



THE CHALLENGE OF BIG CHANGE

ZMT Programme Area 2
"Global Change Impacts and Social-ecological Responses"

ON EXPEDITION

It is impossible to record the effects of climate change on the oceans and tropical coasts on a solely regional basis. With the changes in water temperature, for example, fish stocks move across national borders or mussels settle where no mussels lived before. A global perspective is therefore needed to address the environmental changes and the concomitant redistribution of resources that this major transformation involves. ZMT thus collaborates with its international partners in more than 20 research projects.

"Programme Area 2 'Global Change Impacts and Social-ecological Responses' has a strong focus on processes operating at a global scale." (Sonia Bejarano, Spokesperson PA 2)

"Our topics therefore range from global warming and pollution to the rise of CO₂ and sea levels through to changes in laws, politics, norms, prices and markets." (Agostino Merico, Spokesperson PA 2)

What are the stress factors that affect the planet globally? And how will they impact it – under what conditions? Take the example of CO₂ emissions and the resulting changes in the carbonate chemistry of the ocean. Ocean acidification is threatening coral reef futures by reducing the concentration of carbonate ions that corals need to construct their skeletons. The search for solutions to these problems is beyond the scope of local coastal management. In order to find alternative approaches to cross-border coastal and marine policy, however, comprehensive knowledge of coral calcification is required.

This is delivered by ZMT's long-term project CORCAL (Coral calcification in relation to ocean acidification and other stressors) that models these processes. REEF FUTURES (The future of reef services in the Anthropocene) is another PA 2 project. Together with nine partner countries, it runs until 2022 and aims to quantify five key ecosystem services underpinned by reef fishes and predict future ecosystem service levels under multiple scenarios of human demography, economic development, and climate change. [>MORE](#)

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WIND, CLOUDS AND WATER

Jan Haerter on the dynamics of cloud clustering

Clouds are his thing: the towering storm clouds that darken the sun and release torrents of rain over the earth. Jan Olaf Haerter is, however, not driven by his love of dark romanticism. Rather, it is his passion for complexity that drives him when he contemplates the sky. "I am fascinated by the complex interactions in a dynamic system, whether I am modelling them for a coastal ecosystem in the tropics, for social networks or, indeed, for cloud populations."

Harbingers of cloud clustering

To ensure that we will know more about cloud populations in the future, Jan Haerter was awarded a Consolidator Grant by the European Research Council (ERC). His research project, "Cloud-cloud interaction in convective precipitation" (INTERACTION), focuses on cloud clustering, a phenomenon linked to extreme tropical weather events.

Thunderstorm cells propagate and create ever more mountains of cloud. "In some cases, storms produce bursts of cold air flows known as cold pools, which can sprawl out for many kilometres along the Earth's surface," Haerter explains. If they collide, they force the air masses caught between them upwards where the humidity they contain condenses once again. "This is roughly the principle on which storm clouds are continuously formed." But how exactly does this propagation mechanism work? So far, there has been a dearth of models and data – that is, basic research. And that is why Jan Haerter has come to ZMT.

More knowledge about extreme weather events in the tropics

The German researcher had started investigating cloud clusters at the University of Copenhagen's Niels Bohr Institute before ZMT and Jacobs University offered him a collaborative professorship in Bremen. Since April 2020, Haerter has been in charge of ZMT's Theoretical Ecology and Modelling Department, complementing it with his working group on Complexity and Climate. This group is treading new ground and hopes to achieve breakthroughs in our understanding of extreme weather events. Such knowledge is vital for forecasting and early-warning systems, the cloud physicist explains:

"At the moment, even the best weather and climate models are not fit for purpose."

The models on the formation of cloud clusters are a valuable addition to ZMT's tropical marine research. The clusters determine the intensity of rainfall, for example over a river basin. Cyclones cause flooding and ecological as well as social disasters. Moreover, water masses that flow into coastal areas in raging rivers have an impact on the biogeochemical composition of coasts and coastal waters, for instance when they flush out nutrients or agricultural chemicals. Jan Haerter is thus particularly looking forward to the interdisciplinary cooperation at ZMT. "The institute has a special focus on people, and works together with local authorities and scientists," Haerter adds. "So, I am expecting inspiring new field studies." More data on the formation of tropical rainfall will inspire yet more ZMT models on dynamic changes along tropical coasts.

The ERC funded project "Cloud-cloud interaction in convective precipitation" (INTERACTION), which runs until 2023, is being coordinated by ZMT (working group Complexity and Climate) and conducted together with the University of Copenhagen's Niels Bohr Institute. It is part of PA 2 – "Global Change Impacts and Social-ecological Responses".
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SHARED OCEANS

How do you manage jointly used resources fairly and sustainably?
Questions for ZMT social scientist, Samyia Selim

Ms Selim, what are the conflicts surrounding ocean resources today?

Politically motivated borders divide the world's oceans in the form of maritime rights but, in spatial terms, they are not as clear as they are on land. That is an area of conflict: who has the right to which resources? Moreover, there are conflicts of interest that result from changes in use over time. For millennia, the oceans were used for food and transport. Today, there are diverse interests such as mineral deposits, tourism, conservation and energy. You could argue that the world's oceans hold an abundance of resources for everyone – but how do you divide them up fairly and how do you use marine resources so sustainably that everyone can benefit from them in the future, as well?

How serious are the conflicts of interest?

In some marine areas the pressure on resources from several stakeholders has grown disproportionately. In our studies we refer to these areas as "ocean change hotspots". In such cases you first have to look carefully for the origins of the conflicts: who are the stakeholders that are clashing, and which resources are involved.

Where are these "ocean change hotspots"?

One example is the Bay of Bengal in the Indian Ocean. Its resources are used by several bordering countries such as India, Sri Lanka and Bangladesh. Each country has its own agenda as to how the waters should best be used for its own social development. One country wants to extend its transport routes across the ocean, the other wants to use it as a source of protein and intensify aquaculture and fisheries. We are currently studying six such hotspots where there are different conflicts of interest that are, however, comparable at the same time – like the conflict between

the need to conserve biodiversity on the one hand and the need to promote economic development and protect jobs on the other. These conflicts, in turn, differ from country to country.

How do you envisage good ocean management?

First of all, you should definitely get all the stakeholders round the same table. The key to fair distribution and sustainable use is to involve all resource users in a bottom up conversation. It is crucial to create platforms where you can organise communication amongst all the stakeholders, including local users and communities, with the aim of making jointly coordinated decisions on sustainable use. One existing tool that is very useful is marine spatial planning which maps out the jointly used space. You can identify, for example, the places where fishermen, environmental protectionists, ships and wind parks share space, so you can foresee potential conflicts and act to prevent them.

Driving participation in times of pandemic – how does that work?

The Corona pandemic is a challenge, but it also highlights how essential all kinds of collaboration with local communities are when you are studying tropical coasts. Our project involving research teams from six countries started in June 2020. Some of them have been able to embark on field work because they have strong partners locally. Without them we would not at present be able to access the research areas.

Samiya Ahmed Selim is a postdoctoral researcher in Marion Glaser's Social-ecological Systems Analysis working group (Social Sciences Department). Together they head the ongoing international project "Negotiating Ocean Conflicts among Rivals for Sustainable and Equitable Solutions" (NO CRISES), which is scheduled to run in Programme Area 2 until 2023. >[MORE](#)

Change of leadership at the top of ZMT



Werner Ekau joined the overall leadership of ZMT on 1 July 2020 when the geologist **Hildegard Westphal** gave up her post as Director after ten highly successful years in office. Until the selection committee has appointed a successor, Werner Ekau has taken on the role of Acting Scientific Director. A fisheries biologist with an international reputation, he has been a researcher at ZMT for nearly 30 years and heads and coordinates collaborative projects worldwide. Hildegard Westphal, who has indelibly stamped her mark on ZMT, is continuing her association with the institute as head of the Geoecology and Carbonate Sedimentology working group. [>MORE](#)



Outcome of ZMT research



Research conducted by the new Fish Ecology and Evolution working group, led by **Oscar Puebla**, resulted in the change of status of the Maya hamlet on the Red List of Threatened Species published by the International Union for Conservation of Nature (IUCN) from “vulnerable” to “endangered”. This reef fish is endemic to the Mesoamerican Barrier Reef System (MBRS) in Belize. Oscar Puebla took up the collaborative professorship in fish ecology and evolution at the Institute for Chemistry and Biology of the Marine Environment (ICBM) at the University of Oldenburg and ZMT in Bremen in 2019. Population genetics, ecological and evolutionary processes in the oceans, and the genesis of new fish species are some of his particular research areas. [>MORE](#)

FAIR with DatAlumni

Findable, Accessible, Interoperable, Reusable or FAIR, for short, is how research data should be made available

to scientific users worldwide. In a DAAD-funded project, “DatAlumni – Scientific Data Cooperation with our Alumni Network”, ZMT alumni are becoming multipliers for FAIR data management at their home institutions. The project has been running since June 2020. At the kick-off workshop of the Alumni Circle of Data Cooperation in September, training strategies for data management and the concept for a planned virtual alumni conference in Spring 2021 were developed. DatAlumni is part of ZMT’s digitisation initiative, DigiZ. [>MORE](#)

Top postdoc at ZMT

In June 2021, Steve Doo will embark on a two-year stint at ZMT supported by a prestigious Alexander von Humboldt Foundation postdoctoral fellowship. He will work on the impact of climate change on the production of beach sediment by reef organisms. Currently, the young marine ecophysiologicalist is a member of ZMT’s Geoecology and Carbonate Sedimentology working group. Doo is one of the outstanding young researchers invited to the 2020 Nobel Laureate Meeting in Lindau, which has been postponed until 2021 due to the Coronavirus pandemic. [>MORE](#)

Policy brief for Hainan

ZMT’s recommendations (2020/3) for conserving China’s coastal resources are available online in English and Mandarin. The policy brief is based on long-term research cooperation between China and Germany and addresses the issue of improving the state of Hainan’s coasts by sustainable management. The ZMT policy briefs are part of a series of briefings aiming to inform policy makers about key results of ZMT research and provide them with specific recommendations for environmental policies. [>DOWNLOAD](#)

REEF e-talks

In the times of the Coronavirus pandemic, trips to field research sites and conferences have been put on hold. But ZMT’s ideas sharing with its partners worldwide continues unabated – one source of inspiration are the “Reef e-talks” organised by ZMT reef ecologist, Sonia Bejarano. Since May 2020, the series of online seminars has featured experts from ZMT’s international network to present and discuss their reef research online. Information on past and future talks can be found on the webpage of the Reef Systems working group, where you can also register. [>MORE](#)