ICYMARE
International Conference for
YOUNG Marine Researchers

BOOK OF ABSTRACTS

ICYMARE 2024 BREMEN
16–20 SEPTEMBER 2024

ICYMARE
International Conference for
YOUNG Marine Researchers

THE BREMEN SOCIETY FOR
NATURAL SCIENCES from 1864

www.icymare.com

ICYMARE 2024 BREMEN

Book of Abstracts

Editors
Anna Joelle Greife
Carolin Müller
Lena Heel

Cover Photograph
Simon Jungblut

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Association of Marine Sciences

Working Group ICYMARE

c/o Übersee-Museum
Bahnhofsplatz 13
28195 Bremen
Germany

E-Mail: hello@icymare.com
Phone: +49 (0)421 16038 153
Fax: +49 (0)42116038 99

Content

Welcome to ICYMARE 2024 BREMEN

The International Conference for Young Marine Researchers (ICYMARE) was founded in 2019 as an interdisciplinary marine science conference designed to provide a platform for early-career students and researchers. Our mission is to create a welcoming and inclusive environment where young scientists can present their work, exchange knowledge across career stages, and build valuable networks. ICYMARE aims to foster new collaborations and specifically address the challenges young researchers face as they begin navigating the world of academia.

ICYMARE 2024 BREMEN is hosted by the Department of Marine Botany at the University of Bremen, with the Icebreaker welcome evening taking place at the renowned Übersee Museum. ICYMARE is an event of the Bremen Society for Natural Sciences and is recognized as an Endorsed UN Ocean Decade Activity. We thank our 18 sponsors, whose generous contributions make ICYMARE 2024 BREMEN possible.

This year, we are proud to offer 18 topical sessions that reflect the diversity and interdisciplinarity of marine science. In a rapidly changing world, where both our understanding of marine ecosystems and the threats to these invaluable habitats grow, it is more important than ever to create a platform for networking, collaboration, and career support. At ICYMARE 2024 BREMEN, we believe everyone's research matters, every voice is important, and respect for each other is key.

By hosting the conference in Bremen, we return to the birthplace of the very first ICYMARE. Though much has evolved over the years, our core mission and values remain unchanged. As we highlight the local marine science community, our primary goal is to foster stronger connections across Europe and beyond. With affordable conference fees and an extensive travel grant program, we strive to keep ICYMARE as inclusive as possible, welcoming participants from 24 countries and five continents.

We extend our deepest thanks to the volunteer organizing team, on-site helpers, and session hosts, whose hard work and dedication made ICYMARE 2024 BREMEN possible. A special thanks to all our presenters, both for talks and posters. You are the heart of ICYMARE, and we are honoured that you chose our conference to showcase your work.

We warmly welcome you to ICYMARE 2024 BREMEN and wish you an inspiring time.
Your ICYMARE organization team

About ICYMARE

ICYMARE is an event of the **Bremen Society for Natural Sciences** ("Naturwissenschaftlicher Verein zu Bremen"). In the following, we would like to introduce this society to you. Although it has a pretty long history, this society acts modern and is open for any people interested in natural sciences to join.

THE BREMEN SOCIETY FOR NATURAL SCIENCES from 1864

History & Aims

At the end of the 18th and the beginning of the 19th century, citizens interested in natural sciences organized themselves in natural history societies. In Bremen, this was, e.g., the "Physical Society" which was later re-named into "Museum Society". This society organized scientific talks, the members purchased and read scientific books together, and established first museum collections. In these times, shared interest for natural history was already able to overcome class distinctions. As these societies were not stable and consistent enough, the "Bremen Society for Natural Sciences" was founded in 1864. Ever since, the overall aim of the society was and is "to spread scientific knowledge and to promote scientific research, especially in northern Germany".

This aim is central to the society until today and was defining the Sciences in Bremen for a long time. The connection between professional and laic research is central and helps to transfer the appreciation of science into the broader public. The most important tools to reach these aims are publicly accessible talks, excursions, and the scientific journal of the society "Abhandlungen des Naturwissenschaftlichen Vereins zu Bremen" ("Essays of the Bremen Society for Natural Sciences")

The Bremen Society for Natural Sciences today

Today, the activities of the Bremen Society for Natural Sciences are mostly organized in working groups. These working groups are dedicated to different groups of botanical or zoological organisms as well as geological sciences. During excursions, organisms may be systematically collected and examined. The results are then later presented in talks or in the scientific journal of the society. Since the 1980s, nature conservation plays an increasing role in such activities. For instance, mapping of organisms, together with the University of Bremen, is of importance as the society is also member of different organizations of environmental protection.

Furthermore, the society organizes a public lecture series together with the University of Bremen in the rooms of the Übersee-Museum. The topics of this lecture series go beyond pure faunal and floral reflections into topics of organismic biology and ecology. The society is also involved in the Bremen Award for Local History Research, which supports professional and laic research with topical connection to the region of northwestern Germany.

Marine Sciences in the Bremen Society for Natural Sciences

The founding of the Bremen Society for Natural Sciences dates back to a time where there was not much professional or laic marine research in Bremen. Therefore, the society never had a marine focus. In April 2018, the Association of Marine Sciences was founded within the Bremen Society of Natural Sciences.

One working group of this association is the working group ICYMARE, which is organizing the new conference series of the same name. With the aim to establish marine sciences as an inherent part of the society, to connect marine professionals and laics, and to raise awareness of marine knowledge into the public, the Association of Marine Sciences is open for everybody who is interested in the field.

The International Conference for YOUNG Marine Researchers – ICYMARE – is a bottom-up initiative organized by young researchers on voluntary basis for young researchers of all marine related disciplines. It provides an inspiring international set-up for an excellent network opportunity and some first conference experience for Bachelor, Master and PhD candidates. The ICYMARE family is open for everyone and meets yearly with changing locations and hosting support to discuss results, ideas, and plans for the future.

But most of all: at ICYMARE we stay open minded for your ideas and input and our team takes extra care for ICYMARE to get that easy-to-talk-to but nevertheless professional atmosphere where you will build your network as well as make friends.

What is special about ICYMARE:

- ICYMARE is an annual on-site conference for young marine researchers with changing locations and hosting support.
- ICYMARE is an opportunity to build your network of young marine researchers in a professional as well as easy-to-talk-to atmosphere.
- ICYMARE offers you the chance to engage in our community to become a part of the ICYMARE family.

Organization Team

ICYMARE is organized on a purely voluntary basis by dedicated marine science students and early career professionals. Throughout the year, and particularly in the months leading up to the conference, our core team secures venues, sponsors, and collaborators, manages calls for sessions, abstracts, and workshops, and keeps our inboxes and social media engaged. During the conference, our on-site volunteers handle participant registration, answer all questions imaginable, and brew countless litres of coffee to keep everyone up and running.

If you are interested in joining the ICYMARE team for ICYMARE 2025 BREMERHAVEN, please email us at **helper@icymare.com**.

The ICYMARE 2024 BREMEN Team

Simon Jungblut
Lena Heel
Yvonne Schadewell
Inês Morão
Carolin Müller
Anna Joelle Greife
Jan Boelmann
L. Kappas
Gregor Wöhle
Jacopo Congia
Franziska Ohl
Sarah Russwurm
Chiara Sickert
Jenny Trujillo
Julia Jung

Theo Krüger
Hannah Rittinghaus
Max Weber
Cindy Meyer
Lea Joly
Svenja Stoehr
Jöran Papp
Katharina Schienbein
Leandra Thoma
Husna Sheik
Daisy Ruhlmann
Sonia Akrour
Lilly Bartlakowski

Thank you to all of you!

Our Portfolio of Top Quality Aquatic Science Journals

MEPS
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AME
Aquatic Microbial Ecology

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Bremen

Join us for ICYMARE 2024, set to convene in the vibrant city of Bremen from 16th to 20th of September! We are pleased to announce our partnership with the **Department of Marine Botany** at the **University of Bremen** for the main conference, and the **Übersee Museum** for the inaugural icebreaker event. All interested participants are welcome to join us — whether you are interested in presenting your work, displaying a poster, or engaging in the conference program. ICYMARE is an opportunity to celebrate marine research and collaboration.

Welcome to the city of Bremen

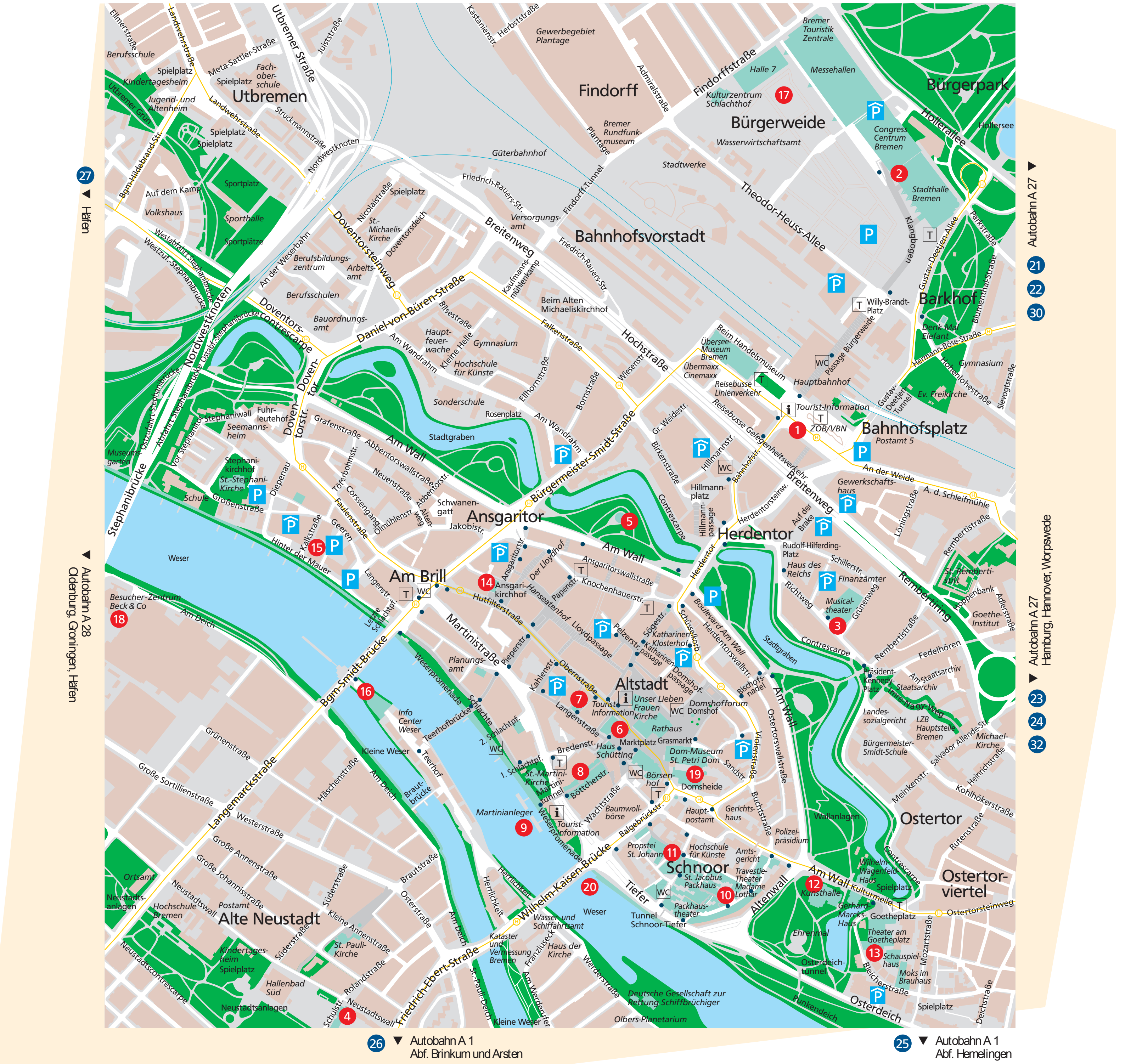
Located in northern Germany, Bremen offers a blend of history and modernity, welcoming visitors to explore its charming streets, iconic landmarks, and vibrant city centre. Its historic district – the Schnoor quarter – features cobblestone streets lined with cafés, bars, and restaurants serving fantastic foods, including the famous "Grünkohl & Pinkel."

At the heart of the city stands the Bremen Town Hall, a symbol of Bremen's rich history and significance. The statue of the Bremer Stadtmusikanten, depicting the ensemble of the Bremen Town Musicians, is a popular tourist attraction and adds a touch of whimsy to the heart of the city. It is customary to touch the legs of the Esel (donkey) for good luck or to make a wish. Make sure to use both hands – otherwise the locals will immediately recognise you as a visitor.

The University of Bremen is a hub for students and researchers in the Marine Sciences. Many of the 12 faculties of the University host marine science related departments and the **MARUM** – the Center for Marine Environmental Sciences – is a research faculty on its own. All Marine Science departments of the University of Bremen are dedicated to studying marine ecosystems and addressing environmental challenges. Equipped with state-of-the-art facilities, the department fosters collaboration among students and professionals to develop sustainable solutions. Additionally, the university actively participates in community engagement and global partnerships to promote marine conservation efforts.

The city of Bremen reflects the essence of Northern Germany perfectly, providing an ideal backdrop for ICYMARE 2024 BREMEN.

Downtown Map of Bremen

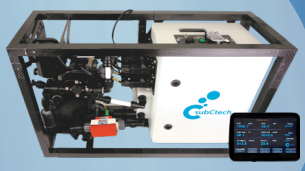


Bremen City Map: www.bremen-mittendrin.de/media/a194f6f8223102c0fff8098fffffff0.pdf

Ocean Engineering

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

OceanPack™ Underway



RACE

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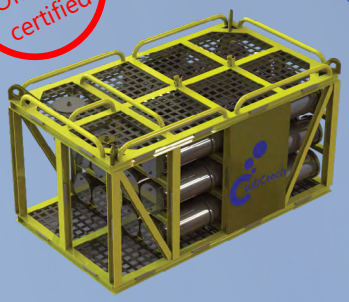
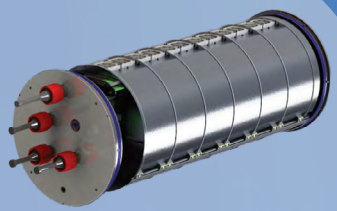


Energy Storage System

Standard

Subsea



Vehicle

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SubCtech

Venues and Directions

Conference Venue: University of Bremen

BIOM Building, James-Watt-Straße 1, 28359 Bremen

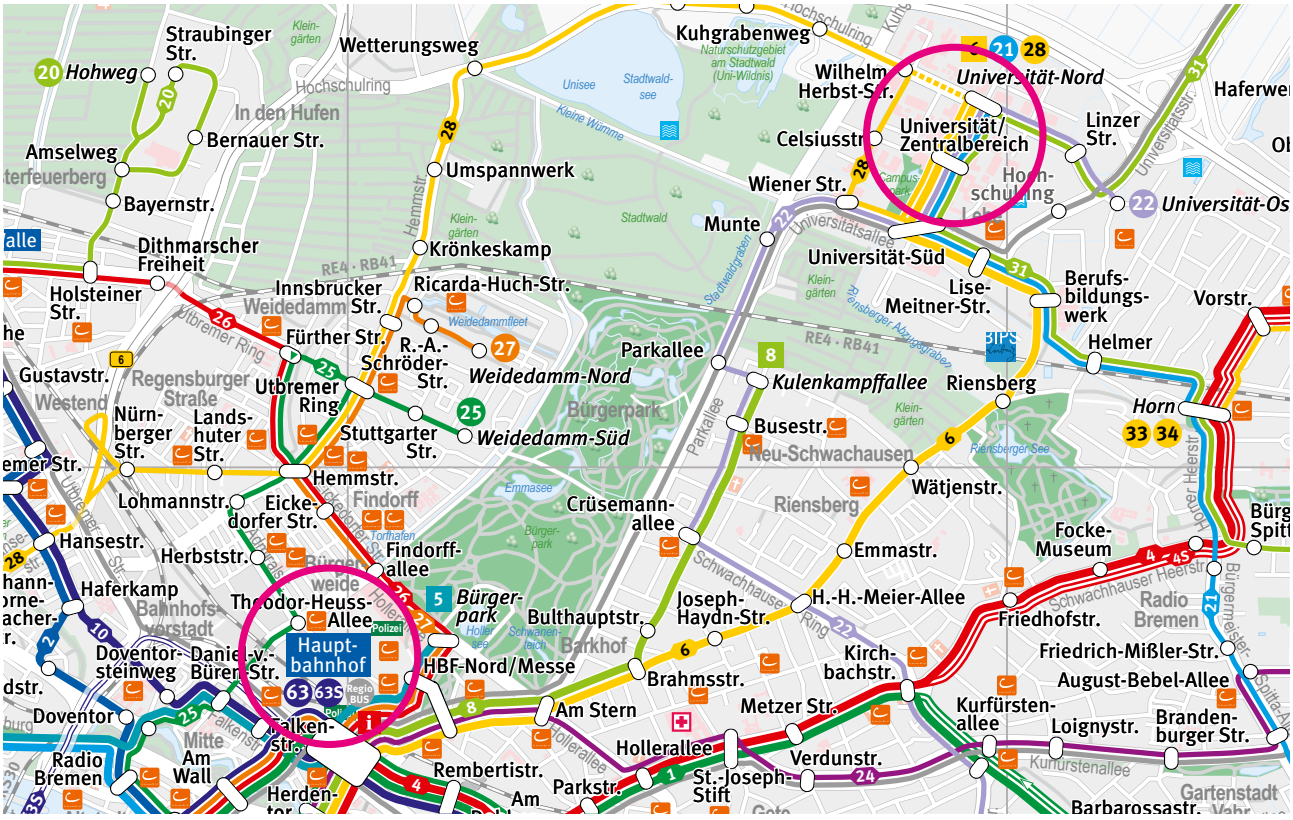
Embracing the motto "ambitious and agile", the **University of Bremen** aligns seamlessly with our ICYMARE core values. Presently, a diverse community of 21,000 individuals from over 120 nations engages in learning, teaching, researching, and working within the university's dynamic environment. Their collective objective is to contribute to the ongoing progress of society.

The University of Bremen offers a broad spectrum of academic disciplines, with around 100 degree programs spanning from the depths of the sea to the expanses of space. As a prominent European research institution, the university fosters collaborations with educational and research establishments worldwide. Notably, in the global effort to combat climate change, the University of Bremen is one of only two German universities involved in the **International Universities Climate Alliance**.

ICYMARE 2024 BREMEN is set to take place at the **BIOM** building, the research and education hub of the Biology department. Inaugurated in mid-2023, the BIOM building has state-of-the-art research laboratories, seminar rooms, and ample space to accommodate the various components of our ICYMARE program. The venue offers a modern and well-equipped environment for our conference, from lecture halls to enough room for the iconic ICYMARE poster session.

If you are arriving in Bremen by train or (Flix-)bus, Bremen Hauptbahnhof (Central Station) is conveniently located near the city centre. From this central transportation hub, the BIOM building is easily reached by public transport, as tram line 6 stops at "Universität-Zentralbereich." Taxis are also readily available next to the Central Station to take you wherever you need. Additionally, rental bikes and e-scooters are at your disposal throughout the city.

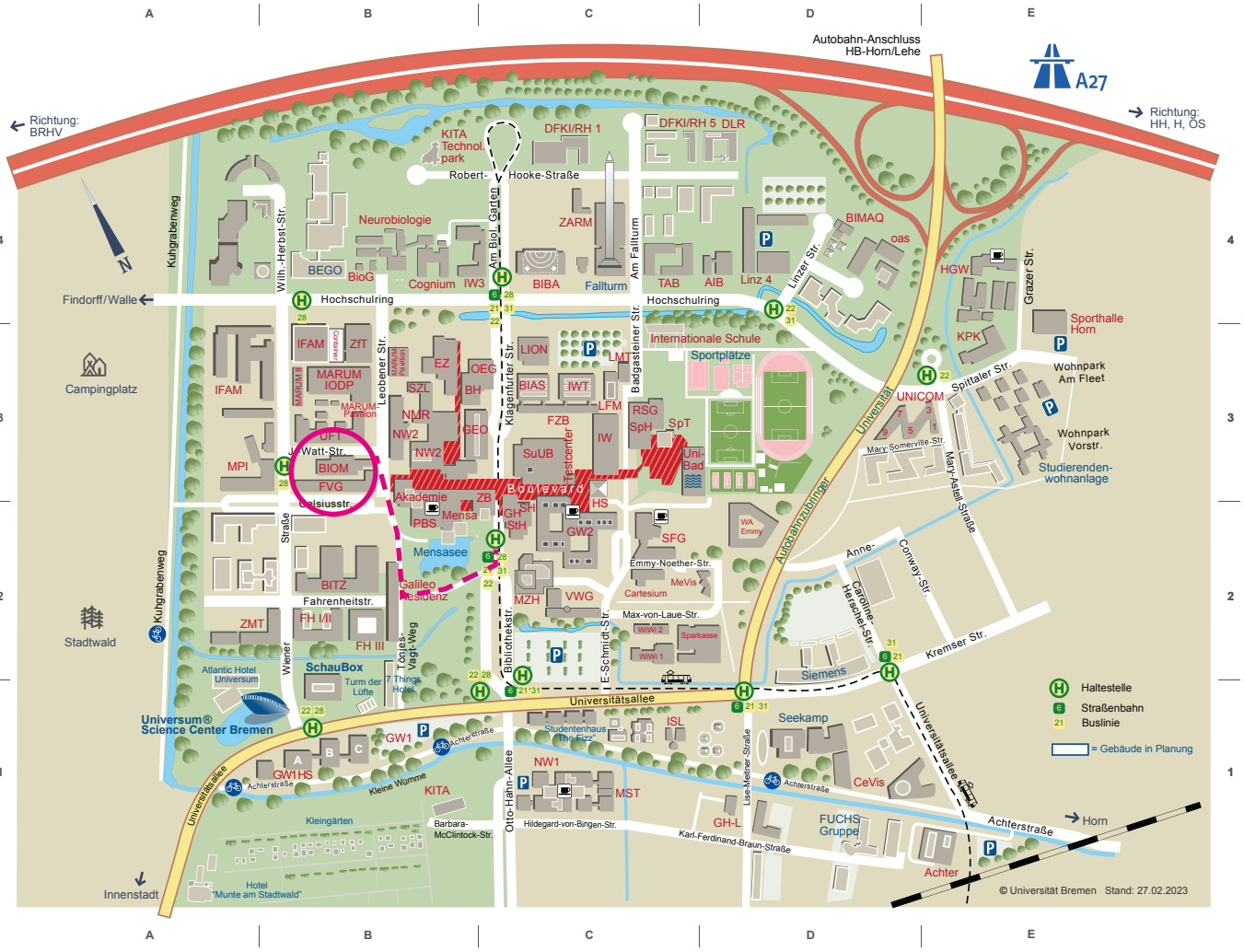
- Central Station to BIOM
  Tram Line 6, every 10 minutes. Destination stop: Bremen Universität/Zentralbereich
- Überseestadt to BIOM
  Bus Line 28, thrice per hour. Destination stops: Bremen Celsiusstraße or Bremen Universität/Zentralbereich
- Sebaldsbrück to BIOM
  Bus Line 21, every 15 minutes. Destination stop: Bremen Universität/Zentralbereich
- Bremen Kattenturm to BIOM
  Bus Line 22, every 20 minutes. Destination stop: Bremen Universität/Zentralbereich



Interactive route network map: www.bsag-netz.de

Public transport system map: www.bsag.de/fileadmin/user_upload/Stadtnetzplan.pdf

Campus Map of the University of Bremen



Downloadable full map of campus map here: www.uni-bremen.de/en/university/campus/campus-map

Venues and Directions

Icebreaker Venue: Übersee-Museum

Übersee-Museum, Bahnhofsplatz 13, 28195 Bremen

On Monday, 16th of September 2024, we will kick off the conference with our iconic ICYBREAKER at the Übersee Museum in Bremen. Join us at 6 pm for an evening filled with camaraderie at this exceptional venue. Enjoy complimentary drinks and finger food as you get to know the ICYMARE team and fellow participants during a friendly game of Human Bingo. The first ten individuals to complete their bingo cards will receive an exciting prize. Don't miss this great start to the 2024 ICYMARE conference!

The Übersee-Museum is located directly at the main station of Bremen. Those arriving by train use the exit in the direction of the city and turn right at the station square. The Übersee Museum's main entrance is located at the end of the meadow.

You can reach the Übersee-Museum Bremen with the tram lines 1, 4, 5, 6, 8, 10 and the bus lines 20, 24, 25, 26, 27, 63 stop Hauptbahnhof. The Übersee-Museum is also located right next to the Central Bus Station (ZOB), where numerous intercity buses stop.

Universität Rostock
Traditio et Innovatio

DFG Deutsche Forschungsgemeinschaft

DFG PRIORITY PROGRAMME 1158

ANTARCTIC RESEARCH

with comparative investigations in Arctic ice areas

Funded disciplines

- ✓ Biology
- ✓ Physics/Chemistry
- ✓ Geoscience

Application process

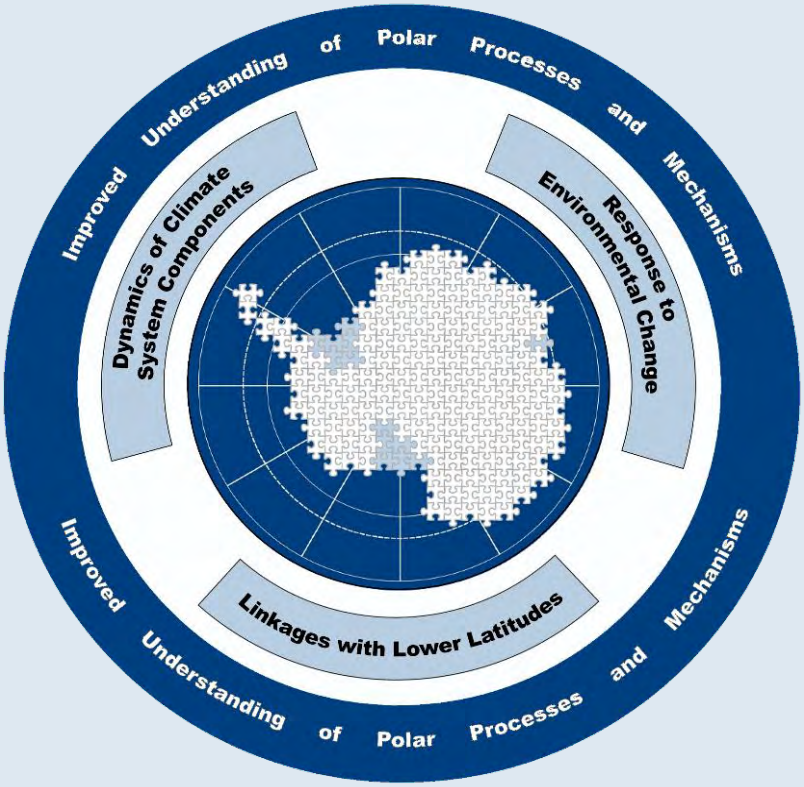
- Once a year
- Closing date 1st week of November
- Obligatory presentation of new project idea at the coordination workshop in September of application year

- 3 years funding for PhD (67%)
- 2 years funding for Postdoc

Further information

www.spp-antarktisforschung.de

Research topics



Prospects

- DFG priority program facilitates resources required for expeditions from the Alfred Wegener Institute in Bremerhaven (AWI), the Federal Institute for Geosciences and Natural Resources in Hannover (BGR) and the German Aerospace Centre in Cologne (DLR).

Get in contact with us

spp-antarktisforschung@uni-rostock.de


Prof. Ulf Karsten
Head coordinator


Dr. Julia Ehrlich


Dr. Angelika Graiff


Prof. Petra Quillfeldt


Prof. Tilmann Harder


Dr. Sonja Berg

Useful Information

Certificate of Attendance

If you want, you can get a Certificate of Attendance that also serves as a proof for all your efforts regarding the ICYMARE 2024 BREMEN conference. Whether you were a listener, a presenter, a session host, or a helper, you will get such a certificate. All your functions during the conference will be listed. If you contributed a poster or talk, the title and the session of your contribution and the type of contribution (oral/poster) can be mentioned. Please check, whether everything is correct. Drop by the registration desk to ask for your certificate – we are happy to print out your personal certificate on demand. Or send an email to **support@icymare.com**.

Mobile Phones

All participants are kindly requested to turn their mobile phones and other electronical devices silent during the oral sessions.

WiFi Information

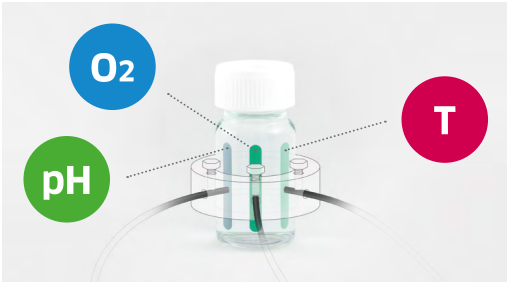
The University of Bremen is member of the eduroam network. So all participants should be able to access the internet with their normal accounts. If you don't have an account at the eduroam network, we will provide you access to the WiFi.

Some 'Concluding' Words

We are delighted that you want to become part of the ICYMARE family and hope that you will learn and network a lot but especially that you will have fun! Please feel free to link ICYMARE on any related social media activities, so that we can spread the impressions more widely to our community! #ICYMAREfamily

pyroscience
sensor technology

One-Device Solutions
in the Lab and ...



... Underwater

O2 pH T

pH (total scale)
ultra-trace O2
(high speed) O2

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Session Overview

Session Overview

1 Deciphering Ocean Transformation in a Changing World

1. **Unravelling the Effects of Global Change on Aquatic Systems: Opportunities and Limitations in State-of-the-Art esocosm Research**
   Hosted by Anika Happe and Maren Staniek
2. **Investigating Controlling Mechanisms of the (Biological) Carbon Pump: The Story of Organic Matter**
   Hosted by Runa Reuter and Aman Akeerath Mundanatt
3. **Fish in a Changing World: Exploring how Climate Change shapes Fish and Their Homes**
   Hosted by Carolin Müller
4. **Benthic Ecology in a Changing Ocean**
   Hosted by Eva K. Rohlfer and Anna Fiesinger
5. **Coastal Ecology and Potential Effects of Climate Change: From the Individual to the whole Ecosystem**
   Hosted by Cindy Meyer & Léa Joly

2 Delving into Marine Socio-Ecological Dynamics

1. **Protection of Marine Environment under International Environmental Law**
   Hosted by S. Ali Hosseiniazad, Nastaran Sadeghi and Dorota Piechowiak
2. **Exploring Human Dimensions within Marine Social-Ecological Systems**
   Hosted by Marissa Levinson and Gabriel Rivas Mena

3 Unravelling the Effects of Marine Pollution

1. **Tackling Plastic in the Seas: Uniting Diverse Research for Insights and Action**
   Hosted by Alena Sakovich and Norlaila Binti Mohd Zanuri
2. **Below the Surface – Fisheries and aquaculture related marine plastic pollution and their impact**
   Hosted by Waranya Wataniyakun and Kristine Cerbule
3. **Marine Ecotoxicology: Pathways, Distribution, and Fate of Pollutants in the Marine Realm**
   Hosted by Louisa Karl and Victoria Wegner

4 Advancing Aquatic Research Through Cutting-Edge Technologies and Methodologies

1. **Maritime Technology:**
   Pushing the Frontier of the Observable
   Hosted by Leonard Günzel, Michele Grimaldi and Sebastian Realpe Rua
2. **Exploring the World from Above:**
   Remote Sensing Applications for Aquatic Environments
   Hosted by Alice Fabbretto, Erika Piaser and Nicola Ghirardi
3. **Sclerochronology –**
   Providing Insights for Life History, Ecology, and Management Studies
   Hosted by Fedor Lishchenko and Roman Petrochenko

5 Exploring the Wonders of Marine Flora

1. **Exploring Marine Phycoflora –**
   Diversity and Significance of Photosynthetic Organisms in Seas and Oceans
   Hosted by Wiktoria Chudzik and L Kappas

6 Unveiling the Mysteries of Life Below the Surface

1. **Reproduction & Early Life History of Marine Animals**
   Hosted by Neele Schmidt
2. **Marine Megafauna: Critical Habitats, Threats, and Conservation Strategies**
   Hosted by Leyla Israpilova
3. **All Things Corals: Ecology, Conservation & Future Trajectories**
   Hosted by Viktoria Sturm

7 Open Session

Hosted by Theo Krüger and Jöran Papp

You can find the entire ICYMARE 2024 BREMEN program here

Full Program: www.conference.icymare.com/unbound/event-calendar

THELMA BIOTEL

Let the fish talk to you.

Monday
16th September 2024

Program - Monday, 16th September 2024

18:00-22:00

Icebreaker

Kick off ICYMARE 2024 BREMEN
with free drinks, finger food, and an unforgettable start

Übersee Museum, Bremen
Bahnhofsplatz 13, 28195 Bremen

Tuesday
17th September 2024

Program - Tuesday, 17th September 2024

07:30	**Registration**	
08:30	**Welcome Words**	
08:45	**Keynote & Plenary Discussion:** **Inclusive Action for the Ocean we Want** Nuri Max Steinmann & Kim Nierobisch, UN Ocean Decade ECOP Node Germany *Lecture Hall*	
10:30	**Coffee break**	
11:00	Session 1.5 **Coastal Ecology and Potential Effects of Climate Change: From the Individual to the Whole Ecosystem** *Session Hall A*	Session 4.2 **Exploring the World from Above: Remote Sensing Applications for Aquatic Environments** *Session Hall B*
12:30	**Lunch break** *(self organized)*	
13:00	**Round Table** **Toxic Working Environments** *Foyer*	
13:30	Session 5.1 **Exploring Marine Phycoflora: Diversity and Significance of Photosynthetic Organisms in Seas and Oceans** *Session Hall A*	Session 3.1 **Tackling Plastic in the Seas: Uniting Diverse Research for Insights and Action** *Session Hall B*
15:00	**Coffee break**	
15:30	Session 2.1 **Protection of Marine Environment under International Environmental Law** *Session Hall A*	Session 3.1 **Below the Surface: Fisheries and Aquaculture related Marine Plastic Pollution and their Impact** *Session Hall B*
17:00	**Poster Session** Enjoy the relaxed atmosphere as you chat with fellow young scientists about their research. Be inspired by engaging discussions, great food, and new connections *Foyer*	

Keynote & Plenary Discussion

Inclusice Action for the Ocean we want

Speaker: Nuri Max Steinmann and Kim Nierobisch
UN Ocean Decade ECOP Node Germany

Geopolitical Inclusivity: This topic explores the structural obstacles that sustain inequalities within the international ocean community. Key challenges include the economic barriers that limit the participation of geopolitically underrepresented voices, political marginalization influenced by global issues, and restricted access to vital data from their regions. The focus is on understanding these hurdles and identifying pathways to ensure more inclusive practices in marine conservation and beyond.

Intersectoral Inclusivity: This theme highlights the importance of involving a diverse range of stakeholders in ocean-related initiatives. Achieving sustainable and equitable marine conservation requires a broader perspective, new funding opportunities and co-developed projects with vulnerable communities.

This keynote presentation promises to provide valuable opportunities for discussion and exchange on how inclusivity, both geopolitical and intersectoral, can be effectively practiced driving meaningful progress in ocean research and conservation.

Biography:
Kim Nierobisch is an ocean activist and is currently completing her master´s degree in interdisciplinary marine research at Kiel University. She is a member of the German Ocean Decade Committee and ECOP Germany.

Nuri Steinmann is a marine biologist, grant manager at Blue Action Fund, a foundation for international marine conservation and member of the German Ocean Decade Committee and ECOP Germany.

Session 1.5
Coastal Ecology and Potential Effects on Climate Change: From the Individual to the Whole Ecosystem

Sessions

Session 1.5:
Coastal Ecology and Potential Effects on Climate Change: From the Individual to the Whole Ecosystem

Hosted by: Cindy Meyer & Léa Joly

Marine coastal environments are considered as the most diverse places on Earth. They are subjected to strong dynamic interactions both with the pelagic and the terrestrial environment, and thus more vulnerable to global change and anthropogenic pressure. There is a strong need to understand current ecological processes at different biological scales in the field (individual to ecosystems) and how climate change could modify the physiology, interactions and ecosystem structure. We are looking for researchers working on coastal ecology and/or climate change effect on coastal ecology, using different tools at any biological and taxonomic level. We would like to bring different expertise together to highlight the potential of using complementary approaches for coastal ecology research.

"You look stressed dear": investigating the behavioural changes in *Calanus sp.* when exposed to anthropogenic noise

Fabio Viotti[1], Saskia Kühn[1], Sidonie Rousseau[2], Katja Heubel[1]

[1] Research and Technology Centre West Coast, University of Kiel, Germany;
[2] Norwegian University of Science and Technology, Norway

Keywords: Underwater Bioacoustics, Invertebrates Behaviour, Zooplankton, Mesocosm

Anthropogenic noise pollution is currently recognized to be one of the most significant threats to the marine environment, with increasing evidence of its negative impacts on the ecosystem. Understanding the overall effect of noise on the ecosystem requires detailed investigations into its impact on individual species and subsequent inferences about potential cascading effects throughout the trophic web. Traditionally, these studies are conducted in controlled laboratory setups, which provide valuable insights but may not fully capture the complex interactions present in natural marine environments. Our study adopts a mesocosm method to explore the effects of noise on the behaviour of Calanus sp., a pivotal copepod species within northern marine food webs. The experimental setup involves housing the individuals in small, transparent cages that facilitate a more natural exchange of water, gases, and small molecules with the surrounding environment. The copepods are subjected to continuous noise recordings from offshore infrastructures, simulating real-world exposure scenarios. Behavioural recordings are conducted every other day by transferring a single cage to a specialized recording setup within the same outdoor environment, minimizing animal handling. The primary hypothesis of this study is that continuous noise exposure significantly alters the swimming behaviours of *Calanus sp*. We will, therefore, present preliminary results from our ongoing research, which provide initial insights into how noise pollution might reshape the behaviour of marine organisms and affect broader ecological dynamics.

Spatio-temporal assessment of the trends in physical and biogeochemical parameters on the primary production of the Gulf of Guinea

Adeola Michael Dahunsi[1], Tolulope S. Oyikeke[2], Mujeeb A. Abdulfatai[3], Lateef A. Afolabi[4]

[1] International Chair in Mathematical Physics and Applications (ICMPA-UNESCO Chaire), University of Abomey Calavi, Abomey Calavi, Benin Republic;
[2] Department of Climate Change and Marine Sciences, Universidade Técnica do Atlanticô (UTA)– ISECMAR, Cape Verde;
[3] Alfred-Wegener-Institute Helmholtz Centre for Polar- and Marine Research, Bremerhaven, Germany;
[4] Department of Fisheries and Aquatic Sciences, University of Cape Coast, Cape Coast, Ghana

Keywords: Coastal waters, Gulf of Guinea, Climate change, Models Primary productivity, Nutrients

This study applied ocean models data from Copernicus Marine Environment Monitoring Service (CMEMS) in assessing the impacts of the trends in key ocean parameters on the primary production of the Gulf of Guinea (GoG). Trend analyses, from 1993 to 2020, were done using linear regression and Mann-Kendall significance test methods to ascertain inter-annual and interseasonal variations and check the significance of the trends, respectively. Results affirm that temperature, salinity, nutrients, and oxygen play significant roles in the primary production of the GoG. Also, parameters such as temperature, salinity, chlorophyll-A, net primary production, phosphate, and dissolved oxygen have been experiencing increases between the study duration while silicate and nitrate have been declining in the GoG. However, there are regions and years with contrary values to the average trends. The varying level of significance of the trend showed that the impacts of the climate on the primary production of the GoG vary basin-wide.

Impact of global change drivers and vertical mixing from extreme rainfall and wind stress on marine phytoplankton communities from the coastal South West Atlantic (Patagonia, Argentina)

Juan I. Vizzo[1], Marco J. Cabrerizo[1,2], E. Walter Helbling[1], Virginia E. Villafañe[1]

[1] Estación de Fotobiología Playa Unión, Consejo Nacional de Investigaciónes Científicas y Técnicas, Rawson, Argentina;
[2] Departamento de Ecología, Facultad de Ciencias, Universidad de Granada, Granada, Spain

Keywords: carbon incorporation, carbon fixation, environmental drivers, photosynthesis, Southwest Atlantic Ocean

Terrigenous material and nutrient inputs (browning) from extreme rainfall events and increased vertical mixing due to strong winds, are more frequent and intense in coastal ecosystems; however, the interactive effects of these drivers on phytoplankton are poorly understood. We conducted a study along a latitudinal gradient of the Atlantic Patagonian coast (40°S to 44.9°S, ca. 600 km) exposing six natural phytoplankton communities to two contrasting scenarios: Present versus Future (with lowered pH, higher terrigenous material and nutrients inputs and increased temperature) under two fluctuating radiation conditions (slow and fast regime) mimicking different vertical mixing conditions. Two key photosynthetic targets were quantified: oxygen production and carbon fixation following a short-term approach. In response to the browning, phytoplankton showed an increase in their chlorophyl-a in all sites. The Future scenario did not have a clear effect on oxygen production but led to decreased carbon fixation. The changes in the productivity resulting from the interactive effects of extreme rainfall and strong winds may have important implications for the trophodynamics of higher trophic levels in the productive South West Atlantic Ocean.

Illuminating Cassiopea Jellyfish: Biochemical Revelations from Metabolism to Coloration under Ultraviolet A and Photosynthetically Active Radiation

Samir Aljbour[1], Susana Agusti[2]

[1] Red Sea Research Center (RSRC), King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia

Keywords: Lipid peroxidation, oxidative stress, metabolic responses, aerobic response

Sunlight is essential for cnidarians with symbiotic zooxanthellae. In contrast to the effects of ultraviolet B and photosynthetically active radiation (PAR) on symbiotic cnidarians, the effects of ultraviolet A (UVA) remain poorly understood. Therefore, we investigated the effects of UVA on the metabolic, oxidative, and photosynthetic responses of Cassiopea jellyfish under different PAR intensities. For 18 days, 24 jellyfish were equally distributed among four exposure groups (i.e., low PAR [±UVA], high PAR [±UVA]). In all groups, the mass and umbrella diameter increased significantly following radiation exposure. However, the magnitude of increase in both parameters was not significantly different. Independent of UVA exposure, PAR intensity had significant effects on aerobic cellular respiration and photosynthetic parameters, with low-intensity PAR promoting higher mitochondrial electron transport system (ETS) activity and increasing the chlorophyll-a concentration ([chlorophyll-a]). Furthermore, ETS activity was positively correlated with [chlorophyll-a] but negatively correlated with jellyfish size. Both PAR and UVA had significant effects on lipid peroxidation (LPO), and their interaction resulted in increased LPO ($P < .05$), being 69% higher under high PAR than under low PAR. The substantial increase in oxidative stress under high PAR suggests a synergistic interaction with UVA. Jellyfish exhibited consistent growth regardless of the PAR and UVA levels, and their coloration changed with PAR exposure, indicating alterations in algal symbiont density. This highlights the robust adaptability of Cassiopea jellyfish to varying light conditions, highlighting their resilience to environmental variation. Overall, the present study underscores the critical role of light, particularly PAR, in shaping the physiology and ecology of marine invertebrates, such as jellyfish, shedding light on their intricate responses to environmental radiation. Moreover, this pioneering study is the first to examine the unique role of UVA in jellyfish responses to PAR, forming the basis for future research on the diverse effects of UVA on jellyfish physiology.

Harmful effects of a toxic dinoflagellate (*Amphidinium carterae*) on the brine shrimp *Artemia franciscana* in response to rising temperatures and eutrophication

Tim Rissel[1,2], Inês Morão[2], Ariana Moutinho[2], Milen Nachev[1], Ana Amorim[3], Helena David[3], Sara C. Novais[2], Marco F.L. Lemos[2], Tiago Simões[2]

[1] Universität Duisburg-Essen, Essen, Germany;
[2] MARE – Marine and Environmental Sciences Centre & ARNET – Aquatic Research Network, ESTM, Politécnico de Leiria, Peniche, Portugal
[3] MARE – University of Lisbon, Lisbon, Portugal

Keywords: Ecotoxicology, *Amphidinium carterae*, *Artemia franciscana*, Climate change, Harmful algal blooms

Amphidinium carterae is a cosmopolitan dinoflagellate known to occasionally form Harmful Algal Blooms (HABs). Due to global warming and increased coastal eutrophication, in recent decades, the frequency and intensity of HABs has significantly increased in certain regions, posing a threat to the ecosystem and human health. This study addresses the ecotoxicological impact of this potentially toxic microalgae on the crustacean *Artemia franciscana*, a keystone organism in the marine food web and commonly used in marine ecotoxicology. Through controlled laboratory experiments, the sub-/lethal effects of *A. carterae* on artemia were initially assessed under reference growing conditions. *Artemia franciscana* specimens were exposed to a gradient of densities of live microalgae cells, cell lysate and supernatant for 48 hours. The mortality and motility rates of *A. fransiscana* were recorded to establish the dose-response relationships. Furthermore, the mortality of artemia was evaluated using a 2x2 factorial design, considering both, temperature (19/24 ˚C) and eutrophication ($N/P_{Reference}$: 1 mM/0,042 mM; $N/P_{Eutrophication}$: 3 mM/0,125 mM) to understand the wider repercussions of microalgae exposure under a changing environment scenario on the nauplii. The results revealed a density-dependent mortality after exposure to *A. carterae*. Sublethal effects were also noted, with the nauplii displaying modified swimming behaviors and reduced distances during recordings. Besides, the study explored different ways of toxic interaction with the crustacean, with the cell lysate presenting the most severe effects and indicating that toxicity may occur mostly through ingestion. Changing the exposure conditions also impacted significantly the crustacean performance. Understanding these interactions is crucial for elucidating the pathways through which *A. carterae* may affect ecosystem health. By identifying both lethal and sublethal effects of *A. carterae*, this research emphasizes the significance of proactive knowledge for management and monitoring strategies to mitigate the adverse outcomes of algal toxin exposure in aquatic ecosystems.

Session 4.2
Exploring the World from Above: Remote Sensing Applications for Aquatic Environments

Hosted by:
Alice Fabbretto, Erika Piaser and Nicola Ghirardi

Sessions

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Exploring the World from Above: Remote Sensing Applications for Aquatic Environments

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Over the past few decades, Remote Sensing (RS) technologies have emerged as pivotal tools for monitoring and assessing health of aquatic ecosystems, estimating water quality and aquatic vegetation parameters by analysing the spectral characteristics of the water bodies and their key components. These technologies offer extensive spatial coverage and frequent monitoring, furnishing near real-time data at a large scale, thereby complementing traditional in-situ measurements. Beyond assessing optically active water quality parameters, RS technologies offer unparalleled capabilities for the retrieval of lake bottom characteristics, turbidity, chlorophyll concentration, dissolved organic matter, and detection of harmful algal blooms. In recent years, spaceborne and airborne hyperspectral imaging, joint with LiDAR and radar sensors, along with the well-established multispectral RS technology, enable mapping and monitoring of aquatic vegetation distribution, abundance, and health, as well as the impacts of human activities on aquatic plant communities. Additionally, the integration of RS data with in-situ measurements are useful to investigate vegetation ecological functions and plant functional traits at different levels. Who should attend: This session is aimed at young researchers interested in advanced remote sensing technologies, real case studies and applications in aquatic environments. If you are involved in environmental activities aimed at preserving precious aquatic ecosystems, this session offers valuable insights, networking opportunities and knowledge exchange in the field of aquatic remote sensing. Join us for an immersive session that explores the potential of Remote Sensing technologies for application in freshwater ecosystems and coastal habitats by crossing a diverse range of aquatic environments, each playing a critical role in supporting life on Earth. This session aims to show innovative approaches and applications in a real-world scenario to address key challenges in water resource management and conservation strategies.

Tracking water quality and macrophyte changes in Lake Trasimeno (Italy) from spaceborne hyperspectral imagery

Alice Fabbretto[1,2], Mariano Bresciani[1], Andrea Pellegrino[1,3], Krista Alikas[2], Monica Pinardi[1], Salvatore Mangano[1], Rosalba Padula[4], Claudia Giardino[1]

[1] National Research Council, Institute of Electromagnetic Sensing of the Environment, Milan, Italy;
[2] Tartu Observatory, University of Tartu, Department of Remote Sensing, Tartu County, Estonia;
[3] University of Sapienza, Department of Engineering, Rome, Italy;
[4] Regional environmental protection agency "ARPA Umbria", Perugia, Italy

Keywords: Rrs, PRISMA, DESIS, EnMAP, water quality

The aim of this work is to show the potential of imaging spectroscopy for estimating water quality parameters and the amount of aquatic vegetation in a meso-eutrophic lake. A total of 13 hyperspectral reflectance products (six provided by PRISMA, six by DESIS and one by EnMap spaceborne missions) with a common spatial resolution of 30 m were acquired from 2019 to 2022 in the summer periods over Lake Trasimeno. The products were evaluated radiometrically with corresponding in situ measurements gathered from WISP-Station, a fixed position radiometer that collects high frequency reflectance measurements, from which an estimate of the bio geo-physical parameters can also be derived. Sun glint correction was also carried out for one DESIS image in the dataset. The validated reflectance products were then used as input in bio-optical modelling for estimating water quality parameters. Particularly, Chlorophyll-a (Chl-a) and Total Suspended Matter (TSM) maps were obtained with BOMBER, a bio-optical model inversion based on optimisation techniques. Phycocyanin (PC) maps were generated through a machine learning algorithm (Mixture Density Network). In optically shallow water, submerged and emergent macrophytes growing in the lake were also mapped with BOMBER. Environmental parameters such as the air temperature were explored to support the discussion of the results. When compared with in situ data, the reflectance derived by the three spaceborne sensors showed a good fit, with $R^2 > 0.9$ and Spectral Angle < 10°. The water quality products were mapped with an average error < 30%. The spatio-temporal variation of macrophyte coverage showed significative variation, with the minimum coverage of both submerged and emergent macrophytes in June 2019 and the maximum coverage in July 2022. This change was most likely associated by a decrease in both cumulative rainfall and lake levels, and by an increase of the average annual air temperature.

Application of hyperspectral PRISMA spaceborne imagery for aquatic ecosystem health monitoring and mapping

Erika Piaser[1,2], Federica Braga[3], Mariano Bresciani[1], Claudia Giardino[1], Paolo Villa[1]

[1] Institute for Electromagnetic Sensing of the Environment, National Research Council (IREA-CNR), Milan, Italy;
[2] Department of Civil and Environmental Engineering, Politecnico di Milano, Milan, Italy;
[3] Institute of Marine Sciences, National Research Council (ISMAR - CNR), Venice, Italy

Keywords: supervised classification, wetlands, spectro-functional traits, aquatic community type

In the framework of a global crisis of wetland biodiversity in both inland and coastal waters, human-induced eutrophication is emerging as a major threat to the health of aquatic plants, by altering nutrient dynamics and ecosystem processes. Furthermore, eutrophic systems often exhibit the coexistence of plants and potentially harmful algae scums (formed at the peak of cyanobacteria bloom events), despite their competition for nutrients and space. Although widely used, multispectral sensors often struggle to differentiate floating/emergent plants from algae scum, while advanced imaging spectroscopy data, characterised by higher spectral resolution, holds promise for addressing this limitation. In this context, we explored the potential of PRISMA hyperspectral imagery for detecting and distinguish aquatic vegetation (AV) from algae scum (AS) across an extensive and heterogeneous dataset of nine shallow lakes and wetlands, covering different biogeographical regions. Starting from this dataset, the - specific for aquatic vegetation mapping, were used as input to both standalone (Support Vector Machine, SVM) and ensemble (Random Forest, Extreme Gradient Boosting – RF, XGBoost) machine learning optimized algorithms, to assess the best classification performance via global and per-class accuracy metrics. Our results demonstrated consistently strong predictive capabilities across all methods achieving a 100% F-score for sites without AS, attributed to the high separability between AV and open water. Moreover, our models exhibited a generally robust performance (F-score > 80%) on validation set, even when AS was present. When analysing the classified maps, optimal classifier was site-specific, with SVM and XGBoost outperforming RF (which overestimated AS). Starting from the best classified wetland maps on AV only, we aim to leverage PRISMA data to generate seasonal variation maps of spectro-functional traits at both canopy (Fractional Cover, LAI, above water dry biomass) and pseudoleaf (pigments content, LMA) scale, using semi-empirical models calibrated previously.

Sea Surface Temperature at 1 km spatial Resolution between 1990 and 2022 for the Baltic and North Sea: Insights from the new TIMELINE AVHRR SST Product

Karina Alvarez[1], Philipp Reiners[2], Laura Obrecht[2], Stefanie Holzwarth[2], Claudia Kuenzer[1,2]

[1] University of Würzburg, Würzburg, Germany;
[2] German Aerospace Center (DLR), German Remote Sensing Data Center (DFD), Wessling, Germany

Keywords: climate change, coastal areas, remote sensing, Europe

Coastal areas are among the most economically and ecologically productive areas in the world but are threatened by rising oceanic temperatures. Sea Surface Temperature (SST) is an essential variable to monitor and understand oceanic warming trends, especially in coastal areas. Remote sensing is one means of measuring SST over long time scales. Current SST products, however, have fairly coarse spatial resolution, limiting the application of remotely-sensed SST at finer scales in coastal zones. We present the novel TIMELINE 1km SST product, derived from the Advanced Very-High Resolution Radiometer instrument, that spans over 30 years for Europe. Additionally, this study analyzes this product in the Northern and Baltic Seas. The analysis of monthly anomaly trends found high positive SST trends in this study area, exceeding the global average SST warming. Warmer and colder periods, such as the 2006 heatwave, could also be identified and aligned with previous research. Seasonal variations reveal peak warming during spring, early summer, and early autumn, suggesting a potential seasonal shift. The spatial analysis of the monthly anomaly trends revealed significantly higher trends in near-coastal areas. The TIMELINE monthly anomaly time series were also compared to monthly anomalies derived from the ESA Climate Change Initiative Level 4 SST anomaly product. The comparison showed an overall strong accordance of the two products (R = 0.77) for the North and Baltic Sea. This study highlights the potential of the TIMELINE SST product for mapping long-term SST trends in areas with high spatial SST variability, such as coastal regions, as well as for preparing for future sea surface temperature extremes.

Monitoring Water Quality of Sub-Sahelian African Lakes using Satellite Data: Comparing the Effects of Extreme Weather Events on Inland and Coastal Waters

Anna Joelle Greife[1], Monica Pinardi[1], Marina Amadori[1], Francesco Pietro Fava[2], Mariano Bresciani[1], Claudia Giardino[1]

[1] CNR - Institute for Electromagnetic Sensing of the Environment, National Research Council, Milan, Italy;
[2] University of Milan - Department of Environmental Science and Policy, Milan, Italy

Keywords: Sentinel-3, Climate Change Impacts

In recent times, extreme weather events have increased in both frequency and intensity and are expected to cause significant impacts globally. However, the effects of such events on African lakes remain understudied. This work exploits satellite remote sensing data to investigate the effects of extreme weather events on spatial-temporal water quality variables for a subset of Sub-Sahelian African lakes. The subset contains 18 lakes and lagoons spanning between 9°N to 29°S of different trophic and morphological characteristics. Datasets available from the ERA5 reanalysis and from the European Space Agency (ESA) Lakes Climate Change Initiative (CCI) project are exploited to obtain timeseries of meteo-climatic data and water variables (i.e., chlorophyll-a, turbidity, and temperature) derived from satellite imagery. The goal is to identify and analyse recent extreme events and their potentially differing effects on inland versus coastal waterbodies. Preliminary results show significant correlations between precipitation and turbidity as well as precipitation and chlorophyll-a concentrations, as proxy for primary production. In addition, correlations between chlorophyll-a and air and lake surface water temperatures are detected. The observed impacts of extreme events, even if limited in number of lakes and time frame, suggest a rapid degradation of water quality.

This work suggests the importance of monitoring the effects of extreme weather events on water quality variables in the climate-vulnerable sub-Sahelian African lakes and lagoons and highlights the potential role of remote sensing to fill the existing knowledge gap and support a more sustainable management of the lakes' vital resources and climate risk mitigation actions.

Session 5.1
Exploring Marine Phycoflora: Diversity and Significance of Photosynthetic Organisms in Seas and Oceans

Hosted by:
Wiktoria Chudzik and L Kappas

Sessions

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Join our distinguished panel of experts as they delve into the fascinating realm of marine phycoflora – an incredibly diverse group encompassing cyanobacteria, algae, and vascular plants, including the vital seagrasses. This panel sheds light on the pivotal role these photosynthetic organisms play in sea and ocean ecosystems, serving as the foundation of intricate food chains. Our discussions will highlight the significance of phytoplankton, the primary producer of oxygen in oceans, contributing not only to global oxygen production but also ensuring the oxygenation of marine waters. Beyond their role in oxygen production and as a food source, these organisms perform multifaceted functions, offering valuable marine resources for human utilisation. Delve into the panel's insights on how seagrasses and macroalgae provide essential habitats and refuge for various species, influencing physiological processes that regulate the circulation of biogenic elements and mineral compounds. Discover the contribution of these organisms to sediment stabilisation, along with the versatile compounds derived from them, such as agar and carrageenan, showcasing their application in biotechnological processes like biofuels. Our esteemed panellists will explore the adaptability of marine phycoflora across diverse ecological conditions, from polar regions to tropical areas, often inhabiting inaccessible territories. Gain insights into their pioneering role in colonising areas and discover how their processes and substances serve as prototypes for pharmaceutical and industrial applications. This conference panel, aptly titled "Marine Phycology," invites you to join an interdisciplinary journey, addressing biology, ecology, genetics, chemistry, and biotechnology aspects. Explore technical and methodological insights that inspire and bring new knowledge to the breeding, identification, and utilisation of these remarkable marine organisms. Do not miss this opportunity to engage with the forefront of marine science and research.

Influence of light and silicic acid on the productivity of the Arctic phytoplankton community

Antonia Thielecke[1], Natasha Bryan[1], Jeffrey Krause [2,3], Mar Fernández-Méndez[1]

[1] Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung, Bremerhaven, Germany;
[2] Dauphin Island Sea Lab, Dauphin Island, United States;
[3] University of Southern Alabama, Mobile, United States

Keywords: diatoms, primary productivity, stable isotopes, Arctic Ocean, silicic acid decline

The inflow of silicic acid, a key element for diatoms which dominate Arctic phytoplankton blooms, into the Arctic Ocean has been declining in recent decades. In the Arctic Ocean phytoplankton are the main primary producers and constitute the base of the marine food web. There are two major functional types of phytoplankton in the Arctic Ocean, both of which are dependent on light and nutrients for their growth: i) silicifiers, dominated by diatoms, which additionally require silicic acid to build their shells made of biogenic silica and ii) non-silicifiers, mostly represented by the haptophyte *Phaeocystis pouchetti*. We hypothesised that declines in silicic acid concentrations will negatively affect overall primary productivity. During two cruises to the Arctic in 2023 we assessed the productivity of phytoplankton under changing silicic acid concentrations using on-board incubations. Samples of the natural phytoplankton assemblage were collected with a CTD and incubated with stable isotopes (^{13}C, ^{15}N and ^{30}Si) under an array of different light levels as well as silicic acid concentrations (Photosynthesis vs. Irradiance vs. Nutrients – PIN surfaces) to model primary productivity not only as a response variable to light but also to nutrient concentrations. From these incubations we calculated uptake rates of carbon, nitrate and silicic acid. Preliminary results indicated that silicic acid uptake rates scaled with silicic acid availability, whereas there was little influence of light availability. Positioned at the base of the foodweb phytoplankton functioning affects trophic transfer, nutrient cycling and carbon export. By studying phytoplankton responses to different light and nutrient levels we will contribute to understanding general Arctic ecosystem functioning as well as the potential impacts of climate change on these crucial processes.

Red Flag: The Toxic Relationship Between a Bacterium and a Marine Diatom

Jasmin Bock[1], Tilmann Harder[1,2]

[1] University Bremen, Germany;
[2] Alfred-Wegener-Institut, Bremerhaven, Germany

Keywords: Ecological Chemistry, *Thalassiosira rotula*, Microalgae and Bacteria Interactions, *Croceibacter atlanticus*

Microalgae and marine bacteria contribute substantially to the Earth's primary production as well as the degradation and remineralisation of organic matter. Their interactions in the ocean are therefore important for the global carbon cycle. Recently, the bacterium *Croceibacter atlanticus* has been found to have an algicidal effect on some marine diatoms by limiting their growth and altering their morphology before ultimately killing them. However, the mechanism of this algicidal effect is currently unknown. We assessed if the algicidal activity of *C. atlanticus* is mediated through chemical substances. The following hypotheses were investigated: H1) The bacterium *C. atlanticus* produces & releases substances with a negative effect on the growth of the marine diatom *Thalassiosira rotula*. H2) The substances of *Croceibacter atlanticus*, which are found in the culture supernatant, are produced in the absence of the marine diatom and released into the medium. A bacterial pellet of *C. atlanticus* was cultivated in enriched artificial sea water medium for 69 hours and the supernatant was tested after sterile-filtration. Bioassays were conducted in 24-well plates compared to negative (only medium) controls. Daily chlorophyll a fluorescence measurements and microscopy of the *T. rotula* diatom cultures with/ without bacterial culture supernatant were used to assess the growth-inhibiting effect of substances released by *C. atlanticus*. Our results show a reduction in growth and morphological changes of the marine diatom *T. rotula* when exposed to filtered growth medium of *C. atlanticus*. The algicidal activity of media-born substances was observed even when bacteria cultures were grown in the absence of diatoms. Supporting both of our hypotheses, our results provide first insights into the mechanism of the algicidal activity of *C. atlanticus* and form the basis for further investigations into the identity of algicidal substances.

Session 3.1
Tackling Plastic in the Seas: Uniting Diverse Research for Insights and Action

Hosted by:
Alena Sakovich and
Norlaila Binti Mohd Zanuri

Sessions

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Tackling Plastic in the Seas: Uniting Diverse Research for Insights and Action

Hosted by: Alena Sakovich and Norlaila Binti Mohd Zanuri

Plastic pollution is a significant global challenge in marine environments. It manifests in various forms, from large-scale plastic garbage patches in the open ocean to the widespread presence of microplastics permeating marine waters, organisms, and sediments. The pervasive presence of this pollutant in the seas and oceans poses a substantial threat to the sustainability and health of marine ecosystems, underscoring the urgency for comprehensive action. Addressing this problem necessitates extensive research and collaborative efforts between scientists from diverse research fields.

The main goal of this session is to encourage dialogue among early-career scientists from different disciplines within the scope of marine plastic pollution, highlighting the importance of a multidisciplinary approach in addressing this issue comprehensively. We welcome work from a broad spectrum of research areas, ranging from observational and modelling studies to identify sources and pathways of plastics, to laboratory experiments assessing their impact on the environment and biota and innovative mitigation strategies to combat plastic pollution. This collective integration of diverse research methodologies and insights is a crucial step towards to provide scientific evidences to support target strategy to mitigate and combating this pressing environmental issue.

This session will also create the space for researchers to emphasize the importance of bridging the gap between plastic pollution research and policy implementation, fostering collaboration between scientists, policymakers, and the public to translate scientific findings into actionable strategies.

Microplastic accumulation in sediment and the bivalve Donax sp. in beaches of Vietnam

My-Yen Nguyen[1], Carl Van Colen, Xuan-Quang Ngo, Ann Vanreusel

[1] Institute of Tropical Biology, Vietnam Academy of Science and Technology, Ho Chi Minh City, Vietnam;
[2] Marine Biology ResearchGroup, Ghent university, Ghent, Belgium

Keywords: Plastics, sandy beach, benthos, ingestion

Plastics are ubiquitous in marine environments worldwide, affecting both the scenery and marine life, especially on beaches due to the deposition both from the ocean and land. This study investigated microplastic pollution (1 µm to 5 mm) in three beach environments in Vietnam categorized as “polluted beach”, “cleaned beach”, and “unpolluted beach” based on the presence of plastic litters on the beaches. The polluted beach was heavily covered with plastic waste, the cleaned beach undergoes regular cleaning, and the unpolluted beach exhibited very little macroplastic litters. The interaction between microplastics and sedimentary characteristics (including grain size, total organic matter, Chlorophyll a), and the ingestion of microplastics by benthic fauna were also studied. Triplicate sediment samples from three tidal zones of each beach were randomly collected in the rainy season of Í2022. Microplastics from sediment and from a selected abundant commercial species *Donax* sp. (bivalve) were extracted and characterized using Micro - Fourier transform infrared (µFTIR) spectroscopy. The results showed the ubiquity of microplastics in all beaches. Polyethylene terephthalate (PET) was the predominant polymer type found in the study areas. Microplastic distribution showed a significant difference between tidal zones within the unpolluted beach. The distribution of microplastics in natural and cleaned beaches was significantly associated with Chlorophyll a, whereas in the polluted beach, it was correlated with sediment granulometry. Smaller sizes of microplastics were more prevalent than larger ones. Microplastics were also detected in the collected specimens of *Donax* sp. with a higher abundance of both polyethylene terephthalate (PET) and polyacrylamides (PAM). The ingestion of PAM, which was less present in the sediment, suggested that suspension feeder *Donax* sp. bivalve might ingest microplastics from the water column.

Quantifying and qualifying the microplastic burden in marine mammals of Arctic waters

Mathilde Piette[1], Bianca Unger[1], Matteo Baini[2], Cristina Panti[2], Ursula Siebert[1]

[1] Institute for Terrestrial and Aquatic Wildlife Research, University of Veterinary Medicine Hannover Foundation, Germany;
[2] Department of Physical, Earth and Environmental Sciences, University of Siena, Italy

Keywords: Plastic pollution, Marine litter, Arctic fauna, Ecotoxicology

Nowadays, microplastics (MPs) pollution affects all ecosystems, even in remote areas such as the Arctic. These pollutants enter the Arctic through various pathways, including water inputs, transfer with animals and melting ice. Small sizes allow MPs to travel vast distances and be easily ingested by marine mammals. As a result, the biota of this sensitive ecosystem is at risk of being exposed to MPs and their additives, potentially toxic. These include also arctic marine mammals, which are an essential part of the arctic trophic web and a valuable food source for the Artic indigenous people. However, despite widespread awareness of the environmental threat posed by these pollutants, there is still a research gap in understanding current level of MPs pollution in arctic marine mammals. This study aims to assess the current state of MPs pollution and the presence of MPs-associated contaminants in marine mammals from the Arctic and to compare these findings with those from marine mammals in German waters. For this purpose, the study utilised intestine contents and faeces samples of ringed seals (*Pusa hispida*) and polar bears (*Ursus maritimus*). The samples were then analysed via a Fourier Transform Infrared (FT-IR) spectroscopy to obtain information about the polymer structure of extracted particles. In addition, blubber and muscle samples of the same species were analysed by gas chromatography – mass spectrometry (GC-MS) to determine the concentration of different phthalates as additives for polymers. The analysis revealed the presence of MPs in faeces of ringed seals and polar bears. The results of this study will provide insight into the environmental burden of MPs on marine mammals in and the potential risk of indirect MPs exposure for indigenous people.

Sustainability in the lab: Testing the reusability of 96 microwell plates

Ane Liv Berthelsen[1], Joseph Ivan Hoffman[1]

[1] Bielefeld University, Bielefeld, Germany

Keywords: sustainable research, reuse, plastic crisis, green lab, microsatellite genotyping

Scientific research is a massive endeavor that relies on consuming vast quantities of single-use plastics. However, in the face of an ongoing global plastic crisis, we cannot hide behind the importance of scientific progress. Therefore, we must take action, also in the lab. Many possible solutions have been proposed, from shifting to reusable materials to generating shared campus-wide laboratory inventories. Rethinking existing laboratory protocols is often encouraged, but it is rarely based on empirical testing. We designed an experimental set-up to evaluate the re-useability of 96 microwell plates in the context of an existing microsatellite genotyping protocol. Microwell plates are used daily in laboratories and made from polypropylene, a durable plastic type, which is prevalent in marine pollution samples. In our standard procedure, 11 microwell plates are required to genotype 96 samples. The samples are distributed from one plate to five plates for the first step (PCR amplification) and transferred to five new plates in the second step (fragment analysis). Due to the risk of contamination, the plates are usually single-use. We cleaned the plates using an environmentally friendly approach and systematically reused the plates in either the first step (re-used PCR plate) or the second step (re-used detection plate) of the protocol. An internal control was included to establish baseline error rates. We found no detectable difference in the quality of the scoring for the 're-used detection plate' treatment. In contrast, the 're-used PCR plates' resulted in a decreased scoring and an increase in genotype errors. We conclude that the washing and reuse of 96 microwell plates for fragment analysis can decrease the need for single-use plastics with ~ 33%, thereby saving costs for research and improving sustainability in the lab, however, performing some procedures will still require singleuse plastics to ensure the accuracy of the method.

Identification of novel PET-degrading enzymes within the genus *Halopseudomonas*

Merle Ohl[1,2], Erik Borchert[2], Ute Hentschel Humeida[2]

[1] Technical University of Braunschweig, Germany;
[2] GEOMAR Helmholtz Centre for Ocean Research, Kiel, Germany

Keywords: Plastic, PET-hydrolases, heterologous expression, agar-based functional screening, Environment

In the last decades, plastics have become an important part of our everyday lives. From 1950 to 2021 the amount of produced plastics increased from two million tons to over 390 million tons. Depending on the application, different types of plastic polymers are used, the most common being polyethylene terephthalate (PET), which is mainly used to manufacture disposable drinking bottles. Due to the widespread use of plastic materials and the modern challenges of plastic waste management (usually related to improper disposal), around 0.5% of the plastic ends up in the ocean. Marine mammals, fish, seabirds or sea turtles become captured or entangled by larger plastic items. Smaller plastic particles can be ingested and lead to suffocation, starvation, and drowning. This detrimental influence of plastic pollution on the ecosystems creates concerns in the modern society, and therefore, there is a need to take action to reduce plastic waste, for example, by developing new recycling ideas. One possible approach in this area is the use of naturally occurring enzymes to break down plastic. The bacterial genus *Halopseudomonas* has proven to be particularly useful for the purposes of plastic degradation due to the presence of PET hydrolases. Using a Hidden-Markov-Model (HMM), 26 genes within the *Halopseudomonas* spp. were identified in advance, which were investigated in this work. In the first step, the genes were amplified by PCR and proteins were produced by heterologous expression in *E. coli* MC1061. Agar-based functional screenings were performed to evaluate their ability to break down various substrates, such as PET and PET precursors. If the objective of the work is achieved and activity can be detected, this can provide further information about the structure of genes coding PET hydrolases and potentially lead to a better recycling- and waste management.

Assessing microplastic ingestion by fish and decapod larvae in two coastal ecosystems in the south of Portugal: Guadiana River estuary and Ria Formosa lagoon.

Giulia Zeri[1], José P. da Silva[1], Isabel Marín-Beltrán[1], Vânia Baptista[1], Maria Alexandra Teodósio[1], Joana Cruz[1]

[1] Centre of Marine Sciences (CCMAR), Universidade do Algarve, Faro, Portugal

Keywords: Plastic, Pollution, Meroplankton, FTIR, Polymers

Over the last century, the exponential increase in plastic production has led to the widespread presence of microplastics (MPs) in our oceans. These tiny particles pose a significant threat to marine life, potentially causing toxic effects, starvation, and developmental abnormalities in zooplanktonic organisms. However, only a limited number of studies have investigated the ingestion of MPs by zooplankton in their natural habitats. Thus, our study seeks to address this gap by examining the uptake of MPs by various economically and ecologically important taxonomic groups of fish and decapod larvae in two protected areas in South Portugal: the Guadiana River estuary and the Ria Formosa Lagoon. Samples were collected using horizontal mesozooplankton hauls (200 µm) monthly, from April 2023 to March 2024. Larvae were identified to the lowest taxonomical level possible and then subjected to digestion using hydrogen peroxide (H2O2 30%) to remove organic material and extract potential MPs. After filtration of the digested residual liquid, MPs were characterized based on their colour, size, and shape (fibre, line or fragment). Finally, polymer composition analysis was carried out using micro-Fourier Transform Infrared Spectroscopy (micro-FTIR). A total of 896 larvae were analysed, and 74 MP particles were found to have been ingested, with slightly higher ingestion rates for fish larvae at both locations. Rayon and Polyethylene terephthalate (PET) were the most abundant polymers, with a prevalence of fibres and blue and transparent being the most common colours. Larval stages are already exposed to environmental stressors and predation; MPs can constitute an additional threat possibly impacting the adult populations, in an area strongly reliant on fishery. Moreover, zooplankton can work as an entry point for MPs in the food web, leading to negative impacts on organisms at higher trophic levels, and eventually culminating in human exposure to MPs through the consumption of affected species.

Session 2.1
Protection of Marine Environment under International Environmental Law

Hosted by:
S. Ali Hosseiniazad, Nastaran Sadeghi and Dorota Piechowiak

Sessions

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Recognising the pivotal role that coastlines, seas, and the ocean play in human existence underscore the critical need to prioritise marine environmental protection. In response to this necessity, major international organisations such as the International Maritime Organization (IMO) have taken extensive and targeted measures to protect marine life. The current international legal regime in the field of marine environmental protection is governed by a relatively advanced treaty and customary legal system. Advancements in marine environmental law even leveraged developments in other fields of environmental law. Despite international endeavours to lawfully protect the marine environment and biodiversity against pollution, overexploitation, or the effects of climate change, the main question arises: how does international environmental law effectively protect and preserve the marine environment? Join our session to scrutinise critical aspects of marine environmental protection, exploring the international legal order consisting of instruments and organisational initiatives contributing to this paramount cause.

From Marine Protected Areas to Sustainable Development: A way Forward

Mahshid Ajeli Lahiji[1], Masoud Ahsannejad[2]

[1] Allameh Tabatabae'i University, Tehran, Iran;
[2] Qom University, Qom, Iran

Keywords: Marine Protected Areas, Sustainable development, marine environment, marine biodiversity, SDGs

United Nations Sustainable Development Goal (SDG) 14 addresses the conservation and sustainable use of the ocean and its resources. In this regard, designating Marine Protected Areas (MPAs) have been introduced as a key target for achieving sustainable development through realizing SDGs. Now, these areas are established around the world using different range of legal Frameworks. Yet, determining a place as marine protected area should not solely be driven by ecological factors; The social and economic context also needs to be identified in order to reach the main goal of sustainability of ocean. Moreover, there are other factors that have great impacts on protection of marine environment; climate change and ocean acidification affect coastal and ocean biodiversity and ecosystems. So the main challenge is that how MPAs cause Ocean Sustainability in a changing world. Incorporating all of the related issues into policies and practices will provide sustainability for ocean. Indeed, preservation and restoration of marine ecosystems and protection of biodiversity only happens when the giant picture of the whole integrated area is considered. While designating MPAs is a vital step towards achieving goals, taking the holistic approach of sustainable development is essential for success.

Convergence of the International Law of the Sea and Climate Change Law for Marine Environment Protection

Mahnaz Rashidi[1]

[1] Law Department, Faculty of Human Science, Shahed University, Tehran, Iran

Keywords: Climate Change, Marine Environment, Mitigation, Adaptation, Law of the Sea

There is undeniable scientific evidence regarding the impact of climate change on the marine environment. Acidification of seawater, increasing ocean temperatures, melting polar ice caps, the loss of coral reefs and other vulnerable marine species, changes in the distribution of marine organisms, and rising water levels are some examples of the adverse effects of climate change on the marine environment. Given this situation, the key question is: "How can the international legal frameworks of climate change and the law of the seas protect and preserve the marine environment from the effects of climate change?" It appears that combating climate change is arguably a fundamental element of the general obligation to protect and preserve the marine environment. Consequently, there is a significant overlap between the legal regime of climate change and the Law of the Sea. While the control and mitigation of climate change are not explicitly addressed in the United Nations Convention on the Law of the Sea (1982) (UNCLOS), Part XII of this treaty, can be interpreted dynamically in light of the two primary obligations in climate change law, namely mitigation and adaptation to climate change. Accordingly, anthropogenic greenhouse gas emissions could be considered a kind of marine pollution, and State Parties under Article 194 of UNCLOS are obligated to prevent, reduce and control them. Protection and conservation of marine environment from adverse effects of climate change are also obligations of States Parties under Article 192 of this treaty. These two articles are consistent with obligations to mitigation and adaptation in climate change law.

Protecting the ABNJ through EIAs: Defining an "equivalent" EIA under the BBNJ Agreement

Holly Leung[1]

[1] Faculty of Law, University of Hong Kong, Hong Kong

Keywords: International law of the sea, International environmental law, Environmental impact assessments

While the BBNJ Agreement sets out States parties' obligation to conduct environmental impact assessments ("EIAs") pursuant to Part IV where planned activities take place in or may cause harm to marine areas beyond national jurisdiction ("ABNJ"), Article 29(4) stipulates that an EIA in accordance with Part IV is not required if an "equivalent" EIA has already been conducted. The main issue with Article 29(4) is that no guidance is provided on what constitutes an "equivalent" EIA. This paper attempts to enunciate the criteria for an EIA regime to be regarded as "equivalent" to that under Part IV BBNJ Agreement: (1) the threshold for triggering the EIA should be substantially the same, meaning that an equivalent regime should require an EIA whenever there is potential for "substantial pollution of or significant and harmful changes" to the marine environment; (2) the substantive requirements of the equivalent EIA regime should be similar in that the scoping report should consider associated economic, social, cultural, and human health impacts while such impacts should be "evaluated using the best available science and scientific information"; and (3) the procedural requirements need not be the exact same as that in Part IV BBNJ Agreement, but an equivalent EIA regime should at least require the EIA to be conducted ex ante and public engagement in the EIA process. These requirements may be more onerous than those under existing treaties and instruments, such as the Convention on the Law of the Sea, the ESPOO Convention, the London Protocol, and guidelines of the International Seabed Authority. Nonetheless, the criteria proposed in this article should be adopted to avoid overburdening States parties while simultaneously ensuring the effectiveness of the BBNJ Agreement's EIA regime at protecting marine ABNJ.

Exploring the Common Heritage of Humankind: Environment-Oriented Deep Seabed Resources Mining

Dorota Piechowiak[1]

[1] Adam Mickiewicz University (AMU), Poznań, Poland

Keywords: Law of the sea, common heritage of humankind, nature protection, deep seabed minerals mining, International Seabed Authority

The deep seabed holds vast and largely untapped reserves of valuable minerals critical for modern technological advancements. However, the exploitation of these resources raises significant environmental concerns. The concept of the Common Heritage of Humankind (CHH) is a concept recognized by United Nations Convention on the Law of the Sea (UNCLOS) for governing deep seabed mining activities. My presentation will explore the application of the CHH principle as a basis for environmentally responsible deep seabed mining. Recognizing the deep ocean's significance as a global commons, this approach emphasizes the shared responsibility of all nations in preserving and utilizing its resources for the benefit of present and future generations. Drawing on principles of international law and environmental ethics, this presentation examines the legal and ethical dimensions of implementing CHH in the context of deep seabed mining. It considers the role of international agreements in establishing a regulatory framework that safeguards environmental integrity while ensuring equitable access to deep seabed resources. Furthermore, my presentation will highlight the importance of technological innovation and cooperation in developing sustainable mining practices that minimize ecological disturbance and mitigate potential harm to marine ecosystems. It will also analyse governance mechanisms set up by International Seabed Authority (ISA) and ways in which seabed resources management involves stakeholders from diverse backgrounds, including governments, industry, academia, and civil society. By promoting a holistic approach to deep seabed resource management rooted in the principles of the CHH, this presentation aims to contribute to ongoing discussions on sustainable development and environmental stewardship in the maritime domain.

Session 3.2
Below the Surface: Fisheries and *Aquaculture* related Marine Plastic Pollution and their Impact

Hosted by:
Waranya Wataniyakun
and Kristine Cerbule

Sessions

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Below the Surface: Fisheries and Aquaculture related Marine Plastic Pollution and their Impact

Hosted by: Waranya Wataniyakun and Kristine Cerbule

Marine plastic pollution is a considerable challenge faced across the globe, irrespective of locations and climates. Considerable sources of marine plastic pollution include several industries, such as fisheries and aquaculture. Both fishing and aquaculture industries and other maritime operations are highly reliant on use of plastic materials in various equipment which can result in production in marine plastic litter. Such plastic materials often used by fisheries and aquaculture industries could remain in the ocean for a long time and create macro- and microplastic pollution with associated negative effects on the marine environment. Furthermore, in fisheries, one of the large challenges is pollution caused by abandoned, lost or otherwise discarded fishing gears (ALDFG). Such gear can result in prolonged continuous capture and mortality of marine animals, so-called “ghost fishing” due to use of persistent plastic material in fishing gear construction. This session aims to bring together ideas and previous and ongoing research on marine plastic pollution resulting from fisheries and aquaculture industries or marine operations as well including, but not limited to, pollution rates, ghost fishing, impact of plastic pollution on the marine environment. The session could include a broad range of topics from fishing gear technology related fields up to toxicity caused by microplastics that are resulted from fisheries and aquaculture.

The cost of marine plastics on small-scale fishing communities in Vietnam: situation and solution from local perspectives

Duc Nguyen[1], Thanh Phuong Phan[2], Tu Trinh Quang[2], Michel J. Kaiser[1]

[1] The Lyell Centre, Heriot-Watt University, Edinburgh, Scotland;
[2] Vietnam Institute of Fisheries Economics and Planning, Hanoi, Vietnam

Keywords: plastic pollution, socioeconomic cost, capture fishery

Many studies have been identifying the sources and spatiotemporal magnitude of marine plastic pollution, but little is known about the socio-economic magnitude of its impacts on coastal communities. Plastic litter from oceans and rivers are pressuring coastal fishing communities, causing losses in revenue, increasing occupational risks, and threatening their sustainable livelihood. In this study, we elucidate the socio-economic impacts of marine plastics on small-scale nearshore fishers in three coastal provinces across Vietnam through quantitative and qualitative data from questionnaires, focus group discussions, and stakeholder interviews. The total average cost of marine plastic debris is estimated at 4750±5400 EUR/boat/year, which is equivalent to 14±16% of each fishing boat's annual revenue, and 30±34% of the owner's income. The incurred cost consists of direct costs (labour and gear repair expenses, accounted for 17% of total cost) and indirect costs from reducing catch efficiency (29%) and increasing downtime otherwise spent fishing (54%). Notably, the indirect cost is often overlooked by fishers and previous studies, which resulted in the underestimation of the hidden cost of plastics. Fishers also report the serious health and safety risks associated with accidents and loss of health or life while untangling plastic ropes stuck in propellers. Plastic pollution creates additional pressure on the sustainable livelihood of small-scale fishers on top of existing pressures from overfishing, increase in oil price and conflicts in fishing zones. We also evaluate the fishers' knowledge, attitude, perception of plastic litter and "ghost gears". This fisher ecological knowledge is crucial to identifying the hotspots and solutions to reduce the leakage and occurrence of marine plastics in local contexts. Understanding the costs, opportunities, and challenges of dealing with marine plastics experienced by coastal fishing communities offers important insights for co-designing sustainable interventions, effective policy interventions for plastic pollution mitigations in Vietnam and the world.

Poster Session

Interactions of phytoplankton-microzooplankton in the Elbe estuary under warming

Diana Nicole Puerto[1], Max Lambrecht[1], Sahed Palash[1], Luisa Listmann[1], Arne Aberle-Malzahn[1], Elisa Schaum[1], Nicole Aberle Malzahn[1]

[1] Institute of Marine Ecosystem and Fishery Science (IMF), Universität Hamburg, Germany

Keywords: mesocosm experiments, food-web interactions, grazing experiment, global change

In the context of global warming, the Elbe estuary is experiencing prolonged summer heat stress and earlier spring warming. Understanding the impact of warming on phytoplankton and microzooplankton is crucial for predicting effects on population dynamics, community structure, and carbon fluxes, given the varying responses of autotrophs and heterotrophs to temperature shifts. The phytoplankton community in the Elbe exhibits spatial gradients, with centric diatoms, cryptophytes, dinoflagellates, and an increase in picocyanobacteria during summer; however, knowledge of rates such as primary production and grazing pressure by micro and mesozooplankton is limited. To investigate these changes, a combination of field samplings, dilution experiments, and mesocosm approaches will be employed. Indoor mesocosms in climate chambers will simulate warming scenarios to assess phytoplankton growth, microzooplankton grazing, and carbon flux dynamics. Methodologies include Fluorometry for chlorophyll-α monitoring, oxygen optode for primary productivity assessment, and inverse microscopy for phytoplankton community analysis. Additionally, Flow Cytometry will be used to study heterotrophic nanoflagellates and pico- and nanophytoplankton. This research aims to advance the understanding of food-web interactions in Elbe estuary plankton, providing insights into carbon flow dynamics under climate change. By investigating the responses of phytoplankton and microzooplankton to elevated temperatures, this study contributes to ecosystem resilience and informs strategies for environmental sustainability.

Heatwave intensity drives eco-physiological responses in Wadden Sea infaunal bivalves: A mesocosm experiment

Maren A. Staniek[1], Christian Pansch-Hattich[2], Lisa Shama[3], Knut Mehler[3], Anna Steinmann[4], Jack Middelburg[5], Lukas Meysick[6]

[1] Polar Biological Oceanography Section, Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany;
[2] Environmental and Marine Biology, Faculty of Science and Engineering, Åbo Akademi University, Turku, Finland;
[3] Coastal Ecology Section, Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Wadden Sea Station Sylt, List, Germany;
[4] Kiel University, Kiel, Germany;
[5] Earth Sciences Department, Utrecht University, the Netherlands;
[6] Helmholtz Institute for Functional Marine Biodiversity at the University of Oldenburg (HIFMB), Oldenburg, Germany

Keywords: Wadden Sea, marine heatwaves, intertidal benthos, bivalve physiology, climate change

Marine heatwaves are increasing globally in intensity and duration. To investigate potential consequences for coastal ecosystems, effects of short-term heat stress must be better understood. In this study, eco-physiological responses in two common intertidal bivalves, *Cerastoderma edule* and *Macoma balthica*, to different heatwave intensities were investigated in a land-based mesocosm experiment with tidal simulation and under near-natural environmental conditions. Single-species assemblages were exposed to a 15-day heatwave of either +2.8˚C (mild heatwave) or +4.4˚C (strong heatwave) above ambient. Survival and biomass were monitored, and filtration rates were tested before and during heatwave exposure to investigate feeding behaviour. Further, respiration rates of individual bivalves were measured before, during, and after heatwave exposure as a proxy for metabolic responses. For *C. edule*, we found indications for increased mortality following exposure to the strong heatwave, and elevated filtration rates during the mild but not the strong heatwave. For *M. balthica*, survival was generally high across treatments, but the strong heatwave led to lower condition index (tissue/ shell mass ratio). While we did not observe immediate heatwave effects on respiration for either species, bivalves exposed to the strong heatwave displayed lower respiration rates in its aftermath. This study revealed interspecific differences in response to varying heatwave intensities, and that short-term heatwaves can have persisting negative effects on bivalve metabolism. Further research is needed on potential longterm effects of marine heatwaves on intertidal fauna and their capacity to provide ecosystem services.

Mobilizable dissolved organic matter as a potential substrate for microbes in deep subterranean estuaries

Grace Abarike[1], Simone Brick[1], Bert Engelen[1], Kojo Amoako[1], Hannelore Waska[1], Jutta Niggemann[1]

[1] Institute for Chemistry and Biology of the Marine Environment (ICBM), Carl von Ossietzky University of Oldenburg, Oldenburg, Germany

Keywords: Subterranean estuaries (STE), Deep-STE sediments, Mobilizable dissolved organic matter, Microbial communities, FT-ICR-MS

Subterranean estuaries (STEs) are active organic matter (OM) turnover sites in coastal ecosystems, where fresh groundwater mixes with seawater. In STEs, microbial communities depend on dissolved organic matter (DOM) introduced from fresh groundwater, seawater, and potentially from the stock of organic matter in sediments. However, little is known about the potential contribution of sedimentary OM to the DOM pool that fuels microbial activity in deep STE (> 2 m). We investigated sediment-leached DOM in the deep STE of a high-energy beach on Spiekeroog Island (German, North Sea). A continuous 24 m long undisturbed core was sampled close to the dunes (ML1) and at the highwater line (ML2) during the drilling of multilevel groundwater wells. 5 ml of sediment from core pieces of 1 m was leached with NaCl solution of intermediate salinity (~15). The leachates were analysed for dissolved organic carbon (DOC) concentrations, and ultrahigh-resolution mass spectrometry (Fourier-transform ion cyclotron resonance, FT-ICR-MS) was used to identify thousands of DOM molecular formulae. Sediment-leached DOC concentrations varied down-core in both cores, with particularly high concentrations at depths characterized by dark-gray sediments, suggesting high OM deposition in these layers. We found a distinct difference between the composition of sediment-leached DOM and DOM in groundwater retrieved from the wells. The DOM composition of the sediment leachates was highly diverse and heterogeneous, with up to 3000 different molecular formulae detected at each depth. DOM composition was more variable down-core at ML2, with a higher abundance of unsaturated compounds compared to leached DOM at ML1. Our results suggest that deep STE sediments, although low in total organic carbon concentrations (typically <0.1 %), store a substantial amount of water-mobilizable OM. This DOM fraction provides an additional carbon and energy source for STE microbial communities, and thus affects the distribution and activity of microbial populations in deep STE.

Spatial and genetic differentiation of marine *Planctomycetota* and *Verrucomicrobiota* populations of the North Sea

Nicole Von Possel[1], Rudolf Amann[1], Luis H. Orellana[1]

[1] Department of Molecular Ecology, Max Planck Institute for Marine Microbiology, Bremen, Germany

Keywords: spring bloom, heterotrophic bacteria, spatial differentiation, genetic differentiation, organic matter degradation

Spring phytoplankton blooms result from massive microalgal growth and increase in primary productivity. Upon its collapse, heterotrophic bacteria consume a myriad of released organic matter (OM) in different forms, such as algalderived polysaccharides. Most OM is quickly remineralized, but some polysaccharides, like fucose-containing sulfated polysaccharides (FCSPs), are stable and harder to degrade for most bacteria. Recent studies report that the *Planctomycetota* and *Verrucomicrobiota* phyla can degrade these hard-to-degrade polysaccharides. However, most of what we know about these phyla corresponds to free-living bacteria, and little is known about particle associated *Planctomycetota* and *Verrucomicrobiota*. This study characterized the *Planctomycetota* and *Verrucomicrobiota* populations in different size fractions from the North Sea spring bloom 2018. Based on metagenomic analyses, we observed a spatial differentiation between the two phyla. Metagenome-assembled genomes (MAGs) belonging to the *Verrucomicrobiota* family MB11C04 were abundant in 0.2–3 µm, whereas members of the family *Akkermansiaceae* were abundant in the +10 µm. Additionally, MAGs belonging to *Planctomycetota* family SMA102 were only abundant in the 3–10 µm size fraction. Using a metaproteomic approach, we detected critical components for FCSP degradation that underscore the putative role of *Verrucomicrobiota* in the degradation of these complex polysaccharides. For instance, an increased abundance of fucosidases of glycoside hydrolase family 29 (GH29) and the components of the bacterial microcompartment (BMC) corresponded to two representative *Verrucomicrobiota* MAGs. In addition, using catalyzed reporter deposition Fluorescence in situ hybridization (CARD-FISH), we visualized particle-attached *Akkermansiaceae* cells in the 0.2–3 µm size fraction. The results of this study add to the growing knowledge of the role these phyla play in the degradation of complex polysaccharides in marine environments.

Diatom-bacteria interactions drive glyco-carbon storage

Ella Case[1,2], Jan-Hendrik Hehemann[1,2]

[1] MARUM - Center for Marine Environmental Sciences, University of Bremen, Bremen, Germany;
[2] Max Planck Institute for Marine Microbiology, Bremen, Germany

Keywords: Aggregation, Carbon Sequestration, Diatom, Bacteria, Symbiosis

For hundreds of millions of years, diatoms and bacteria have shared the same ocean environment. Coexisting over this evolutionary timescale has allowed for not only the transfer of genes between these ubiquitous microbes, but also for multitudes of intricate interactions to develop. Such relationships can span from mutualistic to parasitic, and everything in between. These relationships influence the physiology of both organisms. Given the key role these microbes play in global biogeochemical cycles, the effects of such relationships must be fully understood.

Previous work has shown that bacteria are required to enhance the production of extracellular polymeric substances in diatom cultures. This in turn can enhance aggregate formation. Since sinking aggregates are a key component of the biological carbon pump, such diatom-bacteria interactions have important implications for carbon sequestration. Furthermore, work in our lab has shown a certain type of extracellular polymeric substance to accumulate during diatom blooms. This recalcitrant molecule, a fucose-containing sulphated polysaccharide, accumulates in the particulate organic matter pool thereby contributing to the formation of sinking particles.

But why do diatoms put energy and resources into producing a hard to degrade molecule such as this? Could it act as a defensive cell coating, analogous to that of mucins in human bodies. This could be a vital defence mechanism against attacking bacteria. In the proposed poster, I will discuss further how our lab is investigating and developing bioanalytical tools to help uncover the implications of diatom-bacteria interactions on carbon sequestration.

Mysid shrimps as a source of nutrition for Baltic herring (*Clupea harengus membras*) in the northern Baltic Sea

Laura Lammi[1], Katja Mäkinen[1], Marjut Rajasilta[1], Jari Raitaniemi[2]

[1] Archipelago Research Institute, Biodiversity Unit, University of Turku, Finland;
[2] National Resources Institute Finland

Keywords: Baltic herring, Mysid shrimps, Archipelago Sea, Baltic Sea, Climate change

Mysid shrimps (Mysida), a genus of mysid crustaceans, are a great source of nutrition for small pelagic fish such as the Baltic herring (*Clupea harengus membras*). However, changing environmental conditions can affect the amount and quality of mysid shrimp accessible for the herring to prey upon. The Baltic herring's size and condition have decreased in its vital spawning area, the Archipelago Sea, as well as in the fish's overwintering area in the Bothnian Sea. One possible reason for this is the amount of quality food within their living area, nevertheless, our understanding of herring's prey use is limited and outdated. In the present study, the occurrence, diel vertical migration, and size distribution of Mysid shrimps *Mysis relicta* and *Mysis mixta* in the water column of the Archipelago Sea, northern Baltic Sea, are investigated. The study is related to a project investigating the spatial, temporal, and seasonal variation of prey use of Baltic herring in the Bothnian Sea. The initial results indicate that mysid shrimps play an important role in herring nutrition, especially during their growing season in autumn. Smaller mysids were also found to reside closer to the surface both during the day and night. Near the surface, the higher intensity of light is an important enabler for visual predation by Baltic herring. Thus, the size distribution and occurrence of mysid shrimps in different depths affect the amount and quality of nutrition available for Baltic herring. The studies highlight the need for regionally specific information in order to understand climate-driven changes in the ecosystem.

Biodiversity survey of Tunicata with a focus on Ascidiacea in the waters of Heligoland Island, North Sea

Olga Gordetckaia[1]

[1] University of Rostock, Rostock Germany

Keywords: Tunicates, Species distribution, Biodiversity survey, Heligoland archipelago

Ascidians, being key filter feeders, significantly influence the structure and functioning of benthic communities. They contribute to bioturbation and nutrient circulation, creating favourable conditions for marine organism diversity. Global warming, pollution, and human activities impact marine ecosystems worldwide. To better understand how benthic communities have changed over the past centuries in the southern part of the North Sea, I conducted a field study on the coast of the German island of Heligoland and its surroundings, tracking specific marine environments. In this study, I investigated which ascidian species are currently present and how this relates to previous assessments. Some tunicate species still inhabit only specific areas of the coastline, highlighting the need for conservation measures to protect the biodiversity of these unique ecosystems. However, I observed changes in the ascidian species composition on Heligoland over time. While the locality named 'Tiefe Rinne' marks the deepest point in the southern North Sea and remains mostly stable in the species diversity of Ascidiacea, the species richness in the rocky shore has increased. *Botrylloides leachii*, *Perophora listeri*, and *Aphilidium glabrum*, previously found only in harbour areas, are now also living in the rocky intertidal zone. *Clavelina lepadiformis* and *Diplosoma migrans*, detected before at all collection points, were not encountered in my samples at all. These results could be explained by the displacement of certain ascidian species due to the introduction of new species, such as *Morgula manhattensis* in harbour areas, potentially impacting local fouling communities. Additionally, anthropogenic impacts play a role, as ascidians are sensitive to environmental factors near increasing tourist activities.

Diversity and distribution of Ischnomesidae Hansen, 1916 (Crustacea: Isopoda) in the Bering Sea and Aleutian Trench

Katharina Kohlenbach[1,2,3], Andreas Kelch[3,4], Stefanie Kaiser[3], Davide Di Franco[3], Angelika Brandt[3,4]

[1] Alfred-Wegener Institute (AWI), Bremerhaven, Germany;
[2] University of Bremen, Faculty of Biology and Chemistry (FB 02), Bremen, Germany;
[3] Senckenberg Research Institute, Department of Marine Zoology, Section Crustacea, Frankfurt, Germany;
[4] Goethe University Frankfurt, Department of Biological Sciences, Institute for Ecology, Diversity and Evolution, Frankfurt am Main, Germany

Keywords: Taxonomy, Biogeography, Northeast Pacific, Brooders, Deep sea

Examining species distribution in the deep sea across various spatial and depth scales helps us understand how environmental factors shape biogeographical patterns, which is crucial for predicting future changes amid climate change. The aim of this study was to investigate the distribution and diversity of the deep-sea isopod family Ischnomesidae in the northeast Pacific and how it links to environmental drivers. The material came from the AleutBio expedition (SO293), which conducted sampling in the Bering Sea and along the eastern Aleutian Trench (AT). Isopods are one of the most abundant and diverse taxa in deep-sea soft bottoms and the Ischnomesidae represented one of the most dominant isopod families in the samples. Their species delimitation can be difficult due to cryptic species, sexual dimorphism, and damaged specimens so an integrative taxonomic approach was used including both morphological as well as molecular methods. Our findings revealed a high diversity in this family, with 16 morphospecies identified and most confirmed by proteomic fingerprinting. Many were putatively new to science. Comparing the results with data from the adjacent Kuril-Kamchatka Trench (KKT) area in the northwest Pacific showed that abundance levels were similar, yet the trenches differed tremendously since the AT harbours significantly less Ischnomesidae (as well as other mega- and macrofauna) than the KKT. Surprisingly, some morphospecies were able to disperse across the Aleutian Island Ridge and the AT despite that Ischnomesidae, like all isopods, are brooders and have limited dispersal capabilities. The great diversity of species presented in this study underlines the importance of taxonomic work and the necessity to know what is living where, because only known species can be studied and protected.

The richness falls by the fall. An investigation of cryptic snail species microbiome plasticity

Dmitrii Kuriachii[1], Elizaveta Gafarova[1], Ekaterina Zubova[2], Arina Maltseva[1], Andrei Granovitch[1]

[1] Department of Invertebrate Zoology, St. Petersburg State University, St. Petersburg, Russia;
[2] University of Helsinki, Helsinki, Finland

Keywords: bacterial microbiomes, 16S, Littorina, cryptic species, symbiosis

Microorganisms linked to metazoans impact the adaptation of their hosts. Thus, the composition of the microbiome may improve host adaptation to their niche. Adaptation to habitats, which are spatially close but different in ecology, may be mediated by environmental or intestinal bacteria. When characterizing the associated microbiome of sympatric species, it is essential to consider temporal and spatial variations. In our study, we analyzed microbiomes associated with sister snail species, *Littorina fabalis* and *L. obtusata*. We sampled in two remote regions (Barents Sea and White Sea); on the White Sea shore, the samples were obtained in the summer and autumn seasons. The gut samples were obtained individually, while samples of the mantle and environmental biofilms were pooled. The bacterial composition was assessed through 16S-rDNA metabarcoding. Several key findings can be drawn. [1] The microbiomes of the environment and body surface significantly contrasted with those of the gut. Species richness and community evenness were higher in the environmental samples compared to the gut-associated ones. [2] Minor yet significant distinctions were observed in the gut-associated microbiota of the two species under analysis. Notably, the abundance of bacterial lineages associated with *L. obtusata* was notably greater than those specific to *L. fabalis*. [3] Seasonal variability of the gut associated microbiota was strong in both analyzed species. In the autumn, the snail-associated bacterial communities significantly decreased in richness; moreover, between-species differences in the microbiome composition become insignificant in this season.

Environment or host: what shapes the composition of periwinkles microbiomes

Elizaveta Gafarova[1], Dmitrii Kuriachii[1], Marina Varfolomeeva[1], Ekaterina Zubova[1], Arina Maltseva[2], Andrei Granovitch[1]

[1] Department of Invertebrate Zoology, St. Petersburg State University, St. Petersburg, Russia;
[2] University of Helsinki, Helsinki, Finland

Keywords: microbiome, cryptic species, metagenome, antimicrobial peptides, metabarcoding

Multicellular creatures function as holobionts, where an organism and its microbiome work together as a system. The composition of the associated microbiome is influenced by various factors, including the host's diet, immunity, and interactions between the hosted bacteria. This highly flexible system can adapt to even minor differences in an ecological niche or diet changes. In closely related sympatric host species, the spatial differentiation of their populations and feeding preferences determine the spectrum of absorbed microorganisms. This leads to the formation of species specific microbiomes, which may influence speciation. We assessed the bacterial communities associated with several closely related North Atlantic intertidal molluscs (genus Littorina). We analyzed three types of samples: environmental biofilms, snail mantle, and gut samples. Microbial composition was assessed via 16S-rRNA gene metabarcoding, followed by feature identification in the SILVA database. We revealed that intestinal bacterial communities differed significantly from those of the body surface and the environmental ones. We have established how the microbiome varies with seasonal changes and according to trematode infection. We found bacterial taxa common and characteristic of different species and hypothesized their functions. Studies of the antimicrobial activity of host tissues have led us to suggest several proteins potentially involved in the regulation of bacterial microbiomes.

Shifts in the Copepod Community of the Arctic Fjord Nuup Kangerlua

Christian W. G. Detsch[1], Thomas Juul-Pedersen[2], Tobias R. Vonnahme[2], Lorenz Meire[2, 3], John Mortensen[2], Marja Koski[4], Simon Jungblut[1], Mie H. S. Winding[2]

[1] University of Bremen, Bremen, Germany;
[2] Greenland Climate Research Center, Nuuk, Greenland;
[3] NIOZ Royal Netherlands Institute of Sea Research and Utrecht University, Yerseke, The Netherlands;
[4] National Institute of Aquatic Resources - DTU Aqua, Lyngby, Denmark

Keywords: zooplankton ecology, population dynamics, long-term study, West Greenland, Arctic fjord systems

Copepods are key secondary producers of Arctic pelagic food webs. Therefore, long-term changes in their biomass can have far-reaching consequences for the marine food web. Increasing inflow of warm water masses in various Arctic regions has been suggested to lead to a shift from large lipid-rich copepods like *Calanus* spp. and *Metridia* spp. towards smaller copepods that have less lipid reserves. Thus, we studied the change of the copepod community in the Arctic fjord Nuup Kangerlua in West Greenland using a 13-year time series of the eleven most abundant zooplankton taxa that differ in their characteristics such as size, dietary preferences or lipid content. The time series showed abrupt shifts in the biomass of specific taxa indicating three regimes: 1) 2005 – 2008: Overall high biomass, 2) 2009 – 2015: Mostly lower biomass and 3) 2016 – 2018: Regeneration of biomass. These changes coincided with extreme environmental events like a record high heatwave observed in Nuup Kangerlua in 2010, and inflow of water masses from Baffin Bay (2008, 2012 & 2015-17) and the Atlantic Ocean (2009).

A vulnerability of Arctic tidal flats to climate change

Marta Lukasik[1], Lech Kotwicki[1], Sabine Cochrane[2]

[1] The Institute of Oceanology of the Polish Academy of Sciences;
[2] Akvaplan Niva, Norway

Keywords: Intertidal Area, Climate Impact, High Latitude, Benthic Community

This research is of significant importance as it aims to extend the limited knowledge about the abundance and species composition of benthic assemblages on the tidal flats at high latitudes. Moreover, environmental parameters are under study, as they influence living conditions in tidal flats, which are undeniable and can change rapidly under climate change in intertidal Arctic zones. We are focusing on three tidal flats in the Svalbard archipelago and three tidal flats in the Tromsø area. The findings from these studies will significantly contribute to our understanding of this unique habitat type.

Samples from Svalbard were taken in August 2022 and 2023 from Borebukta, Flintholmen areas and Trygghamna in Isfjorden fjord. The observations on Tromsø's tidal flats started in the monthly cycle in June 2022 and are ongoing (according to the weather conditions) in Oldervik, Nordbotn, and Sørlenangsbotn tidal flats.

Our comprehensive research primarily employs a multi-disciplinary approach, focusing on the inhabitants and the factors that impact tidal flats in high latitudes. We are examining the intricate interplay between seabed morphology and climatic impact, which profoundly affects the living conditions in these flats. Our observations encompass ice cover, temperature, salinity changes, and water dynamics in the shoreline zones. We are also collecting samples for various analyses, including qualitative and quantitative macrofauna, meiofauna, E-DNA, sediment chemistry, chlorophyll, and granulometry, to understand this habitat completely.

The study's preliminary findings are compelling, revealing a high heterogeneity of the habitat and biological assemblages depending on the location. The data also suggests that changes in the water level and length of ice coverage may have the most significant effects on tidal flats.

These early insights highlight the urgency of understanding the functioning of this valuable habitat in the Arctic under ongoing climatic changes, making it a critical area for further research.

Diversity and status of fish communities in tidal creeks of the German Wadden Sea

Josephine Lorenzen[1], Katja Heubel[1]

[1] Forschungs- und Technologiezentrum Westküste (Kiel University), Büsum, Germany

Keywords: Climate change, Community assessment, species distribution, Habitat shift

With ongoing change of climate, the Wadden Sea is facing new challenges and it is important to acknowledge the changes that result from this. For many fish species the Wadden Sea functions as a nursery and thus has an important role in fish life cycles in the North Sea. By monitoring certain areas and age classes of fish an effort is made to understand the status of fish in the Wadden Sea. In Germany the two monitoring programs DYSF (Demersal Young Fish Survey) and Schleswig-Holstein stow net provide information about the fish in the German Wadden Sea and are summarized in the Wadden Sea Quality Status report. However, sampling fish in only three (August to October) and one month (August), respectively, the data gives no insight about seasonal variations and only a very small timeframe for long term comparison. In 1983/84, Dieter Piepenburg made the effort to sample fish in the tidal creeks in the North Frisian Wadden Sea from May to October using a beach seine and discovered a remarkable variation in the abundance of different species throughout the study. Other than that, several parameters like species diversity, condition factors, monthly growth rates and the length-weight-relations, were derived from measurements and dissections of the sampled fish. In this study we aim to recreate this assessment of fish communities in two locations and a similar time frame. The first location is a tidal creek near the island Amrum, which was also used for the study in 1983 The other location is a tidal creek near Büsum in Dithmarschen. With this study we collect up to date information about the diversity and status of fish species in the Wadden Sea and how they compare to the data from forty years ago.

Exploring interactions between biological invasions and anthropogenic pollutants on a coastal marine bivalve model

Tania Russo[1,3], Francesca Coppola[2], Carla Leite[2], Debora Paris[3], Lucia De Marchi[4], Valentina Meucci[4], Marianna Carbone[3], Andrea Motta[3], Valeria Maselli[1], Amadeu M. V. M. Soares[2], Carlo Pretti[4], Anna Di Cosmo[1], Ernesto Mollo, Rosa Freitas[2], Gianluca Polese[1]

[1] Department of Biology, University of Naples Federico II, Naples, Italy;
[2] Department of Biology & CESAM, University of Aveiro, Aveiro, Portugal;
[3] Biomolecular Chemistry Institute, National research council, Pozzuoli, Italy;
[4] Department of Veterinary Sciences, University of Pisa, San Piero a Grado, Italy

Keywords: Global Change, *Mytilus galloprovincialis*, Biomarkers, NMR-based metabolomics, Histopathology

Within the context of global change, the Mediterranean Sea is notably susceptible to the impacts of biological invasions, exacerbated by rising temperatures, and anthropogenic pollution. The present study investigated these crucial ecotoxicological issues using *Mytilus galloprovincialis* as a model organism through a multidisciplinary approach. Particular attention was given to caulerpin from *Caulerpa* algae for its potential impact on native fauna. Comparative analyses were conducted between caulerpin and fenofibrate, a known aquatic hazard, given their shared affinity for PPAR receptors. Additionally, synergistic effects of caulerpin and the marine pollutant caffeine were evaluated, given their co-occurrence in marine environments and human diets. The toxicological potential of crude extracts from the invasive calcareous sponge *Paraleucilla magna*, colonizing Mediterranean mussel farms, was also explored. Mussels were exposed to pure metabolites and crude extracts during different assays. Caulerpin and fenofibrate were administered via food at concentrations of 1 mg/g dry food. Mussels were exposed to caffeine dissolved in seawater at the concentration of 3 µL/L while fed with caulerpin. Finally, mussels were fed with food added with a crude extract from P. magna at the concentration of 50 mg/g dry food. Subsequently, biochemical analyses, NMR-based metabolomics, and histopathological examinations were conducted. Results revealed no significant impact of caulerpin on mussels' physiology, while fenofibrate exposure led to negative impacts. Combined exposure to caulerpin and caffeine did not have cumulative effects. Furthermore, *P. magna* diethyl ether and butanol extracts induced significant variations in osmolyte levels and biochemical markers. Overall, the study confirms the harmful effects of fenofibrate and caffeine in marine environments. However, it supports the safety profile of caulerpin, suggesting sustainable exploitation of invasive species biomass for biotechnological applications. Furthermore, it highlights the possible chemical threat posed by P. magna in the Mediterranean Sea, necessitating further research to identify specific sponge metabolites responsible for observed effects.

The impact of heat waves on the reproductive behavior of common gobies (*Pomatoschistus microps*)

Cindy Meyer[1], Katja Heubel[1]

[1] Forschungs- und Technologiezentrum Westküste (Kiel University), Büsum, Germany

Keywords: intertidal fish, reproduction cycle, paternal care, environmental stressor

Marine heatwaves, short periods of extremely elevated sea temperatures, have become increasingly frequent due to global climate change. Understanding their impact on marine ecosystems is crucial for predicting ecological responses. This study investigates the influence of heatwaves on the reproductive behaviour of the common goby (*Pomatoschistus microps*), a small, intertidal fish. Common gobies are one of the most abundant fish species in the Wadden Sea. As a secondary consumer, they play an important role in the food web rendering an essential prey for predators such as commercially fished fish and mammals like seals and harbour porpoises. Therefore, shifts in gobies' reproductive decisions and its population level consequences can be used as an indicator for community changes caused by climate change in the future Wadden Sea. However, not only increased temperature per se, also the seasonal timing of heatwaves during gobies' reproductive cycle may be relevant. We predicted (i) a postponement of mating decisions for heatwaves hitting prior to mating during nest-building and mate choice and (ii) an increased need of paternal care activities and risk of brood loss for heat waves hitting after mating. Through a controlled laboratory experiment, common gobies were exposed to simulated marine heatwave conditions hitting the reproductive cycle at two different sensitive time points of reproductive decision-making: facing a heat wave either during nest building and courtship, or after mating during paternal care. Data on nest building, mating success, clutch size, and paternal care, hatching success and filial cannibalism is and will be collected. Our results will be discussed on how marine heatwaves influence the reproductive behaviour of the common goby, contributing to our understanding of the direct responses of marine organisms to changing oceanic conditions. Such studies are crucial for predicting the resilience of coastal ecosystems in the face of ongoing climate change and can aid in developing conservation strategies and sustainable management practices for vulnerable marine species.

Developing a holistic framework to help guide the EU towards zero pollution

Linda Del Savio[1], Ben Boteler[1]

[1] Research Institute for Sustainability – Helmholtz Centre Potsdam, Germany

Keywords: source to sea approach, marine pollution governance, tyre wear particles, European Seas, European Green Deal

Achieving zero pollution levels in the European Seas as established in the EU's Green Deal through its Zero Pollution Ambition Framework requires practical governance approaches which integrate sustainability goals and circular economy principles into individual policy areas. This integration is necessary to develop effective measures to reduce pollutant emissions and their impact on marine ecosystems. Emerging pollutants, such as tyre wear particles, are particularly challenging for the governance of the marine environment due to their diffuse sources (on land), environmental impacts, poor regulation and existing knowledge gaps. Once emitted, tyre wear particles remain in the environment for a long time and are very difficult to remove. Furthermore, they contain a wide range of chemicals, with damaging effects on ecosystems and species. The Horizon Europe project "Source to Seas – Zero Pollution 2030 (SOSZEROPOL2030)" is developing a holistic stakeholder-led framework to guide the process towards achieving zero pollution levels in European Seas. The project utilises a "source to sea" approach, which considers the sources, pathways, and ecological effects of various pollutants, including tyre wear particles, in order to explore governance responses. The holistic framework builds on the inter- and transdisciplinary concept of the SOS-ZEROPOL2030 project, which includes multi-stakeholder engagement, expert consultations, living labs and brings together expertise from different disciplines (natural sciences, social sciences and human behaviour). An essential step is the analysis of EU governance arrangements (rules of the game, discourses, actors and power relations) in regard to e.g. tyre wear particles to identify the current gaps and challenges within marine pollution governance. Ultimately, the holistic framework will help to provide the necessary building blocks for zero pollution governance that will support the achievement towards the EU's Green Deal and its Zero Pollution Ambition Framework – underpinning the health and resilience of European marine ecosystems.

Killer whale (*Orcinus orca*) fibroblasts: changes in cellular respiration due to PFAS exposure.

Marta del Castillo González[1,2], Odd André Karlsen[1], Anders Goksøyr[1], Sofie Søderstrøm[1], Sara Zamani[1]

[1] University of Bergen, Bergen, Norway;
[2] Basque Country University, EHU, Bilbao, Spain

Keywords: PFOSA, PFOS, metabolism, Sea Horse assay

Killer whales (*Orcinus orca*) are among the most polluted animals in the world due to their position as top predators. Many of the substances they contain are considered "contaminants of emerging concern" (CECs), such as the per- and poly-fluoroalkyl substances (PFASs), including PFOSA (perfluorooctanesulfonamide) and its metabolite, PFOS (perfluorooctyl sulfonate). PFASs are a class of chemicals used in a broad range of consumer products and industrial applications. They have recently received increasing global attention because of their environmental persistence and toxicity, bioaccumulation potential, and possible adverse health impacts. Some of these PFASs have been regulated through the Stockholm Convention, because their persistence in the environment makes them a risk for wildlife. The main objective of this study is to assess if these compounds are affecting the cellular respiration of the killer whales' fibroblasts by in vitro cell culture and exposing them to different concentrations of PFOSA and PFOS. To do this, the Agilent Seahorse XF Cell Energy Phenotype Test is used. This live cell test is a real-time analyser of cellular energy metabolism, which provides a single measurement of the two major energy-producing pathways in live cells, mitochondrial respiration, and glycolysis, allowing the rapid determination of energy phenotypes of cells and investigation of metabolic change.

Hyperspectral PRISMA products for water quality mapping in the South Vietnamese region

Andrea Pellegrino[1,2], Mariano Bresciani[2], Alice Fabbretto[2,3], Emiliana Valentini[4], Serena Sapio[5], Claudia Giardino[2], Francesco Nutini[2], Andrea Taramelli[5]

[1] Department of Civil, Constructional and Environmental Engineering, Sapienza University of Rome, Rome, Italy;
[2] Institute for Electromagnetic Sensing of the Environment, National Research Council (CNR-IREA), Milano, Italy;
[3] Tartu University, Department of Remote Sensing, Tartu, Estonia;
[4] Institute of Polar Science, National Research Council of Italy, 30172 Venice, Italy;
[5] Institute for Advanced Study of Pavia - IUSS, 27100 Pavia, Italy

Keywords: Remote sensing, Atmospheric correction, Algorithms, Turbid waters, Spaceborne sensors

The aim of this study is to promote the use of hyperspectral imagery and develop value-added products in tropical areas to provide additional information supporting trade-off analyses of ecosystem services. In the present study, the hyperspectral PRISMA images (6images-VNIRspectrum-GSD=30m), provided by the Italian Space Agency, were explored to estimate Suspended Particulate Matter (SPM) and turbidity concentrations for the Saigon-Dong Nai Delta area, located in the southern region of Vietnam, close to the metropolitan area of Ho Chi Minh City and included in the Cần Giờ Mangrove Biosphere. The reserve has undergone significant changes in recent years and, due to urban growth and aquaculture practices, is now significantly fragmented. For the purpose of the study, the ACOLITE code was used for atmospheric correction and retrieval of SPM and turbidity concentrations. As input to the code, PRISMA L1 radiance products and PRISMA L2C reflectance products (for automatic metadata extraction) were provided. Thanks to the availability of in situ measurements, it was possible to clarify the optical properties of the water in the study area to define Optical Water Types (OWT) and choose the most suitable algorithms for the different OWT (Moderately turbid waters, Turbid waters and Highly turbid waters). Given the high variability of the SPM concentration (values even higher than 100 g/m^3), the Novoa algorithm was used to generate the maps. According to the OWT classification, in the southernmost area, where the NHA Be river flows towards the coastal area, a distinction between the three classes emerged: from Highly turbid waters to Moderately turbid waters. The SPM and turbidity products obtained confirmed the critical conditions of this study area and highlighted the advantages of using a specific improved algorithm on PRISMA images to study water conditions. Moreover, the study could be extended by integrating products provided from other sensors (e.g., EnMAP).

Estimation of Secchi disk depth based on hyperspectral PRISMA images in Venice Lagoon, Italy

Congju Fu[1,2], Gian Marco Scarpa[1], Vittorio Ernesto Brando[1], Federica Braga[1]

[1] Istituto di Scienze Marine ISMAR-CNR, Venezia, Italy;
[2] Department of Civil, Building and Environmental Engineering, Sapienza Università di Roma, Rome, Italy

Keywords: water clarity; remote sensing; semi-analytical algorithm

PANDA-WATER (PRISMA products AND Applications for inland and coastal WATER) project aims to provide a set of innovative products from PRISMA hyperspectral imagery (30 m spatial resolution) over inland, transitional, and coastal waters. Secchi disk depth (Z_{SD}) is one of the products of interest as a proxy of water transparency, which is a good indicator for inland and coastal water quality. Semi-analytical model was applied to PRISMA data in 2023 to obtain high spatial-resolution maps of water clarity in the Venice Lagoon (Italy). In details, the methodology comprised three steps: i) total absorption (a) and backscattering (b_b) coefficients were retrieved from PRISMA's remote sensing reflectance (Rrs) with Quasi-Analytical Algorithm (QAA); ii) the diffuse attenuation coefficient (K_d) was obtained from a and b_b following the semi-analytical K_d model; iii) Z_{SD} was calculated as minimum K_d at the visible band (400-800 nm). This model was then tested on in situ Rrs acquired with WISP-3 spectroradiometer, and the results were validated with synchronous in situ Z_{SD} measurements. A good correlation was found between the estimated and measured Z_{SD} ($N = 12$, $R^2 = 0.79$, RMSE = 0.40 m). The model was further applied to PRISMA imagery both standard Level 2C (L2C) products and L1 products atmospherically corrected with ACOLITE/DSF model. The preliminary results show that: (1) the obtained spatial distribution of Z_{SD} is quite consistent with in situ measurements ($N = 12$, $R^2 > 0.74$, RMSE < 0.55 m, MAPD < 25%); (2) Z_{SD} derived from PRISMA corrected with ACOLITE/DSF is more reliable in waters close to land, because PRISMA L2C is likely affected by adjacency effects. The methodology will be applied to an extended dataset of PRISMA images, available for the Venice Lagoon, and then spatial and temporal variability of Z_{SD} will be assessed considering optically active water constituents and submerged vegetation.

From Space to Coast: Exploiting Satellite-Derived Water Quality Variables for Climate Studies

Anna Joelle Greife[1], Marina Amadori[1], Mariano Bresciani[1], Laura Carrea[4], Claudia Giardino[1], Luigi Lupo[1], Natalia Lizana[1], Christopher Merchant[2], Monica Pinardi[1], Iestyn Woolway[3], Clément Albergel[4], Rossana Caroni[1]

[1] CNR - Institute for Electromagnetic Sensing of the Environment, National Research Council, Milan, Italy;
[2] Department of Meteorology, University of Reading, Reading, UK;
[3] School of Ocean Sciences, Bangor University, Menai Bridge, Anglesey, Wales;
[4] European Space Agency Climate Office, ECSAT, Harwell Campus, Oxfordshire, UK

Keywords: Global Dataset, Coastal Waterbodies, Climate Change Impacts

Lakes and lagoons are crucial ecosystems with large populations depending on them for a variety of reasons. They are often referred to as sentinels of climate change due to their responses in physical, chemical and biological properties. It is expected that the ongoing global warming will have an even more pronounced impact on biodiversity, nutrient cycling, and hydrology in the future, specifically in regards to increasing extreme weather conditions. Monitoring of such water bodies to understand their complicated behavioural changes is highly challenging to be achieved using in-situ data at a global scale. Here, satellite technologies provide a relevant source of data. The Lakes_CCI project provides the most complete collection of consistent satellite observations for water level, water extent, lake surface water temperature, ice cover, water-leaving reflectance and derived products including chlorophyll-a concentration and turbidity. With the release of version 2.1 the products span from 1992-2022 providing daily data at 1 km resolution for over 2000 relatively large lakes including many coastal lakes and lagoons. Data can be conveniently visualised and explored using the WebGIS interface. So far, within the project six use cases have been explored which investigate long-term timeseries of bio-physical water quality parameters, in view of understanding possible causes of their trends. These use cases include the examination of sentinel lakes of Sub-Sahelian Africa, global shallow lakes, impacts of heatwaves on lakes, and an assessment of climate change impacts on South American lakes. This work is a synthesis of these use cases specifically highlighting the use of Lakes_CCI data for coastal lakes and lagoons.

Integrating moonlight signals in predicting coral skeletal extension along depth gradients

M. Isabel Martinez-Rugerio[1,2,3,4], Gabriela Gutierrez, Susana Enriquez, Juan Pablo Carricart-Ganivet, Roberto Iglesias-Prieto, Iliana B. Baums

[1] Helmholtz Institute for Functional Marine Biodiversity at the University of Oldenburg, Oldenburg, Germany;
[2] Institute for Chemistry and Biology of the Marine Environment, Oldenburg, Germany;
[3] Unidad Académica de Sistemas Arrecifales Puerto Morelos, Puerto Morelos, Mexico;
[4] The Pennsylvania State University, University Park, United States of America

Keywords: Moon, dissepiments, vertical extension, growth model, light attenuation

Coral skeletal extension rate is one of the most commonly reported metrics to assess coral stress responses. However, the lack of physiological knowledge regarding the mechanisms controlling skeletal extension has hindered our ability to predict their responses across environmental gradients. Corals extend vertically as they form structural components called dissepiments. Dissepiment formation is controlled by a moonlight cue and exhibits a binary response: they are formed in the presence of the moonlight stimulus and entirely suppressed when the stimulus is absent. Here, we combine empirical data and theoretical concepts to build a mathematical model capable of predicting changes in coral skeletal extension based on the number of dissepiments. To investigate the relationship between skeletal extension and the number of dissepiments, we performed skeletal analyses on coral cores collected along the vertical distribution of *Orbicella faveolata* in Akumal, Mexico (5-40m). Linear regression analyses showed that the number of dissepiments is a robust predictor of skeletal extension, explaining 86% of its variance. To construct the model, we defined a moonlight depth threshold (Z_{moon}) as the depth at which corals cease to detect moonlight, leading to the cessation of dissepiment formation. Furthermore, we incorporated two main variables impacting Z_{moon}: the light attenuation coefficient (Kd), influenced by factors such as turbidity, and the atmospheric attenuation coefficient (Kd_{at}), governed by atmospheric phenomena like cloud cover. We developed a moonlight-dependent, depth-resolved model for coral skeletal extension and compared patterns in sites with contrasting water clarity. The moonlight-extension model accounted for 70-96% of the variance, indicating that much of the variability in extension rates is driven by the fractional contribution of moonlight availability. These results suggest that moonlight is a key factor in explaining morphological changes in massive reefbuilding corals.

Age determination of the whelk *Buccinum pemphigus* Dall, 1907 using the method of counting statolith growth increments

Olga Khoroshutina[1], Dmitry Artemenkov[1], Denis Sologub[1], Roman Petrochenko[2], Fedor Lishchenko[2]

[1] Russian Federal Research Institute of Fisheries and Oceanography, Moscow, Russia;
[2] A.N. Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences, Moscow, Russia

Keywords: age determination, statolith, gastropoda, grow

The population dynamics, the size-age ratio, the age of mature animals all represent essential matters of fishery management. The key parameter for determining these characteristics is the individual age of the animals, but gastropod studies lack the universal age determination method. The age of some gastropod species is determined using the length frequency analysis, in the case of others, methods based on the application of recording structures are applied. The age of whelks is traditionally determined by the number of operculum increments. However, since operculums are exposed to adverse environmental conditions, the results of increment counting may be unreliable. To address this issue an alternative method based on statolith increment counting was developed. The present study aimed to test this new method for age determination of deep-water whelk *Buccinum pemphigus*. A total of 29 specimens of *B. pemphigus* were caught in 2021 in the north of the Sea of Okhotsk at depths of 193-234 m. All statoliths were extracted, processed and measured following standard methods. The microstructure of statoliths was studied using a light microscope. The age of all molluscs was estimated, and the diameters of the concentric increments were measured. It was found that the microstructure of *B. pemphigus* statoliths is typical for gastropod molluscs: the dark nucleus was located in the center, surrounded by concentric light and dark zones, representing periods of fast and slow growth. Average increment diameter ranged from 40,67 to 347,55 μm. The total diameter of the statoliths ranged from 301 to 383 μm, the number of increments found was 10 to 17. This method provides greater accuracy than operculum-based age estimation, but also requires more time and greater skills of the reader.

The microstructure of *B. osagawai* statoliths: application in age determination

Olga Khoroshutina[1], Roman Petrochenko[2], Fedor Lishchenko[2]

[1] Russian Federal Research Institute of Fisheries and Oceanography, Moscow, Russia;
[2] A.N. Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences, Moscow

Keywords: age determination, statolith, gastropoda, grow

Buccinum osagawai (Habe & Ki. Ito, 1968) is a moderate-sized gastropod mollusc inhabiting Northern Pacific. It is a valuable commercially exploited species, but the quality of its stocks' management is relatively poor, mainly due to a lack of baseline life-history knowledge. In particular, there is no reliable information on the growth rates of the mollusc, its size and age at maturity, and general longevity. These issues are the result of the lack of reliable method for age estimation. At present, the most common method of *B. osagawai* age estimation is counting increments on its operculum, but this approach has serious flaws. Since the operculum serves for the protection of the mollusc's soft body and is exposed to harsh environmental conditions, its readability is pretty low. To cope with these limitations an alternative method of age estimation, statolith increment counting, was developed. The present research aims to test if the statolithbased age estimation applies to *B. osagawai*. Material for this study was collected in the bottom trawl survey in the northern part of the Sea of Okhotsk in September 2021. In total 32 different size class individuals were collected randomly. The statoliths of all individuals statoliths were processed following standard methods. To validate the increment deposition periodicity, increments on opercula were counted as well. All statoliths were globular in shape and had a smooth surface. The statolith diameter varied from 240.5 to 333 μm. All statoliths were successfully read by two readers, and the number of increments varied from 8 to 18. On another hand, the readability of only 69% of opercula increments was considered acceptable. It was possible to preliminarily confirm the annual periodicity of statolith increment deposition, however, additional research is required to test whether this pattern persists in younger and older individuals.

Organic compounds drive growth in phytoplankton taxa from different functional groups

Nele Martens[1], Emilia Ehlert[1], Widhi Putri[1], Martje Sibbertsen[1], C. Elisa Schaum[2]

[1] Institute of Marine Ecosystem and Fishery Science, Hamburg, Germany;
[2] Center for Earth System Research and Sustainability, Hamburg, Germany

Keywords: picophytoplankton, mixotrophy, estuary, green algae

Phytoplankton are usually considered autotrophs, but an increasing number of studies shows that many taxa are able to also utilise organic carbon. Acquiring nutrients and energy from different sources might enable an efficient uptake of required substances and provide a strategy to deal with a varying resource availability, especially in highly dynamic ecosystems such as estuaries. In our study we investigated the effects of 31 organic carbon sources on the growth (proxied by differences in cell counts after 24 h exposure) of 17 phytoplankton strains from the Elbe estuary spanning four functional groups. All of our strains were able to make use of at least 1 and up to 26 organic compounds for growth. Pico-sized green algae such as *Mychonastes* spp., as well as the nano-sized green alga *Monoraphidium* spp. in particular were positively affected by a high variety of substances. Reduced light availability, typically appearing in turbid estuaries and similar habitats, resulted in an overall poorer ability to utilise organic substances for growth, indicating that organic carbon acquisition was not primarily a strategy to deal with darkness. Our results give further evidence for mixotrophy being a ubiquitous ability of phytoplankton and highlight the importance to consider this trophic strategy in research.

Expanding Microalgal Diversity for Cosmeceutical Applications: Cultivation, Bioactivity Screening, and Predictive Analysis

Anagha Kerur[1], Giovanna Santaniello[2], Giovanna Romano[2], Angela Sardo[2], Ida Orefice[2], Alyaa Gaber Gomaa Mohamed Mahmoud[2], Fortune Makinde Siyanbola[1]

[1] Faculty of Sciences, Ghent University, 9000 Ghent, Belgium;
[2] Department of Ecosustainable Marine Biotechnology, Stazione Zoologica Anton Dohrn (SZN), Naples, Italy

Keywords: microalgae, cosmeceuticals, bioactivity screening, biomass production, sustainable skincare

Microalgae hold promise as sustainable sources of bioactive compounds for cosmeceutical applications. This study aims to expand the current understanding of microalgae as cosmeceutical producers. Our approach involves the cultivation of microalga species, some of them endemic from the Gulf of Naples (Campania Region, Italy) focusing on fast-growing strains with high biomass production potential. The study comprises three main objectives: (1) Selection of optimal strains through screening for growth rate and biomass production; (2) Identification of culturing conditions to enhance bioactivity, including stress simulations (nutritional and physical parameters); and (3) Assess the potential of selected microalgal species for antioxidant and/or anti-ageing effects through biochemical assays. We anticipate that strains selected for their high productivity will exhibit enhanced bioactivity under optimized culturing conditions. Additionally, a platform of biochemical assays will be conducted for a fast evaluation of the biological activity of microalgal extracts towards oxidative stress, and for inhibitory activity against enzymes relevant for cosmeceutical applications. This interdisciplinary approach integrates microbiological cultivation techniques with biochemical assays to identify promising candidates for cosmeceutical applications. Results will contribute to the development of sustainable sources of bioactive compounds for the cosmetic industry, fostering innovation in natural product-based skincare formulations.

Potentials of artificial floating wetlands for local water quality improvement and increase of biodiversity

Kazakova Mariia[1], Franziska Stoll[2], Nardine Stybel[2]

[1] IMBRSea master program, Ghent, Belgium ;
[2] EUCC - The Coastal Union Germany, Rostock, Germany

Keywords: ecosystem service assessment, macrophyte growth, sessile organisms on the structure, nature-based solutions

Artificial floating wetlands provide several ecosystem services, e.g. nutrient removal, increasing water transparency, and enhancing biodiversity by creating diverse habitats for birds, fish, and insects. Following up two projects, EU-funded LiveLagoons project and BaMS HaFF (funded by the German Federal Ministry of Education and Research), that aimed at reducing nutrients in eutrophic coastal waters by growing macrophytes/halophyte plants on artificial floating islands, the following research focuses on the ecosystem services provision by the artificial floating wetlands with the case study and application of the assessment table in the Baltic Sea coast of Germany. The methodology included theoretical research and data analysis based on previous research and EU methodology for the ecosystem services assessment. The case study of three previously installed floating wetlands provides an overview of the assessment table application and further focuses on the pilot project development. Additionally, assessments of pilot installations, e.g.: macrophyte growth, survival rates, underwater habitat (e.g. invertebrates, fish in the root system), sessile organisms on the structure, insect fauna on the island, are part of the overall research and are presented as part of the ecosystem service summarization.

Quantifying ROS formation from photosynthesis in *E. timida* and *E. crispata* by optimizing DCF staining.

Roos Buys[1], Vesa Havurinne[2], Stan Dams[1], Paulo Cartaxana[2], Sónia Cruz[2]

[1] Thomas More University of Applied Sciences, Geel, Belgium;
[2] ECOMARE-Laboratory for Innovation and Sustainability of Marine Biological Resources, CESAM – Centre for Environmental and Marine Studies, Department of Biology, University of Aveiro, Aveiro, Portugal

Keywords: Photosynthesis, Reactive Oxygen Species (ROS), Sacoglossan sea slugs, Kleptoplasty, High light stress

'Solar-powered' sacoglossan sea slugs have the unique ability to seize and preserve functional chloroplasts from the algae they consume while degrading other cell components, a phenomenon known as kleptoplasty. Various species in the genus Elysia can maintain photosynthetically functional chloroplasts for weeks or months. Despite the benefits of photosynthesis, exposing chloroplasts to light can lead to the formation of Reactive Oxygen Species (ROS), that potentially harm cell processes. In algae, several mechanisms are known to reduce ROS production, which prompts the question: how do sea slugs keep them to a minimum? We have started the optimization of inspecting general ROS accumulation using 2',7' Dichlorodihydrofluorescein Diacetate (DCF-DA). Two species of photosynthetic sea slugs, *Elysia timida*, and *Elysia crispata*, were compared to each other by exposing them to different red-light treatments. It is known that *E. timida* is more efficient in dealing with high light stress than *E. crispata*, but the specifics of ROS production in these animals are lacking. The results suggest that most ROS detected by DCF during high light exposure in *E. timida* are of photosynthetic origin. Surprisingly, the order of magnitude of ROS production in high light seems similar between the two slug species, indicating that the better tolerance of *E. timida* might not be attributable to ROS management. However, the light response of ROS production shows that the DCF signal might be saturated already at medium light, suggesting that a detailed time response of ROS production is needed to find the dynamic range of DCF-based ROS detection in these animals. This research is the first step in a bigger project that will shed light on the mechanisms by which sea slugs deal with ROS formation in high light stress, which can give us insights into their remarkable ability to maintain stable photosynthesis inside their animal cells.

I can't live without you - or can I? The influence of bacteria on the growth of marine benthic diatom biofilms

Anja Ruhl[1,2], Lena Keller[1,2], Christina C. Roggatz[1,2]

[1] Faculty 2 Biology & Chemistry, University of Bremen, Bremen, Germany;
[2] UFT – Center for Environmental Research and Sustainable Technology, University of Bremen, Bremen, Germany

Keywords: marine chemical ecology, microbial community, chemical communication, interactions

Marine biofilms are both ubiquitous and curious entities, harboring a variety of microorganisms that contribute to primary production and drive biogeochemical cycles at the same time while sharing this communal habitat. Diatoms and bacteria have co-occurred in biofilms for millions of years and developed mutualistic, facilitative, but also antagonistic interactions likely mediated through different metabolites and signaling molecules. However, the importance of diatombacteria interactions for growth and stability of marine benthic biofilms have not been conclusively studied to date. We therefore aimed to determine how the presence or absence of bacteria and their compounds influences biofilm growth and stability over time by comparing biofilms grown from xenic (i.e., with associated bacteria) and axenic (i.e., bacteriafree) cultures of three different monoclonal diatom strains. Axenic diatom cultures were obtained by treating xenic biofilm-forming diatom cultures with a mixture of antibiotics. For comparative quantification and monitoring of biofilm biomass, growth and stability over time, experiments were set up in 24-well-plates and we used three different methods employed over at least 14 days: (1) manual counting of cells using a microscope and counting grid, (2) in vivo measurements of chlorophyll a fluorescence, and (3) fluorometric determination of chlorophyll-a content after acetone extraction. The results of our study indicate different growth patterns for different diatom strains and show how the biofilm is affected by the presence or absence of the associated microbiome. These findings provide useful insights into the importance of the associated microbiome of diatoms for biofilm growth and stability and can serve as a first baseline for further investigations into their exchange of metabolites and signals.

Deciphering short-term polysaccharide dynamics in a model diatom

Margret Menke[1,2], Tilmann Harder[3], Greta Reintjes[3,4]

[1] University of Bremen, Bremen, Germany;
[2] Helmholtz Graduate School for Polar and Marine Sciences (POLMAR), Bremerhaven, Germany;
[3] Alfred Wegner Institute, Bremerhaven, Germany;
[4] Max Planck Institute for Marine Microbiology, Bremen, Germany

Keywords: Carbohydrates, Diatom, Chemical Ecology, Degradation

Chaetoceros socialis, a ubiquitous bloom-forming diatom, has been shown to produce a complex fucose-containing polysaccharide which remains largely undegraded during Helgoland blooms. We are trying to further understand the carbohydrate profile of this alga in culture through analytical chemistry (mass spectrometry and nuclear magnetic resonance). Based on the results, we will study the degradability of said polysaccharides by well-characterized bacterial strains with the help of fluorescently-labeled polysaccharides. To test environmental relevance of the culture experiments, we will also try to track observed patterns of production and degradation in the field. Overall, we aim to contribute to the detailed understanding of short-term polysaccharide dynamics during phytoplankton blooms based on the example of a model alga and its microbiome.

Assessing nitrogen-fixing bacterial groups in *Orbicella faveolata* from the Mexican Caribbean for their application as potential probiotics during coral breeding.

Amanda Pérez-Trejo[1], José Q. García-Maldonado[1], Anastazia T. Banaszak[2]

[1] Center for Research and Advanced Studies of the National Polytechnic Institute, Merida Unit, Mexico;
[2] National Autonomous University of Mexico, Institute of Marine Sciences and Limnology-Academic Unit of Reef Systems, Mexico

Keywords: 16s rRNA, *Orbicella faveolata* culture, diazotrophs, microbiome, Mexican Caribbean

Orbicella faveolata (OFAV) is a reef-building species which has been bred using assisted fertilization in the Mexican Caribbean. High mortalities of coral settlers have led to efforts to reduce post-settlement mortality under cultured conditions. The aim of this this study was to identify microorganisms involved in the nitrogen-fixing process in lab-bred OFAV samples, through 16s rRNA high-throughput sequencing, and compare them to cultured OFAV that had been outplanted onto the reef. Bioinformatic analyses indicated that among the ten most abundant bacterial orders, two (Cyanobacteria and Rhizobiales) corresponded to nitrogen fixers and they appear to be less prevalent in the reef environment compared to those bred in aquaria. Instead, for OFAV outplanted onto the reef, there was greater abundance of Cytophagales and Flavobacteriales, which have previously been reported for their potential to break down algal walls, suggesting that they may potentially affect the zooxanthellae. Functional prediction analysis revealed that aerobic conditions play a significant role in metabolic processes observed in both cultured and reef environments. The most representative nitrogen-related processes across samples were nitrogen respiration ranging from 1-3% in the reef environment, nitrogen fixation ranging from 3-5% under culture conditions, and nitrate reduction ranging from 5-7% in the reef environment. Another significant process essential for coral growth, such as photosynthesis, ranges from 5-10% in culture conditions, compared to a range of 1-5% in the reef environment. As a preliminary conclusion, the limited presence of nitrogen-fixing groups and nitrogen cycling processes within the reef environment suggests that the utilization of potential probiotics to enhance the nitrogen-fixing process during culture of coral settlers may yield benefits to enhance growth and health of recruits prior to outplanting.

Studying the thermal tolerance of deep-sea corals in the Northwest Atlantic Ocean

Maria Rakka[1], Anna Metaxas[1]

[1] Department of Oceanography, Dalhousie University, Halifax, NS, Canada

Keywords: Deep-sea, Benthic, Climate change, Warming, Ecophysiology

Corals are essential ecosystem engineers in the deep sea where they sustain high biodiversity by forming three dimensional structures that provide habitat for several invertebrate and fish species. Climate change is posing increasing pressure on deep-sea ecosystems, however, its potential effects on coral communities remain uncertain, as most physiological studies to date have focused on a few species. The present study envisions filling this knowledge gap for understudied species in the NW Atlantic, a region that has been characterized as a climate change hotspot due to extreme warming. We aim at studying the thermal tolerance of selected deep-sea coral species, to better understand their potential responses to future warming. Our study takes place at the continental shelf and slope off New England (US) and Nova Scotia (Canada), which host rich deep-sea coral communities. Corals were maintained in aquaria under different temperature conditions and coral physiological performance was quantified by measuring coral respiration, polyp activity, and food capture. Our study is the first to provide comprehensive results on thermal tolerance of deep-sea corals in the NW Atlantic, contributing significantly to physiological knowledge, and leading to a more holistic understanding of climate change impacts on deep-sea ecosystems.

The population structure of *Trapezia* crabs on early stages of coral reef ecosystem development

Vadim Merkin[1]

[1] Institute of Ecology and Evolution A.N. Severtsov of the Russian Academy of Sciences, Russia

Keywords: crabs, corals, reef ecology

Many works dedicated to symbiotic crabs' biology appeared last time. It has been shown that *Trapezia* crabs mostly occur in pairs, one pair occupies one colony. However, the population structure of earlier stages of community development has not been clearly researched. In my research, two spieces of the genus *Trapezia* have been observed, *T. septata* and *T. serenei*, during a long-term experiment. Fragments of coral *Pocillopora verrucosa* were set on metal frames at four meter depth in Nha Trang bay, Vietnam during two expositions. Each exposition included 200 colonies. The first exposition lasted 3 months, the second one 9 months. Then, all colonies were sampled and their symbionts were observed. The following parameters of studied crabs were measured: number, sex, fecundity. *T. septata* specimens inhabit much more colonies of the 3 months exposition than *T. serenei* ones, making much more pairs and ovigerous females. On the second exposition, both studied species drastically increased in number, and the population structure of both *T. septata* and *T. serenei* looks similar because both species contain many pairs and ovigerous females. The difference between two populations of *Trapezia* species on the 3 months exposition, which decreases on the 9 month one, suggests that there are two different strategies of colonization – opportunistic and specialized for *T. septata* and *T. serenei*, respectively. The data obtained from this population biology research could be important for the development of future coral reef conservation strategies and coral recovery programs. To know how to conserve or recover a coral reef, you have to know how a population of coral-associated fauna forms. This presentation was funded by RScF grant 24-14-00288.

Nature-based Solutions (NbS) to enhance coastal ecosystem resilience: development of a conceptual model to mitigate marine pollution.

Gardawheh Gad Boe[1], Vânia Serrão Sousa[2]

[1] University of Algarve, Faro, Portugal; [2]University of Algarve, Faro, Portugal;
[2] Center for Environmental and Sustainability Research & CHANGE - Global Change and Sustainability Institute, Lisbon, Portugal

Keywords: Habitat restoration, Habitat degradation, Green infrastructure, Ecosystem services, Sustainable blue economy

Coastal ecosystems, such as mangroves, salt marshes, and coral reefs, offer numerous benefits such as flood protection, erosion control, habitat preservation, and carbon sequestration. However, these areas are facing unprecedented challenges mainly due to climate change and human activities contributing to marine pollution which threatens ecosystem integrity resulting in habitat degradation and loss weakening the natural ecosystem resilience. Implementing well-crafted nature-based solutions (NbS) can support the restoration and recovery of degraded coastal ecosystems and mitigate marine pollution while increasing economic and societal benefits cost-effectively and sustainably. The proposed model offers an approach in which a suit of NbS can be selectively implemented targeting specific goals in an area-specific context and highlighting ecosystem benefits to people and communities. For instance, combining the rehabilitation of critical habitats such as seagrass and saltmarsh to enhance carbon sequestration and nutrient/pollution bio-remediation with the management of coastal habitats to preserve biodiversity and protect people from extreme weather events while increasing material benefits in a sustainable blue economy context. The proposed study will conduct a comprehensive assessment of the effectiveness of NbS, such as habitat restoration, green infrastructure, and ecological engineering, in reducing pollution impacts and promoting long-term environmental sustainability. The conceptual model will highlight pathways for the effective implementation of NbS, contribute to the knowledge surrounding coastal resilience, and provide practical guidelines for coastal management and planning.

How is biodiversity assessed and monitored in European seas? - A literature map

Anika Happe[1], Maren Striebel[1], Helmut Hillebrand[1,2,3]

[1] Institute for Chemistry and Biology of the Marine Environment (ICBM), University of Oldenburg, Wilhelmshaven, Germany;
[2] Helmholtz-Institute for Functional Marine Biodiversity at the University of Oldenburg (HIFMB), Oldenburg, Germany;
[3] Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI), Bremerhaven, Germany

Keywords: biodiversity, policy frameworks, ACTNOW, assessment, monitoring

Climate change and anthropogenic disturbances are precedingly impacting natural marine ecosystems and the biodiversity that they preserve. Assessing and monitoring the status and trends in biodiversity changes is the most effective way of bringing the urgency of the conservation of these ecosystems to policymakers and regulators directly in charge of implementing sustainable development. Nevertheless, the landscape of international, regional, national and sub-national biodiversity assessment frameworks is complex with many different approaches and tools in use for assessing biodiversity. This systematic literature map aims to present a structured overview of the applied frameworks, the spatial and temporal resolution of biodiversity monitoring and identify gaps in coverage of biodiversity assessment in terms of ecosystem components (i.e., organism group) or regions. The results describe the current state of how biodiversity assessment and monitoring is conducted in European waters. This ultimately helps to understand the differences in assessment and monitoring strategies, and to build the base for identifying potentials for further development and harmonizing strategies in biodiversity assessment and monitoring across Europe.

Economic viability of seaweed and sea cucumber tank culture in IMTA with oysters or milkfish on Zanzibar, Tanzania

Markus Bernard[1,2], Hafzur Rahman[1,2], William Mangile[1,2,3], Flower E. Msuya[4], Andreas Kunzmann[1,2]

[1] Leibniz Centre for Tropical Marine Research, Bremen, Germany;
[2] University of Bremen, Bremen, Germany;
[3] School of Aquatic Science and Fisheries, University of Dar es Salaam, Dar es Salaam, Tanzania;
[4] Zanzibar Seaweed Cluster Initiative, Zanzibar, Tanzania

Keywords: Aquaculture, integrated polyculture, cost-benefit ratio, RAS, social viability

New and sustainable aquaculture systems need to be developed in order to meet the ever so increasing demand for food. In developing countries especially, there is a great need for sustainable yet low-cost aquaculture to provide local farmers with food and income. This study looked at the co-culture of seaweed and sea cucumbers under different conditions, including integrated multitrophic aquaculture (IMTA) systems with oyster and recirculating aquaculture systems (RAS) with milkfish, in Zanzibar, Tanzania. Seaweed production was especially aggravated by the ice-ice disease, resulting in specific growth rates (SGRs) between 1.32 and -1.96 % d^{-1}. Nitrogen content in the seaweed thallus and inorganic nutrients in the water showed good results, thus demonstrating the potential of seaweed to be used as a biofilter. An economic analysis showed the economic viability of IMTA systems, co-culturing *Kappaphycus alvarezii*, *Holothuria scabra* and *Pinctada margaritifera*, achieving a maximum benefit-cost ratio (BCR) of 1.61 over one year. Furthermore, interviews with local farmers on Zanzibar showed their willingness to accept new aquaculture systems. However, the farmers also aired a lot of constraints, such as a lack of infrastructure, funds and expertise.

Navigating Complexity: An Analysis of Coastal and Marine Governance in Europe

Thanne Walawwe Gedera Fathima Mafaziya Nijamdeen[1,2], Raoul Beunen[2], Ansje Lohr[2]

[1] Department of Environmental Sciences, The Open University of the Netherlands, Heerlen, the Netherlands;
[2] Systems Ecology and Resource Management Research Unit (SERM), Department of Organism Biology, Université Libre de Bruxelles - ULB, Brussels, Belgium

Keywords: Ecosystem dynamics, Policy challenges, Environmental resilience, Interdisciplinary strategies

Coastal and marine environments are dynamic systems spanning terrestrial and marine realms, presenting significant challenges for policy formulation and implementation. This study examines European Union (EU) policies regulating coastal and marine ecosystems from an evolutionary perspective. Given the complexity and sensitivity of European regional seas, regional conventions may offer more effective governance. However, studies show that current legal frameworks often fail to incorporate recent scientific knowledge, needs of the coastal communities and stakeholder perspectives on coastal and marine socio-ecological systems management. Recognizing the need for an integrated approach, regional governments acknowledge the importance of cohesive coastal and marine policies. Traditional institutions have weakened under sectoral rationality, necessitating a shift toward a complex systems approach. The Marine Strategy Framework Directive represents a significant step in this direction, promoting a holistic view of EU marine systems. Additionally, the EU is developing comprehensive coastal and marine policies to enhance environmental protection measures. For instance, in 2024, the European Council formally adopted the "Nature Restoration Law," the first regulation aimed at restoring nature. This law aims to restore at least 20% of the land and sea regions in the EU by 2030, and by 2050, it seeks to cover all ecosystems in need of restoration. Despite these advancements, challenges persist due to ambiguous system boundaries and various dependencies, including path dependencies, interdependencies, goal dependencies, and material dependencies. These challenges demand multidisciplinary and cross-sectoral approaches. Through our analysis, we present the evolution of various policies and laws related to coastal and marine conservation in Europe and discuss the implications and development of legal measures. We believe that sustainable development and preservation of coastal and marine ecosystems require coordinated efforts to negotiate these complexities among member states and beyond.

Evolution of Mangrove Management Strategies in Sri Lanka: A Historical Perspective

T.W.G.F Mafaziya Nijamdeen[1], T.W.G.F Ashara Nijamdeen[2], Thahira Thajudeen[3], Viraj Gunarathne[4]

[1] The Open University, Heerlen, The Netherlands;
[2] University of Bonn, Bonn, Germany;
[3] University of Peradeniya, Peradeniya, Sri Lanka;
[4] University of Wuppertal, Wuppertal, Germany

Keywords: Mangrove management, Conservation, Sri Lanka, Ecosystem-based management, Community engagement

Mangrove ecosystems are important coastal habitats globally, providing numerous ecological, economic, and social benefits. Sri Lanka, has extensive mangrove forests along its coastlines. Over the past 50 years, the management of these mangroves has evolved significantly in response to changing environmental, economic, and social dynamics. We studied the historical trajectory of mangrove management in Sri Lanka, examining key milestones, policies, and practices that have shaped its evolution. Initially, mangroves were often viewed as wastelands, subjected to deforestation for various purposes, including agriculture, aquaculture, and urban development. However, with growing recognition of their ecological importance, conservation efforts began to emerge in the mid to late 20th century. The 1970s witnessed the establishment of protected areas and the enactment of legislation aimed at conserving mangroves. These efforts intensified in subsequent decades, with a shift towards more holistic approaches that integrated conservation with sustainable resource use and community engagement. The importance of mangroves in coastal protection, carbon sequestration, and fisheries support became increasingly recognized, driving the adoption of ecosystem-based management strategies. After the Indian ocean Tsunami in 2004 the importance of mangrove ecosystems were highly recognized. In recent years, there has been a notable emphasis on participatory approaches, involving local communities, NGOs, and government agencies in mangrove conservation and restoration initiatives. The role of traditional knowledge and practices has also gained prominence, complementing scientific expertise in mangrove management. Despite these advances, challenges persist, including habitat degradation, pollution, and climate change impacts. Addressing these challenges requires continued collaboration, innovation, and adaptive management approaches. Moreover, integrating mangrove conservation into broader coastal management frameworks is essential. We examined mangrove legislation and conservation methods in Sri Lanka along with insights into the evolving paradigms of mangrove management in Sri Lanka, highlighting lessons learned, best practices, and future directions for sustaining these invaluable coastal ecosystems.

Beyond Marine Paper Parks? Evaluating the Success of German Marine Protected Areas in the North Sea

Natascha Jaspert[1], Jessica MacCarthy[2], Elizabeth P Pike[2], Jaime S Davies[1], Awantha Dissanayake[1]

[1] University of Gibraltar, Gibraltar, UK;
[2] Marine Conservation Institute, Seattle, Washington

Keywords: The MPA Guide, Germany, Natura 2000, 30by30

Measuring and understanding the concept of 'success' of marine protected areas (MPAs) is critical to effective marine conservation, as in recent decades, MPAs have become a key tool for achieving conservation goals. International commitments, like the Kunming-Montreal Global Biodiversity Framework which aims for 30 % global coverage of MPAs by 2030 (30x30), fuel the rapid designation of MPAs; however, less consideration is often given to evaluating if MPAs are effectively and equitably managed. Worldwide, a lack of MPA management has created a multitude of 'Paper Parks' that do not afford meaningful protection, making it imperative to measure the success of MPAs to avoid overestimating the outcomes of established marine protection. Germany has contracted to many ambitious goals for marine protection, however, a clear assessment of German MPA success is missing. The present research aims to (1) assess six German MPAs in the North Sea using The MPA Guide Framework to determine their likely outcomes and (2) highlight progress and potential barriers to MPA success in Germany. The MPA Guide assessments demonstrated that approximately 80 % of German MPAs are actively managed demonstrating transnational collaboration, adaptive management and continual monitoring. However, most provided little protection (90 %) from human activities with eight MPAs or zones found to be incompatible with MPA conservation objectives. The main barriers impeding MPA success included the tedious and long enduring processes to establish cohesive regulations in Germany on regional, national and EU levels, exhausting transnational collaboration and the vague phrasing in some management plans. If MPA governance and management continue in their current state, these shortcomings could hinder Germany from meeting international commitments including the 30x30 goal. Although the complexity of governance will persist, Germany could strengthen marine conservation in the future by incorporating human dimensions further, creating transparent management, building capacity and setting realistic and clear goals.

Using photo voicing and mental modeling to identify climate change effects to coastal tourism; case study of Kilifi, Kenya

Lucy Atieno[1]

[1] Leibniz- Centre for Tropical Marine Research (ZMT), Bremen, Germany

Keywords: marine socio-ecological systems, participatory methods, tourism

This study explores the use of photo voicing and mental modeling as participatory methods to capture local observations of climate change effects on coastal tourism. It considers gender-related factors and contributes to filling a gap for locally held knowledge. There is a growing recognition in research that locally held knowledge remains under represented in conventional climate change discourses. Observations by women working in tourism in Kilifi, coastal Kenya, provided a livelihood context to frame concepts of climate change in the data-poor socio-ecological system. This was taken as one of the perspectives of local knowledge that reflects climate effects to coastal tourism. Results show climate change effects commonly associated with tourism in the marine socio-ecological system, differences in data focus when using photo voicing and mental modeling as participatory methods, and the convergence of these data on gender-related themes.

Inter-generational diversity is the key to the UN Ocean Decade: The ECOP National Node of Germany, Austria and Switzerland

Cora Hörstmann[1], Laura Meyer[2], Tristan de Silva e Ornelas[3], Kim Nierobisch[4], Nuri Max Steinmann[5], Anabel von Jackowski[6]

[1] Alfred-Wegener Institute for Polar and Marine Research, Bremerhaven, Germany;
[2] Utrecht University, Utrecht, Netherlands;
[3] University of Aveiro, Aveiro, Portugal;
[4] Kiel University, Kiel, Germany;
[5] Blue Action Fund, Berlin, Germany;
[6] Microbial Oceanography Laboratory, Banyuls-sur-Mer, France

Keywords: early career, network, action

The United Nations Decade of Ocean Science for Sustainable Development is a global framework aimed at shaping "the science we need for the ocean we want" between 2021-2030. Science-based solutions must be continuously developed and implemented to attain a healthy, protected, and sustainably managed ocean. An integral component of achieving the outcomes of the UN Ocean Decade involves early career ocean professionals (ECOPs). ECOPs are individuals with ten years or less of professional experience in any field related to the ocean and are uniting as part of the UN-endorsed "ECOP Program". The ECOP Program is a network of nodes that bring together individuals from a country or region. For example, the node "ECOP-Germany, Austria, and Switzerland" (ECOP-GER/AUT/CH) is a space to connect ECOPs living in German-speaking countries. Since its launch in December 2023, the node has been a platform for ECOPs to make their voices heard during joint meetings and in writing through our survey. The survey provides insight into the background and future needs of around 50 individuals within our node. Here, we present the results from the survey and the goals set by ECOP-GER/AUT/CH as we create a shared vision of a strong network that connects ECOPs from different sectors of the ocean community, promotes knowledge exchange, and innovation. Our support for the transfer of knowledge within the ECOP community reflects a commitment to collaboration and engagement in sustainable ocean science and development. Join the network and contribute to the change the ocean needs and deserves!

Integrating the 3rs principles for wild invertebrate conservation: a holistic approach to marine ecosystem sustainability

Emanuela Cirillo[1], Mariangela Norcia[1], Valeria Maselli[1], Gianluca Polese[1], Anna Di Cosmo[1]

[1] Biology Department, University of Naples Federico II, Naples, Italy

Keywords: Marine environmental protection, International legal regime, International maritime organizations

Marine invertebrates, constituting a diverse and ecologically vital group, are increasingly threatened by human activities such as overfishing, habitat destruction, and climate change. Despite their ecological significance, conservation efforts for these species have historically lagged behind those for vertebrates. This study proposes adapting the 3Rs (Reduction, Replacement, and Refinement) principles, commonly employed in animal research, to improve conservation strategies for wild invertebrates. Initially championed by cephalopod conservation initiatives, this movement is expanding to encompass a broader spectrum of marine invertebrates. Leveraging insights from existing legislation and conservation associations, the research examines the applicability of the 3Rs principles to wild invertebrate conservation. As an example, we examined the fishing practices for *Octopus vulgaris*, where concepts of animal welfare are applied to an activity conducted in the wild. This innovative approach aligns with evolving conservation efforts, highlighting the importance of considering the ethical and humane treatment of marine invertebrates in wildlife management practices. Through the integration of the 3Rs principles, a more holistic and sustainable approach to marine conservation can be achieved, ensuring the well-being of both animals and ecosystems. Advocacy from organizations such as the Marine Conservation Society and the World Wildlife Fund underscores the urgency of protecting marine invertebrates and their habitats through holistic conservation approaches. Reduction strategies, including catch quotas and marine protected areas, aim to alleviate population pressure. Replacement efforts seek to promote sustainable livelihoods, reducing reliance on invertebrate resources. Refinement focuses on adopting humane harvesting methods to minimize stress and mortality. Collaboration among stakeholders, encompassing governments, conservation groups, and local communities, is essential to ensure the viability of invertebrate populations and the resilience of marine ecosystems for future generations.

Exploring the bioactive potential of invasive seaweeds in the Mediterranean Sea

Carmela Celentano[1,2], Rubina Paradiso[3], Giorgia Borriello[3], Stefano Vianello[4], Paolo Ardizio[2], Gianna Falascina[2], Angela Marino[1,2], Debora Paris [2], Marianna Carbone[2], Maria Letizia Ciavatta[2], Andrea Motta[2], Federico Capuano[3], Gianluca Polese[1], Vincent Laudet[4], Ernesto Mollo[2], Fabio Di Nocera[3]

[1] Dipartimento di Biologia, Università di Napoli Federico II, Napoli, Italy;
[2] Istituto di Chimica Biomolecolare, CNR, Pozzuoli, Italy;
[3] Istituto Zooprofilattico Sperimentale del Mezzogiorno, Portici, Italy;
[4] Marine Research Station, Institute of Cellular and Organismic Biology (ICOB), Academia Sinica, Taipei, Taiwan

Keywords: Natural metabolites, invasive species, model organisms, palatability

Invasive seaweeds pose a critical threat to the biodiversity of the Mediterranean basin, given their enormous biomasses and disruptive impact on local ecosystems. These organisms harbour natural metabolites with diverse bioactive properties, holding significant potential across various industries such as nutraceutical, pharmaceutical and agricultural activities. Specifically, bisindole caulerpin and sesquiterpene caulerpenyne from *Caulerpa cylindracea*, and flavone apigenin isolated from *Halophila stipulacea*, are of particular interest in this study. Bisindole caulerpin exhibits various biological activities relevant to food science and pharmacology, including its role as a peroxisome proliferator-activated receptors (PPARs) agonist and its influence on fish metabolism, food intake, and reproductive function. Caulerpenyne demonstrates antibiotic properties against gram-positive bacteria, making it a potential candidate for combating bacterial pathogens. Apigenin is renowned for its health-promoting effects and nutritional benefits. This study assesses the palatability and effects of caulerpenyne and apigenin on *Danio rerio* (zebrafish), a widely used model for studying aquatic vertebrate physiology and nutrition. Additionally, caulerpin's impact is evaluated on marine model fish species, *Amphiprion clarkii* and *A. ocellaris*. The effects of these phytochemicals on fish metabolism and intestinal microbiota composition are analyzed using visual observations, metabolomics, and metagenomic sequencing approaches, including palatability tests to assess the acceptance and consumption of the compounds by the fish. The high palatability of both compounds underscores their potential value for the potential valorization of marine invasive species in nutraceuticals and aquaculture applications. Further research on bioactive metabolites from these species could promote their sustainable utilization in nutraceutical and aquaculture practices, contributing to both environmental conservation and economic development.

Disentangling the effects of particle displacement and sound pressure on three copepod species

Franziska King[1], Karen de Jong[2], Emilie Hernes Vereide[2], Katharina Foerster[1]

[1] University of Tuebingen, Tuebingen, Germany;
[2] Norwegian Institute of Marine Research, Bergen, Norway

Keywords: zooplankton, anthropogenic noise, seismic surveys, mortality

Anthropogenic noise in the ocean is an increasing problem for marine fauna. Unintentional sound, such as shipping noise from vessels, as well as intentional sound from military sonar or seismic surveys, can cause several problems for marine organisms. Many marine organisms are able to produce and perceive sound and they often depend on the underwater soundscape for migration, mating and finding food. These essential activities can be hindered by anthropogenic noise overlapping the natural soundscape. High-impact anthropogenic noise, such as that produced by seismic surveys, can directly harm marine organisms. The potential impact of anthropogenic sound on marine organisms in general is poorly researched. Marine mammals are considered the most extensively studied group, followed by fish. The least explored group are marine invertebrates, although a huge part of the marine fauna consists of invertebrates. An essential component of marine invertebrates is zooplankton, with copepods comprising the majority. Copepods play an important role in marine ecosystems linking different trophic levels in marine foodwebs. Copepods are able to perceive sound with their mechanoreceptors placed on their body, on their antennules and their telson. Despite their crucial role in marine foodwebs little is known about the influence of anthropogenic noise on copepods mortality, the potential physiological impact and influence on behaviour. Underwater sound is characterized by particle displacement and sound pressure fluctuations. By using a pressure chamber it was possible to partially separate the sound components sound pressure and particle displacement and to investigate the impact on direct mortality and behaviour on three different copepod species. The aim was to understand better if and how copepods might be affected differently by different parts of underwater sound. No difference in mortality was observed immediately following the treatment, nor approximately 24 hours later. This could support previous findings of copepods being relatively robust.

Wednesday
18th September 2024

Program - Wednesday, 18th September 2024

08:00 — **Registration**

08:30 — **Keynote**

Unlocking the Future of Marine Research Through Effective Data Management

Gauvian Wiemer,
Deutsche Allianz für Meeresforschung

Lecture Hall

09:30

Session 1.5
Fish in a Changing World: Exploring How Climate Change Shapes Fish and Their Homes

Session Hall A

Session 4.3
Sclerochronology: Providing Insights for Life History, Ecology and Management Studies

Session Hall B

10:30 — **Coffee break**

11:00

Session 6.1
Reproduction & Early Life History of Marine Animals

Session Hall A

Session 1.1
Unravelling the Effects of Global Change on Aquatic Systems: Opportunities and Limitations in State-of-the-Art Mesocosm Research

Session Hall B

12:30 — **Lunch break** *(self organized)*

13:00 — **Round Table**

Non-linear Path to Happiness

Foyer

13:30-17:00 — **Workshops**

Exploring pCO2 Measurments in the Ocean Surface and the Technology behind it

Barbara Glemser, SubCtech GmbH

Session Hall B (1)

Navigating Peer Review: Tips for Optimizing your Success

Susanne Schüller, Inter-Research Science Publisher

Seminar Room 2

Unexpected Data Adventures: From Environmentalist to Data Scientist

Sarah Büker, DataNord @ Data Science Center (University of Bremen)

Session Hall A (1)

Crash Course on Thelma Biotel Acoustic Receivers + Tips and Tricks
Hilde Johannesen, ThelmaBiotel

Seminar Room 3

Generation Sea: Youth-driven Solutions to Protect the Baltic
Katja Laingui, PROTECT BALTIC/HELCOM

Seminar Room 1

Exploring PyroScience Optical Oxygen and pH Sensors for Marine Applications
Dr. Münevver Nehir, PyroScience GmbH, Sales & Technical Support

Session Hall B (2)

How to Turn Science into a Story
Tim Schröder, Freelance Journalist

Session Hall A (2)

Excursions

Guided tour through the MARUM, the Bremen core repository of the International Ocean Discovery Program (IODP) and the Geosciences Collection of the University of Bremen
Ulrike Prange, MARUM - Center for Marine Environmental Sciences at the University of Bremen

Guided tour through the Übersee-Museum Bremen
Michael Stiller, Übersee-Museum Bremen

19:00

Science Speed Meeting Evening

What's a conference without making new friends?
And what better way to find out if you click with someone than by comparing your favorite science fun facts?

Session Hall A

Keynote & Plenary Discussion

Unlocking the Future of Marine Research Through Effective Data Management

Speaker: Gauvain Wiemer,
Deutsche Allianz Meeresforschung

Effective data management is the cornerstone of rigorous scientific research, particularly in marine science, where complex datasets are critical to understanding ecosystems, climate change, and biodiversity.

This talk will explore the importance of proper data handling, from collection to storage, ensuring data integrity, accessibility, and reproducibility. We will also discuss the role of data management in modern research tools, including artificial intelligence, and how well-structured data enhances the accuracy and reliability of these tools. By adopting good data management practices, marine scientists can drive more transparent, collaborative, and impactful research.

Biography:
Gauvain Wiemer studied geosciences at Université Louis Pasteur in Strasbourg and the University of Bremen, earning his PhD from MARUM-Center for Marine Environmental Sciences in 2014. His research on the geotechnical properties of sediments under earthquake conditions advanced the understanding of submarine landslide triggers. After his doctoral work, he shifted focus to data and science management, interning at the Brussels office of the Konsortium Deutsche Meeresforschung, where he represented the German marine science community in data management aspects at the European Commission. He now leads the data management and digitalization core area at the German Marine Research Alliance.

Session 1.3
Fish in a Changing World: Exploring How Climate Change Shapes Fish and Their Homes

Hosted by:
Carolin Müller

Sessions

Session 1.3:
Fish in a Changing World: Exploring How Climate Change Shapes Fish and Their Homes

Hosted by: Carolin Müller

Climate change operates at both local and global scales, leading to varied effects that manifest gradually or rapidly. The observed impacts exhibit ecosystem-specific differences contingent on geographical locations. Oceans and waterways are experiencing notable shifts in temperature, salinity, acidity, and oxygenation, underscoring the critical need to address fish adaptability. Fish, as vulnerable yet ecologically and economically significant organisms, play a pivotal role in maintaining biodiversity. This session, delves into the profound consequences of climate change on oceans and aquatic ecosystems through the lens of fish. We invite scholars to showcase their research projects in this pivotal field, welcoming contributions focused on any fish species worldwide. The call-to-action is clear: apply your insights, contribute to the dialogue, and help shape the future of fish-focused research.

Transcriptomic signatures of heat stress in the eelpout *Zoarces viviparus* through time and space

Marie V. Brasseur[1,2], Christina Bakowski[2], Nico Fuhrmann[1], Stefan Prost[3], Christoph Mayer[2], Henrik Krehenwinkel[1]

[1] Trier University, Trier, Germany;
[2] Leibniz Institute for the Analysis of Biodiversity Change (LIB), Bonn, Germany;
[3] University of Oulu, Oulu, Finland

Keywords: ocean warming, marine bioindicator, RNA-seq, viviparous blenny

Global warming results in higher annual mean ocean temperatures, larger differences between seasonal minimum and maximum temperatures, and more frequently occurring marine heatwaves. Since physiological coping of individuals as well as population adaption is ultimately driven by molecular processes, a species' survival ability in the long-term depends on its genomic background. Here, we used the marine bioindicator *Zoarces viviparus* as a model system to identify genes that change their expression behaviour due to acute and chronic heat stress in fish. These genes are expected to represent prime candidate loci that might contribute to a phenotype which is successful under future climatic conditions. Genes which were differentially expressed due to acute heat stress (i.e., short-term and strong temperature increase) were identified after performing a well-controlled indoor experiment, in which *Z. viviparus* individuals were kept at either 12˚ C or 18˚ C water temperature for two weeks. Transcriptomic signatures of chronic heat stress (i.e., long-term and subtle temperature increase) were derived from tissue samples that have been cryoconserved for 30 years in environmental specimen banks, allowing to track the impact of global warming on natural *Z. viviparus* populations from a retrospective perspective. With more than 10% of the *Z. viviparus* genome being differentially expressed, we found that heat stress induced a strong systemic response in the eelpout. Genes whose expression was stimulated due to increasing water temperatures were often involved in energy metabolism and respiration. The activation of cellular respiratory processes is in line with previous studies showing that the thermal limit of marine ectotherms is mainly driven by temperature-limited oxygen supply. As such, these findings provide mechanistic insights into functional genomic responses which contribute to ecological and evolutionary processes that determine the consequences of climate change for individuals and populations.

Environmental DNA monitoring of fish communities in humic substance rich freshwaters of the Hunte river (Oldenburg, Germany).

Sarah Büker[1,2]

[1] Institute of Biology and Environmental Sciences, Carl von Ossietzky University of Oldenburg, Oldenburg, Germany;
[2] Data Science Center, University of Bremen, Bremen, Germany

Keywords: Environmental DNA, Ecology, Molecular Biology, Climate Change, ecological gradient

The rapid change of ecosystems due to human impact and climate change challenges researchers to establish effective monitoring protocols to understand their influence on species and communities. Climate change, in particular, alters water temperatures and habitat availability, significantly impacting fish communities in rivers. Environmental DNA (eDNA) monitoring is a relatively new, fast and cost-effective method to monitor these community changes. However, high levels of humic substances in many freshwater and brackish water systems can inhibit DNA amplification, making eDNA monitoring challenging. This study aimed to establish an effective eDNA extraction protocol that removes humic substances, enabling future monitoring approaches of the Hunte river (Lower Saxony, Germany). Despite its ecological importance (surrounding nature reserves, highly variable habitats, various commercial uses) little is known about the river's fauna. A recent study on three-spined sticklebacks (*Gasterosteus aculeatus*) revealed genetic patterns along the ecological gradient from upper streams to tidal areas. Monitoring fish communities along the Hunte river is crucial for understanding these patterns, future changes, and their relation to climate change. The results showed that numerous native fish taxa and species could be identified using eDNA. Notably, even though the differences between sampling sites were not statistically significant, the method successfully detected a previously unknown fish farm, with a downstream decreasing eDNA pattern. This demonstrates that the established eDNA extraction protocol is suitable for monitoring species in similar freshwater environments. While the current protocol is useful, further improvements in bioinformatics analyses, primer selection, and handling are recommended to achieve faster and more accurate results. By offering a way to track changes in species distribution and community composition, the established eDNA protocol can help researchers to understand how climate change affects biodiversity.

Fatty acid composition and stomach contents of two North Sea squid

Hanna Rittinghaus[1], Anne Sell[2], Reinhard Saborowski[3]

[1] University of Bremen, Bremen, Germany;
[2] Johann Heinrich von Thünen Institute of Sea Fisheries, Bremerhaven, Germany;
[3] Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany

Keywords: trophic markers, food web, gas chromatography, Loliginidae, Ommastrephidae

Worldwide, abundances of cephalopods are on the rise, and their distribution ranges are expanding. They appear to benefit from current global changes which also act upon the North Sea. From the 1980s to the 2010s, the average sea surface of the North Sea increased by 1.7˚C, causing a regime shift towards warm temperate. Similar to global trends, abundances and distribution of many taxa are affected by this regime shift, and North Sea squid stocks have increased. This includes the stocks of the, in terms of biomass, dominant squid species in the North Sea: *Loligo forbesii*, the veined squid, as well as of *Illex coindetii*, the broadtail shortfin squid. *I. coindetii* is a mainly Mediterranean species that used to be rare in the North Sea until the 2010s. Since then, it has become one of the most abundant squid species and established successful breeding populations in the North Sea. The prey spectra of the two squid species appear to overlap and they have been found to also prey on each other. Their role in the food web as both predators and prey, however, is not well understood and feeding studies are rare. A suitable tool to gain insights into their role as predators as well as their own nutritional value is the analysis of their fatty acids and the application of the fatty acid trophic marker concept. Together with optical stomach content analysis, fatty acid profiles allow insight into prey spectra. Organs relevant for fatty acid analysis are the mantle and the midgut gland. So far, the fatty acid compositions showed a systematic difference between both tissue types as well as between both species, in both overall ratios as well as total number of identified fatty acids. In combination with stomach content analysis, this study helps elucidate the trophic positions of *L. forbesii* and *I. coindetii* in the North Sea.

Session 4.3
Sclerochronology: Providing Insights for Life History, Ecology, and Management Studies

Hosted by:
Fedor Lishchenko
and Roman Petrochenko

Sessions

Session 4.3:
Sclerochronology: Providing Insights for Life History, Ecology, and Management Studies

Hosted by: Fedor Lishchenko and Roman Petrochenko

Sclerochronology is known as a discipline that provides baseline data for a variety of life history, ecology, and management studies. Nowadays it's hard to imagine a comprehensive study on species biology that does not provide a piece of information on its maximum age or growth rates. In paleoclimatic studies, it allows the reconstruction of past environmental conditions. Many stock assessment protocols presume collecting data on the age composition of the stock units. But sclerochronology is much more than a convenient tool! The discipline provides a great variety of insights per se. Analysis of recording or hard structures trace element or isotope composition, modelling of morphological responses in these structures to different environments, and global variation in growth rates of animals, all are just the tip of the iceberg of the variety of sclerochronological studies. Moreover, the field of research has been rapidly developing in the past years, and the dream technologies of the past, like 3D image analysis or modelling of hydrodynamic properties of molluscan shells, become true and even routine. In our eyes, this theme session provides a platform for a broad discussion on the recent advances in all the fields of sclerochronology, from studies on micro- and macrostructure of recording structures to the practical application of the age and growth data in stock assessment. Are there fields of sclerochronological research we didn't mention here or ones we even can't imagine? We are excited to hear about it! At the "Sclerochronology – providing insights for life history, ecology, and management studies" theme session we warmly welcome paleontologists, biologists, ecologists, fishery scientists, and everyone who shares our passion for sclerochronological research.

An assessment of the historical population trends of *Crassostrea tulipa* in West Africa.

Gabriella Akpah Yeboah[1], Stephani Asantewaa Wiafe[1], Edem Mahu[1]

[1] University of Ghana, Accra, Ghana

Keywords: sclerochronology, Crassostrea tulipa, Age, growth rates, shellfish

This study carried out a comparative assessment of the shellfish fishery in four water systems; two in Ghana (Densu and Anyanui), one in Benin (Ouidah) and one in Nigeria (Lagos). It assessed the historical trends in the growth of the species, their ages, their growth performance, and the possible pressures influencing the change by comparing data estimated from fossilized shells to the modern population. Radiocarbon dating was used to determine the year of death for excavated fossilized shells. The ages of the oysters were estimated using the thin section technique (counting = of annual growth rings deposited at the hinge section of the oyster shells). Ages estimated in these regions ranged from two to twenty-five years while the highest recorded fossilized age was recorded in Anyanui (25) and the highest in the modern shells was fourteen from Nigeria. two-year-old oysters were seen in all populations in all regions except for Nigeria which recorded the minimum age. The ages estimated showed the interference of humans playing a role in the possible decline of the shell fishery in their regions over time. This was validated by fitting the von Bertallany growth function into the length at-age data to estimate their various growth parameters to calculate their growth rates, mortality, and exploitation rates. Based on the results, oyster population exploitation in some regions has shown a decline but some regions are reported to be over-exploited (Benin and Nigeria). However, generally, the growth of the oysters was reported to have decreased with time and this could be a result of overfishing, over-dependency, and/or unfavorable environmental conditions. The study detailed the possible pressures associated with the growth decline.

Application of gastropod statoliths in life history and ecology studies

Roman Petrochenko[1], Olga Khoroshutina[2], Fedor Lishchenko[1,3]

[1] A.N. Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences, Moscow, Russia;
[2] Russian Federal Research Institute of Fisheries and Oceanography, Moscow, Russia;
[3] Vietnam-Russia Tropical Centre, Marine Branch, Nha Trang, Vietnam

Keywords: Gastropoda, Statolith, Age estimation, Growth, Migrations

The organ of balance is among the main sense organs present in both vertebrates and invertebrates. In the latter group, this organ is called a statocyst. The structure of a statocyst may significantly vary from one taxon to another, although the generic statocyst comprises two parts: receptor cells and inertial mass. In the case of gastropod molluscs, the inertial mass is represented either by several small statoconia or by a single relatively large statolith. The gastropod mollusc statoliths have a globular outline while their morphometric characteristics are determined by species, age, and individual variability. The internal structure of statoliths is represented by a nucleus located in the centre, surrounded by concentric increments of different transparency and width. Each increment comprises narrow dark and wide zones, representing periods of fast and slow growth, respectively. Statoliths are mainly made of calcium carbonate ($CaCO_3$), like shells they can include several $CaCO_3$ polymorphs, usually both calcite and aragonite. During the formation of carbonate structures in molluscs, Ca^{2+} ions can be replaced by ions of other divalent metals with similar ionic radii. The concentrations of trace elements incorporated in the structure of calcium carbonate depend on several factors including salinity, seawater temperature, and physiological condition of the mollusc. These traits make statoliths very promising recording structures. Since they are located inside the mollusc body, protecting them from external impacts, they can be used as a very efficient tool for age estimation. Unlike shells and operculum, they usually have greater readability, and the interpretation of increments is easier. On another hand, since the chemical composition of statoliths is affected by the composition of the seawater, the data on the trace element composition of statoliths can be used to determine the area of mollusc origin or its migration routes.

Session 6.1
Reproduction & Early Life History of Marine Animals

Hosted by:
Neele Schmidt

Sessions

Session 6.1:
Reproduction & Early Life History of Marine Animals

Hosted by: Neele Schmidt

Understanding how marine organisms reproduce and grow is crucial for uncovering the secrets of their life cycles. Exploring facets such as fertilization and embryo development, as well as adaptations for survival, growth, and successful reproduction is essential in reproduction research. These concepts, involving various reproductive strategies and life cycle stages, significantly shape the dynamics of marine communities. By grasping these aspects, we can better conserve and manage marine resources, ensuring the sustainability of marine ecosystems. This session welcomes presentations covering aspects of recruitment and early life history across various organisms and scientific disciplines, including (but not limited to) ecosystem health, population dynamics, marine conservation, as well as fisheries and aquaculture.

Thiamin deficiency in higher trophic levels of the northern hemisphere

Marc M. Hauber[1], Vittoria Todisco[1], Samuel Hylander[1]

[1] Linnaeus University, Kalmar, Sweden

Keywords: Thiamin deficiency, Vitamin B1, Reproduction, Fish, Birds

Thiamin deficiency, i.e. the lack of vitamin B1, has been proposed as a threat to global biodiversity. It is affecting species of varying taxa such as fish, reptiles, molluscs, and birds across Europe and North America. Organisms affected by thiamin deficiency suffer from sublethal health effects such as immunosuppression, neurological damages, behavioural changes, and an altered metabolism. While these sublethal effects may reduce an individual's survival and fitness, severe thiamin deficiency can also directly cause mortality. Especially the offspring of egg-laying organisms such as fish and birds seem vulnerable to the deficiency. Salmonids in the Baltic Sea are periodically suffering from low reproductive output due to the thiamin deficiency syndrome called M74. Recent studies also suggest that several other species in the Baltic Sea such as eider ducks, herring gulls and cod are thiamin deficient. Throughout the years, several hypotheses have been put forward trying to explain the causes for thiamin deficiency including toxins, lipid peroxidation, thiaminase and a depleted transfer from lower to higher trophic levels. However, researchers have not been able to present enough evidence to agree upon one root cause. Here I will give an introduction into the research field of thiamin deficiency and our latest findings regarding its spread and development.

Marking the otoliths of hatchling cod (*Gadus morhua*) for release-recapture studies: a method comparison

Neele Schmidt[1], Yvette Heimbrand[2], Karin E. Limburg[3]

[1] Department of Ecology & Genetics, Uppsala University, Visby, Sweden;
[2] Department of Aquatic Resources, Swedish University of Aquatic Sciences, Uppsala, Sweden;
[3] Department of Environmental Biology, College of Environmental Science and Forestry, State University of New York, Syracuse, NY, USA

Keywords: Baltic Sea, otolith chemistry, strontium, cod larvae, restocking

Restocking programs aim to restore native fish species to waters where they have been overfished or can no longer reproduce. In the Baltic Sea, the eastern Baltic cod population is severely threatened due to a combination of several factors, creating the need for conservation efforts, such as restocking. In order to assess the success of hatch and release efforts, it is crucial to identify released fish larvae during recaptures at a later stage. We therefore investigated the marking success of different otolith labeling techniques, as well as lethal effects of these methods. Tested approaches include chemical labeling using different concentrations of alizarin complexone or incubation in strontium-enriched water, as well as various thermal marking techniques. Ultimately, the identification of an effective method to label yolksac larvae is a critical factor in hatch and release endeavors. A suitable method facilitates the recapture of released larvae, allowing for the assessment of the overall success of restocking efforts, as well as other release and recapture studies.

Assessment of Nursery System in Promoting Growth Performance of Sea cucumber *Holothuria scabra* in Earth Ponds

Lisa F. Indriana[1,2,3,4], Andreas Kunzmann[2], Matthew J Slater[1]

[1] Alfred Wegener Institute (AWI), Bremerhaven, Germany;
[2] Leibniz Centre for Tropical Marine Research (ZMT), Bremen, Germany;
[3] University of Bremen, Bremen, Germany;
[4] National Research and Innovation Agency BRIN Lombok, Indonesia

Keywords: aquaculture

Sea cucumber *Holothuria scabra* is a highly valuable marine organism that is diminishing in population owing to overexploitation, therefore aquaculture plays a crucial role in both the conservation and meeting market demand. In order to optimize the hatchery rearing period, it is necessary to transfer juveniles to an outdoor nursery system since indoor culture is less effective due to space, cost, and nutrition constraints. The aim is to observe the effect of different nursery methods on the growth performance of juvenile *H. scabra* in earth ponds. The study was conducted in four treatments such as a reservoir (N1), a stirred pond (N2), a non-stirred pond (N3), and the main inlet sluice (N4) with a completely randomised design with five replicates over 84 days within earth ponds. The results show that the range of survival rate was between 64.0±2.4 and 74.8±5.8%. The highest weight gain was in N4 (6.9±0.9 g) and the lowest was in N1 (1.3±0.1 g). We conclude that maintaining sea cucumber close to the main inlet sluice is the most effective method to enhancing the growth performance of juvenile *H. scabra* in earth ponds.

Session 1.1
Unravelling the Effects of Global Change on Aquatic Systems: Opportunities and Limitations in State-of-the-Art Mesocosm Research

Hosted by:
Anika Happe and Maren Staniek

Sessions

Session 1.1:
Unravelling the Effects of Global Change on Aquatic Systems: Opportunities and Limitations in State-of-the-Art Mesocosm

Hosted by: Anika Happe and Maren Staniek

Climate change and additional anthropogenic pressures induce a wide range of environmental changes in aquatic environments, such as gradual warming, ocean acidification, amplified extreme events, or altered light- and nutrient regimes. However, community and ecosystem level responses to these changes remain unclear as highly controlled laboratory experiments cannot reflect the full complexity of natural systems. Mesocosm experiments are an important tool to fill this knowledge gap by providing a near-natural setting for studying higher system complexity, species interactions, and by offering a wide range of possibilities to manipulate environmental conditions and to test mitigation measures. In this session, we welcome submissions on mesocosm experiments examining single or multiple stressor impacts on different aquatic systems. Studies can focus on the effects on single organisms, populations, or communities (e.g., phytoplankton, zooplankton, benthos, fish), their ecosystem functions, resistance, resilience and recovery as well as eco-evolutionary responses. We aim to include studies across a wide range of aquatic habitats (e.g., fully marine, intertidal, lakes, rivers). Overall, the session aims to provide a comprehensive insight into the possibilities and limitations of mesocosm research for assessing the impacts of global change related stressors on aquatic systems. We hope that this session will fuel the discussion on the status quo in mesocosm research and inspire future collaborations. Join us in exploring the diversity of mesocosm-based experiments used across aquatic systems!

Shining light on CDOM & FDOM dynamics at the sea-surface microlayer: A mesocosm study

Claudia Thölen[1], Jochen Wollschläger[1], Oliver Zielinski[2]

[1] Carl von Ossietzky Universität Oldenburg, Institute for Chemistry and Biology of the Marine Environment, Germany;
[2] Leibniz-Institute for Baltic Sea Research Warnemünde, Germany

Keywords: Optical spectroscopy, Phytoplankton bloom, Organic matter enrichment, UV degradation

The thin boundary layer between ocean and atmosphere, the sea-surface microlayer (SML), plays an important role in biogeochemical and climate-related processes. When the SML is enriched in organic matter, it is known to hinder gas, light, momentum, and heat exchanges between ocean and atmosphere. Yet the processes of organic matter enrichment and biogeochemical cycling in the SML are still subject of research. In the framework of the BASS project (Biogeochemical Processes and Air-Sea Exchange in the Sea-Surface Microlayer) a phytoplankton bloom mesocosm experiment was conducted for a month in May and June of 2023. The mesocosm was set up in the basin of the SeaSurface Facility of the Institute for Chemistry and Biology of the Marine Environment (ICBM Wilhelmshaven). Daily SML and underlying water (ULW) samples were taken and analyzed for multiple biogeochemical parameters. Sampling of the under 1 mm thin SML is a timely process which only produces little amounts of sample. These amounts often do not fulfil the requirements for deep chemical analyses. Optical methods like fluoro- and photo spectroscopy have a high sensitivity and structural specificity and only need small sample volumes. This facilitates the analysis of organic matter contents in the SML. Fluorescent and colored dissolved organic matter (FDOM and CDOM, respectively) were sampled alternately in the morning and afternoon, so the samples were always exposed to the sun for different lengths of time. Their analyses provide information about the chemical composition of organic matter in the course of the day and the induced phytoplankton bloom. Additional parameters like irradiance, temperature, chlorophyll-a, and salinity were recorded within the mesocosm basin. FDOM and CDOM data showed strong dependencies with the incident light and correlations to the biological activity of the bloom. This study shows that FDOM and CDOM function as real-time tracers of organic matter transformation processes in the SML.

Effects of warming on microzooplankton trophic interactions in the Elbe estuary

Max Lambrecht[1], Diana Nicole Puerto Rueda[1], Sahed Ahmed Palash[1], Luisa Listmann[1], Arne Malzahn[1], Elisa Schaum[1], Nicole Aberle-Malzahn[1]

[1] Institute for Marine Ecosystem and Fisheries Science (IMF), University of Hamburg, Germany

Keywords: Mesocosm, Grazing experiments, Community analysis, Climate Change

Microzooplankton (MZP) are small, heterotrophic organisms that occupy important roles within carbon and nutrient cycling in aquatic food webs. They have the highest direct grazing rates on primary production and serve as the main source of food for mesozooplankton and higher trophic levels, making them vitally important for ecosystem health. As a link between primary producers and higher trophic levels, MZP can have large impacts on biogeochemical cycles. However, studying MZP can be challenging due to their vast species and functional diversity, highly sensitive physiology and complex interactions within the food web, especially in the light of anthropogenic stressors. Previous studies have primarily concentrated on oceanic ecosystems, with coastal, estuarine, and riverine ecosystems receiving comparatively little attention. Particularly, the Elbe estuary has been underexplored, with most research dating back over 20 years and lacking focus on the role of MZP. Hence, we conduct indoor mesocosm experiments (May and October 2024) studying the plankton community composition and biomass, growth, grazing and respiration rates under current (+0˚C) and projected warming (+1.5˚C and +3˚C) conditions. We will focus on interactions between MZP with lower trophic levels (phytoplankton, potentially bacteria and viruses) and higher trophic levels (mesozooplankton), as well as carbon cycling (photosynthesis, respiration, grazing, sinking).

Multiple stressor effects in freshwater invertebrates – lessons learned from transcriptomics

Marie V. Brasseur[1,2], Florian Leese[2], Christoph Mayer[1]

[1] Leibniz Institute for the Analysis of Biodiversity Change (LIB), Bonn, Germany;
[2] University of Trier, Trier, Germany;
[3] University of Duisburg-Essen, Essen, Germany

Keywords: Mesocosm Experiment, ExStream, Functional Genomics, RNA-Sequencing

Identifying the consequences of anthropogenic activities on stream ecosystems is urgently required to maintain their ecological integrity. The impact of anthropogenic stressor exposure is often quantified at the population level, i.e., assessed via changes in specimen abundances following stressor exposure. While this provides valuable insights in stressor induced structural alterations of biological communities, sublethal effects might remain undetected. Physiological responses, which are ultimately controlled at the level of gene expression, are more sensitive in this regard. We integrated transcriptomic sequencing data in mesocosm field experiments to reveal how globally relevant stressors such as pesticides, fine sediment deposition, reduced discharge and salinization affect selected freshwater macroinvertebrates. In some cases, multiple stressor effects and their interactions at the transcriptomic level are in line with ecological response patterns at higher levels of biological organization, inferred from specimen abundance changes within the same experiment. Additionally, functional genomics data provide new mechanistic insights into multiple stressor dynamics: for instance, pesticide exposure affected gene regulatory networks, which were not expected based on the substance's described mode of action, and the effects of increased salinity would have been missed when relying solely on specimen abundance changes. Here, the induced transcriptional program might represent a physiological compensatory strategy of organisms to cope with sublethal salt stress. These findings highlight further layers of complexity in multiple stressors dynamics, as effects are inconsistent not only across spatial and temporal, but also biological scales. Identifying mechanistic targets of stressors like the exposure-induced physiological response mechanisms will advance our understanding of the context-dependency of multiple stressors in natural systems, since shared mechanistic targets are a prerequisite for stressor interactions. One possibility to achieve this can be the integration of functional genomics data into multiple stressor research, making use of the potential provided by nextgeneration sequencing technologies in an ecological framework.

The tropical sea anemone *Exaiptasia diaphana* displays resilience when exposed to the "deadly trio" of climate change related environmental stressors.

Bianca Allegra Parodi[1], Ioana Stanca[1], Laia Burgués Palau[1], Qin Zhen[1], Elise M. J. Laetz[1]

[1] University of Groningen, Groningen, The Netherlands

Keywords: Thermal tolerance plasticity, Metabolic depression, Hypoxia, Hypercapnia, Hyperthermia

Understanding the effects of climate change on marine ecosystems and identifying "winners and losers" is imperative for informing conservation strategies. Three primary stressors resulting from climate change threaten marine life — water warming, deoxygenation, and ocean acidification, termed the "deadly trio". While prior research has examined these stressors individually or in pairs, little is known about their combined effects. This study investigates the effects of the deadly trio, using a fully crossed experimental design in a system of twelve independent aquaria, on *Exaiptasia diaphana*, a tropical sea anemone, model for cnidarian-zooxanthellae symbioses. To mimic conditions found in tropical coral reefs, the hypoxic treatments included a cycle of decreasing night time oxygen saturation (40%) and increasing daytime levels (100%; nightly hypoxia). The parameters to simulate water warming and ocean acidification were selected based on the IPCC worst case scenario (30 ˚C and 7.6 pH). Multiple physiological responses were measured to provide insights into the stressors effects on the model organism: metabolic rate (overall performance), critical thermal maximum (CT_{max}, thermal tolerance) and acclimation response ratio (ARR, thermal tolerance plasticity). Furthermore, symbiont density was investigated as a proxy of symbiotic relationship health. We found no signs of symbiont expulsion or bleaching, suggesting a lack of stress caused by the treatments. Interestingly, metabolic depression was observed in anemones exposed to the deadly trio. We hypothesize this to be an energy conserving strategy, due to a correlation with increased CT_{max}. Furthermore, an association between ocean acidification and nightly hypoxia was found: combined exposure led to enhanced thermal tolerance plasticity, highlighting the importance of considering multiple stressors in climate change ecophysiological studies. This study reveals *E. diaphana* to be resilient to climate change and to display a particular metabolic response, associated with increased thermal tolerance, following exposure to the deadly trio.

Workshops & Excursions

Workshops & Excursions

Guided tour through the MARUM, the Bremen core repository of the International Ocean Discovery Program (IODP) and the Geosciences Collection of the University of Bremen

Excursion Host: Ulrike Prange,
MARUM - Center for Marine Environmental Sciences at the University of Bremen

MARUM produces fundamental scientific knowledge about the role of the ocean and the ocean floor in the total Earth system. The dynamics of the ocean and the ocean floor significantly impact the entire Earth system through the interaction of geological, physical, biological and chemical processes. These influence both the climate and the global carbon cycle, and create unique biological systems.

Come with us on a journey down to the ocean floor and discover the secrets of the deep sea. In our deep-sea cinema we show videos taken by our diving robot at several thousand meters of water depth. A tour through MARUM will give you an overview on deep-sea technologies such as the MARUM-MeBo sea floor drill rig or the remotely operated diving robot MARUM-QUEST. Only the use of these underwater technologies enables research work at MARUM. MARUM is also home of the Bremen core repository of the International Ocean Discovery Program (IODP) where more than 187 kilometers of cores from the ocean floor are stored.

The second part of the tour will present the Geosciences Collection of the University of Bremen at the Faculty of Geosciences. Today, it is housed in the buildings of the Research Faculty MARUM which, in addition to collection and office space, also includes a mechanical preparation workshop and a chemical laboratory for the processing of artefacts and in-house research. The collection currently comprises around 300,000 specimens, ranging from dinosaur bones to meteorites. Even zoological objects are included, especially modern snail shells, some of which were first described in historical publications. In addition to research work, the material is also regularly used for training and teaching in universities, schools and the public sector and presented in special exhibitions.

Workshops & Excursions

Guided tour through the Übersee-Museum Bremen

Excursion Host: Michael Stiller,
Übersee-Museum Bremen

Dr. Michael Stiller from the Übersee-Museum Bremen is offering a guided tour through the highlights of the exhibition.

The tour will start at 3 pm from the entrance area of the museum. Dr. Stiller is the head of the natural history department of the museum and the vice president of the Bremen Society for Natural Sciences from 1864.

Workshops & Excursions

Generation Sea:
Youth-driven solutions to protect the Baltic

Workshop Hosts: Katja Laingui, Paul Trouth, Cecilia Nyman and Jannica Haldin, PROTECT BALTIC, HELCOM

Are you tired of sitting at the kids' table and ready to be part of the conversation? PROTECT BALTIC is calling on youth (15-24 years) and young professionals (25-35 years) to share your perspectives and help shape our work on Baltic Sea protection. While we might be older millennials and Gen Xers, we recognize that we cannot assume to know how the younger generation thinks or the wealth of knowledge you can bring to the table. PROTECT BALTIC is pioneering a science-based, data-driven, and holistic approach to marine protection. We combine ecosystem-based frameworks with socio-economic considerations to effectively manage marine protected areas. The Baltic Sea countries are committed to protecting 30% of their waters by 2030, with a goal of 10% under strict protection. However, our focus goes beyond percentages; we strive to maximize biodiversity benefits.

Currently, most marine sectors, governments, research institutions, and NGOs are well-represented in our efforts, but there’s a glaring gap where young stakeholders should be. As the generation that will face the consequences of current actions and inactions, your input is crucial. We are offering you a seat at the table to ensure your voices are heard and considered. Whether you're interested in our Regional Restoration Plan, the augmented reality (AR) app, or the potential for scalability, your involvement will help the project ensure sustainable outcomes.

Join us in this interactive workshop where we will explore your motivations and concerns, find innovative ways to enhance your engagement in PROTECT BALTIC, and establish sustained participation throughout the project’s duration. Since the products of this project have the potential to be adaptable and scalable, we welcome young marine professionals from other regions, not just the Baltic. Together, we can shape the future of Baltic Sea protection, rooted in science, and enhanced by your participation.

Workshops & Excursions

Navigating peer review: Tips for optimising your success

Workshop Host: Susanne Schüller,
Inter-Research Science Publisher

Getting ready to publish your first article? Feeling daunted by or fearful of peer review? Wondering what editors, reviewers and also publishers pay attention to? Need tips on how to manage criticism and formulate effective responses?

In this workshop we give you an opportunity to gain inside knowledge from a publisher and editorial perspective. We consider what is important when preparing a manuscript for submission and what to pay attention to during the peer-review process.

We provide an overview of common pitfalls and how to avoid them, and give advice on how to deal with inappropriate reviewer comments, tough editors and their decisions. We will also discuss publication processes post article acceptance and the attributes that define a high-quality journal.

Workshops & Excursions

Crash course on Thelma Biotel acoustic receivers and tips and tricks

Workshop Host: Hilde Johannesen,
Thelma Biotel

Thelma Biotel wishes to invite attendees at ICYMARE to join us for a workshop outlining how to set up and use our Thelma Biotel receivers in the field.

Acoustic telemetry allows detailed observations of the movement behavior of many aquatic species such as elasmobranchs, anadromous and other migratory fish, and benthic and coral fish. With the development of smaller transmitters over the last years acoustic telemetry has also been increasingly used in the behavioral study of invertebrates such as crabs and other benthic organisms.

During our 2 hours workshop we will give you an introduction to the basic principles of aquatic telemetry and the equipment Thelma Biotel has developed to study different types of behavior in aquatic animals. You will get the chance to practice the activation and de-activation of transmitters and receivers. How to configurate our receivers and change their batteries as well as data downloading. We will show you how to deploy and retrieve receivers using different mooring and recovery options. deployment and retrieval of receivers, as well as data downloading.

Workshops & Excursions

Unexpected Data Adventures: From Environmentalist to Data Scientist

Workshop Hosts: Sarah Büker and Annika Nolte,
DataNord @ Data Science Center, University of Bremen

Have you ever wondered why everyone is talking about data science, whether you are a marine biologist, chemist, or social scientist?

Join us in this engaging workshop, where we will navigate the vast field of data science, discuss your research topics, and explore why (and how) you should care about your data. We will introduce you to key concepts of data management and FAIR data principles, and address the chances and challenges of interdisciplinary work through shared data and methods. In marine science, we deal with incredible useful machines, technologies and inventions, generating more and more data. Rocks can be stored in shelves, water can be put into flasks, plants can be preserved in fridges, but how do you store your data? How do you ensure its usability a decade later, when you can't even remember what you had for dinner last week? What role does metadata play in this context? And how can data science help to unlock the full potential of your research?

Annika and Sarah work as data scientists at the Data Science Center (University of Bremen), where they support researchers at all levels of data management and analysis. They started out in environmental and marine sciences, not planning to become a data scientist. Their unexpected journeys into data science were driven by curiosity and the challenging yet compelling nature of their own research data. They will share their stories, connect with yours and demonstrate why, at some point, everyone is a data scientist.

Workshops & Excursions

How to turn science into a story

Workshop Host: Tim Schröder,
Freelance Journalist

If you want to be understood by everyone, you need to be able to formulate your ideas in a clear and structured way.

The workshop shows you how to present your own research topic and field of work confidently and comprehensibly to people outside your field and how to respond confidently to critical questions - for example in dialogue with project partners, media representatives and the public, at conferences or science communication events.

Workshops & Excursions

Exploring pCO_2 measurements in the ocean surface and the technology behind it

Workshop Host: Barbara Glemser,
SubCtech GmbH

The changing global climate has become one of mankind's most pressing problems and it is a constant topic of discussions all around the globe. As the climate crisis can neither be denied nor stopped we need reliable models, which can help predict possible climate scenarios. Approximately 70.8% of the earth are covered by oceans, which makes scientific ocean data undeniably important for the calculation of climate models.

To produce reliable climate models, good quality data of different parameters is essential. In the case of CO2 in the oceans on crucial parameter is the partial pressure of CO2 (pCO2) in the ocean's surface. In this workshop we will together explore, why it is so important and tricky to measure pCO2.

We will take a short look on the measuring principle behind the technology before diving into the working principle of the SubCtech flat membrane equilibrator pCO2 analyzers. For this we will get hands on with our systems, testing them out in the lab, discussing their working principles and comparing them to other systems. In the end you will have a comprehensive overview of how and why we measure pCO2 in the oceans and what the further challenges for a new generation of scientists are.

Workshops & Excursions

Exploring PyroScience Optical Oxygen and pH Sensors for Marine Applications

Workshop Host: Dr. Münevver Nehir, PyroScience GmbH

PyroScience GmbH is one of the leading manufacturers of advanced optical sensors for pH, oxygen, and temperature for scientific applications. These sensors are utilized across a wide range of marine environments. These include the open ocean, deep sea, and various coastal ecosystems such as mangroves, estuaries, mudflats, kelp forests, seagrass meadows, salt marshes, intertidal zones, oyster reefs, and coral reefs. They are also used in rivers, lakes, and water reservoirs. Monitoring oxygen and pH levels is crucial for understanding ecosystem dynamics and assessing environmental status. This is due to their links to significant phenomena such as global warming, ocean deoxygenation, and acidification.

In this workshop, we will provide an overview of oxygen and pH optode technology and their applications in marine research. Participants will engage in hands-on experience with our plug-and-play FireSting-PRO multi-analyte lab meter, FireSting-GO2 pocket oxygen meter, and AquapHOx long-term standalone loggers. This includes demonstration of calibration procedures, measurement settings, and data retrieval techniques.

A brief presentation will cover the following topics: the necessity of optical sensor technology for marine environmental monitoring, an overview of PyroScience sensor solutions, and calibration procedures for precise measurements. Furthermore, typical set-up recommendations for key oceanographic applications like water column profiling, pumped FerryBox systems, aquatic eddy covariance, sediment, coral, and respiration rate studies will be presented. Introductions to the free Workbench and DataInspector software will be provided, along with case studies highlighting successful applications. Concluding the event, a Q&A session will be held. It will provide participants with valuable insights into utilizing advanced instrumentation for monitoring key environmental parameters in aquatic ecosystems. This also includes the opportunity to directly engage with the sensors and read-out devices and our expert, facilitating integration of state-of-the-art underwater optical sensors into research projects and development of efficient monitoring strategies for marine environments.

Thursday
19th September 2024

Program - Thursday, 19th September 2024

08:00	**Registration**	
08:30	**Keynote** **The EU Project FACE-IT:** **How Research Projects can Enhance your Network** Dr. Simon Jungblut, Marine Botany, University of Bremen, Germany *Lecture Hall*	
09:30	Session 1.4 **Benthic Ecology in a Changing Ocean** *Session Hall A*	Session 7.0 **Open Session** *Session Hall B*
10:30	**Coffee break**	
11:00	Session 1.4 **Benthic Ecology in a Changing Ocean** *Session Hall A*	Session 7.0 **Open Session** *Session Hall B*
12:15	**Group Photo** *Lecture Hall*	
12:30	**Lunch break** *(self organized)*	
13:00	**Round Table** **tba** *Foyer*	
13:30	Session 2.2 **Exploring Human Dimensions within Marine Social-Ecological Systems** *Session Hall A*	Session 7.0 **Open Session** *Session Hall B*
15:00	**Coffee break**	
15:30	Session 2.2 **Exploring Human Dimensions within Marine Social-Ecological System** *Session Hall A*	

Keynote & Plenary Discussion

The EU Project FACE-IT: How Research Projects can enhance your Network

Speaker: Dr. Simon Jungblut,
Marine Botany, University of Bremen, Germany

Arctic ice is melting, turning sea-terminated into land-terminated glaciers. This rapid loss of cryosphere is accompanied by biodiversity changes, with likely far-reaching effects on ecosystem functioning in Arctic fjords and related human activities. FACE-IT is an EU-funded Horizon 2020 project, aiming to enable adaptive co-management of social-ecological fjord systems in the Arctic in the face of rapid biodiversity changes and its consequences. Within FACE-IT, selected Arctic fjord systems at different stage of cryosphere loss in Greenland, Svalbard and Finnmark, Northern Norway, are being compared for biodiversity changes, effects on local communities, food production, livelihoods, fisheries, tourism and other ecosystem services.

This presentation will illustrate results from the project in combination with showcasing how an open and engaging attitude towards a big research project may benefit the network and scientific output especially of early career researchers.

Biography:
Simon is a marine zoologist specialized on the ecology and ecophysiology of crustaceans and sea urchins, based at the University on Bremen, Germany. He is the project manager of FACE-IT and coordinates its research consortium of about 60 people from 14 institutions. He also is the connection to the European Commission and is responsible for the outreach activities of the project, including homepage, social media channels, conference sessions and policy advice. Simon co-founded ICYMARE and the monthly Ocean Chat within the Bremen Society for Natural Sciences and is now member of its board.

Session 1.4
Benthic Ecology in a Changing Ocean

Hosted by:
Eva K. Rohlfer and Anna Fiesinger

Sessions

Session 1.4:
Benthic Ecology in a Changing Ocean

Hosted by: Eva K. Rohlfer and Anna Fiesinger

Benthic ecosystems, comprising the diverse communities of organisms inhabiting the ocean floor, play a pivotal role in maintaining ecological balance and sustaining the health of marine environments. Focusing on these vulnerable ecosystems, we examine the multifaceted threats faced by benthic organisms and the subsequent repercussions for ecosystem resilience. Benthic organisms are exposed to a myriad of stressors such as rising sea temperatures, ocean acidification, and alterations in nutrient cycling. Benthic macrofauna plays a key role in organic matter processing and benthic-pelagic carbon cycling directly through their metabolism and indirectly through bioturbation. The ongoing changes in the ocean disrupt symbiotic relationships, hamper reproductive success, and influence biodiversity elements and physiological traits of benthic communities. The environmental changes could therefore lead to a different functional role of benthic flora and fauna in key ecosystem processes. Linkages between benthic ecology and ecosystem health including local stressors and global climatic factors, need to be recognised for effective conservation and management strategies of benthic ecosystems in the face of an uncertain future. If you are studying the benthic ecosystems (no matter if fauna, flora, sediment or water) in our changing oceans, you are very welcome in our session!

A species on the brink of extinction: The ecological role of *Pinna nobilis* and the situation along the Italian coasts

Davide Pensa[1], Luca Grosso[1], Mohammad Magdy[1], Alessandra Fianchini[1], Arnold Rakaj[1]

[1] Experimental Ecology and Aquaculture(LESA), Department of Biology, University of Rome Tor Vergata, Italy

Keywords: *Pinna nobilis*, Ecology, *Posidonia oceanica*, Visual census

Pinna nobilis is an endemic species of the Mediterranean Sea and is one of the largest bivalve molluscs worldwide. This species can reach considerable densities and biomasses, playing a key ecological role in benthic habitat, filtering large quantities of seawater, and contributing to the recycling of organic matter. Since 2016, *P. nobilis* has been facing a Mass Mortality Event (MME), hypothetically, caused by a synergetic action of a variety of pathogens including the protozoan *Haplosporidium pinnae*. The violent effect of the infection was rapidly addressed throughout the Mediterranean and, as a consequence, *P. nobilis* entered the IUCN Red List as a critically endangered species in December 2019. Regarding the Italian coasts, there is a lack of surveys aiming to assess the effect of the MME on species distribution on a large geographical scale. In 2022 a study on the *P. nobilis* distribution and effect of the MME was carried out by Pensa et al. 2022 in the Eastern Mediterranean, covering over 90 km of underwater transects. The same experimental design was replicated in 2023 in the Western Mediterranean (Pontine archipelago) covering 20 km of transects among 21 sites and several habitat types. Comparing the macroscale distribution of *P. nobilis* and the distribution of the habitat, it emerges that there is an overlap between the distribution of *P. nobilis* and that of seagrass meadows, in particular *Posidoni oceanica*. In detail, based on the meso- and microscale observations emerges how most of the *P. nobilis* specimens were found inside the *P. oceanica* meadows, decreasing rapidly outside the boundaries. We, therefore, assumed that there is a strong relationship between *P. nobilis* distribution and seagrass meadows, likely due to a trophic link between the specimens and the phanerogamic detritus.

Circadian Symbiont Relocation in a Bioeroding Sponge

Kay Watty[1]

[1] Department of Freshwater and Marine Ecology, University of Amsterdam, Institute for Biodiversity and Ecosystem Dynamics, Amsterdam, The Netherlands

Keywords: Cliona, Circadian rhythms, Symbiodiniaceae, Photosynthesis, Symbiosis

Excavating sponges are important bioeroders on coral reefs, counteracting the reef-building of corals. They are thought to be more resistant to bleaching than corals and are predicted to outperform calcifiers in future conditions, potentially leading to net reef erosion in locations where they are abundant. Endosymbiotic dinoflagellates serve as an important autotrophic energy source for photosymbiotic Clionaida and stimulate their bioerosion. Observations on the Great Barrier Reef described a diurnal colour change of these sponges that has been explained by the relocation of the symbionts. Synchronized behaviour and physiology with external rhythms are advantageous and promote optimal performance and survival in organisms. Here, we investigated circadian rhythmicity in a sponge-dinoflagellate holobiont (*Cliona* cf. *caribbaea* and Symbiodiniaceae) concerning the symbionts' photosynthesis and the host's diel relocation of symbionts. We quantified the retraction into the sponge tissue via surface reflectance measurements and tested the symbiont relocation as a potential protection mechanism against light stress. Different light regimes were used to test the persistence of rhythms under constant conditions where oxygen production served as the measure for photosynthesis and surface reflectance as the measure for symbiont relocation. Light stress was induced with direct sunlight, and chlorophyll fluorescence was measured to determine stress responses. Findings suggested the existence of intrinsic circadian clocks which regulate photosynthesis in the dinoflagellate and symbiont relocation in the host, respectively. Reflectance measurements were a reliable, non-invasive method to quantify the relocation of symbionts and supported visual evidence. Stress experiments questioned the hypothesis of symbiont relocation as a coping mechanism for photo stress, but they supported the sponge's resilience to stress and its ability to outperform calcifiers with the progression of climate change.

Life on the edge: Does disturbance shape vertical epibenthic communities in Arctic fjords?

Olivia Kohler[1,2], Karl Attard[3], Lorenz Meire[4,5], Patrick Meire[6], Henning Schröder[1], Sandra Maier[4], Claudio Richter[1,2]

[1] Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany;
[2] University of Bremen, Bremen, Germany;
[3] University of Southern Denmark, Odense, Denmark;
[4] Greenland institute of Natural Resources, Nuuk, Greenland;
[5] Netherlands Institute for Sea Research, Netherlands;
[6] University of Antwerp, Antwerp, Belgium

Keywords: Image analysis, Remotely operated vehicle, Environmental drivers, Baseline, Abundance

Arctic benthic ecosystems are affected by particularly rapid climate change. Yet, we currently lack baseline knowledge on these ecosystems, specifically on abundance, biomass, and activity of epibenthic communities on fjord walls and steep slopes, which are difficult to access. During the Fate of Carbon in Greenland Fjords (FATE) research cruise in the Nuup Kangerlua fjord system in West Greenland in May 2023, footage of vertical benthic communities was collected by a remotely-operated vehicle (ROV), equipped with a camera and parallel dot lasers for area quantification. A total of 10 vertical wall transects were run from deep (maximum depth 280 m) to shallow (minimum depth 7 m), and images were taken regularly every 0.5 seconds. Images have been analysed for the abundance of epibenthic taxa and their surface cover. So far, we have found different wall ecosystems, depending on water depth and location in the fjord. These include higher occurrences of sessile feeders such as ascidians, sponges, and anemones between 100 - 280 m water depth, encrusting red algae dominating the shallow regions, and sites almost barren of macroscopic life. Relation with parameters such as sedimentation and disturbance from landslides and icebergs will allow us to derive environmental drivers of epibenthic communities on vertical walls and predict their distribution in this and other Arctic fjords today and in the future.

Marine heatwaves and Arctic sea urchins: a new challenge to the grazing behaviour and metabolic performance of *Strongylocentrotus droebachiensis*

Marie Koch[1,2], Simon Jungblut[3], Sandra Götze[1], Christian Bock[1], Reinhard Saborowski[1]

[1] Integrative Ecophysiology, Alfred-Wegener-Institute, Helmholtz Centre for Polar and Marine Research, Bremerhaven, Germany;
[2] Faculty 2 Biology/Chemistry, University of Bremen, Bremen, Germany;
[3] Marine Botany, BreMarE, University of Bremen, Bremen, Germany

Keywords: NMR-Spectroscopy, Marine Heat Waves, Metabolite profiling, Thermal tolerance

Subarctic fjords face challenges through continuous warming, enhanced climatic variability, and higher frequencies and intensities of marine heat waves (MHW). Sea urchins are an integral part of fjord ecosystems and the dominating grazers on habitat-forming kelps. At high abundances, sea urchins transform kelp beds through pronounced grazing into unproductive, alternative ecosystem states, so-called sea-urchin-barrens. We investigated the influence of temperature, a main driver of ecosystem change, on the grazing activity as well as the metabolic performance of the green sea urchin *Strongylocentrotus droebachiensis* in the Subarctic Norwegian Porsangerfjord. The average monthly temperatures at the study site range from 2.5˚C in March to 10˚C in August. An increase in the average annual temperature was evident between 1982 and 2022. The intensity and duration of summer MHW increased, exceeding sea surface temperatures of 16 ˚C. In a laboratory experiment, sea urchins were fed with the kelp *Saccharina lattissima* under acute warming within their thermal window of 2 to 22˚C. Initially, grazing rates increased with temperature but declined above 10 ˚C. Metabolite profiling based on ^{1}H-NMR spectroscopy revealed a close correlation between glucose levels in the digestive organs with feeding rates. At 22˚C increased levels of acetate, lactate, and succinate were observed, indicating a clear shift from aerobic metabolism to anaerobiosis. Accordingly, elevated temperatures over the year intensified grazing pressure by sea urchins on the kelp community. Nevertheless, during summer, new temperature records and the intensification of MHWs have adverse effects on the well-being and lasting survival of *S. droebachiensis*, resulting in a lessened grazing pressure which in turn might preserve the rich kelp forest ecosystem. Revealing and understanding the intricate effects of temperature and the consequential behavioural as well as metabolic responses is fundamental in predicting the possible ecological and economic future of Subarctic coastal ecosystems.

Polyphosphate dynamics in marine *Beggiatoa* 35Flor during overplus P conditions

Nadezhda Iakovchuk[1], Jenny Fabian[1], Olaf Dellwig[1], Heide Schulz-Vogt[1]

[1] Leibniz Institute for Baltic Sea Research, Warnemünde, Germany

Keywords: polyphosphate, *Beggiatoa*, marine sediment, phosphate uptake rate

Earth's oceans currently undergo a multitude of changes including the increase in low-oxic events thereby fostering the growth of large sulfide-oxidizing bacteria such as *Beggiatoa*. Its extensive bacterial mats can cover large surface areas of marine sediments and their ability to accumulate polyphosphate suggests a profound influence on phosphorus (P) fluxes in aquatic environments. However, the extent to which they can contribute to P sequestration or release remains poorly estimated. In an experimental set-up, we investigated the dynamics of polyphosphate built-up and storage in the marine culture *Beggiatoa* 35Flor under P overplus conditions and its potential contribution to the P turnover in marine benthic environments. We first determined the number of generations required to grow filaments without P supplementation to induce polyphosphate starvation. Subsequently, starved bacterial cultures were exposed to a P overplus, and their P uptake and polyphosphate formation capacity were investigated. We measured concentrations of dissolved inorganic P (DIP), particulate P (PP), and polyphosphate to tackle time-specific changes in the various P pools. Our preliminary results suggest that the uptake rate of DIP is higher than reported in previous reports for culture-based studies on polyphosphate-accumulating cyanobacteria. Our data also indicate a strong temporal dynamic in the build-up of intracellularly stored polyphosphates, which is rapid in the first fifteen minutes but significantly slows down in the following hours. The results from this study expand our knowledge of the role of marine sulfur bacteria in the marine phosphorus cycle. This is a crucial step forward in understanding the impact of bacterial activities on benthic-pelagic P exchange in low-oxygen oceanic environments.

Microbial communities in the subterranean estuary of the barrier island Spiekeroog

Simone Brick[1], PD Dr. Bert Engelen[1], Dr. Anja Reckhardt[1], Grace Abarike[1], Dr. Jutta Niggemann[1]

[1] Institute for Chemistry and Biology of the Marine Environment (ICBM), Carl von Ossietzky University of Oldenburg, Oldenburg, Germany

Keywords: Microbial communities, Sandy beach, Subterranean estuary, Nanoarcheota

Coastal areas play an important role in global nutrient cycling with microorganisms being the main drivers of all relevant biogeochemical processes. In permeable systems such as sandy beaches, terrestrial groundwater mixes with seawater in a so-called subterranean estuary (STE). While seawater introduces oxygen and freshly produced organic matter into the beach subsurface, oxygen-depleted terrestrial groundwater brings in aged organic matter and nutrients such as nitrogen and phosphorus. The distribution of the sea- and groundwater in the STE is highly influenced by the constantly changing beach topography. Thus, microorganisms in the STE must be adapted to changing salinities and nutrient supply. In our study, we monitored microbial communities in the STE of Spiekeroog Island over one year. Water samples were collected every six weeks from 6 m, 12 m, 18 m and 24 m depth from the dune base, the high-water line and the low-water line. Microbial community compositions were analyzed using Illumina sequencing of 16S rRNA genes. Additionally, the sediment-attached fractions of microorganisms in the STE were examined from two 24 m long sediment cores collected at the dune base and the high-water line. We found that the community compositions of the free-living microorganisms in the porewater and the sediment-attached fractions differed dramatically. The free-living communities exhibited high ratios of archaea with up to 70% at certain sites and depths, mostly associated to uncultured Nanoarchaeota. The attached communities had archaea-to-bacteria ratios of 5% to 25%. Nevertheless, the community compositions varied throughout the year, whereby differences were most pronounced in deeper layers of the low-water line where terrestrial groundwater discharges into the sea. Overall, our findings indicate that microbial communities are susceptible to variations in their environment, which may affect their contribution to nutrient cycling.

Session 7.0
Open Session

Hosted by:
Theo Krüger and Jöran Paap

Sessions

Session 7.0:
Open Session

Hosted by: Theo Krüger and Jöran Paap

If you think your research does not fit into any of our other sessions, please feel free to submit your abstract to this session!

Accumulation of Dissolved Organic Carbon (DOC) in Subtropical Gyres: An Analysis along Lagrangian Trajectories.

Benjamin Owusu[1], Leonard Lücken[1], Takasumi Kurahashi-Nakamura[1], Sinikka T. Lennartz[1]

[1] Institute for Chemistry and Biology of the Marine Environment (ICBM), Carl von Ossietzky University of Oldenburg, Oldenburg, Germany

Keywords: microbial community, consumer-resource model, ocean parcels

Dissolved Organic Carbon (DOC) forms a large pool of carbon, with about 700 PgC, with the largest accumulation observed in the subtropical gyres. However, the understanding of the factors that control the accumulation of DOC in the subtropical gyres is limited. This lack of understanding hampers modelling approaches of DOC concentrations on basin scales. The DOC concentration patterns in the subtropical gyres, as well as its observed abundance in the bulk dissolved organic matter (DOM) over dissolved organic nitrogen and phosphorus, underscores the significance to test the factors that control these observations. Numerical studies that involve a mechanism which incorporates feedback from microbial community in a consumer-resource based model has been adopted to explain the mechanism behind this observed DOC patterns. A Lagrangian framework that simulates nutrient dynamics has been coupled to the consumer-resource model in the North Atlantic to test how nutrient limitation regimes influences DOC accumulation along particle trajectories from the margins to the centre of the gyres. The results explain that different nutrient limitation regimes influence accumulation and degradation of DOC from the microbial community. This as a result leads to the observed DOC abundance in the bulk DOM due to the preferential remineralization from the microbial community.

Deciphering the ecological significance of marine fungi in carbon cycling

Berin Sena Arslan-Gatz[1], Tilmann Harder[2], Marlis Reich[1]

[1] Molecular Ecology, The Faculty 2 of Biology / Chemistry, University of Bremen, Germany;
[2] Marine Chemistry, The Faculty 2 of Biology / Chemistry, University of Bremen, Germany

Keywords: organic matter, growth patterns, carbohydrates, standardization, fungal isolates

Marine fungi play a crucial role in carbon cycling by breaking down marine-derived organic matter. However, studying marine fungi presents challenges due to their complex life cycles, diverse morphological and physiological characteristics, and specific nutrient requirements. Despite the increasing number of studies on marine fungi, there is a lack of standardized methods to study their behaviour and ecological importance. To address this gap, we aimed to establish a standardized technique for studying fungal growth. We conducted a culture-based study to examine the behaviour and morphology of 11 fungal isolates belonging to Ascomycota and Basidiomycota. Different culture medium formulations with various organic matter sources were used to analyse fungal growth. Our results revealed that the fungal isolates exhibited different growth patterns under varying culture conditions. There was significant behavioural diversity among the isolates, even when degrading the same organic compounds. Additionally, we found that our fungal isolates efficiently degraded laminarin, which is an important and very abundant algal polysaccharide in the marine environment. Our findings provide valuable insights into the distinct capabilities of individual fungal species and their ecological roles in the marine carbon cycle. By generating robust research data, we have established a solid groundwork for subsequent replication and comparative analysis across studies, contributing to the advancement of scientific knowledge in the marine field.

Who lives in eukaryotes under the sea: Giant viruses from an in-situ incubation

Theo Krüger[1], Yu-Chen Ling[1], Fabian Wittmers[1], Rachel Harbeitner[2], Alexandra Z. Worden[3,4]

[1] GEOMAR Helmholtz Centre for Ocean Research Kiel, Kiel, Germany;
[2] University of California, Santa Cruz, USA;
[3] Marine Biological Laboratory, Woods Hole, USA;
[4] University of Chicago, Chicago, USA

Keywords: metagenomics, deep sea, phylogeny

Giant viruses infect eukaryotic organisms and encode many proteins originally thought unique to cellular life, as well as others that can reshape host physiology. Many eukaryotes that might serve as hosts of these viruses have yet to be cultured, forcing reliance on metagenomic assembled genomes (MAGs) to explore giant viruses in nature. In marine habitats this approach is limited by the diversity of templates and limitations they impose on genome assembly. Here, we incubated Pacific Ocean deep-sea waters (1000 m) in situ with representative detrital organic matter for up to 4 months and performed metagenomic sequencing and assembly. At the end of the incubation period the replicated samples were enriched for few eukaryotic taxa, mainly the Apusomonadidae and MAST-8A protists. Moreover, five novel giant viruses were recovered ranging from 413 to 862 kb in genome size and G+C% content between 33 to 36%. Maximum likelihood phylogenetic analyses indicated four belonged to lineages of diverse giant viruses that contain few cultured representatives, and those with known hosts infect protists. These viruses harbored on average 41% predicted proteins previously unseen (orphan genes), based on comparisons to reference databases. Additionally, a giant virus related to the Asfarviridae, a group with relatively few known members, which also harbors the virus behind African swine fever, was recovered that likely infects multicellular eukaryotes and had many more novel predicted proteins (66%) than the other recovered viruses. These results show that despite recent major efforts to recover giant virus diversity from metagenomic datasets, more targeted approaches continue to reveal novel diversity and insights to the evolution of marine giant viruses.

Developing CRISPR/Cas9 in *Micromonas* — New genetic tools for a marine model alga

Jöran Paap[1], Lisa Sudek[2], Olga Matantseva[3], Haller Igel[2], Jan Muschiol[1], Pratyasha Dash[1], Manuel Ares Jr.[2], Alexandra Z. Worden[1,2,3]

[1] GEOMAR Helmholtz Centre for Ocean Research Kiel, Kiel, Germany;
[2] University of California, Santa Cruz, USA;
[3] Max Planck Institute for Evolutionary Biology, Plön, Germany

Keywords: pico phytoplankton, protist, genetic engineering, genetic modification, transfection

Marine protists are a key component in ocean ecosystems, displaying a great diversity in their lifestyles and contributing to major biogeochemical cycles. Despite their pivotal role, our understanding about the physiology of marine protists remains limited and is mostly based on comparison of their functional proteins to homologs in a few model taxa which may not adequately represent overall protist diversity or ecological relevance in the marine environment. However, over the recent years multiple efforts were undertaken to develop new model systems encompassing all major marine protist lineages. Thereby, tools have been developed that enable genetic manipulation of *Micromonas*, a phototrophic marine picoeukaryote closely related to plants, which is globally distributed and can dominate the phytoplankton pico-size fraction. By delivering foreign DNA into cells of *Micromonas commoda* followed by CRISPR/Cas9-mediated genome editing, we successfully induced a change in phenotype. Efforts to expand the developed transfection methods to the polar species *Micromonas polaris* resulted in the successful expression of foreign DNA, providing valuable groundwork for implementing stable genome editing in this polar species. Ultimately, our study aims to target ecologically relevant genes in *Micromonas* to study the physiology of these marine protists. Projections suggest that phytoplankton in the pico-size fraction will thrive and become more dominant under future ocean conditions, particularly in polar regions. Thus, expanding the genetic tool-kit available for *Micromonas* becomes increasingly imperative. Here, we will report on our latest achievements and advancements on *Micromonas* genetics.

A comparative analysis of the Antarctic fur seal skin and gut microbiome

Petroula Botsidou[1], Michael Schloter[2], Jaume Forcada[3], Rebecca Nagel[4], Joseph Hoffman[1]

[1] Bielefeld University, Bielefeld, Germany;
[2] Technical University of Munich, Munich, Germany;
[3] British Antarctic Survey, Cambridge, UK;
[4] University of St Andrews, St Andrews, UK

Keywords: host-microbe interactions, social stress, health, Southern Ocean

Microbial communities are crucial for the functions of all vertebrates, outnumbering host genes by orders of magnitude. They aid in pathogen defense, immune regulation, nutrient absorption, and growth promotion. Various intrinsic and extrinsic factors such as age, sex, and stress can impact the host microbiome. Studying these interactions allows one to gain insights into host resilience and adaptation to environmental changes, particularly while studying wild populations residing in remote areas where systematic knowledge is often lacking. This applies to a population of Antarctic fur seals (Arctocephalus gazella) that breeds on Bird Island, South Georgia, and has been decreasing over the last thirty years due to anthropogenic decreases in krill availability. By using 16S rRNA amplicon sequencing, we explore the factors that shape the composition and structure of both gut and skin microbiota of Antarctic fur seal mum-pup pairs inhabiting two colonies of high and low population density. By focusing mainly on age, sex, and density (an indicator of social stress) and by studying comparatively skin and gut microbial communities, this study aims to draw broader ecological and health inferences about host-microbiome interactions in Antarctic fur seals and highlights the importance of using omic tools to inform ecological forecasting.

Forensic genetic analysis of fish: Genetic markers for relatedness analysis in European smelt (*Osmerus eperlanus*) by RADseq

Yassine Kasmi[1], Stefan Reiser[1], Tina Blancke[1], Benita Möckel[1], Reinhold Hanel[1]

[1] Thünen Institute of Fisheries Ecology, Bremerhaven, Germany

Keywords: parental test, mating experiment, aquaculture, smelt, Close Kin Mark Recapture

The European smelt, *Osmerus eperlanus*, is an anadromous fish species of the family Osmeridae, found in coastal waters of the north-east Atlantic as well as in rivers, streams and lakes in northern Europe. In recent decades, the stock status of the European smelt has deteriorated considerably. Consequently, the here presented project aims at exploring the possibility of integrating genetic techniques into the assessment of European smelt stocks. It shall be evaluated, if the application of a Close Kin Mark Recapture (CKMR) method allows an estimation of smelt stock sizes in the Elbe and Weser rivers as well as the German North Sea coast. A major challenge for the implementation of this technique is the identification of suitable genetic markers for a reliable genotyping to reveal kinship patterns among individuals. In this context, a mating experiment was carried out with 4 females and 8 males. Half of the egg mass from each female was fertilized by one male each. Following rearing for 40 days, 60 juveniles per mating were sampled. Parents and offspring were then subjected to RADseq analysis targeting the restriction sites of the enzyme SbfI, and the results were analysed using Stacks2 and Plink v1.9 to identify the genetic markers capable of distinguishing the different relationships. Based on this analysis, two sets of genetic markers of different sizes were selected to reliably resolve the relatedness among the individuals in the experiment. The results of this work pave the way for a better understanding and more accurate assessment of the European smelt population through the use of innovative genetic methods coupled with conventional aquaculture mating experiments.

Clawing through research: a checklist of Atlantic decapods

Cátia Alves[1,2,3], Ricardo Araújo[5], António M. Santos[2,3,4], Harald Meimberg[6], Manuel Curto[2], Sérgio P. Ávila[2,4,7]

[1] CIBIO - Pólo dos Açores, Ponta Delgada, Portugal;
[2] BIOPOLIS Program in Genomics, Biodiversity and Land Planning, CIBIO, Vairão, Portugal;
[3] Universidade do Porto, Porto, Portugal;
[4] CIBIO - Universidade do Porto, Vairão, Portugal;
[5] Museu de História Natural do Funchal, Madeira, Portugal;
[6] University of Natural Resources and Life Sciences (BOKU), Vienna, Austria;
[7] UNESCO Chair – Land Within Sea: Biodiversity & Sustainability in Atlantic Islands, Universidade dos Açores, Ponta Delgada, Portugal

Keywords: Brachyura, Crustaceans, Marine biogeography

Marine invertebrates play a vital role in ecosystem dynamics and their vulnerability to climate change makes them a good indicator of the ocean's health. Despite their ecological significance and abundance, there is a noticeable gap in research, especially regarding decapod species. Our study aims to address this gap by compiling available data to create a comprehensive checklist for decapods (Brachyura and Anomura) in the Atlantic Ocean. Ultimately, this checklist has the potential to uncover marine biogeographical patterns and set a baseline for several community assemblages' analyses in the Atlantic. Data was extracted from primary literature and complemented by employing a combination of search methodologies including Google Scholar, Scopus, Ocean Biodiversity Information System (OBIS), and Global Biodiversity Information Facility (GBIF), data will be collected and standardized. The data compiled will also be formatted following Darwin Core guidelines and the FAIR data principles for later publication, facilitating further research and conservation efforts in the field of marine invertebrate decapods.

Resource defence as a driver of grouping behaviour and its influence on the function of herbivory by a coral reef fish.

Harshul Thareja[1], Anish Paul[1], Rucha Karkarey[2], Teresa Alcoverro[3,4], Rohan Arthur[4]

[1] National Centre for Biological Sciences (NCBS - TIFR), Bangalore, India;
[2] Lancaster Environment Centre, Lancaster University, Lancaster, United Kingdom;
[3] Centre d'Estudis Avançats de Blanes (CEABCSIC), Girona, Spain ;
[4] Nature Conservation Foundation, Mysore, India

Keywords: social foraging, *Chlorurus sordidus*, fish shoals, territoriality, interspecific aggression

Herbivorous fishes perform the essential function of algal removal in coral reefs. They are significant determinants of benthic community structure and are essential for reef functioning and resilience. Single and multi-species grouping behaviour is well described in these fishes, and they exhibit considerable variation in group size and composition. However, the drivers and functional consequences of this variation in grouping behaviour are not well understood. Defence of algal resources by territorial fishes has been hypothesised to be one of the potential drivers of herbivore group formation. We tested this hypothesis by sampling the herbivorous fish community using timed transects and quantifying algal resource at 15 sites in two coral atolls of the Lakshadweep Archipelago. Our data supports the hypothesis that resource defence promotes grouping behaviour in herbivorous coral reef fishes. We further asked how grouping influences resource acquisition by an individual, and ultimately the function of herbivory on coral reefs. We observed feeding rates and aggressive encounters with territorial fish for a small herbivorous excavator species, *Chlorurus sordidus*, across varying group sizes, resource levels, and territorial fish densities. We found that (i) individuals in larger groups have higher feeding rates irrespective of group composition, (ii) feeding rates are negatively affected by aggressive encounters, and (iii) individuals in larger groups receive less aggressive encounters. We use predictions from our model to show that the same number of herbivores can show substantial variation in their function of algal removal depending on their grouping behaviour. Our study demonstrates that variation in the ecological context can drive variation in social behaviour – which influences foraging by individuals, and ultimately their functional contribution in coral reef ecosystems.

Beyond fear: Role of predators in facilitating herbivory in nutrient-limited coral reefs

Anish Paul[1], Harshul Thareja[2], Rohan Arthur[2,3], Teresa Alcoverro[2,3], Rucha Karkarey[4]

[1] National Centre for Biological Sciences, Bangalore, India;
[2] Nature Conservation Foundation, Mysore, India;
[3] Centre d'Estudis Avançats de Blanes (CSIC), Girona, Spain;
[4] Lancaster University, Lancaster, United Kingdom

Keywords: phosphorus limitation, predator-derived nutrient, predatory fishes, reef recovery, epilithic algal matrix

Despite extensive research on predator-prey interactions and trophic cascades in terrestrial ecosystems, studies from marine ecosystems are few, and the role of apex predators is highly debated and equivocal. Algae removal by herbivorous fishes is an ecologically indispensable process in coral reefs, which prevents coral-algal phase shifts, especially following mass-disturbance events. Predators can suppress herbivory through fear but can boost primary productivity by providing nutrients, leading to enhanced herbivory. Predators' influence on herbivory through top-down and bottom-up processes has rarely been studied simultaneously. The Lakshadweep Archipelago, a chain of coral atolls situated in the northern Indian Ocean, has been severely affected by recurrent mass-bleaching events since 1998, accentuating the importance of herbivorous reef fishes in the system. The nutrient-limited nature of Lakshadweep's reefs, paired with relatively less commercial fishing pressures, provide a suitable system to explore predator influence on herbivory. We examined primary productivity, the behaviour of the herbivorous fish *Ctenochaetus striatus*, and overall herbivory rates along a gradient of predatory reef fish biomass. Our results indicate that predators enhance primary productivity via nutrient input. *C. striatus* reduced its feeding in the presence of high predator biomass without any significant changes in its anti-predatory behaviours, suggesting the reduction is due to increased nutritional gain per feeding effort. At the reef level, herbivory increased with predator biomass, indicating facilitation of herbivory by predators. This highlights the importance of consumer-derived nutrients in essential processes like herbivory in nutrient limited ecosystems. Amid global climate change and growing commercial reef fisheries, understanding these links between consumer populations and ecosystem functions is vital to maintaining the socioecological, functional, and commercial integrity of coral reefs in the Anthropocene.

Flipbook-ENA: Towards a dynamic Ecological Network Analysis under changing environmental conditions

Joel Habedank[1], Sabine Horn[1], Dan Baird[2], Peter Lemke[1], Jasmin Renz[3], Vera Sidorenko[1], Karen H. Wiltshire[1]

[1] Wadden Sea Station Sylt, Alfred-Wegener-Institute, Helmholtz Centre for Polar and Marine Research, List, Germany;
[2] Department of Botany and Zoology, Stellenbosch University, Stellenbosch, South Africa;
[3] German Centre for Marine Biodiversity Research (DZMB), Senckenberg Research Institute, Hamburg, Germany

Keywords: quantitative ecological networks, food web, abiotic factor, temperature, climate change

Changes in the abiotic environment (e.g. temperature, light availability, salinity, nutrient concentration) alter the structure and function of ecosystems in direct and indirect ways. Increasingly, modifications of ecosystems are occurring outside the actual community structure via changed ecological, economic, and social parameters and due to the high degree of interconnectedness of socio-ecosystems. Understanding the influence of environmental changes on structural properties and connections of the different levels of interaction is crucial for an effective ecosystem-based management. Ecological network models typically describe the internal and external relationships of an ecosystem (e.g. trophic and energetic) by modelling the flow of biomass between species and their external environment. Based on these models, Ecological Network Analysis (ENA) provides a suite of analysis techniques for quantifying ecosystem properties, facilitating objective and comparable assessments tailored for management needs via descriptive indicators. Some of these indicators have been adopted by the European Marine Framework Directive (MSFD) for ecosystem evaluation. Dynamic abiotic alterations of an ecosystem, however, cannot be resolved with the "state of the art" ENA as the methodology of analyses is static in both space and time. In this presentation, we present a new, almost dynamic approach "Flipbook-ENA" which allows for the trend analysis of system indicators over a defined range of abiotic factors. Flipbook-ENA discretizes the continuous influence of abiotic factors, providing insights into dynamic system responses.

We applied this new concept to two Wadden Sea food web models focusing on temperature as the influencing abiotic factor. Our analysis revealed that increasing temperature led to heightened system activity and complexity, rendering the systems more resilient to external disturbances but reducing organizational efficiency. The case studies demonstrate an increased flexibility of ENA and facilitate the provision of a quantitative assessment basis for ecosystem management under the pressure of climate change.

Session 2.2
Exploring Human Dimensions within Marine Social-Ecological Systems

Hosted by:
Marissa Levinson and Gabriel Rivas Mena

Sessions

Session 2.2: Exploring Human Dimensions within Marine Social-Ecological Systems

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How humans interact with the environment has a considerable influence on marine ecosystems and the associated species. The interconnectedness between human societies and marine ecosystems unravels into multifaceted dimensions, requiring multi- and transdisciplinary approaches to address complex challenges and identify sustainable solutions. Looking through a social-ecological lens, opportunities arise to apply knowledge with innovative resource management strategies that cultivate a positive relationship with nature. Moreover, there is an opportunity to explore best practices and applications across diverse dimensions such as adaptive governance, marine spatial planning, policy formulation, and economic frameworks. Moreover, a discussion on the varying interpretations of sustainable use among stakeholders and communities is essential for advancing the development and utilization of tools for biodiversity conservation. The complexity of the challenges faced requires a balance between human and ecological needs to ensure a sustainable future. In this session, we invite presentations showcasing case studies that exemplify the innovative application of interdisciplinary and participatory methodologies across different scales to address the challenges confronting marine ecosystems. By sharing experiences and insights, we aim to enrich our collective understanding and chart pathways toward a more resilient and thriving marine environment.

Accounting for the environmental impact of Fish farming in an Algerian coastal city

Sonia Akrour[1], Sarra Tasakkourth[1], Rania Yasni[1]

[1] Tipaza University Center, Morsli abd Allah. Tipaza, Algeria;

Keywords: Fish farming, Ecological Footprint, Gilt-head bream, Blue Economy

This study aims to assess the ecological footprint of marine aquaculture in the Tipaza region of Algeria. The analysis is based on data collected at the Gouraya (Medi Fish) fish farming site. This fish farm produces Gilt-head bream (*Sparus aurata)* and European seabass (*Dicentrarchus labrax*). The main aspects examined are the consumption of raw materials (feed, farming production, equipment), energy needs (fuel, electricity), and occupied areas at sea and on land. The study aims to present a standardized device for assessing emerging activities related to the blue economy strategy in Algeria with positive socio-economic benefits (job creation and supply of local markets with aquaculture products). This comprehensive analysis aims to provide a holistic assessment of the ecological footprint of marine aquaculture in Tipaza to guide more sustainable practices and highlight potential environmental impacts, especially CO2 emissions, energy consumption, and land use. The research confirms that aquafarming in the region currently has a low ecological impact. However, with the anticipated growth of the city and the planned establishment of more than eight fish farms, the ecological footprint of the activity is expected to increase.

Ghost fishing gear: Understanding the main drivers, the socioecological effects and main solutions from the perspective of fishers & divers in the Gulf of Tribugá, Colombia

Giovanna Jácome Ruiz[1], Pilar Herrón[2], Gabriela Navarrete[2], Achim Schlüter[1,3], Lina M. Saavedra-Díaz[4,5], Lotta C. Kluger[6,7]

[1] Bremen University, Bremen, Germany;
[2] ECOMARES Fundation, Colombia;
[3] Leibniz Centre for Tropical Marine Research (ZMT), Bremen, Germany;
[4] Universidad del Magdalena, Santa Marta, Colombia;
[5] Grupo de Investigación Sistemas Socioecológicos para el Bienestar Humano (GISSBH), Santa Marta, Colombia;
[6] Kiel University, Kiel, Germany; [7] Center for Ocean and Society (CeOS), Kiel, Germany

Keywords: Ghost fishing gear, Local communities, Participatory approach, Stakeholders perspectives, Mitigation measures

The Gulf of Tribugá, characterized by its mangroves and rocky reefs, serves as a crucial habitat and refuge for a diverse range of marine species, both commercially and ecologically significant. These ecosystems are integral to the region's ecological equilibrium and supporting the livelihoods of local communities dependent on these resources. Ghost fishing gear has been identified by inhabitants of the region as a major contributor to ecosystem degradation. However, comprehensive information regarding this issue is scarce, impeding the development of effective solutions and the understanding of its impact on marine ecosystems and coastal communities. Therefore, this study aims to address this gap by comprehensively exploring the socioecological conflict associated with the abandonment, loss, and discarding of fishing gear in the Gulf of Tribugá. Through a participatory approach involving key stakeholders such as fishermen and divers, we seek to gain insights into the root causes and potential solutions to this issue. Fieldwork was conducted in the Gulf of Tribugá communities from October 2023 to February 2024. Semi-structured interviews were conducted, with artisanal fishers and divers, to gather demographic data, information on fishing gear characteristics and vessels, the participants' knowledge and perceptions of ghost fishing and an analysis of the primary factors contributing the production of ghost fishing gear. Interviews captured perspectives from 20% of the artisanal fisher population in the region (n=61), alongside insights from 21 recreational and fishing divers. Preliminary findings suggest that a significant factor driving ghost fishing gear production is the lack of knowledge among artisanal fishers regarding the physical characteristics of fishing areas, the socioecological impacts of ghost fishing gear, and economic pressures. This research aims to contribute to the development of strategies to mitigate the impacts of ghost fishing gear in the Gulf of Tribugá, thereby safeguarding marine ecosystems and the livelihoods of coastal communities.

Challenges and facilitating factors of mangrove (re)establishment - an interdisciplinary perspective

Mondane Fouqueray[1]

[1] Leibniz Centre for Tropical Marine Research

Keywords: Stakeholder Engagement, Local Communities, Natural Resource Management, Restoration, Rehabilitation

Mangrove forests are inherently social-ecological, whereby the social and ecological aspects are deeply interconnected and interdependent. Coastal zones, however, are often densely populated and subject to much land-use competition, including urban development, expansion of agricultural areas, and pond-building for the aquaculture industry. Additional factors like coastal erosion, sea-level rise, and extreme events are contributing to global mangrove loss. Due to the rapid development of payment for ecosystem services mechanisms, such as carbon credits, and the increased demand for "nature-based solutions", there is currently a lot of momentum for mangrove (re)establishment projects, in the form of funding and increased knowledge production and distribution. However, historically, such projects have had high rates of failure. This research focuses on identifying and analysing the different factors (both ecological and social), either hindering or facilitating mangrove (re)establishment initiatives worldwide. The research was conducted through a qualitative literature review. After inclusion and exclusion criteria were applied, 49 records were retrieved for analysis from Web of Science, and coded with the Dedoose software, using both deductive and inductive coding. The preliminary results show that there is a lack of project monitoring and evaluation globally. The main challenges were conflicts among stakeholders involved, poor planning, and not planting according to ecological criteria. The main facilitating factors were training and capacitation of local actors, community involvement, and stakeholder cohesion. Therefore, for mangrove (re)establishment efforts to be lastingly successful, more emphasis needs to be put on including local communities in the decision-making process, ensuring good communication between all stakeholders, and providing adequate training and long-term capacitation.

Mangroves and society, the challenge of collaborative sciences. Colombian case study

Camilo A. Arrieta-Giron[1]

[1] Leibniz Centre for Tropical Marine Research, Bremen, Germany

Keywords: co-design, transformative sciences, mangrove re-establishment, Blue Carbon Credits

In the ocean, especially on the world's coasts, societal imbalances persist, leading to disparities that require comprehensive and adaptable solutions to effectively address today's challenges. This research explores the intersection of the Ocean Decade's call for 'Transformative Science' and the co-design methodology seeking to generate sustainable outcomes for communities and the environment. Through the sea4soCiety project, the case study explores how a participatory ecosystem design—multi-stakeholder collaboration to design and implement ecosystem management strategies—can offer viable solutions. It particularly focuses on mangrove ecosystems in the pursuit of climate change mitigation due to their high CO2 sequestration capacity and the societal co-benefits that come with it. As the mangrove re-establishment is presented within a Blue Carbon Credit initiative, the complexities of the carbon credit market and its negative societal impacts are explored. A roadmap is provided to guide the co-design process, incorporating both literature and field data from the Barú Peninsula in Colombia, evaluating key stakeholders' needs, interests, and expectations, while offering insights into potential conflicts and collaboration strategies. The field data was collected throughout semi-structured interviews with focal groups such as fisheries, ecotourism, mangrove nurseries, and environmental authorities. Additionally, a workshop was developed to build a common approach among stakeholders for the re-establishment initiative. The results indicated a significant need to establish cooperation mechanisms, support the local economy, and generate capacity building to address issues such as 'Lack of Trust,' 'Community Negative Impacts,' and 'Conflict of Interests,' among others. The research culminates in presenting a blueprint for aligning theoretical frameworks with practical execution, demonstrating how co-design can bridge the gap between societal needs and business-as-usual research approaches. This raises the critical question for researchers: Is science capable of fulfilling societal needs?

Stakeholder perceptions of marine and coastal Nature-based Solution – A UK case study

Daisy Taylor[1], Ian Hendy[2], Ewan Trégarot[1], Pierre Failler[1], Cindy C. Cornet[1]

[1] Centre for Blue Governance, Faculty of Business and Law, University of Portsmouth, Portsmouth, UK;
[2] Institute of Marine Science, University of Portsmouth, Portsmouth, UK

Keywords: Management, Community, Engagement

Nature-based solutions (NbS) are gaining traction in the science-policy-practice interface as a practical approach to mitigating climate change, enhancing human well-being, and increasing biodiversity simultaneously. Their effective implementation requires a multi-disciplinary approach, with multiple stakeholders, including community members, to be actively involved. Despite the potential of marine and coastal NbS, their uptake has been slow due to limited understanding of stakeholder and community knowledge. Indeed, stakeholder engagement through marine and coastal NbS is often underreported, with limited qualitative data available. This study aims to understand stakeholders' perceptions, motivations, and engagement in marine and coastal NbS. As NbS build on existing practices, a case study approach was followed and semi-structured interviews were conducted with various stakeholder groups, including community members from the Isle of Wight UNESCO Biosphere Reserve, which is in its early stages of implementation. The interviews, built around the themes of motivations, acceptance, and engagement, allowed for the exploration of the drivers behind stakeholder perceptions of marine and coastal NbS interventions prior to their implementation. The first results will show different levels of understanding and perceptions of marine and coastal NbS among different stakeholder groups. Overall, despite initial support, current industries on the Isle of Wight show resistance to NbS-like interventions, and we anticipate that overcoming and changing negative interactions will be challenging. We argue that understanding stakeholder behaviour and uncovering the drivers behind their concerns early on is a key parameter for the success of NbS implementation. We also suggest that further research should consider how effectively communicating ecosystem services valuations to stakeholders can enhance engagement and motivate active participation, bringing forward the value of NbS implementation.

Challenges and opportunities for the governance of a marine socio-ecological system, a systematic literature review

Linda Del Savio, Maila Guilhon, Ben Boteler[1]

[1] Research Institute for Sustainability – Helmholtz Centre Potsdam, Germany.

Keywords: marine Socio-Ecological System, Ecosystem Based Management, ocean governance, systematic literature review

Human well-being and the balance of the natural world, including thriving ocean ecosystems, are interconnected and fundamental within a socio-ecological system. Governing this social-ecological system and addressing interconnected social and environmental challenges confronting humanity necessitates a deep understanding of how different elements within a system function and interact across spatial and temporal scales. As part of the Horizon Europe project "Marine Systems Approaches for Biodiversity Resilience and Ecosystem Sustainability" (Marine SABRES) a systematic literature review was conducted to assess the main challenges and opportunities for the governance of a socio-ecological system and explore how governance might support the application of a socio-ecological systems approach and accelerate the uptake of ecosystem-based management in European seas. The research further explored whether there are generally accepted 'good governance' attributes in the context of a marine socio-ecological system.

For this, a total of 149 peer-reviewed articles were screened, based on the content of the title, keywords, and abstracts. Furthermore, a double-blind analysis was applied, resulting in 62 abstracts that were selected for full-text analysis. The main findings will support an improved understanding of how marine governance and the management of human activities in the marine space can be adapted or improved to support a social-ecological system approach in the three case-study areas of Marine SABRES and beyond.

Sea level change and the cross-cultural manifestation of cognitive biases

Tobias Ossmer[1,2]

[1] University of Bremen, Bremen, Germany;
[2] Leibniz Centre for Tropical Marine Research (ZMT), Bremen, Germany

Keywords: Scales, Perception, Cognitive bias, Culture, Environmental change

The large-scale threat of sea level rise caused by human-induced climate change presents humanity with a dilemma requiring global mobilization. We perceive the world around us differently depending on our cultural, historical, and traditional backgrounds. The contemporary, socio-economic constraints that govern our daily realities likely affect the implementation of collective and decisive action steps. Cognitive Biases - such as present bias, positive illusion, and risk perception bias - can significantly influence people's judgements about appropriate responses, affecting their willingness to participate in and comply with adaption and mitigation measures. Concerning contemporary constraints, the poorly understood clashing scales of societal organization in a globalized world are at the centre of attention. Considering the individual scope of action, the social, temporal, physical and cognitive scales across which life is staged are examined. To comprehend how culturally embedded cognitive biases (CECB) alter people's perception of environmental change was approached via qualitative interviews concerning sea level rise in Nordstrand, Germany and a Bajo village in Wangi-Wangi, Southeast Sulawesi, Indonesia. In both places people live in close interaction with and dependent on the sea. This study aims to understand the potential risks and benefits of biased perception regarding climate change. Culturally distinct motivations have to be taken into account to further improve communication and cooperation. A profound understanding of environmental change perception can greatly contribute to a solid foundation upon which we design measures moving forward without losing touch with the people on the way.

Beyond the Surface: How Intrinsic Scenarios guide the Work of Science and other Stakeholders in Shaping the Wadden Sea's 2050 Outlook

Jonathan Heimer[1]

[1] Institute for Chemistry and Biology of the Marine Environment, University of Oldenburg;
[2] German Marine Research Consortium (KDM)

Keywords: Wadden Sea, socioecological systems, scenarios, stakeholder, REST-COAST

The Wadden Sea, a UNESCO World Heritage Site, stands as a complex nexus of ecological, social, and economic dynamics. Amidst 21st-century pressures, scenarios paving the way towards a more harmonized future become paramount. However, marine research often overlooks researchers and stakeholders' intrinsic motivations and visions, as well as implicit prerequisites hidden in research questions. This research delves into the intrinsic ideas and narratives guiding research and stakeholder activities within the Wadden Sea region, using the European Union's Green Deal project REST-COAST as a lens. Introducing the terms of intrinsic and implicit scenario, the study aims to look at the setting and targeting of scenarios and goals holistically. By analyzing stakeholders and interviewing scientists from German and Dutch partners of the project, it exemplarily covers a multinational European research project. First results indicate that the definition of desirable scenarios is often driven by ecosystem functions and a redefinition of perception of the environment and the land-sea interface. A process-oriented thinking and operating principle contradicts single parameter targets and shines a new light on target setting and quantifiability. Besides different scenarios in mind, the divergence does not seem to create conflicts. This study helps to adjust multilateral target setting and identifies expertise needs and gaps in large interdisciplinary research projects. Unveiling implicit narratives guiding coastal restoration, it offers insights for policymakers, project coordinators, and stakeholders, enriching understanding and alignment towards restoring and sustaining marine ecosystems.

Friday
20th September 2024

Program - Friday, 20th September 2024

Program Friday (20th September)

08:00	**Registration**	
08:30	**Keynote** **The Year-round Ecosystem Study on Svalbard YESSS – An Example of Merging "Constructive Journalism" and Research for the Greater Good** Christoph Sodemann, Constructify.Media, Bremen, Germany *Lecture Hall*	
09:30	Session 4.1 **Maritime Technology: Pushing the Frontier of the Observable** *Session Hall A*	Session 6.2 **Marine Megafauna: Critical Habitats, Threats, and Conservation Strategies** *Session Hall B*
10:30	**Coffee break**	
11:00	Session 3.3 **Marine Ecotoxicology: Pathways, Distribution, and Fate of Pollutants in the Marine Realm** *Session Hall A*	Session 6.2 **Marine Megafauna: Critical Habitats, Threats, and Conservation Strategies** *Session Hall B*
12:30	**Lunch break** *(self organized)*	
13:00	**Round Table** **Mental Health** *Foyer*	
13:30	Session 6.3 **All Things Corals: Ecology, Conservation & Future Trajectories** *Session Hall A*	Session 1.2 **Investigating Controlling Mechanisms of the (Biological) Carbon Pump: The Story of Organic Matter** *Session Hall B*
15:00	**Coffee break**	
15:30	Session 6.3 **All Things Corals: Ecology, Conservation & Future Trajectories** *Session Hall A*	Session 1.2 **Investigating Controlling Mechanisms of the (Biological) Carbon Pump: The Story of Organic Matter** *Session Hall B*
17:00	**Farewell** *Lecture Hall*	
18:30	**Post-Conference Party** *Schwimmverein Bremen von 1910 e.V., Strandweg 102, 28201 Bremen*	

Keynote & Plenary Discussion

The Year-round Ecosystem Study on Svalbard YESSS – An Example of Merging "Constructive Journalism" & Research for the Greater Good

Speaker: Christoph Sodemann,
Constructify.Media, Bremen, Germany

"Constructive Journalism" is a style of reporting that does not only evaluate the status quo of crises and conflicts. It also asks questions about the future and illustrates potential solutions and pathways to overcome these crises and conflicts. Constructify.Media is a young media association, which aims to overcome the generally wide spread trend of negativism. In cooperation with universities and other educational institutions, the association develops and implements workshops, trainings and curricula that apply the concept of constructive journalism to climate, environment and water reporting. The recently funded research project YESSS (Year-round Ecosystem Study on Svalbard) includes Constructify.Media as the partner responsible for outreach activities.

This lecture will introduce the concept of Constructive Journalism, its implementation into the outreach activities of YESSS, and how Constructive Journalism and research can benefit from each other.

Biography:
Christoph has a 30-year history as a journalist and media expert with a strong focus on media training. After graduation from the University of Bremen in German literature and history, he worked as an editor, reporter and presenter at Radio Bremen for more than ten years. In 1999, he founded his own TV production house Südost-Medienagentur with branches in Bremen, Belgrade, Chisinau and Sofia. Südost-Medienagentur conducted TV trainings for young journalists from South-Eastern Europe, and produced films for German TV (3sat/ZDF, Deutsche Welle). From 2009 to 2011 he was editor-in-chief of center.tv Bremen. He is the founder of a Bremen-based PR agency and was head of PR for five years at BORDA, an NGO implementing water and sanitation projects around the world. During that time, he was responsible for the communication of the EU Horizon 2020 project INNOQUA, and held media workshops on water reporting in Jordan, Kurdistan/Northern-Iraq and Uzbekistan. Since 2012 he has been a lecturer in the media department of the University of Bremen. Today he is managing director of constructify.media e.V.

Session 4.1
Maritime Technology: Pushing the Frontier of the Observable

Hosted by:
Leonard Günzel, Michele Grimaldi and Sebastian Realpe Rua

Sessions

Session 4.1: Maritime Technology: Pushing the Frontier of the Observable

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The vastness of our ocean is still largely unexplored, and it is becoming clearer that to unravel its mysteries, scientists need to be able to generate and handle an expansive amount of data. The tools that have become standard in the field in recent years are plentiful. With autonomous technology, we can overcome singular high-cost measurement campaigns and move towards recurring autonomous monitoring of the oceans. Using novel high-accuracy sonars, we are able to monitor swarm characteristics better. Back on shore, we can find correlations in large datasets that would take humans centuries to process. Technology, once an enabling tool to support scientists in their venture into the ocean realm, has transformed into an independent discipline. It now facilitates every aspect from data acquisition to finding correlations in huge datasets. Thus, the scope of this session is supposed to be broad and wide arching. Join us in this broad-ranging session where ocean technologists meet to share innovative solutions from their respective fields. This session aims to be a hub for young researchers, fostering interdisciplinary collaboration and novel ideas. We welcome proposals in ocean technology, ranging from new adhesives to cutting-edge machine learning models, to contribute to a vibrant and constructive community.

Detection of DNA from marine species using an isothermal amplification tool and gold nanoparticles

Patricia Alcázar González[1], María Luisa Fernández-Sánchez[1], Jose Manuel Costa-Fernández[1], Yaisel J Borrell[2], Ruth Coya[2], María Teresa Fernández-Argüelles[1]

[1] Department of Physical and Analytical Chemistry, University of Oviedo, Oviedo, Spain;
[2] Department of Functional Biology, University of Oviedo, Oviedo, Spain

Keywords: Nanoparticles, MNAzyme, Signal amplification, Fisheries, Fraud

Artisanal fisheries are seriously threatened by socio-economic factors as well as by events related to climate change and overexploitation of fish stocks. Recent global analyses reveal that an average of 30% of seafood products worldwide are misdescribed or mislabelled. One of the reasons behind this is that not all fish catches are properly recorded, due to inaccurate species identification in fisheries landings. Knowing the different biological units of commercial species is crucial for their sustainability and stock management. In recent years, nanotechnology and DNA-based techniques have been combined to achieve targeted and rapid detection of genetic sequences of interest.

The present work shows a methodology that takes advantage of the optoelectronic features of Gold Nanoparticles (GNPs) for colorimetric detection, based on changes of the surface-plasmon resonance absorption peak of dispersed and aggregated nanoparticles, that produce a colour change. In order to increase the sensitivity of the assay, an isothermal nucleic acid amplification technique called Multicomponent Nucleic Acid Enzymes (MNAzymes) is used. With the use of MNAzymes coupled to GNPs, the aim is to identify the presence of certain marine species of commercial interest in real samples (tissues or environmental samples). Therefore, the first step is to carry out the assay with specific DNA from the species *Octopus vulgaris* and *Silurus glanis*, which are currently of special commercial or environmental interest. The aim is to design several types of MNAzymes that allow the detection of these species with the highest possible sensitivity, and to couple this technique to a rapid, simple microfluidic system that allows its use for visual detection in situ.

Digitalization of Ghana Fisheries Data

Peter Teye Busumprah[1]

[1] UN Ocean Decade, Early Career Ocean Professionals and Ministry of Fisheries and Aquaculture Development

Keywords: DATA

This oral presentation addresses the UN Ocean Decade Challenges 8.9 &10 which focuses on digital representation of the Ocean, create skills, knowledge and technology for all and change human relationships with the Ocean. It focuses on SDGs 9 & 14 which is centered on industry, innovation and infrastructure and life below water. In Ghana, the fisheries sector is a crucial contributor to the national economy, but the country's fish stocks are facing declining trends due to overfishing and degradation. Accurate monitoring and analysis of fish species are essential to inform sustainable fishing practices and conservation efforts. However, traditional methods of data collection are often limited by inadequate resources and expertise. To address this challenge, we developed "Sea Rock Base App", a mobile based citizen science app designed specifically for local fishermen in Ghana. The app enables fishermen to collect and submit data on fish species they encounter during their daily activities. The app includes a user-friendly interface for recording species information, photographs, and geolocation data. The submitted data is then analyzed using machine learning algorithms to identify patterns and trends in fish species distribution and abundance. The app also provides real-time feedback to fishermen on the most common species found in their fishing grounds, allowing them to make informed decisions about their fishing activities. Pilot testing of the app in four coastal communities in Ghana revealed high user adoption rates and accurate data collection. The app has also led to the identification of new fish species and areas of high conservation concern. By empowering local fishermen with data analysis tools, Sea Rock Base App aims to promote sustainable fishing practices, improve fisheries management, and support the conservation of Ghana's marine biodiversity. This citizen science approach has the potential to be replicated in other fisheries contexts worldwide, contributing to the global effort to safeguard marine ecosystems and ensure food security for future generations.

Building of a Water Current Energy Converter (WACEC)

Fridjof Forthaus[1], László Heeder[1], Steffen Brock[1], Tom Reichert[1], Georg Friedrich[1]

[1] University of Applied Sciences Bremerhaven, Bremerhaven, Germany

Keywords: Marine technology, Rotormanufacturing, 3D printing, Ocean engineering

Stationary measuring devices form a part of the equipment used in marine research. As these are deployed freely, without the infrastructure for data transmission and energy supply, they are inevitably operated using data storage and batteries. As a result, they are limited in terms of deployment time and level of measuring detail. However, especially in deployment areas with significant flowing water volumes, there is an opportunity to generate energy for measurement systems. This possibility is addressed with a Water Current Energy Converter (WACEC). Using the wind energy technology as a role model, a first prototype of the stationary sea based, self-aligning WACEC was developed in this project. The aim was to construct and evaluate a system within one year. This involved four areas of work: developing a suitable rotor, selecting a generator, creating a monitoring system, and constructing a foundation/housing. Production using 3D printer was evaluated for designed rotors. A moulded-in three-phase current generator, mounted outside the watertight housing, was used. A voltage monitoring and data acquisition were realised with a microcontroller. The supporting structure is a frame with four legs and a weight in the centre. A trailing fin allows the converter to align itself independently in the current. The electronics are housed in a watertight pressure resistant nacelle. A prototype of the system was tested with a three-day and a one-day field test off the islands Helgoland and Sylt in summer and autumn of the year 2023. Possibilities for further development were identified. The alignment mechanism and rotor were functional Additionally the manufacturing process of parts with a 3D printer were successful. These results serve as a base for further projects in the development of the WACEC.

Session 6.2
Marine Megafauna: Critical Habitats, Threats, and Conservation Strategies

Hosted by:
Leyla Israpilova

Sessions

Session 6.2:
Marine Megafauna: Critical Habitats, Threats, and Conservation Strategies

Hosted by: Leyla Israpilova

Marine megafauna serve as a key role in maintaining ecosystem health in open waters and coastal environments. Despite their importance, these large-bodied organisms including sharks, rays, bony fishes, whales, delphinids, seals, sea turtles, and species of squids and octopuses face numerous threats, including exploitation of resources, habitat loss, pollution, bycatch, underwater noise, and climate change. Over the last century, the combined effects of these factors have caused population declines and local extinctions. Recognizing the urgent need for conservation, this session aims to bring together current research on marine megafauna with a focus on addressing their ecological importance, highlighting critical habitats facing anthropogenic stress, and proposing effective conservation strategies.

Unraveling the Implications of Shark Bycatch in the Persian Gulf: Insights from Kish Island

Sara Asadi Gharabaghi[1], Hamid Reza Bargahi[2], Mohammad Reza Shokri[1]

[1] Shahid Beheshti University of Tehran, Tehran, Iran;
[2] Iran Fisheries Organization, Tehran, Iran

Keywords: taxonomy, morphology, bycatch

Bycatch, the unintentional capture of non-target species during fishing operations, poses a significant threat to marine biodiversity and ecosystem health, especially in the case of sharks. Incidental catches often result in high mortality rates and population declines, disrupting marine food webs and ecosystem dynamics. Despite regulatory efforts, bycatch remains a pressing issue in global fisheries, necessitating comprehensive studies to assess its ecological implications and inform management strategies. This study investigates the ecological ramifications of a notable incident involving the discovery of approximately 400 deceased sharks as bycatch in bottom traps near Kish Island in the Persian Gulf. By examining the species composition and ecological consequences of this event, we aim to shed light on the broader issue of bycatch in shark species and its detrimental effects on marine ecosystems. Through rigorous taxonomic analysis, including morphological methods, we identified representatives from at least eight different shark species, including the smoothtooth blacktip shark (*Carcharhinus leiodon*), milk shark (*Rhizoprionodon acutus*), scalloped hammerhead (*Sphyrna lewini*), spottail shark (*Carcharhinus sorrah*), snaggletooth shark (*Hemipristis elongata*), spinner shark (*Carcharhinus brevipinna*), and blacktip shark (*Carcharhinus limbatus*). This diverse assemblage underscores the extensive impact of bycatch on shark populations in the Persian Gulf. Additionally, tissue samples were collected for future stable isotope studies to better understand their habitat and ecological concept, thereby providing insights into the environmental impacts of bycatch. Our findings highlight the urgent need for enhanced monitoring and mitigation measures to minimize the unintended consequences of fishing activities on vulnerable marine species in the region. Moreover, this study emphasizes the importance of implementing targeted conservation strategies to preserve the ecological integrity of the Persian Gulf and ensure the long-term sustainability of shark populations.

Using drift models and correlations with fisheries to evaluate common dolphin strandings in Irish waters

Patricia Navarro Gonzalez[1]

[1] Atlantic Technological University, Galway, Ireland

Keywords: bycatch, drift modelling, strandings, small cetacean

Marine top-predators face numerous anthropogenic stressors, especially accidental capture or bycatch, which is a large concern in the Northeast Atlantic. Efforts to mitigate bycatch have been inconsistent across the EU, despite regulatory directives, and it remains to be an unquantifiable risk. With the growing anthropogenic pressure on cetaceans in European waters, including shipping, fishing, whale watching, and offshore renewables, it is vital to assess the degree of impact from each stressor. Stranding data offers insights into marine mammal ecology and provide early warnings of threats, although it has been historically underutilised due to uncertainties when relating stranded and at-sea populations. Alternative calculations of bycatch to observer programmes have been explored using strandings in recent years. After setting common features implicating bycatch on carcasses, time of death is calculated and can be used alongside reverse drift modelling to estimate the origin at-sea of said carcasses. Our research aims to apply reverse drift modelling methods on Irish strandings and correlate them with fishing effort distributions to identify high-risk areas. The research is currently ongoing. Preliminary findings confirm previous work on stranding data and indicate a steep increase of common dolphin strandings in the last decade (2010-2023), peaking in winter months (January-March). Drift models revealed high frequency of hotspot in coastal areas and to a lesser certainty hotspot near the continental shelf surrounding Ireland. Correlations with fishing effort through General Additive Models would allow to identify potential fisheries contributing to bycatch events. Our hypotheses include offshore pelagic fisheries and gillnets as most likely correlated with mortality hotspots due to their common prey target. Inshore fisheries remain largely understudied and could be the key to minimising bycatch. Despite the caveats, we demonstrated the efficiency of this method in assessing minimal levels of bycatch and identifying target and flag- specific mitigation measures.

Passive acoustic monitoring of marine mammals in Algoa Bay, South Africa

Carolin Kalmbach[1], Silke Laakmann[2], Ilse Van Opzeeland[1]

[1] Alfred-Wegener-Institute Helmholtz Center for Polar and Marine Research (AWI), Bremerhaven, Germany;
[2] Helmholtz-Institute for Functional Marine Biodiversity Research at the University of Oldenburg (HIFMB), Oldenburg, Germany

Keywords: biodiversity assessment, non-invasive methods, autonomous sampling, pilot study, ocean conservation

Information on the occurrence and distribution of marine mammals is of great importance to better protect, assess potential impacts and formulate recommendations for marine protected areas. Non-invasive methods such as passive acoustic monitoring (PAM) and environmental DNA (eDNA) are potentially complementary methods for cost-effective data sampling on a non-invasive basis. Particularly for marine mammals, which release DNA and are highly vocal, combining these two methods, could provide valuable insights into the distribution of marine mammals. However, there are currently still many unknows with respect to the sensitivity of each method. Algoa Bay in South Africa is easily accessible for research and hosts a large diversity of marine megafauna, providing an excellent location for comparing the species that each method captures when PAM, eDNA and visual sighting data are collected simultaneously.

The PAM, eDNA and visual data were sampled in the context of a short pilot study from 14 -18 November 2019. Data sampling was carried out from a 28-foot catamaran. In total 186 min of PAM and visual data and 36 eDNA filters were simultaneously sampled over three days. Acoustic signatures of marine mammals ranging from high-frequency odontocete clicks to low-frequency baleen whale sounds, are used to identify callers on species level. For the eDNA, genetic material from organisms in the seawater was extracted and captured by filtration and analysed for the diversity based on the metabarcoding approach. It allows assessing the presence of marine mammals and gives an insight to species communities.

By comparing the PAM, visual and eDNA data, we can understand how these methods can be best combined to complement non-invasive data collection on marine mammals. The current study focuses on the analysis and outcomes of the PAM data that were collected.

Does foraging behaviour in Galápagos sea lions (*Zalophus wollebaeki*) change with time and under different climate conditions?

Svenja Stoehr[1], Jonas F. L. Schwarz[2], Alexandra Childs[1], Oliver Krüger[1]

[1] Bielefeld University, Bielefeld, Germany;
[2] University of California, Santa Cruz, United States

Keywords: Marine Mammal, Individualization, Animal Behaviour, El Niño, climate change

Studying foraging behaviour is key to understanding the ecology of species, populations and even individuals. Achieving balance between energy expenditure and intake during foraging is crucial for an individual's fitness and the allocation of resources towards survival and reproduction. Within species and even on population level a range of diverse foraging strategies can arise. Understanding how these different strategies develop is becoming increasingly relevant, as they can be differently adapted to contrasting conditions and can influence the coping ability of entire populations towards environmental change. Inhabiting the highly variable equatorial Pacific Ocean, Galápagos sea lions (GSL) (*Zalophus wollebaeki*) are confronted with such contrasting conditions, especially increasingly strong interannual fluctuations in sea surface temperature and prey availability due to El Niño and La Niña events. Previous studies have used biologging devices to discover distinct foraging niches that differ in their geographical and temporal distribution, prey sources, as well as their coping ability with climate change. In this study, we aim to dive deeper into the foraging behaviour and investigate the temporal development and stability of these strategies by re-deploying biologging devices after multiple years on animals that were previously monitored. Through this, we want to investigate individual variation as well as potential adaptations to fluctuating environmental conditions within an individual's respective foraging strategy. While we anticipate long-term stability of foraging strategies even under contrasting climatic scenarios, we expect to observe variation in behaviour within those strategies in order to mitigate potential negative effects of climate change. By expanding our knowledge on the temporal development and adaptability of foraging in a top ocean predator, we aim to better understand how marine species can cope with environmental change.

Session 3.3
Marine Ecotoxicology: Pathways, Distribution, and Fate of Pollutants in the Marine Realm

Hosted by:
Louisa Karl and Victoria Wegner

Sessions

Session 3.3:
Marine Ecotoxicology: Pathways, Distribution, and Fate of Pollutants in the Marine Realm

Hosted by: Louisa Karl and Victoria Wegner

The marine environment stands as a testament to the impact of anthropogenic activities with pollutants infiltrating every corner of its vast expanse. From plastic debris littering coastlines to chemical contaminants permeating the depths of the ocean trenches the influence of human actions is pervasive. In this context marine ecotoxicology emerges as a crucial discipline offering insights into the intricate processes shaping the health of our oceans and the many life forms they harbour. This session delves into the multifaceted realm of marine ecotoxicology shedding light on the pathways through which contaminants enter and move through marine ecosystems and the diverse effects they exert on their organisms. From elucidating uptake mechanisms in marine organisms to unravelling the molecular and behavioural consequences of exposure our discussions aim to deepen our understanding of the intricate interplay between contaminants and the marine environment. Join us as we investigate the challenges posed by pollutants in marine ecosystems and connect with fellow ecotoxicologists and scientists from other fields to create a better understanding of our oceans!

Seasonal variation of UV filter distribution in the Baltic Sea

Harshada Sakpal[1], Ina Stachewicz[1], Marion Kanwischer[2], Detlef Schulz-Bull[2], Kathrin Fisch[1]

[1]Julius Kühn Institute (JKI) – Federal Research Centre for Cultivated Plants, Institute for Ecological Chemistry, Plant Analysis and Stored Product Protection, Berlin, Germany;
[2] Leibniz Institute for Baltic Sea Research Warnemünde (IOW), Warnemünde, Germany

Keywords: Pollutants, UV filters, Baltic Sea

The Baltic Sea is one of the world's most polluted seas due to its topography, high freshwater input, and increasing anthropogenic pollution. One of the greatest threats to the Baltic Sea is the pollution by persistent, toxic and bioaccumulative pollutants. One group of pollutants are organic ultraviolet (UV) filters. UV filters are contaminants of emerging concern (CECs) and have the potential to cause endocrine disrupting effects on aquatic ecosystems. Their input through recreational activities and wastewater treatment effluents could have long-term detrimental impacts. The primary objective of this study is to contribute to a better understanding of UV filter distribution and fate in the marine environment. This project aims to help identify enrichment areas, as well as, which transport processes contribute to the distribution of UV filters into the Baltic Sea. Previous studies found UV filter concentrations in Baltic Sea coastal regions; thereby, the current study intends to investigate UV filters in both coastal and open seas. This study investigates occurrence of a more comprehensive variety of UV filters and their simultaneous detection in water and sediment. Seasonal water sampling was carried out in spring, summer, and winter to evaluate the variability of UV filter concentrations and the regional and temporal distribution of UV filters in the Baltic Sea. Octocrylene, Avobenzone, and PBSA were detected in water samples around the coastal areas in summer with concentrations as high as 1040 ng/L, 135 ng/L, and 63 ng/L, respectively. Thus, proving that UV filter concentrations are variable based on the time of sampling and location. UV-P and BP-4 were the most prominent UV Filters detected in open seas as well as coastal regions in Baltic Sea water samples throughout the year. Furthermore, these findings provide a widespread occurrence and distribution of UV filters in the Baltic Sea.

Stable lead isotope signatures in Carcharhiniform sharks: an insight into the metallic pollution of the West Africa Ocean

Houangninan E. C. Midinoudewa[1,2,3], Rémi Freydier[3], Samuel Tulashie [1,4], Zacharie Sohou[2], Ismaila Ndour[5]

[1] Africa Centre of Excellence in Coastal Resilience, University of Cape Coast, Cape Coast, Ghana;
[2] Institut de Recherches Halieutiques et Océanologiques du Bénin, Cotonou, Benin;
[3] HydroSciences Montpellier, Université de Montpellier, Montpellier, France;
[4] Department of Chemistry, University of Cape Coast, Cape Coast, Ghana;
[5] Centre De Recherches Océanographiques Dakar Thiaroye, Dakar, Sénégal

Keywords: Large Marine Ecosystems, Trace metals, Sharks, Pb ratio, marine environment

The West African facade of the Atlantic is home to a diverse array of marine species, both known and yet to be discovered. It comprises the Canaries and the Guinea Current Large Marine Ecosystems (LME) featuring various oceanographic conditions. In the context of various pressures on marine resources, and mainly of marine environment degradation, there is a need to design management plans for these resources based on species' regional responses to stressors in the area. These management strategies must be based on scientific evidence. Moreover, data on the current and past states of pollution in the West African Ocean as here defined, are scarce. This study aims to evaluate the Stable Lead isotope signatures in Carcharhiniform sharks as a proxy for tracing the origin of trace metals in these ecosystems. A large array of metals and the stable lead isotope signatures were measured in both muscle and vertebrae of *Carcharhinus falciformis*, *Carcharhinus limbatus*, *Mustelus mustelus*, and *Prionace glauca* using an ICP-MS, and the contribution of each source was estimated. $^{206}Pb/^{207}Pb$ and $^{208}Pb/^{207}Pb$ ratios measured in the tissues showed a natural origin for Lead in sharks from the Canaries LME (Senegal), whereas Lead in sharks from the Guinea current LME (Benin and Ghana) originated from a mix of sources. The stable lead isotope signatures show the potential to be useful in discriminating regional sharks' populations along with the existing methods. Pb ratios measured in the tissues showed a natural origin for Lead in sharks from the Canaries LME (Senegal), whereas Lead in sharks from the Guinea current LME (Benin and Ghana) originated from a mix of sources. The stable lead isotope signatures show the potential to be useful in discriminating regional sharks' populations along with the existing methods.

Are salmon farms a source for rare earth elements in the Norwegian marine environment? Findings from an active biomonitoring

Juliane A. Riedel[1], Keran Zhang[2], Julia Farkas[3], Stefania Piarulli[3], Anna V. Ryvænge[1], Tomasz M. Ciesielski[4], Morten Krogstad[1], Torstein Kristensen[1], Bjørn H. Hansen[3], Pål A. Olsvik[1]

[1] Faculty of Biosciences and Aquaculture, Nord University, Bodø, Norway;
[2] Physics & Earth Sciences Workgroup, Constructor University, Bremen, Germany;
[3] Ecotoxicology laboratory, SINTEF SeaLab, Trondheim, Norway;
[4] Arctic Technology Department, The University Centre in Svalbard (UNIS), Longyearbyen, Norway

Keywords: Salmon feed contaminants, Technology-critical elements, Environmental risk, Kelp and mussels, Bioaccumulation patterns

Sea-based salmon farms are a source for a multitude of feed contaminants including metals, pesticides, microplastics, and excess nutrients, to the marine environment. Previous analyses revealed that also the technology-critical rare earth elements and yttrium (REY) can be found in salmon feeds at levels exceeding local seawater concentrations by four orders of magnitude. Like other metals, REY are environmentally persistent and accumulate especially in invertebrates and plants, with a potential for adverse effects. With growing demands for green energy solutions, Norway has set the course for REY mining in the near future; yet, little is known about the risks of REY in the marine environment, including their natural distribution in biota and existing anthropogenic sources. The present study aims to disclose potential REY emissions from Norwegian salmon farms by means of an active biomonitoring using sugar kelp (*Saccharina latissima*) and blue mussel (*Mytilus edulis*). Kelp and mussels were exposed in different proximities to three salmon farms and retrieved after four months, followed by ICP-MS analysis for REY and other elements. First findings from a farm in Trøndelag (Central Norway) indicate species-specific REY uptake patterns, while elevated levels of typical feed contaminants, but not REY in individuals near the fish cages suggest that this farm was no significant source for REY in the upper water column. The results from two farms in Nordland (Northern Norway) will be available soon, adding to the understanding of the distribution and risks of REY in the marine ecosystem.

Session 6.3
All Things Corals: Ecology, Conservation & Future Trajectories

Hosted by:
Viktoria Sturm

Sessions

Session 6.3:
All Things Corals: Ecology, Conservation & Future Trajectories

Hosted by: Viktoria Sturm

Explore with your peers current gaps in the understanding of corals and coral reef environments by joining this session! Coral reefs are vital for marine biodiversity, serving as essential habitats for a multitude of marine species. They also play a critical role in supporting the livelihoods of millions of people through economic activities. However, these invaluable ecosystems are under severe threat from human activities, including climate change, overfishing, and pollution. Urgent conservation measures and solutions to combat climate change are imperative to preserve coral reefs and the countless benefits they provide to both marine life and human communities. This session aims to bring together early-career coral scientists and friends to discuss innovative ideas, insightful studies, and exchange knowledge. Together, we will unravel the complexities of corals, contributing to the shared pursuit of advancing scientific understanding and conservation efforts.

Evaluation of Cold-Water Coral habitats for restoration purposes in the Cap de Creus, western Mediterranean Sea

Gabriel Rivas-Mena[1], Marina Biel-Cabanelas[1], Jordi Grinyó[1]

[1] Institute of Marine Sciences (ICM-CSIC), Barcelona, Spain

Keywords: Cold Water Corals, Benthic ecosystems, Bottom trawling, Restoration, Vulnerable marine Ecosystems

Technological advancements in remote operating vehicles (ROVs) have enabled the exploration of depths greater than 50 m, in which cold water corals (CWCs) are the main bioengineering species. However, the escalating impact of bottom trawling fishing activities in sensitive regions such as the Mediterranean Sea, poses a substantial threat to CWC health and the ecosystem services they provide. In this study, we aim to evaluate the biodiversity of CWC habitats and their health across three different sites of Cap de Creus, western Mediterranean Sea. Utilizing ROV video transects, we surveyed a total seabed length of 9.5 km with depths ranging from 50 to 100 m. Sites were differentiated into control areas, subjected to commercial fishing, and protected areas, where commercial fishing was prohibited two years ago. Quantitative video analysis was performed on the 12 h of video transects recorded by identifying all the organisms to the lowest taxonomic level possible using the software BIIGLE. Biodiversity was quantified by using community analysis and performing different multivariate analyses (PERMANOVA, NMDS) to characterise habitats. Our findings revealed significantly higher biodiversity within the protected areas in comparison to the control areas. Sea pens were the most dominant species in soft bottom habitats, while gorgonians dominated hard bottoms. CWCs showed similar signs of fishing intensity and necropsies in both reserve and control areas. The observed increase in biodiversity after ceasing commercial fishing aligns with previous studies. In addition, the ceasing of fishing could potentially lead to a recovery of ecosystem services such as the spill-over effect. However, the slow recovery of CWC and the signs of degradation in the evaluated areas indicate the need to increase restoration efforts and continued protection measures.

Coral phenotypic plasticity and acclimatization to an extreme and marginal reef environment

Riccardo Mazza[1], Sarah L. Solomon[1], Maya E. Powell[2], Kelly Johnson Won[1], Chris Lippens[1], Rene van der Zande[1], Verena Schoepf[1]

[1] University of Amsterdam, Amsterdam, the Netherlands;
[2] University of North Carolina, Chapel Hill, United States

Keywords: Reciprocal Transplant Experiment (RTE), Coral Reef Ecology, Climate Change, Calcification Rate, Photosynthesis

Coral reefs are threatened by global and local stressors, however, some corals have increased stress tolerance compared to others. Significant knowledge gaps remain on the full extent of coral adaptive strategies and their phenotypic plasticity response, in the context of multiple co-varying stressors. Extreme and marginal habitats can be used as natural laboratories to gain insight into the ability of coral species to cope with multiple stressful physiochemical conditions, including increased seawater temperatures, lower pH, and elevated nutrients. Here, we utilized a semi enclosed inland bay in Curaçao as a natural laboratory to evaluate coral adaptive strategies under extreme conditions, such as high average and highly variable seawater temperatures, acidity, and nutrient concentrations compared to a nearby fringing reef site. We conducted a reciprocal transplant experiment (RTE) between the inland bay and the nearby reef using two species (branching *Porites sp*. and massive *Siderastrea siderea*) and monitored key physiological parameters after 0, 4, and 12 months of transplantation. To evaluate the corals' acclimatization capacity, we measured calcification, respiration (R), and photosynthesis (P) rates, and calculated P:R ratios. After 12 months, reef-to-bay *S. siderea* transplants had a 100% survival rate and maintained calcification rates despite decreases in P:R ratios driven by increased respiration. This may indicate that *S. siderea* possesses high trophic phenotypic plasticity or energy management strategies to compensate for reduced P. Conversely, we found evidence of negative physiological trade-offs for reef-to bay *Porites sp*. transplants, as calcification rates and P:R ratios decreased significantly after 12 months. Although *Porites sp.* had a less favorable plastic phenotypic response, their high survival rate (90%) indicates acclimatization ability to survive extreme conditions at the cost of lower physiological fitness (low P:R ratios and calcification rates). *Siderastrea siderea* have remarkable tolerance to extreme conditions and high acclimatization capacity, making them potential candidates for coral restoration.

Symbiont restructuring on the hottest coral reefs on Earth

Anna Fiesinger[1], Yulia Iakovleva[1], Rachel Alderdice[1], Gabriela Perna[2], Hannah Manns[1], Line K. Bay[3], Nitin Baliga[4], Jacob J. Valenzuela[4], Iliana B. Baums[5], Daniel J. Barshis[6], John A. Burt[7], Christian R. Voolstra[1]

[1] University of Konstanz, Konstanz, Germany;
[2] Ecole polytechnique fédérale de Lausanne, Lausanne, Switzerland;
[3] Australian Institute of Marine Science, Townsville, Australia;
[4] Institute of Systems Biology, Seattle, USA;
[5] Helmholtz Institute for Functional Marine Biology, Oldenburg, Germany;
[6] Old Dominion University, Norfolk, USA;
[7] New York University Abu Dhabi, Abu Dhabi, United Arab Emirates

Keywords: Symbiodiniaceae, Symbiosis, Climate Change, Coral Holobiont, Persian Arabian Gulf

Corals in the Persian Arabian Gulf (PAG) and Gulf of Oman (GO) exhibit resilience to a range of disturbances (e.g., high water temperature, high salinity), exceeding those observed in the majority of reefs globally. These local coral communities offer valuable insights into potential adaptive mechanisms for global coral reefs in the face of climate change. The stress tolerance of the coral holobiont has been shown to be influenced by its associated microbes, particularly the endosymbiotic microalgae in the family *Symbiodiniaceae*. Previous studies have identified the thermotolerant species *Cladocopium thermophilum* that broadly associates with corals in the southern PAG. However, the level of partner fidelity is unclear, and it is unknown if distinct lineages of *C. thermophilum* are found associated with different coral hosts and whether those associations are temporally stable. Here, we sampled two dominant corals (*Porites harrisoni* and *Platygyra daedalea*; n = 198) at three sites along the coast of the United Arab Emirates, two in the southern PAG and one in the GO. Using high throughput ITS2 marker gene sequencing and the SymPortal analytical framework, we identified several ITS2 type profiles of *C. thermophilum* as the dominant symbiotic partners in both corals in the southern PAG. In the marginally cooler waters of the GO, the two coral species were predominantly associated with symbionts of the genus *Durusdinium*, typically found in warmer regions outside the PAG as a thermotolerant alga. Comparative analyses revealed a shift in ITS2 type profiles in *Platygyra daedalea* both in the PAG and GO over the recent decade. If correct, this suggests loss of high partner fidelity due to even more extreme environmental conditions or population demise of formerly associated algae that prompted algal symbiont switching, both of which hold important clues for our understanding of the consequences of changing thermal regimes in coral reefs globally.

Effects of partial mortality in scleractinian corals on species richness and biodiversity of symbionts

Roman Petrochenko[1], Fedor Lishchenko[1,2], Temir Britayev[1]

[1] A.N. Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences, Moscow, Russia;
[2] Vietnam-Russia Tropical Centre Marine Branch, Nha Trang, Vietnam

Keywords: Symbiosis, *Pocillopora verrucosa*, Lesions

Coral reefs are uniquely complex among the ocean's ecosystems. The high biodiversity of coral communities can be attributed to various macrosymbionts, which rely on corals for food and shelter, providing them with nutrients, protection from predators, and clearing out algal growth. Recently it was shown that algal fouling could be a key factor in coral mortality and general reef degradation. The present study aims to evaluate the impact of algal growth on the richness of the coral symbiont community. 200 colonies of *Pocillopora verrucosa* were planted on metal frames for 9 months. After the exposure, corals were sampled for macrosymbionts, their fauna was collected, counted, and identified. Colonies were split into two groups: with signs of partial mortality (PM) indicated by algal growth and healthy colonies. Out of 190 colonies alive by the end of the experiment, only 62 colonies suffered from PM. Only one displayed more than 50% of the surface fouled, another 4 had 50% PM, and the mean PM percentage reached 16,24%. The number of symbiont species was 85, 71 were found on the colonies with PM and 65 on the healthy ones. All but 3 species making the difference between the two groups of colonies were facultative symbionts. In turn, the findings of 3 obligate symbiont species were occasional, which suggests that there is likely no specific pattern of these encounters. Generalized linear models have shown a statistically significant increase in species richness and abundance of facultative symbionts in the colonies with PM. However, no significant differences were found in obligate symbionts. The results above can be attributed to an increase in substratum for nonspecific organisms to settle. The loss of live coral coverage could also be not severe enough to impact the obligate symbiofauna. This research and presentation were funded by RScF grant 24-14-00288.

Density and Bleaching of Corals and Their Relationship to the Coral Symbiotic Community

Roman Petrochenko[1], Yulia Burmistrova[1], Fedor Lishchenko[1,2], Temir Britayev[1]

[1] A.N. Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences, Moscow, Russia;
[2] Vietnam-Russia Tropical Centre, Marine Branch, Nha Trang, Vietnam

Keywords: *Pocillopora verrucosa*, Obligate symbionts, Facultative symbionts, Vietnam, Environmental factors

Coral reefs provide habitat for diverse communities of macrosymbionts. Branching corals are the most notable, harboring many species of symbionts. The structure of the symbiotic community is linked to different factors, the impact of which is often not entirely understood. The present study aims to experimentally test the connection between several factors, namely the density of coral colonies, colony size, bleaching, and the abundance and species richness of symbiotic communities. In the experiment, 200 small colonies of *Pocillopora verrucosa* were planted on metal frames with different densities for 3 months. After the exposure, colonies were sampled, measured, and visually assessed according to the coral health chart. All discovered macrosymbionts were collected, identified, and counted. The obligate symbiont diversity on planted corals in Nha Trang Bay was higher than the diversity of other studied faunas of the branching scleractinian corals from different parts of the world's ocean. Statistical tests using generalized linear models have shown that generally, both the species richness and the abundance of symbionts increase with an increase of colony size and density, while no statistically significant impact of bleaching was found. While the characteristics of obligate symbiofauna were positively related to host population density, in facultative symbionts, the species richness, and the abundance decreased. The different responses to host density might be caused by the different patterns of larvae attraction and settlement in obligate and facultative symbionts. The negative effect of host population density on the facultative symbiotic community can be attributed to the competitive pressure imparted by obligate symbionts, which increases with higher abundance. The level of bleaching sustained by the colonies, however, was not sufficient enough to impact the community. This presentation was funded by RScF grant 24-14-00288.

Effects of different sunscreens on the bleaching susceptibility of hard corals *Acropora digitifera*, and *Pocillopora verrucosa* from Kunfunadhoo Island, Maldives

Julia Rücker[1], Md Saddam Hossain[1], Johanna Leonhardt[2], Christian Wild[1]

[1] Marine Ecology Department, University of Bremen, Bremen, Germany;
[2] Soneva Conservation and Sustainability Maldives, Soneva Fushi Resort, Maldives

Keywords: Coral reefs, Pollution, Sunscreen, UV filters, Ecophysiology

Climate change-induced increases in seawater temperatures and local pollution, particularly from tourism-related activities, pose significant threats to coral reefs. Introducing chemicals and body products into the ocean, including sunscreen, is particularly concerning. So-called "reef-safe" products have been developed by different companies, but related scientific studies are scarce. Consequently, this field study undertook a comparative analysis of three commonly used sunscreen products from different companies (V.Sun®, Surface®, and Soneva Fushi Resort (SFR) sunscreen). Conducted at Kunfunadhoo Island, Maldives, a series of tank experiments assessed the bleaching response of the widespread Indopacific hard corals, *Acropora digitifera* and *Pocillopora verrucosa*, to sunscreen addition (230 mg/L, n=5). Results indicated that V.Sun® and Surface® sun lotion did not induce bleaching, while exposure to SFR sunscreen caused bleaching (p-value < 0.05, MIG difference, 96h). Bleaching rates of 56% (*A. digitifera*) and 54% (*P. verrucosa*) were observed for the SFR sun lotion, compared to 10% (*A. digitifera*) and 11% (*P. verrucosa*) in control treatments, attributable to heat stress (mean temperature increase of 1.05 ˚C ± 0.56 ˚C in the SFR sunscreen experiment). For the V.sun treatment, a maximum bleaching rate of 7.8% for *A. digitifera* (9.5% control) and 9.8 % for *P. verrucosa* (7.5% control) was observed. The Surface lotion showed a bleaching rate of 3.7% for *A. digitifera* (2.9% control) and 8.7 % for *P. verrucosa* (-0.4% control). The combination of elevated temperature and ingredients in the SFR sun lotion likely contributed to the observed bleaching. Despite being labeled reef-safe, the SFR sunscreen triggered coral bleaching, unlike the V.Sun® sunscreen, which did not induce more bleaching than the controls (p-value > 0.05). The divergent ingredients, UV filters, and the disparity in waterproofness highlight the need for further investigation into ingredients. This study underscores the potential impact of sunscreen formulations on coral (reef) health and advocates for the development and promotion of genuinely reef-safe sunscreen products.

Session 1.2
Investigating Controlling Mechanisms of the (Biological) Carbon Pump: The Story of Organic Matter

Hosted by:
Runa Reuter and Aman Akeerath Mundanatt

Sessions

Session 1.2:
Investigating Controlling Mechanisms of the (Biological) Carbon Pump: The Story of Organic Matter

Hosted by: Runa Reuter and Aman Akeerath Mundanatt

In the context of increasing greenhouse gas concentrations, it is getting even more important to better understand the marine carbon cycle and its crucial role in modulating changes in climate. In the surface waters of the ocean photosynthetically active organisms fix carbon dioxide into organic matter which is moved by the biological carbon pump to the seafloor, where it can be sequestered for many years. This session aims to bring together marine early career researchers from different disciplines, studying controlling mechanisms of the (biological) carbon pump – from particle formation to degradation and preservation of organic matter. Contributions regarding all aspects of carbon cycle research, from modern settings to the geological past and from in situ observations to modelling approaches are invited. Presentations covering novel or unconventional approaches or ideas are particularly encouraged.

Constraints on iron limitation of primary productivity in an Earth system climate model

Ben Perrett[1], Markus Pahlow[1], Andreas Oschlies[1], Christopher Somes[1]

[1] GEOMAR – Helmholtz-Zentrum für Ozeanforschung, Kiel, Germany

Keywords: Optimality-based plankton–ecosystem model; Non-reductive iron dissolution; Combustion-derived iron; Prognostic ligand tracer; Hydrothermal venting

The growth of marine primary producers is a key driver of Earth's climate via the biological carbon pump, which sequesters carbon in the deep ocean. In large swaths of the ocean, primary productivity is controlled by the availability of iron (Fe), which plays an essential role in a range of cellular processes. Consequently, in order to predict the future strength of the biological carbon pump, a sufficient representation of the marine Fe cycle in Earth system models is needed. However, the key source processes that provide the ocean with iron are often not included in Earth System Models. This limits their capacity to reproduce observed Fe distributions as well as to reliably predict the Fe cycle under future climate scenarios. Major shortcomings in current global ocean Fe models include incorporating the full set of source inputs and the parametrisation of Fe-solubilising ligands. To address these shortcomings, we implemented several improvements into an optimality-based plankton–ecosystem model (OPEM) within an Earth system model of intermediate complexity (UVic), including: a prognostic ligand tracer; state-of-the-art atmospheric soluble Fe deposition, including combustion-derived Fe; and updated parametrisations for key seafloor Fe fluxes from sedimentary sources, including both reductive and non-reductive dissolution, as well as hydrothermal venting. This new model version better reproduces global dissolved Fe observations, indicating that source seafloor fluxes are significantly higher than previously thought and are an important control on marine distribution of Fe. Counter-intuitively, global average surface Fe concentrations decrease with higher seafloor source fluxes due to the correspondingly enhanced scavenging that balances higher seafloor fluxes. Therefore, our new model suggests that previous models neglecting these processes overestimate the availability of surface Fe and consequently underestimate the importance of Fe limitation and its control on the strength of the biological carbon pump.

Spatial patterns of arctic phytoplankton and organic matter composition: A comparison between Fram Strait and Kara Sea

Sophia Hirschmann[1], Anabel von Jackowski[2], Benjamin Pontiller[1], Vasily Povazhnyi[3], Katja Metfies[4], Anja Engel[1]

[1] GEOMAR Helmholz Centre for Ocean Research Kiel, Kiel, Germany;
[2] CNRS/Sorbonne Université, UMR7621 Laboratoire d'Océanographie Microbienne, Banyuls-sur-Mer, France;
[3] Arctic and Antarctic Research Institute, St. Petersburg, Russia;
[4] Alfred Wegener Institute, Helmholz Centre for Polar and Marine Research, Bremerhaven, Germany

Keywords: Atlantification, Haptophytes, Carbohydrates, Amino acids, Freshwater input

Organic matter produced by phytoplankton forms the basis of the marine food web and plays a key role in the biological carbon pump. Climate change induced impacts on phytoplankton dynamics, particularly in the Arctic Ocean due to e.g., a decrease in sea-ice extent and thickness and increased advection of warm waters, are already being observed. However, how related changes in phytoplankton community composition and physiology may affect organic matter pool sizes and composition is still poorly understood. In the summer of 2021, water column samples were collected during two Arctic expeditions in the Fram Strait (LTER Hausgarten) and the Kara Sea (Arctic Century) to investigate the dissolved organic matter (DOM) pool, as a function of the phytoplankton community composition using 18S metabarcoding. Preliminary results showed differences in the composition of the major component in semi labile DOM, dissolved combined carbohydrates, and phytoplankton community composition between the Fram Strait and Kara Sea, in particular in the relative sequence abundance at higher taxonomic level e.g. Haptophyta and within the Chlorophyta, respectively. The composition of organic matter and phytoplankton community are likely linked to water mass characteristics (physical and biogeochemical), suggesting that climate change-induced modification of water masses like Atlantification in the Arctic Ocean has the potential to alter phytoplankton structure and, thereby, the organic matter pool.

The carbon storage of seagrass meadows in the northern Wadden Sea and its possible environmental drivers

Nele Schildt[1,2], Laura Hommes[3], Nicola Camillini[2], Lasse Sander[2], Svenja Reents[2]

[1] University of Bremen, Bremen, Germany;
[2] Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, List, Germany;
[3] Leiden University, Leiden, Netherlands; [3]Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, List, Germany

Keywords: Seagrass, Blue Carbon, Carbon Sequestration, Wadden Sea, *Zostera noltii*

Vegetated coastal ecosystems of the Wadden Sea, such as seagrass meadows, are important habitats and provide various ecosystem services. Moreover, they came into focus in climate change research as potential marine carbon sinks due to their high productivity and carbon sequestration. In the Wadden Sea, intertidal seagrass meadows comprise an area of over 20,000 ha, raising the question about the order of magnitude of the carbon stock in this area. Currently, however, very little data exists on carbon storage and dynamics in seagrass environments in the German Wadden Sea. After a massive reduction in abundance, the two seagrass species in the Wadden Sea, *Zostera noltii* and *Zostera marina*, recovered in Northern Germany over the last decades, but remain mostly absent in western Germany and in the Netherlands. This highlights not only the potential for ecosystem recovery of Wadden Sea seagrass meadows but also possible carbon storage capacity. In this study, we investigate habitat characteristics (e.g. sediment properties, wind exposure and hydrodynamic conditions) and carbon content at seven seagrass sites, located on tidal flats along dikeforelands of the North Sea coast of Schleswig-Holstein. We aim to (I) give a first assessment of the carbon stock in this region and (II) find potential environmental factors that locally drive or inhibit the carbon storage capacity. In this presentation we will show our preliminary results and interpretations.

Trapping of Terrigenous Organic Matter by Metal-Enriched Permeable Sediments Beneath a High-Energy Beach.

Kojo Amoako[1], Anja Reckhardt[2], Thorsten Dittmar[1], Hannelore Waska[1]

[1] Research Group for Marine Geochemistry (ICBM-MPI Bridging Group), Institute for Chemistry and Biology of the Marine Environment (ICBM), Carl von Ossietzky Universität Oldenburg, Oldenburg, Germany;
[2] Research Group for Marine Isotope Geochemistry, Institute for Chemistry and Biology of the Marine Environment (ICBM), Carl von Ossietzky Universität Oldenburg, Oldenburg, Germany

Keywords: Terrigenous organic matter, Sandy beach sediments, Adsorption, Fate, Spiekeroog

Terrigenous organic matter (OM) can adsorb onto the surfaces of sediments or form complexes with minerals present in the sediment. However, less is known about the role of high-energy sandy beach sediments in trapping terrigenous OM from land sources. In this study, we analysed the OM composition in 24 long sediment cores from Spiekeroog Island in the German North Sea from different beach sites: close to the dune base (ML1), near the high-water line (ML2), and near the low-water line (ML3). OM and trace metals (TM) were sequentially leached with ultra-pure water (UPW) and 0.5 M HCl to obtain information about the spatial distribution of weakly and strongly bound OM and TM, respectively. The quantity and quality of OM in the leachates were characterized using a Total Organic Carbon analyser and ultrahigh resolution mass spectrometry. The concentrations of TM were analysed using Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES). Results showed that HCl leached more organic carbon (OC) compared to UPW, with average concentrations of 2 µM/g sediment versus 1 µM/g sediment, respectively. OC concentrations followed a ranking of ML1 > ML2 > ML3. TM concentrations in HCl leachates followed the ranking: Fe > Al > Mn. They were up to 6 times higher than the OC concentrations but had similar spatial distribution patterns. Analysis of thousands of molecular formulas revealed more hydrogen-rich (H/C ≥1.5) and oxygen-poor (O/C ≤ 0.5) compounds in the UPW leachates, indicating the presence of more labile, easily degradable OM. In contrast, the HCl leachates contained more hydrogen-poor (H/C ≤1.5) and oxygen-rich (O/C ≥ 0.5) compounds, suggesting the retention of more recalcitrant, humified OM. These findings highlight the crucial role of permeable beach sediments in trapping terrigenous OM, with the more labile fractions being preferentially mobilized and the more recalcitrant components retained within the metal-enriched sediments.

Laboratory studies towards understanding barrier functioning and integrity during CO_2 storage

Adigozalli Nijat[1], Christian Deusner[2]

[1] Christian Albrechts University, Kiel, Germany;
[2] GEOMAR Helmholtz Center for Ocean Research, Kiel, Germany

Keywords: CO_2 storage, Permeability, Fluid-rock interactions, Micro-computed tomography, Carbonate content

Geological carbon storage, a crucial transitional strategy for mitigating greenhouse gas emissions, involves capturing and sequestering carbon dioxide (CO_2) in deep underground formations. This study aims to improve the understanding of transport-reaction processes and permeability in storage and barrier formations through controlled laboratory experiments simulating real underground conditions. By percolating individual sandstone samples and stacks of samples with different carbonate contents having various CO_2-rich fluids at elevated temperatures (90°C) and pressures (8 MPa), we aim to trigger dissolution-precipitation reactions which are expected to occur in the complex deep underground environment. Employing a constant-pressure flow-through methodology, we simulated a scenario in which pore water without CO_2 is replaced in two steps by CO_2-saturated water and supercritical CO_2. Preliminary results indicate a systematic decrease of apparent permeability in response to multiphase-fluid migration, chemical reactivity and phase transitions induced by large hydraulic gradients (Δp = 8 MPa) over the course of experiments. Pre- and postexperimentation micro-computed tomography (Micro-CT) scans were conducted to analyse structural changes of the samples and to link bulk permeability with micro-scale features. The study underscores the importance of understanding fluid-rock interactions for effective CO_2 storage strategies and enhances our understanding of how permeability evolves under varied experimental conditions.

Physicochemical characterization of dissolved organic matter in riverine and estuarine systems

María Martínez-Cabanas[1], David Gómez-Carnota[1], Teresa Vilariño[1], Roberto Herrero[1], Joao C. A. Macedo[2], Carlos ReyCastro[2], Pablo Lodeiro[2], José L. Barriada[1]

[1] Department of Chemistry & Interdisciplinary Center for Chemistry and Biology (CICA), University of A Coruña, A Coruña, Spain;
[2] Department of Chemistry, Physics, Environmental and Soil Sciences, University of Lleida – AGROTECNIO-CERCA Center, Lleida, Spain

Keywords: DOM, carbonate system, potentiometry, rivers, estuaries

The carbon exchange with the atmosphere is controlled by the oceanic carbonate system. The ocean acts a vast reservoir storing CO_2 at depths in both organic and inorganic forms. The interrelationships between chemical, biological and physical processes play a major role in the capacity of the ocean to uptake and store atmospheric CO_2. Dissolved organic matter (DOM) is one of the key parameters of the oceanic carbonate system and acts as a bioactive carbon reservoir. Besides its contribution to the storage of atmospheric CO_2 in the ocean, DOM sustains ecosystems and influences metal cycles, that are essential for primary production and agriculture. Moreover, DOM may also influence the transport, behaviour, and fate of pollutants in the environment. Modifications in the chemical composition of DOM due to global changes are expected in the future. DOM comprises a broad range of structurally complex organic compounds with a size range <0.2/0.7 µm. The diversity on the chemical composition of DOM has large implications on its accumulation, fate, physicochemical properties, and binding behaviour. Despite the heterogeneous nature of marine DOM, carboxylic acids and phenolic compounds are two of its main structural components. Hence, although so far it has not been deeply studied, the acid-base nature of marine DOM is well-known. In this study the physicochemical characteristics of DOM extracted from riverine and estuarine water were evaluated by potentiometric titrations. The proton binding capabilities of DOM extracted from Mero and Ebro Rivers (NW and NE Spain) were assessed. Several sampling locations were selected to examine the changes of DOM from the source of the rivers to their outflow into the ocean (Atlantic Ocean and Mediterranean Sea, respectively). Seasonality of DOM and its ancillary parameters in the selected study sites was also studied. The DOM binding properties were analysed by fitting the data to the NICA-Donan model.

The evolution of the marine 13C Suess Effect over the Anthropocene

Emma Bavoux[1], Stefan Mulitza[1]

[1] MARUM – Center for Marine Environmental Sciences, University of Bremen, Bremen, Germany

Keywords: Suess effect, stable carbon isotopes

The Suess Effect, an anthropogenic phenomenon, is the dilution of carbon in atmosphere and ocean with C-12 enriched carbon from the burning of fossil fuels (decreasing of δ13C). Studying the migration of the Suess effect into the ocean provides clues for the amount and speed of oceanic carbon uptake and the carbon cycle in general. The aim of this research is to quantify the Suess Effect in the principal water masses of the North Atlantic Ocean. To this end, the stable carbon isotope ratio (δ13C) from the dissolved inorganic carbon (DIC) of water samples from several hydrographic transects from North Atlantic were analysed using a mass-spectrometer. The Suess effect was calculated by comparing the measured δ13C values with preindustrial values. Preindustrial values of the δ13C in the ocean were obtained using a two-stage-back-calculation using SF6 and/or oxygen data. Our data show to what extent and how deep the anthropogenic carbon has already penetrated into the ocean and provides a useful benchmark to confirm the Suess Effect recorded in proxy archives.

Brown algae secrete fucoidan around the globe

Inga Hellige[1,2], Hagen Buck-Wiese[1,2,3], Margot Bligh[1,2], Timothy Thomson[4], Carol Arnosti[5], Dariya Baiko[5], Jana K. Geuer[2], Sherif Ghobrial[5], Camilla Gustafsson[6], Mohammed Kajee[7], Manuel Liebeke[7], C. Chad Lloyd[3], Dan Potin[8], Philippe Potin[8], Mark Rothman[7,9], Beatriz Salgado Murillo[10], Michael Seidel[11], Catharina Uth[6], Evie Wieters[10], Lydia White[6], Marie Magnusson[4], Jan-Hendrik Hehemann[1,2]

[1] MARUM, Center for Marine Environmental Sciences, University of Bremen, Bremen, Germany;
[2] Max-Planck Institute for Marine Microbiology, Bremen, Germany;
[3] University of Southern California, Los Angeles, United States of America;
[4] University of Waikato, Hamilton, New Zealand;
[5] University of North Carolina at Chapel Hill, Chapel Hill, United States of America;
[6] University of Helsinki, Tvärminne Zoological Station, Hanko, Finland;
[7] Department of Biological Sciences, University of Cape Town, Cape Town, South Africa;
[8] Station Biologique de Roscoff, Roscoff, France;
[9] Department of Environment, Forestry and Fisheries, Cape Town, South Africa;
[10] Estación Costera de Investigaciones Marinas, P. Universidad Católica de Chile, Las Cruces, Chile;
[11] Institute for Chemistry and Biology of the Marine Environment (ICBM), Carl von Ossietzky Universität Oldenburg, Oldenburg, Germany

Keywords: Brown Algae, Carbon Sequestration, Glycans, Organic Matter

Brown algae annually convert gigatons of carbon dioxide into carbohydrates including chemically complex and variable fucoidan, a secreted extracellular matrix polysaccharide. However, the global extent of this secretion, and thus its impact on the global carbon cycle, is still unknown. Here, we show active fucoidan secretion by six tested species of Fucales and Laminariales in local mesocosm experiments in the South Pacific Ocean, the North and South Atlantic Ocean, the English Channel, and the Baltic Sea for two weeks. Up to 50% of dissolved organic carbon accumulation can be attributed to fucoidan carbon accumulation, up to 19% confirmed by analysis of the strongly anionic fucoidan fraction. Fucoidan showed persistence against immediate microbial consumption for further two weeks of incubation. We showed accumulating dissolved fucoidan being able to aggregate to form particles and confirmed fucoidan presence in sinking particles. Environmental assessments validated the presence of dissolved fucoidan in surface waters along global transects, as well as its ability to aggregate to particles. The findings indicate fucoidan secretion is a general feature of brown algae, which conservatively estimated invest 1-2% of net primary production into secreted fucoidan. Initial persistence against consumption by bacteria and the ability to form sinking particles support the hypothesis that fucoidan is a potential pathway for global carbon sequestration in the ocean.

Algal sulfated fucan as a global carbon sink

Aman Akeerath Mundanatt[1,2], Silvia Vidal-Melgosa[1,2], Jan-Hendrik Hehemann[1,2]

[1] MARUM - Center for Marine Environmental Sciences, University of Bremen, Bremen, Germany;
[2] Max Planck Institute for Marine Microbiology, Bremen, Germany

Keywords: Sulfated fucans, Anion exchange chromatography, Carbon sequestration, Marine sediments

Sulfated fucans are complex polysaccharides produced by diatoms and brown algae that resist microbial degradation. These anionic polysaccharides assemble into gel-like transparent exopolymer particles and aggregate as larger sinking particles. Sulfated fucans may limit the microbial remineralization of the sinking particles and promote carbon transport to the sediment. Preliminary studies detected sulfated fucans in sediments of various regions and depths using monoclonal antibodies. Due to the semi-quantitative nature of these methods, the concentrations of sulfated fucans in the sediment were not revealed. In this study, we selected sediment cores from Bransfield Strait with varying depths, the oldest depth being 11.8 ka. We extracted and then purified the sulfated fucans by anion exchange chromatography. Quantification of fucose by high-performance anion exchange chromatography with pulsed amperometric detection estimates the concentration of sulfated fucans buried in the sediment. Similar studies with quantitative measurements are necessary to establish the contribution of sulfated fucans to carbon sequestration and cycling.

Sweet but Selfish: Carbohydrate Processing by Marine Bacteria

Mahum Farhan[1,2], Dr Greta Reintjes[1,2]

[1] University of Bremen, Bremen, Germany;
[2] Max Planck Institute of Marine Microbiology, Bremen, Germany

Keywords: Selfish uptake, Fluorescently-labelled polysaccharides

A significant portion of marine sequestered carbon is in the form of polysaccharides that were not subject to bacterial degradation. These sugars are still under-studied, with a lack of data reflecting which substrates are vulnerable to hydrolysis and how others may contribute to sequestration. Flavobacteria possess polysaccharide utilization loci, which contain genes involved in the binding, hydrolysis, and uptake of specific polysaccharides. Research has demonstrated that these genetic systems can process polysaccharides through multiple mechanisms. The large polysaccharides can be externally degraded into small mono-, di- and tri-saccharides by enzymes, and subsequently, the hydrolysis products can be readily taken up into the cell. Alternatively, they can be processed intracellularly using the "selfish" mechanism, which limits competition with other microbes for the same substrate by restricting external substrate production. In this study, fluorescently-labelled polysaccharides (FLAPs) were used to understand by which mechanism flavobacteria process different substrates.

Saturday & Sunday
21st & 22nd September 2024

Program - Weekend, 21st & 22nd September 2024

Program Saturday and Sunday (21st and 22nd September)

Whole day

Forschungsmeile, Schlachte
ICYMARE Exhibition

As a 2024 first, ICYMARE participates in the Bremen Maritime Week – a long-standing event highlighting all things maritime, from the city's rich history as a shipping hub to the outstanding marine research happening in and around the area

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You can find the program here:
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