HIFMB NEWS #01/20

Top Story: Ice Melting into Music + Call for Postdoc Research Fellowships + Guest Lecture by Prof. Alexandre Antonelli + New at HIFMB: Prof. Kimberley Peters + Research: Selected Publications + Editorial: On Complexity

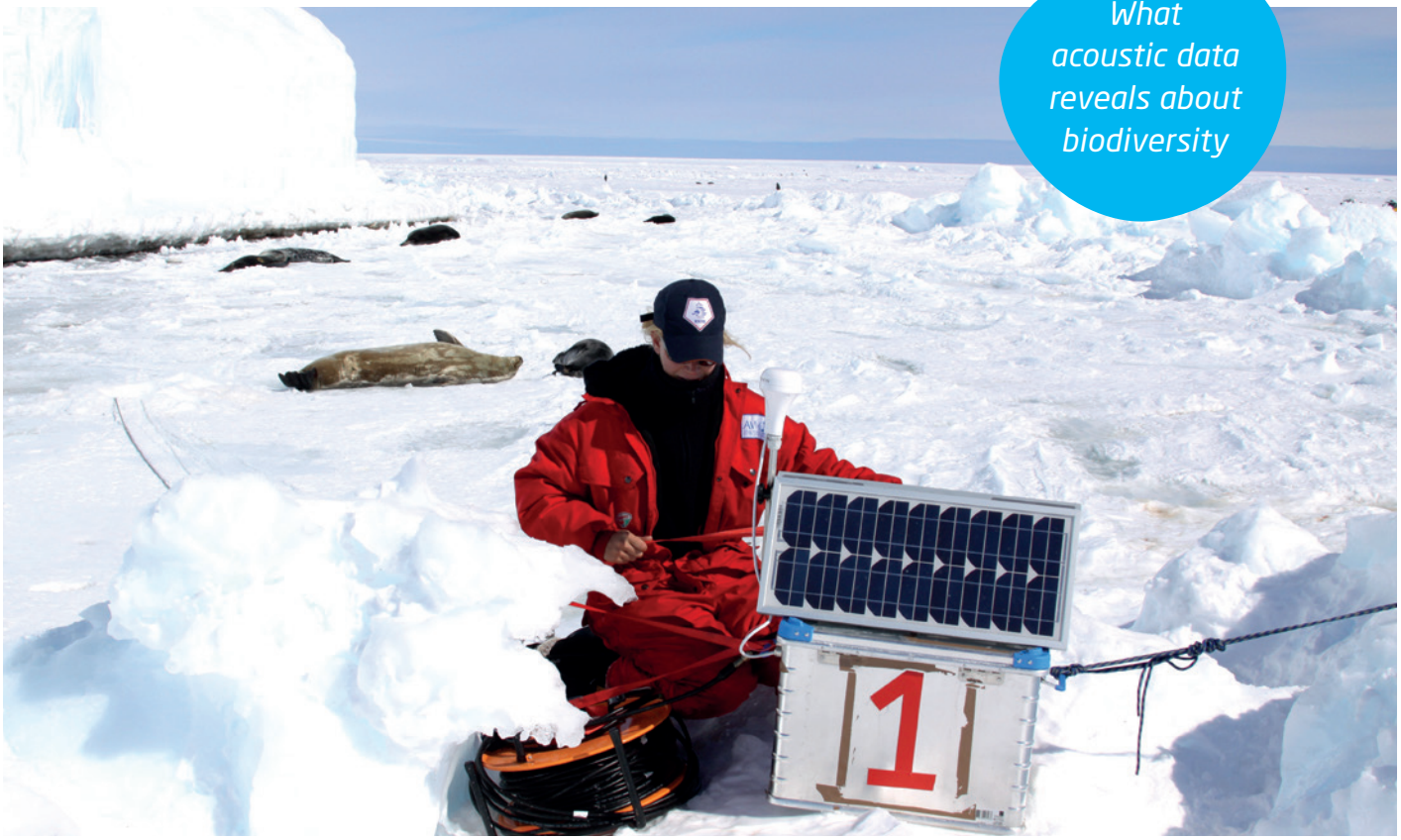


photo © Cornelia Kreiss

TOP STORY

Ice Melting into Music

Close your eyes for a moment and listen to the space you are in. Maybe you hear colleagues talking in the hall, the purr of a hard disc spinning, rain hitting the window, or when in the field the humming of a research vessel's engine, with the hint of breaking waves against your cabin window. The world around us is full of sound and we are often only partly aware of the important role it plays in our perception of the environments we enter and the information we implicitly derive from it.

For animals, often even stronger relying on sound than humans, the soundscape is key to obtain information from their environment, which can range from danger to courtship. Detection of such environmental sounds can mean survival, reproduction or a foraging opportunity. In underwater environments, sound is often the most important sense through which animals relate with their environments, given that sound propagates well in water and visibility is often severely restricted. When listening underwater with a hydrophone in polar areas, there are complex symphonies of seasonal ice melt, calling seals, singing whales and stranding icebergs to be heard everywhere. Sound is the heartbeat of the biosphere and measuring the sounds within ecosystems and habitats can therefore reveal a lot about the condition of the realm. →

»By evaluating the quality of underwater acoustic environments, we aim to develop species-specific measures for the status of local underwater soundscapes. «

Dr. Ilse van Opzeeland, Marine Biologist and HIFMB Founding Member

→ My work at the HIFMB together with my postdoc Irene Torrecilla Roca evolves around the above; firstly, we use the sounds produced by different species to measure diversity to see how this can function as a remote sensing tool for biodiversity and second we want to evaluate the acoustic quality of underwater acoustic environments, which could find application in e.g. habitat suitability studies. Acoustic diversity has been explored and applied as tool to monitor biodiversity of sound-producing species in terrestrial environments, but to date has found surprisingly little application in the aquatic realm. Together with Helmut Hillebrand, we applied 'regular' biodiversity metrics to species count data (i.e., daily acoustic presence) that were derived from recordings. Given that marine mammals form one of the dominant biotic sound sources in our recordings from the HAFOS array (the Hybrid Antarctic Float Observing System , which holds various oceanographic instruments) in the Antarctic Weddell Sea, our work focuses on identifying the spatio-temporal patterns in occurrence of the ten marine mammal species that occur in this region. This work showed almost complete seasonal overturn of community composition for all six sites that were examined. This shows that species replace each other and that there are species present throughout the year, irrespective of local ice cover. Our next approach used the actual recordings to calculate diversity from the acoustic data directly, i.e., looking at acoustic entropy and acoustic complexity (along with 21 further acoustic metrics) and related this to information from hand-browsed data on species presence. This work showed that a combination of different acoustic metrics well characterizes marine acoustic communities. An interesting aspect of both approaches is that also archived acoustic recordings can be retrospectively analysed to evaluate how communities and diversity developed over longer time frames.

By evaluating the quality of underwater acoustic environments, we aim to develop species-specific measures for the status of local underwater soundscapes. Current indicators of Good Environmental Status Species for ambient sound are limited to

photos © Stefanie Speisecke

The underwater recorders are deployed to a depth of 1500 m. For species producing low frequency sounds, such as antarctic blue whales, the reception range can be up to 100 km. For high frequency species and seals the range is in tens of km.

The recordings provide information about the spatio-temporal patterns in occurrence of large baleen whales, toothed whales and seals.

photos © left: Awi; right: Karolin Thomisch

two standard frequency bands only. Marine mammals, however, hear and produce sound in species-specific frequency ranges. If these frequency bands are 'blocked' by other sounds, e.g., of human origin such as ships or seismic surveys, the animal cannot use the sound channel for its regular communication, and must revert to alternative strategies. It can e.g. call louder or more often or it can move away to a less noisy area, all of which with potential reproductive or energetic penalties associated to it. More detailed characterization of local soundscapes can tell us how local noise conditions may interfere in time and frequency with species-specific calling patterns and how acoustically 'suited' this area is for a given species.

Furthermore, climate-induced changes have been shown to affect acoustic structures of soundscapes in terrestrial realms. Sueur (TREE 2581, 2019) strikingly compared musicians in an orchestra where changing the thermal and humidity conditions of the concert hall will detune the ensemble and affect individual performance, to the Earth's natural soundscapes, which also will detune due to changes in temperature e.g., through altering the vocalization rates or overall occurrence of species.

For studies in polar environments, acoustics has already proven a highly versatile tool, because of the possibility of collecting data autonomously over multi-year time spans. Likewise, I believe that for many biodiversity and conservation purposes the applications of passive acoustics are just waiting to be uncovered.

photo © Ilse van Opzeeland

Weddell seals

SAVE THE DATE

Guest Lecture by Prof. Alexandre Antonelli

This Year's E.O. Wilson Lecture on Biodiversity will be helt by Alexandre Antonelli, Director of Science at the Royal Botanic Gardens of Kew and Professor in Systematics and Biodiversity at the University of Gothenburg.

Date June 10th, 2020

Time 16.00-17.00

Place: Campus Wechloy, room: tba (hifmb.de/en/events)

The E.O. Wilson Lecture is a special program inviting one excellent international researcher in biodiversity sciences to Oldenburg once per year. It is named after Prof. E.O. Wilson, honoring his fundamental work in bio-geography, biodiversity and conservation.

PERSONALIA

Prof. Kimberley Peters

Enhanced perspectives at HIFMB: Newly announced Professor in "Marine Governance" Dr. Kimberley Peters is the first social scientist to support HIFMB's interdisciplinary approach to functional marine biodiversity.

Since her PhD in Geography, awarded by Royal Holloway, University of London, Kimberley has focused on Maritime Geography. She first taught at the University of Sheffield, before spending four years as a Lecturer in Human Geography at Aberystwyth University. In 2016 she joined the University of Liverpool as a Lecturer in Human Geography and soon was promoted to Senior Lecturer and Reader.

Kimberley is a leading human geographer whose work is recognised internationally as having helped shape and define Maritime Geography, authoring and editing key books in this area. Only over the past decade geographers have been moving their studies from almost entirely terrestrial parts of the earth to parts beyond the shoreline. Kimberley's research is providing a corrective to this land-locked perspective, thinking of seas and oceans as places with social, cultural and political meaning. Her particular focus lies on governance regimes at sea.

This does not just include the governance of maritime space and resources but a range of planetary environments that make governance 'tricky' – such as ice, which melts and reforms; air, which cannot be grasped; electromagnetic waves, which can be harnessed for political ends. Therefore, one of Kimberley's key questions in research is, how to address these geophysical challenges for effective governance and conservation in an age of anthropocentric change.

RESEARCH

5 Selected Recent Publications

Blasius B., Rudolf L., Weithoff G., Gaedke U. & Fussmann G.F. (2019). Long-term cyclic persistence in an experimental predator-prey system. Nature.

Grass D., Uecker H. & **Upmann T.** (2019). Optimal fishery with coastal catch. Natural Resource Modeling, 32, e12235.

Hillebrand H. & **Kunze C.** (2020). Meta-analysis on pulse disturbances reveals differences in functional and compositional recovery across ecosystems. Ecology Letters, 23, 575-585.

Noriega-Ortega B.E., Wienhausen G., Mentges A., **Dittmar T.**, **Simon M.** & Niggemann J. (2019). Does the Chemodiversity of Bacterial Exometabolomes Sustain the Chemodiversity of Marine Dissolved Organic Matter? Frontiers in Microbiology, 10.

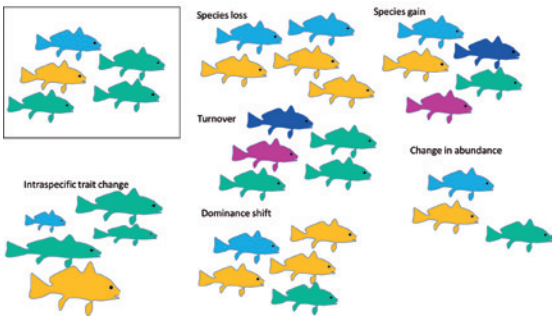
Strahl J., Rocker M.M. & Fabricius K.E. (2019). Contrasting responses of the coral Acropora tenuis to moderate and strong light limitation in coastal waters. Marine Environmental Research, 147, 80-89.

+ More on google scholar: bit.ly/HIFMB-publications

VIEW FROM NORTHWEST

On Complexity

In the light of an increasing need to address impacts of global change, environmental sciences have moved from problem-oriented approaches to understanding and predicting potential consequences to a focus on developing solutions. Societal stakeholders and policy-makers rightfully expect recommendations for actions, and the environmental sciences reflect this need by establishing interdisciplinary and transdisciplinary projects as well as transformative approaches to research. These shifts in a discipline are already worth a whole series of essays, but here I would like to focus on a request for simplification that reappears in many expert panels and discussions.



Biodiversity change is complex. In addition to gaining or loosing species, biodiversity change comprises altered abundances, species identities and dominance patterns that come without changes in the overall number of species.

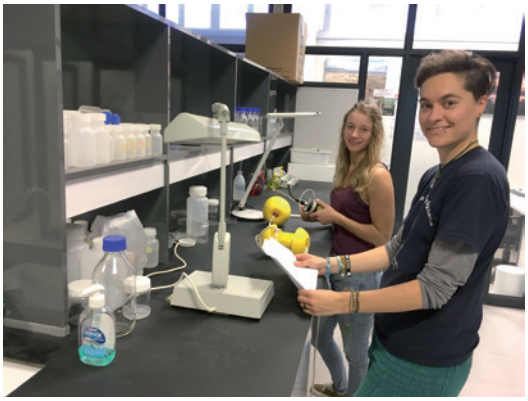
Asking for reduced complexity is motivated by, e.g., the need to explain the solutions to diverse groups of stakeholders, the need to keep solutions affordable and technically doable, or the need to quantify the outcome in simple metrics of success. Environmental researchers often face the demand for simple metrics of status and trends in ecosystems, e.g. in order to quantify return on investment in programs mitigating global change. However, the inherent complexity of (socio-)ecological systems is not accessory, but fundamental as it partly explains their ability to absorb the anthropogenic change. Ignoring this complexity can lead to useless or even detrimental actions, as can be learned from previous examples such as biomanipulation (mitigate eutrophication by manipulating lake food webs) and biocontrol (introducing natural enemies to reduce pest species). Both ideas were rooted in valid ecological concepts and led to the expected short-term effects, but because the concepts had been stripped off their complexity, their long-term impacts reversed to the dominance of grazing-resistant (and sometimes toxic) phytoplankton or the spread of invasive species.

In environmental sciences, simplification does not lead to a clearer picture – by contrast, it masks the actual dynamics. Biodiversity, as a central topic at HIFMB, is a great example for this. The simple story is that many species face extinction at the global scale and the population size of many species in local ecosystems declines. However, biodiversity change is much more complex: immigration of species (e.g., in a warming temperate sea) leads to massive turnover, and the temporal dynamics of winners and losers make simple metrics of diversity (e.g., species richness) useless, as they do not capture this turnover. Moreover, the same species can persist but change functionally (e.g through changes in size or physiology), which transfers into altered species interactions. Biodiversity change has to be addressed as what it is, a complex multi-dimensional problem that comprises changes in the identity, functional traits, and number of the component populations and their interactions. Boiling this down to a single metric or a single bivariate relationship between cause and response will not inform decisions on how to mitigate biodiversity change. Instead, unravelling the box of complexity will not only produce better science, but also inform the highly needed discussion on operational targets in biodiversity conservation.

Sincerely, Helmut Hillebrand

Director – Professor of Pelagic Ecology
helmut.hillebrand@hifmb.de

Research in the field...



...and in the lab.

photos © left: Tabea Hildebrand; right: Ruth Krause

OPEN CALL

The HIFMB Integrative Postdoc Pool HIPP Will Open Soon for Applications

We are pleased to announce the first HIPP Postdoc research fellowships programme commencing in January 2021.
The HIPP is an annual funded opportunity for postdoctoral scientists to develop own research ideas and to actively shape their scientific careers. Its mission is to stimulate integrative and innovative research on functional marine biodiversity and marine conservation, funding is possible for up to three years.
The **call will open in May 2020** for applications. Register here for a notification when the call is open: bit.ly/hipp-news

HIFMB TEAM

Fun Fact Brexit

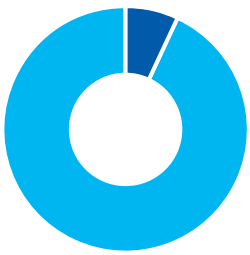
What impact will the Brexit have on EU science?

0 % Great, better chances to receive HORIZON EUROPE funds

7 % Great, all the smart people from the UK will come here.

93 % Science depends on scientist and the free movement of specialists is likely hindered

0 % No impact at all



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