1st BBO Dialogue Forum
18/19 March 2025 in Bremen
Documentation

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FONA Research for Sustainability

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Background: The BBO projects and stakeholder dialogue fora

The BBO projects

The BBO project consortium comprises four projects funded under the Biodiversity in the Blue Ocean programme by the Federal Ministry of Education and Research (BMBF):

- AGELESS: Focuses on using geological information to assess and dynamically protect marine biodiversity in the face of future climate change.
- IMAPP: Develops decision-making tools for EBSAs (Ecologically or Biologically Significant Areas) and MPAs (Marine Protected Areas) in international waters.
- INDIFUN-AI: Captures plankton diversity and develops indicators for monitoring marine biodiversity.
- BEnToolsMaPs: Integrates seabed biodiversity into the management of marine protected areas.

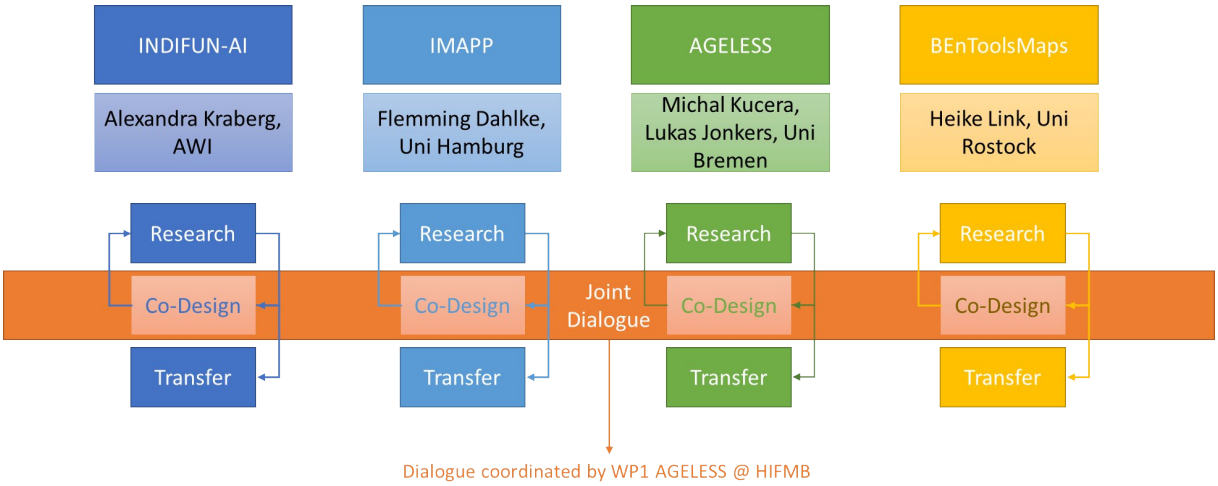

Figure 1: Joining of the four BBO projects on the topic of co-design and dialogue

These projects collaborate to develop innovative co-designed approaches for assessing and protecting marine biodiversity (Figure 1).

Three Dialogue Fora

The dialogue fora are central to the co-design process in the BBO projects and aim to establish a foundation for long-term collaboration between science and practice regarding marine biodiversity issues. They aim to engage stakeholders from various sectors and co-create solutions for marine biodiversity conservation challenges in three stages: co-design, co-production and co-evaluation (Figure 2). Three dialogue fora are planned within the projects' time frame:

- 2025: Co-design in Bremen
- 2026: Co-production in Hamburg
- 2027: Co-evaluation in Bremerhaven

All three dialogue fora are held under Chatham House Rules - a set of guidelines that allow participants to use information from discussions without attributing it to specific individuals or organisations, promoting an open and honest dialogue.

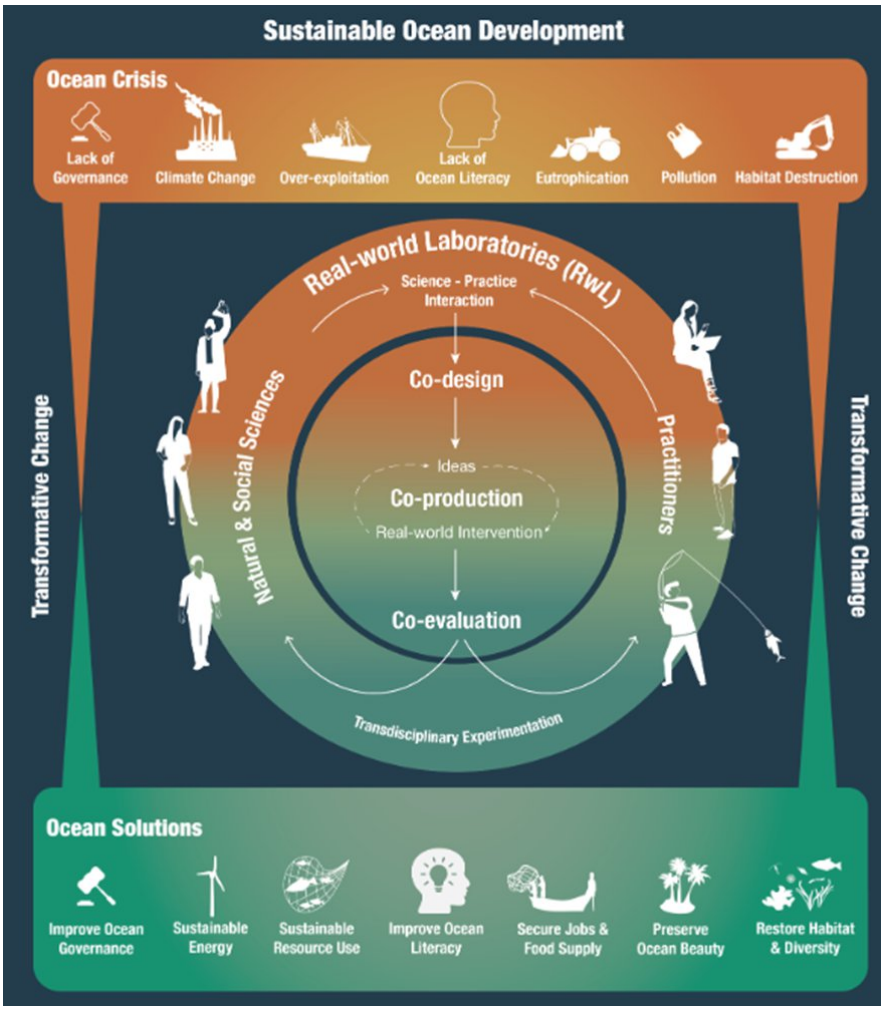

Figure 2: The three central processes to co-creation: co-design, co-production, co-evaluation that will form the three overarching topics of the three BBO dialogue fora; from Franke et al. 2023

Aims and agenda of the 1st BBO dialogue forum

Aims

The first dialogue forum on 18/19 March 2025 in Bremen brought together 8 stakeholders and 16 scientists from the BBO projects to co-design research aims for contributing to marine biodiversity conservation within the BBNJ Agreement. The first dialogue forum also aimed at contributing to a coordinated communication and participation plan by the BBO projects and to lay the groundwork for future collaboration.

The first day featured presentations of the projects AGELESS, IMAPP, INDIFUN-AI, and BEnToolsMaPs, along with a discussion of stakeholder expectations and a co-design workshop to include stakeholder expectations in the further planning of the BBO projects.

On the second day, breakout groups discussed three pre-defined dialogue topics by the projects. These were: A. Indicators that are aligned with the needs of stakeholders, B. Science-informed MPA-design that is aligned with timelines of implementation, C. Product types that are most relevant to stakeholders. We also held an on-stage interview with Hans-Otto Pörtner, former Co-Chair of the IPCC Working Group II (WG II) and member of the German Advisory Council on Global Change (WBGU), that highlighted the need to act and pointed out the intertwined dual-crisis of climate change and biodiversity change.

Agenda

Day 1 (18 March 2025) - Dialogue Forum

- Introduction and welcome words by hosts and BMBF
- Presentations of the BBO projects and their objectives
- Discussion with stakeholders about their expectations
- Workshop: Co-design of research aims for the BBO projects

Day 2 (19 March 2025) - Dialogue forum

- Topic-specific breakout groups
- Interview with Hans-Otto Pörtner (IPCC, WBGU)
- Plenary session: Presentation and discussion of the results of the breakout groups

Presentations of the four BBO projects

In the first part of the dialogue forum, the four projects presented their research aims and project structures. The presentations of the four BBO projects are attached at the end of this documentation (see Appendix).

Before the dialogue forum, the four BBO projects were asked to name their key research aims. These were presented on a pinboard (see Figure 3).

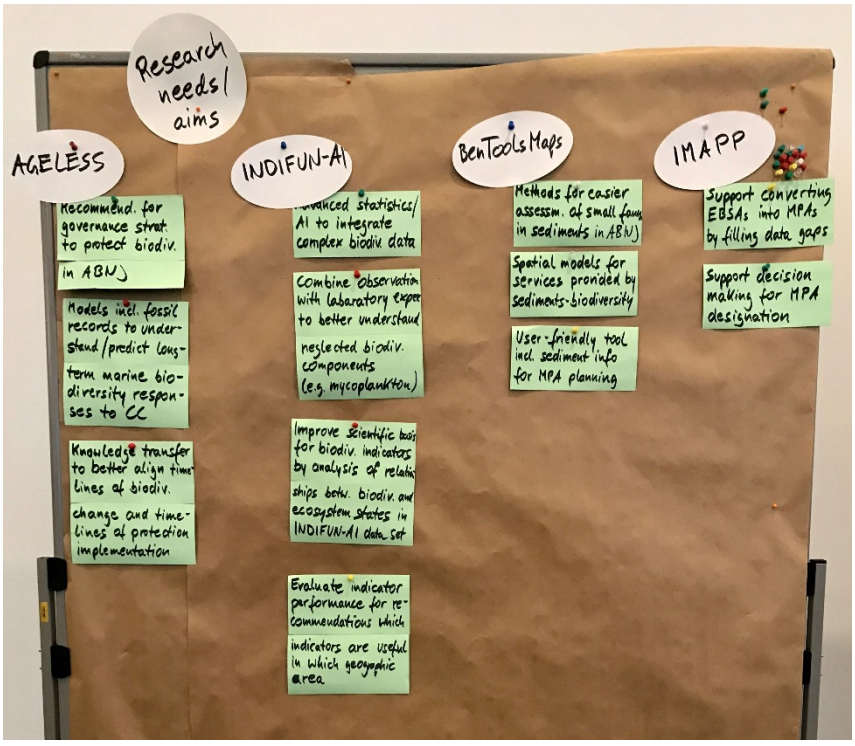

Figure 3: Key research aims of the four BBO projects

Co-design of research needs and aims for the BBO projects

After the project presentations, the participating stakeholders were asked for their recommendations, which further research needs and aims should be addressed by the BBO projects to generate knowledge, outputs and products that are relevant for stakeholders from governmental and non-governmental organizations. In the following discussion between the participating stakeholders and scientists, various aspects were identified, which should be considered in the BBO projects. These aspects were visualized on a pinboard (Figure 4).

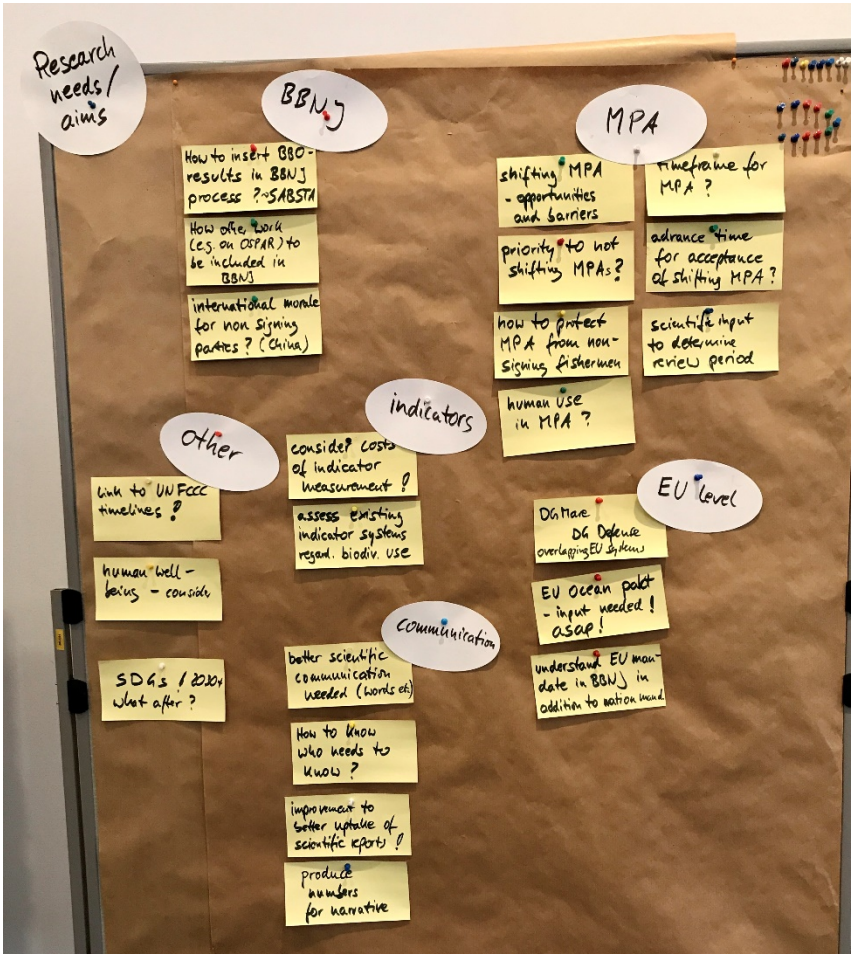

Figure 4: Research needs and aims co-designed with stakeholders

The recommendations by the participating stakeholders focused on aspects related to the BBNJ Agreement, Marine Protected Areas (MPAs), biodiversity indicators, science communication and on recommendations related to the European level.

BBNJ

Regarding the BBNJ agreement, it was recommended that the BBO projects should plan how their results could be made useful for the BBNJ process, for example, by giving scientific advice or contributing to the establishment of a scientific advisory board for the implementation of the BBNJ Agreement at the national level in Germany. This recommendation also related to the issue of science communication that was discussed in more detail later in the co-design process (see below).

While it was mentioned that the BBNJ Agreement will not interfere with existing conventions and treaties on marine biodiversity (e.g., CCAMLR, OSPAR), a stakeholder recommended to analyze the BBNJ Agreement in the context of existing treaties on marine biodiversity (e.g., in terms of how well they can address EBSAs or how their COPs might be linked to each other). Furthermore, it was recommended to explore whether one can still rely on an “international morale” that also non-signing parties, which are not going to ratify the BBNJ Agreement, will accept the MPAs that will probably be established under the BBNJ Agreement. It was argued, on the hand, that non-signing countries would probably still refrain from misuse of MPAs because of their concern to lose international reputation. On the other hand, in view of the ongoing weakening of international institutions and the strengthening of national interest politics, the concern for international reputation might decrease in certain countries.

MPAs

Closely related to the discussion on the BBNJ Agreement, high seas Marine Protected Areas (MPAs) were deliberated. Here the question was raised again, how MAPs, created as measures to implement the BBNJ Agreement, could be protected from actors (e.g., fishers) of countries that did not sign the BBNJ Agreement. In this context, it was also recommended to study how much human use of MPAs should and could be allowed to guarantee both the acceptance of the MPAs as well as biodiversity protection.

To address climate change and the migration of species, due to impacts of climate change in the oceans, shifting or dynamic MPAs (i.e., MPAs that migrate with the species they aim to protect, also named "climate-smart MPAs") were discussed. Here, it was recommended to study the opportunities of and barriers to establishing such dynamic MPAs, but also to consider the option of prioritizing non-dynamic MPAs (i.e., static MPAs) because of their higher acceptance among legislators. On the one hand, a stakeholder argued that dynamic MPAs would make sense scientifically, but not politically, as actors (e.g., fishers) would need static boundaries of MPAs. On the other hand, a scientist strongly argued for the need of dynamic MPAs since protection of marine biodiversity would not be possible with static boundaries. Hence, the role of science should be to strongly advocate for dynamic MPAs and address the research question how – and not if – dynamic MPAs could be implemented. In this context, the following research questions were proposed by the stakeholders and scientists at the dialogue forum: What are the conditions for the acceptance of dynamic MPAs among stakeholders such as fishers? Could the protection of migration corridors for marine species between stable MPAs be an alternative to dynamic MPAs? What timeframes are needed to create MPAs under the BBNJ Agreement (including the time needed for the political discussions and negotiations)? What time is needed by stakeholders (like fishers) to be able to prepare for a shift of a MPA to a new location? How should a science-based review be structured for evaluating if a MPA needs to be moved to a new location and which review periods (e.g., biodiversity assessments of MPAs every 5 or 10 years) would be necessary? What scientific data can be used to set and reset the boundaries of a MPA? Can seafloors and their carbon storage potential also be included in MPA design? To answer these questions natural as well as social science expertise would be needed.

On a more general level, a stakeholder, who is experienced in international negotiations on marine biodiversity protection, stressed that there are very different concepts and understandings of MPAs one needs to be aware of in order to adequately understand MPA-related statements by stakeholders and decision-makers and communicate understandably with them.

Indicators

The discussion and recommendations related to biodiversity indicators focused on the question which and how biodiversity indicators could contribute to implementation and monitoring of the BBNJ Agreement and high seas MPAs. As an important challenge, the relatively high costs of gathering data on biodiversity in the high seas were discussed. Hence, it was recommended to consider the costs of the necessary measurements in development of indicator systems (e.g., for monitoring MPAs) and assess existing indicators and measurement systems, which are already being used (e.g., Argo[1]), for their suitability to provide valid assessment of high seas MPAs. One scientist stressed that - due to high costs of measurement in the high seas - regular data gathering on biodiversity in MPAs in the high seas will probably have to rely primarily on remote sensing. One further option mentioned to deal with the high costs of gathering data on biodiversity in the high

[1] International program that collects information from inside the ocean using a fleet of robotic instruments that drift with the ocean currents

seas is to develop indicators not only for the quality of biodiversity but also for the management processes to protect biodiversity, such as the global target to protect 30 % of the world's ocean and land areas by 2030. Although the achievement of such management goals can relatively easy be assessed, it was stressed that the selection of these management goals and indicators must be informed by science: An achievement of the 30 % target based solely on ocean areas with low relevance for biodiversity protection would generate only small effects for biodiversity protection.

Furthermore, the understandability of indicators for policy-makers was stressed as an important issue to generate indicators' impact on and use for policy. Complex scientific indicators could be ignored by policy-makers. The credibility and acceptance of scientific indicators among policy-makers and the potentially higher credibility of measured indicators compared to modeled indicators was also discussed. Here, a stakeholder, experienced in international negotiations on marine biodiversity protection, stressed that countries, which do not want any MPAs, would not accept them no matter how credible or scientifically valid the indicators are (see also section below for results of the breakout group on indicators).

Communication

Related to the issue of understandable indicators, recommendations by the participating stakeholders addressed the communication of scientific research on biodiversity on a more general level. Here, it was stressed that experiences from IPBES showed there is a need to develop capacities in the scientific community to communicate with different stakeholders because there are certain scientific terminologies (such as "risk" or "transformation") that are not familiar to everybody. If possible, this capacity should be strengthened in the BBO projects. Furthermore, the BBO projects should reflect upon their processes (in project management and dissemination products) for contributing to the uptake of their research results in decision-making. To generate policy relevance, it would also be helpful to systematically reflect on the value of the various scientific results by the BBO projects for policy-makers and how much information decision-makers actually need for making a decision.

Responding to this statement, a scientist described that she often does not know who needs to know of her research results. Hence, it would not only be necessary to know *how* to communicate with different stakeholders, but also *who* the stakeholders are that might be interested in the research results.

Generally, the need was stressed to improve the understandability and thereby the uptake of scientific reports addressing a non-scientific audience, such as IPBES reports. Here, also BBO scientists could become reviewers or even authors for these IPBES publications and make sure that knowledge produced in the BBO projects is included in IPBES publications.

A more specific stakeholder recommendation regarded communication especially to policy-makers: There, numbers should be included because numbers would have the potential to become very influential in decision-making as did the 2 or 1.5 degree targets in climate policy. Further ideas and recommendations on science communication were developed in a breakout group on the second day of the dialogue forum (see section below for results of the breakout group on communication products).

EU level

Regarding the European level, a stakeholder pointed out that there are scattered and partly overlapping responsibilities in different European institutions, for example, in the Directorate-General for Maritime Affairs and Fisheries (DG MARE) and the Directorate-General for Defence Industry and Space (DG DEFIS). Therefore, it would be very difficult to find the right agency for

matters in a EU context. Nevertheless, the stakeholder stressed the importance of considering the European level, because the EU is a signing party of the BBNJ Agreement and might take a coordinating role for the signing states in the EU. Additionally, the exclusive economic zones (EEZ) by European countries cover a significant portion of the world's oceans. One option for the BBO projects to become influential on the European level would be to contribute to the European Oceans Pact paper, which shall be published in June 2025. Another option to bring the BBO projects' knowledge into the EU was proposed by another stakeholder, as he highlighted that when the EU ratifies the BBNJ agreement, there might be a possibility to input during the ratification process, likely at the UN-Ocean Decade Conference 2025 in Nice. In any case, for analyzes of and recommendations for ocean governance, the BBO projects should consider the European level as an important level of decision-making.

Further recommendations and ideas

Linked to developing governance recommendations, related to the implementation of the BBNJ Agreement and due to the strong link between biodiversity protection and climate change mitigation, it was recommended to advocate for a close link between timelines of the COPs for the BBNJ Agreement and for UNFCCC.

Furthermore, it was recommended to think about a link to the Sustainable Development Goals (SDGs), which shall be achieved by 2030, and how the BBO project results could inform any subsequent agreements so that knowledge on protection of marine biodiversity is adequately included in a 2030+ agenda.

Related to the discussion on indicators, but also on MPAs and science communication, it was suggested to consider human well-being in the research of the BBO projects so that it becomes clear how impacts on biodiversity link to impacts on human well-being.

Breakout Groups on indicators, MPA-design and project products

On the second day of the dialogue forum the participants discussed three topics in three breakout groups. The three topics were:

- **Indicators**: Aligning key ecological indicators with indicators important to stakeholders
- Science-informed MPA-design: Aligning **timelines** of change with timelines of implementation
- **Products**: Aligning scientific products by the BBO projects with products important to stakeholders

Participants were divided into three groups that discussed the three topics iteratively, wandering from one topic room to next one. Discussion on each topic were facilitated by a scientist, who is an expert on the topic. In the topic rooms participants could write aspects they regarded as important on large sheets of paper (see Figure 5, Figure 6 and Figure 7)

Discussion on ecological indicators

The indicator group discussed a diverse range of issues related to biodiversity indicators. We started by the basis for the indicators and what indicators are actually already in use. All groups were aware of different indicators and also made suggestions about what other indicators might be useful. The great diversity of indicators and lack of robust data, on which to assess the scope of indicators, was apparent. Suggestions to cope with this were the production of fact sheets and a dashboard to visualize indicators. In this context, it was also discussed whether threshold based indicators were actually useful. All participants agreed however that indicators need to be simple enough to be broadly applicable and usable by as many practitioners as possible but at the same time specific

enough to be actionable. Furthermore, the need to better map potential indicators to relevant users (how many users need the same indicator) was discussed (see Figure 5 for further discussion points).

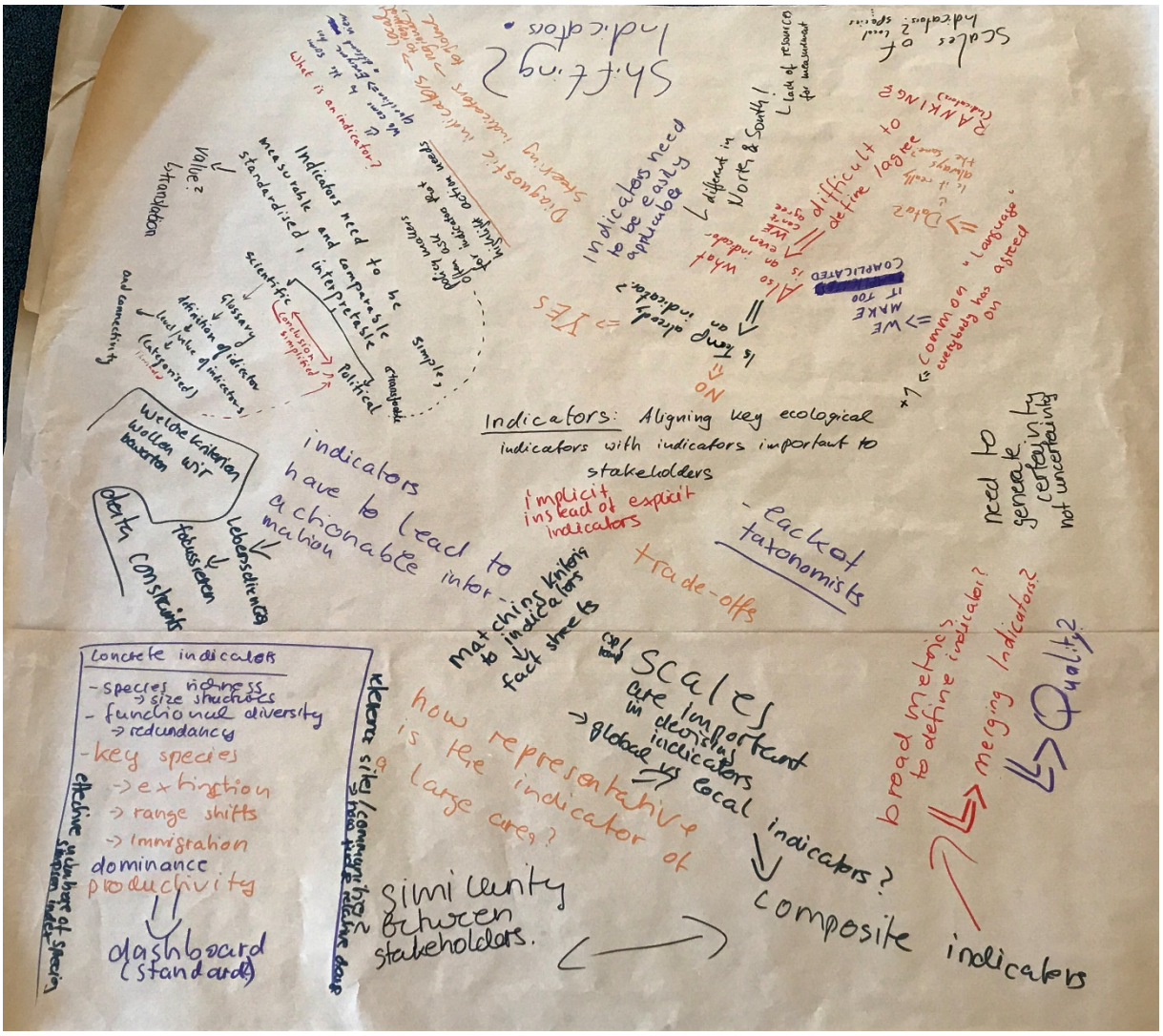

Figure 5: Biodiversity indicators breakout group – discussion aspects

Discussion on timelines

The group discussed four different time scales of science-informed MPA design in the context of the BBNJ Agreement. We found that the project timeline (another 2.5 years) aligns well with the potential implementation timeline of BBNJ. This gives the BBO projects a unique headstart, which may be useful in the context of establishing a national coordination board for BBNJ as well as the Science Technical Body at the BBNJ level. However, the BBO projects are not in line with the decades it (will) take(s) to implement MPAs. Moreover, these time scales are in potential conflict with the rate of biodiversity change. From range shift studies we see that on average marine ranges change by 60 km per decade, but maxima go up to 500 km per decade. Moreover, turnover rate calculations indicate that any increase in temperature will lead to increased community composition turnover. The regions of concerns – simultaneously potentially suitable for BBNJ MPAs – are moreover prone to data-shortages (see Figure 6 for further discussion points).

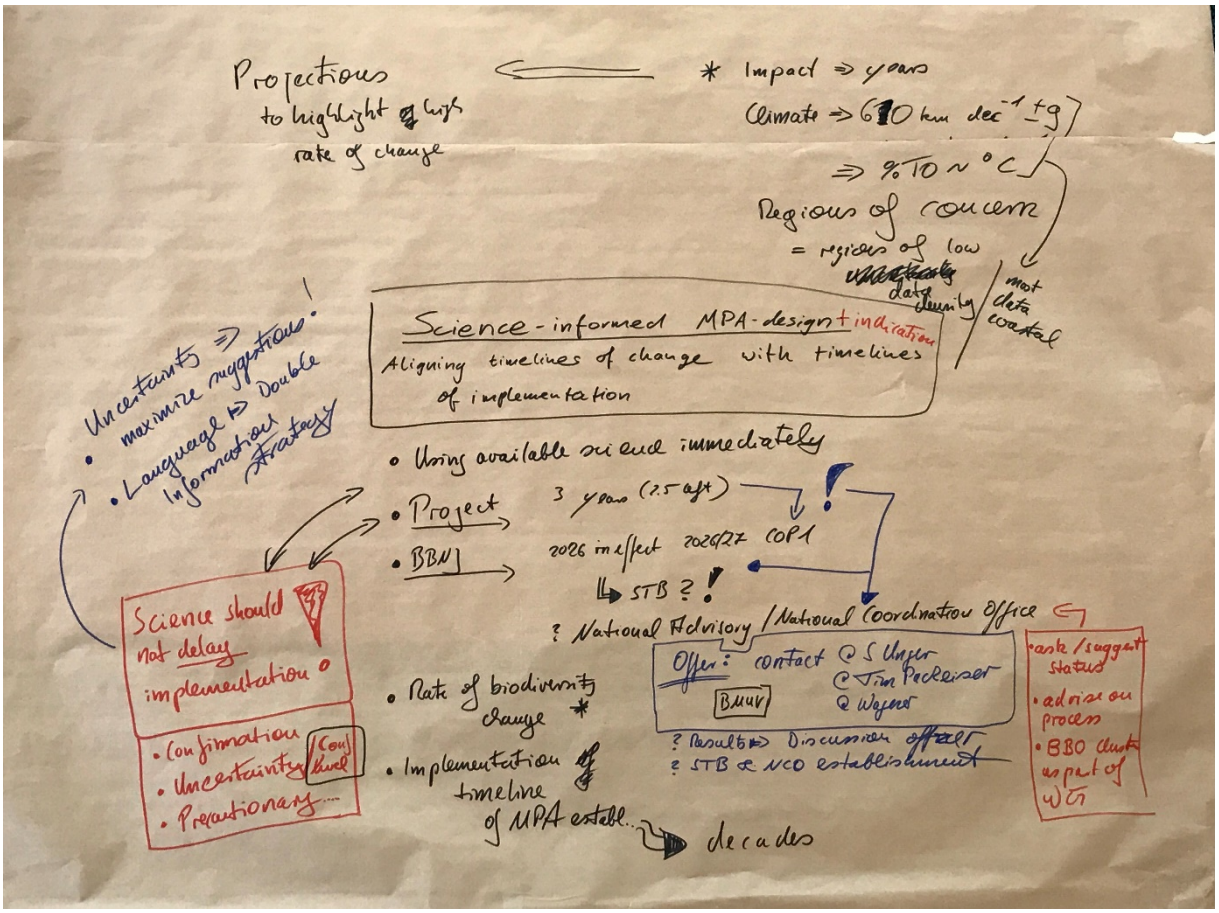

Figure 6: Timelines breakout group – discussion aspects

Discussion on project products

The group discussed the alignment of scientific products with those that are important and useful for stakeholders. A key focus was on ensuring that complex scientific models and data are translated into accessible formats, such as user-friendly interfaces/dashboards on websites, which can be effectively utilized by policy-makers.

A central point of discussion was a joint BBO website (plus own project websites), which could serve as a joint platform for sharing scientific insights. The website should include infographics to explain complex scenarios, employ storytelling techniques to highlight the societal value of the research, and maintain a high-quality, visually appealing design to engage diverse stakeholders. Additionally, the sustainability of such a platform was considered, emphasizing the need to transfer it to other projects or institutions after the end of the BBO projects to ensure its long-term continuation.

Beyond digital platforms, the group recognized how important it is to train communication skills in order to better communicate scientific findings. In addition, concise fact sheets or policy briefs (max. 2 pages) were suggested to summarize key findings and make them easily digestible for policy-makers. Furthermore, the potential role of social media was discussed as a tool to reach a broader audience, including the younger generation (see Figure 7 for further discussion points).

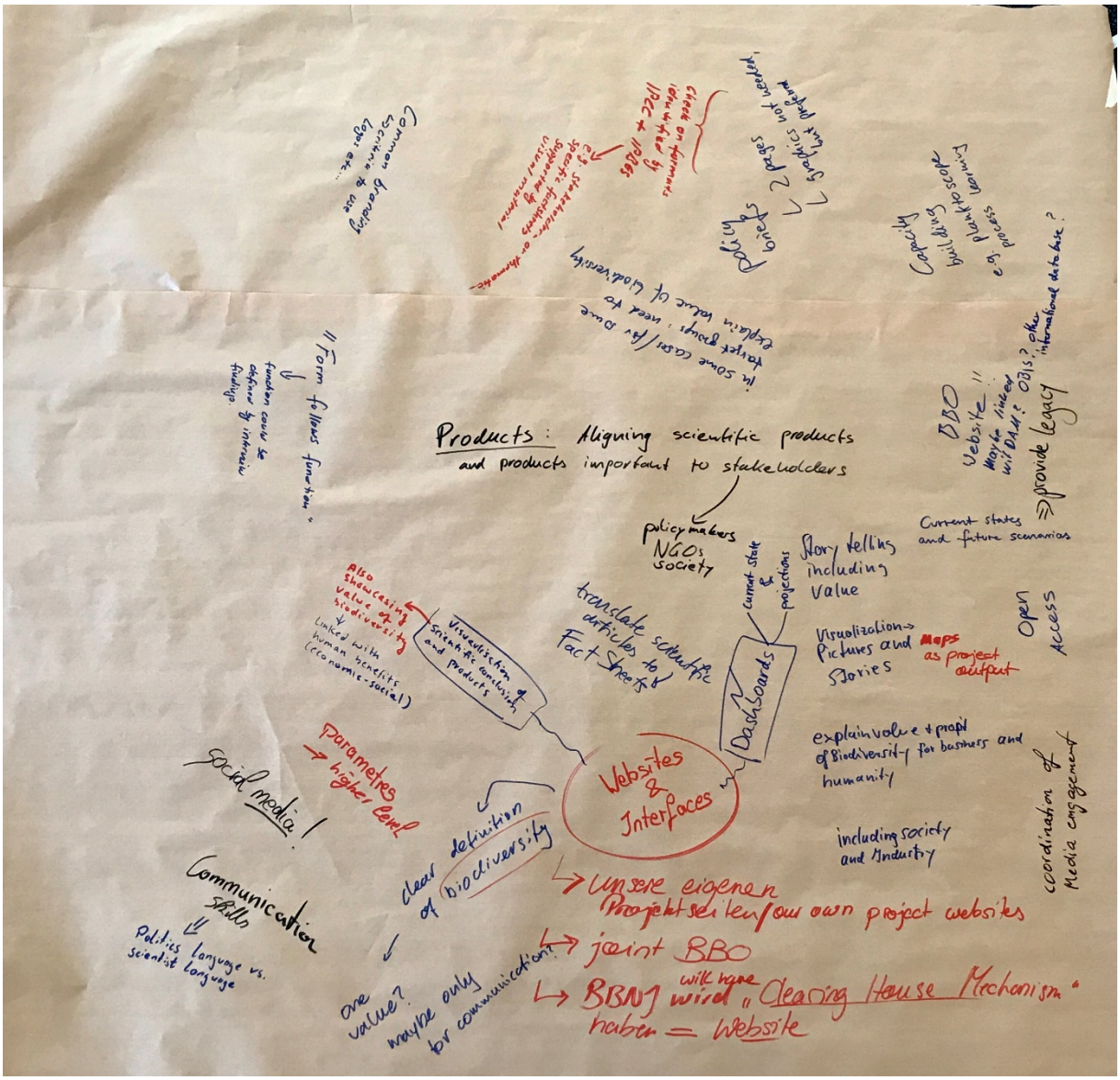

Figure 7: Communication products breakout group – discussion aspects

Interview with Prof. Dr. Hans-Otto Pörtner

One part of the programme was a thirty-minute interview with Prof. Dr. Hans-Otto Pörtner, who has worked on the IPCC for over 20 years and is still a member of the German Advisory Council on Global Change (WBGU) and an advisor in UN climate conferences. He is an expert on the dual crisis of changing climate and biodiversity and has invaluable insights, especially on the political side of these topics. He highlighted that for biodiversity change we are just at the beginning of global action and that biodiversity has yet to reach top levels of political agendas. For biodiversity one could learn from experiences on climate change mitigation on how to overcome political obstacles. Currently, he said, there is no political will to act on biodiversity loss and some actors would pursue a procrastination strategy to delay action, including delaying reports such as IPCC reports.

Pörtner stated, that we currently still have a fast closing window of opportunity - in 2022 this window was estimated to be open for another 20 years. Bending the curve would be essential as we are on track of losing species with irreversible results, but there are currently little signs that everybody is on board for the aim of bending the curve. He emphasized, that we need to elevate biodiversity

protection to a constitutional level, as the climate target is. By that “human energy” could be saved by putting the energy into implementing action rather than fighting procrastination strategies.

To get actors on board, Pörtner argued for better communication of current biodiversity loss and of a positive vision for the future. We should create narratives such as “healthy living on a healthy planet”. Due to their fear, people would escape into the denial of the crisis and thus positive solutions are needed and the interest of politicians must be gained. The biggest obstacle would be telling people to significantly change their current way of living.

Furthermore, there he stressed that there are knowledge gaps and needs for further scientific research, as we would not have a good understanding what happens to biodiversity with ongoing climate change. Unified principles to get a clearer understanding would be important - principles that are putting us as humans back into the concept of a natural world. Also, we should go beyond empirical research towards mechanism-based understanding.

Pörtner recommended to the scientists to become facilitators for the transformation and communicate with policy-makers but not every scientist would be qualified to do so. At least 50% of the ability to communicate would depend on personality, the rest would depend on the ability to formulate clear and concise scientific messages without ranting.

Finally, it was asked, how we would get the public and policy-makers to act. Pörtner suggested to start from scratch by modifying education and including biodiversity topics into schools. To convince society we would need to stress that we already know enough to act. Moreover, new scientific information would need to make it into the media but also repetition would be important to get the message to sink in (“repeat the same year by year”). As we are living on a shifting baseline, we would need to produce science at the same time as pushing action.

Next steps

Following the successful first dialogue forum of the BBO projects, where key stakeholders were engaged and research aims were co-designed, interviews with further stakeholders are now planned. These interviews aim to gather the expectations, wishes, and information needs of those stakeholders, who were unable to attend the first dialogue forum. This ensures that also their perspectives are incorporated into the ongoing planning and implementation of the BBO projects.

After integrating the information from these interviews with the stakeholder feedback from the first dialogue forum **two additional dialogue fora** will be organized:

- **Second Dialogue Forum** (1st quarter of 2026): This forum will focus on discussing interim results from the BBO projects with stakeholders. The aim is to enrich these findings with stakeholder knowledge and collaboratively refine approaches for addressing marine biodiversity challenges.
- **Third Dialogue Forum** (1st quarter of 2027): The final forum will focus on co-evaluation - present final results of the projects and evaluate them collaboratively with stakeholders. The aim will be to derive actionable recommendations for marine biodiversity conservation and ensure the long-term application of the developed measures and tools.

These steps provide an integrative framework for collaboration between science and practice, ensuring that the BBO projects are both scientifically robust and practically relevant.

Contacts

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Appendix: Presentations by the four BBO projects

1. AGELESS
2. IMAPP
3. INDIFUN-AI
4. BEnToolsMaps

Federal Ministry
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Biodiversity in the Blue Ocean (BBO) Cluster Dialogue Forum 1

Co-design of research for the protection of marine biodiversity

AGELESS, IMAPP, INDIFUN-AI, BEnToolsMaPs

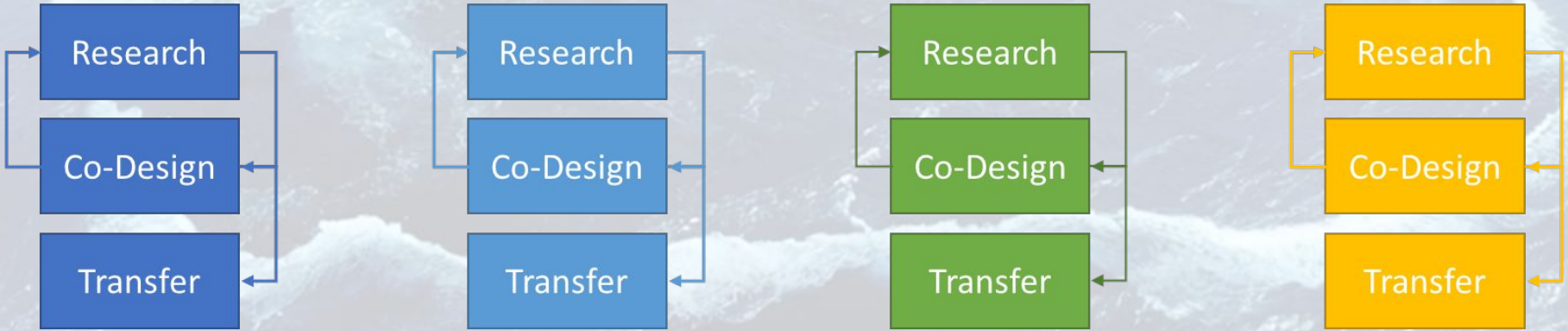
marum
Center for Marine
Environmental Sciences

CARL VON OSSIETZKY
UNIVERSITÄT
OLDENBURG

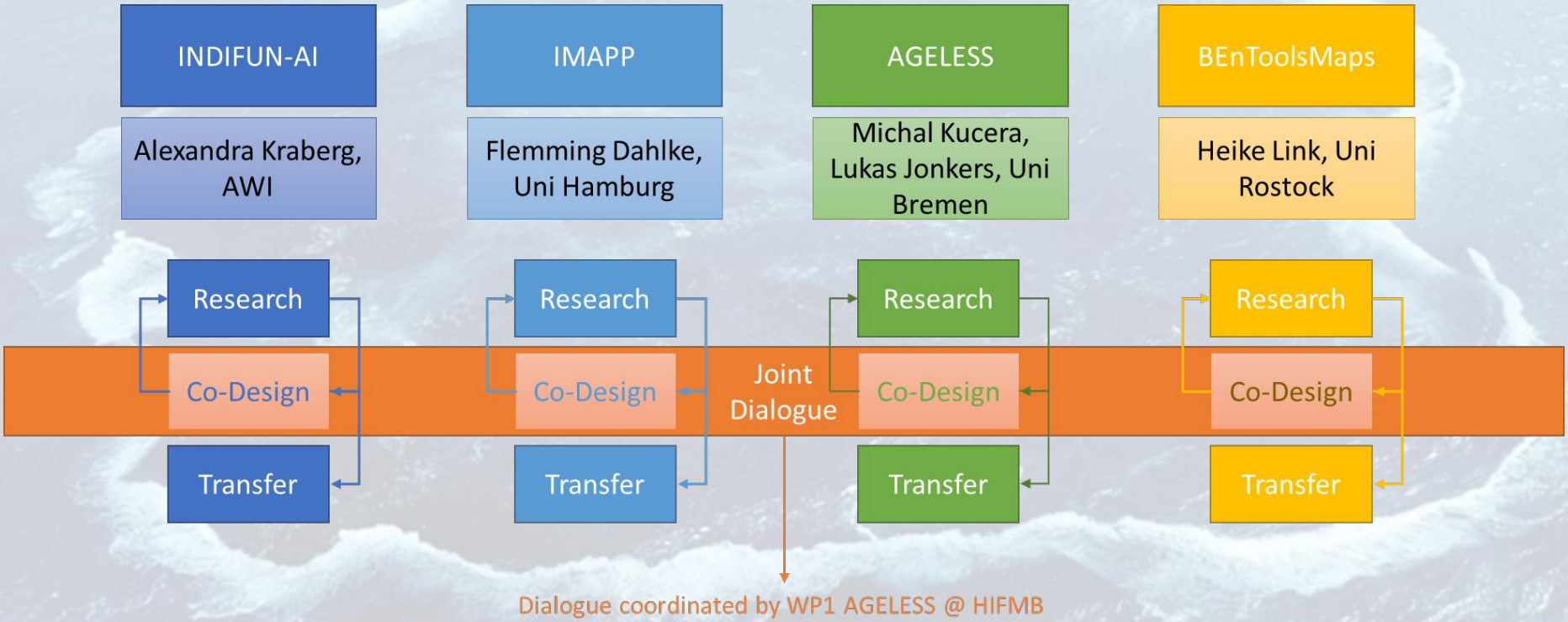
HIFMB Helmholtz Institute
for Functional Marine Biodiversity
at the University OLDENBURG

Projects, initially

INDIFUN-AI	IMAPP	AGELESS	BEnToolsMaps
Alexandra Kraberg, AWI	Flemming Dahlke, Uni Hamburg	Michal Kucera, Lukas Jonkers, Uni Bremen	Heike Link, Uni Rostock

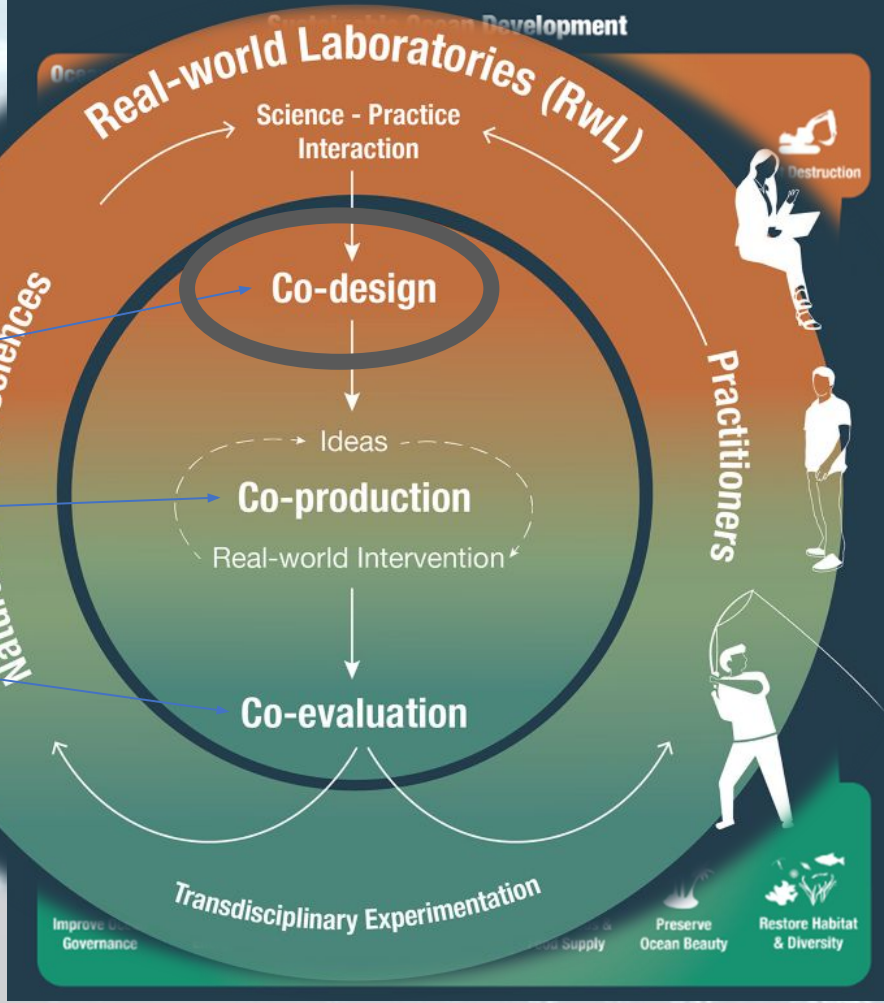


Projects, evolved



Dialogue Forum 1, 2, 3

1. Bremen: Quarter 1 of 2025
2. Hamburg: Quarter 1 of 2026
3. Bremerhaven: Quarter 1 of 2027



Franke et al. 2023 People and Nature

Answers of the BBO **Project Scientists** during the Kickoff

What are **your** expectations for the a successful stakeholder dialogue?

72 responses

1. collaboration
2. understanding
3. compromise



Previous session
Go back to current

(“)Co-Designing(”) Research Topics

What is possible under the BBNJ for biodiversity protection?

<u>Breakout groups:</u>

1. **Plenary** room:

A. **Science-informed MPA-design**: Aligning timelines of change with timelines of implementation

2. Room “**Sitzungsraum OG**”:

B. **Indicators**: Aligning key ecological indicators with indicators important to stakeholders

3. Room “**Dachgeschoss**”:

C. **Products**: Aligning scientific products with products used and important for stakeholders

Timetable for Dialogue Forum 1 (18. & 19.03.2025)

Day 1 (18 March 2025) - Stakeholder Forum

12:00 - 13:00 Arrival, lunch and registration

13:00 - 13:30 Introduction and **welcome** words by hosts and BMBF

13:30 - 15:00 Presentation of the Cluster **projects** and their objectives

15:00 - 15:30 Coffee break

15:30 - 17:00 Discussion with **stakeholders** about their **expectations**

17:00 - 18:30 Workshop: **Co-design** process for the BBO Cluster

19:30 Networking **dinner** at **Ratskeller**

Day 2 (19 March 2025) - Stakeholder forum

09:00 - 10:30 Topic-specific **break-out groups**: Plans for stakeholder engagement

10:30 - 11:00 Coffee break

11:00 - 11:30 Fireplace **talk** with Hans-Otto Pörtner (IPCC)

11:30 - 12:30 Plenary session: Presentation and discussion of the results of the break-out groups + survey

12:30 - 13:30 Lunch and **end** of the stakeholder forum

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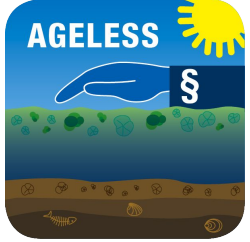


FONA
Research for Sustainability

AGELESS

Leveraging long-term planktonic diversity data to develop a framework to assess and protect biodiversity in areas beyond national jurisdiction

Jan-Claas Dajka

marum
Center for Marine
Environmental Sciences

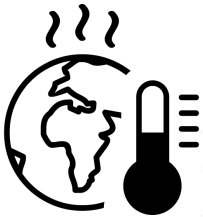
CARL VON OSSIETZKY
UNIVERSITÄT
OLDENBURG

FAU

HIFMB Helmholtz Institute
for Functional Marine Biodiversity
at the University OLDENBURG

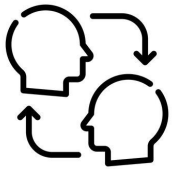
Problems AGELESS aims to address

- **Problem: Biodiversity is affected by climate change over a range of time scales**
  - Solution: Develop models that have been tested using the fossil record to predict and understand long-term marine biodiversity responses to climate change.
- **Problem: Difficult to implement protection measures in areas beyond national jurisdiction**
  - Solution: Co-design recommendations for governance strategies to effectively implement protection measures such as climate-smart MPAs in ABNJ.
- **Problem: Timelines of change and timelines of implementation are misaligned**
  - Solution: Science-informed MPA-design that applies co-design and co-evaluation methods for knowledge transfer, ensuring scientific findings are effectively communicated and integrated into policy-making processes.

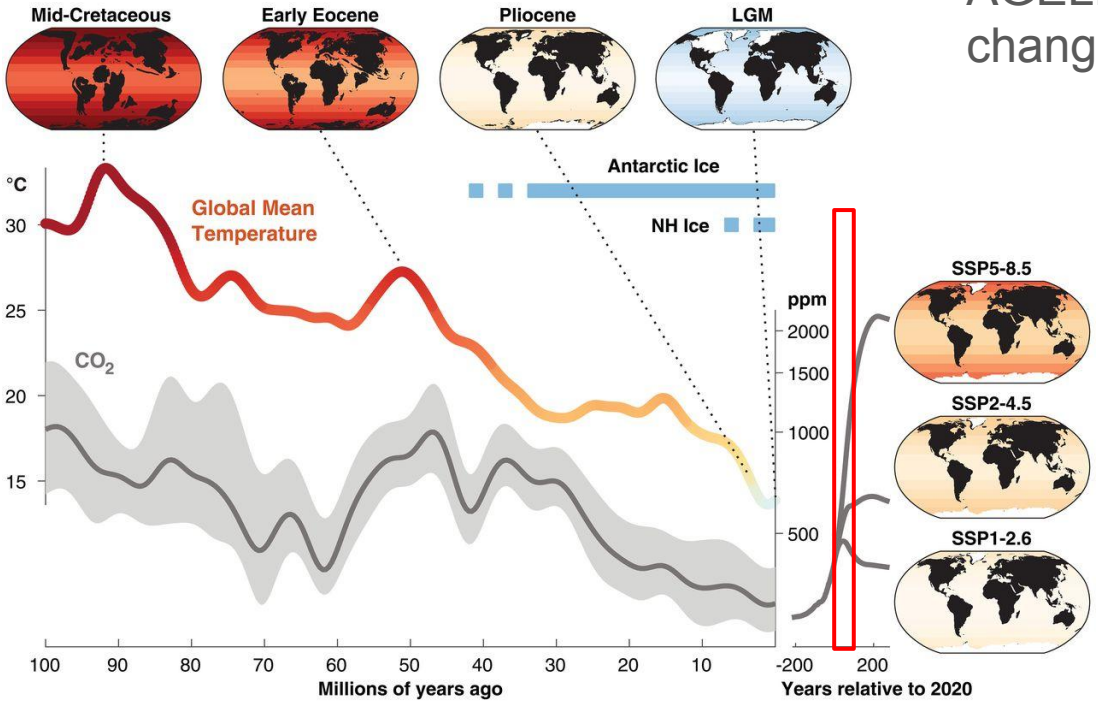








A long-term perspective for biodiversity protection



Tierney et al., 2020

AGELESS links biodiversity change with climate change

To **protect marine biodiversity** in a changing world, we need to know how marine communities respond to climate change.

To **predict the response** of marine biodiversity to climate change we need:

- An estimate of **baseline turnover**
- Knowledge on the **long-term response**
- Identify the **mechanisms** of change

Only the fossil record can provide observational constraints on these processes.

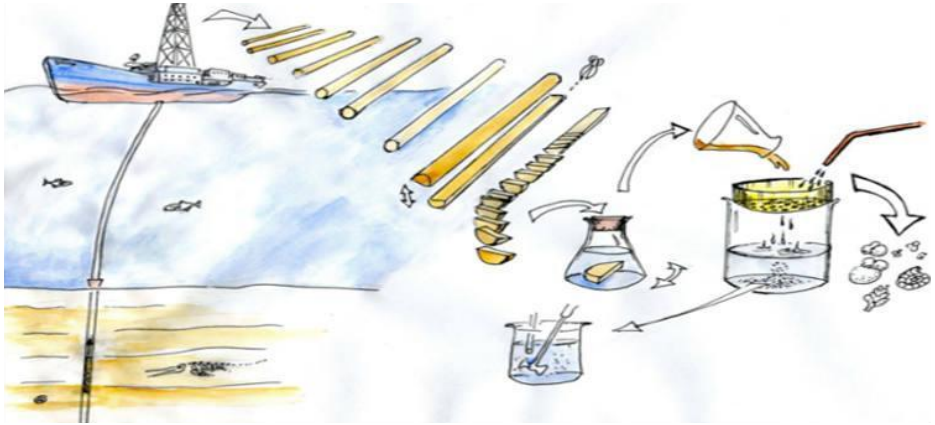
Reading the past using microfossils



Courtesy: Wilfried Rönnfeld

Microfossils: model system for marine biodiversity

Sediment cores provide time series of microplankton abundance



Courtesy: Simon Crowhurst

Geological data help to predict marine biodiversity response to climate change



We can learn from the past

- Past clade response consistent with observed climate-related stress (Reddin et al., Nature Climate Change, 2020).



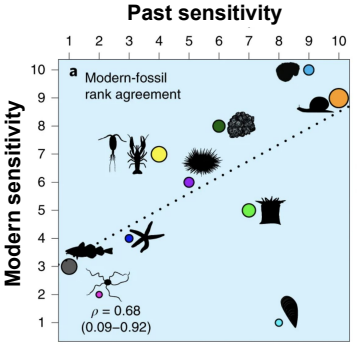
The past matters

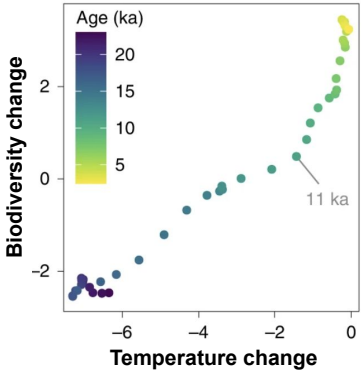
- Extinction risk controlled by interaction of short and long-term climate (Mathes et al., Nature Ecology and Evolution, 2021).



Potential of long-term effects

- Marine biodiversity continued to change for millennia following warming comparable to future predictions (Strack et al., Nature Ecology and Evolution, 2022).



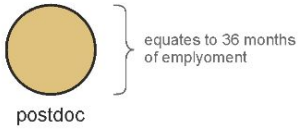


AGELESS structure

Partners and positions

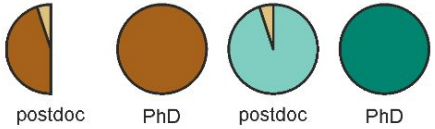
HIFMB Helmholtz Institute for Functional Marine Biodiversity at the University of OLDENBURG

PI: Jacob and Hillebrand



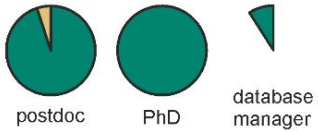
Carl von Ossietzky Universität Oldenburg

PIs: Siebenhüner, Freund and Blasius



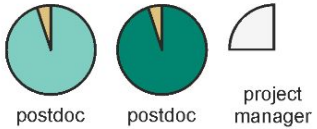
FAU

PI: Kiessling

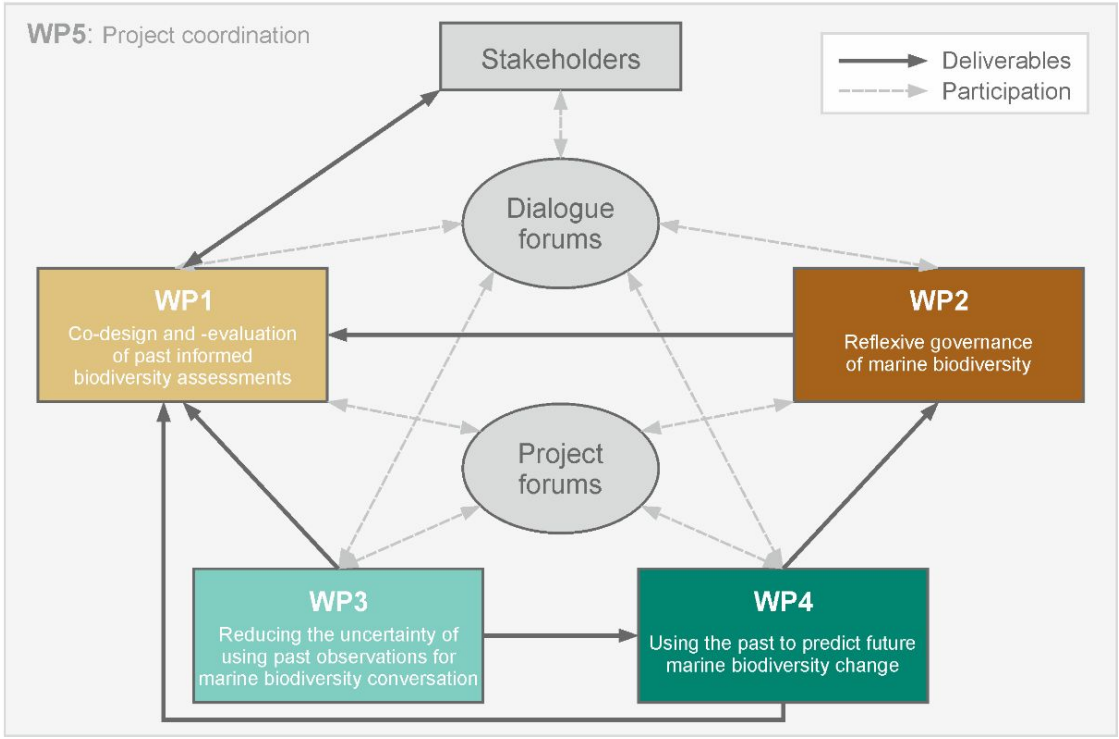


marum Zentrum für Marine Umweltwissenschaften Universität Bremen

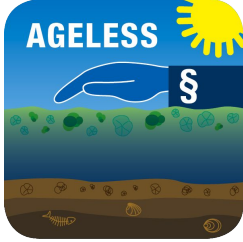
PIs: Jonkers and Kucera



Work package structure



AGELESS Objectives / Research questions



AGELESS addresses three critical needs:

1. Understanding Natural Variability: By utilising **geological records**, we aim to establish a **baseline for natural fluctuations in marine biodiversity**, which is essential for assessing the impact of climate change. **-> Better understanding of biodiversity-related problems**

2. Informing Practical Policies: Our research will lead to **actionable policy recommendations** (regarding effective science-policy interfaces and policy instruments) for **dynamic marine biodiversity conservation**. **-> Better understanding of solutions to biodiversity problems**

3. Facilitating Knowledge Transfer: We will create **platforms for dialogue** between **scientists**, **policymakers** and **stakeholders**, ensuring that **historical data and knowledge on effective governance informs current decision-making** processes regarding marine ecosystems.

Stay involved with AGELESS

Our main topic to discuss with you is “**Science-informed MPA-design: Aligning timelines of change with timelines of implementation**”

→ How to we stay in touch more instantly? Emails, newsletters, online meetings, …



Federal Ministry
of Education
and Research

Biodiversity in the Blue Ocean (BBO) Cluster Meeting

Co-design of research for the protection of marine biodiversity

AGELESS, IMAPP, INDIFUN-AI, BEnToolsMaPs

marum
Center for Marine
Environmental Sciences

CARL VON OSSIETZKY
UNIVERSITÄT
OLDENBURG

HIFMB Helmholtz Institute
for Functional Marine Biodiversity
at the University OLDENBURG

Timetable for Project Scientist Cluster Meeting

Day 2 (19 March 2025) - Cluster meeting

13:30 - 15:00 Discussion of the co-design **recommendations** of the stakeholder forum at BBO cluster level

15:00 - 15:30 Coffee break

15:30 - 17:00 Discussion of the recommendations for **individual projects**

19:30 Dinner at Ma

Day 3 (20 March 2025) - Cluster Meeting

09:00 - 10:30 Scientific **exchange**: scientific updates of the projects (**talks** and **posters**)

10:30 - 11:00 Coffee break

11:00 - 12:30 Finalisation of the **communication** and **participation plan** and project-stakeholder **work plans**

12:30 Departure

Stakeholder-List:

Birgit Klein (BSH: Argo Germany)
Susanne Schlaack (BMEL)
Mariam Akhtar-Schuster (IPBES)
Hans-Otto Pörtner (IPCC)
Stefan Hain (CCAMLR)
Frank Schweikert (High Seas Alliance: German Ocean Foundation)
Lydia Gustavs (BMBF: PtJ)
Anne Parge (BMBF: PtJ)



IMAPP: Prioritizing Marine Protected Areas in the Atlantic High Seas

Balancing ecological, economic, and legal considerations for sustainable ocean conservation

Problem Statement: Data Gaps in EBSA Areas

Convention on Biological Diversity

1 EBSA Definition and criteria

Ecologically and Biologically Significant Areas are scientifically defined **regions of high ecological importance but lack lega protection.**

- Uniqueness or rarity
- Importance for life-history stages
- Importance for endangered species/habitats
- Vulnerability, fragility, slow recovery
- Biological productivity
- Biological diversity
- Naturalness



2 Data Gaps

Converting EBSAs into Marine Protected Areas (MPAs) requires filling critical data gaps: ecosystem services (e.g., carbon sequestration, trophic interactions), climate vulnerability (risks to biodiversity and ecosystem stability), economic & legal constraints (fisheries, governance challenges)

3 IMAPP Solution

IMAPP enhances the EBSA knowledge base & develops decision-support tools for MPA designation.

The EBSA Network: Coverage & Protection Gap

EBSAs provide the scientific foundation for future marine protection, but a significant implementation gap exists between identification and actual protection.

>321

EBSAs Identified globally

Scientific areas recognized for high ecological significance worldwide

20%

Ocean Coverage

Portion of global oceans designated as EBSAs

1%

High Seas MPAs

Minimal actual protection despite EBSA identification

0

Automatic Protection

EBSAs require additional steps to become protected areas

IMAPP focuses on bridging this gap by developing tools to transform Atlantic EBSAs into effective Marine Protected Areas under the BBNJ Agreement.

Supporting Spatial Prioritization for MPAs

1

Refining EBSA Boundaries

IMAPP uses **advanced spatial analysis to optimize and refine conservation priorities** within existing EBSAs, ensuring protection efforts target the most critical areas.

2

Climate Resilience Assessment

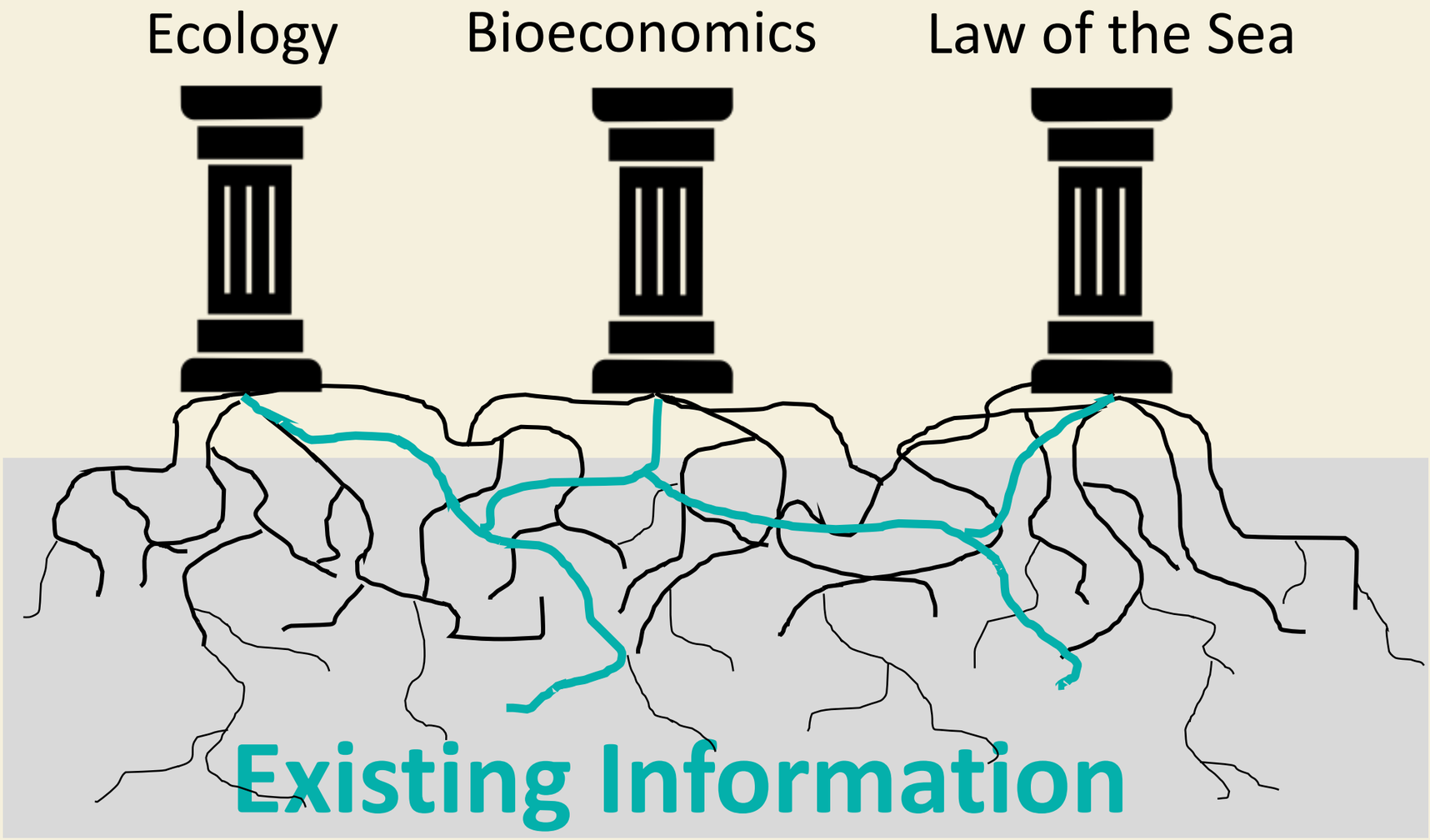
IMAPP **identifies high-priority areas for protection** based on future climate scenarios and anthropogenic pressures, building resilience into conservation planning.

3

Habitat Connectivity

IMAPP **identifies corridors between EBSA-based MPAs**, such as whale migration routes and larval dispersal pathways, **maintaining ecosystem integrity**.

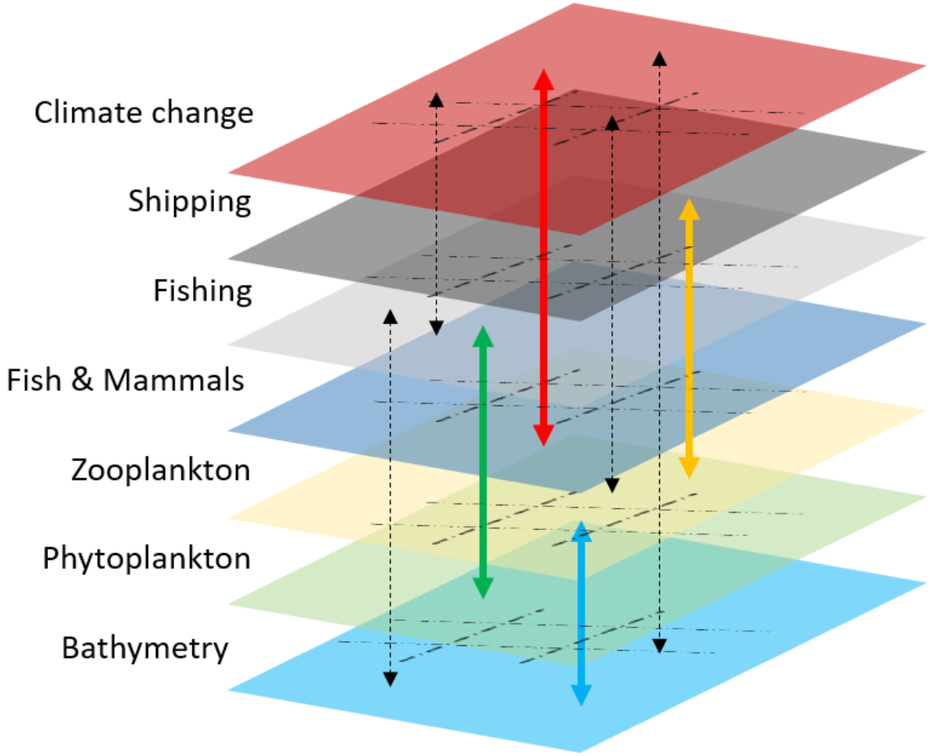
Guidelines for balancing conservation priorities with economic and legal interests in the High Seas



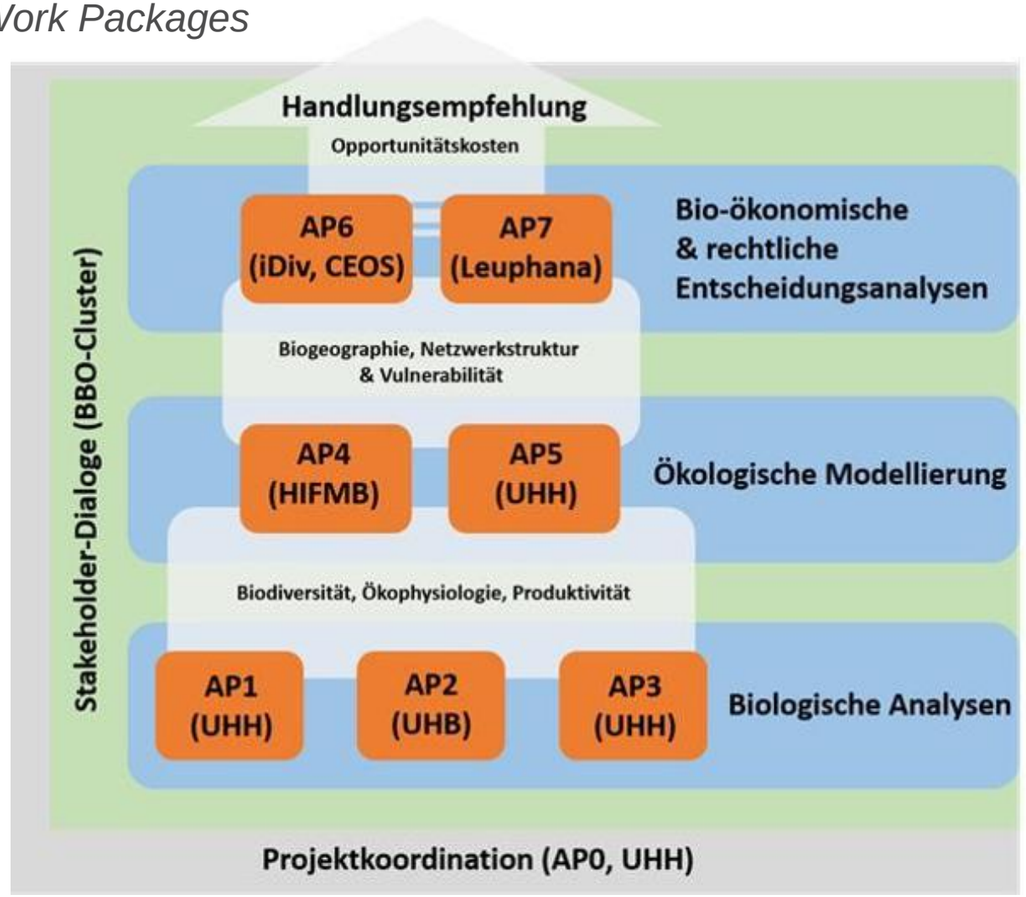
IMAPP Research Structure

IMAPP is structured into **seven work packages (WPs)**, each addressing key ecological, economic, and legal aspects related to marine biodiversity conservation and MPA prioritization.

Spatial Data Layers



Work Packages



IMAPP Consortium

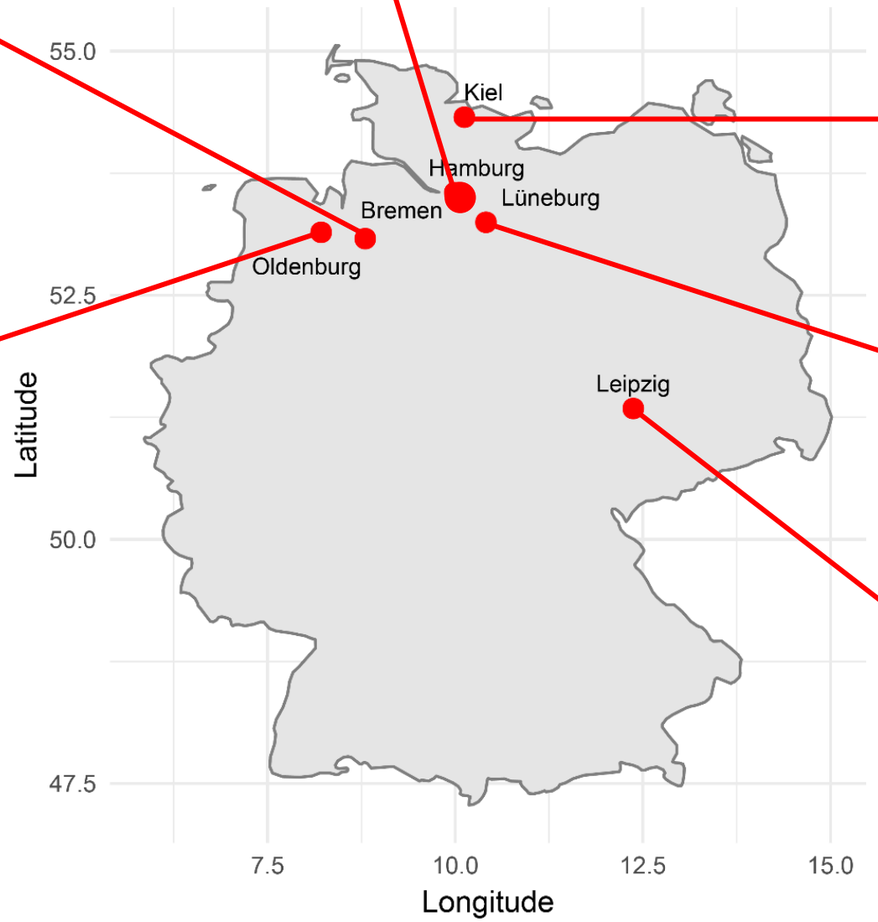
Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

Chhaya Chaudhary
Rolf Koppelmann
Helena Herr
Henriette Horn
Nicole-Aberle Malzahn
Sacha Viquerat

Molly Showers
Christian Möllmann
Flemming Dahlke

Universität Bremen

Holger Auel
Simon Jungblut



Center for Ocean and Society

Marie-Catherine Riekhof
Biao Huang

HIFMB Helmholtz Institute for Functional Marine Biodiversity at the University OLDENBURG

Thilo Gross
Kate Maia

LEUPHANA
UNIVERSITÄT LÜNEBURG

Valentin Schatz
Alice Bertram

iDiv
German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig

Martin Quaas

Ecological Research & Biodiversity Assessments

1

WP1: Plankton Biodiversity (Uni Hamburg)

Maps phytoplankton and micro-zooplankton diversity in the Atlantic using expedition data and remote sensing. Assesses primary productivity and trophic energy flow to **identify key regions supporting marine food webs**. Evaluates plankton responses to climate change and their role in carbon sequestration.

2

WP2: Zooplankton & Micronekton (Uni Bremen)

Analyzes mesozooplankton and micronekton species distributions across EBSA regions. Investigates their role in nutrient cycling and trophic connectivity in the pelagic ecosystem. **Quantifies carbon export via the biological pump to support ecosystem service valuation**.

3

WP3: Fish & mammals (Uni Hamburg)

Maps fish and invertebrate distributions based on historical and new datasets. **Analyzes diversity and abundance trends of commercially important species**. **Assesses whale occurrence and migration routes** for MPA network optimization.

Ecosystem Modeling & Climate Impact Assessments

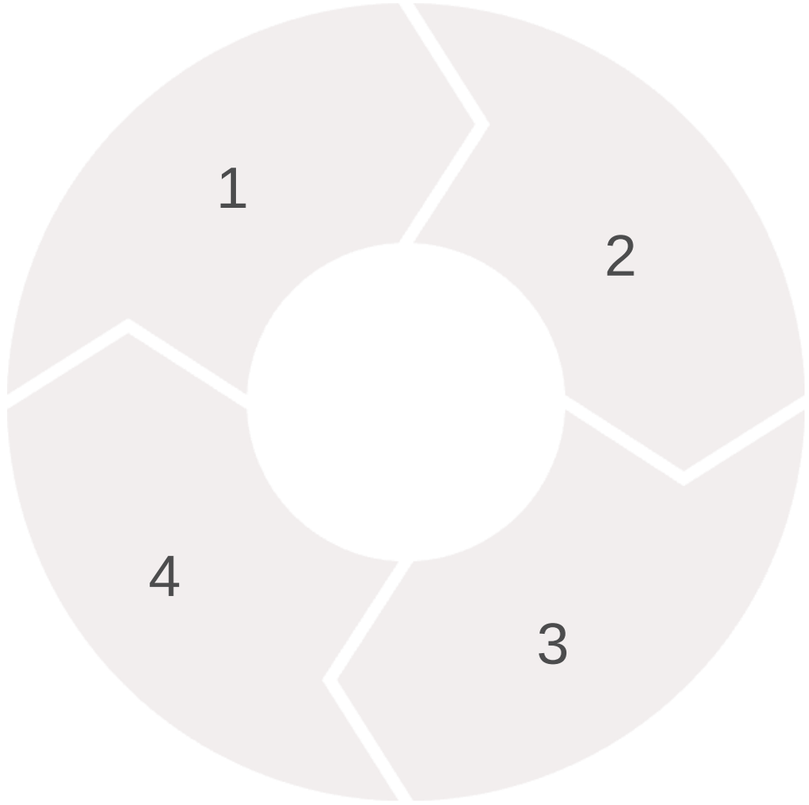
Work packages 4 (HIFMB) and 5 (Uni Hamburg) include spatial analyses based on the data collected in WP1-3. **Different modeling approaches are used to depict large-scale patterns in diversity**. Anthropogenic activities such as climate change, fishing and shipping are taken into account. This data forms the basis for the prioritization of protected areas based on the EBSA criteria.

Predictive Modeling

Developing ecosystem models to predict future biodiversity shifts due to climate change and human activities

Biodiversity Integration

Integrating species distribution models to predict biodiversity hotspots under different climate scenarios



Stability Assessment

Assessing trophic network stability under different stress scenarios including overfishing, shipping and warming oceans

Resilience Mapping

Identifying climate-resilient areas that should be prioritized for protection

Fisheries Economics & Spatial Prioritization

Work Package 6 (Uni Kiel/CEOS & iDIV) **addresses the critical economic dimensions of marine conservation**. By quantifying both costs and benefits of protection measures, IMAPP helps policymakers make informed decisions that balance ecological needs with human livelihoods.

Opportunity Cost Analysis

Estimating economic impacts for fisheries when establishing MPAs, including short-term costs and long-term benefits for sustainable fishing.

Trade-off Assessment

Analyzing economic trade-offs between marine conservation and resource use, including commercial fishing and shipping routes across different regions.

Prioritization Modeling

Developing spatial models that balance conservation goals with economic activities to identify optimal MPA locations that minimize conflicts.

Future Projections

Projecting long-term economic impacts of MPAs under different climate and policy scenarios to inform sustainable development planning.

Governance Models & Stakeholder Integration

Work Package 7 (Leuphana Uni Lüneburg) **focuses on the legal dimension of marine conservation**. By ensuring stakeholder engagement and co-design of protection measures, IMAPP aims to develop science-based conservation policies that are socially accepted and effectively implemented across international boundaries.

Legal Framework Assessment

Assessing existing legal frameworks for MPAs in areas beyond national jurisdiction (ABNJ) to identify regulatory gaps and opportunities for improvement.

Governance Challenge Identification

Identifying key governance challenges and policy gaps in international ocean protection that hinder effective implementation of conservation measures.

Stakeholder-Informed Scenarios

Developing inclusive governance approaches that incorporate diverse perspectives from fishing communities, conservation groups, and industry representatives.

International Collaboration

Collaborating with **CBD, BBNJ, and regional ocean governance bodies** to enhance EBSA-MPA transitions and ensure policy coherence across jurisdictions.

Stakeholder Input Needed to Achieve IMAPP's Goals

1 Marine Area Significance

Which marine areas do stakeholders consider ecologically significant?

2 Biodiversity Monitoring Gaps

Are there data gaps in biodiversity monitoring that need to be addressed?

3 Protection Priorities

What species, habitats, or ecosystem services should be prioritized for protection?

4 Existing Conservation Initiatives

Are there existing conservation initiatives (MPAs, fisheries closures, EBSA updates) that should be considered?

5 MPA Selection Criteria

What criteria should be used for selecting MPAs? (e.g., climate resilience, connectivity, ecosystem services)

Federal Ministry of Education and Research

FONA
Research for Sustainability

INDIFUN-AI

Innovate ‘Pressure-state’ indicators for biodiversity change based on a globally unique plankton data set, using state-of the art machine learning statist

LEIBNIZ-ZENTRUM für Marine Tropenforschung

Alexandra Kraberg
For the INDIFUN-AI Team

AWI

University of Bremen

Carl von Ossietzky Universität Oldenburg

DATA SCIENCE CENTER

GEOMAR

Aqua Ecology

Problems INDIFUN-AI aims to address



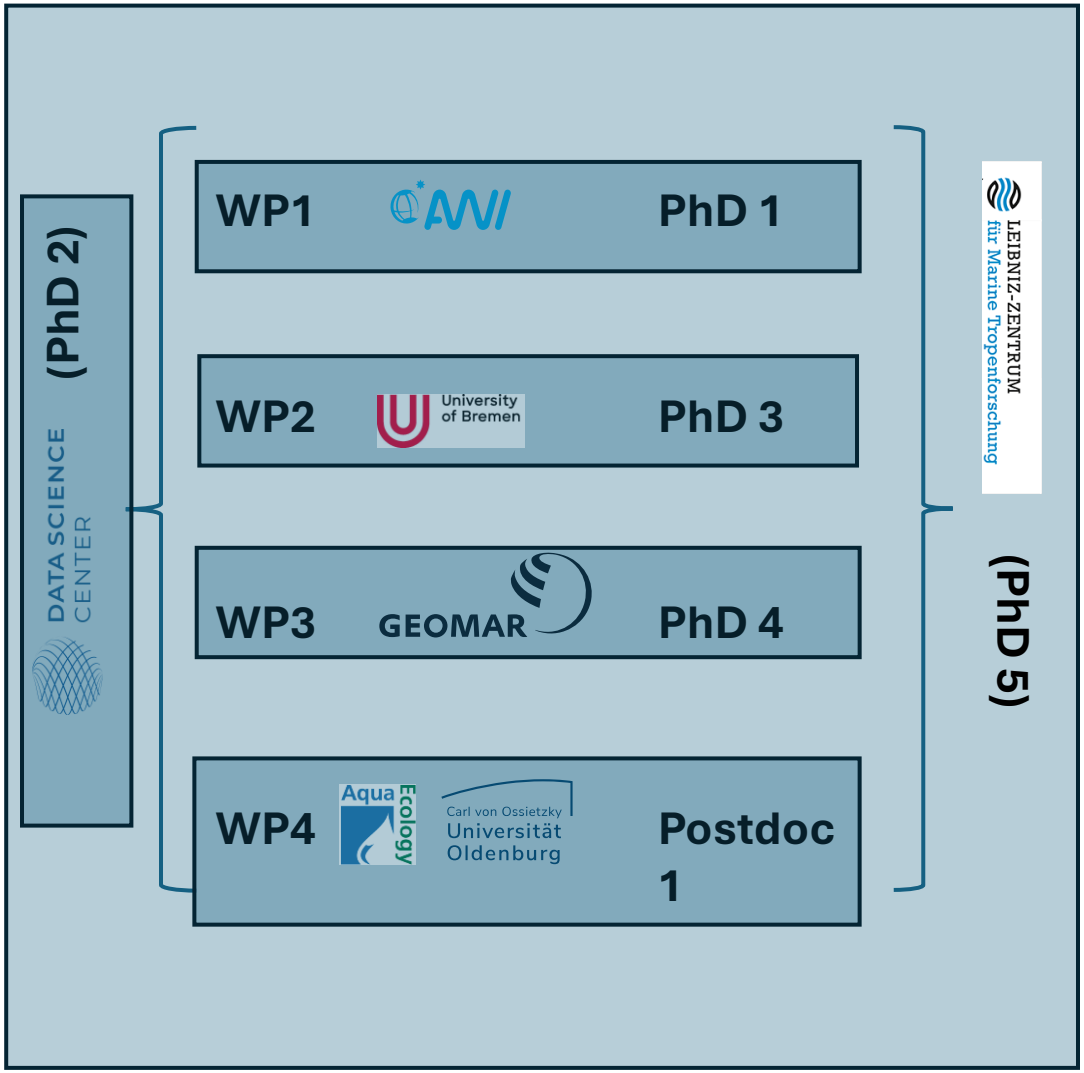
- **Problem:** Biodiversity data are increasingly complex with manual counts combined with data from high throughput imaging devices (e.g. planktoscope)
  - **Solution:** use good data science practices and advanced statistics to produce an integrated data set **(INDIFUN-AI data set)** for later analyses

- **Problem:** Biodiversity assessments are often made on incomplete community data, as not all taxonomic groups are assessed
  - **Solution:** combine different observation technologies and laboratory experiments to understand neglected biodiversity components e.g parasites and saprotrophic fungi

- **Problem:** Biodiversity change is often assessed using biodiversity indicators. However, the scientific basis for these indicators is often insufficiently known
  - **Solution:** Use the INDIFUN-AI data set to develop robust relationships between biodiversity and ecosystem states,

- **Problem:** The scope (spatially and temporally) of biodiversity indicators is insufficiently understood.
  - **Solution**: Make them adaptable. Using AI-based statistics we will evaluate indicator performance thus allowing better recommendations about their scope

INDIFUN-AI WP structure and partner tasks



AWI: Project Co-ordination, planktoscope, data provision and analysis

UIB: Mycoplankton dynamics, diversity

GEOMAR: Functional role of mycoplankton (laboratory)

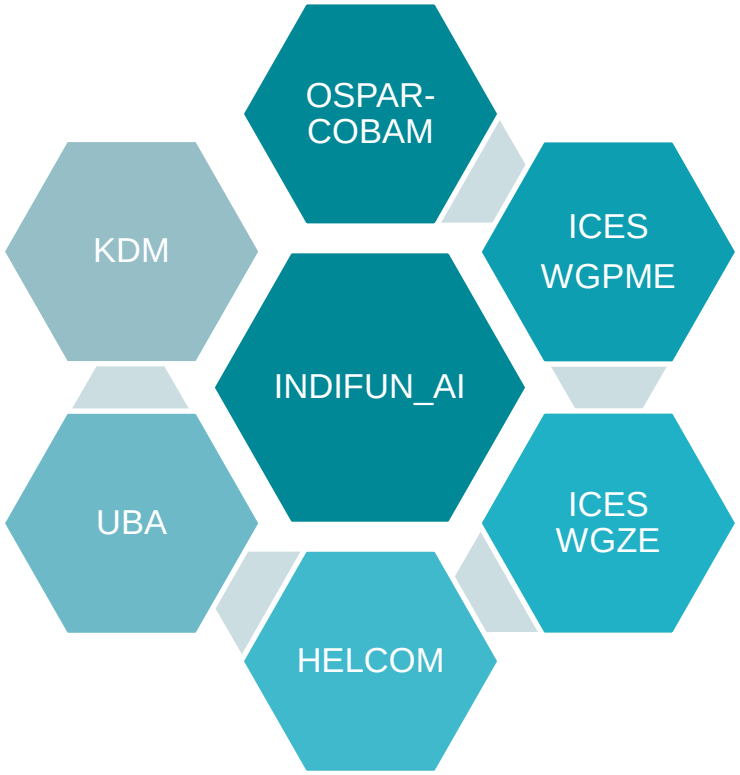
UIO: Development of new indicators

Aquaecology: Testing scope of existing indicators, link to relevant stakeholder

DSC: Data science support, adaptable indicator development

Stakeholder Interactions (WP5)

Goal: Assure relevance and ease of use of newly developed indicators

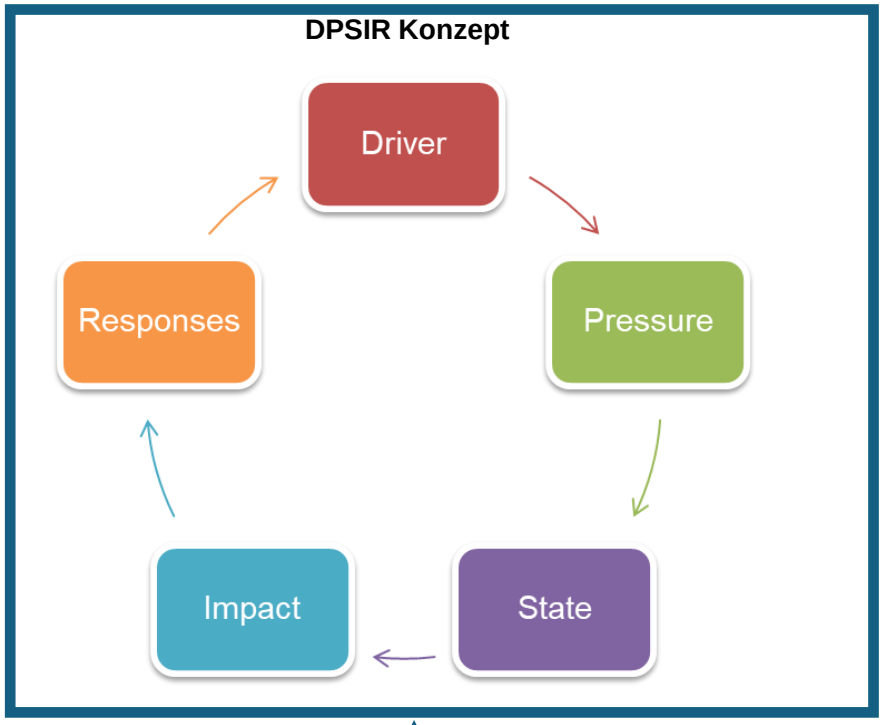


Recommendations:

- Definition of key organisms for regular monitoring
- new/improved biodiversity indicators
- Roadmap for the establishment of low-cost high resolution monitoring tools **(Planktoscope, PhD)**
- **Online Tool** for the calculation of indicators

ZMT: Manage stakeholder interaction process, especially establishment of planktoscope as monitoring tool (PhD 5)

Why indicators?



Statistics/: Explorative analyses, k-means clustering, decision trees, diffusion maps

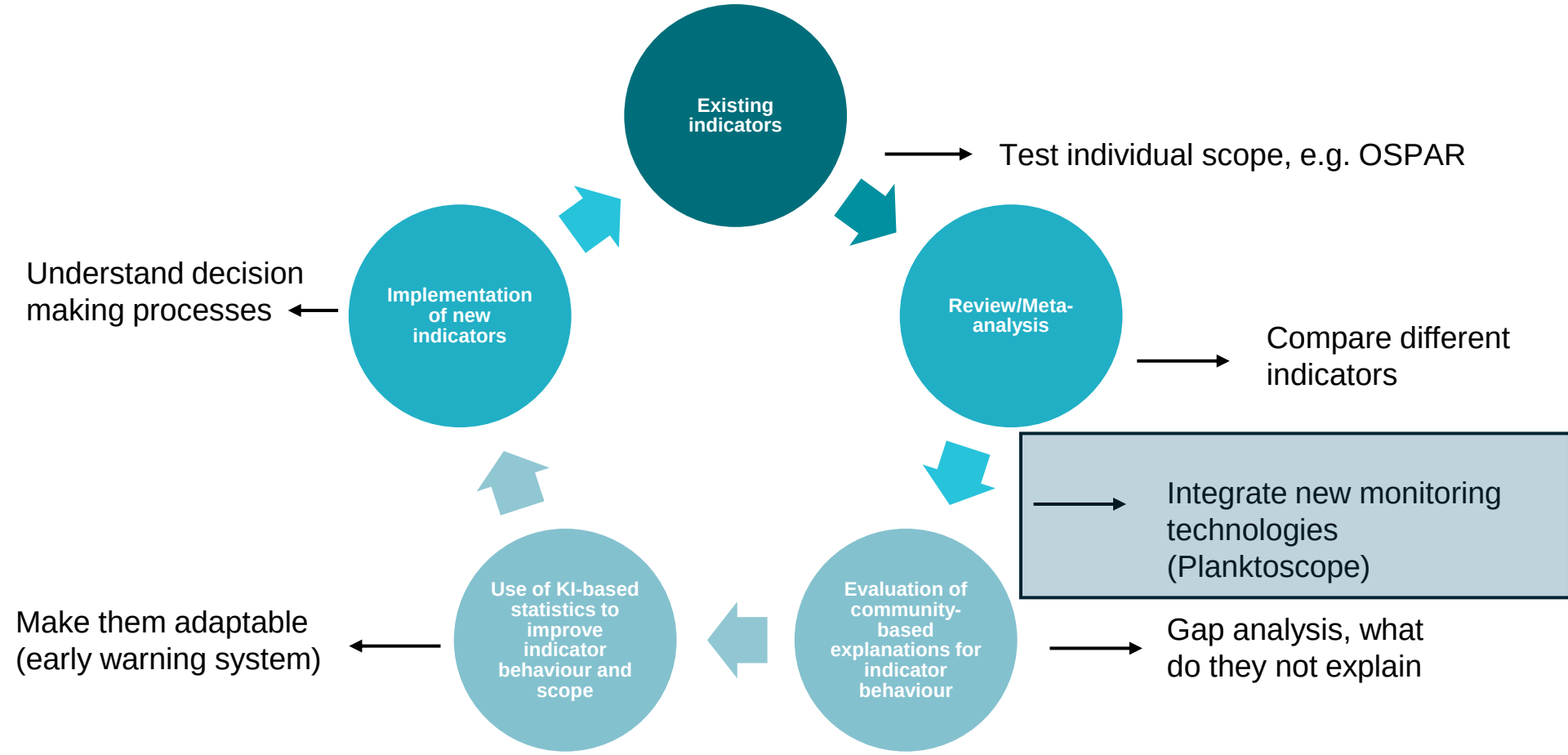
Goal: Extract simple indicators representing complex relationships as a basis for decision making

Problem:

- Drivers/Pressures are often not defined well
- →the scope of different biodiversity indicators is unclear
- Traits of individual taxa used in indicators not sufficiently known
- Many taxon groups (e.g mycoplankton) not included in indicators

INDIFUN-AI

Biodiversity indicators using INDIFUN-AI data

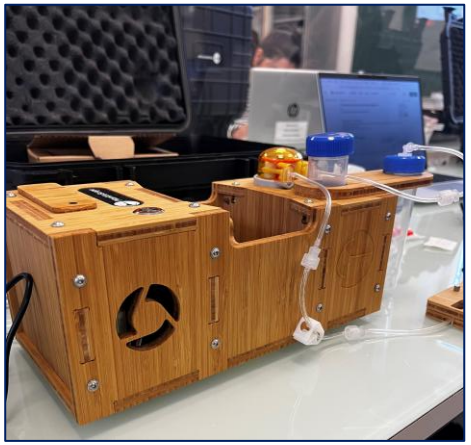


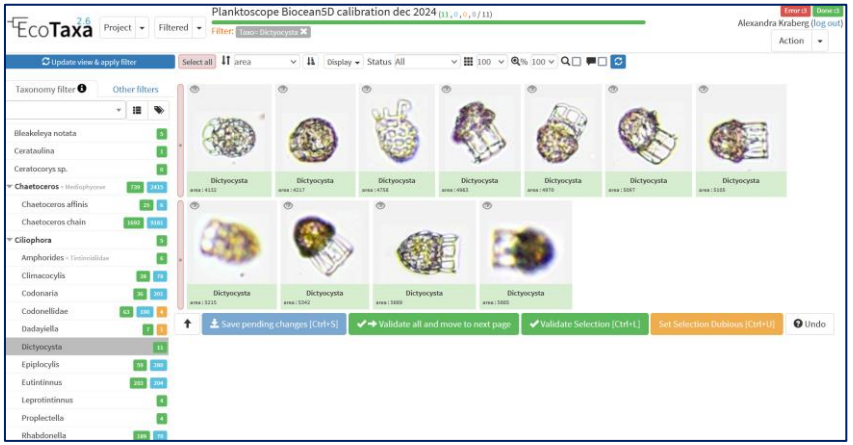
Integrating data from existing and novel monitoring technologies

Region	Project	Sample type	Status of analysis	Time frame
Central Arctic	MOSAiC	Microscopy/Metabarcoding (PMZ) pigment data (P) in situ images (Z) Environmental data	Partially analysed Partially analysed PANGAEA PANGAEA	2019 - 2020
	Various cruises	Microscopy (PMZ) pigment data (P) in situ images (Z) Environmental data	Gaps (PM) PANGAEA Partially analysed PANGAEA	20?? - 2022
Core	Fram Strait	Microscopy (PMZ) Metabarcoding (PMZ) pigment data (P) in situ images (Z) Environmental data Primary production	Partially analysed (PM) Partially analysed (MZ) PANGAEA Partially analysed PANGAEA	2009 – 2022 (P) 2011 – 2022 (Z)
Subarctic		Molecular data	Ready for further analysis	
		Phytoplankton net samples	To be analysed	Since 2019
All	Historic data	Literature, Scientific databases (e.g. OBIS, PANGAEA)	Analysis is ongoing	prior to 2010

Geographic Focus: Arctic and Sub-Arctic

Planktoscope

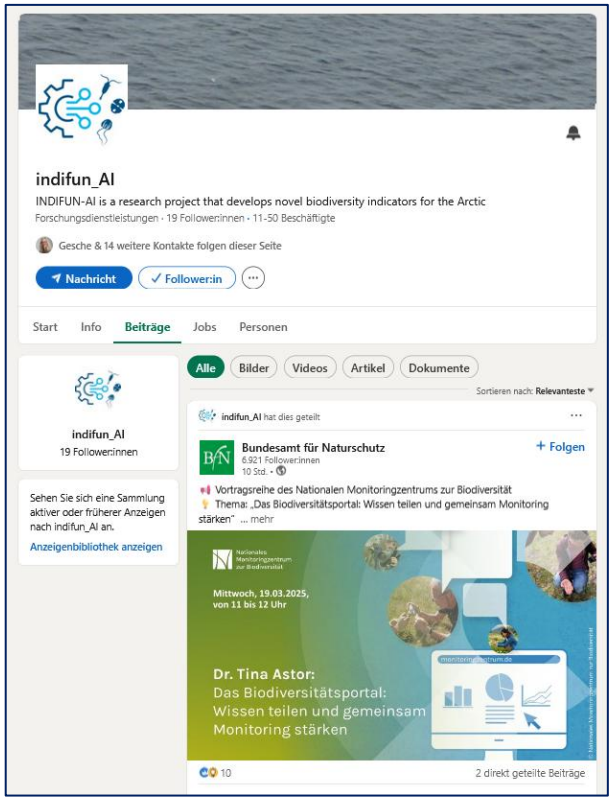




Stay involved with INDIFUN-AI

Our main topic to discuss with you: **“Requirments for adaptable biodiversity indicators – how can we incorporate them into existing indicator frameworks”**

Indifun-AI website: https://www.awi.de/forschung/biowissenschaften/polare-biologische-ozeanographie/indifun-ai.html





LinkedIn https://www.linkedin.com/company/indifun-ai/posts/?feedView=all&viewAsMember=true

INDIFUN-AI Objectives/Research questions

- introduction of low-cost imaging tools (Planktoscope) to process existing phytoplankton samples **(WP 1).**
- Produce an integrated data set of phytoplankton and zooplankton from the Hausgarten LTER and surrounding areas including both existing data and analysis of samples processed in WP1 **(WP2).**
- Carry out an analysis of the diversity of plankton based on the entire integrated data set and identify the dominant physico-chemical drivers of community composition **(WP2).**
- Explore machine learning tools to develop indicator systems for different ecosystem states and relate indicators to concrete pressures based on identified drivers and key taxa **(WP 2 and 4).**
- Carry out a case study to incorporate an under-investigated taxon group (mycoplankton) to produce a biodiversity baseline to monitor and mitigate against future biodiversity losses **(WP2).**
- Establish a dialogue with stakeholders and political actors during the development phase of the indicators to ensure that the developed metrics are relevant, locally meaningful and practical as a day-to-day monitoring tool **(WP5).**

BEnTools MaPs

From **B**iodiversity to **E**cosystem Fu**n**ctions: Seafloor **Tools** for Integrative **Ma**nagement of Marine **P**rotected Area**s**

heike.link@uni-rostock.de

FONA
Research for Sustainability
GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

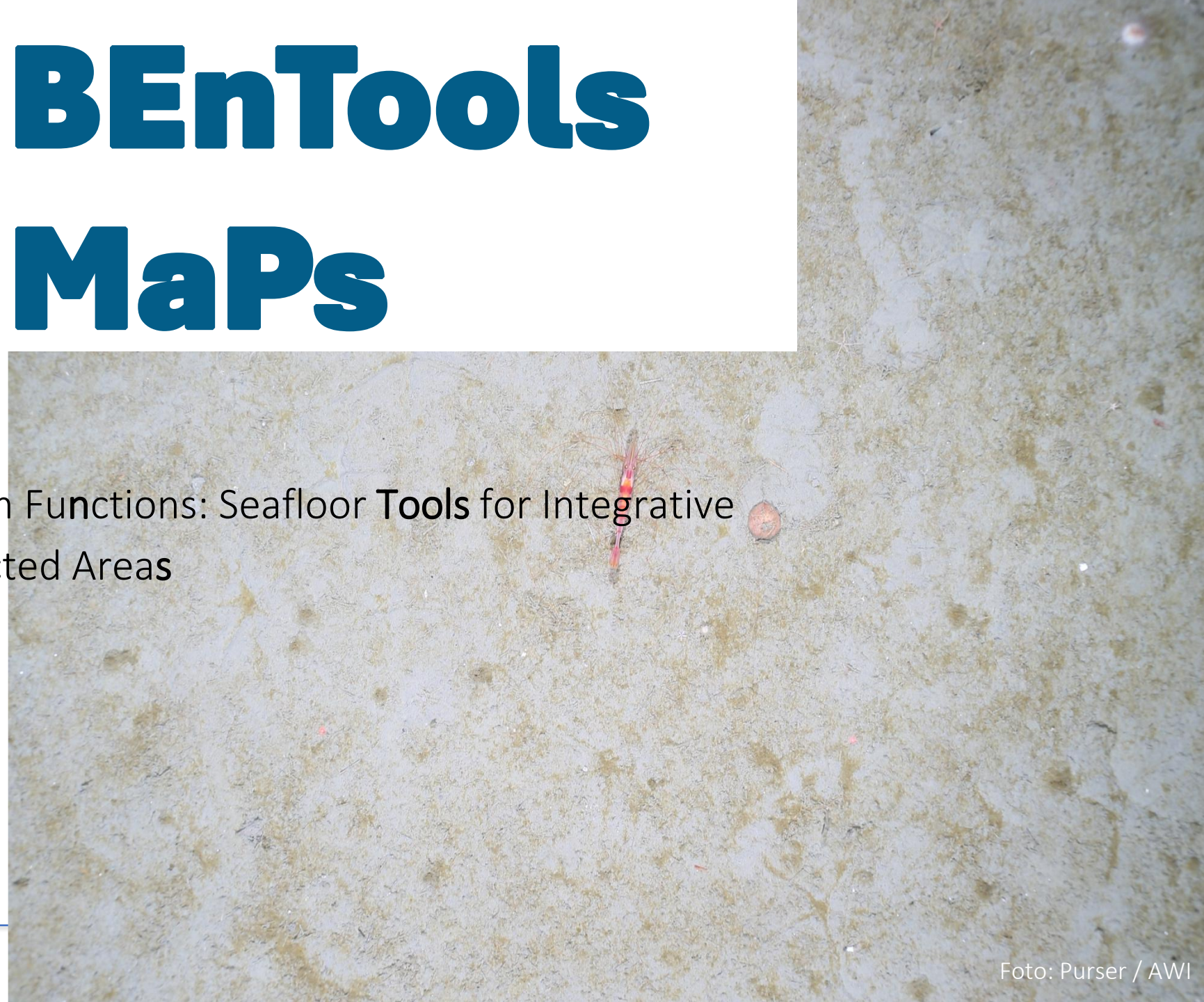
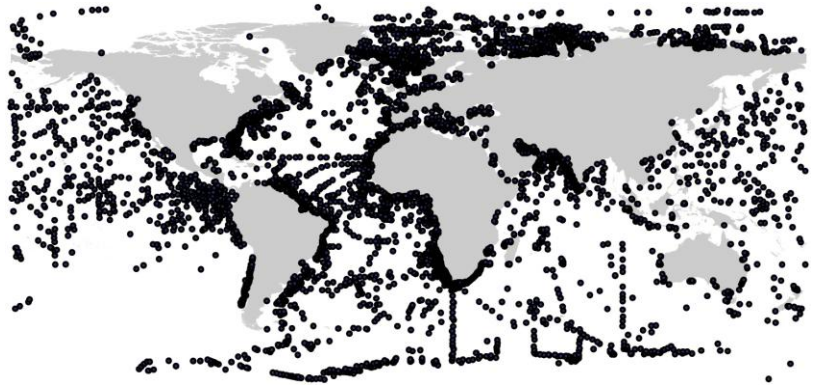


Foto: Purser / AWI

Problems BEnToolsMaPs aims to address

- Problem: Climate change is affecting biodiversity – but it still is poorly known in sediments beyond national jurisdiction
  - Solution: Develop methods for easier assessment for small fauna including metabarcoding and functional traits

- Problem: Information on service provided by sediment biodiversity in remote areas is lacking
  - Solution: Develop spatial models based on assessments of carbon cycling and bioturbation in the field



Sediment cores from ocean floor (Atwood et al. 2020)

- Problem: Sediment ecosystem is often neglected in MPA planning
  - Solution: Develop user-friendly tools for marine spatial planning and apply in the case study area Weddell Sea

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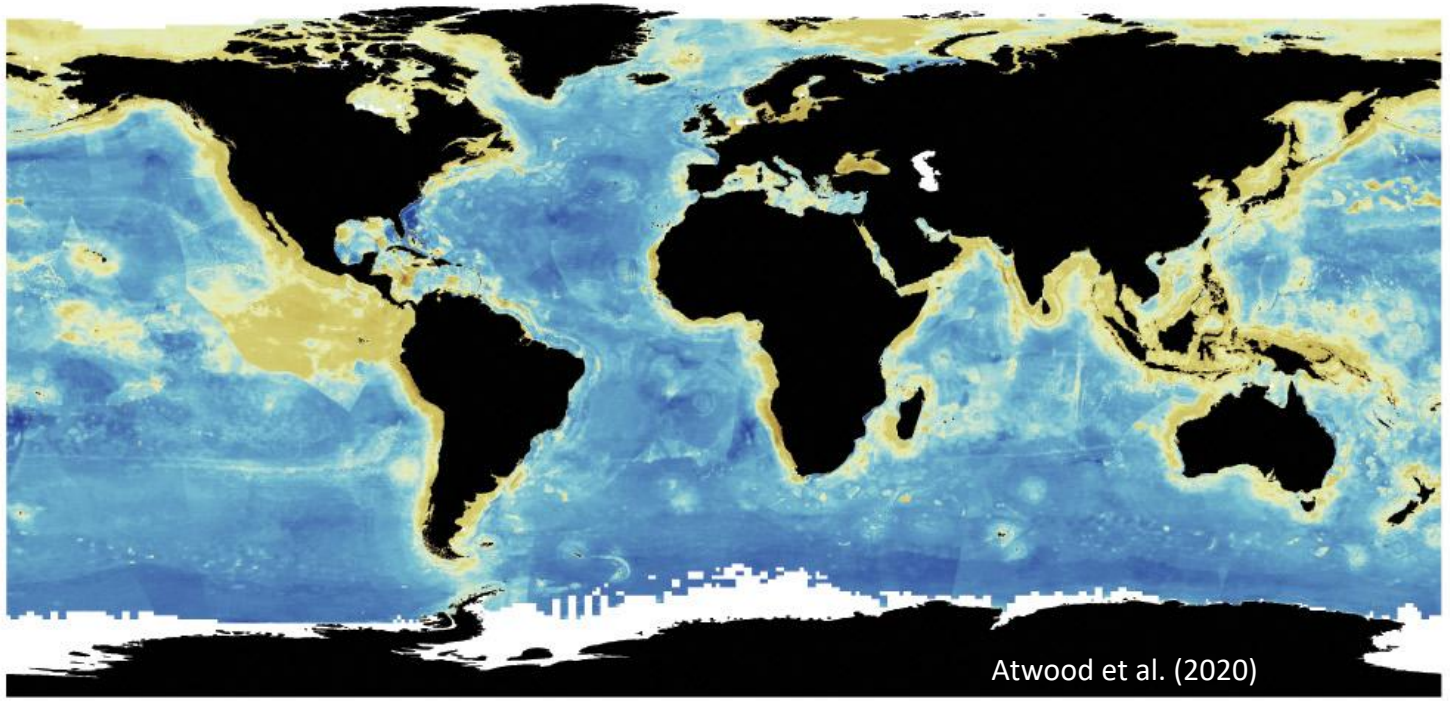
Why biodiversity of sediments?

- 65.5% of the seafloor are below 130m depth (Snelgrove 1999)



Atwood et al. (2020)

- soft bottom is the largest habitat storing 2x carbon of terrestrial soils
  - > 50% of carbon in ABNJ (Atwood et al. 2020)

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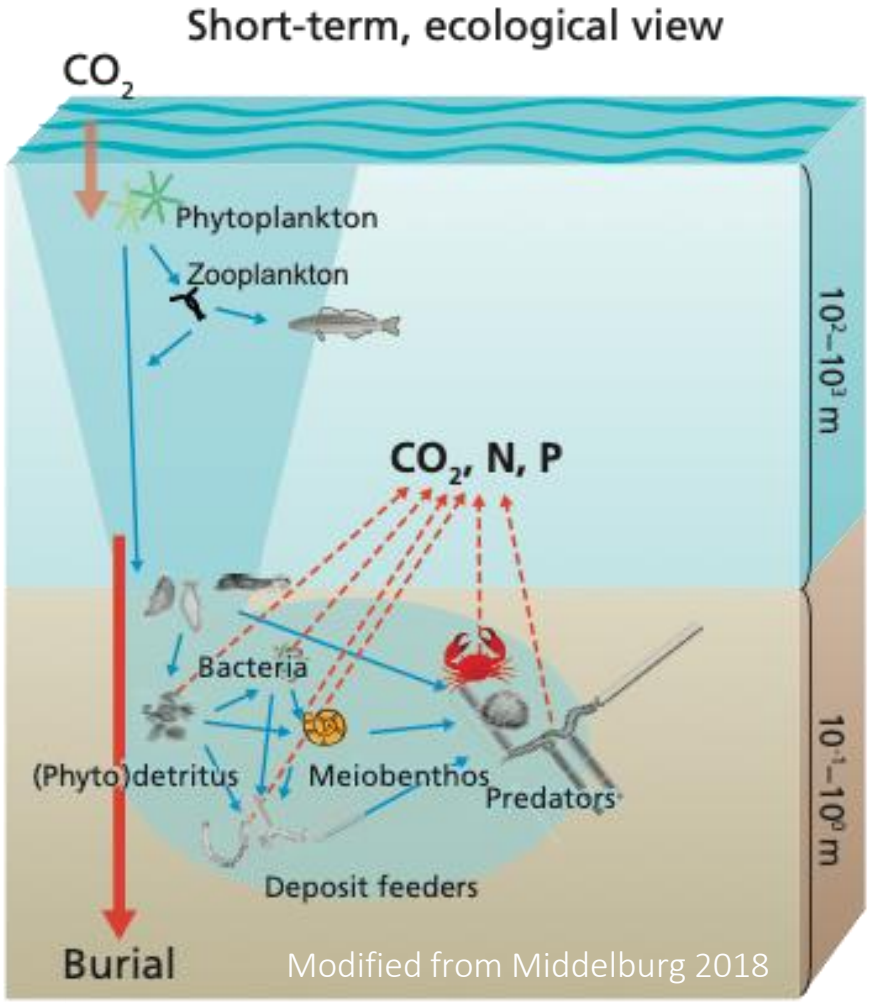
Foto: Purser / AWI

Why biodiversity of sediments?



Modified from Middelburg 2018

- Endofauna and their functions are essential for global biogeochemical cycles
- Standards for integrating soft-bottom seafloor in ABNJ are not available
  - BBNJ-Theme 2: Area-based Management Tools
  - BBNJ-Theme 3: Environmental Impact Assessment

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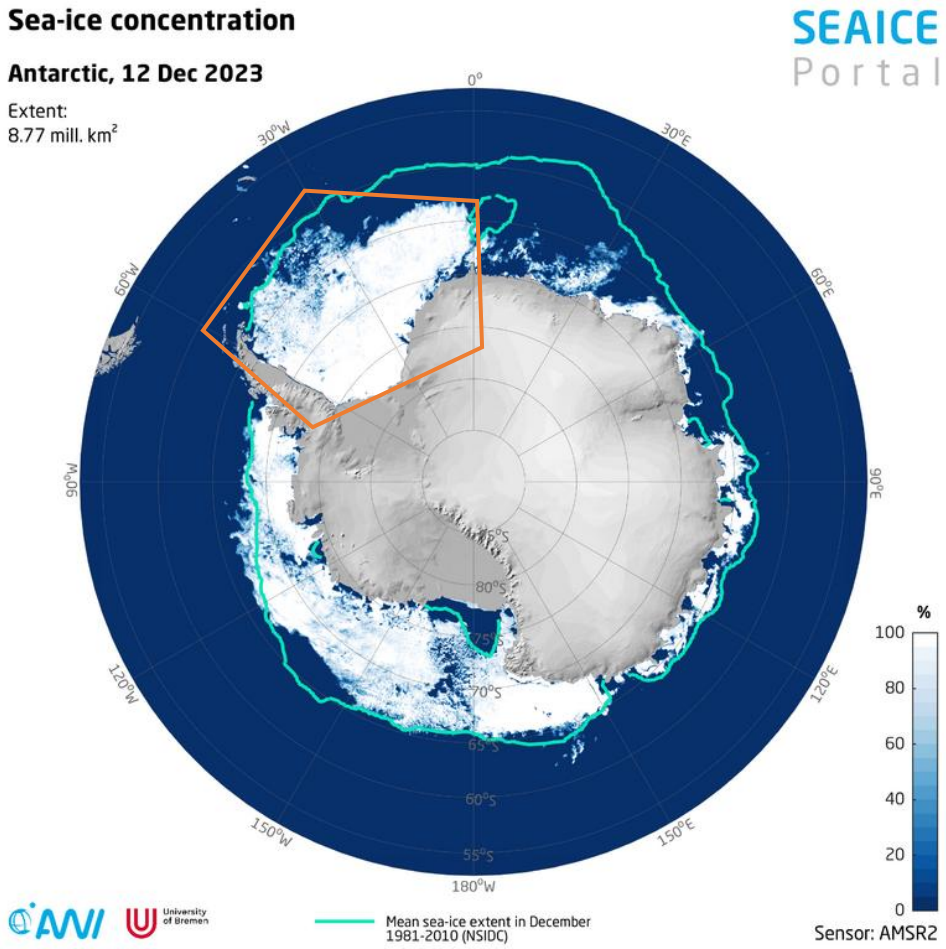
Use-Case Weddell Sea



- community composition of endofauna is related to sea-ice cover

=> sea-ice retreat will influence soft bottom communities

Säring et al. 2022 MEPS

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Use-Case Weddell Sea

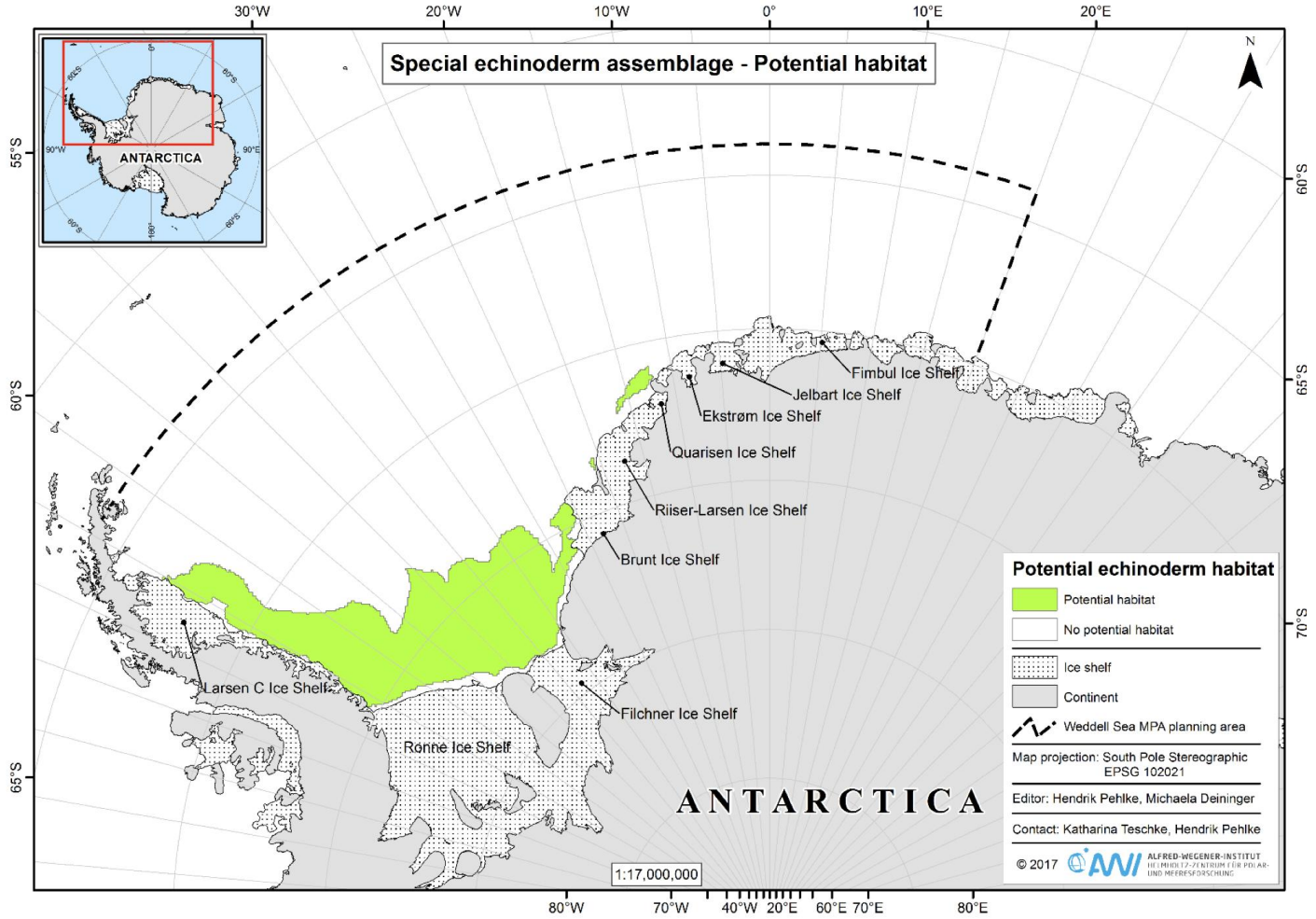


Figure S8. Potential habitat of a special echinoderm assemblage in the WSMPA Planning Area. Teschke et al. (2020)

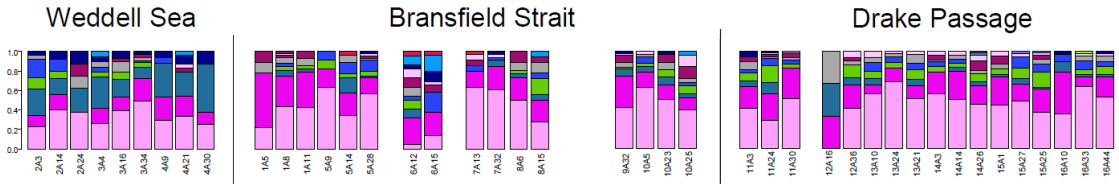
- International collaboration for management established

CCAMLR

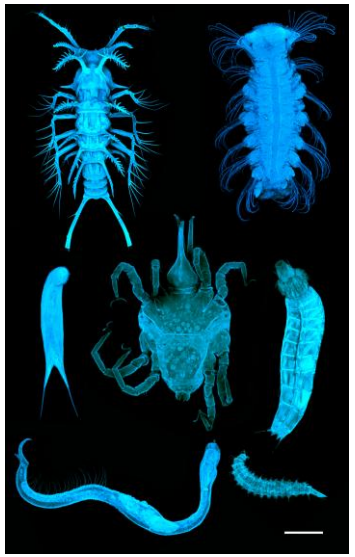
- Area-based management tool application for Weddell Sea MPA

=> test tools for BBNJ recommendation

Joint sediment habitat assessment can facilitate integration in MPA planning



Number of reads per higher taxon, 0-1 cm sediment depth



Meiofauna from the Antarctic
S. Durst, J. Schuckenbrock

- **New methods, including metabarcoding and functional group approach will enhance biodiversity assessment coverage** in sediments

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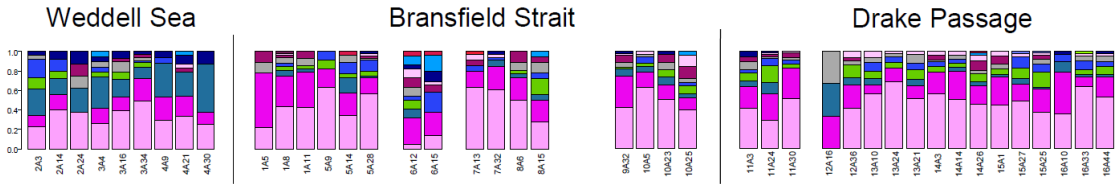
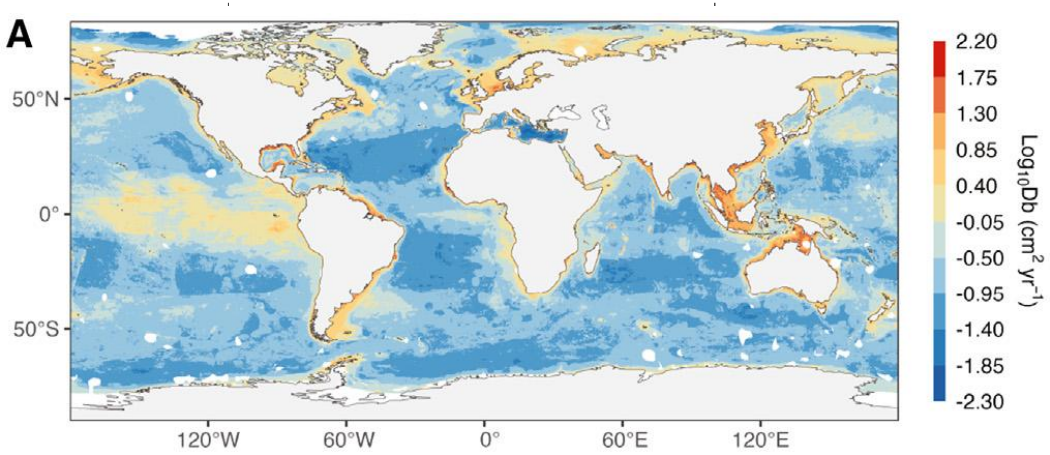
Joint sediment habitat assessment can facilitate integration in MPA planning



Number of reads per higher taxon, 0-1 cm sediment depth



Prediction of marine bioturbation intensity (Zhang et al. 2024)

- **New methods, including metabarcoding and functional group approach will enhance biodiversity assessment coverage** in sediments
- **Linkage of C cycling and bioturbation activity** can provide sediment ecosystem service

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Joint sediment habitat assessment can facilitate integration in MPA planning

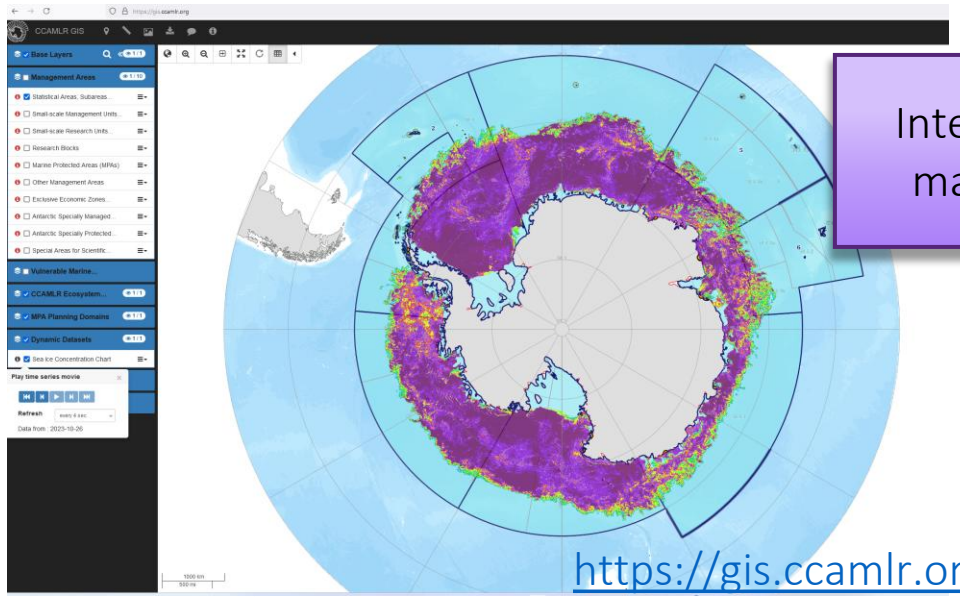
BEnTools MaPs

Environment

Biodiversity of benthic communities

Sediment turnover activity

- **New methods, including metabarcoding and functional group approach will enhance biodiversity assessment coverage** in sediments
- **Linkage of C cycling and bioturbation activity** can provide sediment ecosystem service



Interactives map tools

https://gis.ccamlr.org/

Our structure

OBJECTIVES

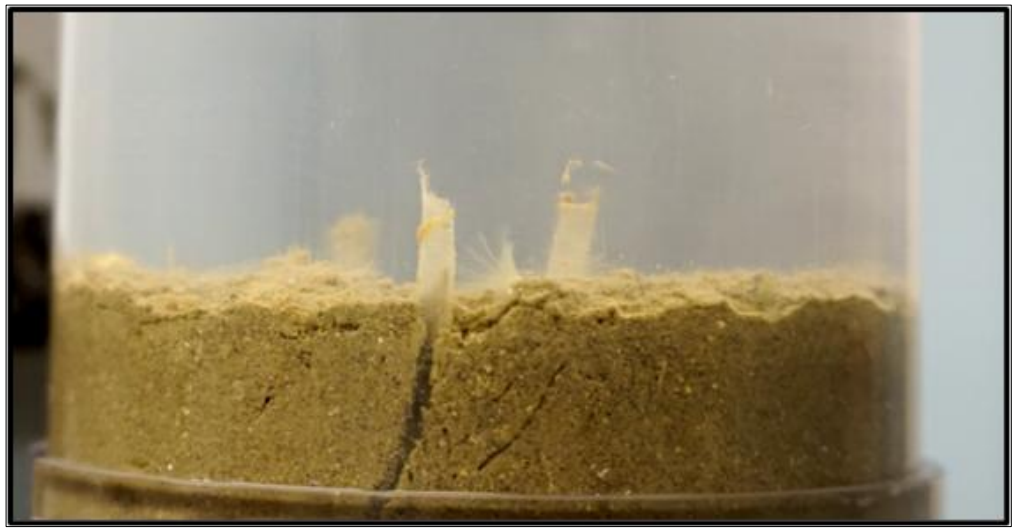
PROVIDE MAPPING TOOLS FOR BENTHIC BIODIVERSTY & FUNCTION

APPLY FUNCTIONAL & GENETIC APPROACHES TO BIODIVERSITY

ASSESS BIODIVERSITY FROM MEIOFAUNA TO MACROFAUNA

UNDERSTAND ECOSYSTEM FUNCTIONS OF WS SEDIMENTS

TRANSLATE SMALL FAUNA SEAFLOOR KNOWLEDGE FOR MPA PLANNING & CONSERVATION



Burrow structures resulting from sediment reworking activity (C. Gebhardt / Uni Rostock)

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Our structure



PROVIDE MAPPING TOOLS FOR BENTHIC BIODIVERSTY & FUNCTION

APPLY FUNCTIONAL & GENETIC APPROACHES TO BIODIVERSITY

OBJECTIVES

WP4
Spatial modelling of ecosystem traits

WP3
Integration of biodiversity and ecosystem function knowledge as base for spatial mapping

WP1
Biodiversity assessment of the sediment community from meio- to macrofauna applying molecular and functional group techniques

WP2
Quantification of bioturbation, C cycling and their relation to key taxa

WP5
Communication and integration of seafloor functions for marine spatial planning

ASSESS BIODIVERSITY FROM MEIOFAUNA TO MACROFAUNA

UNDERSTAND ECOSYSTEM FUNCTIONS OF WS SEDIMENTS

TRANSLATE SMALL FAUNA SEAFLOOR KNOWLEDGE FOR MPA PLANNING & CONSERVATION

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BEnTools MaPs

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Particle and fluid transport modelling



Pascal Lüder cand. MSc
Labwork, website and illustrations



Clemens Abraham
cand. MSc
Labwork, bioturbation

Macrofauna diversity & Benthic Functions

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



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PI of BEMO, sampling strategy evaluation



Dr. Katharina Teschke
Marine spatial planning



Hendrik Pehlke
Data processing and modelling



Dr. Friederike Weith
Modelling benthic biodiversity, C-Flux

Benthic Ecological Modelling

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