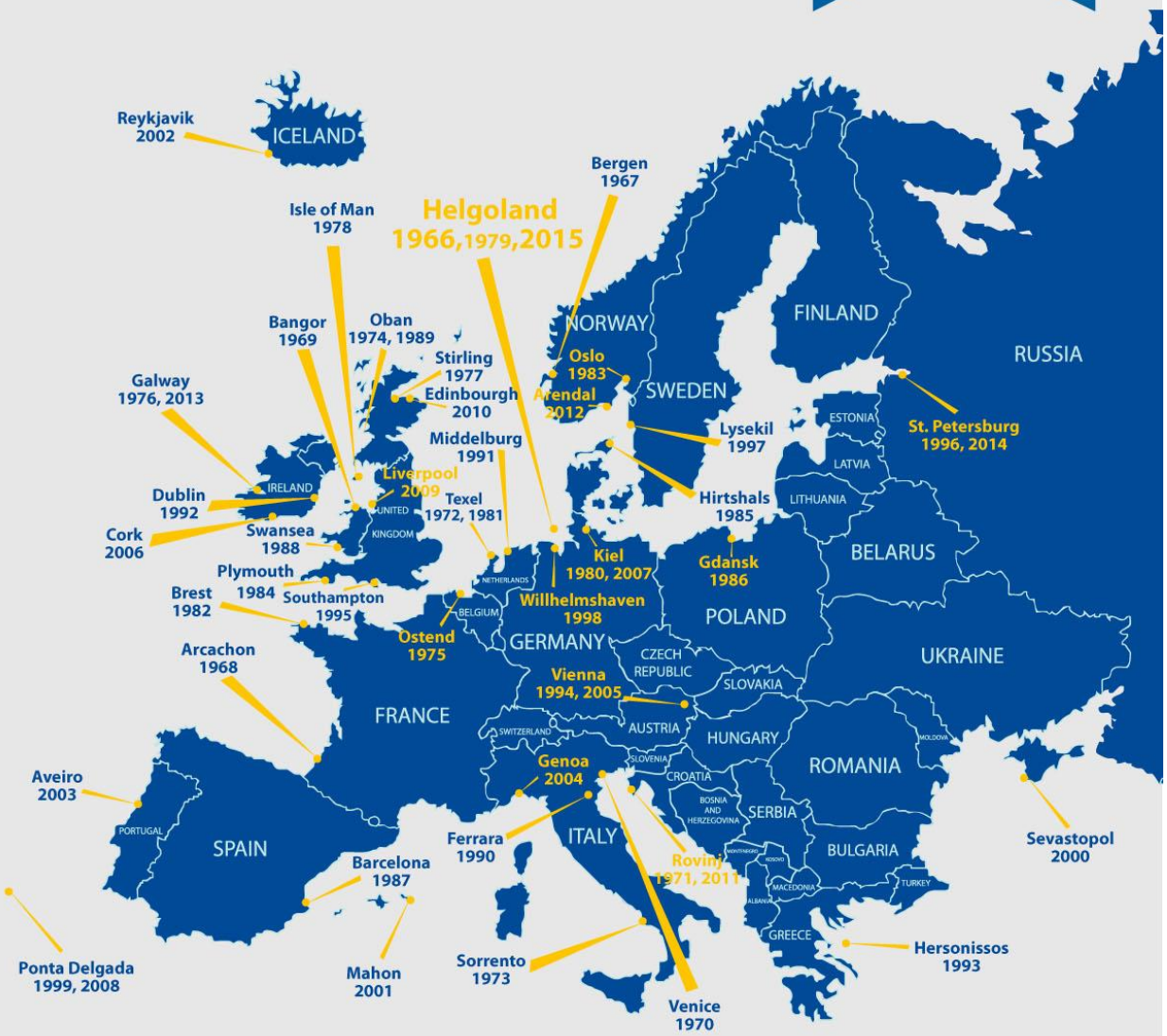
ABSTRACTS

50. HELGOLAND

EUROPEAN EMBS MARINE BIOLOGY SYMPOSIUM



September 21st - 25th 2015

50. HELGOLAND

EUROPEAN EMBS MARINE BIOLOGY SYMPOSIUM

NORDSEEHALLE 1

Monday, 21 / Sep / 2015	
11:00am	**OBS 01_1** // Drivers of ecosystem change in marine/coastal systems
02:00pm	**KEY 01** // Keynote 1
03:30pm	**OBS 01_2** // Drivers of and responses to ecosystem change in marine/coastal systems
Tuesday, 22 / Sep / 2015	
09:00am	**DM 01** // (Big) data management and vizualisation: *How to cope with the data deluge?*
11:00am	**OBS 15** // Consequnces of a less icy future: *Long-term changes in the arctic*
02:00pm	**KEY 02** // Keynote 2
03:30pm	**OBS 11_2** // Biodiversity as a response to or a driver of change
05:00pm	**POST** // Poster session 1
Wednesday, 23 / Sep / 2015	
09:00am	**OBS 01_3** // Drivers of and responses to ecosystem change in marine/coastal systems
11:00am	**KEY 03** // Keynote 3
12:00pm	**OBS 11_1** // Biodiversity as a response to or a driver of change
Thursday, 24 / Sep / 2015	
09:00am	**DM 03** // Molecular Monitoring systems: *Promises and challenges for long-term observations*
11:00am	**OBS 04** // Large-scale spatio-temporal analyses exploring climate change impacts in marine systems
02:00pm	**KEY 04** // Keynote 4
03:30pm	**SOC 04** // Protective structures of coasts and oceans
05:00pm	**POST 1** // Poster session 2
Friday, 25 / Sep / 2015	
09:00am	**OBS 06** // Fostering a better understanding of marine ecosystems through modelling approaches
11:00am	**KEY 05** // Keynote 5

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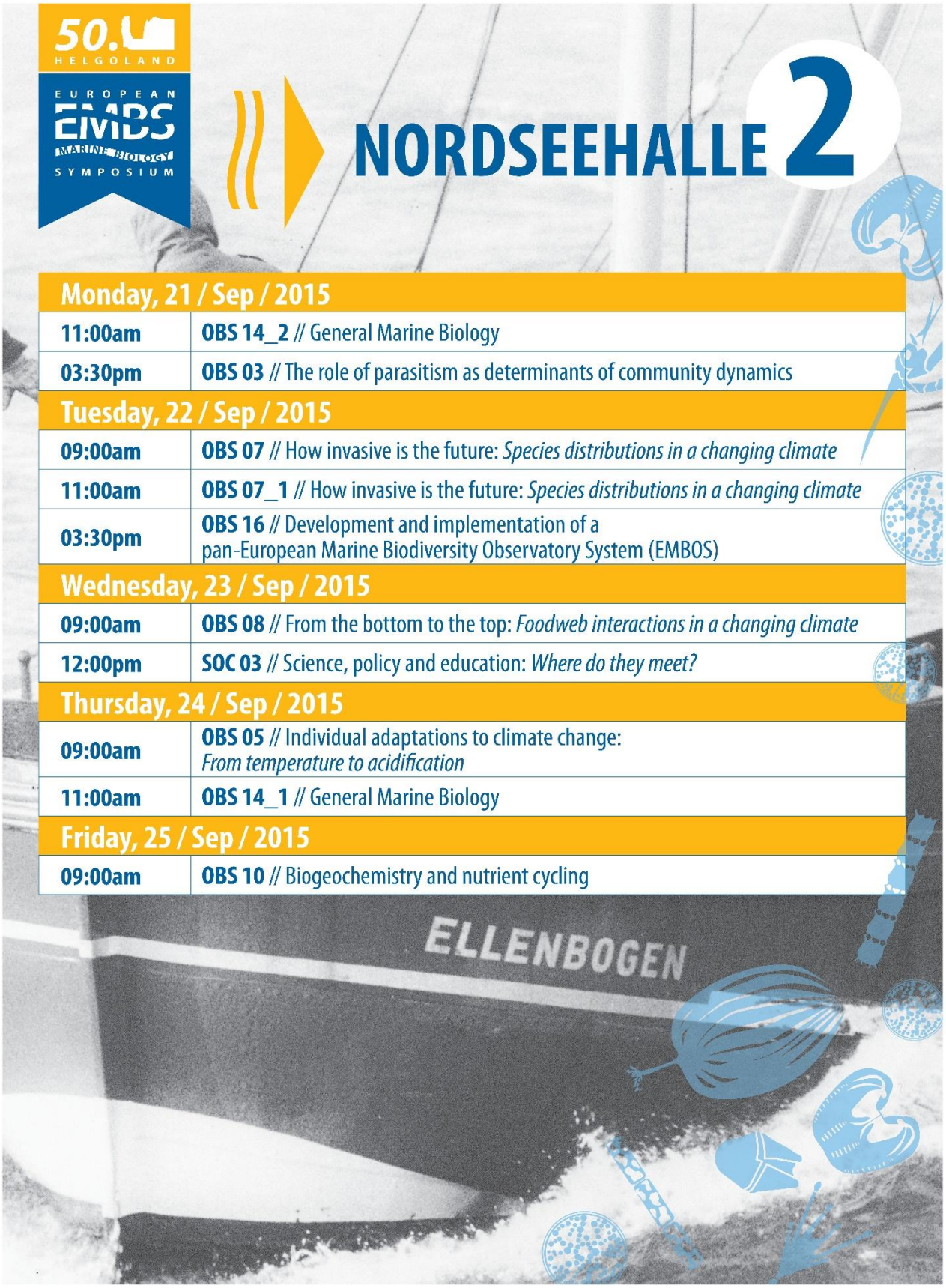
EUROPEAN EMBS MARINE BIOLOGY SYMPOSIUM

NORDSEEHALLE 2

Monday, 21 / Sep / 2015	
11:00am	**OBS 14_2** // General Marine Biology
03:30pm	**OBS 03** // The role of parasitism as determinants of community dynamics
Tuesday, 22 / Sep / 2015	
09:00am	**OBS 07** // How invasive is the future: *Species distributions in a changing climate*
11:00am	**OBS 07_1** // How invasive is the future: *Species distributions in a changing climate*
03:30pm	**OBS 16** // Development and implementation of a pan-European Marine Biodiversity Observatory System (EMBOS)
Wednesday, 23 / Sep / 2015	
09:00am	**OBS 08** // From the bottom to the top: *Foodweb interactions in a changing climate*
12:00pm	**SOC 03** // Science, policy and education: *Where do they meet?*
Thursday, 24 / Sep / 2015	
09:00am	**OBS 05** // Individual adaptations to climate change: *From temperature to acidification*
11:00am	**OBS 14_1** // General Marine Biology
Friday, 25 / Sep / 2015	
09:00am	**OBS 10** // Biogeochemistry and nutrient cycling



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50th European Marine Biology Symposium

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11:00am - 12:30pm Nordseehalle 1	OBS01_1: Drivers of ecosystem change in marine/coastal systems
11:00am - 12:30pm Nordseehalle 2	OBS14_2: General Marine Biology
12:30pm - 2:00pm self-catered	LU01: Lunch
2:00pm - 3:00pm Nordseehalle 1	KEY01: Keynote 1
3:00pm - 3:30pm Nordseehalle_foyer	COF02: Coffee break
3:30pm - 5:00pm Nordseehalle 1	OBS01_2: Drivers of and responses to ecosystem change in marine/coastal systems
3:30pm - 5:00pm Nordseehalle 2	OBS03: The role of parasitism as determinants of community dynamics

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Date: Wednesday, 23/Sep/2015

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2:00pm - 9:00pm various	EXC: Excursions (a separate schedule will be provided)

Date: Thursday, 24/Sep/2015

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9:00am - 10:30am Nordseehalle 2	OBS05: Individual adaptations to climate change: From temperature to acidification
10:30am - 11:00am Nordseehalle_foyer	COF06: Coffee break
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3:00pm - 3:30pm Nordseehalle_foyer	COF07: Coffee break
3:30pm - 5:00pm Nordseehalle 1	SOC04: Protective structures of coasts and oceans
5:00pm - 6:30pm Nordseehalle_foyer	POST1: Poster session 2

Date: Friday, 25/Sep/2015

9:00am - 10:30am Nordseehalle 1	OBS06: Fostering a better understanding of marine ecosystems through modelling approaches
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12:00pm - 12:30pm	Closure: Awards presentation and closing remarks

Opening session — Monday September 21st 9 am

Monday, 21/Sep/2015, 09:30am - 10:30pm *Location:* **Nordseehalle 1**

9:30 am Opening addresses

09:30 – 09:40 **Prof Karin Lochte:** Welcome Address by the Director of the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research

09:40 – 09:50 **Prof Karen H. Wiltshire** Welcome Address by the Vice Director of the Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research and director of the Biologische Anstalt Helgoland

09:50 – 10:00 **Mr Jörg Singer** Welcome Address by the mayor of Helgoland

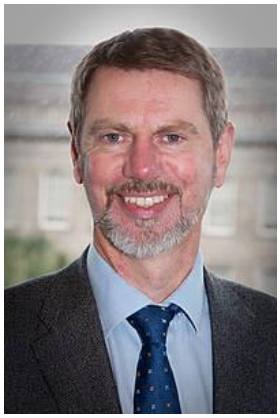
10:00 – 10:30 **Prof Victor Smetacek:** Obituary for **Prof Otto Kinne**

KEYNOTE LECTURES

Monday September 21st, Nordseehalle 1, 14:00

Prof Poul Holm - Trinity College Dublin

Integrated approaches to ocean management - a view from human and social sciences

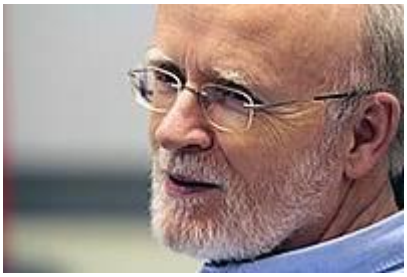


The Oceans Past Platform aims to measure and understand the significance and value to European societies of living marine resource extraction and production to help shape the future of coasts and oceans. The Integrative Platform will lower the barriers between human, social and natural sciences; multiply the learning capacity of research environments; and enable knowledge transfer and co-production among researchers and other societal actors, specifically by integrating historical findings of scale and intensity of resource use into management and policy frameworks.

Tuesday September 22nd, Nordseehalle 1, 14:00

Prof Hans-Otto Pörtner Alfred-Wegener Intsitute

Impacts of climate change on ocean biology: physiological underpinnings, projections and uncertainty



Understanding thermal ranges and limitations of organisms becomes important in light of climate change and observed effects on ecosystems as reported by the IPCC (Pörtner et al., 2014). This understanding also supports efforts to project climate-induced shifts in the distribution and productivity of marine species. For animals, the integrative concept of oxygen and capacity limited thermal tolerance (OCLTT) has successfully characterized the earliest thermal limits to performance and the consequences of such limits at ecosystem level. Steady state temperature dependent performance profiles trace the thermal window and indicate a key role for aerobic metabolism and energy budget in shaping the temperature dependence of steady state performances, from growth to exercise and reproduction. Recent modeling efforts (Deutsch et al., 2015) illustrate how routine energy demand characterizes the limits of the realized niche and defines how much excess energy animals need to invest to sustain a living and biotic interactions. Acid-base disturbances and reduced oxygen supply may link temperature effects to CO2- or hypoxia-induced constraints and thereby integrate the effects of the key climate drivers. Accordingly, temperature-induced constraints in the capacity of oxygen supply systems and in demand define animal limits. Evolutionary adaptation is presently unable to keep animals in place; they rather follow the moving isotherms. If unsuccessful to do this and remain at the same temperatures, they undergo a reduction in the maximum body sizes of species. Assessments across climate zones require consideration of how OCLTT principles were modulated on evolutionary timescales, e.g. in permanently cold polar waters. The role of physiological processes in reducing uncertainty about projected impacts will be discussed.

September 23rd, Nordseehalle 1, 11:00

Dr Alessandra Conversi CNR - ISMAR - La Spezia

Marine regime shifts around the world: non-linear responses to increasing challenges

Regime shifts, or phase shifts, or critical transitions, are abrupt changes in ecosystems structure and functioning. They have been found in all environments (terrestrial, lacustrine, marine). In the marine realm they have been reported worldwide and in multiple habitats, from benthic reefs to pelagic ecosystems. This field of study is rapidly expanding, as these phenomena interest scientists and managers alike. These shifts can in fact carry significant socio-economical impacts and losses of ecosystem services, for example when they involve fisheries collapses or coral reef degradations. Regime shifts can be explained with theory on nonlinear systems crossing critical thresholds. In this Anthropocene Era, marine habitats are increasingly affected by multiple, multi-scale stressors, from large scale global change and regional fishing, to local pollution. With marine (pelagic) populations generally moving northward, it is likely that we will experience more frequent and encompassing regime shifts. The questions, still open, are whether we can predict them, reverse them and at what cost, or how can we better adjust to them. While regime shift theory is well developed, there is still no common understanding on drivers and mechanisms of abrupt changes in real marine ecosystems. Global studies however find interesting analogies and patterns around the world and provide a larger scale point of view. They suggest that regime shifts should be approached through multi-scale investigations, maintaining a holistic view that considers time-delayed synergies of multiple exogenous stressors eroding the resilience of the ecosystem. Marine management approaches should incorporate knowledge on environmental thresholds and develop tools that consider regime shift dynamics and characteristics.

Thursday September 24th, Nordseehalle1, 14:00

Prof Angela Wulff - University of Gothenburg

Benthic microalgae - a hidden jewel box

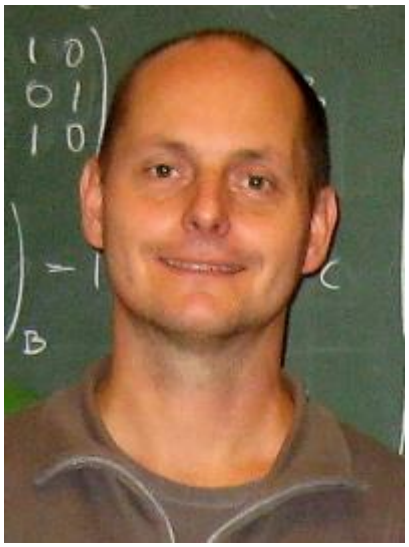
Shallow-water sediments are widely distributed around the world but despite the fact that they are recognised as important feeding and nursery grounds for fish and fish prey, much less is known about the microbenthic communities inhabiting these sediments than, for example, planktonic communities. The autotrophic component of the microbenthic community (the microphytobenthos) consist of unicellular algae living in or on the sediment. The microphytobenthos is usually dominated by diatoms and cyanobacteria. The photosynthetically active part of the microalgal assemblage is concentrated in a thin photic zone (a few millimeters thick), forming a highly active biofim at the sediment/water interface, and thereby influencing the exchange of both dissolved and particulate matter between the sediment and the water column. In shallow-water areas lacking macroalgal vegetation, sediment-associated microalgae can contribute significantly to the primary productivity. Benthic diatoms also reduce sediment erosion through their motility-mediated production of extracellular polymeric substances (EPS). Global climate change is currently a major

concern. For the marine environment, different scenarios have been proposed including increased temperature and increased levels of CO2 (with consequent acidification) and in polar areas also decreased salinity. Secondary effects include e.g. decreased radiation due to increased sedimentation (polar areas) but also increased radiation caused by more pronounced water stratification and further reduction of the stratospheric ozone layer. Thus, the possible effects on microphytobenthic communities are indeed complex. Do benthic microalgae have the capacity to face challenges of climate change? Results from both temperate and polar areas indicate that on a community level they are indeed tolerant to large fluctuations in the environment but species-specific effects are apparent.

Friday September 25th, Nordseehalle 1, 11:00

Prof Bernd Blasius ICBM Oldenburg

The risk of marine bioinvasion by global shipping



Transportation networks play a crucial role in human mobility, the exchange of goods, and the spread of invasive species. With 90% of world trade carried by sea, global shipping provides one of the most important modes of transportation. Shipping also constitutes the world largest transportation vector for marine bioinvasion, transferring accidentally numerous species around the world. Here, we use AIS databases to reconstruct the network of shipping connections between ports worldwide. Coupling the shipping network with port environmental conditions and biogeography, we develop a model for marine bioinvasion by world-wide ballast water exchange. The model allows to identify high risk invasion routes, hot spots of bioinvasion, and major source regions from which bioinvasion is likely to occur, and it can be used to classify coastal ecoregions with respect to total invasion risk and risk composition from other regions. Our model predictions agree with observations in the field and reveal a pattern of maximal invasion risk at intermediate geographic distances. We apply the model to investigate strategies for risk reduction by ballast water treatment. Finally, we project changes in worldwide shipping intensity due to the predicted opening of Arctic sea passages.

OBS01_1: Drivers of ecosystem change in marine/coastal systems

Monday, 21/Sep/2015, 11:00am - 12:30pm *Location:* **Nordseehalle 1**

LONG-TERM CLIMATE-INDUCED SHIFTS IN COMPOSITION OF EPIBENTHIC AND DEMERSAL FISH SPECIES IN THE JADE

Julia Meyer, Ingrid Kröncke, Ulrike Schückel
Senckenberg am Meer, Germany; julia.meyer@senckenberg.de

During the last decades, drastic changes in species distribution and composition occurred in the entire North Sea ecosystem including pelagic, benthic and fish communities caused by climatic changes such as species distributions shifts through increasing temperatures. Aim of this long-term study was to analyze the long-term variability of the epibenthic and demersal fish species in relation to climate-driven environmental changes in the nearshore tidal bay system of the Jade.

Epifauna and demersal fish sampling took place quarterly from 1972 to 2014 by using a 2m – beam trawl at different stations located in the Jade (German Wadden Sea/southern North Sea). The analysis focused on thesecond and third quarter data of one station located in the central part of the Jade, representing the overall trend of all stations.

Mann-Kendall analyses revealed significant increasing trends in total abundance and species number from 1972 to 2014, with shifts in abundance in 1989 and 1993 and in species number in 1988 and 2002 for the second and third quarter. Abundances of *Carcinus maenas, Liocarcinus holsatus, Osmerus eperlanus*, *Pomatoschistus spp*. and especially warm-temperate species like *Solea solea* or *Syngnathus spp*., showed significant increasing trends since the late 1980s, while cold-temperate species like *Gadus morhua* and *Limanda limanda* showed significant decreasing trends. It thus appears that climate driven increase in water temperature has influenced the long-term variability of total species number, abundance and distribution patterns of epibenthic and demersal fish species even in the Jade, resulting in community shifts in the late 1980s and early 2000s.

CROSS-BOUNDARY SUBSIDIES OF MACROPHYTE DETRITUS INFLUENCE SOFT SEDIMENT ECOSYSTEM FUNCTION

Rebecca Vivian Gladstone-Gallagher[1], Conrad A. Pilditch[1], Carolyn J. Lundquist[2], Andrew M. Lohrer[2], Ian Hogg[1]
[1]University of Waikato, Hamilton, New Zealand; [2]National Institute of Water and Atmospheric Research Ltd. (NIWA), Hamilton, New Zealand; rgladstonegallagher@gmail.com

Ecosystems are often connected by the transfer of organic material across their boundaries. In temperate estuaries, marine macrophytes produce substantial quantities of organic detritus that can be transported from growing sites by the tides to unvegetated soft sediment habitats. Anthropogenic changes in catchment land use are modifying the distributions of coastal marine vegetation and possibly the detrital subsidy they provide to soft sediments. To assess the role of macrophyte detritus in structuring soft sediment habitats, we added three detrital sources with differing decay rates (seagrass, mangrove and macroalgae litter) to plots (2 m^2), then monitored the effects on ecosystem function and structure. Benthic chambers were deployed 4, 17, and 46 days post- addition of 220 g m^{-2} of detritus to measure nutrient fluxes and benthic primary production, and on these dates we also assessed macrofaunal community structure and sediment properties. Initial results indicate that benthic ecosystem function (nutrient regeneration and primary production) of the sediments was stimulated by the detritus, and that detrital quality and decay rate controls the magnitude of the response. Our results highlight the importance of macrophyte detritus as a cross-boundary subsidy to benthic ecosystems, as well as the need to consider the connectivity among temperate estuarine habitats to maintain ecosystem function.

IMPROVING WAYS TO RESOLVE THE CONTRIBUTION OF BENTHIC BIODIVERSITY TO ECOSYSTEM FUNCTIONING

Alf Norkko[1], Anna Villnäs[1], Judi Hewitt[2], Simon Thrush[3], Paul Snelgrove[4], Johanna Gammal[1], Camilla Gustafsson[1], Guillaume Bernard[1], Joanna Norkko[1]
[1]Tvärminne Zoological Station, University of Helsinki, Finland; [2]National Institute of Water and Atmospheric Research, Hamilton, New Zealand; [3]Institute of Marine Science, University of Auckland, New Zealand; [4]Department of Ocean Sciences and Biology Department, Memorial University of Newfoundland, Canada; alf.norkko@helsinki.fi

The accelerating losses of biodiversity highlight the urgent need to improve our understanding of biodiversity-ecosystem function relationships. Soft-sediment habitats are important in the global cycles of elements and energy and the benthic fauna play pivotal roles in affecting benthic-pelagic coupling and sediment biogeochemistry. Nevertheless, our real-world understanding remains scarce. The majority of studies of the relationship between benthic fauna (usually species diversity) and ecosystem function have been conducted either in the laboratory or at only one or a few field sites, encompassing only a limited range of environmental variability. We advocate for the urgent need to expand the spatial and temporal extent of studies to include larger ranges of environmental variables and stressors. Through examples from a number of field surveys, manipulative field experiments and mechanistic lab experiments, we emphasize the importance of exploring the contribution of biodiversity, with emphasis on species identities, functional traits and dominance patterns, across gradients of disturbance and in different types of heterogeneous habitats. Indeed, exploring changes in natural communities across environmental disturbance gradients may yield significant insights into how species and their relative dominance may affect ecosystem functioning (e.g. nutrient cycling). Of central importance is to resolve the context-dependency of biodiversity ecosystem-functioning relationships to meet the demands of management and conservation.

ALIEN TURF: THE PROFOUND TRANSFORMATION OF EASTERN MEDITERRANEAN REEFS

Gil Rilov[1], Ohad Peleg[1,2], Dar Golomb[1], Tamar Guy-Haim[1,2], Erez Yeruham[1,2], Gideon Levy[1], Ofrat Rave[1,2]

[1]National Institute of Oceanography, Israel Oceanographic and Limnological Research, Israel; [2]Leon H. Charney School of Marine Sciences, University of Haifa; rilovg@ocean.org.il

The eastern Mediterranean is perhaps one of the most changed marine regions globally. It is simultaneously exposed to extensive ocean warming, massive bioinvasions—mostly of thermophilic alien species—and overfishing, acting together to transform ecosystems. Until recently, quantitative data of reef communities in the southeastern Mediterranean (the Levant), that would enable following these impacts, have been extremely rare. Extensive ecological surveys and monitoring of both intertidal and subtidal reefs between 2009-2015, including also a marine reserve, and accompanied by experimental studies in the field and in the lab (microcosms and mesocosms testing performance ranges and sensitivity to warming and acidification) reveal several highly-disturbing patterns. These include (1) near extinction of several highly important species (ecosystem engineer, predator, herbivores) and potentially many more, (2) complete domination of non-indigenous species in several important groups such as molluscs, (3) rarity of brown algae (canopy-forming) meadows and instead the domination of turf barrens (overgrazed by alien fish) and meadows of alien macroalgae, (4) reefs almost empty of large predators due to overfishing, (5) high sensitivity of native species to ocean warming and acidification, evident by a greatly-reduced physiological activity of several still-abundant native species when exposed to peak and future summer temperatures. The ecological implications of the ecosystem phase shift (caused by species collapses and invasions), including their effects on ecosystem functions, must be profound and are now under study. We expect that with additional warming, species collapses and invasions will advance westward and impact the rest of the Mediterranean—and potentially its ecosystem functions and services.

DETECTING TRENDS IN COMPLEX DATA SETS – APPLICATION OF INLA ON PHYTOPLANKTON BIODIVERSITY MONITORING

Alexa Sarina Jung[1], Henk W. Van der Veer[1], Roland Bijkerk[2], Peter M. J. Herman[3], Alain Peperzak[1], LouisF. Zuur[4]

[1]NIOZ Texel, The Netherlands; [2]Koeman en Bijkerk, Postbus 111, 9750 AC Haren, The Netherlands; [3]NIOZ Yerseke, The Netherlands; [3]Highland Statistics Ltd., United Kingdom [4]; sarina.jung@nioz.nl

Phytoplankton species composition in coastal zones is tightly linked to variability of water quality, biogeochemical processes including ocean–atmosphere CO_2 exchange, and production at higher trophic levels including living marine resources. Biological monitoring programmes have been set-up worldwide to detect changes in biodiversity of phytoplankton as indices for ecosystem functioning and foodweb relationships within coastal systems. The statistical analysis of these data is complicated, however, for several reasons including irregular sampling in space, seasonal heterogeneity and the presence of spatiotemporal correlation structures. During the last decades, new statistical methods have developed for social and medical sciences to deal with such structures, including Bayesian models with an integrated nested Laplace approximation (INLA). Within the framework of the Dutch national monitoring programme MWTL (Monitoring van de Waterstaatkundige Toestand des Lands), phytoplankton has been consistently sampled and analysed on a regular base since 2000 in the Dutch Wadden Sea and the adjacent coastal zone of the North Sea. We will present the results of an INLA analyses for whether there are trends visible in the phytoplankton community, and if any, what trend, and whether there is a relationship with environmental variables (nutrients, salinity, temperature).

OBS14_2: General Marine Biology

Monday, 21/Sep/2015, 11:00am - 12:30pm *Location:* **Nordseehalle 2**

SUBTIDAL EPIBENTHIC MEGAFAUNA IN RÍA DE VIGO (NW IBERIAN PENINSULA)

Fernando Aneiros[1,2], Marcos Rubal[2,3,4], Rafael Bañón[5], Jesús S. Troncoso[1,2]

[1]ECIMAT, Marine Sciences Station of Toralla; University of Vigo; Spain; [2]Department of Ecology and Animal Biology; Faculty of Marine Sciences; University of Vigo; Spain;[3]CIIMAR/CIMAR, Centro Interdisciplinar de Investigação Marinha e Ambiental; University of Porto; Portugal; [4]Department of Biology; Faculty of Sciences; University of Porto; Portugal;[5]Servizo de Planificación; Dirección Xeral de Desenvolvemento Pesqueiro; Consellería do Mar e Medio Rural; Xunta de Galicia; Spain; f.aneiros@uvigo.es

Ría de Vigo is a semi-enclosed bay under the influence of coastal upwelling and downwelling. During upwelling events, nutrient-rich water enters the Ría enhancing its productivity. This area is heavily populated and affected by numerous human activities, which lead to sediment modification. Epibenthic megafauna in the non-estuarine zones of this bay has been studied. 75 sites all around the area were sampled by means of a towing dredge. Megafauna was identified to the lowest taxonomic level possible, counted and weighted. Total abundance and biomass were calculated, as well as the contribution of the main taxonomic groups. Univariate variables of the assemblages were also calculated. Multivariate analyses were carried out to check the differences between the inner and outer parts of the studied area.

113 different taxa were identified, taxa richness in a single tow varied between 1 and 29 taxa, while abundance ranged from 2 to 7532 individuals and biomass from 30g to 64kg. Suspension-feeding molluscs dominated the innermost part of the studied area, and were substituted by echinoderms towards the external zones. This spatial pattern was also reflected in the results of the multivariate analyses. Previous studies of macrobenthic infauna in this area had already spotted such longitudinal pattern, although the nature of the changes observed from inner to outer parts in those studies was different. Environmental variables and anthropogenic pressures that may be causing this spatial distribution are discussed.

ZOOBENTHOS HOT-SPOT NEAR HELGOLAND: RESULTS FROM LONG-TERM MONITORING UNDER EUROPEAN QUIDELINES

Ralph Kuhlenkamp[1], Kind Britta[1], Karez Rolf[2]

[1]PHYCOMARIN, Germany; [2]State Agency for Agriculture, Environment and Rural Areas; ralph.kuhlenkamp@phycomarin.de

Long-term monitoring for the European Water Frame Work Directive was initiated in 2008 at a deep trench southwest of Helgoland (Tiefe Rinne) which is characterized as a shell gravel habitat interspersed with sand and mud sediments. It was always known to be a species-rich region compared to the otherwise shallow German Bight with its soft sediments. Investigations of dredge samples revealed nearly 350 sessile and motile invertebrate species including cryptogenic, neobiotic and very rare species. Due to the employed taxonomic expertise, species richness has increased significantly from year to year and is actually much higher than in historic accounts. Some taxa showed an exceptionally high diversity, like the top-ranking Bryozoa with about 75 species. There are suggestions to consider the trench as a refugium for rare species and those which need more constant conditions of temperature and salinity than provided by the surrounding shallow areas of the North Sea. As a species rich and rare biotope it is already protected by national legislation and could serve as module to assess ecosystem status under the new Marine Strategy Framework Directive.

An introduction to the LifeWatch ESFRI programme

Christos Arvanitidis

HCMR, Greece; arvanitidis@hcmr.gr

This presentation will give a brief introduction to some of the features and capabilities of LIFEWATCH an e-science and technology infrastructure for biodiversity and ecosystem research to support the scientific community and other users. It is putting in place the infrastructure and information systems necessary to provide an analytical platform for the modelling and simulation of both existing and new data on biodiversity to enhance the knowledge of biodiversity functioning and management.

ROLE OF MACROFAUNA FOR HABITAT-SPECIFIC SEDIMENT STABILITY IN COASTAL ENVIRONMENTS

Mari Joensuu[1,2], Conrad Pilditch[3], Alf Norkko[2]

[1]University of Helsinki, Finland; [2]Tvärminne Zoological Station, University of Helsinki, Finland; [3]University of Waikato, New Zealand; mari.joensuu@helsinki.fi

Sediment resuspension due to waves and currents are common in shallow coastal environments, but remain poorly quantified. Resuspension occurs when critical shear stress is exceeded at the seafloor and sediment particles are resuspended into the near-bottom water. Concurrently nutrients are released from pore-water to the water column and become available to primary producers. Biogeochemical and biological features of the sediment play a key role in modifying sediment erodibility. Benthic macrofauna modify the sedimentary environment, for example, through feeding and bioturbation. The effect of macrofauna on sediment stability might differ, depending on the animal size, species or population density. Microbiolally produced extracellular polymeric substances and biogeneic structure such as macrophyte roots and rhizomes may also play a significant role in sediment stability. We measured critical bed shear stresses across 18 locations in the Hanko archipelago encompassing sediment types from mud to sand to determine the main phyiscal and biological factors influencing sediment stability. Critical bed shear stress was determined using a core-based erosion device (EROMES). After erosion measurements macrofauna and the roots and rhizomes of macrophytes were quantified and analysed together with sediment characteristics. The results of the study highlight the importance of accounting for habitat-specific resuspension in coastal environments.

INTERACTIONS BETWEEN POPULATION DYNAMICS OF LANICE CONCHILEGA AND SEDIMENT CONSOLIDATION.

Renata Mamede da Silva Alves[1], Carl van Colen[1], Magda Vincx[1], Jan Vanaverbeke[1], Bart De Smet[1], Jean-Marc Guarini[2], Tjeerd J Bouma[3]

[1]Marine Biology Section, Ghent University. Krijgslaan 281/S8, 9000 Ghent, Belgium.; [2]Observatory Oceanographic of Banyuls s/Mer, University Paris VI. Quai Racovizta, 66650 Banyuls-sur-mer, France.; [3]Spatial Ecology Workgroup, Royal Netherlands Institute for Sea Research. Korriganweg 7, 4401 Yerseke, Netherlands.;RenataMamedeSilva.Alves@UGent.be

The tube-worm *Lanice conchilega* is an ecosystem engineer that builds biogenic reefs. We investigated the reciprocal interactions between these structures and the surrounding sediment, specifically (1) assessing the impact of local population density on sediment consolidation, (2) searching for evidence of spatial dependence in population dynamics, and (3) investigating the effect of sedimentation on population mortality. Sediment consolidation was quantified and compared for high and low density reefs, and bare sand. Population dynamics within reefs was assessed by quantifying spatially explicit mortality patterns during a three weeks *in-situ* study. The effects of sedimentation on mortality were investigated by exposing cores containing on average 10ind·core^{-1} in laboratory to a single sedimentation event ranging between 0 and 12cm in height, and measuring survival after one week. We found that populated reefs regardless of density, did not affect sediment consolidation. The highest mortality rates were recorded at the centre of the reefs compared to the edges. In the laboratory, sediment deposition triggered an increase in tube-building activity while mortality fluctuated around 64%. Results contrast with previous works on both sediment consolidation and mechanistic schemes for reef accretion. The presence of *L. conchilega* had little effect on sediment consolidation, suggesting that these dynamics may differ between the present wave-dominated and the previously studied flow-dominated environments. The observed increase in mortality may generate instabilities at the centre of the reefs, which is inconsistent with the accepted mechanistic explanation for reef growth even if polychaetes have the capacity to increase their tube-length in reaction to deposition.

Long-term observation of shell disease in brown shrimp (Crangon crangon) in the North Sea

Alexandra Segelken-Voigt[1], Thomas Lang[2], Gabriele Gerlach[1]

[1]Carl von Ossietzky University Oldenburg; [2]Thünen-Institute of Fisheries Ecology; alexandra.segelken.voigt@uni-oldenburg.de

Shell disease is an increasing problem affecting various freshwater and marine crustaceans all over the world. It is caused by bacteria which settle on the shell of their host, resulting in black erosive lesions in the cuticle of the exoskeleton. Shell disease is also common in the brown shrimp *Crangon crangon* (Linnaeus, 1758), which is abundant around the coasts of Northern Europe, and is commercially fished there. As *C. crangon* is of widespread commercial and ecological significance, it is important to understand this disease and its characteristics.

Therefore, the abundance and occurrence of shell disease in brown shrimp has been investigated with varying spatial and temporal coverage of the North Sea from the 1980´s to 2014. Lesions on each shrimp were analyzed with respect to sex and size of the organisms and subsequently correlated to locality and year.

Clear differences were detected between locations and years. The highest prevalence of shell disease was found at the beginning of the 1980´s near the estuary mouths of Elbe. In that area the correlation of shell disease and different environmental parameters showed that the prevalence of this bacterial disease correlates with the water temperature as well as the occurrence of a few ecologically harmful substances.

Additionally, disease incidence fluctuates throughout the year with minima in May and June and maxima during winter months. Furthermore, female shrimps were more likely to be affected by shell disease than males.

OBS01_2: Drivers of and responses to ecosystem change in marine/coastal systems

Monday, 21/Sep/2015, 3:30pm - 5:00pm *Location:* **Nordseehalle 1**

EFFECTS OF KELP HARVESTING AT THE COAST OF NORWAY

Frithjof Emil Moy, Henning Steen, Torjan Bodvin
Institute of Marine Research, Norway; moy@imr.no

Laminaria hyperborea kelp forests are highly productive and species rich coastal ecosystems that serve as nursery grounds for a variety of fish and crustaceans. Approximately 150.000-170.000 tonnes are harvested by trawl along the Norwegian coast each year for production of alginate and this may have ecological implications. The Institute of Marine Research have monitored the kelp vegetation and associated organisms including fish and crustaceans before and after kelp harvesting in mid-Norway (counties of Nord-Trondelag and Nordland), that is in areas that were heavily grazed by sea urchins until 15 years ago.

The kelp rapidly re-monopolizes the substratum after harvesting, but still after four years the plant sizes and epiphyte communities have not reached pre-harvesting levels. Age structure of plants collected from harvested areas, suggests that the new kelp generation mainly is recruited from juveniles already present in the understory vegetation prior to harvesting. Densities of sea urchins were generally low and grazing on recovering kelp plants appeared negligible. Tentative results showed no effects on the abundances of crabs. But reduced abundance of juvenile gadoids and increased abundance of wrasse apparently indicates opposite effects of kelp harvesting on these two groups of fish. However, our knowledge on the effects of kelp harvesting on fish and other organisms is still limited and will be supplemented by future studies.

THE IMPACT OF EXTREME STORM EVENTS ON RESILIENCE OF INTERTIDAL *FUCUS SERRATUS* COMMUNITIES

Inka Bartsch[1], Luis Gimenez Noya[2], Ralph Kuhlenkamp[3], Schubert Philipp[5], Lars Gutow[1], Rolf Karez[4]
[1]AWI Helmholtz Center for Polar and Marine Research, Bremerhaven, Germany; [2]School of Ocean Sciences, Bangor, United Kingdom; [3]PHYCOMARIN, Hamburg, Germany; [4]State Agency for Agriculture, Environment and Rural Areas, Flintbek, Germany; [5]GEOMAR Helmholtz-Center for Ocean Research, Kiel, Germany; inka.bartsch@awi.de

Intertidal serrated wrack *Fucus serratus* is common throughout the temperate N-Atlantic and plays an important role as a bioengineering species structuring lower intertidal communities. Several studies have addressed the impact of *Fucus* cover and its disturbance on species richness, diversity and succession of associated species in manipulative experiments. However, natural catastrophic eventshave scarcely been followed on a spatial mesoscale. We analyzed a 10-yrs time series on 140 permanent geo-referenced plots in the intertidal zone at the island of Helgoland (North Sea) covering an area of approx. 100 x 100 m. Samples were taken biannually in winter and summer. We describe the general intra- and interannual dynamics of *F. serratus* coverage and associated seaweed and mollusk species. The spatio-temporal extent and percentage coverage of *F. serratus* displayed a regular intra-annual pattern with lower coverage in winter than in summer whereas the spatial extent of the zone remained stable over many years. In winter 2006/2007 there was considerable loss of cover (from 100% to ≤30%), probably caused by several successive strong autumn and winter storms. Recovery of the *F. serratus* population required three vegetation periods. We will present data on the temporal co-variation of associated seaweed and mollusk species richness, evenness and diversity before and after the disturbance and discuss differences between investigations at different spatial scales.

EFFECTS OF NANOZOSTERA NOLTII ON INTERTIDAL MACROZOOBENTHIC ASSEMBLAGES IN THE VENICE LAGOON

Davide Tagliapietra[1], Michele Cornello[2], Giuseppe Pessa[3], Andreina Zitelli[4], Paolo Magni[5]
[1]Consiglio Nazionale delle Ricerche – Istituto di Scienze Marine, Venice, Italy; [2]Istituto Superiore per la Protezione e la Ricerca Ambientale, Chioggia, Italy; [3]Via Pio X 5, 30025 Fossalta di Portogruaro, Italy; [4]University IUAV of Venice, Venice 30123, Italy; [5]Consiglio Nazionale delle Ricerche – Istituto per l'Ambiente Marino Costiero, Oristano, Italy; paolo.magni@cnr.it

Along the European coast, most studies on macrozoobenthic assemblages have been conducted on *Zostera marina* or *Posidonia oceanica* seagrass beds in the subtidal. By contrast, studies on the effect of seagrass beds on intertidal macrozoobenthos are relatively scant. In the present work, we determined the spatial variation and temporal patterns in intertidal macrozoobenthic assemblages associated with meadows of *Nanozostera noltii* (Hornemman) Tomlinson et Posluzny, (2001), and different types of bare sediments within and outside the seagrass beds. Two intertidal areas, few hundred meters apart, were selected in the northern sub-basin of the Venice lagoon. Three stations ranging in the degree of vegetation cover in area 'A' and two unvegetated stations in area 'R' were sampled nine times at regular intervals from March 1996 to March 1997. Results showed that the most structured and taxa-rich macrozoobenthic assemblage occurred at the station in area 'A' covered by a continuous stand of *N. noltii*. During the study period, the macrozoobenthic assemblages tended to show a cyclical pattern, with fluctuations increasingly larger moving away from the seagrass beds. *N. noltii* beds thus appeared to be a very stable environment, probably playing a role as a reserve and protection area for intertidal assemblages especially in summer. Such a role of *N. noltii* beds, within this particular environmental context, can be attributed to both the shading effect of seagrass meadows, protecting from high (up to 35°C) temperatures during the warm season, and a better oxygenation of the water and sediments in the presence of the seagrass.

RESISTANCE AND RESILIENCE OF BENTHIC INTERTIDAL COMMUNITIES TO MULTIPLE DISTURBANCES AND STRESSES

Mathieu Cusson, Stéphanie Cimon, Laetitia Joseph
Université du Québec à Chicoutimi, Canada; mathieu.cusson@uqac.ca

Many ecosystems are facing environmental changes and anthropogenic pressures that may affect both structure and/or functions of communities. Understanding the response of communities facing multiple disturbances is necessary for the evaluation of their resistance and resilience. Species structure and productivity of a rocky intertidal subarctic community dominated by a macroalgae canopy (*Fucus* spp.) were followed during 15 months under different disturbance treatments. Orthogonal factorial experiments with three press-disturbances were applied (in 0.25 m^2 plots): enrichment (slow nutrient diffusion), grazer reduction and canopy removal. Main and interactive effects of the three disturbances were evaluated for species structure (% cover and biomass) and productivity. Results show that the community without canopy had low resistance and resilience with low impact from nutrient addition and a reduced grazing pressure on community properties. The canopy removal induced strong changes in structure and function with noticeable change in dominance among grazers. When the three disturbances were added synergetic effects were observed. The inclusion of multiple disturbances in field experiments will help gaining better understanding of mechanisms that maintain or shape community structure and their function following disturbances.

REGIME SHIFTS IN NORWEGIAN KELP FORESTS

Kjell Magnus Norderhaug[1,2], Camilla With Fagerli[1], Guri Sogn Andersen[3], Hartvig Christie[1], Frithjof Moy[4], Hege Gundersen[1], Trine Bekkby[1,5], Eli Rinde[1], Stein Fredriksen[2], Morten Foldager Pedersen[6], Karsten Dahl[7]
[1]NIVA, Norway; [2]University of Oslo, Dept of Biosciences, Norway; [3]Norconsult, Norway; [4]IMR, Norway; [5]University of Oslo, Natural History Museum, Norway; [6]Roskilde University, Denmark; [7]University of Aarhus, Denmark; kmn@niva.no

Kelp forests along the Norwegian coast are greatly affected by climate change. Regime shifts between Alternative Stable States (ASS) are being observed from the Skagerrak in the south to the Barents Sea in the north. *Saccharina latissima* forests are reduced by 80 and 40%, on the Skagerrak and North Sea coast, respectively. In Northern Norway, sea urchin*Strongylocentrotus droebachiensis* populations are collapsing and *Laminaria hyperborea* forests recovering in the southern part of a 2 000 km^2 overgrazed area where sea urchins have dominated for more than four decades. Kelp forests have recovered in 450 km^2 of the urchin barrens since the 1990s. Kelp communities are highly diverse and among the most productive systems on the planet and these shifts have large implications for the coastal production and diversity. The underlying mechanisms responsible for shifts between the ASS are not fully understood and temperature seems to have different influence in different regions: Kelp forest in the north are positively influenced by warmer water through a direct negative influence on sea urchins and indirectly by changing the distribution of predators, like the edible crab. In the south, the combination of warmer water and eutrophication is detrimental for kelp and thus warming may call for more drastic actions from environmental managers to reverse negative effects from anthropogenic pressures like eutrophication and over-fishing.

QUANTIFYING THE FUNCTIONAL ROLE AND SPATIAL DISTRIBUTION OF ENDANGERED SPECIES IN THE NORTH SEA

Jennifer Dannheim, Lars Gutow, Jan Holstein, Dario Fiorentino, Thomas Brey
Alfred Wegener Institute, Germany; Jennifer.Dannheim@awi.de

Biodiversity is seen as a core-service of marine ecosystems, and rare and endangered species play a crucial role in maintaining biodiversity. In shallow shelf seas such as the North Sea, benthic organisms contribute significantly to overall biodiversity. Hence, knowledge of biological characteristics and spatial distribution of benthic biodiversity and of benthic rare species is essential for sustainable ecosystem management and for the conservation of endangered species. In 2013, the status of endangered species was revised and published via the new “red list”. Regarding the marine benthic species on this list, the evidence used to judge them “endangered” is quite often scientifically unsatisfying by insufficient data and an imperfectly picture on their spatial occurrence.

We use an extensive information system on benthic invertebrates in the German EEZ of the North Sea (>9000 stations x >740 species) for a high-resolution and large-scale analysis of occurrence and spatial distribution of “red list” species. For the first time, we evaluate the functional role of endangered species by means of their biological traits and analyse their spatial distribution in the EEZ. Finally, we identify potentially sensitive areas where endangered species cluster. This information constitutes a sound scientific base for a sustainable ecosystem management.

OBS03: The role of parasitism as determinants of community dynamics

Monday, 21/Sep/2015, 3:30pm - 5:00pm *Location:* **Nordseehalle 2**

EVOLUTION AND ADAPTATION IN TWO INVASIVE PARASITES

Marieke Eveline Feis, K Mathias Wegner
Wadden Sea Station Sylt, Alfred Wegener Institute for Polar and Marine Sciences, Germany; marieke.feis@awi.de

Biological invasions of parasites offer ideal opportunities to study coevolution in nature – especially when hosts are faced with repeated invasions of parasites. Such invasions not only lead to selection on the host, but also to selection on parasites arising from direct competition. Here, we present data from a crossed coinfection experiment using two closely related copepod parasites that have invaded the Eastern Atlantic, infecting blue mussels. One is the specialist *Mytilicola intestinalis* that invaded from the Mediterranean Sea in the 1930ies and the other one is the generalist *Mytilicola orientalis* that invaded from Japan inthe 1990ies. This system thus offers the opportunity to study host-parasite interactions along a gradient of different coevolutionary timescales and host specificity. Here we report the first results of this experiment on the phenotypic level focusing on the balance and trade-offs between host and parasite traits, i.e. infectivity - virulence for parasites and virulence - tolerance for hosts. We find different interactions along these trade-offs between both interactions. We also find that the generalist new invader is outcompeting the old invader.

DIRECT AND INDIRECT EFFECTS OF INVASIVE PARASITES ON NATIVE BLUE MUSSELS

Felicitas Demann
AWI, Germany; felicitas.demann@awi.de

Parasite-mediated effects are widespread in nature. These effects can be direct or indirect and the role of indirect effects in restructuring biological interactions can have profound effects on hosts that might even exceed the consequences of direct effects. Here we combined field surveys with experimental data to examine the direct and traitmediated indirect effects of parasites of the genus *Mytilicola* on an intertidal blue mussels *Mytilus edulis*. We investigated net effects on the host (direct + indirect) from the population dynamics of *M. intestinalis* in relation to the condition of the host from field survey data. Next to direct harm, these parasites can also reduce shell strength and/or condition of mussels and thus increase the predation pressure. In order to study these interactions we conducted predation experiments in the lab where we offered infected and uninfected mussels to crabs *Carcinus maenas* and seastars *Asterias rubens* in a choice experiment. Since *Mytilicola intestinalis* causes lesion in the gut wall of the host, infections may also alter the intestinal gut flora and thus increase the risk of bacterial secondary infections. To elucidate the indirect effect of parasite infection on host associated microbial communities we compared gut microbiota from naturally infected and uninfected mussels and experimentally applied secondary infections with pathogenic bacteria. These results show that trait mediated indirect effects might alter the vulnerability of the host against their predators or unknown pathogens exceeding the direct effect of *Mytilicola intestinalis* on its host. The combination of lab experiments and field surveys will thus significantly contribute to our understanding of parasite-mediated indirect effects.

TEMPERATE PHAGES OF POTENTIALLY PATHOGENIC VIBRIO SPECIES FROM THE NORTH SEA

Alexa Garin-Fernandez, Inga Vanessa Kirstein, Sidika Kirmizi, Gunnar Gerdts, Antje Wichels
Alfred-Wegener-Institut, Germany; alexa.garin@awi.de

Temperate phages are important players in genetic diversification of their bacterial host by transforming their genomes by transduction. During this process, the phage forms a stable interaction with its host, either by integrating into the bacterial chromosome or as plasmid. The integrated phage genome replicates along with the host until the lytic cycle is induced.

Temperate phages carry mobile genetic elements which contribute to emergence of disease-causing strains from environmental bacterial populations, e.g. temperate Vibriophages can turn its host *Vibrio cholera* into a fatal disease upon successful infection and transduction. However, the potential of transferring pathogenic genes due in the marine environments to temperate phages is far less understood.

We present results of potential pathogenic *Vibrio* strains isolated from the North Sea which were screened for lysogenic phages. Three potentially pathogenic *Vibrio* species V. *vulnificus, V. parahaemolyticus* and *V. cholera* were induced using Mitomycin C. New Vibriophages were isolated to investigate their role in pathogenicity. The present work shows the first insights of temperate phages presence on potential pathogenic *Vibrio* strains from Northern European seawaters.

OOMYCETE DIVERSITY IN A PLANKTON BLOOM AS INFERRED FROM HIGH-THROUGHPUT ENVIRONMENTAL SEQUENCING

Marco Thines, Bora Nam, Rahul Sharma, Lisa Nigrelli, Louis Hanic
Senckenberg Biodiversität und Klima Forschungszentrum, Germany; marco.thines@senckenberg.de

Oomycetes are widespread in terrestrial and limnic ecosystems, from the Polar Regions to the Tropics. However, the diversity of oomycetes in marine environments, in which most of the early-diverging lineages are exclusively found, remains largely unexplored. In a pilot study to investigate the diversity of oomycetes in a plankton bloom, plankton samples were harvested off the west coast of North America. Microscopically, the presence of an oomycete pathogen infecting *Pseudo-nitzschia* diatoms was found. DNA was extracted from the plankton sample and PCR was carried out using universal straminipile primers for the amplification of a part of the *cox*2 gene. PCR fragments were sequenced using Illumina MiSeq and reads were clustered into OTUs using both available tools and new scripts. Four oomycete OTUs were detected. One of these is closely related to *Pythium rostratum* and another one had affinities to the Peronosporales, but could not be assigned to any peronosporalean genus with certainty. Interestingly, two new lineages with affinity to an uncharacterized species of Olpidiopsis were found that were not previously recorded. Primers have been developed for the detection of each oomycete OTU have been developed to

be tested on plankton organisms with structures that might be related to oomycete infection, to identify the organisms to which the OTUs can be attributed. These primers can also be used for subsequent evaluation of the population dynamics of these OTUs in plankton blooms, which might provide clues to their ecological significance, in particular their potential role in restricting plankton organisms.

CAN INTRASPECIFIC COMPETITION ATTENUATE PARASITISM?

Luísa Magalhães[1,2], Rosa Freitas[1], Xavier de Montaudouin[2]

[1]University of Aveiro & CESAM, Portugal; [2]University of Bordeaux & UMR EPOC, France; luisa.magalhaes@ua.pt

Parasites with complex life-cycles alternate free-living and parasitic stages. In the case of trematodes, for example cercariae larvae emerge from the first intermediate host, experience a short free-living life and infect the second intermediate host as metacercariae. However, prediction of second intermediate host infection and associated fitness decline remains hazardous, taking into account the various factors that can impair transmission of cercariae from one host to the other. At the scale of the individual, one reason of not being infected by a given cercariae could be that its neighbour is. Thus, higher the density of second intermediate host is, lower could be the individual infection (dilution of parasites among hosts).

From a 15-y data set where cockles (*Cerastoderma edule*)have been monthly sampled and their trematode parasites identified and counted, we propose to investigate the relationship between trematode infection and intraspecific host competition. The method consists in measuring the average metacercariae infection per cockle and per trematode species along a standard infection period and for a given cohort and to compare it with second intermediate host biomass (i.e. proxy of intraspecific competition) during this period. The tested hypothesis is that a high host density has a cost in terms of competition that could be compensated by a lower parasitism pressure mediated by parasite dilution processes. Conversely, the alternate hypothesis is that high cockle density facilitates trematode life-cycle by attracting the different necessary hosts and that higher cockle density is, higher will be their parasite load.

DANGEROUS HITCHHIKERS? EVIDENCE FOR POTENTIALLY PATHOGENIC VIBRIO SPP. ON MICROPLASTIC PARTICLES

Inga Vanessa Kirstein[1], Sidika Kirmizi[1], Antje Wichels[1], Alexa Garin-Fernandez[1], Rene Erler[3], Martin Löder[2], Gunnar Gerdts[1]

[1]Alfred Wegener Institut, Germany; [2]University of Bayreuth, Germany; [3]Diagnostikum, Germany; inga.kirstein@awi.de

The qualitative and quantitative composition of biofilms on microplastic surfaces is widely unknown. But recently potentially pathogenic bacteria (*Vibrio* spp.) were detected on floating microplastic particles. Hence microplastics could function as vectors for the dispersal of microorganisms to new habitats. Several *Vibrio* species are serious human pathogens. Contact with contaminated water and consumption of raw seafood are the main infection factors for *Vibrio* associated diseases. On research cruises to the North- and Baltic Sea as well as on the Helgoland beach, microplastic particles were collected and subjected to APW (alkaline peptone water) enrichment. Growth on selective CHROMagar™ Vibrio and further identification of isolates by MALDI-TOF (matrix assisted laser desorption/ionization time-of-flight) clearly indicate the presence of potentially pathogenic *Vibrio* spp. on microplastics. *Vibrio* species identifications were confirmed by species-specific and virulence-associated PCR approaches. Collected microplastics were characterized by ATR FT-IR (Attenuated Total Reflectance – Fourier Transform Infrared Spectroscopy). In total 199 particles were collected, out of these 157 were clearly identified as plastics. On 20 microplastic particles *V. spp* were detected, including 12 microplastic particles (polyethylene, polypropylene and polystyrene) harbor potentially human pathogenic *V. parahaemolyticus.* Our results highlight the urgent need for detailed microbiological analyses of floating microplastic particles in the future. Considering the possibility of distributing potentially pathogenic bacteria, this study demonstrated the occurrence of *V. parahaemolyticus* on marine microplastics for the first time.

DM01: (Big) data management and vizualisation: How to cope with the data deluge?

Tuesday, 22/Sep/2015, 9:00am - 10:30am *Location:* **Nordseehalle 1**

ASSESSING THE DATA QUALITY, COMPLETENESS AND FITNESS FOR USE OF MARINE BIOGEOGRAPHIC DATA

Leen Vandepitte[1], Samuel Bosch[1,2], Lennert Tyberghein[1], Filip Waumans[1], Bart Vanhoorne[1], Francisco Hernandez[1], Olivier De Clerck[2], Jan Mees[1]

[1]Flanders Marine Institute, Belgium; [2]Research Group Phycology, University of Ghent, Belgium; leen.vandepitte@vliz.be

Being able to assess the quality and level of completeness of data has become indispensable in marine biodiversity research, especially when dealing with large databases that typically compile data from a variety of sources. Very few integrated databases offer quality flags on the level of the individual record, making it hard for users to easily extract the data that are fit for their specific purposes. During 2014, different quality control steps were developed to analyze the quality and completeness of the distribution records within the European and international Ocean Biogeographic Information Systems (EurOBIS and OBIS). Records are checked on data format, completeness and validity of information, quality and detail of the used taxonomy and geographic indications and whether or not the record is a putative outlier. The corresponding quality control (QC) flags help users with their data selection and help the data management team and the data custodians to identify possible gaps and errors in their data, providing scope to improve data quality. The results of these quality control procedures are available on the EurOBIS and OBIS databases. Through the Biology portal of EMODnet, a subset of EurOBIS records—passing a specific combination of these QC steps—is offered to the users. In the future, EMODnet Biology will offer a wide range of filter options through its portal, allowing users to make specific selections themselves. Through LifeWatch, users can already upload their own data and check them against a selection of the here described quality control procedures.

CREATING A TAXONOMIC BACKBONE: MERGING MARINE TAXONOMY, GEOGRAPHY AND ECOLOGY FROM VARIOUS SOURCES

Leen Vandepitte, Klaas Deneudt, Stefanie Dekeyzer, Bart Vanhoorne, Simon Claus, Aina Trias-Verbeek, Wim Decock, Daphnis De Pooter, Filip Waumans, Francisco Hernandez

Flanders Marine Institute, Belgium; leen.vandepitte@vliz.be

The aim of the LifeWatch Taxonomic Backbone (TB) is to (virtually) bring together different component databases and data systems, all of them related to taxonomy, biogeography and ecology and with a primary focus on the marine environment. Several global databases on marine species have been established and are widely used, but are mostly limited to either taxonomy or distribution data. The importance to describe species distribution patterns and their underlying processes is essential in determining the current status and predicting the future evolution of marine ecosystems. However, the lack of an integrated, standardized system serving this biological information hampers these large scale functional analyses. Although current applications are already broad, the benefits of these databases can be multiplied by associating the taxonomy and distribution of species with their ecological and biological information. Within the European LifeWatch project, online tools are being prepared to easily link data from WoRMS and OBIS with species traits. These tools will be available through the Marine Virtual Research Environment (Marine VRE or e-Lab). These activities aim at increasing standardization of species data and integration of distributed biodiversity data repositories and operating facilities for Europe into this TB. In the long run, services will be offered to the scientific community, building support to answer specific ecological questions which are currently hard or nearly impossible to address due to a lack of accessibility, availability, standardization and linking of data. The Taxonomic Backbone will also offer access to genetic data and create a strong link with existing literature.

VISUALIZING BIOLOGICAL GEOSPATIAL DATA THROUGH SPECIES DISTRIBUTION MODELING FOR THE MAREANO PROGRAM

Genoveva Gonzalez-Mirelis[1], Pål Buhl-Mortensen[1], Margaret Dolan[2], Lene Buhl-Mortensen[1], Gjertrud Jensen[1], Anne Sveistrup[1], Kjell Bakkeplass[1], Børge Holte[1]

[1]Institute of Marine Research, Norway; [2]Geological Survey of Norway; genoveva@imr.no

The Marine AREAl database for NOrwegian waters (MAREANO) is a government-funded program for documenting the Norwegian offshore, seabed environment in a systematic way. Since it was launched in 2005 large amounts of biological, chemical and sedimentological, geospatial data, as well as acoustic data have been collected under this program.

The main biological sampling tool used in MAREANO is an underwater camera platform with high-definition video capture capabilities. Video survey stations are positioned on average 10 km apart following a sampling design based on multibeam echosounding data. At each sampling station, a 700-m long video transect is undertaken.

At the lab, footage (visual data) is translated into species abundance data. Each occurrence of epibenthic megafauna (> 5 cm) is identified to the lowest possible taxonomical resolution, and geo-referenced using navigation data collected via hydroacoustic positioning. To date, 1147 video transects have been analyzed. This constitutes an unparalleled dataset of epibenthic fauna, both in terms of spatial resolution and area coverage.

Species Distribution Modelling (SDM) has proven an efficient way of visualizing these geospatial biological data, as well as summarizing patterns of response to environmental drivers including oceanographic and terrain variables. Two sets of results

are generated through SDM at the community level: (1) a classification of the surveyed area into benthic biotopes (biotope maps), and (2) the predicted distributions of selected megafaunal habitats, e.g. deep sea sponge aggregations, and coral gardens. These map products are used to advance ecological knowledge, as well as to inform spatial planning.

OPTIMIZED R FUNCTIONS FOR ANALYSIS OF ECOLOGICAL COMMUNITY DATA USING THE R VIRTUAL LABORATORY

Theodore Patkos[1], Anastasis Oulas[2], Pattakos Nikos[2], Varsos Kostas[1], Vanden Berghe Edward[3], Fernandez-Guerra Antonio[4], Christina Pavloudi[2,5,6], Chrysoula Bekiari[1], Martin Doerr[1], Christos Arvanitidis[2]

[1]Institute of Computer Science, Foundation of Research and Technology Hellas, Heraklion 70013, Crete, Greece; [2]Institute of Marine Biology, Biotechnology and Aquaculture, Hellenic Centre for Marine Research, Heraklion 71500, Crete, Greece; [3]Vrije Universiteit Brussel, 1050 Brussels, Belgium; [4]University of Oxford, Oxford e-Research Centre, Oxford OX1 3QG, United Kingdom; [5]Department of Biology, Faculty of Sciences, University of Ghent, 9000 Ghent, Belgium; [6]Department of Microbial Ecophysiology, Faculty of Biology, University of Bremen, 28359, Bremen, Germany; cpavloud@hcmr.gr

Parallel data manipulation using R has previously been addressed by members of the R community. Our targeted users, ranging from the expert ecologist/microbiologists to the average R user, often experience difficulties in finding optimal ways to exploit the full capacity of their computational resources and improve performance of commonly used R scripts. This presentation has two goals: (i) describe a complete methodology for the analysis of large datasets by combining capabilities of diverse R packages, and (ii) present their application on a virtual R laboratory (RvLab) that makes execution of complex functions and visualization of results, easy and readily available to the end-user, developed in the context of the LifeWatch Research Infrastructure.

Our methodology relies on the processing of data on different levels of abstraction. The pbdMPI package is used to implement Single Program Multiple Data (SPMD) parallelization on primitive mathematical operations, allowing for interplay with functions of the Vegan package. The dplyr and RPostgreSQL packages are further integrated offering secondary storage solutions whenever memory demands exceed available RAM resources.

RvLab is running on a PC cluster and offers an intuitive User Interface, enabling users to perform analysis of ecological and microbial communities based on optimized Vegan functions. A beta version of the Rvlab is available at: http://biocluster.her.hcmr.gr/Rvlab/

THE FIRST YEAR OF THE NEW ARCTIC AWIPEV-COSYNA UNDERWATER OBSERVATORY IN KONGSFJORDEN, SPITSBERGEN.

Philipp Friedrich Fischer

AWI, Germany; philipp.fischer@awi.de

In June 2012, a new and fully remote controlled underwater observatory has been installed at 12 m water depth in Kongsfjord, Spitzbergen at 79°N. The observatory is equipped with high-end sensor technology including a fully functioning FerryBox. The system is able to continuously measure the main hydrographic parameters as well as additional biological data like macroinvertebrate, jellyfish and fish densities as well as their length-frequency distributions. All data from the system are transferred in real time to a Server at the AWI Helgoland in Germany and are available for the public. The system additionally provides power and Internet access under water for external sensors from international cooperation partners. Such a year round operated and fully remote controlled sensor platform was on the wish list of most researches in the Kongsfjord ecosystem since several years. Together with our summer field campaigns, the system significantly expands our possibility to be “on site” even under the extreme Arctic winter conditions and significantly fosters our general understanding of the temporal dynamics of Arctic fjord ecosystems. Our ongoing studies since 2012 already revealed a remarkable species richness and species activity especially during the arctic winter when aquatic research is more-or-less pending. This polar “darkness” community and its adaptation to arctic conditions will be one of the foci of our research in the next years. The studies are performed by three work groups from the AWI in Bremerhaven, Sylt and Helgoland accompanied by an increasing number of international partners from France, Netherlands and further countries.

WAYS OF INTERACTION BETWEEN WORMS AND PANGAEA TO IMPROVE BIODIVERSITY DATA DISCOVERY AND RE-USE

Stefanie Schumacher, Alexandra Kraberg, Stephan Frickenhaus

Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Germany; Stefanie.Schumacher@awi.de

The activities of the online repository Pangaea (http://pangaea.de) in improving the parameter catalogue for enhanced search functions in biodiversity data portals like GFBio require interaction with WoRMS to leverage existing data and to support current bio-data curation. PANGAEA’s marine taxon-related parameter shall be semantically linked to WoRMS taxonomic information. Parameters that do not match to WoRMS items correctly are addressed for updating WoRMS with further taxon names (first of all Recent species, later on fossil species) and for validation of PANGAEs parameter names. We aim to discuss how such an interaction can be structured for a high throughput at a high level of quality and consistency.

OBS07: How invasive is the future: Species distributions in a changing climate

Tuesday, 22/Sep/2015, 9:00am - 10:30am *Location:* **Nordseehalle 2**

PRIORITIZING MANAGEMENT OF NON-INDIGENOUS SPECIES IN THE LAGOON OF VENICE: MISSION IMPOSSIBLE?

Agnese Marchini, Jasmine Ferrario, Anna Occhipinti-Ambrogi

Department of Earth and Environmental Sciences, University of Pavia (Italy); agnese.marchini@unipv.it

The Lagoon of Venice (432 km^2 surface) is a major hotspot of non-indigenous species (NIS) introductions in the Mediterranean Sea and represents the site of first-introduction for several NIS that eventually have spread elsewhere. In order to suggest priority areas for management we surveyed the entire Lagoon for sites of high NIS occurrence. Benthic assemblages colonising artificial substrates (wooden poles) were compared from harbours, marinas, sites of live seafood import, shellfish farms as well as control sites, in all the three sub-basins of the Lagoon (for a total of 45 samples analysed). Nineteen species out of the 214 taxa identified in the Lagoon were NIS. The isopod *Ianiropsis serricaudis* and the bryozoan *Tricellaria inopinata* were very abundant and widespread, occurring in 90-100% of samples. Single samples displayed an average number of 8 NIS (range: 2-11), accounting for 20% (range: 6%-30%) of the taxonomic richness of benthic assemblages. The central sub-basin, where shipping activities are more intense, displayed the highest number of NIS and NIS/all taxa ratio. The differences in NIS composition among sub-basins were mainly due to dissimilar abundances of dominant NIS. Interestingly, no significant differences in number and composition of NIS were found among sites: even control sites, where no human activities related to NIS introduction take place, displayed a rich NIS assemblage. These results suggest that eradication actions are virtually impossible to actuate in Venice, and that pre-border management should integrate multiple vectors of introductions.The monitoring of pathways departing from the Lagoon is also advised.

DO HARBOURS AND NEARBY MARINAS SHARE NON-INDIGENOUS SPECIES? EXAMPLES FROM NORTHERN ITALY

Jasmine Ferrario, Agnese Marchini, Anna Occhipinti-Ambrogi

Department of Earth and Environmental Sciences, University of Pavia (Italy); jasmine.ferrario@unipv.it

The fouling community of three harbours (Genoa, La Spezia and Leghorn) and three neighbouring marinas (Santa Margherita Ligure, Lerici and Viareggio), in the Ligurian Sea and North Tyrrhenian Sea, wereanalysed in July 2013, for a total number of 63 samples collected from docks and pontoons. This systematic survey aimed at investigating the role of ports as sink and source habitat of non-indigenous marine species and the role of recreational boating in their secondary spread. A total of 261 macroinvertebrate species wereidentified, out of which 18 were non-indigenous species (NIS). In contrast with current belief, the 3 harbours do not seem “hotspots of introduction”, since the number of NIS in all sites was moderate (10 to 12 species). Moreover differences in richness of native species among the sites did not affect the number of NIS found, that were rather constant in all locations. The most frequent NIS were *Hydroides elegans*, *Watersipora subtorquata*, *Hydroides dianthus, Zoobotryon verticillatum, Caprella scaura* and *Paranthura japonica* that were common in harbours. Noteworthy records include: *Watersipora arcuata,* a Pacific cheilostome bryozoan new to the European coasts,was found in Santa Margherita Ligure marina; *Grandidierella japonica*, a Indo-Pacific amphiopod new to the Mediterranean Sea, was recorded in the marina of Viareggio; and *Celleporaria brunnea,*the cheilostome bryozoan already recorded in the Western Mediterranean Sea, was well represented in most of the localities. All marinas exhibited their own peculiar non-indigenous assemblages, independent from those observed in the nearby harbours.

UNDERSTANDING AND FORECASTING INVASIVE MARINE DECAPOD DISTRIBUTION IN THE WATERS OF NORTHERN EURASIA

Anna Konstantinovna Zalota, Vassily Albertovich Spiridonov

P.P. Shirshov Institute of Oceanology RAS, Russian Federation; azalota@gmail.com

Russia encompasses most of the Northern Eurasian seas, the Black and Azov seas which belong to the Mediterranean Basin and the Caspian Sea. This makes them a representative area for the study of introduction and invasion patterns of marine organisms, such as decapods crustaceans, which are among most important metazoan invaders (Galil et al., 2011). These species have not been detected in Russia’s North-West Pacific and most of the Siberian shelf seas. In European Russia Chinese mitten crab (*Eriocheir sinensis*) is the most widely occurring alien decapods species, but there are no indications of its establishment in Russia’s waters on the Atlantic side. The king (*Paralithodes camtschaticus*) and snow (*Chionoecetes opilio*) crabs are established in the Barents Sea. The king crab is present in the White Sea while the snow crab is rapidly expanding into the Kara Sea. In the eastern Baltic two introduced brachyurans, Harris mud crab (*Rhithropanopeus harrisii*) and rockpool prawn (*Palaemon elegans*) showed a remarkably rapid expansions. Among these seas, the Black Sea is known for the greatest number of alien decapods species. Some may be in process of naturalization, i.e. *Callinectes sapidus*, but only Harris mud crab is fully established. This species along with *P. elegans* and *P. adsperus* also form an established alien decapods component of the Caspian Sea fauna. Future scenarios indicate a possibility of nearly circum-Arctic expansion of the snow crab and a high risk of several new invasions in the Black and Japan seas which have similar position in temperate latitudes.

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FOOD CHAINS OF COASTAL ECOSYSTEMS IN BALTIC ESTUARIES AFTER ESTABLISHMENT OF ALIEN CRUSTACEANS

Nadezhda A. Berezina[1], Arturas Razinkovas-Baziukas[2], Sergei Golubkov[1]

[1]Zoological Institute RAS, Russian Federation; [2]Coastal Research and Planning Institute, Klaipeda University, Lithuania; na-berezina@rambler.ru

This paper studies structure of trophic chains in coastal communities of the NevaRiverestuary and Curonian Lagoon (Baltic Sea) with eutrophication and climate influence. Coastal communities consist of eurybiotic and tolerant to the threats taxa such as aquatic insects, annelids and recent invasive species (amphipods, mysids and mollusks). The main question is to clarify what trophic level is *occupies* in a *food chains* by newly established crustaceans and whether the invaders may affect the number of benthic invertebrates as a result of carnivore nature. The evaluation is based on complex analyses of microscopic gut content, stable isotopes C, N in the body tissue of the community members, experimental data on consumption rate of adult amphipods and an assessment of the possible predation impact by the alien amphipods on the macrobenthos. Stable isotope analysis (δ15N) allocated 4 trophic levels in the coastal food webs of theNeva estuary. The lowest values (2-4 ‰) were evaluated for detritus and algae (producers), and the largest for carnivorous invertebrates (10.5-12 ‰) and fish (12-14 ‰). Important role of alien amphipods and mysids in coastal food chains of both estuaries are confirmed by this study. They are classified as omnivores (trophic level: 2-3) with varying percentage of plant and animal food in a diet during ontogenesis. Their predation impact on community was assessed as middle (<0.5) but vary between sites being determined not only species abundance and food habits but related to food resources availability and hierarchical complexity degree of disturbance of community.

TOP-DOWN OR BOTTOM-UP – THE ROLE OF BIRDS IN THE WADDEN SEA FOOD WEB

Sabine Horn[1], Harald Asmus[1], Ragnhild Asmus[1], Leonie Enners[2], Stefan Garthe[2], Philipp Schwemmer[2]

[1]Alfred-Wegener-Institut, Germany; [2]Forschungs- und Technologiezentrum Westküste, Germany; sabine.horn@awi.de

The Wadden Sea at the western coasts of Germany, Denmark and the Netherlands is one of the globally most important foraging areas for breeding and migrating birds acting as indicators for the ecological condition of the ecosystem. However, little is known about how the intense predation pressure of birds influences the Wadden Sea food web. The aim of the interdisciplinary project STopP is to determine the food web structure in terms of the interaction between the basis of the food web and birds as top predators. Studied habitat types included the most important foraging areas of birds; mussel banks, cockle beds, sand flats, mud flats, seagrass meadows and beds of the immigrant razor clam *Ensis directus* a recently preferred prey item of several bird species. Data were analysed using the Ecological Network Analysis (ENA) that reflects trophic structures within the systems and reveals direct and indirect relations between the lower and the upper trophic levels. Preliminary results show that bird predation increases the complexity of the food web due to an increase in connections and a higher total system throughput. On the other hand the predation has also a destabilizing effect due to a high demand of system's carbon stocks and increased exports out of the tidal system. Furthermore, analyses show considerable indirect dependencies of birds to lower trophic levels such as sediment POC and phytoplankton. Future scenarios modelled with ENA shall show how changes within the lower trophic levels would affect foraging birds due to anthropogenic or natural impacts.

OBS07_1: How invasive is the future: Species distributions in a changing climate

Tuesday, 22/Sep/2015, 11:00am - 12:30pm *Location:* **Nordseehalle 2**

THE SHALLOW WATER FISH COMMUNITY OF KONGSFJORDEN, SVALBARD

Markus Brand, Philipp Fischer

Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Germany; markus.brand@awi.de

Due to interaction of cold Arctic and warmer Atlantic water masses, the west coast of Svalbard is highly interesting for the study of ecosystem dynamics with respect to climate change. The Kongsfjorden ecosystem is located at the west coast of Svalbard at 79°N and is known as one of the best-investigated areas in Svalbard. Nevertheless, almost no quantitative data are available for the shallow water fish community. Previous deep-water studies revealed a fjord community dominated by characteristic arctic species, especially the polar cod (*Boregadus saida*). In a first explorative shallow water study in 2012, we found a primarily Atlantic fish community dominated by the shorthorn sculpin (*Myoxocephalus scorpius*) and Atlantic cod (*Gadus morhua*). Extended field campaigns in 2013 and 2014 revealed a complex situation with an atlantic-arctic species gradient from the outer to the inner fjord areas. An integrated capture-recapture experiment with *M. scorpius* gave a first impression of the growth rates of this fish species in the arctic summer. A further assessment by otolith analysis is in preparation for all key species. Based on these data, seasonal and diel growth rates will be analyzed and correlated with hydrographic parameters and further seasonal factors.

A NEW ONLINE WORLD DATABASE OF OVER 1,400 INTRODUCED MARINE SPECIES AS PART OF WORMS

Stefanie Dekeyzer[1], Shyama Pagad[2], Leen Vandepitte[1], Simon Claus[1], Mark J. Costello[3], Francisco Hernandez[1]

[1]Vlaams Instituut voor de Zee, VLIZ – InnovOcean site, Wandelaarkaai 7, 8400 Oostende, Belgium.; [2]The International Union for Conservation of Nature Species Survival Commission (IUCN SSC) Invasive Species Specialist Group, University of Auckland, Tamaki Campus, Auckland, New Zealand.; [3]Institute of Marine Science, University of Auckland, New Zealand 1142.; stefanie.dekeyzer@vliz.be

For the first time, the known marine species introduced by human activities around the world are listed into one database: the World Register of Introduced Marine Species (WRIMS). WRIMS lists an indication of their introduced range and whether a species is considered invasive in that area. For each region the year of first introduction or report, the introduction type or pathway, and any indication of management is documented where available. Each record is linked to a publication or database. WRIMS is a subset of the World Register of Marine Species (WoRMS). The species' taxonomy is managed by the taxonomic editor community of WoRMS, whereas the introduced-related information is managed by both taxonomic and thematic editors. Both WoRMS and WRIMS are edited daily.

Within WRIMS users can generate species lists per geographic region, taking into account their provenance and invasiveness. When combining WRIMS with biogeographic data from e.g. the (European) Ocean Biogeographic Information System ((Eur)OBIS), powerful dynamic maps can be generated, showing the change in distribution and invasion evolution of species over time. WRIMS was launched in 2015 in partnership between the Invasive Species Specialist Group (ISSG) and the Flanders Marine Institute (VLIZ).

WRIMS is supported by the Biology Project of the European Marine Observation and Data Network (EMODnet) and LifeWatch, and contributes to the Taxonomic Backbone of LifeWatch, which aims at combining taxonomic, biogeographic and species-related (ecological) trait data.

DO INVASIVE GRACILARIA VERMICULOPHYLLA HAVE STRONGER DEFENSE AGAINST FOULING?

Shasha Wang, Mark Lenz, Florian Weinberger, Martin Wahl

Helmholtz-Zentrum für Ozeanforschung Kiel (GEOMAR), Germany; swang@geomar.de

Biological invasions are an important component of global change that can alter local biodiversity and ecosystem services. Their prevention and management require a solid understanding of the mechanisms that underlie successful invasions. Invasion success in marine plants depends, besides several other factors, on the capacity of introduced species to defend against enemies, such as grazers or foulers, which they encounter in the target range. One of the most successful invasive seaweed species is the perennial red alga *Gracilaria vermiculophylla* that originates from the Northwest Pacific. In this study, we compared susceptibility to fouling between populations from the native and the invasive range of *Gracilaria*. Living thalli and surface extracts of individuals from 4 populations from the native range (Yellow Sea and Northwest Pacific) and 4 populations from the invasive range (North Sea, Baltic Sea and Eastern Atlantic) were exposed to two different fouling organisms. These were strains of the diatom *Stauroneis constricta* and epiphytic red algae of the genus *Ceramium,* which were both collected in Rongcheng, China (*Gracilaria*'s native range) as well as in Kiel, Germany (*Gracilaria*'s invasive range). Foulers, regardless of whether they were from the native or the invasive range, generally attached less to living thalli and surface extracts from *Gracilaria* individuals from invasive populations. We suggest that the lower susceptibility of invasive specimens of *G. vermiculophylla* to fouling is attributable to a more effective chemical defense. This may explain the invasive success of *Gracilaria* in many sea areas worldwide.

GROWTH, REPRODUCTION AND RECRUITMENT OF THE PACIFIC OYSTERS (CRASSOSTREA GIGAS) IN AN INVASION FRONT

Torjan Bodvin[01], Jon Albretsen[01], Anders Jelmert[01], Åsa Strand[02], Frithjof Moy[01], Per Dolmer[03], Stein Mortensen[01]

[1]Institute of Marine Research, Norway; [2]University of Gothenburg, Sweden; [3]Orbicon, Denmark; torjan.bodvin@imr.no

Observations of individual specimen of the Pacific oyster *Crassostrea gigas* has been recorded in Scandinavia since early in the 20th century. But in 2007, Swedish scientist discovered a massive settlement of spat from the Pacific oyster along the coast of Bohuslän. Later, in 2008, the first population of Pacific oyster in Norway was recorded in the Tønsberg fjord. The introduction and dispersal of this marine alien species was described through collaboration between scientists from Sweden, Denmark and Norway. Since 2010, 6 populations, 4 in the county of Vestfold and 2 in the county of Aust-Agder have been followed to monitor growth, reproduction, recruitment and survival of *Crassostrea gigas.*The locations were chosen in 2010 because they were in the invasion front. In 2013, populations in Hafrsfjord, Rogaland were also mapped. The results show a growth rate on the same level as in the species natural distribution area. Increase in standing stock is shown to be as high as a 10 times increase from one year to the next. Reproduction rates vary from one year to another, but there have been recruitment every year in 4 of the 6 populations during the surveillance period. These variations seems to be linked to water temperature. Shallow, sheltered localities can during the summer have water temperature 3-5°C higher than what is registrated as surface temperature in the fjord systems. These habitats seems to function as population refugees and reproduction focal points for the invasion of pacific oyster along

LONG TERM CHANGES OVER 40 YEARS IN TWO ROCKY SHORE COMMUNITIES ON THE SWEDISH SKAGERRAK COAST

Ellen Schagerström, Lena Kautsky, Nils Kautsky

Stockholm University, Sweden; ellen.schagerstrom@su.se

There are few long term studies of benthic flora and fauna on rocky shores. Here, we present data from two sites, one sheltered and one exposed, on the Swedish west coast in the Skagerrak. We have recorded species presence and depth distribution along a transect and sampled for biomass estimates on each site for a period of 40 years, beginning in 1972. Our time series show for example the change in distribution of *Sargassum muticum*, *Bonnemaisonia hamifera* and *Codium fragile*, three macroalgae with different time of introduction into Swedish waters. Over time, there have also been shifts in ecological functional groups, from more perennial to shorter lived species. Our data further reveals how the epiphytic communities of brown perennial macroalgae have shifted over time. The data presented will be discussed from a Marine Water Framework perspective and address the question of using macroalgae functional groups as indicators of eutrophication and climate change.

GROWTH AND GRAZING OF MEDIOPYXIS HELYSIA UNDER FUTURE OCEAN CONDITIONS: A CONTINUING SUCCESS STORY?

Sudhir Kumar Joon[1,2], PD Dr. Nicole Aberle-Malzahn[1], Dr. Alexandera Kraberg[1], Prof. Dr. Maarten Boersma[1], Prof. Dr. Karen Helen Wiltshire[1]

[1]Alfred Wegner Institute, Helgoland, Germany; [2]University of applied sciences Bremerhaven, Gemrany; joon.sudhir.kumar@awi.de

The diatom *Mediopyxis helysia* was first recorded as a non-indigenous species at Helgoland Roads, North Sea, in 2009. Since then, this large and weakly-silicified diatom has established in the phytoplankton around Helgoland where it is now common. It has a strong potential for bloom formation, particularly at reduced salinities. In this study we present the growth pattern of *M. helysia* under different environmental conditions with special emphasis on potential future ocean conditions (e.g. increases in sea surface temperature and changes in salinity). Using a full-factorial design, we tested the performance of *M. helysia* at six different salinities (26-33) and ten different temperatures (11°*C* -21°*C*) over the duration of 8 days at a 16:8 light/dark cycle. Results from the growth experiment showed that *M. helysia* had significant growth at a broad range of environmental conditions. Grazing experiments were conducted with the copepod *Acartia tonsa* in order to estimate the consumption of *M. helysia* by North Sea zooplankton. Grazing by the copepods on *M. helysia* was observed in all treatments thus proving its significance as a food source for North Sea primary consumers. The high tolerance to changes in environmental conditions seems to be *M. helysia's* formula for success. However, zooplankton predation is considered to be an important top-down control in bloom termination of this non-indigenous phytoplankton species new to the North Sea.

OBS15: Consequnces of a less icy future: Long-term changes in the Arctic

Tuesday, 22/Sep/2015, 11:00am - 12:30pm *Location:* **Nordseehalle 1**

RESILIENCE CAPACITY IN THE WHITE SEA ECOSYSTEM

Vassily A. Spiridonov[1], Andrew D. Naumov[2], Margarita V. Chikina[1], Uliana V. Simakova[1]

[1]P.P. Shirshov Institute of Oceanology of Russian Academy of Sciences, Moscow, Russian Federation; [2]O. A. Skarlato White Sea Biological station, Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia; vspiridonov@ocean.ru

The White Sea is an enclave of the Arctic ocean. Paleontological, paleoecological, and archaeological data demonstrate that during the Holocene temperature maximum when the coasts of the White Sea were covered by broad-leaf forests, marine ecosystems retained the Arctic features. Our studies indicate that several types of subtidal (dominated by quahog,*Arctica islandica*, horse mussel, *Modiolus modiolus* and cockle, *Clinocardium ciliatum*) and deep water communities (dominated by *Portlandia arctica*) have been found in the same localities over decades if not centuries up to 2000s. At the same time components of inshore ecosystem, such as coastal communities associated with eelgrass, *Zostera marina* undergo significant decadal changes and show slow recovery after declines. The Arctic/ cold water component of the White Sea system is considered physically and biologically resilient. Physical mechanisms of stability are determined by the processes in Gorlo, a narrow and shallow strait connecting the outer and the inner part of the sea. There formation of cold deep water takes place which buffers conditions in the water column below seasonal thermocline and in most subtidal habitats of the White Sea. The biological basis of resilience is related to the presence of dominant Arctic-boreal and cold water Boreal species that have passed through the Holocene “environmental filter” and show tolerance to a wide range of physical conditions. It is also important that human influence on the White Sea ecosystem has been never really significant. This makes it a unique area for study and monitoring in the time of global climate transformation.

BATHYMETRIC PATTERNS IN BRYOZOA ZOOID SIZE ON SHELF AND CONTINENTAL SLOPE OFF ICELAND

Anna Stępień[1], Piotr Kukliński[1], Maria Włodarska[1], Małgorzata Nowak[1], Gudmundur Gudmundsson[2]

[1]Polish Academy of Sciences, Poland; [2]Icelandic Institute of Natural History; stepie.anna@gmail.com

Plasticity of the morphological characters is one of organism adaptations to environmental conditions. Understanding the drivers of phenotypical changes is a crucial challenge in natural science.

One of the best documented relationship between morphology and environmental changes is Temperature-Size Rule. The rule assuming reduction of the body size in rising temperature was confirmed for nine phyla, including Bryozoa.

Bryozoans are colonial invertebrates, dominant in shallow hard bottom habitats. Their colonies are composed of functional modules called zooids. Some earlier studies indicated correlation between zooid size and temperature occurring over geographical ranges. Several hypothesis explain the described effects by influence of food concentration, oxygen availability or reproductive state of colony.

Aim of the study was to investigate patterns of change in zooid size with increasing depth. There are several factors changing dramatically along the depth gradient - including water temperature and food concentration and we expect to observe significant responses in zooid sizes to those changes. Seventy eight samples from six depths were selected from BioIce collection, gathered in vicinity of Iceland. Thirteen bryozoan species, with at least five colonies per species at each depth were chosen for the study. From each colony length and width of 20 randomly chosen zooids were measured. Differences in zooid size among depth zones were tested using Permanova. Preliminary results indicate significant difference ($p<0.05$) in zooid length in part of the species (eg. *Bicellarina alderi*). Width does not change significantly. In some species (eg. *Chartella barleei*) zooid size do not change significantly between depth zones.

REVISION OF MACROZOOBENTHIC BIOMASS AND PRODUCTION AT HANSNESET, KONGSFJORDEN, AFTER 15 YEARS

Martin Paar[1], Andrey Voronkov[2], Inka Bartsch[3], Max Schwanitz[3], Thomas Brey[3], Christian Wiencke[3], Benoit Lebreton[4], Harald Asmus[1], Ragnhild Asmus[1]

[1]Alfred-Wegener- Institut Helmholtz-Zentrum für Polar und Meeresforschung, Wadden Sea Station Sylt, Hafenstrasse 43, 25992 List/Sylt, Germany; [2]Institute of Marine Research, PO Box 6404, No-9294 Tromsø, Norway; [3]Alfred-Wegener- Institut Helmholtz-Zentrum für Polar und Meeresforschung, Am Handelshafen 12, 27515 Bremerhaven, Germany; [4]Littoral, Environnement et Sociétés (LIENSs), Institut du Littoral et de l’Environnement, UMR 7266 CNRS-Université de La Rochelle, 2, rue Olympe de Gouges, 17 000, La Rochelle, France;mpaar@awi.de

The macrozoobenthos biomass and secondary production was studied along transects (2.5m-15m) in a macroalgal belt at Hansneset in the Arctic Kongsfjord, Svalbard, from 2012 to 2013. Compared to a study from 1996/98 this re-sampling indicated a drastic change in the depth-distribution of macrozoobenthic biomass and secondary production at Hansneset. While both biomass and secondary production increased with water depth in the 1996-98 period, the distribution was inversed in 2012/13 owing to a tenfold increase of biomass and secondary production in the upper most sublittoral (2.5-5m). Biomass of longliving suspension feeders gained the most, and community productivity (P/B ratio) decreased accordingly. Reduced ice scouring during winter months is thought to allow persistent colonization of very shallow (2.5-5m) habitats. Variability of macrozoobenthic biomass and secondary production corresponded to differences in the physical environment and macroalgal vegetation along the depth gradient. Increased macroalgal cover on shallow coasts of Kongsfjorden may have facilitated living conditions for macrozoobenthos by changing habitat properties like water currents and sedimentation rate. Increasing sea surface temperatures and thus a longer ice-free season in Kongsfjorden may have enhanced primary production and thus food availability for the fauna. However, faunal secondary production is low compared to macroalgal primary production, indicating a considerable export of most of the algal production from the shallow to the adjacent deeper areas.

SEAWEED BIOLOGY IN A CHANGING ARCTIC

Kai Bischof[1], Inka Bartsch[2], Katharina Zacher[2], Stein Fredriksen[3], Christian Wiencke[2]

[1]Marine Botany, University of Bremen, Germany; [2]Biology of Macroalgae, Functional Ecology, Alfred Wegener Institute, Bremerhaven, Germany; [3]Department of Biosciences, University of Oslo, Norway; kbischof@uni-bremen.de

Arctic fjords host a diverse seaweed community forming the base of the benthic foodweb and providing habitat and shelter for a vast diversity of associated fauna. Seaweed model species as well as seaweed communities are intensively studied with reference to their general adaptive and functional traits, as well as their responses to global environmental change. Our long-term project at Svalbard aims at a holistic understanding of seaweed ecosystem function spanning from the environmental control of gene expression to energy flow through trophic levels.

Research is currently focusing on the sugar kelp *Saccharina latissima* and the wing kelp *Alaria esculenta* under a set of combined stressors such as elevated UV-B radiation and temperature or increased sedimentation and grazing. In the frame of this global change scenario species-specific acclimation patterns are studied at the physiological level and species competition at the community level. Both approaches intend to predict shifts in the competitive strength of habitat engineering species, potentially resulting in a changing seaweed community. Comparative community analyses conducted in 1996-98 and 2012-2014 indicate a considerable change in seaweed biomass, vertical distribution limits and species richness at the study site off Hansneset/Kongsfjord, Spitsbergen all possibly correlated to the recent increase in winter temperatures. The seaweed biomass maximum was shifted from 5 to 2.5m depth and overall biomass increased. Future surveys are needed to separate climate related signals against a background of high interannual variability.

Responses of polar cod to changing sea ice conditions

Hauke Flores

Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Germany; Hauke.Flores@awi.de

The Arctic Ocean faces a complete loss of the summer sea ice cover in the coming decades. Sea ice is an important habitat for microalgae ('ice algae') and a diverse ice-associated community. Hence, the rapid deterioration of sea ice habitats will cause major repercussions on the structure and functioning of Arctic ecosystems. How sea ice habitat structure shapes the ice-associated community, however, is barely understood. Using an under-ice trawl equipped with a bio-environmental sensor array throughout the Eurasian Basin, we investigated (1) the relationship between sea ice properties, and under-ice community structure; (2) the under-ice distribution of polar cod *Boreogadus saida*, an important carbon source for Arctic endotherms, and (3) the significance of ice algal carbon for a number of key species from the under-ice habitat. According to sea ice structure and other parameters, the environment was separated in two distinct regimes, which was resembled in the under-ice community structure. Polar cod were ubiquitous throughout the Eurasian Basin. Higher fish abundance was associated with thicker ice, higher ice coverage and lower surface salinity. Back-tracking of the ice floes hosting polar cod indicated potential areas of under-ice recruitment on the Siberian shelf. First results from fatty acid and stable isotope analysis indicate a significant contribution of ice algal carbon to the carbon budget of the food web at multiple trophic levels. This, in combination with the observed response in community composition to different environmental regimes indicates potential long-term alterations in Arctic marine ecosystems as the Arctic Ocean continues to change.

OBS11_2: Biodiversity as a response to or a driver of change

Tuesday, 22/Sep/2015, 3:30pm - 5:00pm *Location:* **Nordseehalle 1**

DISTURBANCE AND DEGRADING BIODIVERSITY: IMPLICATIONS FOR RESILIENCE AND ECOSYSTEM MULTIFUNCTIONALITY

Anna Villnäs, Alf Norkko
Tvärminne Zoological Station, University of Helsinki, Finland; anna.villnas@helsinki.fi

Ecosystem functioning is threatened by an increasing number of anthropogenic stressors, creating a legacy of disturbance that undermines ecosystem resilience. Oxygen deficiency is a major driver of change in benthic infaunal communities. The effects of oxygen deficiency on benthic ecosystem functioning were explored by performing a range of experiments *in situ* in coastal, sandy habitats. The type of hypoxic disturbance, and its specific temporal and spatial characteristics directed the degradation of benthic community structure and function. Functional changes took place well before species were lost from the system. Observed shifts in benthic trait composition were primarily the result of reductions in species' abundances, or of changes in demographic characteristics, such as the loss of large, adult bivalves. Reduction in community functions was expressed as declines in the benthic bioturbation potential and in secondary biomass production.

Individual ecosystem functions (i.e. measures of sediment metabolism, elemental cycling, biomass production, organic matter transformation and physical structuring) were observed to differ in their response to increasing disturbance. Interestingly, the results suggested that an impairment of ecosystem functioning could be detected at an earlier stage if multiple functions were considered. The benthic communities and their degradation accounted for a substantial proportion of the changes observed in ecosystem multifunctionality. The results show that even small-scale hypoxic disturbance can reduce the buffering capacity of the sedimentary ecosystem, and increase the susceptibility of the system towards further stress. The findings imply that healthy benthic communities are essential for sustaining functions and services of coastal ecosystems.

MOLLUSCAN COMMUNITIES IN A LOW-SALINE ESTUARINE TRANSITIONAL ENVIRONMENT OF THE SOUTHERN BALTIC SEA

Dmitry Philippenko[1,2], Elena Naumenko[2,3]
[1]Kaliningrad Regional Center for Environment and Tourism, Russian Federation; [2]Kaliningrad State Technical University; [3]Atlantic Research Institute of Marine Fisheries and Oceanography; dmiphi@gmail.com

Estuaries and coastal waters characterized by a freshwater-marine transition and heterogeneity of aquatic environment that is reflected in the structure and functioning of biota. In this study we examined the structure, diversity and the spatial distribution of molluscan communities in estuarine transition and effect of its environmental variables (i.e. salinity, habitats) on diversity patterns. Study area covered two shallow water estuaries – Darss-Zingst Bodden Chain and Rugia lagoon (southern Baltic Sea). Waterbodies were characterized by environmental transition and salinity gradient (overall range 1.4 - 10.2 PSU), which includes the holohalinicum zone (5-8 PSU), where the effect of "species minimum" occurs. Obtained results demonstrated a general increase of abundance and biomass both of species and a total community along the salinity gradient. A comparison of molluscan communities between oligohaline (0.5-5 PSU) and mesohaline (5-10 PSU) salinity zones displayed the significant differences. Molluscan communities in oligohaline waters were characterized by profoundly reduced species composition as well as by low abundance, biomass and diversity descriptors. Alternatively, a considerably higher diversity and quantitative characteristics were estimated in mesohaline waters, where notable changes in community structure associated with habitat-sediments differentiation were also detected. At the same time the highest molluscan abundance, biomass and α-diversity indices were detected for the sandy-macrophytes habitats, the lowest were derived for communities inhabited mud sediments. Neither declining nor species minimum were found in the horohalinicum salinity zone. Distribution of the most species was limited by salinity 5 PSU, which is argued as a lowest spread border of marine molluscan in the Baltic Sea estuaries.

MACROZOOBENTHOS OF THE GULF OF FINLAND: CURRENT STATUS AND TRENDS

Alexey Maximov[1], Henrik Nygård[2], Ilmar Kotta[3]
[1]Zoological Institute Russian Academy of Sciences, Russian Federation; [2]Finnish Environment Institute, Finland; [3]University of Tartu, Faculty of Science and Technology, Estonian Marine Institute, University of Tartu, Estonia; alexeymaximov@mail.ru

The dataset collecting within the framework of the trilateral Gulf of Finland Year 2014 program was used to characterize current status of macrozoobenthos in the open areas of this Baltic Sea basin. Altogether about 70 macrobenthic taxa were recorded at monitoring stations. However diversity and abundance of benthic macrofauna decreased with depth. The vast expanses of deep open areas were inhabited by only a few species. The assessment period (1996—2012) was preceded by the collapse of deep-water benthic communities because of drastic deterioration of oxygen conditions in 1996. The subsequent short-term recovery was interrupted by hypoxic/anoxic events in early 2000s. At the deepest sub-halocline bottom macrofauna did not recover during assessment period. The rest of sites were colonized by hypoxic-tolerant invasive polychaete *Marenzelleria* sp. (most probably *Marenzelleria arctia*). At the western sites the invasion seems to begin earlier (middle 2000s) then in the eastern inner reaches of the gulf. By 2011 these polychaetes occupied the entire gulf area and become the dominant component of the soft-bottom communities. Locally all macrofauna consisted of monoculture of *Marenzelleria*. The hypoxia-induced changes in macrozoobenthos of the Gulf of Finland are repeatedly registered early and are caused substantially by large-scale cyclic variations of hydrographic conditions in the Baltic Sea. In contrast to these reversible changes replacement of

native benthos by invasive polychaetes can be characterized as irreversible regime shifts resulting in formation of new alternative community. It is difficult to predict the future trends because feedback effects of other components of ecosystem remain unclear.

LIFE CYCLES ADAPTATIONS TO SEASONAL ICE COVER: POLYCHAETES IN WHITE AND BARENTS SEAS

Alexander Tzetlin, Glafira Kolbasova

M.V.Lomonosov Moscow State University, Faculty of Biology, Russia; atzetlin@gmail.com

The White Sea is a semi-isolated region of the Arctic Ocean with the seasonal ice cover. In comparison to Barents Sea, it characterized by low yearly temperature, low salinities (24–25‰) and depressed photosynthesis. Due to low concentration of phytoplankton during polar winters, benthic fauna, especially filter-feeders survive practically without food from November to April. In some species it leads to slow growth, dwarfism or to the change of reproduction mode. We've investigated life-cycle transformations in three common polychaete species – deposit feeders *Maldane sarsi, Nicomache minor* (Maldanidae) and filter-feeder *Pseudopotamilla reniformis* (Sabellidae), widely distributed in North-Atlantic and Arctic. Asexual reproduction was noted for *M. sarsi, N. minor* and *P. reniformis* in Barents Sea. In the White Sea it is regular and frequent. According to previous data, asexual reproduction was not described for them in the other studied parts of their distribution. The sexual reproduction of this species in the Whit Sea is sporadic and takes place not every year. We suppose that in the White Sea the sexual reproduction with swimming larvae is used mainly for the new substrata searching, whereas the asexual one is less energy-intensive and it allows quick occupying of the new substratum. Perhaps, this reproduction mode is common for benthic filter- and deposit-feeders living in seasonal ice ecosystems. Therefore, life-cycle transformations in studied polychaete species seems very interesting in spite of the global thinning of the ice cover in Arctic and the extension of the seasonal-ice cover in Arctic seas.

EVIDENCE OF LONG-TERM CHANGES IN THE DISTRIBUTION OF INTERTIDAL SPECIES

Maria L. Vale[1,2,3], Ana I. Neto[2,3,4], Gustavo M. Martins[2,3,4], Stephen J. Hawkins[1]

[1]University of Southampton (UoS), United Kingdom; [2]Interdisciplinary Centre of Marine and Environmental Reasearch (CIIMAR/CIMAR), Portugal; [3]University of the Azores (UAc), Portugal; [4]Center of Research in Natural Resources (CIRN), Portugal; Maria.Vale@noc.soton.ac.uk

Biodiversity is under increasing pressure from human activities driving global environmental change. Changes in the distribution and abundance of species have been observed in response to global change. Long-term and broad-scale data are required to distinguish human-induced changes from natural fluctuations. Such data sets are also important to help diagnosis the relative importance of global change from regional and local scale impacts, being particularly valuable in placing recent changes into context, since current abundances and biogeographic distributions of species can be compared to those of previous periods. Rocky shores are vulnerable to human induced impacts, such as overexploitation of their resources, introduction of alien species, changes in shore line (e.g. coastal structures for defence), pollution, as well as responses to global climate change. These ecosystems are relatively simple which makes them an excellent model system for understanding the consequences of climate change and other impacts at the community and ecosystem level. This work compares long-term data from repeated surveys (1980s compared to 2012-2014) in two Marine Protected Areas in the Azores (Caloura in São Miguel Island and Monte da Guia in Faial Island). Observed changes were discussed in relation to factors affecting Azorean rocky intertidal shores. Comparing the zonation patterns and abundance of key intertidal species in both locations revealed that most taxa were still present, but changes in abundance and vertical distribution were observed. These changes are tentatively interpreted as a consequence of increased temperatures and wave action (both predicted by climate change scenarios).

THE INVASIVE MUD CRAB ENFORCES AN INVERTEBRATE COMMUNITY SHIFT IN ROCKY LITTORAL OF THE BALTIC SEA

Veijo Jormalainen, Karine Gagnon, Joakim Sjöroos, Eva Rothäusler

University of Turku, Finland; veijo.jormalainen@utu.fi

In marine littoral environments, trophic cascades often arise as producers, herbivores and predators form distinct trophic levels, herbivory is severe, and predation can strongly affect herbivore population dynamics. Invasive crabs can enforce top-down regulation and strongly modify trophic structures due to their voracious predatory feeding mode, the effect of which may extend to ecosystem functioning.

The North American mudcrab *Rhithropanopeus harrisii* invaded the Finnish Archipelago Sea in 2009 and is spreading quickly. Here we studied on the effect of invading *R. harrisii* on the invertebrate community associated with bladderwrack *Fucus vesiculosus*. With the invasion of the mudcrab, the *Fucus*-associated invertebrate community overcame a major quantitative and qualitative transition. Both the species richness and diversity dropped with the increasing abundance of mudcrabs. The most pronounced changes occurred in gastropods, amphipods and *Idotea* spp. isopods, all of which decreased in abundance. The gastropod- and crustacean- dominated community changed into a mussel-dominated community with low overall abundance of invertebrates.

We suggest that such a shift in the invertebrate community composition may have far-reaching consequences for ecosystem functioning of the rocky littoral macroalgal assemblages. These arise through changes in the producer - herbivore -interaction, the strength of which diminishes. The interaction has a major structuring role in producer communities and largely determines the ecological function of ecosystems, i.e. productivity and flow of energy to higher trophic levels.

OBS16: Development and implementation of a pan-European Marine Biodiversity Observatory System (EMBOS)

Tuesday, 22/Sep/2015, 3:30pm - 5:00pm *Location:* **Nordseehalle 2**

GEOGRAPHIC PATTERNS OF BIODIVERSITY IN EUROPEAN COASTAL MARINE BENTHOS

Herman Hummel[1], Pim van Avesaath[1], Loran Kleine-Schaars[1], Steven Degraer[2], Francis Kerckhof[2], Natalia Bojanic[3], Maria Rousou[4], Helen Orav-Kotta[5], Jérôme Jourde[6], Maria Luiza Pedrotti[7], Jean-Charles Leclerc[8], Nathalie Simon[8], Guy Bachelet[9], Nicolas Lavesque[9], Christos Arvanitidis[10], Christina Pavloudi[10], Sarah Faulwetter[10], Tasman Crowe[11], Jennifer Coughlan[11], Lisandro Benedetti-Cecchi[12], Martina Dal Bello[12], Paolo Magni[13], Serena Como[13], Stefania Coppa[13], Anda Ikauniece[14], Tomas Ruginis[15], Emilia Jankowska[16], Jan Marcin Weslawski[16], Jan Warzocha[17], Teresa Silva[18], Pedro Ribeiro[19], Valentina Kirienko Fernandes de Matos[19], Isabel Sousa-Pinto[20], Jesús Troncoso[21], Xabier Guinda[22], Jose Antonio Juanes de la Pena[22], Araceli Puente[22], Free Espinosa[23], Angel Pérez-Ruzafa[24], Matt Frost[25], Ohad Peleg[26], Gil Rilov[26]

[1]Monitor Taskforce, Royal Netherlands Institute for Sea Research, Yerseke, the Netherlands; [2]Royal Belgian Institute of Natural Sciences, OD Nature, Marine Ecology and Management, Brussels and Oostende, Belgium; [3]Institute of Oceanography and Fisheries, Split, Croatia; [4]Marine & Environmental Research Lab Ltd, Nicosia, Cyprus; [5]Estonian Marine Institute, University of Tartu, Tallinn, Estonia; [6]Observatoire de la biodiversité (OBIONE), UMR 7366 LIttoral ENvironnement et Sociétés, University of La Rochelle, France; [7]Sorbonne Universités, UPMC Univ. Paris 06, UMR 7093, LOV, Villefranche-sur-mer, France; [8]Station Biologique de Roscoff, CNRS UMR7144 AD2M and Sorbonne Universités UPMC Univ Paris 6, Roscoff, France; [9]Arcachon Marine Station, CNRS, Université de Bordeaux, EPOC, Arcachon, France; [10]Institute of Marine Biology, Biotechnology and Aquaculture, Hellenic Centre for Marine Research, Heraklion, Crete, Greece; [11]School of Biology and Environmental Science and Earth Institute, University College Dublin, Ireland; [12]Department of Biology, University of Pisa, Pisa, Italy; [13]CNR, Institute for Coastal Marine Environment, Torregrande, Oristano, Italy; [14]Latvian Institute of Aquatic Ecology, Riga, Latvia; [15]Marine Science and Technology Centre, Klaipeda University, Lithuania, Klaipeda, Lithuania; [16]Institute of Oceanology, Polish Academy of Sciences, Sopot, Poland; [17]Marine Fisheries Institute, Gdynia, Poland; [18]Marine and Environmental Sciences Centre (MARE), Laboratório de Ciências do Mar, Universidade de Évora, Sines, Portugal; [19]Marine and Environmental Sciences Centre, Universidade dos Açores, Departamento de Oceanografia e Pescas, Horta, Azores, Portugal; [20]Centre for Marine and Environmental Research, CIIMAR, Porto, Portugal; [21]ECIMAT, Station of Marine Sciences of Toralla, Dpt of Ecology and Animal Biology, University of Vigo, Spain; [22]Environmental Hydraulics Institute of the University of Cantabria, Santander, Spain;[23]Universidad de Sevilla, Sevilla, Spain; [24]Dpt. Ecology and Hydrology, Regional Campus of International Excellence "Campus Mare Nostrum", University of Murcia, Spain; [25]Marine Biological Association, Plymouth, UK; [26]National Institute of Oceanography, Israel Oceanographic and Limnological Research, Haifa, Israel; herman.hummel@nioz.nl

Marine waters are not restricted by national boundaries. Therefore, issues regarding the marine realm should be studied at large scale, yet, always taking into account the diversification of larger units into smaller systems with their own characteristics. However, knowledge on the marine realm is strongly fragmented between disciplines and nations and in time. During the last years the COST Action EMBOS (the European Marine Biodiversity Observatory System) has set first steps to overcome this fragmentation by initiating a large-scale system using harmonized methodologies. In surveys carried out along the European coastline the degree and variation of benthic diversity was measured. We will show geographic patterns of diversity along the European coastline. Results are compared to patterns revealed in BIOCOMBE, 10 years ago. Geographic latitude appears a strong factor, shaping benthic diversity of hard substrata, since high diversity occurs at lower latitudes (south) and lower diversity at higher latitudes. The diversity of soft substrata peaked at latitudes between 40 and 50° North.

Diversity differentiated with tidal level, being highest around LWL and MTL, and lower at HWL or shallow Subtidal. Taxa diversity was related to environmental variables (salinity, temperature, grain size). Some taxa in the soft substrata are numerically more dominant in one region or the other. Therefore it may be argued that latitudinal trends and regional differences in diversity are indirect and merely a result of including typical areas, like the Baltic (enclosed, strong salinity clines, high proportion insects), and Mediterranean (semi-enclosed, relatively high salinities and temperatures, high proportion crustaceans).

THE ROLE OF PHYSICAL VARIABLES IN BIODIVERSITY PATTERNS ALONG EUROPEAN COASTS

Araceli Puente[1], Xabier Guinda[1], José A. Juanes[1], Beatriz Echavarri-Erasun[1], Elvira Ramos[1], Steven Degraer[2], Francis Kerckhof[2], Natalia Bojanic[3], Maria Rousou[4], Helen Orav-Kotta[5], Jérôme Jourde[6], Maria Luiza Pedrotti[7], Jean-Charles Leclerc[8], Nathalie Simon[8], Guy Bachelet[9], Nicolas Lavesque[9], Christos Arvanitidis[10], Christina Pavloudi[10], Sarah Faulwetter[10], Tasman Crowe[11], Jennifer Coughlan[11], Lisandro Benedetti-Cecchi[12], Martina Dal Bello[12], Paolo Magni[13], Serena Como[13], Stefania Coppa[13], Andrea de Lucia[13], Anda Ikauniece[14], Tomas Ruginis[15], Emilia Jankowska[16], Jan Marcin Weslawski[16], Jan Warzocha[17], Teresa Silva[18], Pedro Ribeiro[19], Valentina Kirienko Fernandes de Matos[19], Isabel Sousa-Pinto[20], Jesús Troncoso[21], Ohad Peleg[22], Gil Rilov[22], Free Espinosa[23], Angel Pérez-Ruzafa[24], Matt Frost[25], Herman Hummel[26], Pim van Avesaath[26]

[1]Environmental Hydraulics Institute (IH Cantabria), Universidad de Cantabria, Spain; [2]Royal Belgian Institute of Natural Sciences, OD Nature,Marine Ecology and Management, Brussels and Oostende, Belgium; [3]Institute of Oceanography and Fisheries, Split, Croatia; [4]Marine & Environmental Research Lab Ltd, Nicosia, Cyprus; [5]Estonian Marine Institute, University of Tartu, Tallinn, Estonia; [6]Observatoire de la biodiversité (OBIONE), LIttoral ENvironnement et Sociétés, University of La Rochelle, France; [7]Sorbonne Universités, UPMC Univ. Paris 06, UMR 7093, LOV, Villefranche-sur-mer, France; [8]Station Biologique de Roscoff, CNRS UMR7144 AD2M and Sorbonne Universités UPMC Univ Paris 6, Roscoff, France; [9]Arcachon Marine Station, CNRS, Université de Bordeaux, EPOC, Arcachon, France; [10]Institute of Marine Biology, Biotechnology and Aquaculture, Hellenic Centre for Marine Research, Heraklion, Crete, Greece; [11]School of Biology and Environmental Science and Earth Institute, University College Dublin, Ireland; [12]Department of Biology, University of Pisa, Pisa, Italy; [13]CNR, Institute for Coastal Marine Environment, Torregrande, Oristano, Italy; [14]Latvian Institute of Aquatic Ecology, Riga, Latvia; [15]Marine

Science and Technology Centre, Klaipeda University, Lithuania, Klaipeda, Lithuania; [16]Institute of Oceanology, Polish Academy of Sciences, Sopot, Poland; [17]Marine Fisheries Institute, Gdynia, Poland; [18]Marine and Environmental Sciences Centre (MARE), Laboratório de Ciências do Mar, Universidade de Évora, Sines, Portugal; [19]Marine and Environmental Sciences Centre, Universidade dos Açores, Departamento de Oceanografia e Pescas, Horta, Azores, Portugal; [20]Centre for Marine and Environmental Research, CIIMAR, Porto, Portugal; [21]ECIMAT, Station of Marine Sciences of Toralla, Dpt of Ecology and Animal Biology, University of Vigo, Spain; [22]National Institute of Oceanography, Israel Oceanographic and Limnological Research, Haifa, Israel;[23]Universidad de Sevilla, Sevilla, Spain; [24]Dpt. Ecology and Hydrology, Regional Campus of International Excellence "Campus Mare Nostrum", University of Murcia, Spain; [25]Marine Biological Association, Plymouth, UK; [26]Monitor Taskforce, Royal Netherlands Institute for Sea Research, NIOZ, Yerseke, the Netherlands; juanesj@unican.es

It is well know that temperature has a strong influence on the biogeographical distribution of marine species, but few studies address the relationship with other climatic and oceanographic variables. With this aim our study focused on testing the role of different physical variables in the biodiversity patterns of benthic communities along the European coast. The variables considered are salinity, sea surface temperature, photosynthetically active radiation and significant wave height. These variables are parameterized to represent both average and extreme conditions. They are obtained from three different sources: remote sensing, reanalysis of databases and in situ measurements. Biological data were compiled in the frame of the EMBOS project, including surveys carried out at a range of marine stations along the European coastline (Baltic, Atlantic, Mediterranean). A multivariate approach is used to link the environmental conditions with the distribution of biota.

SPATIAL VARIABILITY IN HARD AND SOFT BOTTOM COMMUNITY STRUCTURE ACROSS SCALES AND REGIONS OF EUROPE

Martina Dal Bello[1], Lisandro Benedetti-Cecchi[1], Jean-Charles Leclerc[2], Steven Degraer[3], Francis Kerckhof[3], Natalia Bojanic[4], Maria Rousou[5], Helen Orav-Kotta[6], Jérôme Jourde[7], Maria Luiza Pedrotti[8], Nathalie Simon[2], Guy Bachelet[9], Nicolas Lavesque[9], Christos Arvanitidis[10], Christina Pavloudi[10], Sarah Faulwetter[10], Tasman Crowe[11], Ohad Peleg[12], Gil Rilov[13], Paolo Magni[14], Serena Como[14], Stefania Coppa[14], Andrea de Lucia[14], Anda Ikauniece[15], Tomas Ruginis[16], Emilia Jankowska[17], Jan Marcin Weslawski[17], Jan Warzocha[18], Teresa Silva[19], Pedro Ribeiro[20], Valentina Kirienko Fernandes de Matos[20], Isabel Sousa-Pinto[21], Jesús Troncoso[22], Xabier Guinda[23], Jose Antonio Juanes de la Pena[23], Araceli Puente[23], Free Espinosa[24], Angel Perez-Ruzafa[25], Matt Frost[26], Pim van Avesaath[13], Herman Hummel[13]

[1]Department of Biology, University of Pisa, Italy; [2]Station Biologique de Roscoff, CNRS UMR7144 AD2M and Sorbonne Universités UPMC Univ Paris 6, Roscoff, France; [3]Royal Belgian Institute of Natural Sciences, OD Nature, Marine Ecology and Management, Brussels and Oostende, Belgium; [4]Institute of Oceanography and Fisheries, Split, Croatia; [5]Marine & Environmental Research Lab Ltd, Nicosia, Cyprus; [6]Estonian Marine Institute, University of Tartu, Tallinn, Estonia; [7]Observatoire de la biodiversité (OBIONE), Littoral Environnement et Sociétés, University of La Rochelle, France; [8]Sorbonne Universités, UPMC Univ. Paris 06, UMR 7093, LOV, Villefranche-sur-mer, France; [9]Arcachon Marine Station, CNRS, Université de Bordeaux, EPOC, Arcachon, France; [10]Institute of Marine Biology, Biotechnology and Aquaculture, Hellenic Centre for Marine Research, Heraklion, Crete, Greece; [11]School of Biology and Environmental Science and Earth Institute, University College Dublin, Ireland; [12]National Institute of Oceanography, Israel Oceanographic and Limnological Research, Haifa, Israel; [13]Monitor Taskforce, Royal Netherlands Institute for Sea Research, NIOZ, Yerseke, the Netherlands; [14]CNR, Institute for Coastal Marine Environment, Torregrande, Oristano, Italy; [15]Latvian Institute of Aquatic Ecology, Riga, Latvia; [16]Marine Science and Technology Centre, Klaipeda University, Lithuania, Klaipeda, Lithuania; [17]Institute of Oceanology, Polish Academy of Sciences, Sopot, Poland; [18]Marine Fisheries Institute, Gdynia, Poland; [19]Marine and Environmental Sciences Centre (MARE), Laboratório de Ciências do Mar, Universidade de Évora, Sines, Portugal; [20]Marine and Environmental Sciences Centre, Universidade dos Açores, Departamento de Oceanografia e Pescas, Horta, Azores, Portugal; [21]Centre for Marine and Environmental Research, CIIMAR, Porto, Portugal; [22]ECIMAT, Station of Marine Sciences of Toralla, Dpt of Ecology and Animal Biology, University of Vigo, Spain;[23]Environmental Hydraulics Institute of the University of Cantabria, Santander, Spain; [24]Universidad de Sevilla, Sevilla, Spain; [25]Dpt. Ecology and Hydrology, Regional Campus of International Excellence "Campus Mare Nostrum", University of Murcia, Spain; [26]Marine Biological Association, Plymouth, UK; martina.dalbello@for.unipi.it

The analysis of spatial variation in populations and communities, with regard to abundance of species, functional groups and assemblages, is an essential basis for understanding the scales at which organisms interact with one another and with their environment. Integrating the analysis of spatial patterns along environmental gradients (e.g. height on the shore, i.e vertical) with that on multiple (e,g. geographic, i.e. horizontal) spatial scales is, whenever possible, the best way to assess how processes and patterns relate across spatial scales.

Non-random patterns of species distribution and abundance usually reflect the scales of the underlying causal processes. Some processes operate mainly at small spatial scales (e.g., biotic interactions) and some mostly at large scales (e.g., climatic factors). The documentation of patterns of variation in population abundance at a range of scales, therefore, focuses attention on the range of potential processes that are likely to be the most important in influencing species distribution.

The framework of the EMBOS pilot integrates several spatial scales that provide information on vertical (level on the shore) and horizontal (among quadrates, sites, locations, biogeographic regions) sources of variability for rocky shore and soft bottom benthic assemblages.

The objective of this presentation is to show the patterns and the degree of variability in benthic assemblage in the different tidal-regime regions along the coastline of Europe (Atlantic and Mediterranean) and explore whether these patterns are consistent between regions.

LINKING NUTRIENT LOADING AND THE DIVERSITY OF HARD BOTTOM COMMUNITIES: A PAN-EUROPEAN STUDY

Jonne Kotta[1], Helen Orav-Kotta[1], Christos Arvanitidis[2], Pim van Avesaath[3], Guy Bachelet[4], Lisandro Benedetti-Cecchi[5], Natalia Bojanic[6], Serena Como[7], Tasman Crowe[8], Martina Dal Bello[5], Valentina Kirienko Fernandes de Matos[9], Steven Degraer[10], Free Espinosa[11], Matt Frost[12], Xabier Guinda[13], Anda Ikauniece[14], Emilia Jankowska[15], Jérôme Jourde[16], Jose Antonio Juanes de la Pena[17], Jean-Charles Leclerc[18], Paolo Magni[19], Christina Pavloudi[2], Maria Luiza Pedrotti[20], Ohad Peleg[8], Araceli Puente[13], Pedro Ribeiro[21], Maria Rousou[22], Tomas Ruginis[28], Angel Ruzafa[23], Teresa Silva[28], Nathalie Simon[18], Isabel Sousa-Pinto[24], Jesús Troncoso[25], Jan Warzocha[26], Jan Marcin Weslawski[27], Sander Wijnhoven[3], Herman Hummel[3]

[1]Estonian Marine Institute, Estonia; [2]Institute of Marine Biology, Biotechnology and Aquaculture, Hellenic Centre for Marine Research, Heraklion, Crete, Greece; [3]Monitor Taskforce, Royal Netherlands Institute for Sea Research, NIOZ, Yerseke, the Netherlands; [4]Station Marine d'Arcachon, Université de Bordeaux, France; [5]Department of Biology, University of Pisa, Pisa, Italy; [6]Institute of Oceanography and Fisheries, Split, Croatia; [7]CNR, Institute for Coastal Marine Environment, Torregrande, Oristano, Italy; [8]University College Dublin, Ireland;[9]Marine and Environmental Sciences Centre, Universidade dos Açores, Departamento de Oceanografia e Pescas, Horta, Azores, Portugal; [10]Royal Belgian Institute of Natural Sciences, MUMM, Brussels, Belgium; [11]Universidad de Sevilla, Spain; [12]Marine Biological Association, Plymouth, UK; [13]Environmental Hydraulics Institute of the University of Cantabria, Santander, Spain; [14]Latvian Institute of Aquatic Ecology, Riga, Latvia; [15]Institute of Oceanology, Polish Academy of Sciences, Sopot, Poland; [16]Université de La Rochelle, France;[17]Environmental Hydraulics Institute of the University of Cantabria, Santander, Spain; [18]CNRS, UMR7144 AD2M, Station Biologique de Roscoff, Roscoff, France; [19]CNR, Institute for Coastal Marine Environment, Torregrande, Oristano, Italy; [20]Université Pierre et Marie Curie, France; [21]Marine and Environmental Sciences Centre, Universidade dos Açores, Departamento de Oceanografia e Pescas, Horta, Azores, Portugal; [22]Marine & Environmental Research Lab Ltd, Nicosia, Cyprus; [23]Universidades de Murcia, Spain; [24]Centre for Marine and Environmental Research, CIIMAR, Porto, Portugal; [25]University of Vigo, Department of Ecology and Animal Biology, Spain; [26]Marine Fisheries Institute, Gdynia, Poland; [27]Institute of Oceanology, Polish Academy of Sciences, Sopot, Poland; [28]Not available; jonne@sea.ee

Nutrient loading causes changes in the structure and functioning of many coastal ecosystems. It is known that increasing availability of inorganic nutrients stimulates the abundance of ephemeral macroalgae and causes the dominance shift from perennial to annual species and perturbations among sessile fauna. However, other environmental variables such as salinity, tidal range, exposure to waves may modulate the relationships between nutrient loading and biota. To date, we still lack scientific evidence for the nutrient biota relationship for the majority of marine habitats in order to adequately assess the role of eutrophication across the European seas. Such a relationship can be found, however, when the correlation structure between environmental variables and biotic patterns is analysed in the multivariate space and non-linearities are taken into account.

In the frame of the COST Action EMBOS on a European Marine Biodiversity Observatory System, hard bottom intertidal macroalgal communities have sampled in standardized way across European seas. We analysed links between nutrient loading and hard bottom communities and sought whether and how local abiotic variables modulated the nutrient biota relationship. The study showed that nutrient load strongly correlated to the richness and cover of macroalgal and invertebrate species and often interacted with local abiotic variables. Generally elevated nutrient loads increased the species richness of macroepiphytes and benthic invertebrates, but reduced the richness of canopy forming macroalgae. The study also showed that the effect of nutrient loading was scale-specific, i.e. different responses to nutrients were observed at sample, site and regional scales.

STRUCTURAL VS FUNCTIONAL PATTERNS IN THE EUROPEAN SOFT BOTTOM COMMUNITIES

Christos Arvanitidis[1], Sarah Faulwetter[1], Christina Pavloudi[1], Maria Rousou[2], Pim van Avesaath[3], Sander Wijnhoven[3], Steven Degraer[4], Natalia Bojanic[5], Helen Orav-Kotta[6], Jérôme Jourde[7], Maria Luiza Pedrotti[8], Jean-Charles Leclerc[9,10], Nathalie Simon[9,10], Guy Bachelet[11], Tasman Crowe[12], Ohad Peleg[12], Lisandro Benedetti-Cecchi[13], Martina Dal Bello[13], Paolo Magni[14], Serena Como[14], Anda Ikauniece[15], Tomas Ruginis[16], Emilia Jankowska[17], Jan Marcin Weslawski[17], Jan Warzocha[18], Teresa Silva[19], Pedro Ribeiro[20], Valentina Kirienko Fernandes de Matos[20], Isabel Sousa-Pinto[21], Jesús Troncoso[22], Xabier Guinda[23], Jose Antonio Juanes de la Pena[23], Araceli Puente[23], Free Espinosa[24], Angel Ruzafa[25], Matt Frost[26], Herman Hummel[3]

[1]Institute of Marine Biology, Biotechnology and Aquaculture, Hellenic Centre for Marine Research, Heraklion, Crete, Greece; [2]Marine & Environmental Research Lab Ltd, Nicosia, Cyprus; [3]Monitor Taskforce, Royal Netherlands Institute for Sea Research, NIOZ, Yerseke, the Netherlands; [4]Royal Belgian Institute of Natural Sciences, MUMM, Brussels, Belgium;[5]Institute of Oceanography and Fisheries, Split, Croatia; [6]Estonian Marine Institute, University of Tartu, Tallinn, Estonia; [7]Observatoire de la biodiversité (OBIONE), Littoral Environnement et Sociétés, University of La Rochelle, France; [8]Sorbonne Universités, UPMC Univ. Paris 06, UMR 7093, LOV, Villefranche-sur-mer, France; [9]CNRS, UMR7144 AD2M, Station Biologique de Roscoff, Roscoff, France; [10]Sorbonne Universités, UPMC Univ Paris 6, Station Biologique de Roscoff, Roscoff, France; [11]CNRS, Université de Bordeaux, EPOC, Arcachon Marine Station, Arcachon, France; [12]School of Biology and Environmental Science and Earth Institute, University College Dublin, Ireland; [13]Department of Biology, University of Pisa, Pisa, Italy; [14]CNR, Institute for Coastal Marine Environment, Torregrande, Oristano, Italy; [15]Latvian Institute of Aquatic Ecology, Riga, Latvia; [16]Marine Science and Technology Centre, Klaipeda University, Lithuania, Klaipeda, Lithuania; [17]Institute of Oceanology, Polish Academy of Sciences, Sopot, Poland; [18]Marine Fisheries Institute, Gdynia, Poland; [19]Marine and Environmental Sciences Centre (MARE), Laboratório de Ciências do Mar, Universidade de Évora, Sines, Portugal; [20]Marine and Environmental Sciences Centre, Universidade dos Açores, Departamento de Oceanografia e Pescas, Horta, Azores, Portugal; [21]Centre for Marine and Environmental Research, CIIMAR, Porto, Portugal; [22]ECIMAT, Station of Marine Sciences of Toralla, Dpt of Ecology and Animal Biology, University of Vigo, Spain; [23]Environmental Hydraulics Institute of the University of Cantabria, Santander, Spain; [24]Universidad de Sevilla, Sevilla, Spain; [25]Dpt Ecology and Hidrology, Fac. of Biology, Regional Campus of International Excellence "Campus Mare Nostrum", University of Murcia, Spain; [26]Marine Biological Association, Plymouth, UK; arvanitidis@hcmr.gr

The interrelations between the structure and function of the marine communities is an important issue. The everlasting debate is on whether patterns from the community structure (abundance data) and function (functional trait data) are convergent or divergent and in which habitats and scales.

This study summarizes the results of such pattern comparisons from data collected during the COST Action EMBOS. The data come from a single sampling campaign (spring 2014) from a number of habitats from all over the European territorial waters (Baltic, Atlantic, Mediterranean) with the same protocols and gear but the focus here is on the soft bottom communities.

The results obtained by the application of multivariate techniques (nMDS, second-stage MDS and Spearman's coefficient for pattern correlation) show an overall congruence of the structural and functional patterns, with the samples in the latter being more similar to each other than in the former pattern. This is an expected result, coming from the fact that saturation of the cells with values from the functions is easily achieved as more species are discovered in a sample. However, in the matrix with species abundances there is always a large number of cells without values.

The results obtained are in accordance with those produced by a study in the Baltic Sea, with datasets coming from multi-annual observations. However, more detailed analysis is needed in order to test the same hypothesis in specific habitats, at the scales of the European regional Seas and with data from the most abundant taxa (polychaetes, crustaceans, molluscs).

ARE SPECIES POOR MARINE COMMUNITIES MORE SUSCEPTIBLE TO SETTLEMENT AND OUTBREAKS OF INVASIVE ALIENS?

Pim van Avesaath[1], Herman Hummel[1], Loran Kleine-Schaars[1], Steven Degraer[2], Francis Kerckhof[2], Christos Arvanitidis[3], Christina Pavloudi[3], Sarah Faulwetter[3], Jan Warzocha[4], Natalia Bojanic[5], Maria Rousou[6], Helen Orav-Kotta[7], Jérôme Jourde[8], Maria Luiza Pedrotti[9], Jean-Charles Leclerc[10], Nathalie Simon[10], Guy Bachelet[11], Nicolas Lavesque[11], Tasman Crowe[12], Jennifer Coughlan[12], Lisandro Benedetti-Cecchi[13], Martina Dal Bello[13], Paolo Magni[14], Serena Como[14], Stefania Coppa[14], Anda Ikauniece[15], Tomas Ruginis[16], Emilia Jankowska[17], Jan Marcin Weslawski[17], Teresa Silva[18], Pedro Ribeiro[19], Valentina Kirienko Fernandes de Matos[19], Isabel Sousa-Pinto[20], Jesús Troncoso[21], Xabier Guinda[22], Jose Antonio Juanes de la Pena[22], Araceli Puente[22], Free Espinosa[23], Angel Pérez-Ruzafa[24], Matt Frost[25], Ohad Peleg[26], Gil Rilov[26]

[1]Monitor Taskforce, Royal Netherlands Institute for Sea Research (NIOZ), Yerseke, the Netherlands; [2]Royal Belgian Institute of Natural Sciences, OD Nature, Marine Ecology and Management, Brussels and Oostende, Belgium; [3]Institute of Marine Biology, Biotechnology and Aquaculture, Hellenic Centre for Marine Research, Heraklion, Crete, Greece; [4]Marine Fisheries Institute, Gdynia, Poland; [5]Institute of Oceanography and Fisheries, Split, Croatia; [6]Marine & Environmental Research Lab Ltd, Nicosia, Cyprus; [7]Estonian Marine Institute, University of Tartu, Tallinn, Estonia; [8]Observatoire de la biodiversité (OBIONE), LIttoral ENvironnement et Sociétés, University of La Rochelle, France; [9]Sorbonne Universités, UPMC Univ. Paris 06, UMR 7093, LOV, Villefranche-sur-mer, France; [10]Station Biologique de Roscoff, CNRS UMR7144 AD2M and Sorbonne Universités UPMC Univ Paris 6, Roscoff, France;[11]Arcachon Marine Station, CNRS, Université de Bordeaux, EPOC, Arcachon, France; [12]School of Biology and Environmental Science and Earth Institute, University College Dublin, Ireland; [13]Department of Biology, University of Pisa, Pisa, Italy; [14]CNR, Institute for Coastal Marine Environment, Torregrande, Oristano, Italy; [15]Latvian Institute of Aquatic Ecology, Riga, Latvia,; [16]Marine Science and Technology Centre, Klaipeda University, Lithuania, Klaipeda, Lithuania,; [17]Institute of Oceanology, Polish Academy of Sciences, Sopot, Poland;[18]Marine and Environmental Sciences Centre (MARE), Laboratório de Ciências do Mar, Universidade de Évora, Sines, Portugal; [19]Marine and Environmental Sciences Centre, Universidade dos Açores, Departamento de Oceanografia e Pescas, Horta, Azores, Portugal; [20]Centre for Marine and Environmental Research, CIIMAR, Porto, Portugal; [21]ECIMAT, Station of Marine Sciences of Toralla, Dpt of Ecology and Animal Biology, University of Vigo, Spain; [22]Environmental Hydraulics Institute of the University of Cantabria, Santander, Spain;[23]Universidad de Sevilla, Sevilla, Spain; [24]Dpt. Ecology and Hydrology, Regional Campus of International Excellence "Campus Mare Nostrum", University of Murcia, Spain; [25]Marine Biological Association, Plymouth, UK; [26]National Institute of Oceanography, Israel Oceanographic and Limnological Research, Haifa, Israel; pim.van.avesaath@nioz.nl

Marine biodiversity provides many ecosystem services upon which humans depend, and is undergoing profound changes due to anthropogenic pressures, like global warming, eutrophication, artificial modifications. For the sustainable management of marine resources in this changing environment, proper understanding of biodiversity changes and patterns is needed at relevant spatiotemporal scales.

To this end, the COST Action EMBOS has set up a Pan-European network of observatories with an optimized and standardized methodology to elucidate patterns and changes in marine biodiversity at large scales. In spring 2014, 25 EMBOS partners have carried out a pilot, using their own resources, to test the feasibility of sustained observation of marine biodiversity patterns of communities of rocky shores, soft-bottom (including lagoons) and the pelagic along the European coast, in a network approach using a set of standardized methodologies.

Apart from feasibility tests, the results are used to address the hypothesis that species poor marine communities are more susceptible to intrusions (settlement) by alien (non indigenous) species than communities that are more diverse.

At the EMBS the outcome of the falsification of this hypothesis on the influence of alien species will be presented, in connection with the relevance of a network like EMBOS for the sustained observation of marine biodiversity patterns and changes at large spatiotemporal scales.

OBS01_3: Drivers of and responses to ecosystem change in marine/coastal systems

Wednesday, 23/Sep/2015, 9:00am - 10:30am *Location:* **Nordseehalle 1**

White Sea Biological Station: 50 years of coastal ecosystem monitoring

Alexey Sukhotin, Kirill Galaktionov, Viacheslav Khalaman, Inna Kutcheva, Daria Martynova, Andrew Naumov, Kirill Nikolaev, Nikolay Usov

Zoological Institute, Russian Academy of Sciences, Russian Federation; alex_sukhotin@hotmail.com

Since 1957 the White Sea Biological Station (Kartesh) of the Zoological Institute carries out several monitoring studies in coastal ecosystems. Observations of the marine pelagic and benthic communities all year round in a freezing sea with a 6-months-long ice cover made these studies rare and thus very valuable among the similar ones. Here we present an overview of the results of these long-term studies.

Our observations showed that besides the weak trend of long-term warming of the upper (<70 m) waters of theWhite Sea, the onset of hydrological summer in the surface water layers has shifted earlier in the last 50 years. The Arctic zooplankton species appeared to be affected by these changes to a greater extent than the boreal ones. Rare extreme events such as abnormally cold or warm years and/or ice scouring of the soft sediments in the intertidal zone are followed by a relatively fast recovery of the pelagic and benthic communities. To the contrary, the anthropogenic influences such as increased disturbance of marine birds during the recent 15 years determined the long-term trends in populations of the parasites that spend part of their life cycles in intertidal assemblages. Analyses of over 20-years-long data set allowed suggesting the general scheme of succession in fouling communities in cold waters, which helps to distinguish normal succession processes from cyclical oscillations from anomalies and spontaneous events in these epibenthic assemblages. This in turn is an essential pre-requisite for identifying climate-change induced regime shifts in coastal ecosystems.

Spawning bed selection of Atlantic herring in coastal waters of the Western Baltic Sea

Dorothee Moll, Paul Kotterba, Patrick Polte

Thünen Institute of Baltic Sea Fisheries, Germany; dorothee.moll@ti.bund.de

Coastal areas are essential spawning and nursery habitats for many fish species, however they are also subject to multiple anthropogenic threats. Within these shallow waters, submerged aquatic vegetation (SAV) often plays a crucial role in structuring the habitat and providing suitable substrate for feeding, predator avoidance and spawning. Some commercially important fish species, such as Atlantic herring in the Western Baltic Sea, are strongly dependent on the availability of appropriate spawning beds formed by meadows of SAV in shallow brackish lagoons. The SAV composition within these estuarine systems usually follows a depth-dependent gradient with a pondweed community in water depths below 2 meters and a seagrass dominated zone between 2 and 4 meters. Hypothesizing a distinct habitat-related utilization of these different zones as spawning beds, SAV meadows at fixed transects of different water depths were sampled weekly during the spring herring spawning season (March to June) in three successive years. Herring spawn concentrations and egg mortalities were quantified along with the amount and composition of SAV. Additionally, hydrographical features (temperature, salinity, turbidity, sea state and oxygen saturation) were measured to analyze the impact of these parameters on spawning intensity and egg mortality. Our results showed a strong seasonal variation in spawning bed utilization but also strong inter-annual changes in SAV-composition (e.g. increasing amount of floating algal mats) and resulting spawning intensities and egg mortalities. Considering the persistent eutrophication-related general trend in decreasing SAV meadows, our results underline the demand for an integrated and sustainable management of shallow coastal spawning grounds.

The impact of ice winters on the spring bloom in the Sylt-Rømø basin

Johannes Josef Rick, Karen Helen Wiltshire

AWI, Germany; johannes.rick@awi.de

Hydrochemistry (since 1973) and plankton data (since 1992) are available from the List, Sylt time series. Despite a significant decrease since the mid-nineties both in nitrate and phosphate loading the systems average chlorophyll concentrations are not affected. The diatom-dominated spring bloom is the most prominent signal in the area. Ice or cold winters have a severe impact on the timing, biomass and prevalent temperature of the spring bloom. After ice winters it consists of only two major phytoplankton players, the centric diatoms *Odontella aurita* and*Porosira glacialis*. Biomass maximum occurs earlier (> 1 month), with elevated biomasses and at lower temperatures compared to warmer winters. Since ice winter frequency in the Sylt-Rømø basin was reduced by almost 40% over last 50 years, a severe impact on the system can be expected.

Zooplankton distribution in a low-oxygen eddy - an “open ocean dead zone”?

Helena Hauss[1], Svenja Christiansen[1], Rainer Kiko[1], Miryan Edvam Lima[2], Elizandro Rodrigues[2], Florian Schütte[1], Damian Grundle[1], Johannes Karstensen[1], Carolin Löscher[1,3], Arne Körtzinger[1], Björn Fiedler[1]

[1]GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany; [2]Instituto Nacional de Desenvolvimento das Pescas (INDP), Mindelo, Cabo Verde; [3]Institute for General Microbiology, Kiel, Germany; hhauss@geomar.de

The Eastern Tropical North Atlantic features a permanent mesopelagic oxygen minimum zone (OMZ) at approximately 300-600 m depth, coinciding with the daytime depth of many vertically migrating zooplankton organisms. Here, currently observed

O_2 concentrations seldom fall below 40 µmol kg^{-1}, but are thought to decline in the course of climate change. The recent discovery of mesoscale eddies that harbor a shallow suboxic (<5µmol kg^{-1}) OMZ just below the mixed layer has led us to conduct an interdisciplinary "eddy hunt". In spring 2014, an anticyclonic mode water eddy passing north of Cape Verde was tracked using satellite data and gliders, followed by ship-based sampling. The eddy was characterized by increased nitrate and Chl-*a*, along with a 1.5 to 2-fold increase in total area-integrated zooplankton abundance.O_2 concentrations were as low as 4.5 µmol kg^{-1} (85 to 120 m depth). In this depth level, a marked reduction in target strength (shipboard ADCP, 75kHz) at nighttime was evident Acoustic scatterers were avoiding this zone and were compressed at the surface. However, vertically stratified multinet hauls and Underwater Vision Profiler (UVP5) image data revealed that this depth range was not completely void of metazoan life. Many of the smaller and/or less mobile organisms targeted by the multinet were able to tolerate conditions in the shallow OMZ. In particular, *Oncaea* spp., ostracods, eucalanoid copepods and siphonophores seemed to favor this zone as their daytime depth, while e.g. euphausiids appeared to avoid it. Habitat compression at the surface might make them more vulnerable for predation.

Control of Phytoplankton Productivity by Zooplankton: An analyses for the Helgoland Roads Time Serie

Karen Helen Wiltshire, Mirco Scharfe, Maarten Boersma

Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Germany; Karen.Wiltshire@awi.de

Zooplankton control of phytoplankton growth (Top Down Control) is accepted for aquatic systems. How such relationships have changed in terms of long term climate shifts is subject of much debate. Using The Helgoland Roads Time series, one of the longest and most detailed marine time series available, we analyze this relationship. Here the emphasis were on 1. General trends and the evaluation of the role zooplankton drivers on phytoplankton productivity, 2. shifts in phenology and relative timing of zooplankton versus phytoplankton and 3) species shifts related to shifts of algal size classes or grazing defense mechanisms. We found that the zooplankton numbers in the system are declining steadily in the last 50 years while algal biomass has increased. This is discussed in terms of nutrient and Hydrographic shifts of the German Bight. The timing of the phytoplankton as a food source has shifted considerably in the past 50 years to underpin a potential mismatch. Compounding this is that from species analyses we postulate that the quality of the algae as a food has become reduced. Here we discuss shifts in food size spectra and potential grazer defense mechanisms of the micro algae a as a variant of shift in the phytoplankton zooplankton interaction.

Habitat utilization of herring larvae in an inshore retention area in the Western Baltic Sea

Paul Kotterba[1], Sarah Beyer[2], Julia Heiler[2], Dorothee Moll[1], Patrick Polte[1]

[1]Thünen-Institute of Baltic Sea Fisheries, Germany; [2]University of Rostock; paul.kotterba@ti.bund.de

Many commercial pelagic fishes such as Atlantic herring run through a life cycle which is tightly bound to the offshore pelagic zones. Their population dynamics are therefore mainly driven by large scale hydrography or climate conditions and studies on early life-stages are usually focused on outer shelf bank spawning grounds and adjacent areas. However, larval herring of East-Atlantic sub-populations spawned within estuarine inshore systems develop in a quite different suite of environmental conditions than their shelf-spawned conspecifics in the neighboring North Sea. Hypothesizing that herring larvae in shallow brackish lagoons utilize different estuarine habitats along their early ontogenesis we sampled ichthyoplankton at distinct pelagic and littoral sites within a major spawning area of the Western Baltic herring. Additionally, we analyzed the vertical distribution of herring larvae which is generally assumed to reflect the well mixed condition of shallow waters in the lagoon. Samples in the littoral zone unexpectedly contained comparably high numbers of herring larvae as samples taken at the pelagic sites. Furthermore we observed high abundances of older flexion larvae in very shallow areas (<1m) close to the shore line. Despite a well-mixed water column, herring larvae showed a distinct vertical distribution indicating an active depth selection potentially influencing the drift potential along the current regimes. Our study underlines the importance of shallow littoral zones for the reproduction success of pelagic key stone species. Future discussions on management and protection demands should take into account the significant function of these habitats for larval fish.

OBS08: From the bottom to the top: Foodweb interactions in a changing climate

Wednesday, 23/Sep/2015, 9:00am - 10:30am *Location:* **Nordseehalle 2**

Junk food is less junk when it's warm.

Arne M. Malzahn[1], Dijana Doerfler[2], Maarten Boersma[2]

[1]Sultan Qaboos University, Oman; [2]Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung; arne.malzahn@gmail.com

Global temperatures and CO_2 concentrations are increasing, which has fundamental effects on biota, but how the two stressors interact is still largely unknown. We tested these interacting effects of temperature and carbon availability in a phytoplankton species (*Rhodomonas salina*) on developmental rates of a keystone plankton herbivore, *Acartia tonsa*. We fed the copepod along a temperature gradient of 8 temperatures from 8˚C to 22˚C and a gradient of 5 food qualities from phosphorus limited to phosphorus replete algae. Temperature and food quality as well as their interaction significantly affected copepod growth. Food quality effects were strongest at low temperatures and lessened with increasing temperatures. We conclude that negative effects on secondary production due to increased carbon availability in the future ocean may be counteracted by increased temperature because of the temperature dependent increase in routine metabolism and the associated need for an increase in carbon supply.

HOW CAN KELP AND SEAGRASS BEDS PERSIST BEING BOTH FOOD AND HABITAT?

Hartvig Caspar Christie[1], Kjell Magnus Norderhaug[1], Stein Fredriksen[2], Patrik Kraufvelin[3]

[1]Norwegian Institute for Water Research (NIVA), Norway; [2]University of Oslo, Norway; [3]Aabo Akademi University, Finland; hartvig.christie@niva.no

Marine macrophyte beds along the Norwegian coast can house more than 100 000 mesograzers per m^2. These invertebrate grazers use the macrophyte both as their habitat and as major food source. A key to persistence of these ecosystems is the different strategies among the grazer's feeding behavior and also how their population density may be controlled. In the kelp forest, the mesograzers feed on kelp detritus (POC) rather than the fresh kelp, or some prefer ephemeral algae rather than grazing the perennial foundation species. Secondary production has been found to be only between 3 and 8 percent of the primary production in rich kelp forests, and the grazer activity may be controlled by predation and/or by their mobile behavior leading to dispersal/emigration as a result of space limitation. Field studies, field experiments and mesocosm experiments have revealed how the different feeding strategies, and processes that normally limit the population density are of importance for the stability properties of these ecosystems, but also how anthropogenic pressures may contribute to severe alterations of these systems.

BACTERIAL COMMUNITY ASSOCIATED WITH SCYPHOMEDUSAE AT HELGOLAND ROADS

Antje Wichels[1], Wenjin Hao[2], Sabine Holst[3], Gunnar Gerdts[1]

[1]AWI, Germany; [2]Binzhou Medical Unversity, China; [3]University of Hamburg, Germany; antje.wichels@awi.de

Different modes of asexual and sexual reproduction are typical for the life-history of metagenetic Scyphozoa. Numerous studies have focused upon the general life history distribution, reproductive behavior, factors leading to strobilation, growth rates and impact of predation rate of medusa. However, bacteria associated with different life stages of Scyphozoa have received less attention. In the present study, bacterial communities associated with different body fractions and different life stages of two Scyphomedusae *Cyanea lamarckii* and *Chrysaora hysoscella*, which are common species in the German Bight, North Sea, were analyzed via automated ribosomal intergenic spacer analysis (ARISA). Regarding to the analysis of different body fractions (umbrella, gonad, tentacle and mouth arm), significant differences are revealed between umbrella and other body fractions (gonad and tentacle) in terms of the associated bacterial community in both species. With regard to the different life stages, bacterial community structure varied from the early stage planula larvae to polyp even to adult medusa with significant differences in both species by multivariate analysis. Furthermore, the free-living and attached bacterial community of food source did not influence the bacterial communities of polyps, however, polyps displayed a significantly different bacterial community in response to different food source. The bacterial community associated with scyphozoan presented species-specific structure.

ROLE OF THE WADDEN SEA FOR HARBOR SEALS AND INFLUENCE OF HARBOR SEALS ON ITS FOOD WEB

Camilla de la Vega[1], Ragnhild Asmus[1], Benoit Lebreton[2], Ursula Siebert[3], Harald Asmus[1]

[1]Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung, Germany; [2]Université de La Rochelle, Institut du Littoral et de l'Environnement; [3]Stiftung Tierärztliche Hochschule Hannover Institut für Terrestrische und Aquatische Wildtierforschung; camille.de.la.vega@awi.de

The Sylt-Rømø Bight, situated on the German Wadden Sea Coast, is well studied and its food web has been modeled, taking into account most of the trophic compartments. But top-predators are not yet included in the model due to the difficulties to determine their diet based in a wide range of possible prey types. However, the Wadden Sea has an important role for marine mammals in terms of resting, nursing and foraging. Using Ecological Network Analysis, the aim of this study was to determine if this coastal ecosystem plays a major role for the food intake of harbour seals (*Phoca vitulina*), the main mammal species in the area.

The first step was to determine the seals diet; trophic markers analyses (stable isotopes and fatty acids) were performed on harbour seals (muscles and/or vibrissae) and their potential prey items from the Sylt-Rømø Bight and from the North Sea in order to study seasonal patterns in the diet and in the foraging location.

Secondly, the seal compartment was included in the existing Ecological Network Analysis model to study the impact of harbour seals on the Sylt-Rømø Bight food web. The preliminary results showed a top down influence of the seals on the system, revealed by a trophic cascade effect visible along several compartments of the food web. Nevertheless, the impact of seals on fish appeared to be relatively low. These results are an interesting base for the understanding of changes in coastal ecosystems and management decisions.

OBS11_1: Biodiversity as a response to or a driver of change

Wednesday, 23/Sep/2015, 12:00pm - 1:30pm *Location:* Nordseehalle 1

DOES THE NUMBER OF SPECIES MATTER? BIODIVERSITY AND SEAFLOOR FUNCTIONING UNDER HYPOXIC STRESS

Joanna Norkko[1], Johanna Gammal[1], Conrad Pilditch[2], Rutger Rosenberg[3], Maria Granberg[4], Fredrik Lindgren[5], Stefan Agrenius[3], Alf Norkko[1]

[1]Tvärminne Zoological Station, University of Helsinki, Finland; [2]Department of Biological Science, University of Waikato, New Zealand; [3]Department of Biological and Environmental Sciences, University of Gothenburg, Sweden; [4]Norwegian Polar Institute, Fram Centre, Tromsø, Norway; [5]Department of Shipping and Marine Technology, Chalmers University of Technology, Gothenburg, Sweden; joanna.norkko@helsinki.fi

Seafloor ecosystems play pivotal roles in biogeochemical cycling, but hypoxia is changing the way they contribute to ecosystem function on a global scale. While the effects of hypoxia on benthic communities are well documented, less attention has been paid to how organisms' contribution to ecosystem functioning changes as environmental conditions deteriorate. Moreover, this has only rarely been assessed *in situ*. To better understand the real-world links between biodiversity, hypoxia and ecosystem function (benthic nutrient cycling), we used field data from 11 sites in Havstensfjord (Swedish west coast), covering a gradient from oxic to anoxic bottom water, with a corresponding gradient in diversity. Intact sediment cores were incubated to measure fluxes of oxygen and nutrients (NO_3^-, NO_2^-, NH_4^+, PO_4^{3-}, SiO_4) across the sediment-water interface. Sediment profile imaging was used to assess the depth of the bioturbated sediment layer, and samples were collected for sediment characteristics, macrofauna and meiofauna. Bottom-water oxygen conditions were the main driver of macrofauna communities, with threshold-like shifts in species richness, abundance and biomass; meiofauna on the other hand appeared less sensitive. Oxygen concentration was the main driver of nutrient fluxes, but macrofaunal diversity and abundance was also a significant predictor. To assess whether the number of species actually matters when conditions deteriorate, we compared these results with similar studies in the low-diversity Baltic Sea, thus providing generality to the findings, which supports management decisions aimed at protecting the dwindling biodiversity in coastal zones around the world.

PLANKTON PHENOLOGY ON THE LONG–TERM SCALE: CONSISTENCY AND VARIATION OBSERVED AT HELGOLAND ROADS

Mirco Scharfe, Karen Wiltshire

AWI, Germany; mirco.scharfe@awi.de

The annual and periodical recurrence of events and processes in marine plankton populations plays a central role in pelagic food webs. Phytoplankton in shallow coastal seas is subject to high seasonal variability which makes analyses of phenological changes and their classification as imprints of climatic changes difficult. The extent of natural variability relative to trend-like dynamics can only be determined if phytoplankton observations are both regular and long-term. We analyze phenological variability of diatom species monitored at Helgoland Roads during the period 1962-2013. We derive temporal indices based on the cumulative percentage of annual abundance to approximate the beginning and the end of individual annual growth periods and analyze their relationships to abiotic and biotic parameters. Timing of phytoplankton species is highly variable and only very few species exhibit significant trends in phenological characteristics over the entire period. Phytoplankton species can exhibit a wide range of environmental conditions associated with the beginning of growth. As a result, strong fluctuations in winter/spring temperatures do not automatically lead to changes in timing dates. Most species exhibit a broader timing window at the beginning of the growth period than at the end. Short phases of rapidly changing light conditions during spring and autumn seem to play an important role as a sort of ´climatic boundary` for phytoplankton seasonality. We will put the phenological response in context to long-term trends in abiotic determinants (e.g. temperature) observed at Helgoland Roads and discuss the potential of making assessments about consequences for the marine ecosystem.

DOES OCEAN ACIDIFICATION AFFECT NORTH SEA MICROZOOPLANKTON COMMUNITIES?

Henriette G. Horn[1], Nils Sander[1], Maria Algueró-Muñiz[1], Martin G.J. Löder[1], Maarten Boersma[1], Ulf Riebesell[2], Nicole Aberle[1]

[1]Biologische Anstalt Helgoland, Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research; [2]GEOMAR Helmholtz Centre for Ocean Research; henriette.horn@awi.de

In order to assess the effects of ocean acidification (OA) on natural plankton communities, a large-scale mesocosm experiment was conducted in Gullmar Fjord (North Sea) from a spring bloom to a mid-summer situation.

Here, the emphasis was on the pivotal role of microzooplankton (MZP) as trophic intermediary between the microbial loop and higher trophic levels. Due to its high specific growth and grazing rates, MZP has a strong impact on phytoplankton standing stocks which can lead to dietary competition between MZP and mesozooplankton. Furthermore, the ability of MZP to act as trophic upgraders for mesozooplankton by buffering nutritional imbalances of algae might gain importance given the expected decrease in algal food quality with OA.

We present data on MZP communities (abundance, biomass, taxonomic composition) with emphasis on phytoplankton-MZP-mesozooplankton interactions. Overall, two phytoplankton peaks occurred (1st peak: around day 30, 2nd peak: around day 50). While there was no direct numerical response of MZP biomass to increases in phytoplankton biomass during the 1stpeak, a clear numerical response of MZP to the 2nd peak was observed. However, no significant differences in MZP biomass with regard to the different CO_2 scenarios occurred.

In general, the ciliate community was dominated by small Strombidiids and no clear CO_2 impacts on the ciliate community composition could be detected. Additional grazing experiments conducted during the 1st phytoplankton peak showed negative phytoplankton growth rates throughout. MZP grazing could only be detected in some of the low pCO_2 treatments, pointing towards complex responses of MZP communities to OA.

EFFECTS OF OCEAN ACIDIFICATION ON ZOOPLANKTON: METABARCODING RESULTS FROM A MESOCOSMOS EXPERIMENT

Julia Lange[1], Maarten Boersma[1], Klaus Schwenk[2]

[1]Alfred-Wegener-Institut, Germany; [2]Universität Koblenz-Landau, Molekulare Ökologie, Germany; julia.lange@awi.de

Zooplankton play a key role in marine food webs as they consume and process phytoplankton and other food sources. Those primary consumers are the intermediate link that transfers energy captured by phytoplankton to higher trophic levels. The ongoing acidification process of the oceans may have consequences for these marine biota. During a long-term mesocosmos experiment (BIOACIDII) regular plankton samples were taken to investigate species composition, succession and genetic variation comparing species suffering under ocean acidification with those exposed to present-day CO_2 conditions. The combination of DNA barcoding and next generation sequencing (metabarcoding) provides an opportunity to estimate the response to acidification with unprecedented detail. Preliminary results indicate that metabarcoding identified members of all major groups as well as previously unknown taxa. Current analyses aim to reveal the response of the entire community to raised CO_2 conditions covering all trophic levels (protists, fungi, phyto- and zooplankton).

LINKING TRAITS TO PROCESSES – THE EFFECT OF BENTHIC MACROFAUNA ON SEDIMENT NUTRIENT CYCLING

Marie Järnström[1], Johanna Gammal[2], Guillaume Bernard[2], Alf Norkko[2], Erik Bonsdorff[1]

[1]Åbo Akademi University, Finland; [2]University of Helsinki, Finland; marie.jarnstrom@abo.fi

Due to the complex mosaic of habitats, coastal zones support a high biodiversity and are therefore ecologically important areas in terms of maintenance of ecosystem functions, such as primary production and nutrient cycling. The activities of benthic macrofauna are tightly linked to biogeochemical processes included in the nutrient transformation and retention of marine sediments, and it is thus important to investigate the relationship between functional diversity and ecosystem functioning. Studies have shown that benthic macrofauna affect the biogeochemical processes at the sediment-water interface, but few have explored and compared the relationships under natural conditions in different habitats and over environmental gradients. In our study, we aim to determine biological traits of benthic macrofauna directly linked to these processes. We sampled 18 stations on a gradient from silt to coarse sand while ensuring to include the variability of shallow coastal habitats regarding vegetation and exposure. Sediment cores from each station were incubated in order to obtain information on sediment oxygen and nutrient fluxes to accompany the faunal results. With this information we aim to show the links between nutrient cycling processes and faunal functioning, as well as possible differences in functional trait distribution across habitats.

MACROBENTHIC COMMUNITY COMPOSITION DRIVES DENITRIFIER RESPONSE TO NUTRIENT LOADING

Emily Douglas[1], Conrad Pilditch[1], Casper Kraan[2], Louis Schipper[1], Andrew Lohrer[2], Simon Thrush[3]

[1]University of Waikato, New Zealand; [2]National Institute of Water and Atmospheric Research Ltd., New Zealand; [3]University of Auckland, New Zealand; emilydouglas@outlook.com

Denitrification is one of few ways to remove nitrogen from coastal ecosystems. This microbial process is mediated by environmental conditions and by the activities of resident macrofauna. We do not know to what extent variation in macrofaunal community composition influences denitrification, yet this is important as anthropogenic stressors are altering benthic biodiversity. To test this, a nutrient enrichment experiment was set up across a 300,000 m^2 area of inter-tidal sandflat that encompassed variation in sediment properties, seagrass coverage, and the functional composition of the macrobenthic community. Four treatment combinations of macrofaunal functional diversity (high/low) and functional abundance (high/low) were replicated 7 times within the study area. Species were grouped based on their ability to affect biogeochemical processes. At each site, 1 m^2 plots consisting of a control (no addition), medium (150 g N/m^2) and high (600 g N/m^2) nitrogen enrichment treatments were established. After 5 weeks of enrichment, pore water ammonium concentrations had significantly increased in both medium and high treatment plots. We hypothesised that higher functional diversity and functional abundance would provide resilience to nutrient stress through facilitating denitrification. Results showed that denitrification enzyme activity (DEA) was highest (170 % of control rates) at sites with fine sediments, and high abundance and diversity of macrofauna. Conversely, DEA was supressed by nutrient enrichment (1 % of control rates) when site abundance and diversity were low. These results support our hypothesis and highlight the importance of community structure for ecosystem function in the face of environmental change.

SOC03: Science, policy and education: where do they meet?

Wednesday, 23/Sep/2015, 12:00pm - 1:30pm *Location:* Nordseehalle 2

THE NF-POGO ALUMNI NETWORK FOR OCEANS (NANO)

K. Avarachen Mathew[1], Olga Shatova[2], Lilian Krug[3], Victoria Cheung[4], Sophie Seeyave[4]

[1]Cochin University of Science and Technology, India; [2]University of Ottago, New Zealand; [3]University of Algarve, Portugal; [4]Partnership for Observation of Global Oceans, United Kingdom; mathew.k.avarachen@gmail.com

The Nippon Foundation (NF) and the Partnership for Observation of the Global Oceans (POGO) have worked closely together for the last decade to train the next generation of ocean scientists. Promoting networking among the alumni of their joint training programmes has always been a priority, and led to the creation of the NF-POGO Network of Alumni for the Oceans (NANO) in 2010. NANO currently comprises 210 members from 46 countries on five continents (70% of all NF-POGO trainees). NANO alumni are held together by a common interest in, and commitment to, ocean science, and by the common will to communicate the results of their work to the general public. The network also collaborates with ~50 distinguished ocean scientists who provide advice and share their experience and expertise with the alumni. One of the main objectives of the network is to promote collaborative work between NANO alumni to address societally-relevant issues impacting their coasts (e.g. water quality, harmful algal blooms, coastal erosion). Five regional research projects are being conducted in Latin America, North-West Africa, South-East Asia, Indian Subcontinent and the Caribbean.

In addition, a NANO outreach programme provides modest grants to alumni to perform educational activities aiming to improve public awareness of marine issues. Rapid progress and successful accomplishment of NANO initiatives are evidence that NANO work is highly relevant for the benefit of the blue planet and society-at-large.

APPLICATION OF SCIENCE TO POLICY IN THE HARVESTING OF PARACENTROTUS LIVIDUS (LAMARCK, 1816)

Xabier Guinda[1], Gorka Bidegain[2], Araceli Puente[1], José Antonio Juanes[1]

[1]Environmental Hydraulics Institute "IH Cantabria", Universidad de Cantabria, Spain; [2]Gulf Coast Research Lab, University of Southern Mississippi, U.S.A.; guindax@unican.es

The rock sea urchin *P. lividus* constitutes a very valuable marine resource which must be carefully managed. The objective of this work is to identify the most appropriate locations for the sustainable harvesting of *P. lividus* in the coast of Cantabria (Bay of Biscay) in order to establish adequate management measures. The study was carried out in five coastal areas distributed along 110 km of coastline. 41 transects and two depth ranges (<5m and 5-10m) were considered for the study. Sea urchin abundance was recorded *in situ* and replicates of 10 individuals per depth range were collected at 21 transects. Total body size, fresh weight, gonadal fresh weigh and gonadal index were measured at the laboratory. Differences between coastal areas and depth ranges were analyzed using ANOVA and Kruskal-Wallis tests. Significant differences were subsequently analysed by Bonferroni and Mann-Whitney post-hoc tests. Correlations between abundance and biometrical variables were studied by linear regression models. Percentage frequency distributions of the biometric variables were built and used to estimate the available stock of commercial individuals (size>55mm). The results showed significant differences between areas but not between depth ranges. All the biometric variables, except the gonadal index, showed significant negative correlations against abundance data. Three areas showed low densities with big individuals and two areas showed high densities with smaller individuals. Despite the average smaller size of the individuals, the latter two areas accumulated the 71% of the commercial stock, being the most suitable zones for the sustainable harvesting of *P. lividus*.

EVIDENCE TO INFORM POLICY: CLIMATE CHANGE AND MARINE BIODIVERSITY LEGISLATION.

Matt Frost[1], Georgia Bayliss-Brown[2], Paul Buckley[2], Martyn Cox[3], Stephen Dye[2], Bethany Stoker[4], Narumon Withers Harvey[5]

[1]Marine Biological Association, Plymouth, PL1 2PB, UK; [2]MCCIP Secretariat, Marine Climate Change Centre, Cefas, Lowestoft, NR33 0HT, UK; [3]Marine Scotland, Scottish Government, 1A-south, Victoria Quay, Leith, Edinburgh, EH6 6QQ; [4]UK Joint Nature Conservation Committee, Peterborough, PE1 1JY; [5]UK Marine Environmental Strategy and Evidence, Defra, London, SW1P 3JR, UK; matfr@mba.ac.uk

Legislation is a key means by which the protection and conservation of marine biodiversity is achieved. Important legislation includes the designation of marine protected areas and the Marine Strategy Framework Directive (MSFD) with its aim of meeting 'Good Environmental Status' (GES) for European seas by 2020. There is concern however that the impacts of climate change on marine biodiversity may compromise the effectiveness of any legislation. The UK Marine Climate Change Impacts Partnership (MCCIP) works with marine scientist to supply independent scientific evidence for policy makers and government. MCCIP was given the task of examining the effect of climate change impacts on the implementation of marine biodiversity legislation and reporting this to government and policy stakeholders.

This presentation reports the outcomes of the study, describing the main marine biodiversity legislation (with a focus on marine biodiversity policy on marine protected areas). The latest key climate change impacts are briefly summarized along with an analysis of whether current marine biodiversity legislation accounts for these impacts (e.g. in the first instance or through inbuilt flexibility in legislative mechanisms allowing for adaptation). Finally, the importance of making links between scientific evidence on environmental change (climate-driven or otherwise) and implementation of policy and legislation is highlighted.

30 YEARS NATURE CONSERVATION ON HELGOLAND: LINKING PROTECTION AND EXPERIENCE IN AN INTERDISCIPLINARY APPROACH

Rebecca Störmer

Jordsand, Germany; rebecca.stoermer@jordsand.de

The island of Helgoland hosts a unique environment including, various different species of vertebrates and invertebrates. It has the highest diversity of flora and fauna in the German Bight, some species being unique for Germany. Therefore two natural reserves: “Helgoländer Felssockel” and “Lummenfelsen” were designated in 1964 and 1981 respectively. The NGO “Verein Jordsand zum Schutz der Seevögel und der Natur e.V.” is in charge for these reserves since 1983. During the past thirty years data on breeding birds were recorded by the Institute of Avian Research, the local birding club “OAG Helgoland” and the “Verein Jordsand”, while Grey Seals and Harbour Seals are recorded in cooperation with the nature representatives of the community. Long term trends show increasing numbers of most seabirds as well as marine seals, making Helgoland an attractive destination for seabirds, marine mammals and tourists interested in nature. The presentation will focus on an overview of these trends giving also an impression of the increase of public interest to experience Helgolands nature. The tasks covered by the Verein Jordsand have developed from various nature guiding tours for visitors towards active parts in conservation of seals, seabirds and their environment. We are proud to support the community Helgoland in their touristic management and thus work as a cooperation and linkage partner for nature conservation with both science and politics in a worldwide unique environment.

DM03: Molecular Monitoring systems: Promises and challenges for long-term observations

Thursday, 24/Sep/2015, 9:00am - 10:30am *Location:* **Nordseehalle 1**

MOLECULAR ANALYSES OF PROTISTS IN THE DEEP-SEA OBSERVATORY HAUSGARTEN

Katja Metfies, Estelle Kilias, Pim Sprong, Juliane Riedel, Christina Bienhold, Eduard Bauerfeind, Eva-Maria Nöthig
Alfred-Wegener-Institute Helmholtz Centre for Polar and Marine Research; Katja.Metfies@awi.de

In 1999, the Alfred-Wegener-Institute Helmholtz Centre for Polar and Marine Research established the "Deep-Sea Observatory HAUSGARTEN" to carry out time-series studies by regular observations of the ecosystem in the eastern Fram Strait. Since 2009, protist diversity and community structure were investigated in various samples collected in the area of the observatory from the pelagic and the benthic realm by molecular fingerprinting methods, quantitative PCR (q-PCR) and next generation sequencing (NGS) of the 18S rDNA.

NGS of pelagic samples collected on an annual basis between 2009 – 2013 revealed variability in protist community structure and identified taxa accounting for this variability. Sequences affiliated with *Phaeocystis pouchetii* and *Micromonas pusilla* were major constituents of the sequences assemblages in the observation area, constituting more than 60% of 18S rDNA reads in 2010, and between 15-40% in the remaining years. A survey of these two species in benthic samples via q-PCR suggests differences in sedimentation beween these two species. While *Micromonas pusilla* was found in all benthic samples, *Phaeocystis pouchetii* was only found occasionally, This reflects different ecological performance of the both genera in the overlying water column. Furthermore, molecular fingerprint analyses of protist assemblages exported at HGIV during the period of highest flux in September (2000-2010) suggest change in the protist community structure after 2006.

Overall, our findings demonstrate that molecular observations are valuable components for marine long term studies. Molecular approaches and the data sets presented here might serve as cornerstones to establish a molecular long term observatory in Fram Strait.

IMPROVED MARINE FUNGAL COMMUNITY ANALYSES BY USING OPTIMIZED 18S RRNA GENE SEQUENCE PRIMER PAIRS

Stefanos Banos[1], Anna Kopf[2,3], Katrin Panzer[1], Guillaume Lentendu[4], Tesfaye Wubet[4], Frank Oliver Glöckner[2,3], Marlis Reich[1]
[1]University of Bremen, Germany; [2]Max Planck Institute for Marine Microbiology, Bremen, Germany; [3]Jacobs University gGmbH, Bremen, Germany; [4]Helmholtz Centre for Environmental Research GmbH – UFZ, Halle/Saale, Germany; stefanosbanos@gmail.com

For a long time, fungi were thought to have negligible ecological functions in aquatic systems but recent studies showed that planktonic and marine subseafloor fungal communities contribute significantly to elemental cycles and mineralization processes.

The 18S ribosomal RNA (rRNA) gene sequence is the most used marker gene for marine fungal community analyses allowing the phylogenetic assignment of the numerous undescribed fungal species found in marine environments. However, fungal sequence amounts in fungal-specific next generation sequencing (NGS) surveys reached often only 30-50% of total sequence output due to high co-amplification of other non-target eukaryotic groups. Additionally, the results are usually highly biased towards the groups of Dikarya and thus, do not reflect fungal community composition correctly.

The aim of our study was the identification of an optimized 18S rRNA primer pair for NGS technique showing low co-amplification with non-target groups and covering taxa from the complete fungal tree of life.

The analysis included: (i) *in silico* evaluation of newly combined primer pairs of existing primers, (ii) design of new primers, (iii) *in vitro* amplification of the six best primer pairs on diverse reference species. Finally, the two most promising primer pairs were applied in environmental community analyses which resulted in successful amplification of several different fungal phyla including the so called basal fungal lineages. The results of this study may be used as a guideline for selecting primer pairs for generating a less biased picture of marine fungal communities and reduce the co-amplification of non-target sequences to a minimum.

ANNUAL DYNAMICS OF NORTH SEA BACTERIOPLANKTON: SEASONAL VARIABILITY SUPERIMPOSES SHORT-TERM VARIATION

Judith Lucas[1], Antje Wichels[1], Hanno Teeling[2], Meghan Chafee[2], Mirco Scharfe[1], Gunnar Gerdts[1]
[1]AWI, Germany; [2]MPI Bremen, Germany; gunnar.gerdts@awi.de

Dynamics of microbial communities are driven by a huge range of seasonally changing abiotic and biotic factors. Hence changes in microbial communities on annual time-scales as well as short-term response to phytoplankton blooms can be presumed. The objective of this study was to examine the variability of the free living bacterioplankton at Helgoland Roads (North Sea) over a period of one year on high temporal and taxonomical resolution. 16S rRNA gene tag sequencing of the bacterioplankton community suggests annual recurrence and resilience of few main taxa belonging to *Alphaproteobacteria, Betaproteobacteria, Flavobacteria, Acidimicrobia* and *Thermoplasmata*. Multiple regression analyses with various environmental factors revealed temperature to be the main forcing factor for this seasonal succession. Short-term variation was mainly driven by changes in current patterns and resulting phytoplankton blooms. Comparison of spring and summer bloom

succession revealed the same dominating *Flavobacteria* operational taxonomic units (OTUs) but shifts in*Roseobacter* related OTUs (*Alphaproteobacteria*) and SAR92 clade members (*Gammaproteobacteria*). Higher diversity was observed during the summer bloom, represented by additional dominating groups, in particular Marine Group II (*Euryarchaeota*). Network analyses demonstrated pronounced formation of temperature dependent guilds during spring and summer phytoplankton blooms. In conclusion our data imply that short-term succession as response to phytoplankton blooms is indirectly affected by temperature being a major factor in defining ecological niches in the German Bight.

MONITORING EUKARYOTIC MICROBES USING MOLECULAR METHODS-A REVIEW

Rowena Fay Stern, Katja Metfies, Alexandra Kraberg

Sir Alister Hardy Foundation for Ocean Science, United Kingdom; rost@sahfos.ac.uk

Monitoring photosynthetic and some heterotrophic eukaryotes using light microscopy have been established over several decades and have standardised to some degree, allowing cross comparisons to be made at larger scales. The application of DNA and RNA-based molecular detection methods has revealed many more microbial species and even new families that are often too small or cryptic to detect by light microscopy. The use of molecular tools to monitor a wider range of eukaryotic microbes is a real possibility. However, its use may be limited by the lack of standardised methodologies. A recent review has revealed where these differences such as volumes, assay types and analysis methods that is heavily influenced by project design. Such differences create biased datasets that cannot be compared. Most researchers felt that some level of standardisation would be useful. Here, we share our findings and discuss if and how standardisation could be achieved.

USING QPCR TO DETECT ICHTHYOTOXIC FLAGELLATES ALONG THE NORWEGIAN COAST

Anette Engesmo[1,2], David Allan Strand[1,3], Wenche Eikrem[1,2]

[1]Norwegian Institute for Water Research, Norway; [2]University of Oslo, Department of Biosciences, Norway; [3]Norwegian Veterenary Institute, Norway; anette.engesmo@niva.no

In traditional monitoring efforts it is not uncommon that small, fragile flagellates are grouped together in large indistinct groups or that they go undetected. Therefore it is necessary with molecular techniques to compliment light microscopy cell counts in the monitoring of known ichthyotoxic species. A semi quantitative qPCR assay was developed for the ichthyotoxic dinoflagellates *Karenia mikimotoi* and *Karlodinium veneficum,* the haptophyte *Prymnesium polylepis* and the raphidophyte *Heterosigma akashiwo.* All are permanent residents along the Norwegian coast, have previously bloomed or caused fish kills and are difficult to detect by traditional monitoring efforts. The assay was tested on material collected monthly from the outer Oslo fjord over a period of three years (august 2009-june 2012). Preliminary results indicate that all four species are present and that the sensitivity of the qPCR assay is far greater than that of light microscopy cell counts. In addition to traditional microscopy based methods, qPCR assays can be a powerful tool in the identification and quantification of ichthyotoxic flagellates and other harmful algae and may prove especially useful if applied in early warning programs

IDENTIFICATION OF SERPULIDAE (POLYCHAETA) RESPONSIBLE OF STALACTITE CORES IN ITALIAN SUBMARINE CAVES

SALVATORE CAUSIO, ELISA GIANGRANDE, GENUARIO BELMONTE

UNIVERSITY OF SALENTO, Italy; genuario.belmonte@unisalento.it

Stalactites of organic origin were found in submarine caves of the Salento (S-E Italy). Their cores are formed by strings of Serpulidae tubes, around which a concretion coat is added with time. In some cases these tube aggregateswere discovered naked, and with living worms inside. This lead to their identification as belonging to the genus *Protula*. The present work aims to identify the worms which build the biostalactites, because in literature there are not informations about *Protula* gregarism. DNA sequences of *Protula* from GenBank, ad from *Protula*specimens outside the cave, have been compared with those of the cave worms. The work was mainly based on molecular analysis but provided also a morphological description of the worm. Barcoding genes as ITS2 and Cyt b, but also nuclear genes as the ribosomal 28S were analyzed as molecular markers. Molecular analysis showed a significant divergence with the sequences of the Mediterranean *Protula tubularia* available from GenBank. Unfortunately, there are not available sequences of the second Mediterranean species, *Protula intestinum.* The morphological analysis showed morphological characters in common with both the Mediterranean *Protula* but not a complete morphological coincidence with any of them. The present research demonstrates that the cave species is not attributable to any of the two known species of *Protula* reported from the Mediterranean Sea. In addition, it could represent a biological exclusive because up to now biostalactites are not reported from any other parts of the world.

OBS05: Individual adaptations to climate change: From temperature to acidification

Thursday, 24/Sep/2015, 9:00am - 10:30am *Location:* **Nordseehalle 2**

OCEAN ACIDIFICATION INDIRECTLY AFFECTS THE GROWTH OF TWO ZOOPLANKTERS

Cédric Meunier, María Algueró-Muñiz, Henriette Horn, Julia Lange, Maarten Boersma
Alfred Wegener Institute, Germany; cedric.meunier@awi.de

Ocean acidification negatively affects a number of organisms directly by, for example, dissolving the calcium carbonate structures of calcifying species. However, marine organisms may suffer other adverse effects. To disentangle the direct and indirect effects of ocean acidification on zooplankton growth rate, we carried out a study with model organisms. We investigated the individual effect of short term exposure to (1) high and low water pCO2 and (2) different phytoplankton qualities on the growth of micro- and mesozooplankters. On the one hand, unicellular organisms have high surface:volume ratio which should increase CO2 diffusion and cause hypercapnia. On the other hand, higher CO2 concentrations also decrease phytoplankton food quality. We therefore expected a significant interaction of water pCO2 and phytoplankton quality, decreasing zooplankton growth. We tested the hypotheses that unicellular zooplankton should be more affected than metazoan zooplankton by changes in water pCO2 and that lowest growth rate for all zooplankters should be observed under high water and algae pCO2. Although we expected consumer size-specific response to elevated water pCO2, none of the zooplankton species responded to this treatment. We found that direct pH effects on consumers seem to be of lesser importance than the associated decrease in algal quality. The decrease of primary producers' quality under high pCO2 conditions negatively affected zooplankton growth, which may lead to lower availability of food for the next trophic level and thus potentially affect the recruitment of higher trophic levels.

OCEAN ACIDIFICATION EFFECTS ON THE PRODUCTIVITY OF UNDER-ICE ALGAE IN ANTARCTIC COASTAL ECOSYSTEMS

Andrew M. Lohrer[1], Vonda J. Cummings[1], Simon F. Thrush[2]
[1]NIWA, New Zealand; [2]University of Auckland, New Zealand; drew.lohrer@niwa.co.nz

Coastal marine ecosystems in the Ross Sea are dynamic and diverse, with distinct zones of primary production and secondary consumption. In spring, when the water column beneath sea ice contains very little phytoplankton, highly concentrated diatom films can be observed on the underside of the ice. Productivity by under-ice algae is critical to the local marine food web and supports numerous iconic Antarctic species, yet information on the responses of under-ice algae to ocean acidification and other aspects of climate change are lacking. To address this, we installed sixteen incubation chamberson the underside of coastal Antarctic sea ice, and applied four distinct pCO2 treatments, which allowed us to monitor under-ice algal productivity responses continuously for 2 weeks in situ. This talk will present these results along with related research on the processing of detrital algal material by underlying benthic habitats. These observations represent some of the first explorations of functional linkages between ecosystem components in ice-covered coastal marine habitats, providing insights into potential responses to impending environmental change.

CLIMATE CHANGE EFFECTS ON EARLY LIFE STAGES OF THE MOON JELLYFISH (AURELIA AURITA, SCYPHOMEDUSAE)

María Algueró-Muñiz[1], Cédric L. Meunier[1], Ursula Ecker[1], Sabine Holst[2], Maarten Boersma[1,3]
[1]Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung, Biologische Anstalt Helgoland, Germany; [2]German Center for Marine Biodiversity Research Senckenberg am Meer, Hamburg, Germany; [3]University of Bremen, Bremen, Germany; malguero@awi.de

Ocean warming is not the sole changing factor currently affecting marine ecosystems. Together with increases in temperature decreases in pH and oxygen content may also impact many organisms, especially since these stressors do not come alone, but act simultaneously. Very little is known about these interactive effects, especially when it comes to gelatinous zooplankton. Therefore, we carried out an experiment investigating the effects of pH, temperature and oxygen content of the water on early life stages of the moon jellyfish, *Aurelia aurita*.Starved one-day-old ephyrae were exposed to a range of pCO_2 (400 to 4000ppm) and different oxygen levels (20%, 10%, 5%), in two different temperatures (5°C and 15°C) for 7 days. At the end of the incubation period, the swimming behaviour of the animals was first analysed using videomicroscopy. Afterwards, the ephyrae were collected and dried, and dry weight and carbon content were established. We observed an effect of pCO_2 at both temperatures, but no O_2 effect on growth or swimming behaviour was found. Swimming behaviour was not affected by the pH of the water, despite the potential effect of pH on the statocyst structures in the ephyrae. Based on the vulnerability of these early life-stage scyphozoans, as here they transfer from relatively stable benthic conditions to pelagic conditions, we conclude that *A. aurita* is very tolerant to environmental stressors. This might imply that this jellyfish species is going to be one of the winners of global change processes, with potentially large impacts on ecosystem services.

GENETIC VARIABILITY IN POPULATION RESPONSES OF ATLANTIC COD TO TEMPERATURE

Rebekah Oomen[1,2], Halvor Knutsen[2,3], Esben Olsen[2,3], Sissel Jentoft[2], Nils Christian Stenseth[2], Jeff Hutchings[1,2]

[1]Department of Biology, Dalhousie University, Canada; [2]Centre for Ecological and Evolutionary Synthesis, University of Oslo, Norway; [3]Institute of Marine Research, Flødevigen Research Station, Norway; rebekahoomen@gmail.com

Key questions surrounding the issue of variable population responses to environmental change include the spatial scale at which differences in plasticity exist and the molecular basis (i.e. specific genes or genetic variants) of these adaptations. We are interested in how Atlantic cod inhabiting different thermal regimes respond differently to changes in temperature. Traditional approaches to studying local adaptation evaluate either genotypic (e.g. mapping spatial variation in genetic markers thought to be under selection) or phenotypic (e.g. common-garden experiments) variation within species, often failing to establish either the phenotypic consequences or the molecular basis of adaptive variation, respectively. By integrating common-garden experiments across a range of temperatures with transcriptomics (i.e. genomic expression profiles) using RNA sequencing, we aim to bridge the gap between genotypic and phenotypic variation among Norwegian cod populations to determine: 1) the transcriptomic response of larval cod to temperature, 2) the spatial scale of adaptation for plasticity, and 3) the molecular basis of thermal adaptation in cod. This presentation will focus on how larval cod gene expression varies in response to temperature for a Skagerrak coastal cod population, how gene expression changes through early development, and how these patterns of expression relate to the increased growth and decreased survival that was observed in response to warmer temperatures in the lab. Understanding the genetic basis of thermal plasticity will help us to predict the response of wild cod populations to rising ocean temperatures and manage populations effectively to prevent population collapse and biodiversity loss.

SLOW GROWTH IN A WARMING OCEAN: THE EFFECT OF TEMPERATURE ON ENERGY ALLOCATION IN ANTARCTIC FISH

Tina Sandersfeld[1], William Davison[2], Miles Lamare[3], Claudio Richter[1], Rainer Knust[4]

[1]Alfred Wegener Institute Helmholtz Center for Polar and Marine Research and University of Bremen, Germany; [2]School of Biological Sciences, University of Canterbury, New Zealand;[3]Department of Marine Science, University of Otago, New Zealand; [4]Alfred Wegener Institute Hemlholtz Center for Polar and Marine Research, Germany; tina.sandersfeld@awi.de

Temperature affects the physiology of animals, which becomes evident in climate driven shifts in fish species distribution and changes in production. Antarctic fish are highly adapted to the cold and stable temperature conditions of the Southern Ocean which makes them particularly vulnerable, as the Antarctic is one of the most rapidly warming regions on the globe. Species abundances and population structures are driven by reproduction and growth, which depend on the energy allocation within an organism. While it is known that temperature affects this energy allocation, specific consequences for Antarctic fish are unknown. The aim of this study was to assess long-term temperature effects on the energy budget of two Antarctic fish species to identify possible life-history trade-offs for the whole organism. Our results show a temperature compensation for routine metabolic costs after long-term acclimation to elevated temperature. As a trade-off, we found that growth was significantly reduced by up to 80% at 2°C. If laboratory results are transferred to the environment, such a significant growth reduction would likely influence structure, abundance and production of Antarctic populations. Fish make up a large part of the biomass in Antarctic coastal ecosystems. Thus, severer decreases in fish production would have far reaching consequences for whole Antarctic ecosystem dynamics.

DETERMINING THE STRESS LEVEL OF MARINE ECOSYSTEM ENGINEERS. AN ENVIRONMENTAL METABOLOMICS STUDY OF THE SEAWEED *ECKLONIA RADIATA*

Tilman Harder

[1] AG Meereschemie, University of Bremen, Germany t.harder@unsw.edu.au

Seaweeds around Australia's coast are shifting their distributions towards the South Pole with drastic consequences for benthic ecosystem ecology. Coinciding with these distributional changes, many Australian seaweeds increasingly display signs of disease, evidenced by discoloration (bleaching) of their thalli.

We analyzed the metabolome and the thallus-associated microbiome on the dominant brown kelp (Ecklonia radiate) along a 1000 km latitudinal gradient of the Australian East coast. We observed clear metabolomics patterns that correlated with the disease state of *E. radiata*. These findings suggest that health-specific molecular biomarkers can be derived from these data to assess ecosystem health of seaweed-dominated marine benthic habitats. Moreover, we identified site–specific metabolomes in *E. radiata* that is metabolomes of the northern most populations differed significantly from populations in southern Tasmania. These findings suggest a phenotypic variation between northern and southern kelp populations.

At the southern sample sites, the correlation of kelp disease with the epiphytic bacterial community composition resulted in clear patterns of health-specific epiphytic bacterial communities, whereas no such patterns were observed in kelp originating from the northern sites.

I will discuss these data in their environmental context and finish off with concluding remarks of the power of high-resolution and accurate mass-based environmental metabolomics as a tool to study marine ecosystem health.

OBS04: Large-scale spatio-temporal analyses exploring climate change impacts in marine systems

Thursday, 24/Sep/2015, 11:00am - 12:30pm *Location:* Nordseehalle 1

DETECTION OF ALGAL BLOOMS IN INDIAN WATERS USING SATELLITE OBSERVATIONS

K. Avarachen Mathew[1], N. R Menon[2], Nashad M[1,2], Smitha A[2], N. Nandini Menon[2], Lasse H. Pettersson[3]

[1]Cochin University of Science and Technology, India; [2]Nansen Environmental Research Centre India; [3]Nansen Environmental and Remote Sensing Center, Norway;mathew.k.avarachen@gmail.com

Around hundred algal blooms have been reported from Indian waters during early and late nineties. *Trichodesmium erythraeum* and *Noctiluca scintillans* are the major ones among several species that bloom in Indian waters. The blooms usually occur during pre-monsoon (Feb-May) or immediately after southwest monsoon (Jun-Sept) seasons. Nutrient enrichment due to river discharge or seasonal upwelling could be the causative factors for this phenomenon. Even though toxic algal blooms are rare in Indian waters, these blooms have caused extensive fish mortality resulting in significant economic loss to more than 4 million people depending directly on fisheries and around 10 million on related activities. Of late, algal blooms have become more frequent and several species capable of producing potent toxins have started appearing in Indian waters. This could be associated with ballast water discharge. Early detection of algal blooms employing satellite imageries has become an important scientific exercise. Available in-situ observations are very useful tool to interpret remote sensing data in conjunction with harmful algal bloom (HAB) events. This would help in realising the gravity of frequent occurrence of blooms with reference to fishery resources. The present paper has made an attempt to delineate these aspects employing secondary and remote sensing data. It is also anticipated that understanding the community composition of algae occurring in blooming areas would help to detect species, potential of blooming, that would eventually influence fisheries of Indian seas.

GEOSPATIAL ANALYSIS OF LONG-TERM CHANGES IN N/P RATIO AND CHLOROPHYLL CONCENTRATION AT GERMAN BIGHT

Subrata Sarker, Karen H. Wiltshire, Maarten Boersma, Silvia Peters, Kristine Carstens

Alfred-Wegener-Institut, Germany; Subrata.Sarker@awi.de

Long-term changes in nutrients concentration in marine ecosystem have an influence on primary production. Measures taken to reduce phosphate loads of European rivers have an effect on the nutrients and chlorophyll concentration change in the marine system of this area. Thus present study aimed to assess the long-term geospatial change in N/P ratio and its impacts on Chlorophyll distribution at German Bight. Long-term (1981-2010) geo-spatial data of total N and P, and chlorophyll were gathered from different sources (BAH, ICES, DOD, AREGE, KUSTOS and MUDAB) and analyzed in Arc GIS platform as decadal basis. Findings showed that, German Bight is becoming P limited and this increase of P limited area is moving towards the coast. Total chlorophyll concentration is increasing and area with high chlorophyll concentration is moving towards the coast. Present study found that high chlorophyll concentration occurred when N/P ratio was found at Redfield ratio or near to that. The overall analysis provides an insight on the influence of long-term nutrients ratio change on Chlorophyll distribution at the German Bight.

CONTEXT-DEPENDENCY OF MACROFAUNA BIOTURBATION WITHIN THE HABITAT MOSAIC OF A BALTIC SEA ARCHIPELAGO

Guillaume Bernard[1], Johanna Gammal[1], Marie Järnström[2], Joanna Norkko[1], Alf Norkko[1]

[1]Tvärminne zoological station, University of Helsinki, Finland; [2]Åbo akademi University, Finland; guillaume.bernard@helsinki.fi

Bioturbation (*i.e.* both the solute and particulate mixing in the sediment column induced by benthic fauna), plays a major role in organic matter remineralization and nutrient retention/release. In situ evidence on what controls the intensity of this process is however scarce. The Baltic Sea coastal zone is characterized by a highly diverse habitat mosaic but a low alpha-diversity of the benthic macrofauna. In this ecosystem bioturbation is thus the result of the activities (relatively well known through experimental studies) of a few species mediated by the different characteristics of the habitats. This makes these archipelago ecosystems particularly interesting study sites in order to unravel the spatial context-dependency of bioturbation processes.

To address this objective, we carried out an extensive field study in summer 2014, along gradients of spatial variability (in term of sediment characteristics and exposure) covering 18 sites within the same depth range of the Tvärminne archipelago (Finland). It encompassed the measurements, at the scale of individual cores, of both particle mixing and bioirrigation rates, macrofauna community composition, and habitat characteristics (grain-size; sediment organic content; vegetation characteristics and coverage). Results highlight the effects of local biotic and abiotic factors affecting macrofaunal activities controlling bioturbation processes and thereby ecosystem function in terms of nutrient fluxes.

REAL WORLD BIODIVERSITY AND ECOSYSTEM FUNCTIONING – A FIELD STUDY ALONG A HYPOXIC GRADIENT

Johanna Gammal[1], Joanna Norkko[1], Conrad Pilditch[2], Alf Norkko[1]

[1]Tvärminne Zoological station, University of Helsinki, Finland; [2]University of Waikato, New Zealand; johanna.gammal@helsinki.fi

Concern over the loss of biodiversity has led to increased research concerning the importance of biodiversity for ecosystem functions and services. Recently, however, the knowledge gap between theories, small-scale experiments and verification in the field has been increasingly acknowledged. In order to better understand the biodiversity-ecosystem function relationship, it is of great importance to broaden the scale on which experiments are conducted. Without including the heterogeneity of natural ecosystems it is difficult to understand and predict the drivers and responses of ecosystem functionality and change.

We conducted a coastal field study in the western Gulf of Finland. Samples were collected from muddy sediments, depths of 8-33 m, along a gradient of hypoxia. Nutrient fluxes were measured across the sediment-water interface by incubation of the sediment cores. The results showed that nutrient fluxes varied significantly even within a relatively small coastal area, with a marked influence of bottom-water oxygen concentration and of the benthic macrofauna on the ecosystem functioning. During the last few decades the distribution of hypoxia has increased noticeably in the coastal areas of the Baltic Sea as well as globally. In relation to the spatial magnitude of this problem it is important and urgent to clarify the feedback mechanisms between hypoxia, biodiversity and ecosystem functioning, in order to develop sufficient management procedures.

LONG-TERM PROGRESSION AND DRIVERS OF COASTAL ZOOBENTHOS IN A CHANGING SYSTEM

Benjamin Weigel[1], Helén C. Andersson[2], H.E. Markus Meier[2,3], Thorsten Blenckner[4], Martin Snickars[1], Erik Bonsdorff[1]

[1]Environmental and Marine Biology, Department of Biosciences, Åbo Akademi University, Turku, Finland; [2]Swedish Meteorological and Hydrographical Institute (SMHI), Norrköping, Sweden; [3]Department of Meteorology, Stockholm University, Stockholm, Sweden; [4]Baltic Nest Institute, Stockholm Resilience Centre, Stockholm University, Stockholm, Sweden;benjamin.weigel@abo.fi

Coastal zones are facing climate-driven change coupled with escalating eutrophication. With increasing shifts in hydrographic conditions during the last decades, a focal task is to understand how environmental drivers affect zoobenthic communities, which are central for energy acquisition and for overall ecosystem functioning. By using long-term data, spanning 40 years (1973-2013) in the northern Baltic Sea, we show a disparity in zoobenthic responses with pronounced changes in community composition, and decreased biomass in sheltered areas while biomasses increased in exposed areas of the coastal zone. We used generalized additive modeling to uncover that oxygen saturation alone explained over one third of the deviation in the biomass developments in sheltered areas, while exposed areas were mainly limited by organic content of the sediments in combination with increasing temperatures. We analysed high-resolution climate-scenario simulations, following the IPCC scenarios for the Baltic Sea region in combination with different nutrient load scenarios, for the end of the 21st century. The scenario outcomes show negative trends in bottom oxygen concentrations throughout the coastal and archipelago zone, along with overall increasing temperatures, primary production and decreasing salinity. Our results indicate that these projected future conditions will strengthen the observed pattern in decreasing zoobenthic production in the immediate coastal zones. Despite the shown contrasting development, functional diversity (abundance weighted functional dispersion) of zoobenthic communities followed similar trends towards high, and relatively stable values in both sheltered and exposed habitats. This suggests that shifts in species identity/biomass do not necessarily imply changes in functional complexity of the system.

RELATIONSHIPS BETWEEN SPATIAL TURNOVER IN SPECIES AND BIOLOGICAL TRAIT DIVERSITY

Judi Hewitt[1], Anna Villnäs[2], Mats Westerbom[2], Alf Norkko[2]

[1]National Instit Water & Atmospheric Research NZ, New Zealand; [2]Tvärminne Zoological Station, University of Helsinki; judi.hewitt@niwa.co.nz

Beta diversity represents the heterogeneity over either space or time in diversity, and is a key component driving the potential resilience to and recovery from disturbances, whether natural or human-induced. Generally, beta diversity is calculated from taxonomically classified data, yet increasingly biological trait analysis is being used to detect functional consequences of degradation in biodiversity over large spatial scales. Biological traits are expected to show less spatial variability as different species replace each other in abundance along physical and chemical gradients and thus may be more appropriate for making comparisons in status between areas that differ in natural environmental characteristics and species composition. Here we compare the beta diversity exhibited both at the species and the biological trait level within defined Water Areas of the Gulf of Finland. We also investigate whether species and biological trait data have the same ability to detect effects of low oxygen conditions and whether different environmental factors are important in driving variability in composition. We found that species and biological trait data were similar in their ability to detect low oxygen conditions, but that beta diversity based on trait composition was affected by fewer environmental variables. In particular, wave exposure and temperature were less likely to affect biological trait diversity. These results support the use of biological traits for impact assessment across broad environmental variation.

OBS14_1: General Marine Biology

Thursday, 24/Sep/2015, 11:00am - 12:30pm *Location:* Nordseehalle 2

DESCRIPTION OF THREE NEW SYMPATRIC SPECIES OF NANNOPODIDAE (COPEPODA: HARPACTICOIDA) FROM MUDFLATS OF THE DONGUM ISLAND, KOREA, WITH MOLECULAR PHYLOGENY AND SCANNING ELECTRON MICROSCOPIC ANALYSIS

Vinod Vakati[1], Wonchoel Lee[1], Terue Cristina Kihara[2]

[1]Department of Life Sciences, College of Natural Sciences, Hanyang University, Seoul 133-791, South Korea; [2]Senckenberg am Meer, German Centre for Marine Biodiversity Research (DZMB), Südstrand 44, 26382 Wilhelmshaven, Germany; vinodbio88@gmail.com

A combined approach was used to study the diversity and variability of three new sympatric species dwelling on intertidal mudflats of Dongum Island (Ganghwa Province), Korea. We described based on specimens of both sexes of the genus *Nannopus* Brady, 1880. Here, we attempted molecular phylogenetic analyses based on nuclear (28SrDNA) and mitochondrial (COI) gene sequences. Genetic analyses revealed with high divergence among all three species and also supported with high bootstrap values of all the analyses (ML/NJ/MP) either in COI and 28SrDNA. Scanning Electron Microscopy (SEM) permitted to investigate morphologically about how intriguing ornamentations produced all over the surface of habitus. Nonetheless, comprehensive analysis of prominent characters like ornamentations and setation using SEM would serve as a benchmark to separate these conservative groups of species. Consistently, among these three species, SP3 is a modest specimen by its distinctive anatomical features in caudal rami setae locations. These three new species extends the group distribution to the west (Yellow Sea) coast of Korea. These are the first ever descriptions from Korean waters under genus *Nannopus*, this also becomes the first ever descriptions in combination with molecular data to the entire family of *Nannopodidae* (Brady, 1880) groups.

SPECIES SEPARATION WITHIN THE LESSONIA NIGRESCENS COMPLEX IS MIRRORED BY ECOPHYSIOLOGICAL TRAITS

Kristina Koch[1,2], Martin Thiel[3,4,5], Florence Tellier[6], Wilhelm Hagen[1,2], Martin Graeve[7], Fadia Tala[3,8], Philipp Laeseke[1,2], Kai Bischof[1,2]

[1]University of Bremen, Bremen, Germany; [2]Bremen Marine Ecology - Center for Research and Education (BreMarE), Bremen, Germany; [3]Universidad Católica del Norte, Coquimbo, Chile;[4]Centro de Estudios Avanzados en Zonas Áridas (CEAZA), Coquimbo, Chile; [5]Nucleus Ecology and Sustainable Management of Oceanic Island (ESMOI), Coquimbo, Chile; [6]Universidad Católica de la Santísima Concepción, Concepción, Chile; [7]Alfred Wegener Institute for Polar and Marine Research (AWI), Bremerhaven, Germany; [8]Centro de Investigación y Desarrollo Tecnológico en Algas (CIDTA), Coquimbo, Chile; Kristina.Koch@uni-bremen.de

Lessonia nigrescens used to be an abundant kelp species along the Chilean coast, but recent molecular studies revealed the existence of a *L. nigrescens* species complex, which includes the two cryptic species *Lessonia berteroana* and *L. spicata*. Since these species have different distributions (16°S to 30°S for *L. berteroana* and 29°S to 42°S for *L. spicata*), they experience differences in environmental conditions, such as solar irradiance, seawater temperature and air exposure during low tide. This study tested to what extent the genetic distinctness of each of the two species (identified by a mitochondrial marker (*atp8/trnS*)), is reflected by ecophysiological traits (total lipids, fatty acid composition, phlorotannins, pigments and variable chlorophyll *a* fluorescence of PSII) in response to the respective environmental conditions, prevailing along the latitudinal gradient. We studied algal individuals from eight populations (27°S to 32°S, including the species overlapping zone) Phlorotannins, pigments and Chl *a* fluorescence of PSII were most crucial for species-specific adaptations at the respective growth sites, whereas changes in total lipids and fatty acid compositions were negligible. Hence, species differentiation within the *L. nigrescens* complex is also manifested at the ecophysiological level. These findings may help to predict kelp responses towards future environmental changes.

TROPHIC NICHE OF TWO CO-OCCURRING OPHIUROID SPECIES IN IMPACTED COASTAL SYSTEMS

Aline Blanchet-Aurigny[1], Stanislas Dubois[1], Claudie Quéré[1,2], Fabrice Pernet[1,2]

[1]IFREMER, centre de Bretagne, France; [2]UMR 6539 LEMAR-CNRS-IRD -IFREMER, France; ablanche@ifremer.fr

The trophic niches of two common co-occurring ophiuroids *Ophiocomina nigra* and *Ophiothrix fragilis* (Echinodermata, Ophiuroidea) in two contrasted coastal systems of Brittany (France) were investigated. The fatty acid (FA) biomarkers and stable isotopic compositions were combined to explore the contributions of oceanic *vs* continental inputs to the diet of ophiuroids. We investigated 2 contrasted systems with an inshore *vs* offshore comparison. We sampled potential food sources and surveyed organisms every 2 months for a year. Spatiotemporal variations in stable isotopes and fatty acid profiles of ophiuroids were generally low compared to interspecific differences. Fatty acid markers showed that both ophiuroids rely on diatom inputs. However, a more δ^{15}N-enriched isotopic composition as well as a more balanced plant-derived *vs* animal-derived FA composition in *O. nigra* support that a broader range of food sources are being used by this species irrespective of locations and sampling times. The positive correlation between 18:1n-9/18:1n-7 FA ratio and δ^{15}N values, showed higher trophic position for *O. nigra* suggesting omnivorous feeding mode whereas *O. fragilis* appeared more herbivorous. Moreover, a low PUFA/SFA ratio associated with elevated bacteria FA marker indicates that *O. nigra* preferentially consumed detritus, while *O. fragilis* relied more on fresh phytoplankton. Both stable isotopes and FA suggest that terrestrial inputs do not significantly contribute to the diet of ophiuroids. However, phytodetritus derived from decomposing green macroalgae contribute locally to the diet of *O. nigra* .

DEPOSIT FEEDING ACTIVITY AND MICROPHYTE BIOMASS RELATIONSHIPS ACROSS A BENTHIC SEDIMENT GRADIENT

Daniel Pratt[1], Conrad Pilditch[1], Andrew Lohrer[2], Simon Thrush[3], Casper Kraan[4]

[1]University of Waikato, New Zealand; [2]National Institute of Water and Atmospheric Research, New Zealand; [3]University of Auckland, New Zealand; [4]University of Freiburg, Germany;dan.prtt@gmail.com

The density, structure and functional roles of macrofauna and microphytobenthic (MPB) communities are known to change across sedimentary gradients, yet how relationships between deposit feeders and MPB scale-up across such transitional environments, is poorly understood. Here, sediment chlorophyll-*a* concentration (a proxy of MPB biomass) was measured in relation to the occurrence of feeding traces made by the tellinid bivalve *Macomona liliana* together with macrofaunal densities and sediment properties within 55 plots (0.12 m^2) across a sediment mud content gradient. Correlative relationships between recent deposit feeding activity and MPB biomass were scale dependent, significant only at the site scale. Generalised Least Squares regression was used to determine the relationships between mean MPB biomass and measured predictor variables between plots. MPB biomass declined by 28 % as coverage of feeding traces increased from 2 to 28 %, with feeding trace area contributing significantly to variation in chl-*a* (std. coef. = -0.24, p = 0.01). However, the interaction term between mobile suspension feeding cockles *A. stutchburyi* and sediment mud content explained a larger amount of the variability (std. coef. = 0.72, p < 0.001). Therefore, we need to consider the potential for interactive effects involving non deposit-feeding species on MPB across abiotic gradients.

ADJUSTMENT OF PHOTOPROTECTION TO TIDAL CONDITIONS IN INTERTIDAL SEAGRASSES

Dorothea Kohlmeier[1], Conrad A. Pilditch[2], Janet F. Bornman[3], Kai Bischof[1]

[1]Department of Marine Botany, University of Bremen, Germany; [2]Department of Biological Sciences, University of Waikato, New Zealand; [3]International Institute of Agri-Food Security, Curtin University, Australia; dkohlmeier@uni-bremen.de

Light adaptation strategies were studied in a comparative analysis of the congeneric seagrass species, *Zostera muelleri* and *Zostera marina*, derived from two case study areas in New Zealand and Germany. Surveys were conducted from pre-dawn until sunset when low and high tide occurred at noon at two intertidal seagrass meadows. The results show that clear fluctuations of photosynthesis (measured as changes in chlorophyll fluorescence of PS II and pigment compositions) occur over daily and tidal cycles. Depending on tidal conditions different patterns in photophysiology (optimum and effective quantum yield, non-photochemical quenching, cycling of xanthophyll cycle (XC) pigments) could be observed, but similar responses were found at both locations. We observed a complete conversion of violaxanthin to zeaxanthin at times with high irradiance and a rapid and complete de-conversion under subsequent lower light conditions. At the New Zealand site we additionally observed clearly larger XC-pigment pool sizes in seagrass leaves sampled in a week when low tide coincided with noon (larger daily fluence and higher maximum irradiance), compared to leaves sampled in a week when high tide was at noon. This rapid adjustment of xanthophyll pool sizes (and compositions) has not been reported previously for seagrasses and is an important instrument for acclimation to the dynamic light environment in the intertidal zone.

SPONGE FLUORESCENT MOLECULES AND DERIVATIVES USED FOR LIVE IMAGING. WHAT IS THEIR NATURAL ROLE?

Ulf Bickmeyer, Thorsten Mordhorst

Section Ecological Chemistry, Alfred-Wegener-Institut Helmholtz Zentrum für Polar- und Meeresforschung, Am Handelshafen 12, D-27570 Bremerhaven; Ulf.Bickmeyer@awi.de

Marine sponges are known to produce different bioactive secondary metabolites. One substance out of this group is a brominated pyrrole imidazole alkaloid, which showed anti-angiogenic activity and was later described to be a pH sensitive live imaging dye. This compound, Ageladine A, permeates membranes when uncharged. In acidic cellular compartments or organs Ageladine A is protonated and is trapped and not expelled by MDR and MRP transporters, which are present in eukaryotic cells. Given the interesting properties of Ageladine A we synthetized twenty-five derivatives of which several are brightly fluorescent. Some compounds are as well pH-sensitive and at least one allows ratiometric measurements over a wide pH-range. As metabolic states like hypoxia or apoptosis are reflected by the cytosolic pH-values, these dyes can be used to indicate the viability of cells. The major increase of fluorescence of Ageladine A and its sensitivity is in the pH-range of pH 5 to pH 7, which is most interesting range for physiological measurements. Due to the non-toxic properties the dyes can be used to stain whole animals (transparent aquatic animals), tissues and e.g. astrocytes and cultured neuronal cells.

The very high quantum yield of the natural product Ageladine A and some derivatives raises the question to its function in sponges. We propose fluorescing compounds in sponge cells to act in symbioses with autotroph organism to convert UV/blue light to longer wavelength in high efficiency, which supplies autotroph organisms to highly effective blue/green light for photosynthesis.

SOC04: Protective structures of coasts and oceans

Thursday, 24/Sep/2015, 3:30pm - 5:00pm *Location:* **Nordseehalle 1**

COASTAL SQUEEZE: CAN INVERTEBRATES COMPENSATE FOR LOSS OF INTERTIDAL AREA BY INCREASING IN DENSITY?

Melanie Jane Bishop, Belinda C Cooke
Macquarie University, Australia; melanie.bishop@mq.edu.au

Coastal armouring by structures such as seawalls is increasingly undertaken to protect coastal development from erosion and storm surge. In preventing the landward migration of shorelines and exacerbating erosion, these structures may reduce beach width and habitat availability for sandy beach fauna. Habitat loss may result in smaller populations of fauna, or alternatively increases in their density. We tested how (1) sandy beach invertebrate communities differ between stretches of shoreline that are unarmoured or amoroured by rock walls or sandbags; and (2) the tidal elevation at which structures are placed influences their impact. Sampling of macrofaunal and meiofauna was conducted at five tidal elevations, of 3 sites without armouring, 3 with rock walls and 3 with sandbags at Belongil Beach in northern New South Wales, Australia. The primary differences in infaunal communities between armoured and unarmoured sites were related to the loss of the supratidal and, in some instances the high intertidal areas, used by ghost crabs and other infaunal taxa. Hence the magnitude of ecological impacts of coastal structures was dependent on the tidal elevation at which they were built. Interestingly, however, densities of fauna were greater in the low intertidal zones of beaches with rock walls than those with sandbags or without armouring. The enhancement of density in low intertidal zones may be an effect of reducing habitat area or alteration of environmental conditions. Understanding the mechanisms by which coastal structures impact sandy beach ecosystems will assist in refining their design to reduce ecological impacts.

FACTORS PREDICTING THE NATIVE AND INVASIVE COMPONENT OF BENTHIC ASSEMBLAGES ON ARTIFICIAL STRUCTURES

Velda Lauringson, Katarina Oganjan, Jonne Kotta
Estonian Marine Institute, University of Tartu, Estonia; velda@ut.ee

Coastal and estuarine ecosystems are changing at an accelerating pace, and human impact is increasing in both intensity and dimensionality. Increasing numbers of anthropogenic pressures are cumulating in these already heavily modified ecosystems, while the cumulative effect of pressures is poorly known. Concomitant with the diversifying utilization of marine resources, artificial structures are commonly built or installed at coastal seascapes for various purposes. At the same time, other anthropogenic factors such as pollution and the distribution of non-indigenous species (NIS) are modifying communities at these very same seascapes. We studied concrete artificial structures (AS) hosting NIS and native species in a shallow turbid heavily exploited bay in the brackish NE Baltic Sea. Among about 30 taxa found on AS, 14 % were NIS. We investigated the deviation of community composition on AS from random and quantified the amount of variability in densities of frequent species on AS explained by major environmental gradients in the area, namely annual mean water temperature and average water Chl content of ice-free season, water salinity, velocity, depth, wave exposure and seabottom slope. We evaluated the variability in AS communities unexplained by the observed environmental gradients. Benthic assemblages at adjacent natural substrates and the contribution of artificial structures to local biodiversity are discussed.

MODELLING CLIMATE CHANGE EFFECTS ON BENTHOS: IMPLICATIONS FOR MARINE PROTECTED AREAS

Michael Weinert[1], Moritz Mathis[2], Ingrid Kröncke[1], Thomas Pohlmann[3], Henning Reiss[4]
[1]Senckenberg am Meer, Germany; [2]Max-Planck-Institute for Meteorology, Germany; [3]Institute of Oceanography, University of Hamburg, Germany; [4]University of Nordland, Faculty of Biosciences and Aquaculture, Norway; Michael.Weinert@senckenberg.de

Global climate warming is supposed to be one of the key drivers, which causes distributional shifts of species by changing environmental conditions and habitat suitability. In the marine realm, climate change can affect a variety of physico-chemical properties with wide-ranging biological effects, but the consequences of distribution shifts of benthic species for ecosystem management are rarely taken into account.

In this study, the distribution of 10 benthic key species of the North Sea were modelled (i) to assess the responses to projected changes in temperature and salinity until 2099 and (ii) to evaluate the effectiveness of Marine Protected Areas (MPAs) in this region. Six model algorithms (GLM, MARS, FDA, RF, GBM, MAXENT) and a consensus model were compared to test the robustness and uncertainty of the distribution projections. These results were then used to assess the distribution patterns of species within the assigned MPAs in the North Sea for 2050 and 2099.

Our results showed that particularly the benthic communities of the southern North Sea, where the strongest mean bottom temperature increase of up to 5.4°C was projected, will be strongly affected by the distributional changes, with projected northward shift of most species. These shifts will affect the effectiveness of MPAs, because key species will decrease or sometimes increase within the protected areas irrespective of the purpose of an MPA to exclude other anthropogenic impacts. Thus, distribution modelling approaches can be used to better understand climate change driven shifts in species distribution and to guide ecosystem management.

USE OF REEF STRUCTURE WITH OYSTERS FOR COASTAL HABITATS FACILITATION

Mohammed Shah Nawaz Chowdhury[1,2,3], A Smaal[1,2], T Ysebaert[1,4], Hossain M. S[3]

[1]IMARES-Wageningen UR, Netherlands, The; [2]Aquaculture and Fisheries Group, WIAS, Wageningen University and Research Center, Wageningen, The Netherlands; [3]Institute of Marine Sciences and Fisheries, University of Chittagong, Chittagong, Bangladesh; [4]Spatial Ecology Department, NIOZ Yerseke, Royal Netherlands Institute of Sea Research, Yerseke, The Netherlands; shah.chowdhury@wur.nl

Coastal habitats of Bangladesh are severely being threatened by coastal erosion, especially due to sea level rise and tidal surge caused by global warming. The consequences of coastal erosion are manifold and not solely limited to direct habitat loss. Together with habitat loss ecosystem services and the intertidal ecosystem as a whole are affected. Oyster reefs are increasingly recognized worldwide as a potential tools for coastal protection in the face of sea level rise. In cooperation with a joint Dutch – Bangladesh project (ECOBAS), a research study has been designed to explore the use of reef structure with oysters for enhancing coastal habitats in near shore islands of Bangladesh. Various substrate designs are being tested for oyster spat settlement and growth. Circular concrete rings (diameter : 1 m) with 75 cm vertical relief were found as promising reef structure where 291 ind. m^{-2} yr^{-1} spat settlement rate was recorded in the Kutobdia Island. Dynamic energy budget (DEB) model is used to estimate the potential growth of oyster reefs. Model results indicate that 18 kg m^{-2} oyster biomass can grow in prevailing environmental conditions, while the annual growth (length) rate of oyster is 5cm. Monthly monitoring of morphological effects indicate that sediment accumulation rate is greater in the tidal flats of artificial reef site than control sites. The reef structures with oysters is also playing a positive role on mangrove regeneration and salt marsh succession as well as habitat facilitation for fishes, shrimps, crabs and other invertebrates in the tidal flats.

OBS06: Fostering a better understanding of marine ecosystems through modelling approaches

Friday, 25/Sep/2015, 9:00am - 10:30am *Location:* **Nordseehalle 1**

NICHE SEPARATION BETWEEN NATIVE AND INVASIVE GAMMARID AMPHIPODS IN THE NORTHERN BALTIC SEA

Kristjan Herkül, Velda Lauringson, Jonne Kotta
Estonian Marine Institute, University of Tartu, Estonia; kristjan.herkyl@sea.ee

Anthropogenic invasions of non-indigenous (NIS) species are largely modifying global biodiversity. Despite large interest in the topic, niche separation and specialization of invasive and closely related sympatric native species are not well understood. Specifically, the combined use of various methods may reveal different aspects of niche separation and provide stronger evidence compared to using a single method. We applied multivariate ordination together with species marginality index (OMI) in parallel with species distribution modeling (SDM) to northern Baltic sympatric gammarid (Crustacea, Amphipoda) species to see if environmental niche spaces differ between taxonomically and functionally closely related sympatric invasive and native species and how is niche pattern reflected in the species distribution overlap. Niche differences assessed by OMI were in good accordance with SDM results and showed that the niche of invasive *Gammarus tigrinus* was significantly narrower and more segregated than that of the studied three common native gammarids in the northern Baltic Sea. The results indicate that the success of invasion of *G. tigrinus* has been facilitated by specific habitats that are of lower suitability for the native gammarid species. Considering the intraguild competition and predation between the invasive and native gammarids, *G. tigrinus* most likely has the strongest effect on *G. zaddachi* as the distribution overlap between the two was the largest.

A HIERARCHICAL CLASSIFICATION SYSTEM OF COASTAL AREAS AT DIFFERENT SPATIAL SCALES: THE NEA CASE

José A Juanes, Elvira Ramos, Araceli Puente, Camino Fernández
Environmental Hydraulics Institute (IHCantabria), Universidad de Cantabria, Spain; juanesj@unican.es

Ecological classification of coastal waters has become increasingly important as one of the basic issues in ecology of conservation. Management and protection of coastal areas take place at different spatial scales. Thus, proper classification schemes should integrate equivalent information at various levels of definition in order to show its feasibility as a useful tool for assessment of coastal environments at the required scales. In this work, a methodological approach applied to the classification of the NE Atlantic coast is presented. A hierarchical system was implemented at three different geographical scales: European, Regional (Biscay Gulf) and Local (Cantabria region). At each of these scales, the methodology includes two phases: i) the physical classification; ii) the analysis of biological suitability. Thereby, a selection of physical variables (e.g. exposure to wave action, radiation, salinity, temperature, tidal range) was made according to their ecological meaning and their significant spatial variability at each scale. This information was based mostly on satellite data and mathematical modelling of natural coastal processes. The coastline was subdivided into stretches of different lengths that were classified using several multivariate analysis. In order to validate these classifications, the distribution of intertidal macroalgae at those scales was used. In general, statistical analyses based on biological data confirmed the ecological meaning of physical typologies previously established. Based on those results, further applications of the physical classification for management of biodiversity in different environmental scenarios are analysed.

EVALUATING SPECIES DISTRIBUTION MODELS WITH HISTORICAL MACROFAUNA DATA: A HINDCAST FOR THE JADE BAY

Anja Singer[1,2], Ulrike Schückel[1], Melanie Beck[3], Heiko Westphal[4], Karsten A. Lettmann[3], Gerald Millat[5], Joanna Staneva[6], Oliver Bleich[3], Jörg-Olaf Wolff[3], Anna Vanselow[3], Ingrid Kröncke[1]
[1]Senckenberg am Meer, Dept. for Marine Research, Wilhelmshaven, Germany; [2]University of Bremen, Dept. for Biology/Chemistry, Bremen, Germany; [3]Institute for Chemistry and Biology of the Marine Environment, Oldenburg, Germany; [4]Coastal Research Station - Lower Saxony Water Management, Coastal Defence and Nature Conservation Agency, Norderney, Germany; [5]National Park Administration Lower Saxony Wadden Sea, Wilhelmshaven, Germany; [6]Helmholtz-Center Geesthacht, Geesthacht, Germany;anja.singer@senckenberg.de

During the last decades severe climatic- and environmental changes have been monitored for the European Wadden Sea (North Sea), causing pronounced changes in the abundance and spatial distribution of characteristic benthic species. Due to their sessile and sedentary habit, benthic species are ideal organisms for small-scale Species Distribution Modelling (SDM) and important indicators for environmental changes and disturbances. In a first step, the present distribution (for 2009) of 10 characteristic macrofauna species was modelled for the Jade Bay (German Wadden Sea), built on statistical relations between species presences and 13 high-resolution environmental grid layers (maximum entropy approach-MAXENT). In a second step, the potential past species distribution was hindcasted (for the 1970s and the 1930s), based on recorded habitat changes since the last eight decades: Increasing water temperatures, sea-level rise, changing nutrient supply, changing biogenic structures (*Zostera noltii*, *Mytilus edulis*), increasing sediment volume and increasing mudflats. Model results for the past distribution scenarios show a good match with historical macrofauna data from the 1970s and 1930s and are therefore a reliable validation of the MAXENT algorithm. Quantified habitat changes since the 1930s, such as a continuous habitat gain for the polychaete

worm *Tubificoides benedii* on mudflats, are well reflected in the predictions maps. We conclude that the good fit of the hindcast model results provide a reliable basis for forecasting macrofauna species distribution under potential future conditions, such as ongoing sea-level rise and temperature increase.

BIOGEOCHEMICAL NORTH SEA CLIMATOLOGY

Iris Hinrichs[1], Viktor Gouretski[1], Johannes Pätsch[1], Manfred Bersch[1], Kay Emeis[1,2], Detlef Stammer[1]

[1]University of Hamburg, Germany; [2]Institute of Coastal Research, Helmholtz Center Geesthacht; iris.hinrichs@uni-hamburg.de

We present a climatological data set of biogeochemical parameters in the wider North Sea region (15°W-15°E, 47°N-65°N). The data set is based on a broad collection of observational data of ammonium, chlorophyll-a, nitrate, dissolved oxygen, phosphate and silicate for the time period 1960-2014. Different data centres contributed data to this collection. The data collection itself went through a thorough procedure of pre-processing (unification of data formats, identification of duplicate observations) and of elaborate quality control before 3-D time series of the biogeochemical parameters were generated.

The data set complements the hydrographical climatology of temperature and salinity for the same region (Bersch et al., 2013, http://icdc.zmaw.de/knsc_hydrographic.html?&L=1). Furthermore, it can be used to initialise ecosystem models and/or for validation of model results of biogeochemical numerical simulations.

UNDERSTANDING VARIATION AND CHANGES IN KELP FOREST ECOSYSTEMS USING MODELLING APPROACHES

Trine Bekkby[1,2], Eli Rinde[1], Kjell Magnus Norderhaug[1,3], Gro Angeltveit[1,4], Camilla W. Fargerli, Janne K. Gitmark[1], Hege Gundersen[1], Lise Ann Tveiten[1], Hartvig Christie[1]

[1]Norwegian Institute for Water Research, Norway; [2]Natural History Museum, University of Oslo, Norway; [3]Department of Biosciences, University of Oslo, Norway; [4]County Governor of Buskerud, Norway; trine.bekkby@niva.no

The *Laminaria hyperborea* kelp forests are highly diverse and amongst the most productive systems on the planet. This is partly related to its role as a three dimensional habitat, hosting hundreds of thousands of animals per square meter. Our studies show that the biomass, size and morphology of kelp and its associated macroalgae are strongly influenced by water flow (wave and ocean current exposure), thereby also influencing the fauna. Along the Norwegian coast, the kelp forests have since the 1960s been extensively grazed by green sea urchins (*Strongylocentrotus droebachiensis*). Our results show that the distribution of kelp and green sea urchins are driven by variations in the physical environment and temporal changes in temperature. At present, green sea urchins are retreating and kelp forests are recovering, and our study identifies the borders for kelp recovery and sea urchin persistence along north-south and coast-ocean gradients. Red sea urchins (*Echinus esculentus*) grazing has in this context gone more or less under the radar. However, they are grazing on epiphytic macroalgae, and our study shows that they occur in high densities in recently recovered kelp forests and that they reduce the abundance of the epiphytic macroalgae, especially in shallow areas. The grazing of kelp and associated macroalgae by sea urchins interacts with physical factors and are likely to affect kelp forest resistance to and resilience from pressures, such as climate change.

ADULT-JUVENILE ASSOCIATIONS IN BIVALVES DISENTANGLED FROM ENVIRONMENT

Henrike Andresen[1], Simon F. Thrush[2], Casper Kraan[1,3]

[1]National Institute of Water and Atmospheric Research (NIWA), Hamilton, New Zealand; [2]Institute of Marine Science, University of Auckland, Auckland, New Zealand; [3]University of Freiburg, Department of Biometry and Environmental System Analysis, Freiburg, Germany; henrikea@gmx.de

Adult bivalves can influence the spatial distribution of juveniles on intertidal flats. Besides competition, juvenile bivalves can be negatively affected by accumulation of biodeposits or habitat disturbance by adults. Conversely, juvenile bivalves might also profit from adults providing substrate or enhancing nutrient cycling and providing food resources. Such interactions are rarely obvious when looking at the large-scale (100's m) spatial distributions of organisms, as these interactive effects are often masked by habitat preferences and responses to environmental factors. Experiments would investigate mechanisms directly, but usually cover a limited range of conditions, making generalization difficult.

To incorporate much habitat and density variation, we conducted macrobenthic surveys in three New Zealand estuaries, each with 400 samples in a design that encompasses inter-core distances from 30 cm to > 1 km. Focussing on the two numerical and biomass dominants, the Tellinid deposit-feeding *Macomona liliana* and the Venerid suspension-feeding*Austrovenus stutchburyi*, we investigated with General Linear Models how much of the observed overlap in spatial patterns is due to common responses to environmental variables. The remaining patterns were then analysed with cross-correlations for the extent and intensity of intra- and interspecific associations. Possible causes and consequences of the scale of correlations and the potential importance to population dynamics are discussed.

OBS10: Biogeochemistry and nutrient cycling

Friday, 25/Sep/2015, 9:00am - 10:30am *Location:* **Nordseehalle 2**

BALTIC SEAGRASS MEADOWS AS A SEDIMENT CARBON SINK

Emilia Katarzyna Jankowska[1], Maria Włodarska-Kowalczuk[1], Loïc Michel[2], Agata Zaborska[1]

[1]Institute of Oceanology Polish Academy of Sciences, Poland; [2]University of Liège, Belgium; ejankowska@iopan.gda.pl

Seagrass meadows are highly productive habitats also regarded as ecosystem engineers. They have strong capacity to change abiotic conditions by facilitating sedimentation, reducing resuspension, trapping seagrass derived and other particles. Recently a lot of studies are dedicated to “the blue carbon sinks” subject. Most of the studies assessing seagrass sediment carbon sink capacity are based on results obtained in the *Posidonia oceanica* meadows. Present study is the first estimation of seagrass sediment carbon sink storage in the *Zostera marina* beds. To evaluate seagrass engineering effects, we compared main parameters describing organic matter and sediment characteristics as well as possible organic matter sources in the sediment at vegetated and unvegetated bottom. The study was conducted in Southern Baltic Sea in summer seasons of 2012, 2013 and 2014. Collected data indicate that carbon stock in the Baltic Sea vegetated area (1480-2100 km^2) amounts 0.6-0.8 Mt, whereas Carbon annual accumulation is around 0.08 Mt. All tested descriptors of organic matter, pigments and sediment were enhanced at vegetated bottom. The result of SIAR modeling (Stable Isotopes in R) show high percentage of organic matter originated from seagrass production. Therefore, the obtained results indicate the importance of seagrass vegetated coastal habitats in the Baltic Sea as carbon storage and efficient ecosystem engineers.

INVASIVE SPECIES AND ECOSYSTEM FUNCTION: EFFECTS OF MARENZELLERIA SPP. ON SEASONAL NUTRIENT DYNAMICS

Laura Elina Kauppi[1], Joanna Norkko[1], Jussi Ikonen[2], Alf Norkko[1]

[1]University of Helsinki, Tvärminne Zoological Station, Finland; [2]University of Helsinki, Laboratory of Radiochemistry, Finland; laura.kauppi@helsinki.fi

Remineralization of nutrients in the sediment is influenced by temperature, organic matter, oxygen content and the activities of bioturbating fauna, which all vary seasonally. The invasive polychaete *Marenzelleria* spp. provides unique functionality to the Baltic Sea sediments via its deep burrowing and extensive gallery formation, and can thus have a major effect on benthic oxygen and nutrient fluxes. This has, however, not been studied previously in the northern Baltic Sea. In addition, virtually nothing is known about the functioning of these benthic communities in winter. In this study the seasonal contribution of *Marenzelleria* spp. to oxygen and nutrient fluxes was assessed by means of monthly field measurements of fluxes and porewater nutrients at two sites, 10 and 33 m deep, in the northern Baltic Proper from June 2013 to June 2014. Highest oxygen consumption occurred during the summer months indicating highest activity of the fauna, but likely also high microbial respiration rates. Faunal density, at the deeper site also *Marenzelleria* spp. density, peaked in late July at both sites. There was seasonal variation in the fluxes of NH^{4+}, NO_x, PO_4^{2-}, Si, Fe and Mn, with clear differences between the deeper and the shallower site. Phosphate fluxes corresponded to the changes in faunal density. We discuss these results in relation to the sediment characteristics and the seasonal differences between the two sites.

LONG TERM CHANGES OF EUTROPHICATION IN THE VILAINE BAY (FRANCE)

Widya RATMAYA[1], Philippe SOUCHU[1], Jordy Salmon MONVIOLA[3], Dominique SOUDANT[2], Evelyne GOUBERT[4], Nathalie COCHENNEC-LAUREAU[1]

[1]IFREMER LER MPL, France; [2]IFREMER DYNECO/Vigies, France; [3]INRA/AGROCAMPUS OUEST, France; [4]University of South Brittany (UBS), France; widya.ratmaya@ifremer.fr

Eutrophication of aquatic ecosystems remains an important issue over the last few decades. Since the 1980s, efforts to decrease eutrophication have been made particularly in terrestrial aquatic ecosystems. Accordingly, the amount of nutrient inputs to the coastal waters has been expected to decrease. The Vilaine Bay, one of the most eutrophic zones along the European Atlantic coast, regularly suffers from summer hypoxia in the bottom water. In the present study, long term changes of nutrient concentrations and phytoplankton biomass (Chlorophyll *a*) in the Vilaine Bay were compared with those of nutrient inputs from the Vilaine River (1982 – 2013), the main external source of nutrients in the bay.

A significant diminution of winter N and P concentrations in the Vilaine River was observed in the early 90s, leading to a significant decrease in P inputs, but not in N inputs. Winter nutrient and spring Chl *a* meanconcentrations in the Vilaine Bay did not show a significant trend, even if the maximum of Chl *a* tended to decrease. Concerning summer periods, there was no significant trend for N concentrations in the Vilaine River and in the Vilaine Bay. However, summer P concentrations in the Vilaine River showed significant decrease, while a significant increase was observed in the Vilaine Bay. In parallel, summer Si concentrations in the bay showed increasing trend, which was not the case for river inputs of Si. These results suggested the presence of other nutrient source fertilizing the Vilaine Bay during summer periods, presumably a sedimentary source.

INTERACTIVE EFFECTS OF CO2 AND LIGHT ON TWO ANTARCTIC DIATOM SPECIES

Jasmin Pascale Heiden[1,2], Kai Bischof[2], Scarlett Trimborn[1,2]

[1]Alfred-Wegener-Institute, Germany; [2]University Bremen, Germany; jasmin.heiden@awi.de

It is largely unknown how climate change, including rising atmospheric CO_2 concentrations and altered vertical mixing depths of surface waters and their subsequent effects on light availability, will affect phytoplankton in the Southern Ocean. To investigate the combined effects of CO_2 and light in two Antarctic diatoms (*Fragilariopsis curta* and *Odontella sp.*) a matrix of three light

intensities (20, 200, 500 µmol photons*m^{-2}*s^{-1}) and three pCO_2 levels (180, 380, 1000 µatm) was applied measuring growth, particulate organic carbon fixation and photophysiological effects. Generally, growth rates of both species were not stimulated by high pCO_2.. The two diatoms showed diverging responses in growth and carbon fixation under the applied treatments. Using fast repetition rate fluorometry, both species showed increased photosynthetic electron transport rates (rETR) with increasing growth light intensities. Yet, there were no differences between the applied pCO_2 levels apart from the low pCO_2 and high light treatment, where rETRs were decreased. *Odontella* always had higher photosynthetic yields than *Fragilariopsis*. However, the recovery after short-term exposure to high light was higher in *Fragilariopsis*. Our results suggest that Southern Ocean diatoms are sensitive to changes in CO_2 and that key diatom species will respond differently to the predicted environmental changes. Photophysiological results further indicate that the two species represent different ecotypes of phytoplankton, with *Fragilariopsis* being able to cope with short periods of light stress as occurring during deep vertical mixing and *Odontella* using more effectively high irradiances as occurring in a less variable stable mixed layer.

IN SITU STUDY OF NITROGEN FLUXES IN MEDITERRANEAN SPONGES REVEALS DICHOTOMY BETWEEN HMA-LMA SPECIES

Teresa Maria Morganti[1,2], Marta Ribes Llordes[1], Rafael Coma Bau[2], Gitai Yahel[3]

[1]Instituto de Ciencies del Mar (ICM-CSIC), Spain; [2]Centre d'Estudis Avançats de Blanes (CEAB-CSIC), Spain; [3]The School of Marine Sciences, Ruppin Academic Center, Michmoret, Israel; tmorganti@icm.csic.es

Sponges are commonly divided into high (HMA) and low (LMA) microbial-abundance species. These two groups reflect different aquiferous structures and pumping behaviors. To directly measure the uptake/excretion of different compounds by three HMA (*Chondrosia reniformis*, *Agelas oroides*, *Petrosia ficiformis*) and two LMA (*Dysidea avara* and *Crambe crambe*) sponge species, we used an *in situ* technique (VacuSIP). Simultaneous sampling of the water inhaled and exhaled by undisturbed animals sharing the same rocky wall in the NW Mediterranean allowed us to measure plantkon uptake and the fluxes of dissolved organic (DON) and inorganics (NH_4^+, NO_x^-) mediated by the sponges. The pico and nano plankton retention efficiency was high in all species, irrespective of their microbial abundance. However, dissolved nitrogen fluxes markedly differed between HMA and LMA species, likely related to the microbial activity inside the sponge. HMA species removed DON and NH_4^+, and excreted NO_x^-, end product of nitrification. Dissolved N compounds were the major N sources, representing up to 97% of N ingested by HMA species respect to pico and nano plankton fraction. In contrast, removal of planktonic microorganisms accounted for the entire N uptake in LMA species, with no evidence of dissolved compounds uptake. They excreted N as DON and NH_4^+, leaving a mismatch between N ingested and excreted. These findings elucidate the differences on the metabolic strategies of the sponge holobiont, suggesting that HMA are able to use a broader spectrum of resources, mainly dissolved phase when picoplankton abundances are scarce.

POSTER SESSION

1. NEUSTON COMPOSITION AND DISTRIBUTION IN CENTRAL AND WESTERN MEDITERRANEAN SEA

GENUARIO BELMONTE[1], CANDIDO IRENE[1], HAJDERI EDMOND[2], LIPAROTO ANITA[1], MOSCATELLLO SALVATORE[1]

[1]UNIVERSITY OF SALENTO, O.U. CoNISMa, LECCE, ITALY; [2]UNIVERSITY OF OUR LADY OF GOOD COUNCIL, O.U. CoNISMa, TIRANA, ALBANIA;genuario.belmonte@unisalento.it

A collection of 86 neuston samples has been carried out in the framework of two oceanographic cruises in May-June 2013, from a total of 59 stations in the Central and Western Mediterranean Sea. The collection represents, at present state of knowledge, the most important sampling effort for a study on the neuston in the Mediterranean Sea. Analyses of samples gave a total of 101 taxa (identified at the minimum taxonomic level of Family). The emerged differences grouped the most stations in 5 assemblages: Corsica, South W-Mediterranean, Northern S-Adriatic, Western S-Adriatic, Eastern S-Adriatic. True neustonic organisms (euneuston) were represented by 7 taxa. The most abundant euneston taxon was Isopoda (Idotheidae) found in 35 of 59 stations, followed by Copepoda (Pontellidae) found in 31 stations. Hydrozoa Velellidae were completely absent from the S-Adriatic (27 stations) and present in 9 of the 32 stations of the W-Mediterranean. Marine litter and plastics were well represented in the whole sample set, thus highlighting the delicate situation this transitional habitat. The interaction of the marine litter with the neuston will be evaluated carefully, also with the replication of a cruise, in another season, to enrich the number of observations.

2. THE OCCURRENCE OF THE INVASIVE ASIAN SHORE CRAB IN THE GERMAN BIGHT – COEXISTENCE OR DISPLACEMENT?

Simon Jungblut[1,2], Jan Beermann[3], Karin Boos[1,4], Reinhard Saborowski[2], Wilhelm Hagen[1]

[1]Bremen Marine Ecology (BreMarE), Marine Zoology, University of Bremen, P. O. Box 330440, 28334 Bremen, Germany; [2]Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Functional Ecology, P. O. Box 120161, 27515 Bremerhaven, Germany; [3]Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Biologische Anstalt Helgoland, P. O. Box 180, 27438 Helgoland, Germany; [4]MARUM - Center for Marine Environmental Sciences, University of Bremen, Leobener Strasse, 28359 Bremen, Germany;jungblut@uni-bremen.de

The Asian shore crab *Hemigrapsus sanguineus* was initially introduced to the French Atlantic coast in the late 1990´s. Since then it has successfully established persistent populations along the European Atlantic coasts propagating further north. The invasive crab was found in the German part of the Wadden Sea for the first time in 2007 and at Helgoland in 2008. There, it now shares its intertidal habitat with the native European green crab *Carcinus maenas*. In order to test for potential interspecific effects between these two ecological equivalents, we analysed populations of both species in the rocky intertidal of the island of Helgoland (German Bight, North Sea) in 2009 and 2014. Numbers of animals and their biomasses of both species from four sites around the island were recorded. Although mean abundances of *H. sanguineus* around Helgoland more than doubled from 2009 to 2014, they were still lower than the abundances of *C. maenas*, which were similar between the years. In contrast, mean biomass of *C. maenas* slightly decreased from 2009 to 2014, while values for *H. sanguineus* increased almost sevenfold. Differences between sites may be due to differences in local habitat characteristics such as topography, algae coverage, wave exposure, and/or predation risk. Nonetheless, the results showed that both species co-occur and reproduce in the rocky intertidal of Helgoland, providing no clear evidence for a displacement of either species.

3. *PHORCUS SAUCIATUS* IN THE IBERIAN PENINSULA. RANGE EXPANSION WITHOUT LOSING INTRASPECIFIC DIVERSITY

Marcos Rubal[1,2,3], Puri Veiga[2,3], Juan Moreira[4], Jesus Souza Troncoso[1,5]

[1]Departamento de Ecoloxía e Bioloxía Animal, Universidade de Vigo, Campus de As Lagoas, 36310 Vigo, Spain; [2]CIIMAR/CIMAR, Centro Interdisciplinar de Investigação Marinha e Ambiental, Rua dos Bragas, 289, 4050-123, Porto, Portugal; [3]Department of Biology, Faculty of Sciences, University of Porto, Via Panoramica 36 4150-564 Porto, Portugal;[4]Departamento de Biología (Zoología), Universidad Autónoma de Madrid, Cantoblanco, E-28049 Madrid, Spain; [5]ECIMAT, Station of Marine Sciences of Toralla, University of Vigo, Toralla Island s/n, E-36331, Spain.; troncoso@uvigo.es

The sub-tropical gastropod *Phorcus sauciatus* has a discontinuous distribution in the Iberian Peninsula. Historically this species was present from Cantabria (North Spain) to Galicia (North-West Spain) and from the Strait of Gibraltar (South Spain) to Sesimbra (central Portugal). However, in recent years the range of *P. sauciatus* has considerably expanded southwards in the North of the Iberian Peninsula (about 180 km) in coincidence with an increase of sea surface water temperature in this region. The main objective of this study was to explore shifts in the distribution of *P. sauciatus* along the Iberian Peninsula. Moreover, we explored the possible loss of intraspecific diversity in range-edge populations comparing to non range-edge ones due to recurring founder effects or genetic drift. To achieve these objectives, the presence/absence of *P. sauciatus* was explored in 160 rocky shores from North Spain to South Portugal. Moreover, 30 animals were collected from South Portugal, 30 from North Spain (non range-edge populations) and 30 from North Portugal (range-edge). Finally, the gen COI was sequenced and differences in nucleotide and haplotype diversity were explored among populations. Results confirmed the range expansion of 180 km southward previously detected by the authors and a range expansion about 100 km northwards from Sesimbra to near Peniche in central Portugal. Despite this significant range expansion no significant intraspecific differences in haplotype or nucleotide diversity were found among range-edge and non range-edge populations. However, non range-edge populations showed a high number of private haplotypes than range-edge populations.

4. DIVERSITY AND ABUNDANCE OF METHANE OXIDIZING BACTERIA IN THE ELBE ESTUARY

Patrick Schaal, Steffen Hackbusch, Ingeborg Bussmann, Antje Wichels

Alfred Wegener Institut, Germany; ingeborg.bussmann@awi.de

Rivers represent a transition zone between terrestric and aquatic environments, as well as a transition zone between methane rich and methane poor environments. Methane concentrations in freshwater systems are in general higher than in marine

systems. The Elbe River is one of the important rivers draining into the North Sea and with the Elbe River high amounts of methane are imported into the water column of the North Sea. The major biological sink is the oxidation of methane by aerobic methanotrophic bacteria. Eight cruises from November 2013 until November 2014 were conducted from Hamburg towards Helgoland. Methane oxidation rate was measured with radiotracers and methanotrophic abundance was assessed by q-PCR. Community fingerprinting was performed with monooxygenase intergenic spacer analysis (MISA). Combining all the data we could identify four environments (marine, coast, outer and inner estuary) with significantly different abundances. The marine environment had lowest abundances and highest abundances were found in the inner estuary. Comparison of the corresponding communities is in progress

5. TEMPORAL VARIATION OF PARAONIDAE (ANNELIDA: POLYCHAETA) IN FINE SEDIMENTS OF RÍA DE ALDÁN (NW SPAIN)

Fernando Aneiros[1,2], Juan Moreira[3], Jesús S. Troncoso[1,2]

[1]ECIMAT, Marine Sciences Station of Toralla; University of Vigo; Spain; [2]Department of Ecology and Animal Biology; Faculty of Marine Sciences; University of Vigo; Spain; [3]Department of Biology (Zoology); Faculty of Biology; Autónoma de Madrid University; Spain; f.aneiros@uvigo.es

Paraonids are small-sized, burrowing, non-selective deposit-feeding polychaetes. They are usually present in sandy-muddy sediments, often in high numbers. The Ría de Aldán is a small bay located in the NW of the Iberian Peninsula, subjected to coastal upwelling and downwelling processes. The Ría shows a high variety of sedimentary habitats and a diverse benthic fauna. Two sampling sites were studied in this work: an 18m-depth muddy sand bottom (site 1) and a 17m-depth organically-enriched muddy bottom (site 2), both in the inner half of the Ría. Five replicate samples were taken monthly at each site from May 1998 to May 1999 by means of a Van-Veen grab with an operating surface of 0.056m^2. An additional sample was taken to measure grain size, carbonate and total organic matter contents of the sediment. Sampling yielded 12040 paraonid specimens belonging to four different species. "*Paradoneis lyra*" (Southern, 1914) and "*P. armata*" Glémarec, 1966 were the two numerically dominant species and found at both sites. "P. lyra" was the most abundant species at site 2 during the whole study period, showing remarkably high densities (up to 7461 indivs./m^2); on the contrary, "*P. armata*" was more abundant at site 1. "*Aricidea* (Acmira) *cerrutii*" Laubier, 1966 and "*Cirrophorus furcatus*" (Hartman, 1957) were sporadically found at sites 1 and 2, respectively; in both cases, their presence was associated to conspicuous changes in the characteristics of the sediment. There were significant correlations among species abundance and sediment variables, particularly at site 1.

6. LONG-TERM ACCLIMATION OF A SENSITIVE BARNACLE POPULATION TOWARDS OCEAN ACIDIFICATION

Mara Elena Heinrichs[1,2], Jonathan Havenhand[1], Christian Pansch[1,3]

[1]University of Gothenburg, Sweden; [2]University of Oldenburg, Germany; [3]GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany; mara.elena.heinrichs@uni-oldenburg.de

A species' capacity to acclimatise or adapt to projected near-future reductions in seawater pH induced by ocean acidification is an important factor in determining its future population structure and ecosystem service. Due to on-going selection and acclimation, marine organisms from habitats with relatively constant pH levels are expected to already today respond more sensitive to pH perturbations than organisms naturally exposed to more variable pH regimes. In a long-term study, we investigated the potential of a barnacle (Amphibalanus improvisus) population originated from an area with naturally low pH fluctuations to acclimatise to reduced seawater pH (Δ of -0,6 pH units). We recorded survival, growth, respiration rates, feeding activity, reproductive maturity and larval release over 16 and 8 months in two cohorts of juvenile barnacles. Low pH had a strong negative impact on the survival of individuals. The survivors, however, grew at similar rates with similar metabolic activities as the control-barnacles indicating a certain potential for acclimation. Grown-up barnacles invested resources into development of gonads but we could neither find any fertilized individuals nor any larvae released by individuals kept at low-pH conditions. In contrast to earlier studies, we reveal a strong sensitivity of the barnacle population from a habitat with relatively constant pH regimes. Fertilization was considerably impaired by reduced pH suggesting significant implications for population structures. However, in a gradually changing environment, we assume that the selection of genotypes will lead to populations that might be able to cope with low seawater pH as projected for the near future.

7. RESTING VS ACTIVE STAGES: THE UP AND DOWN IN PLANKTON DYNAMICS

Manuela Belmonte[1,2], Fernando Rubino[1], Genuario Belmonte[2]

[1]Institute for Coastal Marine Environment, CNR UOS of Taranto, Italy; [2]Lab. of Zoogeography and Fauna, DiSTeBA, University of the Salento, Lecce, Italy; rubino@iamc.cnr.it

Composition of the marine coastal plankton undergoes seasonal fluctuations and interannual variations also due to the alternance of active and resting stages (cysts) in the water column and sediments. To fully understand the functioning of planktonic systems in marine coastal areas we need to integrate information coming from pelagos and benthos into a continuum that helps us to quantify the biological transfer between these two domains. To achieve this goal we have set up an ad-hoc experimental design in a confined marine basin at Taranto (southern Italy, Ionian Sea). We considered: active stages in the water column; cyst production (sediment traps); cyst accumulation in the sediments and in situ cyst germination (inverted traps). The whole study was structured in two "times", one in autumn, to observe the encystment dynamics, and one in the following spring, to observe the excystment. A total of 222 taxa were found in all the components of the system. In particular, 150 were active in the water column, 88 were cysts sunk in the sediment traps, 72 constituted the "cyst bank" in the sediments, and 63 were found as newly excysted active stages in the inverted traps. Only 17 taxa resulted common to all the sampling types. *Scrippsiella trochoidea* (Dinoflagellata), *Ciliophora spp*. and *Acartia sp*. (Copepoda) were selected as examples of life-cycle strategies. Different behaviours of taxa and their tuning with the environmental conditions result in the apparent unpredictability of plankton dynamics and composition in confined marine coastal areas.

8. ARTIFICIAL SUBSTRATES IN MARINE HABITATS: EFFECTS ON COMMUNITY COMPOSITION AND SEAWEED RECRUITMENT

Merle Bollen[1], Christopher N. Battershill[2], Conrad A. Pilditch[3], Kai Bischof[1]

[1]Department of Marine Botany, University of Bremen, Germany; [2]Department of Coastal Sciences, University of Waikato, Hamilton, New Zealand; [3]Department of Biological Sciences, University of Waikato, Hamilton, New Zealand; mbollen@uni-bremen.de

Coastlines are subject to ongoing development and construction activities enhancing the availability of artificial substrates to benthic organisms. To investigate the effect of substrate type on seaweed recruitment, tiles (30x30cm) of four different artificial substrates (concrete, steel, fibreglass and rope) and natural occurring basalt were installed in two experimental sites (Pilot Bay, Butters Wharf) in Tauranga Habour, New Zealand. After the duration of one year the community was analysed. Additionally, settling preferences of spores of the invasive kelp *Undaria pinnatifida* were tested in a tank experiment using smaller (4x4cm) substrate tiles. Species number and cover significantly depended on experimental site. However, for both sites lowest species number and cover was associated with steel tiles. Preliminary results on the composition of algal functional groups indicated differences between locations and substrates. Multidimensional scaling will be applied to identify patterns of similarity for the community composition on different substrates. Understanding the impact of artificial substrates on adjacent communities will provide valuable information for harbor management. Moreover, to predict future distribution patterns of invasive species it is crucial to evaluate the significance of artificial structures as potential “stepping stones” for their spread.

9. CHANGE IN LIFE SPAN OF THE PONTO-CASPIAN AMPHIPOD *PONTOGAMMARUS ROBUSTOIDES* IN THE NORTHERNMOST AREA

Nadezhda A. Berezina

Zoological Institute RAS, Russian Federation; na-berezina@rambler.ru

Mid-summer observations were conducted in 2000-2014 at 12 sites in the Russian waters of the Gulf of Finland; Baltic Sea (Neva River estuary) to monitor status and distribution of the Ponto-Caspian amphipod *Pontogammarus robustoides* after its first records (1999). To recognize dynamics of abundance, population structure and reproductive variables, *P. robustoides* populations were studied monthly from May to October 2002-2008 at two locations in the Neva estuary. By present it is widely distributed species in the estuary preferring to colonize the stone-sandy vegetated habitats (from the shore to 5 m of depth) with water salinity 0.2-3. This species coexists with other amphipods such as Baikalian Gmelinoides fasciatus, North-Atlantic *Gammarus tigrinus* and native *Gammarus spp*. Abundance of *P. robustoides* was varied between years and sites reaching maximum 1000 for adults and 3000 ind. m-2 for juveniles. Duration of *P. robustoides* embryogenesis is temperature-dependent; the annual number of generations varied between years, reaching three generations in most years and two in coldest years. Size-dependent clutch size (fecundity) averaged between 33–43 (maximum 75) eggs per clutch in the range 11.2–12.2 mm of female body length. At least 1.5-2 times decline in fecundity, longer life cycle and a decrease (from 4 to 2) in number of generations in a year were occurred when *P. robustoides* was moving from south to the north. This paper concludes that the population characteristics of invasive *P. robustoides* such as the number of generations, fecundity and abundance might be changeable depending on local climate in recipient

10. IMPACT OF INVASIVE BIVALVE *ANADARA KAGOSHIMENSIS* ON THE TAMAN BAY (SEA OF AZOV) BENTHIC ASSEMBLAGES

Galina Kolyuchkina[1], Birukova Svetlana[2], Semin Vitalii[2], Simakova Uljana[1], Basin Alexandr[1], Nabozhenko Maxim[2], Spiridonov Vasilij[1]

[1]P.P.Shirshov Institute of Oceanology of the Russian Academy of Sciences (IO RAS) , Russian Federation; [2]Institute of Arid Zones of Southern Scientific Center of Russian Academy of Sciences (IAZ SSC RAS); galka.sio@gmail.com

The Taman Bay is a particular area of the Azov-Black sea basin where an invasive ark *Anadara kagoshimensis* (Tokunaga, 1906, Bivalvia) lives in virtual absence of predator *Rapana venosa* (Valenciennes, 1846, Gastropoda). The latter one strongly determines macrobenthos’ dynamic of the remaining region. Our aim was to estimate the standalone impact of *A.kagoshimensis* invasion on native macrozoobenthos. We compared invaded and non-affected assemblages from 0.5-1 and 4-6 m depths of the Taman Bay using integral parameters: abundance, biomass, species richness, Shannon and Pielou indexes. Integral parameters of invaded and native communities at each depths range did not differ at statistically significant level (Mann-Whitney test).

At 0.5-1 m *A.kagoshimensis* was included in four different assemblages once being dominant. Ark contribution to *Mytilaster lineatus*, *Abra segmentum* and *Donax semistriatus* assemblages was 1-20% of the total metabolic rate (a function of both biomass and abundance of species.). At 4-6 m we have distinguished two groups of samples with native *Cerastoderma glaucum* and alien *A. kagoshimensis* as dominants. The contribution of dominants exceeded 65% of the community total metabolic rate. They define main differences between station groups (80%), masking the contribution of minor species. Exclusion of *A.kagoshimensis* from the analysis, leads to aligning of ark dominated samples with corresponding native dominated. We suggest that *A. kagoshimensis* becomes incorporated into native assemblages without significantly changing the structure and integral parameters. The field and laboratory studies were supported by Presidium of RAS (Program 23) and RFBR grant 14-04-32063 respectively.

11. A GLIMPSE INTO COPEPOD PHYSIOLOGY IN RELATION TO HYPOXIA

Marina Giunio, Anna Schukat, Holger Auel

University of Bremen, Germany; giunio@uni-bremen.de

Ocean deoxygenation is one of the consequences of global warming. Naturally occurring areas with low dissolved oxygen concentrations (DO) in eastern boundary systems have shown spatial expansion; decline in DO and shoaling over past decades. Zooplankton, in which copepods are the most abundant components, represent a crucial link in the marine food web, therefore, understanding copepod physiology and determining possible adaptations to low DO are one of prerequisites to assess the impact of global changes on marine ecosystems. In order to investigate copepod physiological response to hypoxic DO (<1.4 ml O2 l-1), the most abundant species were sampled in stratified vertical hauls in the intermediate oxygen minimum zone (OMZ) of the Benguela Current eastern boundary system off the SW African coast. Respiration rates (RR) and electron transport system (ETS) activities were used as proxies for metabolic activity. RR were measured at in situ DO, ranging from 0.24 to 9.7 ml l-1. Results showed no significant change in species-specific RR, regardless of DO levels, however, there were differences in interspecific RR. ETS measurements presented no significant differences in relation to in situ oxygen concentration or changes over time, when kept in oxygen-saturated sea-water. Since both proxies showed no changes (over DO gradient and over time), that might suggest that the adaptation threshold has not been reached in the Benguela OMZ or other adaptation mechanisms, e.g. anaerobic metabolic pathways, were taking place. Further investigation is necessary to reveal physiological adaptations and clarify the effect of ambient oxygen concentration on copepod metabolism activity.

12. A REVISION OF THE SPECIES INVENTORY OF ULVALES IN NORTHERN GERMANY

Sophie Steinhagen[1], Rolf Karez[2], Florian Weinberger[1]

[1]GEOMAR - Helmhotz Centre for Ocean Research Kiel, Germany; [2]State Agency for Agriculture, Environment and Rural Areas Flintbek, Germany; ssteinhagen@geomar.de

Green macroalgae of the order Ulvales are abundant and often dominant in European marine and brackish shallow water environments and thus ecologically important. However, their morphology is often extremely variable, which largely hampered their taxonomic identification until recently. Cryptic or alien species were often not recognized, while different phenotypes of the same species were in many cases regarded as distinct taxa. Here we report the results of a survey on Ulvales biodiversity in the Baltic and North Sea areas of the German state of Schleswig-Holstein and adjacent areas that was based upon analyses of the plastid elongation factor *tuf*A gene in more than 350 samples. This molecular approach combined with morphological analyses so far allowed for the discrimination of 19 species, including 4 cryptic and 6 newly introduced taxa (thereof one potentially invasive) that were not known from the area yet. Further, several species that were until now estimated to occur in high abundance are seemingly very rare or even absent.

13. SEAGRASS VEGETATION ENHANCES THE BACTERIAL ABUNDANCE (BALTIC SEA)

Emilia Katarzyna Jankowska[1], Katarzyna Jankowska[2], Maria Włodarska-Kowalczuk[1]

[1]Institute of Oceanology Polish Academy of Sciences, Poland; [2]Gdańsk University of Technology, Poland; ejankowska@iopan.gda.pl

This study presents the first report of the bacteria abundance in the sediments of eelgrass (Zostera marina) meadows in the shallow southern Baltic Sea (Puck Bay). Total bacteria cell number (TBN) and bacteria biomass (BBM) was compared between bare and vegetated sediments in the vegetated summer seasons. Significantly higher abundance of bacteria community were recorded at bottom covered by the seagrass meadows (vegetated: 2.8 ± 1.45, unvegetated 1.85 ± 2.05 [cell/g sed. DW*107]) in both localities and in both sampling months. The same trend was observed for bacteria biomass (vegetated: 10.6 ± 5.1, unvegetated: 8.1 ± 2.4 [µgC/g sed. DW]). The DISTLM procedure indicated that main parameters which may explain bacteria characteristics are: meiofauna community structure, bottom type (vegetated, unvegetated), total nitrogen in the sediment, percentage of coarse sand fraction and sediment sorting. The strong positive effect of seagrass meadows on bacteria abundance reported by this study, highlight the importance of the macrophyte vegetation for the microbial communities associated with marine sediments.

14. *MACOMA BALTHICA* POPULATION RECRUITMENT IS AFFECTED BY SEASONAL TEMPERATURE VARIATION IN THE WHITESEA

Sophia A. Nazarova[1,2], Dmitry A. Aristov[2,3], Alexey V. Poloskin[2,4], Evgeny A. Genelt-Yanovsky[1,2], Vadim M. Khaitov[2,4,5]

[1]Department of Ichthyology and Hydrobiology, St-Petersburg State University, Russian Federation; [2]Laboratory of Marine Benthic Ecology and Hydrobiology, Russian Federation; [3]White Sea Biological Station, Zoological Institute, RAS, Russian Federation; [4]Department of Invertebrate Zoology, St.-Petersburg State University, Russian Federation; [5]Kandalaksha Nature Reserve, Russian Federation; sophia.nazarova@gmail.com

Factors affecting Macoma balthica recruitment in the Arctic populations are still poorly understood. To assess the patterns of long-term *Macoma* recruitment fluctuations we used 1992-2012 data for 6 adjacent intertidal sites in the Kandalaksha bay of the White Sea. We fitted two generalized additive models (GAM) with different parameters. GAM1 included recruits (yearling individuals) abundance as dependent variable, year smoother common for all sites and 6 particular year smoothers for each site, and site as fixed categorical factor. GAM2 included the same predictors except 6 particular smoothers. Likelihood ratio test did not reveal significant differences between models. Therefore we may consider the simpler GAM2 (R-sq = 0.26) as a better model indicating spatially synchronous pattern of long-term recruitment variation among sites. Thus we suppose that *Macoma* recruitment is regulated by climatic factors influencing populations at the scale of several kilometers. We also fitted mixed effect model with recruitment abundance as a response variable and monthly averaged regional air temperatures as fixed predictors (site and year were random components of the model), and then performed backward model selection. The simplest model indicates that the recruit abundance is positively dependent on the air temperature in previous October and December (soon after settlement) and in July of the year of observation, but negatively dependent on the temperature in January and May (last month before complete sea ice melting) of the year of observation. The study was supported by SPbSU research project No.1.38.253.2014.

15. ABOUT MACROBENTHOS MICRODISTRIBUTION IN LITTORAL COMMUNITIES OF THE WHITE SEA KANDALAKSHSKY BAY

Nadezhda Filippova, Maria Kireeva, Nikolay Maximovich
St. Petersburg State University, Russian Federation; naticaf@gmail.com
Drastic changes in marine littoral communities in rather stable environment are common for the White Sea. Changes of abiotic characteristics of biotope, predation, epizooty and competition are considered the main reasons for such successions. But the mechanisms of the organization of the White Sea soft bottom infaunal communities are insufficiently explored. The aim of this study is to detect an influence of the dominant species on the distribution of associated taxa. For this purpose in 2013 material was collected at 4 soft bottom sites typical for White Sea Kandalaksha Bay. As a result we described following traits in the organization of soft bottom communities. On sandy beach, subjected to moderate levels of wave activity, high abundance of macro- and meiofauna occurs in the areas characterized by presence of seagrass *Zostera marina*. But there is spatial isolation of areas with dense stands of seagrass and areas with high abundance of lugworms *Arenicola marina*, probably due to restriction of funnel formation by rhizome mats. On silty-sand beaches soft-shell clams *Mya arenaria* define heterogeneity of infauna distribution. In particular, most meiobenthic species avoid areas with high density of clams, but another bivalves *Macoma balthica* and polychaetes *Alitta virens* are attracted to such areas. There is no unambiguous evidence for competitive relations between dominant macrobenthic species. Our main hypothesis is that species separate distribution in soft sediment can be explained not only by the quality of relations, but the degree of domination, that is formed as a response of population to the environmental factors.

16. BIOLOGICAL POLLUTION AS A DRIVER OF CHANGE IN MARINE ENVIRONMENTS: WHAT ABOUT THE TARANTO SEAS?

Fernando Rubino, Ester Cecere, Manuela Belmonte, Giuseppe Portacci, Antonella Petrocelli
Institute for Coastal Marine Environment - CNR, UOS of Taranto, 74100 Taranto, Italy; rubino@iamc.cnr.it
In the last years, the introduction of alien species registered a considerable expansion worldwide, often ascribed to the increase of globalized transoceanic trade, which favoured the shifting of these species outside their natural distribution range, through several kind of vectors. Alien species have become a serious trouble for marine ecosystems, since some of them can establish in the new environment, posing severe threaten for biodiversity, structure and functioning of the receiving system, productive activities and human health. Those species, which proved to have negative effects on the recipient ecosystem, are called invasive and their negative effects are collectively named as biological pollution. Port zones and mussel farming areas seem to be the most exposed to this emerging menace. The Taranto seas are seat of many activities predisposing to the introduction of alien species and more than forty species, belonging to all the phyla, have been recorded since the first decades of the last century. Starting from the beginning of the 2000s, more and more comprehensive studies have been performing on this issue and a continuous monitoring of new introductions is in progress nowadays. Particular consideration has been paying to algal aliens, both micro and macro-algae, which gather the highest number of newly introduced species in Mar Grande, Mar Piccolo and Gulf of Taranto. Since now, none of them proved harmful for these environments, but the danger for a forthcoming invasiveness is real, so we must be alert to this. Research carried out within the framework of the Flagship Project RITMARE

17. POPULATION GENETIC DIVERSITY AND STRUCTURE OF TWO KELP SPECIES (LAMINARIALES) IN NORWAY

Ann Marie Evankow[1], Stein Fredriksen[1], Hartvig Christie[2], Claudia Junge[3], Anne Brysting[1]
[1]University of Oslo, Norway; [2]Norwegian Institue for Water Research (NIVA); [3]University of Adelaide, Australia; ann.evankow@gmail.com
Kelp forests are well known for their role as habitat for high diversity of species and primary production in the marine environment. They are also economically valuable for harvesting and aquaculture. Despite their importance, few studies have investigated population genetics or genomics of kelp species. Our study set out to provide a baseline phylogeographic survey of *Laminaria hyperborea* and *Saccharina latissima* along the coast of Norway. We co-amplified established microsatellite markers from species in the same genera and used the successful candidates to compare populations from southern to northern Norway. Our results suggest there is significant population structuring, especially between southern and northern populations. As the kelp aquaculture industry grows and the climate shifts, molecular population markers will become increasingly valuable tools to provide insight into marine ecosystems.

18. SPATIAL AND SEASONAL VARIABILITY OF PHYTOPLANKTON BLOOMS IN THE GERMAN BIGHT

JOELINE EZEKIEL ELIKALIA[1], Astrid Bracher[2], Birgit Heim[2], Roland Doerffer[2], Signorelli Natalia[3]
[1]OLDENBURG UNIVERSITY, Germany; [2]Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research (AWI); [3]Universidade de São Paulo (USP); joelineezekiel@gmail.com
We have used remote-sensing data to characterize spatial and inter-annual variations of bloom areal surface coverage in the German Bight and we have investigated the influence of environmental factors (Elbe River discharge and wind field) on bloom areal surface area variations. Remote-sensing observations of Chl-a (proxy for presence of phytoplankton) were obtained from Medium Resolution Imaging Spectrometer (MERIS) for the period between 2008 and 2011. The technique developed by Shutler et al. (2010) was applied to retrieve phytoplankton surface areal coverage. Analysis of the spatial and temporal variations of blooms in the German Bight revealed high bloom surface areal coverage in April and May. Correlation between bloom areal surface coverage with Elbe River discharge was significant ($r=0.75$, $n= 157$, $p\text{-value} < 0.05$) but not significant between bloom surface areal coverage and wind speed. Comparison between the blooms areal surface coverage with the Helgoland Time Series Chl-a concentration and Sylt Chl-a Time series data shows that Chl-a concentration is generally high and above 2 mgm-3. Wind direction plays a major role in the spatial and temporal distribution of bloom coverage in the German Bight rather than the magnitude of wind.

19. First genetic quantification of sex- and stage-specific feeding in the ubiquitous copepod Acartia to

Stefanie MH Ismar, Johanna Kottmann, Ulrich Sommer

GEOMAR, Germany; sismar@geomar.de
Marine copepods provide the major food-web link between primary producers and higher trophic levels, and their feeding ecology is of acute interest in light of global change impacts on food-web functioning. Recently, quantitative polymerase chain reaction (qPCR) protocols have been developed, which can complement classic diet quantification methods, such as stable isotope or fatty acid analyses tools. We here present first results of feeding experiments assessing food intake by the ubiquitous calanoid copepod *Acartia tonsa*. In triplicated mixed-diet feeding treatments, three suitable *A. tonsa* diets were offered in equal biomass proportions under constant conditions. Fixed-effect size models highly significantly explained 53.89 % of variation in copepod Rhodomonas balthica gut content, and unraveled significant effects of copepod sex and stage on the amount of R. balthica detected in copepod guts. Particularly, male adult copepods had higher *R. balthica* gut contents than females, or than copepodites. A trend towards higher amounts of ingested diatoms *Thalassiosira weissflogii* in adult female *A. tonsa* than in males was detected with newly developed and tested primers, while overall effects of sex- and stage-specific differences in copepod gut content of this diatom were non-significant. Genetic gut content quantifications showed no consistent sex- or stage-specific differences of *Isochrysis galbana* content in *A. tonsa*. Our results highlight diet-specific feeding differences between *Acartia* life-stages and sexes, which can have implications on food-web dynamics and specific nutrient transfer to higher trophic levels in copepod populations of varying age-composition under changing environmental parameters, such as rising temperatures and increasing ocean acidification.

20. PLANKTON PARASITES AT HELGOLAND ROADS: A SYNTHESIS OF AVAILABLE TIME SERIES DATA

Alexandra Kraberg, Christian Volk, Silvia Peters
AWI, Germany; Alexandra.Kraberg@awi.de
The Helgoland Roads time series is one of the most detailed ongoing phytoplankton time series in the world. Its dynamics have been studied for both top-down and bottom-up processes but two factors that have not been investigated in great detail are life-cycle characteristics of the involved species and parasites as determinants of population and community dynamics at Helgoland Roads. There are qualitative accounts of the types of parasites that have been observed in the past 50 years, but no quantitative data have yet been collected from the Helgoland Roads monitoring station. During the period 2013-2015 several diatom parasites were abundant with distinct periods of occurrence for *Cryothecomonas aestivalis* (July 2013), an oomycete in Pseudo-nitzschia pungens (May 2014) and *Lagenisma coscinodisci* in Coscinodiscus wailesii (August 2014). In this poster we will describe re-analyses of existing Helgoland Roads samples and net samples from Helgoland and additional stations in the German Bight to quantify the importance of these parasites in the affected host populations between 2013 and 2015 and link the available data to the existing Helgoland Roads phytoplankton data sets as well as physico-chemical parameters.

21. FROM SEQUENCE DATA TO BIODIVERSITY INFORMATION - TOWARDS TIME SERIES DATA

Stefan Neuhaus, Stephan Frickenhaus
Alfred-Wegener-Institute Helmholtz Centre for Polar and Marine Research, Germany; stefan.neuhaus@awi.de
Current bioinformatics analyses for biodiversity from molecular sequence data are discussed on the background of next generation high throughput sequencing technology. In particular, for creating time series of community composition data from amplicon sequencing approaches, different methods and their implications are compared: OTU-clustering based, cluster-free methods, tree-based vs. similarity-based taxonomic placements. Software and Hardware requirements as well as aspects of sustainable bioinformatics support are discussed. As a concrete example of analyses support, results obtained from the AWI pipeline QZIP are shown.

22. FUNDING MARINE RESEARCH: THE BIG, THE SMALL AND THE GREEDY?

Christiaan Hummel, Pim van Avesaath, Herman Hummel
Royal Netherlands Institute for Sea Research (NIOZ), The Netherlands; christiaan.hummel@nioz.nl
In Europe there is a vast amount of marine research facilities, i.e. marine stations, marine institutes, and universities. All these facilities are financed either by local authorities, regional and national governments, or at the level of the European Union, mostly a combination of all these types of financing. As vast as the amount of facilities in Europe, is also the amount of networks connecting them. Here we present for a wide variety of European marine networks an analyses on the type of financing, the type of facilities (i.e. marine station, institute, or university), and their interrelationships. We will focus on the interaction of the size of the facility, funding level, and differences between local, governmental or EC funded institutes. With regard to networking, we will focus on what type of institutes are represented in which networks, and if there is a connection between the size of the network, the size of the institute and the source of funding of the institute. It appears that the larger stations are the major representatives in the large-scale overarching EC funded projects, whereas the smaller stations are more linked to, and dependent on, funding at local or national level. We will also analyse the importance of certain key-institutes in EC projects and in the European scientific arena in general.

23. SHORT-TERM RESPONSES TO WATER ACIDIFICATION IN BENTHIC INVERTEBRATES FROM THE SOUTHERN BALTIC SEA

Magdalena Jakubowska, Monika Normant, Jerzy Drzazgowski
Institute of Oceanography, University of Gdansk, Poland; monika.normant@ug.edu.pl
The ocean acidification connected with absorption of anthropogenic CO2 is a global problem which negatively affects a variety of marine taxa. In the Baltic Sea intensified biological production which leads to increased decomposition of organic matter causes additional large CO2 inputs into coastal waters. This results in high annual pH amplitude especially near the bottom layers. We investigated the effect of short-term (36-48 hours) exposure to CO2-induced water acidification (pH from 8.1 to 6.0) on the behavior and total metabolic rate of four invertebrate species which are important components of benthic communities in the Baltic Sea (crustaceans: *Saduria entomon* and *Gammarus oceanicus*; bivalves: *Macoma balthica* and *Mytilus edulis*

trossulus). To this end we applied direct calorimetry which measures non-invasively the heat dissipated by organism and simultaneously allows for continuous monitoring of behavioral changes. Decreased pH did not significantly ($p > 0.05$) affect the resting or active metabolic rate of studied species, however in *G. oceanicus*, *M. balthica* and *M. edulis trossulus* the noticeable trend in reduction of both metabolic levels with decreasing pH was observed. Moreover, the gaping behavior (shell opening and closing) of studied bivalves was also unaffected ($p > 0.05$). Our data suggest that studied species developed some physiological and behavioral adaptations to cope with hypercapnic exposure in a short term, probably connected with the fact that they live in environment with highly fluctuating water ph.

24. LONG-DISTANCE TRANSPORT BY FLOATING HIMANTHALIA AND RECURRENT MASSIVE SPECIES DROP-OFF AT HELGOLAND

Ralph Kuhlenkamp, Kind Britta
PHYCOMARIN, Germany; ralph.kuhlenkamp@phycomarin.de
In 2012, floating masses of the brown seaweed *Himanthalia elongata* reached Helgoland from as far as Brittany, France. Observations on 120 of those *Himanthalia-thalli* revealed an extremely high number of viable intertidal species attached to the small button-like base. In total, we identified 70 invertebrates and 54 macroalgae of which up to 45 % were not native to Helgoland. The last occurance of a similar massive accretion of *Himanthalia* at Helgoland was observed in 1999 and according to historical accounts it is generally a sporadic event. Nevertheless, floating *Himanthalia* very effectively supports species dispersal within Europe including transfer of neobiota.

25. THE INFLUENCE OF SUBMERGED TETRAPODS ON HELGOLAND'S FISH AND MACROINVERTEBRATE COMMUNITY

Christopher Groß, Philipp Fischer
Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Science, Helgoland, Germany; cgross@awi.de
Many coastlines of Northern Europe constitute high-energy environments and are therefore often protected against erosion by artificial breakwaters. Our knowledge on the effects that these artificial structures have on the coastal ecosystem and especially on shallow water fish and macroinvertebrate communities is still very limited, however. In a research approach combining remote-controlled in situ stereo-photogrammetry and diver based line transect fish assessments, we study the temporal and spatial dynamics of fish and macroinvertebrate communities on artificially enhanced coastlines. We use the Island of Helgoland (German Bight) with its more than 10 000 submerged tetrapods (four-footed concrete breakwaters) as a model area to investigate the diel variations in diversity, abundance and size class distribution of the breakwater-associated fish and macroinvertebrate community. By comparing the temporal and spatial dynamics of the communities close to the artificial structures with those from unaffected natural surroundings and by integrating additional hydrographic variables such as current patterns, we aim to better understand the effects of submerged coastal protection structures on the diel dynamics of cold-temperate subtidal fish and macroinvertebrate communities in the southern North Sea.

26. LIVING AWAY FROM POPULATION: NON-INDIGENOUS CRAB *ERIOCHEIR SINENSIS* IN THE VISTULA LAGOON (POLAND)

Dagmara Jowita Wójcik, Monika Normant
Department of Experimental Ecology of Marine Organisms, Institute of Oceanography, University of Gdańsk, Poland; ocedw@ug.edu.pl
Chinese mitten crab Eriocheir sinensis is one of non-native species which have appeared in European waters more than 100 years ago as the result of human activity. It is a catadromous species, undertaking long migrations which enables quick spread and colonization of new habitats. It refers also to the Baltic Sea and adjacent brackish water bodies, where abundance of this species is growing continuously since few decades. This fact is very interesting, because E. sinensis is not able to reproduce in such a low salinities. It is assumed that crabs living in the Baltic Sea are only a splinter of the "German" population. In Vistula Lagoon, which is located on the Polish Baltic Sea fisherman catch up around 100 adult crabs every year, however there is lack of documented data on their annual collection as well as on size and sex structures. This stimulated us to undertake these studies. In years 2008-2014 in the Vistula Lagoon 295 adult E. sinensis specimens of the carapace width 33.26-89.07 mm (mean: 66.62 ± 7.71 mm) were collected during commercial fishing. Males accounted for 56.95%, and females 43.05%. Majority of females had gonads in forth gonad maturity stage what indicate that they follow regular reproduction cycle which takes place only once, in the end of their life. In the stomachs of analyzed crabs were found animal tissues, plant remains and also some organic matter. Taken studies complete background information about this exotic species.

27. BIODIVERSITY OF WATAMU MARINE NATIONAL PARK, KENYA: STATUS AND CONSERVATION OPPORTUNITIES

Benjamin Cowburn[1,2], Robert D Sluka[1,3], Peter Musembi[1], Dorothea Kohlmeier[1,4]
[1]A Rocha Kenya, Mwamba Field Study Centre, Watamu, Kenya; [2]Department of Zoology, University of Oxford, United Kingdom; [3]A Rocha International, Marine and Coastal Conservation Programme, Cambridge, United Kingdom; [4]Department of Marine Botany, University of Bremen, Germany; dkohlmeier@uni-bremen.de
Watamu Marine National Park (WMNP) was gazette in 1968 making it East Africa's oldest marine protected area. Small in size (10 km²), it forms part of a network of Kenyan MPAs. A Rocha Kenya's field study center is located directly on the shore of WMNP and in 2010 initiated a long term programme to study marine biodiversity. Appropriate habitat and taxon-specific methods were used to study and record 375 fish species, 40 coral genera, 11 seagrass species, 32 echinoderm species, 55 mollusc species and 20 crustacean species. Maps were created documenting the location of rockpools, seagrass beds, sand/rubble habitat, beach, and coral reefs. 17 IUCN red listed species were found including a relatively large population of the rare and Vulnerable coral Anomastraea irregularis, 7 elasmobranchs (Near Threatened to Vulnerable), 4 groupers (Serranidae) (Near Threatened to Vulnerable), 4 sea cucumbers (Holothuroidea) (Vulnerable to Endangered) and the Vulnerable seagrass species Zostera capensis. Additionally, five species of Endangered to Critically Endangered sea turtles have been recorded by

others in WMNP. We have identified opportunities to work towards meeting the effectiveness criterion of Aichi Target 11 of the Convention on Biological Diversity through projects that will focus on rockpool and elasmobranch conservation, a 'Forests to Reefs' research programme incorporating links between our research in the local watershed and the marine park, and community development/education.

28. NEMATODE FEEDING TYPE IS A POOR PREDICTOR OF FEEDING RATE AND SELECTIVITY: A CASE STUDY

Xiuqin Wu, Tom Moens
Ghent University, Belgium; xiuqin.wu@ugent.be

Free-living marine nematodes have various direct and indirect roles in ecosystem functioning, roles which are often linked to their feeding behaviour. Nematodes may, for instance, affect diatom biofilm productivity and sediment stabilization potential through grazing on diatoms. In the absence of much empirical species-specific information on nematode feeding, mouth morphology is often used as a predictor of food sources and feeding mechanisms. Here, we use a laboratory experiment with three different species of 13C-labeled diatoms to assess diatom grazing rate and feeding selectivity in two known diatom grazers with contrasting feeding modes. *Metachromadora* is an *epistratum* feeder, which uses a tooth to pierce cells and empty their contents, and which moves sluggishly. Previous studies have suggested that diatom shape and size are determinants of feeding selectivity in *epistratum* feeders. *Praeacanthonchus* ingests diatom cells whole, and does so across a fairly broad range of diatom sizes. It is also a more motile species. We therefore expected to find (a) considerably higher diatom grazing rates in *Praeacanthonchus*, and (b) a higher selectivity in *Metachromadora*. However, when standardized per unit nematode biomass, *Metachromadora* consumed on average nearly twice as much diatom carbon than *Praeacanthonchus*. Feeding selectivity was more pronounced in *Metachromadora* than in *Praeacanthonchus*, but not spectacularly so, and both nematode species exhibited the same order of preference among the three diatom species. These experimental results confirm conclusions from recent natural isotope abundance data that the traditional morphology-based nematode feeding types have very limited predictive power of actual feeding behaviours and rates.

29. THE SUCCESS STORY OF A NATIVE CTENOPHORE - COMPETITION FOR RESOURCES BETWEEN *P. PILEUS* AND *M. LEIDYI*

Ursula Ecker[1], María Algueró-Muñiz[1], Maarten Boersma[1,2]
[1]Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung, Biologische Anstalt Helgoland, Germany; [2]Bremen University, Bremen, Germany; uecker@awi.de

Gelatinous zooplankton species represent an important component of higher trophic levels in the pelagic food web of the southern North Sea. Whereas there has been some work done on the interactions between fish and gelatinous zooplankton, interactions within the gelatinous zooplankton are still understudied. Especially the importance of the interaction of the invasive ctenophore *Mnemiopsis leidyi*, which invaded the North Sea in the last ten years, with the native ctenophores remains elusive. In contrast to other areas of the world, the impact of *M. leidyi* seems small. During this study (April - October 2014), species composition and trophic interactions of ctenophores and *Scyphomedusae* were investigated around the island of Helgoland. Stable isotope and fatty acids analyses were used to examine trophic interactions and food sources of local gelatinous species. The competition between the ctenophores *Pleurobrachia* pileus and *Mnemiopsis* leidyi was investigated through grazing and starvation experiments. Two distinct species compositions were observed during the study period: *Scyphomedusae* dominated the first period, whereas the second consisted mainly of ctenophores. Species interactions such as the competition of P. pileus with Aurelia aurita and with M. leidyi were found. Little temporal overlap of P. pileus and M. leidyi was observed. P. pileus was found to be competitively superior with larger grazing rates at high temperatures and a better starvation resistance. This allowed P. pileus to establish high abundances in spring and summer. Thus, the native P. pileus pushed the invasive *M. leidyi* to more unfavourable conditions at the end of the season.

30. MICROBIAL FUNCTIONAL DIVERSITY AND GENETIC DIVERSITY PATTERNS OF BENTHIC POLYCHAETES

Christina Pavloudi, Katerina Vasileiadou, Anastasis Oulas, Georgios Kotoulas, Christos Arvanitidis
Hellenic Centre for Marine Research, Greece; cpavloud@hcmr.gr

Mechanisms affecting macrobenthic population establishment are not yet clearly understood. Microbial assemblages are considered to be one of the primary factors affecting the settlement of benthic invertebrates. On the other hand, burrowing taxa such as polychaetes may cause alterations to oxygen concentration in the sediments, with significant impact on microbial communities.Transitional water ecosystems, are hosting a number of habitats with variable conditions and represent model study sites regarding macro- and microorganismic interactions. This study shows the results of micro- and macrobenthic assemblages of the lagoonal ecosystems in Amvrakikos Gulf (W Greece). Sulfate-reducing bacteria are the dominant inhabitants in these lagoons, producing high concentrations of hydrogen sulfide and causing hypoxic events. The burrowing polychaete of the species *Nephtys hombergii* is commonly found in the study area. A fragment of the COI gene for the species was analyzed. Concurrently, microbial DNA was extracted from the sediment and processed through next generation sequencing of a region of the dissimilatory sulfite reductase (dsr) gene, which is found in sulfate reducing bacteria. The microbial community pattern was compared to the one derived from the genetic diversity of N. hombergii. For the evaluation of the data the C–score index was used, as indicative measure of taxon co-occurence. The results show that the observed values of the index were significantly different from the simulated ones, suggesting that the species co–occurrence is not random and that genetic diversity patterns of the benthic assemblages could be influenced by the functional processes of the microbial communities.

31. MICROZOOPLANKTON AS A TROPHIC UPGRADER IN A HIGH CO2 OCEAN: EVIDENCE FROM A SMALL-SCALE EXPERIMENT

Nils Sander, Henriette Horn, Maarten Boersma, Nicole Aberle
Biologische Anstalt Helgoland, Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research; nils.sander@awi.de
Within the framework of BIOACID II, the impact of ocean acidification (OA) on plankton communities is currently analyzed. To assess the relevance of microzooplankton (MZP) and its distinct role as a trophic upgrader buffering stoichiometric imbalances at the base of pelagic food webs under future OA conditions, an experimental approach using a three-level food chain was conducted. The setup consisted of a cryptophyte as primary producer (Rhodomonas salina), a heterotrophic dinoflagellate as MZP (*Oxyrrhis marina*) and the copepod *Acartia tonsa* as a mesozooplankton predator. Three different pCO2 scenarios were simulated (200, 800 and 1600 ppm). Preconditioned *O. marina* was fed with *R. salina*, incubated at the respective pCO2-conditions. As OA is expected to stimulate phytoplankton growth, while simultaneously reducing the nutritional quality of primary producers, the capability of copepods to select actively for specific prey items depending on the preys' food quality (here, the more nutritious O. marina) was investigated. Response parameters measured were developmental stages, respiration rates, DOC, and C:N:P ratios of the copepods were measured. C:N:P ratios and growth rates of the algae were measured on a daily basis.
Overall, *A. tonsa* experienced the lowermost C:P on low pCO2 diets and highest C:P ratios at intermediate pCO2 when fed with either O. marina as single diet or mixed diets. Further, *A. tonsa* showed distinct growth patterns in response to changes in dietary composition at different pCO2 scenarios thus pointing at the substantial role of MZP as a trophic upgrader especially at high CO2 conditions.

32. RETREAT OF M. EDULIS AT HELGOLAND ROCKY INTERTIDAL: EFFECTS OF RECRUITMENT SUCCESS AND PREDATION

Julia Bass[1], Inka Bartsch[1], Ralph Kuhlenkamp[2], Markus Molis[1]
[1]Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung, Am Handelshafen 12, 27570 Bremerhaven, Germany; [2]PHYCOMARIN, Bredenbergsweg 1, 21149 Hamburg, Germany; julia.bass@uni-oldenburg.de

During the recent decade, the blue mussel *Mytilus edulis* faced a general decline in the North Sea with variable responses in the German Wadden Sea area and partially correlated to the invasion of the Pacific oyster *Crassostrea gigas*. At the island of Helgoland (North Sea), the former large *M. edulis* stock in the northern rocky intertidal has almost vanished during the last 15 years, a process not directly mediated by competition with *C. gigas*. In contrast to intertidal sites, subtidal mussel stocks in several harbor locations of the island are still present and new recruits settle each year. The present study evaluates whether an insufficient larval supply and/or recruitment success, or a major predation pressure through either the eider duck*Somateria mollissima* or benthic predators are drivers of mussel disappearance in the northern intertidal. Recruit density on artificial substrata was significantly lower at mussel-rich harbour sites than at mussel-poor rocky intertidal sites. The separate and combined exclusion of avian and benthic predators with cages revealed that benthic predators consumed, on average, only 31.2 and 17.3 % of small (≤ 20 mm) and larger (> 20 mm) mussels, respectively, in two month. Potential avian predation did not have any significant additional effects. These results indicate that neither recruitment failure nor current predation pressures may explain the retreat of intertidal adult mussels.

33. THE EFFECTS OF COASTAL DEFENCE STRUCTURES ON THE BENTHIC FISH COMMUNITY OFF HELGOLAND

Philipp Fischer, Lisa Spotowitz
Alfred Wegener Institut, Germany; lisa.spotowitz@awi.de

Northern Europe coastlines are often characterized as high-energy environments exposed to severe wind and storms impacts over the year. Many of these densely populated areas are artificially enhanced by different kinds of coastal protection measures. Helgoland island, located in the southern North Sea, is stabilized with over 10 000 tetrapods (4 footed concrete breakwaters) to avoid erosion and land loss over time. Tetrapod like artificial structures are used world wide for coastal protection measures but there is only limited knowledge available on their influence on the coastal ecosystem and the associated biota. In 2009, the Centre for Scientific Diving of the Alfred- Wegener-Institut, Helmholtz Centre for Polar and Marine Sciences established a sublittoral experimental tetrapod field (MarGate) to study the effects of such artificial constructions on the coastal environment. Using identical methods as in previous investigations in the MarGate field (SCUBA supported underwater visual census for species composition, abundance and size classes distribution), fish data are collected from Mai to August on a monthly basis along predefined transects at a total of 60 stations. Until now, 10 fish species were recorded, with Pomatoschistus minutus being the most abundant species. An accumulation especially of YOY fish has been recorded in the first data assessments. This indicates that the reef structures off Helgoland have been established as enhanced nursery ground and habitat for local fish species.

The presented data are part of an ongoing long-term assessment project to finally get a better understanding of the role of "artificial reefs" on coastal ecosystems.

34. HEMOLYTIC ACTIVITY OF DIFFERENT SPECIES OF THE GENUS *PRYMNESIUM* (HAPTOPHYTA) ISOLATED WORLDWIDE

Sergio Seoane, P. Riobó, J. Franco
University of the Basque Country (UPV/EHU), Spain; sergio.seoane@ehu.es
The genus *Prymnesium* Massart emend. Edvardsen, Eikrem & Probert 2011, includes several species that produce toxins with cytotoxic, ichthyotoxic, neurotoxic and hemolytic activity. Also these species can produce antibacterial and allelopathic effect, and the episodes of economical losses due to these organisms in the aquaculture and fisheries have been high in some areas of the world. The ichthyotoxic effects of *Prymnesium* have been linked to the presence of two toxins, prymnesin-1 and prymnesin-2, and their activity has been studied taking into account different conditions of growth, light, nutrients and other parameters. In this study, we have tested the hemolytic activity of 8 different strains of *Prymnesium*, isolated from different places of the world, in two different phases of growth (exponential growth phase and stationary phase). We can observe a very

high variability in the hemolytic activity among different strains and a higher hemolytic activity in almost all the strains in the stationary phase.

35. BODY SIZE OF COLONIAL ORGANISMS ALONG SALINITY GRADIENT

Monika Izabela Orchowska[1], Piotr Kukliński[1,2]
[1]Institute of Oceanology, Poland; [2]Natural History Museum, London, UK; monikao@iopan.gda.pl

This study compared the sizes of zooids of cheilostome bryozoans collected at the rocky substrata within the Baltic Sea system, including the Kattegat and Skagerrak, which is characterised by strong salinity gradient. We investigated the effects of environmental variability, especially the salinity gradient, on zooid sizes of eight bryozoan species from the Baltic Sea system; one opportunistic brackish specialist Einhornia crustulenta and seven marine species *Electra pilosa*, *Callopora lineata*, *Cribrilina cryptooecium*, *Cribrilina annulata*, *Cribrilina punctata*, *Cryptosula pallasiana* and *Escharella immersa*. All of these bryozoans showed considerable differences in zooid length and width between studied locations and strong inter-colonial variability. Although there was no linear relationship between salinity and zooids size of bryozoans and no clear spatial pattern was observed, the values of the relative zooid length and width of studied species were the highest in the areas of highest salinity. Differences between zooid sizes among colonies from different environments were significant and species-specific, but did not show a specific pattern, suggesting that multiple factors were responsible for the observed variability.

36. THE OUTREACH COMPONENT OF THE NF-POGO ALUMNI NETWORK FOR OCEANS (NANO-OUTREACH)

Monika Izabela Orchowska[1], Lilian Krug[2], Olga Shatova[3], Vikki Cheung[4], Sophie Seeyave[4]
[1]Institute of Oceanology, Poland; [2]Universidade do Algarve, Portugal; [3]University of Otago, New Zealand; [4]POGO Secretariat, Plymouth Marine Laboratory, UK; monikao@iopan.gda.pl

The NF-POGO Network of Alumni for the Oceans (NANO, https://www.nf-pogo-alumni.org) emerged from the desire to strengthen the network among NF-POGO trainees and extend it into joint scientific and educational activities. In its 5th year, NANO comprises of 210 motivated young researchers from 46 countries on five continents. NANO has five regional research projects carried out by 34 alumni members in Africa, India, the Caribbean, Latin America and Southeast Asia. In 2014 the Outreach component of NANO was launched with the objective of providing support for engaging initiatives in increasing general public awareness of marine issues in developing countries. The Outreach component acts on two fronts: a) Constructing an online educational catalogue of support materials for outreach activities developed by NANO members; and b) Providing funding for small projects led by alumni members aiming to implement outreach activities in their countries. Covering four different educational levels, the online educational catalogue currently contains 13 lectures, mostly in English. The call for proposals happens twice a year and five proposals have being funded so far. Alumni developed marine science-related educational activities targeting school teachers (Bangladesh), primary and secondary school students (China and Ghana), undergraduate students (India) and recreational divers (Argentina). NANO believes the success of these activities will encourage more members to develop activities in their own communities and share their own material with fellow alumni. The truly international character of NANO provides a strong potential for raising awareness and disseminating knowledge worldwide for the preservation of our common marine heritage.

37. Fish Atlas of the Celtic Sea, North Sea, and Baltic Sea. Based on international research-vessel surveys

Henk Heessen[1], Niels Daan[1], Jim Ellis[2]
[1]IMARES, Netherlands, The; henk.heessen@wur.nl, [2]CEFAS, Lowestoft, United Kingdom

In September 2015 a fish atlas will be published, which is the result of a 6-year study by the three editors, with contributions by 28 other scientists. The atlas presents a unique set of abundance data to describe the spatial, depth, size, and temporal distribution of demersal and pelagic fish species over an extensive area, together with accounts of their biology. A large amount of pictures, graphs and distribution maps illustrate the text. By largely avoiding – or at least explaining – scientific terms and providing extensive references, the book should be useful for both laymen and interested scientists. The quantitative information on some 200 fish taxa is derived from 72,000 stations fished by research vessels during the period 1977-2013 (mainly during international ICES-coordinated surveys, but also during a number of national surveys). The area covers the northwest European shelf from west of Ireland to the central Baltic Sea and from Brittany to the Shetlands. Although the surveys extend beyond the shelf edge, only taxa reported at least once in waters less than 200 m are included. Typical deep-water species and typical fresh-water species are excluded. We hope this publication will contribute to gain a better understanding of the ocean ecosystems.

38. Ecological interactions along salinity and biodiversity gradients

Monika Izabela Orchowska[1], Piotr Kukliński[1,2]
[1]Institute of Oceanology, Poland; [2]Natural History Museum, London, UK; monikao@iopan.gda.pl

Aquatic community development structure is often controlled by factors such as predation and competition for food or space. Here we investigate the variation in competitive interactions within encrusting assemblages from the shallow rocky coast of the Baltic Sea as an effect of species number and identity, abundance and percent coverage of substrate by encrusting fauna. Encrusting assemblages' competition structure shows strong spatial variation, and is indirectly related to the assemblage diversity, which change across the environmental gradient of salinity increase. The comparison of ecological interactions within encrusting assemblages with the biological parameters was conducted. Substrate percent coverage by fauna the best represented the number of interactions, which increased with this parameter. Although higher species number indicated more complex interactions structure and variable pair-wise interactions, the frequency of competitive encounters was insensible to diversity. Most importantly, we have found interactions structure variation reflected in transition from domination of intraspecific interactions to interspecific as an effect of diversity gradient along the Baltic Sea system.

39. THE OUTREACH COMPONENT OF THE NF-POGO ALUMNI NETWORK FOR OCEANS (NANO-OUTREACH)

Monika Izabela Orchowska[1], Lilian Krug[2], Olga Shatova[3], Vikki Cheung[4], Sophie Seeyave[4]

[1]Institute of Oceanology, Poland; [2]Universidade do Algarve, Portugal; [3]University of Otago, New Zealand; [4]POGO Secretariat, Plymouth Marine Laboratory, UK; monikao@iopan.gda.pl

The NF-POGO Network of Alumni for the Oceans (NANO, https://www.nf-pogo-alumni.org) emerged from the desire to strengthen the network among NF-POGO trainees and extend it into joint scientific and educational activities. In its 5th year, NANO comprises of 210 motivated young researchers from 46 countries on five continents. NANO has five regional research projects carried out by 34 alumni members in Africa, India, the Caribbean, Latin America and Southeast Asia. In 2014 the Outreach component of NANO was launched with the objective of providing support for engaging initiatives in increasing general public awareness of marine issues in developing countries. The Outreach component acts on two fronts: a) Constructing an online educational catalogue of support materials for outreach activities developed by NANO members; and b) Providing funding for small projects led by alumni members aiming to implement outreach activities in their countries. Covering four different educational levels, the online educational catalogue currently contains 13 lectures, mostly in English. The call for proposals happens twice a year and five proposals have being funded so far. Alumni developed marine science-related educational activities targeting school teachers (Bangladesh), primary and secondary school students (China and Ghana), undergraduate students (India) and recreational divers (Argentina). NANO believes the success of these activities will encourage more members to develop activities in their own communities and share their own material with fellow alumni. The truly international character of NANO provides a strong potential for raising awareness and disseminating knowledge worldwide for the preservation of our common marine heritage.

Authors and associated sessions

Aberle, Nicole	OBS11_1, POST
Aberle-Malzahn, PD Dr. Nicole	OBS07_1
Agrenius, Stefan	OBS11_1
Albretsen, Jon	OBS07_1, OBS14_2
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Algueró-Muñiz, Maria	OBS11_1
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Andersen, Guri Sogn	OBS01_2
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Angeltveit, Gro	OBS06
ANITA, LIPAROTO	POST
Antonio, Fernandez-Guerra	DM01
Aristov, Dmitry A.	POST
Arvanitidis, Christos	DM01, OBS16, OBS16, OBS16, OBS16, OBS16, OBS16,POST
Asmus, Harald	OBS07, OBS08, OBS08, OBS08
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Bass, Julia	SOC04
Battershill, Christopher N.	POST
Bauerfeind, Eduard	DM03
Bayliss-Brown, Georgia	SOC03
Bañón, Rafael	OBS14_2
Beck, Melanie	OBS06
Beermann, Jan	POST
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Bekkby, Trine	OBS01_2, OBS06
Belmonte, Genuario	POST
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Belmonte, Manuela	POST, POST
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Berezina, Nadezhda A.	OBS07, POST
Bernard, Guillaume	OBS01_1, OBS04, OBS11_1
Bersch, Manfred	OBS06
Beyer, Sarah	OBS01_3
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Boersma, Maarten	OBS01_3, OBS04, OBS05
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Bojanic, Natalia	OBS16, OBS16, OBS16, OBS16, OBS16, OBS16
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Bonsdorff, Erik	OBS04, OBS11_1
Boos, Karin	POST
Bornman, Janet F.	OBS14_1
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Bracher, Astrid	POST
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Buckley, Paul	SOC03
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Bussmann, Ingeborg	POST
Carstens, Kristine	OBS04
CAUSIO, SALVATORE	DM03
Cecere, Ester	POST
Chafee, Meghan	DM03
Cheung, Victoria	SOC03
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Chikina, Margarita V.	OBS15
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Claus, Simon	DM01, OBS07_1
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de Lucia, Andrea	OBS16, OBS16
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Guarini, Jean-Marc	OBS01_1
Gudmundsson, Gudmundur	OBS15
Guinda, Xabier	OBS16, OBS16, OBS16, OBS16, OBS16, OBS16, SOC03
Gundersen, Hege	OBS01_2, OBS06
Gustafsson, Camilla	OBS01_1, OBS10
Gutow, Lars	OBS01_2
Gutow, Lars	OBS01_2
Guy-Haim, Tamar	OBS01_1
Günther, Carmen Pia	OBS08
Hackbusch, Steffen	POST
Hagen, Wilhelm	OBS14_1, POST
Hanic, Louis	OBS03
Hao, Wenjin	OBS08
Harder, Tilmann	OBS01_1

Hasan, Md.Emran	SOC04
Hauss, Helena	OBS01_3
Havenhand, Jonathan	POST
Hawkins, Stephen J.	OBS11_2
Heiden, Jasmin Pascale	OBS10
Heiler, Julia	OBS01_3
Heim, Birgit	POST
Heinrichs, Mara Elena	POST
Herkül, Kristjan	OBS06
Herman, Peter M. J.	DM01
Hernandez, Francisco	DM01, DM01, OBS07_1
Hewitt, Judi	OBS01_1, OBS04
Hillen, Jasmien E. J.	OBS14_2
Hinrichs, Iris	OBS06
Hogg, Ian	OBS01_1
Holst, Sabine	OBS05, OBS08
Holstein, Jan	OBS01_2
Holte, Børge	DM01
Horn, Henriette	OBS05, POST
Horn, Henriette G.	OBS11_1
Horn, Sabine	OBS07
Hummel, Christiaan	POST
Hummel, Herman	OBS16, OBS16, OBS16, OBS16, OBS16, OBS16, POST
Huserbråten, Mats Brockstedt Olsen	OBS14_2
Hussel, Birgit	OBS08
Hutchings, Jeff	OBS05
Ikauniece, Anda	OBS16, OBS16, OBS16, OBS16, OBS16, OBS16
Ikonen, Jussi	OBS10
IRENE, CANDIDO	POST

Ismar, Stefanie MH	POST
Jakubowska, Magdalena	POST
Jankowska, Emilia	OBS16, OBS16, OBS16, OBS16, OBS16, OBS16
Jankowska, Emilia Katarzyna	OBS10, POST
Jelmert, Anders	OBS07_1
Jensen, Gjertrud	DM01
Jentoft, Sissel	OBS05
Joensuu, Mari	OBS14_2
Joon, Sudhir Kumar	OBS07_1
Jormalainen, Veijo	OBS11_2, OBS15
Joseph, Laetitia	OBS01_2
Jourde, Jérôme	OBS16, OBS16, OBS16, OBS16, OBS16, OBS16
Juanes de la Pena, Jose Antonio	OBS16, OBS16, OBS16, OBS16
Juanes, José A	OBS06
Juanes, José A.	OBS16
Juanes, José Antonio	SOC03
Jung, Alexa Sarina	DM01
Jungblut, Simon	POST
Junge, Claudia	POST
Järnström, Marie	OBS11_1, OBS04
Kadel, Petra	OBS08, OBS08
Karez, Rolf	OBS01_2, POST
Karstensen, Johannes	OBS01_3
Kauppi, Laura Elina	OBS10
Kautsky, Lena	OBS07_1
Kautsky, Nils	OBS07_1
Kellnreitner, Florian	OBS08
Kerckhof, Francis	OBS16, OBS16, OBS16, OBS16
Khaitov, Vadim M.	POST

Kihara, Terue Cristina	OBS14_1
Kiko, Rainer	OBS01_3
Kilias, Estelle	DM03
Kireeva, Maria	POST
Kirienko Fernandes de Matos, Valentina	OBS16, OBS16, OBS16
Kirmizi, Sidika	OBS03, OBS03
Kirstein, Inga Vanessa	OBS03, OBS03
Kleine-Schaars, Loran	OBS16, OBS16
Knust, Rainer	OBS05
Knutsen, Halvor	OBS05
Koch, Kristina	OBS14_1
Kohlmeier, Dorothea	OBS14_1, POST
Kolbasova, Glafira	OBS11_2
Kolyuchkina, Galina	POST
Kopf, Anna	DM03
Kostas, Varsos	DM01
Kotoulas, Georgios	POST
Kotta, Ilmar	OBS11_2
Kotta, Jonne	OBS06, SOC04, OBS16
Kotterba, Paul	OBS01_3, OBS01_3
Kottmann, Johanna	POST
Kraan, Casper	OBS06, OBS11_1
Kraan, Casper	OBS14_1
Kraberg, Dr. Alexandera	OBS07_1, DM03, POST
Kraufvelin, Patrik	OBS08
Krug, Lilian	SOC03
Krug, Lilian	SOC03
Kröncke, Ingrid	OBS01_1, OBS06, SOC04
Kuhlenkamp, Ralph	OBS01_2, OBS14_2, POST, SOC04

Kukliński, Piotr	OBS14_2
Kukliński, Piotr	OBS15
Körtzinger, Arne	OBS01_3
Laeseke, Philipp	OBS14_1
Lamare, Miles	OBS05
Lange, Julia	OBS05, OBS11_1
Lauringson, Velda	OBS06, SOC04
Lavesque, Nicolas	OBS16, OBS16, OBS16, OBS16
Lebreton, Benoit	OBS08, OBS15
Leclerc, Jean-Charles	OBS16, OBS16, OBS16, OBS16 , OBS16, OBS16
Lee, Wonchoel	OBS14_1
Lentendu, Guillaume	DM03
Lenz, Mark	OBS07_1
Lettmann, Karsten A.	OBS06
Levy, Gideon	OBS01_1
Lima, Miryan Edvam	OBS01_3
Lindgren, Fredrik	OBS11_1
Lohrer, Andrew	OBS11_1, OBS14_1
Lohrer, Andrew M.	OBS01_1
Lohrer, Andrew M.	OBS05
Lucas, Judith	DM03
Lundquist, Carolyn J.	OBS01_1
Löder, Martin	OBS03
Löder, Martin G.J.	OBS11_1
Löscher, Carolin	OBS01_3
M, Nashad	OBS04
M. S, Hossain	SOC04
Magalhães, Luísa	OBS03
Magni, Paolo	OBS01_2, OBS16, OBS16, OBS 16, OBS16, OBS16, OBS16

Malzahn, Arne M.	OBS08
Marchini, Agnese	OBS07, OBS07
Martins, Gustavo M.	OBS11_2
Mathew, K. Avarachen	OBS04, SOC03
Mathis, Moritz	SOC04
Maxim, Nabozhenko	POST
Maximov, Alexey	OBS11_2
Maximovich, Nikolay	POST
Maximovich, Nikolay Vladimirovich	OBS15
Mees, Jan	DM01
Meier, H.E. Markus	OBS04
Menon, N. Nandini	OBS04
Menon, N. R	OBS04
Metfies, Katja	DM03, DM03
Meunier, Cédric	OBS05
Meunier, Cédric L.	OBS05
Meyer, Julia	OBS01_1
Michel, Loïc	OBS10
Millat, Gerald	OBS06
Moens, Tom	POST
Moland, Even	OBS14_2
Molis, Markus	SOC04
Moll, Dorothee	OBS01_3, OBS01_3
MONVIOLA, Jordy Salmon	OBS10
Mordhorst, Thorsten	OBS14_1
Moreira, Juan	POST, POST
Morganti, Teresa Maria	OBS10
Mortensen, Stein	OBS07_1
Moy, Frithjof	OBS01_2, OBS07_1
Moy, Frithjof Emil	OBS01_2

Musembi, Peter	POST
Nam, Bora	OBS03
Natalia, Signorelli	POST
Naumenko, Elena	OBS11_2
Naumov, Andrew D.	OBS15
Nazarova, Sophia A.	POST
Neto, Ana I.	OBS11_2
Neuhaus, Stefan	POST
Nigrelli, Lisa	OBS03
Nikos, Pattakos	DM01
Norderhaug, Kjell Magnus	OBS01_2, OBS06, OBS08
Norkko, Alf	OBS01_1, OBS04, OBS04, OBS 04, OBS10, OBS10,OBS11_1, O BS11_1, OBS11_2, OBS14_2
Norkko, Joanna	OBS01_1, OBS04, OBS04, OBS 10, OBS11_1
Normant, Monika	POST
Normant, Monika	POST
Nowak, Małgorzata	OBS15
Nygård, Henrik	OBS11_2
Nöthig, Eva-Maria	DM03
Occhipinti-Ambrogi, Anna	OBS07, OBS07
Oganjan, Katarina	SOC04
Olsen, Esben	OBS05
Oomen, Rebekah	OBS05
Orav-Kotta, Helen	OBS16, OBS16, OBS16, OBS16 , OBS16
Orav-Kotta, Helen	OBS16
Orchowska, Monika Izabela	OBS14_2, SOC03
Oulas, Anastasis	DM01, POST
Paar, Martin	OBS15
Pagad, Shyama	OBS07_1

Pansch, Christian	POST
Panzer, Katrin	DM03
Patkos, Theodore	DM01
Pavloudi, Christina	DM01, OBS16, OBS16, OBS16, OBS16, OBS16, OBS16,POST
Pedersen, Morten Foldager	OBS01_2
Pedrotti, Maria Luiza	OBS16, OBS16, OBS16, OBS16, OBS16, OBS16
Peleg, Ohad	OBS01_1, OBS16, OBS16, OBS16, OBS16, OBS16, OBS16
Pereladov, Mikhail	OBS07
Perez-Ruzafa, Angel	OBS16
Pernet, Fabrice	OBS14_1
Pessa, Giuseppe	OBS01_2
Peters, Silvia	OBS04, POST
Petrocelli, Antonella	POST
Pettersson, Lasse H.	OBS04
Philipp, Schubert	OBS01_2
Philippart, Catharina J. M.	DM01
Philippenko, Dmitry	OBS11_2
Pilditch, Conrad	OBS11_1, OBS04, OBS11_1, OBS14_1, OBS14_2
Pilditch, Conrad A.	OBS01_1, OBS14_1, POST
Piltti, Tiina	OBS15
Pockberger, Moritz	OBS08
Pohlmann, Thomas	SOC04
Poloskin, Alexey V.	POST
Polte, Patrick	OBS01_3, OBS01_3
Portacci, Giuseppe	POST
Pratt, Daniel	OBS14_1
Puente, Araceli	OBS16, OBS16, OBS16, OBS16, OBS16, OBS06, OBS16,SOC03

Pätsch, Johannes	OBS06
Pérez-Ruzafa, Angel	OBS16, OBS16, OBS16
Quéré, Claudie	OBS14_1
Rahman, Muhammad Mizanur	SOC04
Ramos, Elvira	OBS06, OBS16
RATMAYA, Widya	OBS10
Rave, Ofrat	OBS01_1
Razinkovas-Baziukas, Arturas	OBS07
Reich, Marlis	DM03
Reiss, Henning	SOC04
Ribeiro, Pedro	OBS16, OBS16, OBS16, OBS16, OBS16, OBS16
Ribes Llordes, Marta	OBS10
Richter, Claudio	OBS05
Rick, Johannes Josef	OBS01_3
Rico, Jose M.	OBS14_2
Riebesell, Ulf	OBS11_1
Riedel, Juliane	DM03
Rilov, Gil	OBS16, OBS16, OBS16, OBS16, OBS01_1
Rinde, Eli	OBS01_2, OBS06
Riobó, P.	POST
Rodrigues, Elizandro	OBS01_3
Karez, Rolf	OBS14_2
Rosenberg, Rutger	OBS11_1
Rothäusler, Eva	OBS15, OBS11_2
Rousou, Maria	OBS16, OBS16, OBS16, OBS16, OBS16, OBS16
Rubal, Marcos	OBS14_2, POST
Rubino, Fernando	POST, POST
Ruginis, Tomas	OBS16, OBS16, OBS16, OBS16, OBS16, OBS16

Ruzafa, Angel	OBS16, OBS16
Saborowski, Reinhard	POST
SALVATORE, MOSCATELLLO	POST
Sander, Nils	OBS11_1, POST
Sandersfeld, Tina	OBS05
Sarker, Subrata	OBS04
Schaal, Patrick	POST
Schagerström, Ellen	OBS07_1
Scharfe, Mirco	OBS01_3, OBS11_1, OBS11_1
Schipper, Louis	OBS11_1
Schukat, Anna	POST
Schwanitz, Max	OBS15
Schwemmer, Philipp	OBS07
Schwenk, Klaus	OBS11_1
Schückel, Ulrike	OBS06, OBS01_1
Schütte, Florian	OBS01_3
Segelken-Voigt, Alexandra	OBS14_2
Seeyave, Sophie	SOC03, SOC03
Seoane, Sergio	POST
Sharma, Rahul	OBS03
Shatova, Olga	SOC03, SOC03
Siebert, Ursula	OBS08
Silva, Teresa	OBS16, OBS16, OBS16, OBS16, OBS16, OBS16
Simakova, Uliana V.	OBS15
Simon, Nathalie	OBS16, OBS16, OBS16, OBS16, OBS16, OBS16
Singer, Anja	OBS06
Sjöroos, Joakim	OBS11_2
Sluka, Robert D	POST

Smaal, A	SOC04
Snelgrove, Paul	OBS01_1
Snickars, Martin	OBS04
Sommer, Ulrich	POST
SOUCHU, Philippe	OBS10
SOUDANT, Dominique	OBS10
Sousa-Pinto, Isabel	OBS16, OBS16, OBS16, OBS16, OBS16, OBS16
Spiridonov, Vassily A.	OBS15
Spiridonov, Vassily Albertovich	OBS07
Spotowitz, Lisa	POST
Sprong, Pim	DM03
Stammer, Detlef	OBS06
Staneva, Joanna	OBS06
Steen, Henning	OBS01_2
Steinhagen, Sophie	POST
Stenseth, Nils Christian	OBS05
Stern, Rowena Fay	DM03
Stoker, Bethany	SOC03
Strand, David Allan	DM03
Strand, Åsa	OBS07_1
Störmer, Rebecca	SOC03
Stępień, Anna	OBS15
Sukhotin, Alexey	OBS01_3
Sunny, Atiqur R.	SOC03
Sveistrup, Anne	DM01
Svetlana, Birukova	POST
Tagliapietra, Davide	OBS01_2
Tala, Fadia	OBS14_1
Teeling, Hanno	DM03

Tellier, Florence	OBS14_1
Thiel, Martin	OBS14_1
Thines, Marco	OBS03
Thrush, Simon	OBS14_1, OBS01_1, OBS11_1
Thrush, Simon F.	OBS05, OBS06
Trias-Verbeek, Aina	DM01
Trimborn, Scarlett	OBS10
Troncoso, Jesus Souza	POST
Troncoso, Jesús	OBS16, OBS16, OBS16, OBS16, OBS16, OBS16
Troncoso, Jesús S.	OBS14_2, POST
Tveiten, Lise Ann	OBS06
Tyberghein, Lennert	DM01
Tzetlin, Alexander	OBS11_2
Uljana, Simakova	POST
Vakati, Vinod	OBS14_1
Vale, Maria L.	OBS11_2
van Avesaath, Pim	OBS16, OBS16, OBS16, OBS16, OBS16, OBS16
van Avesaath, Pim	POST
van Colen, Carl	OBS01_1
Van der Veer, Henk W.	DM01
Vanaverbeke, Jan	OBS01_1
Vandepitte, Leen	DM01, DM01, OBS07_1
Vanhoorne, Bart	DM01, DM01
Vanselow, Anna	OBS06
Vasileiadou, Katerina	POST
Vasilij, Spiridonov	POST
Veiga, Puri	POST
Villnäs, Anna	OBS01_1, OBS04, OBS11_2
Vincx, Magda	OBS01_1

Vitalii, Semin	POST
Volk, Christian	POST
Voronkov, Andrey	OBS15
Wahl, Martin	OBS07_1
Wang, Shasha	OBS07_1
Warzocha, Jan	OBS16, OBS16, OBS16, OBS16, OBS16, OBS16
Waumans, Filip	DM01, DM01
Wegner, K Mathias	OBS03
Weigel, Benjamin	OBS04
Weinberger, Florian	OBS07_1, POST
Weinert, Michael	SOC04
Weslawski, Jan Marcin	OBS16, OBS16, OBS16, OBS16, OBS16, OBS16
Westerbom, Mats	OBS04
Westphal, Heiko	OBS06
Wichels, Antje	DM03, OBS03, OBS03, OBS08, POST
Wiencke, Christian	OBS15, OBS15
Wijnhoven, Sander	OBS16, OBS16
Wiltshire, Karen	OBS11_1
Wiltshire, Karen H.	OBS04
Wiltshire, Karen Helen	OBS01_3
Wiltshire, Karen Helen	OBS01_3
Wiltshire, Prof. Dr. Karen Helen	OBS07_1
Withers Harvey, Narumon	SOC03
Wolff, Jörg-Olaf	OBS06
Wu, Xiuqin	POST
Wubet, Tesfaye	DM03
Wójcik, Dagmara Jowita	POST
Włodarska, Maria	OBS15

Włodarska-Kowalczuk, Maria	OBS10, POST
Yahel, Gitai	OBS10
Yeruham, Erez	OBS01_1
Ysebaert, T	SOC04
Zaborska, Agata	OBS10
Zacher, Katharina	OBS15
Zalota, Anna Konstantinovna	OBS07
Zitelli, Andreina	OBS01_2
Zuur, Alain F.	DM01