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PROTECTING THE NORTH SEA: NEW RESEARCH FOR BIODIVERSITY RECOVERY



PROTECTING THE NORTH SEA: NEW RESEARCH FOR BIODIVERSITY RECOVERY

Credits

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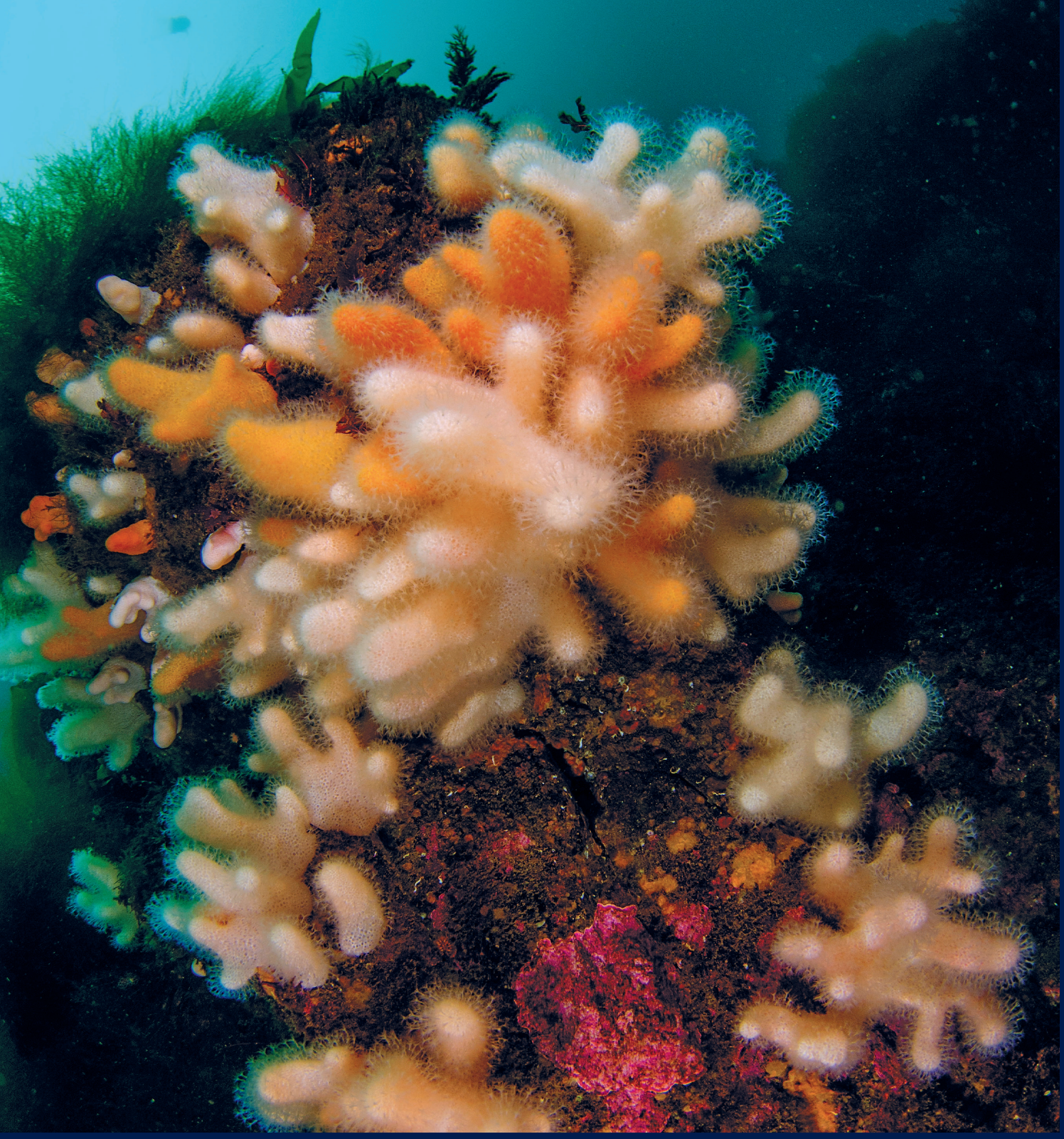
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A RICH AND PRODUCTIVE SEA

The North Sea is regarded as one of the most biologically productive seas in the world.[1] It is relatively shallow (with an average depth of 90 m), descending to greater depths towards the north, where it reaches a maximum depth of 725 m in the Norwegian Trench. It hosts a wide variety of habitats, such as bays, estuaries, fjords, mudflats, sandbanks, pockmarks, and rocky bottoms, which sustain valuable marine ecosystems such as cold-water reefs, kelp forests, and seagrass meadows, among many others. These ecosystems are home to a rich array of marine life, ranging from plankton to molluscs, cnidarians, fishes, seabirds, and marine mammals. For example, approximately 230 species of fishes inhabit the waters of the North Sea,[2] including commercially fished species with important spawning areas in the region. Its coasts provide breeding areas for roughly 2.5 million pairs of seabirds of 31 different species, which depend on North Sea waters for feeding.[1,3] These waters are also home to various marine mammals, including minke whale, long-finned pilot whale, harbour porpoise, white-sided dolphin, Risso's dolphin, grey seal, and harbour seal.

The seabed of the North Sea is also characterised by diverse and productive communities, which live in association with a variety of substrates. Soft sediments (e.g., mud, muddy sand, sand, and gravelly mud) are predominant, although there are some patches of hard substrate – such as stone reefs, gravel and cobble beds – as well as rocky shores (mainly in the northern North Sea, along the coasts of Norway and the United Kingdom).[1] Biological reefs also occur in the North Sea, most typically those formed by ross worm (*Sabellaria spinulosa*) and sand mason worm (*Lanice conchilega*).

The composition of benthic assemblages varies depending on factors such as latitude, depth, and substrate type. For example, most macrofaunal species tend to be found either more to the south or to the north, with the northern edge of Dogger Bank (i.e., the 50 m depth contour) acting as a rough division between the two regions.[4] Deep-sea species are restricted to the few areas that reach depths below 200 m, such as the Norwegian Trench[5] and Devil's Hole (in the north-central North Sea, off Scotland).

School of pouting (*Trisopterus luscus*) over a shipwreck. Holderness, United Kingdom. © OCEANA/ Juan Cuetos





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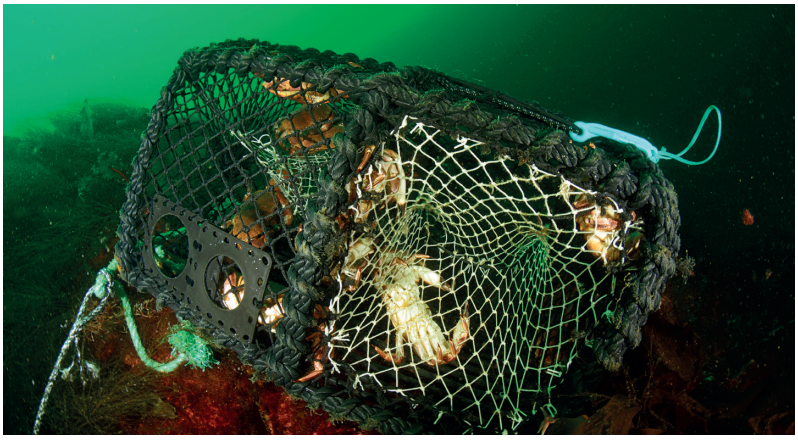
HEAVY HUMAN PRESSURE ON MARINE LIFE

Eight nations (Belgium, Denmark, France, Germany, Netherlands, Norway, Sweden, and the United Kingdom) border the North Sea, many of which are densely populated; approximately 184 million people live in its catchment areas.[6] As a result, the North Sea has become very industrialised. Its fisheries, oil and gas extraction, shipping, harbours, and wind farms are of high socio-economic value, and contribute to making it one of the busiest, most highly disturbed seas in the world.[7] The International Council for the Exploration of the Sea (ICES) describes the current state of the North Sea ecosystem as "perturbed".[8]

Across the North Sea, multiple and overlapping activities compete for resources and space, both at the surface and, less visibly, on the seafloor. The many threats to benthic marine ecosystems in the region include extensive fisheries, maritime shipping, oil and gas exploitation, wind energy development, and the extraction of sand and gravel. In coastal areas, further impacts arise from coastal development, harbours, and recreational activities, among other pressures. In combination, these activities have caused widespread damage to North Sea ecosystems, and few areas of the seabed remain in their natural state.[7]

The North Sea has historically been – and remains – one of the most important fishing areas in Europe, and is potentially the most heavily fished region in the world.[9] More than a century of intensive, industrial fishing pressure has resulted in marked ecosystem changes in its waters. For example, the biomass of large fishes has been reduced by 97-99%,[10] and long-term declines and local extirpations have been documented in large-bodied, vulnerable species such as common skate, thornback ray, and angel shark.[11,12]

One of the most widespread fishing practices in the North Sea is bottom trawling, which is regarded as the largest anthropogenic source of physical damage to the seafloor globally.[13] According to ICES, approximately 43% of the seabed of the Greater North Sea was trawled in 2013,[14] which implies extensive damage to benthic habitats and species across the region. The damage generated by the use of these gears ranges from direct physical impacts on the seabed and destruction of biogenic structures, to broadscale changes in the structure and functioning of entire benthic ecosystems.[15,16] For example, beam trawling, which is particularly prevalent in the southern North Sea, has been shown to cause dramatic losses in infauna and epifaunal biomass,[17] with the greatest impacts on biogenic reefs.[18,19] A meta-analysis based on 18 separate studies found that an average of 23 species were lost from a system as a result of beam trawling.[20]



Ghost fishing trap.
© OCEANA/ Carlos Minguell

Although fishing effort has been reduced during the last 15 years[21] and some stocks have recovered to a certain extent, others remain in poor condition. One of the most iconic North Sea fish species – Atlantic cod – was recently reassessed as overfished, having returned to critical levels after a period of apparent recovery. ICES has recommended a significant reduction in catches (i.e., by 60%) in order to avoid the collapse of the population.[22]



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THE NEED FOR STRONGER PROTECTION

Marine protected areas (MPAs) are the main policy measure and management tool for biodiversity conservation in the North Sea. Created under a variety of legislative frameworks, North Sea MPAs aim to safeguard an array of features (i.e., habitats or species) that are considered priorities for conservation, at the international, EU, and/or national level.

At the international level, North Sea waters fall within the remit of the Convention for the Protection of the Marine Environment of the North-East Atlantic (the 'OSPAR Convention'). Under OSPAR, MPAs are intended to protect and conserve species, habitats, ecosystems, or ecological processes.[23] The countries that are Contracting Parties to OSPAR committed in 2010 to create an ecologically coherent and well-managed network of MPAs by 2016.[24]

Within the European Union, the Habitats and Birds Directives[25,26] lay the basis for the designation of the two most common types of MPAs in the EU: Special Areas of Conservation (SACs, for habitats and non-avian species) and Special Protection Areas (SPAs, for birds). Together, they comprise the marine Natura 2000 network. The EU Marine Strategy Framework Directive (MSFD)[27] also includes provisions for spatial marine protection, including of features not covered by the Habitats and Birds Directives, with the aim of achieving the Good Environmental Status of EU marine waters.

In national waters, North Sea countries also apply their own individual figures of protection. Such MPAs include a wide array of designation types (e.g., marine conservation zones, national parks, nature reserves, and wildlife conservation areas), with differing objectives. As a result, the levels of protection that they imply can vary widely among types and among countries.

Considering the many different types of designations, and based on the best available information, twenty-two percent of North Sea waters are currently designated as MPAs.[28] Even though this total area designated is higher than the 10% minimum target established by the United Nations Convention on Biological Diversity,[29] it does not yet approach the more ambitious target of 30% by 2030, as called for by the International Union for Conservation of Nature.[30] Nor is the current network of MPAs ecologically coherent; there are clear gaps in protection, particularly with respect to seabed habitats and species in deeper and/or offshore areas.

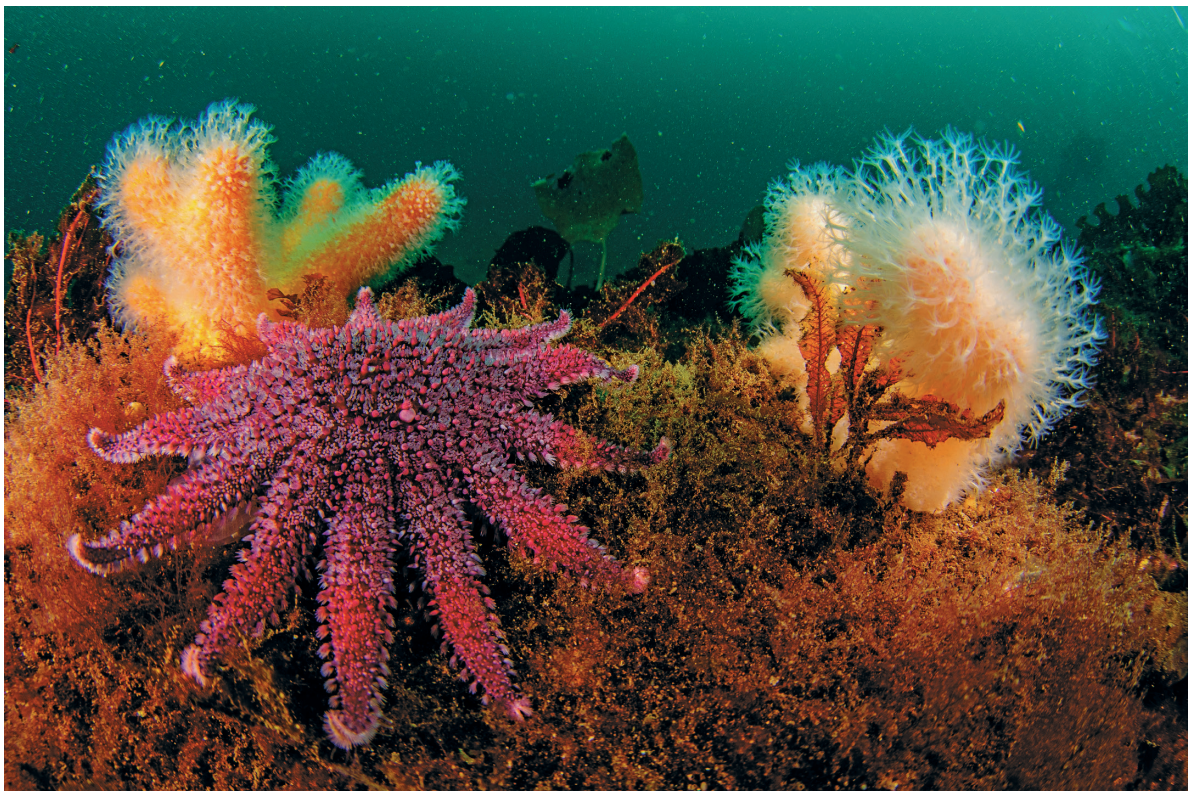


Research vessel *MV Neptune*.
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Moreover, many of the designated MPAs lack management plans and measures, and therefore grant limited to no protection to the features for which they are designated. According to OSPAR, only 12% of OSPAR MPAs in the North-East Atlantic have implemented management measures, while an additional 54% have only partially done

so.[31] Of the Natura 2000 MPAs in the North Sea, fewer than half (47%) have a management plan, and only 15% are designated for the protection of benthic ecosystems.[32] Given the weaknesses in management, it is not surprising that assessments of the status of seabed features within Natura 2000 MPAs have shown many to be in poor or unknown condition.[33,34] As one example, according to the latest official assessment, all three habitat types that are designated features of Natura 2000 sites in the Danish North Sea (i.e., reefs, sandbanks and submarine structures made by leaking gases) have been assessed as being in 'Unfavourable-Bad' condition.[30]

There is a clear need to strengthen the network of North Sea MPAs, with respect to increasing the coverage and ecological coherence and representativeness of sites, and ensuring their effective management. Identifying new sites for designation and developing management measures both depend, however, on knowledge about the distribution and abundance of marine life. In the case of seabed habitats and species, this poses a particular challenge. Despite the fact that the North Sea is one of the most studied seas on the planet, knowledge regarding its benthic ecosystems is patchy – particularly in offshore areas – which represents an obstacle for MPA designation and management.[35]



Common sunstar (*Crossaster papposus*), dead man's fingers (*Alcyonium digitatum*) and algae.
© OCEANA/ Juan Cuetos



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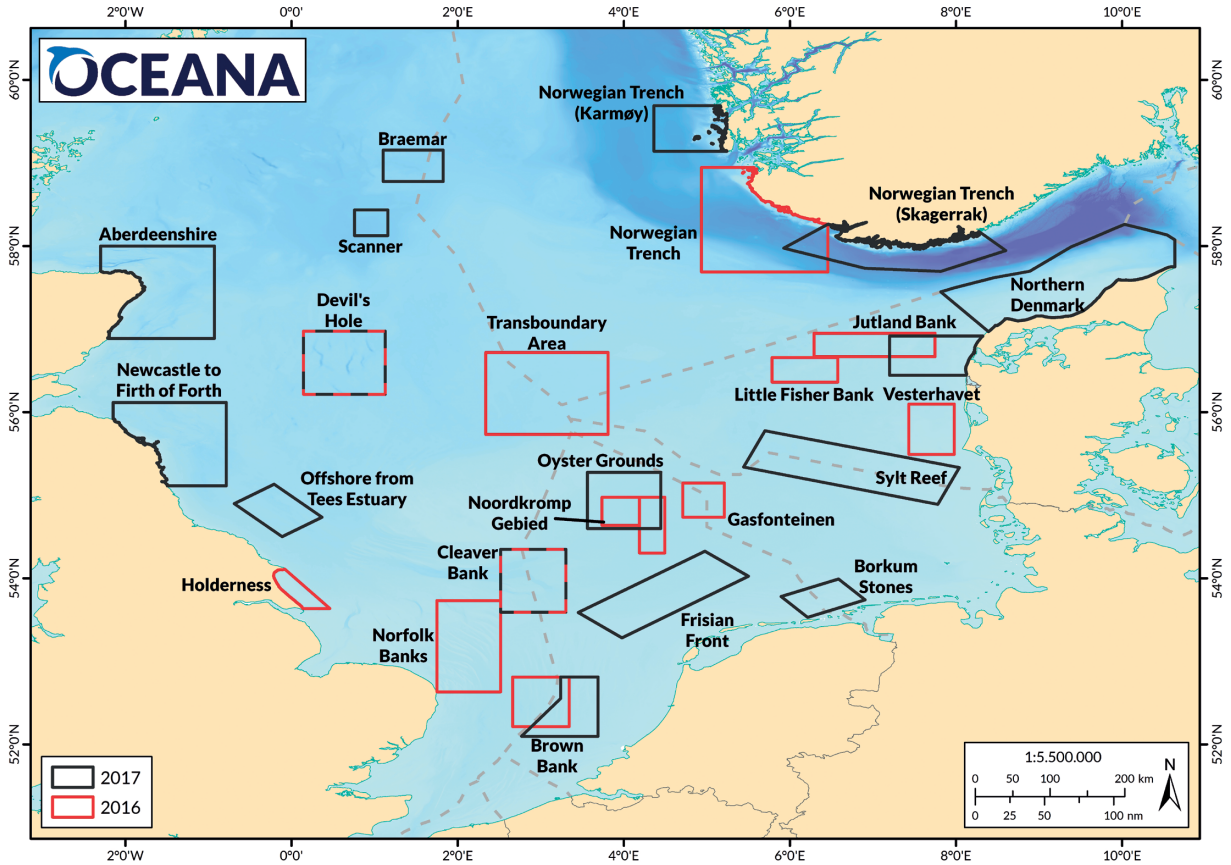
OCEANA'S NORTH SEA RESEARCH

To help fill gaps in knowledge about marine biodiversity in the North Sea, Oceana carried out two eight-week research expeditions, in 2016 and 2017.

The main objectives of this research were to:

- Gather first-hand information from areas of known or potential ecological importance, but from which benthic biological data were lacking.
- Provide decision-makers with better data about North Sea benthic biodiversity for conservation and management.
- Help to strengthen the network of MPAs in the North Sea.

Research was conducted in 29 areas, across the waters of five North Sea countries (Denmark, Germany, the Netherlands, Norway, and the United Kingdom; Map 1). The surveys were carried out on board the *MV Neptune*, a fully equipped vessel of 49.85 m overall length and 10 m extreme breadth.



Map 1. Routes and areas surveyed during the 2016 and 2017 Oceana North Sea expeditions.

Areas to be surveyed were selected on the basis of published and grey literature; spatial data on marine biodiversity, bathymetry, and substrate types; and through consultation with local scientific experts, governments, and NGOs. These areas primarily included sites that were known or believed to be ecologically important but from which data on benthic marine life were limited. Some of the areas had previously been considered as candidate sites for protection.

Surveys were done using primarily non-intrusive (visual) methods: filming with a remotely operated vehicle (ROV) with a high-definition camera and by a team of professional SCUBA divers (in shallow areas). A total of 159 ROV dives and 66 SCUBA dives were done during the two expeditions, producing more than 172 hours of ROV video footage, and 3509 high-definition underwater videos and 4169 underwater still images from SCUBA. These videos and images were later analysed by Oceana scientists, who identified all of the visible species to the finest taxonomic resolution possible, classified habitats, and noted evidence of human impacts.

Additionally, a 12 L Van Veen grab sampler was used in soft sediments to examine benthic infaunal community composition. A total of 384 grab samples were taken and processed onboard; specimens retained on 0.5 mm and 1 mm sieves were kept and identified.

In total, Oceana identified 1283 taxa during the two expeditions, of which 906 were identified to the species level.



Diver filming in forest of kelp (*Laminaria* sp.) and other algae.
© OCEANA/ Juan Cuetos



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KEY RECOMMENDATIONS FOR SURVEYED AREAS

Oceana's surveys documented a wide range of habitats and species that are considered priorities for conservation, under national, EU, and international frameworks that recognise them as threatened and/or establish legal requirements for their protection. Such habitats included stone reefs, ross worm (*S. spinulosa*) reefs, bamboo coral (*Isidella lofotensis*) gardens, deep-sea sponge gardens, kelp forests, sandbanks, bubbling reefs, sea pen fields, and other soft-bottom areas. Threatened and/or protected species included bamboo coral (*Isidella lofotensis*), European flat oyster (*Ostrea edulis*), ocean quahog (*Arctica islandica*), Atlantic cod (*Gadus morhua*), European eel (*Anguilla anguilla*), thornback ray (*Raja clavata*), and minke whale (*Balaneoptera acutorostrata*), among others.

While features of conservation interest were observed across most of the sites surveyed during the two expeditions, seven areas stood out as being of particularly high ecological value, because of the features that they hosted. Some of these areas had previously been identified as potential areas of conservation interest but had not yet been proposed for protection; others were sites where existing MPAs excluded important features outside their boundaries; and for others, previous data were extremely limited or non-existent.

For each of these selected priority areas of conservation, Oceana has prepared a report that presents the biodiversity features of interest in the area and details Oceana's research findings. On the basis of those findings, Oceana proposes measures for the protection of the priority areas. These key recommendations are summarised below:

- Aberdeenshire (UK): Oceana supports the designation of the proposed *Southern Trench* MPA, and further proposes to extend it or designate new areas to the south, to encompass nearby priority features including ocean quahog (*A. islandica*), sandeels (*Ammodytes marinus* and *A. tobianus*), ross worm (*S. spinulosa*) reefs, kelp beds, and underwater caves. Sandeels, ross worm reefs, and kelp beds were also found inside the proposed boundaries of *Southern Trench*, and Oceana recommends that they be considered for formal protection within the site.
- Borkum Stones (Germany and the Netherlands): Oceana recommends the protection of the Dutch waters of Borkum Stones, to safeguard the complexity and biodiversity of the rich mosaic of ecosystems present, including sandbanks, geogenic reefs, and biogenic reefs formed by sand mason worm (*Lanice conchilega*).
- Brown Bank (Netherlands and UK): Oceana recommends to urgently protect Brown Bank, in order to protect fragile ross worm (*S. spinulosa*) reefs, as is required under both EU and international conservation frameworks. In parallel, comprehensive benthic studies must be carried out by the Dutch and UK governments to identify any additional biogenic reefs and to assess their condition and extent.
- Cleaver Bank (Netherlands and UK): Oceana proposes that the entire area designated as *Klaverbank* SAC should be closed to all types of bottom-contacting fishing gears, which represent a threat to fragile benthic ecosystems in this, the largest expanse of hard substrate in Dutch waters. In addition, the UK government should carry out more detailed habitat mapping, to better identify features and necessary measures to safeguard the part of this system that lies in UK waters.

- Holderness (UK): Oceana proposes that the two existing Marine Conservation Zones in Holderness (*Holderness Inshore* and *Holderness Offshore*) be adjoined, to create a single continuous MPA – rather than leaving an unprotected corridor that cuts between these sites. This corridor is likely to limit their effectiveness in protecting priority features, and to weaken ecological connections between the inshore and offshore areas.
- Northern Danish waters: Oceana recommends the designation or enlargement of MPAs to safeguard valuable features (e.g., stony reefs, coral gardens, bubbling reefs, sea pen fields, soft-bottom habitats) in specific areas, and the formal protection of such features that occur within existing MPAs but which are not officially listed as being present in the area, and therefore remain unprotected.
- Norway: Oceana recommends that new MPAs be designated in both shallow and deep-water areas, to safeguard an array of threatened species and habitats, vulnerable marine ecosystems, and areas of essential fish habitat. Oceana also urges Norway to dedicate resources to studying the habitats and species of the Norwegian Trench, to match efforts that have been made in other marine regions of the country.

Finally, although the data obtained from Oceana's two research expeditions have significantly contributed to the knowledge of benthic marine life in the North Sea, it should be noted that these surveys were non-exhaustive. Further benthic surveys across lesser-known areas of the North Sea would be likely to reveal additional sites that should be prioritised for protection. Oceana urges North Sea countries to conduct detailed benthic habitat mapping in areas of known or potential ecological importance, particularly to determine the extent and condition of sensitive and threatened habitats and species. Such efforts fall within countries' obligations as Contracting Parties to OSPAR and lay the foundation for designing and implementing targeted actions to recover and rebuild marine biodiversity in the North Sea.

Oceana's research has underscored the fact that much remains to be discovered about marine life on the seabed of the North Sea. Continued research is critical for informing efforts to recover biodiversity, an urgent priority in the face of the multiple, intense pressures facing the North Sea's marine habitats and species.



Grey seal (*Halichoerus grypus*) in the port of Thyborøn, Denmark. © OCEANA/ Juan Cuetos



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