MGF-Nordsee

Exclusion of mobile bottom-contact fishing in Marine Protected Areas of the German EEZ of the North Sea

Background and aims

Marine nature conservation measures within the designated protected areas of the German Exclusive Economic Zone (EEZ) represent a central management approach to counteract the steady decline in fish stocks, the destruction of marine habitats and the loss of biodiversity.

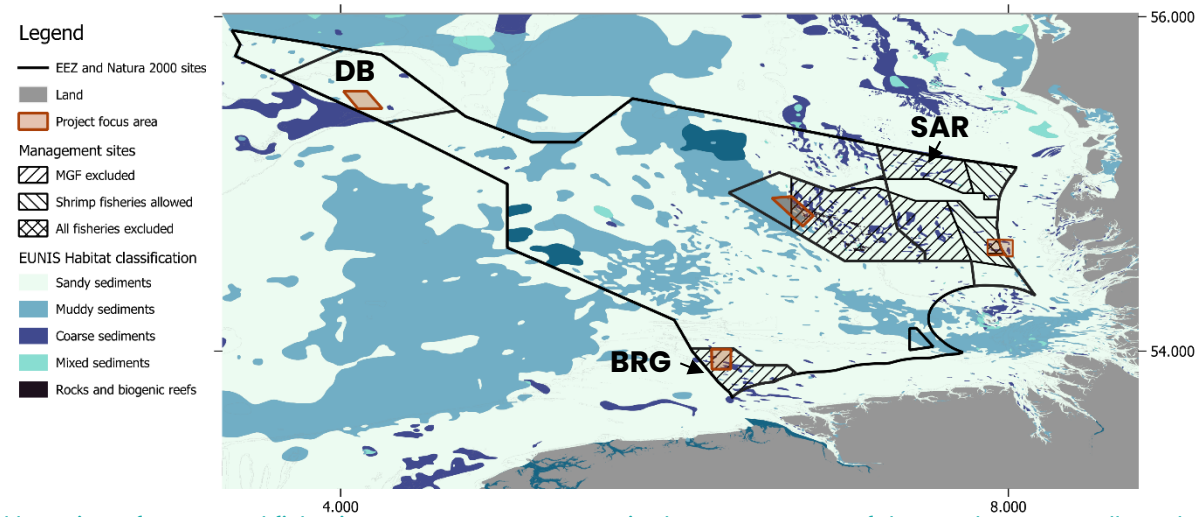
The project MGF-Nordsee investigates the effects of the exclusion of mobile bottom-contacting fisheries (in German *mobile, grundberührende Fischerei*: MGF) in the German marine protected areas of the North Sea Borkum Reef Ground (BRG), Dogger Bank (DB), and Sylt Outer Reef - Eastern German Bight (SAR) with the associated Amrum Bank (AMB). In March 2023, fisheries management measures restricting the use of MGF came into force at BRG and SAR.

A reduction in disturbance by MGF can result in changes to the seabed morphology, the biogeochemistry of marine sediments and the exchange processes between the sediment and water column. Biotic communities in and on the sediment beds can recover potentially resulting in a regeneration of structure, function and biodiversity. However, the actual effects and influences of marine protected areas on habitats and the ecosystem have hardly been investigated to date. One reason for this is often a lack of basic data before marine protection measures come into force. In Phase I of MGF-Nordsee, a comprehensive baseline status of the three German marine protected areas in the North Sea was therefore recorded.

Phase II of MGF-Nordsee now addresses two core objectives:

1) Investigating the physical, biological and biogeochemical MGF exclusion effects on the marine protected area ecosystem.

2) Development of an integrative monitoring concept that intercalibrates and combines alternative and conventional methods



Spatial location of MPAs and fisheries management areas in the German EEZ of the North Sea. Small-scale focus areas in MGF-Nordsee are highlighted in red.

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Insights into the results

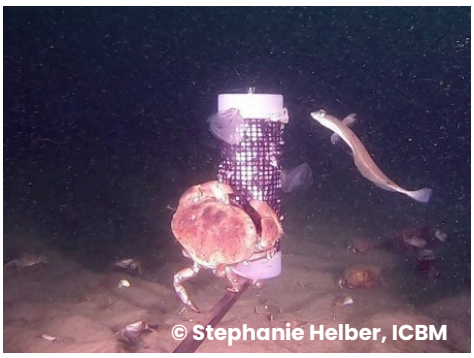
First effects and new methods

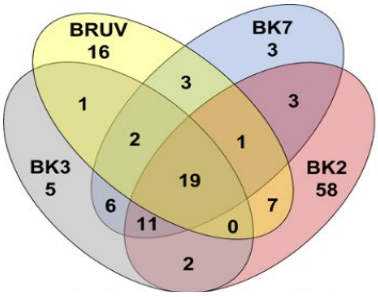
In the course of the project, we were able to show that the position of the large-scale sediment patterns in all study areas is stable overall, but that frequent local rearrangements take place. For this reason, MGF traces are only visible for a short time in the sandy sediments of the North Sea protected areas. Furthermore, a comprehensive catalog of the abiotics of the three protected areas was compiled. The areas differ significantly in central hydrodynamic features such as the maximum tidal-induced current velocity or bottom-shear stress, as well as in other parameters such as temperature and salinity fields at the surface and near the bottom, Secchi depth and mixed layer depth. Seasonal fluctuations in these parameters were also shown.

In order to follow the biological development, we have continued to carry out extensive sampling inside and outside the MGF exclusion areas. In the meiofauna communitites, nematodes proved to be the most diverse taxonomic group, while in the macrozoobenthos small Polychaeta occur in high abundances, but also the lancelet (*Branchiostoma lanceolatum*) characterizes the endobenthos, mainly at the BRG. A combined analysis of microbiota and macrofauna shows that changes in microbial communities and metabolism are accompanied by shifts in the macrofauna, which are influenced by MGF. Thus, MGF influences microbiota and metabolic rates not only directly but also indirectly. Using a modeling approach, we were also able to show the key role of commercially relevant fish species such as *Ammodytes* spp., *Limanda limanda* and *Pleuronectes platessa* in the SAR food web.

In addition, we focus on the comparison of conventional and alternative sampling methods. There are overlaps between the conventionally used bottom trawls and non-invasive methods such as Baited Underwater Video Stations (BRUVS) and eDNA. However, each method also detects species that the others do not.

By the end of the project, we will gain further exciting insights into the dynamic developments in the protected areas and use the findings to propose an integrative monitoring concept.





Detected species with conventional beam trawls (BK2, BK3, BK7) and BRUVS

Non-invasive methods such as BRUVS (left) are compared with conventional methods such as beam trawl (right) of different sizes.

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Consortium

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