OSPAR COMMISSION

Evaluation of the OSPAR system of Ecological Quality Objectives for the North Sea (update 2010)

Biodiversity Series

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OSPAR Convention

The Convention for the Protection of the Marine Environment of the North-East Atlantic (the “OSPAR Convention”) was opened for signature at the Ministerial Meeting of the former Oslo and Paris Commissions in Paris on 22 September 1992. The Convention entered into force on 25 March 1998. It has been ratified by Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland and the United Kingdom and approved by the European Community and Spain.

Convention OSPAR

La Convention pour la protection du milieu marin de l'Atlantique du Nord-Est, dite Convention OSPAR, a été ouverte à la signature à la réunion ministérielle des anciennes Commissions d'Oslo et de Paris, à Paris le 22 septembre 1992. La Convention est entrée en vigueur le 25 mars 1998. La Convention a été ratifiée par l'Allemagne, la Belgique, le Danemark, la Finlande, la France, l’Irlande, l’Islande, le Luxembourg, la Norvège, les Pays-Bas, le Portugal, le Royaume-Uni de Grande Bretagne et d’Irlande du Nord, la Suède et la Suisse et approuvée par la Communauté européenne et l’Espagne.

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Contents

Executive Summary

Committed to the Ecosystem Approach to management OSPAR has gained fifteen years of experience in developing a conceptual framework for ecological indicators and objectives and applying these to the North Sea as a test case. This document focuses on the evaluation of the first set of Ecological Quality Objectives (EcoQOs) which are being applied in the North Sea and provides suggestions for future steps.

The main added value of the EcoQO system lies at present in providing examples of objectives and indicators that can be used to define Good Environmental Status (GES) under the Marine Strategy Framework Directive (MSFD). Using the developing framework for biodiversity monitoring and assessment, led by the UK, they can contribute to a well-structured and effective monitoring programme. However, the generic qualitative descriptors of GES are only partly addressed by the current EcoQOs. Therefore, OSPAR needs to start filling the gaps as soon as possible, using the same framework for biodiversity monitoring and assessment to identify the most important issues. Also, in view of the MSFD, OSPAR needs to work on a complete and coherent set of EcoQOs for OSPAR regions beyond the North Sea.

The evaluation of the current set of EcoQOs shows that very few are being met. In a number of cases monitoring and/or reporting is inadequate to enable a full evaluation. There is, therefore, a need to improve the implementation of EcoQOs, and in particular monitoring across the North Sea to improve this evaluation. Most of the EcoQOs would gain in strength and usefulness if all Contracting Parties invested the necessary resources to support the EcoQOs and re-emphasised their commitment to maximise the relevance for the European MSFD. Recommendations are made for improved implementation and adjustment of some of the EcoQOs.

Recommendations are made on the relation between EcoQOs and the GES, on future development, communication and commitment.

Better communication of the EcoQO system is needed, primarily to key marine user groups, but also to the wider public. To support this, an illustrative document on the OSPAR system of Ecological Quality Objectives for the North Sea has been prepared – OSPAR Commission 2009/404 (update 2010).

The Annexes to this report provide evaluations of the individual EcoQOs on spawning stock biomass of commercial fish species, grey and common seal, harbour porpoise, oiled common guillemots, plastic particles in the stomachs of beached seabirds, contaminants in seabird eggs, changes in the proportion of large fish, imposex in dogwhelks and eutrophication. Certain sections of the report and Annexes have been updated in 2010 to include further available information in support of the OSPAR QSR 2010.

Récapitulatif

OSPAR s'est engagée à appliquer l'approche écosystémique adoptée pour la gestion et jouit de quinze années d'expérience dans le développement d'un cadre de travail conceptuel pour les indicateurs et les objectifs écologiques et leur application à la mer du Nord, à titre d'étude de cas. Le présent document se concentre sur l'évaluation de la première série d'Objectifs de qualité écologique (EcoQO) qui sont appliqués dans la mer du Nord et suggère de futures étapes.

La principale valeur ajoutée du système d'EcoQO consiste actuellement à donner des exemples d'objectifs et d'indicateurs utilisables pour définir le Bon état écologique (GES) dans le cadre de la Directive cadre de stratégie marine (MSFD). Ils peuvent contribuer à un programme de surveillance efficace et bien structuré, en utilisant le cadre de travail en cours de développement pour la surveillance et l'évaluation de la biodiversité, piloté par le Royaume-Uni. Les EcoQO actuels n'abordent cependant que partiellement les descripteurs qualitatifs génériques du GES. Il convient donc qu'OSPAR commence à combler les lacunes, dès que possible, en utilisant le même cadre de travail que pour la surveillance et l'évaluation de la biodiversité pour déterminer les questions les plus importantes. De plus, OSPAR devra élaborer une série complète et cohérente d'EcoQO pour les régions OSPAR situées au delà de la mer du Nord, en raison de la MSFD.

L'évaluation de la série actuelle d'EcoQO révèle que très peu d'entre eux sont atteints. Dans un certain nombre de cas la surveillance et/ou la notification ne sont pas adéquates et ne permettent pas une évaluation complète. Il est donc nécessaire d'améliorer la mise en oeuvre des EcoQO, et en particulier la surveillance dans la mer du Nord pour obtenir une meilleure évaluation. La plupart des EcoQO pourraient être plus forts et plus utiles si toutes les Parties contractantes investissent les ressources nécessaires permettant de les soutenir et renouvellent leur engagement de maximiser la pertinence pour la MSFD européenne. Le présent document comporte des recommandations pour améliorer la mise en œuvre et l'adaptation de certains EcoQO et sur la relation entre les EcoQO et le GES, le développement, la communication et les engagements futurs.

Il convient d'améliorer la communication du système d'EcoQO aux groupes principaux exploitants des océans essentiellement mais aussi au grand public. A l'appui de ceci, un document illustratif sur le système d'EcoQO OSPAR pour la mer du Nord a été préparé, il s'agit de la publication OSPAR 2009/404 (actualisée en 2010).

Les annexes au présent rapport comportent les évaluations des EcoQO individuels sur la biomasse du stock reproducteur des espèces halieutiques commerciales, le phoque gris et le phoque commun, le marsouin, le guillemot commun mazouté, les particules de matière plastique dans les estomacs des oiseaux de mer, les changements intervenus dans la proportion de gros poissons, l'imposex du pourpre et l'eutrophisation. Certains parts de ce rapport et de ses annexes ont été actualisé en 2010 avec des informations supplémentaires disponibles afin d'étayer the QSR 2010 d'OSPAR.

1. Introduction

1.1 Background

The Ecosystem Approach is becoming a leading principle for the management of the North Sea since the 1990s. Particularly OSPAR and consecutive North Sea Ministerial Meetings, starting with the 1997 Intermediate Ministerial Meeting on the Integration of Fisheries and Environmental Issues, called for development and implementation of this concept. In 2002 the OSPAR Commission and the International Council for the Exploration of the Sea (ICES) accepted a joint invitation from the fifth North Sea Conference to develop a North Sea pilot project on Ecological Quality Objectives (EcoQOs). The 2003 joint OSPAR/HELCOM Ministerial meeting adopted a statement "Towards an Ecosystem Approach to the Management of Human Activities" (Report of the First Joint Meeting of the Helsinki and OSPAR Commissions, Annex 5).

The Ecosystem Approach puts people and their natural resource use practices at the centre of decision-making. However, applying the approach is not straightforward and operational tools need to be developed. EcoQOs are being developed to provide objectives, and thus operational tools, as part of the Ecosystem Approach. EcoQOs also require indicators for monitoring whether the objective is being met and whether progress is being made in the right direction or not. These indicators are an integral part of the EcoQO system.

OSPAR, in collaboration with ICES, has been developing the EcoQO system since 1992. EcoQOs provide a means by which OSPAR Contracting Parties in the North Sea define desired qualities of the marine environment, can identify measures for the management of human activities that affect those qualities and, where there is a need, address gaps or seek improvements. EcoQOs specify the desired state of an ecological component or mechanism. The Handbook for the Application of Ecological Quality Objectives in the North Sea (OSPAR publication 2007/307) gives an overview of the EcoQO system.

The EcoQO system is designed in a manner that enables OSPAR to consider different components of the marine environment and to build an overall picture of the state of the marine environment. The approach to defining the EcoQO system is firstly to identify the main components (*e.g.* species, habitats functions and ecological processes) of the marine ecosystem (the ecological quality issues listed in table 1). The next step is to identify the main impacts on these components from human uses of the sea (*e.g.* pollution, overfishing, eutrophication) and the indicators of these impacts that can be monitored. For each indicator the desired level of quality is defined as an Ecological Quality Objective (EcoQO).

Fifteen years of EcoQO development have delivered a limited set of EcoQOs that have been tested in practice by North Sea countries. This report is an evaluation of their performance that includes recommendations for monitoring and needs for harmonisation and additional management measures. This is important for the forthcoming OSPAR Quality Status Report 2010 that will use EcoQOs for the first time to inform the overall assessment. Moreover, this evaluation is also important for the implementation of the EU Marine Strategy Framework Directive (MSFD, 2008/56/EC) that requires determination of its main objective ‘Good Environmental Status’ (GES), mainly on the basis of the generic descriptors in Annex 1 of the Directive, by 2012. Subsequent programmes of measures should aim at achieving Good Environmental Status in 2020.

1.2 Process

The Netherlands and Norway lead the overall EcoQO process. Several Contracting Parties have the lead on one or more individual EcoQOs or EcoQOs under development. All lead countries (Netherlands, Norway, United Kingdom, Belgium, Germany and Portugal) are represented in an Intersessional Correspondence Group on-EcoQOs (ICG-EcoQOs), which has played a key role in the

development of the EcoQO process. All North Sea Contracting Parties were requested to contribute to the evaluation and reporting on EcoQOs in the North Sea. These Contracting Parties are: Norway, Sweden, Denmark, Germany, the Netherlands, Belgium, France and the United Kingdom.

However, due to lack of capacity in ICG-EcoQOs and lack of input of requested data by certain Contracting Parties, the development of EcoQOs has been a slow process.

The structure of OSPAR, including the Biodiversity Committee (BDC), is currently being reviewed. The evaluation of the EcoQOs and recommendations are made on the basis of the current structure of OSPAR. If the structures changes, ICG-EcoQOs notes that adaptation of the recommendations might be necessary.

Table 1: *Ecological quality issues and the EcoQOs that correspond to these issues*[1].

Ecological Quality Issue	Ecological Quality Objective
Commercial fish species	Maintain the *spawning stock biomass* above precautionary reference points for commercial fish stocks agreed by the competent authority for fisheries management.
Marine mammals	*Seal Population Trends* (a) There should be no decline in harbour seal population size within any of eleven sub-units of the North Sea. (b) There should be no decline in pup production of grey seals within any of nine sub-units of the North Sea.
	Annual *by-catch of harbour porpoises* should be reduced to below 1.7% of the best population estimate.
Seabirds[2]	The *proportion of oiled common guillemots* should be 10% or less of the total found dead or dying in all areas of the North Sea.
	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.
	Concentrations of mercury in the eggs of Common Tern (*Sterna hirundo*) and Eurasian Oystercatcher (*Haematopus ostralegus*) breeding adjacent to the eight industrialised estuaries, should not exceed concentrations in eggs of the same species breeding in similar habitats in south-western Norway and in the Moray Firth. Concentrations of organochlorines in the eggs of Common Tern (*Sterna hirundo*) and Eurasian Oystercatcher (*Haematopus ostralegus*) breeding adjacent to the eight industrialised estuaries, should not exceed set values.
Fish communities	At least 30% of fish (by weight) should be greater than 40 cm in length
Benthic communities	(a) The average level of *imposex* (development of male characteristics by females) *in female dog whelks* should be consistent with specified levels. (b) There should be *no kills in benthic animal species* as a result of oxygen deficiency and/or toxic phytoplankton species.
Plankton community	(a) Maximum and mean *phytoplankton chlorophyll a* concentrations during the growing season should remain below specified limits. (b) Area-specific *phytoplankton species that are indicators of eutrophication* should remain below specified limits
Threatened and/or declining species	*Under development*
Threatened and/or declining habitats	*Under development*
Eutrophication	*All parts of the North Sea should have the status of non-problem areas with regard to eutrophication by 2010*
	Winter concentrations of dissolved inorganic nitrogen and phosphate should remain below specified limits.
	Maximum and mean phytoplankton chlorophyll a concentrations during the growing season should remain below specific limits
	Area- specific phytoplankton species that are indicators of eutrophication should remain below specific limits
	Oxygen concentration should remain above specified limits.

1 *(NB. Some eutrophication EcoQOs correspond to more than one issue*)

2 *Additional seabird EcoQOs are under development for seabird population trends, and local sand eel availability for black legged kittiwakes*

1.3 Aim of the document

The document presented here focuses on the evaluation of the first set of EcoQOs for the North Sea. The document provides suggestions for future steps to come to a complete and coherent set of EcoQOs for within and beyond the North Sea area using the concept of Good Environmental Status as the main basis for the further development of the EcoQO system.

2. Evaluation of the EcoQO system and relation with Marine Strategy Framework Directive (MSFD)

2.1 Aims and value of the EcoQO system

The aims of the EcoQO system, and thus their potential added value, are to:

a. define in measurable objectives the 'envelope' within which the general OSPAR goal of a healthy and sustainable marine ecosystem lies;

b. give an integrated view on how the OSPAR Strategies together can deliver this general goal;

c. contribute to the development of indicators, with reference levels, targets and limits that will be required to apply the generic qualitative descriptors of GES for the MFSD at the (sub-)regional level;

d. provide tools for integrated assessments of the quality status of the OSPAR Regions for the QSR 2010 (which will contribute to the initial assessment required under the MSFD);

e. structure strategic biological monitoring using the DPSIR (Driving forces-Pressure-State-Impact-Response) model;

f. communicate objectives and increase environmental awareness.

This evaluation attempts to assess progress in realising these added values and what further steps are needed for the QSR 2010 and the development of the definition of GES by 2012.

a. Define in measurable objectives the 'envelope' within which the general OSPAR goal of a healthy and sustainable marine ecosystem lies

In recent years efforts have focused mainly on developing the initial set of EcoQOs, with emphasis on their performance and practical consequences of implementation in terms of monitoring needs, including harmonisation, the needs for additional management measures and the financial implications. Several other EcoQOs are under development in order to further complete the original list of Issues and Quality Elements, but this work has been given less priority.

At present, there are still major gaps and we are not able yet to assess to what extent OSPAR has delivered the main aims. The development of the MSFD has raised questions on the usefulness of the original EcoQO system in the further development of EcoQOs. Alternatively, GES and its generic qualitative descriptors could be accepted as a leading framework. Given the slow progress of EcoQO development (and particularly implementation) since 1992, OSPAR needs to identify an overall plan with priority issues for each OSPAR Region. Ideally, these should address the most important aims of both the OSPAR Strategies and the GES descriptors for that region. The work needed to deliver such a prioritisation is included in the work to develop biodiversity monitoring and assessment to underpin an ecosystem approach.

b. Give an integrated view on how the OSPAR Strategies together can deliver this general goal

The OSPAR Committees on eutrophication (EUC), assessment and monitoring (ASMO) and biodiversity (BDC) are formally responsible for the development of the EcoQOs relating to their work. ASMO and EUC report to BDC as the co-ordinating Committee. Work in OSPAR Committees is targeted at reaching the goals laid out in the relevant strategy; Quality Status Reports (QSRs) are the only OSPAR assessment products that integrate these strands of work. For the QSR 2010 it has been recognised that the EcoQO system is not yet suitable to be used in a complete integrated assessment and steps have been taken to develop a complementary approach (see below).

c. Contribute to the development of indicators, with references, targets and limits, that will define the generic qualitative descriptors of Good Environmental Status for the Marine Strategy Framework Directive at the (sub-)regional level

The potential use of EcoQOs for the implementation of the MSFD has been noted by OSPAR Contracting Parties. The EcoQO system is a rare example of a set of indicators for biological elements that have been tested in practice. However, the relatively 'safe' (from a Member States' perspective) 'learning-by-doing' environment in OSPAR is different from that of implementing EU Directives, where Member States can be penalised if they do not implement such legislation correctly. The present evaluation is therefore important to enable translation of the existing EcoQOs to the MSFD environment and to enable development of new EcoQOs (including additional criteria) under the MSFD.

Moreover, the present EcoQOs do not cover all GES generic descriptors, see Annex 1. Some descriptors address topics that are relatively new, *e.g.* underwater noise and non-indigenous species and others are insufficiently covered. This will be an important issue in the implementation process of the MSFD and regional co-operation. Art. 9(3) of the MSFD sets out that the European Commission shall lay down, through comitology and after having consulted the regional seas conventions, criteria and methodological standards to ensure consistency and to allow for comparison between main Regions and Sub-regions of the extent to which good environmental status is being achieved.

In further developing the EcoQO system, OSPAR should note the experience of HELCOM. In HELCOM's Baltic Sea Action Plan (BSAP) qualitative Ecological Objectives are defined which are made operational through the definition of related indicators and quantitative targets. HELCOM's Ecological Objectives can be regarded as fairly concrete policy objectives that guided and accelerated the development of indicators and targets and possibly enhanced commitment. The BSAP was warmly welcomed by the European Commission as it can be seen as the Baltic regional contribution to define and achieve Good Environmental Status.

A representative of the OSPAR Secretariat and a representative of the Netherlands visited the HELCOM Secretariat on 14-15 January 2008, to exchange information and experiences and to seek further co-operation especially on EcoQOs. They discussed possibilities for co-ordinating their contributions to the production of the initial assessments and the definition of GES. A result of this meeting is the comparison at Annex 1 between EC MSFD GES Descriptors, and the system of environmental objectives targets and indicators developed by HELCOM under the BSAP and what is in place in the OSPAR framework in terms of environmental objectives, indicators and targets.

OSPAR should continue its work on EcoQOs, but Contracting Parties will need to supply more resources and act with greater urgency. EU Member States should use the period 2008 to 2012 to complete the EcoQO system, with an eye on GES and developments elsewhere in Europe, and to test prospective new EcoQOs in practice. OSPAR can take a strong position in the MSFD implementation process with a well-developed EcoQO system if it is able to demonstrate clearly the experience of the North Sea EcoQO system.

OSPAR can contribute to the development of criteria and methodological standards for the North Sea and even the whole OSPAR area on the basis of the EcoQO experience, Therefore, a compilation of how EcoQOs were defined and set is needed.

d. Provide tools for integrated assessments of the quality status of the OSPAR Regions for the QSR 2010

As has been discussed above, the EcoQO system cannot yet provide an integrated assessment of the quality status of an OSPAR Region. It is far from complete and it lacks an integrating method. In the context of preparation for the QSR 2010, a process has been set up to develop a method for integrated assessments at the level of OSPAR Regions for the QSR 2010 which will be presented in chapter 11 of the report (see OSPAR 2009/468) This will be a rather experimental approach and potentially trend setting for the Initial Assessment under the MSFD. The present evaluation of EcoQOs delivers quantitative assessments of the status compared to the objectives. These are important building blocks for the integrated assessment.

e. Structuring strategic biological monitoring using the DPSIR model

Although the name EcoQO suggests a measure of desired Status or level of Impact, some EcoQOs (*e.g.* oiled guillemots) are also directly related to a specific Pressure. For implementation of the Ecosystem Approach indicators are needed for both pressure and status/impact[3]. Given a known relationship between human activity and ecosystem effect, it may be more (cost) effective to monitor pressure than status or vice versa.

Monitoring of hazardous substances under OSPAR's Joint Assessment and Monitoring Programme (JAMP) can be regarded as an example. A substance is monitored in the appropriate compartment, which might be at source, in a river or in the receiving marine environment, or a combination of these. Depending on the properties of the substance, it then may be measured in the water column, the sediment or in organisms.

The position of an EcoQO on the DPSIR axis should receive more attention. The discussion within the ASMO framework on the most appropriate medium for monitoring the effects of the ban on TBT *i.e.* monitoring imposex and/or TBT in sediments is a good example.

f. Communicate objectives and create environmental awareness

The current EcoQOs have been selected to explain ecological objectives to stakeholders and politicians. They were recognised by North Sea Ministers as potential tools for the implementation of the Ecosystem Approach. Communication with stakeholders and their involvement however, has proven to be a difficult yet crucial process. This evaluation enables OSPAR to present concrete results. EcoQOs need to be included in OSPAR's Communication Strategy.

2.2 Liaison with scientists and other regional conventions

The MSFD requires by 2012 that Member States:

- make an initial assessment of the environmental status of their waters,
- determine, for their waters in a regional or sub-regional context, and using a set of 'descriptors' and criteria and methodological standards (still to be specified), what constitutes GES,

[3] Note however that there is a distinction in the MSFD between the assessment of environmental status (Art. 8-9) and the use of 'targets and associated indicators' (Art. 10), both of which inform the establishment of monitoring programmes (Art. 11) and the development of programmes of measures (Art. 13).

- and at the same time, formulate a set of operational targets and associated indicators that reflect that GES.

Development of methodologies to formulate environmental objectives should switch to a higher gear in the European regional seas, starting with a focus on the main human impacts and the most important ecosystem elements. The interaction between environmental assessment and simultaneous policy objective formulation requires intensive dialogue between managers and environmental status assessors. Active support of marine scientists is still needed to develop scientifically sound and coherent methodologies. Existing approaches, such as the EcoQO system of OSPAR, HELCOM and other regional conventions should be used as a basis for the tools necessary to implement the MSFD. Using the concepts, methodologies and the operational experience from these existing frameworks may save years of development.

3. Summary of the individual evaluations of EcoQOs

The evaluations of application of the first set of North Sea EcoQOs presented in the annexes to this document, cover, as far as possible, the following issues:

a. whether the EcoQO is met, and if not, why not;

b. (potential) consequences of failing to meet the EcoQO (see paragraphs 14 – 17 of OSPAR agreement 2006-4);

c. suitability of present monitoring and reporting;

d. developments in harmonisation of monitoring and reporting schemes;

e. costs of present monitoring and reporting;

f. extra costs of harmonising the monitoring;

g. performance of the EcoQO in terms of the ICES criteria for good EcoQOs and with regard to the Ecosystem Approach to management (both within OSPAR and the MSFD);

h. the specific linkages with the MSFD and how the EcoQO might be used in relation to the MSFD initial assessment, drawing up programmes and measures and elaborating GES;

i. gaps in knowledge, present conditions that hamper the implementation process and ways and means to overcome these problems;

j. effectiveness of communication, *i.e.* amount of support and knowledge on this EcoQO among stakeholders;

k. whether the status of the EcoQO should be target, limit or indicator;

l. if needed, a proposal for modification and improvement of the EcoQO, including consideration on whether the EcoQOs set originally in 1999 would require revision in the light of the timing for GES under the MSFD and are consistent with other regional agreements and legislation;

m. proposals for possible milestones up to the achievement of the objective; and

n. potential applicability of the EcoQO in other OSPAR regions than the North Sea.

The complete Evaluation Reports are found in Annexes 2-9. Summaries of these reports are presented below.

3.1 EcoQO on spawning stock biomass of commercial fish species

This EcoQO is based on the system of evaluations of the status of commercial fish stocks used in practical fisheries management. By using this information, it contributes to the integration of fisheries and environmental issues as part of the application of the ecosystem approach to management.

The objective is to have none of the North Sea fish stocks outside limits for spawning stock biomass and harvesting rate (fishing mortality) and to have most of the stocks (50 - 100%) inside precautionary values (that are set with a safety zone in relation to the limits). This evaluation indicates that the overall picture for the North Sea fish stock is mixed. There has been a positive development with an increased number of stocks in favourable condition within the precautionary values (*e.g.* haddock, saithe and sole) but there has also been an increase in the number of stocks outside the limits. This reflects in part the difficult situation for cod and also Norway pout.

The status of the stocks is assessed by ICES. Monitoring requirements are generally in place as part of the fisheries management system. One general problem is the often poor quality in catch statistics which lowers the ability of ICES to carry out assessments. Thus there has been an increase also in the number of stocks of unknown status due to lack of assessment (*e.g.* whiting and plaice).

This EcoQO reflects the objectives of fisheries management for North Sea fish stocks, and, since OSPAR has no competence in fisheries management, OSPAR can take no management action. EU Member States would have to work together under the Common Fisheries Policy, and with Norway, to achieve any fisheries-related objectives under the MSFD. For these reasons, this EcoQO is particularly important in broadening the suite of EcoQOs and in helping to integrate across sectors in the application of the ecosystem approach to management.

3.2 EcoQOs on harbour and grey seal population trends

The original EcoQO was for both seal species, but in 2005 OSPAR agreed to divide the EcoQO and reformulate the grey seal EcoQO as: “Taking into account natural population dynamics and trends, there should be no decline in pup production of grey seals of ≥10% as represented in a five-year running mean or point estimates (separated by up to five years) within any of nine sub-units of the North Sea”. The harbour seal EcoQO was reformulated as: “Taking into account natural population dynamics and trends, there should be no decline in harbour seal population size (as measured by numbers hauled out) of ≥10% as represented in a five-year running mean or point estimates (separated by up to five years) within any of eleven sub-units of the North Sea”.

In general, production of grey seal pups in the North Sea has increased, while that of the harbour seal has decreased over the past five years. This summary masks some regional variance though and incomplete data mean that not all sub-units of the North Sea could be assessed. The EcoQO has thus probably been met for grey seals for all significant units of the North Sea population. The harbour seal EcoQO has probably not been met; in some areas this may be a consequence of seal epizootics, but in other areas the cause of decline in numbers hauled out is unknown.

Seals are not mentioned specifically in the MSFD, however, the status of seal stocks in the North Sea (and elsewhere) are certainly of concern to users of the marine environment and the general public. It would be surprising if seal numbers and trends were not reported as part of the MSFD initial assessment and in descriptions of GES. Seal numbers and trends are also reported under the ‘Conservation Status’ monitoring of the EU Habitats Directive (92/43/EEC). If the EcoQO was not met, and following investigation into causes, the EcoQO could be useful in indicating suitable measures that might be taken. Plainly, it is difficult to take measures against the epizootic-driven declines, but if in the future, causes were found to be directly related to anthropogenic activities, measures might be possible.

A proposal is made for a slight modification to the language of the grey seal EcoQO. Recommendations are made to attempt to obtain missing data from certain Contracting Parties, to obtain costs from nearly all relevant Contracting Parties and to improve the presentation of reports on EcoQOs.

3.3 EcoQO on harbour porpoise by-catch

This EcoQO is formulated as: “Annual by-catch levels should be reduced to levels below 1.7% of the best population estimate.”

The monitoring of by-catch of harbour porpoises in the North Sea was inadequate to assess whether or not the EcoQO was being met. Monitoring for EU Member States that is supposed to be carried out under an EU Fisheries Regulation is inadequate to assess overall effects of fisheries on harbour porpoise. Monitoring is also supposed to be carried out to meet the requirements of the EU Habitats Directive. Apart from not being fulfilled by most Member States this Directive sets very few standards, and the monitoring that is conducted is also insufficient for the purposes of the EcoQO. Some monitoring occurs in Norwegian fisheries though it is not known how representative this monitoring is of all relevant fisheries. In order to assess any by-catch as a percentage in this EcoQO, a best estimate of harbour porpoise numbers is needed.

Harbour porpoise by-catch is not mentioned specifically in the MSFD; however, this by-catch is certainly of concern to the people living around the North Sea. By-catch though is closely related to the Common Fisheries Policy and at present the links between this policy and the MSFD are not fully clear. It would be surprising if harbour porpoise numbers and trends, along with known by-catch were not reported as part of the MSFD initial assessment. Harbour porpoise numbers and trends are also reported under the ‘Conservation Status’ monitoring of the EU Habitats Directive (92/43/EEC). If the EcoQO was not met and following investigation into possible causes, the EcoQO could be useful in indicating suitable measures that might be taken.

An ICES Study Group is examining the monitoring needs of the EC Regulation 812/2004; OSPAR could approach ICES to see if this study group’s work might be extended to cover the needs of 812/2004. In addition, discussions should occur with ASCOBANS with a view to bringing together the needs of Parties under that Agreement and those in relation to this EcoQO. All Contracting Parties will need to improve internal coherence between environmental commitments and decisions being taken in relation to the fishing industry.

3.4 EcoQO on the proportion of oiled guillemots

The EcoQO is “The average proportion of oiled common guillemots in all winter months (November to April) should be 10% or less of the total found dead or dying in each of 15 areas of the North Sea over a period of at least 5 years”. The present oil rates in the North Sea vary between 4 and 40%, where the highest oil rates are found in the southern North Sea. Downward trends in oil rates are recorded. On the basis of recent information (2006/2007, as described in this document) and on information on the period 1997/1998 up to 2001/2002 (as described in OSPAR 2005/252) it can be concluded that this EcoQO is not met in most sub-regions.

This EcoQO meets all ICES criteria; especially the communication of this EcoQO is very effective: it is clear that all common guillemots being oiled are a result of oil pollution caused by human activities.

The monitoring of oil by using this EcoQO is much cheaper than monitoring by ships or planes. Costs for establishing and implementing the EcoQO for oiled guillemots are not excessive, at least for data deliveries and international co-ordination. To establish national beached bird schemes in areas where the coverage is weak or incomplete (such as in most of the UK, France, Denmark, Sweden and

Norway), further national support is required from Contracting Parties. Measures to decrease the amount of oil in the North Sea may be substantial, because of expensive control mechanisms. OSPAR is not competent to take these measures.

It is recommended that the EcoQO on oiled guillemots is adopted as an indicator and environmental target in relation to the GES conceptual descriptor: "concentrations of contaminants are at levels not giving rise to pollution effects" under the MSFD. However, the 10% objective was originally based upon what was achievable in relation to measures to address oil discharges from a single main shipping sector in a relatively remote area (Shetland Islands). In a marine area subject to pressures from multiple shipping sectors a slightly revised target would be more appropriate.

It is recommended that the EcoQO should be reformulated as follows:

> *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.*

3.5 EcoQO on plastic particles in seabird stomachs

The EcoQO is that: "There should be less than 10% of northern fulmars having more than 0.1 g of 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".

The northern fulmar is distributed throughout the northern part of the OSPAR area, including the greater North Sea. Fulmars forage exclusively at sea, capturing prey from the sea surface. They frequently ingest floating marine litter, including plastic objects presumably confusing them with food. Because fulmars do not regurgitate these small plastic items, the amount in their stomachs indicates the abundance of litter encountered at sea. Ingested plastics may reduce food intake and the birds' ability to process food, leading to a deterioration in body condition, increased mortality and reduced breeding success. The EcoQO aims to reduce the number of dead fulmars with more than 0.1 g of plastic in their stomachs.

The EcoQO has not been met in any of the study areas and is probably only currently achieved in Arctic populations. Over the period 2002 to 2006, the stomachs of 1090 beached fulmars from the North Sea were analysed. The percentage of fulmars with more than 0.1 g of plastic in the stomach ranged from 45% to over 60%. The Channel area is the most heavily polluted area while the Scottish Islands are the 'cleanest' with a mean mass for plastics in fulmars of about a third of the level encountered in the Channel. A long monitoring series from the Netherlands shows a significant reduction in plastic abundance from 1997 to 2006, mainly through a reduction in raw industrial plastics. To meet the EcoQO, further refinements may be needed on the implementation of the EU Directive on Port Reception Facilities and MARPOL Annex V, as well as specific measures on lost fisheries materials.

The EcoQO provides an indication of the quantities of floating litter in the marine environment and could be used as an indicator in respect of the GES descriptor "Properties and quantities of floating litter do not cause harm to the coastal and marine environment".

3.6 EcoQOs on contaminants in seabird eggs

The objective is for the concentrations of mercury in eggs of Common terns and Oystercatchers to be at the level of the concentrations found in eggs from non-industrial estuaries. Concentrations of organochlorines should be below set values. 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.

Monitoring results from a pilot survey are available from along the continental coast of the North Sea (Belgium, Netherlands, Germany, Denmark) and the coasts of southern Norway and Sweden. 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 are below 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.

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 term and oystercatcher at estuarine and coastal sites.

The EcoQO on seabird eggs can be used as an indicator for quality objective 8 of Annex 1 of the MSFD: “Concentrations of contaminants are at levels not giving rise to pollution effects. In the context of the initial assessment under the EC MSFD, the EcoQO is able to provide an indication of the environmental quality status with regard to the contaminant load in the food web of the marine environment.

3.7 EcoQO on proportion of large fish in (demersal) fish community

The EcoQO is that “at least 30% of fish (by weight) should be greater than 40 cm in length”.

The average length of fish in a community can be used to indicate the impact of fishing. This is because larger species of fish and larger and older individuals are more likely to be caught by fisheries than smaller individuals. This means that the relative abundance of small and early maturing species increases as a 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 each year by ICES in the North Sea part of Region II. The reference period for the EcoQO is the early 1980s; a period when stock assessments suggested that stocks were not being over-exploited 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. From the early 1980s, the proportion of demersal fish in the North Sea greater than 40 cm fell from around 30% to its lowest point of less than 5% in 2001. The proportion of large demersal fish has subsequently recovered to around 22% in 2008. The EcoQO is therefore not met but in general the situation has been improving. There is, however, some way to go to reach the EcoQO.

Use of this EcoQO in a management context must be the responsibility of the competent authorities for fisheries management but the EcoQO can have an important supplementary role to the MSFD by covering a key aspect of fisheries in relation to the overall objective of achieving good environmental status

3.8 EcoQO on imposex in dogwhelks

The objective of this EcoQO is that the average level of imposex in a sample of not less than 10 female dog whelks should be consistent with exposure to TBT concentrations below the environmental

assessment criterion (EAC) for TBT – that is, <2.0, as measured by the Vas deferens Sequence Index. Where the dog whelk does not occur naturally, or where it has become extinct, the red whelk, the whelk or the netted dog whelk should be used.

The assessment of the environmental status in relation to the EcoQO in imposex in dog whelks or other selected gastropods was prepared on the basis of data submitted by OSPAR Contracting Parties to ICES under the Coordinated Environmental Monitoring Programme (CEMP). This assessment shows that, with the exception of a limited number of locations in France, Denmark and the UK (North), the EcoQO has not been met in the North Sea area, particularly in the vicinity of major ports, shipping lanes and shipyards (this is to be reviewed after a more elaborate assessment with more data). A significant trend has been detected at 28 stations, with 24 stations having a general downward trend indicating that the situation in general is improving. However, the area still suffers from the consequences of historic inputs related to shipping activities as is confirmed by the levels of TBT that are still found in sediments. The relative absence of positive trends indicates that only a limited input still remains, linked to very local situations.

The EcoQO has been designed with the aim of monitoring the effectiveness of the Convention on the Control of Harmful Anti-fouling Systems on Ships (AFS Convention) and EC Community Regulation, (Regulation (EC) No 782/2003) implementing the AFS Convention within the EU, and the required monitoring is already included as part of the CEMP.

It is recommended that the EcoQO is adopted as an indicator and environmental target in relation to the GES conceptual descriptor: “concentrations of contaminants are at levels not giving rise to pollution effects” under the MSFD and that Contracting Parties specify the stations at which the EcoQO will be monitored.

3.9 EcoQOs on eutrophication

The EcoQO system includes an overall general (overarching) EcoQO for eutrophication, which represents the overall objective of the Eutrophication Strategy to combat eutrophication in order to achieve and maintain a healthy marine environment where eutrophication does not occur, by 2010. This EcoQO is based on an integrated sub-set of five EcoQOs for eutrophication. The five specific EcoQOs (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 under the Comprehensive Procedure of the Common Procedure for assessing the eutrophication status of an area.

The use of the integrated set of five EcoQOs for eutrophication is identical to the application of the Comprehensive Procedure, both in procedure and frequency of application, and they can be seen as part of the target-oriented approach of the Eutrophication Strategy. The elaboration of work on eutrophication EcoQOs has been tested in the Second Application of the OSPAR Comprehensive Procedure which provides a summary of the experience gained by Contracting Parties.

The results given in the 2008 OSPAR Integrated Report show that all North Sea Contracting Parties have applied the overarching EcoQO, and that it is not met in several parts of the OSPAR Maritime Area. For the North Sea a number of, in particular, coastal waters off France, Belgium, UK (some estuaries), the Netherlands, Germany, Denmark, Sweden and Norway are classified as problem areas with regard to eutrophication.

Almost all Contracting Parties have responded on their implementation of the integrated set of EcoQOs for eutrophication (Annex 9 Table 9.3). Ireland and Portugal reported their experience on the voluntary use of the overall eutrophication EcoQO and its integrated set of five EcoQOs for the Celtic Sea and the Iberian Coast. The integrated set of five EcoQOs was implemented and used through the

application of the corresponding assessment parameters and assessment levels of the Comprehensive Procedure.

The experience from the second application of the Comprehensive Procedure is that there is a need to improve monitoring in spatial and temporal coverage. To this end, the use of additional tools such as airborne surveys (*e.g.* under the BONN Agreement) and novel observation techniques and platforms including the emerging GMES Marine Core Services could be considered.

With respect to the MSFD, the qualitative descriptor of good environmental status covering eutrophication is that "human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters". In this context, the application of the Comprehensive Procedure, including the integrated set of five EcoQO components, is a good building block and is able to provide an assessment of the environmental quality status with regard to nutrient inputs and eutrophication effects.

The assessment parameters of the Comprehensive Procedure, including the integrated set of the five EcoQOs, offer a possibility to see more clearly and in more detail the possible changes affecting the eutrophication status of a particular area over the assessed period of time and/or between different applications of the Comprehensive Procedure (long-term trends). This would allow a further harmonisation and comparability with the classification of the Water Framework Directive (WFD). The relationship between the integrated set of EcoQOs, the Common Procedure and the WFD is described in Annex 9 Figure 9.2.

The integrated set of EcoQOs is in a testing phase. Further work within the OSPAR Eutrophication Committee (EUC) would be required for modifying them for their region-specific application.

4. Towards a complete and coherent set of EcoQOs for the North Sea and other OSPAR Regions

4.1 Approach to develop a complete EcoQO system per OSPAR Region

Further development of the EcoQO system should build upon both OSPAR Strategies and the generic descriptors of GES. Regional differences however require a tailor-made approach. Priority human activities and their main impacts may differ from region to region. These will define, within the scope of generic OSPAR and MSFD objectives, what is needed to protect or improve the marine environment[4].

[4] Article 9 of the MSFD states:|

Determination of good environmental status

1. By reference to the initial assessment made pursuant to Article 8(1), Member States shall, in respect of each Marine Region or Sub-Region concerned, determine, for the marine waters, a set of characteristics for good environmental status, on the basis of the qualitative descriptors listed in Annex I.

Member States shall take into account the indicative lists of elements set out in ***Table 1 of*** Annex III and, in particular, physical and chemical features, habitat types, biological features and hydro-morphology.

Member States shall also take into account the pressures or impacts of human activities in each Marine Region or Sub-Region, having regard to the indicative lists set out in Table 2 of Annex III.

For these priority human activities and/or impacts concrete 'policy objectives' may be defined, which both guide the development of EcoQOs and promote commitment of governments. Part of these policy objectives may already be addressed by OSPAR work, *e.g.* the OSPAR List of threatened and/or declining Species and Habitats (OL) and Marine Protected Areas (MPAs). Existing indicators developed by OSPAR Contracting Parties or outside OSPAR could inform the development of additional EcoQOs. A stocktaking of present monitoring programmes in OSPAR countries will be needed to assess the suitability of new EcoQOs. Figure 1 provides a schematic presentation of this approach.

4.2 Actions needed to deliver a complete and coherent EcoQO system

The EcoQO system can be completed for the North Sea and developed for the other OSPAR Regions by taking the following steps:

1 *Compare the generic descriptors of GES (Annex I to the MSFD) with OSPAR Strategies*
Similarities between GES descriptors and OSPAR objectives provide a powerful generic framework for completing the EcoQO system. OSPAR objectives can be very useful to explain GES and ensure commitment of OSPAR Contracting Parties, EU Member States as well as non-EU countries. This exercise can be done for the entire OSPAR area.

2 *Define priority human activities and their main impacts on ecosystem elements*
The framework for biodiversity monitoring and assessment considered by BDC 2008 has the potential to identify pressures of primary importance for each OSPAR Region. Indicator development should focus on these pressures and/or address those ecosystem elements that are most affected.

3 *Develop concrete policy objectives*
Learning from the experience of HELCOM, OSPAR could develop policy objectives that are easily communicated to stakeholders and at the same time explain the GES descriptors for a specific OSPAR Region. These policy objectives should address the most important pressures and guide the development of (new) EcoQOs. To ensure their communicative value, active stakeholder participation should be considered.

4 *Develop a complete set of EcoQOs per OSPAR Region*
For each policy objective one or more EcoQOs should be developed, taking into account relationships between objectives and harmonising between Regions where possible. This work should build upon the following strands of work:

   a. Existing EcoQOs and EcoQOs under development;

   b. The OSPAR List of Threatened and/or Declining Species and Habitats (OL);

   c. The work on Marine Protected Areas;

   d. Existing indicators that have been developed by OSPAR countries or outside OSPAR;

   e. Current monitoring programmes carried out by OSPAR Contracting Parties.
   This work can be developed parallel to the actions above.

As stated earlier, there is little time left to deliver complete and coherent sets of EcoQOs for each OSPAR Region and hence fulfil the ambitions of the MSFD. Cooperation within OSPAR and with other international conventions, partly through the process of the informal MSFD working group European Marine Monitoring and Assessment, is essential.

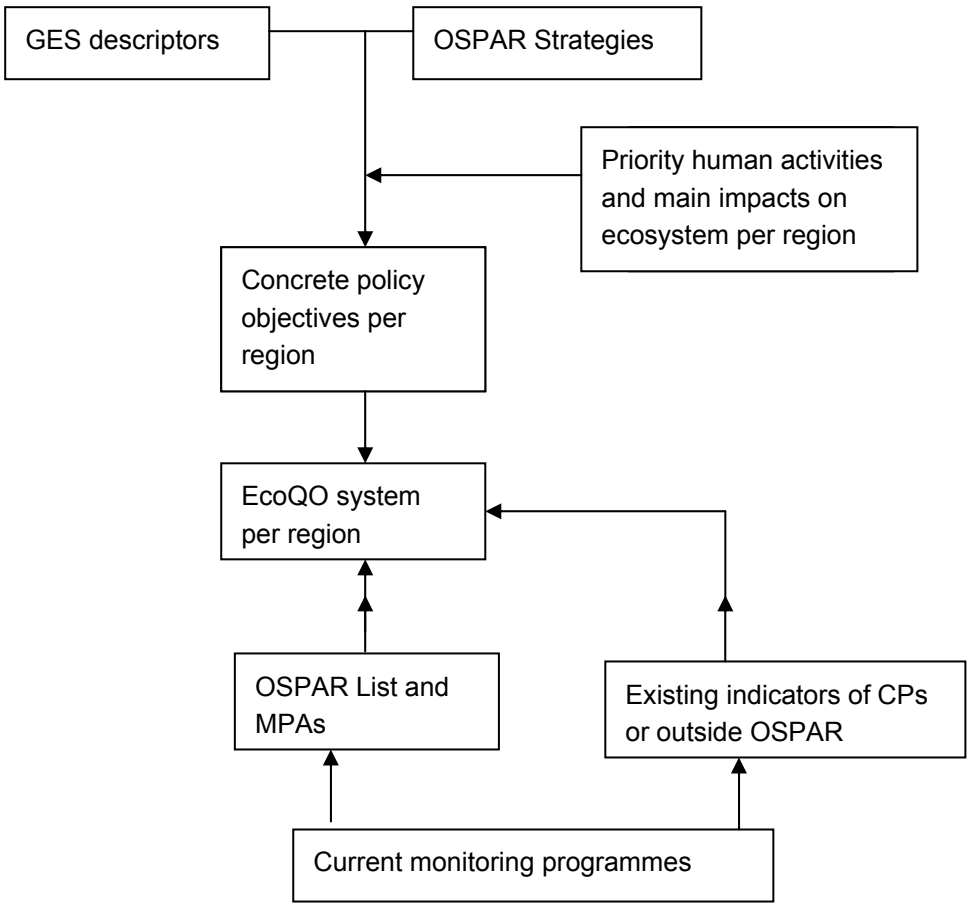


Figure 1: *Approach for the development of a complete and coherent EcoQO system per OSPAR Region.*

5. Linkage of the present EcoQO framework to monitoring

The EcoQO system has linkages with other strands of work within the Biodiversity Committee, including the monitoring and assessment of threatened and/or declining species and habitats on the OSPAR List and of human activities. Additionally, some EcoQOs stem from OSPAR's work on eutrophication (Eutrophication Committee) and contamination (Hazardous Substances Committee: imposex in dog whelks). The EcoQOs therefore form part of a wider set of monitoring and assessment 'indicators', which include physical, chemical and human activity indicators and collectively contribute to the OSPAR Joint Assessment and Monitoring Programme (JAMP).

Ongoing work within the Biodiversity Committee, led by the United Kingdom, to establish a strategic framework for biodiversity assessment and monitoring has placed the suite of EcoQOs in the context of other indicators, both within OSPAR and those in use in other frameworks (*e.g.* EC Directives). For instance, monitoring is needed for the EcoQOs for grey and harbour seals, as well as under the Habitats Directive; there is a consequent need to ensure effort is not duplicated between strands of OSPAR work and between OSPAR and other environmental protection instruments.

It has also been noted that EcoQO monitoring appeared to be at a different stage of maturity compared to much of the current monitoring included under the CEMP. The introduction of quality assurance procedures is an important aspect of EcoQO monitoring that needed to be addressed.

Additionally, data for EcoQOs is not as yet being handled in a coordinated way, but through lead countries. In the present structure of OSPAR there is insufficient coordination of biodiversity monitoring.

The considerations above are currently being addressed in OSPAR work on developing biodiversity assessment and monitoring, with the aim of delivering an efficient and well coordinated programme to support implementation of the MSFD. The following steps are crucial:

1. to develop an overview of all requirements for biological monitoring under OSPAR, *e.g*. EcoQOs, Threatened and/or declining species and habitats and Marine protected areas;
2. to investigate what monitoring is already being carried out by Contracting Parties to fulfil these and other requirements and which indicators are being used;
3. to develop a framework for coordinating biodiversity monitoring and assessment and prioritize additional monitoring required to fill gaps.

An overarching plan for the OSPAR biodiversity monitoring would:

- use for example, a decision tree system to develop an overview of requirements for biological monitoring, and should be completed, for instance by an external consultant.
- summarize existing overviews held by Contracting Parties of the current biological monitoring and indicators under EU Directives and other international or national obligations continuing the work started by the OSPAR Intersessional Correspondence Group on Synergies in Assessment and Monitoring (OSPAR 2008/357).
- develop proposals for BDC to further develop the framework.

In order to achieve good biological monitoring practices, OSPAR needs to put in place QA/QC, data management, guidelines for monitoring and assessment criteria etc., according to current practice of the CEMP. The integrated set of eutrophication EcoQOs and the EcoQO on imposex are already included in the CEMP. Others are being monitored through EC regulations (commercial fish, harbour porpoise by-catch) and therefore do not require monitoring through OSPAR. Other EcoQOs, for which not all prerequisites of the CEMP are in place, should first be included in the pre-CEMP.

There is currently no OSPAR group that has sufficient expertise to address technical aspects and coordination of biological monitoring and assessment. The most pragmatic way to proceed would be the establishment of a dedicated working group under ASMO. It will also be necessary to investigate the need for monitoring of human activities and related pressures related to the current BDC work on the environmental impact of human activities.

At the level of individual EcoQOs the following activities need to be carried out in the short term:

1. Seals (harbour seals and grey seals):
    a. Overview of all seal monitoring by the relevant Contracting Parties;
    b. Organisation of common data collecting, management and disclosure system;
    c. Overview of guidelines for quality assurance and
    d. Harmonisation if needed.
2. Oiled guillemots

    Norway, Sweden, Denmark, France and (parts of) the United Kingdom are requested to submit the required information on an annual basis to the Netherlands.

6. Summary of the past work on EcoQOs: strengths and weaknesses

In OSPAR, progress is made using a system of lead countries. A lead country may develop a particular issue according to its own views, reporting regularly to OSPAR. This system does not easily generate commitment from other Contracting Parties. Norway and the Netherlands have led the EcoQO development. Belgium, Germany, Portugal, the United Kingdom and the Common Wadden Sea Secretariat took responsibility to develop one or more individual EcoQOs. The following strengths and weaknesses of the work that has been carried out by the ICG-EcoQOs can be identified:

Strengths

a. Accelerated by North Sea Conferences and EU Marine Strategy Framework Directive: Ecosystem Approach becomes leading principle for North Sea management

As described above EcoQO development was accelerated by increasing political interest and the urgent need for a suitable tool to implement the Ecosystem Approach.

b. Much knowledge available

Unlike most other marine regions the North Sea is relatively well studied and some EcoQOs could be based on long time series of data. It may be difficult for other regions to develop EcoQOs that can fulfil the present requirements of quality and robustness.

c. Quality control by ICES

Although formal ICES advice to OSPAR on EcoQOs only commenced in 2001, ICES working groups inspired the early development of EcoQOs. Especially the working groups on ecosystem effects of fishing, marine mammal population dynamics and habitats, seabird ecology, benthos ecology, marine chemistry and phytoplankton ecology provided valuable advice. They contributed to the conceptual framework, including criteria for a good EcoQO, reviewed OSPAR products and developed new EcoQOs (see ICES ACE reports 2001 to 2004). In general, ICES advice improved the scientific credibility of the framework, thereby facilitating commitment of the scientific community and other stakeholders.

d. Tested in practice

An EcoQO is developed according to a fixed protocol. The first step is to draft a background document, describing existing knowledge and monitoring information and proposing a suitable indicator and reference levels. Next, an objective is developed by scientists and adopted for testing by policy makers. The objective needs to be included in the background document. During an evaluation phase the EcoQO is tested in practice and, where necessary, adjusted. Subsequently, OSPAR can decide to apply the EcoQO.

e. Communication tools to inform stakeholders and politicians

Most EcoQOs have been designed to explain the Ecosystem Approach to stakeholders and politicians in an attractive way. Lead countries distributed glossy leaflets explaining the EcoQO framework. International and national stakeholders were informed on several occasions. We learned that explaining ecological objectives is essential, yet difficult to accomplish. The focus on eye-catching species led to under representation of ecosystem elements of more functional importance.

BDC has started to investigate the application of the EcoQO system in other regions. This requires selection of issues that are relevant for a specific region, development of Ecological Quality Elements and Objectives for these issues or modification of North Sea EcoQOs.

Weaknesses

a. Slow start, scientific and operational difficulties

EcoQO development in OSPAR has been a 'bottom-up' process, started by a few dedicated scientists and only guided by the high level strategic objectives of the OSPAR Convention. The scientific debate took many years, partly due to the complexity inherent to marine indicators and partly to a lack of guiding principles. Progress was further hampered by operational difficulties, such as a lack of harmonised monitoring data and limited capacity in North Sea countries to assist the process.

b. Lack of coordination amongst the many organisations involved

Biological monitoring in the marine environment is still in its infancy while EU Directives (Birds and Habitats Directives, Water Framework Directive, Marine Strategy Framework Directive) and other international agreements call for a rapid development of monitoring programmes. Investigations in OSPAR have showed that biological monitoring is carried out by a wide range of institutions and that Contracting Parties are currently acknowledging the need for better coordination in order to develop efficient and cost-effective programmes.

c. No success in the short term

For almost a decade EcoQO development was considered a scientific playground of a few experts, who were unable to show appealing results to the OSPAR world. It was through growing political commitment to the Ecosystem Approach that the EcoQOs turned into a promising concept and OSPAR could show how they can be used in practice. In addition, any improvement of the marine environment as a result of the Ecosystem Approach may take decades, while investments in capacity and resources should be made in the short term.

d. Lack of commitment

North Sea countries hesitated to contribute to EcoQO development, as personnel and budgets for environmental monitoring and assessment are limited and demands, especially from EU Directives, are high. The 2008 and 2009 evaluations will inform Contracting Parties on practical and financial consequences, providing a basis for informed decision-making.

Owing to the situation described above OSPAR followed a very pragmatic approach, choosing mainly indicators that were already monitored by most North Sea countries and, where possible, objectives that were already accepted by OSPAR or other international agreements such as the EU Common Fisheries Policy and ASCOBANS.

7. Conclusions and recommendations

On the basis of evaluations of individual EcoQOs and the EcoQO framework, lessons learnt have been identified, leading to conclusions on the progress of this work. Furthermore, recommendations have been made on the further development of the set of EcoQOs, the general framework and the relationship with GES of the MSFD.

7.1 Conclusions

General conclusions

The main added value of the EcoQO system lies at present in providing examples of objectives and indicators that can be used to define GES under the MSFD. Using the developing framework for biodiversity monitoring and assessment and the DPSIR model they can contribute to a well-structured and effective monitoring programme. Methods for integrated assessments are currently being considered as part of the QSR 2010 process and may be used for the further development of the EcoQO system.

OSPAR has to make a firm statement on EcoQOs in order to give a clear message to the outside world and confirm its role in the (regional) implementation of the EU Marine Strategy Framework Directive.

Contracting Parties and the relevant OSPAR Committees need to start preparations now for the 2010 Ministerial meeting in order to ensure that the EcoQO system becomes a key part of the OSPAR framework including incorporation into the monitoring and assessment framework.

Relation with 'good enviroenmental status' (GES)

The principles of the EcoQO system can be applied to fulfil the requirements of MSFD in two ways – firstly by completing the set of EcoQOs in the North Sea; secondly through expansion of its geographic coverage to areas beyond the North Sea, preferably in the Sub-Regions which will be used as management units for the marine strategies under the MSFD.

The generic qualitative descriptors of GES are only partly addressed by the current EcoQOs. Therefore, OSPAR needs to start filling the gaps as soon as possible, using a developing framework for biodiversity monitoring and assessment to identify the most important issues and the proposed scheme in Chapter 4 of this report. Essential to this scheme is the development of 'policy objectives' for each OSPAR Region.

Existing approaches, such as the EcoQO system of OSPAR, HELCOM and other regional conventions should be used as a basis for the tools necessary to implement MSFD. Using the concepts, methodologies and the operational experience from these existing frameworks will save years of development.

Current EcoQOs provide a valuable, tested, starting point for the requirements of the MSFD. They have demonstrated their applicability despite relatively low intensity support and participation from some Contracting Parties.

Most of the EcoQOs would gain in strength and usefulness if all Contracting Parties invested the necessary financial and personal resources (in most cases, not great) to support the EcoQOs and re-emphasised their commitment to maximise the relevance for the MSFD.

Similarities between GES descriptors and OSPAR objectives provide a powerful generic framework for completing the EcoQO system. OSPAR objectives can be very useful to explain GES and ensure commitment of OSPAR Contracting Parties, EU Member States as well as non-EU countries.

Future development of EcoQOs

Good quality monitoring is essential to the implementation of EcoQOs. OSPAR needs to establish guidelines for QA/QC and data management (see CEMP guidelines) where appropriate, taking into account existing and developing biological monitoring programmes under OSPAR strands of work or other (EU) obligations. As part of this, use should be made of existing biological indicators.

The development of a framework for biodiversity monitoring and assessment has the potential to identify pressures of primary importance for each OSPAR Region. Indicator development can focus on these pressures and/or address those ecosystem elements that are most affected.

Experience from HELCOM can be used by OSPAR to develop policy objectives that are easily communicated to stakeholders and at the same time explain the GES descriptors for a specific OSPAR Region. These policy objectives can address the most important pressures and guide the development of (new) EcoQOs. To ensure their communicative value, active stakeholder participation can be considered.

To achieve a complete and coherent set of EcoQOs gaps have to be identified and filled. For some subjects, there are already some EcoQOs (in various stages) under development. For other issues EcoQOs development still has to be started (*e.g.* underwater noise and non-indigenous species).

Commitment of OSPAR towards the development of EcoQOs

Two of the prime purposes of international agreements are firstly to ensure that the actions of one State do not harm the interests of one or more other State and secondly to attempt to ensure that States work efficiently together towards a common good. In the OSPAR context, Contracting Parties have a good track record in working together to ensure the reduction and elimination of discharges of hazardous substances. The EcoQO programme is one of the first attempts to ensure that goals for the condition of marine biodiversity are harmonised in an efficient way. The EcoQO project applies initially in the North Sea (OSPAR Region II) only.

Involvement and commitment by Contracting Parties have been patchy. In many cases Contracting Parties have only taken part using existing monitoring programmes and have devoted no further funding to either monitoring of the EcoQ or attempting to ensure that the EcoQO would be met by taking further management actions. This has meant that it has proved very difficult to evaluate whether or not EcoQOs are being met and has ultimately led to a very protracted period of 'development'. One advantage that could have derived from this period of development would be a good understanding of what approaches to EcoQOs are likely to work and what are not. The levels of commitment by Contracting Parties have not been sufficient to realise this advantage fully.

Communication

Better communication of the EcoQO system is needed, primarily to key marine user groups, but also to the wider public. It is therefore important to enhance and extend work on stakeholder involvement.

The interaction between environmental assessment and the simultaneous formulation of policy objectives requires intensive dialogue between managers and environmental status assessors. Active support of marine researchers is still needed to develop scientifically sound and coherent methodologies.

Conclusion on EcoQO status

Results of this evaluation regarding the environmental status of the individual EcoQOs are summarised in Table 2. It shows that the ecological quality objectives are rarely met, suggesting that research and/or management actions are required. In a number of cases monitoring and/or reporting is inadequate to enable a proper evaluation, indicating a clear need for improvement.

Table 2: *Present status of individual EcoQOs and possible actions*

EcoQO	Status	Possible Action
Spawning stock biomass of commercial fish species	Mixed picture Increased number of stocks in favourable condition within the precautionary values (e.g. haddock, saithe and sole). Increase in the number of stocks outside the limits, reflecting in part the difficult situation for cod and also Norway pout.	Synchronize the objective with the new goals of the EU Common Fisheries Policy and Norwegian Fisheries Policy. EU Member States work together through the EU Common Fisheries Policy, and with Norway, to achieve the (new) objective
Proportion of large fish in the (demersal) fish community	Not met, although movement towards the objective is detected	This needs to be considered by the relevant authorities for fisheries management in Region II
Seal population trends	The EcoQO probably has been met for grey seals for all significant units of the North Sea population The harbour seal EcoQO has probably not been met; in some areas this may be a consequence of seal epizootics, but in other areas the cause of decline in numbers hauled out is unknown	Encourage research is in place to explain the decline in harbour seal population in areas where it is unknown. Continue monitoring and/or data reporting especially in units of the eastern North Sea
Harbour porpoise by-catch	Monitoring of by-catch of harbour porpoises in the North Sea was inadequate to assess whether or not the EcoQO was being met	Communicate the need for improved monitoring to the EC
Proportion of oiled guillemots	Oil rates in the North Sea vary between 4 and 50%. Highest oil rates are found in the southern North Sea Downward trends in oil rates are recorded	Norway, Sweden, Denmark, France and UK: submit the requested information to the Netherlands before 1 July 2008 Communicate the oiling rates for beached birds to the shipping industry
Plastic particles in seabird stomachs	The EcoQO is not met in any parts of the North Sea and current levels in most parts of the region are well below the objective	To achieve the EcoQO level further refinements may be needed on the implementation of the EU Directive on Port Waste Reception facilities and MARPOL Annex V. Action may also be needed to address lost fishing gear
Contaminants in seabird eggs	EcoQO is met at very few sites	Continue the reductions in inputs of hazardous substances Consider data from throughout the North Sea to evaluate the suitability of the EcoQO for MSFD purposes
Imposex in dogwhelks or other selected gastropods	The EcoQO has not been met in the North Sea Area with the exception of a limited number of locations in France, Denmark and UK (North) Downward trend indicate that the situation in general is improving The relative absence of positive trends indicates that only a limited input of TBT still remains, linked to very local situations	Continue monitoring as the EcoQO is measuring the effectiveness of measures that have only recently entered into force for shipping at a global level
EcoQO on eutrophication	The overarching objective is not met in several parts of the OSPAR maritime area. 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, Netherlands, Norway, Sweden and the UK (estuaries)	Improve monitoring

7.2 Recommendations

On the basis of the evaluation of EcoQOs OSPAR 2008 agreed to endorse the following recommendations and the associated implementing action.

Recommendation 1: Integration of the EcoQOs into the future OSPAR policy framework

In the future OSPAR policy framework, EcoQOs should be set in the context of further defined GES descriptors, that are clearly communicable ("policy objectives") as has been done in the Baltic Sea Action Plan.

OSPAR should establish such a system of policy objectives to be launched at the 2010 Ministerial Meeting. Policy objectives provide the framework within which more technical expression of desired ecological quality can be defined.

The OSPAR publication "Working for a healthy North Sea" (OSPAR 2009/404) provides a starting point for such qualitative policy objectives in relation to EcoQOs although these were not specifically defined in relation to the GES descriptors.

Recommendation 2: Integration of EcoQOs with the work to make the concept of GES under the MSFD operational

As demonstrated through their application in the North Sea, the following EcoQOs, where applicable, provide a valuable, tested, starting point for the requirements of the MSFD:

(i) spawning stock biomass of commercial fish stocks;

(ii) harbour and grey seal populations;

(iii) by-catch of harbour porpoises;

(iv) oiled guillemots;

EcoQOs for (i) plastic particles in seabirds' stomachs and (ii) proportion of large fish are available and the contribution that could be made by these EcoQOs to the MSFD should be reconsidered following the development of the relevant implementation guidance for inclusion in the EcoQO Handbook (OSPAR 2007/307) together with the evaluations presented at Annexes 6 and 7 of this report;

As part of the preparations for the OSPAR Ministerial Meeting for 2010, OSPAR should put in place work to:

a. define a clear vision reflecting the Ecosystem Approach to management encompassing these EcoQOs as tools;

b. include the EcoQOs as an integral part of the future OSPAR framework, taking into account the potential of the EcoQO approach to contribute to action plans for the OSPAR (sub)-regions. These action plans will define OSPAR's input to the MSFD;

c. embody clear and achievable commitments to the monitoring of EcoQOs in any redefinition of the OSPAR JAMP and the coordinated parts of OSPAR's monitoring programme and that these commitments should be related to GES under MSFD.

Future work on EcoQOs should be integrated with the work to make the concept of GES under the MSFD operational and therefore:

a. Contracting Parties that are EU Member States should be invited to consider the usefulness of the OSPAR EcoQO system for making the MSFD concept of GES operational in the OSPAR maritime area;

b. Contracting Parties that are EU Member States should be invited to determine as early as possible the boundaries of the Sub-regions they will use as management units for the marine strategies under the MSFD, preferably working through OSPAR to ensure coordination.

In the context of GES, BDC agreed that OSPAR's initial role should include:

a. offering OSPAR's experience with EcoQOs to inform the work of the European Commission on defining criteria and methodological standards for GES. In this context the EcoQO Handbook (OSPAR 2007/307) should be updated to fully document the methodologies developed and used to define EcoQOs. It would be advantageous if this were done in a practical way (*e.g.* in standard templates), hence facilitating development of new EcoQOs in the North Sea and in other Sub-regions and Regions;

b. as the MSFD will require good environmental status assessment at the level of the entire Region or Sub-region, definition of adequate methods for determining how, for the different issues, status assessment is undertaken at the largest scale (being the Sub-region or Region) based on information collected by Member States in that Region or Sub-region on smaller geographical scales (in their different marine waters and in smaller ecological sub-units). This needs to include discussion of situations where the distribution of a given ecological quality element is very skewed (*e.g.* certain populations may be healthy in one Sub-region but not in another). This should be included in the improved evaluations of the EcoQOs;

c. to establish a process to coordinate the development of EcoQOs and to improve the descriptions of GES for other OSPAR Regions, especially Regions III and IV.

Recommendation 3. Commitment to monitoring in relation to EcoQOs

Relevant Contracting Parties are urged to meet their existing commitments on monitoring and assessment in relation to EcoQOs under the JAMP and OSPAR agreement 2006-4.

The development of a coordinated programme of monitoring in relation to EcoOQs (beyond that already included in the CEMP or in other frameworks) should be as part of the development of a biodiversity and assessment monitoring programme also addressing features on the OSPAR List of threatened and/or declining species and habitats and monitoring of MPAs.

Recommendation 4: Reformulation of EcoQOs

The following adjustments to individual EcoQOs have been recommended, together with associated actions to improve implementation:

a. Seal EcoQOs

"*Taking into account natural population dynamics, movements and trends, there should be no decline in pup production of grey seals of ≥10% as represented in a five-year running mean or point estimates (separated by up to five years) within any of nine sub-units of the North Sea. These sub-units are: Orkney; Firth of Forth; the Farne Islands; the Greater Wash; the French North Sea and Channel coasts; the Netherlands coast; the Schleswig-Holstein Wadden Sea; Helgoland; Kjørholmane (Rogaland)*."

All North Sea Contracting Parties should supply relevant data in time to the Lead Contracting Party (UK). OSPAR should consider passing the data collection and evaluation of this EcoQO to ICES.

b. Harbour porpoise by-catch

At present, insufficient monitoring for evaluating whether or not this EcoQO is being met has been carried out. The scale and nature of the monitoring required is related to EU Fisheries Regulation 812/2004. To address this:

(i) OSPAR should initiate a discussion on improvements to monitoring standards with the European Commission and possibly ASCOBANS.

(ii) Contracting Parties should fulfil their currently existing legal requirements.

c. Oiled Guillemots

The EcoQO on Oiled Guillemots was originally based upon what was achievable in relation to measures to address oil discharges from a single main shipping sector in a relatively remote area (Shetland Islands). In a marine area subject to pressures from multiple shipping sectors a revised target would be more appropriate. In the light of the current evaluation and review, the objective should be changed as follows:

"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."
Monitoring of this EcoQO can be implemented parallel to the process of deciding on the new objective.

References

Report of the First Joint Meeting of the Helsinki and OSPAR Commission (2003)

Handbook for the Application of Ecological Quality Objectives in the North Sea: OSPAR 2007/307

Background Document on the Ecological Quality Objective on Oiled Guillemots: OSPAR 2005/252

Synergies in Assessment and Monitoring between OSPAR and the EU: Biodiversity: OSPAR 2006/294

Working for a Healthy North Sea: OSPAR 2009/404

Annex 1: Thematic cross-comparison of goals/strategies and objectives, including possible indicators and targets or descriptors reflecting good environmental/ecological status in different international frameworks

Global	EU MSFD (Annex I descriptors)	HELCOM BSAP	OSPAR
Eutrophication			
UNEP/GPA/Global Partnership on Nutrient Management O: To reduce nutrient over-enrichment of coastal and marine ecosystems and their associated watersheds	D: Human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters.	**1. A Baltic Sea unaffected by Eutrophication (whole Baltic Sea with possible**) 1.1. Concentrations of nutrients close to natural levels **Winter surface concentrations of nutrients* *(Nutrient concentrations' sub-basin reference levels with max +50% deviation)* 1.2. Clear water **Summer Secchi depth* *(Secchi depth sub-basin reference levels with max +25% deviation)* 1.3. Natural level of algal blooms **Chlorophyll a concentrations* *(Chlorophyll a concentrations' sub-basin reference levels with max +50% deviation)* 1.4. Natural distribution and occurrence of plants and animals **Depth range of submerged vegetation and possible phytoplankton species indicators* *(To be defined in HELCOM eutrophication assessment 2009)* 1.5. Natural oxygen levels **Area and length of seasonal oxygen depletion* *(To be defined in HELCOM eutrophication assessment 2009)*	**1. All parts of the North Sea should have by 2010 the status of non-problem areas with regard to eutrophication** 1.1. **Winter nutrient (DIN and DIP) concentrations (Winter DIN and DIP should remain below a justified salinity-related and/or area-specific % deviation from background not exceeding 50%)* 1.2. 1.3. **Phytoplankton chlorophyll a* *(Maximum and mean chlorophyll a concentrations during the growing season should remain below a justified area-specific % deviation from background not exceeding 50%)* 1.4. **Phytoplankton indicator species for eutrophication* *(Area-specific phytoplankton eutrophication indicator species should remain below respective nuisance and/or toxic elevated levels (and there should be no increase in the average duration of blooms)* **Kills in zoobenthos in relation to eutrophication* *(There should be no kills in benthic animal species as a result of oxygen deficiency and/or toxic phytoplankton species)* 1.5. **Oxygen* *(Oxygen concentration, decreased as an indirect effect of nutrient enrichment, should remain above area-specific oxygen assessment levels, ranging from 4 – 6 mg oxygen per litre)*

Global	EU MSFD (Annex I descriptors)	HELCOM BSAP	OSPAR
Biodiversity and nature protection			
Convention on Biological Biodiversity G: To achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level I: Marine trophic index I: Water quality of aquatic ecosystems T: Status of threatened species improved	D: Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.	**1. Favourable conservation status of Baltic Sea biodiversity** 1.1. Natural marine and coastal landscapes **Percentage of marine and coastal landscapes in good ecological and favourable status* 1.2. Thriving and balanced communities of plants and animals **Trends in spatial distributions of habitats within the Baltic Sea regions* **Percentage of all potentially suitable substrates covered by characteristic and healthy habitat-forming species such as bladderwrack, eelgrass, blue mussel and stoneworts,* **Trends in abundance and distribution of rare, threatened and/or declining marine and coastal biotopes/habitats included in the HELCOM lists of threatened and/or declining species and habitats of the Baltic Sea area* 1.3. Viable populations of species **Trends in the number of threatened and/or declining species* *(Abundance, trends and distribution of Baltic seal species compared to the safe biological limit (limit reference level) as defined by HELCOM HABITAT)* *(By 2015, improved conservation status of species included in the HELCOM lists of threatened and/or declining species and habitats of the Baltic Sea area, with the final target to reach and ensure favourable conservation status of all species)* *(By 2015 by-catch of harbour porpoise, seals, water birds and non-target fish species has been significantly reduced with the aim to reach by-catch rates close to zero)*	**1. To protect and conserve the ecosystems and the biological diversity of the maritime area which are, or could be, affected as a result of human activities, and to restore, where practicable, marine areas which have been adversely affected** 1.1. 1.2. Restore and/or maintain the quality and extent of threatened and/or declining habitats in the North Sea, as shown on the Initial OSPAR List * to be defined 1.3. [Seal population trends] * Harbour seal population size: Taking into account natural population dynamics and trends, there should be no decline in harbour seal population size (as measured by numbers hauled out) of ≥10% as represented in a five-year running mean or point estimates (separated by up to five years) within any of eleven sub-units of the North Sea. These sub-units are: Shetland; Orkney; North and East Scotland; South-East Scotland; the Greater Wash/Scroby Sands; the Netherlands Delta area; the Wadden Sea; Helgoland; Limfjord; the Kattegat, the Skagerrak; the Oslofjord; the west coast of Norway south of 62oN. * Grey seal pup production: Taking into account natural population dynamics and trends, there should be no decline in pup production of grey seals of ≥10% as represented in a five-year running mean or point estimates (separated by up to five years), and in breeding sites, within any of nine sub-units of the North Sea. These sub-units are: Orkney; Fast Castle/Isle of May; the Farne Islands; Donna Nook; the French North Sea and Channel coasts; the Netherlands coast; the Schleswig-Holstein Wadden Sea; Helgoland; Kjørholmane (Rogaland). [By-catch of harbour porpoises] *Annual by-catch levels should be reduced to below 1.7% of the best population estimate [Local sand eel availability to black-legged kittiwakes] *Breeding success of the black-legged kittiwake (*Rissa tridactyla*) should exceed (as a three-year running mean) 0.6 chicks per nest per year in each of the following coastal segments: Shetland, north Scotland, east Scotland, and east England *Presence and extent of threatened and/or declining species in the North Sea, as shown on the Initial OSPAR List (to be defined)

Global	EU MSFD (Annex I descriptors)	HELCOM BSAP	OSPAR
IMO International Convention on the Control and Management of Ships' Ballast Water and Sediments (BWMC) G: To prevent, minimize and ultimately eliminate the transfer of harmful aquatic organisms and pathogens through the control and management of ships' ballast water and sediments *HELCOM/OSPAR collaboration on regional management of ballast water	D: Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems.	**1. Favourable conservation status of Baltic Sea biodiversity** 1.1 No introductions of alien species from ships ** Number of new introductions observed per year* ** Number of established alien species per year* ** Amount of sediments delivered to port reception facilities* ** Trends in the numbers of detections of non-indigenous aquatic organisms introduced into the Baltic Sea* *(To prevent adverse alterations of the ecosystem by minimising, to the extend possible, new introductions of non-indigenous species)*	-
Convention on Biological Biodiversity G: To achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level I: Marine trophic index T: Status of threatened species improved	D: Populations of all commercially exploited fish and shellfish are within safe biological limits**,** exhibiting a population age and size distribution that is indicative of a healthy stock.	**1. Favourable conservation status of Baltic Sea biodiversity** 1.2. Thriving and balanced communities of plants and animals 1.3. Viable populations of species **Trends in the number of threatened and/or declining species* *(By 2012 spatial/temporal and permanent closures of fisheries of sufficient size/duration are established thorough the Baltic Sea area)* *(By 2009 illegal, unregulated and unreported fisheries are close to zero)* *(By 2008 successful eel migration from the Baltic Sea catchment area to the spawning grounds is ensured and national programmes for conservation of eel stocks are implemented)* *(By 2015, improved conservation status of species included in the HELCOM lists of threatened and/or declining species and habitats of the Baltic Sea area, with the final target to reach and ensure favourable conservation status of all species)* *(By 2015, to have the re-introduction programme for Baltic sturgeon in place, and - as a long term goal, after their successful re-introduction has been attained - to have best natural reproduction, and populations within safe genetic limits in each*	**1. To protect and conserve the ecosystems and the biological diversity of the maritime area which are, or could be, affected as a result of human activities, and to restore, where practicable, marine areas which have been adversely affected** [Spawning stock biomass of commercial fish species in the North Sea] *(Above precautionary reference points for commercial fish species where those have been agreed by the competent authority for fisheries management)* [Changes in the proportion of large fish and hence the average weight and average maximum length of the fish community] (The proportion of fish greater than 40 cm in length should be greater than 0.3)

Global	EU MSFD (Annex I descriptors)	HELCOM BSAP	OSPAR
		potential river) *(By 2015, to achieve viable Baltic cod populations in their natural distribution area in Baltic proper)* *(Spawning stock biomass of western Baltic cod and eastern Baltic cod compared to precautionary level (Bpa) as advised by ICES and/or defined by EC management plans & Fishing mortality level of western Baltic cod and eastern Baltic cod, compared to precautionary level (Fpa) as advised by ICES and/or defined by EC management plans)* *(By 2015 discards of fish are close to zero (<1%))* *(By 2015, as the short-term goal, to reach production of wild salmon at least 80%, or 50% for some very weak salmon river populations, of the best estimate of potential production, and within safe genetic limits, based on an inventory and classification of Baltic salmon rivers)* *(By 2009, appropriate breeding and restocking activities for salmon and sea trout are developed and applied and therefore genetic variability of these species is ensured)* *(By 2009 illegal, unregulated and unreported fisheries are close to zero)* *(By 2008 successful eel migration from the Baltic Sea catchment area to the spawning grounds is ensured and national programmes for conservation of eel stocks are implemented)*	
Convention on Biological Biodiversity G: To achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level I: Marine trophic index T: Status of threatened species improved	D: All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.	**1. Favourable conservation status of biodiversity** 1.2. Thriving and balanced communities of plants and animals **Trends in trophic structure and diversity of species (e.g. caught in scientific surveys)* 1.3. Viable populations of species * *Trends in the number of threatened and/or declining species* **Abundance, trends and distribution of Baltic seal species compared to the safe biological limit (limit reference level) as defined by HELCOM HABITAT* *(By 2015, improved conservation status of species included in the HELCOM lists of threatened and/or declining species and habitats of the Baltic Sea area, with the final target to reach and ensure favourable conservation status of all species)*	**1. To protect and conserve the ecosystems and the biological diversity of the maritime area which are, or could be, affected as a result of human activities, and to restore, where practicable, marine areas which have been adversely affected** 1.3. *[By-catch of harbour porpoises]* *(Annual by-catch levels should be reduced to below 1.7% of the best population estimate)* *[Seal population trends]* *(Harbour seal population size: Taking into account natural population dynamics and trends, there should be no decline in harbour seal population size (as measured by numbers hauled out) of ≥10% as represented in a five-year running mean or point estimates (separated by up to five years) within any of eleven sub-units of the North Sea. These*

Global	EU MSFD (Annex I descriptors)	HELCOM BSAP	OSPAR
		(By 2015 by-catch of harbour porpoise, seals, water birds and non-target fish species has been significantly reduced with the aim to reach by-catch rates close to zero)	*sub-units are: Shetland; Orkney; North and East Scotland; South-East Scotland; the Greater Wash/Scroby Sands; the Netherlands Delta area; the Wadden Sea; Helgoland; Limfjord; the Kattegat, the Skagerrak; the Oslofjord; the west coast of Norway south of 62oN.)* (Grey seal pup production: Taking into account natural population dynamics and trends, there should be no decline in pup production of grey seals of ≥10% as represented in a five-year running mean or point estimates (separated by up to five years), and in breeding sites, within any of nine sub-units of the North Sea. These sub-units are: Orkney; Fast Castle/Isle of May; the Farne Islands; Donna Nook; the French North Sea and Channel coasts; the Netherlands coast; the Schleswig-Holstein Wadden Sea; Helgoland; Kjørholmane (Rogaland)) [Seabird population trends as an index of seabird community health] [Changes in the proportion of large fish and hence the average weight and average maximum length of the fish community]
Convention on Biological Biodiversity *To achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level	D: Sea floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected.	**1. Favourable conservation status of biodiversity** 1.1. Natural marine and coastal landscapes **Percentage of marine and coastal landscapes in good ecological and favourable status* **Percentage of endangered and threatened habitats/biotopes' surface covered by the BSPAs in comparison to their distribution in the Baltic Sea* **Trends in spatial distributions of habitats within the Baltic Sea regions* *(By 2021 to ensure that "natural" and near-natural marine landscapes are adequately protected and the degraded areas will be restored)*	

Global	EU MSFD (Annex I descriptors)	HELCOM BSAP	OSPAR
Convention on Biological Biodiversity *To achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level	D: Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems.	**1. Favourable conservation status of biodiversity** 1.1 Natural marine and coastal landscapes **Percentage of marine and coastal landscapes in good ecological and favourable status* **Percentage of endangered and threatened habitats/biotopes' surface covered by the BSPAs in comparison to their distribution in the Baltic Sea* **Trends in spatial distributions of habitats within the Baltic Sea regions* *(By 2021 to ensure that "natural" and near-natural marine landscapes are adequately protected and the degraded areas will be restored)*	
Hazardous substances			
Stockholm Convention on Persistant Organic Pollutants (POPs), Aarhus Protocol on POPs to the UNECE Long-Range Transboundary Air Pollution, EU Regulatory framework for Registration, Evaluation, Authorisation and Restriction of Chemicals REACH (EC1907/2006)	D: Concentrations of contaminants are at levels not giving rise to pollution effects.	**1. Baltic Sea with life undisturbed by hazardous substances** 1.1. Concentrations of hazardous substances close to natural levels **Cadmium measured from fish (herring, flounder or perch) liver and blue mussel or Baltic clam soft tissue* *(Primary target of decreasing concentration trend, ultimate target level to reach near background concentrations)* **Mercury measured from fish (herring, flounder or perch) muscle and blue mussel or Baltic clam soft tissue* *(Primary target of decreasing concentration trend ultimate target level to reach near background concentrations)* **Dioxins, furans, dioxin-like PCBs in fish (herring or salmon or perch) muscle* *(Primary target of decreasing concentration trend, intermediate quantitative target given in BSAP, ultimate target level to reach near background concentrations)* **TBT in sediment or biota (fish or mussel) or imposex i.e., biological effects monitoring* *(Primary target of decreasing concentration trend and/or decreasing effects, ultimate target level to reach near background concentrations)* **PFOS in sediment or fish (species optional) liver*	1.a. To prevent pollution of the maritime area by continuously reducing discharges, emissions and losses of hazardous substances (as defined in Appendix 2), with the ultimate aim of achieving concentrations in the marine environment near background values for naturally occurring substances and close to zero for man-made synthetic substances 1.b.To prevent pollution of the maritime area from ionising radiation through progressive and substantial reductions of discharges, emissions and losses of radioactive substances, with the ultimate aim of concentrations in the environment near background values for naturally occurring radioactive substances and close to zero for artificial radioactive substances 1.1. Concentrations in the marine environment near background values for naturally occurring substances and close to zero for man-made synthetic substances *[*Cadmium, mercury, lead and PCBs, etc. measured from fish, shellfish and sediments]* ***Imposex in dog whelks (*Nucella lapillus*) or other selected gastropods (former n) *(The average level of impose in a sample of not less than 10 female dog whelks (Nucella lapillus) should be consistent with exposure to TBT concentrations below the environmental assessment criterion (EAC) for TBT – that is, < 2.0, as measured by the Vas deferens Sequence Index, Where Nucella does not occur naturally, or where it has become extinct, the red whelk (Neptunea antiqua), the whelk (Buccinum undatum) or the*

Global	EU MSFD (Annex I descriptors)	HELCOM BSAP	OSPAR
		(Primary target of decreasing concentration trend, ultimate target level to reach near background concentrations) 1.2. Healthy wildlife **White tailed sea eagle (and/or osprey) - proportion of successfully reproducing pairs and/or mean brood size* *(To be defined)* **Commercial Fish species - Fish Disease index* *(To be defined)* **Marine mammals: Grey seal for entire Baltic and ringed seal for northern Baltic, also harbour porpoise - Rate of pregnancy (CA), rate of fecundity (CL), occurrence of uterine pathology (occlusion, stenosis, "myoma"), occurrence of intestinal ulcers in 1-3 year-old seals* *(Targets to be defined)* 1.3. Radioactivity at pre-Chernobyl level **Cs-137 in herring muscle as indicator for whole Baltic Sea* *(Primary target decreasing trend, ultimate target level to reach pre-Chernobyl level which is 2.5 Bq/kg wet weight)* **Cs-137 in plaice and flounder muscle for Southern Baltic Sea (southwards from Gotland)* *(Primary target decreasing trend, ultimate target level to reach pre-Chernobyl level which is 2.9 Bq/kg wet weight)* **Cs-137 in sea water for whole Baltic Sea* *(Primary target decreasing trend, ultimate target level to reach pre-Chernobyl level which is of 14.6 Bq/m3)* **Cs-137 in sediment for whole Baltic Sea* *(Primary target decreasing trend, ultimate target level to reach pre-Chernobyl level which is 1 640 Bq/m2)*	*netted dog whelk (Nassarius reticulatus) should be used, with exposure criteria on the same index of <2.0, <0.3 and <0.3, respectively.)* 1.2. **Mercury concentrations in seabird eggs* *(The average concentrations of mercury in the fresh mass of ten eggs from separate clutches of common tern (Sterna hirundo) and Eurasian oystercatcher (Haematopus ostralegus) breeding adjacent to the estuaries of the Rivers Elbe, Weser, Ems, Rhine/Scheldt, Thames, Humber, Tees, and Forth, 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 in south-western Norway and in the Moray Firth)* **Organohalogen concentrations in seabird eggs* *(For each site, the average concentrations in fresh mass of the eggs of common tern (Sterna hirundo) and Eurasian oystercatcher (Haematopus ostralegus) should not exceed: 20 ng g−1 of PCBs; 10 ng g−1 of DDT and metabolites; and 2 ng g−1 of HCB and of HCH. Sampling should be of ten eggs of each species from separate clutches of birds breeding adjacent to the estuaries of the Rivers Elbe, Weser, Ems, Rhine/Scheldt, Thames, Humber, Tees, and Forth, and in similar (but not industrial) habitats in south-western Norway and in the Moray Firth)* **Proportion of oiled common guillemots among those found dead or dying on beaches (former f)* *(The proportion of such birds should be 10% or less of the total found dead or dying, in all areas of the North Sea)* 1.3. Concentrations in the environment near background values for naturally occurring radioactive substances and close to zero for artificial radioactive substances
EC 1881/2006 Maximum levels in fish muscle of mercury, cadmium, dioxins and dioxin like PCBs	Contaminants in fish and other seafood for human consumption do not exceed levels established by Community legislation or other relevant	**1. Baltic Sea with life undisturbed by hazardous substances** 1.1 All fish safe to eat *Cadmium in fish (herring or flounder or perch) muscle / edible part (Primary target of decreasing concentration trend ultimate target level to reach near background concentrations, intermediate	-

Global	EU MSFD (Annex I descriptors)	HELCOM BSAP	OSPAR
	standards.	targets for some fish including eel *Anguilla anguilla*) *Mercury in fish (herring or flounder or perch) muscle / edible part (Primary target of decreasing concentration trend ultimate target level to reach near background concentrations, intermediate targets for some fish including pike *Esox lucius* and eel *Anguilla anguilla*) *Dioxins, furans, dioxin-like PCBs in fish (herring or salmon or perch) muscle / edible part (Primary target of decreasing concentration trend ultimate target level to reach near background concentrations, intermediate target for dioxins include 4 x 10 -3 µg/kg (WW fish) measured as WHO-PCDD/F-TEQ)	
Maritime activities			
UNCLOS and Resolution by UN Assembly A/60/L.22 - Oceans and the Law of the Sea –of 29 November 2005 *Baltic Sea has a Special Area status under Annex V to MARPOL 73/78	D: Properties and quantities of marine litter do not cause harm to the coastal and marine environment.	1. *Amount of ship-generated waste delivered to port reception facilities in the Baltic ports in relation to the total number of calls at ports [(Regulations for the Prevention of Pollution by Garbage, The Baltic Strategy on Port Reception Facilities for Ship-generated Wastes, Marine litter covered by “no-special-fee” system for ship-generated wastes, Public awareness]	1. * (There should be less than 2% of northern fulmars (*Fulmarus glacialis*) having ten or more plastic particles in the stomach in samples of 50–100 beach-washed fulmars found in winter (November to April) from each of fifteen areas of the North Sea over a period of at least five years)
Others			
	D: Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment.	-	

Annex 2: EcoQO on spawning stock biomass of commercial fish species (Lead country: Norway)[5]

Background

Spawning stock biomass of commercial fish species is one of the Ecological Quality Objectives (EcoQOs) in the EcoQO system of the North Sea. The background and technical basis for this EcoQO is described in an OSPAR background document (OSPAR 2005/242).

Commercial fish stocks are evaluated by ICES based on estimated size of their spawning stock biomass (B) and rate of fishing mortality (F). Limit and precautionary reference points (values) are set for B and F. The limit on spawning stock biomass (B_{lim}) is where reproduction to the stock is impaired, and the limit on fishing mortality (F_{lim}) is where there is high probability that fishing will cause the stock to decline, eventually to below B_{lim} where reproduction is impaired. The precautionary reference points are set with a safety or buffer zone, so that B_{pa} is higher than B_{lim} and F_{pa} is lower than F_{lim}. The purpose of the buffer zones is to have low probability that the limits are crossed due to uncertainties in the assessment. Thus, if the stock is estimated to be at B_{pa}, there is low probability that it in reality could be below B_{lim}.

A distinction is made between an underlying and an operational objective in the routine use in fisheries management. The underlying objective is to maintain or move the spawning stock biomass above B_{lim} with high probability, and to maintain or move fishing mortality below F_{lim} with high probability. The operational objective is to maintain or move the (usually annual) point estimate of spawning stock biomass above B_{pa} and to maintain or move the point estimate of F below F_{pa}.

ICES has advised that this EcoQO should be applied at the aggregate level for all commercial fish stocks and not for each single stock that is managed according to limit and precautionary reference points. It is therefore proposed that the results should be presented by stating the proportion of the stocks for which the operational objective is met, while spelling out the fish stocks for which it is not met.

Overview of the rsults of recent Monitoring - Status of North Sea fish stocks 2006

The status of 26 stocks of 15 species of commercial fish in 2006 is presented in Table 2.1. This is based on the information from ICES (mainly 2007 assessments) downloaded from their web-page (www.ices.dk). The table gives 2006 information on the same 26 stocks that were included in the Background document with status for 2003 (OSPAR 2005).

The stocks in Table 2.1 are a mixed bag. Some are large North Sea stocks (North Sea cod, haddock, saithe, whiting, plaice, sole, and herring), others have more restricted distributions in the Kattegat-Skagerrak area or in the Eastern Channel (cod, whiting, plaice, sole, and herring), while others again are large migratory populations whose distributions include the North Sea part of the time (mackerel, horse mackerel, blue whiting).

[5] This assessment is based on ICES advice in 2007, including data up to 2006. An updated assessment including data up to 2009 has been undertaken as part of the OSPAR assessment of the environment impact of fishing (publication no. 2009/465).

Table. 2.1: *Commercial fish stocks in the North Sea and their status in 2006 based on the ICES assessments (www.ices.dk)* 1) Changed after 2003; B_{lim} and B_{pa} lower, F_{pa} higher

Species	Area	B_{lim}	B_{pa}	F_{pa}	SSB 2006	Stock status
Cod	North Sea, Eastern Channel, Skagerrak	70 000	150 000	0.65	28 000	Outside safe biological limits
	Kattegat	6 400	10 500	0.6	low <Blim	Outside safe biological limits
Haddock	North Sea, Eastern Channel, Skagerrak	100 000	140 000	0.7	238 000	Within safe biological limits
Saithe	North Sea, Skagerrak, and west of Scotland	106 000	200 000	0.4	298 000	Within safe biological limits
Whiting	North Sea and Eastern Channel	225 000	315 000	0.65	na	Uncertain; declining trend since 1995, likely Outside safe biological limits
	Skagerrak, Kattegat	na	na	na	na	Unknown; likely decline of stock since 2002
Hake	Northern stock (Biscay-Celtic Sea-North Sea-Skagerrak)	100 000	140 000	0.25	142 000	Within safe biological limits
Plaice	North Sea 1)	160 000	230 000	0.60	197 000	Outside safe biological limits
	Skagerrak, Kattegat	na	24 000	0.73	na	Unknown
	Eastern Channel	5 600	8 000	0.45	na	Unknown
Sole	North Sea	25 000	35 000	0.4	28 000	Outside safe biological limits
	Skagerrak and Kattegat	770	1 060	0.3	3 900	Inside safe biological limits
	Eastern Channel	na	8 000	0.4	11 600	Inside safe biological limits
Herring	North Sea, Eastern Channel, Skagerrak	800 000	1 300 000	0.25	1 208 000	Outside safe biological limits
	Kattegat, Western Baltic	na	na	na	185 000	Unknown
Sprat	North Sea	na	na	na	na	Unknown, appears at a median level
	Skagerrak and Kattegat	na	na	na	na	Unknown
Mackerel	North Sea stock component					Severely depleted since the 1970s
	Combined (Western, Southern, North Sea	na	2 300 000	0.17	2 200 000	Harvested outside safe biological limits
Horse mackerel	North Sea, Eastern Channel, Skagerrak	na	na	na	na	Unknown
	Western stock component	na	na	na	na	Unknown
Norway pout	North Sea and Skagerrak	90 000	150 000	na	80 000	Outside safe biological limits
Sandeel	North Sea	430 000	600 000	na	450 000	Outside safe biological limits
	Skagerrak, Kattegat	na	na	na	na	Unknown; possibly same stock complex as North Sea
Blue whiting	Portugal- Norway	1 500 000	2 250 000	0.32	5 500 000	Harvested outside safe biological limits
Anglerfish	North Sea, Skagerrak, Kattegat, west of Scotland	na	na	0.30	na	Unknown

Four of the stocks were assessed to have spawning stock biomass below B_{lim}, while another 4 stocks were assessed to be below B_{pa}. In addition, 2 stocks are fished outside F_{pa} ($F>F_{pa}$). Five stocks were assessed to be inside (on the safe side) of the precautionary reference points ($>B_{pa}$, $<F_{pa}$). For 11 of the stocks, either reference points had not been set or quantitative assessment had not been possible due to inadequate data, and their status was therefore given as unknown or uncertain. In terms of the aggregated EcoQO, 5 of the 26 fish stocks were assessed to meet the EcoQO criteria on spawning stock biomass. The ones that failed to do so are:

With spawning stock below B_{lim}:

- Cod in the North Sea including Eastern Channel and Skagerrak
- Cod in Kattegat
- Mackerel, North Sea stock component
- Norway pout

With spawning stock below B_{pa}

- Plaice in the North Sea
- Sole in the North Sea
- Herring in the North Sea including Eastern Channel and Skagerrak
- Sandeel in the North Sea

Harvested outside F_{pa}:

- Mackerel, combined stocks
- Blue whiting

The aggregated status of stocks in 2006 is shown in Figure 2.1 where it is compared to that in 2003. The same number of stocks (4) was below B_{lim} in each of the two years, with North Sea cod, cod in Kattegat, and North Sea mackerel being in this group both years. Norway pout fell from being within safe limits in 2003, to below B_{lim} in 2006. In contrast, North Sea plaice improved its situation from being below B_{lim} in 2003 to above B_{lim} (but below B_{pa}) in 2006.

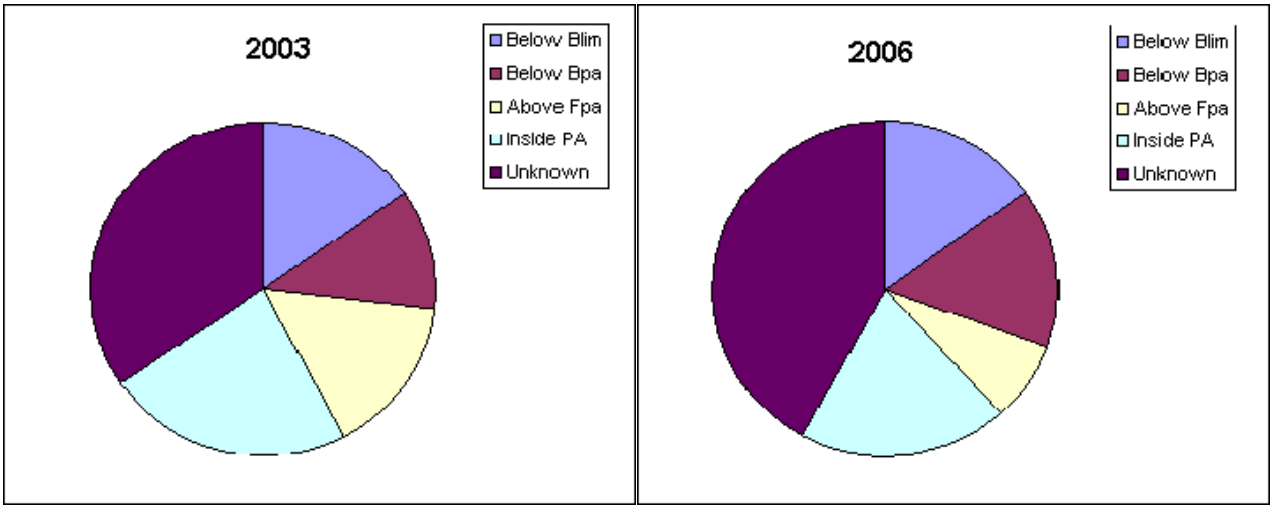


Figure 2.1. *Proportions of North Sea fish stocks outside and inside safe biological limits. Three categories are used for stocks outside safe limits: stocks below Blim, stocks below Bpa but above Blim, and stocks harvested above Fpa but with spawning stock above Bpa. Based on the information on 26 stocks in Table 2.1 for 2006. The information for 2003 is from OSPAR (2005).*

Four stocks were assessed to be below B_{pa} in 2006, compared to 3 in 2003. The four stocks in 2006 were the North Sea stocks of plaice (up from $<B_{lim}$), sole (as in 2003), herring (down from inside safe limits), and sandeel (change from uncertain). Two stocks were harvested outside F_{pa} in 2006 compared to 4 in 2003. The two were the combined stock of mackerel and blue whiting, which were in the same category also in 2003.

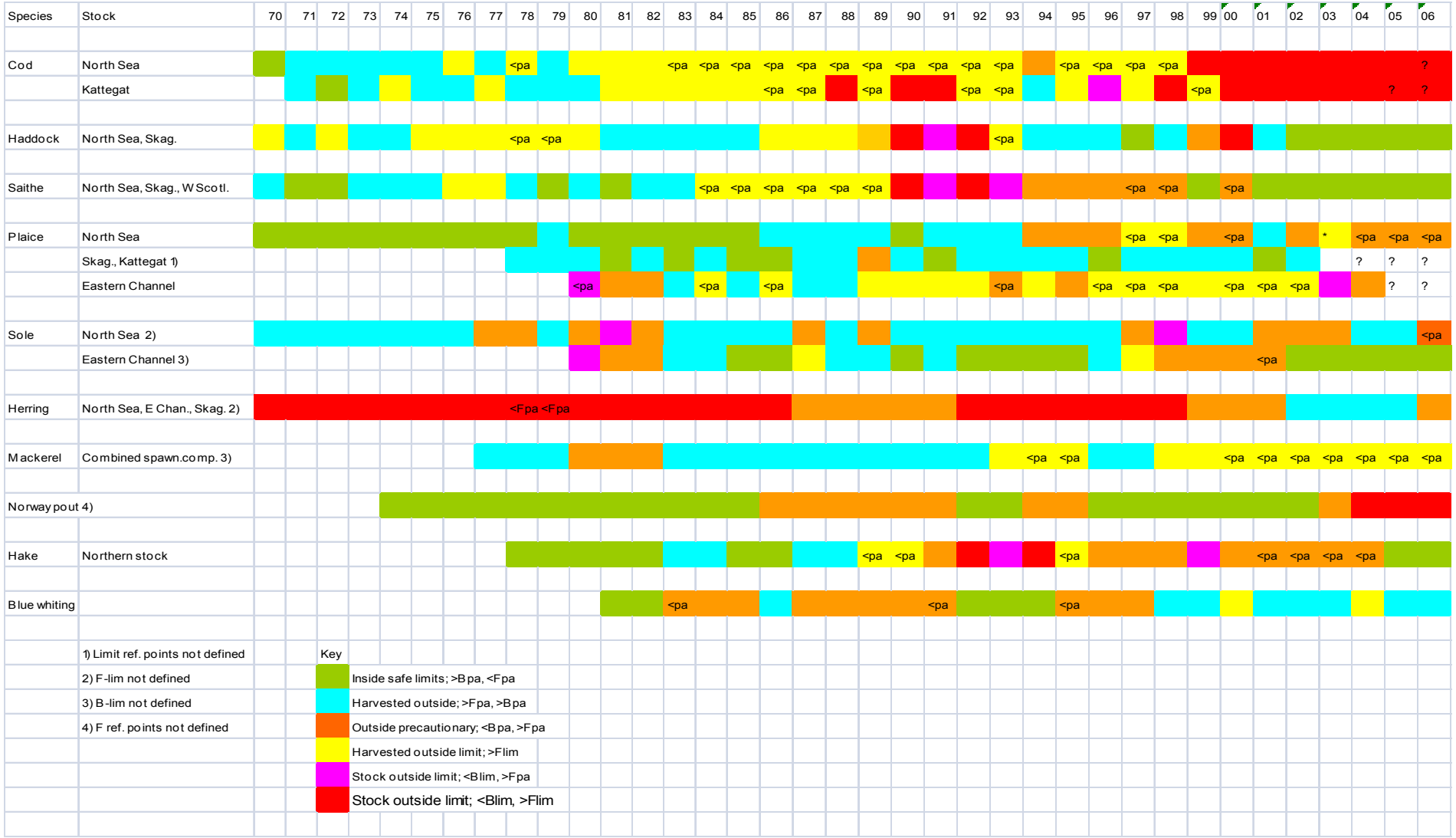
Five stocks were assessed to be within safe limits ($>B_{pa}$, $<F_{pa}$) in 2006, compared to 6 in 2003. These were haddock, saithe, sole in Skagerrak-Kattegat and in the English Channel, and hake. The first four of these were within safe limits also in 2003, along with North Sea herring and Norway pout.

Eleven stocks were classified as having unknown or uncertain status in 2006, compared to 9 in 2003. For seven of these stocks, no reference points have been determined. These are whiting, herring, sprat, and sandeel in Skagerrak and Kattegat, sprat and horse mackerel in the North Sea, and the western stock of horse mackerel. Quantitative assessments were not possible for whiting in the North Sea (also in 2003), plaice in Skagerrak-Kattegat and in the English Channel, and anglerfish. In 2003 there was no assessment result for sandeel in the North Sea.

Figure 2.2 shows a time series of status of 14 of the North Sea fish stocks from 1970 (starting later for some of the stocks) to 2006. This is an update of Figure 9 in the Background document (OSPAR 2005/242). Since assessment results may change back in time based on the most recent information, there are also some smaller changes in stock status for years prior to 2004.

North Sea cod and cod in Kattegat have fallen into the red zone (stock below B_{lim} and fishing mortality above F_{lim}) since 1999 or 2000. Norway pout has come into the red zone since 2004. Other stocks have shown the opposite trend. Thus haddock and saithe have come out of red or orange into the safe green zone from 2001 or 2002. Also sole in the Eastern Channel and hake have come into the green zone in recent years.

***Figure 2.2**. (Next page). Time series of stock status for main North Sea fish stocks for the period from 1970 to recent. The stock status is shown by colour codes as identified in the key. <pa in yellow cells indicates spawning stock biomass below Bpa. <pa in orange cells indicates fishing mortality below Fpa*


Species
Stock
70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06
Cod
North Sea
Kattegat
Haddock
North Sea, Skag.
Saithe
North Sea, Skag., W Scotl.
Plaice
North Sea
Skag., Kattegat 1)
Eastern Channel
Sole
North Sea 2)
Eastern Channel 3)
Herring
North Sea, E Chan., Skag. 2)
Mackerel
Combined spawn.comp. 3)
Norway pout 4)
Hake
Northern stock
Blue whiting
<pa
<Fpa <Fpa
1) Limit ref. points not defined
2) F-lim not defined
3) B-lim not defined
4) F ref. points not defined
Key
Inside safe limits; >Bpa, <Fpa
Harvested outside; >Fpa, >Bpa
Outside precautionary; <Bpa, >Fpa
Harvested outside limit; >Flim
Stock outside limit; <Blim, >Fpa
Stock outside limit; <Blim, >Flim

Has the EcoQO been met?

This question was also addressed in the Background document (OSPAR 2005/242) where the difficulty of interpreting the objective was discussed.

The short answer to the question is that the objectives are not met. Five out of 26 stocks within safe limits, or 5 out of 15 stocks for which reference points are set and assessment could be carried out, is lower than the objective. It is far below the objective if this is understood to mean that the operational objective of being within safe limits relative to the precautionary reference points (stock above B_{pa} and fishing mortality below F_{pa}) should be met for all stocks. However, this may imply double precaution since the operational objective is related to the underlying objective, which is to have low probability that the stock in reality should fall below B_{lim}.

The true stock size is not known but is estimated with uncertainty. However, we can use the estimated stock size falling below B_{lim} as an indication to what degree the underlying objective is being met. Four stocks represent about 15% of the total of 26 stocks, or about 25% of the 15 stocks for which stock status is available. If low probability for falling below B_{lim} is taken to be 5%, this would mean that 1 in 20, or about 5% of the stocks, could be estimated to be below B_{lim} by chance.

Figure 2.3 shows a graphical representation of the status of the 14 stocks, grouped into 4 categories: stock size below B_{lim}, stock below B_{pa}, stock fished outside precautionary limit ($>F_{pa}$), and stock within safe limits (stock $>B_{pa}$, fishing mortality $<F_{pa}$). The proportion of stocks below B_{lim} has increased from <10 % in the 1980s to around 20% in the 1990s and 2000s. This reflects a history where North Sea herring was the only species with stock below B_{lim} in the 1980s, through a situation where haddock, saithe, herring and hake were below B_{lim} in the early 90s, followed by a recovery of these stocks but a deterioration for cod and Norway pout falling below B_{lim} in the 2000s.

The proportion of stocks falling below B_{pa} (including those below B_{lim}) increased from 30-40% in the 1980s to about 50-60% in the 1990s. The proportion has declined somewhat to around 50% in the 2000s (Figure 2.3).

The proportion of stocks that were harvested at a rate above the precautionary limit ($F>F_{pa}$) but where the stock level still remained above B_{pa}, decreased from 40-50% in the 1980s, to around 30% in the 1990s and to around 20% in the 2000s.

The proportion of stocks that were within safe limits (spawning stock $>B_{pa}$ and fishing mortality $<F_{pa}$) were around 20-40% in the 1980s, decreased to 10-20% in the 1990, and increased again to around 30% in the 2000s. This reflected a shift from plaice, Norway pout, hake and blue whiting being within safe limit in the early 1980s, to haddock, saithe and sole being within safe limits in the recent years.

The precautionary approach with **pa** reference points was introduced in the ICES advice and fisheries management from the mid 1990s. One question is whether this helped to improve the situation for the fish stocks. To a moderate degree, this seems to have been the case. As seen from Figure 2.3, the number of stocks within safe limits increased, and the proportion of stocks harvested outside F_{pa}, and the proportion with spawning stock below B_{pa}, decreased from the late 1990s to the 2000s. At the same time there was an increase in the stocks below B_{lim} reflecting mainly the negative development of the two cod stocks (North Sea and Kattegat).

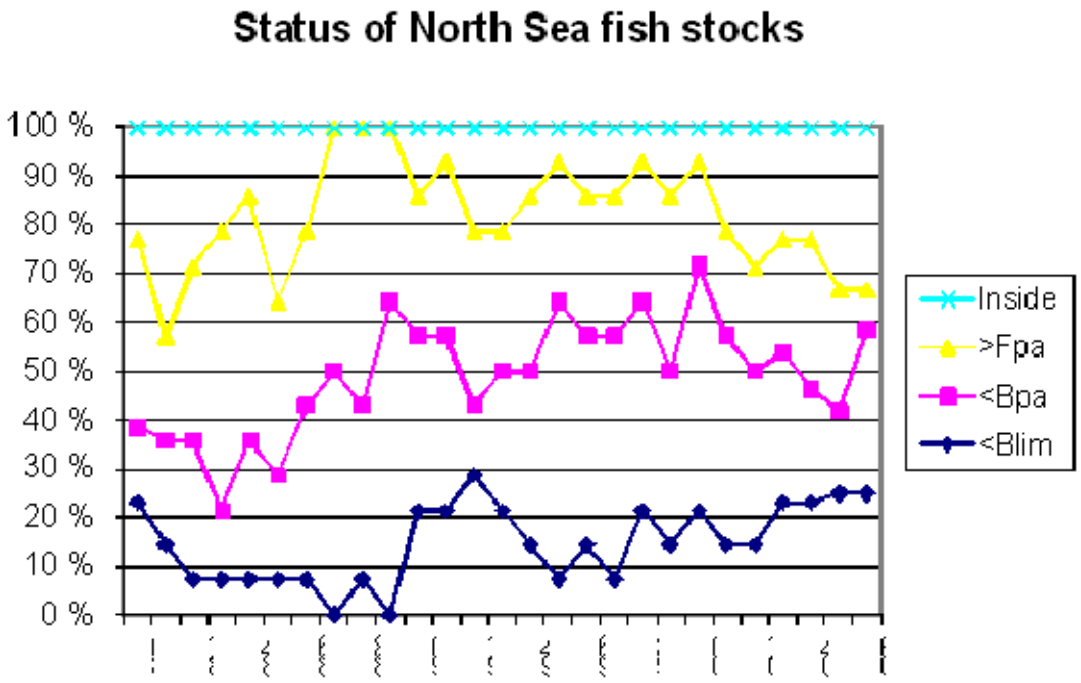


***Figure 2.3**: Proportions (cumulative) of fish stocks assessed to have spawning stock biomass <B_{lim}, spawning stock biomass <B_{pa} (but >B_{lim}), fishing mortality higher than F_{pa}, and stocks being within safe limits (biomass >B_{pa}, fishing mortality <F_{pa}. Based on time series from 1980 to present for 14 stocks shown in Figure 2.2.*

Use of the EcoQO

The EcoQO for commercial stocks of fish species in the North Sea is largely of the limit-type of objectives, being based on a lower limit for spawning stock biomass, below which recruitment (production of offspring) will be impaired.

The use of this EcoQO is the responsibility of the competent fisheries management authorities, which are the EU and Norway. OSPAR has no competence to adopt programmes and measures on questions related to the management of fisheries.

The fish stocks are routinely monitored by the North Sea countries and their status assessed by ICES. Poor quality of catch statistics may limit the quality and sometimes prevent quantitative assessments.

Management objectives have been set for several of the stocks. For some of the major North Sea stocks this is done as part of management agreements between the EU and Norway. This is the case for North Sea cod, haddock, herring, plaice and saithe. For these stocks, the objective is to maintain the stock above B_{lim} while aiming at a fishing mortality at or below F_{pa}. For North Sea herring the management plan is a harvest control rule (HCR), while for North Sea cod the plan includes a recovery plan aiming to rebuild the stock to above B_{pa}. The European Commission has enacted Council Regulations with recovery plans for cod in Kattegat and for hake (northern stock). Management objectives have also been set for the large stocks of mackerel (combined stocks) and blue whiting as parts of agreements between the coastal states (Faroe Islands, Iceland, Norway and EU). The objectives are to maintain the stock above B_{pa} (mackerel) or B_{lim} (blue whiting), while keeping F at or below F_{pa}.

There are no explicit management objectives set for about half of the stocks listed in Table 2.1. These include smaller stocks such as plaice, sole, whiting and sandeel in Skagerrak and Kattegat, plaice and sole in the Eastern Channel, and sprat in Skagerrak. Management objectives are also lacking for

some larger stocks including North Sea stocks of sole, whiting, sandeel and sprat, and also Norway pout, horse mackerel, and anglerfish.

Relation to Ecosystem Approach and the EC Marine Strategy Directive

The set of EcoQOs for the North Sea was developed with the aim of being an integral part of the Ecosystem Approach (EA) to the management of the North Sea, contributing to the objectives part of the EA. As such it is particularly important, as it can contribute to the further integration of fisheries and environmental protection, conservation and management measures, as called for in the Statement of Conclusions from the Intermediate Ministerial Meeting on the Integration of Fisheries and Environmental Issues in Bergen in March 1997.

The MSFD does not include fisheries, as it is a directive for measures to be drawn up by EU Member States, and the competence for fisheries management has been given to the European Commission. The EcoQO on commercial fish stocks can therefore have an important supplementary role to the MSFD by covering a key aspect of fisheries in relation to the overall objective of achieving good environmental status.

References

OSPAR (2005). North Sea Pilot Project on Ecological Quality Objectives. Background document on the Ecological Quality Objective for spawning stock biomass of commercial species in the North Sea. OSPAR Commission 2005, Publication No. 2005/242.

ICES (2007). Report of the ICES Advisory Committee on Fishery Management, Advisory Committee on the Marine Environment and Advisory Committee on Ecosystems, 2007. ICES Advice Books 5, 6 and 9.

Annex 3: EcoQOs on harbour and grey seal population trends (Lead country : UK)

Background

It was agreed at the fifth North Sea Conference in 2002 (5NSC) that an Ecological Quality Element relating to seal population trends in the North Sea would be given an Objective: "No decline in population size or pup production of ≥10% over a period of up to 10 years". The further development of this Element and Objective was subsequently included in the work programme of BDC and at BDC 2003 UK agreed to act as the lead country for it. ICES was also requested to undertake work in relation to the Element (see BDC 04/2/2). The original EcoQO was for both seal species and following a recommendation, OSPAR 2005 agreed to divide the two seals and reformulate the grey seal EcoQO as: "*Taking into account natural population dynamics and trends, there should be no decline in pup production of grey seals of ≥10% as represented in a five-year running mean or point estimates (separated by up to five years) within any of nine sub-units of the North Sea. These sub-units are: Orkney; Fast Castle/Isle of May; the Farne Islands; Donna Nook; the French North Sea and Channel coasts; the Netherlands coast; the Schleswig-Holstein Wadden Sea; Heligoland; Kjørholmane (Rogaland)*."

The harbour seal EcoQO was reformulated as: *"Taking into account natural population dynamics and trends, there should be no decline in harbour seal population size (as measured by numbers hauled out) of ≥10% as represented in a five-year running mean or point estimates (separated by up to five years) within any of eleven sub-units of the North Sea. These sub-units are: Shetland; Orkney; North and East Scotland; South-East Scotland; the Greater Wash/Scroby Sands; the Netherlands Delta area; the Wadden Sea; Heligoland; Limfjord; the Kattegat, the Skagerrak and the Oslofjord; the west coast of Norway south of 62°N"*.

OSPAR 2006 adopted the agreement on the application of the EcoQO system in the North Sea (*OSPAR agreement 2006-4*). This sets out *inter alia* the work to produce evaluations of each EcoQO, which will form the basis of:

a. in 2008, a first evaluation of the results of the application of the EcoQO system, leading to

b. in 2009, an improved evaluation of the results of the EcoQO system, as a contribution to the QSR 2010.

Guidance on reporting formats for the seal EcoQOs was circulated to Contracting Parties on 20 December 2006.

This document evaluates the following issues:

a. whether the EcoQO is met, and if not, why not. This is based on an evaluation of the status of seals in the North Sea in relation to the EcoQO prepared by ICES following a request from OSPAR. (ICES, 2008);

b. (potential) consequences of failing to meet the EcoQO (see paragraphs 14 – 17 of OSPAR agreement 2006-4);

c. suitability of present monitoring and reporting;

d. developments in harmonisation of monitoring and reporting schemes;

e. costs of present monitoring and reporting;

f. extra costs of harmonising the monitoring;

g. performance of the EcoQO in terms of the ICES criteria for good EcoQOs and with regard to the Ecosystem Approach to management (both within OSPAR and the MSFD);

h. the specific linkages with the MSFD and how the EcoQO might be used in relation to the MSFD initial assessment, drawing up programmes and measures and elaborating GES;

i. gaps in knowledge, present conditions that hamper the implementation process and ways and means to overcome these problems;

j. effectiveness of communication, *i.e.* amount of support and knowledge on this EcoQO among stakeholders; and

k. if needed, a proposal for modification and improvement of the EcoQO, including consideration on whether the EcoQOs set originally in 1999 would require revision in the light of the timing for GES under the MSFD and are consistent with other regional agreements and legislation;

l. proposals for possible milestones up to the achievement of the objective;

m. potential applicability of the EcoQO in other OSPAR regions than the North Sea.

Overview of the results from recent monitoring

Results available to the UK from a variety of sources are shown below for grey seal pup production (Table 3.1) and harbour seal counts (Table 3.2).

Table 3.1: *Grey seal pup production in sections of the North Sea and where known, pup production trends over the past five years. . (Based upon ICES 2008 unless otherwise indicated)*

Location	Year 1	Pup production	Year 2	Pup production	Overall change Year 1–Year 2	Survey frequency	Average annual change Year 1–Year 2
Orkney, UK	2002	17 942	2006	19 332	+8%	annual	+1.9%
UK North Sea colonies							
*Fast Castle/Isle of May**	2002		*2005*	*2718*		annual	*+4.2%*
*Donna Nook**			*2005*	*1276*			*-2.4%*
Total		4 520	2006	5 322	+18%		+4.4%
French North Sea and Channel coasts*			2006	11	?		?
Netherlands coast	2002		2006	200	+50%	annual	
Schleswig-Holstein Wadden Sea			2007	58	+20%		
Heligoland*			2006	23			?
Kjorholmane (Rogaland)*#			2006	170-200			
ICES IVa (Norway south of 62°N)			2003	35	stable	occasional	

*Data reported to OSPAR by relevant Contracting Party in 2007. #Individual animals (not a pup count)

Table 3.2: *Recent moult counts of harbour seals in OSPAR region II (North Sea). The average annual change in absolute numbers counted over a five year period is given in the final column. (Based upon ICES 2008 unless otherwise indicated).*

Location	Year 1	Moult Count	Year 2	Moult Count	Overall change Year 1–Year 2	Survey frequency	Average annual change Year 1–Year 2
Shetland, UK	2001	4 883	2006	3 057	−37%	4–5 yearly	−7.5%
Orkney, UK	2001	7 752	2006	4 256	−45%	4–5 yearly	−9.0%
East Scotland	1997		2005			4–5 yearly	
North and East[1]		*1709*		*1169*			*-4.6%*
South-east[2]		*749*		*650*			*-1.8%*
Total		2 458		1 819	−26%		−3.2%
Greater Wash to Scroby Sands	2001	4 274	2006	2 784	−35%	annual	−7.0%
Netherlands delta area (report by Netherlands)	2002	173	2006	171			
The Wadden Sea							
Netherlands	2003	*2 365*	2007	*4 159*	*+76%*	annual	*+19.0%*
Germany		*7 285*		*10 947*	*+50%*		*+12.6%*
Denmark		*1 160*		*2 499*	*+115%*		*+28.8%*
Total		10 810		17 605	+62.9%		+15.7%
Heligoland (report by Germany)		?	2007	150-200			
Limfjorden, Denmark	2003	?	2007	879	−23%	annual	*c.* −4.6%
Kattegat, Skagerrak and the Oslofjord							
Kattegat	2003	?	2007	6 182	+35%	annual	*c.* +7.0%
Skagerrak		?		2 689	+20%	occasional	*c.* +4.0%
Norwegian Skagerrak (ICES IIIa)		?		291	+20%	occasional	?
West coast of Norway (south of 62° N ICES IVa)	2003	?	2006	685	−40%	occasional	*c.* −8.0%?

Notes: [1]Montrose to Cape Wrath; [2]English Border to Montrose

Have the EcoQOs been met?

As can be seen from Tables 3.1 and 3.2, it is not possible to evaluate this question for all sub-units of the North Sea coast. For the grey seal, ICES have advised that the EcoQO was achieved for all sub-units where data are available (ICES 2008). There were no declines in pup production of 10% or greater, as represented by a five year running mean or point estimates. One section (Farne Islands) has experienced a decline in pup production believed to be associated with density dependence (there is no more space for seals to breed at this location) – this can be regarded as "natural population dynamics" and thus the EcoQO is met in this sub-unit also.

In contrast, ICES have advised that the EcoQO for Harbour seals was not met in the following sub-units due to declines of 10% or more (as represented by a five-year running mean or point estimates:

Shetland, Orkney, east of Scotland (North and East Scotland; South-East Scotland), Greater Wash to Scroby Sands, Limfjorden and the west coast of Norway south of 62° N (ICES, 2008). Of these areas only the Limfjorden has been affected by morbillovirus in recent years. The reasons for changes in the other areas are not yet clear.

Consequence of failing to meet the EcoQOs

If the EcoQOs are not met, then the best first step would be to determine why. Further actions would depend on the results of that research. The UK has started studies of the causes of the decline in harbour seals on the east coast of Scotland.

Suitability of present monitoring and reporting

As can be seen from Tables 3.1 and 3.2, not all Contracting Parties have submitted information, and for other the information submitted insufficient to evaluate whether the EcoQOs were being met or not. It is not known whether this was due to either insufficient monitoring and/or a breakdown in the reporting process.

Developments in harmonisation

In general, seal monitoring has evolved to best suit local circumstances in various areas of the North Sea – for instance monitoring of large numbers of small rocky islands in the Orkney Islands will have different challenges than those posed by seals using sand and mud banks in the southern North Sea. Luckily the nature of this EcoQO means that harmonisation is not required across the whole North Sea – what is required is consistency in monitoring within each sub-unit over time. It would though be useful to have the protocols in use at present within each sub-unit of the North Sea written down and on record within OSPAR so that any subtle variation in counting technique can be recorded and allowed for in assessing changes. This should be a relatively simple collation and editing task following contact with the groups of scientists undertaking the monitoring. This task might be undertaken by ICES or by an independent contractor, and there may be a more general task covering all EcoQOs where methods and standards are not currently on formal OSPAR record. It is recommended that the Secretariat investigates the scope of work across the EcoQOs and brings forward suggestions for undertaking this work.

Costs of present monitoring and reporting

Costs of seal monitoring in the UK by the Sea Mammal Research Unit vary, but are approximately £270 000 per year. This figure includes the extensive portion of the UK seal population that occurs in western UK (OSPAR Region III), but does not include the costs of monitoring by other organisations at several colonies on the UK's North Sea coast. Costs have not been obtained from other Contracting Parties.

Extra costs of harmonisation

These costs have not been evaluated, but as noted above, may not be relevant.

Performance of these EcoQOs

The performance of the two seal EcoQOs do not differ from the ICES evaluation of the combined seal EcoQO (OSPAR, 2006). In essence, the EcoQOs generally perform well, but are not tightly linked to a

single manageable human activity. It is not believed that this short-coming affects their overall usefulness.

Specific linkages with the MSFD

Seals are not mentioned specifically in the MSFD, however, the status of seal stocks in the North Sea (and elsewhere) are certainly of concern to users of the marine environment and the general public. It would be surprising if seal numbers and trends were not reported as part of the MSFD initial assessment and in descriptions of GES. Seal numbers and trends are also reported under the 'Conservation Status' monitoring of the EU Habitats Directive (92/43/EEC). If the EcoQOs were not met, and following investigation into causes, the EcoQOs could be useful in indicating suitable measures that might be taken. Plainly, it is difficult to take measures against the epizootic-driven declines, but if in the future, causes were found to be directly related to anthropogenic activities, measures should be possible.

Gaps in knowledge

See above in relation to the supply of data by certain Contracting Parties. The full conditions hampering implementation of these EcoQOs are not known. A proposal to ask ICES to undertake evaluation of these EcoQOs at regular intervals was made to BDC 2007; this might make the collation of data from national sources a little more automatic than is evident at present. In addition, the composition of ICES Working Groups brings together the expertise often of those actually collecting the data, thus ensuring correct interpretation (with suitable caveats) and potentially helping in harmonisation of collection procedures.

Effectiveness of communication

The EcoQOs are not well known, but the general state of seal populations is reasonably well known among the general public and users such as fishermen. The overall communication of EcoQOs though is at present rather technical and scientific – with in many cases tracts of text with few figures. There are insufficient resources available at present to improve this, but it is recommended that the Secretariat examines options for improving this situation in the next round of reporting in 2009.

Proposals for modification and improvement of the EcoQOs

The earlier revision from the single seal 1999 EcoQO (as described above) was a distinct improvement. Grey seal numbers though have continued to increase in the UK, with breeding starting in new areas. For instance, in the past 5 - 6 years, grey seals have started to breed at two colonies in Norfolk, at Blakeney Point (north) and at Horsey/Winterton (east), with 234 pups born at Blakeney in 2006 and 133 at Horsey. It is thus recommended that the relevant EcoQO region be adjusted to become the 'Greater Wash' to conform with the area used for harbour seals. Similarly, new colonies in the Firth of Forth lead to the suggestion that 'the Isle of May and Fast Castle' should in future be referred to as 'Firth of Forth colonies' allowing other colonies in the area to be included. The revised grey seal EcoQO might therefore read:

> "*Taking into account natural population dynamics and trends, there should be no decline in pup production of grey seals of ≥10% as represented in a five-year running mean or point estimates (separated by up to five years) within any of nine sub-units of the North Sea. These sub-units are: Orkney; Firth of Forth; the Farne Islands; the Greater Wash; the French North Sea and Channel coasts; the Netherlands coast; the Schleswig-Holstein Wadden Sea; Heligoland; Kjørholmane (Rogaland)*."

Possible milestones up to the achievement of the objective

None seem necessary.

Potential applicability of the EcoQOs in other OSPAR Regions

Grey and harbour seals occur also in OSPAR Regions I and III. The potential for using these EcoQOs in these regions seems high. An evaluation would need to be made of the extra monitoring needs in these areas. It is known that suitable data exist for all UK coasts in Region III. ICES (2008) reported that if the EcoQO was applied in Regions I and II, the harbour seal EcoQO may not be met in the Outer Hebrides (a 13% decline between 2000 and 2003 has been reported) and the grey seal EcoQO may not be met in Iceland (a 30% decline between 2001 and 2006 has been reported).

References

ICES (2008). Advice on the status of seals and harbour porpoises in the North Sea. ICES Advice Book 2008 Book 1 Section 6.3.3.1 6pp.

OSPAR (2006). Report on North Sea Pilot Project on Ecological Quality Objectives. OSPAR Commission. Publication Number: 2006/239.

Annex 4: EcoQO on harbour porpoise by-catch (Lead country: UK)

Background

It was agreed at the fifth North Sea Conference in 2002 (5NSC) that an Ecological Quality Element relating to harbour porpoise by-catch in the North Sea would be given an Objective: "Annual by-catch levels should be reduced to levels below 1.7% of the best population estimate." The further development of this Element and Objective was subsequently included in the work programme of BDC and at BDC 2003 the UK agreed to act as the lead country for it. ICES was also requested to undertake work in relation to the Element (see Section 6 of the 2003 ICES Advisory Committee on Ecosystems (ACE) Report: Ecological Quality Objectives).

OSPAR 2006 adopted the agreement on the application of the EcoQO system in the North Sea (*OSPAR agreement 2006-4*). This sets out *inter alia* the work to produce evaluations of each EcoQO, which will form the basis of:

a. in 2008, a first evaluation of the results of the application of the EcoQO system, leading to

b. in 2009, an improved evaluation of the results of the EcoQO system, as a contribution to the QSR 2010.

Guidance on reporting formats for the harbour porpoise by-catch EcoQO was circulated on 20 December 2006.

Reporting on certain cetacean by-catches from all EU Member States around the North Sea is required under EC Regulation 812/2004; these reports are relevant but are not fully comprehensive for the North Sea (OSPAR Region II). Those reports that are relevant and publicly available have been used in compiling this evaluation. In addition, evaluation of the scale of by-catch of cetaceans in fisheries is required under the EU Habitats Directive, but precise standards have not been set and there has been little actual evaluation or enforcement of this Directive requirement.

The UK and ICG-EcoQO evaluated the following issues:

a. whether the EcoQO is met, and if not, why not;

b. (potential) consequences of failing to meet the EcoQO;

c. suitability of present monitoring and reporting;

d. developments in harmonisation of monitoring and reporting schemes;

e. costs of present monitoring and reporting;

f. extra costs of harmonising the monitoring;

g. performance of the EcoQO in terms of the ICES criteria for good EcoQOs and with regard to the Ecosystem Approach to management (both within OSPAR and the MSFD;

h. the specific linkages with the MSFD and how the EcoQO might be used in relation to the MSFD initial assessment, drawing up programmes and measures and elaborating GES;

i. gaps in knowledge, present conditions that hamper the implementation process and ways and means to overcome these problems;

j. effectiveness of communication, i.e. amount of support and knowledge on this EcoQO among stakeholders;

k. if needed, a proposal for modification and improvement of the EcoQO, including consideration on whether the EcoQOs set originally in 1999 would require revision in the light of the timing for GES under the MSFD and are consistent with other regional agreements and legislation;

l. proposals for possible milestones up to the achievement of the objective;

m. potential applicability of the EcoQO in other OSPAR regions than the North Sea.

It should be noted that as part of the 2008 ICES work programme, OSPAR has asked ICES to evaluate the harbour porpoise by-catch in the North Sea in relation to the EcoQO. ICES' response was published as section 6.3.3.1 of the ICES 2008 Advice (Book 6).

Overview of results from recent monitoring

Reported information on harbour porpoise by-catch in the North Sea is shown in Table 4.1 (including information from ICES (2008).

Table 4.1: *Harbour porpoise by-catch reported by Contracting Parties around the North Sea in 2005-2007*

Country	Observation	Extrapolation
Norway[1]	A total of 149 harbour porpoises were reported by-caught by 18 coastal gillnet vessels observed between 1 January and 31 December 2006	None reported
Sweden	No report received. Informal information from Sweden indicates that the on-board observation programme was performed according to EU Regulation 812/2004, and identified no by-catch of harbour porpoises	
Denmark	As required for Regulation 812/2004, Denmark is running an observer programme related to pelagic trawl fisheries in the North Sea, but this is not expected to show harbour porpoise bycatch	An extrapolation to Danish North Sea fisheries based on data of the late 1990s has been published
Germany	In 2007, one animal from the North Sea was reported by-caught. However, due to lesions two additional animals from the North Sea (140 total animals necropsied) were diagnosed during necropsy as possible by-catches	None reported
Netherlands	Based on the necropsy of 62 porpoises stranded in 2006 (total of more than 500 stranded animals) and the cause of death being established, it was estimated that between 53% and 70% of porpoises were by-caught	None reported
Belgium	Based on the necropsy of 70 porpoises in 2007 and the cause of death being established, it was estimated that between 30% and 45% of porpoises were by-caught. There has been a recent increase in strandings (and by-catch)	None reported
France	The report for Regulation 812/2004 covered only pelagic fisheries. No harbour porpoises were reported caught in these fisheries. Some stranded porpoises in northern France show evidence of by-catch in this area	
UK	Report on 2005-06 season was based on observations on selected fisheries in the North Sea. No harbour porpoise by-catch was observed in the North Sea and 14 animals were observed in the south-west UK waters (including in areas north and west Region II)	No estimate possible in North Sea, but c350 (2005) and c530 (2006) with wide confidence intervals, in southwest area (but note that this includes west of OSPAR Region II)

[1]including Norwegian waters in OSPAR Region I

In order to assess any by-catch as a percentage in this EcoQO, a best estimate of harbour porpoise numbers is needed. An international survey of small cetaceans (SCANS II) occurred in north-west EU (and some Norwegian) shelf seas in July 2005, funded by the EU and most relevant Contracting Parties to OSPAR. For the North Sea north of the Straits of Dover, a best estimate of 239 061 harbour porpoises was made, while for the Celtic Shelf (the south-west part of OSPAR Region II but the Celtic Shelf also includes much sea area to the west of this) the best estimate was 79 468. The relevant portion of these figures (1.7%) is 4064 and 1351 respectively.

Has the EcoQO been met?

As can be seen from Table 4.1, it is not possible to evaluate whether or not the EcoQO has been met on the basis of reports received. This is due mostly to the lack of a comprehensive requirement for observing by-catch in fisheries that might affect harbour porpoises in the EU. It is regrettable that such a requirement is not in place at least for the most relevant fisheries.

Consequences of failing to meet the EcoQO

A potential consequence of not meeting the EcoQO would be a decline in the harbour porpoise population. This risk might be avoided by asking relevant fisheries managers to take suitable management measures. In essence, this has occurred in the past prior to the introduction of Regulation 812/2004. The Regulation though does not appear to be effective in that there are technical problems with some of the gear modifications required and there is no requirement to monitor effectiveness of any changes in the fisheries concerned. A consequence of this lack of knowledge might therefore be to improve the gear modification requirements and to ask fisheries managers to require monitoring of a sufficiently high standard in all relevant fisheries. OSPAR might bring this issue to the attention of relevant fisheries managers.

Suitability of present monitoring and reporting

It is plain that the present monitoring and reporting across the North Sea is inadequate for EcoQO purposes. As noted above, monitoring and reporting under EU Fisheries Regulations or equivalent Norwegian regulations does not fully match that needed for the EcoQO. Regulation 812/2004 does not require the monitoring of fisheries that should be using pingers on nets as a porpoise deterrent regardless of whether the pingers have actually been deployed; this Regulation does not cover vessels of less than 14 m in length (much netting that is risky to harbour porpoises is deployed from such vessels) and monitoring is not required in all fisheries that catch harbour porpoises. Although monitoring and reporting is needed under the Habitats Directive, and should cover relevant fisheries, the exact specification or scale of such monitoring has not been defined and may vary between Member States, and in practice is not adequate for evaluating the EcoQO. OSPAR might consider approaching ASCOBANS to discuss a joint approach to harbour porpoise by-catch and ensuring that suitable monitoring is undertaken by all relevant fishing nations.

Developments in harmonisation

ICES has established a group that is considering the harmonisation of monitoring and reporting for Regulation 812/2004. That group will also be looking at strategies for monitoring including requirements for sampling and extrapolation (from sample to population scale). OSPAR should ask ICES to determine how much further monitoring might be needed to meet the requirements of this EcoQO (this would incidentally also help ASCOBANS in their purposes). A proposal to ask ICES to undertake evaluation of this EcoQO at regular intervals was made to BDC 2007; this would help in ensuring that reporting occurs.

Costs of present monitoring and reporting

No costs have been reported.

Extra costs of harmonisation

These costs have not been evaluated.

Performance of the EcoQO

This does not differ from ICES evaluation when the EcoQO was established (OSPAR, 2006). In general the EcoQO performs well against the criteria with the exception that there is no long term data.

Specific linkages with the MSFD

Harbour porpoise by-catch is not mentioned specifically in the MSFD, however, this by-catch is certainly of concern to the public living around the North Sea. By-catch though is closely related to the Common Fisheries Policy and at present the links between this policy and the MSFD are not fully clear. It would be surprising if harbour porpoise numbers and trends, along with known by-catch were not reported as part of the MSFD initial assessment. Harbour porpoises do not respect national borders and the population is international and pressures on the population are international, so it follows that conservation responsibilities should also be international. Harbour porpoise numbers and trends are also reported under the 'Conservation Status' monitoring of the EU Habitats Directive (92/43/EEC). The EcoQO could be useful in indicating suitable measures that might be taken, should the EcoQO not be met.

Gaps in knowledge

See above. The full conditions hampering implementation of this EcoQO are not known. The core of the problem is a mismatch between what EU Fisheries Council (and the Norwegian equivalent) are prepared to implement for fisheries and the requirements for understanding the true impact of fisheries on harbour porpoises.

A proposal to ask ICES to undertake evaluation of this EcoQO at regular intervals was made to BDC 2007; this might make the collation of data from national sources a little more automatic than is evident at present. In addition, the composition of ICES Working Groups brings together the expertise often of those actually collecting the data, thus ensuring correct interpretation (with suitable caveats) and potentially helping in the harmonisation of collection procedures, and reporting procedures for the various frameworks that are interested in by-catch.

Effectiveness of communication

Knowledge of the EcoQO (as with most other EcoQOs) is low, however knowledge of the issue is generally high and is the cause of considerable public concern as demonstrated by letter-writing campaigns and political lobbying. Conversely many fishers (and their regulators), although in some cases being concerned are demonstrably unwilling to either allow observers aboard their vessels to assess the scale of by-catch or to be regulated to reduce that by-catch. It is debatable as to whether OSPAR is the most appropriate body to address these wider issues. ICG-EcoQO recommends that OSPAR should discuss these public support issues with ASCOBANS and the EU fisheries managers to determine the best way forward.

Proposal for modification and improvement of the EcoQO

The EcoQO, as currently formulated, is consistent with the objectives of other international agreements, most notably ASCOBANS. North Sea Ministers, meeting at Gothenburg in 2006 have agreed a limit of 1% of the best population estimate, but gave no timescale (again consistent with the ASCOBANS objectives). No proposal is made for modifying the EcoQO at this time. It is recommended that the OSPAR Secretariat discuss this issue with ASCOBANS to see if any change in the EcoQO would be appropriate.

Possible milestones up to the achievement of the objective

Milestones are very difficult to set given the difficulties with political will.

Potential applicability of the EcoQO in other OSPAR regions

Harbour porpoises are present additionally in OSPAR Regions I, III and IV, although their density and distribution in Region IV is low (therefore making monitoring particularly difficult). The potential for using this EcoQO in further OSPAR regions, especially Region III therefore seems high. An evaluation would need to be made of the extra monitoring needs in these areas. In other areas, it might be more suitable to use by-catch of the commonest cetacean present in the area rather than harbour porpoise (*e.g.* common dolphin in Regions III, IV and V).

References

ICES (2008). Advice on the status of seals and harbour porpoises in the North Sea. ICES Advice Book 2008 Book 1 Section 6.3.3.1 6pp.

OSPAR (2006). Report on North Sea Pilot Project on Ecological Quality Objectives. OSPAR Commission. Publication Number: 2006/239.

Annex 5: EcoQO on the proportion of oiled guillemots (Lead country: the Netherlands)

Background

As a result of chronic marine oil pollution, many thousands of seabirds wash ashore on beaches every year. Systematic Beached Bird Surveys (BBS) have been conducted since the early 1960s around the North Sea to study temporal and spatial trends in oil-related mortality in seabirds. Common guillemots are common and widespread seabirds that are sensitive to oil pollution. Spatial patterns in common guillemot oil rates reflect different levels of chronic marine oil pollution around the North Sea, whereas temporal trends in oil rates are indicative for changes in these levels over time. The bird is common enough to provide useful data on an annual basis in all North Sea countries, and the species has therefore been selected as a prime object for the monitoring study. The EcoQO Oiled Guillemots describes the proportion of oiled common guillemots *Uria aalge* among those found dead or dying on beaches within the OSPAR area.

The EcoQO Oiled Guillemots is not only meant to monitor current patterns in oil rates, but can also be used to check if set targets will actually be reached. In the more heavily polluted parts of the North Sea, only a few decades ago, around 90% of all stranded common guillemots were oiled. Oil rates have substantially declined in most areas, and the most heavily polluted areas today produce oil rates of around 50%. Even though this means a considerable improvement in comparison with the 1960s, 1970s and even 1980s, such levels are still considered high. Law enforcement, in combination with new measures to minimise chronic oil pollution at sea, should lead to further reductions, so that eventually:

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

The implementation of the EcoQO Oiled Guillemots is currently under consideration. This evaluation describes the suitability of present (existing) monitoring schemes around the North Sea and provides an update of current levels of oil pollution in stranded guillemots around the North Sea. BBS co-ordinators around the North Sea were consulted to check the current status of the various monitoring projects, to see what steps should be taken to modify schemes that are currently sub-standard or simply different from the international monitoring scheme now proposed, and to provide an inventory of any costs that may be involved to upgrade existing schemes and to have countries participating. Finally, the co-ordinators were asked to provide an update on current levels of oil rates in stranded common guillemots. Gaps in knowledge will be highlighted and suggestions to improve existing BBS programmes and to harmonise the collections of data will be provided.

Overview of results from recent monitoring

Monitoring of oiled common guillemots around the North Sea

Although national boundaries may be the most practical subdivision of the North Sea in terms of financing and logistics, a further subdivision is required to describe spatial differences in oil rates all over the North Sea. Following OSPAR 2005, 15 sub-regions were studied:

Sub-regions	
1	Shetland UK
2	Orkney and north coast of Scotland UK
3	East Scotland Duncansby Head to Berwick on Tweed UK
4	North-East England Berwick on Tweed to Spurn Head UK
5	East England Spurn Head to North Foreland UK
6	Eastern Channel line between North Foreland and Belgian/French border to line from Cherbourg to Portland UK, F
7	Western Channel line between Cherbourg and Portland to line from Lizard to Ouessant UK, F
8	Eastern Southern Bight French border Belgian coast to Texel B, NL
9	Southern German Bight North Sea coast Frisian Islands Texel to Elbe NL, D
10	Western Wadden Sea mainland and Wadden Sea coast Frisian Islands Texel to Elbe NL, D
11	Eastern Wadden Sea mainland coast and Wadden Sea coast Elbe to Esbjerg D, DK
12	Eastern German Bight North Sea coast Wadden Sea Islands Elbe to Fanø D, DK
13	Danish west coast mainland coast Esbjerg – Hanstholm DK
14	Skagerrak east of line between Hanstholm to Kristiansund, north of a line from Skagen to Gothenburg N, DK, S
15	SW Norway Kristiansund to Stadt N

Oil rates are species- and area-specific, but also vary seasonally and can even be age-specific (annual natural mortality of juvenile guillemots is proportionally higher than in adults). The use of scavenged or otherwise incomplete corpses ('remains') found on beaches may bias the results. For reasons of consistency, participants are asked to systematically search for guillemots between November and April, to identify and age the birds they find according to standardised ageing techniques, to check the corpses for missing parts, and to carefully check for oil in the feathers.

Overview and evaluation of the information provided by each Contracting Party:

In **Britain**, the situation is fairly complex. There are currently no surveys conducted according to the standards set for the EcoQO Oiled Guillemots, with the exception of Shetland, Orkney, NE England, and small parts of SE England. The Royal Society for the Protection of Birds, co-ordinating the national BBS, only carries out the annual census at the end of February, so a BBS network is in place, but the one for the EcoQO is not. The Shetland and Orkney (monthly) surveys are intact and available for the EcoQO.

For **France**, the *Ligue pour la Protection des Oiseaux* (LPO) provided a single data sheet showing numbers of oiled common guillemots in winter (November - April) 2003 - 2007. Neither the observer effort (km surveyed), nor the exact geographical location are known. There is no information on the age of the birds, or on numbers found without any oil in the feathers and oil-rates can therefore not be calculated. While the timing of the surveys is in accordance with the EcoQO Oiled Guillemots, the rest of the material provided is not. It is not clear if the rest of the necessary information is unavailable, or if the database analysis has been incomplete.

Germany's BBS is suitable for the evaluation of the EcoQO Oiled Guillemots. In Niedersachsen, the monitoring system is ideal. Counts are carried out every two weeks at spring tide on a number of survey sites throughout the year. In Schleswig-Holstein counts are carried out every two weeks at spring tide on a number of survey sites. However, the monitoring season needs to be extended to cover April (now only monitoring in October - March, test for April in 2007). To improve the quality of the data, notably with regard to ageing and percentage of plumage covered with oil, an improved schooling of survey workers will be necessary. Minor amendments to databases will be necessary.

Note that only 19 complete guillemot corpses were found in the winter 2005/06 in Schleswig-Holstein. Unless this was an exceptional winter, more effort (*i.e.* more km) will be required in the future to increase the number of corpses found and used to calculate the oil rate.

Winter-surveys (BBS) in **Belgium** are co-ordinated by the Research Institute for Nature and Forest (INBO) on a monthly basis during October - March covering the entire Belgian coastline including the outer port of Zeebrugge. Occasionally, surveys were conducted outside the winter season (*e.g.* April 1998). Exceptionally high numbers of stranded birds (wrecks) were encountered in February 1999. On average, adults constitute about 51% of the guillemot strandings in Belgium. The Belgian BBS programme can be considered fully suitable for the EcoQO Oiled Guillemots, while the scope for regular extension of the monitoring work into the month of April may be investigated.

In **The Netherlands**, surveys are co-ordinated by the Royal Netherlands Institute for Sea Research and conducted by volunteers recruited from the Dutch Seabird Group. BBS are conducted year-round, but at a rather low level from May through October. Mainland coast surveys are seriously hindered by clean-up operations of coastal communities and high levels of damage from scavengers. For most sub-regions, however, annual indices will be available based on a sufficiently large number of intact and aged carcasses. The most recent data were published in June 2007 (covering winter 2006/07), showing an all-time low in common guillemot oil rates.

No response was received despite enquiries from **Norway** and **Denmark**. It is possible that changes in the address or person of co-ordinators have led to a lack of response, but the risk that BBS schemes have actually been discontinued cannot be excluded. The establishment of an international monitoring project would require immediate action to clarify these matters and to see if the relevant data can (still) be obtained from the NE North Sea countries.

It was clear that most co-ordinators were awaiting the implementation of the EcoQO Oiled Guillemots before they were prepared to (if needed) re-structure their monitoring programme and to collect and analyse the data on the scales required to fully meet the requirements. A summary of BBS programmes around the North Sea and the potential to provide data for each of the 15 sub-regions on an annual basis given the current conditions of monitoring work is provided below:

Sub-region		Countries involved	BBS scheme running	Compliance EcoQO	Update for 2006
1	Shetland	UK	Yes (SOTEAG)	complete	available
2	Orkney	UK	Yes (RSPB Orkney)	complete	available
3	E Scotland	UK	Annual mid-winter	not	not available
4	NE England	UK	Yes (Dan Turner)	needs modification	not yet available
5	E England	UK	Annual mid-winter	not	not available
6	E Channel	UK	Annual mid-winter	not	not available
7	W Channel	UK, F	Annual mid-winter	not	not available
8	E Southern Bight	B, NL	Yes	complete	available
9	S German Bight	NL, D	Yes	complete	available
10	W Wadden Sea	NL, D	Yes	complete	available
11	E Wadden Sea	D, DK	D Yes, DK unknown	partly	partly available
12	E German Bight	D, DK	D Yes, DK unknown	partly	partly available
13	Danish W coast	DK	unknown	not known	data deficient
14	Skagerrak	N, DK, S	unknown	not known	data deficient
15	SW Norway	N	unknown	not known	data deficient

B = Belgium, D = Germany, DK = Denmark, F = France, N = Norway, NL = the Netherlands, S = Sweden, UK = United Kingdom.

Oil rates in relation to the objective

Sub-region		Countries involved	Oil rate 2006/07	Compliance EcoQO	Notes
1	Shetland	UK	UK Ad 21.1%, Juv 0.0%	UK fully; 14.3% for all intact, Nov-Apr 2006/07 data	
2	Orkney	UK	UK 4.2%	no age, complete corpses only, all year 2006-07 data	
3	E Scotland	UK	No data		
4	NE England	UK	Not yet available	Annual report expected	
5	E England	UK	No data		
6	E Channel	UK	No data		
7	W Channel	UK, F	No data		
8	E Southern Bight	B, NL	NL Ad 39.6%, Juv 11.9% B Ad 34.5%	NL fully, Nov-Apr data 2006/07 B fully, Nov-Apr data 2005/06 is most recent available	
9	S German Bight	NL, D	NL Ad 22.8%, Juv 27.6% D 8.3%	NL fully, Nov-Apr data 2006/07 D no age, Niedersachsen Oct-Mar data 2005/06	
10	W Wadden Sea	NL, D	NL Ad 17.1%, Juv 19.2%	NL fully, Nov-Apr data 2006/07	
11	E Wadden Sea	D, DK	No data		
12	E German Bight	D, DK	D 9.5%	D no age, North Sea data combined, Oct-Mar 2005/06	
13	Danish W coast	DK	No data		
14	Skagerrak	N, DK, S	No data		
15	SW Norway	N	No data		

From **Shetland**, updates on oil rates for 2005/06 (12.0%) and 2006/07 (14.3%) were received. The Shetland BBS fully accommodates the EcoQO standards and overall oil rates (all intact corpses) as well as a breakdown for age is provided. Sample sizes are rather small, however, because scavengers damage most corpses found. In 2005/06, adults scored 14.3%, whereas birds identified as juveniles had an oil rate of 11.1%. For both categories, the sample size was in fact too small (16 and 9 birds respectively). In 2006/07, adults scored 21.1%, juveniles 0.0%, but again, after breakdown the sample size was in fact too small (19 and 9 birds respectively).

Orkney reports an oil rate of 3.2% for all common guillemots found stranded between March 2006 and February 2007. There was no ageing of guillemots reported, but when only 'complete' carcasses were considered (as required for the EcoQO), the oil rate is 4.2%.

From surveys in **Belgium**, an overall oil rate of 40.4% is calculated for the 2005/06 season (more recent data is currently unavailable). Since the late 1990s, common guillemots are routinely aged during surveys, but in most seasons, the sample for aged birds is too small to calculate age-specific oil rates. Over the years, oil rates in juveniles in Belgium were only half (22.5%) the levels found in adult birds (55.6%). In 2005/06, the last year available, adult oil rate amounted to 34.5% (insufficient data for juveniles).

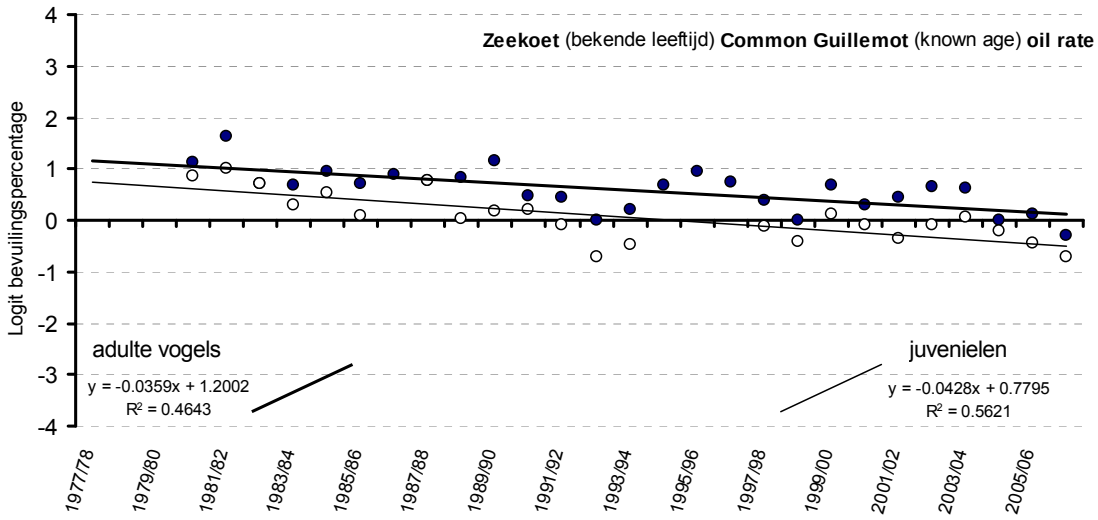


Figure 5.1: *Logit-transformed oil-rates for common guillemots of known age in winter (● = adults, ○ = juveniles). Oil-rates were calculated when at least 25 complete carcasses were found; linear regression for both categories. Graph from Camphuysen 2007*

The **Netherlands** reported an oil rate of 28.1% for all common guillemots suitable (complete) in winter (*n* = 576). Broken down for age and EcoQO sub-regions (fully complying), oil rates varied between 3.7% and 39.6% in mature birds and between 11.9% and 27.6% in juveniles, with young birds on average having a lower oil rate (18.6%) than adults (32.0%), and with particularly low levels within the Wadden Sea. A recent annual report showed that the difference between oil rates in adults and juveniles was highly consistent over time (Figure 5.1). The oil rates over 2006/07 were an all time low for the area.

Oil rates in **Germany** have declined over time (Figure 5.2). Data were split between Niedersachsen, Helgoland and Schleswig-Holstein North Sea coast. No separate data set for the Wadden Sea area (sub-regions 10 and 11) was received. Oil rates in Germany in 2005/06 (the most recent data) were very low in comparison with neighbouring countries.

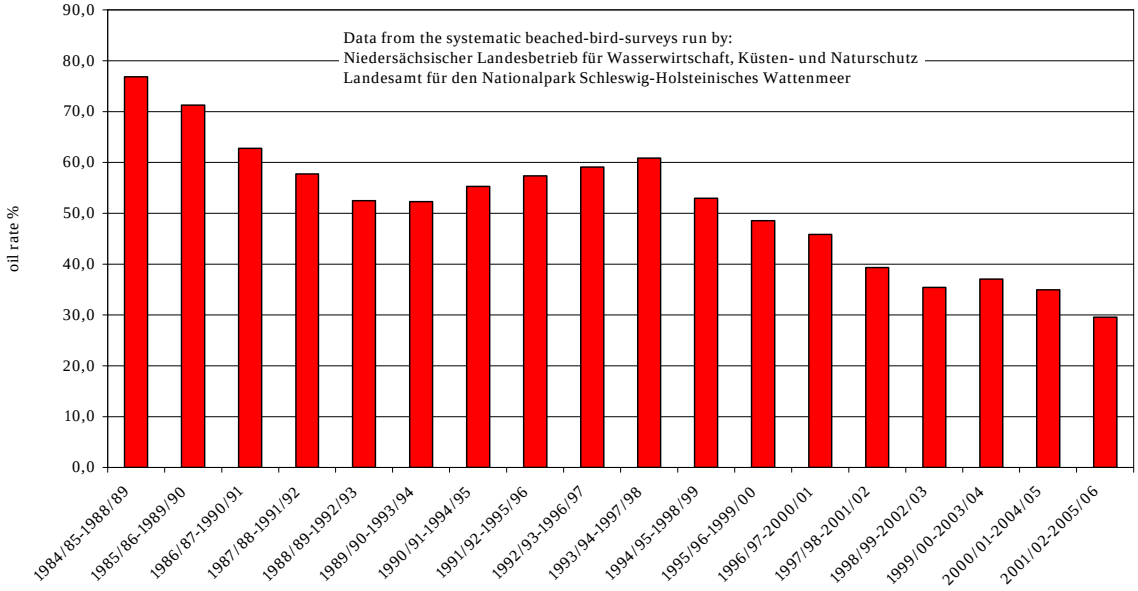


Figure 5.2*: Common guillemot oil rates on the German North Sea coast (5-year running means). Graph courtesy David Fleet.*

Consequences of failing to meet the EcoQO

The ecological consequences of failing to meet the EcoQO do not only apply to guillemots, but also to other species of birds, and other elements of the North Sea ecosystem.

From a management point of view, exceeding the level of 10% indicates oil rates that should be reduced. The pilot project mentioned the following management measures could be taken to achieve the EcoQO:

The North Sea is a "Special Area" under MARPOL which means that discharge into the sea of oil or oily mixture from any oil tanker and ship over 400 gt is prohibited. OSPAR has developed regulations on discharges of oil in produced water from offshore installations. Other possible measures are related to control and enforcement of MARPOL, prevention, oil recovery/clearing and education.

Suitability of present monitoring and reporting

At present, in the absence of an international co-ordinator, the reporting of oil rates is infrequent, differs in structure between countries, and is difficult to compare. In Shetland, Orkney, NE England, Belgium, the Netherlands and Germany, it should be possible to obtain a full update and in some cases even a long-term trend of oil rates over the past decades. So far, countries listed here that share EcoQO sub-regions (sub-regions 8, 9, 10) have not attempted to combine their data on a regular basis. The participation of these countries, however, should guarantee that for sub-regions 1, 2, 4, (some data for 5), 8, 9, 10, 11, and 12 an annual index can be calculated. Sub-regions 3, (5), 6, 7, and 13-15 will be data deficient unless further steps are taken.

There is still a lack of information from Norway, Sweden, Denmark, France and (parts of) the United Kingdom.

Developments in harmonisation of monitoring and reporting schemes

There is already clear monitoring guidance available for implementation of this EcoQO (see the Handbook for the Application of Ecological Quality Objectives in the North Sea (OSPAR 2007/307)). This allows for harmonisation of monitoring of this EcoQO by the North Sea countries.

For NE England, the BBS data collection includes monthly censuses providing information on distance surveyed, number of guillemots found and number of guillemots oiled. Slight modifications are required to fully meet the EcoQO standards (ageing and recording state of corpses). Orkney and Shetland fully comply, whereas a substantial change is required to set up a national (UK wide) BBS that would produce data in accordance with standards outlined earlier. For Belgium, Germany and the Netherlands, there is no need to further harmonise the data, even if the material delivered to the EcoQO may be slightly different from the manner in which the data are presented and analysed nationally. The guillemots are properly aged and checked for completeness of the corpses, and the EcoQO sub-regions are properly sampled on a monthly basis during all (NL, D) or nearly all (B) in winter. The material received from LPO in France is incomplete and negotiations will have to be started to see where and how the French workers could modify their set-up to fully meet the EcoQO standards. Danish and Norwegian BBS organisers have shown in the past that their material is useful. In the absence of a response during the preparation of the present report, we must be prepared to accept that BBS schemes have perhaps either deteriorated, or were stopped entirely.

Costs of present monitoring and reporting

The monitoring of oil by using this EcoQO is much cheaper than monitoring by ships or planes. An important assumption for the budget presented below is that budgeted costs include only costs necessary for the successful completion of the project: an international combination of data.

Such (annual) costs include:

- overall international co-ordination and an annual report (lead country only, estimated at *c.* € 13 250 = per annum) and
- national expenses on top of the costs required to run a BBS and
- organisation of participating volunteers (estimated at € 1500 = per annum for participating countries).

The actual costs of a national BBS vary per country and these are not budgeted here, for they are seen as a national responsibility of countries represented at the North Sea Ministers Conference; those that signed the Bergen Declaration.

Additional costs are involved when the monitoring programme includes systematic oil sampling and the analysis of these samples as a study of the sources of oil. Costs would then include materials for sampling, the distribution of sampling tools and the central collection of the samples. A central laboratory is the most cost-effective solution for this task. Budgeted costs are based on estimates by the Bundesamt für Seeschiffart und Hydrographie in Hamburg (Germany). It should be highlighted that the Oiled Guillemot EcoQO could start even if a decision regarding the need for chemical analysis of oil samples is postponed.

Overview of costs involved

Co-ordination, lead country	**Days**	**Rate (€)**	**Subtotal**	**Remarks**
*Project co-ordination (work time)	10	750	7500	p.a.
*Production annual report	5	750	3750	p.a.
*Mailing, printing report, expendables		1000	1000	p.a.
*Travel		1000	1000	p.a.
Subtotal			13 250	p.a.
National co-ordination				UK, N, DK, D, NL, B, F
***Running BBS			p.m.	National responsibility; costs depend on present state of volunteer network and travel expenses
*EcoQO participation	2	750	1500	p.a. per country, as a compensation for work needed to implement the EcoQO on a national level: data preparation and steering of volunteers to follow the protocols exactly
Chemical analysis of oil and other substances				
*Technician	full time		40 000	BSH, Hamburg
***Supervision of work and reporting	5		3750	BSH, Hamburg
			43 750	

Extra costs of harmonising the monitoring

In **Britain**, the national co-ordinator (RSPB) has not adopted the EcoQO methodology and field work scheme (Nov-Apr) because there is no funding available. Shetland, Orkney, and NE England are prepared to deliver data at no extra costs and fully in compliance with the EcoQO standards.

In **Germany** the oiled bird monitoring takes place as part of the management activities of the national parks. Co-ordination, analysis and reporting of the beached bird surveys are also carried out, at least in part, as part of the managing system or the general operations of the national parks. The effort and costs are directly related to the number and length of sites surveyed as well as the frequency of the surveys. Germany has about 40 standard sites with a total length of about 180 km. These sites are counted twice a month during the winter period. Currently, there is no need to greatly expand the work on a regular basis and there will therefore only be a demand for the extra costs to deliver data annually for the EcoQO reports.

Surveys in **Belgium** are supported by national funding. The delivery of data and formatting to meet EcoQO Oiled Guillemots standards are the only, fairly insignificant, extra costs needed to fully participate.

Surveys in **the Netherlands**, conducted by volunteers of the Dutch Seabird Group and co-ordinated by the Royal Netherlands Institute for Sea Research (NIOZ), are subsidised on an annual basis by the Dutch Ministry of Transport, Public Works and Water Management. The maintenance of the network is highly dependent on that financial contribution and future support is required to fulfil the national commitments for the Oiled Guillemot EcoQO. As long as the national surveys are subsidised nationally, there is no extra funding required to deliver data for the annual EcoQO report.

No information for **France**, **Denmark** and **Norway**.

Performance of the EcoQO

The technical performance of the EcoQO as provided by ICES, has been summarized by OSPAR (2006).

ICES criteria	Comments
Relatively easy to understand by non-scientists and those who will decide on their use	A guillemot polluted with oil will die soon, because it is not able anymore to dive for gathering food.
Sensitive to a manageable human activity	The guillemots are sensitive to oil. Input from oil arises mainly from shipping, oil incidents and to a lesser extent from the offshore mining industry.
Relatively tightly linked in time to that activity	A guillemot polluted with oil will die soon, because it is not able to dive to gather food.
Easily and accurately measured, with a low error rate	Volunteers can search on the beaches for dead guillemots, keeping counts of those polluted by oil. If volunteers are educated the error rate can be very low.
Responsive primarily to a human activity, with low responsiveness to other causes of change	In a natural situation there should be no oil in the North Sea. All oil pollution originates from human activities.
Measurable over a large proportion of the area to which the EcoQ metric is to apply	In each country sub-regions should be chosen to sample the entire coastline appropriately. The selection of sub-regions should take into account local conditions and will vary between countries, with different strategies in those whose coastline is mainly comprised of long sandy beaches and countries where the coast consists of numerous islands, fjords or long stretches of cliff. A representative fraction of the coast directly bordering the sea should be chosen and remain standardised over the years. The length of coast chosen should produce sufficient beached birds of the most common species to enable the calculation of reliable oil rates. Information on the amounts of input of oil should be available.
Based on an existing body or time-series of data to allow a realistic setting of objectives	Most North Sea countries have already measured oiled guillemots. There are already certain time series.

Gaps in knowledge

As outlined above, several areas are data deficient, while other projects require (some) modifications to fully meet the EcoQO standards. While the most extreme areas in terms of oil rates (very low rates generally in the NW North Sea and normally by far the highest oil rates in the SE North Sea) are currently well monitored, those areas that should produce intermediate levels are not very well surveyed at the moment. Immediately after implementation, an international co-ordinator should put emphasis on improving that situation.

Effectiveness of communication

It is clear that all guillemots being oiled are a result of oil pollution caused by human activities, and stakeholders and the public could easily see the relevance of this EcoQO.

Inputs of oil come from ships, from land-based sources, by accidents and to a lesser extent from the offshore oil industry. In cases where oil slicks occur at sea, discharges are likely to be illegal. Since the discharge of oil or oily mixtures that cause slicks is prohibited, possible measures would be to further enforce current regulations. In addition, prevention, education, and effective oil recovery may lead to cessation of illegal discharges or reductions in impacts. The aim of this EcoQO is therefore to avoid the occurrence of oil spills and their effects.

Recommendations

Whether the status of the EcoQO should be target, limit or indicator

It is proposed that the objective for EcoQO for oiled guillemots should be considered as a *"**limit**"*, *i.e.* a quantitative value of an indicator associated with the state of ecosystem (*i.e.* physical, chemical or biological characteristics), usually expressed as a maximum or minimum, beyond which undesirable or even irreversible effects to living organisms may occur. If a limit has been exceeded, it should trigger management actions.

Proposals for modification and improvement of the EcoQO

The German co-ordinator regrets that there is no longer a systematic analysis of oil from the plumage of all birds found. A systematic analysis of oil samples may be implemented in the North Sea region. Furthermore, information on shipping densities and on the distribution of guillemots in the winter period would be helpful for the interpretation of the results.

The co-ordinator in the Netherlands would immediately support the suggestion to implement a systematic analysis of oil samples from feather samples as a very valuable source of extra information. A recent spill of a complex mixture of some vegetable oil and cleaning detergent (incidentally dissolving the soft parts of birds affected) has once more demonstrated the need to learn more about the origin and source of incidental spills.

No specific suggestions were provided by any of the other co-ordinators.

Specific linkages with the MSFD

The EcoQO on oiled guillemots can be used to contribute to the GES generic descriptor for "Concentrations of contaminants are at levels not giving rise to pollution effects". Oil is a significant issue in the North Sea. The EcoQO expresses its impact at the level of individual organisms and populations. This EcoQO was defined as an aspirational objective in 1999, on the basis of what was achieved in terms of measures to address impacts from a single source in a remote area. This was well in advance of the concept of a region wide GES under the MSFD. The objective of 10% may not

therefore be realistic for areas subject to impacts from multiple pressures and therefore may have to be redefined for use in a GES context.

The ICG-EcoQOs recommends that the objective should be redefined. The objective of 10% would still serve as the long-term objective (to reach by 2030). For the short term, however, an adjustment to 20% is recommended based on the current rate of decline in the number of oiled guillemots. The proposal for the new objectives is:

> *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.*

Potential applicability of the EcoQO in other OSPAR regions

An EcoQO Oiled Guillemots could be useful in the entire Bay of Biscay area (France, NW Spain), although the ageing of birds in these waters is critical, given high proportions of juveniles in these waters. Further to the south, the Razorbill *Alca torda*, could be used to replace common guillemots as indicators.

Conclusions

On the basis of recent information (2006/2007, as described in this document) and on information on the period 1997/1998 up to 2001/2002 (as described in the Background Document on the EcoQO on Oiled Guillemots – publication 2005/252) it can be concluded that this EcoQO is not met in almost all sub-regions. Downward trends in oil rates are recorded, but it is unclear if the objective will be reached in all sub-regions by the year 2021. This date is important for the MSFD. EcoQOs can play a role in implementing this Directive.

This means that all the North Sea Contracting Parties have to take action on the control and enforcement of existing measures to achieve this EcoQO. It is not clear yet how realistic this is, in terms of cost-effectiveness.

It is proposed that the EcoQO for oiled guillemots should be considered as a “limit”.

The performance of this EcoQO is good, especially the communication of this EcoQO is very effective: It is clear that all guillemots being oiled are a result of oil pollution caused by human activities.

The monitoring is not fully in compliance with the requirements for the EcoQO in all 15 sub-regions, the same applies to the availability of data for 2006.

It is clear that BBS schemes have deteriorated on a North Sea scale since the first proposals to join forces and form an international database were written. This is partly because co-ordinators lost interest, or funds (or both), and partly because it took too long for the EcoQO to become implemented. Sceptic responses about an eventual implementation were received several times. However, we may expect an upsurge in interest as soon as the monitoring programme actually starts. For the moment, an incomplete coverage is better than no coverage. So far, excessive costs are not foreseen to establish an EcoQO Oiled Guillemots, at least as far as data deliveries and international co-ordination is concerned. To establish national BBS schemes in areas where the coverage is weak or incomplete (such as in most of the UK, France, Denmark and Norway), national support may be required.

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Annex 6: EcoQO on plastic particles in seabird stomachs (Lead country: the Netherlands)

Background

The occurrence of plastics (and other man-made types of litter) in the marine environment is due solely to human activity, and can therefore be controlled by human management. Operational and cargo-related wastes from ships are an important source of litter in the marine environment in the entire North Sea. Marine litter, in which plastic has the dominant role, causes huge economic damage (Hall 2000) through costs for coastal clean-ups, reduced tourism, disabled ship propellers and engines, tainted fish-by-catch, and damage to coastal agriculture. Furthermore, marine litter causes ecological damage to a wide range of marine organisms, including at least marine mammals, birds, turtles and fish (Laist 1997; Derraik 2002). Such damage results from: a) entanglement in litter items leading to lethal injury, drowning or starvation, and b) ingestion of plastic and other litter by many species that mistake marine debris for food. Ingested plastics, if not directly lethal, deteriorate body condition by a reduced intake of normal food, negative effects on digestion and elevated body-burdens of toxic chemicals.

The Northern Fulmar is a particularly convenient species to measure plastic pollution by stomach content analysis. Like the whole group of 'tubenosed' seabirds (the albatrosses and petrels), it frequently ingests plastic litter. Fulmars are abundant in the North Sea, forage exclusively at sea, regularly ingest litter, and accumulate wear-resistant items like plastic in their stomach. Stomach contents thus provide an integrated picture of litter abundance at the sea surface. In a pilot study, it was shown that stomach contents of beached emaciated birds have the same amounts of plastics as healthy birds.

Sampling programmes of beached dead fulmars have already been established in a number of locations around the North Sea. Most of these are conducted as a part of existing long-term Beached Bird Surveys. A monitoring programme using litter abundance in stomachs of beached fulmars has been in effect in the Netherlands since 1982. As of 2002, the Dutch fulmar research was expanded to all countries around the North Sea as a project under the Save the North Sea (SNS) programme and has been developed further as an 'Ecological Quality Objective (EcoQO)'.

> The EcoQO is formulated as: *"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."*

The aim of the EcoQO is not just a healthy fulmar population, but a healthy environment for all species in the ecosystem, the fulmar is a convenient monitoring tool. The 10% target-level was advised to OSPAR as a relaxation to OSPAR's initial proposal of 2%. Compared to levels just out of the North Sea at the Faroe Islands (at that time about 25% birds with > 0.1 g plastic) the 10% target-level seemed ambitious but achievable (ICES 2006). The choice for 10% is thus not directly related to a particular health status of fulmars, but a political choice. Currently 10% levels probably only occur in arctic populations (Van Franeker *et al.* 2008). The 0.1 g level is also not directly related to harm to the fulmar; originally an amount of 10 particles was proposed, this was later changed to the more exact measure of 0.1 g (the average weight of 10 particles). A biologically meaningful level cannot be really established, because a 'no effect' level for fulmars could still be harmful to other ecosystem components. Thus, the EcoQO is an indication of the level of litter in the marine environment, not of harm to the fulmar or to the marine environment.

The main sea-based sources of marine litter are shipping and fisheries. Other sources include coastal tourism and land-based waste dumps that are either located directly at the coast or near rivers that discharge into the sea. In the short term, the most promising measure to reduce litter is a focus on litter from shipping and fisheries through a further refinement of the implementation of the EU Directive on Port Reception Facilities (EU Directive 2000/59/EC). In the longer term, amendments to MARPOL Annex V (simplifying rules to basically 'no discharge') and support to the 'Clean Ship' concept offer potential to reduce marine littering from ships. Specific measures may be needed with regard to discarded and lost fisheries materials including those from mariculture.

Overview of results from recent monitoring

Over the period 2002 - 2006, 1090 Fulmar stomachs from the North Sea were analysed, 304 from the Netherlands, 786 from other locations. Preliminary results from a study on the Faroe Islands (685 birds), supported by Chevron Upstream Europe, have been added for comparison.

Details on sample sizes by year and location (Table 6.1) show that high spatial or temporal resolution is often not yet available. But the data very well describe the baseline of current (5-year) levels of plastic abundance in fulmar stomachs in different geographical regions of the North Sea.

EcoQO compliance by fulmars in the North Sea and on the Faroe Islands is shown in Figure 6.1: in spite of clear regional differences, the percentage of fulmars with more than 0.1 g plastic in the stomach ranges from about 45% to over 60% anywhere in the North Sea and even on the Faroe Islands. The Channel area is the most heavily polluted, with plastic incidence 100%, average number of plastic particles 56 pieces, weighing 0.26 g (geometric mean mass 0.14 g). Moving further to the north, pollution levels are reduced. As discussed in earlier reports this pattern, and relative abundances of sub-categories of litter, indicate a major role of shipping and fisheries in marine litter in the North Sea. The Scottish Islands are the ‘cleanest’ region in the North Sea, with 91% incidence and on average 18 pieces per bird weighing 0.21 g. The geometric mean mass for plastics in fulmars from the Scottish Islands is 0.05 g, representing only about a third of the level encountered in the Channel, a significant difference (T-test p=0.002). Compared to the Scottish Islands, the situation on the Faroe Islands is only marginally better. In our earlier studies, a small sample of fulmars from the Faroe Islands suggested substantially lower levels, but at this stage it is very difficult to assess whether data indicate if levels around the Faroes are increasing.

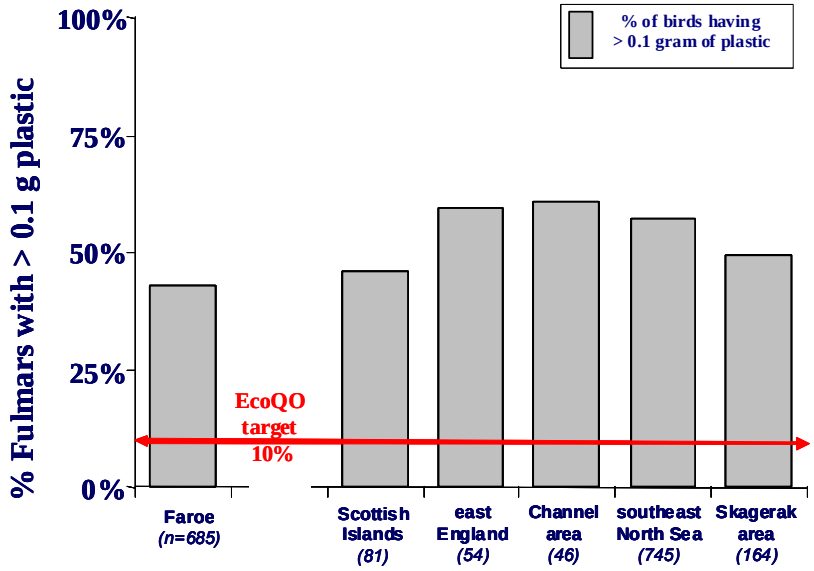

Figure 6.1: *The EcoQO performance of Fulmars from study areas around the North Sea and the Faroe Islands over the 5 year period 2002 - 2006: the percentage of beached Fulmars having more than 0.1g plastic in the stomach. All age groups combined.*

The 2002 - 2006 study period is too short to properly analyse for temporal trends in separate locations or regions. However, good sample sizes were obtained in the Netherlands, Belgium and Germany, which are of specific interest as they permit a closer examination of the somewhat confusing data for the most recent years in the Netherlands. Annual geometric means for Belgium, the Netherlands and Germany, and the combined data for these three locations (region: south-eastern North Sea) in Figure 6.2 show a weak general downward trend. In 2006, the German mean went up, as in the Netherlands, but the Belgian mean continued to decrease from 2003 onwards. Linear regressions of the individual data mark all three, and the combined trends over the 2002 - 2006 period, as negative (decreasing plastic mass). However, only the Belgian decrease was significant (p=0.05). Nevertheless, this wider regional perspective leads to a somewhat more optimistic view on developments in the litter situation than is the case with the isolated analysis of just the Dutch data, and indicates (slow) improvements following implementation of the EU Directive on harbour reception facilities. Over a longer time series 1982 - 2006 Dutch data indicate that peak levels of plastics were observed in the late 1990s and have significantly declined since. Composition of plastic litter has changed since the early 1980s with strong reductions in industrial plastic but increases in garbage type plastics.

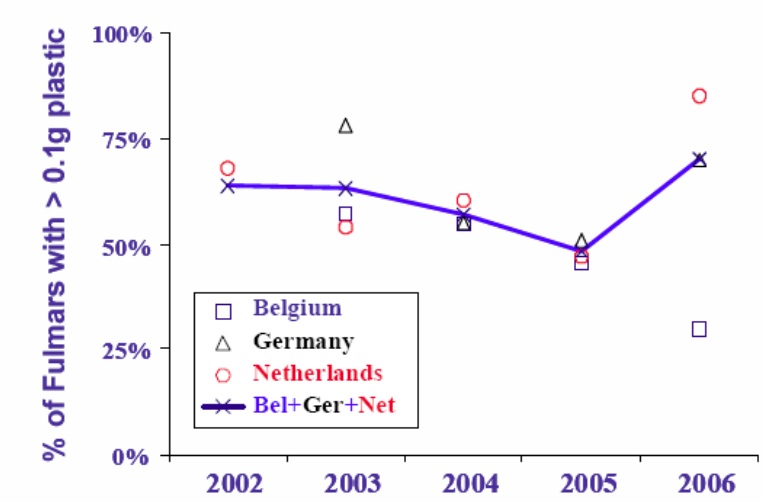

***Figure 6.2**: EcoQO performance in the south-eastern North Sea 2002 - 2006 – Annual percentages of beached Fulmars having more than 0.1 g plastic in the stomach in Belgium, Netherlands, Germany and the combined region.*

Has the EcoQO been met?

As can be seen from Figure 6.2 the EcoQO has not been met in any of the study areas anywhere in the North Sea.

Consequence of failing to meet the EcoQO

The ecological consequences of failing to meet the EcoQO do not only apply to fulmars but also to other species of birds, marine mammals, fish and other elements of the marine ecosystem. Damage results from a) entanglement in litter items leading to lethal injury, drowning or starvation, and b) ingestion of plastic and other litter by many species that mistake marine debris for food (Laist 1997; Derraik 2002). A more recent concern is the issue of microplastics and toxic chemicals built into or adhered to the surface of plastics acting as a booster of bioaccumulation of toxic chemicals in marine organisms eating plastic. Small microscopic size plastic particles become increasingly abundant in the marine environment and are ingested by all filterfeeders (Thompson *et al*. 2004; Teuten *et al*. 2007)

The economic consequences of continued high levels of marine litter include high costs for coastal clean-ups, damage to fisheries and danger for shipping accidents.

From a management point of view, exceeding the level of 10% indicates that the amount of plastic entering the marine environment should be further reduced. In the background document for the EcoQO on plastic particles in stomachs of seabirds (publication number 2008/355) the following priority measures to achieve the EcoQO are mentioned:

a. Most litter in the North Sea region comes from shipping including fisheries. In the short term, the most promising measure to reduce litter from these sources is a further refinement of the implementation of the EU Directive on Port Reception Facilities (EU Directive 2000/59/EC). The Directive leaves room for national choices, and competition between harbours occurs. Effectiveness of the Directive can be increased by regional agreements on indirect financing and on uniform implementation with a much higher level of service for ship to shore delivery, combined with strict control and enforcement. In the longer-term, amendments to MARPOL Annex V (simplifying rules to basically 'no discharge') and support to the 'Clean Ship' concept offer potential to reduce marine littering from ships. Specific measures may be needed with regard to discarded and lost fisheries materials including those from mariculture.

b. Potential measures to reduce input from other sources are many, including waste recycling and processing instead of landfill, policy measures to reduce single-use packaging and stimulating awareness among the public and stakeholders.

Suitability of present monitoring and reporting

Over the 2002 - 2006 period, 1090 stomachs of fulmars from around the North Sea have been analysed (see table 6.1) Financial support from the EU Interreg IIIB North Sea programme and the NYK Group Europe Ltd has made this possible and has established a strong international research network. However, EU support has ended, and alternative finances are needed to ensure the network survival and continued data collection for implementation of the Fulmar- Litter-EcoQO.

In the sampling network, the east coast of Britain and the Channel area have been weak links. However, from the SNS project, gradually, a regular Beached Bird Survey is being re-established in North-east England (Dan Turner). In the Channel area, more regular sampling was started in Normandy in 2007, but the French Pas de Calais or English Channel coasts are still poorly represented, as beach sampling has been limited so far to mass mortality events. Efforts will continue to gradually strengthen the sampling network to further improve good regional coverage in the EcoQO research.

Table 6.1: *Sample sizes for the Fulmar Litter EcoQO by location and region, and selected parameters for plastic abundance over the 2002 - 2006 period of study. Full details in IMAREA Report no. C033/08. Insufficiently sampled locations printed in light italics.*

		BY LOCATION												REGION COMBINATIONS					North Sea
		Scottish Islands		East England		Channel		SE North Sea			Skagerak area								
number of stomachs analysed	*Faroe*	**Shetland**	**Orkney**	*Northeast-England*	**Southeast England**	*France Normandy*	**France Pas de Calais**	**Belgium**	**Netherlands**	**Germany**	**Denmark Skagen**	**Norway Lista**	*Sweden Sotenas*	**Scottish Islands**	**East England**	**Channel**	**Southeastern North Sea**	**Skagerak area**	**NORTH SEA**
2002	*38*	11	6					1	56	4	1			17	0	0	61	1	**79**
2003	*277*	13	10	*1*				21	39	32	55	7	*6*	23	1	0	92	68	**184**
2004	*84*	17	8	*5*	40	*6*	36	97	131	153	51	26		25	45	42	381	77	**570**
2005	*238*	5	2	*6*		*4*		44	51	69	7	10		7	6	4	164	17	**198**
2006	*48*	9	0	*2*				10	27	10		1		9	2	0	47	1	**59**
total 2002-2006	***685***	**55**	**26**	*14*	**40**	*10*	**36**	**173**	**304**	**268**	**114**	**44**	*6*	**81**	**54**	**46**	**745**	**164**	**1090**
acronyms	**FAE**	**SHE**	**ORK**	*NEE*	**SEE**	*NMD*	**FRA**	**BEL**	**NET**	**GER**	**SKA**	**LIS**	*SWE*	**SCOI**	**EENG**	**CHAN**	**SENS**	**SKAG**	**North Sea**
summarized plastic abundance:																			
incidence	88%	91%	92%	*100%*	93%	*100%*	100%	95%	94%	94%	94%	98%	*83%*	91%	94%	100%	94%	95%	**94%**
avg items / bird	13.8	14.9	25.6	*24.8*	29.8	*52.3*	57.6	47.6	29.3	26.1	36.8	51.8	*48.2*	18.3	28.5	56.4	32.4	41.3	**33.5**
avg gram / bird	0.17	0.18	0.28	*0.27*	0.21	*0.31*	0.25	0.29	0.30	0.30	0.35	0.36	*0.63*	0.21	0.22	0.26	0.30	0.36	**0.30**
geometric mass	0.045	0.048	0.072	*0.205*	0.086	*0.147*	0.137	0.083	0.094	0.084	0.066	0.105	*0.071*	0.054	0.108	0.139	0.088	0.075	**0.085**
EcoQO % > 0.1 g	43%	45%	46%	*71%*	55%	*70%*	58%	51%	61%	57%	46%	55%	*67%*	46%	59%	61%	57%	49%	**55%**

Developments in harmonisation

During the SNS project, three SNS-Fulmar-study workshops have been held at Alterra, Texel, the Netherlands. Each workshop was attended by representatives of nearly every partner in the project. Workshops lasted several days and were used to discuss co-ordination of procedures, analysis of preliminary results, and practical training in the dissection of fulmars. Dissection procedures, methods for measurements, sexing, ageing etc. were thus calibrated among participants. Based on the experiences from these workshops, a manual has been produced describing methods, standard forms and codes used in the dissection of fulmars for the SNS study and future EcoQO monitoring (Van Franeker, 2004).

To ensure full comparability of results in regional comparisons, stomachs from all locations were transported to IMARES on Texel to be analysed by the same team (J.A. van Franeker, A. Meijboom, M.L. de Jong, H. Verdaat). Methods for stomach content analyses were described in Van Franeker & Meijboom (2002) and will be published, in a slightly adjusted format, in the Handbook for the Application of Ecological Quality Objectives in the North Sea (OSPAR 2007/307).

Cost of present monitoring and reporting

Litter EcoQO monitoring in the North Sea has been operational since 2002 by the combination of an existing Dutch monitoring programme of the Netherlands Ministry of VenW, and the international SNS project (EU funded under Interreg IIIB). The Dutch monitoring is anticipated to continue, but EU funding ceased after 2004. Collection of beached fulmars is embedded in existing beached bird surveys or other activities, and requires virtually no additional cost, except for incidental purchases like a freezer. Costs are involved in international co-ordination and mostly laboratory processing of stomach samples. A North Sea wide Fulmar-Litter-EcoQO monitoring programme, on top of the current Dutch effort requires approximately € 10 000 on average per Contracting Party.

Extra cost of harmonisation

Up until now, all stomach analyses in this EcoQO project have been conducted in the Netherlands, with obvious advantages for consistency in methods and maximum comparability of results. Also all database work, calculations and reporting has been integrated in the Netherlands, in association with the Dutch long-term monitoring project for marine litter. Participants in the Save the North Sea Fulmar study group favour the option that project coordination and at least stomach content analysis, database work and reporting continues centrally in the Netherlands. In that case no extra costs of harmonisation are necessary.

Performance of the EcoQO

The technical performance of the EcoQO as provided by ICES, has been summarized in the background document to this EcoQO (OSPAR), some extra information is added here.

ICES criteria	Evaluating comments
Relatively easy to understand by non-scientists and those who will decide on their use.	The message of birds having plastic in the stomach (nearly every Fulmar in the North Sea) is easily conveyed to policy-makers as well as stakeholders and general public, stimulating compliance with measures taken. The Fulmar was the symbol of the successful '*Save the North Sea*' campaign, receiving two prestigious awards for the way in which it created awareness on the marine litter issue (Environmental Award from the International PR Association 2005; United Nations Dept of Public Information Grand Award 2005)
Sensitive to a manageable human activity	All plastics in the (marine) environment are due to human activity, mostly intentional disposal, which can be controlled by management intervention
Relatively tightly linked in time to that activity	Persistence of plastic materials could suggest long time-lags in response of the metric to changed activities. However, the EcoQO study (regional differences; changes over time) shows good measurable linkage of the metric to the input-rates of litter in the marine environment within the area under consideration. It is estimated that the amount of plastic in the stomach of a Fulmar is reduced by approximately 75% per month if no new plastics are ingested
Easily and accurately measured, with a low error rate	Easily measured from stomach contents of beached birds. Accuracy and low error amongst other shown by inter-annual consistency and comparability between neighbouring locations
Responsive primarily to a human activity, with low responsiveness to other causes of change	Fully responsive to human activity
Measurable over a large proportion of the area to which the EcoQ metric is to apply	Fulmars are abundant throughout the North Sea area (*), with sufficient spread of locations where beached birds can be collected. (* this species abundant throughout North Atlantic and North Pacific Oceans, with suitable comparable indicator species of tube-nosed seabirds occurring worldwide)
Based on an existing body or time-series of data to allow a realistic setting of objectives	The combination of a long time series of data for the Netherlands (since the 1980s) and the wider 'Save the North Sea' study (since 2002) has already led to modification of earlier wording of the EcoQO to a more realistic one as defined (*See ICES 2006 and EcoQO reports cited)*

Specific links with the MSFD

The EcoQO on plastic particles in stomachs of seabirds can be used as an indicator for GES Descriptor 10 of Annex 1 of the MSFD: “Properties and quantities of marine litter do not cause harm to the coastal and marine environment.”

In the context of the initial assessment under the MSFD, the EcoQO is able to provide an indication of the environmental quality status with regard to the effect of floating litter on the marine environment.

Gaps in knowledge

Some areas do not yet have a Beached Bird survey as complete as might be desirable. As a consequence sample sizes from some areas are small, implying that it will take a longer period before meaningful statistics can be applied. Overall, longer time-series are needed to analyse temporal trends.

Effectiveness of communication

The fulmar was the symbol of the successful 'Save the North Sea' campaign, receiving two prestigious awards for the way in which it created awareness on the marine litter issue (Environmental Award from the International PR Association 2005; United Nations Dept of Public Information Grand Award 2005).

Possible milestones up to the achievement of the objective

Given the limited timeframe in which the measures have been taken and the fact that monitoring in most areas has only recently started, a sensible evaluation of the situation and hence the prediction of milestones, will only become possible at a later date.

Potential applicability of the EcoQO in other OSPAR Regions

The Northern Fulmar is abundant throughout the North Atlantic and North Pacific Oceans. IMARES is currently providing assistance to organisations along the Pacific US coast, which are in the process of establishing a similar litter monitoring programme using fulmars. For seabird based monitoring of plastic in southern OSPAR regions and the Mediterranean, where fulmars do not occur, a pilot study is being conducted using the Cory's Shearwater (*Calonectris* sp). There are suitable comparable indicator species of tube-nosed seabirds (albatrosses and petrels) occurring worldwide.

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Annex 7: Evaluation of EcoQOs on mercury and organochlorines in seabird eggs (Lead party: Common Wadden Sea Secretariat)

Background

Mercury and organochlorines in seabird eggs have been one of the 10 issues considered when developing the EcoQO-system for the North Sea. In 2005, following advice from ICES, OSPAR agreed on the EcoQOs for these two ecological quality objectives but also decided that these EcoQOs required further development in order to bring them to the level achieved by the advanced EcoQOs (OSPAR 2005).

In 2007, the Common Wadden Sea Secretariat in cooperation with the German Institute of Avian Research prepared a background document for these EcoQOs based on the experiences in monitoring of contaminants in seabird eggs in the Wadden Sea, Sweden and the UK. This report has been prepared by the Common Wadden Sea Secretariat (CWSS) in the framework of the EU Interreg IIIB project “HARBASINS” (www.harbasins.org).

The German Institute of Avian Research “Vogelwarte Helgoland” in cooperation with the CWSS in the framework of the Trilateral Monitoring and Assessment Program (TMAP) coordinated a pilot project in the North in 2008-2009..This pilot study covered sampling in Belgium, Netherlands, Germany, Denmark, Norway, Sweden and UK. This evaluation is based on preliminary results of this pilot study. A final report on the North Sea Pilot Project will be prepared in the beginning of 2010 in order to include the results of the UK analysis of 2009.

Seabird eggs have been proven to be a favourable matrix in numerous studies and monitoring projects. The removal of eggs is less damaging than that of adults, having only a minor impact on the breeding success of the studied population. Several studies have shown seabird eggs to be good indicators of local pollutant contamination, even in migrating species like terns.

In 2005 following advice from ICES, OSPAR agreed that the EcoQOs for these two ecological quality elements should be as follows:

- EcoQO 3.2 Mercury concentrations in seabird eggs,

  The average concentrations of mercury in the fresh mass of ten eggs from separate clutches of Common Tern (*Sterna hirundo*) and Eurasian Oystercatcher (*Haematopus ostralegus*) breeding adjacent to the estuaries of the Rivers Elbe, Weser, Ems, Rhine/Scheldt, Thames, Humber, Tees, and Forth, 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 in south-western Norway and in the Moray Firth.

- EcoQO 3.3 Organochlorine concentrations in the eggs of North Sea seabird:

  For each site, the average concentrations in fresh mass of the eggs of Common Tern (Sterna hirundo) and Eurasian Oystercatcher (Haematopus ostralegus) should not exceed: 20 ng g-1 of PCBs; 10 ng g-1 of DDT and metabolites; and 2 ng g-1 of HCB and of HCH. Sampling should be of ten eggs of each species from separate clutches of birds breeding adjacent to the estuaries of the Rivers Elbe, Weser, Ems, Rhine/Scheldt, Thames, Humber, Tees, and Forth, and in similar (but not industrial) habitats in south-western Norway and in the Moray Firth

Overview of the results from recent monitoring

In 2008, sampling was carried out at 18 stations in cooperation with Norway, Sweden and Belgium. The UK locations were not sampled in 2008 but in 2009 because of logistical reasons. In Norway (site 18) and Denmark (16) Arctic Tern *Sterna paradisaea* eggs were sampled instead of Common Tern eggs. At the same site both species have similar contaminant levels in their eggs (unpubl.).

In total, 280 eggs have been analysed from 18 locations, four of them outside the Wadden Sea: 1: Zeebrugge (B), 2 Scheldt (NL), 17 Tjärnö (S) and 18 Rogaland (N). The chemical analyses were carried out in the ICBM-Terramare laboratory in Wilhelmshaven (one-lab approach).

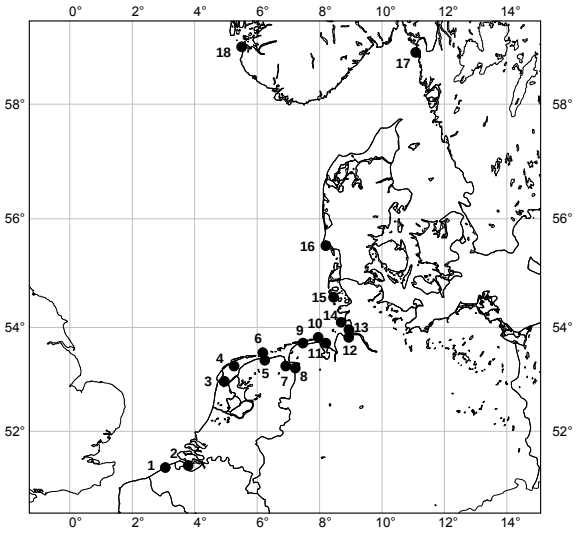

Figure 1 *(right): Sampling stations of bird eggs (Eurasian Oystercatcher, Common or Arctic Tern) in 2008*

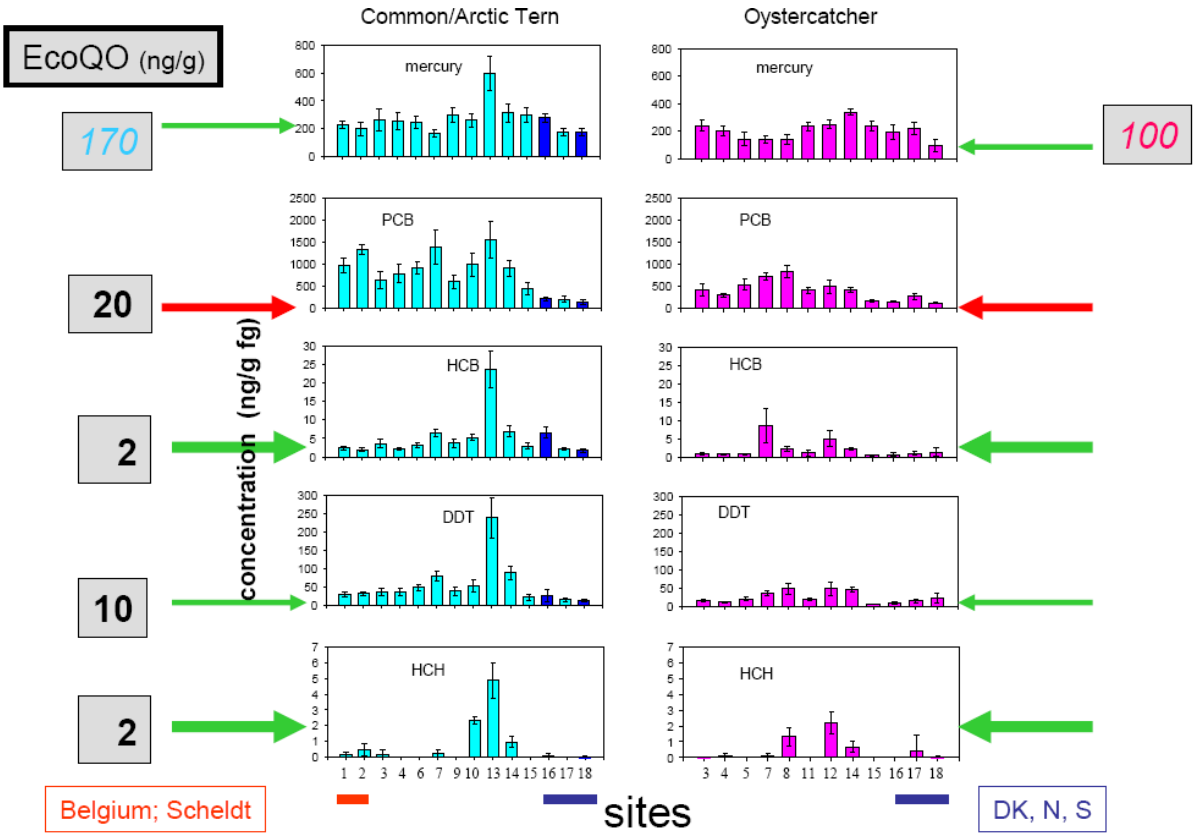

Figure 2: *Spatial variation of mercury and organochlorines in seabird eggs in 2008. See Figure 1 for location of sites (sites outside the Wadden Sea are marked by a red and blue bar, respectively). Results for Common (light blue) or Arctic Tern (dark blue) on the left, for Eurasian Oystercatcher (pink) on the right. EcoQOs: The metric for mercury (in italics) was adjusted to the reference site no. 18 (Rogaland, Norway). Arrows, green thick line: The proposed EcoQO (grey boxes) is met at most sites; green, thin line: the EcoQO is met at some sites; red arrow: the EcoQO is met at none site.*

Spatial distribution

The pilot study in 2008 offered a good geographical coverage (Fig. 1) which allowed the study spatial variability along the southern and eastern North Sea coasts (Fig. 2).

The proposed reference site (18) for the EcoQO in southern Norway had the lowest concentrations of most chemicals. The concentrations at the other Scandinavian sites, in Sweden (17) and the Danish Wadden Sea (16), were also comparably low.

The spatial variation in contaminant levels form the Wadden Sea eggs corresponds to that described before (Becker et al. 2001), with two hot spots emerging, the Elbe estuary (12, 13) with the adjacent inner German Bight (14), as well as the Ems estuary (7,8). Because of the direction of North Sea currents, the pollutant loads originating from the Elbe are transported into north-eastern and northern directions. Accordingly, bird contamination decreased from the Elbe estuary towards the Danish Wadden Sea and Norwegian coast, obviously in parallel with an increasing dilution of chemicals in water, sediment and food web (Bakker et al. 2005).

The additional sites on the coast of Belgium (1) and western Netherlands (2) indicate some input of PCBs into the North Sea. Slightly elevated levels of mercury and PCBs in Eurasian Oystercatcher eggs from the western Wadden Sea (sites 3 and 4) indicate the influence of the Rhine effluents.

In consequence, despite the reduced riverine and atmospheric (see 2.2) inputs of chemicals into the North Sea,, the contamination of the seabird eggs clearly indicates distinct geographical variation even today, with the Elbe estuary still persisting as the most important hot spot.

Common Tern eggs, had higher contaminant levels than that of Eurasian Oystercatchers, reflecting their higher position in the food chain and consequent bioaccumulation.

The spatial coverage, as in 2008, seems to be sufficient for this EcoQO given that the proposed sites in UK can be implemented. For the purpose of the North Sea wide geographical comparison not all of the sites sampled within the TMAP in the Wadden Sea are necessary. Some locations should be selected with respect to their distance from estuaries (hot spots as well as sites close to open sea). The Dutch site at the Rhine/Scheldt estuary should be relocated to the north of the estuary to better reflect the inputs from the Rhine.

Temporal resolution

Both, laboratory experiments and oral dosing of birds in the field with mercury and other chemicals have shown that concentrations in tissues including eggs are dose-dependent (e.g. Lewis and Furness 1991). For this reason, birds indicate the current environmental burden of chemicals and also react relatively fast to change. This is clearly shown in the long-term egg contaminant data for Guillemots *Uria aalge* in the Baltic (Bignert et al. 1995, 1998) and of Common Terns on the Elbe river (Becker et al. 2001).The long term data in the Wadden Sea (since 1981) show a general decline of all substances monitored at an annual basis in eggs of Common Tern and Eurasian Oystercatcher, at both estuarine and coastal sites throughout the study period.

Due to high and stable fat content of the bird egg and high bioconcentration factors for many organic contaminants the random/unexplained between-year variation is lower compared to other matrices. These results in superior statistical power at temporal trend analysis (see OSPAR Publ. No 331). Nevertheless, monitoring of the EcoQO on an annual basis is necessary in order to be able to distinguish short- term fluctuations from long-term trends (Becker & Dittmann 2009).

Have the EcoQOs been met?

The reference site in southern Norway allowed to refine the provisional proposal for an EcoQO metric for mercury which was set at 200 ng g^{-1} fresh weight in Common Tern and 100 ng g^{-1} in Eurasian Oystercatcher (ICES 2003, 2004). The levels measured in 2008 at Rogaland were 172 ± 12 ng g^{-1} for Arctic Tern and 97 ± 21 ng g^{-1} (mean ± se) for Eurasian Oystercatcher. In consequence, we propose as preliminary EcoQO for mercury 170 ng g^{-1} in Common/Arctic Tern eggs and 100 ng g^{-1} in Eurasian Oystercatcher eggs. However, the results from the first sampling on the east coast of UK have to be awaited to discuss proposals for modification of the EcoQ metric.

The first results from the North Sea pilot project on EcoQO in 2008 presented here indicate that although the EcoQOs are met at many sites, enhanced values are observed at some areas, especially at those close to estuaries (Fig. 2). Concentrations of HCB and HCHs are below the EcoQO values at most sites, whereas mercury and DDT levels are above the EcoQO at most sites, and PCB-levels are above the EcoQO at all sites. So the EcoQO by far has not been met in the North Sea area. This evaluation of course is preliminary as the sites on the UK coasts have not yet been included in this first analysis of the EcoQO.

The results of the reference areas in Scandinavia show that the tentatively proposed levels of this EcoQO (ICES, OSPAR) were appropriate with respect to the aims of this EcoQO. So, the preliminary EcoQO values are reasonable.

Consequences of failing to meet the EcoQOs

Toxic persistent pollutants such as organochlorines and mercury affect the entire ecosystem and give reason for concern. For birds, manifold effects of toxic environmental chemicals on reproduction, growth and survival have been described, and threshold levels have been presented (Muñoz et al. 2004). The two species selected for this EcoQO are top predators feeding on organisms which belong also to human diet. Consequently their contamination level has relevance as early warning of contaminants in fish and other seafood for human consumption. Political action should be strengthened as long as the EcoQO has not been met.

Suitability of present monitoring and reporting

The comprehensive monitoring of Common Tern and Eurasian Oystercatcher contaminant egg levels in the Wadden Sea (TMAP, covering 13 stations, Fig. 1) in this pilot project has been extended to the Scheldt estuary, to Sweden, Norway, and UK east coast (in 2009) covering now almost all relevant coastal areas of the North Sea. The location net in the Wadden Sea reflects the important inputs via the rivers Ems, Weser and Elbe, the stations in Belgium and western Netherlands the input via the rivers Rhine and Scheldt.

Sampling sites were selected according to the following criteria; to

- Address hot spots of anthropogenic contamination, especially the estuaries (Marine Strategy Directive);
- Include also sites with an expected lower degree of contamination as reference sites,
- Include important Bird Areas such as the German Bight, which are in the focus of the EU Birds and Habitats Directives;
- Consider logistics of sampling (number of breeding pairs available for sampling per site, also in the future prospect);
- Select an appropriate number of monitoring stations along the North Sea coast to assess the EcoQO on a larger scale.

The dense network in the Wadden Sea is suitable to allow a small scale, region specific assessment. For a North Sea wide assessment, however, a sub-selection of Wadden Sea stations may be sufficient.

ICES (2003, 2004) suggested to define the geographical specificity of monitoring (and EcoQOs) by focusing on areas of high riverine inputs and other hot spots. The sites of the pilot project are suitable

- to obtain a North Sea wide overview of the spatial distribution of selected contaminants addressing both hot spots as well as reference areas,
- to assess temporal changes in concentration of contaminants in different parts of the North Sea,
- to assess the status in implementation of the EcoQos by using a consistent and comparable approach.

Additional stations at the UK coast may be considered depending on the outcome of the pilot project in the UK in 2009.

The costs of present and future monitoring can be estimated as follows:

- Collecting of bird eggs: 200 – 1500 € per site (depending on location and country),
- Shipping of bird eggs: 50 – 100 € per site, (depending on location and country),
- Central coordination of collection for the North Sea: 4500 €,
- Data compilation and drafting of the EcoQO report for the North Sea: 5500
- Chemical analysis: 8000 € per site (20 eggs per site, 400 € per egg),
- The one-lab approach of the chemical analysis has the advantage of comparability of results, and intercalibration is not applicable, which is time consuming and cost-intensive. As an alternative it should be discussed, however, to integrate several laboratories from different countries in the chemical analyses, each specialized on and responsible for a specific group of substances. The samples could be partitioned and distributed among the laboratories.

Costs for staff and coordination on the national level are not included in this estimate.

Performance of these EcoQOs

The technical performance of the EcoQO as provided by ICES can be summarized as follows:

ICES criteria	Evaluating comments
Relatively easy to understand by non-scientists and those who will decide on their use.	There is a clear link between the anthropogenic input of mercury and organochlorines into the environment and the concentration of these substances in bird eggs. Their level in bird eggs provides an indication of their level and trends in the ecosystem. Common Tern (Arctic Tern) and Eurasian Oystercatcher are seabirds which are well known to the public.
Sensitive to a manageable human activity	Most of these substances enter the ecosystem entirely through human activities, which can be controlled by management intervention.
Relatively tightly linked in time to that activity	Bioaccumulation and persistence in ecosystems mean that some linkage will occur, but not always. Mercury and organochlorines in the environment are very persistent, and tend to increase up food chains. Because of this persistence, a time lag would exist between applying management measures and the response in seabird eggs.
Easily and accurately measured, with a low error rate	Eggs are readily available and the analytical methods are well established. The ability to integrate pollutant signals over time and space of bioaccumulating contaminants in tissues means that to obtain a given level of accurate measurements, a smaller number of animal samples is required than of physical samples thus increasing the power of trend analyses.

Responsive primarily to a human activity, with low responsiveness to other causes of change	Fully responsive to human activity. However, due to the persistence of many of these compounds, it will take many years before they disappear from the environment.
Measurable over a large proportion of the area to which the EcoQ metric is to apply	Common Tern and Eurasian Oystercatcher are abundant throughout the North Sea area, with sufficient spread of locations where bird eggs can be collected. Alternatively, eggs of Arctic Tern can by analysed instead of Common Tern. As these species occur also on coasts of the west Atlantic and comparable species (Arctic Tern, Roseate Tern *Sterna dougallii*, South American Tern *Sterna hirundinacea*, Amercian Oystercatcher *Haematopus palliatus*, Black Oystercatcher *Haematopus bachmani*) even on the coasts of other oceans there is potential expanding the EcoQO to other seas of the world.
Based on an existing body or time-series of data to allow a realistic setting of objectives	The combination of long time series of data for the Wadden Sea (since 1980's) and the current pilot project (2008-2009) confirm the existing EcoQO metrics and values.

Specific linkages with the MSFD

The set of EcoQOs for the North Sea was developed with the aim of being an integral part of the Ecosystem Approach (EA) to the management of the North Sea, contributing to the objectives of the EA.

The EcoQO on seabird eggs can be used as an indicator for quality objective 8 of Annex 1 of the MSFD: “Concentrations of contaminants are at levels not giving rise to pollution effects.”

In the context of the initial assessment under the EC MSFD, the EcoQO is able to provide an indication of the environmental quality status with regard to the contaminant load in the food web of the marine environment.

Gaps in knowledge

To develop the EcoQO further and to answer the question if geographic coverage is adequate, the results from the first sampling on the east coast of UK have to be awaited.

EcoQO levels proposed fit well to the chemicals’ levels measured at the reference areas (Fig. 2). The preliminary metric for mercury should be confirmed or refined after getting information from the other reference area, Moray Firth, UK. An EcoQO level for other relevant toxic organic substances which may be measured in future has to be developed in due time (*e.g*. Chlordanes, polybrominated biphenyles, PCDDs/PCDFs, personal care products, phthalates).

The cooperation of the laboratories between countries has to be clarified (see 10.).

We have temporal trends of the chemical levels for the Wadden Sea (see e.g. Becker et al. 2001, Becker and Muñoz 2004, Becker & Dittmann 2009), but we are still lacking temporal trends in other regions of the North Sea

Effectiveness of communication

Monitoring of mercury and organochlorines in seabird eggs within the frame of this EcoQO demonstrates clearly the hot spots of chemical contamination in the North Sea area. Monitoring chemicals levels in seabird eggs with respect to the EcoQO will present temporal trends in the chemicals’ levels and their change with respect to the EcoQ metric. The EcoQO is suitable to show management success by decreasing concentrations in eggs towards the EcoQO.

This EcoQO can be linked with bird populations and demography making use of birds as sensitive indicators (*e.g.* reproductive success). This approach was successfully tested and adopted by the

TMAP in the Wadden Sea (Thyen et al. 1998, 2000), and the parameter “breeding success” will be implemented by the TMAP is in 2010 (Koffijberg 2007).

Proposals for modification and improvement

Results from the proposed sampling sites in UK, especially form the reference area Moray Firth (Scotland) are needed. Therefore, the results from the first sampling on the east coast of UK have to be awaited to discuss proposals for modification and improvement of the EcoQO. The western Dutch site should be a location better reflecting the chemical input by the river Rhine.

More knowledge on new and emerging substances such as Chlordanes, polybrominated biphenyles, PCDDs/PCDFs, personal care products, phthalates is required and should be used to propose EcoQO levels for these substances. However, the spectrum of substances covered by this EcoQO can only be extended if additional funding is available.

The cooperation and intercalibration between participating laboratories is an important element for the success of the EcoQO. An intercalibration between the laboratories in Germany and UK (CEH) for egg mercury levels was very satisfactory (means ± s_e in ng g^{-1} fw: 494 ± 113, 492 ± 117; r^2=0.99, n=10). The intercalibration for organochlorines has still to be done. In case that the sampling and analyses will continue, more effort is necessary for chemical intercalibration between the participating laboratories. Alternatively, in order to reduce intercalibration costs, the participating laboratories could divide the samples for specific substances instead of carrying out all types of chemical analysis in each lab in parallel. Especially for analysis of new substances which requires high personal and financial effort this approach would be of relevance.

Possible milestones up to the achievement

Given the persistence of mercury and organochlorines in the environment, the prediction of milestones is difficult.

Potential applicability in other OSPAR regions

Common Tern and Eurasian Oystercatcher are abundant throughout the North Sea area, with sufficient spread of breeding locations where bird eggs can be collected. Alternatively, eggs of Arctic Tern can be analysed instead of Common Tern. These species occur also on coasts of the western Atlantic and comparable species even on the coasts of other oceans; consequently, there is potential to expand the EcoQO to other seas.

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Annex 8: EcoQO on proportion of large fish in the (demersal) fish community (Lead country: Norway)

Background

"Fish communities" has been one of the issues considered when developing the EcoQO system for the North Sea. In 2005 the OSPAR report on the North Sea Pilot Project on EcoQOs concluded that the EcoQ element "proportion of large fish" could be meaningful, but that considerable further development work was needed on the metrics "mean weight" and "mean maximum length of fish". OSPAR 2005 consequently agreed that the 2006 ICES Work Programme should include a request for ICES to carry out further development work on the EcoQO changes in the proportion of large fish and hence the average weight and average maximum length of the fish community.

In response to the OSPAR 2005 request, ICES in 2006 suggested that the goal for the North Sea fish community should be:

a. to halt as rapidly as possible, and begin to reverse by 2010, both the decline in the mean weight; and

b. the decline in the proportion of large fish;

c. and that the short-term operational targets should be:

- Based on survey catches: Halt the decline in the proportion of fish greater than 30 cm in length as rapidly as possible.
- Based on survey estimates: Halt the decline in the mean weight of fish as rapidly as possible.

ICES continued work on this EcoQO in 2007, and determined that the metrics in the form proposed by ICES in 2006 are clearly sensitive to environment-related variations, and trends due to high fishing pressure may be lost or obscured. Based on its work in 2007 ICES therefore recommended:

- the EcoQO for restoration/conservation of the size-structure of the fish community of the North Sea should be: The proportion (by weight) of fish greater than 40 cm in length should be greater than 0.3, based on the ICES Q1 IBTS survey series.
- no EcoQO needs to be set for the Mean Weight of Fish metric in the North Sea.

The metric for the EcoQO (proportion of fish greater than 40 cm) should be calculated for the demersal part of the fish community as sampled in the IBTS survey, excluding the catch of pelagic species like herring, sprat and sandeel.

While the metric for mean weight of fish is not needed as a basis for an EcoQO, ICES recommended that it should still be retained as a supplementary metric that reflects important fish community properties such as recruitment events.

Has the EcoQO been met?

The EcoQO is not met. From the early 1980s, the percentage of demersal fish in the North Sea greater than 40 cm fell from around 30% to its lowest point of less than 5% in 2001. The percentage has subsequently recovered to around 22% in 2008 (figure 7.1). This is an improvement although there is still some way to go to meet the objective.

ICES plans to continue work on the 'Proportion of Large Fish' metric, and will then concentrate on the connection between management action and the time scale required to achieve the target value of 0.3 for this EcoQO metric.

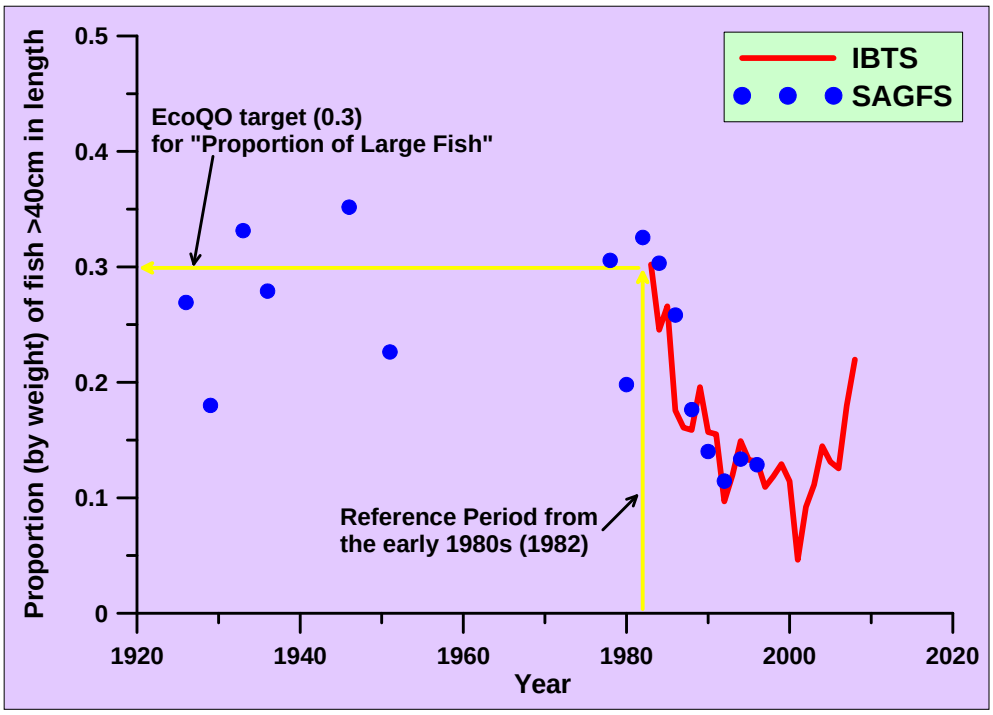


Figure 7.1: *Plot showing the Scottish Autumn Groundfish Survey (SAGFS) aggregated year group data (circles, with unfilled circles indicating two outliers related to strong year classes of gadoids). Variation in the IBTS data set is shown (solid red line). 1982 was considered to represent the "early 1980's" reference period and derivation of 0.3 as the target value for the metric is illustrated. (OSPAR, 2009)*

Use of the EcoQO

This is a target type EcoQO. There is not as yet a reference level for the pristine state (no fishing), although possibly such a reference could be developed through theoretical modelling. However, a practical reference exists as the early part of the time series for which this metric is constructed. This is also the target value for the EcoQO suggested by ICES (value 30% for the proportion of large fish).

The use of this EcoQO is the responsibility of the competent fisheries management authorities, which are the EU and Norway. OSPAR has no competence to adopt programmes and measures on questions related to the management of fisheries.

The metric for this EcoQO is tied to the ICES IBTS Survey for the 1st quarter. As advised by ICES, this is the only existing survey considered suitable for monitoring changes in the proportion of large fish in the North Sea fish community. This time series needs to be consolidated and if necessary improved to provide the data needed to use this EcoQO.

To develop specific management measures to move the metric from current levels towards the advised EcoQO target, additional modelling is required. In its advice, ICES stresses that progress towards the target requires, as a minimum, a reduction in fishing mortality to below F_{pa}. However, until the appropriate modelling is undertaken, it is not possible to say with any confidence what level of fishing mortality is likely to result in achieving targets for the large fish metric within given time frames.

ICES should be requested to continue work to consider and advise on management measures that could be taken to achieve this EcoQO.

Relation to Ecosystem Approach and the MSFD

The set of EcoQOs for the North Sea was developed with the aim to being an integral part of the Ecosystem Approach (EA) to the management of the North Sea, contributing to the objectives part of the EA. As such it is particularly important, as it can contribute to the further integration of fisheries and environmental protection, conservation and management measures, as called for in the Statement of Conclusions from the Intermediate Ministerial Meeting on the Integration of Fisheries and Environmental Issues in Bergen in March 1997.

The MSFD includes fisheries related issues as part of the definition of GES *i.e.* GES descriptors (1), (3) and (4)

(1) Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions.

(3) Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock.

(4) All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.

The EcoQO on proportions of large fish can therefore have an important supplementary role to the MSFD by covering a key aspect of fisheries in relation to the overall objective of achieving good environmental status. However, measures concerning fisheries would appear to lie outside the scope of the Directive as the competence for fisheries management has been given to the European Commission.

Applicability of the EcoQO in other OSPAR Regions

The analysis presented to identify the most appropriate length threshold for defining a large fish is specific to the North Sea. The threshold of 40 cm may be entirely inappropriate for fish communities resident in other marine regions and subject to different fisheries regimes and environmental conditions. If a similar metric is required for other fish communities, then an analytical procedure similar to the one followed here will be needed to identify appropriate length thresholds.

References

ICES (2007a). Report of the Working Group on Fish Ecology (WGFE). ICES CM 2007/LRC:03.

ICES (2007b). Report on the Working Group on Ecosystem Effects of Fishing Activities (WGECO). ICES CM 2007/ACE:04.

ICES (2007c). Report of the ICES Advisory Committee on Fishery Management, Advisory Committee on the Marine Environment and Advisory Committee on Ecosystems, 2007. ICES Advice. Book 1 (Books 1 - 10. 1,333 pp.)

OSPAR (2009). Assessment of the environmental impact of fishing. Publication No. 2009/465.

Annex 9: EcoQO on imposex in dogwhelks (Lead countries: Belgium and Portugal)[6]

Background

The Ecological Quality Issue is Benthic Communities. The EcoQ Element is Imposex in dogwhelks (*Nucella lapillus*) or other selected gastropods. The EcoQO is that: "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 (EAC) for TBT – that is, <2.0, as measured by the Vas deferens Sequence Index, Where Nucella does not occur naturally, or where it has become extinct, the red whelk (*Neptunea antiqua*), the whelk (*Buccinum undatum*) or the netted dogwhelk (*Nassarius reticulatus*) should be used, with exposure criteria on the same index of <2.0, <0.3 and <0.3, respectively."

Has the EcoQO been met?

An assessment of the environmental status in relation to the EcoQO was prepared on the basis of data submitted by OSPAR Contracting Parties to ICES. Only time series with at least four years of data were used for the trend assessment and the fitted value for the last year of monitoring was used to assign an assessment class according to the JAMP TBT Assessment Classes (OSPAR agreement 2004-15). Data older than 5 years were excluded from the assessment. It was not possible to take the number of female gastropods in each sample into account, as this information is not consistently available from the ICES data base. OSPAR's Working Group on Trends, Concentrations and Effects of Substances in the Marine Environment (SIME) 2008 recommended that imposex data be submitted to ICES as individual observations (*e.g.* VSD) rather than summary statistics (*e.g.* VDSI).

The JAMP TBT Assessment Classes (OSPAR agreement 2004-15) relate the levels of imposex in the 5 key gastropod species monitored in the North Sea in a 6-class assessment scheme A-F. The EcoQO is met if assessment classes A and B are achieved.

Figure 8.1 provides an overview of the status in relation to the EcoQO in the North Sea. For colour presentation in the maps a colour code has been used for the different classes shown below. In this scheme, green indicates that the EcoQO is met. It should be taken into account that the EcoQO only applies to the species in the white columns. Significant trends are represented in Figure 8.1 by a triangle which indicates the direction of the trend. Spatial data assessed were for all sites monitored in the period 2000-2006.. Monitoring stations for which the times series were not included in the trend analysis (*i.e.* with less than 4 years) are represented in the map by a smaller symbol as illustrated in Figure 8.1 below. Similar presentations are made of data from Brittany (Figure 8.2) and Shetland (Sullom Voe, Figure 8.3).

[6] This evaluation is based upon the results of the 2007 CEMP Assessment (OSPAR 2007), including data up to 2007. An updated assessment has been published in OSPAR Publication 2009/390.

Assessment class	*Nucella* VDSI	*Nassarius* VDSI	*Buccinum* PCI	*Neptunea* VDSI	*Littorina* ISI
A	< 0.3			< 0.3	
B	0.3 - <2.0	< 0.3	< 0.3	0.3 - <2.0	
C	2.0 - < 4.0	0.3 - <2.0	0.3 - <2.0	2.0 - <4.0	< 0.3
D	4.0 - 5.0	2.0 – 3.5	2.0 - <3.5	4	0.3 - < 0.5
E	>5.0	> 3.5	3.5		0.5 - 1.2
F					> 1.2

This assessment shows that, with the exception of a limited number of locations, the EcoQO has not been met in the North Sea area, particularly in the vicinity of major ports, shipping lanes and shipyards (this is to be reviewed after a more elaborate assessment with more data). A significant trend is found at 28 stations, with 24 stations having a general downward trend indicating that the situation in general is improving. However, the area still suffers from the consequences of historic inputs related to shipping activities as is confirmed by the levels of TBT that are still found in sediments. The relative absence of positive trends indicates that only a limited input still remains, linked to very local situations.

The 2008-2009 assessment will seek to develop this approach to provide a clearer explanation of the situation in key regions.

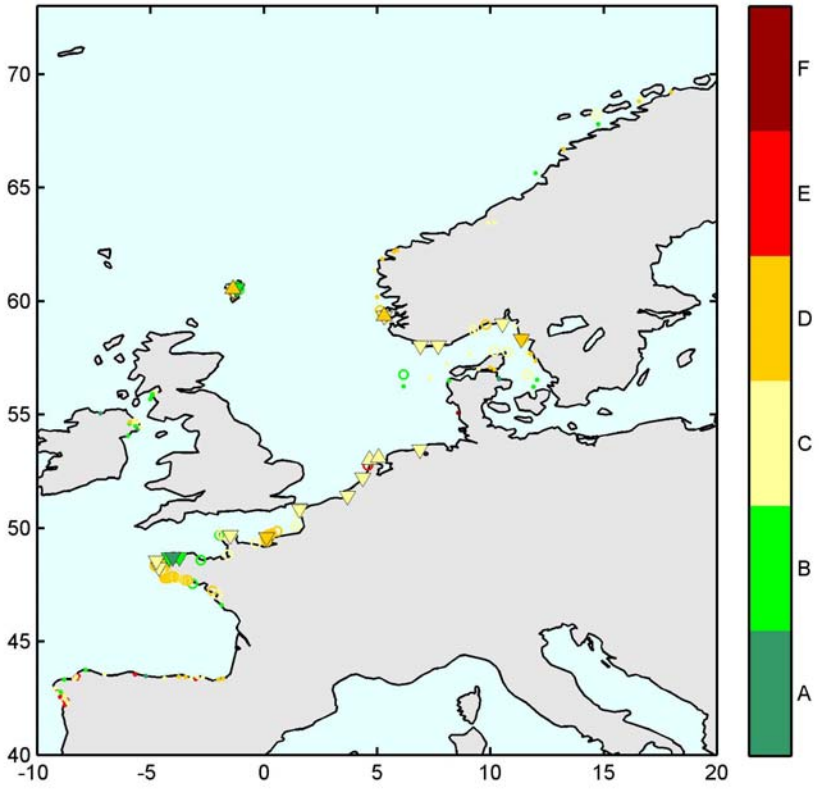


Figure 8.1: *Overview map showing stations where the EcoQO is met (green – classes A and B, trends (upward trends – upward triangles; downward trends – downward triangles; circles – no significant trend)*

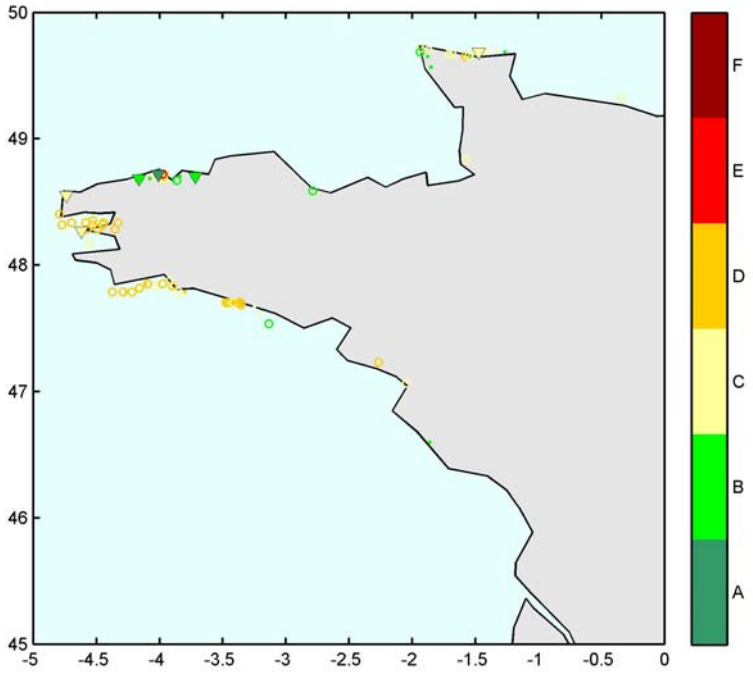


Figure 8.2: *Overview map of EcoOQ status in Brittany (Stations to the south of Brittany are not in the greater North Sea)*

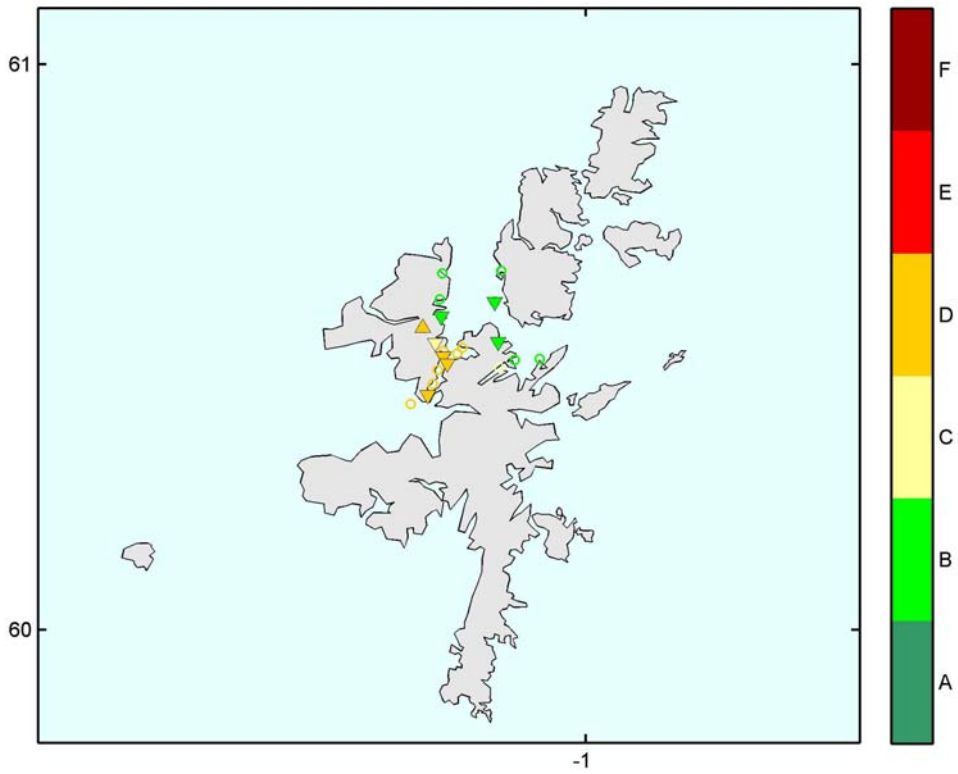


Figure 8.3: *Overview map of EcoOQ status in Shetland*

Consequences of failing to meet the EcoQO

The EcoQ is intended to provide a basis for monitoring the level of TBT in the environment after implementation of the following measures:

a. restrictions on the marketing and use of organic tin compounds as antifouling under Directive 1999/51/EC of the Commission of 26 May 1999 adapting to technical progress for the fifth time Annex I to Council Directive 76/769/EEC;

b. *International Convention on the Control of Harmful Anti-fouling Systems on Ships* (*AFS Convention*) adopted on 5 October 2001 which bans the application of TBT based anti-fouling paints by 1 January 2003 and a ban on the presence of TBT on ships' hulls by 1 January 2008;

c. EC Community Regulation, (Regulation (EC) No 782/2003) implementing the AFS Convention within the EU;

d. PARCOM Recommendations 87/1 on the Use of Tributyl-Tin Compounds and PARCOM Recommendation 88/1 on Measures to Reduce Organotin Compounds Reaching the Aquatic Environment through Docking Activities.

Given the comprehensive nature of these measures in addressing sources of TBT in the marine environment, any failure to meet the EcoQO indicates the need for the further implementation of the agreed measures. Therefore the progress made in implementing the key measures (AFS and Regulation 782/2003) should also be taken into account. In the immediate future status in relation to the EcoQO should be assessed on a regular basis to check the progress being made and the effectiveness of the measures. However, there should be an analysis of the need to urge improved implementation of the existing measures or the adoption of additional measures.

Suitability of present monitoring and reporting

Monitoring in relation to the EcoQO on imposex in dogwhelks and other gastropods is a mandatory commitment of Contracting Parties under the CEMP and should be carried out in accordance with technical Annex 3 of the JAMP Guidelines for contaminant specific biological effects monitoring (Agreement 2008-9) in the gastropod species *Nucella lapillus, Nassarius reticulata, Buccinum undatum* and *Neptunea antiqua*. The monitoring provides the basis for the assessment reported under section 2. Data resulting from this monitoring is reported to the ICES data centre.

The table below presents an overview of the monitoring being carried out by Contracting Parties in relation to this EcoQO in the North Sea based on information reported by Contracting Parties to OSPAR.

Contracting Party	Number of locations monitored								Remarks
	2004		2005		2006		2007		
	Temporal	Spatial	Temporal	Spatial	Temporal	Spatial	Temporal	Spatial	
Belgium					3	3	tbc	tbc	Littorina
Denmark	13	13	14	0	0	0	4	4	
France	117	117	0	113	91	91	tbc	tbc	Snails
Germany			6	6	4	4	tbc	tbc	
Netherlands	0	6	0	7	0	7	7	0	
Norway	9	13	8	0	8	22	22	9	Snails
Sweden	0	15	0	0					Dogwhelks
UK					[46]	[46]	53	75	

Note: Not all stations monitored by France, Norway and the UK are in OSPAR Region II

As with other aspects of monitoring under the Coordinated Environmental Monitoring Programme (CEMP) there is currently no specific guidance on the spatial intensity of monitoring although the JAMP monitoring guidelines include recommendations for monitoring:

a. in the vicinity of point sources (marinas/shipyards/offshore installations/harbours);

b. in shipping lanes. The following shipping lanes are suggested in the North Sea (Strait of Dover, German Bight - Texel T.S.S; Off Ushant Island (North-west France); Pentland Firth and the Skagerrak;

c. as part of a regional TBT survey.

To be consistent with the level of specification of monitoring for the other EcoQOs, it is recommended that a set of stations for time trend monitoring of imposex and other TBT-related effects in gastropods should be defined (taking into account the station dictionary for the CEMP).

Developments in harmonisation of monitoring and reporting schemes

The arrangements for monitoring under the CEMP seek to ensure that monitoring and reporting is fully harmonised. OSPAR has adopted provisional assessment criteria for TBT-specific biological effects which have already been mentioned above and can be found in OSPAR agreement number 2004-15.

Costs of present monitoring and reporting

Given that the monitoring of TBT-specific effects has become mandatory under the CEMP since 2003, there should be no additional cost for implementing the monitoring required for this EcoQO. Assessments under the current CEMP should allow determination whether the EcoQO is met or not. However, if the monitoring frequency is increased, if the current monitoring is extended to include other relevant species occurring at different locations (*e.g.* inshore – offshore) and/or if sample sizes and the number of sites sampled are increased, then costs will rise accordingly.

Extra costs of harmonising the monitoring

The tools needed for harmonising monitoring are already in place (monitoring guidelines, quality assurance procedures and assessment tools).

Performance of the EcoQO

The cause-effect relationship between the presence of TBT and imposex in dog whelks is clear and direct. The toxicological effects of TBT on gastropods occur at very low concentrations in seawater, below the levels that can be routinely measured by most laboratories. The technical evaluation in relation to the ICES criteria for a good EcoQO is as follows *(adapted from ICES, 2004a):*

ICES criteria	Comments	
Relatively easy to understand by non-scientists and those who will decide on their use	Usually	Dogwhelks are very sensitive to TBT. A number of scientific reports documenting this are available
Sensitive to a manageable human activity	Usually	Several documented cases of a recovery in dogwhelk populations after the decrease in the use of TBT
Relatively tightly linked in time to that activity	Usually	Detection of change after a decrease in the use of TBT should be less than 10 years
Easily and accurately measured, with a low error rate	Usually	There is a standard method (VDSI). Refere to interlaboratory variation in QUASIMEME
Responsive primarily to a human activity, with low responsiveness to other causes of change	Usually	There is a clear cause-effect relationship between the presence of TBT and imposex in dogwhelks
Measurable over a large proportion of the area to which the EcoQ metric is to apply	Usually or occasionally	Dogwhelks are widely distributed in the North Sea area, but only on rocky substrates and predominantly intertidally
Based on an existing body or time series of data to allow a realistic setting of objectives	Usually	Data exist from “pristine areas” where TBT concentrations are zero or almost zero

Specific linkages with the MSFD

In the context of the initial assessment under the MSFD, this EcoQO is able to provide an indication of the environmental quality status with regard to inputs of a synthetic chemical giving rise to concern (*i.e.* TBT).

The EcoQO provides an indicator and an environmental target in relation to the GES conceptual descriptor: “concentrations of contaminants are at levels not giving rise to pollution effects”.

In terms of programmes and measures the EcoQO is a means of measuring the effectiveness of measures addressing the marketing and use of TBT, including EC Community Regulation, (Regulation (EC) No 782/2003) implementing the AFS in the EU.

Gaps in knowledge

Presently there is still a lack of data to come to an elaborate assessment of the situation in the North Sea. Also, most time series are not long enough to assess the evolution for the entire area; the monitoring of TBT-specific biological effects has only become mandatory in 2003. It will take a while for monitoring to be properly established and to solve the above shortcomings. No immediate action is therefore necessary.

Effectiveness of communication

Imposex/intersex effects in gastropods are one of the most vivid effects of hazardous substances measured in the marine environment and provide an effective and eyebrow raising topic on which to engage interest among stakeholders and the wider public interested in the marine environment. There is a need to ensure that the reporting of status in relation to the range of measurements that can be made in relation to TBT-specific biological effects is as harmonised as possible to ensure effective communication and to ensure that any assessment is backed up by solid science.

Whether the status of the EcoQO should be target, limit or indicator

The EcoQO provides a limit above which undesirable or even irreversible effects to living organisms may occur, however given the current general status in relation to the EcoQO it is also possible to interpret the objective as a target *i.e.* a goal to be met in the future, although one currently without a timeframe. Additionally, it can be used as an indicator for the status of the area.

There are no proposals for revision of the EcoQO.

Proposals for possible milestones up to the achievement of the objective

Given the limited timeframe in which the measures have been taken and the fact that monitoring has only recently started, a sensible evaluation of the situation and hence the prediction of milestones, will only become possible at a later date.

Potential applicability of the EcoQO in other OSPAR regions

Under the CEMP, monitoring in relation to TBT-specific biological effects in gastropods is carried out throughout the OSPAR maritime area in coastal regions and the data that have been reported to ICES have been assessed as part of the 2006/2007 CEMP assessment. Some Contracting Parties that have carried out monitoring have not reported the data to ICES (*e.g.* Iceland, Portugal). The JAMP assessment classes for TBT-specific biological effects, on which the EcoQO is based, are intended to provide a means of harmonising the results from monitoring of TBT-specific effects found in different gastropods across the OSPAR maritime area. The EcoQO is suitable for application in the OSPAR regions beyond the North Sea.

Reference

OSPAR (2007). 2006/2007 CEMP assessment. Trends and concentrations of selected hazardous substances in the marine environment. Publication No. 2007/330.

Annex 10: EcoQO on eutrophication (Lead countries : The Netherlands and Norway)

Background

Excessive enrichment of water with nutrients can cause an accelerated growth of algae and higher forms of plant life. This in turn may have a range of undesirable effects on the marine ecosystem including shifts in the composition of the flora and fauna, affecting habitats and biodiversity, and oxygen depletion, causing death of fish and other species.

The quality of the North-East Atlantic and its five Regions is periodically assessed by OSPAR through the "Comprehensive Procedure" of the Common Procedure for the identification of the eutrophication status of the OSPAR maritime area (Agreement 2005-3) by classifying the Convention waters as 'problem areas', 'potential problem areas' and 'non-problem areas' with regard to eutrophication.

In 2006, OSPAR agreed on the application of the EcoQO system in the North Sea, including the integrated sub-set of 5 specific EcoQOs and the overall general (overarching) EcoQO for eutrophication (OSPAR 2006-4). The implementation of the integrated set of the 5 EcoQOs is through the second application of the Comprehensive Procedure, which has been carried out to produce the 2008 OSPAR integrated report on the eutrophication status for the period 2001 up to 2005 (hereinafter the "2008 OSPAR integrated report"; OSPAR 2008a).

OSPAR overall EcoQO and its integrated set of five EcoQOs for eutrophication

The overall EcoQO for eutrophication is that "All parts of the OSPAR Maritime Area should have the status of non-problem areas with regard to eutrophication by 2010, as assessed under the OSPAR Common Procedure for the Identification of the Eutrophication Status of the OSPAR Maritime Area". The integrated set of 5 specific EcoQOs for eutrophication corresponds to a selection of assessment parameters as applied under the Comprehensive Procedure (Table 9.1) and is as follows (codes 9.1.1 - 9.1.5):

- Winter concentrations of dissolved inorganic nitrogen and phosphate should remain below a justified salinity-related and/or area-specific % deviation from background not exceeding 50%.
- Maximum and mean phytoplankton chlorophyll a concentrations during the growing season should remain below a justified area-specific % deviation from background not exceeding 50%.
- Area-specific phytoplankton species that are indicators of eutrophication should remain below respective nuisance and/or toxic elevated levels (and there should be no increase in the average duration of blooms).
- Oxygen concentration, decreased as an indirect effect of nutrient enrichment, should remain above area-specific oxygen assessment levels, ranging from 4 – 6 mg oxygen per litre.
- There should be no kills in benthic animal species as a result of oxygen deficiency and/or toxic phytoplankton species.

The integrated set of the 5 EcoQOs for eutrophication for the North Sea are implemented through the second application of the Comprehensive Procedure which extends to other regions of the OSPAR maritime area beyond the North Sea.

Table 9.1: *OSPAR harmonized assessment parameters and associated elevated levels. The integrated set of 5 EcoQO components for eutrophication are also indicated.*

Category I	**Degree of nutrient enrichment**	
	1	**Riverine inputs and direct discharges (area-specific)** Elevated inputs and/or increased trends of total N and total P (compared with previous years)
	2	**Nutrient concentrations (area-specific) (*EcoQO*)** Elevated level(s) of winter DIN and/or DIP
	3	**N/P ratio (area-specific)** Elevated winter N/P ratio (Redfield N/P = 16)
Category II	**Direct effects of nutrient enrichment (during growing season)**	
	1	**Chlorophyll *a* concentration (area-specific) *(EcoQO)*** Elevated maximum and mean level
	2	**Phytoplankton indicator species (area-specific) *(EcoQO)*** Elevated levels of nuisance/toxic phytoplankton indicator species (and increased duration of blooms)
	3	**Macrophytes including macroalgae (area-specific)** Shift from long-lived to short-lived nuisance species (e.g. *Ulva*). Elevated levels (biomass or area covered) especially of opportunistic green macroalgae).
Category III	**Indirect effects of nutrient enrichment (during growing season)**	
	1	**Oxygen deficiency *(EcoQO)*** Decreased levels (< 2 mg/l: acute toxicity; 4 - 6 mg/l: deficiency) and lowered % oxygen saturation
	2	**Zoobenthos and fish** Kills (in relation to oxygen deficiency and/or toxic algae) (*EcoQO)* Long-term area-specific changes in zoobenthos biomass and species composition
	3	**Organic carbon/organic matter (area-specific)** Elevated levels (in relation to III.1) (relevant in sedimentation areas)
Category IV	**Other possible effects of nutrient enrichment (during growing season)**	
	1	**Algal toxins** Incidence of DSP/PSP mussel infection events (related to II.2)

For an initial classification of an area, the observed levels for each assessment parameter are scored and evaluated in relation to each other to reflect cause-effect relationships (Table 9.2). Following the initial classification, a final area classification is made through an overall appraisal of all relevant information concerning the harmonised assessment parameters, their respective assessment levels and the supporting environmental factors (see the 2008 OSPAR integrated report, Annex 2).

For eutrophication purposes, the boundary between a problem area and a non-problem area in the coastal region should align with the boundary between the good and the moderate ecological status under the WFD (Figure 9.3).

Table 9.2: *Examples of the integration of categorised assessment parameters (see Table 8.1) for an initial classification.*

	Category I Degree of nutrient enrichment Nutrient inputs Winter DIN and DIP Winter N/P ratio	Category II Direct effects Chlorophyll *a* Phytoplankton indicator species Macrophytes	Categories III and IV Indirect effects/other possible effects Oxygen deficiency Changes/kills in zoobenthos, fish kills Organic carbon/matter Algal toxins	Initial Classification
a	+	+	+	problem area
	+	+	-	problem area
	+	-	+	problem area
b	-	+	+	problem area[1]
	-	+	-	problem area[1]
	-	-	+	problem area[1]
c	+	-	-	non-problem area[2]
	+	?	?	Potential problem area
	+	?	-	Potential problem area
	+	-	?	Potential problem area
d	-	-	-	non-problem area

[1] For example, caused by transboundary transport of (toxic) algae and/or organic matter arising from adjacent/remote areas.
[2] The increased degree of nutrient enrichment in these areas may contribute to eutrophication problems elsewhere.

(+) = Increased trends, elevated levels, shifts or changes in the respective assessment parameters in Table 9.1

(-) = Neither increased trends nor elevated levels nor shifts nor changes in the respective assessment parameters in Table 9.1

? = Not enough data to perform an assessment or the data available is not fit for the purpose

Note: Categories I, II and/or III/IV are scored '+' in cases where one or more of its respective assessment parameters is showing an increased trend, elevated level, shift or change.

Has the EcoQO been met?

The assessment of the eutrophication status of the OSPAR maritime area was prepared on the basis of national assessments of Contracting Parties for the period 2001 – 2005 for relevant areas in the Greater North Sea (Region II), the Celtic Sea (Region III) and the Bay of Biscay/Iberian Coast (Region IV). The results of the national assessment processes are synthesised in the 2008 OSPAR integrated report.

Despite extensive nutrient reduction measures put in place in the last years to prevent eutrophication, the overall EcoQO is not met in the North Sea where eutrophication is still a problem in 71 areas and a potential problem in 5 areas. This concerns in particular, coastal waters off France, Belgium, UK (some estuaries), the Netherlands, Germany, Denmark, Sweden and Norway (Figure 9.1). Yet, some areas showed improving trends in individual parameters but these trends are not yet visible in the overall area classification since the last assessment in 2002/2003.

In many cases measures targeting point sources as well as agricultural sources have been taken later than envisaged under OSPAR and/or relevant EU legislation. Another time lag can be observed between the implementation of such measures and a positive response from the ecosystem which can take many years.

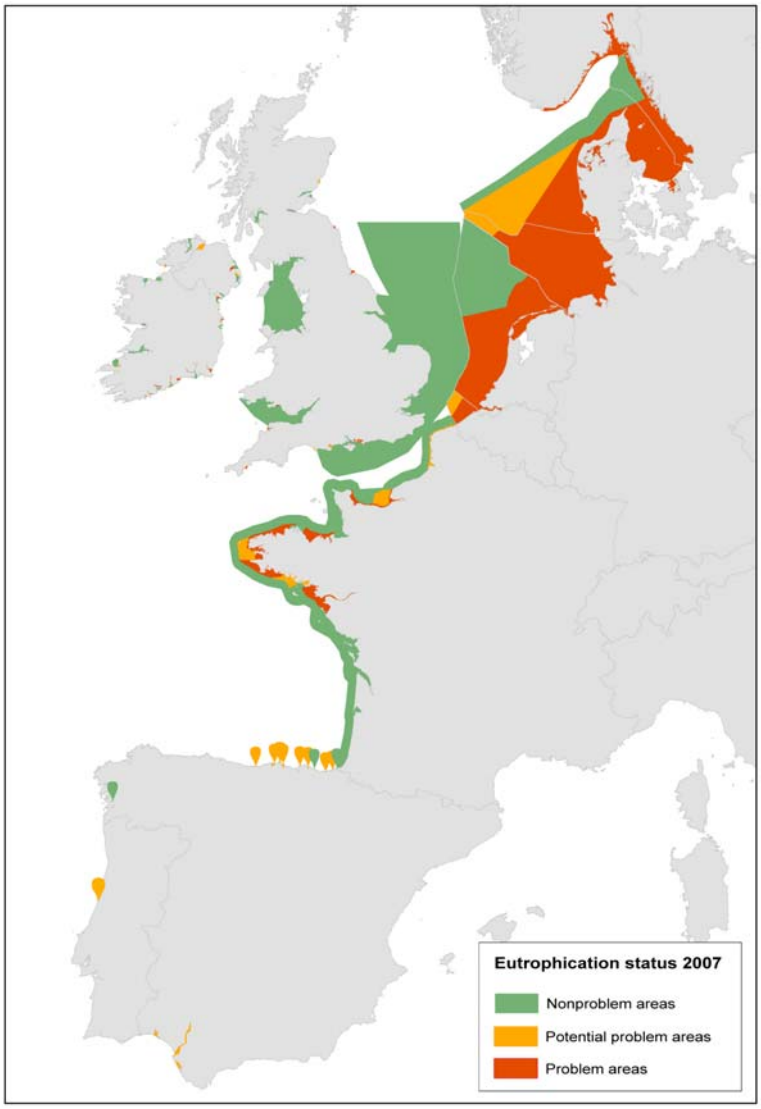


***Figure 9.1**: Quality status of the OSPAR maritime area in relation to eutrophication of the areas assessed by Contracting Parties in the second application of the Comprehensive Procedure in 2007.*

Consequences of failing to meet the EcoQO

In cases, in which the final classification results in problem areas with regard to eutrophication, and the overall eutrophication EcoQO are not met, the Eutrophication Strategy requires the OSPAR Commission and Contracting Parties, individually or jointly, to take measures to reduce or to eliminate the anthropogenic causes of eutrophication and to assess, based on implementation reporting, the effectiveness of those measures on the state of the marine ecosystem. In the case of potential problem areas with regard to eutrophication, preventive measures shall be taken in accordance with the precautionary principle and monitoring and research shall be urgently implemented to enable a full assessment of the eutrophication status of each area concerned after five years of its classification.

Measures are in place to combat human induced eutrophication, and the Eutrophication Strategy builds on long-standing work of OSPAR. This includes the commitment of Contracting Parties to achieve a substantial reduction at source, in the order of 50% compared to 1985, in inputs of phosphorus and nitrogen into areas where these inputs are likely, directly or indirectly, to cause

pollution.[7] These areas are defined as problem areas. The implementation of the Eutrophication Strategy takes place within the framework of the obligations of Contracting Parties in this field. This includes for example the Urban Waste Water Treatment Directive (91/271/EEC) and the Nitrates Directive (91/676/EEC) which require Member States of the European Community and the European Economic Area to identify "sensitive areas" and nitrate "vulnerable zones", respectively, as basis for the implementation of targeted measures to reduce nutrient inputs to these areas. Under the WFD (2000/60/EC) an assessment framework, closely linking to the conceptual approach of the Common Procedure, has been set up to assess, classify and monitor the ecological quality of transitional and coastal waters.

The 50% nutrient reduction target has been met by most Contracting Parties for phosphorus but, with the exception of Denmark, not for nitrogen. Reductions for nitrogen were less consistent and explicit, ranging from 10% to 48% across OSPAR (OSPAR 2008b). This can partly be explained by a time lag between implementation of nutrient reduction-measures and the actual effects of the measures. It is predicted that nutrient reductions beyond the 50% target are needed for certain areas to achieve the Strategy's objective.

Suitability of present monitoring and reporting

Monitoring in relation to the integrated set of EcoQOs for eutrophication is a mandatory commitment of Contracting Parties for problem and potential problem areas under the Eutrophication Monitoring Programme (agreement 2005-4) which forms part of the CEMP. Monitoring should be carried out in accordance with JAMP monitoring guidelines for nutrients, oxygen, chlorophyll a, phytoplankton species composition and benthos (agreements 1997-2 to 1997-6). Data resulting from this monitoring should be reported to the ICES data centre.

Monitoring, analytical methods and quality assurance are of key importance to enable the integrated set of EcoQOs for eutrophication to deliver an accurate picture of the eutrophication status and have been addressed by the second application of the Comprehensive Procedure and in the national reports of Contracting Parties.

For non-problem areas the current agreement is that the monitoring only covers nutrient concentrations every three years in winter. Thorough test of the EcoQO system (and especially the specific EcoQOs of the integrated set) would however require extended monitoring in non-problem areas.

For (potential) problem areas, the 2008 OSPAR integrated report synthesises information reported by Contracting Parties on the (in)sufficiency in their temporal and spatial monitoring in estuaries, fjords, coastal and offshore areas. It is recommended to improve the frequency and area coverage of monitoring and to make sure that this is done in a coherent way, taking also care of the additional and supporting environmental factors to cover correctly the more dynamic parameters like chlorophyll. Furthermore it is recommended to solve problems with data handling and as far as possible to make use of the arrangements made with ICES and its data bank.

Developments in harmonisation of monitoring and reporting schemes

To complement, and help improve spatial and temporal coverage of monitoring in relation to the integrated set of eutrophication EcoQOs, the use of additional tools may be considered such as

[7] PARCOM Recommendation 88/2 on the reduction in inputs of nutrients to the Paris Convention; PARCOM Recommendation 89/4 on a coordinated programme for the reduction of nutrients; and PARCOM Recommendation 92/7 on the reduction of nutrient inputs from agriculture

airborne surveys (*e.g.* under the BONN Agreement) and novel observation techniques and platforms including the emerging GMES Marine Core Services.

Costs of present monitoring and reporting

Given the fact that the monitoring of nutrients and eutrophication effects is mandatory under the CEMP for problem and potential problem areas on an annual basis, and for non-problem areas only for nutrient concentrations in winter at triennial basis, there may be additional costs involved if the monitoring to support the EcoQO system had to be extended to cover non-problem areas, as these areas are by far the largest part of the maritime area. There are, however, emerging opportunities to mitigate the costs through joint international monitoring and airborne surveys and using information that will become available through GMES Marine Core Service and other EC projects.

Extra costs of harmonising the monitoring

The tools needed for harmonising monitoring are already in place (monitoring guidelines, quality assurance procedures and assessment tools). But further work is needed to improve and update the respective guidelines and to ensure that the requirement for appropriate temporal and spatial coverage are understood and implemented where relevant.

Performance of the EcoQO

A number of Contracting Parties have gained positive experience of the EcoQO approach (Table 9.3). Ireland and Portugal provided voluntary information on their experience with the integrated set of the 5 EcoQOs for the Celtic Sea and the Iberian Coast which they had applied through the corresponding assessment parameters and processes of the Common Procedure.

A technical evaluation in relation to the ICES criteria for a good EcoQO was prepared in 2005 for the overall EcoQO for eutrophication and each specific EcoQO of the integrated set which is still valid (OSPAR 2006). The set of EcoQOs for eutrophication are interrelated through a cause-effect relationship, and link anthropogenic nutrient inputs with direct and indirect effects. The response is more direct and tightly linked for the specific EcoQOs for direct eutrophication effects. The cause-effect relationship may, however, be spatially and temporally separated through transboundary effects. Ecosystem or environmental factors (*e.g.* nutrient dynamics in sediments) may cause a time lag. Integrated monitoring and assessment of the cause-effect related parameters is needed to relate the response to human activities.

This first evaluation of the EcoQOs for eutrophication has not thoroughly addressed the role of each specific EcoQO of the integrated set as objective. This is partly also for reasons that the current monitoring of some assessment parameters is not sufficient in time and in space. ICES has previously concluded that three of the specific EcoQOs of the integrated set did not meet the criteria for good EcoQOs and recommended that these parameters cannot be used on their own as ecological objectives and should only be used as part of an overall assessment scheme (ICES 2004). This recommendation has been adopted by EUC by applying the overall EcoQO and its integrated set of 5 specific EcoQOs through the Comprehensive Procedure.

Table 9.3: *Experience with the use of the overall EcoQO for eutrophication and the integrated set of 5 specific EcoQOs by Contracting Parties through the OSPAR Comprehensive Procedure.*

Contracting Party	**Status of implementation taken from National Reports and observations**	**Score based on information provided on the trial application of the overall EcoQO and the 5 specific EcoQOs of the integrated set for eutrophication taken from national reports indicating their use as assessment criteria or objectives (OSPAR 2008a).** + means evaluated. – means not evaluated due to lack of spatial/temporal coverage, lack of sufficient data or for other reasons					
		Over-aching	**DIN/DIP**	**Chloro-phyll a**	**Phyto-plankton species**	**O_2 concen-tration**	**Benthic kills**
Sweden	Overarching objective and some of the sub-EcoQOs evaluated	+ (suitable)	-	+ (not suitable)	+ (not suitable)	+ (suitable)	+ (suitable but further development of indicator needed)
Norway	Implemented in the context of COMP[2]	+					
Denmark	Uses HELCOM HEAT assessment which is aligned with WFD quality elements	+	+	+	+	+	No observations registered
Germany	Has set thresholds for the sub-ecoQOs for various waters. (Implementation not explicit	+	+	+	+	+	+
Netherlands	Implemented in the context of COMP	+	+	+	+	+	+
Belgium	Partial implementation	+	+	+	+[1]	Not relevant in Belgian waters	Not relevant in Belgian waters
France	Not addressed						
United Kingdom	Prefers overall assessment provided by CP as indicator of ecosystem health						

[1] Not fully implemented with long-term monitoring but information on alternative assessment options is given.

[2] All five EcoQO components of the integrated set have been used in COMP but not evaluated as separate EcoQOs.

Specific linkages with the MSFD

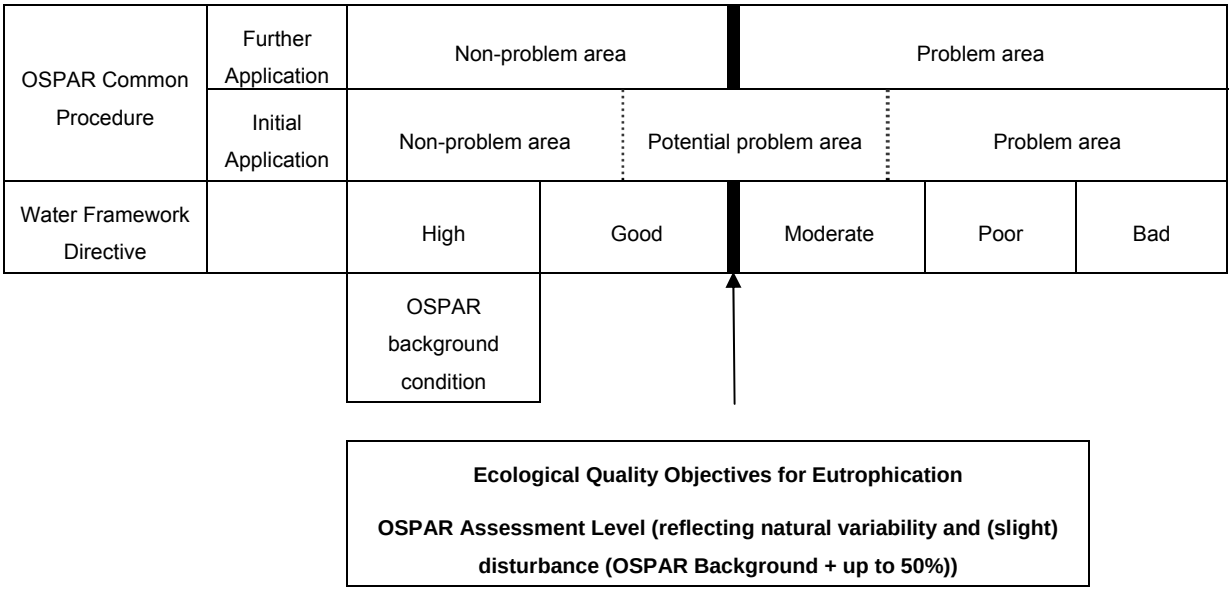
With respect to the EC Marine Strategy Framework Directive (EC MSFD), the qualitative descriptor of good environmental status covering eutrophication is that "human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algae blooms and oxygen deficiency in bottom waters".

The overall EcoQO for eutrophication as laid down in the corresponding overall objective of the Eutrophication Strategy and applied through the Comprehensive Procedure, is able to provide a good overview of the eutrophication status of the North-East Atlantic and can provide a sufficient indication of the environmental status which takes account of nutrient inputs and eutrophication effects.

For transitional and coastal waters which overlap with the régime of the Water Framework Directive (WFD), the biological and physico-chemical quality elements contributing to determining the ecological quality of water bodies under the WFD provide similarities and synergies with the use of the integrated set of EcoQOs for eutrophication (Figure 9.2) (OSPAR 2005). The 2008 OSPAR integrated report reviews those synergies in the light of progress in the WFD intercalibration process. For eutrophication purposes, the boundary between a 'problem area' and a 'non-problem area' in the coastal region

should align with the boundary between the 'good' and the 'moderate' ecological status under the WFD. While for the eutrophication classification the Common Procedure and the integrated set of 5 EcoQOs for eutrophication relate to nutrient enrichment and eutrophication effects, the overall classification of the ecological status under the Water Framework Directive takes into account all kinds of significant human pressures.

Figure 9.2: *Relationship between the classification under the Common Procedure, the integrated set of OSPAR EcoQOs for eutrophication and the Water Framework Directive (WFD).*



Gaps in knowledge

While improvements can be made to the OSPAR Comprehensive Procedure, the outcome of the Comprehensive Procedure assessment can be used for implementation of the eutrophication EcoQO. Yet, the specific EcoQOs of the integrated set have not been tested sufficiently in their own right to come to a judgement about their use.

Effectiveness of communication

Eutrophication effects in relation to nutrient enrichment give rise to adverse, and sometimes visible, effects on the marine environment (*e.g.* changes in the persistence and extent of algal blooms, oxygen deficiency, fish kills etc.) but also adverse effects to users of the sea (clogging of fishermen's nets, unpleasant foam on beaches affecting tourists).

These anecdotal observations are important, and powerful tools for communicating the nature of the problems that need to be combated / addressed to a wide variety of stakeholders, including policy makers, while for other stakeholders the outcome of the Comprehensive Procedure in terms of Problem or non-problem area status may be sufficient.

Whether the status of the EcoQO should be target, limit or indicator

The overall EcoQO for eutrophication provides a target *i.e.* a goal to be met in the future, although one that will probably not be met in the current timeframe (2010).

Proposal for modification and improvement of the EcoQO

It is clear that the overall eutrophication EcoQO supported by the outcome of the Comprehensive Procedure assessment does not need significant further development. The status of the specific EcoQOs of the integrated set is less clear as they have yet to be further tested.

The integrated set of EcoQOs is in a testing phase. Further work within the OSPAR Eutrophication Committee (EUC) would be required for modifying them for their region-specific application.

Proposals for possible milestones up to the achievement of the objective

Milestones have been highlighted in the 2008 OSPAR integrated report.

Potential applicability of the EcoQO in other OSPAR regions

Given the link with the OSPAR Comprehensive Procedure which is applicable to the whole OSPAR Convention Area, the overall EcoQO and its region-specific integrated set of five EcoQO components for eutrophication may be very well suitable for application in the OSPAR regions beyond the Greater North Sea.

Main conclusions

The first evaluation and recommendations on the overall EcoQO and its integrated set of 5 EcoQOs for eutrophication has been made in the 2008 OSPAR integrated report.

The following main conclusions can be drawn:

- The results given in the 2008 OSPAR integrated report show that the overall objective is not met in several parts of the OSPAR Maritime Area. For the North Sea a number of areas, in particular, coastal waters off France, Belgium, UK (some estuaries), the Netherlands, Germany, Denmark, Sweden and Norway are classified as problem areas with regard to eutrophication.
- The assessment parameters of the Comprehensive Procedure, including the integrated set of the 5 EcoQOs, offer a possibility to see more clearly and in more detail the possible changes affecting the eutrophication status of a particular area over the assessed period of time and/or between different applications of the Comprehensive Procedure (long-term trends). This would also allow a further harmonisation and comparability with the classification of the Water Framework Directive (WFD).
- A start has been made with the evaluation of the specific EcoQOs of the integrated set, but more work would be necessary to develop them further and assess their fitness for purpose and their suitability to function as objectives.
- For the time being, the outcome of the Comprehensive Procedure assessment offers a tried and tested methodology that can be used to implement the overall eutrophication EcoQO.
- The Comprehensive Procedure assessment, which includes the overall EcoQO and its integrated set of specific EcoQOs, currently forms a good basis to address the descriptor of good environmental status under the Marine Strategy Framework Directive.
- OSPAR should decide what further work should be undertaken to develop and evaluate the specific EcoQOs of the integrated set.

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