



LEIBNIZ CENTRE  
for Tropical Marine Research

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Association

ZMT



## CONFERENCE PROCEEDINGS

The 1<sup>st</sup> ZMT Annual Conference (ZAC1)  
14<sup>th</sup> Jan 2020



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## I. SESSIONS

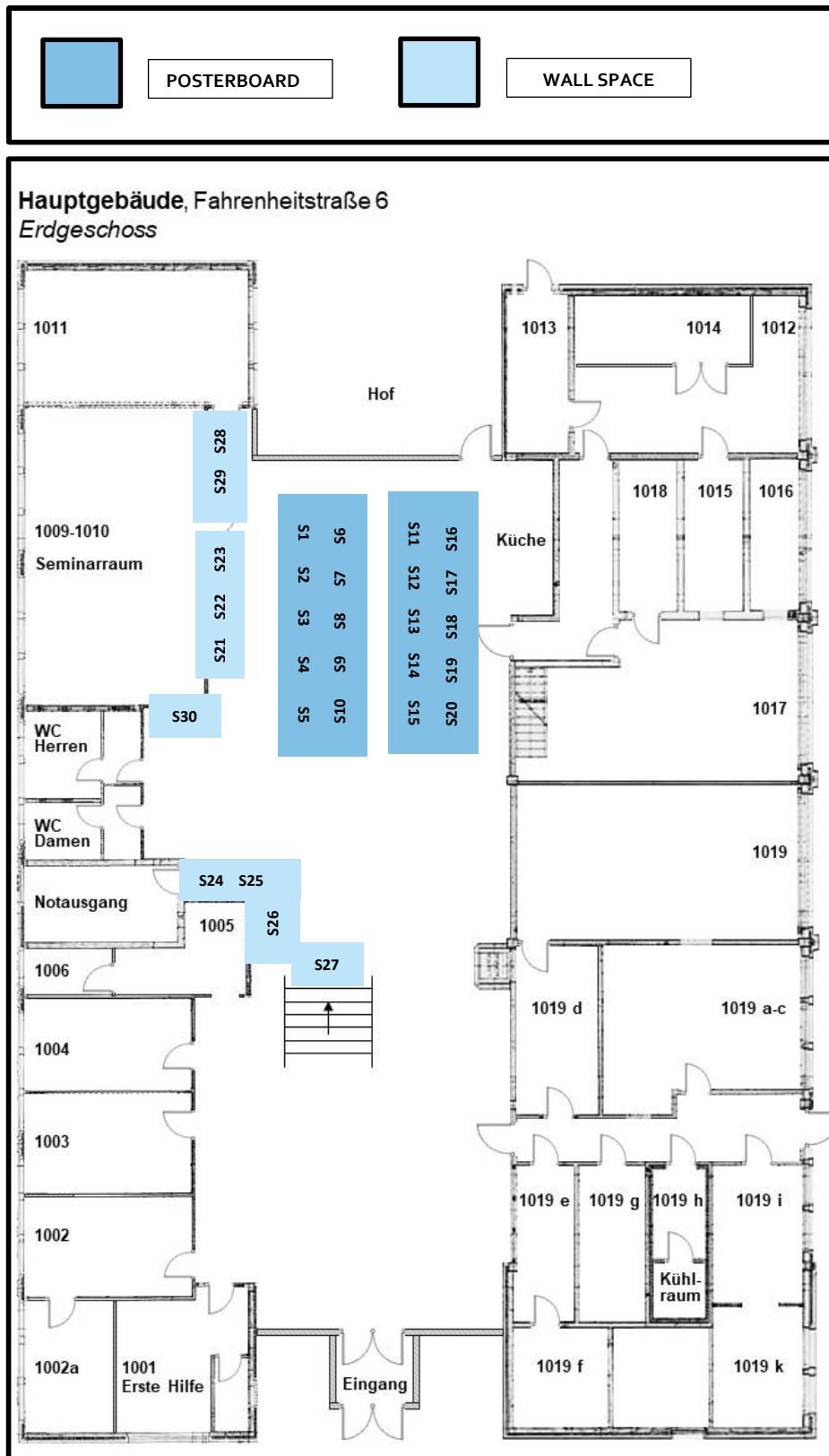
<b>Session 1</b>	Stress at ZMT
<b>Session 2</b>	The coasts of the South Pacific
<b>Session 3</b>	Understanding tropical marine systems through functional ecology
<b>Session 4</b>	Aquatic resource use and protection
<b>Session 5</b>	Biodiversity Studies at ZMT
<b>Session 6</b>	'Omics: one future of ZMT?
<b>Session 7</b>	How do coral reefs respond to anthropogenic disturbances?
<b>Session 8</b>	From Bremen to Indonesia: scientific exchange on policy, socio-economic and natural sciences
<b>Session 9</b>	Integrating scientific approaches to study life in a polluted ocean
<b>Session 10</b>	More than the sum of its parts - the power of network analysis
<b>Session 11</b>	Conservation, restoration and design of tropical coastal ecosystems
<b>Session 12</b>	Open Poster Session
<b>Session 13</b>	Networks as essential infrastructure for science, knowledge exchange and impact

## II. SCHEDULE

	BIG SEMINAR ROOM	SMALL SEMINAR ROOM	FOYER
09:00	Session 1: Oo1, <b>Juan Molina</b> - Stress in Fish and Researchers: climate change research	Session 2: Oo7, <b>Léa Riera</b> - Protected species and fishing bans	
09:15	Session 1:Oo2, <b>Jakiel Islam</b> - Climate change induced extreme temperature stress effects in the European seabass	Session 2:Oo8, <b>Juliette Kon Kam King</b> - Practices of knowing and monitoring offshore marine ecosystems	
09:30	Session 1: Oo3, <b>Lara Stuthmann</b> - Sea Grapes: our Solution to avoid stress	Session 2:, Oo9, <b>Nils Moosdorf</b> - Land-ocean connectivity through groundwater in Tahiti	
09:45	Session 1: Oo4, <b>Marion Glaser</b> - Leverage points for pro-poor livelihood transformations through IMTA in coastal Bangladesh	Session 7: O22, <b>N. Alexia Raharinirina</b> - Mechanisms driving symbiont shuffling in corals	
10:00	Session 1: Oo5, <b>Matthias Birkicht</b> - Stress Management - What is positive versus negative stress?	Session 7: O23, <b>Steve S. Doo</b> - Net Community Calcification of Recovering Coral Reefs are Less Impacted by Ocean Acidification	
10:15	Session 1: Oo6, <b>Theresa Schwenke</b> - Reflections on work intensification: The ZMT as show case of an escalating phenomenon	Session 7: O24, <b>Hauke Reuter</b> - Using Mechanistic Models as virtual laboratories to study complex dynamics in coral reefs	
10:30			Coffee / Exhibition
11:15			
11:30	Session 4: O12, <b>Seth Mensah Abobi</b> - Assessing the exploitation status of main fisheries resources in Ghana's reservoirs	Session 5: O16, <b>Esteban Acevedo-Trejos</b> - Latitudinal patterns of phytoplankton size diversity	
11:45	Session 4: O13, <b>Paula Senff</b> - Novel Recirculating Aquaculture System integrating milkfish, sea cucumber and sea purslane	Session 5: O17, <b>G.A. Castellano-Galindos</b> - Marine Fish Invasions at the Panama Canal	
12:00	Session 4: O14, <b>Mirta Teichberg</b> - Seagrasses under pressure from intensive seaweed farming in Rote Island, Indonesia	Session 8: O25, <b>Rifki Furqan</b> - Implementation of Rights Based Fishery Management through Territorial User Rights for Fishery	
12:15	Session 4: O15, <b>Christiane Hassenrück</b> - Structure of milkfish gut microbial communities in open-cage mariculture	Session 8: O26, <b>Tim Jennerjahn</b> - Environmental change affecting the mangrove-fringed Segara Anakan Lagoon, Java, Indonesia	
12:30	Session 6: O18, <b>Jonas Geburzi</b> - Genomics unlock old collections for new insights in global change biology	Session 8: O27, <b>Marie Fujitani</b> - The first months of project TransTourism in Gili Trawangan	
12:45	Session: 6. O19, <b>Kosmas Hench</b> - The genomic onset of reeffish radiation	Session 8: O28, <b>Mithra-Christin Hajati</b> - Quantifying Fresh Submarine Groundwater Discharge (FSGD) and its nitrogen loads at regional scale	

	BIG SEMINAR ROOM	SMALL SEMINAR ROOM	FOYER
13:00			
13:15	<b>Session 13:</b> Networks as essential infrastructure for science, knowledge exchange and impact  Introduction & Flashtalks  World Cafe  Final discussion	Lunch	
14:00			
14:15			
14:30	Session 6: O <sub>20</sub> , <b>Véronique Helfer</b> - <i>Mangroves in a network of connected ecosystems: tracing back organic matter origin using omics</i>	Session 11: O <sub>38</sub> , <b>Mirco Wölfelschneider</b> - <i>How mangroves drive organic matter dynamics in coastal waters</i>	
14:45	Session 6 O <sub>21</sub> , <b>Christiane Hassenrück</b> - <i>TropicOmics - sequencing tropical coastal ecosystems</i>	Session 11: O <sub>39</sub> , <b>Michael Kyei Agyekum</b> - <i>Forest gaps in mangroves and their contribution to ecosystem services</i>	
15:00	Session 10: More than the sum of its parts - the power of network analysis  Speed Talk Group 1:  Yvonne Kunz, Marina Corrêa,	Session 11: O <sub>40</sub> , <b>Marie Fujitani</b> - <i>Bioremediation of wastewater: acceptability and feasibility of designed ecosystems for sustainable nature tourism</i>	
15:15	Eike Holzkämper, Marion Glaser	Session 9: O <sub>29</sub> , <b>Jailson F. Moura</b> - <i>Using data analysis to explore mercury accumulation in cetaceans at global scale</i>	
15:30	Session 10: More than the sum of its parts - the power of network analysis  Speed Talk Group 2:  Ben Nagel, Saavedra-Hortua Daniel,  Mensah Abobi, Theresa Schwenke	Session 3: O <sub>10</sub> , <b>Davi Castro Tavares</b> - <i>Traits shared by marine megafauna and their relationships with ecosystem functions and services</i>	
15:45		Session 3: O <sub>11</sub> , <b>Gary Murphy</b> - <i>Spatial variation in the rates of calcification by calcareous encruster communities</i>	
16:00			Coffee & Poster Sessions
16:45			
17:00			Open discussion with snacks

### III. POSTER PLAN



### POSTER SPOTS

<b>S1</b>	P67 Nils Moosdorf - Does groundwater discharge increase fish abundance?
<b>S2</b>	P68 Davi Castro Tavares - Effects of environmental change on waterbird functional traits in tropical coastal wetlands
<b>S3</b>	P54 Yustian Rovi Alfiansah - Addition of carbohydrates ameliorates water and natural feed quality in shrimp pond aquaculture
<b>S4</b>	P60 Marie Harbott - Reconstruction of anthropogenic environmental changes from a Cuban coral over the last 175 years
<b>S5</b>	P61 Sara Todorović - Tracking the anthropogenic influence on surface temperatures and pH in Southwest Pacific since the Industrial Revolution
<b>S6</b>	P65 Florian Hierl - The impact of microplastic exposure on coral growth
<b>S7</b>	P66 Sönke Hohn - The long-term legacy of plastic mass production
<b>S8</b>	P71 Mercy Grimon-Thompson - Pathways of Heavy Metals from the Agbogbloshie E-Waste Dump Site into Coastal Waters.
<b>S9</b>	P74 Amon Kimeli - Sediment dynamics in a transboundary mangrove habitat
<b>S10</b>	P75 Claire Siddiqui - Project TRAFFIC: Investigation of carbon fluxes within the Benguela upwelling system
<b>S11</b>	P62 Paula Senff - A stakeholder workshop informed by scientific findings on pond aquaculture
<b>S12</b>	P63 Till Oehler - Ups and downs during field campaigns on Java, Bali and Lombok
<b>S13</b>	P64 Yustian Rovi Alfiansah - Research permit in Indonesia: is it really complicated?
<b>S14</b>	P69 Yannis Kappelmann - Changes in sediment facies through time in an Indonesian reef island
<b>S15</b>	P70 Thomas Mann - Holocene and Anthropocene sea-level records from Indonesia (HAnsea)
<b>S16</b>	P44 Kimberly Schwarz - The effect of different nutrient concentrations on growth, photosynthetic performance and antioxidant potential
<b>S17</b>	P47 Lisa Röpke - Alternative Antifouling Applications (A3) for Coral Reef Restoration: A technological solution?
<b>S18</b>	P48 Holger Kühnhold - It's Getting Hot in Here - Temperature-dependent aerobic scope and <i>Hsp70</i> expression in the sea cucumber <i>Holothuria scabra</i>
<b>S19</b>	P49 Holger Kühnhold - Can Aquaculture Relieve Stress on Global Food Systems?
<b>S20</b>	P50 Rapti Siriwardane-de Zoysa - The Wickedness of Governing Land Subsidence: Policy Contradictions in Urban Southeast Asia
<b>S21</b>	P55 Stefan Partelow - COMPASS: Comparing Aquaculture Systems Sustainability
<b>S22</b>	P51 Elodie Fache - SOCPacific's transdisciplinary research protocol based on children's drawings
<b>S23</b>	P52 Annette Breckwoldt - Reflections on participatory and transdisciplinary research approaches and their societal relevance
<b>S24</b>	P56 Davi Castro Tavares - Mortality of seabirds migrating across the tropical Atlantic in relation to oceanographic processes
<b>S25</b>	P57 Mirta Teichberg - Seagrass, macroalgae, and microphytobenthic community dynamics under varying nutrient and temperature experimental treatments
<b>S26</b>	P58 Dr. César E. Giraldo-Herrera - From Skilled Perception and Spectral Apparitions to Exploring Traditional Knowledge of Marine Emerging Infectious Diseases
<b>S27</b>	P59 Véronique Helfer - Temporal dynamics of total and active microbial communities in mangrove sediments
<b>S28</b>	P72 Jana Harders - Global estimate of recirculated submarine groundwater discharge using hydrogeological models
<b>S29</b>	P73 Elisa Casella - ZMT has a new point of view on tropical coastal environments
<b>S30</b>	P53 Agustín Moreira-Saporiti - From traits to plasticity: How will seagrass look in a changing world?

#### IV. EASTER EGG HUNT

Spring is coming – thus, during the ZAC1, QR-codes will be distributed on the scientific posters to play an “easter-egg hunt”. Scanning each QR-Code with your smartphone will provide you with one letter of a word. If you email the correct word to: [game@leibniz-zmt.de](mailto:game@leibniz-zmt.de).

Everyone who sent an email with the correct word to the mentioned email-address **UNTIL 7pm on Jan 14th 2020** will take part in a raffle for a voucher to buy a textbook for up to 100 €. The Winner will be notified. Obviously those who were part of the game development can't take part.

And one last hint: If your word refers to a comic figure, you are quite right.

Have fun!

## V. EXHIBITION

In this showroom format, members of ZMT present their work, support and exhibit hands-on objects.

The exhibition shows classical exhibition objects, invented and optimized measuring devices, formats of presenting knowledge transfer, e.g. for pupils, students or the general public.

On the other hand also examples of the ZMT's field equipment are shown. You might get the possibility to dive through a virtual coral reef, see measuring option of multiparameter sensors, experience an example of citizen's science, and learn about infrastructure units and their support at ZMT.

Exhibition pieces:

EXHIBIT	CONTACT
3D Riff	Hauke Reuter
groundwater model	Nils Moosdorf
measuring probe (chemistry)	Donata Monien/Christina Staschok
ANCHOR project	Natalie Prinz
ALFRESCO SYSTEM	Thomas Rau

## VI. TALK ABSTRACTS

**SESSION 1 - Oo1 Stress in Fish and Researchers: climate change research****Authors:**

Juan Molina,  
Andreas Kunzmann

Today, whether climate change and pollution represent a threat for marine species in the future is not under discussion, but to what extent will the organisms be affected is what needs to be thoroughly investigated. Given that physiological processes are the link between the environment and the individual-level responses, studies focusing on the effects of environmental drivers on the physiology of marine organisms are sorely needed. In this aspect, the study of fish responses to the stressors related to climate change and pollution is of high relevance. The anticipated assessment of the stability of fish stocks and the sustainability of fisheries is a direct area of application for such information. Extensive and semi-intensive aquaculture production is also affected by climate change, with direct impact on yields and economic solvency. At ZMT, in the Ecophysiology / Experimental Aquaculture working group we will be employing a combination of traditional (respirometry) and modern (multi-biomarker) physiological tools and modeling techniques to look into this issue. The experimental fish we will use is from the family Batrachoididae, which comprises coastal bottom dwelling fish that have one of the most sluggish behaviors among fish. They have world-wide distribution, and can tolerate a wide range of temperature, salinities and oxygen concentration. The European toadfish, *Halobatrachus didactylus*, lives associated to the sea floor and has sedentary habits, being first handedly exposed, and inevitable subject, to the particular stressors of its habitat, which makes it a potential bioindicator species. The life history traits of the toadfish make it ideal to study the physiological effects of global warming, hypoxia and pollution. As part of an Assemble Plus funding granted to our group we will work in cooperation with CCMAR in Faro, Portugal, where this species naturally occurs. Our aim is to quantify and determine the physiological effects of increased temperature, reduced dissolved oxygen concentration and mercury pollution on the stress response of *H. didactylus*. We expect that the results from this investigation will contribute to the production of bioenergetic models that contains a solid mechanistical base for the prediction of climate change and contamination impacts on fishes. The potential results could be useful for the conservation of species, management of fisheries, and aquaculture in the Anthropocene.

## SESSION 1 - Oo2 Climate change induced extreme temperature stress effects in the European seabass (*Dicentrarchus labrax*): growth performance and physiological functions

### Authors:

M. Jakiul Islam<sup>1,2</sup>,  
Andreas Kunzmann<sup>2</sup>,  
Matthew J. Slater<sup>1</sup>

<sup>1</sup>Alfred Wegener Institute for  
Polar and Marine Research  
(AWI), Bremerhaven,  
Germany; <sup>2</sup>ZMT Bremen,  
Germany

Due to global climate changes, the extreme temperature events are a great concern. The study was conducted to understand the extreme warm events on the growth and hematology on European seabass (*Dicentrarchus labrax*). Fish were exposed to 8°C, 16°C, 24°C, 32°C for 30 days mimicking to climate change-induced temperature events. Blood lactate, plasma triglycerides, erythrocytic abnormalities were observed. Growth performances were tended to impair in 8°C and 32°C compared to 16°C and 24°C. Besides, somatic indexes were also found disfavored for fish at 8°C and 32°C. White blood cell (WBC) and plasma triglycerides were significantly ( $p<0.05$ ) increased in 8 °C and 32°C, while red blood cell (RBC) showed an inverse trend. Blood lactate values were observed significantly ( $p<0.05$ ) higher in 32°C. Erythrocytic abnormalities frequencies were found to be significantly ( $p<0.05$ ) higher for fish reared at 8 °C and 32°C and to be higher at day 10 compared to day 20 and 30. Despite European seabass is known to withstand wide variation of environmental factors, both extreme low and high temperatures for prolonged period augmented blood triglycerides, lactate levels and erythrocytic abnormalities in this fish species. This study confirmed that extreme temperatures 8°C and 32°C are likely stressful and unsuitable.

## SESSION 1 - Oo3 Sea Grapes: our solution to avoid stress

### Authors:

Lara Stuthmann<sup>1</sup>, Karin  
Springer<sup>2</sup>, Andreas  
Kunzmann<sup>1</sup>

<sup>1</sup>ZMT Bremen, Germany;  
<sup>2</sup>University of Bremen,  
Germany

With an increasing world population, stress on the food producing sector is increasing. Aquaculture is an essential part of the strategy to cover the demand of food for future generations. However, many common culture approaches entail disadvantages for the environment. The culture of seaweeds, on the other hand, is a sustainable and simple solution for the emerging problem of food shortage. Sea grapes (*Caulerpa lentillifera*) are green macroalgae, which are also known as green caviar, due to their special texture. The unique appearance together with the nutritional benefits, including high antioxidant potential and a high concentration of polyunsaturated fatty acids result in a high demand for this alga, especially in Japan and Singapore and the use in the gourmet kitchen. However, also *C. lentillifera* aquaculture suffers from stress, i.e. high irradiances and unfavorable nutrient contents. In this presentation sea grapes will be introduced and a series of experiments, which investigate the physiological stress responses of this remarkable alga in order to better adapt the culture conditions and therefore to provide solutions for a sustainable food production.

## SESSION 1 - Oo4 Leverage points for pro-poor livelihood transformations through IMTA in coastal Bangladesh: An initial systems analysis for the mitigation of stress

### **Authors:**

Marion Glaser<sup>1</sup>, Andreas Kunzmann<sup>2</sup>

<sup>1</sup>University of Bremen,  
Germany; <sup>2</sup>ZMT Bremen,  
Germany

Coastal Bangladesh is highly vulnerable to anthropogenic salinity intrusion. New production systems therefore need to replace the disappearing agricultural livelihoods of up to 20 million coastal people. Integrated multi-trophic aquaculture (IMTA) is new to coastal Bangladesh. It can mitigate the harmful ecological impacts of conventional aquaculture and possesses transformative potential for the poor who disproportionately bear the costs of ongoing environmental change. Collaborative innovation development in brackish water aquaculture (BWA) through which poor men and women increase their opportunity space as "experts and experimenters" is needed. So far, aquaculture development has achieved little along these lines and our research indicates that particular attitudinal and institutional hurdles need to be addressed. A group of social and natural scientists from Bangladesh and Germany in dialogue with ministerial, business and NGO representatives are piloting an initiative (IPoor) to enable poor coastal men and women to co-develop innovative, ecosystem-based IMTA and related options. We envisage an Innovation Systems Approach in which multiple stakeholders collaborate in extending opportunity spaces with and for those least successful within conventional transfer of technology models. Social innovation beyond technology and the establishment of "countervailing powers" among poor and marginal coastal residents are likely to be essential to enable economically viable, socially equitable and ecologically sustainable transformative innovation through co-developing innovative aquaculture ideas in ways that include those most affected by environmental change. We aim to support a self-organizing transformation towards sustainable coastal resource use and livelihoods for the poor under new and dynamic environmental change conditions. Donella Meadows's "Leverage Points" serve to analyze sustainability transformation prospects for one of the earth's poorest, most densely populated and climate-change affected regions.

## SESSION 1 - Oo5 Stress Management - What is positive versus negative stress?

### **Authors:**

Matthias Birkicht<sup>1</sup>,  
Lena Oehlmann<sup>1</sup>

<sup>1</sup>ZMT Bremen, Germany

It may seem like there's nothing you can do about stress. The bills won't stop coming, there will never be more hours in the day, and your work and family responsibilities will always be demanding. But you have a lot more control than you might think. In fact, the simple realization that you're in control of your life is the foundation of managing stress. Stress management is all about taking charge: of your lifestyle, thoughts, emotions, and the way you deal with problems. No matter how stressful your life seems, there are steps you can take to relieve the pressure and regain control.

The Health Manager in our Center (Lena Oehlmann) and the Health Circle are working together with the Health insurances and other organizations to go for a good work-life-balance for everybody.

A Guide for Stress Management and a professional survey will help us to determine stress factors and to develop strategies to reduce stressors.

## SESSION 1 - Oo6 Reflections on work intensification: The ZMT as show case of an escalating phenomenon

### Authors:

Theresa Schwenke<sup>1</sup>,  
 Matthias Birkicht<sup>1</sup>,  
 Susanne Eickhoff<sup>1</sup>,  
 Merle Schlawinsky<sup>1</sup>,  
 Epiphane Yéyi<sup>1</sup>,  
 Christian Brandt<sup>1</sup>,  
 Hauke Reuter<sup>1</sup>,  
 Carola Stefes<sup>1</sup>

<sup>1</sup>ZMT Bremen, Germany

"Sometimes I am sitting at my desk, feeling my heart running with an increased frequency. Then I realize that is because I have twenty different things in mind, which I should not forget. Only when I write them down I feel my pulse relaxing again."

Work intensification has been described as increasing work amount per employer and time unit. It is used to increase productivity but has implications for the employer's well-being. Therefore observing and reflecting on work intensification is of relevance for sustaining a physically and mentally healthy working environment.

We introduce definitions, developments, causes and effects of work intensification in theory and specifically at ZMT. Furthermore we elaborate the judicial position of work intensification processes within the German law system.

Finally we want to discuss possible solutions and strategies to shape our present and future work environment at ZMT.

## SESSION 2: Oo7 Protected species and fishing bans: the integration of conservation directives into coastal fisheries management in Fiji and in New Caledonia

### Authors:

Léa Riera<sup>1,2,3</sup>

<sup>1</sup>IRD-GRED (Montpellier, France); <sup>2</sup>ZMT Bremen, Germany; <sup>3</sup>SOCPacific

In Pacific Islands Countries and Territories (PICTs), many multi-lateral commitments and treaties on the marine environment tackle the involved countries' biodiversity conservation strategies and require growing consideration in the management of extractive activities such as fisheries.

Focused on the coastal fisheries management sector, my PhD research project aims at understanding how these external injunctions materialize in practice in two PICTs presenting very distinct ecological, political and economic contexts: Fiji and New Caledonia. This multi-scale comparison provides important insights in divergences and similarities occurring for two interrelated topics: (1) the scaling-up of management instruments (e.g. marine protected areas, species bans, size-regulations), and (2) the transformation of governance models through the formation of new coalitions of stakeholders involved in conservation and fisheries sectors.

I intend to illustrate these two issues with a focus on the national and sub-national implementation of several marine species fishing bans. In each of the case study, which coalitions are involved in the design and the practical implementation of these bans? How does it disrupt or adhere to established fisheries governance models? How are they perceived by resource-users and more specifically fishers? After presenting my research methods and the organisation of my 7-month field work, I will provide preliminary answers to these questions.

## SESSION 2 - Oo8 Transparency at sea: practices of knowing and monitoring offshore marine ecosystems

### Authors:

Juliette Kon Kam King<sup>1,2,3</sup>

<sup>1</sup>IRD-GRED (Montpellier, France); <sup>2</sup>ZMT Bremen, Germany; <sup>3</sup>SOCPacific

Offshore areas, and mostly offshore fisheries, represent an important resource of both food and income for Pacific countries and its inhabitants but are under increasing pressure due to intensifying fishing efforts on already dwindling stocks – including Illegal, Unreported and Unregulated (IUU) fishing –, adverse impacts of industrial tuna fisheries on the rest of the marine ecosystem, and climate change related effects. Ecosystem-based management approaches require more information about fisheries systems, and enhanced Monitoring, Control and Surveillance (MCS) schemes are now at the forefront of national and regional discussions to ensure the sustainable use of offshore fisheries. However, these endeavors stumble over the challenges that offshore ecosystems present in terms of understanding, monitoring and control. Their very materiality, remoteness and immensity, and the high mobility of its inhabitants, both human and non-human, have long hindered efforts to access and comprehend it, let alone harness and control it. Recently, the development of digital informational technologies fosters the hope of providing comprehensive, improved and up-to-date information on fisheries and offshore marine spaces to support informed, adaptive and meaningful management decisions. This transforms both scientific and surveillance endeavors and practices and, along those, offshore marine system representations (e.g., in international negotiations on Areas Beyond National Jurisdiction). This contribution aims at offering preliminary insights into these evolutions by drawing on empirical findings from Fiji and New Caledonia.

## SESSION 2 - Oog Land-ocean connectivity through groundwater in Tahiti

### Authors:

Nils Moosdorf<sup>1,2</sup>,  
Kathrin Haßler,  
Claudia Starke

<sup>1</sup>ZMT Bremen, Germany;  
<sup>2</sup>Kiel University

Groundwater connects land and ocean particularly intensively on volcanic islands, like Tahiti. The island has intensive rainfalls and high permeability paired with sensitive coastal ecosystems. Here we present research from two field trips to Tahiti, looking at nutrient fluxes in the groundwater and effects of submarine springs in coastal ecology. We show that even the small area of settlement around a comparably pristine steep inner island add substantial amounts of nutrients to the groundwater. Isotopic and spatial analyses point to anthropogenic sources of the nutrients. In particular high concentrations are associated with septic waste or manure. These nutrients increase algal growth and may increase fish abundance in the ocean. In particular the effect on ecosystems can be important for local marine productivity around volcanic islands and should receive more scientific attention.

### SESSION 3 – O10 Traits shared by marine megafauna and their relationships with ecosystem functions and services

#### Authors:

Davi Castro Tavares<sup>1</sup>,  
 Jailson Fulgencio Moura<sup>2</sup>,  
 Esteban Acevedo-Trejos<sup>1</sup>,  
 Agostino Merico<sup>1,2</sup>

<sup>1</sup>ZMT Bremen, Germany;  
<sup>2</sup>Jacobs University Bremen,  
 Germany

Trait-based approaches are useful to uncover processes influencing structure and functions of biological communities. Here we review traits that are measurable and comparable among marine megafauna, e.g. marine mammals and seabirds. The variability of these traits within the organisms controls functions mainly related to nutrient storage and transport, and trophic-dynamic regulations of populations. To estimate the contributions of marine megafauna to ecosystem functions and services, traits can be quantified categorically or over a continuous scale, but the latter is preferred to make comparisons across groups. The most relevant traits to comparatively study marine megafauna groups are body size, body mass, dietary preference, feeding strategy, metabolic rate, and dispersal capacity. These traits can be used with information on population abundances to predict how changes in the environment can affect community structure, ecosystem functioning, and ecosystem services.

### SESSION 3 – O11 Spatial variation in the rates of calcification by calcareous encruster communities - implications for reef functioning and management

#### Authors:

Gary Murphy<sup>1,2</sup>,  
 Kyle Morgan<sup>2,3</sup>,  
 Chris Perry<sup>2</sup>

<sup>1</sup>ZMT Bremen, Germany;<sup>2</sup>  
 University of Exeter, UK;  
<sup>3</sup>Nanyang Technological  
 University, Singapore

Calcareous encruster communities (CEC) include crustose coralline algae, foraminifera and many other non-coral organisms. On healthy reefs they generally contribute a small proportion to total carbonate production, but have other functionally important roles; they stabilize dead coral fragments, create micro-habitats and encourage coral larval settlement. CEC also begin to colonise newly available substrate after 2-3 weeks. In the wake of a mass mortality event CEC protect reef structural complexity from biological and physical erosion and create a platform for coral settlement and reef renewal. Bleaching-induced coral mass mortality events have led to widespread decreases in carbonate production on coral reefs and an increase to populations of non-coral species, particularly coralline algae, various macroalgae and bioeroding sponges. Census based carbonate budgets use calcification and bioerosion rates as functional traits of individual species to understand reef functioning. However, there are few data on calcareous encruster calcification and limited quantitative understanding of how these organisms contribute to reef functioning. Here, we describe calcification by CEC on an exposed and sheltered coast of Grand Cayman and their contributions to reef carbonate budgets. Results suggest that environmental conditions affecting calcification have important implications for the maintenance of reef structural complexity after coral mass mortality events.

**SESSION 4 - O12 Assessing the exploitation status of main fisheries resources in Ghana's reservoirs based on reconstructed catches and a Length-based bootstrapping stock assessment method**

**Authors:**

Seth Mensah Abobi<sup>1,2,3</sup>,  
Tobias Karl Mildenberger<sup>4</sup>,  
Jeppe Kolding<sup>5</sup>,  
Matthias Wolff<sup>1,2</sup>

<sup>1</sup>University of Bremen,  
Germany; <sup>2</sup>ZMT, Bremen,  
Germany; <sup>3</sup>University for  
Development Studies,  
Tamale, Ghana; <sup>4</sup>University  
of Denmark, Kemitorvet,  
Denmark; <sup>5</sup>University of  
Bergen, Bergen, Norway

The Cichlid species *Oreochromis niloticus*, *Sarotherodon galilaeus* and *Coptodon zillii*, which are among the most exploited resources in the small-scale fisheries of the Tono, Bontanga and Golina reservoirs in Northern Ghana, were assessed from length frequency samples. Growth, mortality, relative yield per recruit and stock sizes and exploitation status were determined using TropFishR, a novel stock assessment framework which allows for the estimation of uncertainties around the stock parameter estimates (e.g.,  $L_{\infty}$ ,  $K$ , and  $F_{0.1}$ ). Results suggest that the three species studied are heavily exploited in all the three reservoirs, but with no alarming signs of overexploitation. Fishing effort at Golina is comparatively low as a result of insignificant fishing during the agriculture season and relates to low exploitation rates. According to a second assessment approach, based on length-based indicators, all species at Bontanga, and *O. niloticus* and *S. galilaeus* populations at Golina have spawning stock biomasses below 40% of the unfished biomass. This points to a situation of a possible ongoing recruitment overfishing of those species in the two reservoirs and suggests that a further increase in fishing effort should be prevented. Further monitoring of these fisheries will be needed for the improvement of assessments and thus management advice.

**SESSION 4 - O13 Novel Recirculating Aquaculture System integrating milkfish *Chanos chanos*, sea cucumber *Holothuria scabra* and sea purslane *Sesuvium portulacastrum***

**Authors:**

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Sustainable aquaculture can provide food security and income, but manifold improvements are still required before societal needs can be met without adverse ecological impacts. Integrated Multi-Trophic aquaculture (IMTA) is a best management practice that reduces feed input and pollution and optimizes the use of water and space, but few case studies of such systems with tropical species exist. Therefore, an eight-week experiment was carried out at the Zanzibar Mariculture hatchery, Tanzania. Milkfish *Chanos chanos*, sandfish *Holothuria scabra*, and sea purslane *Sesuvium portulacastrum*, an edible halophyte, were cultivated together in a closed recirculation aquaculture system (RAS). Three replicate systems of  $2006 \pm 59$  l (mean  $\pm$  SD) total water volume were operated and each stocked with  $1072 \pm 106$  g of milkfish,  $85 \pm 10$  g of sandfish and  $909 \pm 12$  g of sea purslane, cultivated in separate tanks, connected through continuous water flow. Solid waste collected three times a week from fish tanks was added to the sea cucumber tank as feed. Both milkfish and sea purslane showed good growth, producing an average of  $1147 \pm 79$  g fish and  $1261 \pm 95$  g of plant biomass, while sea cucumber growth was variable with  $92 \pm 68$  g biomass gain. Total N concentrations increased in all tanks over the course of the experiment, but water quality remained tolerable for milkfish. Ammonia levels were reliably decreased to  $< 1$  mg l<sup>-1</sup> and a nitrite peak occurred within the first 30 days, indicating good biofilter performance in the sea cucumber and sea purslane tanks. A nitrogen budget was constructed, accounting for  $63.7 \pm 5.3$  % of the nitrogen added to the system as fish feed. The experiment provides a proof-of-concept of a simple RAS, integrating three tropical species at different trophic levels. The system operated without producing solid waste or discharging polluted water. The biomass of the extractive organisms should be further increased to optimize system performance.

## SESSION 4 – O14 Seagrasses under pressure from intensive seaweed farming in Rote Island, Indonesia

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Seaweed farming in the tropics has expanded rapidly with Indonesia being the main producer of the red seaweeds used in the carrageenan food industry. In Rote Island, East Nusa Tenggara province, Indonesia, seaweed farming is a main source of income to coastal communities. However, farming practices may lead to ecological impacts on seagrass ecosystems, as farms are often placed directly on top of seagrass meadows, shading them from light and competing for inorganic nutrients. Farming practices can also lead to direct disturbance such as trampling by seaweed farmers during cleaning and harvest. To assess the impacts of seaweed on seagrass health in the region, we set up seaweed farm experimental plots in two areas in the Southwest Rote Island varying in population density. We measured seagrass biomass, density, percent cover, and nutrient content in the leaf tissue and sediment in experimental plots before and after two seaweed growth cycles. Seaweed productivity differed between sites in the farms and cycles, with higher growth rates during the rainy season overall. Seagrass biomass, shoot density, and percent cover decreased in the seaweed farm plots compared to unfarmed control plots in both sites. Light penetration to the seagrasses was reduced by the seaweed farms by up to 94% by the end of the experiment, and nuisance algae growing on the seaweeds and lines also increased in the rainy season in the heavily populated site. Total N content of the seagrass leaves was generally higher in the heavily populated site. Organic carbon content in the surface sediment decreased by approximately 20% by the end of the experiment in the farmed plots. These results suggest that current seaweed farming practices can lead to significant seagrass loss over the long-term and that reducing impacts could be possible with better management of farmed areas, such as removal of unused farms, and fallowing periods of farming areas.

## SESSION 4 – O15 Structure of milkfish gut microbial communities in open-cage mariculture

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With the decline in capture fisheries, the importance of aquacultures is increasing rapidly. Gut-associated microbial communities are crucial for the welfare and performance of the cultured fish, and consequently highly relevant for aquaculture management. Here, we investigated gut microbial communities of milkfish (*Chanos chanos*) from intensive open-cage aquaculture in Bolinao, Philippines, via 16S rRNA gene sequencing. Juvenile fish were collected twice from four cages with an intermediate time interval of 15 days, to document differences between cage management and location, as well as short-term temporal changes. Gut microbial community composition differed strongly both within and between cages and over time. The highest community heterogeneity occurred at the cage exposed to the highest rate of disturbance due to boat traffic and changes in feeding strategy. The other cages either exhibited a stable community comprised almost entirely of the genus *Dielma* (least disturbed cage) or displayed a community shift towards such a community. Furthermore, the degree of community change over time correlated with the increase in chronic stress as quantified by ontogenetic scale cortisol. Our study provides insights into the complexity of interactions between gut microbial communities, chronic stress, and management strategies, whose understanding is pivotal to promote sustainable aquaculture practices.

## SESSION 5 – O16 Latitudinal patterns of phytoplankton size diversity

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Latitudinal patterns of species diversity have captured scientist's attention ever since great naturalists including von Humboldt and Darwin noted them. Over time, we have come to accept the general notion that biodiversity, in terms of species richness, tends to increase when moving from the poles to the tropics. While this seems to hold true for large organisms such as trees or mammals, uncertainties remain about latitudinal diversity patterns for microscopic organisms such as marine phytoplankton. Here we use in situ size-abundance distributions to show that, in contrast to the tenet of equatorward increase in diversity, phytoplankton size diversity in the Atlantic Ocean declines with decreasing latitude. We also present evidence for a strong correlation between community size diversity, mean cell size, and biomass. Additionally, by using a trait-based model, we explore the relationship between size diversity and two ecosystem functions along the latitudinal gradient and the mechanisms shaping them.

## SESSION 5 – O17 Marine Fish Invasions at the Panama Canal

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Alien species can have negative effects on biodiversity ultimately affecting the services that humans derive from ecosystems. In the marine realm, interoceanic canals are recognized hotspots for the introduction of alien species. This project intends to investigate the introduction of alien marine fish at the Panama Canal, the most important maritime gateway of the Western Hemisphere connecting the Atlantic and Pacific Oceans. The effect of the recent expansion of the Panama Canal on the introduction of alien fish species will be evaluated using standard fishing techniques, environmental DNA and a citizen science monitoring programme. Functional traits from donor and recipient fish communities will be compared against those of alien fish communities to understand what traits can potentially facilitate invasiveness. Apart from providing an up-to-date assessment of the potential ecological consequences of alien marine fishes at the Panama Canal, the project will help to test contemporary hypotheses in the field of invasion ecology, such as the evolutionary imbalance hypothesis.

## SESSION 6 – O18 Treasures in ethanol: Genomics unlock old collections for new insights in global change biology

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Natural history collections are unique archives of past biodiversity and historical species distribution data. They also hold a wealth of genetic information, which we are just beginning to explore with the recent advent of genomic approaches and high-throughput sequencing techniques.

Incorporating historical specimen in genomic studies can provide exciting new insights in the context of species' reactions to global change: For example, genetic changes in response to e.g. warming temperatures may be tracked over evolutionary significant time spans by comparing historical and present-day samples. Such comparisons also allow to document the consequences of climate-change induced range shifts and anthropogenic habitat fragmentation and degradation for genetic diversity and (meta)population structure. Ultimately, looking into the past can contribute to better projections of the consequences of ongoing and future environmental and climate change.

To date, collection based genomic studies with tropical coastal marine species are still scarce, despite the good collection record of important groups like fish and crustaceans. I will present the high potential of this approach in global change biology by means of a currently developing study, taking a historical genomic perspective on a recent climate-change induced range shift in a (sub)tropical mangrove crab

## SESSION 6 – O19 The genomic onset of a reef fish radiation

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Adaptive radiations are an important source of biodiversity. Yet, despite the incredible diversity of coral reef systems, the genomic onset of adaptive radiation in these environments is still poorly understood. Caribbean hamlets (*Hoploplectrus* spp., Serranidae) offer a rare opportunity to investigate the early stages of adaptive radiation in reef fishes. The group has diversified into a large palette of colour pattern types that mate assortatively in sympatry.

Here, we leverage the chromosome-resolution hamlet reference genome to investigate the population genomic and phylogenomic architecture of adaptive using 167 genomes from eight species and three locations. This dataset provides a total of 28 comparisons between pairs of sympatric species that span the early stages of the speciation continuum, from  $FST \sim 0$  to  $0.1$ . The results indicate that radiation is extremely recent in the hamlets and that it is essentially fuelled by ancestral variation. Diversification appears to be generated modularly by different combinations of a small number of large-effect genes and alleles that have strong functional links to vision and pigmentation.

## SESSION 6 – O20 Mangroves in a network of connected ecosystems: tracing back organic matter origin using omics

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Coastal ecosystems are embedded in a network of interacting marine and terrestrial ecosystems that exchange organic matter. Whether they act as sources or sinks of organic matter (OM) appears to be context-dependent, and notably linked to hydrodynamics and coastal currents. Here we focused on the exchange of organic matter of plant origin among mangrove, seagrass and coral reef systems, in a study site located on the San Andrés (Colombia) Caribbean Island. We used a combination of traditional (stable isotope-analysis) and omics approaches (environmental metabolomic fingerprinting) to trace back the origin of OM, along a regular grid covering an area extending between the mangrove and the reef systems. Based on the environmental metabolomic fingerprinting approach, we were able to identify several biomarkers specific to the distinct sources (reference material from mangrove, seagrass, macroalgae). Based on those markers, we could map the distribution of the distinct sources of OM over the study area. Our findings suggest that the mangroves of North-eastern San Andrés are fuelled by macroalgae and seagrass but export little material into the reef. We will discuss the pros and cons of the omics approaches in this context and how eDNA metabarcoding could help refine those results.

## SESSION 6 – O21 TropicOmics - sequencing tropical coastal ecosystems

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In recent years, many efforts have been undertaken to study marine (microbial) diversity at a global scale. Such endeavors include the TARA Oceans expeditions, the ocean sampling day, and various long-term ecological time-series. However, tropical coasts, specifically South America, Africa, India, and the Indo-Pacific - harboring some of the world's most diverse ecosystems - are severely undersampled, thus introducing a potential bias in global biodiversity studies. ZMT is uniquely positioned to tackle this challenge. Here, we present the project 'TropicOmics' (submitted to DFG), whose aim it is to describe global patterns in taxonomic and functional diversity of tropical coastal ecosystems (coral reefs, seagrass meadows, mangrove forests) using a metagenomic sequencing approach that will cover all domains of life (eukaryotes, including protists and fungi, bacteria, archaea, viruses). Samples will be collected from the water column (size-fractionated) and coastal sediments. With the generated data, we will be able to investigate species distribution patterns across different spatial scales, assess global functional diversity based on gene families, and extend our knowledge base about marine biodiversity.

### SESSION 7 – O22 Mechanisms driving symbiont shuffling in corals

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The success of scleractinian corals in oligotrophic waters of the tropics is the result of an endosymbiotic association with unicellular photoautotrophs called zooxanthellae (the symbiont). Increasing sea temperature causes the breakdown of this association, the expulsion of the symbionts and, in severe cases, the death of corals. Observational evidence suggests that the shift in the relative abundance of symbiont populations within the coral host (symbiont shuffling) enables corals to transcend their thermal tolerance limits. The mechanisms of symbiont shuffling, however, are poorly understood. Using a new trait-based, adaptive dynamics model, we show that classic competition theory can explain symbiont shuffling when the competitive abilities of different symbionts are driven by their thermal tolerances. We also show that rapid symbiont shuffling can occur with the presence of a positive feedback according to which some of the symbiotic benefits received by corals are re-allocated to symbiont growth. Our results narrow down the mechanisms that could explain the observed patterns of symbiont population dynamics during thermal stress and provide new model theories that can be tested with laboratory experiments.

### SESSION 7 – O23 Net Community Calcification of Recovering Coral Reefs are Less Impacted by Ocean Acidification

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Ocean acidification (OA) is expected to severely decrease calcification rates on coral reefs worldwide. Understanding ecosystem-scale responses of coral reefs to OA has largely remained difficult to measure. We previously developed an *in situ* OA experimental setup, the Shallow COral REef-Free Ocean CO<sub>2</sub> Enrichment (SCoRe-FOCE; 2300L internal volume), deployed on the backreef in Mo'orea French Polynesia. In this current experiment, two plots of bare calcareous substrata were propagated with smaller colonies (<10cm) of common reef-building corals, and additional two plots were propagated with larger colonies (>20cm). Over two separate 14-day periods, we incubated one plot with smaller corals and one with larger corals in ambient conditions, and the other two plots of smaller and larger corals in higher CO<sub>2</sub> conditions (~1000μatm), to contrast how size fraction of coral colonies within a population would impact net community calcification (NCC). Similar to previous results, we found that NCC in the larger coral community decreased by ~75% at ~1000μatm compared to ambient conditions. However, NCC in the smaller communities when exposed to ~1000μatm was less impacted as compared to ambient conditions. This suggests coral reefs in recovering states (smaller sized corals) may be less impacted by future projected OA conditions.

## SESSION 7 – O24 Using Mechanistic Models as virtual laboratories to study complex dynamics in coral reefs

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Dynamics in coral reefs are determined by a high number of complex processes of interacting components. Changing environmental conditions or anthropogenic induced disturbances may lead to self-enhancing feedback processes changing reef states from coral dominated to a state in which other benthic organisms are predominant. Testing the overall outcomes of a combination of threats to reefs proofs difficult with field experiments due to long time frames and the high potential number of different combinations. Mechanistic models allow to represent the most relevant parts of reef systems with their internal dynamics and reactions to other components. Overall dynamics emerge as a self-organisation process under the given environmental conditions. With such a setting it is possible to make projections for different combinations of scenario conditions. In this contribution we will display results from a model on coral reefs encompassing mostly coral-algae interactions leading to phase-shifts under common current disturbance conditions. The overarching goal is to include further components and to extend the model to a virtual laboratory which allows to study a variety of different potential scenarios (e.g. threats, resource use etc) to aid in management.

## SESSION 8 – O25 Implementation of Rights Based Fishery Management (RBFM) through Territorial User Rights for Fishery (TURF)

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Overfishing caused by open access has multiple negative impacts to the local community, especially to whom lives in the adjacent of coastal waters. There is no single coastal management approach to encounter problem of overfishing, especially in designated conservation area. Artisanal fishers must compete with outside fishers in their fishing ground. It leads to social conflict and depletion of fish biomass. Responding the open access problem, there has been increasing concern to establish Territorial User Rights for Fishery (TURF) system. Ideally, TURF management aims to be solution on overfishing problem through several practices. One of the effective practices to respond overfishing is providing local fishers with exclusive access to certain fishing area and/or limiting users who can access marine resources in certain granted area. Combining the no-take zone and the TURF system, the Fish Forever program is a global movement that address overfishing problem caused by open access practice through establishment of TURF-Reserve. This presentation elaborates 2 of 15 sites where Rare Indonesia works with local partner in establishing formal TURF-Reserve in Indonesia from the perspective of socio-ecology. Specifically, several social and ecological components such as community profile, marine governance system, marine resources system, and ecosystem services will be elaborated.

## SESSION 8 – O26 Environmental change affecting the mangrove-fringed Segara Anakan Lagoon, Java, Indonesia

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The overarching goal of SPICE topic 4 'Mangrove Ecology' was to investigate the effects of land and resource use and the underlying political and societal framework on the status of mangrove ecosystems and their resource potential. Long-term data on vegetation and benthic invertebrates in the mangrove-fringed Segara Anakan Lagoon display drastic changes. A strong decrease of species numbers within 10 years exemplifies the negative consequences of mangrove degradation drastically. Fisheries resources are almost exhausted in Segara Anakan. The short residence time of water in the lagoon is mainly responsible for a rapid export into the Indian Ocean of large parts of potentially harmful terrestrial inputs from the hinterland (nutrients, sediments, pollutants). Nevertheless, the high sediment input strongly contributes to lagoon infilling. The reconstruction of vegetation and environmental conditions as well as of economic and political decisions revealed major environmental changes in the past centuries. The synthesis of 12 years of SPICE research highlights that intensive use of natural resources in the lagoon and its hinterland strongly impairs ecosystem functions and services. This is to a large extent due to conflicts between government and local stakeholders and the lack of adequate governance instruments.

## SESSION 8 – O27 Tourism, sustainability, and fieldwork: the first months of project TransTourism in Gili Trawangan

### Authors:

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The objective of the research project TransTourism (Transdisciplinary Science for Sustainable Tourism) is to work with communities around the tropics who are dependent on tourism, to support sustainable nature tourism. Nature tourism is an important share of Indonesia's tourism, and project aims take into account the vibrant and growing tourism sector, and the Indonesian Master Plan of National Tourism Development 2010-2025, focusing on sustainable tourism development and growth in the tourism sector, with tourism development that strives to be both pro-jobs and pro-environment, to safeguard social, ecological, and economic sustainability. The project TransTourismus and this research aims to support tourism communities in solving the challenges of wastewater management.

In collaboration with Universitas Mataram (UNRAM) and Dr. Nurliah Buhari, two ISATEC Master's theses are currently in progress in the field on this topic, "Impact of Wastewater on Socio-Ecological System in Gili Trawangan, Indonesia" (Pumpuni Frimpong-Manso) and Collective action and natural resource challenges: Analyzing the social and historical aspects on Gili Trawangan (Hanrahan). This talk will highlight the impressions, accomplishments, and observations in the first two months of fieldwork.

## SESSION 8 – O28 Quantifying Fresh Submarine Groundwater Discharge (FSGD) and its nitrogen loads at regional scale

### Authors:

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Fresh submarine groundwater discharge (FSGD) is a poorly studied flux and water pathway that can discharge a fraction of terrestrial nitrogen surplus into the ocean. Hence, FSGD can locally play a major role in driving water quality in coastal oceans, especially in the tropics: Tropical monsoon rain suggests a large FSGD volume and rapidly changing land use in (sub-)tropical catchments to farmland transporting more nitrogen (N) to aquatic ecosystems. Directly measuring FSGD requires great effort and is currently only feasible at local scale, which motivated us to develop the regional transient lumped water balance model CoCa-RFSGD to quantify daily FSGD at the whole island of Java, Indonesia. As a result, Java drains 15.27 km<sup>3</sup>/a groundwater to the ocean. Catchment soils with higher water-holding capacity and precipitation surplus showed highest FSGD potential. To estimate N recharged into the aquifer the soil modules of CoCa-RFSGD were extended by a mass balance model including N transformations hydrolysis, volatilization, nitrification, denitrification and sorption at the example of a subtropical catchment in Eastern Australia. Catchment N surplus was larger the more farmland was present, and basins in subtropical Australia lost 85% of that N to the atmosphere and only 15% to water ways.

## SESSION 9– O29 Using data analysis to explore mercury accumulation in cetaceans at global scale

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The accumulation of mercury in the global ocean is increasing the toxicological risks for marine life and in particular for predator such as cetaceans. Using spatial analysis and random forest techniques, we assessed intra and interspecific variations of mercury concentrations in cetaceans in relation to their functional traits (length and trophic position) and environmental factors (mercury at sea surface). Our results reveal regional hotspots of mercury concentrations in cetaceans and uncovered regions with extensive lack of information. We also found a strong selenium-mercury antagonistic relationship, substantiating the role of selenium, in addition to traits such as length and trophic position, as a mercury-detoxifying agent. Our findings provide a better understanding of the variables associated with mercury accumulation in cetaceans, an essential first step for the development of conservation strategies.

## SESSION 10 – O30 Assessing environmental governance through the net map tool

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Multi-stakeholder sustainability certification schemes have become a favorite instrument within environmental governance, though studies indicate their inefficiency at the producer level. In this study, we used a mixed-method approach to first, map the institutional context of independent oil-palm smallholders in rural Sumatra while, second, reflecting upon the impact of the Smallholder Standard proposed by the Roundtable on Sustainable Palm Oil on smallholder management practices using the novel Net-Map tool, which has not been applied yet to investigate oil-palm smallholders' institutional backgrounds towards sustainable certification schemes. The Net-Map tool was developed by Schiffer (2007) to respond to criticism of common governance analysis tools. It combines social network analysis, to identify actors and their interaction within a social network (Lauber, Decker, and Knuth 2008; Bodin, Crona, and Ernstson 2006), and power mapping, to investigate how much influence one actor has on decision-making processes (Schiffer and Waale 2008). This combination allows not just mapping formal hierarchies but allows identifying networks that "tend to be located outside the existing hierarchies" (Schiffer and Waale 2008, 1). We hold that non-recognition of micro-scale perspectives within governance processes may partially explain noncompliance with certification principles among smallholders.

## SESSION 10 – O31 Ecosystem-Based Management in beaches: Network Analysis as a tool to access challenges and opportunities towards sustainability

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Ecosystem-Based Management (EBM) is a pertinent tool to manage coastal zones in the Climate Change (CC) context: it considers the diagnosis of socio-ecological vulnerabilities to early respond to them. The EBM recognizes the importance of social-ecological components of the system for sustainable management decisions. Therefore, the way in which social networks are structured and perceived, as well as anticipated, may affect management practices. Historically, beach management is characterized by the lack of communication among public agencies, misinformed and centralized decision making. Thus, this research aims to understand how the municipal managers' comprehensions of beaches as social-ecological systems represent opportunities for EBM implementation. Applying the Ecosystem Services (ES) vulnerability to CC as a communication tool with beach managers, 11 workshops were conducted in four Brazilian coastal municipalities. During the workshops, a multi-method approach based on the integration of the Focus Group and Net-Map methodology was applied to map and discuss the current beach management network and the actions and changes needed in this network to sustain beaches ES provision in the future, as perceived by the participants. Here, we present the preliminary results of the Network Analysis and discuss EBM implementation opportunities related to the perception of municipal beach managers.

## SESSION 10 – O32 Analysing Net-Map data: merging network perceptions or searching for the common ground?

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Net-Map is a group-dynamic participatory social network data collection and analysis method. While Net-Map visualizes the social network as perceived by one interviewee or as a perception consensus of an interview group, authors who apply the method nevertheless oftentimes combine the network data of different perceived networks, creating one aggregated Net-Map as a proxy of the actual overall network. This approach generates a result with certain explanatory limitations due to the bias towards the different network perceptions. In this paper, I discuss how Net-Map data is analysed in the literature. I further present a case study from Brazil where the Net-Map method was applied to map the governance network of a marine protected area, and point out the lessons learned in terms of methodological challenges from this case. In conclusion, I compare different ways how to analyse Net-Map data and discuss opportunities for method development.

Forthcoming in: Special Issue in the Journal of Human Ecology Review: Methods for network analysis in the governance of social-ecological systems.

## SESSION 10 – O33 Ecosystem user perceptions of governance interactions in Marine Protected Areas

### Authors:

Marion Glaser<sup>1</sup>,  
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<sup>1</sup>ZMT Bremen, Germany;

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Germany

The presentation contributes to the emerging field of perception studies in environmental governance and management. With stakeholder-specific netmapping as the main approach for identifying the perceptions of local ecosystem users, it analyzes the subjective local realities of fishers and tourism operators in two sites of a large marine protected area in north-east Brazil. Our netmaps show that fishers and tourism operators view themselves as part of various different webs of social relations with variations in associated power asymmetries, and that they perceive these marine governance networks in relation to their own interests and vulnerabilities. The different de facto marine governance experiences of our netmap exercise participants set the scene for their actions and enable us to identify leverage arenas for sustainability enhancing governance. These are inclusiveness, knowledge building, legitimacy and equity. presentation also reflects on netmapping as a tool for analysing perceptions on environmental governance. Our results show that where ecosystem users perceived the environmental rule system to be equitable, its implementation was enhanced, where they do not, implementation is, as a consequence perceived by ecosystem users, fraught with difficulties. Complementary findings from a number of other case studies of MPAs across the tropical belt are also presented in a quest to develop an innovative approach to differentiating perceptions and their change over time as drivers of human behavior towards nature, as part of integrated sustainability research.

**SESSION 10 – O34 Network connectivity and innovative technology engagement: a case study of social network analysis in rural Bangladesh.**

**Authors:**

Ben Nagel<sup>1</sup>

<sup>1</sup>ZMT Bremen, Germany

Social Network Analysis (SNA) is being increasingly applied as a tool for investigating the role of actor ties within social systems. Here we focus on the context of climate adaptation in coastal agricultural regions. Rural farming communities are often heavily dependent on networks of informal social ties to maintain livelihoods through knowledge and resource exchange (Eriksen & Selboe, 2012), and households more isolated within such a community social network might have greater climate vulnerability. This paper explores a case study in a farming community in climate impacted coastal Bangladesh, where SNA methodologies were applied to investigate the role of community social networks and network connectivity in household access to climate adaptive innovative production technologies, such as saline tolerant crops, which may provide a means of climate adaptation without migration. Since certain households might have more access to these innovations than others, the relationship between innovation engagement and social network connectivity was explored. This paper explains how the “whole” network analysis methodology was applied to map a complete local community level network of all households and relevant external actors such as NGOs, focusing on social ties that were important for climate adaptation. This paper demonstrates how SNA methods were applied to a household survey based design to collect quantitative network data and combined with qualitative focus groups and key informant interviews to study household innovation engagement within the community, and discusses the benefits, practical applications, challenges and biases in applying the “whole” network approach within a rural case study context. Methodological options for future applications of SNA design at the local community level are then presented.

**SESSION 10 – O35 Factors affecting seascape carbon dynamics: a perspective from Zanzibar mangrove forests and seagrass beds**

**Authors:**

Saavedra-Hortua Daniel<sup>1</sup>,  
Zimmer Martin<sup>1</sup>,  
Teichberg Mirta<sup>1</sup>,  
Gillis LucyGwen<sup>1</sup>

Evaluating mangrove and seagrass ecosystem including adjacent ecosystem will contribute to gain a better knowledge of carbon dynamic at the seascape level. We selected six locations in Unguja Island in Zanzibar archipelago, three mangrove forests were adjacent to seagrass beds, therefore only one isolated mangrove forest and two isolated seagrass beds were evaluated. We quantified carbon in mangrove and seagrass biomass, additionally we measured the quantity of organic and inorganic carbon in the sediment across the seascape. We evaluated the carbon content in the sediment, using partial least square models using factors such as biomass, species composition and traits (Functional richness), sediment characteristics and area of the ecosystem as a predictors. Composition of the sediment carbon within mangrove forests presented a higher proportion of organic carbon while sediments in seagrasses the inorganic carbon presented a higher proportion. Our model found that a combination of factors influenced carbon accumulation in the sediment. In mangroves forests, factors like area of the forests and Functional richness could explain the changes of percent of carbon accumulation in the sediment. Carbon dynamics at the seascape are driving for different factors, however the interaction of those factors influence carbon accumulation differently in each location.

**SESSION 10 – O36 Comparative assessment of biodiversity, food web structure and fisheries productivity of three man-made lakes in Ghana**

**Authors:**

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Lotta Clara Kluger<sup>2,4</sup>,  
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Bremen, artec Sustainability  
Research Center, Bremen,  
Germany

Understanding food web dynamics and ecosystem functioning of Man-made lakes systems is crucial for developing sustainable ecosystem-based management strategies. With the aim to assess differences in production characteristics and food web structures, this study addresses three important Ghanaian man-made lakes (Tono, Bontanga and Golina) through a food web modelling approach (Ecopath with Ecosim). The mean trophic level of the catch was lowest in the largest and deepest reservoir (Tono), likely resulting from higher trophic level species occupying less accessible deep 'refuge' habitats. In the medium-sized and small shallow lakes, in contrast, a larger catch portion resembles high trophic level species. Lake Bontanga differs from the other reservoirs by having a lower human population impact, a significantly lower P/R ratio, a higher TB/TST ratio, a higher FCI, a higher D:H ratio as well as the greatest gross efficiency of the catch, all indicative for a more developed ecosystem. Our work suggests that the use of man-made lakes and respective catchment areas should be assessed and managed carefully to prevent the loss of local nutrition and livelihoods contributions. By this, our work provides basis for the development of sustainable ecosystem-based management measures not only for these local ecosystems, but for other reservoirs exposed to human activities around the world.

**SESSION 10 – O37 Development of a social-ecological network under the influence of a network facilitator - implications for regional environmental governance**

**Authors:**

Theresa Schwenke<sup>1</sup>

<sup>1</sup>ZMT Bremen, Germany

The Bay of Babitonga is located in the south Brazilian federal state Santa Catarina. It encompasses an area of 6200ha (130km<sup>2</sup>) and six municipalities (Balneário Barra do Sul, São Francisco do Sul, Araquari, Joinville, Garuva and Itapoá). 80% of the mangroves of Santa Catarina and the most southern mangrove forests of Brazil are located within the region. Besides the ecological interest a diverse variety of interest groups, like industrial and artisanal fishers, construction industry, shipping industry, social and environmental non-governmental organizations, tourists and governmental organizations have a stake within the Bay of Babitonga. Following an oil spill event in 2008 the public call for the protection of the bay increased and projects were founded to compensate the damages caused by the oil spill. To support an integrative, participatory governance process and the development of an ecosystem management plan, the social-ecological network (SEN) concerned by respective regulations within the Bay of Babitonga, had been examined. We present the status of the SEN at t0 (2013 – 2105) and t1 (2015 – 2017) and discuss its development over time, the influence of a network facilitator, as well as possible implications for regional environmental governance.

### SESSION 11 – O38 How mangroves drive organic matter dynamics in coastal waters

**Authors:**

Mirco Wölfelschneider<sup>1</sup>,  
 Véronique Helfer<sup>1</sup>,  
 Nils Asp<sup>2</sup>,  
 Ulf Mehlig,  
 Vanessa Hatje,  
 Thorsten Dittmar,  
 Martin Zimmer<sup>1</sup>

<sup>1</sup>ZMT Bremen, Germany

Tropical vegetated coasts more and more suffer from degradation with natural dynamics being interrupted and formerly provided ecosystem services lost. To be able to restore such lost services or even create environments that provide other specific ecosystem services we need to know which species are best suited for the provisioning of these services. By modeling species interactions based on their specific traits we can identify species-specific contributions to the underlying ecosystem processes. This, in turn, requires sound in-depth knowledge on ecological processes and their drivers. As a case study, the ExManCoast project aims at providing such in depth-knowledge on organic matter dynamics driven by coastal mangrove vegetation. The project comprises field studies in two regions of the Brazilian coast within different tidal regimes, one on the northern coast close to Bragança (PA), and the other one on the northeastern coast close to Salvador (BA). With the collected data we will further unravel the still quite unknown fate of organic matter that enters the complex dynamics of mangrove vegetated coastal systems from a variety of sources.

### SESSION 11 – O39 Forest gaps in mangroves and their contribution to ecosystem services

**Authors:**

Michael Kyei Agyekum<sup>1</sup>,  
 Véronique Helfer<sup>1</sup>,  
 Fiona Mackay<sup>2</sup>,  
 Steven C. Weerts<sup>3</sup>,  
 A. Aldrie Amir<sup>4</sup>,  
 Christophe Proisy<sup>5</sup>,  
 João Marcelo Brazão Protazio<sup>6</sup>,  
 Martin Zimmer<sup>1</sup>

<sup>1</sup>ZMT Bremen, Germany;  
<sup>2</sup>Oceanographic Research Institute (ORI), SAAMBR, Durban, South Africa; <sup>3</sup>Council for Scientific and Industrial Research, Durban, South Africa;

<sup>4</sup>Institute for Environment and Development (LESTARI), University Kebangsaan Malaysia;  
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<sup>6</sup>Universidade Federal do Pará, Brazil

Ecosystem-Design, -management and conservation-planning require a sound understanding of those ecosystem processes that underlie ecosystem services and how they depend on the composition and structure of the ecological community. Natural forest gaps are integral features of mangrove ecosystems. These natural gaps often drive regeneration of the forest stand thus rendering the forest as a young ecosystem without reaching senescence. Forestry driven gaps (i.e. spatially limited tree felling) hold similar potential as natural gaps e.g., for forestry purposes: young fast growing trees vary from mature trees in terms of productivity, fate and stability of organic matter sequestered in the sediment. This means spatially limited controlled tree-felling may provide a sustainable pathway for the storage of organic matter in the sediment as compared to adjacent matured forest. We adopt different techniques to study the variations of fundamental ecosystem processes that drive ecosystem services in both natural and forestry generated gaps in order to answer the question, whether controlled tree-felling might be an ecosystem design-intervention for improving the storage of organic matter in mangrove sediments.

### SESSION 11 – O40 Bioremediation of wastewater: acceptability and feasibility of designed ecosystems for sustainable nature tourism

#### Authors:

Marie Fujitani<sup>1</sup>

<sup>1</sup>ZMT Bremen, Germany

Wastewater is a serious sustainability challenge in tropical coastal tourism destinations. Wastewater produced through the tourism economy is frequently discharged into the environment, either with no or with inadequate treatment. Pollution from nutrients, pathogens, and chemicals enters the ecosystem where it is most fragile, such as into the freshwater lenses of islands. In the case of nature tourism destinations that seek to bring people closer to nature, pollution is discharged directly into sensitive and unique natural environments. Coastal small-scale tourism destinations face added challenges, as land is at a premium, and low-maintenance solutions require space, while high-maintenance solutions are costly and often not suitable for tropical climates. This proposal explores the potential of bioremediation to address the challenges of wastewater generated in coastal nature tourism destinations, and presents a potential research agenda to meet the social, environmental, and economic questions of acceptability and feasibility.

### SESSION 13 – O41 The ZMT Alumni Network –Managing and Measuring Impact

#### Authors:

Janine Reinhard<sup>1</sup>

<sup>1</sup>ZMT Bremen, Germany

- Purpose, goals and activities of the ZMT Alumni Network
- Describe the ZMT Alumni Network (size, Country of Origin, Career development) and its statistics
- Develop and discuss a system on how to measure “impact” of the Alumni network and the individual Alumni

Moreover, the presentation will elaborate future activities based on mutual benefits for the Alumni and ZMT alike.

### SESSION 13 – O42 Future Earth Coasts: Lead hub International Project Office at ZMT

**Authors:**

Sebastian Ferse<sup>1</sup>,  
Hannah Jansen<sup>1</sup>

<sup>1</sup>ZMT Bremen Germany

Presentation/Flashtalk about Future Earth Coasts (FEC) will focus on:

- Purpose, vision and mission of FEC
- Structure of FEC (size, members, global distribution)
- Activities, Products (ongoing and planned)
- Benefits for ZMT (institute and staff)

Emphasis will be on structures, objectives and activities that relate to knowledge exchange and impact

### SESSION 13 – O43 Discovering ZMT's internal and external networks – potential collaborations and research synergies

**Authors:**

Theresa Schwenke<sup>1</sup>,  
Rebecca Lahl<sup>1</sup>,  
Marion Glaser<sup>1</sup>

<sup>1</sup>ZMT Bremen, Germany

The Leibniz Centre for Tropical Marine Research (ZMT) engages in a variety of research themes and regions worldwide. To systematically discover the structure of ZMTs collaborations would support the identification of hotspots for research and collaboration, as well as underused links within and beyond ZMT. Applying a network analysis we could examine:

- Which type of partners does ZMT collaborate with/What is their mandate?
- What institutional and personal work networks exist and what roles do these play?
- How do we monitor the quality and/or impact of cooperation?

Furthermore, ZMTs research themes are connected spatially and in content. To identify and characterize ecological and legal or informal social linkages globally could be an essential asset for addressing upcoming environmental governance challenges and identify additional research synergies.

By interviewing all ZMT staff members and identifying and using network relevant natural and social scientific data sets existing at ZMT, these two sets of networks could be derived. We show how such an approach would enable ZMT to critically reflect on its internal and external relations and on opportunities for future developments. Additionally we discuss ZMTs potential to provide an innovative way for the investigation of coastal and marine social-ecological systems from a network perspective.

**SESSION 13 – O44 How transdisciplinary collaborative research projects and networks can contribute to improving the knowledge base for science and society****Authors:**Tim Jennerjahn<sup>1</sup><sup>1</sup>ZMT Bremen, Germany

The island of Hainan in the South China Sea is China's largest special economic zone, in which agriculture, fisheries, aquaculture and tourism are of major economic importance. The exploitation of natural resources and sewage disposal are endangering the health of coastal waters and ecosystems (mangroves, seagrass meadows, coral reefs), which form the basis for a flourishing tourism. The collaborative research project LANCET investigated potential anthropogenic influences on coastal ecosystems, identified aquaculture effluent input into coastal seas as a major threat and communicated recommendations for management to decisionmakers. The follow-up collaborative research project ECOLOC specifically investigated the effects of aquaculture effluent disposal on ecosystem health. The collaborative networking, capacity development and knowledge exchange project TICAS provided the opportunity for a better use and societal benefit of the research results. The specific framework of the Sino-German collaboration in marine science and technology and the differences in funding strategies of the funding organisations in both countries underscore the relevance of networking between scientists as well as between scientists and other stakeholders. It helps to improve (i) the knowledge base for science and society and (ii) the societal use of research results for a sustainable management of coastal zones.

**SESSION 13 – O45 “Ocean Governance for Sustainability – Challenges, Options and the Role of Science”****Authors:**Anna-Katharina Hornidge<sup>1</sup>,  
Bianca Hurlemann<sup>1</sup><sup>1</sup>ZMT Bremen, Germany

The United Nations Sustainable Development Goal 17 'Partnerships for the Goals' emphasises the crucial role of regional and global science, exchange and practice networks play in building the support across societal sectors and scale levels for transregionally negotiated action towards the formulated targets of the UN Agenda 2030 for Sustainable Development. The here proposed conference contribution reflects the network project 'OceanGov' (EU-financed) implemented under the lead of ZMT, by taking the 19 targets of SDG 17 as frame of reference. It is the aim to show (a) processes of building the science to policy network and (b) how tangible achievements of these networks in the shape of publications, meeting platforms, staff exchanges and training schools are measures for monitoring success of this network. For doing so, the structural conditions in which this network is being built are outlined and conclusions drawn (also critically) for future networking projects at ZMT with the aim, to fruitfully contribute to ZMTs role as hub for transregional partnership networks on marine and coastal ecosystem management.

## VII. POSTER ABSTRACTS

### SESSION 1 – P46 Sea Grapes (*Caulerpa lentillifera*): The effect of different nutrient concentrations on growth, photosynthetic performance and antioxidant potential

#### **Authors:**

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Lara Stuthmann<sup>2</sup>,  
Karin Springer<sup>1</sup>,  
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<sup>1</sup>University of Bremen, <sup>2</sup>ZMT  
Bremen, Germany

*Caulerpa lentillifera*, also often known as “sea grapes” or “green caviar”, is one of a few edible green macroalgae, which are cultivated and eaten in Asian countries due to their nutritional properties and excellent taste. Traditionally, sea grapes are cultured in open tidal ponds with water influx from the nearby coast. But there is only little known about the optimum culture conditions especially nutrient preferences. With a better understanding of the alga’s nutrient requirements, higher harvest can be achieved. First experimental trials showed that sea grapes might be nitrate limited; therefore we tested three different N:P ratios (2:1, 8:1, 16:1) while maintaining fixed phosphate concentrations (0.075 mmol/L) as well as three different nitrate concentrations (0.15, 0.6, 1.2 mmol/L). The experiment was run for 21 days to find the optimum nutrient concentration for the seaweed’s growth. Furthermore, the photosynthetic- and antioxidant performance was observed as a physiological measure under changing culture conditions.

### SESSION 1 – P47 Alternative Antifouling Applications (A<sup>3</sup>) for Coral Reef Restoration: A technological solution?

#### **Authors:**

Lisa Röpke<sup>1</sup>,  
David Brefeld<sup>1,2</sup>,  
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Marine biofouling creates several problems and serious drawbacks in many industrial sectors and hinders restoration efforts from an increase in effectiveness. Not in the shipping industry only, but also in the marine ornamental trade and in aquaculture, research concerning “antibiofouling” has increased in the past decade with more attention and awareness today. New innovative and sustainable applications are needed, because numerous ecotoxicological studies have clearly shown tremendous side effects in organisms from conventional antibiofouling treatments, such as ship coatings, timber preservatives, textile industries, roof sheetings etc.. TBT (Tributyltin), an antifouling agent introduced in the 1950s and strictly prohibited in 2010 in most countries, can still be detected in sediments of various marine and freshwater habitats. Today, mainly so called booster biocides with copper compounds are being used and start to show harmful effects in a diverse group of marine organisms already.

In the course of the project A<sup>3</sup> new and innovative low-toxicity antifoulant coatings and surfaces are being tested for their effects and usefulness for a potential application in tropical coral reef restoration. Millimeter-scale juvenile corals are highly vulnerable to overgrowth during the first months on the reef. This is a bottleneck for coral reef rehabilitation, which can only be successful if a high proportion of juveniles survive this period. The ZAC 1 conference is the ideal panel to present first results in poster format and launch important discussions between scientific experts from different fields at the same research institute, ZMT.

**SESSION 1 – P48 It's Getting Hot in Here: Temperature-dependent aerobic scope and Hsp70 expression in the sea cucumber *Holothuria scabra***

**Authors:**

Holger Kühnhold<sup>1</sup>,  
Nuri Steinmann<sup>1</sup>,  
Yi-Hsuan Huang<sup>1</sup>,  
Achim Meyer<sup>1</sup>,  
Andreas Kunzmann<sup>1</sup>

<sup>1</sup>Working group  
Ecophysiology, ZMT  
Bremen, Germany

The aerobic scope (AS), which reflects the functional capacity for biological fitness, is a highly relevant proxy to determine thermal tolerance in various taxa. Despite its importance, its implementation is often hindered, due to lacking techniques to accurately measure standard- (SMR) and maximal- (MMR) metabolic rates, especially in sluggish marine invertebrates. In this study the traditional AS concept was modified to define a temperature-induced aerobic scope (TAS), based on temperature-induced maximal (TMMR)- and minimal (TSMR)- O<sub>2</sub> consumption rates, for the sea cucumber *Holothuria scabra*. Next to O<sub>2</sub> consumption, mRNA expression of Hsp70 was measured to define critical threshold temperatures on an interlinked basis. Between 39–41°C *H. scabra* decreased respiration progressively, while gene expression levels of Hsp70 were significantly increased, indicating prioritization of heat shock response (HSR) and homeostatic disruption. At the cold end (17–22°C) homeostatic disruption was visible through incrementally increasing energetic expenses to fuel basal maintenance costs, but no Hsp70 induction occurred. Our approach to link respiration physiology with the molecular HSR, gave novel insights into the aerobic performance window and thermal limits of *H. scabra*. Overall, this study will help to define and predict lethal temperature boundaries for sea cucumber and other sluggish marine invertebrates.

**SESSION 1 – P49 Can Aquaculture Relieve Stress on Global Food Systems? Tapping the Potential of Marine Aquaculture for Global Food Provisioning**

**Authors:**

Holger Kühnhold<sup>1</sup>,  
Andreas Kunzmann<sup>1</sup>

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It is one of the grand challenges of humanity to increase food production, while reducing pressure on ecosystems and its resources. Particularly, the request for more and more animal protein will need alternative and innovative supply forms to prevent food system shocks. Terrestrial food systems are facing growing resource scarcities (e.g. fresh water supply, availability of mineral fertilizers and arable land) and are a major driver of ecosystem degradation (e.g. biodiversity loss, greenhouse gas emission and biogeochemical cycling). The strive to increase agriculture productivity will intensify climate change and resource competition, which will ultimately aggravate the stability of global food systems. It is for that reason that aquaculture, especially marine aquaculture (mariculture), should take over a more prominent role in terms of global food security and nutrition (FSN). In order to reach its full FSN potential, mariculture has to find novel ways to supply animal protein. Therefore, research need to focus on: 1) The culture of more low-trophic level species (e.g. omnivore fish, mollusks and algae); 2) Novel feed for carnivore species with low trophic level ingredients (e.g. algae, microbes, plants, insects and other none-fish resources. 3) Reuse wastes by applying ecosystem based farming concepts, such as integrated multi-trophic aquaculture (IMTA).

## SESSION 1 – P50 The Wickedness of Governing Land Subsidence: Policy Contradictions in Urban Southeast Asia

### Authors:

Rapti Siriwardane-de Zoya<sup>1</sup>,  
Alessio Rovere<sup>2</sup>

<sup>1</sup>ZMT Bremen, Germany;  
<sup>2</sup>MARUM

Drawing on Metro Manila, Jakarta and Singapore as case studies, we explore the paradox of slow political action against the urgency of addressing subsiding land, particularly along high-density urban coastlines. We argue that while narratives on coastal identities range from 'slowly sinking, soon moving' (Jakarta) to 'regularly at risk and successful coping' (Manila) and 'impenetrable fortification' (Singapore), land subsidence is portrayed in all three sites in surprisingly similar ways as reversible, quasi-natural and/or a highly individualised problem. In unpacking these diverse contexts, the presentation will examine their fragmented policy landscapes, and will question the extent to which land subsidence can be interpreted as a 'wicked problem.' Based on empirical insights from urban geography, geodesy analysis, and coastal anthropology, we illustrate how political action for dealing with and preparing for large-scale coastal transformations remains markedly reactionary than adaptive.

## SESSION 2 – P51 SOCPacific's transdisciplinary research protocol based on children's drawings

### Authors:

Elodie Fache<sup>1</sup>

<sup>1</sup>IRD - GRED (Montpellier, France), SOCPacific

Children are often marginalized in research on local views of marine spaces and species. Yet, they are directly concerned by – and sometimes involved in – the various uses of these spaces and species, issues related to their sustainability, and questions regarding the transmission of different registers of so-called 'local knowledge' (customary, religious, scientific, technical, etc.). Moreover, they are the next stakeholders of fisheries management and marine conservation endeavors. Some of them will even play an instrumental role in future decision- and policy-making processes.

To contribute to fill in this research gap, as part of *SOCPacific*, we have designed a transdisciplinary research protocol based on drawings made by children between 9 and 14 years of age. We have already applied this protocol in different schools in Fiji (Sept-Nov 2019) and New Caledonia (Nov 2019), and will replicate this initiative in Vanuatu in 2020. Here, we present the protocol, some preliminary results of the work already achieved, and our objective to establish comparative perspectives between SOCPacific's three study areas.

## SESSION 2 – P 52 Look who's asking: Reflections on participatory and transdisciplinary research approaches and their societal relevance

### Authors:

Annette Breckwoldt,  
Elodie Fache,  
Alifereti Tawake,  
Hugh Govan,  
Joeli Veitayaki

So what...? What's in for the local population? How can we get people to react on the available knowledge? These questions from our partners have accompanied us throughout the first year of our SOCPacific project ([socpacific.net](http://socpacific.net)). In this paper we reflect on the question of who is actually asking and setting the research questions in local community-based marine conservation and management efforts. After decades of efforts to foster participatory research, and many advancements in transdisciplinary research design, this question has still not lost its relevance. Research questions still seem to be framed and formulated outside the actual geographical, social, cultural and ecological setting in which the research projects are supposed to be anchored. Even though research pathways have become more diverse, the direction of the information flow still seems predominantly one way, not supported by the slow progress in transforming academic and funding environments for true 'level-playing-field' research projects. Often within research collaborations involving international 'north-south/east-west' teams it remains worth asking a number of questions, such as who is asking the research questions? Who is framing the research questions? What are the local questions? Whose knowledge is used where (in which decision-making processes – and for whom)? What are the benefits for the resource users/managers/decision-makers of the countries where the research is taking place? Whose lens is used to undertake the data analysis, draw conclusions and write recommendations?

## SESSION 3 – P53 From traits to plasticity: How will seagrass look in a changing world?

### Authors:

Agustín Moreira-Saporiti<sup>1</sup>,  
Sonia Bejarano<sup>1</sup>,  
Elizabeth Fay Belshe<sup>1</sup>,  
Inés González-Viana<sup>2</sup>,  
Mirta Teichberg<sup>1</sup>

<sup>1</sup>ZMT Bremen, Germany;  
<sup>2</sup>Universidade de Vigo

Traditionally, seagrass community responses to environmental change were studied through its diversity, abundance and the measurement of some response variables. Nevertheless, in the last two decades trait-based approaches have been developed under the umbrella of functional ecology for the study of both community response and function. We studied 13 different seagrass traits in seven seagrass communities in Unguja Island (Zanzibar) to understand how seagrass copes with environmental change. The traits were collected for the building of a functional space, which includes all the species present and their intraspecific variability. Our results show that some seagrass species are very plastic and able to change their strategy depending on the environmental conditions, whereas others are more specialized. The balance between specialization and plasticity allowed us to explain the presence and absence of species in different sites, and why some species flourish and dominate in some environments and others disappear. This results have an important implication under global change, and will allow us to predict how seagrass communities will look like in a dynamic environment and under an ever increasing anthropogenic pressure.

## SESSION 4 – P54 Addition of carbohydrates ameliorates water and natural feed quality in shrimp pond aquaculture

### Authors:

Yustian Rovi Alfiansah<sup>1</sup>,  
Astrid Gärdes<sup>1</sup>

<sup>1</sup>ZMT Bremen, Germany

Shrimp pond water contains high amount of suspended particulate matter, inorganic nutrients and microorganisms including phytoplankton and bacteria, which can be utilized to form larger aggregates so-called bio-flocs. They serve as a feed source and govern inorganic nutrients in pond water. However, the aggregates may load associated bacteria including pathogenic one. We conducted rolling tank experiments generating bio-flocs to assess bio-flocs formation and quality. We added molasses in tanks containing shrimp pond water and rolled them for 48 hours. We recorded water parameters, analyzed water bacteria in free-living and aggregate associated fraction via 16S rRNA amplicon sequencing and measured macromolecules (carbohydrates, lipids and proteins) in bio-flocs. Molasses increased bacterial cells numbers, specifically in the aggregate fraction with  $2.5 \times 10^7 \pm 1.0 \times 10^6$  cells mL<sup>-1</sup>. Moreover, potential beneficial bacteria (probiotics) were detected such as *Halomonas*, *Psychrobacter*, *Mesonia*, and *Chromohalobacter* dominating the aggregate fraction. Furthermore, carbohydrate contents in aggregates increased up to 4-fold higher ( $43.98 \pm 5.35$  mJ mg<sup>-1</sup>) compared to those generating without molasses. Potential pathogens such as *Vibrio* and *Alteromonas*, were found in the aggregates without molasses. We conclude that molasses influences pond water quality resulting in higher proportion of probiotics as well as increase of nutrients in bio-flocs.

## SESSION 4 – P55 COMPASS: Comparing Aquaculture Systems Sustainability

### Authors:

Stefan Partelow,  
Achim Schlüter

Aquaculture is the fastest growing food production sector worldwide. COMPASS will examine how the pond aquaculture sector can transition towards sustainable development using the social-ecological systems framework and a knowledge types framework for sustainable development. COMPASS will develop three types of knowledge (system, target, transformative) within four working packages. System knowledge will be generated by examining pond aquaculture systems as interdependent social-ecological systems, combining social and natural systems functionality. Target knowledge will be generated by developing tools to facilitate deliberative processes, and then implementing and examining them within communities using field experimental methods. Transformative knowledge will be developed through incorporating knowledge into a globally accessible open-access data database (SESMAD/ESSN KB) for comparison and synthesis within and outside the sector.

**SESSION 5 – P56 Mortality of seabirds migrating across the tropical Atlantic in relation to oceanographic processes**

**Authors:**

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We present here the direct and indirect effects of ENSO and oceanographic variables on the mortality of three migratory seabird species targeted by conservation programmes: the Atlantic yellow-nosed albatross, the Magellanic penguin and the Manx shearwater in a non-breeding area in Brazil, tropical Atlantic. We find that the intensification of ENSO increases the mortality of Manx shearwaters by enhancing the local storm activity. The mortalities of Atlantic yellow-nosed albatrosses and Magellanic penguins are also connected to a local increase in storm activity but are unrelated to ENSO. Increased mortality of Magellanic penguins is observed when biological productivity falls below the annual average ( $1.7 \text{ mg m}^{-3}$ ). We argue that conservation and management strategies for the seabirds studied here should not only focus on direct human impacts but should also consider mitigating the effects of climate variability.

**SESSION 5 – P57 Seagrass, macroalgae, and microphytobenthic community dynamics under varying nutrient and temperature experimental treatments**

**Authors:**

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Eutrophication is one of the main drivers affecting marine benthic communities in coastal habitats. Tropical seagrass ecosystems are particularly vulnerable to increasing nutrient pollution, and seagrass loss can be exacerbated under global warming scenarios as levels exceed temperature tolerance limits, providing competitive advantage to different phytophobenthic bloomers. To examine the dynamics of an Indo-pacific seagrass community, a multifactorial mesocosm experiment with varying nutrient and temperature treatments tested the changes in community composition of macroalgae, microphytobenthic algae, seagrass, and biofilms. Changes in the community pattern were followed by sequencing photographs, and micro phytophobenthic compositions were confirmed by microscopic and molecular investigations. Preliminary data showed, bloom formation of different phytophobenthic taxa along the benthic algal succession trajectory. As blooms of dinophyceae (e.g. *Prorocentrum* sp.) and *chrysophyceae* peaked over rather short time, the abundances of the cyanobacterial Oscillatoriaceae seems to be linked to the trajectory of either a green (*Cladophoropsis* sp.) or red macroalgal (*Laurencia* sp.)-dominated state within the nutrient enriched treatments. In contrast the brown tide former *Aureococcus* sp. dominated the phytophobenthic communities under nutrient depleted conditions.

## SESSION 6 – P58 From Skilled Perception and Spectral Apparitions to Exploring Traditional Knowledge of Marine Emerging Infectious Diseases

### **Authors:**

Dr César E. Giraldo-Herrera (D.Phil)<sup>1</sup>

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While performing ethnographic research on the skilled forms of perception involved in the practices of seamanship on the Colombian Pacific, I encountered the dilemma of how to address narratives about *Visiones* or spectral apparitions, which codify information about social and ecological relations, and foster bodily and social dispositions towards the environment and other actors on it. This interpretation fails to account for the phenomena experienced or for how people seek to establish interactions with and instrumentalize these entities, and thus to acknowledge the realities they involve. Developing a biocultural ethnohistory of Amerindian shamanism, led to questioning the mainstream translation of these entities as spirits and highlighting instead the parallelisms of their descriptions with contemporary understandings of microbes. Further research offered a hypothesis regarding how microscopic phenomena within the eye could be perceivable in ways that coincide with shamanic depictions of these phenomena. Testing the hypothesis of shamanic proved to be highly delicate issue, the general hypothesis raised the interest of the Gunadule community, leading to a reformulation focused on the microbial ecology of marine sacred sites, aimed at substantiating their own processes of reclamation of these spaces. Further work with Wounan community led to the identification of the potential overlap between the Indigenous category of Autochthonous Diseases and the of Western category of Emerging Infectious Diseases. The future research has the possibility of providing rich and deeply needed sociobiological contextualization to virome research, however as their histories indicate these processes depend on the communities embracing and redirecting them.

## SESSION 6 – P59 Temporal dynamics of total and active microbial communities in mangrove sediments

### **Authors:**

Véronique Helfer<sup>\*1</sup>,  
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\* Equal contributions

Sediment microbial communities play an essential role in organic matter dynamics. In mangrove ecosystems, known as essential carbon stores, these communities are subject to temporal variation, notably due to tidal influence, that is expected to have a strong influence on microbial processes. Here, we studied the effects of tidal cycles on microbial communities in mangrove sediments along an elevation gradient, resulting in different inundation regimes, on San Andrés Island, Colombia. Using a multi'omics approach, we jointly assessed temporal variation in (i) sediment environmental conditions, (ii) the composition of the total and active microbial community using deep 16S rRNA gene and 16S rRNA sequencing, respectively, and (iii) the chemical composition of the sediment organic matter using pyrolysis-GC/MS. Environmental parameters varied substantially over the course of two weeks. Total and active microbial communities displayed congruent patterns, which were strongly correlated to changes in organic matter composition. However, the degree of temporal variation was secondary to spatial differences, suggesting a strong effect of inundation frequency and/or mangrove stands. By quantifying the influence of spatial and temporal variability, we further assess the validity of comparing microbial community data from mangrove ecosystems across divergent sampling times and areas, and our ability to conduct meta-analyses of existing datasets.

## SESSION 7 – P6o Reconstruction of anthropogenic environmental changes from a Cuban coral over the last 175 years

### **Authors:**

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 Henry C. Wu<sup>1,2</sup>,  
 Henning Kuhnert<sup>3</sup>,  
 Simone Kasemann<sup>2,3</sup>,  
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Ocean warming and ocean acidification (OA) are increasingly influencing marine life. A percentage of the increasing amount of CO<sub>2</sub> in the atmosphere will eventually be absorbed by the ocean, which changes the ocean's carbonate chemistry and threatens the ecological competitiveness of calcareous marine organisms. Currently, the global coverage of studies on ocean pH variability since preindustrial times is sparse, which limits our understanding. An important region to study environmental and climate variations is where the Loop Current joins the Florida Current and contributes to the Gulf Stream. The tropical Atlantic is a primary region for the formation of warm surface water of the thermohaline ocean circulation and the Caribbean in particular as a habitat for coral reefs in the Atlantic, making them susceptible to large changes in sea surface temperatures (SST) and carbonate chemistry. The northwestern coast of Cuba provides a unique opportunity to study multiple aspects of the implications of anthropogenic activities such as changes in SST, ocean pH, and carbonate chemistry using the coral skeletal geochemistry as an archive of climate and environmental changes. Here we present results from a multi-proxy approach for the reconstruction of environmental change and natural climate variability from a North Cuban *Siderastrea siderea* coral. The sub-seasonally resolved records indicate interannual to decadal changes in SST and seawater carbonate chemistry since 1830 CE. The comparison with pH will provide clues whether the regional climate variability has been directly affected by atmospheric CO<sub>2</sub> forcing.

## SESSION 7 – P61 Tracking the anthropogenic influence on surface temperatures and pH in Southwest Pacific since the Industrial Revolution

### **Authors:**

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The modern rate of increase in atmospheric CO<sub>2</sub> driven by fossil fuel combustion and land-use change is warming our surface oceans. The absorption of this excess CO<sub>2</sub> by the oceans decreases seawater pH in a process known as ocean acidification (OA), which represents a threat to marine ecosystems with adverse impacts on coral health. In this study, we present multi-proxy (e.g. Sr/Ca, δ<sup>18</sup>O, δ<sup>13</sup>C, B/Ca) reconstructions of sea surface temperature (SST), sea surface salinity (SSS) and surface seawater carbonate chemistry of the Southwest Pacific back to preindustrial times. This region of the Pacific is interesting for tracking the development of OA because of the well-constrained interannual to interdecadal SST and SSS variability from existing coral-based reconstructions in this region. Massive coral (*Porites lutea*) from Rotuma will be analyzed to extend the currently available SST reconstructions and expand the spatio-temporal coverage beyond the instrumental records. New, monthly-resolved, records will provide larger analyses exploring the influence of interannual and decadal-interdecadal climatic fluctuations on CO<sub>2</sub> absorption and pH variation. We aim to quantify the anthropogenic impact on SST, pH and the ocean carbonate system to achieve a better understanding of the status in the South Pacific under open ocean conditions.

**SESSION 8 – P62 Bringing my Thesis Back to Life: A stakeholder workshop informed by scientific findings on pond aquaculture****Authors:**

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The plight of many ecological studies is that their results never make the transition from peer-reviewed literature to application. In 2016, we researched the use of an aquaculture pond area in a coastal community in Indonesia. The results pinpoint key challenges such as a lack of organization of the upkeep of infrastructure, the degradation of the mangrove ecosystem, and the threat of possible mercury contamination in ponds from artisanal gold mining. These identified problems are locally specific and most relevant to stakeholders who will never access the published findings. In July 2018, we are returning to the study community to hold a stakeholder workshop presenting management recommendations drawn from our field research. Members of the local community, as well as government extension workers will participate. We will discuss strategies to improve aquaculture yield, the possibility to cultivate more high-value species as well as improving sustainability by increasing mangrove cover in the ponds. In addition, we will conduct a study to test mercury levels in the pond environment and in the food output. This case provides an example of bridging the science-society gap and gives insights into challenges and lessons learned. We believe that it is important to return relevant results to local communities both for their benefit and to acknowledge their cooperation and hospitality.

**SESSION 8 – P63 Quantifying Fresh Submarine Groundwater Discharge (FSGD) and its nitrogen loads at regional scale****Authors:**

Till Oehler<sup>1</sup>

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Field work in Indonesia can be challenging. The tropical climate, natural hazards, the infrastructure, customs and social and political differences can make work more complicated as expected. On the other side Indonesia belongs to one of the most interesting places to do coastal research worldwide. Good collaboration partners can make work here also very efficient. I want to share my experience from three field trips to Java, Bali and Lombok. We had ups and downs during motorcycle trips through the jungle in eastern Java, diving through submarine springs on Lombok, climbing karst caves in southern Java and boat trips on a crater lake on Bali.

**SESSION 8 – P64 Research permit in Indonesia: is it really complicated?****Authors:**Yustian Rovi Alfiansah<sup>1</sup><sup>1</sup>ZMT Bremen, Germany

Indonesia, a tropical country which has mega-biodiversity and social uniqueness, becomes one of the destination countries for research, especially for marine research. The marine research covers not only in natural science, but also in social, economic and political sciences, which has usually been done by bilateral or multilateral cooperation. Beside these research schemes, collaboration has also been conducted by person to person or institute to institute. Indonesian government put deep concerns for such kind research cooperation. They establish screening and evaluation systems which will benefit Indonesia as well as foreign researchers. The goals of these established systems are to accelerate permit for foreign researchers for their stay and research as well as to monitor the output of the cooperation projects. I propose a review on permit application procedures aiming to inform and explain the process to counterpart candidates. The review informs the roles and tasks of foreign researchers and local partners as well as Indonesian government bodies which participate on the permit processes. By understanding the process, foreign researchers who want to conduct a research in Indonesia can prepare themselves better in term of application processes, research stay and producing research output.

**SESSION 9 – P65 The impact of microplastic exposure on coral growth****Authors:**Florian Hierl<sup>1</sup>,  
Prof. Dr. Hildegard  
Westphal<sup>1</sup><sup>1</sup>ZMT Bremen, Germany

Almost 13 million tons of plastic enter the marine environment every year, accumulating in gigantic garbage patches. Through different processes of degradation, larger plastic pieces are fragmented into microplastic particles. These initially very light particles are constantly subject to biofouling and are gradually being deposited. Microplastics have been detected everywhere in the ocean from beaches and surface waters to deep sea habitats. Microplastics are suspected to threaten the health of marine inhabitants. Certain microplastic particles are capable of soaking heavy metals, as well as leaching toxic components, that potentially harm marine life. We aim to understand the interactions between microplastics and coral skeleton production. To date, little is known about the concrete effects of plastic pollution, and while avoiding is the first choice, research is needed to counteract its effects on the marine realm. Therefore, we conducted experiments in the aquarium facility of Leibniz Centre for Tropical Marine Research. We exposed four different coral species to high concentrations of microplastic and in further analysis investigated their tissue and skeleton for significant alterations to the natural growth form. The impact on skeletal composition and stability as a result of possible microplastic incorporation is a topic for discussion in future research.

## SESSION 9 – P66 The long-term legacy of plastic mass production

### Authors:

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Mismanaged plastic waste is transported via rivers into the ocean where buoyant plastic accumulates in surface waters of the five large ocean gyres. Plastic harms the marine biota and may ultimately return to humans via the food chain. Private initiatives have started to collect plastic from the sea but it is unclear how effective these measures are to mitigate ocean plastic pollution. In this study we calculate the plastic inventory of the global surface ocean to assess the long-term legacy of plastic mass production and to estimate the time scale required to remediate ocean plastic pollution. We conclude that only with a combination of reduced plastic emissions and reinforced collection of plastic waste, the ocean can be rid of its current plastic pollution.

## SESSION 11 – P67 Does groundwater discharge increase fish abundance?

### Authors:

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Submarine springs are visible at many tropical coastal locations. While they can play a significant role in the spiritual life of local population, scientifically they are often either ignored or seen as pollutant pathway and threat to coastal ecosystems. At two examples from Mauritius, we present evidence that fish abundance increases in association with submarine groundwater discharge and argue that the groundwater could actually be a positive factor for the fish.

This means that when planning conservation efforts in coastal ecosystems, groundwater should be considered as one factor that could be needed to improve the overall status of a coastal ecosystem.

## SESSION 11 – P68 Effects of environmental change on waterbird functional traits in tropical coastal wetlands

### **Authors:**

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Biodiversity has been traditionally investigated by focusing on the number of species and their abundances in space and time. However, analyses based on taxonomic units alone are not sufficient for understanding the effects of environmental change on biodiversity and ecosystem function relationships because species that go extinct can be replaced by species with similar traits and roles. We present here the responses of waterbird trait diversity to habitat changes in tropical coastal wetlands of Southeastern South America and West Africa. Our analyses indicate that water depth is the main variable driving changes in waterbird trait composition. During flooding events, small wading birds, i.e. average leg size less than 5 cm, are pushed out of the community. Body size and leg length are traits that maximize niche occupancy in tropical coastal lagoons because larger birds can land and feed in deeper waters, i.e. more than 30 cm. In the future, we plan to expand our database on waterbird traits and implement functional diversity analyses

## SESSION 12 – P69 Changes in sediment facies through time in an Indonesian reef island

### **Authors:**

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Facing climate change and sea-level rise, the existence of low-lying coral reef islands is strongly endangered. Consisting of mostly unconsolidated, reef-derived carbonate sediments, these islands merely reach heights of a few meters above sea-level. Therefore, hydrodynamic energy regimes determine island erosion and accumulation, as well as physical modification of the deposited sediment. However, knowledge on the geological development of reef islands in SE Asia, a geographic region threatened by future sea-level rise, is lacking.

Here we present results from the first detailed study on island formation in Sulawesi, Indonesia. Analysis of changes in sediment facies (components and grain size) along a transect of sediment cores up to 10 m depth from a mid-shelf island in the Spermonde Archipelago reflects changes in the surrounding reef ecosystems and hydrodynamic energy regime over time.

While corals are the dominant constituents in the analyzed cores, gastropods, foraminifera and bivalves also contributed significantly to island-formation. Statistical analysis regarding the abundance of benthic foraminifera indicates community shifts in the reef ecosystems, which may be linked to fluctuations in relative sea-level. Grain sizes tend to increase with depth and coarser layers intermit medium grain sizes in lower depths, suggesting contribution of strong hydrodynamic events to island formation

### SESSION 12 – P70 Holocene and Anthropocene sea-level records from Indonesia (HAnsea)

**Authors:**

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Sea-level changes through the Holocene have been geographically variable. Large-scale mechanisms responsible for the observed variability comprise the interplay between eustatic melt-water contributions and isostatic adjustments of the solid Earth resulting from postglacial mass exchange between polar ice sheets and the oceans. These processes are further nuanced through oceanographic factors that act on shorter time scales and regionally constrained. Knowledge of the spatial and temporal interplay between the dominant drivers of Holocene sea-level changes in the far-field is essential to understand past ice sheet dynamics, constrain Earth parameters in glacial isostatic adjustment models and evaluate anthropogenic influences. This new DFG project contributes to the understanding of the dominant drivers of Holocene / Anthropocene sea-level changes in Indonesia, an archipelago that is highly vulnerable to future sea-level rise. We will determine the rate of early Holocene sea-level rise and the timing when sea level first reached its present position from reconstructions based on coral reef drill cores in the tectonically stable Spermonde Archipelago, Sulawesi. Results will be compared to an ensemble of glacial isostatic adjustment simulations in order to detect at which point in time isostatic contributions became the dominant driver of early Holocene sea-level rise. This project will furthermore validate existing mid-Holocene sea-level reconstructions for southwest Sulawesi, which are characterized by large inconsistencies, through a thorough field evaluation of the origins of the used sea-level indicators. In combination with the early Holocene reconstructions, these results will be used to put precise constraints on the regional Earth model parameters and to provide a reliable isostatic background signal to the ongoing anthropogenic and dynamic oceanographic contributions. Lastly, this project will provide the first high-resolution sea-level record for the late Holocene / Anthropocene in Southeast Asia, based on floating chronologies from slabbed microatolls reaching back in time to the 17th century. This unique record will be used to evaluate the steric contribution on sea-level variability in the Indo-Pacific Warm Pool during the Little Ice Age and the 20th century global warming. In the present contribution, the individual work packages will be displayed in more detail.

### SESSION 12 – P71 Pathways of Heavy Metals from the Agbogbloshie E-Waste Dump Site into Coastal Waters.

**Authors:**

Mercy Grimmon-Thompson<sup>1</sup>,  
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Heavy metals from the E-waste recycling at the Agbogbloshie Dump Site have been emitted into the atmosphere, soil and water bodies. However, it is uncertain how far these heavy metal pollutants have reached the coast. Previous studies indicate the presence of trace metals (Pb, Cd, Cu, Ni, Fe and Cr) in the soil and sediments samples from the Odaw river. This research measures the current concentrations of Ca, As, Cd, Cu, Fe, Mg, Ni, Zn, Na, S and K and analyses their mobility in the Agbogbloshie area. We sample sediments, tap water, puddles, sea water and ground water to analyse the variations of the heavy metals along the river trajectories into coastal waters. The spatial variability is very high and we present explanations and expectations of heavy metal pathways to the ocean.

## SESSION 12 – P72 Global estimate of recirculated submarine groundwater discharge using hydrogeological models.

### Authors:

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The global valuation of submarine groundwater discharge by geochemistry from Kwon et al. (2014) is  $12 \pm 3 \times 10^{13} \text{ m}^3$  per year, over 90 % of this is recirculated seawater (RSGD). Here, we want to complement this estimate by different scenarios of SGD generated by hydrogeological modeling for various categorized 2D coastal cross sections in a theoretical parameter space. The focus is on three main parameters, which are the main driving forces of RSGD that are adapted for each model: permeability, slope inclination and tidal amplitude. The subsequent estimate of global RSGD is done by simple multiplication of the simulation results, the assigned coastline and its portion of the SGD. By comparing the different models, the range of forces and processes on SGD will be determined and it is possible to interpolate the results on global scale. With these results we can make a rough division of global coastline based on fluctuation range of RSGD.

## SESSION 12 – P73 ZMT has a new point of view on tropical coastal environments

### Authors:

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The last few years saw an exponential growth of the use of UAS (Unmanned Aerial Systems, also known as drones), in earth science. This has brought significant advances in scientific research. Since 2016, different groups at the ZMT are using drone technology to study coastal environments. The low altitude view offered by drones represents a novelty in the observation of coastal environments and, in some remote areas, the solution to gather high-resolution information at low cost. In fact, this technology is cheaper and more easily deployable compared to traditional survey techniques. The novelty of the new perspective and the high resolution has the potential to advance our understanding of coastal and shallow water processes.

At the ZMT, drone technology has been used in different projects:

1. within the New Regional Formation project, to advance our knowledge of coastal erosion in Ghana and perform capacity-building;
2. in Moorea (French Polynesia), to reconstruct the first 3d representation of an underwater reef using aerial photos analyzed with photogrammetry;
3. in Bahamas, to measure the volume of large boulders and help understanding the behavior of storms in a past warmer world;
4. in Fiji, to gather high-resolution information on mangrove forests with a multispectral camera;
5. in a remote MPA in Colombia to foster the knowledge of three coastal environments (corals, rocky shores and mangroves) never mapped before at high resolution.

At the ZMT, the number of studies involving UAV is increasing rapidly and the ongoing projects are carried out in different areas: i) Curacao, where drone technology, underwater photogrammetry, ecosounder and numerical hydrodynamic models are used to study the interaction between coastal hydrodynamics and corals; ii) Colombia, where the use of drones in a remote area is allowing to advance our knowledge of mangrove and reef habitats structural characteristics; iii) Palau, where drone technology will be used to unravel information on fishes habitats; vi) Maldives, where the limits of the underwater sea floor reconstruction using drone technology are being evaluated; v) Cape Verde, where drones will be used to map large areas of both fossil and modern reefs.

**SESSION 12 – P74 Sediment dynamics in a transboundary mangrove habitat: a perspective of sediment sources, current and historical sedimentation in Vanga, Kenya**

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Mangroves provide goods and services that are of ecological, economic and environmental values however, their global coverage has been declining. Sea level rise (SLR) is among the main threat to mangroves. However, mangroves can keep pace with rising sea levels, partially due to the balance between the rates of sediment accumulation and SLR. Sedimentation rates higher than SLR rates allow for faster growth of mangrove surface elevation relative to the SLR. This PhD study answers part of the need to generate biophysical data as we seek to investigate the source of sediments, current and historical sediment accumulation rates within the mangroves of Vanga Kenya. Sediment samples were collected along the transboundary Umba River from source to mouth and a combination of sediment-elevation tables and marker horizons used to measure current sediment accumulation rates. Sediment cores were taken to measure  $^{210}\text{Pb}$  activity downcore as proxy of age of sediments and model historical sediment accumulation. A combination of stable isotopes, petrographic and geochemical analyses will be used to partition sources of sediments delivered to Vanga mangroves. We intend to use end-member mixing model to determine the contributing sources of organic matter in surficial sediments to the mangroves in Vanga.

**SESSION 12 – P75 Project TRAFFIC: Investigation of carbon fluxes within the Benguela upwelling system**

**Authors:**

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The project TRAFFIC aims to show that variations of the pelagic food chain within the coastal southwest African upwelling system affect the biologically mediated carbon dioxide uptake of the ocean by changing the stoichiometric carbon to nutrient (C/N/P) ratio between the exported organic matter load and upwelling water masses. Due to the opposing function of the northern and southern Benguela Upwelling System (NBUS and SBUS, respectively) as a  $\text{CO}_2$  source and sink to the atmosphere, it has been hypothesized that enhanced C/N/P ratios within the exported organic matter favor the uptake of atmospheric  $\text{CO}_2$  in the sardine-dominated SBUS, whereas a less efficient utilization of upwelled nutrients increases the  $\text{CO}_2$  emission from the NBUS. Furthermore, the transport of preformed nutrients into the upwelling system that could potentially modulate the uptake of  $\text{CO}_2$  is being assessed.

According to preliminary results of nutrient samples and surface  $p\text{CO}_2$  measurements conducted along the cruise 153 on board the research vessel Meteor during February and March 2019, differences in biogeochemical conditions draw attention towards an inefficient utilization of nutrients within the NBUS that could promote the outgassing of  $\text{CO}_2$  and therefore modulating the ocean's role in mitigating climate change.



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