HIFMB NEWS #04/21

Top Story How Small Critters in the Ocean Help us Understand the Impact of Human Activity + **Cooperation** From Ambition to Biodiversity Action: It Is Time to Hold Actors Accountable + **Opinion** A Step Back to Move Forward? + **Editorial** View from Northwest #10 + HIFMB Team **Fun Fact**

Photo © alamy | SeaTops

TOP STORY

How Small Critters in the Ocean Help us Understand the Impact of Human Activity

Marine model organisms are perfect "tools" to identify physiological acclimation mechanisms to rapid environmental change in the Anthropocene and incorporate them into ecological models to optimize the prediction efforts.

The hydroid *Hydractinia echinata*, which in recent decades has been studied intensively as model organism in developmental biology, is particularly well suited to answer questions in environmental biology. Marine hydroids are relatively inconspicuous inhabitants of the Northern Atlantic Ocean that live in a close symbiosis with the hermit crab Pagurus bernhardus. They lend a fluffy appearance to the shells of the crabs, but are rarely recognized as distinct, colonial cnidarians by untrained observers. *Hydractinia* can be easily cultured in small spaces in temperature-controlled aquaria, but can also be cloned or studied in their natural environment (e.g., mudflats). Laboratory experiments with juvenile *Hydractinia* have shown that their stress responses to increasing water temperatures are strongly modulated by food availability. Temperature stress coupled with a rather sparse food supply causes reduced growth, a disproportionately high metabolic rate, and a high level of cellular damage in juveniles, reflecting the mismatch between increasing energy demand and decreasing supply. On the other hand, a rich food supply mitigates the negative effects of temperature stress and ensures both growth and →

ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

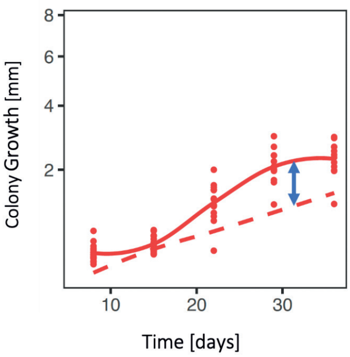
Carl von Ossietzky Universität Oldenburg

»Incorporating complex physiological processes and acclimation mechanisms into ecological models will improve our understanding of future marine biodiversity and its function for marine ecosystems. «

Julia Strahl, Marine Ecophysiologist

→ high tissue vitality in marine hydroids (Eder et al. 2018). The direct relationship between resource availability, allocation, and ecological performance seems trivial and has been demonstrated for a variety of unicellular and multicellular marine species such as phytoplankton, bivalves, and fish. However, many studies investigating the interaction between warming and changing nutrient requirements focus on nutrient-rich conditions and show synergistic effects of eutrophication and warming. These interactions can be very different in oligotrophic ecosystems where temperature-dependent nutrient requirements cannot be readily met, especially in the context of ocean warming. E.g., in the coming decades, primary and secondary production are predicted to decrease in the Northern Atlantic Ocean. For juvenile hydroids, but also other organisms like marine and freshwater phytoplankton, the optimum temperature window for growth saturates at a species-specific nutrient concentration (Tschink et al. 2021, Thomas et al. 2017). Habitat energy availability is a major driver of species distribution ranges and should definitely be considered when predicting the responses of marine organisms to climate change and other anthropogenic impacts.

Discrepancy between experimental growth data (solid line) and numerical growth model data (dashed line) of hydroids at high temperature and low food (modified from Tschink et al. 2021).



Incorporating complex physiological functions and acclimation mechanisms into ecological models will improve our understanding of energetic costs and trade-offs in phenotypic plasticity of marine organisms and future stability of variable marine ecosystems. However, the numerical growth model for juvenile hydroids has shown that parameterization of ecological models reaches its limits when experimental conditions are not optimal and phenomenological relationships (e.g., the "simple" temperature-growth relationship) do not provide a sufficient model basis (Tschink et al. 2021). Currently, a mechanistic framework for integrating the effects of multiple interacting ecophysiological functions on the vitality, growth performance, and reproductive success of marine biota into ecological models is lacking. Studies of *Hydractinia* and numerous other model organisms can be instrumental in drawing attention to physiological stress response mechanisms (e.g., metabolism, cell damage and repair) that can be feed to more complex and holistic modeling approaches of future studies.

Photo © Daniel Tschink

Juvenile hydroid colony on a glass tile with feeding polyps connected by a stolon system.

Tschink, D., Gerlach, G., Winklhofer, M., Kohlmeier, C., Blasius, B., Eickelmann, L., ... & Strahl, J. (2021). Diminished growth and vitality in juvenile *Hydractinia* echinata under anticipated future temperature and variable nutrient conditions. Scientific reports, 11(1), 1-14. doi.org/10.1038/s41598-021-86918-4

Eder, Y., Tschink, D., Gerlach, G., & Strahl, J. (2018). Physiology of juvenile hydroids-High food availability mitigates stress responses of *Hydractinia* echinata to increasing seawater temperatures. Journal of Experimental Marine Biology and Ecology, 508, 64-72. doi.org/10.1016/j.jembe.2018.07.009

Thomas, M. K., Aranguren-Gassis, M., Kremer, C. T., Gould, M. R., Anderson, K., Klausmeier, C. A., & Litchman, E. (2017). Temperature-nutrient interactions exacerbate sensitivity to warming in phytoplankton. Global Change Biology, 23(8), 3269-3280. doi.org/10.1111/gcb.13641

From Ambition to Biodiversity Action: It Is Time to Hold Actors Accountable

Next spring, government envoys are convening at the UN Biodiversity Conference (COP 15) in Kunming, China, to negotiate new global biodiversity goals for the coming decades within the Convention on Biological Diversity (CBD). Looking back, the international community has repeatedly failed to reach most of its biodiversity targets. To achieve global goals for biodiversity conservation, national level implementation must be significantly improved.

A team of 55 scientists came together at the workshop "How can biodiversity science contribute to the CBD's Post-2020 biodiversity framework?" organized by Andrea Perino, Aletta Bonn and Henrique Pereira to now propose a framework on how to effectively implement international biodiversity goals at the national and sub-national level (Perino et al. 2021). The proposed framework consists of three interlinked steps:

1) Translate global targets into national targets and action plans, identifying clearly the sectors responsible for implementation. These action plans need to be co-designed by a wide range of actors from different sectors such as agriculture, trade, or finance to engender a strong, joint ownership of action plans and to overcome responsibility gaps.

2) Implement actions across sectors. This requires the full range of effective behavioural intervention tools to be employed – including redesign of existing regulatory frameworks, finance flows and network structures, which currently support actions harmful to biodiversity. This is the case for many subsidies, e.g., in agricultural or marine policy. According to the scientists, effective finance mechanisms are needed to boost ecosystem restoration. Current CBD plans aim at placing 20% of degraded ecosystems under restoration by 2030.

3) Assess the progress made and hold actors accountable. It is key to define concrete target outcomes and responsible actors. Without accountability the new framework is doomed to failure. To this end, countries must implement national biodiversity monitoring systems. These monitoring systems should be able to trace biodiversity change back to sectors and administrative units, including production and consumption impacts.

Perino et al. emphasise that these three steps are interlinked and must be refined with each implementation cycle. They are convinced that adopting this framework will move national and subnational governments forward in safeguarding national and global biodiversity.

Perino, A., Pereira, H. M., Felipe-Lucia, M., ... & Bonn, A. Biodiversity post-2020: Closing the gap between global targets and national-level implementation. Conservation Letters. 2021; 00 e12848. doi.org/10.1111/conl.12848

New global biodiversity goals are currently being negotiated. The photo shows the Open-ended Working Group on the Post-2020 Global Biodiversity Framework, Feb. 2020 in Rome.

OPINION

A Step Back to Move Forward?

The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) again failed to agree on the establishment of further large marine protected areas (MPAs) in Antarctica at its 40th annual meeting. The 25 member countries could not agree that the three proposals for marine protected areas in East Antarctica, the Antarctic Peninsula and the Weddell Sea are based on sufficient science and are necessary on the scale proposed.

Photo © private

Prof. Thomas Brey, marine ecologist and HIFMB co-director, during nocturnal CCAMLR negotiations

The proposed Antarctic Marine Protected Areas would be an important building block of a global network of protected areas that should cover all important marine ecosystems. They would also be the critical step towards achieving the goal of placing ten percent of the ocean's surface under protection. Each of the Antarctic Marine Protected Areas is special in itself. For example, the area around the Peninsula is highly productive (plankton, krill, fish) and the Weddell Sea is permanently covered by sea ice in the south-western part. This is also a major argument for its protection. If Antarctic sea ice were to decline sharply as a result of climate change, the southwestern Weddell Sea would be a refuge for all species that depend on the ice. The fact that the three marine protected areas were not decided on this year is not a drama in the short term, because these areas are, after all, not directly threatened by human activities. The Antarctic continent is uninhabited, there is no commercial shipping, tourism is limited to small areas on the peninsula, mining is prohibited and fishing is well controlled by CCAMLR. However, marine protected areas would make sense even today, because they would limit the future use - by fishing, for example - of the area. And this, in my opinion, is precisely the decisive reason why the 25 CCAMLR members cannot agree on these marine protected areas. The nations that fish in the Antarctic and want to continue to do so in the future are of the opinion that the proposed areas restrict the future development of fisheries too much. Russia and China in particular are making it very clear that they will not agree to these proposals.

Since CCAMLR has to take all decisions unanimously, nothing is moving. There are now two possibilities: Either the Gordian knot will be cut at the highest political level, or proponents and opponents will take the Japanese delegation's call to heart: "Resume to engage in substantive discussion, it is the only way to find a common path."

That could work: We all take a step back, or two, become more modest in our demands, even if it hurts, and have more patience. Then, hopefully, we can look forward to functioning Antarctic marine protected areas in a few years' time.

RESEARCH

Top Recent Publications

Simmons, B. I., Blyth, P. S., Blanchard, J. L., Clegg, T., Delmas, E., Garnier, A., **Jacob, U.**, ... & Beckerman, A. P. (2021). Refocusing multiple stressor research around the targets and scales of ecological impacts. *Nature Ecology & Evolution,* 5(11), 1478-1489. doi.org/10.1038/s41559-021-01547-4

Bauer, B., Kleyer, M., Albach, D. C., **Blasius, B.**, Brose, U., Ferreira-Arruda, T., **Gerlach, G.**, ... & **Hillebrand, H.** (2021). Functional trait dimensions of trophic metacommunities. *Ecography,* 44(10), 1486-1500. doi.org/10.1111/ecog.05869

Anestis, K., Kohli, G. S., **Wohlrab, S.**, Varga, E., Larsen, T. O., Hansen, P. J., & **John, U.** (2021). Polyketide synthase genes and molecular trade-offs in the ichthyotoxic species *Prymnesium parvum. Science of the Total Environment,* 795, 148878. doi.org/10.1016/j.scitotenv.2021.148878

Pegg, N., **Roca, I.** T., Cholewiak, D., Davis, G. E., & Van Parijs, S. M. (2021). Evaluating the Efficacy of Acoustic Metrics for Understanding Baleen Whale Presence in the Western North Atlantic Ocean. *Frontiers in Marine Science.* doi.org/10.3389/fmars.2021.749802

Catalá, T. S., Shorte, S., & **Dittmar, T.** (2021). Marine dissolved organic matter: a vast and unexplored molecular space. *Applied Microbiology and Biotechnology,* 1-15. doi.org/10.1007/s00253-021-11489-3

Fraschetti, S., McOwen, C., Papa, L., Papadopoulou, N., Bilan, M., Boström, C., **Fiorentino, D.**, ... & Guarnieri, G. (2021). Where Is More Important Than How in Coastal and Marine Ecosystems Restoration. *Frontiers in Marine Science,* 1431. doi.org/10.3389/fmars.2021.626843

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

VIEW FROM NORTHWEST #10

Who Pays the Bridge Builder?

Reinforced by the aftermath of COP15 and COP26, there is an urgent demand to close the gap between science and application, especially in how we understand and manage ecosystems. In particular for the oceans, we observe a discrepancy between on the one side fast increasing bodies of knowledge on the dynamic nature of marine ecosystems and their biodiversity and on the other side similarly complex governance structures, where management schemes remain rather static because they often only emerge from long negotiation processes. The key ingredients for closing the gaps, transdisciplinarity and transformative science, have received wide attention and are reflected in strategic science programs, such as the Helmholtz program of which HIFMB is a part. Indeed, many marine scientists are intrinsically highly motivated to bring their expertise into policy and management discussions and especially early career researchers (ECRs) are interested in building bridges crossing the science-policy gap.

Building such bridges, however, is a huge investment, both of enthusiasm and time, which opens the question what the return on this investment is. The light-hearted answer is that such transfer skills are more and more requested on the academic (and non-academic) job market and thus the effort will pay off for ECRs through higher chances acquiring postdoc or faculty positions. However, my experience in search committees across all ranks of the academic career path does not support this wishful thinking. Work spent on transformation is often – if at all mentioned – a nice-to-have feature, whereas publications, grants and – for professors – supervision and teaching experience are the hard currencies. The impact of a researcher is measured mainly by scientific citations, not by the frequency and effectiveness of their interaction with stakeholders or the public. Otherwise we would ask: Does a certain transdisciplinary effort weigh in as much as two first-author papers or a co-authorship on a contribution in Nature? Can a PhD student afford a chapter less, when they managed to negotiate their findings into management praxis? Is a new integrated monitoring scheme for the national waters of country X worth as much as an ERC Starting Grant?

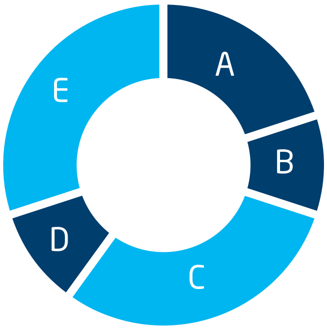
If we want ECRs, the largest and most active group of researchers, to play their role in transformative science, we also need to devise a reward system that encourages building the bridges. This system needs solid recognitions for solutions, not by self-reference in CVs but by actual rewards. Engineering disciplines can serve as a model here, where patents on a technical solution to a certain problem are as meriting as published papers. I wonder what "patent" on finding a management or policy solution we can create in the environmental sciences to pay the bridge builders. Further ideas are welcome, let's discuss them on Twitter: HIFMB_OL.

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

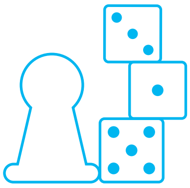
HIFMB TEAM

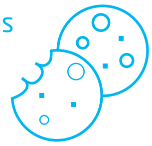
Fun Fact

What is your favorite winter sport?*



A 20 % Skiing
B 10 % Snowboarding
C 30 % Board-games
D 10 % Ice Skating
E 30 % Eating cookies





* 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