

HIFMB NEWS #01/22

Top Story Krill Faecal Pellets are More Efficiently Exported to Depth Than Salp Pellets + **Collaboration** New Project to Reduce Human Impacts on Marine Ecosystems + **Cooperation** New Exchange Program Between Gqeberha and Oldenburg + **Personalia** Prof. Dr. A. Murat Eren + **Editorial** View from Northwest #11 + **HIFMB inside** Online now: HIFMB Podcast + **Fun Fact**



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TOP STORY

Krill Faecal Pellets are More Efficiently Exported to Depth Than Salp Pellets

The Southern Ocean is one of the most important oceanic regions for uptake and storage of carbon dioxide (CO₂) from the atmosphere. This uptake of CO₂ is driven by faecal pellets produced by Antarctic krill (*Euphausia superba*) and salps (*Salpa thompsoni*), krill and salp poo, the most important macrozooplankton grazers in the Southern Ocean.

Even though krill and salp faecal pellets are only millimetre-large, they are carbon-rich, very numerous and sink fast, which all helps in transporting carbon from the surface ocean to the deep-water layers and the sea floor where carbon can be stored for thousands to millions of years.

During the past decades, we have observed climate change with warming water temperatures in large areas of the Southern Ocean. This warming has already affected Antarctic krill populations in the Atlantic sector of the Southern Ocean

and forced them to move to colder areas further south. At the same time, the warming has allowed salps to expand into areas that were previously dominated by krill. As a result, we have observed a long-term shift from krill to salps in large areas of the Southern Ocean.

Since salp faecal pellets are larger, more carbon-rich, and sink faster than krill faecal pellets, we expected that a shift from krill to salps would increase the export of carbon to the deep ocean and that the Southern Ocean therefore would store →

» The results completely change our understanding of how a shift from krill to salps will affect the role of the Southern Ocean in carbon uptake and storage. «

Bettina Meyer, Marine Biologist

→ carbon more efficiently, but to our surprise it turned out differently.

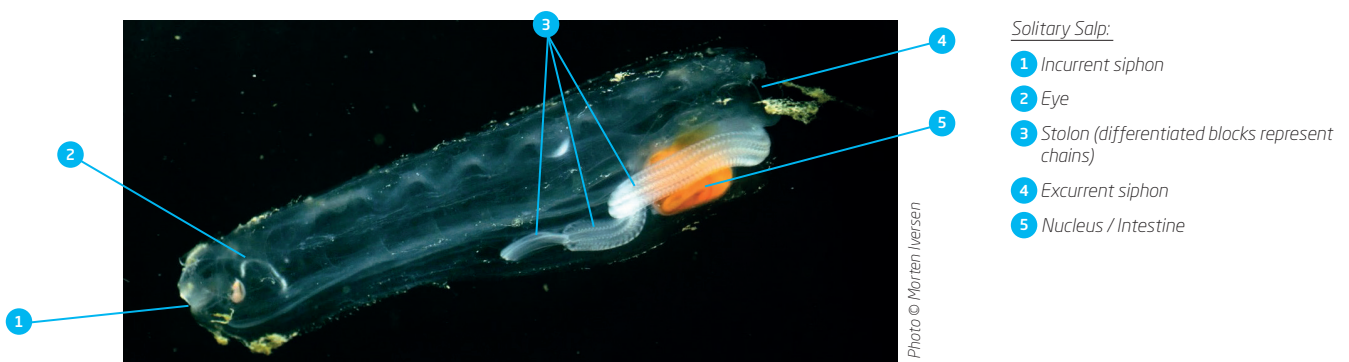
When we went to the Southern Ocean to study how a shift from krill to salps would affect the export of carbon, we found that while krill pellets are efficiently exported out of the euphotic zone, salp pellets were not. Instead, only a small fraction of the salp pellets sank to depths below 200 m and most of the salp pellets were recycled and eaten in the upper 200 meters of the water column. On the Research Ice breaker Polarstern we used a wide set of different methods to study the in-situ biomass of krill and salps, their faecal pellet production, as well as the sinking speed, carbon content and degradation of faecal pellets. Although we found that salp pellets sink faster than krill pellets, only 20% of the salp pellets that were produced in the surface ocean were found in sediment traps that were deployed at 300 meters. 70% of all the krill pellets that were produced in the surface ocean sank to 300 m depth, despite the fact that they sank much slower than salp faecal pellets.

These results completely change our understanding of how a shift from krill to salps will affect the role of the Southern Ocean in carbon uptake and storage. This has huge implications for how the Southern Ocean will mitigate climate change and CO₂ uptake in the future.

This means that if salps continue to increase their distribution and krill is forced to move further southward as the Southern Ocean is warming, the Southern Ocean will become a less efficient carbon sink in the future. However, it is not only increasing temperatures that are forcing krill to move further south. On the expedition we further found the first glimpses of how salps directly compete with krill for the same food.

This was a surprise, because a selective feeding behaviour was previously known for krill, while salps were thought to be indiscriminate 'vacuum cleaners'.

Since salps can reproduce extremely fast, they can double their numbers in a matter of days and pose further risk to krill populations that are already stressed by warming temperatures.



Pauli N-C, Flintrop C, Konrad C, Pakhomov E, Swoboda S, Koch F, Wang X-L, Zhang J-C, Brierley A, Bernasconi M, Meyer B, Iversen M: Krill and salp faecal pellets contribute equally to the carbon flux at the Antarctic Peninsula. (2021). *Nature Communications*, doi.org/10.1038/s41467-021-27436-9

Pauli N-C, Metfies K, Pakhomov E, Neuhaus S, Graeve M, Wenta P, Flintrop C, Badewien T, Iversen M, Meyer B. Selective feeding in Southern Ocean key grazers – diet composition of krill and salps. (2021). *Communications Biology*: 4, 1061, doi.org/10.1038/s42003-021-02581-5

COOPERATION

New Exchange Program Between Gqeberha and Oldenburg

The existing collaboration between the Nelson Mandela University in Gqeberha (NMU) and the Carl-von-Ossietzky University in Oldenburg (UOL) is being extended by a bilateral exchange program.

This allows PhD students and Postdocs in the marine sciences a 3- to 6-month research stay at the Institute for Coastal and Marine Research (CMR) or the Helmholtz Institute for Functional Marine Biodiversity at the University of Oldenburg (HIFMB).

The funding covers travel and living allowances for outgoing students plus additional scholarships for incoming students from NMU. Family allowance to bring dependent children and partners can be requested, too.

+ Start of application period will be announced on hifmb.de/exchange-program and Twitter: [HIFMB_OL](https://twitter.com/HIFMB_OL)

COLLABORATION

New Project to Reduce Human Impacts on Marine Ecosystems

In 2021 the German Alliance for Marine Research (DAM) started the research mission "Protection and Sustainable Use of Marine Areas (sustainMare)". Two pilot projects and five research networks are investigating the ecological, economic and social impacts of the use and pollution of various marine regions.

The HIFMB coordinates the research network "**Concepts for Reducing the Effects of Anthropogenic Pressures and Uses on Marine Ecosystems and on Biodiversity**" (CREATE). Its overall goal is to minimize negative impacts on coastal and marine ecosystems and thus make human-ocean interactions more sustainable.

CREATE integrates experts from 16 institutions in an unprecedented effort to provide solution-oriented knowledge for policy makers, businesses, and civil society to serve as the scientific basis for policy and societal decision-making processes related to the protection and sustainable use of coastal and marine areas.

To do so, CREATE will establish living labs in the North and Baltic Seas to generate practical, implementable and operational innovations that address multiple stressors using transdisciplinary methods. The consortium, consisting of natural and social scientists, economists, engineers, and societal stakeholders, will integrate state-of-the-art data science, modeling approaches, and assessment of (inter)national marine policies.

The Federal Ministry of Education and Research (BMBF) funds the project with about four million euros over an initial period of three years and the whole mission with about 25 million euros.



Photo © Silke Eilers

Shipping and the expansion of renewable energies are two of the many human-induced interventions that the CREATE collaborative project is looking at - for a sustainable interaction between humans and the sea in the future.

+ More on allianz-meeresforschung.de/en/activities/research-missions/protection-and-sustainable-use-of-the-oceans

PERSONALIA

Prof. Dr. A. Murat Eren

Prof. Dr. A. Murat Eren has been appointed as professor of Ecosystem Data Science at HIFMB.



Photo © Daniel Schmitt | UoL

A. Murat Eren, who goes by Meren, studied computer engineering at Canakkale Onsekiz Mart University, Turkey. After his graduation, he started working at the Turkish National Research Institute of Electronics and Cryptology. In 2007 he moved to the United States of America and started a PhD in Computer Science at the University of New Orleans with a focus on machine learning and signal processing. However, towards the end of his graduate education his interests shifted towards microbial ecology, and he developed new high-resolution algorithms, including oligotyping and minimum entropy decomposition, to distinguish very closely related microbial taxa that differ as little as one nucleotide in marker gene surveys of environmental microbes.

In 2011 Meren joined the Marine Biological Laboratory (Woods Hole, USA) as a Postdoctoral Scientist, where he developed an interest in understanding strategies by which microbes respond to environmental change. Together with colleagues, he developed the open source software anvio, which is used by researchers worldwide for data-driven microbiological studies.

Since 2015, Meren has been an Assistant Professor at the University of Chicago, where he and his team employed a combination of integrated 'omics and wet-lab strategies to study the ecology and evolution of microbes in a wide range of habitats, including marine systems, insect ovaries, the human gut, and the oral cavity. He is a Fellow of the Marine Biological Laboratory and Alfred P. Sloan Foundation in Ocean Sciences, and has received the American Society for Microbiology Award for Early Career Environmental Research in 2020.

The Ecosystem Data Science group at the HIFMB will continue to yield computational strategies to study microbial life, with a particular focus on a new research direction to bring together chemical signatures of metabolic activities of marine microbes and genome-resolved insights into microbial diversity and biogeography through high-resolution integrated 'omics.

RESEARCH

Top Recent Publications

Dlugosch L., Poehlein A., Wemheuer B., Pfeiffer B., Badewien T. H., Daniel R., & **Simon M.** (2022). Significance of gene variants for the functional biogeography of the near-surface Atlantic Ocean microbiome. *Nature Communications*, 13(1), 1-11. doi.org/10.1038/s41467-022-28128-8

Hillebrand H., Antonucci Di Carvalho J., Dajka J. C., Dürselen C. D., Kerimoglu O., Kuczynski L., ... & Ryabov, A. (2022). Temporal declines in Wadden Sea phytoplankton cell volumes observed within and across species. *Limnology and Oceanography*, 67(2), 468-481. doi.org/10.1002/lno.12005

Massing J. C., Schukat A., Auel H., Auch D., Kittu L., Pinedo Arteaga E. L., ... & Hagen W. (2022). Toward a Solution of the "Peruvian Puzzle": Pelagic Food-Web Structure and Trophic Interactions in the Northern Humboldt Current Upwelling System Off Peru. *Frontiers in Marine Science*, 8. doi.org/10.3389/fmars.2021.759603

Meysick L., Infantes E., Rugiu L., Gagnon K., & Boström C. (2022). Coastal ecosystem engineers and their impact on sediment dynamics: Eelgrass-bivalve interactions under wave exposure. *Limnology and Oceanography*. doi.org/10.1002/lno.12022

Reverter M., Helber S. B., Rohde S., de Goeij J. M., & **Schupp P. J.** (2021). Coral reef benthic community changes in the Anthropocene: Biogeographic heterogeneity, overlooked configurations, and methodology. *Global change biology*. doi.org/10.1111/gcb.16034

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

VIEW FROM NORTHWEST #11

An Unexpected Journey



Most scientific work has specific goals and deliverables, but sometimes we are able to engage in an unexpected journey, as Peter Jackson entitled the first movie of his Hobbit trilogy. One of these journeys started with an email by Jon Norberg (who was at Stockholm Resilience Centre at that time) in September 2020, a few weeks after I published a paper with a group of colleagues on thresholds (1). Thresholds are often used in environmental policies and management as boundaries avoiding tipping points and regime shifts, but we questioned their usefulness as we found that they cannot easily be derived or predicted from empirical data. Jon disagreed on this conclusion but in his email suggested to avoid the classic cycle of comments and replies but - inspired by a paper by Kahnemann and Klein (2) - to use a failure to disagree for understanding each other's stance in this matter.

Three colleagues joined (Sarah Cornell, Thorsten Blenckner and Owen Petchey) our discussion journey in weekly to monthly meetings to ask why scientific disputes in ecology often end up with different camps, which closely interact within their group but ignore each other. We quickly broadened to general aspects of science philosophy, about how "evidence" for a tenet - or its absence - are interpreted, how context defines results in ecology, and how novel ideas mature from supporting the heureka moment to critical investigation.

However, the coolest thing, to me at least, was that we stopped discussing right or wrong. We had nothing to compete for or to prove, there was no grant to be gathered or award to be won. Instead we just learned from having different perspectives, which felt incredibly old school in times of minimal turnaround times and ever more ambitious grant systems. Realizing that reflecting on this journey might be useful for others as well, we started drafting common text and conceptual figures, which now, 1.5 years later, resulted in a piece on science (philosophy) from a natural scientist perspective (3). Only problem though is that I dearly miss these joyous and inspiring starts of the week (most meetings were Monday mornings) that we now need a different topic we can fail to disagree about.

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

(1) Hillebrand H., Donohue I., Harpole W.S., Hodapp D., Kucera M., Lewandowska A.M., Merder J., Montoya J.M. & Freund J.A. (2020). Thresholds for ecological responses to global change do not emerge from empirical data. *Nature Ecology & Evolution*, 4, 1502-1509.
doi.org/10.1038/s41559-020-1256-9

(2) Kahneman D. & Klein G. (2009). Conditions for intuitive expertise: a failure to disagree. *Am Psychol*, 64, 515-26.
doi.org/10.1037/a0016755

(3) Norberg J., Blenckner T., Cornell, S.E. Petchey, O.L., Hillebrand H. (2022). Failures to disagree is essential for environmental science to effectively influence policy development. *Ecology Letters*, doi.org/10.1111/ele.13984

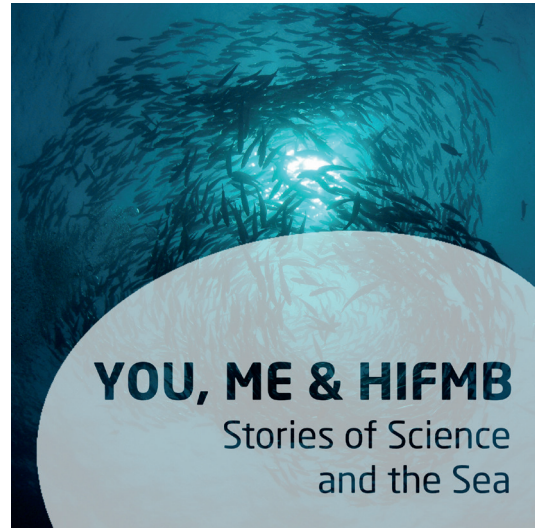
PODCAST

Online Now: HIFMB Podcast

Every two weeks, a new guest takes a seat across from Jan-Claas Dajka and talks to him about current research projects, curious anecdotes as well as paths, detours and companions in the (not only) scientific career.

Jan is interdisciplinary postdoc in marine ecology and marine governance at HIFMB. Chatting with ecologists, geographers, bioacousticians, mathematicians and many more, he shows the interesting and diverse personalities behind the transdisciplinary research at HIFMB.

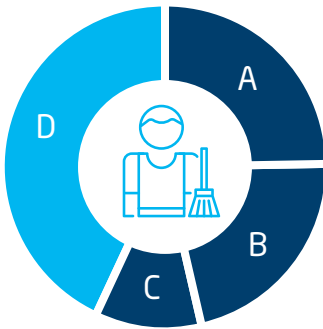
+ hifmb.podbean.com



HIFMB TEAM

Fun Fact*

Clear the Clutter - Spring Cleaning



- A 25 % The spring cleaning rituals are stuck in the 1950s and I leave them there.
- B 22 % Dust is mostly dead skin, so I don't clean, might be somebody I know...
- C 10 % Spring cleaning is a great workout.
- D 43 % I put on the shades, turn the music on and get it done.

* answered by HIFMB employees

PUBLISHER

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