TRANSDISCIPLINARY RESEARCH FOR

OCEAN SUSTAINABILITY

Belmont Forum 'CRA Oceans'

MARISCO

Marine Research and Innovation for a Sustainable Management of Coasts and Oceans

Involved countries:

- Germany
- USA
- South Africa

Involved Organisations:

- Helmholtz Institute for Functional Marine Biodiversity at the University of Oldenburg
- University of California
- Nelson Mandela University

Understanding consequences of human actions for coastal and ocean sustainability has become a cornerstone of environmental research and policymaking. Traditionally, this is achieved in the context of analysing the direct and indirect impacts of anthropogenic drivers on the sustainable use of marine resources.
However, biodiversity change is a multi-dimensional process and rarely characterized by simple changes in emergent community properties such as species richness. Ecosystems display much more complex dynamics, including temporal turnover of composition, changes in the identity/proportion of dominant species, spatial homogenization and functional biodiversity changes, all of which resulting in novel interaction networks and processes.
Successful strategies for marine ecosystem management and biodiversity conservation must therefore incorporate this complexity. This is all the more important because different aspects of biodiversity change can impact society and Nature's Contributions to People (NCP). As for biodiversity, NCPs comprise a multitude of system properties, including the size of a standing stock (biomass, harvest) and the process rates affecting this stock (e.g., CO^2 sequestration). Successful policy targets for biodiversity need to pick up these complexities and be formulated at the local and regional scales where management decisions are effectively being implemented. In addition, recent evidence suggests that successful biodiversity targets should not be threshold-based since biodiversity does not seem to display tipping point behaviour.
Working transdisciplinarily, MARISCO has addressed these multi-layered interactions for the science-policy interface in marine biodiversity change. MARISCO combines interdisciplinary approaches to data synthesis and modelling in globally distributed, well-monitored regions, to arrive at models that display marine biodiversity change meaningfully and suggestions to set policy targets accordingly.

www.marisco-project.de

MARISCO

POLICY RECOMMENDATIONS

We show intricate links between human pressures on marine ecosystems, the change in marine biodiversity and its consequences for ecosystem properties and processes relevant to humans. Biodiversity management thus requires more than global one-dimensional policy thresholds.

Recommendations:

- All marine biodiversity management is multilevel from local to global scales, single level solutions will reinforce the observed implementation deficit.
- Continuous, high precision monitoring of biodiversity metrics and its environmental drivers is required for more accurate interpretations.
- Abandon the idea that a policy threshold like the 2°C-climate target exists for biodiversity change - we need to look for better operational targets.

MULTI-FRAME

Assessment Framework for Successful Development of Viable Ocean Multi-Use Systems

Involved countries:

- Brazil
- France
- Germany
- Mozambique
- Sweden
- USA

Involved Organisations:

- SUBMARINER Network for Blue Growth
- Federal University of Santa Catarina
- Royal Institute of Technology in Stockholm
- University of Rhode Island
- Møreforsking Ålesund AS
- s.Pro-sustainable projects GmbH
- Eduardo Mondlane University
- University of Nantes

Ocean multi-use refers to the joint synergetic use of ocean space and resources where various activities such as renewable energy production, aquaculture, shipping, tourism, and conservation can be integrated in close proximity to one another, and in a way that is mutually beneficial. The systems approach is critical in integrating different priorities in ocean multi-use to find solutions that are holistic and sustainable. It enables stakeholders to consider the interconnectedness of the different activities and resources and their interactions with each other in the ocean space.

For example, renewable energy production from offshore wind farms can be combined with aquaculture activities such as seaweed cultivation, which can help to provide a sustainable source of food while also contributing to the reduction of greenhouse gas emissions. Similarly, conservation measures such as marine protected areas can be designed to protect and enhance biodiversity, while also supporting the sustainable use of ocean resources by other activities such as tourism and fishing.

Overall, the joint synergetic use of ocean resources through an integrated systems approach can help to promote sustainable development, food security, and environmental protection in the ocean space, while also promoting economic growth and social well-being.

The MULTI-FRAME project aims to increase the knowledge base and capacity of public and private actors for ocean multi-use systems, by providing concrete open-source tools, assessment results and best practice examples from Brazil, Sweden, France, United States and Norway.

www.multi-frame.eu

MULTI-FRAME POLICY RECOMMENDATIONS

To ensure a more integrated, collaborative, and fair use of marine resources, it is recommended that the concept of multi-use be recognized and integrated into Marine Spatial Planning (MSP) and regulation. This will ensure that energy, food, nature, and social priorities are met in a balanced and sustainable manner

Recommendations:

- **Establish clear policy, planning, and regulatory frameworks for ocean multi-use** by integrating multi-use activities into coastal and marine spatial planning frameworks and national policies, while also establishing guidelines and regulations for the development and operation of multi-use solutions.
- **Develop and implement transparent and participatory governance frameworks** that involve all relevant stakeholders, building capacity, fostering cooperation and collaboration, and promoting public awareness and engagement about the benefits and risks of multi-use activities.
- **Address power imbalances and financing challenges** by establishing financing mechanisms that support the development of multi-use solutions, prioritizing the needs of less financially capable users to promote equity and fairness, and supporting the shift towards sustainable practices.
- **Provide incentives and support for innovation and collaborative research in ocean multi-use**, including increasing investment in research, monitoring, and evaluation programs, developing pilot projects and new technologies, and fostering international cooperation and knowledge-sharing to develop best practices and common standards.

NOCRISES

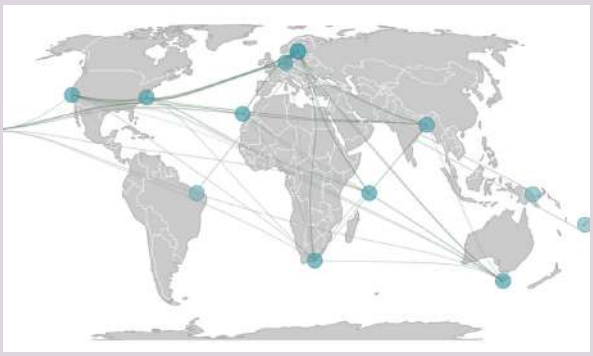
Negotiating Ocean Conflicts among Rivals for Sustainable and Equitable Solutions

Involved countries:

- South Africa
- Sweden
- Germany
- USA
- Bangladesh
- Brazil
- Fiji
- Seychelles
- Papua New Guinea

Involved Organisations:

- Rhodes University
- Stockholm Resilience Centre
- Leibniz Centre for Tropical Marine Research
- University of California Santa Cruz
- University of the Liberal Arts
- University Federal do Pará



NOCRISES pursues a case-study based mixed-method approach to assess the drivers of and management options for ocean conflicts. With 7 case studies, we examine different combinations of pressures and trade-offs which trigger ocean conflict. To facilitate learning across cases, we apply a portfolio of methods across case studies. Our data bank with over 100 conflict theories identifies three causal pathways that lead to 1) Conflicts over marine environments as the outcome of struggles between the 'great geopolitical powers', 2) Ocean-related conflicts caused by livelihood stress for those who depend on access to the marine realm and 3) Ocean conflicts triggered by environmental change. Most conflicts can be traced back to some form of inequality. While conflicts of interest is much in focus, emotional aspects of conflicts are less investigated. There is disagreement on the inevitability and contingency of conflict, and on how conflict may become a force of or tool for desirable transformation.

NOCRISES analyses ocean conflicts by implementing and linking case studies from across the globe. Project goals were formulated without contributions from key stakeholders in the project's chosen case regions. In the course of research, key stakeholders in case regions formulated questions and goals different from project goals. For instance, during the Creative Arts workshops conducted with "marginal/sub-altern" ocean conflict parties in Bangladesh and Brazil, NOCCRISES objectives were found to differ from local workshop participants' goals: While the NOCRISES aimed to capacitate locals in expressing their position in and experience of a conflict, locals wanted first and foremost to construct a better future for themselves despite the conflict(s) in which they felt powerless and vulnerable. We conclude that, even where a study is "only" a case in a globally focused research project, the early inclusion of local and regional stakeholders in formulating project aims and approaches is essential.

www.nocrises.wordpress.com

NOCRISES POLICY RECOMMENDATIONS

Case study-based approaches in global ocean research projects rely on within-case analysis, with little attention to the cross-case analysis needed make the generated knowledge relevant to global issues, to address this diverse actors need to consider a change of practice.

Recommendations:

- Funding is needed during the design phase and synchronized in time - so that global research projects can be co-developed internationally
- Project design needs to assign responsibilities, processes, and structures for cross-case analysis in ways that engage case study participants
- Apply Small-scale Fisheries (SSF) guidelines in coastal and marine resource governance to ensure blue justice in the face of coastal megaproject development
- Ensure democratic participation of fishers in decision-making at all levels (global, national, regional, local)

OCEAN FRONT CHANGE

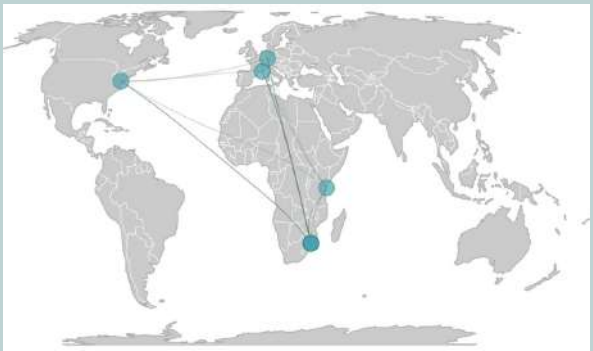
Managing Ocean Front Ecosystems for Climate Change

Involved countries:

- France
- Germany
- Kenya

Involved Organisations:

- Laboratoire d'Oceanographie Physique et Spatiale
- Universitat Heidelberg
- Coastal Oceans Research and Development in the Indian Ocean



Ocean fronts are meeting places of life in the oceans. Marine organisms from plankton to blue whales congregate at the interface of cooler and warmer waters, due to the prevalence of enhanced productivity at fronts. This concentration of marine life constitutes a remarkable ecosystem, from primary producers to top predators that assembles and disperses following frontal structures. This makes ocean fronts extraordinarily valuable, both to fishing and in conservation.

The aim of the OceanFrontCHANGE project, funded through the Belmont forum, is to develop scientific and management techniques together with stakeholder that allow effective fisheries and conservation management at ocean fronts in low- to medium-data settings in tropical oceans, using the Mozambique Channel as a test case. In this project, global remote sensing analysis is used to find further areas in which the conditions that make these solutions relevant apply.

The outcomes of this project fill critical gaps in information identified by stakeholder and planners, helping them to meet individual and collective responsibilities relating to the nature of the ocean and its sustainable use as climate changes. This contribution comes at a critical time, as governments commit to Sustainable Development Goals, communities are struggling to understand how to adapt resource management to climate change and conservation groups look for ways to protect marine life at fronts that are moving in response to climate change.

www.conservation.org/projects/oceanfrontchange

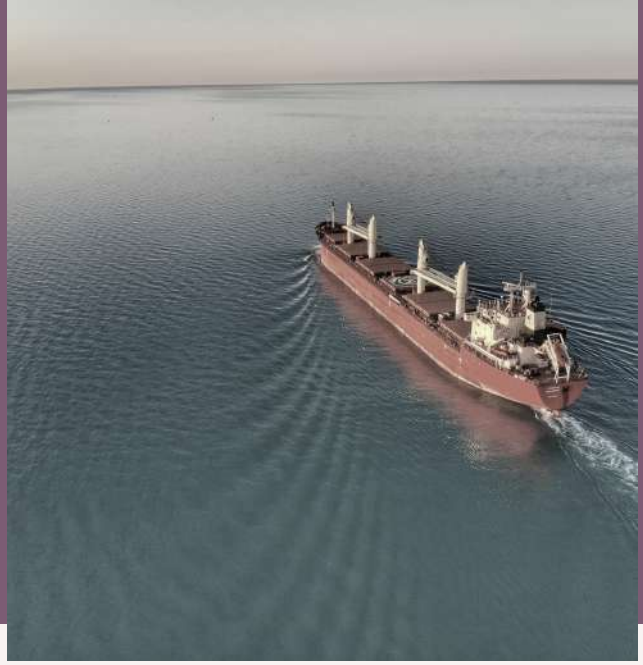
OCEAN FRONT CHANGE POLICY RECOMMENDATIONS

Ocean fronts are boundaries between two or more water regions that generate places of great productivity, attracting marine megafauna. Knowledge and management of these ephemeral ecosystem is still in its infancy.
Recommendations:

- Recognize ocean fronts as transboundary marine ecosystems that should be managed.
- Intensify research on front occurrence, transience, and links to megafauna including citizen-science approaches.
- Protecting ocean fronts and ensuring local livelihoods requires new thinking (stationary no-take zones won't help)

SHIPTRASE

Global Shipping: Linking Policy and Economics to Biogeochemical Cycling and Air-Sea Interaction



Involved countries:

- Germany
- France
- Sweden

Involved Organisations:

- Uppsala University
- GEOMAR Helmholtz Centre for Ocean Research Kiel,
- Kiel University
- Polytechnic School of Paris, and European Institute for Marine Studies
- Chalmers University of Technology

Shipping is the most widely used medium for transport of goods internationally and will continue to increase. Although shipping is a carbon-efficient transport medium, there is an increasing focus on its broader environmental consequences. For a sustainable and equitable use of the oceans, as well as minimizing impacts of global change, a further development to sustainable shipping, or green shipping, is needed. Ship-building and operational standards are introduced and area-based instruments, such as emission control areas (ECAs), are established. However, lack of regulations, vague monitoring, unclear environmental impacts and economic uncertainty might cause problems for industry and society.

In ShipTRASE, the environmental, economic and legal aspects of both near-term and long-term solutions to shipping emission reduction and control mechanisms are analysed. The potential environmental impacts on the lower atmosphere and upper ocean include those from pollutant emission from ship smokestacks and liquid discharge, as well as increased methane-induced greenhouse warming. With our transdisciplinary team (atmospheric sciences, chemical oceanography, international law, environmental economy and engineering), we investigate how the use of scrubbers and alternative fuels impact the environment and feedback on economics and regulation. In addition, we involve stakeholders in both Germany and Sweden to discuss these topics, share information and outcomes, and co-design further scientific research. The work involved various platforms: in-situ measurements, scrubber laboratory measurements, numerical modeling, cost-benefit analysis, and survey methodologies. ShipTRASE will deliver an economic and environmental consequence analysis of implementation of control areas and will assess the impact of policy settings and legal regulation. A methodology for making such analysis is also one important outcome of the project.

www.geomar.de/en/shiptrase

SHIPTRASE POLICY RECOMMENDATIONS

Scrubbers have an immediate chemical effect in the surface ocean – they reduce the concentrations of trace gases even when low concentrations are added. Possible positive feedbacks – for example, climate change allows for more ships in the Arctic due to ice melt, but increased emissions may lead to decreased trace gases that build aerosols and clouds – leading to increased climate change

Together with experts outside of ShipTRASE, 4 future shipping fuel scenarios (green shipping, enivornmentally worst case, and 2 mid-range cases) were developed. The green shipping future case was deemed to be the most likely by the small stakeholder group consulted, which was surprising. Interdisciplinary modelling work using this scenario must be undertaken to determine the full range of envionmental, legal, and economic impacts of this scenario and to recommend future courses of action.

Recommendations:

- Ban open-loop scrubbers! They have an immediate chemical effect in the surface ocean - their effluent reduces the concentrations of climate-active trace gases even when small amounts are added
- Change regulations on content of scrubber effluent
- Consult the experts before implementing alternatives
- Continue research on how to gauge compliance and get responsible parties to work together

RECOMMENDATIONS FOR TRANSDISCIPLINARY PROJECTS FOR OCEAN SUSTAINABILITY

Please use the QR-code to see the illustration "Recommendations for Transdisciplinary projects for Ocean Sustainability" based on the experiences of the MARISCO, MULTI-FRAME, NOCRISES, OceanFrontCHANGE, and ShipTRASE projects. You will be forwarded to the website of the Helmholtz Institute for Functional Marine Biodiversity at the University of Oldenburg.

Belmont Forum CRA 'Transdisciplinary Research for Ocean Sustainability' and the Coordination Project 'SynCRAocean'

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