



DROWNING MEGACITIES?

How humans adapt when the water rises

ON EXPEDITION

Three megacities by the sea: Singapore, Jakarta, Manila. What will happen to their 40-million-odd inhabitants when sea levels rise? "Singapore has been preparing for this threatening scenario for years with standardised infrastructure measures," says Anna-Katharina Hornidge, head of ZMT's Social Science Department. The city-state reinforces the coastline and implements the recommendations made by the Intergovernmental Panel on Climate Change (IPCC). Singapore acts technocratically and efficiently, according to Hornidge, training many internationally-connected scientists, bureaucrats and decision-makers. So far, there is not much evidence of a threatening rise in relative sea levels in Singapore, unlike Jakarta and Manila, the social scientist explains. "These cities are already sinking into the water, but not because of a rise in the sea level but due to compressing swampland. What is being built, is too heavy, too high and too near to the coast - and everyday groundwater extractions take their additional toll."

Jakarta has developed a master plan to save the homes of some 30 million people from being flooded. A habitable sea wall - the "Great Garuda" - will be built in the middle of Jakarta Bay - known to the Chinese who live there as "The Dragon's Mouth". "The public discourse on how to live with sea level change draws on local mythologies and is substantially politically charged," Hornidge explains. "By studying these discourses and the different adaptation strategies employed, we aim at understanding the different ways of making sense of sea level change, and the rationales for preparing for it in one or the other way."

A living lab

Since the predictions about the rise in water levels are being taken seriously in all three urban contexts, these megacities are living laboratories. "Floods in your living room due to subsidence or extreme weather events are already a reality for those living along the coast in Jakarta. And the search for appropriate responses to these challenges is in full swing," Anna-Katharina Hornidge explains. "Social learning processes can be observed." Together with her colleagues at ZMT and the Sustainability Research Center (artec) at the University of Bremen, she is currently exploring how the necessary knowledge can "travel" and be transferred to specific contexts - basic research on learning processes of relevance to coastal cities, for living with a future in which the oceans will swell. [>MORE](#)

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NO MORE BUSINESS AS USUAL

Henry C. Wu's mission to "Make Our Planet Great Again"

Looking back

Southern Taiwan 2004. As part of a research stay, students are working on a conservation project off the coast. The aim is to save the reefs, which are in a parlous state, with coral bleaching at an advanced stage. One of the young people is Henry Wu, who has grown up in the United States and is currently completing a Master's degree in Conservation Biology and Resource Management at the University of Pennsylvania. "It was then that I realised that it's really important to preserve the corals *now*, but that because of climate change we won't be able to if we continue with business as usual." Wu decided to take a step back, find out more about climate change and acquire an additional perspective. He went to the Lamont-Doherty Earth Observatory and worked on climate change with international climate researchers.

Looking now

Germany 2018. Henry Wu is a junior research group leader, building his own group at ZMT. With his staff and colleagues, he wants to fill the gap in our knowledge – with the aim to better understand the impact of climate change. "Using drill cores from coral reefs we want to explore how the oceans have absorbed carbon dioxide (CO₂) from the atmosphere in the last two to three hundred years, that is, before and after the Industrial Revolution," the geoscientist explains. Those threatened tropical reefs just would not leave the American researcher in peace. So now he uses them as an archive for information about the longer-term impact of higher water temperatures and so-called ocean acidification – the drop in the pH of seawater due to increased levels of CO₂. Calcifying organisms like corals are sensitive to sinking pH levels as their skeletons

reveal. "The goal is to reconstruct climate change that is significant for the recent history of humanity," says Wu.

Looking forward

Together with doctoral students in his research group at ZMT, Wu will analyse specific regions of the tropical oceans – with the aid of coral reef specimens from the Pacific, Atlantic and Indian Oceans. To this end, he is not only collaborating with colleagues at ZMT but also, amongst others, with the French Institute of Research for Development (IRD), especially as the project seeks to collate the data into a global synthesis. Henry Wu is thus close to achieving his aim of sustainably helping to protect the coral reefs not just off Taiwan – if one of his hopes is indeed fulfilled: "If my project can play a role in eventually providing the kind of solid, reliable data for future generations of climate models that can bring about societal change – that would be a legacy I should be proud to look back on." [>MORE](#)



Extracting a coral core: afterwards the hole is filled with underwater cement to protect the coral

In his five-year project "Witnesses to the Climate Emergency: Ocean acidification crisis and global warming observations from tropical corals (OASIS)", Henry C. Wu is investigating the development of ocean acidification in tropical seas. His research is being funded by the German Academic Exchange Service (DAAD) under the Franco-German Fellowship Programme on Climate, Energy and Earth System Research "Make Our Planet Great Again - German Research Initiative (MOPGA-GRI)". The ZMT scientist is one of only 13 top researchers chosen by the DAAD from more than 300 applicants.

WHAT ABOUT TOMORROW?

The ocean food source: Hildegard Westphal and Werner Ekau on a threatened resource

Approximately 30 percent of all recorded fish stocks have been overfished. And now?

Hildegard Westphal: The problem will become critical if we don't do something about it. A growing world population will need even more food from the oceans than we are already taking now. But the production of biological goods must not be allowed to grow at the cost of ecology and sustainability because that creates problems in the future.

Werner Ekau: The principle of sustainability in fishing is the same as in forestry: I cut down as many trees as I can replace with regrowth, or in the case of fisheries, I only catch the number of fish that can be replenished by reproduction. These principles were laid down by the Food and Agriculture Organization (FAO) in the Guidelines for Responsible Fisheries back in 1995. Only now, in their new Maritime Policy, has the EU accepted the principle of the Maximum Sustainable Yield. We must return fish stocks, which have been fished down below biologically sustainable levels, to the maximum sustainable yield level.

What are the obstacles to global, sustainable fisheries management?

Hildegard Westphal: Illegal fishing and a lack of national and international political and legal frameworks endanger the implementation of solutions for global fish stocks. Moreover, the parts of the world that are most affected by environmental change are precisely those that depend the most on their own resources and are least prepared to tackle problems like degradation and land loss. Mostly, this is in the Tropics where population growth encounters the dynamic changes in society and the environment.

Werner Ekau: About 38 percent of world fish production enters international trade, more than half of which originates in developing countries and is imported by industrialised nations. Tuna is increasing in popularity and sushi restaurants are popping up all over the place. Pangasius, a catfish, comes from aquacultures in Vietnam, and Victoria perch from Africa – fish species you find ever more frequently in Germany. An indication of our general dependence on imports is the annual "Fish Dependence Day" – that is the day on which marine resources in national waters are declared exhausted. In Germany in 2018, that day was 4 May.

How can we go about finding reasonable solutions?

Werner Ekau: Better management means better control and monitoring to prevent illegal fishing. We must create frameworks in which fish can develop and reproduce optimally. We must fill our knowledge gaps about how and where in the Tropics which fish species reproduce best under what conditions. If you don't know this, you can't protect the overfished species properly. But many countries in the Tropics are also short of scientists who can do this and institutes with the right equipment. This is where we can provide support along tropical coasts.

Hildegard Westphal: ZMT now has more than 25 years' experience of research collaboration in the Tropics as well as an international network of some 750 alumni and about 40 cooperation agreements with institutes. Our interdisciplinary research there is embedded in the needs of tropical partners. This means ZMT is a stable, reliable partner for responsible, sustainable action.

Research – society – business

ZMT scientists engaged with the topic of transferring knowledge to society at a panel discussion organised by the Hamburg Academy of Sciences and Humanities. [>MORE](#) They also continued the conversation on greater cooperation between research, industry and business at the first ZMT Networking Event Marine Bioeconomy. [>MORE](#)

Honoured: UNEP Innovation Prize for “Clean Seas”

Roger Spranz, a former doctoral student at ZMT, was awarded the United Nations Innovation Prize in the “Clean Seas Innovation Challenge” – a competition run by the United Nations Environment Programme (UNEP). From a pool of 200 suggestions submitted, his project “Tasini” was selected as the best idea for combatting ocean plastic pollution. “Tasini”, a foldable, reusable shopping bag made of recycled plastic waste in the shape of sea creatures, is already becoming a coveted fashion accessory in Indonesia. It can replace up to 400 plastic bags a year and promotes an awareness campaign on the issue of marine litter. [>MORE](#)

Always approachable: Young Researchers' Development Coordinator

Since the end of 2017, Janine Reinhard has been coordinating ZMT's Researchers' Development Programme that provides training, development opportunities and career planning support for students, postdocs and junior research group leaders. She also fosters the academic network of more than 700 ZMT alumni in the Tropics and around the world. [>MORE](#)



Successful: BMBF project on social-ecological coral reef systems

With funding from the BMBF, Sebastian Ferse's research group spent five years working on the Pacific Islands – a region characterised by close relations between human communities and coral reef ecosystems – systems that are being impacted by global ecological and socio-economic change. The interdisciplinary research project REPICORE (Resilience of South Pacific coral reef social-ecological systems in times of global change) explored the coupled social-ecological reef systems from a holistic, application-oriented perspective. Its publications can now be used as a basis for the necessary action strategies relating to global change. [>MORE](#)

Third time round: ZMT Regional Alumni Conference

At the end of April 2018, Indonesia was the destination for ZMT alumni from India, Bangladesh, Myanmar, Vietnam, the Philippines, China, New Zealand and several Indonesian islands. At the conference, which was organised together with the Universitas Padjadjaran (UNPAD), participants discussed “Marine Biodiversity in future life: threats, ecosystem services, and future connectivity”. One of the main aims of the meeting was also to enable ZMT alumni to share experiences and knowledge, present new research approaches and establish a working line for cooperation in the alumni network. A two-day lab course on “Genetic Barcoding” successfully rounded off the third regional conference, following on from Tanzania in 2016 and Colombia in 2017. [>MORE](#)

Compendium: “Towards Sustainable Coasts.”

“Bremen Marine Research in the Tropics” is the subject of an entertaining compendium that ZMT published in the “Edition Falkenberg” in September 2017; the English edition appeared in spring 2018. Comprising more than thirty essays edited by ZMT founder Gotthilf Hempel, together with Irmtraut Hempel and Anna-Katharina Hornidge, the collection looks behind the glossy photos of tropical coasts and into the processes taking place in the environment and society around the communities of corals, seagrass beds and mangrove forests. It draws attention to the dangers of climate change and the rise in sea levels, overexploitation of tropical habitats and urbanisation. Moreover, the book reveals how natural resources can be used sustainably and how tropical habitats can be protected from destruction. [>MORE](#)



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