



Nordic Council
of Ministers

Protecting the Skagerrak for biodiversity, food and climate



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Summary

The Skagerrak is a productive miniature deep sea with diverse habitat and nature types harbouring genetically distinct marine populations. Nature protection in the Skagerrak consists of marine protected areas (MPAs) ratified under the OSPAR agreement (EU and non-EU members), the Natura 2000 network of MPAs (EU member states) and national parks. Preliminary analyses suggest that marine protection in Skagerrak is weak overall, especially considering areas with regulation of bottom-contacting fisheries. Further, protected areas in Skagerrak are largely restricted to shallow coastal areas, meaning that important deep-water habitat types are poorly protected. The deepest parts of the Skagerrak are situated in the Norwegian Trench, which is home to vulnerable marine ecosystems, and constitute the most important carbon sink in the greater North Sea region. Establishment of a coherent network of MPAs in the Skagerrak will require international coordination, where marine spatial planning should consider the benefits of protection to biodiversity, fisheries and climate change adaptation and mitigation.

Background

Nature protection is integral to curbing biodiversity loss and to increasing ecosystems' resilience to climate change. The UN CBD Kunming Montreal Biodiversity Framework encourages the signatory nations to achieve 30% representative nature protection by 2030 in protected areas or by means of other effective area-based conservation measures (OECM). Additionally, signatory nations should nominate 30% of degraded ecosystems for restoration^[1]. The Skagerrak Sea is home to genetically and demographically connected marine populations, vulnerable marine ecosystems and the regions' most important natural storage of organic carbon. Nature protection in the Skagerrak features marine protected areas (MPAs) ratified under the OSPAR agreement (EU and non-EU members), the Natura 2000 network of MPAs (EU member states), and national parks. Historically, the productive Skagerrak ecosystem was home to diverse small- and medium-scale fisheries that were important for the regions' food security and generated a multitude of livelihoods in coastal communities. Modern fisheries operations in the Skagerrak are still economically important and are now primarily based on bottom-contacting fisheries of mixed vessel size for northern shrimp, Norway lobster and fish including certain high-value demersal fish species. ^[2] The pelagic fishery is small as quotas have been moved to the North Sea to protect Western Baltic Herring.

1. EU countries must restore at least 30% of habitats in poor condition by 2030, 60% by 2040, and 90% by 2050.
2. ICES. 2022. Greater North Sea ecoregion – fisheries overview. In: Report of the ICES Advisory Committee, 2022. ICES Advice 2022, section 9.2. <https://doi.org/10.17895/ices.advice.21641360>

Boxes

Box 1

Marine protected areas in the Skagerrak

Several instruments for marine protection are represented in the Skagerrak. **OSPAR marine protected areas** are areas ratified under the OSPAR agreement. **Natura 2000 marine protected areas** are designated under the EU Birds- and Habitats Directives. In addition, there are national parks with marine areas designated under national environment protection legislation (Norway). These areas include fully and partially protected areas designated under the EU common fisheries policy and national fisheries legislation. At present, the total coverage of these protection instruments is 22 % of Skagerrak's total area. However, less than 7 % is likely to confer protection benefits on ecosystems.

Box 2

Fisheries management in the Skagerrak: reciprocal access to fishing grounds

Based in the principle of upholding traditional fishing rights, Skagerrak is managed according to the 'Skagerrak agreement' between Norway and the European Union on reciprocal access to fishing grounds in the Skagerrak for vessels flying the flags of Denmark, Norway and Sweden. The agreement allows Danish, Swedish and Norwegian vessels to operate within each country's economic zone and territory outside the 4 nautical mile limit. The agreement is a remnant of the time prior to the United Nations Convention on the law of the Sea from 1982, and a continuation of the 1966 agreement securing reciprocal access to Skagerrak^[3]. (Learn more about the challenges facing fisheries management in Skagerrak in [Fish stocks in Skagerrak with management shortcomings](#)).

3. <https://lovdata.no/dokument/TRAKTATEN/traktat/2015-01-15-1>

Box 3

Vulnerable Marine Ecosystems (VMEs) and threatened nature types

'Coral gardens', 'Cold water coral reefs' and 'Sea pen fields' are types of vulnerable marine ecosystems (VMEs) found in the Skagerrak^[4]. These habitats consist of species that are vulnerable to the impacts of bottom-contacting fishing gear. They provide niches for a number of other species and nursery and feeding areas for demersal fish. The nature type 'Aphotic mud' in the Skagerrak is assessed as Near Threatened (NT) in the Norwegian Red list of Ecosystems^[5] (aphotic = beyond the reach of daylight). For aphotic mud, the impact of bottom trawling is also implicated in the assessment. In this case it is based on environmental degradation due to the loss of organisms and functions in the benthic ecosystem.

Box 4

Burial of organic carbon in deep marine sediments

Continental margin sediments accumulate organic carbon at scales much larger than vegetated coastal ecosystems because of their larger extent, and because they are accumulation bottoms rather than erosion bottoms. Studies are now exploring to what extent management interventions could increase accumulation rates by minimizing anthropogenic disturbance of seafloor sediments through bottom-contacting fisheries. Recent geospatial modeling studies have estimated regional and global aqueous CO₂ emissions resulting from bottom-trawling-induced remineralization of sedimentary organic carbon, with some studies proposing carbon protection zones (CPZs) as an effective climate protection measure.^[6]

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4. Buhl-Mortensen, L., et al. 2023. Sea pens and bamboo corals in Skagerrak and the Norwegian trench. *Marine Biology Research* 19:191–206. <https://doi.org/10.1080/17451000.2023.2224967>
 5. Buhl-Mortensen, P., et al. 2018. Marine deep waters. Norwegian Red List of Ecosystems 2018. Norwegian Biodiversity Information Centre. Downloaded (25.09.2024) from https://www.biodiversity.no/Pages/317605/Marine_deep_waters
 6. Porz, L., 2024. Quantification and mitigation of bottom-trawling impacts on sedimentary organic carbon stocks in the North Sea, *Biogeosciences* 21:2547–2570. <https://doi.org/10.5194/bg-21-2547-2024>

Key findings

Preliminary analyses based on regulation-based classification according to the authoritative guidelines of the MPA guide^[7] suggest that the present marine protection in the Skagerrak (Fig. 1) is insufficient in area coverage, ineffective, and unlikely to confer desired outcomes and regional ecosystem benefits. Increasing the protection levels of existing instruments will help (see Fig. 2B), but marine protection aiming to achieve benefits for biodiversity, fisheries and carbon sequestration would gain from a regional collaborative process where the best available science is incorporated in designing and siting optimal spatial management measures.

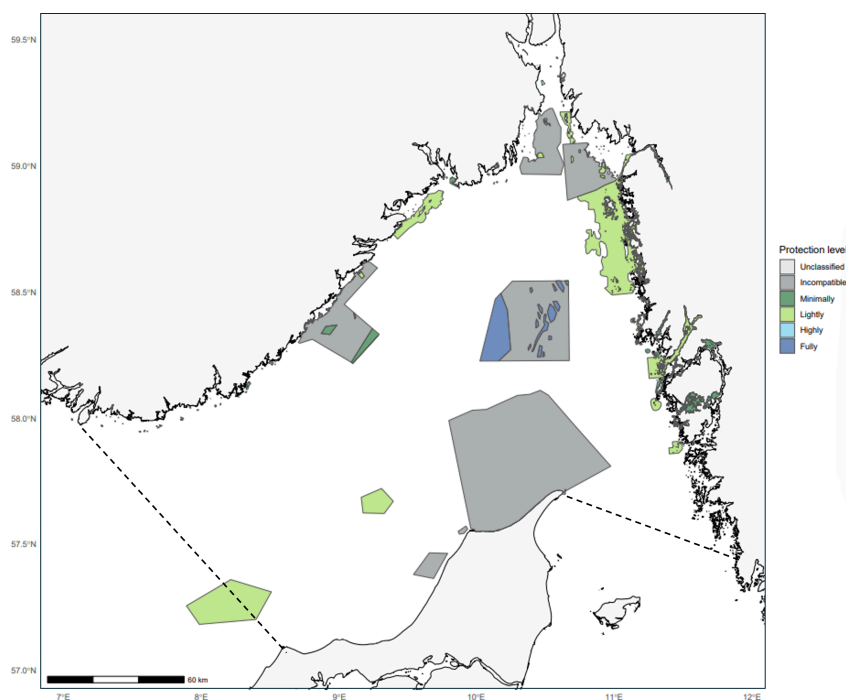


Figure 1. Marine nature protection in Skagerrak consists of Oskar- and Natura 2000 MPAs, in addition to national parks (Norway) designated under national environmental legislation. Preliminary analyses indicate that less than 7 % of Skagerrak's total area (32 231 km²) has protection instruments compatible with conservation objectives. Dashed lines delimit Skagerrak between the North Sea (left) and Kattegat (right). Map courtesy of project MARHAB/CCMAR UAlg.

7. Grorud-Colvert, K. et al. 2021. The MPA Guide: A framework to achieve global goals for the ocean. Science 373:eabf0861. <https://www.science.org/doi/10.1126/science.abf0861>

Population structure – where species are divided into multiple distinct units or populations – is an evident pattern among organisms within the Skagerrak. Such structure is apparent especially among coastal sites and between coastal and offshore sites (learn more about connectivity and population structure in [Spatial population structure and connectivity among marine populations in the Skagerrak](#)). Bottom trawl fisheries target the Skagerrak basin down to 400–500 meter depth (Fig. 2A). A holistic MPA network design in Skagerrak should consider patterns in population structure and population connectivity, as well as configuration and representativity of habitats, and prevailing fishing pressure. Some of the most productive sites, which are essential to include in MPA networks to maximise ecosystem benefits, are likely to be heavily targeted by fisheries, thus risking displacement and intensification of fishing effort in adjacent unprotected areas. To keep negative impacts on fisheries to a minimum while maximizing conservation benefits, it is essential to conduct systematic conservation planning, where maps of conservation values, human pressures and socio-economic interests are considered. An effective MPA network in the Skagerrak, taking both broad conservation and socio-economic objectives into account, would benefit from an international scientific advisory committee including representatives from Norway, Sweden, Denmark and the EU commission.

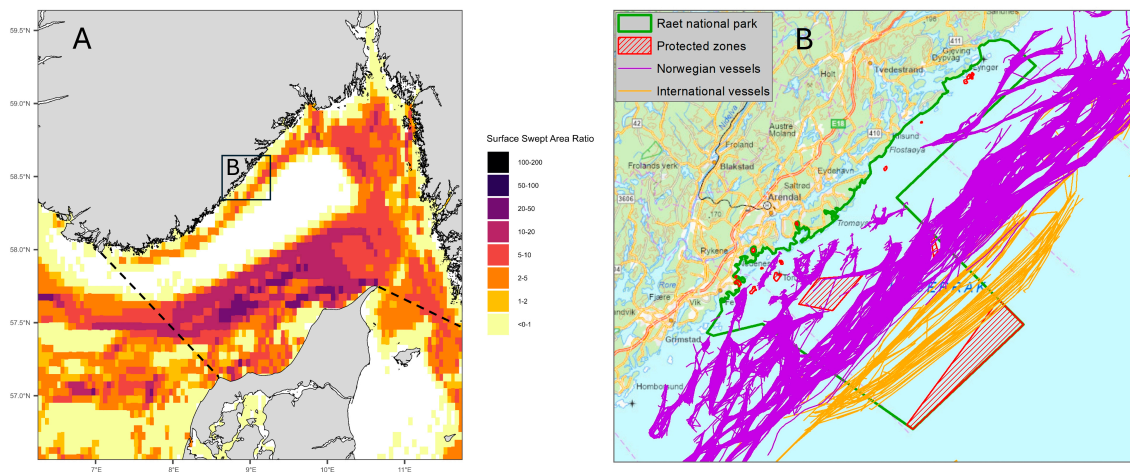


Figure 2. Bottom-contacting fishing activity is widespread in the Skagerrak. A. Footprint and intensity (yr⁻¹) of bottom trawl fisheries as surface swept area ratio (entire width of ground gear with bottom contact, regardless of penetration depth) from 2018-2022^[8]. B. Røst national park in Norway and tracking (VMS) of Norwegian (purple) and international bottom trawl vessels (yellow) filtered based on speed (0.8 – 2.5 knots) within and adjacent to Røst national park from 2019 to August 2024. Dashed lines in A delimit Skagerrak between the North Sea (left) and Kattegat (right). Map in B courtesy of: Norwegian Directorate of Fisheries.

8. ICES. 2022. Greater North Sea ecoregion - fisheries overview. In: Report of the ICES Advisory Committee, 2022. ICES Advice 2022, section 9.2. <https://doi.org/10.17895/ices.advice.21641360>

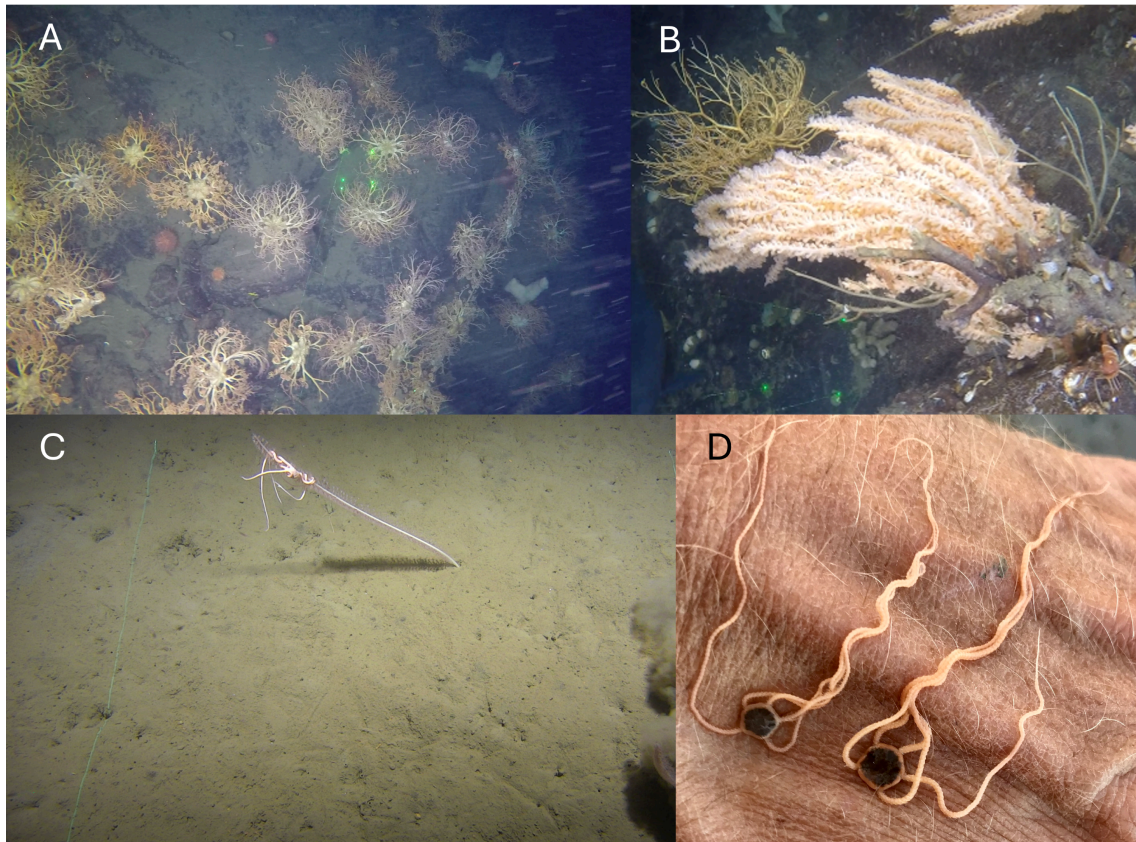


Figure 3. The Bratten Natura 2000 area is a rare example of an offshore MPA with fully protected zones. Situated at the easternmost slope of the Norwegian Trench, Bratten is steep and deep (100-500 m) with canyons, pockmarks and outcropping rocks hosting coral gardens and large soft seafloor areas with sea pen fields. A. Basket stars *Gorgonocephalus caputmedusae* on current swept rock, B. Soft coral *Primnoa resedaeformis* on steep rock wall, C. Large sea pen *Funiculina quadrangularis* with the associated brittle star *Asteronyx loveni* on muddy seafloor. D. The delicate brittle star *Amphilepis norvegica* dominates the burrowing fauna of the deep muddy seafloor of Skagerrak. All photos: SLU.

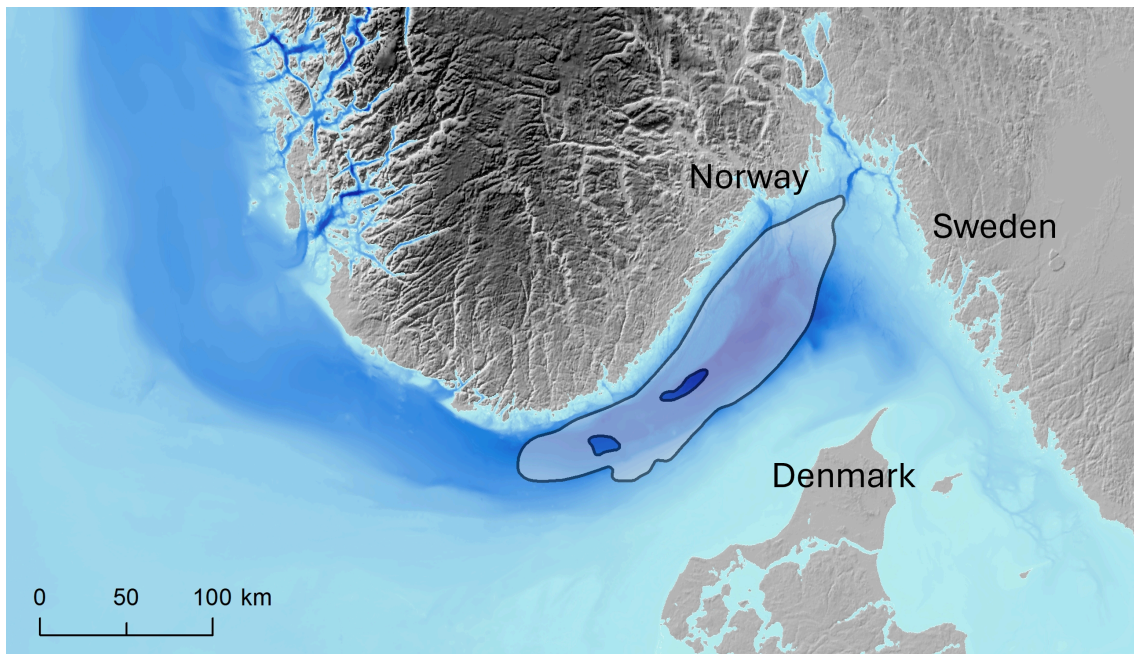


Figure 4. The Norwegian Trench is a deep (<700 m) trough carved into the shelf by fluvial erosion and glacial flows. In the eastern part of the Norwegian Trench, between Norway, Sweden, and Denmark (indicated by polygon), a lot of organic carbon are accumulating annually in the seabed sediments. Courtesy of: M. Diesing/Norwegian Geological Survey, redrawn from Diesing et al. (2024).

The Norwegian Trench and the outer region of the Oslofjord are defined as especially valuable areas (SVO's) due to the richness of ecosystem components meeting the criteria of Ecologically and Biologically Significant marine Areas (EBSA)^[9], ^[10]. The deeper part of the Norwegian Trench is mainly situated within the Norwegian exclusive economic zone (EEZ). It delivers a series of ecosystem functions in supporting essential ecosystems and key species for Skagerrak, fragile and vulnerable deep-sea life^[11] (Fig. 3), and constitute the major carbon sink in the greater North Sea region^[12] (Fig. 4). When assessed according the EBSA criteria, it scored medium to high on uniqueness for benthic communities, zooplankton and fish. Zooplankton and fish scored equally high for six of the seven criteria, except naturalness. Based on water exchange with the North Atlantic Ocean and the refuge areas in the stable environments of the deep trench, it is important for phyto- and zooplankton, particularly *Calanus finmarchicus*, which is of key importance in the food web of the Skagerrak and North Sea ecosystem.

9. Eriksen, E., et al. 2021. Particularly valuable and vulnerable areas (SVO) in Norwegian seas - Environmental values (English summary). Rapport fra havforskningen 2021-26. <https://www.hi.no/hi/nettrapporter/rapport-fra-havforskningen-2021-26>
10. Meld. St. 21 (2023-2024), Barentshavet og havområdene utenfor Lofoten, Norskehavet, og Nordsjøen og Skagerrak. Innst. 375 S (2023-2024), Norwegian Parliament White paper 14.06.2024. (In Norwegian)
11. Álvarez, H., Perry, A.L., Blanco, J., Conlon, S., Petersen, H.C., Aguilar, R. 2019. Protecting the North Sea: Norway. Oceana, Madrid. 96 p.
12. Diesing, M., et al. 2024. Glacial troughs as centres of organic carbon accumulation on the Norwegian continental margin. Communications Earth & Environment 5:327. <https://doi.org/10.1038/s43247-024-01502-8>

Recommendations for management

- Achieving effective marine protection in the Skagerrak depends on sufficient coverage of areas that limit or remove the negative ecosystem effects of fisheries and protect against pressures from other human activities.
- The Skagerrak contains vulnerable marine ecosystems and threatened nature types. To better incorporate protection of biodiversity throughout habitats and nature types, protection must be both horizontally wide and vertically deep and target biodiversity and important ecosystem services.
- MPA network design and marine spatial planning in the Skagerrak need to consider both coastal and offshore marine areas, where representativity, biodiversity, population connectivity and carbon sinks are considered.
- Taking human pressures and socio-economic interests into account, a holistic design of an effective MPA network in Skagerrak will benefit from an international scientific advisory committee to the Nordic Council.

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Further reading

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<https://www.science.org/doi/10.1126/science.abf0861>

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