HIFMB NEWS #02/23

Top Story Biodiversity Dynamics in the Face of Global Environmental Changes **+ Transfer** ArtWaves – Bringing Together Art and Marine Biodiversity Research **+ Cooperation** Transdisciplinary Research for Ocean Sustainability **+ Research** Top Recent Publications **+ Editorial** View from Northwest #16 **+ Fun Fact**

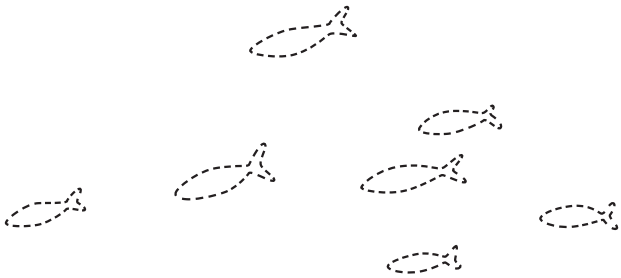
Collage: Mira Antonijevic, © photo: Tom Fisk

TOP STORY

Biodiversity Dynamics in the Face of Global Environmental Changes

How quickly biodiversity responds to environmental changes is a central question in the context of on-going global changes. In particular, knowing whether diversity responds quickly to environmental changes or whether biodiversity changes might be delayed can help us as a society to better preserve the diversity we depend on. However, one needs to quantify the expected changes in diversity when there is no delay if one wants to properly describe diversity dynamics – to put it simply: how can you know you are late if there is no meeting time anyway? To tackle this question, we focused on examining time series data of freshwater fish and breeding birds, aiming to estimate species richness trends under neutral dynamics—where there is no external forcing from global changes. Indeed, because these two taxa have different ecology and dispersal capabilities affecting their ability to respond quickly to environmental changes, we expected significant differences in their diversity dynamics.

Let's imagine a system in which we have equal numbers of 'winners' and 'losers' from a steady environmental change (i.e., a neutral community). When dispersal limitation is low, colonizations happen quickly and often while extinctions might still take some time. For instance, declining dominant species will only go fully extinct after multiple generations. Moreover, the adaptation of populations to new conditions can slow down the extinction process even further, as these populations then cope better with these experienced conditions. Consequently, species richness may transiently increase, even if the environmental change stops, despite equal numbers of 'winners' and 'losers'. →



» Apparently, we have underestimated trends so far. Species are disappearing on a local level faster than we thought. «

Lucie Kuczynski, ecologist and lead author of the study

» A constant or even increasing species diversity does not necessarily mean that everything is fine in an ecosystem and that the number of species remains constant in the long term. «

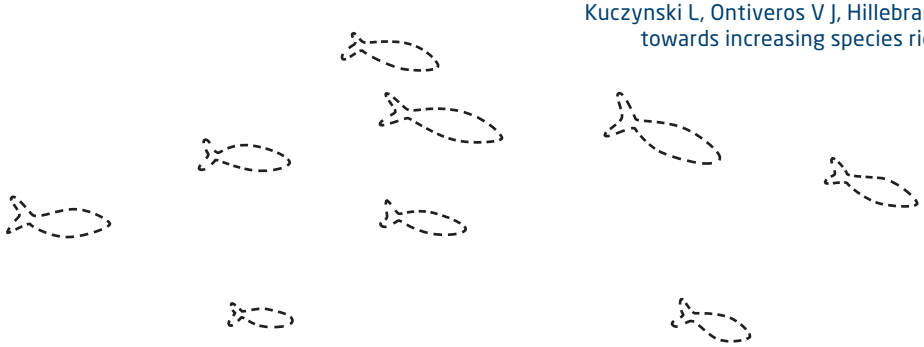
Helmut Hillebrand, plankton ecologist and co-author

→ The analysis of time series data from the RivFishTime dataset (freshwater fish) and the Breeding Bird Survey in North America (breeding birds) showed a modest yet significant increase in local richness over time. Notably, the investigation highlighted that shorter time series tended to underestimate diversity change. This suggests that current long-term datasets may only capture relatively short time spans, limiting our understanding of the dynamic nature of richness. To gain further insights into the observed trends, we conducted simulations of neutral communities, providing a valuable benchmark for comparison. The simulated time series for river fish exhibited increasing species richness over time, suggesting that the fish communities are not in equilibrium with their historical context. In contrast, the breeding bird trends showed no significant deviation from the neutral expectations. This indicates that bird communities, with their comparatively less constrained dispersal, may experience a stronger rescue effect (i.e., the migration of some individuals prevent isolated populations to go extinct). These findings suggest that observed richness trends are not solely driven by the short length of time series but are influenced by the inherent dynamics of the studied communities.

To better understand the mechanisms by which the observed trends emerge, we investigated the net imbalance between the cumulative number of colonizations and extinctions (which gives the cool acronym NICE) for freshwater fish and breeding birds. NICE values showed a significant positive deviation from zero, indicating faster colonization than extinction. However, the disparities between observed and simulated trends suggested that extinctions were catching up with colonizations sooner than predicted. Altogether, the results suggest that richness is increasing but not as fast as one would expect under a neutral scenario and that extinctions are catching up with colonizations which will in turn result in an increased deviation from the neutral predictions.

The study has highlighted the importance of shifting our framework to study the impact of global changes: towards one in which diversity is perceived in a more nuanced way and in which ecological systems display gradual responses because of their remarkable ability to adjust and adapt. By recognizing these systems' adaptability and the need to address their dynamic nature, we can foster more effective strategies to preserve our planet's rich array of life.

Kuczynski L, Ontiveros V J, Hillebrand H. (2023). Biodiversity time series are biased towards increasing species richness in changing environments. Nat Ecol Evol. doi.org/10.1038/s41559-023-02078-w



ArtWaves – Bringing Together Art and Marine Biodiversity Research

From January to April, the Seattle based cut paper, collage and comix artist Mita Mahato was a guest at HIFMB. She was the first artist to take part in a jointly developed Artist in Residence scheme developed by Hanse Wissenschaftskolleg Institute for Advanced Studies (HWK) and HIFMB, aiming to promote the dialogue between marine biodiversity research and art.

Why an artist in residence? With the program we aim to foster the public understanding of marine biodiversity and to develop new formats in order to transfer science into societal debates. Mita supported these objectives, too, emphasizing that one of the main values of an artist in a science community is to demonstrate to each other and to stakeholders that there are natural connecting points between the different disciplines. It is benefit to all thinking about the various ways to approach similar ideas and concerns so we can better come together on solutions.
Mita has participated in working group meetings and has been in intensive exchange with many scientists at HIFMB. She has given workshops for scientists, teenage girls and (prospective) teachers on how to use artistic approaches to understand and process global change, its impact on humans and the emotions associated with it.

» What was exciting to learn was that we share a way of thinking about marine biodiversity, but our different disciplinary backgrounds give us different lenses, vocabularies, motivations, and projects through which to understand, discuss, and share our passions. «

Mita Mahato

During her stay, Mita further developed her project on whale fall. It consists of nine pages of visual poetry that go deep into the phenomenon of whale fall, inviting reflection on the entangled relationships of marine and terrestrial lives. Borrowing from environmental DNA research and sequencing methods that approach organisms in solution, Mita experiments with letterforms and color-coding to ask what voices, throughlines, and possibilities for survival echo in the mesh.

HIFMB scientists appreciated the interaction with the artist and the fact that they were made to step outside their comfort zone and think outside their scientific bubble. They found that tensions between different types of knowledge and ways of thinking can lead to extremely productive new ideas and contribute to a more resilient and rigorous scientific practice. Collaborations between the artist and HIFMB scientists are ongoing. Mita's work on whale fall will be displayed in the new HIFMB building and is printed in the Summer 2023 issue of Ecotone Magazine.

To learn more about Mita's life, work and motivation, go to hifmb.de/podcast and listen to this podcast episode: Mita Mahato - On Art as Science Communication and Her Very Old Cat.

COOPERATION

Transdisciplinary Research for Ocean Sustainability

What does it need for transdisciplinary marine research to be successful? This overarching question was posed when researchers from five projects within the Belmont Forum, Future Earth and JPI Oceans joint action „Transdisciplinary Research for Ocean Sustainability" joined for a final workshop in Berlin on May 23rd to 24th.

The discussion was organized by Kristin Tietje, scientific coordinator of the synCRAocean project, which served as a coordination project across the Belmont projects with German participants, and as this was funded by the Federal Ministry for Education and Research (BMBF). Despite the five projects (MARISCO, MULTI-FRAME, NOCRISES, OceanFrontCHANGE, SHIPTRASE) handling a wide range of topics from biodiversity to ship emissions, the researchers came up with ten joint recommendations on the why, what and how of such projects: *Why do we need transdisciplinary research for ocean sustainability? What is needed to conduct transdisciplinary research? How can we ensure the success of these projects?*
These recommendations were simultaneously illustrated by Charlotte Hintzmann, a graphical harvester. On the next day, the output was handed over to Germany's special representative for the Oceans, Sebastian Unger, together with a brochure on project-specific results of each of the transnational projects in the call. These included policy recommendations developed by the involved projects ranging from regulatory frameworks for ocean multi-use, management of ocean fronts, shipping effluents and fuels, democratic participation and blue justice, to biodiversity assessment. "There is no question how important transdisciplinary projects will be to secure the future of our oceans", summarizes Helmut Hillebrand, lead PI of the MARISCO and synCRAocean projects. "But these projects exist in a political and scientific context that needs to be acknowledged by funding agencies, researchers and stakeholders." The final networking session, hosted by the HIFMB, therefore invited the participants to discuss the policy recommendations and to further strengthen the exchange between science and policy.

More info and brochure download here:
hifmb.de/transdisciplinary

RESEARCH

Top Recent Publications

Massing J C, Fahimipour A K, **Bunse C**, Pinhassi J., **Gross T.** (2023). Quantification of metabolic niche occupancy dynamics in a Baltic Sea bacterial community. *Microbial Ecology.* doi.org/10.1128/msystems.00028-23

Chen W, **Peters K**, Amon D, Baker M, Childs J, Gollner M C S, [...] & Willaert, K. (2023). Assembling the Seabed: Pan-European and Interdisciplinary Advances in Understanding Seabed Mining. Ocean Governance: Knowledge Systems, Policy *Foundations and Thematic Analyses, 25*, 275-294. doi.org/10.1007/978-3-031-20740-2_12

Hillebrand H, **Kuczynski L**, Kunze C, Rillo M C, **Dajka J-C**. (2023). Thresholds and tipping points are tempting but not necessarily suitable concepts to address anthropogenic biodiversity change—an intervention. *Marine Biodiversity 53*, 43. doi.org/10.1007/s12526-023-01342-3

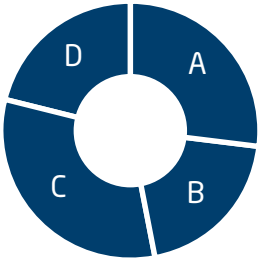
Roca I T, Kaleschke L, V**an Opzeeland I.** (2023). Sea-ice anomalies affect the acoustic presence of Antarctic pinnipeds in breeding areas. *Frontiers in Ecology and the Environment 21* (5). dx.doi.org/10.1002/fee.2622

de Fouw J, Holmer M, Beca-Carretero P, Bostrom C, Brice J, [...], **Meysick, L**, [...], van der Heide, T. (2023). A facultative mutualism facilitates *European seagrass meadows. Ecography.* dx.doi.org/10.1111/ecog.06636

+ More on Google Scholar: scholar.google.de/citations?user=uCoLTyAAAAAJ&hl=en

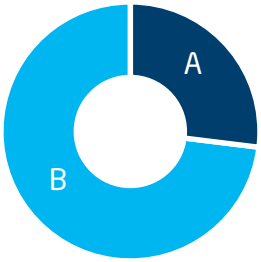
More on Unhappy Global Change Ecologists

Which career stage are you in?



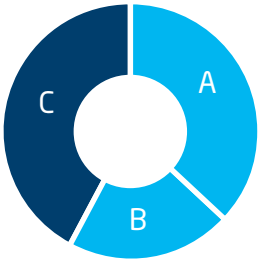
A 27 % Professor
B 20 % PhD/student
C 32 % Postdoc
D 21 % other

How important are global change questions in your research?



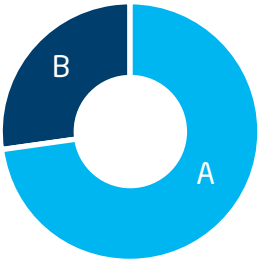
A 27 % always
B 73 % major

Were global change questions a driving force in choosing your study or graduate program?



A 37 % none
B 21 % minor
C 42 % major

Would you rather do other types of research?



A 73 % yes
B 27 % no

In the last editorial, I described some feelings about being "a global change ecologist", especially how sometimes I wish I could warp back to doing curiosity-driven research not caring about pathways to impact. I admit that this seems an almost naive thought in our era of human domination of Earth's ecosystems, leading to the multiple interlinked crises of climate, biodiversity change, and resource overexploitation, not even to mention a full-fledged war and its consequences. However, I had asked myself whether others felt the same, and we offered a little simple survey, which was taken by 19 persons. Although this is too small a group for in depth analysis, the outcome was quite stunning so I decided to share it here with some reflections.

We had quite an even spread across academic groups and career stages. Obviously, the survey was anonymous so we do not know how representative this is for the subscribers of our newsletter. Asked about the current importance of global change topics in their research, 3 out of 4 called it a major part, 1 out of 4 even does nothing else than global change research. Actually, not a single person answered that global change was a small part of (or not even present in) their work.

This contrasts massively with how the researchers decided to pursue their career: 2 out of 3 replied that global change aspects had none or minor impact on the why they started in their discipline. In the light of this, the last answer comes not as a surprise: almost 3 out of 4 of the respondents would love to work more on fundamental questions than they do now.

As said, this was not a scientifically supervised survey, but obviously I am not alone with my own sentiment given the widespread detachment from initial goals and research interests. We did not ask how individual researchers felt about their current roles but it is not far-fetched to guess that some sort of grief is involved when one is not able to research what you want to or feels driven to address the next urgent impact on the environment we feel attached to. Accepting that such pressure exists in science may already be an important first step for researchers, as has been shown on a far more wide-ranging problem: Public health researchers now disentangle syndromes such as ecological grief from climate- or eco-anxiety. While the latter is forward-looking into an uncertain but dark future, the former generally links to experiencing a loss (of some ecological context, species or even some sense of place). So, let's be open about the fact that grief is okay when you need to accept the necessity to do global change research to the prize of losing your favorite research incentives.

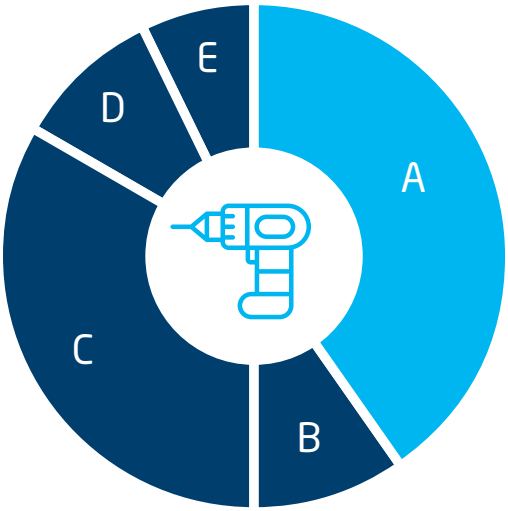
Sincerely, Helmut Hillebrand
Director – Professor of Pelagic Ecology
helmut.hillebrand@hifmb.de

Further reading:
Cunsolo A, Ellis N R. (2018). Ecological grief as a mental health response to climate change-related loss. Nature Clim Change 8, 275–281. doi.org/10.1038/s41558-018-0092-2
Comtesse H, Ertl V, Hengst S M C, Rosner R, Smid G E. (2021). Ecological Grief as a Response to Environmental Change: A Mental Health Risk or Functional Response? Int. J. Environ. Res. Public Health, 18, 734. doi.org/10.3390/ijerph18020734

HIFMB TEAM

Fun Fact*

Are you a do-it-yourselfer?



A	40 %	Whether in the garden or in the house, I repair and build with passion.
B	10 %	I try hard but the hammer always lands on my thumb and not the nail.
C	33 %	I only work with duct tape.
D	10 %	I really just want the reward beer.
E	7 %	I work to be able to afford craftsmen.

* answered by HIFMB employees

PUBLISHER

Helmholtz Institute for Functional Marine Biodiversity at the University of Oldenburg (HIFMB)

Ammerländer Heerstraße 231 / 26129 Oldenburg / Germany / T +49 471 4831 2546 / info@hifmb.de

Twitter @HIFMB_OL / V.i.S.d.P.: Ruth Krause / Legal Notice: **hifmb.de/legal-notice**

Sign up for our online newsletter: hifmb.de/newsletter

hifmb.de