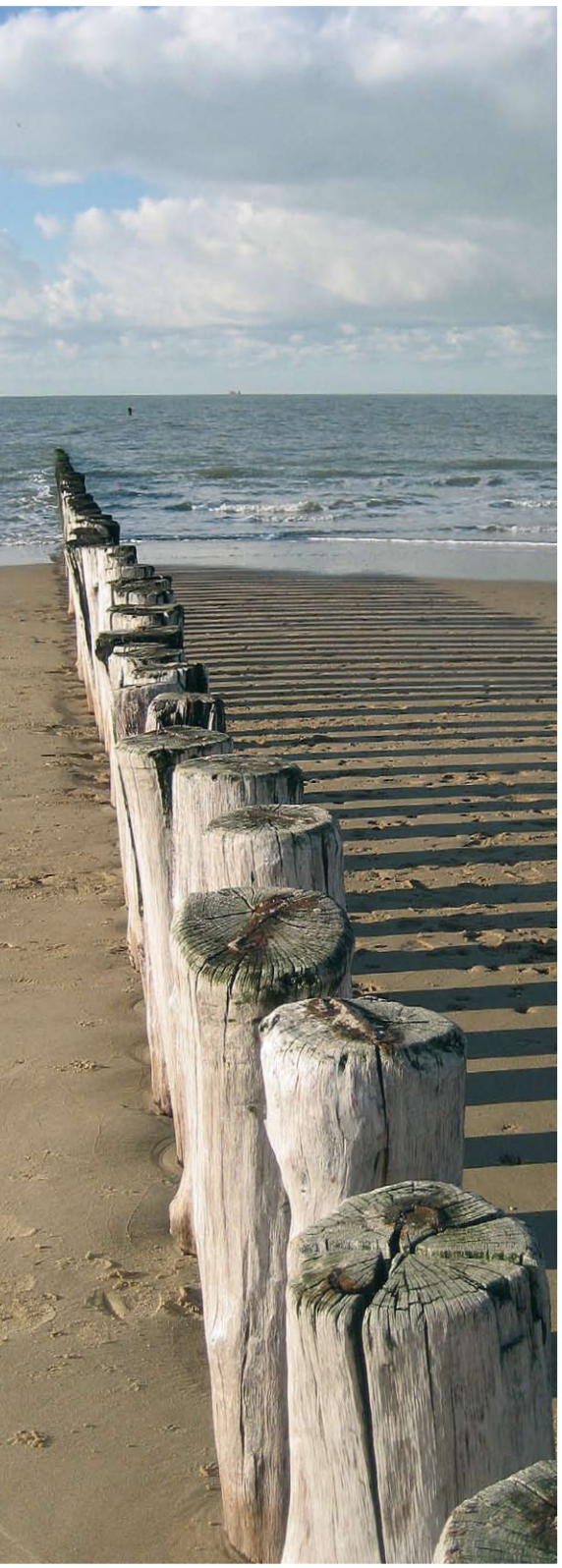
The Dutch Case

A Network of Marine Protected Areas



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Abbreviations

BALANCE	*Baltic Sea Management: Nature Conservation and Sustainable Development of the Ecosystem through Spatial Planning*
BPA(s)	*Benthic Protection Areas*
CFP	*Common Fisheries Policy*
EEZ	*Exclusive Economic Zone*
EC	*European Commission*
EU	*European Union*
HP	*Horse Power*
HELCOM	*Regional Sea Convention for the Baltic Area*
IBN 2015	*The Integrated Management Plan for the North Sea 2015*
ICES	*International Council for the Exploration of the Sea*
IMARES	*Institute for Marine Resources and Ecosystem Studies*
IUCN	*International Union for Conservation of Nature*
Lundy MNR	*Lundy Marine Nature Reserve*
MESH	*(Development of a Framework for) Mapping European Seabed Habitats*
MPA(s)	*Marine Protected Area(s)*
NM	*Nautical Mile (1.852 km)*
NGO(s)	*Non-Governmental Organisation(s)*
OSPAR	*Convention on the Protection of the Marine Environment of the North-East Atlantic*
RFMOs	*Regional Fisheries Management Organisations*
SACs	*Special Areas of Conservation under 92/43 Habitats Directive*
SCI	*Site of Community Importance*
SPAs	*Special Protected Area under 79/409 Birds Directive*
SSB	*Spawning Stock Biomass*
t	*Ton (1,000 kilo)*
TRAC	*Transboundary Resources Assessment Committee (USA/Canada)*
WWF	*World Wide Fund for Nature*

Cover Illustration *(left)*
North Sea wave breakers in Cadzand, The Netherlands

Cover Illustration *(right)*
White-bellied monkfish *(Lophius piscatorius)* is a predominant species in the northern North Sea. Common along the entire Norwegian coast, from the intertidal zone and down to 1200 meters, it occurs on sandy or muddy gravel as well as hard substrate.

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Introduction

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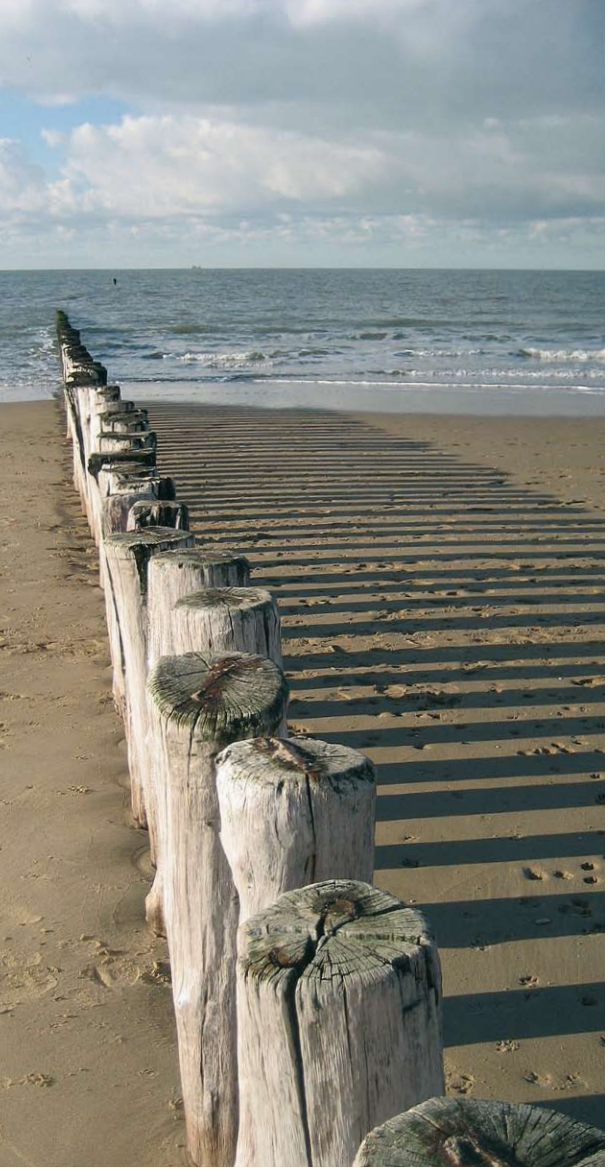
1.1 Report Outline

This report discusses a network of Marine Protected Areas (MPAs) in the North Sea, and is particularly aimed to inform Dutch stakeholders.[1] An MPA is most often defined as *'An area of intertidal or subtidal terrain, together with its overlying waters and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment'*.[2] MPAs can contribute to resilient ecosystems and protection of marine biodiversity in various ways. When designed and managed properly and combined with complementary measures, they can mitigate some of the negative effects of the most pressing issues in the North Sea: pollution, the introduction of alien species, climate change, overfishing and bycatch, damage and disturbance to species and habitats and spatial issues.

This report explores the general concept of MPAs, implementation of MPAs in the North Sea under OSPAR (Convention on the protection of the marine environment of the North-East Atlantic) and the European Birds and Habitats Directives (together forming the so-called Natura 2000 network of protected areas) and potential locations for these MPAs. The report discusses the fisheries management within MPAs under the Common Fisheries Policy (CFP) as a management tool to provide the required protection within MPAs. This is followed by three case studies: Georges Bank (USA/Canada), Lundy Island (UK) and the MPA Network Approach of New Zealand. From this, Dutch stakeholders may extract potential lessons for the Netherlands regarding designation and implementation, benefits of and stakeholder involvement in a network of MPAs. World Wide Fund for Nature Netherlands gives four recommendations to North Sea Stakeholders, which need to be taken up in order to create an effective network of MPAs in the North Sea and to achieve optimal results for the conservation of biodiversity.

North Sea beach in Zeeland, The Netherlands.



North Sea wave breakers in Zeeland, The Netherlands.

1.2 Marine Biodiversity in the EU

Marine biodiversity is the variety of life in the marine environment. It is vital to mankind as it provides essential resources, including fish and shellfish stocks; sources for (new) medicines and services, such as the production of oxygen; nutrient recycling and decomposition of waste. Biodiversity enables the environment to adapt to changing conditions, which have been induced through pollution, fishing, sediment extraction and alteration of the global climate.[3] Marine biodiversity serves a function to mankind and has intrinsic value, as certain species and habitats have been part of this planet for millions of years.

Studies show that biodiversity globally is in great danger as a result of habitat loss, invasive species, pollution, climate change and overexploitation.[4] The European Union (EU) is experiencing biodiversity degradation. The EU acknowledges this threat and has therefore set itself the goal to halt the loss of biodiversity by the year 2010, according to agreements made at the Johannesburg Convention on Biodiversity in 1992. In order to reach this goal, EU member states have committed to European and International obligations to appoint protected areas on land and at sea.

In the year 2010, protected areas under the OSPAR Convention on the protection of the marine environment of the North-East Atlantic (1992) and the European Birds (79/409/EEC) and Habitats Directives (92/43/EEC) are to be a part of a worldwide, ecologically coherent network of marine protected areas (MPAs).

Consequently, the Netherlands has the opportunity and obligation to implement MPAs under OSPAR and Natura 2000 and to take appropriate measures within and outside the MPAs in the Dutch part of the North Sea to ensure an ecologically coherent network of MPAs.

1.3 Ecosystem Approach

Wind turbines and flock of geese near the North Sea Coast, The Netherlands.

The Ecosystem Approach is central in WWF's vision for healthy oceans. It is described as *'a comprehensive integrated management of human activities based on the best available scientific knowledge about the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of the marine ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of ecosystem integrity.'*[5] This implies that human activities in ecosystems need to be managed in such way that they do not compromise ecosystem components that contribute to the structural and functional integrity of the ecosystem.[6]

Marine Protected Areas are one essential element – among others – for the delivery of an Ecosystem Approach and providing the framework to implement those measures, necessary to conserve the most critical ecosystems' components. They can address multiple, cumulative impacts on the ecosystem. An Ecosystem Approach to Management must be applied to all human activities and must follow the precautionary principle. MPAs guide the management through their conservation objectives. While these objectives are commonly biodiversity conservation ones, an MPA's objective can

also be aimed at the sustainable exploitation of commercial fish stocks or other living marine resources (see textbox on page 8). These objectives are rather synergistic than mutually exclusive; an MPA can serve both purposes.

1.4 Pressures on North Sea Marine Biodiversity

The North Sea is divided between seven countries: Norway, the United Kingdom, Denmark, Germany, Belgium, France and the Netherlands. It is not a very deep sea, with depths ranging from 30 to 200 meters and an average depth of 90 meters.[7] It covers an area of 572,000 km^2 and the Dutch part of the North Sea covers 57,000 km^2. The North Sea is a very productive sea and of great ecological value, harbouring various species of marine life, birds and unique flora and fauna. The North Sea is of great socio-economic value and one of the busiest seas in the world with its fishing, oil and gas extraction, harbours, industry, recreation, wind energy, sediment-extraction, military training, the construction of cables and pipelines etc.[8] [9]

The North Sea marine ecosystem is highly disturbed and altered by human intervention.[10] It is polluted with the artificial spread of exotic (alien) species, chemicals, oil and household waste, causing contamination, disease and death to marine life.[11] [12] The noise from shipping and military training with explosives causes inner ear damage to fish species and excludes cetaceans from important habitats and impedes their reproductive and feeding patterns.[13] [14] [15] Marine biodiversity suffers from severe over-harvesting: in 2006, six of the 13 commercially exploited fish species were considered to be overexploited with at least four of those outside safe biological limits.[16] Other pressures include habitat disturbance, damage and increased spatial pressure from wind energy parks, shipping, cables, pipelines, coastal development, recreation, destructive fishing gear and by-catch, platforms and military training.[17] Of all these activities, fishery exerts the most pressure on marine biodiversity[18] and therefore receives relatively more attention throughout this report.

Fisherman tying the cod end on board a North Sea beam trawler.

Shipping of goods such as bananas and coffee often occurs by sea. Container port on the North Sea, Antwerp, Belgium.

Marine Protected Areas

2

2.1 The Concept of Marine Protected Areas

'Marine Protected Area' is an umbrella term, for which the meaning differs according to its specific characteristics and objectives. The prevailing international definition formulated by the International Union for Conservation of Nature (IUCN), is: *'An area of intertidal or subtidal terrain, together with its overlying waters and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment'.*[19] MPAs exist in different forms and vary according to their objective, level and scope of protection (from local to international), involvement of stakeholders and legal authorities, property rights regime[20], management approaches, restrictions on human uses[21] and of course size, which ranges between village level community managed areas to multimillion hectare national parks.[22] Types of MPAs range from multiple use to strict protection in no-take zones or reserves. The confusing element is that in the policy arena, the term MPA is frequently used to point out a *'no take zone'* (no fishing or other extractive activities allowed), when in fact this is not always the case.[23] The term *'marine reserve'* or *'no-take zone'* in this report is used to point out a type of area of the sea completely protected from all extractive activities, usually implemented for the purpose of managing a natural resource. The term 'MPA' in this report is used as the protection of an area for the purpose of conservation of biodiversity and can include so-called multi-use zones, which enable the sustainable use of resources.

2.2 Marine Protected Areas Objectives

It is important that MPA objectives are clear, as success of an MPA is measured by the extent that it has accomplished its objectives. Ecological objectives may include the protection of biodiversity[24] and wild genetic resources, e.g. for use in pharmaceuticals[25]; the restoration of degraded areas and depleted natural resources; to protect coastal areas and their ecological processes or functions[26]; to keep an area safe from or act as a natural buffer zone to mitigate some of the harmful impacts of human activities, such as shipping, fishing, and extraction of sediments.[27] [28]

MPAs may be created for social and economic purposes, e.g. to generate (improved) income and reduce poverty[29] through recreation and ecotourism. Reserves can bring economic benefits through an increase in the amount of commercial species.[30] MPAs are also created as reference area for science, for instance for ecology education purposes and to study the effects of exploitation on the ecosystem (through comparison of exploited and non-exploited areas).[31] [32] MPAs can be implemented to preserve and protect historical and cultural sites, local traditional skills, a way of life and the natural aesthetic values for future generations.[33] MPAs are a management tool for enhanced coordination between resource management and coastal development.[34] In addition, MPAs can resolve conflicts between user groups, for example by installing multi-stakeholder decision-making processes.[35]

Fisheries Management and Nature Conservation Objectives

In nature conservation MPAs, the long-term objective of designating and managing human activities is to reduce human pressures to such an extent, that the ecosystem will fall back into an ecologically balanced state, driven primarily by natural drivers.[36] The nature conservation MPA protects for example critical ecological processes, habitats or areas of high concentration of marine biodiversity or endangered species. The objective of fisheries MPAs is to restore commercially valuable fish stocks (and other 'resources' such as mollusks, crustaceans etc.) to a highly productive state in order to provide for a long-term sustainable fishery.[37] Besides different objectives, the two types of MPAs also differ in size, suitable location, management, measures taken to reach objectives etc.

The closure of a marine area to specific activities and for a specific time is used to reach both fisheries management and nature conservation objectives (closed areas or no-take MPAs).[38] Although the procedure of establishing the protected area is often similar under the two approaches, the exercise is very different in reality. Overlap between the objectives of a nature conservation MPA and a fisheries MPA is possible when for instance the former allows for the creation and protection of non-extractive zones, harvest refugia, nursery and spawning grounds and vice versa when the latter leads to healthier stocks, which not only support the fishing industry, but also populations of marine predators. It is possible to combine objectives for both nature conservation and fish stock management within one site. Closed areas are not new concepts in fisheries management: on the contrary, they are approved management tools to improve fish stock productivity and/or to protect local fisheries. Their target, however, is to optimize fisheries yields, and thus they are different from the targets of nature conservation. However, benefits for both the marine environment and fisheries management can be expected if their targets are successfully harmonized in fishery management plans.[39]

2.3 Effects of Marine Protected Areas

2.3.1 Ecological Effects

As individual MPAs and no-take MPAs vary, its effects vary as well. No-take MPA benefits include rapid increase (detectable after 2-3 years) in size of fish population, in spawning stock size, in animal body size and in reproductive output of exploited species.[40] In a review of 80 no-take zones it was concluded that MPAs can have rapid and lasting effects and higher average values of density, biomass, average organism size and diversity. Biological response inside no-take zones is quick and lasts through time.[41] Many (no-take) MPAs restore their fish stocks and show increased abundance, biomass, age and mean size of various fish.[42] They enjoy a decreased variability in catches and increased habitat recovery.[43] Another important benefit is the so-called spill over effect: juvenile and adult fish increase and move to areas outside the protected area[44] and increase or maintain fishery yields in surrounding areas.[45] No-take zones also increase the age of species, resulting in more fecund individuals. It is argued that a portion of highly mobile stocks can show strong site fidelity, such that populations from small no-take zones may also benefit.[46] IMARES research on historical fish stocks shows that fish stocks strongly increased during the World War I and II, when there was virtually no fishing in the North Sea. The catch in cod after World War I quadrupled and in both cod and plaice, catch tripled after World War II.[47] It is fundamental that fishing effort is controlled, as effort may increase in the areas located outside the MPA, leading to increased pressure and damage on less intensively fished areas (more vessels on less space).

MPAs form a safe haven for marine species of flora and fauna. All year round no-take zones enhance conservation of exploited species and biodiversity overall.[48] Depending on their characteristics, MPAs are safe from habitat destruction, caused by sediment extraction, dredging and bottom trawling. MPAs can sustain living resources at all levels, for example through reducing bycatch, protecting spawning and nursery areas of marine mammals and protecting key habitats. MPAs enable the protection of species of flora and fauna and the recovery and boost of biodiversity. MPAs protect important ecological functions, by protecting certain habitats that provide protection against natural disasters. For example mangroves mitigate tropical storms; sand dunes prevent flooding; coral reefs prevent coastal erosion. MPAs can help safeguard these ecological functions.[49] Although most reported effects stem from subtropical MPAs and reserves, there is increasing theoretical and empirical evidence that MPAs and reserves foster biodiversity and boost the health of the ecosystem in temperate areas. MPAs and reserves in the temperate waters of South Africa, New Zealand, United States, Spain, Japan and other countries all show one or more of the mentioned benefits.[50]

2.3.2 Social and Economic Effects

Some of the social and cultural effects of MPAs may include benefits for education, which may take place onsite, such as in underwater viewing chambers in the Great Barrier Reef in Australia or offsite through publications, lectures and film.[51] No-take MPAs contribute to research and science as a scientific reference area, by which the impact of human activities can be assessed, such as in the Lundy Marine Nature Reserve (see page 32).[52] [53] It is imperative that scientific gaps are filled, as the pace of exploitation – especially the exploitation of fish stocks – of the world's oceans and seas *'is far outstripping the advance of scientific understanding'*.[54]

"Scientific research needs them; nature conservation calls for them; and even fisheries might benefit from them."

Dutch marine biologist Dr. Han Lindeboom on MPAs [55]

MPAs generate income from consumptive benefits, such as SCUBA, dolphin and whale watching. Reserves generate economic benefits from improved fishing.[56] However, these protected areas can also have a detrimental effect on the income of those with an activity in the MPA. For example the loss of fishing grounds for fishermen can have a negative effect on their income[57], but also on the surrounding areas of the reserve, where fishing pressure increases, sometimes in untouched areas. Resistance from stakeholders against the implementation of an MPA or reserve can be expected when their activities are limited or banned. This can result in stakeholders becoming dissatisfied or angry and can subsequently lead to illegal activities.[58]

MPA services and functions are hard to express in monetary value, however in 2004, scientists[59] attempted to estimate the costs of a global MPA network, conserving 20-30% of the world's seas. Based on a survey of 83 MPAs worldwide, they state that the costs of a global MPA network might be *'between $5 billion and $19 billion annually to run and would probably create around one million jobs'*. Although substantial, gross network costs are less than current government expenditures on harmful subsidies to industrial fisheries and they conclude that the gains from improved fisheries, tourism and vital ecosystem services outweigh the costs of establishing a global MPA network.[60]

"Marine Protected Areas are the sociological anchor for averting the 'tragedy of the commons' and fostering a sense of stewardship for ocean resource and ocean space among the people who most rely on healthy intact coastal systems."

Marine Conservationist Dr. Tundi Agardy [61]

2.4 Stakeholder Involvement

The involvement and participation of stakeholders in the process implementing an MPA is important for the success of an MPA. However, support is not always widespread among stakeholders and sometimes the restriction or exclusion of certain activities can lead to resistance and the creation or escalation of conflicts.[62] [63] The more stakeholders support the development of an MPA, the more effective it will be. The more the local community is involved, the greater the chances are to success.[64] Whether stakeholders will support an MPA depends on the extent to which they are involved, able to continue their activity, have access to alternative income or receive compensation.

2.5 Mitigation of External Effects

Even if an MPA is perfectly designed, implemented and managed, the success of an MPA in conserving a site and its natural features also depends on external factors: MPAs are not areas impenetrable to negative external effects. Therefore it is vital that these effects are mitigated or dealt with accordingly.[66] A location that is vulnerable to many negative external influences, or difficult or impossible to control, is likely to fail.[67] MPAs can be affected for example by contamination through chemicals from outside the MPA. Negative external influence can be dealt with by reducing the negative influence or through mechanisms such as buffer zones.[68] When combined with additional measures, MPAs can be effective. For example when an area is protected as a tool to manage fisheries, performance will also depend on how intensively the population is being fished outside the MPA, including how fishing effort shifts in response to implementation of reserves.[69] If combined with other limiting measures on fishing, such as reducing the total capacity of the fishing fleet, MPAs will be (more) successful.

2.6 Monitoring and Enforcement

Once an MPA is designated and implemented, it is crucial for compliance to regulations and success of an MPA that effective monitoring and control is executed. Monitoring and enforcement need to be performed within and outside of the MPA[70], since ocean systems are open and interconnected, allowing the distribution and exchange of material and forcing factors.[71] For small MPAs monitoring by a couple of persons can be sufficient for compliance, but larger protected areas need more measures, for example satellite monitoring of fishing vessels.[72] Monitoring and enforcement can be facilitated by a clear marking of the area, clear and easy-to-navigate boundaries, good communication with stakeholders on allowed activities within the MPA and sufficient resources to enable proper monitoring and enforcement.[73]

2.7 The Right Combination

In order for an MPA to be effective in reaching its objective(s) and to generate ecological and socio-economic benefits, the right combination and configuration of design, stakeholder involvement, legal status[74], mitigation of external effects, good management and monitoring and enforcement is

Stakeholder Involvement: The Heiltsuk Nation

The establishment of an MPA in British Columbia, Canada in 1987 did not involve the indigenous people of the First Nations in planning and management, nor used their Traditional Ecological Knowledge. As a result, First Nations sought to have the area removed as an MPA.
In 2003, after two years of negotiation and 5 years of discussion, the Heiltsuk Nation signed a Collaborative Management Agreement and renamed the area the Hakai Luxvbalis Conservancy, which brought the Province (Government) and the aboriginal people of the Heiltsuk Nation together in a new cooperative relationship, focused on joint management planning, appropriate economic development and capacity building for indigenous people.[65]

needed. Four components for effectiveness should be included: preservation of critical habitats, the protection of threatened species, the mitigation of cumulative environmental degradation, and determining levels of sustainable use for renewable resources.[75] A long-term management vision needs to be integrated in all aspects of an MPA, in order for the MPA to remain effective and viable. MPAs are one of the many tools in the management toolbox, which may also include the modification of fishing gear and practices, the use of pingers and the regulation of human activity, such as shifting a shipping route to avoid oil spills close to seabird colonies.[76] Under the right conditions, MPAs are valuable tools.[77] On a global scale the effectiveness of networks of MPAs will depend on the cooperation between countries and the design, implementation and functioning of international treaties.

2.8 MPA potential to deal with threats to North Sea Biodiversity

A number of problems and threats to North Sea biodiversity have been identified. Although numerous international agreements have been signed and many international, European and national policies, laws, rules and regulations are in place, problems in the North Sea have not been effectively dealt with. Besides the existing measures that have been taken, MPAs may prove a valuable tool to protect and restore North Sea biodiversity. The following table summarizes the potential of MPAs to deal with threats to biodiversity in the North Sea.

Threats	MPA potential to mitigate threats
Pollution	Depending on the scale of protection and monitoring, MPAs can be areas that are safe from pollution and dumping of harmful substances. MPAs boost biodiversity and ecosystem health, which in turn creates larger resilience to pollution.
Alien species introduction	MPAs are not closed systems and they will remain vulnerable to the negative impacts of the introduction of alien species, but when local species are longer lived and have a firm basis in their habitat, they are better equipped to deal with alien species, depending on the characteristics and for example the aggressiveness of the alien species.
Climate change	Climate change is already visible in the North Sea and MPAs will not stop this process. But when MPAs are effective in creating strong ecosystems and more resilient populations of marine species, this helps (to certain extent) to mitigate effects of climate change.
Overfishing and bycatch	Depending on the degree of protection, MPAs create safe havens from destructive practices of fishing and bycatch. They protect important habitats, including spawning and nursery grounds, biodiversity hotspots and migration bottlenecks. With the proper measures taken within the MPAs, they can increase the production of fish stocks and create spill over effects.
Damage and disturbance to species and habitats	MPAs create refuges from bottom trawling and other types of disturbance to the seabed, enabling benthic species to flourish and biodiversity to increase. MPAs protect species and habitats from harmful human activities.
Spatial issues	Spatial problems caused by the many types of activities and lack of spatial planning will not be solved by MPAs, but they can be regulated through MPAs. MPAs can serve as a planning framework and thus mitigate conflicts between stakeholders that claim a particular area.

Marine Protected Area Network

3

3.1 Design

Optimal design of MPAs or a network of MPAs requires tailoring to its specific needs and objectives.[78] In order to create a successful MPA network that achieves its objectives, the design must represent all relevant ecological[79] and socio-economic features. On a local scale MPAs can be effective tools, but on a global scale MPAs are only effective if they are *'substantively representative of all bio-geographic zones, single reserves are networked within bio-geographic zones, and the total amount of area reserved per zone is 20% or greater'*.[80] The spatial planning process of MPAs should be aimed towards the protection of sensitive habitats and species in a network of MPAs, which will then cover the full range of biodiversity, large-scale marine ecosystems and processes of the oceans.[81] As ecosystems are dynamic systems, an MPA network that anticipates these dynamics is better equipped to deal with various challenges. By monitoring the consequences of management actions and responding to results, adaptive management (i.e. trial and error) can improve the network of MPAs.

When the objective is to maintain or develop sustainable fisheries, a network of marine reserves must be designed within an experimental context, maintaining flexibility for changes in regulations as new information becomes available.[82] Protected areas for the purpose of (sustainable) fisheries management should consist of a large area in the right location, for example where adult species do not move around much, but larvae are broadcast widely.[83] Needless to say, a subtropic MPA designed to protect sedentary species will have a different outlook than an MPA in temperate seas aiming to protect migratory species. On the latter, it is argued that few temperate water MPAs are large enough to benefit mobile fish and crustacean species that are able to move tens or hundreds of kilometres in a short time period and few large MPAs (>1,000 km^2) exist in temperate seas.[84] Others argue that MPAs networks can in fact be beneficial to migratory species, when placed strategically around breeding grounds, nursery grounds, feeding areas, migration bottlenecks[85] and biodiversity hotspots[86] and enjoying a high level of protection. For performance over the long-term, networks need to maintain ecological connectivity among various MPAs.[87]

The highly overfished bluefin tuna (Thunnus thynnus) may benefit from mobile MPAs.

Dynamic MPAs

Mobile MPAs may have benefits for oceanic species, such as tunas *(Genus Thunnus)*, billfishes *(Family Istiophoridae)*, sea birds, sea turtles *(Superfamily Chelonioidea)* and marine mammals *(Order Cetacea)*, that are exposed to harmful impacts caused by for example fishery, either through direct catch or bycatch; shipping, when a busy route crosses a marine mammal migration or when oil tankers cross fragile ecosystems etc. MPAs could be made very large, for example, to encompass certain species' movements throughout their entire lives or no-take zones could be placed around the most critical habitats for these species, such as feeding and breeding grounds, or migration corridors. Another, more revolutionary option is a flexible MPA, with dynamic boundaries that follow migration routes of particular species. This can be accomplished with the help of satellite data of locations of frontal areas in ocean currents, which

Long-finned pilot whale (Globicephala melas) and other cetaceans may benefit from mobile MPAs.

Aims and Features of a North Sea MPA Network Approach

A network for the North Sea would preferably include the following aims[94]:

- Protect sensitive and vulnerable habitats and species from harm and restore and recover damaged and degraded habitats
- Rebuild populations of organisms that have declined and sustain and promote fishery production from fishing grounds
- Secure and enhance ecological services (e.g. water purification and coastal protection). Provide opportunities for research, education, recreation and tourism
- Spread fishery benefits throughout country, rather than concentrating them around a few sites.

In order to achieve these aims, the following features need to be included[95]:

- Significant protection from extractive and damaging uses (especially fishing)
- Protection requires networks of no-take zones that are connected by processes of planktonic dispersal
- MPA network must maintain ecological connectivity among different MPAs
- A full spectrum of biodiversity is represented within MPAs and replicated across MPAs
- The size of the individual MPA needs to be scaled to the location, habitats and movement propensities of the marine communities. (Areas offshore generally need to be larger than coastal MPAs, because animal movements are larger offshore)
- There is flexibility in network design
- The network of MPAs represents all habitats and bio-geographic regions (as in the BALANCE project, see page 15)
- According to the combined results of 39 studies, fully protected MPAs need to cover about 20-50% of the sea in order to maximize seafood-catch
- Migratory species of fish can benefit from fixed MPAs when these are strategically placed in breeding grounds, nursery grounds and migration bottlenecks. When these areas are fully protected in MPAs (marine reserves) this can result in wider benefits (for example buffer fishing industry against natural stock fluctuations and protect species from quota set too high)
- Establishing a relatively small number of sites of limited coverage and protection, is *'utterly insufficient to reach either nature conservation or fishery goals.'* [96]

are known for their high productivity and where many marine species come to feed.[88] Dynamic management measures are already in use, which means that this *'real-time ocean management'* is possible. Two examples include time-area closures to avoid sea turtle bycatch off southern California and a mandatory ship reporting system to avoid ship-strikes with northern right whales *(Eubalaena glacialis)* off the coast of Massachusetts.[89] Some suggest that the dynamic MPA might not be practical, as the fishing in an area on one day, might be illegal the next[90] and it will be difficult to equip all those vessels with the right computers and for fishermen to follow unpredictable forbidden areas.[91] Fixed areas encompassing the known variability in the location of oceanographic features could be helpful here.[92] Overall, each MPA and its spatial structure of *'impacted fisheries, ecosystems and human communities should be carefully planned, monitored and evaluated'*.[93]

3.2 North Sea MPA Network Approach

Network Experience

Countries that have already built up experience in designing a network and protecting this network of MPAs are for example the Australia, where 33% of the Great Barrier Reef is fully protected from fishery and other extractive uses, South Africa (20% of the EEZ), Bermuda (20%)[97] and California, where a network of 29 reserves has been established, half of which ban all fishing.[98] [99]

275 Scientists from 24 different European countries signed the Declaration of York stating the need for Marine Reserves and Marine Reserve Networks for the important benefits to scientific understanding of the marine environment and as necessary tools in marine conservation and effective management of the sea.[100]

When designing a network, for example with the computer programme Marxan, certain areas can be excluded from the configuration, making it possible to take stakeholder interests and socio-economic aspects into account. The BALANCE project in the Baltic area uses the Marxan programme.

Case

The BALANCE Project

A Network of MPAs in the Baltic Sea, Skagerrak and Kattegat

The EU funded Interreg IIIB project BALANCE (Baltic Sea Management – Nature Conservation and Sustainable Development of the Ecosystem through Spatial Planning) started in July 2005 and was finalized in December 2007. The project has developed tools and guidelines for marine spatial planning in the Baltic Sea, Skagerrak and Kattegat. One of the main objectives has been to develop practical criteria and methods for assessing and identifying an ecologically coherent network of MPAs and to develop the concept of so-called blue corridors in the Baltic Sea. The BALANCE project has both assessed the existing network to see whether it is ecologically coherent or not and developed an approach to identify and select a representative network of MPAs for the future. The Natura 2000 network and the network of Baltic Sea Protected Areas, designated under HELCOM (which is the regional sea convention for the Baltic Sea area, as OSPAR is for the North East Atlantic area) were assessed with regard to four aspects; representation, replication, adequacy and connectivity (i.e. are the areas close enough to each other). There is a lot of ongoing research on MPA network design and Åsa Andersson and her colleagues, working on the BALANCE project, have tried to identify practical criteria based on scientific recommendations, expert consultation and experiences from similar projects in e.g. New Zealand, Canada and Australia.

The site selection software MARXAN[101] was used to assist the selection of a representative network of MPAs. MARXAN has also been used to design the zoning plan (including protected areas) for the Great Barrier Reef. This tool allowed Andersson and her colleagues to identify examples of what a representative MPA network could look like in the Baltic Sea based on the developed criteria and using available data; e.g. so that at least 20% of each of the marine landscapes, 60% of all the seal haul-out sites, and 100% of the coral reefs in the region are covered in the network.

MARXAN offers decision support for teams considering a large number of biodiversity conservation features and numerous alternative candidate sites. Andersson: *"We also took into account other criteria e.g. to include all existing MPAs and to avoid areas with certain socio-economic interests, if possible without compromising the conservation criteria. However, it is important to stress that the analysis output is only a starting point in the site selection process, and that stakeholder consultation is very important."*

Andersson stresses the fact that this project is done jointly by authorities, scientists and NGOs and that it is a starting point for future work on marine spatial planning. Andersson states that a regional network approach is important, since everything in the sea is connected. All different species and habitats are needed to secure protection of the ecosystem for the future, not only the most interesting sites (e.g. not only cold water coral, *Lophelia pertusa*), but also the more 'boring' representative muddy sea bottoms, because they are important for the ecosystem function too.[102]

Another interesting project that is currently carried out is the development of a framework for Mapping European Seabed Habitats (MESH). The MESH project aims to produce seabed habitat maps for North-West Europe (including the North Sea) and develop international standards and protocols for seabed mapping studies. The outputs of the project include a *'meta database of mapping studies, a web-delivered geographic information system (GIS) showing the habitat maps, guidance for marine habitat mapping including protocols and standards, a report describing case histories of habitat mapping, a stakeholder database and an international conference with published proceedings.'*[103]

All this information can contribute to the establishment of a European network approach for the North Sea.

3.3 MPA Network in the Netherlands

There is a broad range of international and European legal instruments and policy documents that recommend MPAs as a tool for ecosystem conservation and marine reserves as a tool for fishery management.[104] An important international commitment was made by the global community in 2002 at the United Nations World Summit on Sustainable Development to establish a global system of representative networks of marine protected areas (MPAs) by 2012. The European Union has set itself the goal to realize a coherent ecological network of protected areas, the Natura 2000 network, in which it aims to protect natural habitats and species' habitats and to restore or maintain a favourable conservation status. As a contracting party to OSPAR, the Netherlands has also committed itself to the OSPAR goal to ensure that by 2010 an ecologically coherent network of well-managed marine protected areas is in place for the North East Atlantic.[105] Within Natura 2000 and OSPAR MPAs, the CFP holds provisions for European member states to regulate fisheries so the required level of protection within these MPAs can be reached. These obligations and provisions to implement marine protection in the Netherlands each have different objectives and criteria.

OSPAR Obligations

The Netherlands has not yet designated any OSPAR areas, unlike for example the Germany, Sweden and Portugal, which have already declared areas as components of the OSPAR network of MPAs in their offshore waters (beyond 12nm).[110] With the potential OSPAR MPA Central Oyster Grounds not taken up in the upcoming designation of Dutch MPAs, it is clear that fulfilling OSPAR obligations is not considered a priority by the Dutch government. The Dutch government is planning on designating Natura 2000 areas as OSPAR areas[111], with which it will acknowledge OSPAR and which consequently will make it difficult for the Netherlands to disregard the Central Oyster Grounds.

3.4 OSPAR MPAs

The OSPAR Commission in 2003 adopted recommendation 2003/3, which has the purpose to establish the OSPAR Network of Marine Protected Areas (MPAs) and to ensure that by 2010 it is an ecologically coherent network of well-managed marine protected areas.[106] This network aims to protect, conserve and restore species, habitats and ecological processes, which have been adversely affected as a result of human activity; the network will prevent degradation of damage to species, habitats and ecological processes following the precautionary principle; the network has to protect and conserve areas which best represent the range of species, habitats and ecological processes. MPAs are a part of the wider work of OSPAR aiming to protect and conserve the ecosystems and the biological diversity of the maritime area, and to restore marine areas, which have been adversely affected. Therefore, the *'OSPAR network of MPAs should be seen in the context of, and work in partnership with, other measures to achieve this aim'*.[107] OSPAR has a range of criteria that are used for the selection and implementation of OSPAR MPAs.

The various criteria used for the selection and implementation of OSPAR MPAs[108 109]	Practical criteria for OSPAR MPAs
Threatened or declining species and habitats/biotopes	Size
Important species and habitats/biotopes	Potential for restoration
Ecological significance	Degree of acceptance
High natural biological diversity	Potential for success of management measures
Representivity	Potential damage to area by human activities
Naturalness	Scientific value

3.5 Natura 2000 MPAs

In the Netherlands the protection of habitats is arranged in the Nature Protection Law and the protection of species in the Flora and Fauna Law. The former was altered on October 1, 2005 to incorporate the European Birds Directive (1979) and Habitats Directives (1992).[112] These two Directives form the basis of the Natura 2000 network in each EU member state. Goal of the Natura 2000 network is *'to maintain and if necessary restore a favourable conservation status for all naturally occurring species and habitats across all EU member states, by establishing protection for these natural habitats and wild flora and fauna of Community Interest listed in Annex I and II of the European Habitats and Birds Directives.'*[113] The process of designation is based on scientific criteria.[114] These criteria differ between selection of habitats as listed in Annex I of the Habitats Directive and functional habitats for migrating species in Annex II.[115]

The following table shows the Dutch criteria for the selection of protected areas under Natura 2000. For official European criteria, see footnote.[116]

Dutch criteria used for the selection of protected areas (Special Areas of Conservation, SACs) under the Habitats Directive[117]	**Dutch criteria used for the selection of protected areas (Special Protected Areas, SPAs) under the Birds Directive[118]**
• The ecological variation is sufficiently covered and there is a degree of representivity of the natural habitat type on the site • Area of the site is covered by the natural habitat type in relation to the total area covered by the natural habitat type within the national territory • Degree of conservation of the structure and functions of the natural habitat type are concerned and there are restoration possibilities • Global assessment of the value of the site for conservation of the natural habitat type is concerned • The five (for priority species ten) most important areas are included • There is enough geographical spreading and sufficient linkages with Germany and Belgium • The area has recognizable ecological or manageable units, preferably as much as possible following natural or existing recognizable topographic lines • A possibility of restoration is present	• An area includes at least 1% of a bio-geographical population of a bird species that is in the Annex I of the Birds Directive • For migrating water birds, 0.1% of the bio-geographical population is present in the area • For other migrating birds at least 1% of the Dutch breeding population is regularly present in the area and these birds have been declared as Dutch red-list species • An area belongs to one of the five most important resting or breeding areas for birds in Annex I[119]
A habitat is considered to be at a favourable conservation status when the following three aspects coincide:	**A species is considered to be at a favourable conservation status when the following three aspects coincide:**
• Its natural range and areas it covers within that range are stable or increasing • The specific structure and functions, which are necessary for its long-term maintenance, exist and are likely to continue to exist for the foreseeable future • The conservation status of its typical species is favourable[120]	• Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitat • The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future • There is, and will probably continue to be, a sufficiently large habitat to maintain the population on a long-term basis[121]

Natura 2000 in the offshore limit of national jurisdiction
The European Court of Justice has conveyed that the Habitat Directive is to be applied in the entire offshore limit of national jurisdiction.[122] For the Netherlands, which has declared its EEZ in the Netherlands, this means that Natura 2000 must be implemented up to 200NM.[123] Parts of the Wadden Sea and North Sea coast are already protected under Natura 2000. The designation of protected areas in the North Sea will be based on the Nature Protection Law. This law is currently not in place for the EEZ, but an amendment of the Nature Protection Law is in preparation in order to apply the Nature Protection Law onto the entire EEZ.[124] In the first and second quarter of 2009, the law is planned to be in Parliament, where the law will need to be passed.[125]

National Ecological Network
In 1990, the Dutch Ministry of Agriculture, Nature and Fishery (now Ministry of Agriculture, Nature and Food Quality) appointed the entire North Sea as a part of the Ecological Network. This entails activities and user functions on the North Sea must be guided by the precautionary principle. Natura 2000 areas in the Netherlands will be part of the *'National Ecological Network'*, which is to cover the total surface of the Netherlands, including national parks, wetlands and the Wadden and the North Sea and is to conserve biological diversity and recover ecological values.

Natura 2000 shortcomings
It has been noted by Schmidt and Christiansen (2004) that Natura 2000 criteria *'do not contain provisions for targeting the selection process towards establishing an ecologically coherent network of sites, by e.g. including functional characteristics like migration corridors or stepping stone function as strategic criteria.'* [126] In addition, the definitions of the Natura 2000 criteria and favourable status are open to each countries' own interpretation, which does not benefit a coordinated European approach. Because the definition of favourable status is open for interpretation, some countries may have a very limited approach and ignore the protection of the ecosystem that is supporting the ecological feature(s) protected under Natura 2000. In addition, member states are advised to designate 60% of the total extent of the selected habitat type within their national jurisdiction. Less than 20% is considered insufficient and nominations between 20% and 60% are open for discussion at the bio-geographic meetings of the Habitats Committee of the European Commission.[127]

3.6 Fisheries Management within MPAs under the Common Fisheries Policy

The CFP is the instrument of the EU to manage fisheries and aquaculture. The CFP is a direct consequence of the exclusive competence that the member states have vested in the European Commission (EC) to regulate and manage their sea fisheries beyond the Member States' 12NM territorial seas. The policy and legislative basis for spatial fisheries management tools is then fisheries based and embedded in CFP regulation. The CFP offers tools to protect a marine area and its (commercial) fish stocks from fishery. Through the CFP, the EC has the authority to impose a restriction on gear, vessel or days at sea[134], seasonal area closures, real-time closures and rotational area closures. For example, areas can be closed for a period of

Case

The Wadden Sea

The Wadden Sea is an important wetland and tidal area, home to numerous species of birds, mammals and fish. It is shared by the Netherlands, Germany and Denmark, who manage and coordinate their activities in a Trilateral Cooperation since 1978. Protection of the Wadden Sea in the Netherlands started somewhat 30 years ago. Waddensea is now protected under RAMSAR Convention on migrating birds, the World Heritage Convention, European Birds- and Habitats Directive (Natura 2000), Water Framework Directive, Bonn and Bern. The Wadden Sea contains numerous features that require protection under the Birds and Habitats Directive, including wild and migratory bird species listed in Annex I of the Birds Directive, marine mammals and fish species listed in Annex II of the Habitats Directive, and its sandbanks, dunes, estuaries, mudflats and salt marshes under Annex I of the Habitats Directive.[128] The Wadden and its surrounding sea are very vulnerable. Although there is some emphasis on conservation and approximately 50% of the Wadden Sea is protected area, the area is managed mainly for sustainable uses of natural resources and for the economic and social wellbeing of the regional population.[129] Many activities are still allowed to a certain extent, such as shipping, gas and oil drilling, fishing, recreation. According to the Wadden Sea Association, the area is in bad shape.[130] When MPAs do not provide adequate protection from fishing, they may fail in their conservation objectives. This happened in the Wadden Sea, where mechanized cockle *(Cerastoderma edule)* fishery was still allowed for 75% of the intertidal flats until 2004. The dredged areas had a lower settlement rate of cockles and also reduced their quality, leading to decreases in local survival of the red knot *(Calidris canutus)* of the Dutch Wadden Sea and the European wintering population.[131] In 2005 mechanical cockle fishery was prohibited in the Wadden Sea, due to the extensive damage to the seabed and food deprivation for birds. Harvesting by hand is still allowed in the Wadden through a license scheme. Mechanical harvesting is regulated in the Eastern Scheldt and Western Scheldt. Shellfish stocks are substantially higher in the MPAs in the Wadden[132]; a six-fold difference in cockle stocks was observed between fished and unfished areas.[133]

Tidal Mud Flats, Ameland.

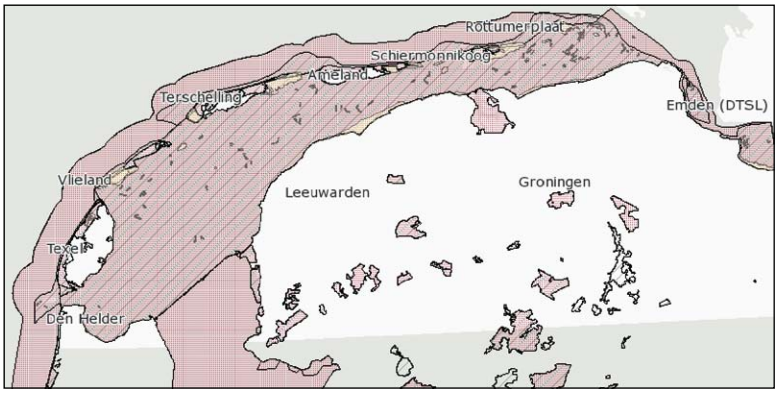
A system of permits regulates the hand harvesting of cockles (Cerastoderma edule) in the Wadden.

Common seal (Phoca vitulina), Wadden Sea.

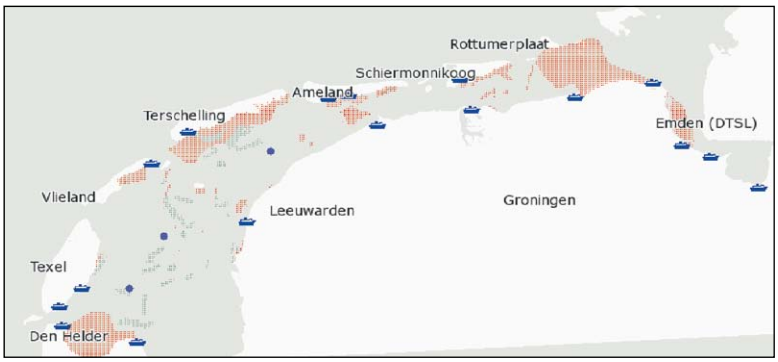
Case

continued from page 19

The Wadden Sea



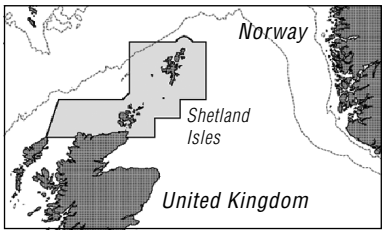
High tide roost
Seal haul-out
Area protected under Habitats Directive
Area protected under Birds Directive



Musselseed
Harbour
Mussel plot
Area closed to fishery

time as a way to manage fishing effort, e.g. for herring around the North Sea at various times of the year. Some areas may be closed all year to boats fishing for certain species, such as the fishing area closures in the North Sea for sand eel *(Ammodytes marinus)*, herring *(Clupea harengus)* and mackerel *(Scomber scombrus)*.[135] CFP can close areas permanently to protect sensitive habitats or vulnerable species (e.g. cold water coral reefs in Azores, Portugal; Darwin Mounds in the UK). The Shetland Box and Plaice Box are examples of CFP protected areas. Closures are formally required to be based on public consultation and to consider social impacts.

The Shetland Box



The Shetland Box, implemented to control access to 'species of special importance in the region' and which were 'biologically sensitive', such as haddock (Melanogrammus aeglefinus), cod (Gadus Morhua) and monkfish (Lophius piscatorius).[136]

The implementation of protection under CFP within an MPA can contribute to the conservation of biodiversity, and ensure the required level of protection needed for that particular MPA. Marine reserves or no-take zones implemented for the purpose of protecting (juvenile) fish stocks, will never be the sole fisheries management tool and need to be combined with other tools, such as effort reduction, using more selective gear, setting quota, etc.[137] Protection zones established under the CFP cannot be regarded as MPAs if they do not provide long-term protection for the wider environment.[138]

CFP objectives and requirements

The CFP provides for a system of protection for marine habitats and species from the harmful effects of fishing activities, especially in cases where the provisions of Natura 2000 do not apply[139], in particular[140]:

- For the protection of nature features not listed in Annexes of the Habitats Directive
- For the protection of features that are listed in the Annexes, but occur in areas outside the jurisdiction of Member States
- For the protection of those listed features, located in marine areas under the jurisdiction of Member States but not included in a Special Protected Area (SPA) or a Special Area of Conservation (SAC).

Fisheries measures may be decided regardless of the stage in which the site designation process is in, as they are not necessarily linked to the implementation of the Habitats or Birds Directive.[141]

Objectives of CFP areas[142]	Requirements
• The protection of sensitive habitats or species (e.g. cold-water coral areas) • The reduction of fishery impact on ecosystem functioning (e.g. closure for sand eel fisheries within the feeding range of seabird colonies) • The improvement of the productivity of fish stocks (e.g. protect juveniles in the Plaice Box) • Avoiding the catching of non-target species (e.g. the Norway Pout Box).[143]	• Environmental, social, economic impact assessments are mandatory for all Commission proposals of consequence to EU citizens, and are based on consultations with stakeholders • Future real time closures: based on industry cooperation – identification, peer pressure in implementation

Application of CFP regulation in Natura 2000 areas

Germany has already designated Natura 2000 areas and has asked ICES to come up with a fishery management plan for their protected areas at sea. The EMPAS project *'Environmentally Sound Fishery Management in Protected Areas'*, lead by the International Council for the Exploration of the Sea (ICES), will gather and analyze the available data and information about the fisheries in and around the NATURA 2000 sites of the German EEZ. The main aim of the project is to develop fisheries management plans for each of ten German NATURA 2000 sites.[144] Two important workshops for the EMPAS project are planned in 2008: 1) Workshop on Fisheries Management in Marine Protected Areas at the ICES Headquarters from the 2nd to the 4th of June 2008 and 2) Workshop on dealing with Natura 2000 and Related Requests held at ICES Headquarters on the 5th of June 2008. These working groups will start setting criteria for fishing within Natura 2000 sites. The Netherlands would like to follow the German route, but only when the areas have been designated and the objectives are clear.[145]

There are already new emerging protection regimes for fisheries within Natura 2000 sites. A recent amendment to EC council regulation 850/98,[146] made it possible to take fisheries measures in a Natura 2000 area in the offshore waters. For the Darwin Mounds, which lie offshore (beyond the 12 NM), it was the first time that CFP regulation was used for habitat conservation measures. Destructive fishing practices are now banned from the area.[147] The Azores, Madeira and Canaries[148] and four cold water coral reef Natura 2000 sites west of Ireland[149] are now closed to destructive fishing practices such as bottom trawling and towed gear under the CFP. The four sites in Ireland are intended to maintain at, or restore to, favourable conservation status the Habitats Directive Annex I habitat *'Reef'*.

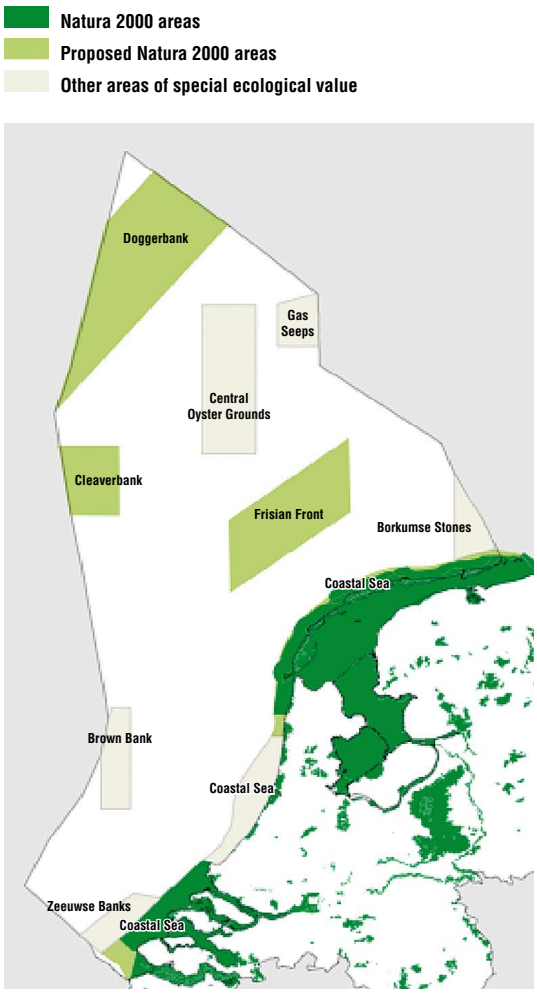
The EC Regulation for conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy (under Council Regulation 850/98) provides an important tool to improve the protection of nature in the marine environment and the attainment of objectives of the Birds and Habitats Directive.[150] ICES states that a Natura 2000 network of protected areas is expected to have benefits for biodiversity as well as benefits for overexploited fish stocks:

"While the primary aims of the of the NATURA 2000 network are to protect threatened, endangered and/or declining species and habitats, the Marine Protected Areas created through the network are also expected to have positive effects on overexploited fish stocks." [151]

3.7 Areas of Special Ecological Value in the Dutch North Sea

The Natura 2000 obligation extends to the EEZ, or for the UK (which has not declared an EEZ) to its offshore limit of national jurisdiction. These obligations are worked out in the *'Nota Ruimte'* (spatial planning policy document) and the *'Integrated Management Plan for the North Sea'* (IBN 2015)[165], which is the spatial planning policy for the next seven years and an elaboration on the Nota Ruimte. In the national spatial planning policy document 'Nota Ruimte', five areas were designated: Frisian Front, Cleaverbank, Doggerbank, Coastal Sea and the Central Oyster Grounds. The Ministry of Agriculture, Nature and Food Quality and the Ministry of Transport, Public Works and Water Management requested a research report on which areas are to be appointed under OSPAR and Natura 2000, besides those mentioned in the *'Nota Ruimte'*. In this report, Lindeboom, Geurts van Kessel and Berkenbosch[166] added the Zeeuwse Banks, Borkumse Stones, Gas Seeps and Brown Bank as potential areas of special ecological value. In the figure *'Areas of special ecological value,'*[167] the dark green areas are already registered with the European Commission and the light green areas are planned for designation in 2008. The other areas are of ecological value, but are not planned for protection under OSPAR at this moment, nor Birds nor Habitats Directive.

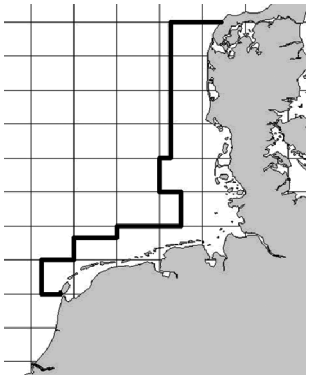
Areas of special ecological value.[168]



The areas taken up in the IBN 2015, did not include the Central Oyster Grounds, nor the Borkumse Stones, nor the Zeeuwse or Brown Banks. The Central Oyster Grounds is an area that would comply with OSPAR commitments only, which are not legally binding and at the moment not seen a priority for the Dutch government. In the IBN 2015, there were some other changes, for example, the middle part of the Coastal Sea was taken out of planned designation, because the two separate Coastal Sea areas were already applied as protected area to the European Commission. The area north of Petten under both Birds and Habitats Directive and the area south of the Voordelta (directly along the southern coast) will be protected as an area of special ecological value.

Case

The Plaice Box



The Plaice Box.[136]

The Plaice Box is an area of 38,000 km^2 in the North Sea along the Dutch, German and Danish coast. It has been partially closed to fishing since 1989, with the aim of reducing discards of undersized commercial demersal species such as plaice *(Pleuronectus platessa)* and sole *(Solea solea)* and their nursery grounds (i.e. protect juvenile fish). The Plaice Box was set up through the CFP in order to protect these commercial fish species and their offspring. The area is closed to beam trawlers of more than 300HP. At first, the closure applied only in the second and third quarters of the year, but in 1994 it was extended to the fourth and since 1995, the box has been closed the whole year round to trawlers >300HP.[152] The overall reduction in fishing effort to 6% of the original level reduced bycatch and discard of juvenile fish of fisheries targeting other species.[153] It has also increased the abundance of commercially sized fish.[154] However, the overall spawning stock biomass decreased significantly.[155] The reduction in mortality of juvenile plaice is thought to have been surpassed by the negative impacts caused by a combination of overfishing (the box remained open to trawlers <300HP and Norwegian vessels[156]) eutrophication and a so-called regime-shift around 1988.[157]

Trawling effort inside the Plaice Box was reduced, but never completely banned. It has been predicted that year-round closures of the entire Plaice Box to all vessels would create larger benefits: landings and spawning stock biomass would increase by 24 and 29% respectively. The limited closure now is detrimental to the young plaice that dies when discarded from shrimp vessels that are still allowed.[159] A full-time closure may also lead to increased recruitment rates in sole, which suffers from high levels of discarding by trawl fisheries.[160] In 2006, it was decided to maintain the Plaice Box for another 3 years. Even though the European Commission could not demonstrate positive effects of the Plaice box on commercially important fish stocks, it was concluded that if bigger vessels that operate at the periphery of the box, would be allowed back in, this could have detrimental effects.[161]

Aquatic ecologist Dr. Piet states that the lack of pre-established criteria and experiments makes it difficult to evaluate the effectiveness of the Plaice Box. Piet declares it is important to *'define targets well, to develop appropriate and measurable criteria and to design a research programme to underpin conclusions with statistical evidence'*.[162] The Plaice Box is not considered to be a representative example of a protected area by scientists, because trawling without effort control has still been allowed in the area. The Plaice Box seems to have been a compromise between government and industry.[163]

Still, a study performed by ICES to predict the effects of different management options of plaice, shows that opening the Plaice Box will lead to deterioration of the situation. Values are given as percentage change relative to the quarters 2 and 3 closure that was in place during 1994.[164]

Option	Biomass	Landings
a. Remove box	-9%	-8%
b. Close all year	+17%	+14%
c. Close all year and no discarding	+29%	+24%

Effects of Plaice Box management options.

3.8 Potential Locations for Dutch North Sea MPAs

The following table shows all locations marked as of special ecological value, under which provision they could be protected and current use.[170]

Areas and Surface	Ecological Value
Doggerbank 4,718 km²	High biodiversity of benthos fauna. Area of importance to birds, including **gannets** *(Sula bassana)*, kittiwake *(Rissa tridactyla)*, guillemot *(Uria aalge)*, razorbill *(Alca torda)*, gulls *(Laridae)* and fish, including thornback ray *(Raja clavata)*. Commercial species, e.g. cod *(Gadus Morhua)*, herring *(Clupea harengus)*, plaice *(Pleuronectes platessa)*, sole *(Solea solea)*, lesser sand eel *(Ammodytes marinus)*, dab *(Limanda limanda)*, haddock *(Melanogrammus aeglefinus)*[171] and marine mammals, e.g. white-sided dolphin *(Lagenorhynchus acutus)* and harbour porpoise *(Phocoena phocoena)*.[172] Sandbanks and foraging area for birds. Icelandic cyprine *(Arctica islandica)*.
Cleaverbank 1,237 km²	Characterized by its gravel sediment surface, with representative algal cover, particular zoo benthos and its special bird values as an area which is unique for the Dutch Continental Shelf: Shellfish, anemones *(Actinia equine)*, deadman's fingers coral *(Alcyonium digitatum)*, rayed artemis *(Dosinia exoleta)*, lesser sand eel and spawning ground for herring.[174] Lobsters *(Homarus gammarus)* in the Botney cut.[175] Concentrations of **harbour porpoise** in summer.[176]
Coastal Sea 3,994 km², of which the already protected Northern part 1,766 km² and southern part 1,108 km², making the gap in the middle 1,120 km².	Benthic fauna diversity and of importance to birds, such as gulls, terns *(Family Sternidae)* and skimmers *(Family Rhynchopidae)* shellfish and fish, such as sole, plaice, cod, whiting *(Merlangius merlangus)* and dia-dromous fish (fish that migrate between fresh and salt water, such as sea lamprey *(Petromyzon marinus)* and twaite shad *(Alosa fallax)*, and marine mammals *(e.g. porpoise and seal)*. The Coastal Sea is of particular importance for fish[178] and contains some of the spawning and nursing grounds.[179] However when the goal is to protect nursing and spawning grounds, the protection of this area will not be sufficient.
Frisian Front 2,881 km²	Unique area with high biomass and high benthic fauna diversity, such as bivalve mollusc *(Abra Alba)*, brittle-star *(Ophiura texturata)* etc. According to the season, high concentrations of birds, like Skua *(Family Stercorariidae)* and Guillemots, especially from August-November. Other fauna, such as and sea cucumbers *(Class Holothuroidea)* sprat *(Sprattus sprattus)*, herring, sole and harbour porpoise.[81]
Central Oyster Grounds 3,453 km²	Important for birds, e.g. fulmar *(Fulmarus glacialis)* foraging area, hotspot of rare species of benthic fauna. Zoo benthos, such as Icelandic Cyprine, **Norway lobster** *(Nephrops norvegicus)*, burrowing mud shrimp *(Callianassa subterranea)*, parchment worm *(Chaetopterus variopedatus)*.[182]
Zeeuwse Banks 655 km²	Sandbanks, fish and further research needed on zoo benthos.
Borkumse Stones 479 km²	Specific zoo benthos, fish and marine mammals, important area for **seals** to stay and forage.
Gas Seeps 593 km²	Possible future unique structures formed by micro flora, which feeds on methane.
Brown Bank 1,292 km²	Birds, such as guillemot, marine mammals, e.g. porpoise. Spawning ground for flatfish. More research needed on the amount of species.
Arctica Islandica Area (Between Doggerbank and Central Oyster Grounds) estimated at 1,000 km²	Area that still harbours relatively high numbers of **Icelandic Cyprine**.

	(Possible) Future Protection Under [173]	Current Use
	Habitats Directive, OSPAR	The pressure of use is limited. Fishery pressure from Dutch vessels is relatively limited. The total actual fishing pressure needs further research. There are only few cables and pipelines and rigs.
	Habitats Directive, OSPAR	Limited fishery pressure; there is a helicopter route and on the south border there is a shipping route.
	In the Coastal Sea, two sites have already been registered with the European Commission: Voordelta as a Special Area of Conservation (SAC) under the Habitats Directive and Coastal Sea north of Petten as a Special Protected Area (SPA) under the Birds Directive. Two more areas are proposed: near Bergen and near the Western Scheldt.[180] The Coastal Sea in particular will need appropriate regulation of fisheries to protect these species. OSPAR	Very high fishing pressure from Euro-cutters <300 HP. Vessels >300 HP are not allowed within the 12NM border. Shipping and oil spills. Platforms, cables and pipelines. Wind park, sand suppletions and sediment extractions. Sand extraction generally between the 20 meter depth line and 12NM border. Military training and recreation. Aquaculture. High spatial pressure.
	Birds Directive, OSPAR	Very high fishing pressure, especially from beam trawlers > 300 HP. Shipping routes and oil spills. Military training area. Helicopter route. Gas platform, cables and pipelines.
	OSPAR	Fishery pressure is moderate and other user functions mainly at the borders.
	Habitats Directive	Cables and pipelines. Sand extraction and certain areas reserved for the deep extraction of sand. Shipping and spilling of waste and oil. Intensive fishery and military training (explosives).
	Habitats Directive, OSPAR	Gas platforms, cables, shipping routes, military training, small-scale sand extraction, overlap with Plaice Box; relatively limited fishing.
	Possibly Habitats Directive	At present, no chalklike structures present; potential for these to build up unknown. (Note: Doggerbank also has gas seeps that may have the potential to form unique structures). Low fishing pressure.
	Birds Directive (depending on delineation of area and local presence of Guillemots in autumn and winter)	Fishing, sand extraction.[183] More research on bird distribution needed here to outline location and size of the area that is to be protected.
	OSPAR	Low fishing pressure, cables.

Gannets (Sula bassana).

Harbour Porpoise (Phocoena phocoena).[169]

Norway lobster (Nephrops norvegicus).

Grey Seal (Halichoerus grypus).

Icelandic Cyprine (Arctica islandica).

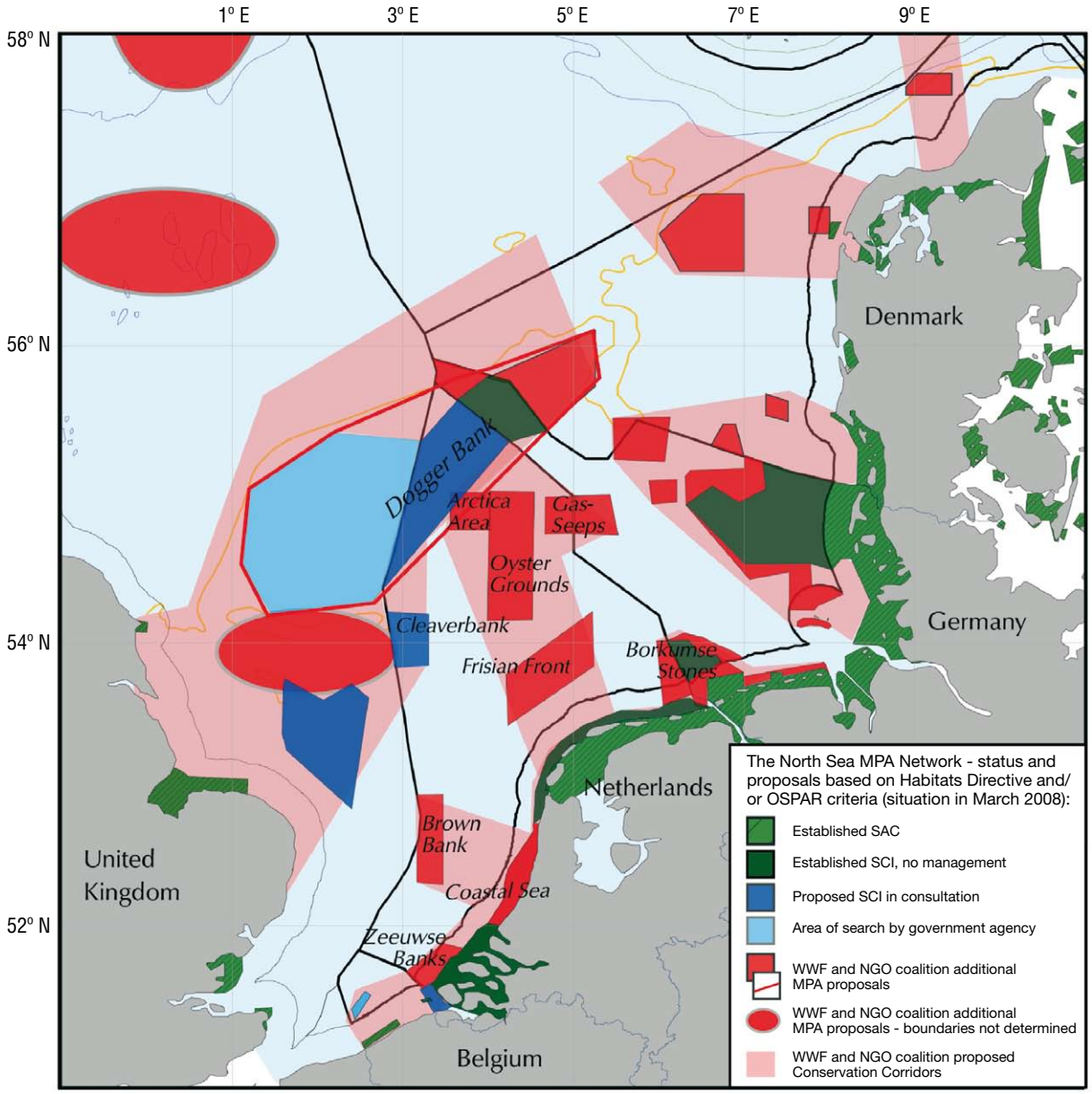
Ambition
When an area is protected under the Habitats Directive or OSPAR, most likely the fishery will need to be restricted in that area in some way. The CFP will most likely provide the tool to regulate and restrict fisheries in these areas. However, the Habitats Directive has an incomplete list of marine habitats and species and is for example not aimed at protecting demersal offshore fish, like rays *(Family Rajidae)*, cod *(Gadus morhua)* and many other species. These 'forgotten' species will need to be incorporated in the Directives.

The following areas are planned for designation as a Natura 2000 MPA: Frisian Front, Coastal Sea (partially designated as protected area under Birds and Habitats Directive), Doggerbank and Cleaverbank.[184] The Netherlands is not fulfilling its Natura 2000 commitments and is procrastinating. According to current planning of the Dutch government, only these Natura 2000 areas will be formally designated in 2010[185], whereas the Netherlands has made a commitment to have an ecological coherent network of MPAs in effect in 2010. If the Dutch government wants to stick to its international commitments, it needs to apply a network approach and this means more and better protection is needed. Natura 2000 areas could make a good starting point for an ecologically coherent network, which, together with OSPAR MPAs and effective complementary measures can benefit marine biodiversity. In keep with the commitment of implementing an effective and coherent ecological network of MPAs in place, ambitions must go up now. In the following paragraph, WWF presents its proposal for a North Sea MPA network.

3.9 Proposal for a North Sea MPA Network

Most governments around the North Sea are in the early stages of establishing an ecologically coherent network of well-managed MPAs outside their territorial waters, but the sites selected so far are insufficient to achieve this goal by 2010. WWF proposes additional areas which will have to be part of any future MPA network, based on existing criteria under the Habitats Directive and OSPAR and the best available knowledge. The proposal shows that with this approach, a step towards a more ecologically coherent network of MPAs is made. The network that WWF proposes is intended for the conservation of marine ecosystems, and does not consider the option of refuges for commercially relevant fish species, other than a few elasmobranchs with limited habitat range on the OSPAR list of threatened and/or declining species. Ecological coherence is increased by proposing 'Conservation Corridors', either as transects including a representative suite of habitats, or by forming clusters of MPAs surrounded by a kind of buffer zone. These conservation corridors, most of them transboundary, are meant to represent those areas where considerations of nature conservation should have priority over economic drivers. Human activities need to be managed in order to achieve a favourable conservation status of the special ecological values within the MPAs and restoration to natural dynamics as driver. The establishment of such a network of MPAs will be an essential step towards reaching a good environmental status of the North Sea by 2020.[104]

Proposal for a Network of Marine Protected Areas in the North Sea*



Established SAC	MPAs established under the EU Habitats Directive with a form of management.
Established SCI, no management	Sites accepted by the European Commission, but no measures in place
Proposed SCI in consultation	Areas in public consultation prior to nomination by Member State to European Commission
Area of search by government agency	Member State is gathering evidence for selection
WWF and NGO coalition additional proposals	Additional areas proposed by WWF and NGO coalition based on OSPAR MPA and Natura 2000 criteria
WWF and NGO coalition additional proposals - boundaries not determined	Additional areas proposed by WWF and NGO coalition based on OSPAR MPA criteria, but insufficient knowledge
WWF and NGO coalition proposed Conservation Corridors	Transects and buffer zones that integrate single MPAs together into a coherent network of MPAs, decisions on the management of human activities shall prioritise nature conservation

* Depending on the availability of scientific knowledge, the proposed areas and corridors are subject to change.
Source: S. Christiansen (in prep). Towards an ecologically coherent network of Marine Protected Areas for the North Sea. Report to WWF Germany. In this report the MPA network proposal and its specific area proposals are explained and justified.

Case Studies

4

4.1 Relevance of Case Studies

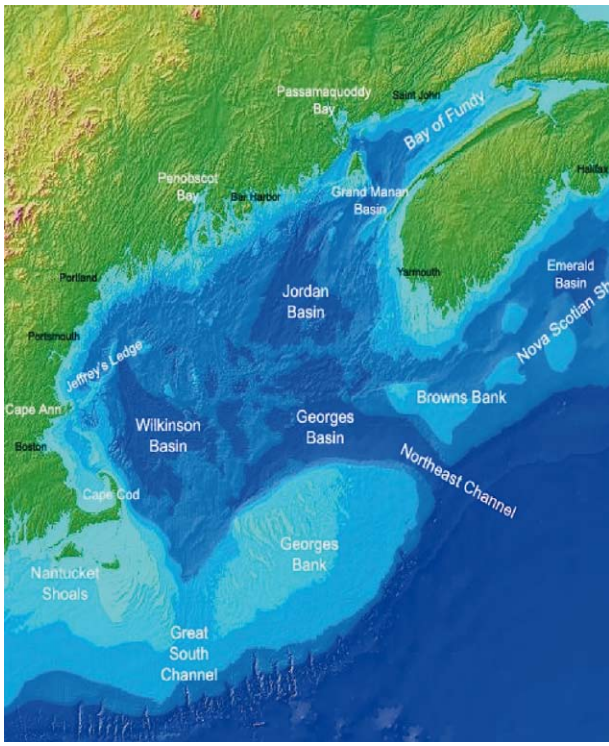
It is important to look at case studies of protected areas in temperate seas comparable to the temperate North Sea, in order to take some of their valuable lessons and experience into consideration.

Georges Bank, Lundy Island and New Zealand are located in temperate seas.[186] Similarities between the North Sea and Georges Bank include dealing with transboundary management and multiple stakeholders involvement, e.g. recreation, fisherman and oil companies. Georges Bank deals with similar threats to its biodiversity, e.g. exploitation and short term profit focus, overfishing, destruction of habitat, invasive species, pollution etc. To certain extent (with precaution as it is difficult to compare the intricate dynamics of these ecosystems), the ecosystems of Georges Bank and Doggerbank compare: both a sand bank, containing spawning grounds and similar species such as haddock, cod, and herring.
Lundy Island has a rocky habitat, which may be compared to Borkumse Stones and there are multiple stakeholders posing similar threats to biodiversity.
New Zealand has similar threats to biodiversity and comparable stakeholder groups and interests and is further ahead in its designation of a network of MPAs. From their process, the Netherlands can learn some valuable lessons regarding the application of a network-approach.

4.2 Georges Bank, USA/Canada

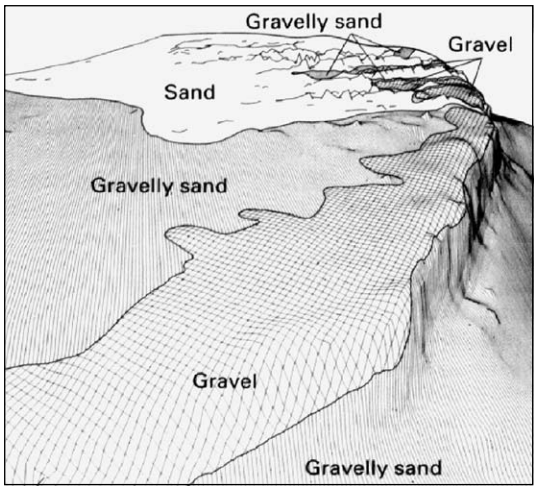
Watch the video of Georges Bank: navigate to the website of the American Museum of Natural History Museum or contact WWF Netherlands for a copy on dvd (see footnote).[192]

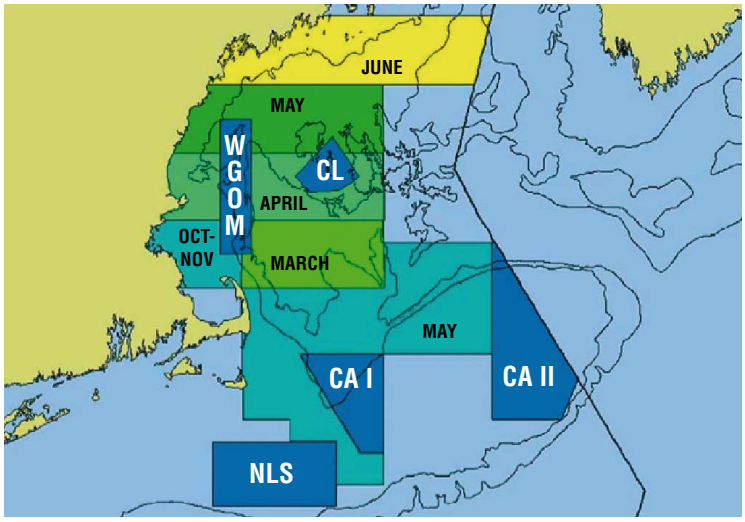
Introduction
Georges Bank is a large submarine bank located at the outer edge of the Gulf of Maine, with mainly a sandy seabed and some gravel on the edge.[193] It measures approximately 33,700 km^2 [194] and is one of the most biologically productive regions in the world's oceans: phytoplankton abundance on top of Georges Bank is three times the average rate for world continental shelves and almost ten times the open ocean abundance.[195] Components of the cold, nutrient-rich Labrador Current sweeps over most of the submarine plateau, and meets the warmer Gulf Stream on its eastern edge, bringing up nutrients to the surface. The mixing of the two currents, along with sunlight penetrating the shallow waters, creates an ideal environment for phytoplankton and zooplankton to flourish, attracting an entire ecosystem of marine animals, including herring *(Clupea harengus)*, haddock *(Melanogrammus aeglefinus)*, cod *(Gadus morhua)*, yellowtail flounder *(Pleuronectes ferrugineus)*, scallops *(Placopecten magellanicus)* and cetaceans *(Order Cetacea)*, such as dolphins, porpoises, and whales. The tides and the Labrador Current combined create a clockwise flow around the perimeter, circulating eggs and larvae throughout the Bank.[196]

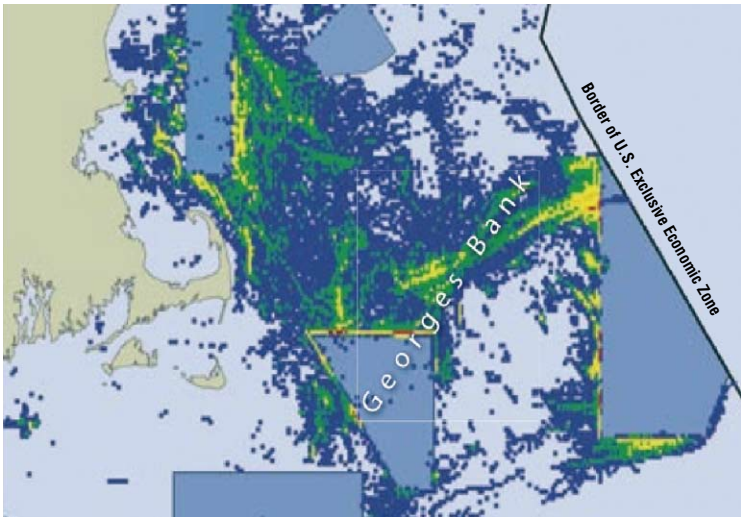


Georges Bank Bathymetry map: lighter blue depicts the more shallow areas.[187]

Georges Bank sea bottom.[188]







(above)
Year-round and seasonal closed areas for groundfish protection off the northeast USA. Coding is: CA-I= closed area I, CA-II =closed area II, NLS= Nantucket Lightship, WGOM= Western Gulf of Maine, CL= Cashes Ledge. Seasonal closure boundaries are partially obscured by various months.[189] [190]

(upper right)
Georges Bank 'Fishing at borders', showing high concentrations of fishing vessels around the closed areas.[191]

Exploitation

The (historical) abundance of species on and around the Georges Bank seemed inexhaustible for a long time, but the trawling techniques that started in the 1920s increasingly decimated stocks.[197] During the late 1950s, 1960s, and early 1970s, trawling fleets from the Soviet Union, East Germany, Poland, Spain, Japan and other countries hauled in hundreds of millions of pounds of haddock and hake. In an hour, a factory ship could haul around a hundred tons of cod, the same amount a typical 17th-century boat could catch in a season.[198] Canada and the USA wanted to preserve their fish stocks and established jurisdiction over a 200NM fishing limit and banned foreign boats. Both countries extended their jurisdiction to the EEZ, which overlapped on Georges Bank. Canada was granted the northeast corner (one-sixth) of Georges Bank after international arbitration in the International Court in The Hague in 1984.[199] With international vessels gone, both Canada and the United States went on to exploit the area themselves. Continued trawling for groundfish and scallops led to even more habitat destruction and overfishing of fish populations, including cod, haddock, herring, and scallops.[200] In the mid-1990s, the fishing industry crashed and resulted in the financial destruction of many fishing communities.[201] It soon became clear that these stocks would only benefit from cooperation in management between Canada and the USA. Joint management was reached through an informal agreement at the regional level. Whereas USA took on input controls (e.g. area/season closures, mesh size, trip limits, etc.), Canada focused more on output controls, mainly catch quota.[202] Now Canada and the USA have a quota sharing arrangement through the Transboundary Resources Assessment Committee (TRAC) across the border in the Gulf of Maine Georges Bank region, e.g. for cod.[203]

Protection

Seasonal closed areas have been an element of fishery management in New England and Canadian waters since 1970 but had limited impact on the conservation of groundfish stocks for which they were designed.[204] In 1993, Canada placed strict quota on cod. In 1994 the National Marine Fisheries Service assessed that the Georges Bank cod stock declined by 40% over the past four years and that the fleet was twice the size Georges Bank could handle. This meant that more protection was needed.[205]

Therefore in 1994, three areas of a total 17,000 km^2 were closed year-round to any gears capable of retaining groundfish, such as trawls, scallop dredges and gill nets,[206] however longlining was still permitted.[207] To ensure proper enforcement, a high proportion of local fishing vessels were equipped with satellite monitoring systems to collect information about their location (see image *'Fishing at borders'*, page 30). Over the years, other measures and MPAs have been installed next to no-take zones, for example in 2004 when the Gully off the coast of Nova Scotia, on the edge of the Scotian Shelf, became an MPA, to conserve and protect the natural marine biodiversity, including the endangered northern bottlenose whale *(Hyperoodon ampullatus)* and over 25 species of both hard and soft corals.[208] Both the USA and Canada installed a moratorium around 1988 on drilling for oil and gas, to conserve Georges Bank's waters, mainly for fishery. The moratorium is in place until 2012.[209]

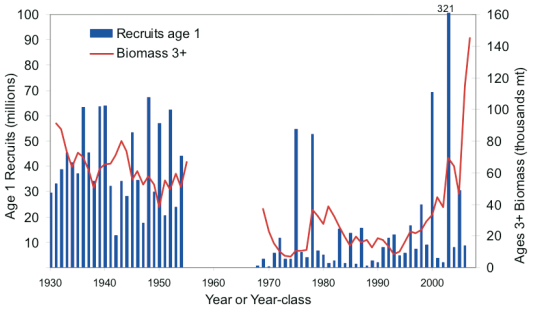
If Georges Bank stakeholders want to achieve a sustainable fishery, this would require a long-term vision and the application of other fisheries management tools besides no-take zones. This results in short term losses, and the pressure from the fishing sector to soften these restrictions is constant. This has already led to the compromise of conservation management.[210]

"The problem with the people (...) out here on the headlands of North America, is that they are at the wrong end of a 1,000-year fishing spree." – Mark Kurlansky [211]

Results of Protection

It is difficult to separate the effects of closed areas from other measures, which included a package of limited permits to fish for groundfish, increased mesh sizes and an effort reduction program[212], but studies show that closures have played an important role in the recovery and increase of various fish stocks. The effects of the marine reserves include[213]:

- The biomass of a number of commercially important fish species on Georges Bank has sharply increased, due to both an increase in the average size of individuals and, for some species, an increase in the number of young surviving to harvestable size
- Spill over of haddock, yellowtail and winter flounder *(Pseudopleuronectes americanus)* is significant
- Benthic organisms inside closed reserves recover and the community structure has re-emerged[214]
- Increased abundance of bushy epifauna taxa, e.g. hydroids *(Order Hydroida)*, providing complex habitats for shrimps *(Crangon septemspinosa)*, worms *(Class Polychaeta)*, brittle stars, mussels and small fish. These more complex habitats can have spin-off benefits for commercial species, for example the complex habitat can provide refuge to juvenile cod from predators[215]
- In 1999 part of the Closed Area II was reopened for scallop fishing, with some of the largest catches in volume of catch and size of scallop.
- The commercial fleet concentrates on the borders of the closed areas, indicating that catch around the MPAs is high (see image *'Fishing at borders'*, page 30)



Biomass and recruitment of Eastern Georges Bank haddock.[221]

- Protection from trawling lead to large increases in density, biomass and species richness and production of benthic fauna[216]
- In 2000, after 6 years of closure of the three areas implemented, the spawning stock biomass of yellowtail flounder had increased by 800%, haddock by 400%, cod by 50% and scallop biomass had increased 16-fold to pre-closure levels[217]
- Eastern Georges Bank cod adult population biomass (ages 3+) declined from 43,800 t in 1990 to 8,500 t in 1995, subsequently increased to 19,600 t in 2001 and was 20,200 t at the beginning of 2007[218]
- Levels of Eastern Georges Bank haddock stock are now probably at the highest biomass level since the 1930's or even earlier: Adult biomass (ages 3+) increased from 8,500 t in 1993 to 69,500 t in 2003. Adult biomass decreased to 46,900 t in 2005 but subsequently increased to 145,300 t in 2007, higher than the 1931-1955 maximum biomass of about 90,000 t. (See graph to the left).[219] [220]

4.3 Lundy Marine Nature Reserve, UK

Watch Lundy on film: navigate to the website of WWF-UK or contact WWF-Netherlands for a copy on dvd.[223]

Lundy Island.[222]

Introduction

Lundy Island is situated at the entrance to the Bristol Channel, about 22 km off the southwest coast of the United Kingdom. It is a 4.9 km long wedge of granite, 1.3 km wide at its widest point. The wedge of granite is 141m above sea level at its highest point but, like an iceberg, more lies below the surface of the water. Lundy is a real biodiversity hotspot.[224] The island is an important breeding site for birds, such as gulls, fulmars and razorbills, oystercatcher *(Haematopus ostralegus)*, guillemot, puffin *(Fratercula arctica)* and has subtidal reefs on the island's eastern side. Marine flora and fauna includes the pink sea fan *(Eunicella verrucosa)*, sunset cup coral *(Leptopsammia pruvoti)*, compass jellyfish *(Chrysaora hysoscella)*, shrimp *(Crangon crangon)*, crab *(Cancer pagurus)*, lobster *(Homarus gammarus)*, wrasse *(Labrus bergylta)*, pollack *(Pollachius pollachius)*, grey seals *(Halichoerus grypus)*, basking sharks *(Cetorhinus maximus)* and many species of dolphins.[225] [226]

Exploitation

The Lundy reefs support fragile benthic species and were regularly fished for crab and lobster.[227] The key commercial activity banned from the no-take zone is potting for crabs and lobsters. The areas outside of the no-take zone are still heavily potted from May to August. There was also scallop harvesting by scuba divers, scallop dredging, beam-trawling by commercial fishermen and boat angling before the implementation of the no-take zone. The area is also popular with tourists and boat users.[228]

Protection

Lundy became Britain's first voluntary reserve in 1973, based on a code of conduct and an agreement with commercial fishermen that trawling and dredging would be banned within the reserve. The voluntary reserve was established also, because divers were collecting souvenirs (sea fans and sea urchins) from the island.[229] After the passing of the Wildlife &

Countryside Act in 1981 and intensive stakeholder consultation, Lundy became a statutory Marine Nature Reserve (MNR) in 1986.[230] Lundy was also designated as a Special Area of Conservation under the Habitats Directive for reef habitats in the late 1990's. It protects marine birds, like endangered puffin and other marine wildlife and enables scientific research.[231] The protection was also foreseen to enhance populations of fish and shellfish inside and outside the reserve, which could provide benefits to the local diving industry and fishermen.[232] Lundy MNR aims to alleviate pressure on fish and shellfish stocks and restore wildlife,[233] so it includes both fisheries management and biodiversity conservation objectives. Activities within the 14 km² Lundy MNR are zoned. The aim was to implement a no-take zone of 8 km², but after stakeholder negotiation, this number was reduced to 3.3 km². It took until 2003 to fully establish this no-take zone.[234] It was the first time in the UK that an area was designated where the removal of any living creature, including lobsters, crabs, scallops and fish, is permanently banned by law.[235]

Results of Protection

After the relative recent implementation, the small no-take zone has already resulted in several benefits. Protection of biodiversity is in effect as the protection of rare species, such as for the pink sea fan and for puffins, is in place. Patience is needed to see how sponges and soft corals will respond.[237]

Effects of the fisheries management (no-take zone) are already visible. Landable lobsters within the Lundy no-take zone increased threefold within 18 months after the closure. The lobsters have also increased in size when compared to reference sites.[239] Ben Bradshaw, the Marine and Fisheries Minister, said: *"The Lundy Island No-Take Zone has been a resounding success. The number and size of crab and lobster both inside and, more importantly, outside the closed area has grown significantly."*[239]

Marine Biologist Dr. Keith Hiscock: *"It is not surprising that the lobster stocks have been first to demonstrate the benefits of the NTZ. Lobsters are a mobile species and will have migrated into the area."* Reductions in fishing mortality have not been defined and the effects of closure on finfish have yet to be researched. Research so far has been focused on scallop, lobster and crab populations.[241] Dr. Hiscock (see film) has reported: *"The studies which have been done in the no-take zone have shown us that the lobster stocks have actually been greatly enhanced by the presence of the no-take zone: there are significantly more lobsters and they are significantly larger, and what that means in rough and ready figures is that they're producing twice as many eggs. Now that's very, very important from the point of view of improving the lobster stocks outside the reserve."*[242] Dr. Hiscock: *"However, there has been a significant observed down-turn in the abundance of southern species. That significant down-turn cannot be linked to human activities, but is more likely part of a long-term (decades) cycle in 'water quality', which has nothing to do with pollution, but something with nutrients and perhaps other factors). (…) The No-Take Zone will not 'save' the biodiversity decline – but it will help to ensure that the marine life has every opportunity to recover"*.[243]

Perhaps the greatest value of the No-Take Zone is that it serves as a reference area for science to compare the area with exploited or damaged areas.

Lundy Marine Nature Reserve Zoning [236]

Lundy Island

No-Take area *(no fishing or collection of sea life of any kind)*

Refuge area *(no fishing except potting or angling)*

Recreation area

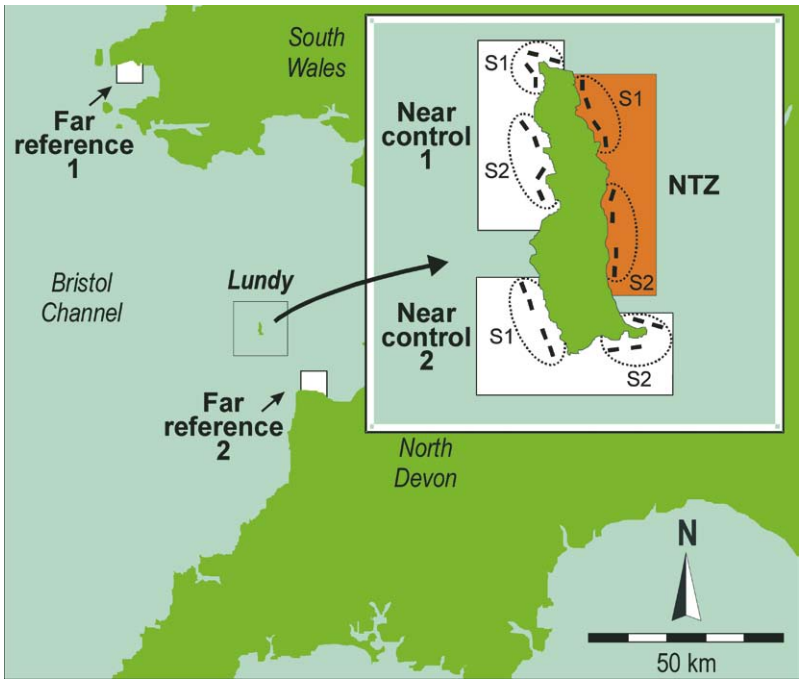
Areas with protected shipwrecks

General area in which most activities are allowed

Lundy Lobster.

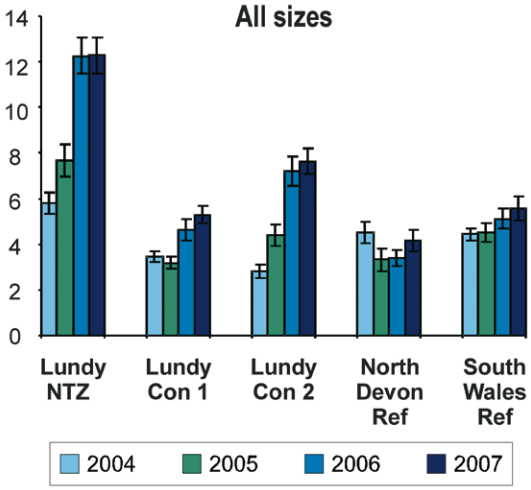
"Initially we were somewhat sceptical of the marine nature reserve, as we weren't quite sure what was being asked of us (...). The wardens and different people such as the divers who look after the area report a huge increase in the stocks of shellfish and also the sizes; so yes, a marine protected area is a very good thing." - John Butterwith, head of the North Devon Fishermen's Association.[244]

Lundy is now serving as an example for other fishing communities that want to push for their own protected area, like the fishing community of Lira, in the northwest of Spain.[245]



Lundy Lobster Abundance

Lundy abundance of lobsters within the no-take zone compared to reference sites. The Lundy No Take Zone and its surrounding areas (Con 1 and Con 2) show increased abundance of lobsters. The mean number per string of traps in the No Take Zone has doubled in three years (from 6 to 12). The quantity of lobsters in the reference areas closer to the NTZ (Lundy Con 1 & Lundy Con 2) have increased more compared to reference areas further away: North Devon Ref (decrease since 2004) and South Wales Ref (small increase since 2004).[240]



4.4 A Network of MPAs in New Zealand

Introduction

New Zealand's marine environment covers some 4,100,000 km^2 of ocean and their EEZ is the fourth largest in the world. New Zealand is a true marine biodiversity hotspot[246] and has about 10% of the global marine biodiversity represented in its waters, including many endemic species, such as the Maui's *(Cephalorhynchus hectori maui)* and Hector's dolphin *(Cephalorhynchus hectori)*.[247] New Zealand has a wide variety of sea-scapes and a great diversity in habitats: there are seamounts, trenches, rocky and sandy bottoms, mangroves, estuaries, mudflats, fiords, coral structures etc.[248]

Exploitation

In New Zealand, the harvesting of marine resources (e.g. mineral extraction and trawling), pollution, introduction of marine pests and invasive species have resulted in biodiversity degradation.[249]

New Zealand's Marine Protection

New Zealand has a range of protective measures that can be taken in order to deal with biodiversity degradation. For example through the legislation marine reserves (MR Act 1971), and the fisheries act (FA 1983), where there is the option to provide for seasonal closures, restrictions on gear and fishing techniques, establishing mammal sanctuaries (MM Act 1990) and other protected areas that afford various levels of protection, such as cable protection zones.[250] At this moment, there are 31 marine reserves established in New Zealand Territorial Waters. They cover about 7.6% of New Zealand's Territorial Sea, which is around 13,000 km^2.[251] 99% of the area is covered in two marine reserves around isolated offshore island groups (Auckland Islands and Kermadec Islands). Of the mainland Territorial Sea, less than 1% is covered in a marine reserve. Of New Zealand's total marine environment, 0.3% is protected in marine reserves. Currently the highest level of protection outside of the Territorial Sea is through fisheries closures on trawling for 18 seamounts. The inclusion of these closures brings the area of marine protection in New Zealand's marine environment to just over 3%.[252] The map also shows other types of MPAs, such as the marine mammal sanctuaries and Mataitai.[253]

There is a Benthic Impacts Strategy to better manage the impacts of bottom trawling on the seabed and seafloor eco-systems.[254] The government has established a closure of 30% of the New Zealand EEZ to bottom trawl and dredge fishing in partnership with a group of deep-sea fishermen, the Deepwater Group Ltd. The Deepwater Group Ltd. proposed the closure of an area of 1,200,000 km^2 or 32% of New Zealand's EEZ to bottom trawling and dredging, so-called benthic protection areas (BPAs), which took effect on 15 November 2007. *"New Zealand's fishing industry chose to be pro-active, rather than having closures imposed on them",* say McMurran and Helson of the Ministry of Fisheries.[255] However, Chris Howe of WWF New Zealand notes that the network does not yet represent the known benthic biodiversity.[256] [257] These BPAs are considered to be the largest single marine protection measure ever designated within the EEZ of a country. However, BPAs only restrict fishing and most of these BPAs are at depths greater than fishing currently occurs.[258] According to the New Zealand Ministry of Fisheries, MPAs are a good complement to wider fisheries management, which include the setting of total allowable catches at a level designed to ensure long term sustainable fishing and a range of input controls, such as closed areas and fishing method restrictions.[259]

Dusky dolphin (Lagenorhynchus obscurus), Kaikoura, New Zealand.

Hector's dolphin (Cephalorhynchus hectori), Hector's dolphin Banks Peninsula, New Zealand.

Industrial deep sea fishermen emptying a mesh full of orange roughy (Hoplostethus atlanticus) into a trawler.

Example of a result of protection

An example of a marine reserve is the Cape Rodney-Okakari Point Marine Reserve (Goat Island or Leigh Marine Reserve), proposed in 1965 and established in 1975. It was one of the world's first no-take marine reserves. The heavy exploitation of snapper *(Pagrus auratus)* and spiny rock lobsters or crayfish *(Jasus edwardsii)* resulted in an invasion of their prey; the sea urchin *(Evechinus chloroticus)*, known as kina. When the reserve was established and fishing stopped, the balance between predator and prey was restored.[260] Density of spiny rock lobsters is at least 15 times higher than outside the reserve. The protection has resulted in overspill and larval export and financial gain for commercial cray fishermen, who were skeptic at first and are now propagators of protection.[261]

Establishing a network of MPAs

The New Zealand Biodiversity Strategy has a target of protecting 10% of New Zealand's marine environment by 2010 and establishing a fully comprehensive network by 2020. The MPA Policy and Implementation Plan, lead by Ministry of Fisheries and Department of Conservation, aims to establish an integrated network of MPAs, comprehensive and representative of New Zealand's marine habitats and eco-systems across its EEZ.[263] The network will protect the full range of natural marine habitats and ecosystems and the government intends to protect at least one example of each habitat or ecosystem and protect outstanding and rare sites. The goal is *'to engage with communities throughout New Zealand, using the best available information, to develop a network of marine protected areas that includes representatives of all our marine environments, from the common to the rare, and everything in between.'*[264]
Key components of the network include a robust, consistent and science-based system to classify the many different types of marine ecosystems and habitats.[265]

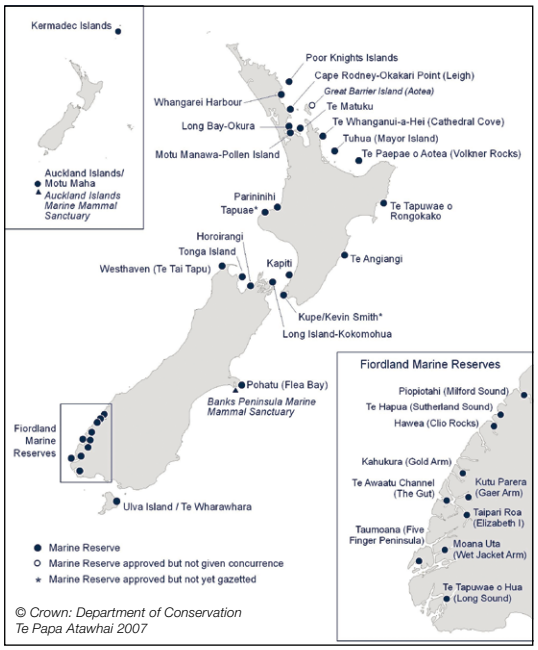
The process is being run jointly by the Ministry of Fisheries and the Department of Conservation, and will involve other government departments, local government, marine users, indigenous groups, and groups with an interest in the marine environment. Stakeholder involvement has been an important part of the process. There is a strategy for Public Awareness Building, which aims to train the staff of the Department of Conservation to boost support for marine protection among stakeholder groups and the public. Regional fora have been set up to make recommendations on areas for marine protection, to share knowledge for example about the various user functions and ecological values of a particular area (e.g.

Why New Zealand needs a Network of MPAs

Ballantine, a scientist involved in the Leigh Reserve from the beginning, explains why New Zealand needs a network of MPAs: *"A network of reserves, which allows the drift of larvae from one reserve to reach others is potentially self-sustaining. The purpose of a network is to maximise the variety of 'connections' (distances and directions between reserves) as well as their number. Since we rarely know the 'sources and sinks' of the larvae for a species, we need this precaution. But even if we could provide the optimum design for one species, other species would have quite different requirements, so to optimise the benefits a network design is necessary".*[262]

West Coast Marine Protection Forum: www.westmarine.org.nz).[267] In 2002, New Zealand's Department of Conservation and National Institute of Water and Atmospheric Research used Marxan software on a trial basis. They tested its possible future application for designing a network of MPAs throughout the nation's EEZ.[268] Marxan, or other algorhythm will be used to the extent of how comfortable regional forums will be with these decision-making tools.[269] [270]

Stakeholders can recommend MPA locations and management tools to the Ministers of Conservation and Fisheries that reduce the impacts on existing activities and meet the MPA Protection Standard and MPA Policy goals. The Department of Conservation and Ministry of Fisheries will then make recommendations to their Ministers based on this advice and comments from stakeholders. The MPA Protection standard will determine whether for example whether a particular area will qualify for the network of biodiversity protected areas. This standard will be the same for MPAs everywhere and the regulatory and legislative tools needed to achieve this will vary. Therefore, a range of government agencies is involved in planning New Zealand's MPA network. For example Fisheries Act tools must be used in a manner consistent with the standard. Where such tools meet the Protection Standard, they will form part of the MPA network.[271] [272] Another key component is the environmental standard that is in place to ensure human activities are appropriate to maintain the health of the MPA. The protection standard requires everything inside a marine protected area to *'allow its biological diversity to be maintained, or recover, to a healthy functioning state at the habitat and ecosystem level'*.[273]

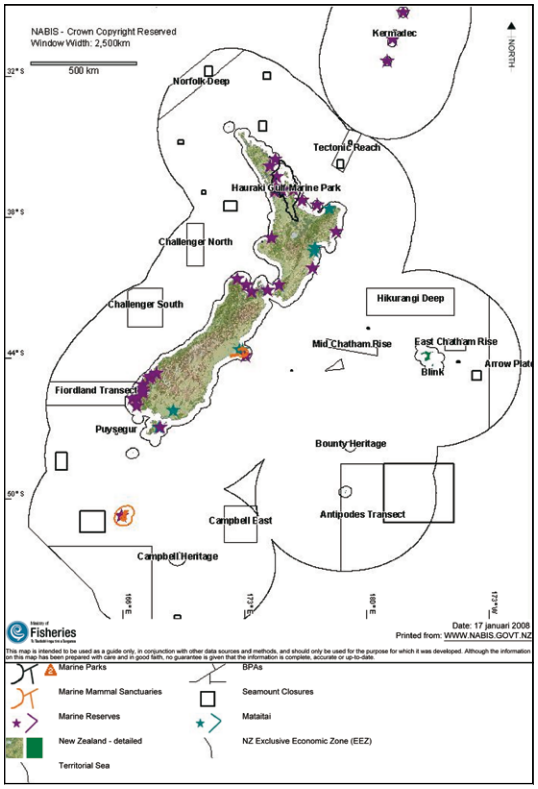


Map of New Zealand's marine reserves (as of August 2007).

Stakeholders have been involved in discussions and formally on the MPA policy and key implementation documents.[274] As described above, the implementation process will allow stakeholders to form a forum and through this forum make recommendations to government for new MPAs, in line with national priorities and policy. At this moment, there are four advanced planning processes, which have begun and are at different stages in the implementation process.[275]

The Deepwater Stakeholder group and the Guardians of Fiordland process[276] have proved that stakeholders can also get together pro-actively and propose a package of MPAs, instead of going through a government driven process. Although this process took a considerable amount of time in the case of the Guardians of Fiordland, it was broadly supported. A difference between the establishment of a network of MPAs in Australia and New Zealand is that Australia has provided compensation to fishermen adversely affected by MPAs. New Zealand has not taken up this approach, which may make fishermen unsupportive.

New Zealand's Economic Exclusive Zone and areas of marine protection.[266]



Status of the Network

New Zealand is working towards a comprehensive and representative MPA network. Care is needed when considering the criterion of connectivity among MPAs. McMurren and Helson of the New Zealand Ministry of Fisheries: *"Movement of marine species, eggs, larvae etc. differs greatly among species, life history stages, seasons, and latitudes. Movement is three dimensional, non-linear, and may reverse over short periods depending on current dynamics."* Therefore the question is whether it is realistic to network MPAs in the purist form (e.g. species entering MPAs

in different life stages), when network features are influenced by so many external factors. They argue that even if you do have some limited connectivity, seeding from one MPA to the next is unlikely and will not necessarily result in biomass increase. A network in theory is a good idea, but reality should not be ignored. Therefore it is important not to oversell an MPA as a cure all, but as part of the toolkit. New Zealand is now forming its network and has made a start in the sense that there are marine reserves and other forms of protection are *'spaced out and in a variety of habitats'*.[277]

4.5 Lessons Learned from Case Studies

Three case studies on MPAs in temperate seas relevant for the Netherlands were analyzed: Georges Bank, Lundy Island and New Zealand. All three provide important lessons and insights.

Georges Bank, USA/Canada
Georges Bank proves that when a temperate reserve of high productivity is large enough and combined and integrated with restrictive measures to fishery, it can allow species to recover from overexploitation. Georges Bank has shown that MPAs and no-take zones can lead to increased biodiversity (increase in size, age and productivity of species, recovery of populations, increased complexity and recolonisation of habitats by marine flora and fauna etc.) and benefits for fishermen and other stakeholders.

Lundy Marine Nature Reserve, UK
Lundy shows that stakeholder involvement may lead to a decrease in the area initially planned for protection. Lundy Marine Reserve has great value serving as a reference area for science to compare the area with exploited areas. Lundy shows that even a small no-take MPA can benefit certain species and contribute to the protection of biodiversity.

A Network of MPAs in New Zealand
New Zealand is one of the leading countries in the protection of marine biodiversity. Many of the MPAs in New Zealand have shown to benefit biodiversity. New Zealand's Network Approach shows the effects of early stakeholder involvement in the process of developing Networks of MPAs from the very beginning. It shows that stakeholders can support the process of MPA designation and establishment, and that an early involvement in the process can reduce friction and confrontation. Fishermen are more likely to support an MPA when some moderate extraction is allowed and when they consider a good process has been followed, when the sites have less adverse effects on fishing activity, but allow biodiversity objectives to be achieved. However, in the effort to conserve a declining biodiversity, conservation interests must be granted primacy and the involvement of stakeholders shall not mean that only those sites are being chosen, that are of least interest to resource users. It is important also to not oversell MPA benefits, as this may create a backlash for future marine conservation. Further, it is important to be clear about the objectives, as this will allow more effective monitoring and evaluation. Compliance and enforcement are very important aspects of an MPA.

Recommendations to North Sea Stakeholders

World Wide Fund for Nature Netherlands gives four recommendations to North Sea Stakeholders, which need to be taken up in order to create an effective network of MPAs in the North Sea and to achieve optimal results for the conservation of biodiversity:

Natura 2000 needs complementary measures: MPAs under Natura 2000 lack in ambition and scope of protection. For example important commercial fish species do not fall under the protection of Natura 2000. Natura 2000 allows for spatial gaps in protection, which is apparent especially in the Coastal Sea. With the currently planned Natura 2000 MPAs, it is expected that local biodiversity will benefit, but North Sea biodiversity overall will probably not.[278] Complementary measures need to be taken, such as the addition of habitats and species to complete the list of the Directives; a clear and complete definition of 'favourable status', which includes the protection of the ecosystem that supports the ecological features protected within the Natura 2000 area. Natura 2000 MPAs need to be complemented with the implementation of MPAs under OSPAR (which have a broader scope) and the implementation of measures under CFP that will regulate and restrict fisheries (e.g. adjusting the fishing fleet to available resources, in order to avoid the shifting of effort). A comprehensive application of the Directives will not meet the international commitment given by the Netherlands to implement a network of MPAs that is representative of the full extent of diversity. Natura 2000 areas should be seen as starting point for an ecologically coherent network of MPAs, which, together with OSPAR MPAs and complementary measures can make up a network of protected areas in the North Sea.

North Sea MPAs need a network approach in an international setting: Currently planned Natura 2000 MPAs lack a network approach, despite the fact that this is of great importance for MPAs to conserve North Sea biodiversity effectively. Natura 2000 MPAs as currently planned (Doggerbank, Frisian Front, Coastal Sea – with gap in the middle – and Cleaverbank) need to be complemented with other Natura 2000 protected areas and OSPAR MPAs. Within and outside these protected areas, appropriate measures and rules under CFP must be taken to ensure an ecosystem and network approach. At the moment, there is no attempt in Europe to assess ecological coherence and to use a network approach for the implementation of European MPAs. Countries are now in the process of designating MPAs, but as yet, there is no European approach. The New Zealand case study shows we can learn lessons from MPA network approach experience in other countries. New Zealand demonstrates that it is in fact possible to implement a network of MPAs, while also considering stakeholder interests and requirements. Oceans and seas are interconnected systems and cross national boundaries: marine flora and fauna do not abide by EEZs. Therefore it is important to connect with other North Sea countries when designating and implementing MPAs and to establish transboundary cooperation with regard to research, monitoring and enforcement and sharing responsibilities.

North Sea MPAs need solid and integrated management: Overall, stakeholders want the Dutch government to take the lead in smart and integrated spatial planning and management of MPAs. MPA management should have a solid basis based on field experience, using scientific understanding of the ecosystem and practical MPA management experience from inside and outside the Netherlands. The management should be integrated with other North Sea management measures and include stakeholder consultation. Management needs to be conservation oriented, promoting both biodiversity and productivity of the North Sea. The management should not be afraid to exclude activities destructive to North Sea biodiversity, such as beam trawling. Therefore, initiatives of fishermen to use more selective and less destructive (more sustainable) fishing gear need to be supported.

Stakeholder perceptions need to be broadened: MPAs need stakeholder support in order for an MPA (network) to be effective. However, stakeholder perceptions on the benefits of MPAs vary extremely. Whereas the majority of stakeholders agree that MPAs have the potential to benefit North Sea biodiversity, fishery organisations and fishermen point to the Plaice Box as an example of the inability of an MPA to benefit biodiversity and fish stocks. However, according to scientists, the Plaice Box is not a good example of an MPA. The lack of knowledge among stakeholders in the Netherlands of MPA experience abroad, is an issue that should be addressed by those stakeholders that want North Sea MPAs to succeed in achieving optimal result for North Sea biodiversity.

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Executive Summary

This report discusses a network of Marine Protected Areas (MPAs) in the North Sea, and is particularly aimed to inform Dutch stakeholders on how to move towards and achieve an ecologically coherent network of MPAs in order to protect and restore North Sea biodiversity. MPAs can contribute to resilient ecosystems and protection of marine biodiversity in various ways.

North Sea biodiversity is threatened by pollution, invasive species, climate change, disturbance and damage to species and habitats, overfishing and bycatch and spatial issues. Current regulation does not deal with these threats adequately. When designed and managed properly, MPAs can – in combination with complementary measures – mitigate some of the negative effects of these pressing issues. MPAs then have the potential to mitigate the effects of the threats to biodiversity and to contribute to North Sea biodiversity in the following ways:

Threats	MPA potential to mitigate threats
Pollution	Depending on the scale of protection and monitoring, MPAs can be areas that are safe from pollution and dumping of harmful substances. MPAs boost biodiversity and ecosystem health, which in turn creates larger resilience to pollution.
Alien species introduction	MPAs are not closed systems and they will remain vulnerable to the negative impacts of the introduction of alien species, but when local species are longer lived and have a firm basis in their habitat, they are better equipped to deal with alien species, depending on the characteristics and for example the aggressiveness of the alien species.
Climate change	Climate change is already visible in the North Sea and MPAs will not stop this process. But when MPAs are effective in creating strong ecosystems and more resilient populations of marine species, this helps (to certain extent) to mitigate effects of climate change.
Overfishing and bycatch	Depending on the degree of protection, MPAs create safe havens from destructive practices of fishing and bycatch. They protect important habitats, including spawning and nursery grounds, biodiversity hotspots and migration bottlenecks. With the proper measures taken within the MPAs, they can increase the production of fish stocks and create spill over effects.
Damage and disturbance to species and habitats	MPAs create refuges from bottom trawling and other types of disturbance to the seabed, enabling benthic species to flourish and biodiversity to increase. MPAs protect species and habitats from harmful human activities.
Spatial issues	Spatial problems caused by the many types of activities and lack of spatial planning will not be solved by MPAs, but they can be regulated through MPAs. MPAs can serve as a planning framework and thus mitigate conflicts between stakeholders that claim a particular area.

Marine Protected Areas: Obligations and Provisions

The European Union (EU) is experiencing biodiversity degradation and has therefore set itself the goal to halt the loss of biodiversity by the year 2010, according to agreements made at the Johannesburg Convention on Biodiversity in 1992. In order to reach this goal EU member states must implement protected areas under the OSPAR Convention on the protection of the marine environment of the North-East Atlantic (1992) and the European Birds (79/409/EEC) and Habitats Directives (92/43/EEC). These MPAs are to be a part of a worldwide, ecologically coherent network of MPAs by the year 2010. Consequently, The Netherlands has several obligations and

provisions for the designation and implementation of protected areas in the North Sea, of which the most important ones are:

- The European Birds (79/409/EEC) and Habitat Directives (92/43/EEC) together forming the basis of the Natura 2000 network of protected areas: Under Natura 2000 an area can be protected when it includes a certain percentage of the population of a species or a specific habitat and this species or habitat is included in the Annexes of the Birds or Habitats Directive. Not all important species and habitats are included in the Annexes, for example some commercial species of fish. Currently, in the Netherlands four areas are planned for designation under Natura 2000: Doggerbank, Coastal Sea – without the middle part –, Cleaver Bank and Frisian Front, but there are several other areas of ecological value that need to be designated and protected.
- The OSPAR Convention on the protection of the marine environment of the North-East Atlantic; The OSPAR Network of MPAs aims to protect, conserve and restore species, habitats and ecological processes, which have been adversely affected as a result of human activity. The network aspires to prevent degradation of or damage to species, habitats and ecological processes following the precautionary principle. It aims to protect and conserve areas, which best represent the range of species, habitats and ecological processes. Overall, the criteria for the OSPAR MPAs are broader than Natura 2000. The Netherlands has not yet designated any OSPAR areas, and with the potential OSPAR MPA Central Oyster Grounds not planned for designation as one of the Dutch MPAs, the Netherlands is not fulfilling its OSPAR commitments.
- Fisheries management within MPAs under the Common Fisheries Policy (CFP): The CFP was created in 1981 to manage the fisheries sector in the EU. Under the CFP, areas may be closed for fisheries objectives, such as improvement of the productivity of fish stocks and the reduction of fishery impacts or the protection sensitive habitats or species. Examples of CFP protected areas are the Plaice Box, the Shetland Box or the Darwin Mounds closure. CFP is the management tool to provide the protection from fisheries impacts required for ensuring that Natura 2000 areas and other MPAs can be successful in reaching their conservation objectives, offshore, i.e. beyond the 12 nm territorial seas.

Case Studies

From comparable temperate sea case studies, Dutch stakeholders may extract potential lessons for the Netherlands regarding designation and implementation, benefits and stakeholder involvement of an MPA network. Three case studies on MPAs in temperate seas relevant for the Netherlands were analyzed: Georges Bank, Lundy Island and New Zealand. All three offer different valuable lessons:

Georges Bank, USA/Canada

Georges Bank proves that when a temperate reserve of high productivity is large enough and combined and integrated with restrictive measures to fishery, it can allow species to recover from overexploitation. Georges Bank has shown that MPAs and no-take zones can lead to increased biodiversity (increase in size, age and productivity of species, recovery of populations, increased complexity and recolonisation of habitats by marine flora and fauna etc.) and benefits for fishermen and other stakeholders.

North Sea Sea Anemone (Sagartia troglodytes).

Lundy Marine Nature Reserve, UK

Lundy shows that stakeholder involvement may lead to a decrease in the area initially planned for protection. Lundy Marine Reserve has great value serving as a reference area for science to compare the area with exploited areas. Lundy shows that even a small no-take MPA can benefit certain species and contribute to the protection of biodiversity.

A Network of MPAs in New Zealand

New Zealand is one of the leading countries in the protection of marine biodiversity. Many of the MPAs in New Zealand have shown to benefit biodiversity. New Zealand's Network Approach shows the effects of early stakeholder involvement in the process of developing Networks of MPAs from the very beginning. It shows that stakeholders can support the process of MPA designation and establishment, and that an early involvement in the process can reduce friction and confrontation. Fishermen are more likely to support an MPA when some moderate extraction is allowed and when they consider a good process has been followed, when the sites have less adverse effects on fishing activity, but allow the biodiversity objectives to be achieved. However, in the effort to conserve a declining biodiversity, conservation interests must be granted primacy and the involvement of stakeholders shall not mean that only those sites are being chosen, that are of least interest to resource users. It is important also to not oversell MPA benefits, as this may create a backlash for future marine conservation. Furthermore, it is important to be clear about the objectives, as this will allow more effective monitoring and evaluation. Compliance and enforcement are two very important aspects of an MPA.

Recommendations to North Sea Stakeholders

World Wide Fund for Nature Netherlands gives four recommendations to North Sea Stakeholders, which need to be taken up in order to create an effective network of MPAs in the North Sea and to achieve optimal results for the conservation of biodiversity:

Natura 2000 needs complementary measures: MPAs under Natura 2000 lack in ambition and scope of protection. For example important commercial fish species do not fall under the protection of Natura 2000. Natura 2000 allows for spatial gaps in protection, which is apparent especially in the Coastal Sea. With the currently planned Natura 2000 MPAs, it is expected that local biodiversity will benefit, but North Sea biodiversity overall will probably not.[1] Complementary measures need to be taken, such as the addition of habitats and species to complete the list of the Directives; a clear and complete definition of 'favourable status', which includes the protection of the ecosystem that supports the ecological features protected within the Natura 2000 area. Natura 2000 MPAs need to be complemented with the implementation of MPAs under OSPAR (which have a broader scope) and the implementation of measures under CFP that will regulate and restrict fisheries (e.g. adjusting the fishing fleet to available resources, in order to avoid the shifting of effort). A comprehensive application of the Directives will not meet the international commitment given by the Netherlands to implement a network of MPAs that is representative of the full extent of diversity. Natura 2000 areas should be seen as starting point for an ecologically coherent network of MPAs, which, together with OSPAR MPAs and complementary measures can make up this network of protected areas in the North Sea.

North Sea MPAs need a network approach in an international setting: Currently planned Natura 2000 MPAs lack a network approach, despite the fact that this is of great importance for MPAs to conserve North Sea biodiversity effectively. Natura 2000 MPAs as currently planned (Doggerbank, Frisian Front, Coastal Sea -with gap in the middle- and Cleaverbank) need to be complemented with other Natura 2000 protected areas and OSPAR MPAs. Within and outside these protected areas, appropriate measures and rules under CFP must be taken to ensure an ecosystem and network approach. At the moment, there is no attempt in Europe to assess ecological coherence and to use a network approach for the implementation of European MPAs. Countries are now in the process of designating MPAs, but as yet, there is no European approach. The New Zealand case study shows we can learn lessons from MPA network approach experience in other countries. New Zealand demonstrates that it is in fact possible to implement a network of MPAs, while also considering stakeholder interests and requirements. Oceans and seas are interconnected systems and cross national boundaries: marine flora and fauna do not abide by EEZs. Therefore it is important to connect with other North Sea countries when designating and implementing MPAs and to establish transboundary cooperation with regard to research, monitoring and enforcement and sharing responsibilities.

North Sea MPAs need solid and integrated management: Overall, stakeholders want the Dutch government to take the lead in smart and integrated spatial planning and management of MPAs. MPA management should have a solid basis based on field experience, using scientific understanding of the ecosystem and practical MPA management experience from inside and outside the Netherlands. The management should be integrated with other North Sea management measures and include stakeholder consultation. Management needs to be conservation oriented, promoting both biodiversity and productivity of the North Sea. The management should not be afraid to exclude activities destructive to North Sea biodiversity, such as beam trawling. Therefore, initiatives of fishermen to use more selective and less destructive (more sustainable) fishing gear need to be supported.

Stakeholder perceptions need to be broadened: MPAs need stakeholder support in order for an MPA (network) to be effective. However, stakeholder perceptions on the benefits of MPAs vary extremely. Whereas the majority of stakeholders agree that MPAs have the potential to benefit North Sea biodiversity, fishery organisations and fishermen point to the Plaice Box as an example of the inability of an MPA to benefit biodiversity and fish stocks. However, according to scientists, the Plaice Box is not a good example of an MPA. The lack of knowledge among stakeholders in the Netherlands of an MPA experience abroad, is an issue that should be addressed by those stakeholders that want North Sea MPAs to succeed in achieving optimal result for North Sea biodiversity.

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