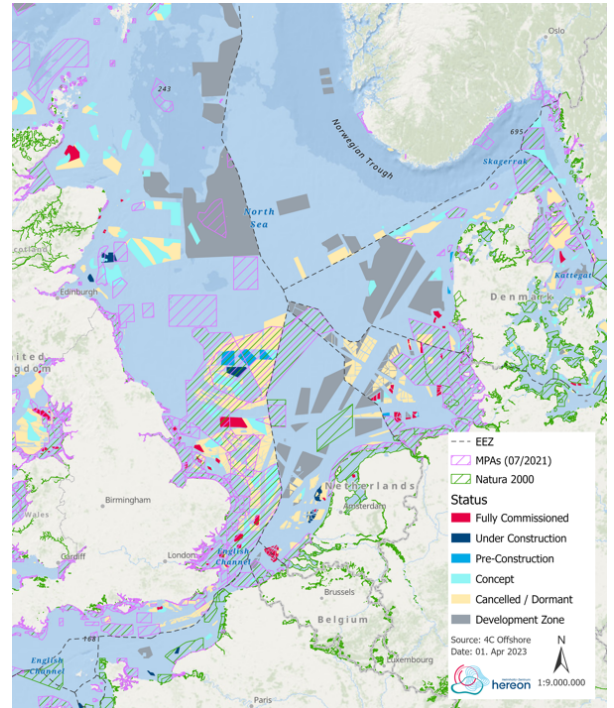
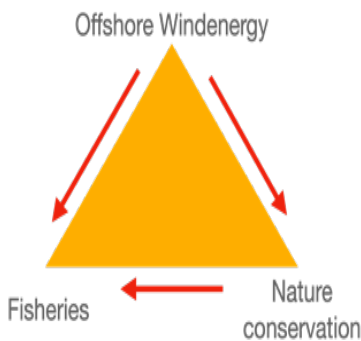


CoastalFutures

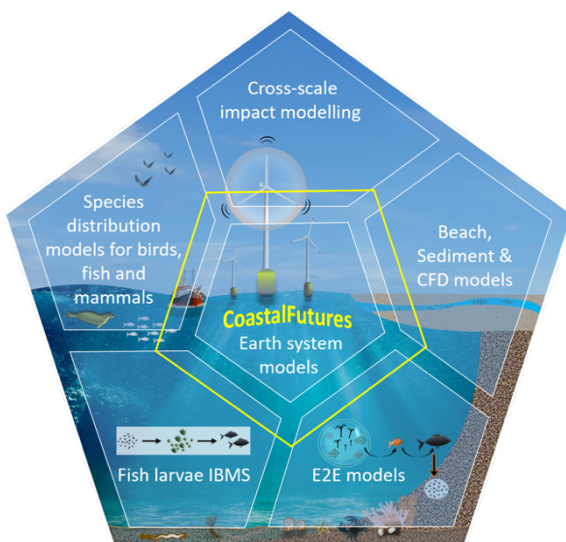
Background The EU biodiversity strategy is a comprehensive and ambitious long-term plan aimed at protecting nature and reversing the degradation of ecosystems to steer Europe's biodiversity towards recovery by 2030. Concerning the marine environment, it outlines that 30% of the EU seas should be protected by 2030, with at least one third of these areas being strictly protected in the future.

At the same time, coastal areas, particularly the North and Baltic Seas, are heavily affected by the rapid utilization of coastal spaces but also by climate change. The increasing implementation of offshore wind energy production further accelerates the contest for marine space within the German North Sea and Baltic Sea and beyond. The combined pressures from regulations in wind farm zones and nature protection zones constrain fishing activities, underscoring the importance of establishing carefully evaluated and effective management strategies for Marine Protected Areas.



Project Aims: CoastalFutures is creating a **virtual model environment** to project and assess impacts of various stressors and to explore the consequences and compound effects of future climate and economic developments. In collaboration with stakeholders from business, administration, and society, CoastalFutures discusses future scenarios for the North and Baltic Seas to simulate impacts from climate change and increasing human activities. Within this virtual environment management measures will be scenario tested for effects and consequences to aid decision-making in management of coastal systems.

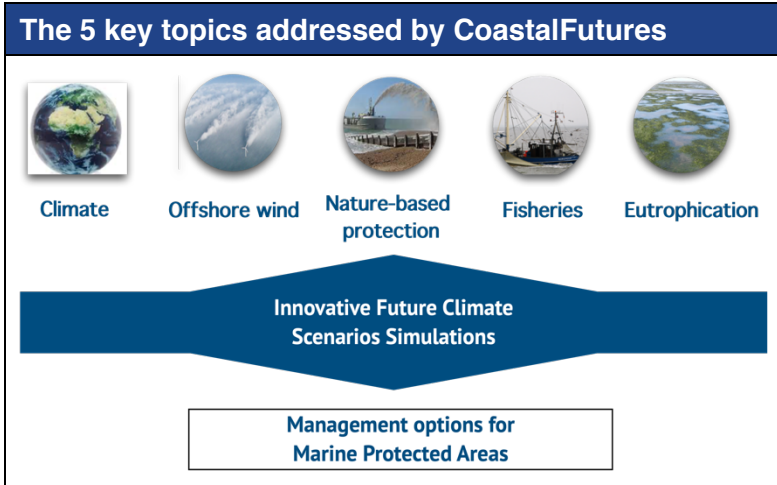
Modelling Framework for Scenario Simulations



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Modelling Framework: CoastalFutures is developing a coastal model framework to assess future climate impacts and impacts of human use and management measures. The core of this framework comprises of high-resolution **Earth System Models** covering the entire Northwest European shelf including the entire North and Baltic Seas. These models are designed to capture the fundamental dynamics of the region, encompassing controlling basic drivers from atmosphere and land.

Coupled to Earth System Models, we incorporate so-called **End-to-End Models, Species Distribution Models for birds, fish and mammals** and **Fish Larvae Individual Based Models** to resolve impacts of changing environmental conditions on species. Within the framework, we also use cross-scale impact modelling to upscale and downscale impacts of climate, human activities, and interventions.



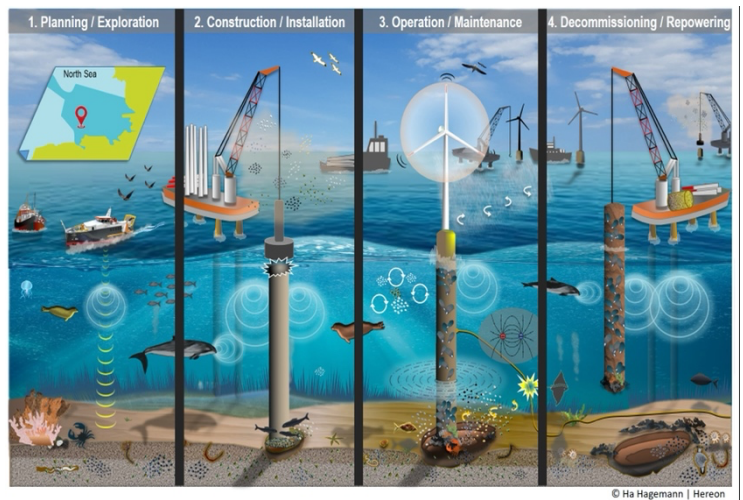
The primary focus of the project is on the impacts of climate change and the pressures stemming from: (i) **offshore renewable energy generation**, (ii) **fisheries**, (iii) **nature-friendly coastal protection**, and (iv) **eutrophication**.

The CoastalFutures project recognizes the importance to evaluate the effectiveness of management options in the current but also in a changing climate. The evaluation encompasses an examination of the ecological effectiveness but also economic and social assessment of measures taken, ensuring that they are not only environmentally sound but also economically and socially viable.

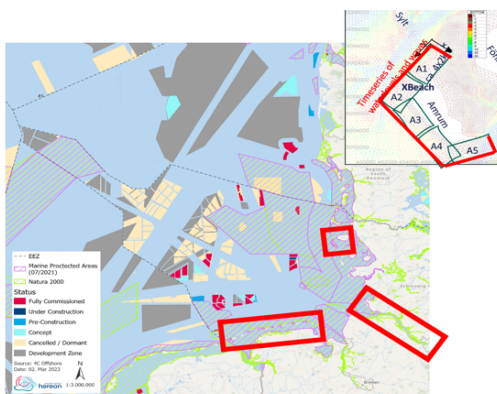
Offshore Wind Farms' Impact and Future Scenarios for Development

Offshore Wind Farms (OWFs) are impacting marine ecosystem through a range of interconnected physical, biogeochemical, chemical and biological processes at all developmental stages, planning, construction, operation- and finally during decommissioning or repowering phases.

Within CoastalFutures we focus on open research questions relating to on **noise effects** during pre-constructional geophysical surveys, clearance of unexploded ordnance, pile-driving and operation of OWF. Secondly, we explore changes and tentative deteriorations in the **physical environment by atmospheric wakes and structures** in the ocean and the resulting changes in ecosystem structure and productivity at local and regional scales. Future development scenarios will be designed based on political strategies and simulations will be conducted to assess environmental impacts of these.



Nature Based Coastal Protection & Sediment Management



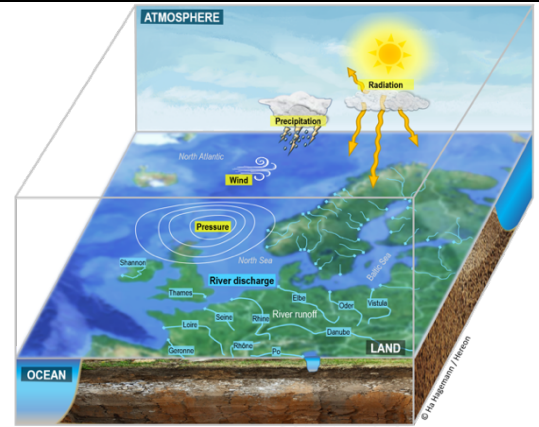
CoastalFutures elaborates the basic physical-biological process chains and marine interactions that occur as a result of nature based coastal protection, maintenance and construction measures along the coasts and estuaries of the North Sea and Baltic Sea, in order to generate and transfer new knowledge for upcoming management decisions, e.g. regarding navigational access and operations of harbors.

The project concentrates on three **key areas**, the island of **Amrum**, the **Elbe estuary** and the **East Frisian islands**. The goal is to estimate the availability and transport of marine sand resources as well as accumulation processes of sediment as a function of management.

Innovative Future Scenarios Simulations

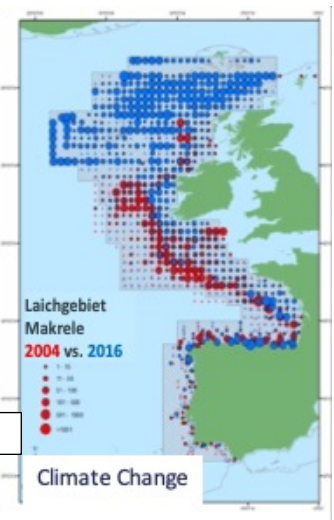
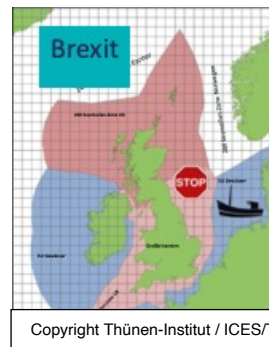
CoastalFutures provides innovative scenario simulations on regional impacts of future climate change in combination with selected utilization scenarios for the North Sea and the Baltic Sea. In this way it provides information and serves needs of stakeholders from public authorities, industry and society and creates a comprehensive data and knowledge base in order to make informed decisions.

The scenario simulations will be carried out with the integrated model system, including species distribution models for key species of marine mammals, seabirds and fishes to predict species response to climate change and other human impacts.



Transdisciplinary Evaluation of Options for Action

Novel methods will be developed to assess consequences of changes in use patterns and effects of climate change, as far as possible using modeling results from the project, and linked to the analysis of options for action for different sectors. This includes an analytical framework for the assessment of ecosystem services, a more in-depth analysis of the consequences of climate change, Offshore Wind expansion and nature conservation regulations for the fisheries sector as well as a risk analysis for different development narratives including multi-use options. More in-depth economic assessments and impact assessment for various sectors, as well as testing operationalized application of the assessment methods on ecosystem services and institutional risk use of the assessment methods will follow in Phase 2 (e.g. wind energy, sand and gravel extraction, tourism). For this purpose, data will be collected and stakeholder contacts established during phase 1.



First results identify for example a **fisheries sector in transformation**. Recent crises, including the pandemic and Brexit, have reduced fishing opportunities and negatively affected the sector. High fuel costs, climate change and upcoming spatial restrictions are additional pressures. The project is exploring fleet transformation to adapt to changing ecosystem conditions and species composition, considering reduction of fishing areas due to expanding offshore wind energy.

The CoastalFutures consortium brings together partners from six different universities and three non-university research institutes. In addition, the Thünen Institutes (departmental research affiliated with the BMEL) and the relevant departments of several federal supervisory authorities in the fields of transportation and environment, including BSH, BAW, BfN, and DWD, are involved in CoastalFutures. The project is coordinated by Hereon and funded by the BMBF.



DAM Forschungsmission „Schutz und nachhaltige Nutzung mariner Räume“

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