

The OSPAR System of **Ecological Quality** **Objectives** for the North Sea



Update 2010

Towards assessing ecosystem health



Photo: © John Costelloe/Aquafact

The North-East Atlantic hosts an ever-growing range of human activities, and faces emerging threats such as climate change. Together they are responsible for a range of impacts on the marine environment. The sustainable use of ecosystem goods and services through the application of the ecosystem approach is a core aspiration that is reflected in OSPAR's vision of a clean, healthy, and biologically diverse North-East Atlantic ecosystem.

The ecosystem approach requires the comprehensive integrated management of human activities based on the best available scientific knowledge about ecosystems and their dynamics, in order to identify and take action on influences which are critical to the health of marine ecosystems. The OSPAR system of Ecological Quality Objectives (EcoQOs) for the North Sea has been developed to provide operational objectives and indicators to support assessments of ecosystem health and to help direct management actions.

A first set of EcoQOs has been tested and evaluated by North Sea countries (OSPAR Region II) in the period 2002–2009 and provides a contribution to the assessment of impacts from selected human pressures on the biodiversity and environmental status of the North Sea. This highlights the need for continued actions and measures to improve quality. A summary of the evaluation of the first application of each of the EcoQOs is given on the following pages.

This updated summary report together with the more detailed evaluation provide a contribution to the assessment of impacts from selected human pressures on the biodiversity and environmental status of the North Sea, and ultimately for the Quality Status Report (QSR) 2010. The QSR 2010 is a holistic assessment of the quality status of the North-East Atlantic that will help inform the 2010 OSPAR Ministerial Meeting on actions needed to protect and conserve the North-East Atlantic.

Ecological Quality Objectives

The ecosystem approach is not straightforward and requires operational tools. EcoQOs are being developed to provide operational objectives and indicators for applying the ecosystem approach.

OSPAR has been developing the EcoQO system for the North Sea, in collaboration with the International Council for the Exploration of the Sea (ICES), since 1992. EcoQOs express the desired qualities of a component of the ecosystem.

The EcoQOs developed so far cover many elements of the ecosystem, including phytoplankton, benthic species, fish, seabirds and marine mammals. Most of the EcoQOs can be linked to specific human activities, such as shipping (oil at sea), litter, fishing and pollution by chemicals and nutrients.

EcoQOs function both as indicators (to provide specific issues for monitoring) and objectives (against which to measure progress). As a set, they are intended to provide comprehensive coverage of the ecosystem and the pressures acting upon it, so that meeting all EcoQOs should indicate that the ecosystem is in a good state. Where EcoQOs are not met, it indicates the need for appropriate measures to regulate this specific human activity, or triggers further investigations into possible reasons for the EcoQO not being met.

A detailed evaluation of the EcoQO system and each of the individual EcoQOs is available on the OSPAR website.

→ **Evaluation of the OSPAR system of Ecological Quality Objectives for the North Sea**

Healthy seal populations

North Sea EcoQO

Taking into account natural population dynamics and trends, there should be no decline in pup production of grey seals of $\geq 10\%$ as represented in a five-year running mean or point estimates (separated by up to five years) within any of a set of defined sub-units of the North Sea.

What is the problem?

Declining seal populations

Photo: © Gail Johnson/Fotolia



What is the Ecological Quality Objective (EcoQO)?

Of the five species of seal that occur in the OSPAR area only the grey seal (*Halichoerus grypus*) and the harbour seal (*Phoca vitulina*) are common in the North Sea. Separate EcoQOs have been adopted for grey seals and harbour seals to account for their differing biological characteristics. Harbour seals breed more widely around the coast than grey seals, which have specific breeding colonies. Changes in population size or pup recruitment may indicate problems in the ecosystem, such as food shortage or pollution. The objective aims to maintain healthy populations of seals by triggering management actions when needed.

Has the EcoQO been met?

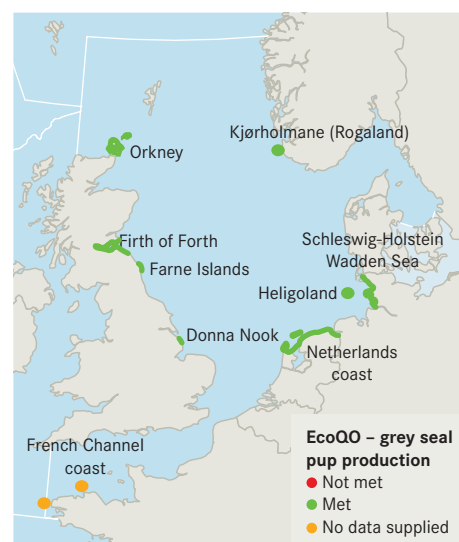
Based upon five years up to 2006, the EcoQO was met for grey seals for all significant units of the North Sea population. Over the same period, the harbour seal EcoQO was not met in several areas where declines of seals of more than 10% occurred (Shetland, Orkney, east of Scotland, Greater Wash to Scroby Sands, Limfjorden in Denmark and the west coast of Norway). Of these areas only the Limfjorden area has been affected by an outbreak of the morbillivirus in recent years. In other areas, the cause of the decline is unknown. Data from 2008 suggest that harbour seal populations in the Wadden Sea have been increasing recently.

How does this affect the quality status?

This EcoQO acts as a general ecological indicator, because seals are top predators and their status depends on a wide range of variables. The failure to meet the EcoQO for harbour seals needs to be investigated. Changes in population size or pup recruitment might indicate wider problems in the ecosystem, such as depletion of food stocks through fisheries, pollutants affecting reproductive ability or changes in distribution associated with climate change.

What happens next?

This EcoQO does not reflect a single environmental factor but reflects the general status of seals. A combination of pressures may cause physiological stress and increase susceptibility to disease. If the decline is found to be the result of human activities, then suitable management measures must be implemented.



Reduce by-catch of harbour porpoises



North Sea EcoQO

Annual by-catch levels of harbour porpoises should be reduced to below 1.7% of the best population estimate.

What is the problem?

By-catch of harbour porpoises in fisheries

Photo: ©Jan Halters

What is the Ecological Quality Objective (EcoQO)?

Harbour porpoises (*Phocoena phocoena*) are small cetaceans found in coastal waters throughout the OSPAR area, which are protected under the EU Habitats Directive. This species is occasionally by-caught by several types of fisheries, especially those using bottom-set gill- and tangle nets. The nets are otherwise considered to be relatively selective and environmentally friendly and their use is increasing.

By-catch rates higher than the EcoQO are considered to be unacceptable, as they are likely to affect the population size of the harbour porpoise in the long term. The EcoQO aims to reduce by-catch in the North Sea to a level that would allow the population to recover to at least 80 % of the ecosystem's long-term carrying capacity for this species.

Has the EcoQO been met?

There is no reliable information on by-catch numbers in the North Sea, as monitoring programmes are lacking in most gillnet fisheries. In the southern North Sea, up to half of stranded porpoises have been killed incidentally in fishing gear, a rate that justifies concern. Further independent monitoring of by-catch must be implemented, through compulsory observer schemes. A second challenge in evaluating whether the EcoQO has been met is the need for a better understanding of the status and inter-relationships of North Sea harbour porpoise population units. Accurate estimates of the porpoise population and abundance numbers are required for all areas in which they occur.

How does this affect the quality status?

The harbour porpoise is an important top predator in the North-East Atlantic and there have been historical declines in some areas. As higher species in the food chain harbour porpoises play an important role in food web structure and ecosystem functioning. Incidental removal of such species can lead to cascading ecological changes.

What happens next?

The EcoQO highlights the need for management measures. A first priority is to monitor the by-catch of harbour porpoises effectively. This should be done in cooperation with national and EU fisheries authorities and in collaboration with ASCOBANS. Where by-catch needs to be reduced, a number of actions are possible. Catches of marine mammals in the North Sea are now always incidental. Most fishermen do not want such by-catch, not least because of gear damage and slower fishing operations. However, individual fishermen rarely catch a harbour porpoise and so may not consider this a significant environmental problem.

National reports of harbour porpoise by-catch around the North Sea in 2006

Country	Observation
Norway	101 harbour porpoises were reported caught by 18 coastal gillnet vessels between October 2005 and September 2006
Sweden	No report received
Denmark	No report received
Germany	No report received
Netherlands	No report received
Belgium	Report provided is based on numbers of stranded harbour porpoises showing net marks; 32 such porpoises were recorded in 2006. There has been an increase in strandings (and by-catch), probably due to an increase in numbers of porpoises in Belgian waters
France	Report for EU Regulation 812/2004 covered only pelagic fisheries. No harbour porpoises were reported caught in these fisheries
UK	No harbour porpoise by-catch was observed in the North Sea, but 14 animals were reported for the south-west of the UK (including in areas outside the North Sea as defined by OSPAR)

Pingers (acoustic alarms) have been seen as one of the most promising prevention measures. EU Regulation 812/2004 makes these compulsory for bottom-set gill- and tangle nets operated from vessels of 12 m length or over, excluding many smaller vessels. Pingers have been applied under Danish law in cod wreck net fisheries since 2000 and are being trialled elsewhere in the North Sea. However, there are still concerns about their practicality and effectiveness over the long term, about negative impacts from the noise

they emit and about the best means of enforcing their use. Designing effective measures must take account of local conditions and fishing practices, and must use the expertise and experience of fishermen, who currently have little to gain in providing information on by-catch, with killing and landing of harbour porpoises being forbidden in several jurisdictions. All Contracting Parties need to improve the internal coherence between environmental commitments and decisions being taken in relation to the fishing industry.



Photo: © Pádraig Whooley/IWDG

Fish stocks at biologically safe levels



North Sea EcoQO

Maintain the spawning stock biomass above precautionary reference points for commercial fish stocks where those were agreed by the competent authority for fisheries management. Spawning stock biomass (SSB) is the part of the biomass of the defined commercial fish stocks that takes part in the reproduction process. This is an important indicator of the biological health of these stocks.

What is the problem?

Overfishing

What is the Ecological Quality Objective (EcoQO)?

Fisheries have a major impact on the North Sea ecosystem, both directly by affecting targeted fish stocks and indirectly through affecting the food web. The EcoQO seeks to maintain safe levels of fish species by management of fisheries based on the precautionary principle.

The objective is to achieve safe levels of defined commercial fish stocks. This means ensuring that the SSB of these fish stocks is kept above the agreed precautionary limits used in fisheries management, so that we can be reasonably confident that the point at which there is a serious risk of stock collapse (the sustainable limit) is never reached. Precautionary limits have been set for 13 North Sea fish stocks (out of 15). There are also some stocks with restricted distribution in the Skagerrak and Kattegat (7 stocks) and the Eastern Channel (2 stocks). Several commercially important pelagic stocks straddle more than one Region (e.g. hake, blue whiting and mackerel) and are assessed at wider geographic scales than the North Sea. The harvesting strategies for all fish stocks should result in a high probability of maintaining them above the agreed limit in the long term. The safest way to achieve this is to keep the fishing mortality (the proportion of the population removed annually by fishing) below the levels that would in the long run result in a SSB below the agreed precautionary limit.

The EcoQO is based on the system of evaluations of the status of commercial fish stocks used in practical fisheries management. Many commercial fish populations in the North Sea are regularly monitored by North Sea countries and assessed annually by ICES as a basis for advice to fisheries managers. By using this information, the EcoQO contributes to the integration of fisheries and environmental issues as part of the application of the ecosystem approach to management.

Has the EcoQO been met?

The status of SSB in relation to the EcoQO for the stocks for which reference points have been defined is shown opposite for the period 1998 to 2009. Evaluations of fishing mortality are also shown. Since 1998, there has been an improvement in the status of several fish stocks in OSPAR Region II, including plaice and hake, which have both been the subject of recovery plans under the EU Common Fisheries Policy.

However, the status of cod stocks throughout the North Sea continues to be of concern, as both SSB and fishing mortality are still on the wrong side of the limits for sustainability. In 2009, SSB for North Sea herring was below the precautionary limit, although fishing pressure has been reduced. Excessive fishing pressure on mackerel (combined stock) increases the risk of SSB moving below the precautionary limit. The North Sea mackerel stock for EU waters, which is assessed within a combined stock covering western European waters, has been considered to be depleted since the 1970s. Herring and mackerel populations play a major role in the structure and function of the North Sea ecosystem. The North Sea and Eastern Channel stock of whiting is among the further eleven stocks in Region II whose status is uncertain either due to a lack of defined reference points or to inadequate data.

How does this affect the quality status?

Commercial fish species are important components of marine ecosystems because they are the most important part of the biomass which provides intermediate links in the food chain, between zooplankton and marine mammals and birds. Several commercial fish species have large populations in the North Sea (e.g. herring and mackerel) and are considered to have major roles in the structuring and functioning of the North Sea ecosystem and food web.



Photo: ©Paul Naylor

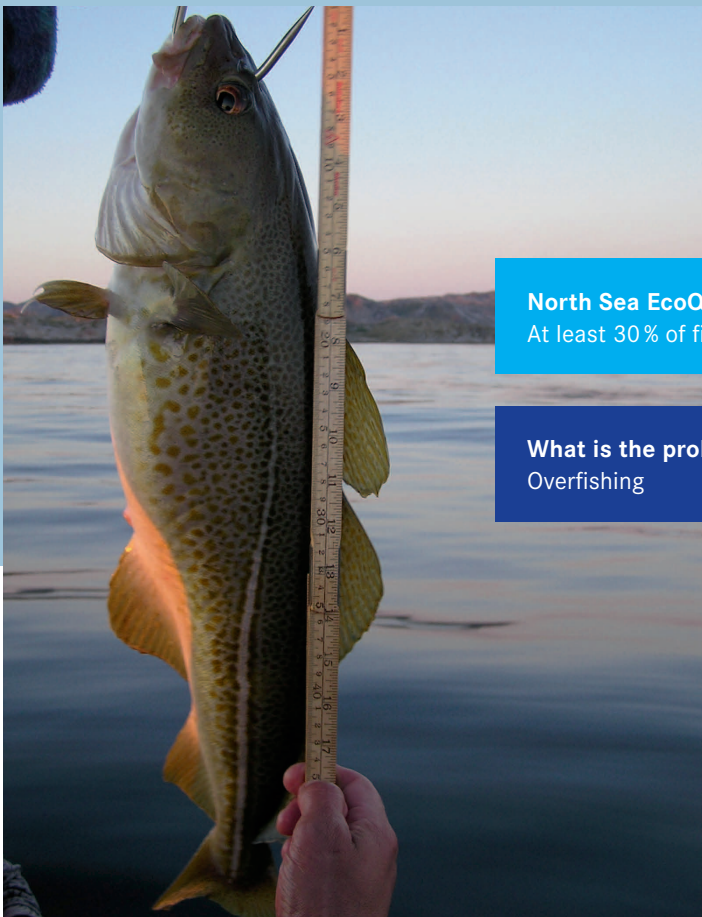
What happens next?

This EcoQO reflects the desired quality status of North Sea fish stocks as important components of the North Sea ecosystem. More data are needed to set precautionary limits for all commercially fished stocks. Management measures could include the regulation of the fishing effort, the catch levels and the establishment of protected areas. Since OSPAR recognises that questions of fisher-

ies management are more appropriately regulated by competent fisheries management authorities, OSPAR will urge these authorities to take appropriate measures for those stocks that fail to meet the objective. EU Member States and Norway should work together under the EU Common Fisheries Policy to achieve any fisheries-related objectives under the EU Marine Strategy Framework Directive.

Species	Stock	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Cod	North Sea, Eastern Channel, Skagerrak	!	!	!	!	!	!	!	!	!	Δ	!	!
Cod	Kattegat	!	!	!	!	!	!	!	?	?	?	?	?
Haddock	North Sea, Eastern Channel, Skagerrak	Δ	Δ	!	Δ	✓	✓	✓	✓	✓	✓	✓	✓
Saithe	North Sea, Skagerrak, west of Scotland	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Hake	Northern stock	Δ	!	Δ	✓	✓	Δ	Δ	✓	✓	✓	✓	✓
Plaice	North Sea	!	Δ	✓	Δ	Δ	Δ	Δ	✓	✓	✓	✓	✓
Plaice	Skagerrak, Kattegat	Δ	Δ	Δ	✓	Δ	Δ	Δ	?	?	?	?	?
Plaice	Eastern Channel	!	!	!	!	!	Δ	Δ	?	?	?	?	?
Sole	North Sea	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	✓	Δ	✓
Sole	Eastern Channel	Δ	Δ	Δ	✓	✓	✓	✓	✓	✓	✓	Δ	Δ
Herring	North Sea, Eastern Channel, Skagerrak	!	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	✓
Mackerel	Combined (Western, Southern, North Sea)	!	!	!	!	!	!	!	!	Δ	!	Δ	Δ
Norway pout	North Sea and Skagerrak	✓	✓	✓	✓	✓	✓	!	!	?	?	?	?
Blue whiting	Portugal to Norway	Δ	Δ	!	Δ	Δ	!	!	!	!	Δ	Δ	✓

Spawning stock biomass		Fishing mortality	
<B _{lim}	Reduced reproductive capacity	!	>F _{lim} Harvested unsustainably
>B _{lim} and <B _{pa}	Risk of reduced reproductive capacity	Δ	<F _{lim} and >F _{pa} At risk of being harvested unsustainably
>B _{pa}	Full reproductive capacity	✓	<F _{pa} Harvested sustainably
	No assessment	?	No assessment



Increase proportion of large fish in the fish community

North Sea EcoQO

At least 30 % of fish (by weight) should be greater than 40 cm in length

What is the problem?

Overfishing

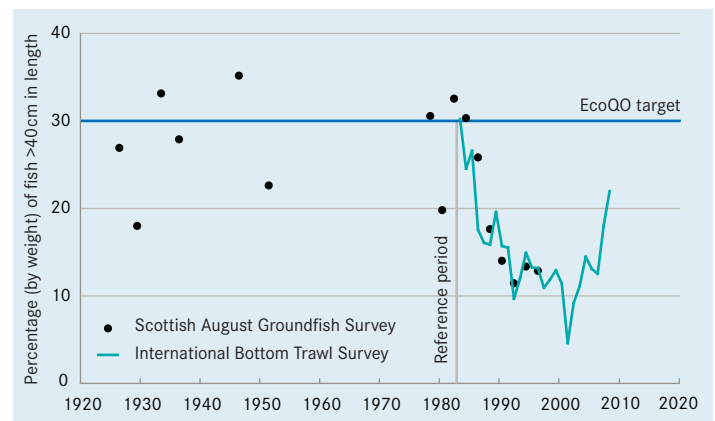
Photo: © Eva Degré

What is the Ecological Quality Objective (EcoQO)?

The average length of fish can be used to indicate the impact of fishing on the fish community. This is because larger species of fish and larger and older individuals are generally more likely to be caught by fisheries than smaller species and individuals. This means that the relative abundance of small and early maturing fish species increases as result of overfishing. This effect can be monitored through changes in the average length of fish in the catch per year, using species from the International Bottom Trawl Survey (IBTS) coordinated every year by ICES in the North Sea. The reference period for the EcoQO is the early 1980s, a period when stock assessments suggested that stocks were not being overexploited and that fishing was at sustainable levels. Analysis of the Scottish August Groundfish Survey (SAGFS), a long-running survey which ended in 1997, confirmed that 30 % of fish at greater than 40 cm in length is an appropriate management target. The EcoQO seeks to halt the decline in the percentage of large fish below the objective and to begin to reverse the negative trend by 2010.

Has the EcoQO been met?

From the early 1980s, the percentage of fish greater than 40 cm declined from around 30 % to a low point of less than 5 % in 2001, since then it has recovered to around 22 % in 2008. This is an improvement, but there is still some way to go to reach the EcoQO.



How does this affect the quality status?

Restoring the percentage of large fish in fish communities would not only mean healthier fish communities, but would also improve fisheries yields. The most relevant human activity to this EcoQO is fishing, but the reproductive success and life cycle of fish may be, less directly, influenced by land-based sources of discharges and emissions of chemicals.

What happens next?

Continued analysis of data from demersal trawl surveys is needed to determine whether current measures continue to move this index towards the objective. If not, further regulation of the spatial and temporal distribution and intensity of fishing effort could be called for. Additional management measures could include the establishment of protected areas.



Eliminate eutrophication

North Sea EcoQO

A marine environment where eutrophication does not occur

What is the problem?

Eutrophication due to excess nutrients from human sources

Photo: ©Yves Gladu

What is the Ecological Quality Objective (EcoQO)?

Eutrophication occurs when the enrichment of water by nutrients, specifically phosphate and nitrogen, leads to an accelerated growth of algae and plants causing an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned. The EcoQO system includes a general (over-arching) EcoQO for eutrophication, which represents the overall objective of the OSPAR Eutrophication Strategy to achieve and maintain a healthy marine environment where eutrophication does not occur by 2010. This EcoQO is based on an integrated subset of five EcoQOs for eutrophication. The five specific EcoQOs for winter nutrients, phytoplankton chlorophyll *a*, phytoplankton indicator species, oxygen and benthos correspond to a selection of cause-effect related assessment parameters and assessment levels as applied across the OSPAR area under the Common Procedure for assessing the eutrophication status of an area.

Has the EcoQO been met?

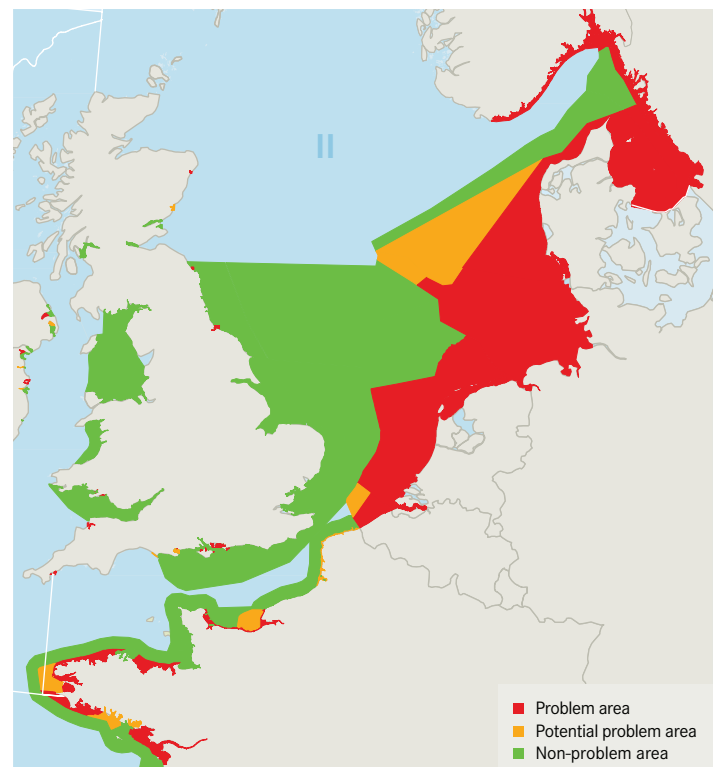
The overarching objective is not met in several parts of the OSPAR area. Eutrophication problems are more apparent in coastal areas than in offshore waters, that is, closer to the main nutrient sources and where environmental conditions make them susceptible to eutrophication. For the North Sea, a number of coastal waters have been classified as problem areas with regard to eutrophication, in particular off Belgium, Denmark, France, Germany, the Netherlands, Norway, Sweden and the UK (estuaries).

How does this affect the quality status?

The EcoQO seeks to combat the negative effects of eutrophication on marine ecosystems which include: algal blooms, increased growth of macroalgae, increased sedimentation and oxygen consumption, oxygen depletion in the bottom water and sometimes the death of benthic animals and fish. Additionally, there is some evidence that changes in nitrogen to phosphorus ratios can affect species composition and food web structure.

What happens next?

The integrated set of EcoQOs is in a testing phase and further work is required to modify the EcoQOs for their application to specific regions. In some areas, current monitoring is not sufficient or coherent and is lacking in spatial and temporal coverage. Thus there is a need to improve monitoring. In this respect, it will be important to coordinate with fisheries agencies that are monitoring nutrients and other variables in order to describe environmental conditions and productivity. Likewise there is a need to make use of other monitoring systems for observing surface algal blooms, such as the routine airborne surveys for spotting oil pollution carried out under the Bonn Agreement. This would have advantages over satellite-based observation where cloud coverage is very often a hindrance.



Reduce the level of imposex in dogwhelks and other marine gastropods

North Sea EcoQO

The average level of imposex in a sample of not less than 10 female dogwhelks (*Nucella lapillus*) should be consistent with exposure to TBT concentrations below the environmental assessment criterion for TBT. Where *Nucella lapillus* does not occur naturally or where it has become extinct, other species may be used.

What is the problem?

Pollution due to TBT-containing anti-fouling paints on ships



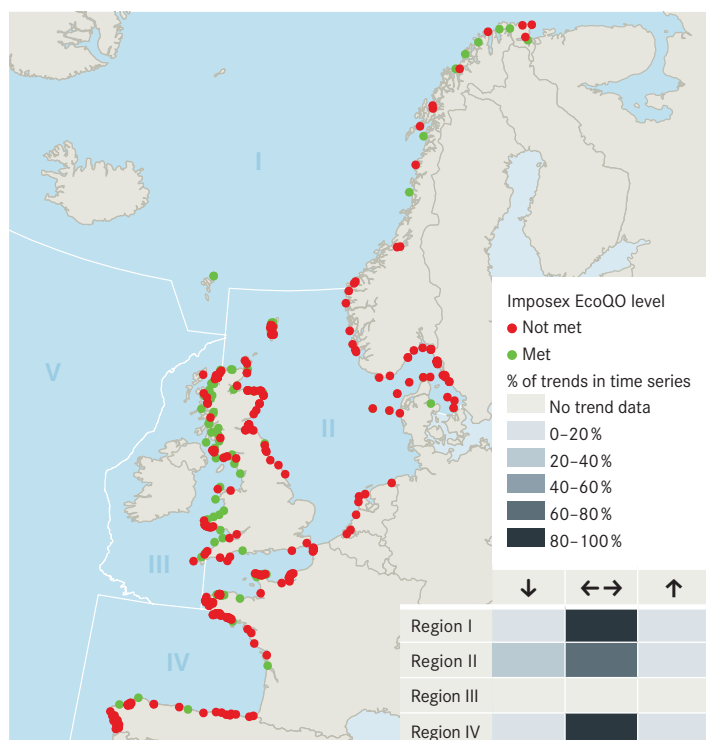
Photo: ©Steve Trehella/FLPA

What is the Ecological Quality Objective (EcoQO)?

The dogwhelk is a carnivorous sea snail that is found on most rocky shores in the OSPAR area. Dogwhelks and related snail species are extremely sensitive to the harmful effects of tributyltin (TBT), which has been extensively used as an anti-fouling agent in ship paints. Depending on the concentration of TBT in the seawater, female dogwhelks develop non-functional male characteristics (such as a male sex organ) in a pathological condition called imposex. This condition prohibits the snails from reproducing which leads to a decline or even disappearance of snail populations. Because of their extreme sensitivity, dogwhelks are used as an indicator species to measure the effects of TBT on the marine ecosystem.

Has the EcoQO been met?

Since 2003, when monitoring began for the entire OSPAR area, the intensity of TBT-specific effects on the dogwhelk and other marine snails has reduced in OSPAR Region II and all other OSPAR Regions, and there are few monitoring sites where such effects are increasing. While the situation is improving, TBT-specific effects are still found over large parts of the OSPAR area and the EcoQO is mostly not met in the North Sea. There is a clear relationship with shipping, with high effect levels near some large harbours (e.g. Rotterdam, Clydeport, Vigo) and lower levels in areas with less large vessel traffic. But even in areas of less large vessel traffic, harbours can have a noticeable impact, highlighting the importance of local sources and historic contamination of harbour sediments.



How does this affect the quality status?

Reductions in the effects of TBT on dogwhelks indicate reduced TBT-pollution and associated pressure on numerous marine species from the presence of TBT. Low-level exposure of aquatic organisms, such as mussels, clams and oysters, to TBT may cause structural changes, growth retardation and death. TBT is also highly toxic to crustaceans. Moreover, TBT bioaccumulates in the food chain posing a potential hazard to birds, sea mammals and even humans.

What happens next?

Measures within the International Maritime Organisation and the European Union prohibit at global and European level respectively the further use of TBT-containing paints on ships. Implementation of these measures should in time lead to the elimination of TBT from the marine environment and improve the water quality. As a result, an improvement in the condition of populations of dogwhelks should be expected over the next 10 years. OSPAR continues to monitor and will, if necessary, propose additional measures.



Reduce the number of oiled guillemots

North Sea EcoQO

The average proportion of oiled common guillemots in all winter months (November to April) should be 20% or less by 2020 and 10% or less by 2030 of the total found dead or dying in each of 15 areas of the North Sea over a period of at least 5 years.

What is the problem?

Oil pollution

Photo: ©Kees Camphuysen

What is the Ecological Quality Objective (EcoQO)?

Guillemots (*Uria aalge*) are deep-diving seabirds that live mostly at the sea surface. They are common and widespread throughout the OSPAR area. Guillemots are very sensitive to oil pollution. A guillemot will soon die once it is oiled, due to hypothermia and because it is unable to forage and feed. These dead birds wash ashore and the proportion of stranded guillemots that are oiled can be used as an indication of oil pollution in specific areas at sea.

Has the EcoQO been met?

In some parts of the North Sea, over 90% of all stranded common guillemots were oiled until a few decades ago. Since then rates of oiled birds have declined substantially in most areas and are still declining. This is thought to be a result of better enforcement of measures (e.g. under the MARPOL Convention of the International Maritime Organisation), improved awareness, and the introduction of port reception facilities for waste oils. However, the EcoQO is achieved in very few parts of the North Sea. Current rates of oiled birds in the North Sea vary significantly from over 50% in the southern North Sea (the Netherlands, Belgium and the south-east of England) to approximately 4% in Orkney in the northern North Sea.

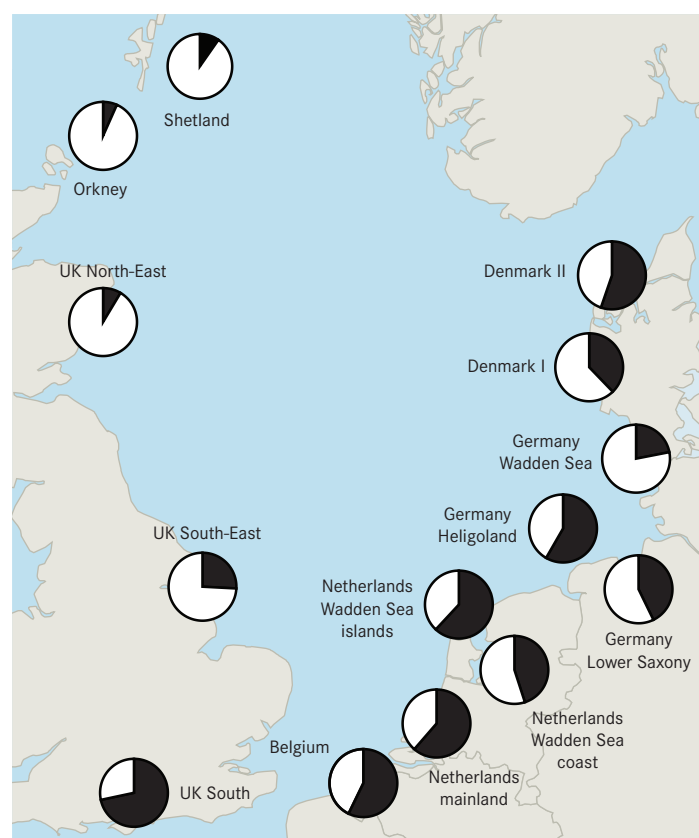
The main inputs of mineral oil originate from operational discharges from ships, land-based sources and, to a lesser extent, from the offshore oil industry. This partly explains why higher bird oiling rates are seen near busy shipping lanes (southern North Sea, Channel). Accidents at sea are a less frequent source.

How does this affect the quality status?

Oil pollution is a problem for many marine species and habitats. Reaching the EcoQO, e.g. having a low level of oil pollution, would benefit all those affected.

What happens next?

Since the discharge of oil or oily mixtures that cause slicks is prohibited in the North Sea, management measures need to focus on the further enforcement of current regulations and raising awareness among operators of vessels to reduce illegal oily discharges. Effective oil recovery may lead to cessation of illegal discharges.



Mean oiled rate (% oiled) in common guillemots in the North Sea in the period from 1997/1998 to 2001/2002

Reduce levels of hazardous substances in seabird eggs



North Sea EcoQO

Mercury: The average concentrations of mercury in the fresh mass of ten eggs from separate clutches of the common tern (*Sterna hirundo*) and Eurasian oystercatcher (*Haematopus ostralegus*) breeding adjacent to certain estuaries should not significantly exceed concentrations in the fresh mass of ten eggs from separate clutches of the same species breeding in similar, but not industrial, habitats.

Organochlorines: For each site, the average concentrations in fresh mass of the eggs of the common tern (*Sterna hirundo*) and Eurasian oystercatcher (*Haematopus ostralegus*) should not exceed: 20 ng/g of PCBs; 10 ng/g of DDT and metabolites; and 2 ng/g of HCB (hexachlorobenzene) and of HCH (hexachlorocyclohexane).

What is the problem?

Input of mercury and organochlorines into the marine environment. Mercury is a naturally occurring highly toxic metal that has been dispersed widely in the environment by human activities. Organochlorines are man-made chemicals that are persistent in the environment. Both mercury and organochlorines tend to accumulate in the marine environment.

Photo: ©Sharpshot/Fotolia

What is the Ecological Quality Objective (EcoQO)?

Many coastal areas are important habitats for seabirds and are protected under the EC Birds and Habitats Directive. These areas are at the same time under pressure from pollution due to environmental chemicals. This contamination affects the coastal food web and accumulates in species at higher trophic level, including birds. Several studies have shown seabird eggs, including those of migrating species like terns, to be good indicators of local contamination with hazardous substances since concentrations in eggs tend to reflect contaminant uptake by the female foraging close to the colony in the days prior to egg-laying. The seabird egg has also been proven to be a favourable matrix for analysing environmental chemicals. The removal of eggs has only a minor impact on the breeding success of the studied population.

Has the EcoQO been met?

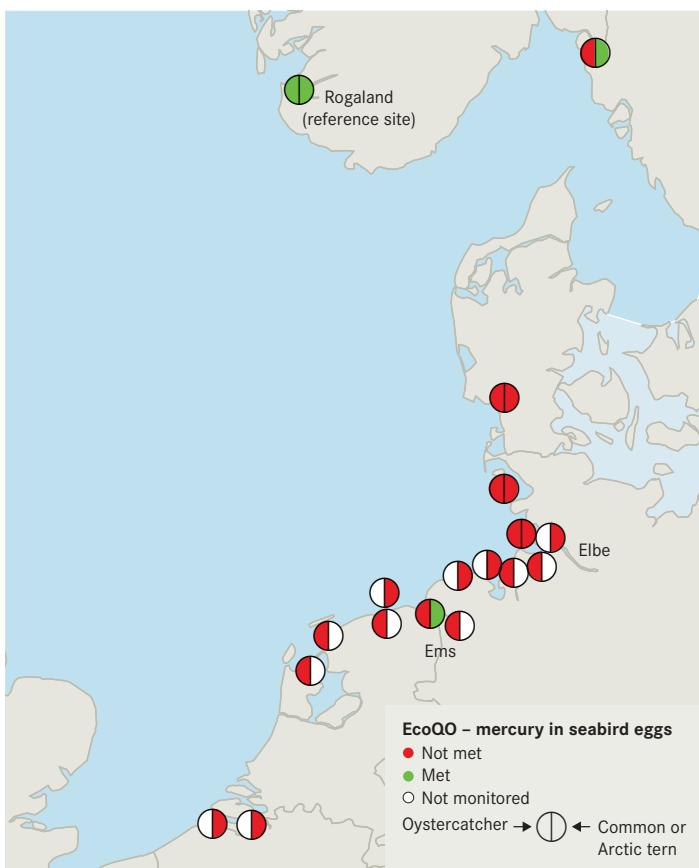
Monitoring results are available from a pilot study along the continental coast of the North Sea (Belgium, Netherlands, Germany, Denmark) and the coasts of southern Norway and Sweden. In Norway and Denmark, Arctic tern eggs were sampled instead of common tern eggs. Similar contaminant levels are thought to occur in the eggs of both species. The EcoQO for mercury is slightly exceeded at most sites, being met at one site in the Ems estuary (Netherlands) and sites in Norway and Sweden. The EcoQO for organochlorines was not met at any of the monitored sites. This was because concentrations of PCBs and DDT exceeded the level of the EcoQO at all sites, approaching concentrations close to the EcoQO only in Norway and Sweden. In contrast, concentrations of HCB and HCHs were below or close to the level of the EcoQO at most sites, but are substantially elevated at sites in the outer Elbe estuary and to a lesser degree in the Ems estuary. A similar spatial pattern can be seen in DDT concentrations, but most sites were above the level of the EcoQO.

Concentrations in common tern eggs were generally higher than in eggs of Eurasian oystercatchers, reflecting their higher position in the food chain and consequent bioaccumulation.

Long-term data from the Wadden Sea (since 1981) show a general decline of concentrations of all substances monitored in eggs of common tern and oystercatcher at estuarine and coastal sites.



Photo: ©Joe Gough/Fotolia



How does this affect the quality status?

Persistent chemicals that are also toxic, such as organochlorines and mercury, may affect many aspects of an ecosystem. For instance, the reproduction of seabirds may be affected by eggshell thinning, which in turn makes eggs vulnerable to damage or results in death of embryos. Since mercury and organochlorines accumulate in the food chain, top predators and humans run the risk of exposure to high levels, leading to serious health problems.

What happens next?

Regulatory action to reduce the main discharges, emissions and losses of mercury and organochlorines to the environment has been taken. However, the persistent nature of these chemicals, combined with their possible remobilisation within the environment, accounts for the chemical burden in seabird eggs which exceeds the EcoQO value in a number of cases. Continued assessment of this EcoQO in the North Sea is required in order to decide on further management measures or approaches.

Reduce levels of litter (plastic particles) in fulmar stomachs



North Sea EcoQO

There should be less than 10% of northern fulmars (*Fulmarus glacialis*) having more than 0.1 g plastic particles in the stomach in samples of 50 to 100 beach-washed fulmars found from each of 4 to 5 areas of the North Sea over a period of at least five years.

What is the problem?

Litter in the marine environment

Photo: ©John Dunn/FRS Marine Laboratory

What is the Ecological Quality Objective (EcoQO)?

The northern fulmar has its distribution in the northern part of the OSPAR area, including in the Greater North Sea (OSPAR Region II). Fulmars forage exclusively at sea, capturing prey from the sea surface. Fulmars frequently ingest floating litter, including plastic objects presumably because they are mistaken for food. Fulmars do not regurgitate plastic particles but accumulate them. The content of plastic particles in their stomachs can therefore be used as an indicator for the amount of litter encountered at sea. Ingested plastics may reduce food intake and the ability to digest food leading to a deteriorated body condition associated with increased mortality and reduced breeding success.

Has the EcoQO been met?

Over the period 2002–2006, the stomachs of 1090 beached fulmars from the North Sea were analysed. The percentage of fulmars with more than 0.1 g plastic in the stomach ranged from about 45% to over 60% per area. The Channel area was the most heavily polluted while the Scottish Islands were the 'cleanest' region with a mean mass for plastics in fulmars of about a third of the level encountered in the Channel. Currently the 10% level of the EcoQO probably only occurs in Arctic populations. A long-term monitoring series for the Netherlands shows a significant reduction in plastic abundance from 1997 to 2006, mainly through a reduction in raw industrial plastics.

How does this affect the quality status?

Litter causes problems in the marine environment for a number of species; animals die because of ingestion of litter or get entangled in larger pieces of litter. Meeting this EcoQO would indicate a reduction of litter at sea which would be of benefit to many marine species and reduce the amount of litter washed up on beaches.

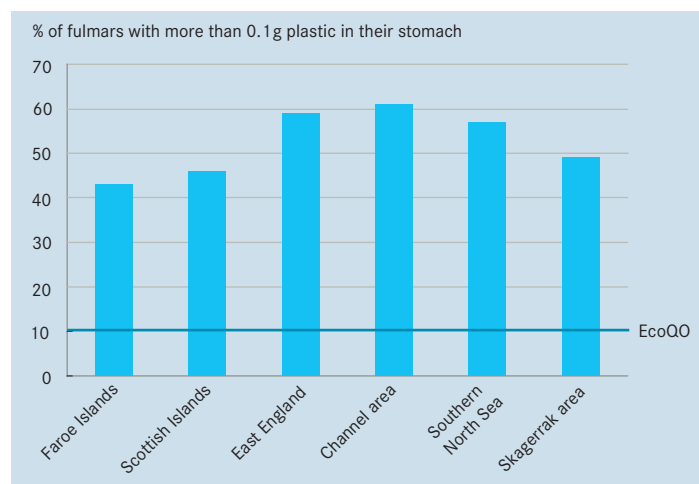
What happens next?

In order to meet the EcoQO, further refinements of the implementation of the EU Directive on Port Reception Facilities (2000/59/EC) and MARPOL Annex V may be needed as well as specific measures to reduce lost fishing gear.



Photo: ©Kees Camphuysen

Example of the stomach contents of a fulmar. Ruler shows centimeters



Percentage of fulmars with more than 0.1 g plastic found in their stomach in each sub-region over the 2002–2006 period

Conclusions and recommendations



Photo: © Sally Sharrock

The EcoQO system provides a clear set of objectives and targets for the quality of different ecosystem components in response to a range of human pressures. Development and implementation of EcoQOs has shown that some are more robust than others and provided valuable experience in developing tools and monitoring programmes via regional cooperation in fields beyond OSPAR's established pollution programmes.

The most important lessons learnt

The EcoQO system can be enforced by a more thorough implementation by all North Sea countries.

The set of EcoQOs does not yet cover all components and processes in the marine environment and hence does not yet provide a comprehensive assessment of the overall status of the marine environment in the North Sea.

What happens next?

The results of the considerable work by OSPAR on EcoQOs, both over the past 15 years and in the future, need to be linked with requirements to assess Good Environmental Status (GES) via the eleven quality descriptors set out in the Marine Strategy Framework Directive.

The EcoQO system needs to be consolidated to provide a more comprehensive coverage of ecosystem components and pressures, which will help to strengthen assessments of the overall status of the North Sea. The EcoQO system needs to be extended to other OSPAR Regions and for this purpose existing EcoQOs may require some adaptation. Additional EcoQOs could be developed that are specific to each of the OSPAR Regions. For example in Region I Norway has developed an EcoQO related to the thick-billed murre (*Uria lomvia*) as a measure of the impact of pollutants. For Region V, an EcoQO related to by-catch of loggerhead turtles (*Caretta caretta*) and leatherback turtles (*Dermochelys coriacea*) could be developed. The EcoQO system needs to be supported by a coordinated monitoring programme throughout the OSPAR area. Its results will provide a basis for developments in the management of the marine environment.

EcoQOs under development

In addition to the nine more advanced EcoQOs described above, work is in progress on further EcoQOs towards a more comprehensive coverage of the ecosystem. The following EcoQOs are currently being developed:

- Seabird population trends
- Quality and extent of threatened and/or declining habitats
- Litter on the beach



The OSPAR System of **Ecological Quality Objectives** for the North Sea

Update 2010

OSPAR publications relating to Ecological Quality Objectives

This brochure updates the summary report on the OSPAR system of Ecological Quality Objectives for the North Sea. Publication 404/2009

Evaluation of the OSPAR system of Ecological Quality Objectives for the North Sea. Publication 406/2009

EcoQO Handbook. Publication 307/2007

Report on the North Sea Pilot Project on Ecological Quality Objectives. Publication 239/2006

Background Document on the EcoQO for

- Healthy seal populations. Publication 245/2005
- By-catch of harbour porpoises. Publication 244/2005
- Large fish. Publication 356/2008
- Safe fish stocks. Publication 243/2005
- Eutrophication. Publication 229/2005
- TBT-specific effects (imposex). Publication 247/2005
- Oiled guillemots. Publication 252/2005
- Contaminated seabird eggs. Publication 331/2007
- Marine litter. Publication 355/2008

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The OSPAR Commission is the body established under the Convention for the Protection of the Marine Environment of the North-East Atlantic through which fifteen Governments of Western Europe, together with the European Community, cooperate to protect the marine environment of the North-East Atlantic.

The OSPAR area and its five Regions

