# Topics for Master- and Bachelor-Theses 2025/2026

## Leibniz-Institute for Baltic Sea Research (IOW)
## Research Unit Coastal Seas and Society

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In case you are interested in topics, please send us your CV, your potential starting date and indicate the topics. Afterwards, we will meet (in IOW, room 400, or via ZOOM) and discuss the suitability of the topics based on your interest, educational background, future perspectives as well as the requirements of your university and your language capabilities (German/English).

## Ecosystem Service provision of changing coastal seas

Ecosystem services are the benefits people obtain from ecosystems. Individual and expert group-based assessment methods, as well as different Ecosystem Service concepts (potential/demand) will be applied using a wide range of data (monitoring, maps, literature, expert knowledge)

- **Heavy storms** (Schernewski) - Analysis how recent extreme storms affected the coastline and the provision of Ecosystem Services of coastal areas. A comparative study using an Ecosystem Service assessment approach.
- **Wind farms** (Schernewski) – Analysis how selected wind farms affect Ecosystem Service provision in the coastal sea. Additionally, complementary activities within wind farm areas, such as aquaculture, nature protection, boat tourism will be assessed.
- **Re-powering of wind farms or conversion?** (Schernewski) – Several wind farms are old and can either re-powered or face a conversion (different use). Possible uses after a wind farm deconstruction will be compiled and assessed with an Ecosystem Service assessment approach.
- **Bathing water quality** (Schernewski) – How important is a good water quality for coastal development, especially tourism? How do new human pathogens (e.g. vibrions) or an increased awareness of infection risks affect the Ecosystem Service provision of southern Baltic Bathing waters, taking into account possible future changes due to climate change
- **Recovery of macrophytes** (Schernewski) – What are the consequences of the wide-spread re-settlement of macrophytes along the southern Baltic waters. A comparative study using an Ecosystem Service assessment approach.
- **Invasive species** (Schernewski) – The round headed goby (benthic fish) invaded southern Baltic waters and caused a destruction of ecosystems. What are the consequences of the destruction and modification of benthic ecosystems for the provision of benthic ecosystem services?
- **Recovery of the seal population in GWB** – a thread for fish stock and fisheries or a valuable iconic species supporting tourism? (Schernewski)
- **Assessing social perception on specific ecosystem services** (Bellon, von Thenen) –Healthy ecosystems perform essential bio-geophysical functions which result in the flow of services society relies on. These functions, known as Ecosystem Services (ES) and their concept was originated as a means to communicate societal dependence on ecosystems to the general public, by reflecting their political, economic, cultural and ecological value. For the successful implementation of new environmental measures, securing the support of the local community and its visitors is crucial. Understanding how these stakeholders perceive potential changes is key to minimising conflict during implementation stages. This study focuses on engaging with the local community, fishermen, and tourists in Greifswald Bay to assess their awareness of specific ES and their perceptions regarding the implementation of a hypothetical artificial reef and small-scale blue economy initiatives, such as seaweed farming. These activities aim to enhance biodiversity, promote nutrient sequestration, support sustainable coastal development, and boost eco-friendly tourism. A structured questionnaire will be

developed to gather stakeholder insights. As this project involves fieldwork in Greifswald to conduct the questionnaires, proficiency in the German language is essential.

- **Valuation of seagrass ecosystem services** (von Thenen) – Seagrasses play an important role in coastal waters and offer many ecosystem services. The objective is to identify those ecosystem services that apply to German Baltic Sea seagrass meadows, based on existing literature reviews, identify suitable valuation methods, and apply one or several of those to valorise German Baltic Sea seagrass ecosystem services.

## Ecological water quality and its management

- **Climate Change: What can we learn from hot years?** (Schernewski) – Recent very hot years provide an idea how average years may look like in 30 years. What can we learn from it and how will our coastal ecosystems change? The work includes a comparative assessment between recent extremely warm years compared to average years.
- **Anti-eutrophication measures** – **macro-algae** (Schernewski) – Eutrophication is still a major problem in German coastal waters. The reduction of external nitrogen and phosphorus loads is often insufficient. Therefore, internal measures are under discussion. One of them is the establishment of macro-algae farms with the aim to provide habitats and remove nutrient with the harvest. Aim is an assessment whether this is ecologically reasonable and cost-effective in the Baltic Sea or its coastal waters. An analysis based on case studies, existing literature and long-term monitoring data.
- **Anti-eutrophication measures** – **phosphorus precipitation** (Schernewski) – Eutrophication is still a major problem in German coastal waters. The reduction of external nitrogen and phosphorus loads is often insufficient. Therefore, internal measures are under discussion. One of them is the reduction of phosphorus concentrations in the water body using a precipitation with different chemical compounds. Aim is an assessment whether this is ecologically reasonable and cost-effective in selected Baltic coastal waters. An analysis based on case studies, existing literature and long-term monitoring data.
- **Assessment of artificial light pollution during night** (Piehl) – Inventory, classification and mapping of various sources of underwater light pollution in the western Baltic Sea. (*Which are the most important sources?)* Assess the sensitivity of different water bodies to underwater light pollution based on view parameters (e.g. optical properties) in order to derive underwater light pollution maps. Assess the sensitivity of relevant organisms to light pollution to derive sensitivity ranges that can be used as thresholds for classifying impacts on marine habitats. (*Which are the most sensitive water bodies and species?)* Combination of pollution and habitat maps in order to derive habitat vulnerability maps. *(Which are the most impacted areas? - Overlap of most sensitive water bodies and habitats)*
- **Extreme weather events** (Piehl) - Impacts of extreme weather events on water quality in the Baltic Sea are not yet considered and thus the implementation of marine policy (MSFD) need to be critically assessed. Several extreme events occurred in the last decades and will be retrospectively analysed for their influence on current monitoring and assessments strategies of water quality indicators (e.g. oxygen deficiency, algae blooms). What is the influence of extreme events on I) existing monitoring strategies and II) on status assessments and trend analysis?
- **Development of an ecological relevant oxygen indicator** (Piehl) – In order to address the link between biodiversity and oxygen stress, existing oxygen deficit indicators shall be linked more closely to the existing HELCOM benthic biodiversity indicator (BQI). For the western Baltic Sea, the relationships between oxygen deficiency and the BQI should be analysed in depth. Further, if target values for the oxygen deficit indicators can be derived from the good condition according to the BQI and whether these are comparable to the oxygen situation around 1960.
- **Cumulative impact assessment of maritime activities in the German Baltic Sea** (von Thenen, Socrate) – HELCOM carries out cumulative pressures and impact assessment at Baltic Sea scale. However, such coarse scale assessment may not be suitable for smaller areas, such as the German Baltic Sea. To improve smaller scale assessments, the task is to 1) collect existing spatial data on

marine activities important in the German Baltic Sea and identify data gaps, 2) to evaluate, based on literature and/or expert interviews, which habitats are important for the area and need to be part of the assessment and to 3) review the impacts of marine activities and evaluate the sensitivity of habitats to these activities.

## Marine protection and nature-based solutions

- **Designation and extension of Marine Protected Areas** (Boubekri) – To protect and restore marine habitats and species populations, the EU Biodiversity Strategy for 2030 sets a target of legally protecting at least 30% of marine area by 2030 (with 10% of marine area under strict protection). Despite an increase in the spatial coverage of MPAs in European seas their effective implementation is lagging behind and many MPAs are still under intensive human uses. Objective of this study is to assess the suitability of the ecosystem services approach for the designation and zoning of marine protected areas in selected case study areas.
- **Effectiveness of hybrid coastal and marine infrastructures (incl. coastal protection, offshore wind energy & low trophic aquaculture)** (Sánchez Jiménez & Bellon) – The integration of nature-based solutions into coastal and marine infrastructures, such as coastal protection, wind energy, port, and aquaculture infrastructures) gain increasing interest to support the preservation and restoration of marine biodiversity and ecosystem services. Objective of this study is to evaluate the social-ecological effectiveness of selected hybrid infrastructures by analysing benefits and potential trade-offs for marine biodiversity and ecosystem services.
- **Defining criteria for key functional habitats in the Mediterranean Sea** (Boubekri) – As part of the EU Biodiversity Strategy for 2030, a coordinated European effort is underway to expand Marine Protected Areas (MPAs), with a particular emphasis on increasing strictly protected zones. The Mediterranean Sea, known for its exceptional biodiversity, is also one of the regions most vulnerable to climate change, necessitating enhanced conservation measures (EC, 2020). However, only 0.04% of the Mediterranean's surface is currently under strict protection—far below the 10% target set for 2030 (MedPAN and UNEP/MAP-SPA/RAC, 2023). To address this gap, the European Commission, in collaboration with Member States and the European Environment Agency, must identify areas of very high biodiversity value or potential, such as key functional habitats (e.g., coastal spawning grounds) and carbon-rich ecosystems (e.g., seagrass meadows). These areas warrant strict protection due to their vulnerability to climate change or their role as Nature-based Solutions (NbS) for enhancing climate adaptation. This study aims to develop scientifically robust criteria for identifying key functional habitats in the Mediterranean Sea, laying the groundwork for future EU environmental legislation. By reviewing up-to-date scientific literature, the research will establish minimum criteria for prioritizing the strict conservation of key functional habitats. The findings will contribute to strengthening marine conservation efforts and support the development of potential new directives to achieve the EU's biodiversity and climate goals.
- **Evaluating EU marine biodiversity conservation 2030 targets** (Boubekri) – The EU Biodiversity Strategy for 2030 aims to protect 30% of EU seas, but this quantitative target alone does not guarantee effective biodiversity conservation. Achieving meaningful outcomes also requires effective management, clearly defined conservation objectives, targeted measures, and robust monitoring frameworks (EC, 2020). This study seeks to evaluate the quality of biodiversity conservation within European Marine Protected Areas (MPAs), moving beyond the mere percentage of protected areas. Applying *The MPA Guide* across EU Member States, this research will conduct a qualitative assessment to measure progress towards marine conservation targets. The study will address the following questions: (1) What types of protection exist within EU MPAs, and what are their implications for biodiversity conservation? (2) Are EU MPAs legally established, effectively implemented, and actively managed? (3) Which areas are effectively under protection within EU waters, and what should be counted towards the EU's 2030 marine biodiversity conservation targets? To support this analysis, an initial inventory of all MPAs within EU waters will be compiled using

existing databases such as the World Database on Protected Areas (WDPA), MAPAMED, etc. This dataset will be cross-referenced and updated with information from the European Environmental Agency (EEA) to ensure accuracy. Subsequently, the consolidated list of EU MPAs will be shared with relevant national authorities in each Member State for verification and updates, ensuring the most current and reliable data informs the assessment.

## Marine litter

- **Meso- and macro-litter monitoring at remote beaches** (Haseler)- In Europe and many countries worldwide the OSPAR 100m beach litter monitoring method is the standard to assess the pollution of beaches with litter items above a size of 25 mm. The rake method is applied to assess the pollution of beaches with litter items between 25 and size of 2-3 mm (meso litter size fraction). Both method shall be applied at several remote beaches (without seasonal cleaning) to identification the state of pollution as well as spatial and temporal gradients. The gathered data should allow the creation of a list of most common items, the identification of indicator items, the assessment of pollution pathways and sources and shall serve as basis for general mitigation measures.
- **Meso- and macro-litter (plastics) monitoring at urban beaches** (Haseler) - In the Baltic Sea region, the rake method is applied to assess the pollution of beaches with litter items between 25 and size of 2-3 mm (meso-litter size fraction). This method shall be applied especially at urban beaches where seasonal macro-litter beach cleaning takes place. This method is complemented by surveys on macro litter. This means the amount and composition of the daily collected litter during cleaning activities will be assessed. Aims are the identification of the state of pollution as well as spatial and temporal gradients. The gathered data should allow the creation of a list of most common items, the identification of indicator items and shall serve as basis for local mitigation measures.
- **Behaviour of floating meso- and macro-litter (plastics) in the sea** (Schernewski) – The emission of litter, especially of plastic items, is still an important problem and relevant in the Baltic Sea, as well. However, there is a discrepancy between the estimated emitted amounts of floating plastic to the sea and the amount finally observed data in the sea and at coasts. A major reason seems to be that floating plastic, once in the sea, is overgrown with micro-organisms and algae that change the buoyancy and cause a sinking and deposition on the sea bottom. Objective is to assess how fast selected floating items are overgrown, change the buoyancy and turn into sinking particles as well as to discuss the consequences for marine litter pollution. The study will be based on field and laboratory experiments.
- **Experiments to track floating plastic litter and seagrass shoots in shallow waters** (von Thenen, De Ramos) – Particle tracking experiments at different places along the German coast (with GPS trackers and/or drones) in different environmental conditions. The aim is to understand the coastal processes (e.g: rip current, longshore currents) that could drive the movement of water and extract from there the potential movement trajectories of seagrass shoots and floating plastic (e.g. where do they end up from known seagrass beds?). This work requires prior testing of the methodology, either done by the IOW team or potentially in a prior internship period.
- **Floating litter pollution by ships in the West Baltic Sea – the role of shipping accidents and extreme events** (de Ramos). The Baltic Sea offers a unique possibility to study marine litter from ships. Detailed shipping densities and routes are well known (e.g.: cargo, fisheries, and passenger ferries), monitoring data about beach litter pollution exists for most Baltic Sea states and suitable high-resolved hydrodynamic models are available. The aims are to simulate shipping accidents that released big litter quantities, map the accumulation areas, and use beach monitoring data as a comparative. Also, the consequences of extreme events such as storms on transport pattern, velocity and accumulation could be tested.