



LEIBNIZ CENTRE
for Tropical Marine Research

ZMT



CONFERENCE PROCEEDINGS

The 2nd ZMT Annual Conference (ZAC2)
21st Jan 2021

Cover photo: Ghana fisheries, © Anna Katharina Hornidge;
Back cover: Aquaculture ponds for shrimp and tilapia in Bangladesh © Samiya Ahmed Selim, ZMT
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Imprint

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Due to the pandemic the ZAC2 will be organised as virtual conference on the 21st of January 2021. Links to the online meetings at the **Giant Moray Room** and the **Leafy Seadragon Room** will be distributed via email.

<https://zac.leibniz-zmt.de/zac2>

ZAC2 program for Thursday 21.01.2021 from 9:00 – 18:00

Only presenting authors are given in the program schedule. The complete list of authors for each contribution is given in the abstract collection (page 8ff). Possible updates at <https://zac.leibniz-zmt.de/zac2/>

	Giant Moray Room	Leafy Seadragon Room
9:00	<p>S1: Aquaculture food systems and sustainability: multiple methods and perspectives</p> <p>Chairs: Holger Kühnhold, Stefan Partelow & Aisa O. Manlosa</p> <p><i>Stefan Partelow:</i> Beyond production: social-ecological indicators and development typologies for global aquaculture</p>	<p>S6: Coral reefs and their response to anthropogenic disturbances in the past, present, and future</p> <p>Chairs: Lisa Röpke, Sonia Bejarano, Henry Wu, Gary Murphy & Steve Doo</p> <p><i>Lisa Röpke:</i> Novel anti-biofouling coatings and their potential to enhance coral restoration practices</p>
9:15	<p><i>Ben Nagel:</i> Operationalizing the social-ecological systems framework as a methodological tool to assess and map aquaculture sustainability</p>	<p><i>Marleen Stuhr:</i> Physiological and proteomic impacts of warming and acidification on different photosymbiotic calcifiers show distinctive links to symbiont condition and pH-regulation</p>
9:30	<p><i>Adiska Octa Paramita:</i> Operationalizing the Social-Ecological Framework as a Deliberation Tool to Assess Target Knowledge for Aquaculture Sustainability</p>	<p><i>Florian Hierl:</i> Microplastic particle incorporation and identification in scleractinian coral skeleton</p>
9:45	<p><i>Aisa O. Manlosa:</i> Institutions and change processes in entangled capture fisheries and aquaculture: a case study from Central Luzon, Philippines</p>	<p><i>Lukas Bublies:</i> Adaptability of deepwater corals <i>Caryophyllia (Caryophyllia) smithii</i> to changing ocean pH</p>
10:00	<p><i>Anne-Katrin Broocks:</i> Larvae, Cash & the City: The Social Costs of Shrimp Production in Guayaquil's Mangroves</p>	<p><i>Christiane Schmidt:</i> The SYMBIOAID project: first results on menthol bleaching as an effective rapid technique to rear foraminifera aposymbiotic</p>
10:15-10:45	Break	

	Giant Moray Room	Leafy Seadragon Room
10:45	<i>Sofia Afoncheva</i> : Current trends in sustainable fish feed development	S2: Navigating uncertain waters: tackling noise, errors, uncertainty and variability in data collection, analysis, modelling and management Chairs: Fridolin Haag, Tim Dudeck & Seth Mensah Abobi <i>Fridolin Haag</i> : Embracing uncertainty for better science and better decision making
11:00	<i>Lara Elisabeth Stuthmann</i> : Triggering antioxidative potential of sea grapes (<i>Caulerpa lentillifera</i>) using different light irradiances	<i>Elisa Casella</i> : Drones and SfM-MVS techniques applied to coastal environments: what are the scales of observable processes and errors associated with reconstructed 3d models?
11:15	<i>Md Jakiul Islam</i> : Effects of extreme ambient cold stress in European seabass, <i>Dicentrarchus labrax</i> at different salinities: Growth, hematological, antioxidants, and immune responses.	<i>Tim Dudeck</i> : Music in your data: Hydroacoustic observations and the art of noise removal
11:30-11:45	Break	
11:45	S5: Managing small scale fisheries, interdisciplinary perspectives Chairs: Achim Schlüter and Matthias Wolff <i>Sara Doolittle Llanos</i> : Analyzing socioecological conflict in a community-based mangrove management area in the Gulf of Guayaquil, Ecuador	S4: Coastal Development and Hinterland Dynamics (PA3) Chairs: Tim Jennerjahn and Marion Glaser <i>Till Oehler</i> : Tropical beaches as biogeochemical groundwater filters
12:00	<i>Samiya Ahmed Selim</i> : Opportunities and Challenges in addressing vulnerability and <i>building</i> resilience in Small Scale Fisheries, Bangladesh	<i>Tim Jennerjahn</i> : Coastal development impairs functioning, services and connectivity of downstream ecosystems – the example of Hainan, China
12:15	<i>Isobomuwa Saint Iriabe</i> : The effects of environmental changes on SSF in India - the current and potential role of fisheries policies	<i>Marion Glaser</i> : Megaprojects in the Coastal Zone of Bangladesh: Impacts and Conflicts
12:30	<i>Annette Breckwoltdt</i> : Reef passages in Fiji and New Caledonia	<i>Juliette Kon Kam King</i> : Baiting Sharks into their 'Right Place': Marine Spatial Planning in a More-Than-Human Ocean
12:45-14:00	Lunch Break	

	Giant Moray Room	Leafy Seadragon Room
14:00	<i>Karl G. T. Schrader</i> : Effect of fishing pressure on mangrove crabs (Crustacea, Decapoda) in Fiji	S7: Tropical climate and coastal change: Learning from physical data and models Chairs: Henry Wu and Jan Härter <i>Marie Harbott</i> : Reconstruction of anthropogenic environmental changes from a Cuban coral over the last 160 years
14:15	<i>Alonso Del Solar</i> : Comparative food web analysis of two Peruvian bay systems along a spatio-temporal gradient: role of fisheries, aquaculture and the environmental envelope	<i>Sara Todorovic</i> : South Pacific convergence zone variability and recent acidification reconstructed from tropical corals
14:30	15min break	<i>Henry Wu</i> : SPCZ zonal and El Niño events impact on surface ocean conditions in the Indonesian Throughflow region
14:45	S3: Understanding and protecting tropical diversity Chairs: Oscar Puebla and Sonia Bejarano <i>Julian Lilkendey</i> : Resource-partitioning in a degraded coral reef: a case study from Eilat, Gulf of Aqaba	<i>Jan O. Haerter</i> : Thunderstorm self-organization and its effect on tropical coasts
15:00-15:15	Coffee Break	
15:15	<i>Theresa Schwenke</i> : Extractive Taxonomies: Untangling Networked Knowledge Flows in Zanzibar's Shell Economy	S8: Open session Chairs: Mirco Wölfelschneider, Rapti Siriwardane-de Zoysa & Nils Moosdorf <i>Jialin Zhang</i> : Developing an empirical understanding of knowledge exchange: experience gained from the TICAS project
15:30	<i>Floriane Coulmance</i> : Dissection of a complex trait: quantitative analysis of reef fish colour pattern	<i>Luisa C. Meiritz</i> : The vertical particle transport in the northern and southern Benguela Upwelling System: A drifter study.
15:45	<i>Niklas Reinhardt</i> : Effects of gastropods on sediment characteristics in mangroves	<i>Janine Reinhard</i> : Virtual Academy for Marine & Coastal Sustainability – connecting partners around the globe for a joint initiative?
16:00	<i>Mattia Ghilardi</i> : Diversity in fish intestine morphology: drivers and use in functional studies	<i>Arjun Chennu</i> : Digital ZMT: vision and roadmap for data and digital collaboration at ZMT and beyond
16:15-16:30	Coffee Break	

Giant Moray Room	
Poster session	
16:30	Session 1: Aquaculture and new food systems <i>Samiya Ahmed Selim</i> : Innovative aquaculture for the poor to adjust to environmental change in coastal Bangladesh? Barriers and Options for Progress
16:40	Session 2: Navigating uncertain waters: Data collection and modelling <i>Nils Moosdorf</i> : Tackling spatial heterogeneity of groundwater discharge between scales
16:50	Session 3: Understand and protect tropical diversity <i>Jonas Geburz</i> : Do the trees matter? Exploring spatial patterns of chemo- and biodiversity in mangrove forests
17:00	Session 6: Coral reef disturbances <i>David Brefeld</i> : Behavioral responses of coral larvae to novel anti-biofouling coatings
17:10	Session 8: Open session <i>Juan Molina</i> : Effects of temperature and oxygen availability on blood parameters of <i>Hallobatrachus dactylopterus</i>
17:20	<i>Janna Just</i> : DatAlumni - Scientific Data Cooperation with our Alumni Network
17:30-17:40	Break
17:40	Open discussion with BYO drinks & snacks
18:00	End of ZAC2

ZAC2 organisation team:

Achim Meyer
Gary Murphy
Mirco Wölfelschneider
Nils Moosdorf
Rapti Siriwardane-de Zoysa

Session 1:

Aquaculture food systems and sustainability: multiple methods and perspectives

Chairs: Holger Kühnhold (Experimental Aquaculture), Stefan Partelow (Institutional and Behavioral Economics) & Aisa O. Manlosa (Institutional and Behavioral Economics)

Aquaculture can provide reliable access to nutrients, proteins, and a consistent livelihood, due to overexploited capture fisheries. Fish presently contributes more than one-third of total animal protein supply in 34 countries. Aquaculture can meet the projected increases in global seafood consumption. This makes the development of sustainable aquaculture practices a key measure to enhance global food systems resilience. However, not all aquaculture impacts are positive and numerous studies suggest a large heterogeneity in social systems linked to aquaculture, making generalizations difficult.

Drawing on multiple perspectives and methods to understand aquaculture sustainability is essential to generate both fundamental and applied knowledge. We aim for a balanced representation of perspectives from the natural and social sciences to highlight synergies.

Our session focuses on: How can aquaculture contribute to feeding the world through the provision of proteins, without harming the environment and vulnerable social groups? Potential subtopics are: resource efficient forms of aquaculture, such as unfed and low trophic-level species, promising species in terms of robustness towards environmental change (e.g., temperature and acidity), nutritional content and environmental impacts of novel biomasses, and insights from aquaculture stakeholders as well as system, target or transformative knowledge research on aquaculture social-ecological systems. Other topics welcome.

9:00 - 9:15

Beyond production: social-ecological indicators and development typologies for global aquaculture

by Stefan Partelow, Ben Nagel and Rebecca Gentry
ZMT | ZMT | Florida State University

Aquaculture is the fastest growing food production sector globally, and has now surpassed capture fisheries production. However, little is known about aquaculture development beyond species tonnage production and trade statistics. To assess the sustainable development of the sector going forward, there is a need to move beyond assessing production as a monolithic development metric towards more meaningful social and ecological indicators. In doing so, this allows for the examination of the broader drivers, challenges and potential contributions of the sector towards the Sustainable Development Goals (SDGs) including food security, livelihoods and environmental protection. We collected over 75 social and ecological indicators at the country level linked to the development of the aquaculture sector in more than 100 countries. We categorized our data into the social-ecological systems framework, and performed a cluster analysis to examine comprehensive development typologies among countries facing similar social and environmental conditions related to the expansion of the sector. We then attempt to align our empirical analysis with future development scenarios in aligned with each typology. This analysis provides a much needed multidimensional assessment of the sectors broader sustainability contributions and challenges.

Abstract Id: 15

Session 6:

Coral reefs and their response to anthropogenic disturbances in the past, present, and future

Chairs: Lisa Röpke (Experimental Aquaculture), Sonia Bejarano (Reef Systems), Henry Wu (Coral Climatology), Gary Murphy (Carbonate Sedimentology) and Steve Doo (Carbonate Sedimentology)

Tropical coral reefs have changed substantially over Earth's history, being subjected to a broad spectrum of increasing pressures due to anthropogenic disturbances. Increasing anthropogenic impacts such as riverine discharge, nutrient loading, pollution, and thermal or acidification stress present issues for coral reef environments with unforeseen consequences from the local to the regional and global scales. In this session we invite opinions, ideas, and/or studies focused on the dynamics, processes and responses of coral reef ecosystems to changing anthropogenic impacts. Contributions may pertain to the use and protection of food resources available for humans on coral reefs (PA1) as well as to organism- to ecosystem-level responses to global-scale impacts (PA2).

9:00 - 9:15

Novel anti-biofouling coatings and their potential to enhance coral restoration practices

by Lisa Röpke, David Brefeld, Andrew Negri, Ulrich Soltmann and Andreas Kunzmann
ZMT | University of Bremen | Australian Institute of Marine Science | Gesellschaft zur Förderung von Medizin-, Bio- und Umwelttechnologien e. V. (GMBU) | ZMT

Tropical coral reefs are suffering from many human induced stressors worldwide. Carbon emission induced water temperature rise, ocean acidification, nutrient and waste water discharges, sedimentation, habitat loss due to construction works and overfishing are only a few to mention. Scientists are developing and exploring new methods to assist corals in order to withstand and overcome these threats by applied interdisciplinary sciences. The bottleneck and most fragile part in the puzzle of coral reef survival is reproduction. Corals will only sustain, if their potential to grow is maximized. Corals and their offspring suffer from increased algae overgrowth, facilitated by nutrient inputs and overfishing. An increased reduction of herbivorous species, as well as nutrient discharges will ultimately result in major algae dominated habitats and the last coral reefs and their small sized offspring will be overgrown and lost.

Therefore, innovative and environmentally benign anti-biofouling coatings, aiming to inhibit algae growth and create a favorable environment for coral offspring, were tested. The effects of three novel anti-biofouling coatings on the fouling community, survival and growth of coral settlers were assessed to explore the potential application of the coatings as a new tool for coral reef restoration practices.

Abstract Id: 14

S1: Aquaculture food systems and sustainability: multiple methods and perspectives

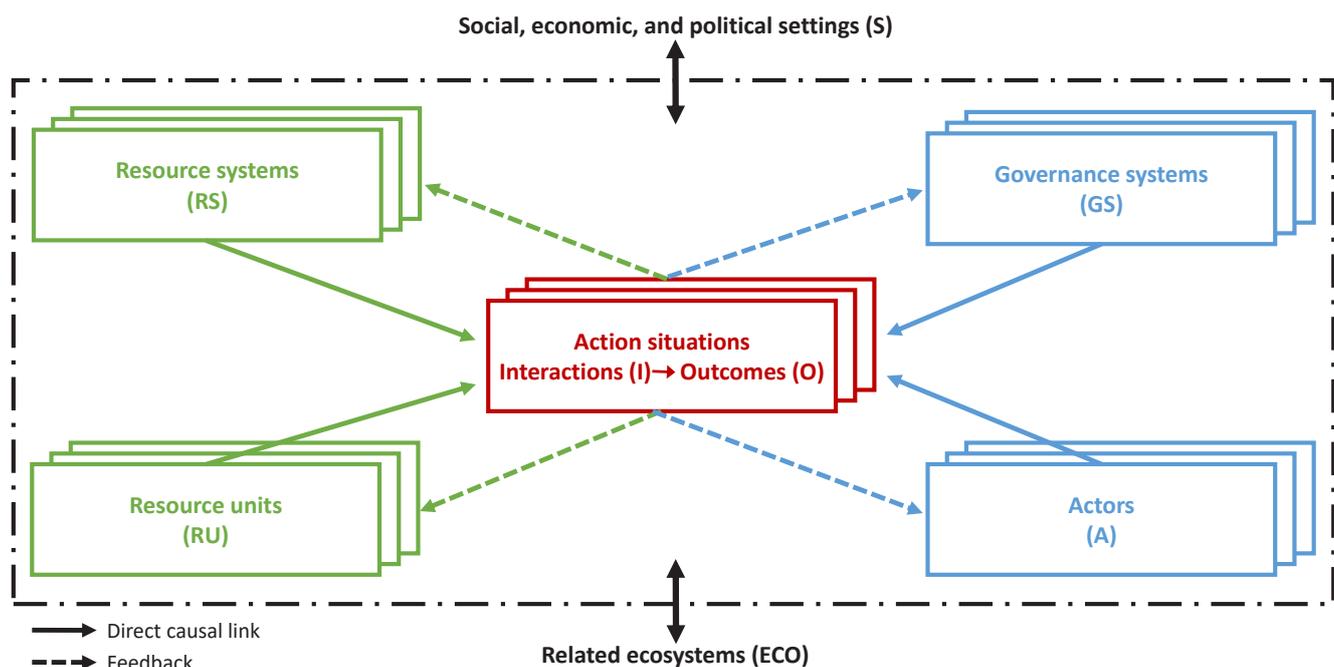
9:15 - 9:30

Operationalizing the social-ecological systems framework as a methodological tool to assess and map aquaculture sustainability

by Ben Nagel
ZMT | Jacobs University

Successfully meeting sustainable development goals and managing shared natural resources requires solutions which specifically account for variations in local social and ecological contexts. Elinor Ostrom’s social-ecological systems (SES) framework was developed as a way to assess and diagnose interlinked social and ecological variables and processes which have been tied to sustainable outcomes of natural resource systems, but so far has mostly been applied to individual community-level studies and few examples exist applying the framework to the rapidly growing sector of aquaculture. In my PhD project, I will explore methods to apply the SES framework across multiple localities for a comparative analysis of aquaculture SES sustainability challenges on the island of Lombok, West Nusa Tenggara, Indonesia. First, I will use a participatory fuzzy cognitive mapping (FCM) approach to generate and explore mental models of how different stakeholder groups perceive aquaculture as an SES. These stakeholder mental models will inform the selection of appropriate SES framework variables which will then be applied to a district-level assessment of aquaculture SESs across Lombok, combining secondary data and standardized expert questionnaires to gather data for each district. This study aims to quantitatively assess and map patterns of social and ecological heterogeneity in the Lombok aquaculture system across the 50 districts on Lombok, as well as integrate local expert knowledge into variable selection, weighting, and modeling of SES interactions to address previously recognized gaps in SES framework methodology. Results of this project may provide input for aquaculture management and policy development in the region through an integrated social-ecological approach grounded in relevance to local resource users, and facilitate future case comparisons.

Social-ecological systems framework



S6: Coral reefs and their response to anthropogenic disturbances in the past, present, and future

9:15 - 9:30

Physiological and proteomic impacts of warming and acidification on different photosymbiotic calcifiers show distinctive links to symbiont condition and pH-regulation

by Marleen Stuhr, Louise P Cameron, Bernhard Blank-Landeshammer, Laxmikanth Kollipara, Claire E Reymond, Albert Sickmann, Hildegard Westphal and Justin Ries

Interuniversity Institute for Marine Sciences, Eilat | Department of Marine and Environmental Sciences, Marine Science Center, Northeastern University, Boston | Leibniz Institut für Analytische Wissenschaften – ISAS – e.V., Dortmund | Leibniz Institut für Analytische Wissenschaften – ISAS – e.V., Dortmund | ZMT | Leibniz Institut für Analytische Wissenschaften – ISAS – e.V., Dortmund | ZMT | Department of Marine and Environmental Sciences, Marine Science Center, Northeastern University, Boston

Globally important calcifiers such as corals and large benthic foraminifera exhibit complex responses to environmental stressors associated with anthropogenic CO₂. While high seawater pH supports calcification, elevated pCO₂ may promote photosynthesis by algal symbionts. Proteomic regulations may facilitate acclimatization to global impacts as proteins are typically the effectors of biological function. To investigate the mechanisms underlying their responses to global change, three tropical coral species and one common reef-foraminifera were exposed to a range of combined ocean acidification and warming scenarios for two months. Physiological parameters and differential protein abundances, quantified via label-free LC-MS/MS-based proteomics, from selected treatments were explored alongside pH-microsensor analyses. All corals increased calcification rates and photosymbiont abundance under elevated pCO₂, except under warming scenarios in which they showed photosymbiont loss and reduced calcification rates. Species-specific effects of ocean acidification were reflected in the proteomic responses, however, we found common increases of proteins involved in antioxidant synthesis, calcium-binding messenger proteins and energy production enzymes, but reductions of ribosomal constituents and proteins involved in cell development. In comparison, foraminifera and their photosymbionts were hardly affected by elevated pCO₂, whereas elevated temperature reduced growth. Exposure to combined stressors reduced pore sizes along with increased microenvironmental pH upregulation. Stable physiological performance at moderate pCO₂ was rendered by substantial proteomic variations in host and symbionts, while minimal proteomic response to higher pCO₂ levels may represent impairment of acclimatization mechanisms. Hence, while linkages between photosymbiont abundance, regulation of calcifying fluid pH, and calcification were identified in corals, reef-foraminifera maintained photosymbiont levels despite altered ion exchange rates, putatively related to micro-skeletal adjustments. Overall, our experiment suggests that photosymbiotic calcifiers can cope with ocean acidification through intensification of photosynthesis and other metabolic pathways, unless thermal stress induces photosymbiont loss. It further indicates trade-offs towards particular cellular functions and highlights species-specific key proteins shaping physiological plasticity.

Abstract ID: 49

S1: Aquaculture food systems and sustainability: multiple methods and perspectives

9:30 - 9:45

Operationalizing the Social-Ecological Framework as a Deliberation Tool to Assess Target Knowledge for Aquaculture Sustainability

by Adiska Octa Paramita

Leibniz ZMT | Jacobs University

Aquaculture tonnage production has continued to grow intensively by overtaking the wild capture fisheries. Despite that, aquaculture is largely unexamined and unexplored in terms of sustainability and governance challenges. Several aquaculture co-management initiatives have been adopted in a decentralized governance system to create a collaborative and participatory process of regulatory decision making among representatives of user groups, government agencies, and research institutions. However, there are challenges in co-management arrangements related to the difficulties to integrate stakeholder preferences and values. This study argues that constructive dialogue in deliberation among actors is important to improve the implementation of co-management that encourages fairness and the ability to learn from the knowledge exchange process. As part of the COMPASS project, this research will develop methodologies to evaluate stakeholder's perspectives, values, and normative goals with deliberative and participatory methods to support co-management arrangement. In order to do so, Social-Ecological System Framework (SESF) will be used as a practical tool for knowledge exchange and empowerment in experimental and non-experimental deliberative settings. The study will be conducted in Lombok, Indonesia, that has demonstrated movement toward sustainable aquaculture production through blue economy development strategies. Several aquaculture communities are chosen to assess the collective action problems related to an irrigation system and gender issues in aquaculture.

Three research plans have been developed accordingly. First, an experimental field study to evaluate the stakeholders' perceptions related to collective action problems in maintaining pond irrigation systems that support aquaculture. Second, a non-experimental field study to assess social-ecological understanding of different relationships between men and women with the aquaculture systems. This study aims to overcome the marginalization of women in aquaculture. Third, a literature review paper based on case studies in marine and coastal governance to understand the conceptualization and problem framing in deliberation research.

Abstract Id: 31

9:45 - 10:00

Institutions and change processes in entangled capture fisheries and aquaculture: A case study from Central Luzon, Philippines

by Aisa O. Manlosa, Anna-Katharina Hornidge and Achim Schlüter

ZMT | Deutsches Institut für Entwicklungspolitik | ZMT |

How we source our fish proteins has substantially changed over the last decades. At a global scale, aquaculture now supplies more fish proteins relative to capture fisheries. As a sector for producing fish and other aquatic food, institutions for aquaculture in the form of state rules, market arrangements, or civil society norms are entangled with that of fisheries particularly when they co-exist in the same geographic area. How responsive are various institutions to the trend of growing aquaculture? An understanding of the diversity of relevant institutions in both fisheries and aquaculture, how they change, and how such institutions interact is important for fostering governance for sustainability in the context of aquaculture growth. We used a qualitative case study approach focused on three municipalities in the region of Central Luzon, Philippines. Methods included qualitative interviews (n=70), participant observations, and thematic analysis of institutional documents across scales. Findings revealed diverse and interlinked institutions in the spheres of state, market, and civil society. The institutional changes in these spheres were developmental and gradual. These were primarily driven by pragmatic needs, opportunities, and were largely enabled by collaborative social relations. A number of the changes were directly related to the increase of aquaculture production. The findings have important implications for re-shaping understanding and re-thinking actions in relation to the role of institutions in promoting sustainability in coastal social-ecological systems that are increasingly dependent on aquaculture. In particular, we emphasize the need for a more holistic and systemic approach in engaging with existing plural institutions in social-ecological systems.

Abstract Id: 24

S6: Coral reefs and their response to anthropogenic disturbances in the past, present, and future

9:30 - 9:45

Microplastic particle incorporation and identification in scleractinian coral skeleton

by [Florian Hierl](#), Henry C. Wu and Hildegard Westphal
ZMT | ZMT | ZMT |

Anthropogenic litter pollution of the marine environment is an emerging threat and is being more and more recognized by society. With an increasing production volume of litter, the amount of plastics entering the marine environment increases each year as well. Initially floating plastic particles are subject to degradation and biofouling, ultimately reaching marine benthos and massively impacting marine health. These microplastics (<5 mm) originate from either degradation of larger plastic pieces or industrial production and have been detected everywhere in the ocean from the surface to the deep-sea and on beaches and coastal habitats. Several laboratory studies have proven, that due to their shape, texture and taste, microplastics can be mistaken for food items by marine organisms. Although only little is known about the ultimate effects of microplastic pollution in coral reefs, its impacts need to be understood urgently. In this study, we aim to determine the interactions between microplastics (polyethylene terephthalate (PET)) and coral skeletal production. We conducted a 5-month aquarium-based experiment exposing four different coral species of various polyp sizes and coral surface morphologies to high concentrations of PET. We observed notably increased mucus production by the corals during times of PET exposure, which can be seen as a defence mechanism against pollutant induced stress. Our skeleton analyses revealed significant alterations to its natural growth form by utilising high-resolution micro-computed tomography and the production of petrographic thin sections for Scanning Electron Microscopy, and Energy Dispersive X-ray Spectroscopy (EDX). While numerous PET particles were observed to be ingested and later expelled by the corals, some PET particles and fibres of unknown origin were integrated into the skeleton during the process of calcification. This integration into skeletal material is potentially caused by tissue necrosis and subsequent overgrowth following adhesion or the ingestion of plastic particles.

Abstract Id: 53

9:45 - 10:00

*Adaptability of deepwater corals *Caryophyllia (Caryophyllia) smithii* to changing ocean pH*

by [Lukas Bublies](#), Henry C. Wu, Anette Meixner, Julia Michaelis, Edwige Pons-Branchu, Simone Kasemann, Claire Reymond and Hildegard Westphal
Universität Bremen | ZMT | Marum | ZMT | LSCE | Marum | ZMT | ZMT

Caryophyllia (Caryophyllia) smithii is a slow-growing aragonitic species of scleractinian coral that occurs in cold to temperate waters from 50 to 1000 m depth. Specimens of *C. smithii* have been sampled during the Meteor M129 Cruise off the coast of Senegal and Mauretania. The samples have been analyzed for trace elements, as well as boron isotopic ratios ($\delta^{11}\text{B}$), as a whole resulting in average element values for the entire lifespan of the coral. Using trace element ratios we were able to reconstruct average water temperature and primary productivity during the lifespan of the corals. The relatively high $\delta^{11}\text{B}$ composition of all specimens ranges from 24.58 ‰ to 26.16 ‰. These values lie above the pH-dependent seawater borate equilibrium curve. This is an indicator for strong up-regulation of the pH of the calcifying fluid (pH_{cf}) inside the coral relative to seawater. Compared to previous measurements of *C. smithii* in the Mediterranean Sea the $\delta^{11}\text{B}$ are significantly lower ($\Delta = 2-4$ ‰), resulting in much lower pH_{cf} by about 0.4 pH units. Upregulation in the pH_{cf} seems to be dependent on location and the surrounding seawater and is not locked to an optimal pH. A major aspect of the current climate change is ocean acidification. This makes it harder for calcifying organisms to secrete their shell from seawater. Therefore it is vital to understand the mechanisms behind pH regulation in corals, to estimate the threat that rising atmospheric CO₂ and therefore lower ocean pH has on deep-water corals.

Abstract Id: 54

S1: Aquaculture food systems and sustainability: multiple methods and perspectives

10:00 - 10:15

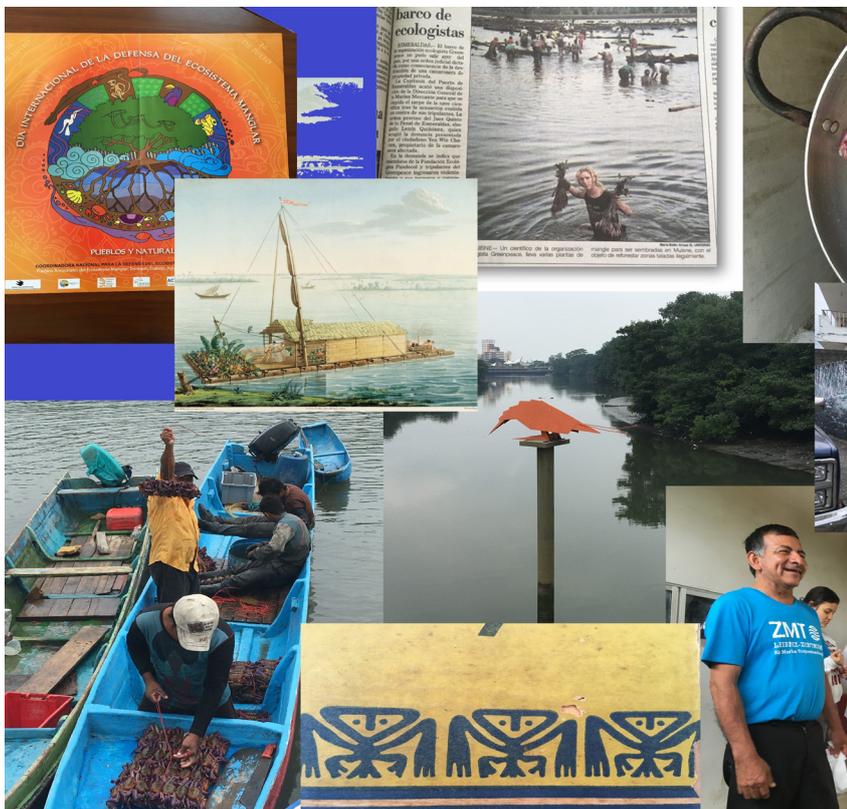
*Larvae, Cash & the City:
The Social Costs of Shrimp Production in Guayaquil's Mangroves*

by Anne-Katrin Brooks

ZMT Development and Knowledge Sociology & Socium - University of Bremen

The biggest port city of Ecuador, Guayaquil, is built within a mangrove swamp and influenced highly by the shrimp aquaculture industry, one of the biggest in the world. Production is in the hand of the economic oligarchy of Ecuador supported by transnational agro-businesses. Production was built up informally since the 1970s. Around 2000 the whitespot disease stopped nearly all shrimp production in Ecuador and led to a financial crisis. Meanwhile production has recovered. While the most obvious effect of shrimp production development was the loss of significant parts of the mangrove ecosystem, the social and cultural effects caused remained understudied so far. Analyzing discourse and ethnographic data collected during an eight months fieldwork for my PhD project in the mangroves of Ecuador in 2019/2020 and guided by the 'Sociology of Knowledge Approach to Discourse'(SKAD) (Keller 2001, Keller 2005, Keller 2011, Keller 2011) I will discuss A) the "El Dorado" of catching wild shrimps in the 1990s. When cutting red mangrove for commercial use was prohibited many former tree-cutter started catching larvae for the shrimp farms. I will outline the effects of the sudden cash influx into the mangrove communities. B) The significant loss of mangrove forest put Ecuador in the 1990s in the center of the international conservation and development discourse. I will describe main events and connect them to the effects of the scientific concepts of "poverty" and "development". I finally C) like to discuss the forms of adaptations mangrove stakeholder have developed to the consequences of shrimp production.

Abstract Id: 18



S6: Coral reefs and their response to anthropogenic disturbances in the past, present, and future

10:00 - 10:15

The SYMBIOAID project: first results on menthol bleaching as an effective rapid technique to rear foraminifera aposymbiotic

by Christiane Schmidt, Debora Raposo, Marleen Stuhr, Raphael Morard, Simon Davy and Hildegard Westphal
ZMT | MARUM | ZMT | MARUM | University of Victoria, Wellington | ZMT

Larger benthic foraminifera are important carbonate producers in tropical and subtropical settings and play a large role in the carbon cycle. They suffer from bleaching of the associated algal community under increased SST due to climate change. We use as a model organisms, the diatom-bearing foraminifera *Amphistegina lobifera*, because of its small size and robustness in the laboratory for symbiosis investigations. Results on menthol bleaching to rear foraminifera aposymbiotic within 6 weeks are presented. Furthermore, re-infections after bleaching with previously isolated symbionts from foraminifera should show whether a single symbiont or a symbiont community can influence the thermal tolerance of the foraminifera. The methodological approach are a combination of ecophysiological experiments, microcopy techniques, and molecular analysis of the symbiont communities, which include diatoms and bacteria. With this approach, SYMBIOAID will contribute to better understanding symbiont flexibility and reveal the capacity of physiological adaptation to climate change.

Abstract Id: 55

Session 2: :

Navigating uncertain waters: tackling noise, errors, uncertainty and variability in data collection, analysis, modelling and management

Chairs: Fridolin Haag (Data Science & Prediction), Tim Dudeck (Fisheries Biology) & Seth Mensah Abobi (Resource Management & University for Development Studies, Tamale, Ghana)

Variance is the spice of science. No matter our discipline, we aim to make sense of phenomena that we cannot observe closely, model exhaustively, or control perfectly. Instead, we are confronted with error, bias, and noise in our observations, with assumptions in our analysis, and researcher degrees of freedom. As scientists we use an array of informal and formal practices to tackle these challenges, for instance experimental design, data collection and analysis protocols, statistical procedures, or sensitivity analysis. The goal of this session is to bring together your perspectives on how such "uncertain waters" can be navigated. Which observation errors do you find difficult to address? How do you decide about data collection schemes and protocols? How do you tackle noise and variability in data? What can support communication about uncertainties? We want to hear your stories of success, learn from your failures, think about your problems, and discuss your ideas.

As such questions arise in any field, we seek contributions from any discipline, working group, and research topic. We would like to learn about the content and results of your projects, but invite a focus on the methodic and methodological issues you encountered, such as those sketched above.

S1: Aquaculture food systems and sustainability: multiple methods and perspectives

10:45 - 11:00

Current trends in sustainable fish feed development

by Sofia Afoncheva, Hilke Alberts-Hubatsch and Andreas Kunzmann

Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI) | ZMT

Demands for aquaculture production will continue to increase in the next years. In order to be sustainable and able to provide enough fish to consumers, aquaculture industry needs innovative changes in fish feeds. Traditionally, the main components of fish feed are fish meal and oil. In the last years, inclusion of these ingredients reduced significantly due to use of protein and oils from non-capture fisheries sources. Among the most common alternatives to fish components in fish feed are oil seeds, microalgae, insects, agricultural by-products or single cell protein obtained from protein-rich microorganisms. Larval nutrition presents additional challenges on the way of new feed formulations. Specific nutritional demands, size and behavioural requirements of fish larvae have to be met when developing a new larval diet. The nutritional value of food is one of the key parameters for approving new diets. In our project we focus on culturing copepods of high nutritional quality as live feed for fish larvae in aquaculture. Nutritional quality of live feed is determined primarily by its fatty acid (FA) composition, the amount of polyunsaturated fatty acids (PUFA) and pigments. Copepod nauplii are rich in PUFA and fulfil the requirements of larval organisms better than traditional aquaculture live feed - rotifers and *Artemia*. The cyclopid copepod *Apocyclops panamensis* has high potential as live feed for fish larvae due to its robustness, small nauplii size, short life cycle and relatively high reproduction rate. At the moment *Apocyclops* is being provided mostly for ornamental fishes and is used as feed only in some Asian aquaculture. Our current research aims to optimize the nutritional value of copepods, by manipulating its biochemical composition through microalgae diets with different FA profiles. This presentation will give an overview about the current challenges to find sustainable protein and PUFA alternatives for fish feed.

Abstract Id: 40

11:00 - 11:15

*Triggering antioxidative potential of sea grapes (*Caulerpa lentillifera*) using different light irradiances*

by Lara Elisabeth Stuthmann, Karin Springer and Andreas Kunzmann

ZMT | University of Bremen | ZMT

Sea grapes (*Caulerpa lentillifera*) are edible, nutritious green macroalgae. The algae are cultured in tidal-ponds, mainly in Vietnam and the Philippines. Sea grapes are of high economic value, due to their special caviar-like texture and numerous health benefits. Additionally, the culture is cost-efficient and sustainable. This makes sea grapes a good-candidate to cover the increasing demand of seaweeds worldwide. The artificial modification of culture parameters provides the opportunity to trigger the production of favorable secondary metabolites, such as antioxidants. Under light-stress, algae may form harmful reactive oxygen species (ROS) and as a protective response, antioxidative compounds can be produced, which neutralize the ROS through their own oxidation. These antioxidative compounds (vitamins, polyphenols) do also have positive effects as part of human diets. This presentation introduces the attempt to trigger the antioxidative potential of sea grapes by using different light irradiances and also considers the application of light as a post-harvest treatment.

Abstract Id: 20

S2: Navigating uncertain waters: tackling noise, errors, uncertainty and variability in data collection, analysis, modelling and management

10:45 - 11:00

Embracing uncertainty for better science and better decision making

by Fridolin Haag
ZMT

As humans we dislike uncertainty in many situations. Not knowing can make us vulnerable. The tendency to avoid uncertainty also appears in human practices such as science or decision making. However, as I will illustrate, knowing the extent of our ignorance can help us take better action. Science, specifically predictions made by science, can be viewed as one important input to decision making, for example, around conservation or management of coastal and marine areas. These predictions come with large uncertainties – though this might be invisible when we focus on point estimates. As I show with a simulation study, large prediction uncertainties do not necessarily prevent the identification of good management options, but their consideration can increase our trust in the robustness of the decision. When uncertainties in our models are indeed overwhelming, addressing specifically those uncertainties that impact a decision allows us to focus costly data collection efforts. A systematic approach that I present facilitates prioritizing the relevant sources of uncertainty. This value of information analysis can be understood as a form of probabilistic sensitivity analysis. Such analysis requires an explicit formulation of the parametric uncertainties in our prediction models with probability distributions that essentially quantify our ignorance. Obtaining such distributions can be a challenge. However, in a Bayesian framework for parameter inference they are a direct result. Thus, I briefly discuss Bayesian approaches of fitting models to data and their (dis-)advantages. By providing examples of how it can be tackled, I hope to spark discussion on how we can find comfort with uncertainty in scientific work. With the perspective on decision support as the intended endpoint of scientific inquiry, I would also like to contribute to the discourse on “user-centered” science, as discussed in transdisciplinarity research.

Abstract Id: 36

11:00 - 11:15

Drones and SfM-MVS techniques applied to coastal environments: What are the scales of observable processes and errors associated with reconstructed 3d models?

by Elisa Casella (Co-authors are listed in the presentation since two different works are presented)
ZMT | University of Bremen

Drones, coupled with Structure-from-Motion and Multi-View-Stereo methods (computer-vision science) have enhanced the capability of observing earth processes. Consumer-grade drones have been on the market for less than eight years. The large availability of this technology led, in relatively few years, to an exponential growth of the number of scientific papers where drones have been employed to study the environment. Coastal areas present challenging conditions for the use of drones, due to the nature of the environment. At the same time, coastal environments are prone to rapid changes due to the interaction between land and marine environments (e.g. beaches) and can be difficult to survey (e.g. shallow-water reefs) with traditional techniques. Drones and SfM-MVS methods proved to be essential in providing new insights into the study of the coastal environment, allowing for more accurate and faster monitoring. This work is divided into two parts. First, we present a review of about 50 papers using drones-SfM-MVS for beach surveys. We show that thanks to drones-SfM-MVS methods, it is possible to map beach environments with a resolution of few centimeters, and with a vertical error of 19 to 0.5 cm. Multi-temporal studies show the ability of the method in catching seasonal volumetric changes. The second part of this work presents one of the first 3d-reconstructions of shallow coral-reefs environment using drones-SfM-MVS. The refraction of light passing between the two different media (air, water) represents the main source of error in the reconstruction of the 3d of the seafloor using aerial images. The results of these studies show that: i) for land coastal environments, drones-SfM-MVS can provide higher-resolution information, with an accuracy comparable with that of the more precise traditional survey techniques (e.g. DGPS); ii) for shallow underwater environments (e.g. coral reefs), it is possible to gather high-resolution maps, but the vertical accuracy of the reconstructed environment presents limitations to study small-scale changes.

Abstract Id: 19

S1: Aquaculture food systems and sustainability: multiple methods and perspectives

11:15 - 11:30

*Effects of extreme ambient cold stress in European seabass, *Dicentrarchus labrax* at different salinities: Growth, hematological, antioxidants, and immune responses*

by Md Jakiul Islam, Matthew James Slater and Andreas Kunzmann

Leibniz Centre for Tropical Marine Research (ZMT), 28359 Bremen, Germany | Alfred-Wegener-Institute, Helmholtz-Center for Polar and Marine Research, 27570 Bremerhaven, Germany | Leibniz Centre for Tropical Marine Research (ZMT), 28359 Bremen, Germany

Climate change-driven extreme weather events are expected to challenge ectotherms' physiological tolerance. The hemato-physiological modulation potentials of fish during extreme ambient cold events at different salinities are poorly studied. In this study we evaluated the growth, hemato-physiological, antioxidants, and immunological response of European seabass, *Dicentrarchus labrax* acclimatized at 30, 12, 6, and 3 PSU followed by an extreme ambient cold (8 °C) exposure for 20 days. Juvenile fish acclimatized at 30 and 3 PSU showed significantly low growth performances ($p < 0.05$). Red blood cells (RBC), hematocrit, hemoglobin, cortisol, and serum protein content were decreased. Besides, phagocytic respiratory burst (RB) and serum lysozyme activities (LSZ) were significantly higher during extreme cold exposure. None of the repeatedly evaluated parameters indicated acclimation capacity to cope with tested salinities during cold exposure. However, taken together, our results indicate that *Dicentrarchus labrax* acclimatized at intermediary salinities (6 and 12 PSU) can perform comparatively better during extreme ambient cold exposure (8 °C).

Abstract Id: 21

S2: Navigating uncertain waters: tackling noise, errors, uncertainty and variability in data collection, analysis, modelling and management

11:15 - 11:30

Music in your data: Hydroacoustic observations and the art of noise removal

by Tim Dudeck
ZMT

Signal-to-noise ratio is a common term in data analysis. But what is noise? For example, hydroacoustic observation systems record a lot of real and “unreal” noise in their raw data output. These can be of biological, physical or electrical origin. Just like in any field data analysis, removing this noise is a critical part of hydroacoustic data analysis. In this study, I show different types of noise and how to deal with them. How do we define noise, what is variance and when does noise become a signal? What are the risks of excessive noise removal or too less noise removal? Moreover, there is often a thin line between unbiased noise removal and data manipulation. Examples will be shown from the modern EK80 hydroacoustic system and how it was possible to observe the deep-scattering layer in the Benguela Upwelling System through noise removal. The ideas and methods behind the examples can be applied to other data and in regards to ever growing datasets, are meant to raise awareness of the risks and benefits of noise.

Abstract Id: 16

Session 5:

Managing small scale fisheries, interdisciplinary perspectives

Chairs: Achim Schlüter (Institutional and Behavioural Economics) and Matthias Wolff (Resource Management)

Small scale fisheries still are one of the most important livelihoods for poor inhabitants along tropical coasts. Among marine resources, fisheries have been investigated the longest from a natural and social science perspective. This is also true for small scale fisheries, the focus of this session. Therefore, we can build on a broad fundament of theoretical and empirical knowledge. Nevertheless, there remain many challenges, so that those fisheries can cope with the ongoing changes. This is particularly true, if we are thinking of social ecological perspectives, so those, which are cooperating deeply between the social and the natural sciences. The session aims for contributions looking at local fisheries from all different kinds of perspectives. We want to catch the diversity at ZMT. Due to the expected diversity, we are planning to give, on the one hand, room for each presentation on its own right. On the other hand, we close the session or series of sessions with a discussion on synergies and cooperation potential. Contributions from all steps of research are welcome: proposals, concrete paper plans, draft papers, submitted papers, or anything else, you believe is interesting for you to share.

11:45 - 12:00

Analyzing socioecological conflict in a community-based mangrove management area in the Gulf of Guayaquil, Ecuador

by Sara Doolittle Llanos, Anna-Katharina Hornidge and César Giraldo Herrera
ZMT | DIE | ZMT

Mangrove forests provide ecosystem services and functions of global relevance but are threatened by a wide range of anthropogenic actions. As a response to mangrove degradation, academics and governing agencies around the world have advocated for Community-Based Mangrove Management (CBMM) to shift mangrove and resource protection from governments to local communities, with mixed outcomes of successes and failures. I studied the socio-ecological conflicts in a CBMM area in the Gulf of Guayaquil, Ecuador, where ancestral communities hold the legal rights of natural resource extraction. Communities have struggled for the past 20 years with resource ownership and effective exclusion of external actors, exacerbated by resource scarcity of the most valuable fishery, red crab (*Ucides occidentalis*). I used a mixed-method qualitative approach, including participatory mapping workshops, participant observation, and semi-structured interviews to describe resource use of different stakeholders. I recorded a variety of resource use practices within and around the concession area, changes to practices in recent years, and the challenges different stakeholders face. Findings suggest the CBMM 's focus on crabbing has resulted in a geographical mismatch between the management framework and the social-ecological processes taking place. Social-ecological conflicts stem from ecological knowledge gaps, concession area border placement, and the disconnect of management circles from the rest of the communities and broader issues in the gulf such as pollution, poverty, market insecurity, and climate change. The success of community organizations in natural resource management strongly depends on their flexibility to include all possible stakeholders, and their ability to adapt to a constantly changing environment. A strong compromise to diversify livelihood strategies, involve a wider range of stakeholders in decision making, and invest in the education of younger generations might help build resilience in these communities in the case that legal or environmental changes render old practices and forms of income obsolete.

Abstract Id: 13

Session 4:

Coastal Development and Hinterland Dynamics; PA3

Chairs: Tim Jennerjahn (Ecological Biogeochemistry) and Marion Glaser (Social-Ecological Systems Analysis)

The ZMT programme areas are relatively new and still in development. In Programme Area 3 we address the causes and consequences of human interventions in the coastal zone and its hinterland on matter fluxes, eutrophication, pollution, habitat and ecosystem distribution, diversity and wellbeing of organisms and people, ecosystem services, socioeconomic conditions and governance (for details see the ZMT/PA3 website: <https://www.leibniz-zmt.de/en/research/research-areas-programme-areas/programme-area-3.html>).

An intensive exchange of what we have so far and what may define the way forward will help to further sharpen PA3 and the PAs as such, as well as the overall ZMT profile.

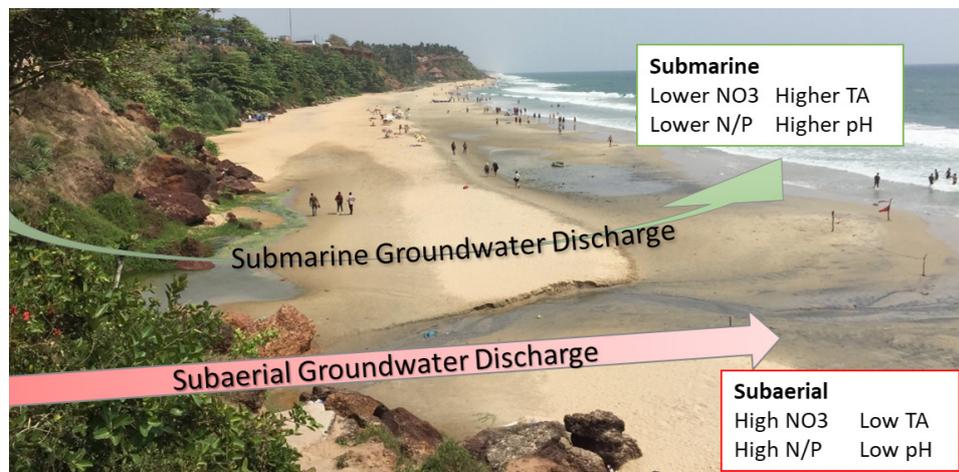
We ask for contributions that are relevant to PA3. These may be reports on ongoing research, plans for research projects, recent own publications and ideas for PA3-relevant synergy activities at ZMT.

11:45 - 12:00

Tropical beaches as biogeochemical groundwater filters

by Till Oehler and Nils Moosdorf

Submarine Groundwater Discharge | Submarine Groundwater Discharge



Beaches occur widespread in tropical regions and their importance, e.g. for tourism, is wellknown. Their role as a buffer zone along the land ocean continuum against inputs of pollutants from the hinterland into the coastal ocean has in turn been neglected so far. Tropical regions are known to be hotspots for groundwater discharge and associated inputs of biogeochemical active compounds such as nutrients into the coastal ocean, which can affect sensitive coastal ecosystems such as seagrass beds or coral reefs, and lead to eutrophication or the occurrence of harmful algae blooms. Before discharge into the ocean, groundwater often flows through the so called subterranean estuary (STE), a mixing zone between groundwater and seawater. In the recent years, this mixing zone has received increasing scientific attention as a biogeochemical reactor, which might be an important but still unexplored filter of pollutants. We therefore carried out a detailed investigation of a STE at Varkala Beach (India). The area belongs to India's most touristic regions including a high anthropogenic stress on the coastal zone. Electrical resistivity tomography data coupled to detailed sampling of beach groundwater revealed that fresh groundwater flows from the hinterland through the beach into the ocean. Sediment incubation experiments, nutrient concentrations and stable isotopes of nitrate revealed that beach groundwater receives nitrogen from anthropogenic sources such as manure and/or sewage in the hinterland. The STE effectively removed nitrate via denitrification and released PO_4 from the mineralisation of organic matter into groundwater. As a consequence, Varkala Beach lowers N/P ratios of discharging groundwater and thereby positively affects the biogeochemistry of its coastal ocean. We herein show that tropical beaches provide important ecosystem services which have so far been almost entirely neglected.

Abstract Id: 33

S5: Managing small scale fisheries, interdisciplinary perspectives

12:00 - 12:15

Opportunities and Challenges in addressing vulnerability and building resilience in Small Scale Fisheries, Bangladesh

by Samiya Ahmed Selim and Marion Glaser

WG Social-ecological Systems | WG Social-ecological Systems

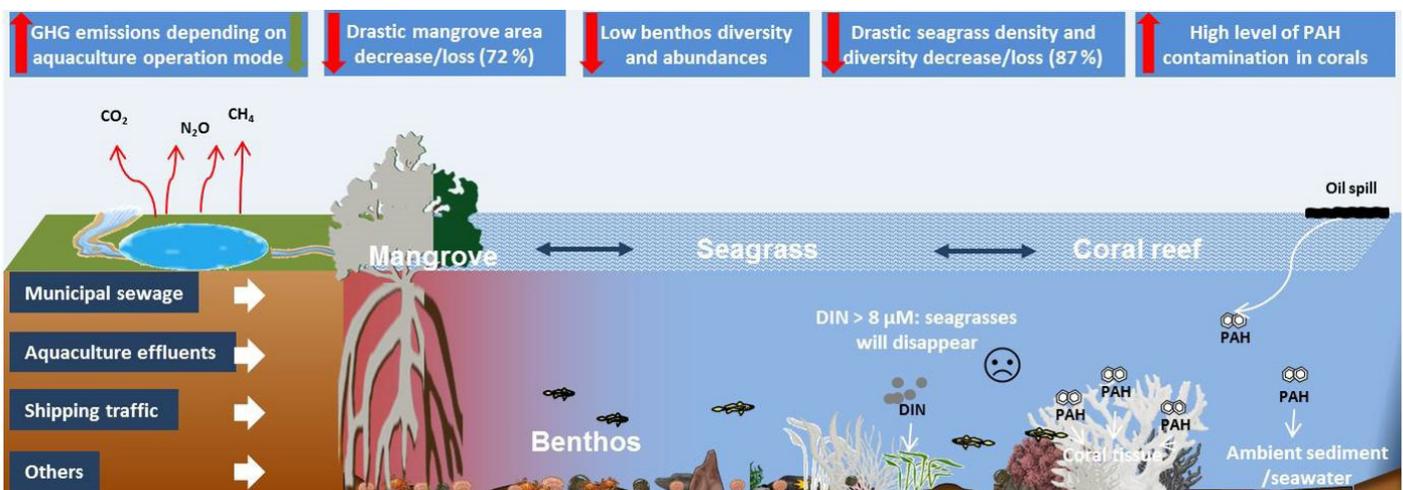
Small-scale fisheries (SSF), including artisanal fisheries, employ more than 90 percent of the world's capture fishers and provide many local communities in the developing world with a source of food security and livelihoods. In Bangladesh, SSF plays a crucial role in society as 60 percent of protein comes from fish. The overall marine and inland fishery sector contributes about 5 percent of gross domestic product (GDP), as well as full-time employment for 1.2 million people and part-time income for an additional 11 million people. However, small scale fisher folk continue to be marginalized and remain vulnerable to various natural and man made (economic) shocks to the system. These fishers face cross-generation poverty, food insecurity, lack of education, gender inequity, and inequitable resource allocation. Their livelihoods and occupational continuity are further threatened by blue economy initiatives that prioritize the economic interests over sustainable resource use. Adaptive ocean governance is fundamental for ensuring a fair and sustainable use of marine resources. This process requires a robust social-ecological approach focusing on social and environmental justice, equity, participatory decision-making and power sharing. This study aims to identify the key barriers and opportunities for addressing vulnerability and building resilience in SSF. In this study, we triangulated the findings from 55 in-depth interviews with fisherfolk, boat owners and a workshop with cross-sectional stakeholders including NGOs, academics, private sector, and grassroots organizations. We explored income opportunities, ownership, risks associated the profession (e.g. disaster, pirates, and waste of catch), intergenerational aspects, perception on fishing ban, (technological issues) and other aspects of vulnerability and resilience. Our results highlight the high economic vulnerability of these SSF communities, with a lack of diversity in household incomes. There is a clear tension between the objectives of fish -stock conservation through an annual 3- month fishing ban imposed by national law, and well being within these communities.

Abstract Id: 22



S4/PA3: Coastal Development and Hinterland Dynamics

12:00 - 12:15

*Coastal development impairs functioning, services and connectivity of downstream ecosystems – the example of Hainan, China*by Tim Jennerjahn
ZMT

The tropical island of Hainan is the largest special economic zone of China and its coasts are lined with mangrove forests, seagrass meadows and coral reefs. The beauty of these coastal ecosystems finds their economic potential for tourism, which is a major and growing industry sector. However, activities in other major economic sectors, i.e. agriculture, aquaculture and urbanization/industrialization, affect and impair the integrity of the coastal ecosystems. Since the 1960s mangroves were massively deforested and to a large extent converted into aquaculture ponds on Hainan. Brackish water aquaculture, with intensive use of artificial fertilizers and feed as well as feeding with trash fish originating from artisanal capture fisheries, was and is a major pillar of Hainan's economy. At the turn of the millennia the pond area reached its present-day areal extent. Untreated wastewater including large amounts of anthropogenic nitrogen is either released into semi-enclosed coastal bays or directly into coastal back-reef areas where it leads to eutrophication. Seagrasses are strongly impaired, abundance and diversity are declining, in some places they disappeared totally. Our data sets allowed to define a threshold of long-term exposure to dissolved inorganic nitrogen of $8 \mu\text{M}$ for seagrass survival. Coral reefs are similarly affected by eutrophication and other threats. We traced the pathway of anthropogenic nitrogen from aquaculture ponds into coastal waters and sediments as well as into the food web over four trophic levels by stable nitrogen isotope analysis. The anthropogenic nitrogen enrichment in the coastal zone is also documented in an age-dated sediment core. Our long-term research in the interdisciplinary collaborative Sino-German projects LANCET, ECOLOC and TICAS enabled us to delineate the causes and consequences of coastal development for ecosystem functioning, services and connectivity in Hainan's coastal zone. We established a dialogue with stakeholders and we propose measures to preserve the valuable coastal ecosystems.

Abstract Id: 34

S5: Managing small scale fisheries, interdisciplinary perspectives

12:15 - 12:30

The effects of environmental changes on SSF in India - the current and potential role of fisheries policies

by Isobomuwa Saint Iriabe and Eike Holzkämper
WG Social-ecological Systems | WG Social-ecological Systems

The majority of Indian fishers is working in the low-tech, labour-intensive small-scale fisheries (SSF), which is the backbone of the fisheries sector and often also of food security for the marginalized poor. The livelihoods of fishers are threatened by the combined pressure from decades of over exploitation, environmental degradation and increasing environmental changes. Recently, the consequences of the Covid-19 pandemic have further imperiled fishers' existence. Fishworker representatives and scholars argue that the importance of SSF in India is underestimated in political narratives and not mirrored in fishery policies. Policies and development approaches for Indian fisheries are centred around the "blue economy" paradigm and do not address the concerns of SSF. By conducting a structured literature review, this study assesses the impacts of environmental changes on the livelihoods of SSF in India and evaluates if and how Indian fisheries policies target this issue. It further investigates the potential of social networks to support policy-making in favour of SSF in India. This recently started research is conducted in the course of a Master thesis of the ISATEC program/University of Bremen. It is associated to the WG Social-ecological systems analysis of the Leibniz Centre for Tropical Marine Research in Bremen, Germany. The M.Sc. project links to and enriches a current PhD project on the role of social networks for adaptation to environmental changes.

Abstract Id: 30

12:30 - 12:45

Reef passages in Fiji and New Caledonia

by Annette Breckwoldt
WG Social-ecological Systems Analysis

The importance of coral reefs for Small Island States in the tropics has long been undisputed. Healthy and protected reefs help island systems (cultural, ecological, social, physical ...) thrive and survive. With this research focus on 'reef passages', a thematic embedded in the DFG-ANR funded project SOC Pacific, we intend to highlight the multi-faceted importance of these special openings in fringing reefs that connect inshore and offshore areas even at very low tides. Every day, living and non-living, human and non-human objects 'pass' through these openings in various ways. This can be sediments from an island's hinterland, fish in spawning mode, predators such as sharks (juvenile/adult), or fishers. Reef passages are like 'communication zones' between inshore coastal and open waters and showcase a number of transboundary issues that need to be better understood, e.g. for MPA planning, supporting fisheries or protecting marine biodiversity. Such knowledge could also contribute to the efforts around the so-called 'ridge-to-reef' approach to coastal conservation and management. We first develop a definition – what are reef passages/channels/breaks/entrances – moving towards a classification system for reef passages as overview, looking at different categories in detail, including their individual and overlapping features, as well as stating exemptions. In addition, local/vernacular terms referring to these openings will be investigated on this background. From an ecological and even more so from a social-ecological focus there has been surprisingly little focus on recognizing reef passages in their own right for their (not only biological) significance, for which MPA status would clearly be relevant (Yvonne Sadovy de Mitcheson, pers. comm. 2020). This research therefore intends to generate data for the much needed recognition of an incredible diversity of life that live from, live at, visit or just pass through reef passages, in a way that highlights the complex interactions and benefits they stand for/produce.

Abstract Id: 37

S4/PA3: Coastal Development and Hinterland Dynamics

12:15 - 12:30

*Megaprojects in the Coastal Zone of Bangladesh: Impacts and Conflicts*by Marion Glaser and Samiya Selim
ZMT | ZMT, ULAB

Some of the clearly undesirable outcomes of human activities in water catchment areas are eutrophication, pollution, and reduced and less diverse marine ecosystems. Riverine and subsurface water flows transfer such impacts of human interventions on coastal lands into marine regions and thus further impacting ecosystem services and the well-being of coastal people. The coastal tropics are hotspots of such adverse social-ecological change and of related conflicts. The drivers of such dynamics are often described as rooted in the needs and life styles of growing human populations. However, across the globe, economic growth and more recently Blue Economy and Blue Growth policies are also affecting coastal regions. The "Blue Economy" agenda frames the ocean as the new economic frontier, and is attracting large amounts of new multi-national capital for large high investment and high impact "megaprojects". This presentation reports on early work in the No CRISES project in Bangladesh. We focus on megaprojects and their role in changing coastal human-nature relations and report first fieldwork results with two groups of key stakeholders of a set of large projects in coastal Bangladesh: representatives of powerful economic actors (e.g. large companies, parastatals) and small-scale coastal fishers. Focusing on major conflicts as perceived by diverse stakeholders, we investigate the role and the potentials of large coastal projects for social-ecological change in the context of ongoing transformation. We report first results for field research in three regions of coastal Bangladesh which was carried out in November 2020.

Abstract Id: 35

12:30 - 12:45

*Baiting Sharks into their 'Right Place':
Marine Spatial Planning in a More-Than-Human Ocean*by Juliette Kon Kam King and Riera Lé
ZMT & IRD | IRD

Marine Spatial Planning (MSP) has been brought forward in the last decade as a promising management tool to sustainably organize and balance in space and time oft-competing claims over marine spaces and resources. Drawing upon a deepening understanding of anthropogenic pressures on the sea, MSP is often mobilized for the management of humans and their marine and coastal activities (including fishing and conservation ones) with relatively little recognition for non-humans' agency. The aim of this communication is to propose a less anthropocentric angle and to interrogate the contours and implementation of MSP in "more-than-human" oceanic worlds. Through the qualitative analysis of two case studies, one focusing on shark-oriented ecotourism in Fiji and one pertaining to shark risk management in New Caledonia, we discuss how the 'right place' of sharks and humans at sea is negotiated, defined and enforced by humans and non-humans in coastal areas. As we compare the practices deployed to control sharks and humans' behaviors and where abouts, we argue that sharks are increasingly incorporated into MSP (which they frame in return), although with distinct patterns of sharks-humans relations.

Abstract Id: 44

S5: Managing small scale fisheries, interdisciplinary perspectives

14:00 - 14:15

Effect of fishing pressure on mangrove crabs (Crustacea, Decapoda) in Fiji

by Karl G. T. Schrader
Uni Bremen | ZMT

Crustacea, such as shrimps, prawns, lobsters and crabs play an important role for small-scale and subsistence fisheries in rural areas of Fiji. The Mud crab *Scylla serrata* and different sesarmid mangrove crabs account for a large part of the catch throughout the year and are frequently sold on local markets. This study focused on fisheries impacts on those two taxa in the Rewa River delta near Suva. The delta is one of Fiji's largest mangrove forest areas. The different villages in the delta vary in their reliance on crab fisheries. Based on the number of active fishermen and fishing frequency, areas of different fishing pressures were identified. Between January and March 2020 eight different sites were repeatedly sampled for *S. serrata*, locally called Qari, and sesarmid crabs, known as Kuka. Four sites were categorized according to low vs. high fishing pressure. Four sites with low fishing pressure area were subjected to a closure for crab fisheries in February and March as a test for potential protection measures. Catch data show a trend of negative impact of intensive crab fisheries on the size of *S. serrata*, while catch per unit effort was not affected by fishing pressure. When comparing the catch data between sites closed for crab fisheries and sites unaffected from the closure, a positive effect of reduced fishing pressure becomes evident for the catch per unit effort of *S. serrata*. For sesarmid crabs, different species compositions at different sampling sites indicate a strong influence of environmental factors on crab distribution and abundance. Recaptures of marked individuals indicate a high site fidelity. Crab collection by local fishermen in those areas is also highly site-selective. However, no relationship between crab abundances and fishing pressure was evident for catch per unit effort or size of the different taxa.

Abstract Id: 38

14:15 - 14:30

Comparative food web analysis of two Peruvian bay systems along a spatio - temporal gradient: role of fisheries, aquaculture and the environmental envelope

by Alonso Del Solar, Lotta Clara Kluger and Matthias Wolff
ZMT Bremen | ZMT Bremen | ZMT Bremen

The Northern Humboldt Current Upwelling System (NHCUS) is one of the most productive marine ecosystems in terms of fisheries. Coastal areas within the NHCUS are highly influenced by its cold upwelling waters and pronounced climatic variability while being important for small-scale fisheries. This work uses two sites in the Peruvian coast that are very productive but differ in their ecosystem features and socio-economic dynamics: Sechura (~4°S), within the ecotone of Humboldt and tropical waters; and Independencia (~14°S), under typical upwelling conditions. Artisanal fisheries are multi-species and multi-gear, with target species differing between the two sites. Both bays sustain important stocks of the Peruvian bay scallop *Argopecten purpuratus*, a highly valuable species that is targeted by a diving fishery and cultivated mainly in bottom systems. During El Niño warming events, the impacts are very different at the two sites, leading to diverging sets of ecological and socio-economic changes. To explore the response of each system to environmental and anthropogenic stressors, food web models were developed using the trophic modelling approach of Ecopath with Ecosim, for the purpose of inter-bay-comparison, placing emphasis on indicators and drivers related to fisheries and aquaculture. In contrast to previous models, these were developed for the coldest period in ~50 years: La Niña 2007. Through the analysis of environmental and fisheries trends, and the inclusion of expert and traditional knowledge, simulation scenarios will be used to explore future climate-change and resource use configurations under which ecological tipping points might occur. We shall then explore the influence on these systems of medium-to-long-term management strategies and of local and global fisheries and aquaculture markets. In the face of possible social-ecological tipping points, these models are intended to provide insight into developing and improving the framework and tools required for adaptive ecosystem-based management of these coastal systems.

Related poster in the annex

Abstract Id: 48

Session 7:

Tropical climate and coastal change: Learning from physical data and models

Chairs: Henry Wu (Coral Climatology) and Jan Härtner (Complexity and Climate)

Preserved in the geological records and instrumental measurements, a wealth of data provides insight into climatic and geological processes such as the history of climate, sea-level, or weather-related extremes of the past. These records and climate models are contrasting but yet complementary sources of information on the evolution of our Earth and how it will evolve in the near future. The aim of this session is to share progress amongst colleagues in our understanding of global changes based on geochemical, paleoenvironmental, sedimentological techniques and numerical studies that use climate model outputs to understand the physical controls of climate variability. Another important topic of this session is the socio-economic responses on extremes or catastrophic events as well as long-term sea-level change. As an integral part of socio-economic response, the perception and social representation of weather and hydrological hazards and extremes (e.g. floods, droughts) are also valuable topics of discussion in the session.

14:00 - 14:15

Reconstruction of anthropogenic environmental changes from a Cuban coral over the last 160 years

by Marie Harbott, Henry C. Wu, Henning Kuhnert, Anette Meixner, Carlos Jimenez, Patricia Gonzales Diaz and Tim Rixen

Leibniz Zentrum für Marine Tropenforschung | Leibniz Zentrum für MarineTropenforschung | Faculty of Geosciences & MARUM – Center for Marine Environmental Sciences | Faculty of Geosciences & MARUM – Center for Marine Environmental Sciences | The Cyprus Institute | Centro de Investigaciones Marinas Universidad de la Habana | Leibniz Zentrum für MarineTropenforschung

Changes in the surface pH and temperature of the ocean, caused by the uptake of anthropogenic CO₂, are posing a threat to calcifying marine organisms. The global coverage of studies focusing on ocean pH and carbonate chemistry are sparse and are limiting our understanding of the current situation as well as future developments. Cuba is situated between densely populated landmasses, and offers a unique environment to study multiple aspects of anthropogenic activity as well as their interconnectivity. By using multiple climate and environmental geochemical proxies, a massive *Siderastrea siderea* coral from Cuba's northern coast was used to reconstruct changes in SST, ocean pH, and carbonate chemistry since preindustrial times. Preliminary results indicate a decrease in δ¹⁸O values indicating warming SST, which is reflected by a decrease in the δ¹¹B signature, a proxy for seawater pH and calcification. Furthermore, an accelerating decrease in δ¹³C values from the 1950s to 2005 of 0.014‰ suggests the rapid rise in anthropogenic CO₂ from fossil fuel combustion that is strongly depleted in ¹³C reflecting the trend of tropical ocean CO₂ uptake. Further investigation and the comparison to trace elements show possible baseline shifts in regional seawater carbonate chemistry that has been affected by anthropogenic activity.

Abstract Id: 43

Session 3:

Understanding and protecting tropical diversity

Chairs: Oscar Puebla (Fish Ecology and Evolution) and Sonia Bejarano (Reef Systems)

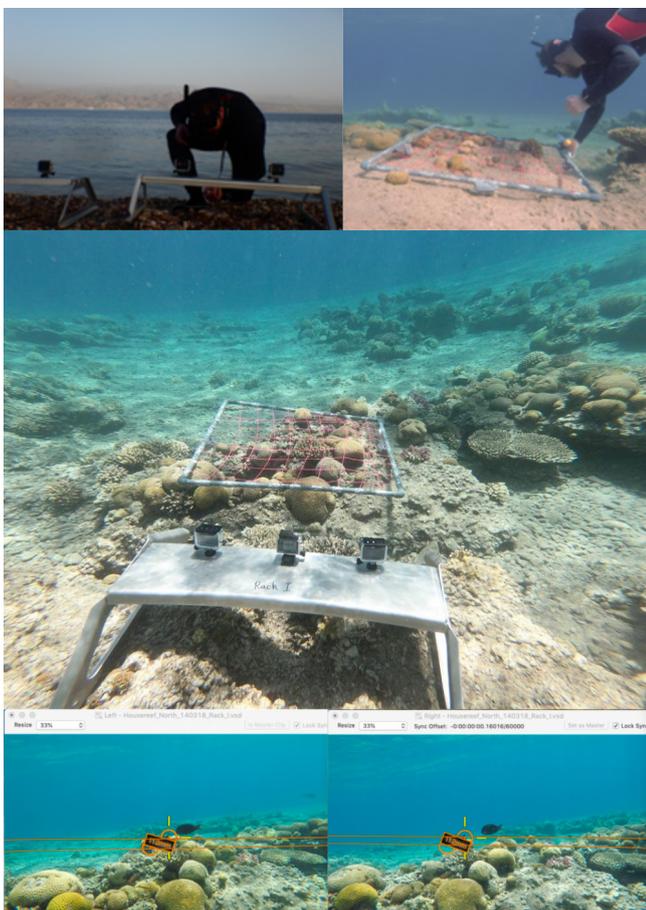
One of the most prominent characteristics of the tropics is their high level of diversity. This is not just true of biological diversity but also of cultural diversity, diversity of biogeochemical and ecological processes, of resources, ... Furthermore, this diversity is often multifaceted. For example, biological diversity includes genetic diversity, biochemical diversity, taxonomic and functional diversity, and the same may apply to other types of diversity. Quantifying patterns of diversity is absolutely fundamental to understanding how the tropics function and respond to ongoing and future environmental changes. Nevertheless, this can be a complex task that often requires an expertise per se and the use of fast-evolving tools and approaches. We invite contributions covering the understanding and protection of all aspects of marine tropical diversity.

14:45 - 15:00

Resource-partitioning in a degraded coral reef: a case study from Eilat, Gulf of Aqaba

by Julian Lilkendey, Michael Meares and Armagan Sabetian

ZMT | Auckland University of Technology (AUT) | Auckland University of Technology (AUT)



Herbivores play an integral functional role as mediators of primary productivity, exerting top-down control on benthic algal production. In return, bottom-up effects of “turf wars” play an important role on the availability of resources for competing herbivores. Little is known, however, about the effects of reef degradation on resource-partitioning and interspecific competition in this ecological guild. In a severely degraded coral reef in Eilat (Israel, Gulf of Aqaba) we conducted remote underwater stereo-video surveys to compare the expression of grazing behaviours (bite rates, bite distances, grazed substrate) between two closely related herbivorous fishes. Here we show that reef degradation had a significant impact on the foraging behaviour of two surgeonfish species of similar functional roles; while bristletooth surgeonfish *Ctenochaetus striatus* mainly grazed nearby detritus on deadcoral substrate, yellowtail surgeonfish *Zebbrasoma xanthurum* preferentially fed on filamentous turf algae which covered rocks and rubble at greater distances. However, depending on the availability of grazable substrate, both model species showed opposing adjustments of their bite rates. This compensation mechanism may be responsible for the observed balance in biomass distribution between the two species. Closely examining feeding strategies in sympatric herbivorous fishes facilitates our understanding of fine-scale specialization, competition for resources, and habitat use in coral reefs. Species with similar functional traits may have an adaptive capacity in the way they exploit resources to compensate for anthropogenic disturbances to their ecosystem.

Abstract Id: 26

S7: Tropical climate and coastal change: Learning from physical data and models

14:15 - 14:30

*South Pacific convergence zone variability and recent acidification reconstructed from tropical corals*by Sara Todorovic, Henry C. Wu, Delphine Dissard, Henning Kuhnert, Braddock Linsley, Albert Benthien, Markus Raitzsch, Klaus-Uwe Richter and Jelle Bijma

ZMT | ZMT | IRD/UMR LOCEAN (Sorbonne Universités, IRD-CNRS-MNHN), Paris, France | MARUM, University of Bremen | Lamont-Doherty Earth Observatory of Columbia University, Palisades, NY, USA | AWI | AWI | AWI | AWI

Massive tropical corals embed extensive records of environmental conditions during their lives, offering a possibility to extend the oceanographic instrumental records available by hundreds of years. Coral based reconstructions allow us to observe oceanographic variability on decadal to centennial scales, including the South Pacific convergence zone (SPCZ) behavior and past El Niño-Southern Oscillation events, which are major drivers of global climate and may exert control on regional CO₂ absorption and pH variability. Porites sp. corals from Tonga and Rotuma (Fijian dependency) are being analyzed for multi-proxy (e.g. Sr/Ca, δ¹⁸O, δ¹³C, δ¹¹B, B/Ca) reconstructions of sea surface temperature and salinity (SST, SSS) and seawater carbonate chemistry and pH, on a monthly to annual resolution. Preliminary data of the Rotuma Porites sp. coral shows δ¹⁸O signature has been decreasing by 0.004 ‰ per year at the end of the 20th century, suggesting freshening and warming of the surface water. In the same period, we observe a δ¹³C decrease of 0.017 ‰ per year inline with the increase in uptake of anthropogenic CO₂ which is depleted in this isotope. The results are in agreement with published coral-based reconstructions from the region. When completed, the new records will provide understanding on the effects of modern anthropogenic influence on ocean carbonate system and pH variation over interannual and decadal-interdecadal timescales.

Abstract Id: 57

14:30 - 14:45

*SPCZ zonal and El Niño events impact on surface ocean conditions in the Indonesian Throughflow region*by Henry Wu, Sophie Zweifel, Tim Rixen, Henning Kuhnert and Braddock K. Linsley

ZMT | University of Edinburgh | ZMT | MARUM-Universität Bremen | Lamont-Doherty Earth Observatory of Columbia University

The Indonesian Throughflow (ITF) is an important ocean current that connects the Pacific and Indian Oceans. It is the only low-latitude inter-ocean conduit that annually transports a large amount of water (10–15 sverdrups, where one sverdrup equals 1×10⁶ m³/s) and heat (~0.5 PW, where 1 PW = 1015 W) from the Pacific to 12°S in the Indian Ocean. The ITF follows an intricate pathway through the Indonesian seas on the edge of the western Pacific warm pool (WPWP) and play a key role in modulating Indo-Pacific climate over a range of time scales. The main path for the ITF is the Makassar Strait and the seasonal surface freshening of the Makassar Strait is the factor controlling the ITF. Here we present reconstructions of seasonal sea surface salinity variability by using coral δ¹⁸O records from the central Makassar Strait. Coral records reveal persistent seasonal freshening and years with significantly truncated seasonal freshening that correlate exactly with South Pacific Convergence Zone (SPCZ) zonal events >4000 km to the east. These truncated SPCZ zonal events coincide with El Niño/Southern Oscillation warm events halting the normal seasonal freshening in the Strait and thus the ITF. Our coral δ¹⁸O time series provides the recurrence interval of these zonal SPCZ events and demonstrate that they have occurred on a semi-regular basis since the mid-1700s. Preliminary coral skeletal trace element-based sea surface temperature reconstructions may provide additional evidence of interannual to interdecadal heat exchange between the Pacific and the Indian Oceans from the ITF.

Abstract Id: 52

14:45 - 15:00

*Thunderstorm self-organization and its effect on tropical coasts*by Jan O. Haerter

ZMT/University of Copenhagen

Tropical thunderstorms are fascinating as they have the ability to cluster, that is, bunch together in larger groups of moist air updrafts, with clusters often spanning hundreds of kilometers. When organized, precipitation intensifies and wind speed can strongly increase, thus posing a threat to communities and ecosystems in terms of mechanical destruction or flash flooding. We study such self-organization both over continents and the sea, and contrast the emergent dynamics. In a process we term "diurnal self-aggregation" clusters akin to mesoscale convective systems (MCS) form within few days in numerical simulations over continental surfaces. Over the ocean, self-organization is much slower, but reaches profoundly segregated states after several weeks. Both mechanisms may be relevant to the initial formation of tropical cyclones, which are known to intensify over warm waters, when rotational acceleration is provided away from the equator.

Abstract Id: 58

S3: Understanding and protecting tropical diversity

15:15 - 15:30

Extractive Taxonomies: Untangling Networked Knowledge Flows in Zanzibar's Shell Economy

by Theresa Schwenke and Rapti Siriwardane-de Zoysa
ZMT | ZMT

Gleaning on Zanzibar is conducted for subsistence and for the local and tourist industry. The gleaning activities minimize the population sizes. For the local human population on Zanzibar increasing effort is required to gain decreasing amounts of food or income. A variety of gastropods and bivalves are present on Zanzibar's coast. Some are harmful or even poisonous. Gleaners need to possess specific knowledge on species abundance and what they can safely collect. As the shell gleaning, processing and usage locally and their global implications are complex in terms of livelihood, social, economic and ecological sustainability the question arises: From which sources do different actors involved in Zanzibar's shell economy gain their knowledge and how do they make sense of, utilize and communicate these "learned taxonomies"? Therefore we investigate a) perceptions on marine organisms presently harvested (and those in the past); b) why certain species are harvested and not others; c) how differentiation and classification between marine organisms occur. In the scope of the MariTA project, we identified and interviewed actors involved in shell gleaning, processing, selling and buying on Zanzibar. We provide first results on 1) Who is involved in Zanzibar's shell economy, 2) What actors have access to what source and kind of knowledge? 3) Which actors are in contact? 4) What forms of knowledge are transferred? and 5) How do actors define and perceive their own and the roles of other actors within the emerging shell gleaning, processing and usage network? Increasing our understanding of the shell gleaning economy on Zanzibar and their interacting actors will help to enhance and make communication and knowledge flows more transparent for governing social, economic and ecological sustainability.

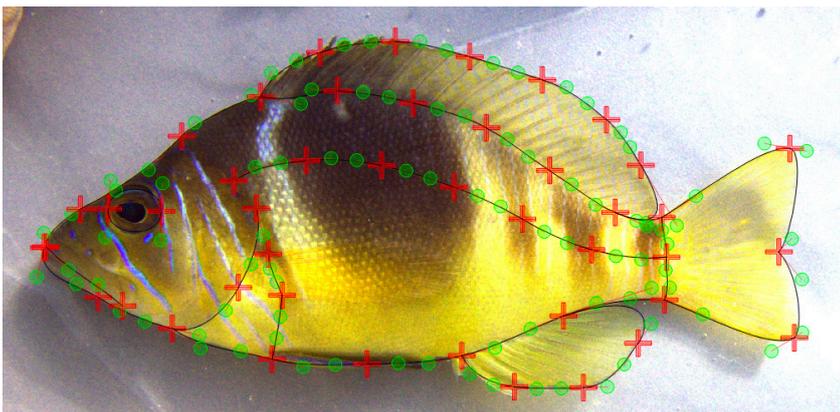
Abstract Id: 29

15:30 - 15:45

Dissection of a complex trait: quantitative analysis of reef fish colour pattern

by Floriane Coulmance, Oscar Puebla, Derya Akkaynak, Yann Le Poul and Owen McMillan
ZMT | ZMT / Oldenburg University | Harbor Branch Oceanographic Institution | München University | Smithsonian Tropical Research Institute

Colour pattern plays a fundamental role in the ecology and evolution of a variety of organisms. This is particularly true for coral reef fishes that live in a highly visual environment and display a stunning diversity of colour patterns. Nevertheless, reef fish colour pattern is a highly complex trait and has not yet been analysed with fully quantitative approaches. Here, I present a pipeline for the objective and quantitative analysis of colour pattern in reef fishes and apply it to the hamlets, a group of Caribbean reef fishes that is characterised by spectacular variation in colour pattern, as a proof of principle. My analysis is based on >1000 photographs of 113 live specimens from 13 species and 4 populations that were taken in situ in a standardised way. Images were colour-standardised with a custom MATLAB script and aligned with a novel machine learning algorithm that uses a combination of landmarks and Bézier curves. This approach allows to conduct pixel-by-pixel comparisons of all photographs for the quantitative analysis of both colour and pattern. In addition, the entire genomes of the 113 samples were sequenced. The combination of these two datasets will allow to dissect the genomic bases of colour pattern variation with unprecedented resolution.



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Abstract Id: 41

Open Session

Chairs: *Mirco Wölfelschneider (Mangrove Ecology), Rapti Siriwardane-de Zoysa (Development and Knowledge Sociology) and Nils Moosdorf (Submarine Groundwater Discharge)*

ZMT is a diverse research institute and not always does all work fits into pre-set categories. This session invites contributions from everyone to any topic they feel is relevant in the context of ZAC2.

15:15 - 15:30

Developing an empirical understanding of knowledge exchange: experience gained from the TICAS project

by Jialin Zhang and Tim Jennerjahn
ZMT | ZMT

To manage the complexity and uncertainty of global environmental problems, it is important to integrate the scientific knowledge into decision-making and practical processes, which requires knowledge exchange between scientists and end users of research. However, this exchange remains a significant challenge. This talk will review experience gained from the TICAS project (Tackling environmental change Issues of China's coastal Aquatic Systems: networking, capacity building and knowledge exchange), which is a trans-disciplinary project aimed at producing and disseminating knowledge that contributes to solving environmental issues of Chinese coastal ecosystems, with a focus on knowledge exchange between scientists and non-scientific stakeholders. This talk will 1) summarize the challenges and barriers experienced throughout the TICAS project, including cultural differences among the groups, as well as a lack of clear guidance, 2) highlight the key features that are needed when conducting a knowledge exchange project, such as involving a third party (e.g. knowledge broker), understanding the complexity of potential impacts, and implementing two-way and participatory communication. In doing so, we hope it can provide empirically-derived experience to help guide future research /implementation projects in this field and improve the sustainable management of coastal resources.

Abstract Id: 25

15:30 - 15:45

The vertical particle transport in the northern and southern Benguela Upwelling System: A drifter study.

by Luisa C. Meiritz, Niko Lahajnar, Claire Siddiqui and Tim Rixen
Institute of Geology, Universität Hamburg, Hamburg, 20146, Germany. | Institute of Geology, Universität Hamburg, Hamburg, 20146, Germany | ZMT | ZMT

The Benguela Upwelling System (BUS) is the most productive eastern-boundary upwelling system in the world's ocean. With an estimated mean annual productivity of $0.37 \text{ Gt C yr}^{-1}$, large amounts of inorganic carbon are transformed into organic carbon and exported through the so-called biological carbon pump. Recent studies have revealed, however, that the northern BUS (nBUS) acts as a source for CO_2 , whereas the southern BUS (sBUS) is considered as a sink for CO_2 . Yet, little is known about the functionality of the biological carbon pump in the BUS, especially about the relevance of actively migrating organisms in comparison to the passively sinking organic matter (marine snow). Within the research project TRAFFIC (Trophic TRANSfer EFFICIency in the Benguela Current), we deployed four free-floating sediment traps in order to collect samples for investigating the transfer efficiency of carbon and associated elements in the food web of the BUS. Our first results indicate slightly higher C/N/P-ratios in the nBUS in comparison to those in the sBUS. This suggests a more efficient use of nutrients in the sBUS due to the occurrence of key-species, which differ between the nBUS and sBUS. Furthermore, our results enable us to assess and to quantify the active and passive transport of carbon in the BUS, which provides some new insights into the functioning of the biological carbon pump in response to changing concentrations of dissolved oxygen in source water masses.

Abstract Id: 28

S3: Understanding and protecting tropical diversity

15:45 - 16:00

Effects of gastropods on sediment characteristics in mangroves

by Niklas Reinhardt^{1,2}, Fiona MacKay^{3,4}, Steven Weerts⁵, Martin Zimmer^{1,2,7}, Véronique Helfer¹

1) ZMT 2) University of Bremen 3) Oceanographic Research Institute, South African Association for Marine Biological Research, Durban, South Africa; 4) School of Life Sciences, University of KwaZulu-Natal, Durban, South Africa; 5) Coastal Systems Research Group, Council for Industrial and Scientific Research, South Africa; 6) Department of Zoology and Coastal Research Unit of Zululand, University of Zululand, South Africa; 7) IUCN SSC-Mangrove Specialist Group

Molluscs in mangroves are ecologically important because they are found on multiple consumer levels. As an important mollusc class, gastropods often occur in high densities across the intertidal and vertically on trees and similar structures in mangroves. Despite their significance in mangrove ecosystems, their ecological role is poorly understood. Here, we investigate the effects of the truncated mangrove snail, *Cerithidea decollata*, on sediment characteristics, such as sediment respiration, organic matter content and quality, and sediment grain size, by means of an enclosure-exclosure experiment in an *Avicennia marina* forest at the east coast of Kwa Zulu-Natal, South Africa. Three different treatments (no snails, ambient density = 16 individuals/0.318 m², high density = 32 ind./0.318 m²) were applied. While we found no significant effects of snail density on sediment respiration or organic matter content, we observed a significant increase in the percent sand in the upper sediment layer over time, at high densities. Likely, *C. decollata* mucus induces sediment grains to bind together into larger particles whilst detritus-feeding. We therefore postulate that snails can help stabilize mangrove sediments and possibly help in counteracting erosion. These snails may therefore contribute to the ecosystem service that mangroves provide as coastal defenses.

Abstract Id: 42

16:00 - 16:15

Diversity in fish intestine morphology: drivers and use in functional studies

by Mattia Ghilardi, Nina M. D. Schiettekate, Jordan M. Casey, Simon J. Brandl, Samuel Degregori, Alexandre Mercière, Fabien Morat, Yves Letourneur, Sonia Bejarano, Valeriano Parravicini

WG Reef Systems | PSL Université Paris: EPHE-UPVD-CNRS, USR 3278 CRIOBE, 66860 Perpignan, France | PSL Université Paris: EPHE-UPVD-CNRS, USR3278 CRIOBE, 66860 Perpignan, France | PSL Université Paris: EPHE-UPVD-CNRS, USR3278 CRIOBE, 66860 Perpignan, France | Department of Ecology and Evolutionary Biology, University of California Los Angeles, Los Angeles, United States | PSL Université Paris: EPHE-UPVD-CNRS, USR3278 CRIOBE, 66860 Perpignan, France | PSL Université Paris: EPHE-UPVD-CNRS, USR3278 CRIOBE, 66860 Perpignan, France | UMRENTROPIE (UR-IRD-CNRS-IFREMER-UNC), LabEx « Corail », Université de la Nouvelle-Calédonie, BPR4, 98851 Nouméa Cedex, New Caledonia | WG Reef Systems | PSL Université Paris: EPHE-UPVD-CNRS, USR3278 CRIOBE, 66860 Perpignan, France

Trait-based approaches are increasingly used in ecosystem functioning studies. However, trait-function relationships are often supported by weak empirical evidence, undermining the strength of these approaches. Digestion and nutrient assimilation remain challenging functions to characterise using traits. In fishes, this is commonly achieved using intestine length. Although there is consensus on the relationship between fish intestine length and species' diets, evolutionary and environmental forces have shaped a great diversity of intestine morphologies that is not captured by length alone. Focusing on coral reef fishes as a model group, we investigate the drivers of inter- and intraspecific variability in intestine morphology. Using a dataset encompassing 142 species and 31 families collected in three locations in French Polynesia, we test whether phylogeny, body size, trophic level, and geographic location predict three intestinal morphological traits: intestine length, diameter, and surface area. We demonstrate that phylogeny, body size, and trophic level explain most of the interspecific variability in fish intestine morphology. Despite the high degree of phylogenetic conservatism, the flexibility of the intestine allowed adaptive convergent evolution through adjustments in both intestine length and diameter. Further, we show intraspecific variability in intestinal traits across geographic location, revealing that fishes may independently adjust one or more intestinal traits to adapt to local conditions. We conclude that intestine surface area may be the most appropriate trait to characterise inter- and intraspecific patterns in intestine morphology, and we posit that it may be a more suitable trait to apply in functional studies than intestine length. Furthermore, the high predictive accuracy of our models highlight their potential application in macroecological studies. Lastly, our results are critical in the understanding of two ecosystem services provided by fish which are affected by intestine morphology: nutrient cycling and inorganic carbon cycling.

Abstract Id: 46

S8: Open session

15:45 - 16:00

*Virtual Academy for Marine & Coastal Sustainability – connecting partners around the globe for a joint initiative?*by Janine Reinhard
ZMT Academy

The currently ongoing “digital turn” can create great opportunities for a global education of early career scientists as important multipliers and future decision makers. In the presentation I would like to develop ideas and visions on How can we as ZMT together with our partners establish transnational capacity development using digital tools? The basic idea is to build a virtual academy together with partner institutes from tropical countries. Each institute brings its expertise, lectures and a target group. The curriculum and course offerings are designed together in a board and early career scientists from all institutes can join. With digital instruments a curriculum is established that leads to skill development and networking. Yearly “live” sessions could be added to foster the socializing part of the program. This model would go beyond the classical graduate school that connects people working at a specific university but connect people around the globe bound to various institutions but somehow dealing the very similar research questions. With this presentation I would like to present the vision, get feedback and ideas from the ZMT community and find collaborators who would be willing to engage in such a virtual academy in case we can gain funding.

Abstract Id: 51

16:00 - 16:15

*Digital ZMT:
Vision and roadmap for data and digital collaboration at ZMT and beyond*by Arjun Chennu, Miroslav Shaltev and Joscha T Schmiedt
ZMT | ZMT | ZMT

The Digital ZMT (DigiZ) strategic expansion seeks to develop and improve the digital landscape of ZMT’s research activities, and enable collaborative analysis and prediction of complex socio-ecological systems in tropical coastal regions. DigiZ will comprise a variety of efforts in infrastructure and capacity development, with the aim to deliver FAIR (findable, accessible, interoperable, re-usable) data and scientific results to academic and non-academic users – both at ZMT and beyond. The path towards DigiZ touches up on many operational and strategic aspects of the institute. In this session, we seek to provide an overview of the DigiZ efforts and present a roadmap on planned developments. One current effort is the establishment of a DataLab, which is being designed as a digital working place with built-in tooling for agile digital collaboration. The design of the DataLab aims for a user experience that welcomes all levels of computational expertise, by supporting different kinds of workflows for both scientific and infrastructural ZMT groups. The DataLab will be useful to extend collaboration potential within, and also beyond, ZMT through finding solutions for shared scientific projects, digital learning and internships, and streamlined data flows. The latter will be an important target of the next phase, which foresees the development of a scalable data facility that will help organize and track data from sample collection to archival storage and publication – and therefore make ZMT’s research data and processes FAIR and possible to easily integrate with national infrastructures. The DataLab and other DigiZ projects will follow an “open development” model, with the decisions and discussions open to all. We present details on how to get involved, and welcome follow up discussions on any relevant issues. A Digital ZMT holds the promise for pervasive collaboration, and welcomes input that helps make it for everybody.

Abstract Id: 57

Poster (presented as speed talks of 3-5 min)

16:30 - 16:40

S1: Aquaculture and new food systems

Innovative aquaculture for the poor to adjust to environmental change in coastal Bangladesh? Barriers and Options for Progress

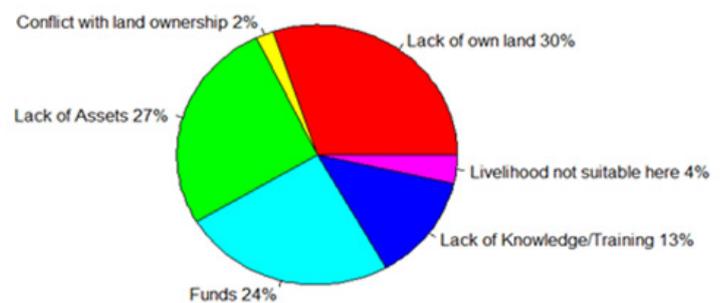
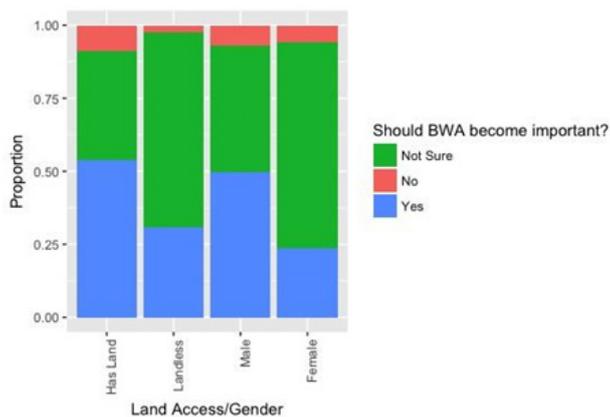
by Samiya Ahmed Selim and Marion Glaser

WG Social-ecological Systems Analysis | WG Social-ecological Systems Analysis

More so than wealthier, less nature-dependent social groups, the poor in tropical coastal regions suffer from adverse environmental change and need new income options. With high levels of salinity intrusion into coastal lands, innovative brackish water aquaculture (BWA) including Integrated Multi-Trophic Aquaculture (IMTA) is a crucial adaptation option to ongoing massive environmental change in coastal Bangladesh. This paper examines how poor Bangladeshi coastal residents view BWA, and what is needed to make BWA a viable and sustainable livelihood. In four salinity-affected sites, we used a semi-structured questionnaire to interview 120 households. We find both information and perception biases that obstruct those in need from engaging with innovative BWA. Coastal residents' views on aquaculture related mainly to previous experiences with monoculture shrimp farming, and its polarizing socio-economic effects, while knowledge on ecosystem-based aquaculture was scarce.

This paper identifies barriers to the participation of poor and marginal coastal populations in innovative ecosystem-based brackish water aquaculture (BWA) using a set of indicative early field research results. We also outline some first steps to initiate a co-development of an innovative, ecosystem-based approach to aquaculture in the brackish and marine areas of Bangladesh (integrated multi-trophic aquaculture; IMTA). As salinity advances into coastal lands in these areas, millions of farmers and rural labourers are losing agriculture as their main income source. We propose strategic fields of action to develop innovative BWA that benefits coastal Bangladesh's poorest communities.

Abstract Id: 23



Barriers to BWA as a sustainable livelihood with increasing salinity

Interest in brackish water aquaculture (BWA) by land ownership category and gender

Poster continued

16:40 - 16:50

S2: Navigating uncertain waters: tackling noise, errors, uncertainty and variability in data collection, analysis, modelling and management

Tackling spatial heterogeneity of groundwater discharge between scales

by Nils Moosdorf and Till Oehler
ZMT | ZMT

Submarine groundwater discharge (SGD) occurs along most coastlines of the world. It can be a major source of nutrients to coastal environments. In order to estimate the impact of those nutrient fluxes, it is important to budget them at the regional scale (e.g. for a single bay). Yet, observations of nutrient fluxes are local. Since spatial and temporal variability of SGD is huge, we have not yet managed to meaningfully extrapolate local results to the regional scale.

At the point scale (meters), direct observations of SGD from seepage meters are available. At the local scale, detailed tracer studies representing subsurface heterogeneity based on geophysics are possible. But at the regional scale, the resolution of observation methods becomes too small to reasonably depict the exact heterogeneity. SGD is extremely sensitive to heterogeneity, and we do not have the capabilities to sufficiently document it at the regional scale. Thus, a method is needed to represent this uncertain heterogeneity at the regional scale based on local scale samples. Here, we will present the problem in order to initiate discussion with ZMT colleagues about possible solutions and ways forward toward regional scale estimates of SGD and its associated solute fluxes and ecosystem impacts.

Abstract Id: 47

16:50 - 17:00

S3: Understanding and protecting tropical diversity

Do the trees matter? Exploring spatial patterns of chemo- and biodiversity in mangrove forests

by Jonas Geburzi, Mondane Fouqueray, Ulf Mehlig, Martin Zimmer and Véronique Helfer
WG Mangrove Ecology | Soil Science, TUM School of Life Sciences, Technical University of Munich |
Instituto de Estudos Costeiros, Universidade Federal do Pará, Campus Bragança, Brazil | WG Mangrove Ecology | WG Mangrove Ecology

Little is known about spatial patterns and the drivers of organic matter (OM) quantity and quality, as well as that of biodiversity in mangrove ecosystems. Yet, such patterns are likely to exist considering the variety of biotic and abiotic gradients that are present throughout mangrove forests. Here, we aim at evaluating the effect of the ecosystem-engineering mangrove trees, as those are likely to influence the surrounding sediment by, e.g., their root system, canopy structure and the chemical composition of their leaf litter. Resolving the influence of different mangrove tree species on chemo- and biodiversity is of particular interest for knowledge-based ecosystem protection and restoration.

We will combine chemical and biological approaches to explore the influence of mangrove tree species on sediment characteristics and the composition and diversity of their associated micro- and macrobiota. To this end, we collected sediment samples from monospecific stands of the tree species *Rhizophora mangle*, *Avicennia germinans* and *Laguncularia racemosa*, from ten sites distributed over a mangrove forest in northern Brazil. The chemical analyses will assess the quantity and quality of the organic matter by, e.g., stepwise combustion (OM recalcitrance) and pyrolysis-gas chromatography mass spectrometry (py-GCMS; OM metabolomic fingerprinting), along with nutrient, C and N contents. The biological analyses will decipher the sediment community composition and diversity using sedimentary environmental DNA (sed-eDNA) metabarcoding, targeting major taxonomic groups: bacteria and archaea, protists, metazoans, and fungi. This study will provide deep insights into distribution patterns of OM quantity and quality and biodiversity, how they are influenced by the species composition of the mangrove forest, and how they potentially influence each other. The results of this study will provide a sound basis for conservation planning and ecosystem design.

Abstract Id: 50

Poster continued

17:00 - 17:10

S6: Coral reefs and their response to anthropogenic disturbances in the past, present, and future

Behavioral responses of coral larvae to novel anti-biofouling coatings

by David Brefeld, Lisa Röpke, Andrew Negri, Ulrich Soltmann and Andreas Kunzmann
ZMT | Universität Bremen | Australian Institute of Marine Science | Gesellschaft zur
Förderung von Medizin-, Bio- und Umwelttechnologien e. V. | ZMT

Coral reefs are under threat by local and global anthropogenic stressors. These stressors often lead to a decline in coral cover and ultimately, the loss of valuable ecosystem services. Mitigation of these stressors in combination with active coral reef rehabilitation programs could help to secure the survival of reef ecosystems and their affiliated ecosystem services for future generations.

The sexual proliferation of corals has a high potential to provide a large number of genetically diverse coral recruits for coral reef restoration projects. However, the number of adult corals that can be propagated this way is limited, due to the high mortality of coral larvae and recruits. The survival of juvenile corals could potentially be improved by inhibiting the growth of the surrounding biofouling community that competes with them for light and space.

Anti-biofouling coatings are commonly used to reduce the degree of undesired biofouling on submerged hard surfaces and could potentially be used to alleviate this competition. Here, the effects of three novel anti-biofouling coatings on the motility and settlement of coral larvae were assessed to explore the potential of the coatings as a new tool for coral reef restoration practices.

Abstract Id: 32

17:10 - 17:20

S8: Open Session

*Effects of temperature and oxygen availability on blood parameters of *Hallobatrachus dactylopterus**

by Juan Molina
ZMT

Temperature and oxygen are two of the most dynamic and influential physical drivers for marine animals. Unsurprisingly, climate change exerts most of its deleterious effects on the biota by changing these two drivers. We simulated climate change scenarios, to see what were the effects of high temperature, hypoxia and a combination of both on the blood parameters of *Hallobatrachus dactylopterus*, as well as a condition index. The two environmental drivers studied showed effects on some of the blood parameters of this species over the course of 30 days of exposure.

The most affected parameter was the hematocrit, which increased significantly in hypoxic conditions. Hemoglobin concentration was unaffected by our treatments. Red blood cell counts were higher in high temperature, but oxygen levels showed no effects on this parameter. Blood pH was significantly lower in the high temperature normoxic scenario in comparison to all other treatments. These changes seem to have negatively impacted the condition of the fish, as individuals on the high temperature conditions exhibited much lower condition index values.

Abstract Id: 32

DatAlumni - Scientific Data Cooperation with our Alumni Network

by Janna Just, Janine Reinhard and Matthias Wolff
ZMT | ZMT | ZMT

The livelihoods of many millions of people are currently threatened by overexploitation of natural resources, climate change and environmental pollution. In particular, the tropics face severe challenges because of natural environmental changes, such as extreme weather events and sea-level rise. Anthropogenic shaping of coastlines and vegetation makes coastal areas more vulnerable to flooding and land-loss. Moreover, the exploitation of biologic and mineral resources severely disturb the balance of ecosystems and biodiversity. Most of the members of the ZMT Alumni Network are based in the tropical belt and are active in marine sciences or in the management, utilization, and protection of natural resources. Thus, they are involved in solving global challenges regarding environment, climate, and marine resources. To facilitate the development of management strategies, international cooperation and a comprehensive scientific data basis is required. The DAAD funded project DatAlumni - Scientific Data Cooperation with our Alumni Network – aims to combine scientific efforts of ZMT Alumni to facilitate the understanding as well as maintaining and managing natural resources. DatAlumni conveys basics and background in research data management, so that research data are **F**indable **A**ccessible **I**nteroperable and **R**eusable contributing to the global data basis. Digital training and information material provides analytical techniques for the Alumni, which they can further utilize for teaching at their home institutes. At networking events, such as workshops of the Alumni Circle on Data Cooperation and a big digital ZMT Alumni Conference in spring 2021, the participants identify needs and ideas for data management and explore collaborations for future data synthesis projects aiming at the understanding of natural (eco-) systems and the sustainable use of marine resources.

Abstract Id: 39

Annex:

Poster delivered by Alonso Del Solar et al. accompanying abstract 48; (page 24: *Comparative food web analysis of two Peruvian bay systems along a spatio-temporal gradient: role of fisheries, aquaculture and the environmental envelope*)

Towards an EBM strategy to face social-ecological tipping points

How to cope with multiple causality and embrace any possible future?

Ecological and socio-economic tipping points of coastal areas within the Northern Humboldt Current System (NHCS): insights from bay systems in Peru (working title, doctoral research)

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CONTEXT

- In coastal bay areas of the NHCS, such as Sechura and Independencia, upwelling has led to a very productive multi-species and multi-gear artisanal fishery and to the development of more recent marine aquaculture endeavours (mainly scallops).
- Social-ecological impacts caused by El Niño differ along the Peruvian coast, ranging from devastating (through torrential rains and physical destruction) in the tropical north to highly profitable (through SST increase) in the more temperate south. Species composition changes, scallop populations proliferate or collapse, and fishers migration occurs.

GENERAL STUDY APPROACH

- Reconstruct and update EwE models of both bays and use ecosystem indices to compare among them.
- Simulate temporal and spatial scenarios, and explore relevant tipping-point configurations.
- Couple EwE models with socio-economic models and fishers network analysis
- Evaluate management strategies in the context of tipping points.



MAIN QUESTIONS AND FURTHER CONCERNS

- How do El Niño events shape the trophic structures of both bays?
- How are fisheries and aquaculture activities affecting ecosystem structure, maturity and resilience?
- What are future climate-change and resource use scenarios under which social-ecological tipping-points might occur?
- ...
- In the face of possible social-ecological tipping points, these models and simulations are intended to provide insight into developing and improving the framework and tools required for an adaptive ecosystem-based management of coastal systems within NHCS.
- How to use the EwE approach to aid in the conservation and management of ecosystem resilience?
- How to incorporate into the model all these factors (see figure), their synergy and uncertainty, when constructing potential tipping-point scenarios?

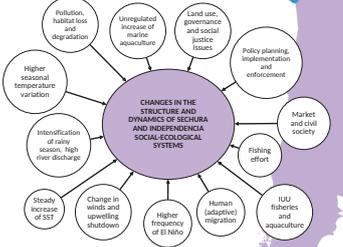


Figure: Potential local drivers contributing to changes in both bay systems through cumulative and synergic effects





Take a picture to visit the Humboldt-Tipping project website

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