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Multiple breeding populations share a common feeding ground.

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TOP STORY

How Singing Whales Tell Us Where They Come From

The humpback whale is probably the most iconic species among the baleen whales. Anyone who listens to Kate Bush knows their long and complex songs. These songs are produced by humpback whale males as a reproductive display, most likely transferring information about individual fitness both to surrounding females and males.

Humpback whales accumulate during the winter months on their tropical and sub-tropical breeding grounds, where females give birth and males compete for the access to receptive females engaging in physical competition and singing their elaborate songs.

While songs undergo constant changes, termed song evolution, all males of a given breeding population converge to singing the same song at any given point in time. The geographical distance among different breeding populations, sometimes

including continental barriers, leads to the independent evolution of songs between breeding populations. Humpback whale songs can therefore be used to attribute singers to the distinct populations.

For many years, it was believed that humpback whale males only sing their songs during the breeding period on the breeding grounds. In the Southern Hemisphere, they were thought to migrate in summer to the Southern Ocean exclusively to feed on Antarctic krill, while reproductive activities including →

» The unexpected extent of song recordings from the Atlantic sector of the Southern Ocean opened possibilities to search for indicators of population identity within the recorded songs. «

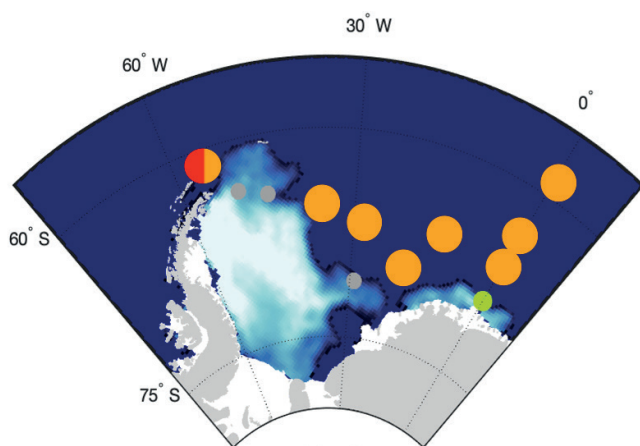
Elena Schall, Bioacoustician

→ singing were thought restricted to the lower latitude breeding grounds. We never expected them that far south, but recordings from PALAOA, our acoustic observatory on the Antarctic shelf near Neumayer Station III, already revealed the presence of their social calls when we started exploring Antarctic soundscapes nearly ten years ago. During further in-depth analyses of recordings from our offshore stations, we discovered that virtually throughout the Atlantic sector of the Southern Ocean, humpback whales start singing in the end of summer and continue throughout fall months while still roaming Antarctic waters. During this period, humpback whale males probably alternate between feeding and singing to maximize both energy uptake and reproductive chances. It has been speculated that singing at these times may, for example, represent low-cost opportunistic male advertising to court females that failed to conceive on the lower latitude breeding grounds during the winter.

The unexpected extent of song recordings from the Atlantic sector of the Southern Ocean opened possibilities to search for indicators of population identity within the recorded songs. The structural analysis and comparison of songs revealed the existence of two distinct song groups in the Atlantic sector of the Southern Ocean. These song groups indicate the simultaneous presence of at least two humpback whale breeding populations which overlap in their geographical distribution. When humpback whales from different breeding populations meet in the Southern Ocean, feed in mixed groups and males start courting females, both genetic and cultural exchange are facilitated. Genetic exchange has direct benefits for population fitness by increasing the gene pool. However, cultural exchange also creates indirect benefits for population fitness as it drives the continuous evolution of songs which is thought to increase individual reproductive success.

The accumulation of multiple breeding populations on a common feeding ground reflects the favorable feeding conditions in the respective area. Due to the high productivity rates and high krill densities in the Atlantic sector of the Southern Ocean, humpback whales from multiple ocean basins seem to migrate to this part of the Southern Ocean. This highlights the importance of the area for humpback whales in particular, but most likely also other Southern Hemisphere baleen whale populations specialized on Antarctic krill. Further research is addressing how humpback whale distribution is governed by environmental factors and also how climate-induced anomalies affect their acoustic presence and behavior.

Elena Schall & Ilse Van Opzeeland



Schall, E., Thomisch, K., Boebel, O., Gerlach, G., Mangia Woods, S., T Roca, I. & Van Opzeeland, I. (2021). Humpback whale song recordings suggest common feeding ground occupation by multiple populations. *Scientific reports*, 11(1), 1-13.

<https://www.nature.com/articles/s41598-021-98295-z>

The Wadden Sea and its Stakeholders

The Wadden Sea creates the largest unbroken tidal flat system in the world. This allows marine organisms of all shapes and sizes to flourish and draws in other migratory species like birds and seals from great distances. Humans in turn have benefitted from this abundance and from the surrounding marsh lands as barriers to winds and flooding.

However, climate change and other anthropogenic forces have disrupted the balance of the Wadden Sea. Sea level rise and more frequent and intense storms have caused an incessant battle of dyke building while changes in water temperature and chemistry put the already vulnerable population of species at risk of collapse. In a place that relies heavily on the sea for subsistence and tourism the need for successful adaptation and management is paramount to the continued success and sustained biodiversity of the Wadden Sea.

Often, governments interact with only a few 'key' stakeholders and utilize scientific findings in ways that could remove greater nuance from results, should more stakeholders and perspectives be included. This can lead to a discrepancy in enforcement and unintended consequences for other stakeholders as well as for organisms in the environment. To overcome some of the past shortcomings, a group of researchers at HIFMB bring together both social and natural science techniques through the MARISCO project (www.marisco-project.de) to ensure future policy reflects both accurate quantifiable data and voices of

different stakeholder groups.

One step towards that goal is understanding who the stakeholders of the Wadden Sea are and if they are documented in the academic literature. A review of journal articles of the past two decades shows that much of the research to date has been geared toward policy creation, implementation, and assessment. Coastal water management, fisheries, and tourism were most often addressed, whereas energy, medicine, agriculture and recreation are notably lacking from the body of literature. Moreover, only 20% of papers included stakeholders from more than one country, although the Wadden Sea Forum utilizes multiple tri-lateral collectivism in decision making.

We hope this review led by Gabriel Gadsden, a Global Sustainability Scholar and honorary member of HIFMB's Marine Governance group, raises awareness of the complexity of stakeholders in the region and spurs greater enthusiasm to bring more voices to the table when crafting policy surrounding the Wadden Sea.

Workshop Series on Mental Health of Early Career Researchers

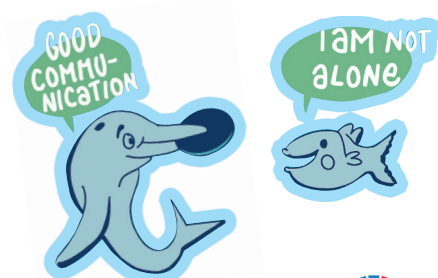
HIFMB and the UN Ocean Decade started taking "Collective Steps for Healthy Researchers and Healthy Oceans".

Mental health issues and daily motivation of young scientists working together on some of the most pressing ocean challenges, such as lack of sustainability and biodiversity loss, show different manifestations and warning signs and require special attention. These problems are often in addition to the familiar vagaries of one's career and fears of failure.

Surveys in the livestream of the workshop revealed that 64% of the participants have already suffered from psychological problems (18% don't know, 18% no), among them mainly the impostor phenomenon, fear of the future and presenteeism.

During the VECOP days (June 1+2, 2021), we started the series with workshops about coping mechanisms at work and in one's daily routines. More than 150 Early Career Researchers have been accompanied by a graphical recorder.

Feel free to download the result, a poster, that reflects a synthesis of motivational boosters, as well as fantastic advice from our favourite marine animals on how to stay resilient and healthy.



Illustrations: Gabriele Schlipf

+ Download the poster here:
www.hifmb.de/event/vecop/



2021 United Nations Decade
 of Ocean Science
 for Sustainable Development



RESEARCH

New Arrivals in Marine Political Ecology Focus Group

The Marine Political Ecology Focus Group is led by geographer Dr. Katherine Sammler (right foto). Broadly, the goals of the group are to better understand how knowledge is created about the ocean, how boundaries are drawn on and in it, the roles technology plays in mediating its depths, and how communities are impacted by marine resource extraction.

Within increasing trends towards blue growth, together they are taking a transdisciplinary approach to examine human-environment systems offshore, with a focus on marine resources and environmental justice. One aspect of their research examines international efforts to develop regulation of biodiversity in the high seas, considering what biodiversity means to different disciplines and stakeholders. Another facet focuses on analyzing converging interests on the seafloor, where geopolitical entanglements and everyday activities are producing the benthic zone as a space of both anticipation and anxiety.

Recently joined by two PhD students, the group is now made up of Solomon Sebuliba (middle), a conservation biologist and political ecologist, and Merdeka Agus Saputra (left), trained in environmental policy and fisheries studies. The group will also work with intern Anne Wolfgramm, a University of Oldenburg student of environmental sciences, completing her undergraduate degree.



photo ©Katherine Sammler

Drying squid on the fishing docks on Penghu Islands, Taiwan

RESEARCH

Top Recent Publications

Dajka J, Beasley V, Gendron G and Graham N (2021). Investigating sea urchin densities critical to macroalgal control on degraded coral reefs. *Environmental Conservation*, 48(2), 136-141. doi.org/10.1017/S037689292000051X

Reverter M, Jackson M, Rohde S, Moeller M, Bara R, Lasut MT, Reinach MS and **Schupp PJ** (2021). High taxonomic resolution surveys and trait-based analyses reveal multiple benthic regimes in North Sulawesi (Indonesia). *Sci Rep* 11, 16554. doi.org/10.1038/s41598-021-95905-8

Pauli NC, **Metfies K**, Pakhomov EA, Neuhaus S, Graeve M, Wenta P, Flintrop CM, Badewien TH, Iversen MH and **Meyer B** (2021). Selective feeding in Southern Ocean key grazers—diet composition of krill and salps. *Commun Biol* 4, 1061. doi.org/10.1038/s42003-021-02581-5

Schall E, Thomisch K, Boebel O, **Gerlach G**, Mangia Woods S, **T Roca I**, **Van Opzeeland I** (2021). Humpback whale song recordings suggest common feeding ground occupation by multiple populations. *Sci Rep*. 2021 Sep 22;11(1):18806. doi.org/10.1038/s41598-021-98295-z

Bauer B, Kleyer M, Albach DC, **Blasius B**, Brose U, Ferreira-Arruda T, Feudel U, **Gerlach G**, Hof C, Kreft H, Kuczynski L, Löhmus K, Moorthi S, Scherber C, Scheu S, Zotz G and **Hillebrand H** (2021). Functional trait dimensions of trophic metacommunities. *Ecography*, 44: 1486-1500. doi.org/10.1111/ecog.05869

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



VIEW FROM NORTHWEST #9

Persistence and Renewal - On the Difficult Task to Keep up Monitoring Time Series

Understanding current and predicting future biodiversity change requires observational time series on species composition and environmental variables. A very simple statement, which however in practice leads to a whole series of problems.

First of all, funding monitoring series is a harsh business. Science funders generally want novelty, so extending existing time series is often not considered because it is a continuation and descriptive. This leaves funding monitoring to federal and part state agencies that need these data for formal reporting, a handful of research institutes that can fund these programs out of their basic budgets, and citizen science projects. This, secondly, puts the budget of the monitoring scheme to close scrutiny and internal competition, often requiring quite some effort to maintain the status quo of the scheme. This finally gives little room for extension, which, however, often would be very useful.

To give two examples: In order to interpret temporal biodiversity turnover, you also need information on spatial differences in composition and the environment, thus, simultaneous monitoring of multiple sites in a grid. In order to keep track of and implement new observational methods (molecular, autonomous), it is mandatory to run these in parallel to existing schemes for an extended time period, because the holy grail of time series analysis is to ensure comparability over time. The organisations and persons working towards continuous monitoring programs cannot be thanked enough for their efforts in maintaining and improving these. I am happy to see that the enormous – and unfortunately often undervalued – efforts by all the colleagues that keep monitoring time series alive becomes more visible as can be seen by high impact publications on changing biodiversity, global databases such as BioTIME (biotime.st-andrews.ac.uk) or the foundation of the National Monitoring Centre (monitoringzentrum.de).

For HIFMB I see a special role in helping maintaining monitoring efforts by providing novel tools for data analysis to handle complex, heterogeneous and potentially inconsistent data. Through recruitments and projects involving monitoring data components, we are in the exciting phase to develop and test new metrics and approaches. If 2022 allows more in-situ interactions, one dream is to offer these tools to the persons creating and interpreting monitoring data while at the same time reflecting the stakeholders' need for metrics.

Stay tuned.

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

HIFMB INSIDE

Groundbreaking for New Building

Work on the new HIFMB building began in July with a symbolic groundbreaking ceremony. A three-story building with almost 2,000 square meters of floor space will be built by 2023. In addition to 85 office workplaces, the building will also offer around 650 square meters of laboratory space, creating the best conditions for marine biodiversity research.

Lower Saxony's Minister of Science, Björn Thümler, was also a guest and presented AWI Administrative Director Karsten Wurr with the 15 million euro grant for the new building. He highlighted the cooperation between the University of Oldenburg and the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, which enables cutting-edge research in the field of marine biodiversity, marine conservation and ecosystem services.



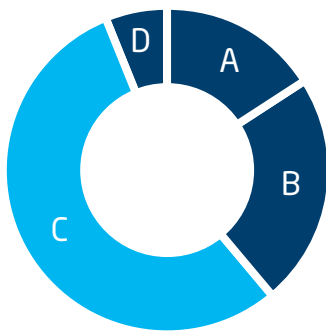
Foto: Universität Oldenburg/Daniel Schmidt

Helping to break ground for the new building of the Oldenburg Helmholtz Institute (from left): former University President Prof. Dr. Dr. Hans Michael Piper, HIFMB Director Prof. Dr. Helmut Hillebrand, Science Minister Björn Thümler, Lord Mayor Jürgen Krogmann, AWI Administrative Director Dr. Karsten Wurr.

HIFMB TEAM

Fun Fact

If you could pick one superpower, which would it be?*



- A 16% Time travelling
- B 23% Breathing under water
- C 55% Teleporting
- D 6% Mind reading



* answered by HIFMB employees

PUBLISHER

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