Abstracts Oral Presentations

Thursday 22nd June

13:15 - Kevin Becker (GEOMAR), Subtopic 6.3
Effects of cyclonic eddies on the biogeochemistry of the eastern tropical North Atlantic'

Mesoscale eddies are important vehicles for nutrients and carbon from coastal upwelling regions to the open oligotrophic ocean that influence biogeochemical cycles on relatively small spatial scales. In cyclones, nutrient injection can affect community structure and productivity with consequences for organic matter composition and carbon export. Yet, the governing dynamical processes are largely unknown, and so is the overall biogeochemical and ecosystem response. I will present how physical processes within cyclonic eddies formed in the Eastern Boundary Upwelling Systems shape small scale variations in the plankton community and with this particulate and dissolved organic matter composition, which has consequences for lateral and vertical transport processes of organic carbon.

13:35 - Björn Raupers (GEOMAR), Subtopic 6.4
Recent and ongoing developments in at-sea detection of munition compounds

Unexploded ordnance and relic dumped munitions in global coastal waters present a risk for humans and nature. In addition to the explosion and security risk, these munitions contain cytotoxic, genotoxic, and carcinogenic chemicals associated with conventional explosives, chemical warfare agents, and toxic structural components. Recently developed laboratory-based methods now show widespread contaminant release from underwater munitions. Real-time chemical detection at sea is critical for monitoring the release and spread of munitions chemicals, but existing methods cannot detect multiple compounds simultaneously and are subject to interferences from non-target compounds.

Two recent projects coordinated at GEOMAR seek to address this technological gap. In the recently-completed ExPloTect project (Ex-situ, near-real-time exPlosive compound deTection in seawater; explotect.eu/de) a prototype shipboard device was developed for preconcentration and analysis of four target explosives in seawater with a detection limit down to 2 ng L-1. The next step is to widen the range of targeted compounds to include compounds such as chemical warfare agents, and to improve the sample collection process and achieve in-situ detection. These aspects are addressed in the ongoing project AMMOTRACe (Marine AMMunitiOn dump site exploration by surface- and underwater-based laser mass spectrometric TRACing technology; geomar.de/en/ammotrace), which is developing an ROV-based mass spectrometric system to measure target explosives and chemical warfare agents in-situ.

13:55 - Marlene Wall (GEOMAR), Subtopic 6.2
An integrated holobiont view on cold-water coral function, acclimation and resilience

Cold-water corals (CWCs) are often found in deep waters, making their physiological evaluation in situ challenging. Only in a few places worldwide, CWCs emerge from the deep, as in Comau Fjord (Patagonia, Chile). Here, we used the CWC Desmophyllum dianthus in its natural habitat to evaluate changes in performance and physiological trade-offs in response to expected future changes (ocean acidification and warming). To do so we use a space-for-time approach and the different physicochemical environmental conditions at deep (300 m) and shallow (20 m) sites, representing OA and warming, respectively. We also considered confounding factors such as high food availability and environmental variability in shallow waters. We examined a range of coral traits (growth, energy reserves, fatty acid (FA) composition) as well as the coral-associated microbial community. Desmophyllum dianthus showed distinct deep and shallow phenotypes. Paradoxically, the deep phenotype showed higher growth rates than the shallow phenotype, suggesting that other factors than aragonite saturation levels alone affect coral traits. Essential FA concentrations that are vital for coral health were maintained across depths, likely reflecting the levels required for coral functioning. Moreover, the deep high-performance phenotypes even accumulated storage lipids (e.g., wax esters), in contrast to the shallow, low-performance phenotypes with limited energy reserves. This likely indicates an increased energy demand in shallow waters in response to higher environmental variability and/or stronger biological disturbance. Differential performance and energy levels were accompanied by restructuring of the coral associated microbiota and a reduction in core microbial community abundance in shallow waters, which declined with coral performance. All studied coral traits provide important insights into holobiont functioning and trade-offs, and show the complex interactions governing the expression of phenotypes and their capacity to deal with environmental changes. Intact food webs providing sufficient energy supply appear vital to coral resilience.

14:15 - Ramona Maja Mattmüller (AWI), Subtopic 6.4
Acoustic metrics to explore polar ocean soundscapes

Soundscapes encompass a wealth of information on the condition of environments. Expanding human activities cause increasing underwater noise pollution in the Arctic. To date, Antarctic underwater sound environments are still relatively pristine and can serve as a reference for intact soundscapes. Using a bi-polar approach, we evaluate data from two oceanographically comparable oceans with strongly differing underwater noise regimes. We used seven acoustic metrics to explore and characterize four months of both offshore polar ocean soundscapes for the dominant sound sources and variation in soundscape characteristics. The dominant sound sources identified from the power spectral densities in the Fram Strait (2016-2017) are year-round anthropogenic activities (ship engine noise and pulses from seismic survey airgun operations) and wind noise, while marine mammals (sperm, fin, and blue whales) contributed to a lesser extent. In contrast, in the Weddell Sea (2017-2018) the dominant sound sources are four marine mammal species (Antarctic blue, fin, Antarctic minke whale, as well as leopard, and crabeater seals). For all acoustic metrics studied, seasonal patterns were weak in Fram Strait due to year-round continuous anthropogenic noise. We observed a strong influence of wind due to a lack of sea ice

cover at the recording site. In the Weddell Sea the acoustic metrics contrastingly reflected seasonal fluctuations governed by marine mammal calling activity and periodical sea ice cover. Overall, the mean sound pressure level in the Fram Strait (112.5 dB re 1 µPa²) is 3.8 dB re 1 µPa² louder than in the Weddell Sea (108.7 dB re 1µPa²). However, the maximum mean broadband SPL is measured in austral winter in the Weddell Sea with 142.2 dB re 1 µPa², likely caused by the high call intensity of Antarctic minke whales, and is thereby 3.5 dB re 1 µPa² louder than the maximum SPL measured in spring in the Fram Strait (138.7 dB re 1 µPa²). Our results suggest that noise-exposed areas are characterized by more static noise patterns with little intra- and inter-seasonal variability and overall higher mean noise levels compared to the Antarctic soundscape.

14:35 - Chhaya Chaudhary (AWI), Subtopic 6.1, Subtopic 6.2
Dynamics of marine biogeography and climate change- a global perspective

Understanding biodiversity at local and regional requires a global context. This talk presents the global marine biogeographic patterns and their change under climate warming. The global patterns are based on the occurrence data of over 50,000 animal species. We found that marine species richness shows bimodality with a slight dip near the equator, peaks in subtropics, and declines at higher latitudes. The pattern remained consistent across pelagic, benthic, vertebrates and invertebrates.
Moreover, richness across latitudinal bands was sensitive to temperature, reaching a plateau or declining above a mean annual sea surface temperature of 20 °C for most taxa. Since the 1970s, species richness has declined at the equator relative to an increase at midlatitudes and has shifted north in the northern hemisphere, particularly among pelagic species. This pattern is consistent with the hypothesis that climate change is impacting the latitudinal gradient in marine biodiversity at a global scale. The intensification of the dip in species richness at the equator, especially for pelagic species, suggests that it is already too warm there for some species to survive. Furthermore, our future climatic suitability predictions of 57 species (cold and warm coral reef ecosystems) suggest similar dynamics.
Climate change may destabilise predator–prey dynamics in the ecosystem and certainly affect the associated countries. This increases the requirement for robust prediction models for assessing the risk. So far, such analysis does not include life stage vulnerabilities, where younger life stages are more sensitive to climate change than adults; and may further restrict biogeographic ranges, thus Including such information in modelling will help improve their robustness.

15:20 - Lukas Miksch (AWI), Subtopic 6.1, Subtopic 6.2
Bioplastics - An alternative to conventional plastics?

The pollution of the environment by plastics is a perpetual problem that poses a great challenge to mankind. A promising strategy to counteract the increasing pollution seems to be the innovation and development of so-called bioplastics. Bioplastics is a collective term for plastic materials that are either biobased, biodegradable or both. However, with increasing production and usage of bioplastics, these novel materials are more likely to reach into the marine environment. It is unclear if and how fast they are degraded under marine conditions. A slow degradation could lead to an accumulation of these materials in the environment. Microparticles originating from

bioplastics might interact with marine biota and be ingested in the same way as conventional microplastics. Furthermore, the question arises if digestive enzymes might be capable of degrading these novel materials and what the consequences might be. Generally, little research has been done on the effects of bioplastics on marine organisms. This study, which was conducted in the framework of the Horizon 2020 project “Bio-Plastics Europe”, provides insight into how five selected bioplastics perform under marine conditions. Their biodegradability under seawater conditions and with digestive fluids from marine invertebrates was investigated, as well as their ecotoxicological impact when ingested or by leaching of chemicals.

15:40 - Jan-Claas Dajke (HIFMB), Subtopic 6.1
Why thresholds concepts are not suitable to address anthropogenic biodiversity change

Thresholds and tipping points are frequently used concepts to address the risks of global change pressures and their mitigation. It is tempting to also consider them to understand biodiversity change and design measures to ensure biotic integrity. Here, we argue that thresholds and tipping points do not work well in the context of biodiversity change for conceptual, ethical and empirical reasons. Defining a threshold for biodiversity change (a maximum tolerable degree of turnover or loss) neglects that ecosystem multifunctionality often relies on the complete entangled web of species interactions and invokes the ethical issue of declaring some biodiversity dispensable. Alternatively defining a threshold for pressures on biodiversity might seem more straightforward as it addresses the causes of biodiversity change. However, most biodiversity change appears to be gradual and accumulating over time rather than reflecting a disproportionate change when transgressing a pressure threshold. Moreover, biodiversity change is not in synchrony with environmental change, but massively delayed through inertia inflicted by population dynamics and demography. In consequence, formulating environmental management targets as preventing the transgression of thresholds is less useful in the context of biodiversity change, as such thresholds neither capture how biodiversity responds to anthropogenic pressures nor how it links to ecosystem functioning. Instead, addressing biodiversity change requires reflecting the spatiotemporal complexity of altered local community dynamics and temporal turnover in composition leading to shifts in distributional ranges and species interactions.

16:00 - Geraint Rhys Whittaker (HIFMB), Subtopic 6.1
Polar Sounds: Re-mixing the Sounds of the Polar seas¶

Out of all the senses, sound is the one that travels the furthest in the oceans. Because of this, acoustic methods are becoming a critical tool that scientists are using to better understand the Polar seas and the marine biodiversity within. When sight is impossible, acoustic data can give invaluable information on breeding habits, migration patterns and the ways in which anthropogenic noise negatively affects marine environments. Thus, studying the soundscapes of the seas can tell us a lot about our ocean’s health. But once we have this data, other than analysing it scientifically, what else can we do with it? How else can we share these otherworldly sounds with the rest of the world?
In an exciting new art science collaboration, the Helmholtz Institute for Functional Marine Biodiversity (HIFMB) and The Alfred Wegener Institute, Helmholtz Centre for

Polar and Marine Research (AWI) have teamed up with one of the world's largest sound projects, Cities and Memory, to make available 50 sound clips from the Arctic and Antarctic seas collection from the Ocean Acoustic Group for sound artists and musicians from all over the world to creatively interpret. Almost 300 artists from 45 countries applied to be able to have the opportunity to re-interpret these sounds. 104 artists were then chosen to take part and were allowed to compose anything using various sound clips which composed of biological (mammals and sea creatures) geological (the melting and movement and glaciers) and anthropogenic noise (human impacts on the polar seas). This project is called Polar seas.
As the UN has declared 2021 – 2030 to be the Decade of the Ocean it is imperative that vital research on our seas is shared with the wider public. Art is a critical way to do this and by asking numerous artists to re-interpret the sounds of the polar seas this project will give alternating and new perspectives to the acoustic data, reimagining these sounds for a new audience and raising awareness of the importance of soundscapes of the polar seas to a wider audience. In this session I will reflect on the project thus far.

Friday 23rd June

09:05 - Kimberly Peters (HIFMB)
What it is and what it isn't, what you can do (and what you definitely shouldn't do!): A guide and toolkit for engaging ocean governance

The climate is changing! Biodiversity is changing! These are phrases we hear (and say) often in our various fields of research. But arguably they could (and should) be rephrased. The climate, and biodiversity doesn't just change. We know it involves complex processes which many of us monitor, measure, assess and analyse in our varied work. And crucially, *people* are changing the climate and biodiversity. *People* are part of the 'problem', and also the 'solutions'. What is more, sometimes those 'solutions' may not always work in positive ways. Some solutions are always destined to fail. In sum, then, no study of our changing earth, changing environment, should be without the inclusion of understanding people: what people do (and don't do), how they act (and react), how they (ab)use power, deploy politics, and shape futures. This is what governance work is. It isn't an act of communicating science that other people do. *It is its own science.* In this brief talk we reflect on what ocean governance work entails specifically and provide a toolkit for thinking about how to engage such science within the natural sciences and in interdisciplinary fields for doing impactful and meaningful research.

09:45 - Martina Wilde (AWI Program Management)
Overview talk: What is PoF IV again and what does it have to do with me?

Topic 6 is part of the Changing Earth program, which in turn is part of one of the six research areas of the Helmholtz Association. Helmholtz is the largest non-university research organization in Germany, along with the Max Planck Society, the Fraunhofer Society, and the Leibniz Society. In the lecture this research landscape and also funding models will be explained.
Furthermore, the talk will give an overview of the meaning of "Program Oriented Funding - PoF", put Topic 6 in the overall context of the program "Changing Earth" and

explain other elements of the program such as SynCom, Cross Cutting Activities, Innopool Projects, as well as the rules that hold all these elements together.
PoF IV is just running in its third year and already the management is busy again with the preparation of PoF V. In addition, there is an outlook on the timeline of the next years but also on how to write a research program together with 7 involved Helmholtz centers.