, Martin, AquaBiota Water Research, AquaBiota Water Research, Sweden

Knowledge on how habitats are expected to change with changing climate conditions is scarce. Spatial probability models contribute to an increased understanding of the factors and processes that structure the distribution of marine habitats, and such models may answer some of the questions related to a changing future. We will here present results and ongoing work on modelling of eelgrass, *Zostera marina*, distribution on the West coast of Norway. *Z. marina* meadows are highly productive, have several associated faunal groups and are regarded as being of great ecological importance. Consequently, changes in *Z. marina* distribution will have an effect on the productivity of coastal areas, locations of spawning grounds etc. Our study integrates field measured and modelled geophysical variables a GIS. Using a Generalised Additive Model (GAM) and the model selection approach Akaike information criterion (AIC), we have developed a spatial predictive probability model for *Z. marina*. By changing the environmental conditions used in the model according to forecast models of climate change, we will be able to analyse how *Z. marina* distribution is expected to change in the future.

**Session 3.2. What lived in the oceans? Shifting baselines in time and space**

Chairs: Bo Poulsen; Loren McClenachan; Andrew A. Rosenberg; Matthew McKenzie

LONG-TERM CHANGES IN THE DIET OF STRIPED DOLPHINS FROM THE WESTERN MEDITERRANEAN: A ROLE FOR ANTHROPOGENIC FACTORS?

C. Blanco; B. Ruiz; B. de Regil; F.J. Aznar; A. Raduán; M. Fernández; J.A.Raga, University of Valencia, Spain

We analyzed stomach contents of 86 striped dolphins, *Stenella coeruleoalba* stranded during the period 1990-2005 along the coasts of the Valencian Community, Western Mediterranean, Spain, to investigate temporal changes in the trophic ecology of this species. No temporal trends were observed in prey diversity, dietary niche breadth, and the number of prey found per dolphin. However, prey composition changed significantly over time. In particular, the number of mesopelagic teuthoid cephalopods decreased and the number of demersal fish and



cephalopods increased, particularly since year 2000. Also, different groups of demersal fish and cephalopods were significantly associated among dolphins, suggesting that dolphins had consumed a diverse array of demersal taxa. The increase of demersal prey in the diet of an otherwise oceanic species is puzzling. We advance the hypothesis that striped dolphins, being rather opportunistic feeders, might have been switched diet because of interactions with fisheries. Dolphins might feed during fishing activities and/or might take advantage of by-catch material. Our study highlights the importance to long-term studies to fully understand strategies, and human impact, on the trophic ecology of cetaceans.

#### HISTORICAL CHANGES IN MACROALGAL DIVERSITY IN THE GULF OF NAPLES: FROM 1878 TO 2007.

Soria, Alessio; Maria Cristina Buia. Stazione Zoologica Anton Dohrn, Punta San Pietro Ischia, Italy

The conservation of marine biodiversity is a highlighted goal on a growing number of national and international policy agendas. Unfortunately, efforts to assess progress, as well as to strategically plan and prioritize new marine conservation measures, have been hampered by the progressive lack of knowledge and expertise on taxonomic diversity. An attempt to measure temporal changes in macroalgal diversity has been performed along the Neapolitan coasts (South Italy), where a new marine protected area will be established. A check-list of the seaweeds for the Gulf of Naples from 1878 up to now, based on literature and recent records, is presented. After nomenclature and taxonomic updating, 561 species (including 378 Rhodophyta, 110 Ochrophyta and 73 Chlorophyta) have been inventoried. Since 1964, 126 species (ca. 22%) represent new records for the Gulf; on the opposite, 132 taxa (ca. 24%) have disappeared or have not been found recently. The analysis of biogeographic elements points out a decreasing trend of cold affinity species in contrast to an increasing of cosmopolitan species.

#### **Session 4.1. Biodiversity and bioprospecting: Ecological roles of marine natural products and biotechnological applications**

Chairs: Adrianna Ianora; Angelo Fontana

#### TERPENE BIOSYNTHESIS AND NOVEL FURANOSESQUITERPENES FROM THE MARINE NUDIBRANCH DORIOPSILLA PELSENEERI

Cutignano, Adele, CNR, Institute of Biomolecular Chemist, Italy  
Gaspar, Helena; Ferreira, Teodora; INETI, Est. do Paço do Lumiar, Portugal  
Fontana, Angelo, ICB-CNR, Italy  
Calado, Gonçalo, Centro de Modelação Ecológica-IMAR, FCT/UNL, Portugal

Nudibranchs are a group of shell-less opisthobranch molluscs, worldwide distributed marine organisms, which are recognized as a rich source of secondary metabolites with interesting ecological and biological properties. Most of these chemicals are accumulated from dietary sources or obtained by biotransformation of dietary metabolites but in few cases they are biosynthesized de novo. *Doriopsilla pelseeneeri* d' Oliveria 1985 (family Dendrodoridae) is an endemic porostome nudibranch occurring in Iberian coastal waters (Atlantic and Mediterranean). The secondary metabolism of *D. pelseeneeri* is characterized by cyclic sesquiterpenes exhibiting three different carbon scaffolds related to sponge metabolites: monocyclofarnesyl-, drimane- and ent-pallescensin A-like skeletons.<sup>2</sup> In the taxonomically related species *Doriopsilla areolata*, previous biosynthetic studies have proved the de novo origin of ent-pallescensin (1) and drimane (2) skeletons by mevalonate pathway.<sup>3-4</sup> Here we report the first biosynthetic study in *D. pelseeneeri*. The ability of this mollusc to produce through the mevalonate pathway the furanosesquiterpenes 1 and 2 was proved by feeding experiments with [1-<sup>13</sup>C]-glucose. These experiments together with the occurrence of pelseeneeriols (3-4) and their novel acetyl derivatives, named 3-acetyl-pelseeneeriol-1 (5) and 3-acetyl-pelseeneeriol-2 (6), bring further details on the biogenetic pathway operating in these marine invertebrates.

# Poster B

## Session 1.2 Recent discoveries in Marine Biodiversity

Chairs: Graham Shimmield; Bhavani Narayanaswamy.

### PHYSIOLOGICAL AND BIOCHEMICAL FOUNDATION OF BIODIVERSITY IN MARINE ANIMALS.

Shulman Georgiy, Animal Physiology and Biochemistry, Institute of Biology of the Southern Seas, Ukraine.

Our investigations in Sea of Azov, Black Sea, Mediterranean, tropic zones of Atlantic and Indian Oceans showed significance of alternative functional and metabolic strategies in biodiversity of marine animals. First strategy bases on large locomotion activity and high level of energy metabolism, developed oxygen transport system, big energy stores used as energy substrates (mainly neutral lipids by free fatty acids), and high content of omega 3 fatty acids in cell and tissue membranes. Second strategy bases on narrow specialization: low locomotion activity and intensity of metabolism with its large efficiency, adaptation to low oxygen concentration in water, high level of anaerobic utilization of energy of glycogen by glucose. There is intermediate strategy too based on moderate locomotion activity with utilization of protein substrates by free amino acids. All these forms of biodiversity manifest in phylogenetic (between species and more large taxons), term (life history, interannual and annual cycles, diurnal rythms) and space aspects. Physiological and biochemical processes just so provide wide heterogeneity of living forms in marine environment.

### ECOLOGICAL AND BIOLOGICAL ASSESSMENT OF *HIPPOCAMPUS INGENS* "PACIFIC SEAHORSE" IN THE NORTHERN PERUVIAN SEA.

Quiñe Marina, Biodiversity, Instituto del Mar del Perú, Peru.

The first ecological and biological assessment of *Hippocampus ingens*, "Pacific Seahorse" in coastal Peruvian waters was carried out during 2005 – 2007. The study took place in the Northern shore off Peru, between 3° 30' and 6° 30' LS. 198 stations were sampled in a total of 6 field assessment. Sampling methods were adapted from the project seahorse protocols. *H. ingens* was found from 4 to 25 m depth and from 19.3 to 27 °C SST. Spatial distribution was patchy with mean population densities between 0.003 and 0.018 ind.m<sup>-2</sup>. Individuals were mainly related to sand bottoms and associated to environments dominated by the macroalgae *Caulerpa flagelliformis* and in less proportion to tube worms *Diopatra* spp. Additionally, microcrustaceans (amphipods) associated to these habitats appeared to be an important feeding source. Community analysis showed that areas dominated by *C. flagelliformis* and other macroalgae communities had higher species richness. Finally, the highest biodiversity was registered between 8 and 14 m. By other hand, the information collected by surveys among fishers' communities, indicate clearly a decreasing of population densities and non official landings among another information collected.

### MEIOBENTHOS ALONG AN DEPTHS OXIC - ANOXIC INTERFACE ALONG A CROSS-SECTIONAL TRANSECT FROM AN ACTIVE GAS SEEPAGE AREA (THE BLACK SEA).

Sergeeva Nelly; Anikeeva Oksana; Mazlumyan Sofiya, Department of Ecology of Benthos, Institute of Biology of the Southern Seas, Ukraine.

The Black Sea is remarkable for deep waters (below 150-200 m) don't mix with upper waters. Those deep waters have no oxygen and contain hydrogen sulfide in toxic concentrations. Meiobenthic fauna at the studied depths oxic-anoxic interface is numerous, specific and diverse (15 high-level taxons were identified). Meiobenthos was marked at all investigated depths, its number peak accounts for depths range 150 - 160 m (fig. 5). The key taxons defining the density of meiobenthic communities at all the depths are the nematods. Foraminifera, Hydrozoa and Tardigrada, together with nematods, make significant number at depths 140 - 160 m. Gromida, Foraminifera and benthic Ciliophora were found among Protozoa. We first found ciliate in the Black Sea at depths deeper than 100 m. Different forms were presented, including moving and attached forms, totally more than 30 species (morphospecies). Foraminifera presented by considerable number of species Allogromiida and only one

calcareous species *Ammonia tepida*. Maximal abundance of foraminifera was registered at depths 150- 160 m. We found about 30 species of the soft-shelled monothalamous foraminifers on the depths 120–240 m.

#### CURRENT STATE AND MAIN CHALLENGES OF TAXONOMIC RESEARCH IN SWEDEN. BRYOZOA – A CASE STUDY.

Fuchs Judith; Sundber Per, Zoology, University of Gothenburg, Sweden.

Obst Matthias, The Sven Lovén Center for Marine Sciences, University of Gothenburg, Fiskebäckskil, Sweden.

As the first country in the world, Sweden has set the goal to give a complete species record of multicellular organisms of the country within 20 years. The organization standing behind this aim “The Swedish Taxonomy Initiative” ([www.artdata.slu.se](http://www.artdata.slu.se)) grounds on three main pillars: inventories, taxonomic research, and presentation of the results for every plant and animal phylum in the Encyclopedia of the Swedish Flora and Fauna, respectively. Five years after the start of the project many large inventories have successfully been established, collecting biological material all over the country. As part of the marine team, we started investigating the mostly unknown Swedish Bryozoa in 2006, and only in the first year of the investigation we found 80 bryozoan species of which 15% are new records for Sweden. By basic biodiversity investigations like these we will in the future be able to address cutting-edge questions concerning climatic change, pollution, and commercial fishing (such as trawling).

#### DEFINING MARINE MEIOFAUNAL GENETIC DIVERSITY AT FINE GEOGRAPHIC SCALES USING 454 METAGENETICS.

Fonseca Vera; Carvalho Gary; Creer Simon, School of Biological Sciences, Environment Centre Wales, Bangor University, UK.

Lamshead John, 2Natural History Museum Auditorium, Bangor, UK.

Lunt Dave, University of Hull, Hull, UK.

Thomas Kelly, Hubbard Center for Genome Studies, University of New Hampshire, Durham, USA.

Power Deborah, CCMAR, University of Algarve, Faro, Portugal.

Benthic meiofauna are a ubiquitous, abundant guild that play a crucial role in ecosystem functioning. Comprised of between 50-90% nematodes, meiofaunal assemblages contribute to nutrient cycling, water column processes, secondary production and stability of sediments. Despite their abundance and ecological importance, a current estimate of global nematode diversity remains speculative. This knowledge gap results from the small size and morphological conservativeness of nematodes that can cause significant problems in species identification. Recently, there has been a noticeable progress on species identification using molecular DNA “barcodes” and molecular appraisals of accepted marine nematode morphospecies are now uncovering previously unrecognised cryptic species. Presently, we performed comprehensive, replicated meiofaunal sampling of two UK sandy sediment locations (Exe and Prestwick) that have been previously extensively studied using morphological taxonomy. Following mass decantation, individual/whole community DNA extraction and 18S PCR, combinations of chain termination and massively parallel 454 sequencing were used to estimate levels of molecular operational taxonomic unit (MOTU) diversity. The diversity estimates are compared with those from morphological appraisals to evaluate the efficacy of metagenetic approaches in assessing meiofaunal diversity.

#### RECONSIDERING ZOANTHID (ANTHOZOA: HEXACORALLIA) BIODIVERSITY USING TRADITIONAL AND MOLECULAR TECHNIQUES.

Sinniger Frederic; Fujii Takuma; Reimer James Davis, Department of Chemistry, Biology and Marine Science, University of the Ryukyus, Japan.

The order Zoantharia is a poorly known group of hexacorallian anthozoans. Zoanthids are found in every benthic marine environment. In the past, analyses of morphological or histological characters were the only methods to describe and identify zoanthid species. Although many species have been described there has been no standardisation of characters used. This lack of standard methods and the difficulties to morphologically identify zoanthids has led to confused taxonomy and to the quasi-abandon of research on zoanthids. Recent molecular studies have clarified some phylogenetic and taxonomical relationships. In light of results obtained with molecular markers, we reconsider different identification methods. While morphological and histological analyses have overestimated zoanthid biodiversity due to synonymous species, molecular techniques have allowed the discovery of many new species both cryptic and from previously unexplored environments. For example, zoanthids were recently discovered at depths over 5300 m in the Japan Trench. Here we discuss the estimated biodiversity and taxonomy of zoanthids in order improve access to zoanthids by non-specialists. Accessible identification techniques will spur more interest and clearer understanding of this long-neglected order.

## MACROBENTHIC DIVERSITY IN DEEP HARD BOTTOM ASSEMBLAGES ALONG THE SOUTHERN TYRRHENIAN COAST OF CALABRIA (ITALY).

Angiolillo Michela; Salvati Eva; Giusti Michela; Cardianli Andrea; Fabroni Fabrizio; Greco Silvestro; Canese Simonepietro, Habitat and Biodiversity Protection, Central Institute of Marine Research (ICRAM), Italy.

A remotely operated vehicle (ROV), equipped with a digital camera, was used to describe qualitatively and quantitatively the depth distribution (50 - 146m) of major macro-benthic taxa that could be confidently identified from photo analysis. During summer 2007 eleven sites were surveyed and 330 pictures were collected along the depth gradient. Two laser pointers, were used as metric scale in order to compare equal areas (2400 cm<sup>2</sup>). The random point count of major taxa was used for quantitative analysis by means of Coral Point Count (CPCe) software. We have observed a high biodiversity and the presence of rare and uncommon species. Taxa composition varies with depth and location also in sites very close to each other. A boundary was detected at the depth of 75m. The assemblages varied roughly, the erect species dominated above 75m, while under this depth the encrusting species were prevalent. These data provide a baseline on the study of this bathymetric range that is understudied and poorly understood.

## BARCODING MARINE LIFE: THE CASE OF NORTHWEST ATLANTIC CRUSTACEANS.

Radulovici Adriana; Dufresne France, Biology, Université du Québec à Rimouski, Canada.  
Sinté-Marie Bernard, Invertebrate Biology and Conservation, Fisheries and Oceans, Mont-Joli, Canada.

Marine crustaceans represent a highly diverse subphylum with an important role in marine ecosystems. Since morphological identification is not always straightforward, especially for larval stages, a DNA-based approach could provide a reliable diagnosis system. The goal of this project is to build a database of DNA barcodes (cytochrome oxidase 1 sequences) for marine crustaceans from the northwest Atlantic. More than 1000 nominal species are known from Davis Strait to Cape Hatteras and 152 of them have already been barcoded in this project. A total of 797 sequences from 98 genera, 57 families, 8 orders and 2 classes have been obtained. The results show a high level of intraspecific divergence (up to 15% in amphipods), indicating the existence of potential cryptic species. Barcodes revealed also some cases of misidentification, which is not surprising because crustaceans are known as a taxonomically difficult group. The results confirm the usefulness of DNA barcoding in crustaceans. In particular, this approach could be appropriate for exploring population structure and larval abundance of crustacean species of effective or potential commercial importance along the Atlantic coast of Canada.

## Session 1.4 Discoveries From Integrated Data Systems

Chairs: Ward Appeltans; Mark J. Costello; Edward Vanden Berghe

## ODINAFRICA: MARINE BIODIVERSITY DATA (MOLLUSCS, DECAPODS AND PORIFERA).

Wambiji Nina, Fisheries, Kenya Marine & Fisheries Research Institute, Kenya.  
Silvi Edith Nsiangango, Instituto Nacional de Investigação Pesqueira, Ministério das Pêças, Luanda, Angola.  
Azza Mint, Institut Mauritanien de Recherches Océanographiques et de Pêches (IMROP), Nouadhibou, Mauritanie.  
Zamouri Nedra, INSTM, Tunis, TUNISIA.  
Mussai Prakash, Mauritius Oceanography Institute, France centre, Quatre Bornes, MAURITIUS.  
Vanden Berghe Edward, Flanders Marine Institute, Oostende, Belgium, Leen Vandepitte.

The ODINAFRICA (Ocean Data and Information Network for Africa) project under its work package III realized the importance of management of marine biodiversity. The primary objective was providing database of named species of taxons in the Indo-Pacific region, with summary data on their distribution and ecology. A secondary objective was combining Indo-Pacific data with existing databases for Western Atlantic and European marine

species form a global database. Already 6,460 records on Mollusca were entered into the aphid database with a "Masdea"-context, representing 4,772 species. Gastropoda had (3,505 species) and 1,105 species of Bivalvia. Only 224 records are considered invalid taxon names. For 3,955 species, the authority is known. Presently, 3 877 taxa from Order Decapoda have 2,948 species and subspecies worldwide. 2 752 species and subspecies names are valid. Seychelles had (649), Mauritania (468) and South Africa (458). North Africa and East Africa are heavily undersampled and West Africa is reasonably sampled. Presently, 1 883 taxa from Phylum Porifera have 1 309 known species and subspecies worldwide. Class Demospongiae had 1 255 species, Calcarea -37 and Hexactinellida (17). 570 species were considered to be invalid or synonyms. 1307 taxa were recorded from East Africa region, 538 West Africa and 318 from South Africa. This database is part of the Ocean Biogeographic Information System (OBIS).

## **Session 1.5 Open Ocean Pelagic And Benthopelagic Diversity: Patterns And Monitoring**

Chairs: Odd Aksel Bergstad; Ann Bucklin; Tone Falkenhaug; Uwe Piatkowski.

### **THE COMPLETE MITOCHONDRIAL GENOME SEQUENCE OF THE PLANKTONIC CHAETOGNATH *SAGITTA NAGAE***

Hiroomi Miyamoto; Shuhei Nishida, Tokyo University, Ocean Research Institute, Japan.

Chaetognaths, commonly called arrow worms, are small marine animals and constitute a single phylum of about 120 species. Recently two complete mitochondrial genome (mtDNA) sequences of two benthic chaetognaths (*Paraspadella gotoi* and *Spadella cephaloptera*) were determined, and they were highly different from those of general metazoans. However, complete mtDNA sequences of planktonic species that comprise most of this group have not been examined. In this study, We determined the complete mtDNA sequence of a planktonic species, *Sagitta nagae*. The *S. nagae* mtDNA (11,468 bp) is one of the smallest circular genome. It encodes 14 genes (11 protein coding genes, 1 tRNA gene, and 2 rRNA genes), and loses 23 genes that are usually present in metazoan mtDNA. This gene set encoded in *S. nagae* mtDNA is the same as in the two benthic chaetognaths. In addition, there were considerable gene rearrangements between *S. nagae* and the two benthic species among a set of 7 genes, while no such rearrangement were observed in the other 7 genes. This is also the case between the benthic species, hence appears to be a common feature in the chaetognath.

### **BIODIVERSITY OF MESOZOOPLANKTON IN THE SULU SEA AND ITS ADJACENT WATERS WITH SPECIAL REFERENCE TO COPEPODS.**

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The Sulu Sea (SS) is a semi-enclosed basin located in the western equatorial Pacific, exhibiting a homogeneous and unusually warm (ca. 10 °C) water from the mesopelagic zone to the sea bottom. The relationships between vertical water-column structure and biomass, biodiversity and patterns of vertical distribution of mesozooplankton were examined and compared with those in the adjacent Celebes and South China Seas which show more enormous oceanic conditions. While the warm and homogeneous mesopelagic water in the SS does not drastically influence total standing stocks, vertical distribution patterns and the community structure at the higher taxonomic levels of mesozooplankton, the marked difference was found in the order, family, genus and species composition of copepods. Species richness of copepods was much lower in the mesopelagic layer in the SS, but several possible new species have found, suggesting the effect of the homogeneous and warm water on biodiversity of copepods.

### **PELAGIC SPECIES DIVERSITY IN THE CENTRAL-SOUTHERN MEDITERRANEAN – OVERVIEW FROM LONG-TERM FIELD RESEARCH.**

Vella Adriana, Conservation Biology Research Group, Dept. of Biol. University of Malta, MALTA.

A ten year (1997-2007) time frame from on-going long-term research on cetaceans, turtles, seabirds, manta rays in the central and southern Mediterranean is considered side by side to Bluefin and other fisheries data to look into the environmental and life history factors affecting distribution and abundance of all these diverse pelagic species. Species associations are investigated to understand if there are beneficial, disruptive or neutral effects. Human activities and impacts are also considered. Considerations of the future off shore developments in the region for fuel exploration and wind energy plants, over and above the ever increasing vessel traffic, fishing effort

and climate change demand urgent consideration of such research and monitoring for integrative conservation management.

#### AMPHIPODA HYPERIDEA DISTRIBUTED IN A LARGE REGION OF THE SOUTH-WESTERN ATLANTIC.

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Alvarez Colombo Gustavo, Laboratorio de Hidroacústica, Instituto Nacional de Investigación y Desarrollo Pesquero (INIDEP), Mar del Plata, Argentina.

Zooplankton has a critical role in the flow of energy and matter through marine ecosystems. There is strong interest for a global-scale assessment of the zooplankton biodiversity in relationship with the environment. The hyperiid amphipods are one of the less known taxonomic groups in the south-western Atlantic in spite of their key importance in the pelagic food webs. The aim of this work is to review the knowledge of the diversity of hyperiids in a widely spread area between 36°-50°S and 60°- 44°W, including the Brazil-Malvinas Confluence and the argentinian shelf waters. Bongo and Nackthai samples (800) were collected between 1978 and 1999, mostly in the upper 50 m of the water column, in national and international cruises. Species belonging to the families Scinidae, Vibiliidae, Paraphronimidae, Hyperiidae, Phronimidae, Phrosinidae, Lycaeosidae, Pronoidae, Lycaeidae, Oxycephalidae, Platyscelidae and Parascelidae were found. *Themisto gaudichaudii* (Hyperiidea) was the dominant species (> 90 %) in shelf waters. Species richness and faunistic assemblages were related to the hydrography of the region. INIDEP, Univ. Nac. de Mar del Plata UNMD-15/E 269, CONICET-PIP5009 partially funded this study.

#### COPEPOD *LIMNOCALANUS MACRURUS* VERTICAL FEEDING ECOLOGY IN THE GULF OF RIGA (BALTIC SEA).

Rubene Gunta; Aispure Gunta, Marine Laboratory, Latvian Fish Resources Agency, Latvia.

The calanoid copepod *Limnocalanus macrurus* is known as herbivore at younger developmental stages and omnivore at latest stages. Its predaceous feeding habits start from the fourth copepodite stage. This investigation is addressing the role of algae in the large copepod diet at different depths in the Gulf of Riga (Baltic Sea). Sampling was performed during February 2007 at three offshore stations of the Gulf of Riga. The winter population of monocyclic *Limnocalanus* was composed mainly of the older stages. The diatom *Actinocyclus octonarius* was the food item found at the major part of the *L. macrurus* guts at different depths, but copepod's food contained also diatoms *Thalassiosira baltica* and blue-green algae *Aphanizomenon flos-aquae*, especially close to the bottom. Thus *Limnocalanus* gut contents mostly consisted of the dominant algae species in the environment. Besides algae feeding on detritus occurred at the deepest water layers.

#### GELATINOUS MACROZOOPLANKTON ON THE MID-ATLANTIC RIDGE. DISTRIBUTION PATTERNS OF TRAWL-COLLECTED PLANKTONIC CNIDARIANS.

Falkenhaug Tone, The composition, abundance and vertical distribution of medusae and siphonophores collected along the northern Mid-Atlantic Ridge (MAR) are presented. Planktonic cnidarians were analyzed in catches from three different midwater trawls (mesh size 3 – 50 mm) on a cruise conducted as a part of the Census of Marine Life field project MAR-ECO. Depth stratified sampling from 18 positions from Iceland to the Azores (~60-44°N, 25-35°W) covered the full depth range, revealing information on vertical distributions from 0 to >3000 m. The most important contributors to the cnidarians biomass (WW) north of the Subpolar Front was the scyphomedusan *Periphylla periphylla* and *Atolla* sp. The vertical distributions of *P. periphylla* and *Atolla* were deeper at day than at night. The bulk of the *Atolla* population usually resided deeper in the water column than *P. periphylla*. Other commonly observed species in the samples were: *Colobonema sericeum*, *Halicreas minimum*, *Aeginura grimaldii*, *Chromatonema rubrum* and *Solmissus incisa*. An increase of species richness toward lower latitudes was found and the sub-Polar Front is the major biogeographic boundary in the studied area. The geographical and vertical distributions of species assemblages were associated with the main water masses in the area.

#### DEPTH RANGE, SIZE DISTRIBUTION AND DENSITY OF POPULATIONS OF RED GORGONIAN *PARAMURICEA CLAVATA* (RISSO 1826) AS IMPORTANT FACTORS IN MAINTAINING KORNATI ARCHIPELAGO BIODIVERSITY, EASTERN ADRIATIC.

Zubak Ivana, Biology Department, University of Zagreb, Faculty of Science, Croatia.

Cizmek Hrvoje, Marine explorers society "20000 leagues", Split, Croatia.

Markov Podvinski Martina, Ecological Association "Argonauta", Murter, Croatia.

Red gorgonian, *Paramuricea clavata* (Risso, 1826) is a sciaphilic gorgonian, which lives on vertical and overhanging surfaces forming large colonies with thick, irregularly ramified branches. Gorgonians play an important ecological role, providing habitats for epifauna and increasing the biomass and diversity of the community. The characteristics of red gorgonian populations were studied using SCUBA diving on four locations in Kornati Archipelago. The locations were selected depending on the strength of human impact. Following parameters were studied: depth range, density and size distribution. Depth range was studied by noting the presence of gorgonians at 5 meter intervals. To estimate the abundance, 60 x 60 cm squares were randomly sampled in each depth range where gorgonians were present. The upper limit of red gorgonian populations in the Adriatic is found at a greater depth than of those in the Mediterranean. Due to that fact this is the first study and first data collected about red gorgonians in the Eastern Adriatic. With this study we expect to determine the status of red gorgonian populations in Kornati Archipelago.

#### CHANGES IN COPEPOD ABUNDANCE AND DIVERSITY IN THE GULF OF TRIESTE (ADRIATIC SEA): 1970-2005: A CHANGING ECOSYSTEM.

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Fonda-Umani S, Department of Biology, University of Trieste, Italy.

Mesozooplankton monitoring in the Gulf of Trieste, Adriatic Sea, has been going since 1970, making this one of the longest time series in the whole Mediterranean. The analysis of the zooplankton temporal variability over the 36 year period (1970-2005) indicates a considerable change in the species composition, with the community shifting toward smaller species. This shift is accompanied by changes in the phenology in the majority (65%) of the species, with the timing of the seasonal peaks moving predominantly forward. Through the analysis of the winter SST, two periods are identified, 1970-1987 and 1988-2005, which are characterized by an overall increase in abundance (+ 93%), the arrival of new species (*Diaxis pygmaea*), the affirmation of previously rare species (*Oithona similis* and *Oithona nana*), and the rise (*Oncaea* spp. and *Euterpina acutifrons*) or decline (*Pseudocalanus elongatus*, *Clausocalanus* spp.) of several species. We hypothesize that the changes in the copepod community in the Gulf of Trieste are related to the general warming in the SST (climate envelope hypothesis), and to the changes in the Mediterranean surface circulation that began at the end of the 1980s and affected the whole basin in the following years

#### DIVERSITY OF THE BALTIC CLAM *MACOMA BALTHICA* L. AT LOCAL AND GEOGRAPHICAL SCALES (BARENTS SEA).

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Gantsevich Mikhail, Department of Invertebrate Zoology, Faculty of Biology, Moscow State University, Moscow, Russia.  
Genelt-Yanovsky E; Department of Invertebrate Zoology, Faculty of Biology and Soil Science, St.-Petersburg State University, Universitetskaya emb., St. Petersburg, Russia.  
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Bivalve mollusc *Macoma balthica* is common and often dominant member of littoral soft-bottom communities along the North European coasts. *Macoma* demonstrates considerably high inter- and intra-population variability in size, growth and morphological characters such as shell shape, colour and hinge structure. Spatial variation of some of these parameters was early studied at local and (or) geographical scales. However there is no common opinion about the level of variation and factors causing the variability. The goal of our study was to analyze spatial variation of *M. balthica* growth and morphology at the scale of Kola Bay, the biggest fjord in the Russian sector of the West Barents Sea. Results of our study show that the southern segment of the Kola Bay and open shore localities represents two the most different marine environments. Top of the Bay is a typical estuary while oceanic conditions predominate in open shore localities. Central and northern segments of the bay can be described as transitory area. populations of *M. balthica* are in fact the most different between the top of the Bay and open coast in respect of shell shape and color, hinge plate abnormalities, and longevity. At the same time growth rate is similarly high in two regions, and is depressed in the transitory area. Latitudinal clines in growth rate, longevity, size and shell shape of *M. balthica* were early revealed in Europe. The result of our investigation shows that variation of all listed parameters in the Kola Bay is comparable to that in the whole Europe.

#### Session 1.6 Biodiversity, Biogeography, And Vulnerability Of Deep-Water Seamount And Chemosynthetic Ecosystems.

Chairs: Tim Shank; Paul A. Tyler

#### BIOGEOGRAPHY OF DEEP-SEA HYDROTHERMAL VENTS: CHARACTERIZATION OF NEW PROVINCES AND INFLUENCE OF SAMPLING EFFORT

Bachraty Charleyne; Legendre Pierre, Sciences Biologiques, Université de Montréal, Canada.  
Desbruyères Daniel, Étude des écosystèmes profonds, Ifremer, Brest, France.

Hydrothermal vents harbour discontinuous and unstable habitats along volcanic ridges, arcs and back-arc basins. They are found where tectonic plates are moving apart, in areas subjected to frequent volcanic and tectonic activity. Vent organisms depend on geochemical energy resulting from these processes. As a result, about 82% of the species are endemic. Until now, biogeographic studies of hydrothermal vents of the World Ocean were only based on visual examination of faunal composition. We applied advanced statistical methods to a recent compilation of all hydrothermal species found in vent fields. A geographically-constrained multivariate regression tree divided the fields into 6 provinces, which differed from previous proposals. Coefficients of dispersal direction identified five significant community fluxes between provinces, originating in the Northern East-Pacific Rise (NEPR) towards the other provinces, suggesting this province as a centre of dispersal. The influence of sampling effort on species diversity estimations was studied by species accumulation curve analysis for each province. The highlighted dispersal flux pathways all belong to the ridges system apart from the NEPR-Atlantic flux. Our hypothesis is a dispersal from NEPR to Atlantic via the cold-seep as stepping-stones.

#### A GLOBAL CENSUS OF MARINE LIFE ON SEAMOUNTS: ARE THEY REALLY OASES IN THE OCEAN?

Consalvey Mireille, Deeper Fisheries, National Institute of Water and Atmospheric Research (NIWA), New Zealand.

Seamounts have been referred to as oases in the ocean, yet our knowledge is such that this notion can neither be refuted nor accepted. Seamounts can support high levels of biodiversity and endemism, can play an important role in patterns of marine biogeography, and can be highly productive ecosystems acting as feeding grounds. However, our current state of knowledge is such that these observations cannot be taken as generalisations. Of the estimated global total of 100 000 seamounts, less than 200 have been studied in sufficient biological detail. Recognising that it is not feasible to sample all of the world's seamounts, future sampling efforts must be standardised and strategically guided, through assessing the current state of knowledge, to fill critical knowledge gaps and target understudied regions and types of seamounts. Under the umbrella of the Census of Marine Life project CenSeam this poster will synthesise the current state of seamount knowledge and research, and evaluate the global sampling effort stimulating discussion about the future of seamount research and associated methodology and data analysis.

#### DISTRIBUTION AND ABUNDANCE OF A SULPHOPHILIC, HYDROTHERMAL VENT FLATFISH.

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Tunncliffe Verena; Dower John, Biology and School of Earth and Ocean Sciences, University of Victoria, Victoria, Canada.

Dense aggregations of flatfish in the genus *Symphurus* (new species) occur near hydrothermal vents on seven seamounts in the Western Pacific. Known populations inhabit relatively shallow and sulphur rich seamounts on the Mariana Volcanic Arc, the Tonga Arc and the Kermadec Arc. On a smaller scale, *Symphurus* n.sp has an apparent affinity for substrata rich in elemental sulphur. They occur in the direct vicinity of point source venting and extend to the periphery of venting influences. On video transects executed by remotely operated vehicles (ROVs) on Daikoku Seamount (Mariana), mean flatfish abundances were 100 and 66 individuals m<sup>-2</sup> in 2005 and 2006 respectively. The food sources that sustain such high abundances of flatfish vary between seamounts. Most populations feed on benthic invertebrates such as polychaetes. On Nikko Seamount (Mariana), *Symphurus* n.sp flatfish feed on the shrimp, *Opaepele loihi*, which is only known to co-exist with *Symphurus* n.sp on this one seamount. The availability of this food item may account for significantly larger flatfish found on Nikko Seamount in comparison with other known *Symphurus* n.sp populations.

#### Session 1.7 Biodiversity Of Deep Continental Margins: Local To Global Patterns And Processes

Chair: Myriam Sibuet.



## THE CONCEPCION METHANE SEEP AREA (CHILE ~36°S): A HOTSPOT OF FAUNAL DIVERSITY ENHANCED BY SUBSTRATE HETEROGENEITY.

Sellanes Javier, Departamento de Biología Marina, Universidad Católica del Norte, Chile.

Quiroga Eduardo, Centro de Investigación en Ecosistemas de la Patagonia (CIEP), Coyhaique, Chile.

Carlos Neira, Scripps Institution of Oceanography, La Jolla, California, USA.

We compare the fauna of the newly discovered Concepción Methane Seep Area (CMSA) with that of a nearby non-seep site, both in terms of community composition and trophic support. Eight chemosymbiotic bivalves, one species of a siboglinid polychaete (*Lamellibrachia* sp.) and two commensal species of the vesicomid *Calypotgena gallardoi* are the seep endemics. The CMSA also harbours abundant non-seep benthic megafauna, making a total of ca. 100 taxa, compared to only 25 species observed at the control site. However, most of the heterotrophic taxa at the seep site are colonists or vagrants (i.e., non methane seep endemics). Isotopic analysis indicates that non-symbiont bearing species utilize photosynthetically fixed carbon as a food source, as they were isotopically distinct from the chemosymbiotic bivalve species present. We hypothesize that in this site, underlying one of the most productive coastal upwelling regions of the world, spatial heterogeneity and hard substrate availability, created by the presence of authigenic carbonate crusts, are more important factors in generating this biodiversity hotspot of non-seep fauna, than the availability of locally-produced chemosynthetic food.

## TRENDS IN NEMATODE SPECIES DIVERSITY AND FEEDING TYPES ACROSS THE WESTERN INDIAN MARGIN.

Ingole Baban, Singh Ravail, biological oceanography, national institute of oceanography, India.

Diversity and distributional of deep-sea nematofauna of the western Indian margin was investigated in August 2007. Eight box corers were collected along the 140 latitude in the Arabian Sea in the depth range of 34-2600m. The abundance of nematodes ranged from 3-244 ind per 10 cm<sup>2</sup>. Of the 69 identified genera, 06 were numerically dominant constituting 75% of the assemblage. Among the various feeding types, deposit and epistrate feeders were predominant while predators and omnivores were less abundant. The dominance of non-selective feeder at the surface layer suggests accessibility of profuse food material. Vertically, the dominance of carnivores-omnivores was apparent within the sediment column, indicating relative importance of organic matter that enters in deeper sediment layers. Species diversity was relatively higher at deeper waters. It is believed that fluxes of organic matter to the bottom in the Arabian Sea, allow for a higher complexity of the nematode communities.

## MEIOFAUNA IN THE BENTHIC BOUNDARY LAYER OF THE DEEP (2347 M) NW MEDITERRANEAN?

Guidi-Guilvard Laurence, Laboratoire d'Océanographie de Villefranche (LOV), CNRS, France.

Thistle David, Department of Oceanography, Florida State University, Tallahassee, USA.

Khripounoff Alexis, EEP/LEP, IFREMER, Brest, France.

Gasparini Stéphane, Laboratoire d'Océanographie de Villefranche (LOV), Université Pierre & Marie Curie, Villefranche sur mer, France.

Meiofauna was collected continuously for two years as "swimmers" in near-bottom sediment traps deployed at the DYFAMED-BENTHOS station (43° 24.61' N – 7° 51.67' E). The flux varied between 26 and 361 individuals m<sup>-2</sup> d<sup>-1</sup>. Copepods (including nauplii) dominated (87% of the organisms collected). Other organisms included annelids (7.8%), nematodes and bivalves (1.8% each), ostracods, isopods, and amphipods (1.2% altogether). Of the 3930 copepods (excluding nauplii) examined, 4% were calanoids, 15% were harpacticoids, and 81% were cyclopoids. Among the benthic copepods, 25 species or groups of species were distinguished. A species of the cyclopinid genus *Barathricola* represented 90% of the cyclopoids, and a species of the tisbid genus *Tisbe* represented 57% of the harpacticoids. Benthic organism fluxes exhibited strong seasonal and interannual variations. When bottom flow speed increased, the flux of organisms with poor swimming abilities (e.g., nematodes) increased, but that of those with good swimming abilities (e.g., copepods) decreased dramatically.

## MAREANO, A NATIONAL MAPPING PROGRAMME DOCUMENTING BOTTOM TOPOGRAPHY, THE ENVIRONMENT AND BOTTOM FAUNA ON THE CONTINENTAL SHELF AND SLOPE OF NORTHERN NORWAY.

Buhl-Mortensen Lene, Research group Benthic Habitat and Shellfish, Institute of Marine Research, Norway.

Description of relationships between the physical environment, species diversity and biological resources is one of the goals for the MAREANO program (Marine Area Database for Norwegian Coasts and Sea Areas). The

Institute of marine Research, Geological Survey of Norway and Norwegian Hydrographic Service collaborate to map the benthic environment and fauna on the continental shelf and slope off Norway. At the end of first phase of the program in 2010, major parts of the Barents Sea will be mapped. The goal is to obtain information relevant for the management of human activities such as petroleum extraction and fisheries. The area mapped in 2006 and 2007 (20 000 km<sup>2</sup>) covers: banks, troughs, ridges, canyons, large sand waves, cold seeps and coral reef areas at depths ranging from 40 – 2000m. Fauna and bottom substratum has been documented with a suite of sampling gears (video, multicorer, grab, boxcorer, beam-trawl, and epibenthic-sled). The mapping of the various seascapes is challenging and poses several questions: What are the relevant methods for documentation of environment and fauna on all bottom-types? How are representative sampling and observation sites selected in a varied seascape? We provide some answers to these questions based on our experience from the MAREANO mapping program. We also present results on the relation between habitat heterogeneity at different scales and the distribution of benthic communities, biodiversity and biomass.

#### DEEP SEA SPECIES DISTRIBUTION IN THE SEA OF MARMARA ON BEAM-TRAWL SURVEY.

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Unsal Nuran, Istanbul University Faculty of Fisheries, Marine Biology, Istanbul, Turkey.  
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The deep water of the Sea of Marmara is unexploited. There is no such study on deep water species distribution and diversity. In this study we analyzed the demersal deep water species in the Sea of Marmara for different depth strata and seasons are presented. Samples were collected on 10 beam-trawl and one bottom trawl surveys from Sea of Marmara during the autumn 2007; spring 2008. Sampling took place of depths from 200 to 800 m. Three depth zones were defined, 200 - 400 m, 400 - 600 m, 600 - 800 m. Species abundance in number and weight were recorded. List of species caught per depth stratum. The finding of some species is the first record for the Sea of Marmara. This study is a preliminary work for describing the deep water demersal species composition of the Sea of Marmara. Further researches will continue on this aim.

#### **Session 1.8 Marine Biogeography And Comparative Phylogeography: Joining Paleontologists, Taxonomists, Ecologists And Geneticists**

Chairs: Anne Chenuil; Filipe Alberto

#### HYPOTHESIS ON DISPERSAL MODE OF *CERASTODERMA GLAUCUM* (BIVALVIA) PROVED BY MITOCHONDRIAL DNA AND MICROSATELLITE STUDIES.

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Chenuil Anne; Feral Jean-Pierre, Laboratoire DIMAR, Centre d'Océanologie de Marseille, Université de la Méditerranée, Marseille, France.  
Wolowicz Maciej, Laboratory of Estuarine Ecology, Institute of Oceanography, University of Gdańsk, Gdynia, Poland.  
Green Andy, Department of Wetland Ecology, Estación Biológica de Doñana-CSIC, Sevilla, Spain.

*Cerastoderma glaucum* originates from the Mediterranean Sea and presently has a wide area of distribution. As this species is a lagoon specialist, populations are often isolated from one another. Although *C. glaucum* reproduces via planktonic larval stage, which is a natural means of colonising new habitats, the larvae remain in the water column for only one week before metamorphosis. Therefore, an alternative hypothesis of past dispersal of this species is proposed, which is long distance dispersal via migrating birds. In order to verify this hypothesis the genetic structure of 17 populations was studied using mitochondrial DNA (COI) and 4 microsatellite loci. The results coming from mtDNA sequences strongly support the idea of an important role of birds in past dispersal of this species, as some pairs of geographically distant populations are composed of similar haplotypes while some pairs of geographically close populations are genetically much more differentiated. The connectivity patterns seem to be consistent with bird migration routes. Some connectivity between distant regions has also been revealed by microsatellites.

#### PHYLOGEOGRAPHIC RELATIONSHIPS IN THE MAUVE STINGER *PELAGIA NOCTILUCA* INFERRED FROM MTCOI GENE SEQUENCES.

Ramšak Andreja, Marine Biology Station, Nacional Institute of Biology, Slovenia.

Stopar Katja; Malej Alenka; Ramšak Andreja, Marine Biology Station, National Institute of Biology, Piran, Slovenia.

Doyle Thomas K., Coastal & Marine Resources Centre, University College Cork, Cork, Ireland.

Recent reports of large swarms of the holoplanktonic scyphozoan *Pelagia noctiluca* in different parts of the Mediterranean Sea and the Atlantic Ocean stimulated renewed attention about connectivity and phylogeography of this species. Several genetic approaches may be applied to determine separation at the scale of population and we have used the COI gene sequences. *P. noctiluca* samples were collected from 10 distinct localities in the Mediterranean and Atlantic during massive swarming. Analyses were based on alignment of 655bp COI sequences and 98 variable sites were found, among them were 53 parsimony informative sites. Samples from the northern Adriatic and from the north-western part of Mediterranean (Villefrance) were genetically impoverished (nucleotide diversity  $\pi$ ;=0.0070 - 0.0085) compared to samples from the southern Adriatic/central Mediterranean (Malta) ( $\pi$ ;= 0.0231 - 0.0123) and samples from the Eastern Atlantic Ocean ( $\pi$ ;= 0.0119 - 0.0106). Calculated uncorrected average pairwise distances between samples were similar among samples, the lowest being between samples from NW Mediterranean and samples from Atlantic Ocean. Phylogenetic relationships between haplotypes revealed a distinct haplotype more common in samples from the southern Adriatic. However, the distribution of haplotypes was not strictly correlated with established biogeographic regions.

#### THE KNOWLEDGE OF SEA SLUGS' DIVERSITY IN PORTUGAL: AN OASIS AMONG MARINE INVERTEBRATES.

Calado Gonçalo, DCEA/FCT, IMAR, Portugal.

As in many other countries, the Portuguese tradition in alpha-taxonomy decreased drastically in the last decades, with few efforts to produce outputs that revert the situation, such as check-lists or complete faunas. Exceptions are found in the vertebrates where these outputs result from international obligations (conventions, directives, etc.) signed by successive governments. In the marine realm, apart from the vertebrates and some invertebrates that have a strong economic impact, few comprehensive studies were recently undertaken. One of the exceptions to this status quo is the Sea Slugs' Fauna (Mollusca: Opisthobranchia). Here I review the reasons for this Oasis, such as the inclusion of Portuguese scientists in the Spanish "Fauna Iberica" programme and point out some guidelines to be followed for other taxonomic groups. This is certainly an example to be followed.

#### BIOGEOGRAPHICAL BARRIERS AND GLACIAL REFUGIA IN THE RED SEAWEED GRACILARIA GRACILIS.

Destombe Christophe; Valero Myriam; Tellier Florence; Engel Carolyn, UMR7144 CNRS-UPMC, Station Biologique de Roscoff, France.

Guillemin Marie Laure, Instituto de Ecologia y Evolucion, Universidad Austral de Chile, Valdivia, Chile.

The north-western Brittany corresponds to a biogeographic transition zone between temperate and cold-temperate/boreal marine assemblages. Sharp genetic break have been shown in seaweeds and marine invertebrates along the North coast of France between Atlantic and English Channel populations. The aim of this study was to determine the impact of this putative biogeographical barrier on gene flow and to investigate phylogeography in the red seaweed *Gracilaria gracilis* in order to identify putative glacial refugia. The high genetic differentiation observed in *G. gracilis* strongly supports the hypothesis of the occurrence of genetic barrier in the Iroise Sea. This barrier could promote local adaptation and speciation as suggested by the observation of two local chromosomic races in the English Channel. Moreover, phylogeographic and population genetics approaches suggest that the Western-English Channel and the Northern Bay of Biscay was one of the glacial refugia during the Last Glacial Maximum. Moreover, the low genetic diversity observed in the north and in the south European coasts suggests an extremely rapid re-colonization probably due to the rapid opening-up of new habitat following postglacial sea level rise.

#### RELATIONSHIPS BETWEEN CLONAL DIVERSITY AND ECOSYSTEM STRUCTURE AND FUNCTION: A FIRST APPROACH IN THE MEDITERRANEAN POSIDONIA OCEANICA SEAGRASS SYSTEM.

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Vasapollo Claudio; Dattolo Emanuela;

Ferrara Adriana; Gambi Maria Cristina; Buia Maria Cristina; Procaccini Gabriele, Stazione Zoologica Anton Dohrn, Napoli, Italy.

In seagrass systems, higher genotypic diversity of a single structural plant species (*Zostera marina*) has been recently related to enhancement of the associated community. In *Posidonia oceanica*, forming one of the most productive and complex ecosystems in the Mediterranean Sea, no studies have explicitly linked clonal diversity with structure and richness of associated communities and other system functions. In the present work, we

investigated spatial variability and relationships among *P. oceanica* clonal diversity (microsatellites), associated animal community (mobile macro-invertebrates), and meadow's structural and functional features, such as shoot density, plant morphology and production. Samples were collected in two meadows (Ischia Island, Gulf of Naples, Italy), submitted to a different degree of human impact, following a nested, hierarchical spatial design: three sites (~150-180 m apart) per meadow, two stations (~20-25 m apart) per site, 3 randomly selected 40 x 40 cm plots (~3 m apart) per station. Our results will represent the first attempt of relating spatial genotypic diversity, and different ecosystem features in *Posidonia oceanica*, and will allow assessing and comparing scale of variability of the different descriptors utilized.

#### HIGH GENETIC DIVERSITY AT A LOCAL SCALE IN DWARF EELGRASS, *ZOSTERA NOLTII*.

Fernandez Maria Victoria, Laboratori d'Ictiologia Genètica, Universitat de Girona, Spain.

Seagrasses are considered key species in coastal ecosystems, but the increase of anthropogenic impacts in the marine environments has recently caused a severe decline in its populations. These phanerogams usually show low levels of outcrossing and gene flow, which may lead to isolated and eventually impoverished populations, with less resilience to future changes in environmental conditions. The genetic population structure of eight dwarf eelgrass (*Zostera noltii*) meadows of North Wales was examined, using six polymorphic microsatellite loci. There was high allelic variation and significant population genetic differentiation between meadows ( $F_{ST} = 0.318$ ). Even though distance was not the cause for isolation, southern Anglesey populations grouped separately from northern Anglesey populations. Local tidal currents were a possible explanation for this situation. Leaf length and sediment structure were variable parameters at every station, but this variability was not correlated with genetic richness ( $r^2 = 0.352$ ,  $p = 0.121$ ) but was related the phenotypic plasticity of *Z. noltii*. Further research is necessary to develop appropriate management plans.

#### DIFFERENT POPULATION STRUCTURE PATTERNS FOR REEF FISHES AROUND CUBA.

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Didier Casane, Laboratoire Evolution, Génomes et Séciation, CNRS Gif Sur Yvette, Paris, France.

José Antonio Sánchez Prado, Laboratorio de Genética Agrícola, Instituto Universitario de Biotecnología de Asturias, Oviedo, España.

The influence of the geographic traits of Cuban archipelago on the genetic population structure of reef fishes inhabiting it was analyzed. Three different species with distinct life histories and broadly distributed within the Caribbean were selected: *Stegastes partitus*, *Acanthurus bahianus* and *Haemulon flavolineatum*. The study comprises the analysis of a mtDNA noncoding region (NCR) fragment on 20 individuals of each species from six locations distributed by the southwest and northern regions of Cuba. Microsatellite loci were also examined on 50 individuals of *S. partitus* from these locations and from Bocas del Toro, Panamá. It was found that the population structure of fishes with different life histories is not heterogeneous. A significant subdivision is found among *S. partitus* populations from the West and East regions of the main island, revealed from microsatellite loci and NCR haplotypes ( $F_{STRNC} = 0.06869$ ;  $F_{STMICROSAT} = 0.0719$ ). The NCR haplotypes analysis on species with larger pelagic larval stages and greater dispersal capabilities, pointed to a lack of population subdivision at this scale.

#### THE IMPORTANCE OF RAFTING ON MACROALGAE FOR DISPERSAL AND GENE FLOW OF NORTH ATLANTIC INVERTEBRATES.

Clarkin Emmett, Maggs Christine; Johnson Mark; Allock Louise, School of Biological Sciences, Queens University, Northern Ireland.

A paradigm of biogeography is that the degree of isolation between populations is inversely correlated with dispersal ability. Among marine invertebrates there are puzzling mismatches between genetic structure and dispersal ability. Rafting of intertidal invertebrate species on detached macroalgae and other buoyant materials may be one possible explanation for this discrepancy. Such dispersal processes may be enhanced by climate change: higher sea temperatures, increased storminess and changes in wind direction could result in more fucoid material entering the drift. This investigation focuses on the importance of rafting on macroalgae for dispersal and gene flow of North Atlantic populations of invertebrates, particularly on species with directly developing larvae. Macroalgal and macrolitter raft invertebrate populations off Irish coasts will be characterized and inventoried. Species richness and (later) haplotype diversity will be examined on shores ranked by the frequency with which

they receive drift material to determine whether recipient shores can be identified by particular biodiversity signatures.

#### LOOKING FOR GENES UNDER SELECTION IN FUCUS SERRATUS, A WIDESPREAD INTERTIDAL BROWN ALGAL.

Coyer James; Hoarau, Galice; Stam Wytze; Olsen Joanne, Marine Benthic Ecology & Evolution, University of Groningen, The Netherlands.

Natural selection influences expressed loci, as well as the untranslated flanking regions. Polymorphic microsatellites in the untranslated regions can be linked via genetic hitchhiking to the expressed gene and thereby provide a means to examine adaptation. We used a suite of 11 anonymously and 22 EST-derived microsatellite loci to investigate adaptation in populations of the intertidal marine seaweed, *Fucus serratus* along salinity and spatial gradients. Three scales were examined: hundreds of km in the Skagerrak-Kattegat-Baltic region (7-22 psu); 10 km in two Norwegian fjords (2-33 psu); and 10 m on a Brittany shore (35 psu). Two neutrality tests were used to identify outlier loci as candidate loci under selection. Preliminary results identified several outlier loci, but few were outliers in both tests or consistent from area to area. Identity of the ESTs was elusive. We will review some of the problems encountered in using non-model organisms.

#### MUNIDOPSIS (DECAPODA: ANOMURA: GALATHEIDAE): BIODIVERSITY & BIOGEOGRAPHY.

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Tsuchida Shinji, Japan Agency for Marine Earth science & Technology, Tokyo, Japan.  
Watanabe Seiichi, University of Marine Science & Technology, Japan.

7 new species of Munidopsis (Decapoda: Anomura: Galatheididae) identified from different hydrothermal vents such as Myojin knoll, Hatoma Knoll, Mariana Back arc, Eifuku Seamount and Brothers Seamount in Pacific Ocean and Kairei field in Indian Ocean was described. The study demonstrate a high diversity of Munidopsis in SW Pacific and Indian Ocean vents and the number of Munidopsis species associated to hydrothermal vents in the world oceans increase to 16. To elucidate the phylogenetic relationships of Munidopsis from different vent fields, genetic analysis by partial sequencing of mitochondrial gene COI and 16S and nuclear gene spacer ITS-1 were attempted. Internal relationships among the species of Munidopsis which could not be solved with both 16S and COI genes could be solved with ITS-1, making it as an appropriate marker at species level, suggesting that it is informative for species identification and phylogenetic analysis. Phylogenetic relationships of all the species analyzed with ITS-1 were clearly resolved. The results of the present study suggest the existence of closely related species in the genus Munidopsis, confirming the utility of molecular data in the identification of species. The small genetic distance observed among different species could suggest a recent and /or rapid diversification. The findings suggest that Munidopsis populations are tightly interconnected between distant and discrete locations. Additional sampling of Munidopsis populations on localized habitats such as woods, vents, seeps and whale falls are required to fully understand the complex phylogenetic relationships and diversity of this group.

#### THE BIOLOGICAL GEOGRAPHY OF THE EUROPEAN SEAS: RESULTS FROM THE MACROFAUNAL INVENTORY OF THE SOFT-SUBSTRATE COMMUNITIES.

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Somerfield Paul J., Plymouth Marine Laboratories, Plymouth, UK.  
Rumohr Heye, Leibniz Institute for Baltic Sea Research, Warnemünde (IOW), Biological Oceanography, Rostock, Germany.

This work has been accomplished in the context of the MarBEF (Marine Biodiversity and Ecosystem Functioning) EU Network of Excellence. The hypothesis tested is whether the zoogeographical regions defined across European seas exist or not. Three criteria were proposed in order to test the performance of the above taxa through the application of a variety of uni- and multivariate methods: (i) interpretability, which refers to the biogeographic patterns produced by each group for each system; (ii) differentiation, which provides a measure of the uniqueness of the pattern; (iii) randomness, which defines the inventories of the various sectors as random samples of the total inventory of each of the systems considered. Results show that only polychaetes meet all three criteria and, accordingly, the only valid marine biogeographic system is the one proposed by Longhurst. Average island distance from the nearest coast, number of islands and the island surface area were the geographic variables best correlated with the pattern produced by polychaetes.

## FRAYED AT THE EDGES: SELECTIVE PRESSURE AND ADAPTIVE RESPONSE IS MISMATCHED IN LOW DIVERSITY EDGE POPULATIONS

Pearson, Gareth; Lago-Leston, Asuncion; Mota, Catarina. CCMAR. Universidade do Algarve. Faro. Portugal

Theory predicts that population structure and dynamics affect the capacity for adaptation to environmental change. In particular, loss of diversity due to random genetic drift in small, fragmented populations at the trailing edge of species distributions may reduce adaptive potential and fitness levels for complex traits. This has important consequences for understanding population responses to, e.g., changing climate, but has rarely been tested in natural populations. For southern edge (N. Portugal) and central (SW U.K.) populations of the intertidal seaweed *Fucus serratus*, we compared thermal environments and vertical range on the shore. Common-garden experiments were conducted to compare physiological and gene expression responses to heat stress. Similar thermal environments prevailed at southern and central locations, but were achieved by a compensatory reduction in vertical shore height in the south. Contrary to expectations under local adaptation, southern individuals were less heat shock tolerant than central ones, and had higher levels of heat shock gene expression at common temperatures (consistent with greater cellular stress). Our results suggest that reduced fitness and adaptive potential make edge populations particularly susceptible to ongoing climate forcing.

## **Session 2.1 Coastal Marine Benthic Biodiversity And Ecosystem Process Under Uncertain Environmental Futures**

Chairs: Martin Solan; Dave Paterson; Dave Raffaelli; Piran Whit

### BENTHIC AMPHIPOD DIVERSITY IN THE AEGEAN SEA, AFFINITIES WITH OTHER MEDITERRANEAN REGIONS AND THE BLACK SEA.

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Katağan Tuncer; Kocataş Ahmet; Bakır Kerem, Hydrobiology Department, Ege University Fisheries Faculty, İzmir, Turkey.

During benthic surveys in the eastern Aegean Sea, 171 sublittoral species were found; three among these comprise new records for the amphipod fauna of the eastern Mediterranean, 14 are reported for the first time from the Aegean Sea and 46 are new for the fauna of the eastern Aegean Sea. A checklist of amphipods known from the Aegean Sea up to present is given (253 species), along with their distribution in certain Mediterranean areas. The original information, combined with that from the relevant literature, allowed analysis of the amphipod fauna of several Mediterranean areas and Black Sea. According to the considered data, the number of species decreases from west to east. Species with an Atlanto-Mediterranean distribution dominate in all areas and are followed in numbers by the Mediterranean endemics or cosmopolitan species, depending on the areas.

### EFFECTS OF POLLUTION ON INTRASPECIFIC GENETIC BIODIVERSITY OF BIOINDICATOR FLATFISH.

Tysklind Niklas; Taylor Martin I, Mc Carthy Ian, School of Biological Sciences, Bangor University.  
Lyons Brett P, Weymouth CEFAS Laboratory, CEFAS, Weymouth, United Kingdom.

Flatfish, such as dab (*Limanda limanda*) and European flounder (*Platichthys flesus*) have long been used as sentinel bioindicators of pollutants. Their benthic lifestyle (close proximity to settled pollutants), widespread nature, and potential long-term ailments development (i.e. liver tumors), makes flatfish ideal organisms in marine biomonitoring programmes. Currently, biomonitoring focuses on biochemical responses, disease levels and compensatory mechanisms triggered by pollution at the individual level. However, recent studies provide increasing evidence of organisms adapting to environmental pollution at the expense of somatic or reproductive growth and disease resistance. Potential long-term evolutionary effects of pollution, such as change or reduction of genetic diversity at the population level need to be addressed. Biomonitoring flatfish species offer a unique scenario in which to study the effects of pollution on the within-species genetic biodiversity. Over 20 microsatellites (both neutral and EST-derived), which allow us to infer the dynamics of population processes, have been developed for both species. Genetic data will be integrated with information from biomonitoring, and discussed in relation to the interaction between pollution levels, selection, genetic diversity and species resilience.

## NORTHERN ADRIATIC SEA "TEGNÙE" (OUTCROPS): DISTRIBUTION OF BENTHIC COMMUNITIES ON THREE STUDY SITES.

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Many submarine outcrops are distributed along the Venice's coast in the Northern Adriatic and are locally called "tegnùe", because for their resistance to the drag-net fishing. They are called "beachrocks" or "reefs", depending on whether they are of clastic or biologic origin. They are real natural marine oasis where many fish species can reproduce and live. Three "tegnùe" are chosen near the ports of " Malamocco", "Lido of Venice" and "Piave Vecchia". In 2007 the fauna and flora were sampled on a surface of 50 x 50 cm<sup>2</sup> and the species abundance and cover percentage were determined for each taxon. Both spatial and temporal benthos distribution is analysed. Poriferans, Mollusks, Tunicates, Red algae had the highest cover percentage values. In total, more one hundred epibiontic species are found. Different community patterns were found between three sites, demonstrating that different spatially and seasonally discrete factors may be acting on each rocky shore. In order to compare the effects due to natural outcrops and artificial reefs, some concrete manufactures were submerged in January 2007 near the "Malamocco tegnùe" and the colonization process is observed.

## BIODIVERSITY PATTERNS OF MOTILE EPIBENTHIC FAUNA AND VEGETATION ALONG THE LARGE SKAGERRAK- BALTIC ESTUARINE GRADIENT.

Nohrén Emma, Inst. Of Marine Ecology, University of Gothenburg, Sweden.

Patterns of biodiversity of motile epibenthic fauna and vegetation were investigated in 30 shallow (0-1 m) soft sediment bays along the Skagerrak - Baltic estuarine gradient (1260 km, 34 to 5 PSU). Ten replicate samples of fauna and vegetation were collected in each bay at two occasions (June and September) with a portable drop trap. All together 110 taxa of fauna and 70 taxa of vegetation were found, and the results showed that the biodiversity pattern changes along the estuarine gradient. The total number of epibenthic fauna taxa increased significant ( $p = 0.04$ ) from the Skagerrak to the Baltic, mainly due to insect larvae and gastropods with limnic origin. The total number of vegetation taxa did not differ along the gradient but there was a shift in species composition from habitats dominated mainly by *Fucus* sp. and other macroalgae in the Skagerrak to habitats dominated by *Chara* sp. and *Potamogethon* sp. in the Baltic. The results from our study are in contrast with the general suggested pattern of decreasing species richness described along the Skagerrak - Baltic estuarine gradient.

## BENTHIC COMMUNITY-MEDIATED SEDIMENT DYNAMICS.

Montserrat Francesc, Spatial Ecology, The Netherlands.

Van Colen Carl; Degraer Steven, Marine Biology, Ghent University, Ghent, Belgium.

Ysebaert Tom; Herman Peter, Spatial Ecology, NIOO-CEME, Yerseke, The Netherlands.

Intertidal benthos influences sediment properties and environmental variables. We compared microphytobenthos and benthic macrofauna recovery between control and defaunated sediments during eight months following that defaunation in replicated 16m<sup>2</sup> plots, focussing on how the temporal scale of biological responses interact with the temporal scale of sedimentological developments.

## DIVERSITY OF RHODOPIRELLULA STRAINS IN EUROPEAN SEAS

Harder Jens, Dep. of Microbiology, Max-Planck-Institute for Marine Microbiology, Germany.

Winkelmann Nadine; Jael Urike, Dep. of Microbiology, Max-Planck-Institute of Marine Microbiology, Bremen, Germany.

Rosello-Mora Ramon, Institut Mediterrani d'Estudis Avançats (CSIC UIB), Spain (Esaporles).

The biogeography of *Rhodopirellula baltica* and related species was studied in European shores along a gradient from Island to Crete. The planctomycete *Rhodopirellula* lives attached to surfaces. Hence the genus was selected to study the geographic size of the species habitat by isolation of strains from benthic samples obtained from MarBEF partner institutes. The isolates were characterized metabolically and genetically. Besides the 16S rRNA

gene sequence we developed a multilocus sequence analysis scheme for the genus. A species identification based on DNA-DNA hybridization experiments indicated the presence of at least four *Rhodopirellula* species in our strain collection. A detailed analysis of the genetic diversity in relation to geological scales will be presented.

#### COPEPODA HARPACTICOIDA FROM THE RÍA DE FERROL (NW IBERIAN PENINSULA): PRELIMINARY RESULTS.

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Martínez Arbizu Pedro, Deutsches Zentrum für Marine Biodiversitätsforschung, Forschungsinstitut Senckenberg, Wilhelmshaven, Germany.

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The rías are fluvial valleys flooded by the sea, very typical and common of the Galician coast (NW Spain). The Ría de Ferrol has one of the largest biological diversity among the Galician rías because of its particular hydrodynamics and sedimentary conditions. Its benthic fauna is well-known but there is a lack of researches about some zoological groups such as Copepoda Harpacticoida and meiofaunal taxa in general. Because of that, a joint research project of the USC (Galicia, Spain) and the DZMB (Wilhelmshaven, Germany) was carried out in order to study the subtidal soft-bottom meiofauna, paying special attention to Copepoda Harpacticoida. During May and June 2006 samples were collected by means of SCUBA diving. Eight stations were chosen along the ría, of which 4 were sandy and 4 muddy, and covered a range of depths and different conditions of salinity and pollution levels. In each station, 3 sampling sites 50 meters away from each other were selected. In each site, two corers were taken, one of them for faunal studies and the other to determine physicochemical parameters.

#### A "HOT SPOT" FOR LEPTOSTRACAN DIVERSITY (CRUSTACEA: LEPTOSTRACA): THE GALICIAN RÍAS (NW IBERIAN PENINSULA).

Juan Moreira Da Rocha; Candás María; Díaz-Agras Guillermo; García Alexandre; Pérez-Señaris Marcos; Tato Ramiro; Varela Catarina; Ugorri Victoriano; Estación de Biología Mariña da Graña, Universidade de Santiago de Compostela, Spain.

Leptostracans (Phyllocarida: Leptostraca) are a small group of marine crustaceans characterised by the presence of a hinged rostrum, a carapace that covers the thoracic segments, eight pairs of phyllopodus thoracic appendages and seven abdominal segments. To date, about 40 extant species are known from shallow waters to the deep-sea. These crustaceans have, however, scarcely been reported from the Iberian Peninsula waters. The Galician rías (NW Spain) are a complex estuarine system which has a great variety of soft-sediment habitats inhabited by a rich benthic fauna. In the last years, examination of leptostracan collections from the rías has resulted in the description of a number of new species and new records of other taxa as well. The Ría de Ferrol is the richest in number of species, with six species belonging to two genera recorded so far. This is the largest diversity of leptostracans ever recorded from a single area. In this communication, we describe the composition and spatial distribution of the leptostracan fauna of the Ría de Ferrol, which seem to be strongly related to the granulometric composition of sediment and hydrodynamism.

#### BENTHIC AND BIOGEOCHEMICAL RECOVERY AFTER AN INDUCED HYPOXIC EVENT: THE STRUCTURING ROLE OF MACROFAUNA SUCCESSION.

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Montserrat Francesc; Middelburg Jack; Herman Peter; Andersson Maria; Rossi Francesca; Gribsholt Britta;

Ysebaert Tom, Centre for Estuarine and Marine Ecology, Netherlands Institute of Ecology, Yerseke, the Netherlands.

Oxygen is necessary to sustain marine invertebrate life and may thus be considered as an important factor in structuring marine benthic communities. To assess biogeochemical, macrobenthos and nematode community recovery after depleted oxygen bottom water concentrations, hypoxic sediments were created by covering tidal flat sediments along the Westerschelde estuary using plastic sheets. Macrofauna recovery developed through different succession stages and was structured by tolerance, facilitation and inhibition models: early colonizers had either no effect or a positive effect on subsequent colonizers, while later succession species negatively affected the stable conditions created by the early colonizing tube-builders. Transitions between different stages were related to changes in environmental characteristics and biotic-environmental interactions (e.g. exploitation competition for food). Nematode community -and biogeochemical recovery were related to macrobenthic succession. Dense polychaete tube aggregations and the development of a fresh diatom bloom, as a result of the low grazing pressure by surface deposit feeding macrofauna during the first stage, enhanced nematode



recruitment success. Bioturbation impact of later succession species increased oxygen input in the sediment, resulting in an enhanced nitrification, denitrification and energy use.

#### SPECIES AND FUNCTIONAL DIVERSITY CORRELATION IN COASTAL BENTHIC COMMUNITIES.

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Species and functional diversity correlation of different coastal benthic communities (i.e. different niches and environmental regimes) was investigated in marine and transitional water ecosystems in the N.E. Aegean Sea based on quantitative benthic samples. Species diversity and community structure patterns in the ecosystems studied were obtained by standard approaches, while functional diversity was derived by summarizing distances between species in trait space. Traits were defined based on species different attributes and energy trade offs with their environment. No remarkable alteration in species diversity between the marine and transitional water ecosystems was observed, whereas functional diversity values were higher in transitional coastal communities in comparison to the marine ones. Community structure patterns indicated a strong separation between marine and transitional water communities suggesting a clear qualitative and quantitative species distribution shift. The fact that functional diversity response, and hence ecosystems processes, varied independently from species diversity (i.e. species richness) in the studied ecosystems, should be probably attributed to key-stone species specific resource requirements and their tolerance to certain environmental conditions prevailing in each one ecosystem.

#### NICHE CONSTRUCTION AND BIODIVERSITY IN ESTUARINE SOFT SEDIMENTS.

Weinmann Birgit, School of Biology, University of St Andrews, UK.

All organisms modify their environment in some way: either actively, by constructing habitational structures or by their trophic activity, or passively, by their physical presence or excretion. Recent investigations of biodiversity and ecosystem function in marine soft sediments have shown that diversity and ecosystem function correlations are not consistently positive and are frequently idiosyncratic to assemblage species identity, i.e. some organisms have much greater functional effects than others. Niche construction is the concept that organismal engineering activity can create or destroy niche space for itself and other organisms by modifying energy and resource flows. Estuarine macrofauna such as *Nereis diversicolor*, *Corophium volutator*, *Macoma balthica* and *Hydrobia ulvae* have been shown to significantly reduce microphytobenthic (MPB) biomass but increase diversity presumably through their selective grazing activity. However, they also bioturbate the sediment, resuspend sediment and release nutrients to the water column which can all effect biomass and biodiversity of MPB. Results of an experiment investigating the effects of macrofaunal modification of the water column on MPB biomass and diversity in the presence and absence of the macrofaunal grazing effect are presented.

#### WHICH GORGONIAN SPECIES CAN BE ENDANGERED BY CLIMATE ANOMALIES?

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Scinto Alice; Cerrano Carlo, Dip.Te.Ris, University of Genoa, Genoa, Italy.

During the last ten years extensive mortality events increase their frequency also in the Mediterranean sea affecting mainly benthic filter feeders and in particular gorgonians. Long periods of unusually high sea water temperatures can deeply compromise the physiological integrity of several taxa. To obtain information on the resilience and resistance of gorgonian species, we compared by laboratory experiments the reaction of two of the most common Mediterranean gorgonians (*Paramuricea clavata* and *Eunicella singularis*) to temperature increase. The oxygen consumption of the gorgonians was monitored with LDO probes over eight hours under different temperature conditions (from 14°C to 25°C). The number of the open polyps and the percentage of the necrosis tissue are also analyzed. For both of the species, the oxygen consumption is not related with temperature. However at 25°C, the zooxanthellate *E. singularis* shows a higher respiration rate, no sign of necrosis and few open polyps. Field data suggest this species can better regenerate after necrosis episodes due to thermal stress compared to other gorgonians, highlighting a possible positive role of zooxanthellae in the future warm Mediterranean scenario.

#### COMMUNITY AND TROPHIC DIVERSITY OF CONTINENTAL SHELF FAUNA IN THE CATALAN SEA.

Zucca Leda; Cartes Joan; Maynou Francesc, Consejo Superior de Investigaciones Cientificas, Institut de Ciencies del Mar, Spain.

Spatial and temporal distribution patterns of diversity were studied for benthos, suprabenthos and megafauna (fish, large invertebrates), together to physical and trophic factors controlling diversity (BIOMARE project, Ref.: CTM 2006-13508-CO2-02/MAR). The study is based on cruises performed between December 2006 and November 2007 off the Besós river (Catalonian coasts, 50-70 m depth), a highly polluted area by anthropic activities. An analysis of assemblage and feeding habits of 35 species of shallow waters fish were performed using multivariate analysis. A first analysis (558 stomachs examined) classified fishes in 3 main trophic guilds: epibenthos feeders (i.e. *Lepidotrigla cavillone*, *Pagellus erythrinus* whose main prey are polychaetes, bivalves and brachyurans), nekton-suprabenthos feeders (i.e. *M. merluccius*, *Mullus surmuletus*, *Citharus linguatula*, preying on mysids and euphausiids), and plankton feeders (i.e. *Spicara* spp., *B. boops*, *Trachurus* spp., preying on cyclopoids and calanoid copepods). Strong seasonal patterns are identified in the diet, trophic diversity and assemblage composition. An in-depth study about feeding habits will include isotopic analysis on the origin of food sources ( $\delta^{15}N$ ) and the trophic level ( $\delta^{13}C$ ) in relationship with the natural and anthropic variability.

#### MICROPHYTOBENTHIC PRODUCTION IN PRESENT AND FUTURE CO<sub>2</sub> CLIMATES.

Hicks Natalie, Sediment Ecology Research Group, Gatty Marine Institute, University of St Andrews, Scotland.

Human induced climate change has already altered ecosystems, and changes in carbon dioxide (CO<sub>2</sub>) and temperature are expected to have global consequences on marine ecosystem processes. Compared to terrestrial ecosystems, very little research has been done in marine ecosystems to determine the possible impacts of rising temperature and carbon dioxide levels. This study determines the relationship between infaunal invertebrate biodiversity and microphytobenthic production (measured using PAM fluorescence) for an estuarine community under a range of temperature-CO<sub>2</sub> regimes using a replicated mesocosm approach with single and multispecies macrofaunal assemblages. The CO<sub>2</sub> levels represent present day atmospheric CO<sub>2</sub> concentration (370 ppmv) and future IPCC projections for the year 2050 (450 ppmv) and 2100 (1000 ppmv) and will be run at three constant temperatures (6°C, 12°C, 18°C) that reflect the seasonal temperatures at the study.

#### OCEAN ACIDIFICATION, LIFE HISTORIES AND DEVELOPMENTAL PLASTICITY IN MARINE INVERTEBRATES.

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We have been exploring the affects of near- future levels of ocean acidification (OA) on various aspects of life history in a range of marine invertebrates with a focus on echinoderms, crustaceans and tunicates. Perhaps one of the key marine groups most likely to be impacted by predicted OA is the echinoderms. Echinoderms are a vital component of the marine environment with representatives in virtually every ecosystem; where they are often keystone ecosystem engineers. In addition, many are indirect developers (e.g. urchins, brittlestars) where both larva and adult have critical (and quite different) episodes of skeletogenic calcification. In contrast others (Asteroids) exhibit adult but not larval skeletogenesis. In this way echinoderms offer a valuable and tractable experimental system for exploring the impacts of OA on marine biota. We have used our CO<sub>2</sub> - based sea water acidification system to investigate the affects of increasing acidity on early developmental success in the brittlestars *Amphiura filiformis* and *Ophiothrix fragilis*, the sea star *Asterias rubens* and the sea urchin *Strongylocentrotus droebachiensis*. In addition, the affects of OA are clearly taxa-specific with some species much more severely impacted than others even at relatively small changes in pH (pH 7.9 and pH 7.7) that are well within those predicted for the end of the current century. This highlights the danger of extrapolation from just a few key species, even within closely related taxa. For example, in *O. fragilis*, low pH induces dramatic mortality after one week due to larval and skeletal malformations while more subtle effects were observed in *A. filiformis* where some individuals survive to the juvenile stage. Urchins and asteroids on the other hand seem relatively unaffected. In addition to apparent direct skeletal effects on larval calcifiers such as urchins and brittlestars there are also likely to be a number of other, perhaps indirect, effects related to a variety of other parameters including respiration and feeding. For example, in non-calcifying asteroid larvae there are significant changes in feeding potential that perturbs normal development. Given the increasing number of genomes becoming available for our chosen models, such inter and intra-specific plasticity opens up the exciting prospect for dissecting the bases of phenotypic plasticity and the evolvability of marine invertebrates in the face of climate change. Moreover, the taxa specificity of the responses combined with variable life history sensitivities argues strongly for an integrated ecosystem approach to this crucial environmental challenge.

#### **Session 2.5 Marine Bioinvasions And Ecosystem Functioning**

Chairs: Sergej Olenin; Anna Occhipinti Ambrogio; Stephan Gollasch

## CONTRASTING HYDRODYNAMICS AND PARTICLE TRAPPING RATES IN SEAGRASS AND ALGAE OF THE CAULERPA FAMILY.

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Mediterranean seagrass meadows are experiencing widespread decline. Opportunistic species can invade these habitats resulting in e.g. replacement of seagrass meadows by *Caulerpa* species. This affects the hydrodynamic properties of the seafloor, since *Caulerpa* canopies differ in height, stiffness and density from seagrasses canopies. Here we evaluate the effects of *Caulerpa taxifolia*, *C. racemosa*, and *C. prolifera* on hydrodynamics and particle trapping capacities and compare them to Mediterranean seagrasses (*Cymodocea nodosa* and *Posidonia oceanica*). Hydrodynamic properties and particle-trapping rates were measured under controlled circumstances in a flume. Volumetric flow rates were reduced from 7% for *C. racemosa* to 60% for *C. taxifolia* when compared to the control. Turbulent kinetic energy profiles showed peak values just below the canopy height while integrated total Reynolds stresses in the water column, showed an increase of between 0.5 (*C. taxifolia*) and 5.9 (*C. racemosa*) times when vegetation is present. Particle retention was separated in background retention and effective retention for the canopy area. Most effective retention was found in *C. taxifolia* canopies, followed by *C. nodosa*, *C. prolifera*, *P. oceanica*, *C. racemosa*, and finally the sand control. Modeled retention rates by canopies ( $k_v$ ) were correlated with shear velocities above them. When retention was corrected for  $m^2$  leaf area, *C. racemosa* emerges as the species with the largest particle retention capacity per unit surface area, followed by *P. oceanica*, *C. prolifera*, *C. nodosa* and finally *C. taxifolia*. Effectively, replacement of seagrasses by *Caulerpa* species should have a limited effect on particle retention properties of the ecosystem.

## INVASIONS OF *LOPHOCLADIA LALLEMANDII* ENHANCE SEAGRASS (*POSIDONIA OCEANICA*) LOSS.

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Biological invasions are considered the second cause of global biodiversity loss and amongst the major threats for native ecosystem structure and functioning. The rate of macroalgal introductions in the Mediterranean Sea is accelerating since 1990, some of these species becoming invasive. We assessed the effect of *Lophocladia lallemandii* invasions on structure and stability of *Posidonia oceanica* meadows, an endemic, millenary ecosystem dominant along the Mediterranean coast. At two locations, we quantified meadow structure and current year shoot mortality of *P. oceanica* under *L. lallemandii* patches between 0  $m^2$  (not invaded) and 2  $m^2$ , the range of patch size observed at the studied locations. *P. oceanica* shoot size and density decreased with increasing macroalga patch size. Shoot mortality rate, estimated retrospectively, under macroalga patches was 3 to 5 fold higher than in not invaded areas. The annual abundance of shoots that died during the last 8 years revealed an increase of shoot mortality since 2004, at least four years after the arrival of *L. lallemandii*. The results demonstrate that *L. lallemandii* invasions accelerate seagrass loss and change meadow structure, and that the magnitude of invasion impacts varies as invasion proceeds.

## IMPACTS OF THE INVASIVE DINOFLAGELLATE *PROROCENTRUM MINIMUM* (PAVILLARD) SCHILLER ON PELAGIC HABITAT AND PHYTOPLANKTON COMMUNITY IN THE BALTIC SEA.

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The dinoflagellate *Prorocentrum minimum* penetrated the Baltic Sea in 1980s-1990s. Since then it became a common member of summer phytoplankton community in the south-western parts of the Baltic Sea (Belt Sea, Arkona Basin), while in the south-eastern waters *P. minimum* appears only in late summer and usually reaches the peak of density in September – October. With saline water inflows, this invasive species penetrates also into the Curonian Lagoon, mainly freshwater body. *P. minimum* shows a wide environmental tolerance range occurring from fully marine to nearly limnic conditions. The lower limit of salinity under which this species was found is 0.7 PSU. The abundance of *P. minimum* shows a very high annual variability: in some years the species caused blooms with abundance up to 350 mln cells/litre, while during other periods it was absent in plankton samples. The paper summarises the results of the long-term (15 years) observations of *P. minimum* abundance in relation to environmental data (water temperature, salinity, nutrients), its role in the phytoplankton community and modification of pelagic habitat occurring during the water blooms.

THE ELECTRONIC JOURNAL "AQUATIC INVASIONS": AN ONLINE INFORMATION TOOL TO SUPPORT RISK ASSESSMENTS AND EARLY WARNING SYSTEMS ON AQUATIC INVASIVE SPECIES.

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Aquatic Invasions (AI) is an electronic open-access international journal with focus on biological invasions in inland and coastal waters of Europe, North America and other regions (ISSN: 1818-5487, <http://www.aquaticinvasions.ru>). The journal provides the opportunity of timely publication of first records of aquatic invaders and other relevant information needed for risk assessments and early warning systems. Also, relevant technical reports and conference proceedings can be considered for publication. Currently AI is serving as an important part of the developing Pan-European early warning system on aquatic invasive species, and provides informational support for risk assessment protocols developing within the EC FP6 Integrated Project ALARM (GOCE-CT-2003-506675). In 2006-2007, approximately 1500 new records of alien species in European inland and coastal waters were published in 117 papers in 8 regular issues of the first two volumes of the journal. AI is published on behalf of the European Research Network on Aquatic Invasive Species (ERNAIS). Manuscripts submitted to AI are reviewed by independent experts. Accounts on inland invaders may be submitted to Dr Vadim Panov ([vpanov@aquaticinvasions.ru](mailto:vpanov@aquaticinvasions.ru)) and for coastal invaders to Dr Stephan Gollasch ([sgollasch@aol.com](mailto:sgollasch@aol.com)).

EFFECTS OF NUTRIENTS FLUCTUATION ON THE ESTABLISHMENT OF THE INVASIVE ALGAE *SARGASSUM MUTICUM*.

Olabarria Uzquiano Celia; Souza Troncoso Jesús; López Pérez Jesús, Ecología y Biología Animal, Facultad de Ciencias del Mar, Universidad de Vigo, Spain.  
Incera Filgueira Mónica, Área de Promoción y Transferencia de Tecnología, Centro Tecnológico del Mar-Fundación CETMAR, Vigo, Spain.

Although many studies on terrestrial ecology have investigated how disturbances (e.g. nutrients addition) relate to invasion process, few experimental studies regarding this issue have been done in marine systems. In the context of the Fluctuating Resources Availability Theory, the susceptibility of a community to invasion fluctuates over time depending upon conditions of resource enrichment or fluctuations in resource supply. With this theory in mind, we conducted a manipulated experiment at two sites on the Galician coast (NW Spain), to test the hypothesis that mean intensity and temporal variability of nutrients addition would affect the invasion of native macroalgal assemblages by *Sargassum muticum*. There was a consistent interaction between mean intensity and temporal variability of nutrients addition on different features of the invasive algae at both localities. Thus, under irregular temporal variability of disturbance the number of plants was larger at low than at high concentration of nutrients whereas under regular temporal variability the trend was the opposite. The same pattern was observed for length and stand biomass of *S. muticum*.

*CORBICULA FLUMINEA* (O.F. MÜLLER, 1774) (BIVALVIA: CORBICULIDAE), AN ALIEN ASIATIC CLAM IN POLAND.

Wawrzyniak-Wydrowska Brygida, Department of Paleoceanology, University of Szczecin, Poland.

*Corbicula fluminea* (O.F. Müller, 1774), a south-eastern Asiatic clam dispersing to other continents since the early 20th century, is now known from Europe. The first Polish record of *C. fluminea* dates back to October 2003 when the bivalve was found in a power station cooling water canal in the downstream reaches of River Odra (NW Poland). It is not known how far the species has been dispersing in the river since and what dispersal means and pathways have been used. To elucidate the present range of *C. fluminea* in River Odra (including its Baltic estuary), surveys were performed in 2005 and 2006 along the entire course of the river down to its discharge to the Pomeranian Bay (Baltic Sea). The clam was observed to have clearly expanded its range. A set of biometric measurements, taken to determine the size structure of the *Corbicula fluminea* population (both live and empty shells), showed the population to consist primarily of young individuals, the oldest specimens being completely absent. This suggests that the population is at its developing stage.

THE AMERICAN COMB JELLY (*MNEMIOPSIS LEIDYI*) IN THE BALTIC SEA - INVASION HISTORY AND POSSIBLE FOOD WEB EFFECTS.

Lehtiniemi Maiju; Vitasalo Satu; Katajisto Tarja, Biological Oceanography, Finnish Institute of Marine Research, Finland.

The American comb jelly (*Mnemiopsis leidyi*) was first observed in the southern Baltic Sea in late autumn 2006 and in the northern parts in August 2007 – in one year the species has spread throughout the sea, except the northernmost Bothnian Sea. The high invasion speed indicates exceptional adaptation abilities over large range of abiotic factors. We studied the distribution and abundance of *Mnemiopsis* from August 2007 to March 2008 in relation to abiotic factors and observed clear differences compared with the existing knowledge from other areas. *Mnemiopsis* occurs in the Baltic Sea near halocline in 50–80 m depths and reproduces at smaller size than previously anticipated. During winter the thermo- and haloclines are broken down at many sites, and a more even distribution of *Mnemiopsis* was observed in the water column. Against our assumptions, the population densities increased from autumn to winter. This winter has been abnormal due to ice-free conditions, which may have helped *Mnemiopsis* to find food and to survive. Availability of suitable prey during winter as well as potential ctenophore-driven alterations in the Baltic ecosystem in the future are discussed.

#### **Session 4.2 Societal and economic benefits of marine biodiversity.**

Chairs: Juan Carlos Castilla; Lalit P. Chaudari; Narendra Kumar Choudhary; Stefan Gelcich; Annette Kimmich; Carolyn Scheurle; Micalis Skourtos; Alyne Delaney; Poul Holm; Melanie Austen.

#### **ASTING THE WEALTH OF SEAFOOD BIODIVERSITY THROUGHOUT EUROPE.**

Fockedeey Nancy, Communication, Flanders Marine Institute, Belgium.

MarBEF, an EU network of excellence, is a platform for integration and dissemination of knowledge and expertise on European marine biodiversity. The network involves 94 European marine institutes with links to researchers, industry, stakeholders and the general public at large. MarBEF supports challenging research, which is exploring the relationship(s) between biodiversity and the functioning of marine ecosystems throughout Europe. European marine systems are currently under threat from overexploitation, habitat destruction, pollution, introduction of alien species and global climate change. However, the consequences of such biodiversity loss for marine systems remain largely unknown to the general public. Outreach projects within the MarBEF network aim to create awareness of the aesthetic, economic and ecological values of marine biodiversity in order to gain support from society to protect and sustain our living marine resources. "The way to people's heart is through the stomach..." One of the outreach initiatives of MarBEF is to produce a marine biodiversity cookbook. Its aim is to illustrate to the public the variety of marine life (seafood) which is eaten daily and how this rich marine and coastal biodiversity is seen to be the life blood of traditional cooking. This cookbook takes the reader and the amateur cook on a journey along our European coasts, beginning at the northern seas and travels south to the Baltic Sea, the North Sea, the Celtic Sea and the Irish Sea, through to the Bay of Biscay and the Iberian waters, the Mediterranean Sea and east to the Black Sea. The cookbook also ventures off the beaten track to include recipes from the remote islands of the Azores, Canaries and the Madeira Islands. We further include seafood delights prepared with non-indigenous species, provide recipes for conventional soups and stews, illustrate the tradition of eating eggs and roes, and the banqueting of raw seafood. The book presents scientific-based, but 'ready-to-digest' information on the distribution, ecology, fisheries or aquaculture of a fine selection of European seafood species. Fish are only 'an aperitif' of the many species that are covered. The book delves as well into recipes and information on molluscs, crustaceans, several other invertebrate species, algae and saltmarsh plants ready to be cooked, eaten and digested at your leisure. Alternative species which can be used in some of the traditional recipes are provided where European stocks have become unsustainable or where the species is not generally locally available.

#### **ECONOMIC AND SOCIOCULTURAL VALUATION OF MARINE BIODIVERSITY.**

Ruiz Ana; Kaiser Michael, School of Ocean Sciences, University of Bangor, United Kingdom.  
Jones Edward-Gareth, School of Environment and Natural Resources, University of Bangor, Bangor/U.K.  
Delaney Alyne, Innovative Fisheries Management, Aalborg University Research Centre, Hirtshals, Denmark.

Different groups of stakeholders have an interest in the goods and services provided by the marine environment and the revenue that can be generated from its resources. However, many of their activities sometimes have conflicting interests. Policy makers are now trying to integrate their needs into management plans through the implementation of Marine Spatial Planning (MSP). Marine protected areas (MPAs) lay within the category of MSP tools and are considered important tools for biodiversity conservation. While a great amount of literature exists on the biological effects of MPAs, fewer studies have focused on the social and economic implications that stem from these management regimes. However, a sound economic valuation of the goods and services provided by the marine environment to all stakeholders is necessary if we are to design cost effective and successfully implemented

MPAs. The present study aims to identify and quantify the value of marine biodiversity around the Welsh coast to different stakeholders. This information will be used to model various scenarios for the implementation of MPAs. Furthermore, the study attempts to clarify the social, cultural and economic importance of marine biodiversity, and as such will be beneficial to support and influence future marine environmental policies.

#### A TOTAL ECONOMIC VALUATION OF THE GOODS AND SERVICES PROVIDED BY MARINE BIODIVERSITY FOR USE IN MARINE SPATIAL PLANNING.

Rees Sian, Marine Institute, University of Plymouth, England.

With numerous and competing uses of the marine environment and increasing pressure on resource use, identifying sites to be designated as Marine Protected Areas needs to encompass the Ecosystem Approach. The Total Economic Valuation methodology captures both the marketed (fish, raw materials etc) and non-marketed values (nutrient recycling, gas and climate regulation etc) of goods and services provided by marine biodiversity. Monetizing the environment remains a controversial approach to decision making. However, it can be argued that if no value is assigned to an essential ecosystem service, such as the provision of food and shelter by a rocky reef habitat, then that service is essentially considered free. In a world where capitalism encourages infinite growth of wealth set against the finite resources of the planet, anything which has no quantifiable value is at risk of being undervalued or ignored in the decision making process. This research examines the recent economic, social and environmental arguments for closing 60 square miles of reef habitat to scallop fishermen in South West UK with consideration of how scientific and economic data is interpreted by policy makers.

#### MARINE GENETIC RESOURCES: RESEARCH, COMMERCIAL EXPLOITATION AND BENEFIT-SHARING. AN ECONOMIC AND LEGAL PERSPECTIVE".

Pierluigi Bozzi, Environmental Economics, University of Rome "La Sapienza", Italy.  
Ribadeneira Sarmiento Monica, Quito, Ecuador.

In the sea there are many "resources" which move about freely. Long years of conflict, commercial agreements and international conventions have revealed some answers about the ownership of the fisheries globally, but what about the genetic resources? The purpose of this article is to show the situation of marine genetic resources and raise questions about their management, ownership, access and benefit sharing accruing out of their utilization. No clear legal framework is in place to guarantee the objectives of conservation, research, and commercial exploitation, taking into account the needs of humanity and local people who live with and survive on marine resources. Overall a socio-economic analysis is needed to consider all the interests and offer a comprehensive framework to design policy measures and international rules. This analysis is indispensable for optimizing uses, economic goals and benefits for resource users as well as for humanity as a whole.

#### **Session 4.3 Conserving Marine Biodiversity: Making Policy, Management Tools, And Scientific Knowledge Work Together**

Chairs: Jake Rice; Heye Rumohr.

#### SPONGES OF THE CHINESE YELLOW SEA: A FAUNAL COMMUNITY UNDER HIGH ANTHROPOGENIC PRESSURE.

Henkel Daniela; Janussen Dorte, Marine Zoology, Research Institute, Germany.  
Brümmer Franz, Biological Institute, Zoology, University of Stuttgart, Stuttgart, Germany.  
Zhang Wei, Marine Bioproducts Engineering Group, Dalian Institute of Chemical Physics, Dalian, China.

China's economy is one of the fastest growing worldwide. As a result, the environmental destruction has reached dramatic levels. The Yellow Sea is one of the biodiversity hotspots in the temperate zone and is exposed to high anthropogenic pressure by extensive aqua-farming, fisheries and polluted river runoffs. It has recently been specified as the "Yellow Sea Ecoregion (YSE)" by the WWF and listed as one of the areas that should be conserved with highest priority. Marine sponges are a main component of the megazoobenthic community structure of the Chinese Yellow Sea. They are used as bioindicators and as a source of bioactive compounds. Furthermore their filtration potential contributes to the natural sewage disposal in this heavily polluted coastal area. For the first time a detailed record of the sponge community of the north-eastern Yellow Sea is presented.

The benthic communities, diversity and growth forms have been documented by underwater mapping and in situ photography. Variations along different ecological gradients have been analysed by semi-quantitative methods. A total of 19 different species have been recorded, most of them new to science.

#### CULTURAL VALUES AND CONSERVATION STRATEGIES - SOCIO-CULTURAL CONTRIBUTION TO MARINE ECOSYSTEM GOODS AND SERVICES.

Marboe Anne Husum, Department of Environmental, Social and Spatial Change, Roskilde University, Denmark.

Based on a case study in the Wadden Sea this paper examines local cultural impact on management plans and implementation of national and international protection and conservation regimes in the marine environment. Cultural values are fundamental for conservation targets and significantly influential in the process of design, management and decisions on conservation, protection and restoration of marine biodiversity. The paper answers the question how cultural values influence the process. Values are difficult to grasp. How can we know more about them? Data are collected from local, national and international sources from the 1970s to the present on nature protection and conservation management and legislation in the Wadden Sea. Understanding value systems is important to make management strategies effective and to prevent political discussions about nature and the value of nature that are often stretched between exploitation and conservation strategies. Communities living close to and related to the sea often connect special identity to marine ecosystems that have played a significant role in the economic or cultural definition of the community.

#### BIOMARES, A LIFE PROJECT TO RESTORE AND MANAGE THE BIODIVERSITY OF LUIZ SALDANHA MARINE PARK.

Cunha Alexandra; Erzini Karim; Serrao Ester, CCMAR, Edificio 7, University of Algarve, Portugal.

Gonçalves Emanuel, ISPA, Lisbon, Portugal.

Henriques Miguel, PNA, ICNB, Setúbal, Portugal.

Henriques Victor, IPIMAR, INRB, Lisbon, Portugal.

Marbá Núria; Duarte Carlos, IMEDEA, CSIC, Esporles, Spain.

Luiz Saldanha a Marine Park and Nature 2000 site is considered to be THE hot spot for Portuguese marine biodiversity. The LIFE-BIOMARES project aimed at the restoration and management of the biodiversity of the area and implemented several conservation tasks. One of the most challenging is the restoration of the seagrass prairies that were completely destroyed by fisheries and recreational boating. It includes the transplanting of seagrasses from donor populations, and the germination and plantation of seagrass seeds to maintain the genetic diversity of the transplanted area. The most popular action was the establishment of environmental friendly moorings, to integrate recreational use of the area with environmental protection. Several actions of information and environmental education about the marine park and the project are also in action. For compensating for fishermen loss of fisheries ground and to increase the knowledge of the habitats of the park, the cartography of the park and the surrounding area is being made. This project is an excellent example of how MPAs implementation can be supported by the EU environmental policies.

#### MODELLING HABITAT DISTRIBUTION AND MACROBENTHIC BIODIVERSITY, WITHIN THE BASQUE CONTINENTAL SHELF.

Galparsoro Ibon; Chust Guillem; Muxika Iñigo; Rodríguez J. Germán; Borja Ángel, Aztimar, AZTI-Tecnalia, Spain.

The spatial distribution and variability in macrobenthic abundance, species richness, and composition, relative to water depth, geomorphology, substrate type, organic content of sediments and bottom wave energy were analysed within the Basque continental shelf. Bathymetric and seafloor backscatter information were acquired using high-resolution multibeam SeaBat8125 system. In situ sampling was based upon van Veen grab samples collected over a 15 year period, totalising 586 benthic samples, from 5 to 200 m water depth. Spatial algorithms were applied, to extract relevant topographic parameters: slope, orientation, shaded relief, ruggedness and the Topographic Position Index. Prediction of species and habitat distribution over the continental shelf was studied by means of canonical analysis and generalised linear models. Moreover, a variation partitioning analysis was carried out in order to differentiate between the role of environmental factors and the effect of spatial autocorrelation. These predictions will allow a better management of marine habitats, regarding different European legislation (such as Habitats Directive and Marine Strategy Directive), and other application like the localisation of "biodiversity hot-spots" and biodiversity patterns at different spatial scales, regarding their conservation.

## MAPPING ROCKY SUBTIDAL COMMUNITIES IN THE ALGARVE AND USING THIS TOOL AS A PLATFORM TO UNDERWATER SUSTAINABLE ECOTOURISM. A CASE STUDY.

Rangel Mafalda, University of Algarve - Coastal Fisheries Research Group, Faculdade de Ciências do Mar e Ambiente, Portugal.

The area between Faro and Portimão was sampled from 2002 to 2007 (ongoing), from 0 to 30m depth. All rocky shore communities were identified and mapped, using SIG's software. The animal and floral organisms were sampled by means of transect (3 transects along a 60m line) and quadrat (50x50cm) techniques, respectively. From these sampling procedures a total 1139 species / taxa were identified and targeted. The information was then used for initiating a grid of sustainable underwater routes, with the careful identification of geographic, animal, floral and route details features written in underwater plates for tourist sustainable use of near shore marine areas. Two of those examples are the routes defined for S. Rafael and Arrifes's Beach, to be implemented in the summer season of 2009 by the Algarve Regional Administration (CCDR-Algarve). Those two underwater routes will be described in detail, as the implication of these routes in sustainable coastal management policies and environment education.

## EVALUATING THE CONSERVATION STATUS OF MEDITERRANEAN MARINE FISH AND IDENTIFYING CONSERVATION PRIORITIES.

Cuttelod Annabelle, International Union for Conservation of Nature, IUCN Centre for Mediterranean Cooperation, Spain.

Marine biological resources support livelihoods, allow sustainable development and foster co-operation between nations. However many species are declining to critical population levels and important habitats are being destroyed through human activities. This is particularly true for the Mediterranean Sea, which is globally recognized for the richness and endemism of its fauna and flora (Myers et al., 2000), but is also subject to intense human pressures (fisheries, urban development, pollution, etc.) (Boudouresque, 2004) and rapid anthropogenic changes (450 million people concentrate in the coastal zone and population growth estimates forecast 600 million by 2025) (Benoit and Comeau, 2005). Many of these people depend either directly (e.g. fisheries) or indirectly (e.g. tourism) on marine biodiversity for their livelihoods. Tools such as the IUCN Red List of Threatened Species<sup>TM</sup> provide the information and overview needed for setting conservation priorities, measuring progress and raising awareness. A first assessment of the conservation status of Marine fish was conducted in the Mediterranean region in 2007. This presentation will give an overview of the results, showing overall patterns emerging and main threats to the species.

## ARGENTINEAN MARINE INVERTEBRATES: PRESENT AND POTENTIAL PROBLEMS ON CONSERVATION AND MANAGEMENT.

Bigatti Gregorio, Biología y Manejo de Recursos Acuáticos, Centro Nacional Patagónico CENPAT – CONICET, Argentina.

Along the coast of Argentina there is a great diversity and abundance of marine invertebrates, which is due in part to its origin from two different biogeographic provinces. The invertebrates, either motile or sessile, play a fundamental role in the communities as bio-constructors and as part of the trophic webs. Comparing the species from cold zones of the Southern Atlantic with those of temperate and tropical zones, the decapods and bivalve crustaceans are less represented, whereas the suspension feeders, pycnogonid crustaceans and echinoderms are the richest and more diverse. Some endemic species from Argentinean coasts are only distributed from the south of the Rio de la Plata and others inhabit sub-Antarctic and Antarctic waters. The greatest threat against marine biodiversity is produced by trawling nets, which devastate the bottoms, the recovery being very slow. This can lead to population declines, that can also be produced by the degradation of sandy beaches due to disturbance caused by urban development and tourist use, to regional aquatic pollution, the presence of introduced species, the fishing of invertebrate target species, the fishing of non target species and by-catch. The present and potential problems of conservation and management of the invertebrates of the Argentinean coast are approached, and some precise examples on biology, population diversity, endemism, population declines, as well as the use of marine snails as bioindicators of contamination in zones of high marine traffic are given.

## MAERL CONSERVATION PLAN IN GALICIA (NW SPAIN): AN EXAMPLE OF HOW THE RESEARCH CAN BE AN OPTIMAL BASELINE FOR CONSERVATION MANAGEMENT.



Peña Freire Viviana; Bárbara Criado Ignacio, Biología Animal, Biología Vegetal y Ecología, Universidad de A Coruña, Spain.

Maerl beds are composed of unattached coralline algae with a slow growth rate which are worldwide distributed. They are considered one of the coastal habitats with highest associated diversity, playing an important ecological role due to their carbonate composition. Their high sensitivity and their low recovery potential have produced a serious decline along the European coasts. Two maerl-forming species, *Lithothamnion corallioides* and *Phymatolithon calcareum*, are listed in the Annex V of EU Habitats Directive. Maerl beds are included in specific habitats under Annex I, they are defined in EUNIS and were added to the OSPAR Initial List. In 2007, the Galician Government published the "Galician Catalogue of Endangered Species" where both maerl species are listed. Based on the results obtained from our current researches on the status conservation and monitoring of the maerl populations along the Atlantic Iberian Peninsula coasts, it is proposed a conservation plan in Galicia. According to the impacts observed on the Galician maerl, the main aims are the establishment of protection measures for this habitat and the proposal of protected areas. \*Contribution to the project CGL2006-03576/BOS (Ministerio de Educación y Ciencia, FEDER).

#### THE MEDITERRANEAN MARINE HABITATS IN THE "EU.N.I.S." EUROPEAN SYSTEM.

Tunesi Leonardo, Marine Habitat and Biodiversity Conservation, ICRAM - Central Institute for Marine Applied Research, Italy.

Moss Dorian, Dorian Ecological Information Ltd, Oakham, United Kingdom.

Evans Doug, European Topic Centre on Biodiversity, France.

Mo Giulia, Marine Habitat and Biodiversity Conservation, ICRAM - Central Institute for Marine Applied Research, Roma, Italy.

The European Topic Centre on Biological Diversity, on behalf of the European Environment Agency, has developed a habitats classification scheme since 1995, in order to cover all the habitats present within European states and beyond. This allows a universal classification of the diverse habitat types present amongst biomes of wide-ranging geographical coverage. The classification, developed within the European Nature Information System (EUNIS), has been designed so as to facilitate the harmonised description and collection of data on all habitats ranging from natural to artificial, from terrestrial to freshwater and marine, through specific criteria used to identify each habitat and its hierarchical positioning within the broader environmental context. EUNIS therefore allows integration of all habitat types and cross comparisons, at the EU marine level, on aspects such as habitat richness, variety and uniqueness. This information represents a baseline for a more holistic EU marine conservation approach. The objective of this work is to present the integrated version of this system which also allows its application to the Mediterranean realm integrating the marine habitat types defined within the Barcelona Convention.

#### WHAT IS BIOMARA

Michele Stanley, Scottish Association for Marine Science, UK

The coastal area of Chachoengsao and Chon Buri Provinces, located to the east and west of the Bangpakong river delta, is one of the most highly diverse and prolific parts of the Gulf of Thailand. This area provides habitat for numerous fauna, fish nurseries and fishing grounds. Inside the Bangpakong river delta, around Nok Island, is the most significant seabass cage culture area in Thailand. The Bangpakong coastal area is important to human use and the quality of life of the local inhabitants. It faces a number of serious threats, such as conversion of mangrove forests to shrimp ponds, over fishing and illegal fishing, and pollution by wastewater due to growing urbanization and industrial development. This paper presents a practical tool based on seven zones and the declaration of the Bangpakong coastal area as an environmental coastal protected area under the Enhancement and Conservation of National Environmental Quality Act (NEQA) 1992 through the participatory process of community involvement and the central government. The seven zones proposed are defined as follows: Zone 1 Controlled use of the Bangpakong river delta, Zone 2 Mangrove forest protection, Zone 3 Controlled activities 3,000 m from the outer edge of the mangrove forest, to conserve small benthic fauna, Zone 4 Control coastal erosion, Zone 5 Management of communities and urban development, Zone 6 Management of industrial areas and Zone 7 Management of rural and agricultural areas. Details of the proposed implementation guidelines in each zone are also provided.

#### THE CARIBBEAN - A CASE STUDY, WITH EMPHASIS ON TRINIDAD AND TOBAGO.

Gobin Judith, Life Sciences, University of West Indies, Trinidad and Tobago,

The Caribbean is well known for its rich biodiversity especially as associated with coral reefs, mangroves and seagrass beds and has been described as a major biodiversity "hotspot". Like most tropical islands, the Caribbean territories are environmentally fragile, being especially vulnerable to both internal and external interference. The human impacts on environments in the Caribbean are significant, because of high population densities, poverty and in many cases the absence of sanitary facilities. Pollution and contamination in coastal and marine environments is common to most of the islands from agriculture, domestic/municipal areas, the tourism industry, shipping and marine transport and heavy industry (mainly Trinidad). Much of the research, management and education programmes to effect sustainable use of biodiversity and conservation are carried out by state agencies, with a more recent emergence of private sector interest and support. The forces promoting protection and conservation of biodiversity are not consolidated and as yet, not powerful enough to influence major policy decisions in favour of effective policies. Government agencies continue to be ineffective due to: inadequate funding, low technical capacities, obsolete policies, and weak management of available resources. The gap in decisive leadership by governments remains a significant impediment to achieving substantive progress in marine biodiversity conservation. Many of the Caribbean islands are signatory to the various multilateral environmental agreements most of which relate directly or indirectly to conservation of terrestrial and marine biodiversity. However, a number of issues impede the achievement of the biodiversity policy goals. These include Inappropriate legislative and policy framework for marine issues; Weak marine pollution policy; Inadequate institutional linkages; Weak implementation of multilateral environmental agreements (MEAs); Weak enforcement regime; Limited stakeholder involvement and sensitization; and Inadequate consideration of technical aspects. This paper presents the wider Caribbean as a case study and highlights issues in one of the wealthier Caribbean nations-Trinidad and Tobago. This twin-island state is located a few kilometres off NE South America (10°30' N) and has a thriving offshore oil and gas industry. Given the number of significant ongoing marine investigations in the region we are still a long way from realizing biodiversity conservation goals in the Caribbean.

#### MARINE BIODIVERSITY INFORMATION RESOURCES TO SUPPORT ENVIRONMENTAL MANAGEMENT AND DECISION-MAKING - THE MARINE LIFE INFORMATION NETWORK.

Tyler-Walters Harvey; Lear Dan; Parr Jon; Baker Guy, Marine Life Information Network, Marine Biological Association, United Kingdom.

The Marine Life Information Network (MarLIN) pioneered the use of the internet to provide information resources to support marine environmental management, protection and conservation in the UK through its dedicated website ([www.marlin.ac.uk](http://www.marlin.ac.uk)). Initiated by the Marine Biological Association (MBA) in 1998, MarLIN has over ten years experience of providing information tailored to the needs of policy and decision makers, environmental managers, conservation agencies and the general public. Policy makers and marine environmental decision makers are making increasing demands on scientists to answer questions regarding ecosystem structure and function, short and long term management, marine spatial planning, the likely effects of human activities on marine biodiversity and the likely changes in biodiversity and ecosystem services as a result of climate change, introduction of non-natives and other impacts both natural and anthropogenic. In many cases, especially emergency response, decision makers need almost instant access to information. Using MarLIN as an example, the presentation will explore how the Web can be used to disseminate information on marine biodiversity to support decision and policy making in the UK and Europe. The presentation will demonstrate several resources designed to answer the above questions, including background information on species and habitats, sensitivity mapping, on-line databases of human impacts and seabed indicator species. Furthermore, examples will be presented of how data (from a variety of sources) and information can be integrated to develop decision support systems such as marine spatial planning GIS, biodiversity mapping and biodiversity hotspot mapping. Future developments, as we move towards a more integrated 'semantic' Web, will be put forward.

#### ERASMUS MUNDUS MASTER OF SCIENCE IN MARINE BIODIVERSITY AND CONSERVATION.

Deprez Tim; Vincx Magda, Marine Biology Research Group, Ghent University, Belgium.

The Erasmus Mundus Master of Science in Marine Biodiversity and Conservation (EMBC) is offered by a University consortium consisting of 6 partners : group I : Ghent University (Belgium), University of Bremen (Germany), University of the Algarve (Portugal), group II : University Pierre et Marie Curie - Paris 006 (France), University of Oviedo (Spain) and University of Klaipėda (Lithuania). The study programme is divided in 3 thematic modules : (1) Understanding the structure and function of marine biodiversity , (2) Toolbox for investigating marine biodiversity, (3) Conservation and Restoration of marine biodiversity. Student mobility is an integral part of the Master : students start in one of the three group I Universities (Gent, Bremen or Algarve) for 2 semesters; for the third semester, students move to one of the group II Universities (Paris, Oviedo or Klaipėda). The research project for the thesis work is performed in one of the partner institutions (including institutes of the MarBEF- NoE).

#### **Session 4.4 Emerging Paradigms In Coastal Research And Related Management And Policy Implication**

Chairs: Natarajan Ishwaran; Luis Valdés, Jerry Melillo; Maria-Lourdes Palomares

PROMOTING SUSTAINABLE HUMAN SETTLEMENTS AND ECO-CITY PLANNING APPROACH: SOUTHEASTERN ANATOLIA REGION AND SOUTHEASTERN ANATOLIA PROJECT(GAP) IN TURKEY AS A CASE STUDY.

Acma Bulent, Economics, Anadolu University, Turkey.

In the recent years, there have been many opportunities flourishing through the development of Turkey. One of these is unvalued rich agricultural and hydro-sources in the Southeastern Anatolia Region. The Southeastern Anatolia Project (GAP), one of the most important projects to develop the remarkable natural resources of the world, is considered as a chance to make use of rich water and agricultural resources of the Southeastern Anatolia Region. In the recent years, the concept of promoting sustainable human settlements and eco-city planning approach have been included into the GAP Project. And by applying these concepts in real projects caused remarkable results through development of the region. The aim of this study is analyze the concepts of promoting sustainable human settlements and eco-city planning approach in the GAP Project that has been still processed. In the first section, the region of Southeastern Anatolia and the GAP Project will be introduced briefly. In the second section, the stages of GAP Project and the project existing will be analyzed. In the third section, the projects and sub-projects used for promoting sustainable human settlements will be introduced. In the last and fourth section, a series of policies and strategies for providing the process of settlements, which is optimal and harmonizes with eco-system will be given.



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