



CONCENTRATING ON CLEAR CONCERNS

ON EXPEDITION

Resources, nutrition, climate, cities, migration ... these are the burning issues affecting the world community. In 2015, the United Nations focused on these problems and formulated its "sustainable development goals" (SDG). "Collaborative research is a very important tool for effectively addressing collective problems," says ZMT's Scientific Director, Hildegard Westphal. "That's why, starting in 2020, the Leibniz Centre for Tropical Marine Research is organising both its established and its future scientific projects and activities into five programme areas (PAs) which will clearly reflect the SDG."

ZMT's new Big Five

1. Aquatic Resource Use and Protection
2. Global Change Impacts and Social-ecological Responses
3. Coastal Development and Hinterland Dynamics
4. Knowledge Systems and Ecosystem Design
5. Strategic Management and Development

In our forthcoming newsletters we will introduce the new programme areas

Ever since it was founded, ZMT has directed its research towards building the foundations for the protection and sustainable use of tropical coastal ecosystems; it can now boast nearly three decades' experience of working in the Tropics. And that will be its clear focus in future, too: research, capacity development and advisory services in interdisciplinary projects and in close cooperation with international and national partners in the Tropics.

Because tropical coasts are constantly subject to highly dynamic processes of change, it is essential to keep re-focussing ZMT's work with a mind to local social issues as well as the international context. Climate change, over-exploitation of resources, population growth and urbanisation all have a particularly big impact on tropical coasts. The socio-ecological and socio-economic structures there change rapidly and pose enormous challenges to society. Against this backdrop, ZMT has identified the most urgent key areas of its research and developed four scientific programme areas, plus one that will support research. "We are thus refining and reinforcing our arguments," says Hildegard Westphal. "The importance of our work stems from fundamental research and social significance." [>MORE](#)

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HOTSPOTS OF CHANGE

ZMT Programme Area 3

»Coastal Development and Hinterland Dynamics«

Lives, goods, finances, diseases, knowledge – just like rivers, people and materials stream to tropical coasts from all over the world. The population grows, urbanisation forges ahead, the pressure on societies and ecosystems increases. Such developments lead to booming coastal cities and a life there impacted by ever greater socio-ecological stress. How can these complex processes of change be dealt with for the long-term good of people and nature? Just managing these pulsating hubs themselves is a growing challenge.

"Giving concrete contents to ZMT's programme areas will facilitate new and exciting collaborations across departments and working groups and set the scene for innovative collaborations with partners from the tropics."

(Marion Glaser, ZMT, Spokesperson PA 3)

Who and what affect whom when and how, and why? Be it industrialisation, new consumer behaviour, the more sophisticated lifestyles of a growing middle class or changes in land use and hydrological regulations – on the coasts of tropical countries the impacts on ecosystem services are accumulating. Clever management of these changing hotspots means enriching robust models with knowledge of the kind delivered by science that has been studying tropical coastal systems for decades.

The Leibniz Centre for Tropical Marine Research focusses on this constellation in its Programme Area, "Coastal Development and Hinterland Dynamics" (PA 3). Of the five programme areas that the Bremen research institute will be addressing with a view to the SDGs from 2020, PA 3 is designed to focus attention on the changes in material flows. Here, ZMT scientists will investigate the causes, consequences and dynamics of human intervention in tropical coastal areas and their hinterland together with

partners in the Tropics. Against the backdrop of human interventions, what is happening to groundwater and sediments, to habitats, individual organisms and whole coastlines?

"Natural coastal dynamics are strongly altered by human activities these days. However, it is not coastal development alone that alters coastal ecosystems and their services, but also the results of human interventions in the hinterland which are transferred into the coastal zone by rivers and human mobility. This, in turn, also affects livelihoods and management there." (Tim Jennerjahn, ZMT, Spokesperson PA 3)

ZMT's research in PA 3 also studies the development strategies that coastal societies draw up in order to improve the interaction between humans and nature. What should the modern age look like? And what consequences will it have on local ecosystems?

PA 3 has set its sights very high for its research goals in the next seven years: ZMT will set one focus on gaining a better understanding of organisms' reactions to microplastic, for example, and will be a central point of contact for the topic of plastic in the Tropics. A box model for material flows will be developed in order to predict the impact of land-ocean material flows (surface water and groundwater), taking account of anthropogenic forcing. Other goals include clear recommendations on how submarine groundwater runoff can be used as a resource on coasts and an assessment of carbon sequestration in vegetated coastal habitats. With an eye to concrete political recommendations, another focus will be set on understanding social learning processes with regard to fluctuations in sea level and human responses to environmental change. [>MORE](#)

LIKE CHRONIC FLU

Microplastics may not kill corals upon contact, but they do weaken them. Biologist Sonia Bejarano and geologist Florian Hierl on the effects of plastic in reefs.

Do corals absorb plastic?

Sonia Bejarano: So far, there have been very few experiments with extremely high concentrations of microplastics in water. These tell us that corals do indeed ingest plastic. But lab situations of this kind do not necessarily occur on real coral reefs. In a project called CORALASTIC I at ZMT's marine experimental facility (MAREE), we exposed branching corals to a concentration of microplastics closer to those found in coral reef waters. This was the first experiment of its kind using both microfibrils and irregular microplastics made of polyethylene terephthalate (PET). We also mixed the microplastics for the corals either with food for the corals or with sediment. We asked how the coral polyps and colonies deal with microplastic pollution on the reef. Would they be able to actively get rid of it?

Florian Hierl: What we don't yet know is whether the microplastic the corals have ingested remains in the tissue or whether they integrate it in their skeleton. How would it influence the stability of skeletons? The properties of plastic are quite different from those of aragonite, which is what coral skeletons are made of. In the last resort, what will this mean at some stage for the reef? That was one of the things that really interested me in the PlastiCoralsGeo research project. So, I did an aquarium experiment with various coral species that were exposed to a very high concentration of microplastic over a period of five months.

What happens when corals eat plastic?

Sonia Bejarano: Our research findings show that corals tend to respond passively to microplastics. The coral polyps didn't put up any particular resistance: they inspected microplastics for a while and passed them on to neighbouring polyps. In most cases, the corals had got rid

of all microplastics within 24 hours. We did not detect any visible signs of stress in the polyps or whole corals. What is interesting is that the microfibrils remained on the surface of the corals nine times longer than irregular microplastics. This means that microfibrils will have a higher potential to transfer toxicants and microbes onto coral tissues.

Florian Hierl: My experiments are still ongoing, but I have already found microplastic fibres incorporated in the carbonate skeletons. Does that then mean that coral skeletons could provide temporary storage for microplastics in the ocean? How stable would that storage be? This could be part of the answer to the question people all over the world are asking as to where all the plastic in the oceans really ends up. So far, we only know that a huge amount is deposited in the deep ocean but not exactly how much reaches the reefs and shallow waters, and what happens to it when it gets there.

What danger does microplastic pose for corals?

Sonia Bejarano: If the plastic is mixed with food, the corals are more willing to eat it and thus ingest fewer nutrition particles. This will weaken them in the long term. If, for example, the plastic fibres from typical functional clothing are contaminated with chemicals and stick to the corals, this permanent contact will put them at risk. We will investigate this more thoroughly in CORALASTIC II (2019-2020). In the current concentrations in reefs, however, microplastics are not immediate coral killers as elevated temperatures can be. We should understand plastic pollution as something that affects the corals more like a chronic weakening cold. If affected colonies are then subject to additional stress, such as heatwaves, this may kill them even faster.

The ZMT research project, "CORALASTIC: Coral polyp interactions with Microplastics and natural particles" (headed by Sonia Bejarano) and "PlastiCoralsGeo: Carbonate production under plastic stress" (headed by Hildegard Westphal) belong to Programme Area 3 "Coastal Development and Hinterland Dynamics".

[>MORE CORALASTIC](#)

[>MORE PlastiCoralsGeo](#)

The future of mangroves - in Berlin ...

In the tidal zones of tropical coasts, mangroves provide a habitat for terrestrial and marine organisms, whilst offering human habitation protection against storm surge flooding. They store CO₂, are some of the most productive ecosystems on earth and deliver foodstuffs such as crabs and mussels – and they are in danger. Climate warming, deforestation, pollution and urbanisation not only afflict tropical forests, their destruction has consequences for the global climate.

In order to enhance our knowledge and understanding of these amphibian forests and how important they are, ZMT invited representatives of academia, business, politics and society to the first Future Mangrove Day at the Berlin representation of the Land Bremen on 25 June 2019. As a result of the workshop, discussions took place on mangrove restoration with a delegation from Samoa and Tokelau (South Pacific) and a Memorandum of Understanding was initiated between ZMT and the Centre d'Etudes et de Recherche de Djibouti (CERD) for scientific support and capacity development. [>MORE](#)

... and in Singapore



ZMT scientists amongst the 330 international mangrove experts at the world's leading mangrove conference "MMM5 - Mangrove Macro-benthos & Management" in Singapore in July 2019

German Marine Research Alliance kicks off

The federal and North German state governments have signed an agreement establishing an alliance of German marine research facilities. The German Marine Research Alliance (DAM) was itself established by 12 institutions, including ZMT, in the legal form of a registered association, on 4 July in Berlin. In joint research missions, DAM will develop potential courses of

action for the sustainable management of the oceans. The first two topics for the pilot phase will comprise, on the one hand, ways of protecting and utilising marine habitats in order to preserve biodiversity and the function of ecosystems, and, on the other, an analysis on the future of marine carbon sinks as a knowledge base for action in shaping climate policy. Beyond this, the DAM will support data management and digitisation in the marine sciences – and in the long term coordinate it is to coordinate and optimise the utilisation of large marine infrastructures. [>MORE](#)

Award for outstanding research

ZMT geoscientist Dini Adyasari from Indonesia has been selected to receive the prestigious Bernd Rendel Prize



2019, awarded by the German Research Foundation (DFG). Adyasari attended university in Indonesia and Norway and wrote her doctoral thesis on "Urban Pollution of Submarine Groundwater Discharge from Jepara Coastal Region and its Implications for Local Water Management" in the ZMT working group Submarine Groundwater Discharge. She received her doctorate from the University of Bremen in June 2019. [>MORE](#)

Nature-based tourism and wastewater management

A healthy habitat is a prerequisite for nature-based tourism. This fast-growing tourism segment creates potential problems for the environment. For example, wastewater management is a major problem in rapidly developing nature tourism communities along tropical coasts. BMBF now funds social-ecological research and a new working group at ZMT in cooperation with the Social Sciences Department at the University of Bremen. The five-year research project "Transdisciplinary Science for Sustainable Tourism" (TransTourisms) will help to identify the link between tourism, ecosystem health, ecosystem services and human well-being. Junior research group leader Marie Fujitani, a social scientist, wants to support and exchange knowledge with tourism communities in Tanzania, Indonesia and Costa Rica to improve their decentralised wastewater management. [>MORE](#)