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Report of the Joint ICES/OSPAR *Ad hoc* Group on Seabird Ecology (AGSE)

28–29 November 2012

Copenhagen, Denmark

ICES International Council for the Exploration of the Sea

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Executive summary

The planned meeting of the Working Group on Seabird Ecology (WGSE) in Texel, the Netherlands, 29 October–2 November 2012 unfortunately had to be cancelled due to lack of participants (other commitments and lack of travel funding).

The group was supposed to provide the scientific background for ICES advice responding to two requests from OSPAR and consequently an alternative solution had to be found.

ICES managed to arrange a joint meeting with the OSPAR ICG-COBAM expert group on seabirds where the two requests could be addressed as well as the important issues of the ICG-COBAM group.

The **Joint ICES/OSPAR *Ad hoc* Group on Seabird Ecology (AGSE)** was chaired by Ian Mitchell (UK) and met in ICES Headquarter on 28–29 November 2012.

The group considered and discussed the two OSPAR requests. The remaining ToRs on the agenda for the cancelled WGSE meeting were not considered.

Only the issues relevant to ICES are presented in this report. The outcome of the meeting consist of three documents (Annexes 3–5) and provide background for the further ICES advisory process responding to the OSPAR requests.

1 Opening of the meeting

The meeting was welcomed by the chair Ian Mitchell who explained the aim and tasks of the meeting. A list of participants is attached in Annex 1. Only two experts among the participants were also members of the WGSE.

2 Adoption of the agenda

The agenda of the Joint ICES/OSPAR meeting as described in the Resolution is found in Annex 2.

ToRs a and b should be reported to ICES for the attention of SCICOM and ACOM while ToRs c–f should be reported to the next OSPAR ICG-COBAM meeting.

3 ToR a: Data collection and storage for seabird recommendations (OSPAR request 4–2012)

In 2011 OSPAR adopted seven Recommendations (OSPAR 2011/1-7) for furthering the protection and conservation of seven bird species:

- Lesser black-backed gull (*Larus fuscus fuscus*)
- Ivory Gull (*Pagophila eburnea*)
- Little shearwater (*Puffinus assimilis baroli*)
- Balearic shearwater (*Puffinus mauretanicus*)
- Black-legged kittiwake (*Rissa tridactyla tridactyla*)
- Roseate tern (*Sterna dougallii*)
- Thick-billed murre (*Uria lomvia*)

The purpose of the Recommendations is to strengthen the protection at all life stages of the species.

ICES was requested to advise on suitable arrangements (including format) for data collection and storage resulting from the implementation of the OSPAR Recommendations. After a brief discussion a short text was drafted (Annex 3). No details were provided due to the limited expertise in the meeting.

4 ToR b: Ecological quality objective for seabird populations (OSPAR request 6–2012)

Before the meeting an information paper: "Update on EcoQO for Seabird Population Trends in OSPAR Region III – Celtic Seas, 1986–2011" had been prepared by Ian Mitchell, Annabel Knipe and Roddy Mavor (Joint Nature Conservation Committee, UK.) This document responding to OSPAR request 4-2012 is attached in Annex 4.

During the discussions related to the ICG-COBAM task to define the technical specifications of the biodiversity indicators (incl. EcoQO) another document with additional consideration was prepared (Annex 5).

Annex 1: List of participants

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Annex 2: Agenda

The meeting will work on the following ToRs:

a) Data collection and storage for seabird recommendations (OSPAR 4-2012)

To provide advice on suitable arrangements (including format) for data collection and storage resulting from the implementation of OSPAR Recommendations 2011/1-7 on seabirds, taking into account existing data collection arrangements and compatibility with current developments under MSFD implementation.

b) Ecological quality objective for seabird populations (OSPAR 6-2012)

i) To update the value of the draft EcoQO indicator on Seabird Population Trends in OSPAR Region III (Celtic Seas) and make any relevant recommendations;

ii) To consider whether or not the target thresholds [both a) the target for a species-specific trend in abundance (e.g. 70% or more of the baseline); and b) the target for the proportion of species meeting species-specific targets (e.g. 75% or more)] used in the EcoQO would be indicative of a seabird community that is at GES.

c) COBAM common indicator submission to BDC 2013: Discuss draft Technical Specifications for each bird indicator.

d) These technical specifications ('tech specs') will be drafted prior to the meeting, by expanding existing two page indicator summaries into a more detailed document that will have a similar function to the chapters of the EcoQO Handbook. The tech specs must follow a template specified by COBAM. The draft tech specs will be reviewed by the meeting and amendments suggested.

e) COBAM common indicator submission to BDC 2013: Identify potential case studies of Indicators.

f) These case studies are to be used to demonstrate to BDC how certain indicators can be constructed from existing monitoring data and then assessed against targets to determine whether GES has been achieved. These case studies do not necessarily need to utilise data from all countries in a subregion, unless they are available. The EcoQO on seabird population trends is the obvious case study for birds but maybe there is another indicator we can provide a case study for.

g) COBAM common indicator submission to BDC 2013: Produce indicator Abstracts.

h) These should be drafted at the meeting for each common indicator, be 150–200 words in length and contain the essential characteristics of each indicator.

i) COBAM common indicator submission to BDC 2013: Provide an overview of monitoring needs.

j) COBAM have asked each expert group to provide a brief overview of monitoring needs that includes the following: i) datasets/ monitoring programmes that would be needed to feed the indicators, ii) does sufficient data or monitoring currently existing, and iii) what are the main gaps in

monitoring? Such information will need to be include in the indicator tech specs (see c above), but some general commentary is also required in the paper COBAM will be presenting to BDC 2013.

Annex 3: Data collection and storage for seabird recommendations

WGSE suggests that one range state (contracting party) takes responsibility for collating the relevant data (according to OSPAR recommendations) for each species. Data collection should follow international standard methods (e.g. Walsh *et al.*, 1995) whenever possible. In many cases, these data are already being collected as part of national monitoring schemes or will be collected as part of implementation of MSFD or other conventions and international agreements. Table 1 sets out known data collection and the suggested responsible contracting party for each species.

Data for each species should be stored by the responsible range state as part of their national monitoring schemes. While some data are easily stored in standard formats (e.g. population size, breeding success), others will require the development of more sophisticated formats for convenient data exchange among contracting parties (e.g. tracking data, diet data (Barrett *et al.*, 2007)). Several other initiatives are currently working towards international standards for collection, exchange and storage of seabird data, and WGSE does therefore not at this stage recommend the creation of a central database. However, it is important that data are stored in a format that allows easy comparison and exchange of data among the contracting parties. Similar principles should apply for OSPAR seabird data in general, not only those for which current OSPAR recommendations exist.

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Table 1. Known data collection for each species. This list may not be complete.

Species	Lead country	Population trends	Breeding success	Survival rates	Diets	Contaminants	Movements
Lesser black-backed gull	Norway	X	X	X	X	X	X
Ivory gull	Norway	X	X			X	X
Little shearwater	Portugal	X	X				X
Balearic shearwater	Spain	X	X	X			X
Black-legged kittiwake	UK	X	X	X	X	X	X
Roseate tern	UK	X	X	X	X		X
Thick-billed murre	Iceland	X	X	X	X		X

Annex 4: Information paper: Update on EcoQO for Seabird Population Trends in OSPAR Region III – Celtic Seas, 1986–2011

By Ian Mitchell, Annabel Knipe and Roddy Mavor (Joint Nature Conservation Committee, UK).

WGSE ToR:

Ecological quality objective for seabird populations (OSPAR 6-2012)

i) To update the value of the draft EcoQO indicator on Seabird Population Trends in OSPAR Region III (Celtic Seas) and make any relevant recommendations;

ii) To consider whether or not the target thresholds [both a) the target for a species-specific trend in abundance (e.g. 70% or more of the baseline); and b) the target for the proportion of species meeting species-specific targets (e.g. 75% or more)] used in the EcoQO would be indicative of a seabird community that is at GES.

Introduction

The EcoQO on seabird population trends was adopted by OSPAR's Biodiversity Committee (BDC) in 2012 (see OSPAR 2012): Changes in breeding seabird abundance should be within target levels for 75% of species monitored in any of the OSPAR regions or their subdivisions.

When adopting the EcoQO on seabird population trends, the OSPAR BDC agreed that it, along with the other EcoQOs, should be taken forward as part of the implementation of the EC Marine Strategy Framework Directive (MSFD) (OSPAR 2012). Subsequently, OSPAR's ICG-COBAM[1] identified the EcoQO as an appropriate target for assessing the achievement of Good Environmental Status (GES) under MSFD. They have included the EcoQO as part of a proposed suite of common indicators to be represented to BDC in February 2013.

The indicators for the EcoQO were intraspecific trends in abundance. These were first constructed by ICES (2008), who used data of eight species in OSPAR Region III during the period 1986–2006 to demonstrate and test the process of determining whether the EcoQO had been achieved in a given year. Data for OSPAR Region III are collected as part of the UK and Ireland's Seabird Monitoring Programme (SMP). There were subsequent updates in ICES (2010) and ICES (2011) that used data from 1986–2009 and 1986–2010 respectively and which both included plot counts as well as whole colony counts and added four more species compared to the first iteration in ICES (2008). In this update we have included data from 1986–2011 and added one more species – common tern (*Sterna hirundo*): the indicator is now based on 13 species. Most colonies in OSPAR III were not surveyed in each year of the time-series, so imputation techniques were used to estimate the missing counts. The imputation methods used in this update are identical to those used in ICES (2010, 2011).

[1] Intersessional Correspondence Group on the Coordination of Marine Biodiversity Assessment and Monitoring.

Reference values for each species were set by the UK and Republic of Ireland following guidance in ICES (2008): They should ideally be set at a level previously observed, preferably prior to any major population change, particularly those that resulted from anthropogenic pressures. The baselines for OSPAR III were derived from previous censuses of the whole region (see Table 1). This update uses the same baselines used in the previous updates (ICES 2010, 2011).

To date, assessments of the EcoQO have used target thresholds originally suggested by ICES (2008): intraspecific annual abundance should be less than or equal to 130% of the baseline and more than or equal to 80% of the baseline, for species that lay only one egg, or more than or equal to 70% for species that lay more than one egg. WGSE debated whether or not an upper target threshold should only be applied to predatory species that are likely to have significant negative impacts on other species (ICES 2011). They recommended that the EcoQO should remain unaltered, because it should be "*a value-free, objective metric that makes no assumptions about the underlying causes of individual seabird species population change.*" However, a group of UK experts assembled by Defra to recommend UK MSFD targets recommended that the EcoQO be used without upper target threshold for abundance of any species. The lack of any upper threshold was consider to be more objective than applying it only to certain species and would mean that the EcoQO would be much more straightforward to interpret in terms of whether or not GES has been achieved or not under the MSFD.

To help resolve the issue, two separate assessments of the EcoQO have been made: one uses an upper target of 130% for all species, the other does not use an upper target at all for any species.

Methods

Since the first assessment of the EcoQO (ICES 2008), JNCC in collaboration with Biomathematics and Statistics Scotland developed an analytical 'wizard' for estimating trends in breeding numbers of individual species at various geographical scales including OSPAR Regions. The seabird trend wizard uses a modified chain method, first developed by Thomas (1993), to impute values of missing counts based on information in other years and sites (details of the Thomas method are given in Annex 3 of ICES 2008). The wizard is a small Delphi application that retrieves counts from an Access database and generates script files and a DOS batch file that instruct R to conduct the trend analysis using the Thomas (1993) method. A further advantage of the new wizard is that the analyses can incorporate both whole colony counts and plot counts, even when they exist for the same colony in the same year.

It is important to note that the confidence intervals about the estimates obtained using the imputation procedure were typically very wide. This reflected the fact that the method is empirical, and that the intervals were based on a form of nonparametric re-sampling that makes only weak assumptions regarding the structure of the data.

Separate trend models were produced for data collected from Britain and from Ireland of the 13 species included in the previous updates (ICES 2010, 2011). For all species, data from throughout OSPAR III were pooled for trend modelling.

The accuracy and precision of the modelled regional trend for northern fulmar were increased by restricting data input from only those colonies that had been surveyed in five years or more during 1986–2011. Data from all other species contained colonies that has been surveyed in two or more years during 1986–2011 (as in ICES 2008, 2010, 2011). This reduced the sample size for fulmar to just 7% of the total number of

pairs known to breed in OSPAR III (1998–2002 Census, Mitchell *et al.*, 2004), compared to over 50% in all other species (Table 1).

Baselines for each species are in Table 1. These same baselines were as used in ICES (2008, 2010, 2011).

Two iterations of the EcoQO were produced:

a) 'Old targets option': this was applied to previous iterations of the EcoQO (ICES 2008, 2010, 2011) – intraspecific annual abundance should be less than or equal to 130% of the baseline and more than or equal to 80% of the baseline, for species that lay only one egg, or more than or equal to 70% for species that lay more than one egg.

b) 'New target option': as above, but an upper target threshold of 130% was not applied to any species.

Results

Using the 'old targets' option, the EcoQO was not achieved in consecutive years during 1989–1992, 1996, 2000 and in consecutive years during 2002–2011 (see Figure 1). Using the 'new target option' the EcoQO was not achieved in 1986, 1989–1990, 1992 and consecutively from 2005–2011. The old targets option included species that exceeded the 130% target at some point during 1999–2011: great cormorant, common tern, little tern and sandwich tern (Figure 2).

For both options, lower target levels were not achieved by six species in 2011 – showing no change compared to the last updates in 2009 and 2010 (ICES 2010, 2011). The six species are northern fulmar (*Fulmarus glacialis*), arctic skua (*Stercorarius parasiticus*), European shag (*Phalacrocorax aristotelis*), herring gull (*Larus argentatus*), black-legged kittiwake (*Rissa tridactyla*) and roseate tern (*Sterna dougalii*).

Roseate tern abundance has been below the lower target throughout 1986–2011, but has steadily increased during this period from 18% to 48% of the reference level.

European shag abundance was relatively lower than roseate tern in 2010 (i.e. 29% of reference level). Shag numbers have been at or below the lower target since 1993, but have been declining further since 2004.

Herring gull numbers have been in decline since the early 1970s, but the reference level was set at the mid-1980s level because numbers were thought to have been previously elevated by anthropogenic activities (e.g. commercial fisheries). Numbers have been steadily decreasing since 2000 and fell below target levels from 2002 onwards. They are currently at 53% of the reference level.

Arctic skua numbers have been below the lower target since 2005 and, in 2011, were at 40% of the reference level.

The decline in northern fulmar numbers started in the mid-1990s but was steeper during 2006–2008. Their numbers dropped below the target level in 2007, remained stable at 73% of the reference level in 2009 and 2010, but declined to 68% in 2011.

Black-legged kittiwake numbers have been declining since around 2000 and dropped just below the target level in 2008, 2010 and again in 2011.

Great black-backed gull numbers have remained within target levels throughout 1986–2011 and have shown no discernible trend. Razorbill and common guillemot numbers had increased steadily during the 1980s and 1990s. Guillemot numbers con-

tinue to increase. Razorbill numbers peaked between 2002 and 2005 but subsequently dropped down to around the reference level and have remained stable since 2006.

Since 2000 the numbers of great cormorant increased but have declined since 2009 returning to the reference level.

Common tern, Sandwich tern and little tern have been increasing since 2000. Numbers of Common tern and Sandwich tern, though lower in 2011 compared to 2010, remain substantially above reference levels. Little tern numbers dipped dramatically in 2010 but in 2011, numbers were once again well above the reference level.

Discussion

ToR i To update the value of the draft EcoQO indicator on Seabird Population Trends in OSPAR Region III (Celtic Seas) and make any relevant recommendations;

The failure to achieve the EcoQO in OSPAR III in consecutive years between 2005 and 2011 (for both target setting options) does represent cause for concern given that 4–6 of the 13 species sampled were all below lower target levels during this period and that five species have shown substantial declines.

The declines in three of these species: roseate tern, Arctic skua and herring gull have already been highlighted within the UK and have been listed on the UK Biodiversity Action Plan and on the Red list of Birds of Conservation Concern in the UK. Roseate tern numbers have been increasing as a direct result of intensive management of colonies in Ireland. Arctic skua are relatively scarce in OSPAR III but the trend in the region is following a steeper decline in the neighbouring Northern Isles (OSPAR II) where impacts of climate and fishing on food supply have has been exacerbated by increased predation and competition from great skua. The cause of the decline in herring gulls throughout the UK and Ireland is less well understood and further work is required.

The EcoQO highlights a substantial decline in shag numbers in OSPAR III. Declines have occurred in the rest of the UK but not to the same extent. Further work is urgently needed to investigate the cause of the decline.

The recent declines in kittiwake and fulmar numbers in OSPAR III are worth continued monitoring and further investigation is required to determine likely causes. Kittiwake colonies within OSPAR III have been more successful than colonies on the east coast of Britain (in OSPAR II), which have been in decline in some areas since the late 1980s. A shortage of sandeels off the east coast is probably responsible for poor breeding there, but kittiwakes at colonies in western Britain tend to feed on other species of fish. More work is needed into the variation in availability of these prey species.

The continued increase in guillemot numbers may be surprising when other predators of small shoaling fish – kittiwakes and shag, have been declining and razorbill numbers have levelled off. The large increase in common terns, sandwich tern numbers is probably due to improved protection from predators at colonies. Despite the 2011 resurgence, the declines in little tern numbers over the previous four years may be of concern and continued monitoring is recommended.

ToR ii To consider whether or not the target thresholds [both a) the target for a species-specific trend in abundance (e.g. 70% or more of the baseline); and b) the target for the proportion of species meeting species-specific targets (e.g. 75% or more)] used in the EcoQO would be indicative of a seabird community that is at GES.

When suggesting a lower target threshold of 70% or 80% depending on the species, ICES (2008) considered them values of abundance that management should be trying to maintain with high probability. This is the same rationale that underlies target-setting to reflect the achievement of GES under MSFD.

There is clearly more debate required about the inclusion of an upper target threshold for specie specific abundance. Does the 'new option' of omitting an upper threshold provide a less ambiguous assessment of GES? Currently four species exceed an upper target of 130%; little tern, sandwich tern and common tern, populations of which were previously in poor health. Cormorant abundance also exceeded the 130% target. Given the *carbo* subspecies is relatively scarce with just 52 000 pairs globally, and is culled both legally and illegally in the UK and Ireland because of conflict with fisheries, is an upper target justified for this species? It is probably worth monitoring the large and expanding cormorant colonies for any impacts on other species. GES in terms of biodiversity in a particular marine subregion is likely to be determined by the assessment of many targets and indicators. The messages conveyed by these assessments need to be clear and unambiguous. This should be considered when assessing the most appropriate target setting approach for this EcoQO in the context of GES.

The EcoQO target threshold of 75% or more species meeting their abundance targets was recently put out to public consultation in the UK as part of its implementation of MSFD. Several NGOs suggested raising the threshold to 90%. Examination of Figure 1 shows that in OSPAR III, the EcoQO would not have been met at all during 1986–2011 under the 'old target' option and met in just two years under the 'new target option'. Instead, Defra kept the 75% threshold with the caveat that no species should be consistently missing their individual targets, where the cause of that decline can be directly linked to human activity.

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gy, Countryside Council for Wales, Department of Agriculture, Fisheries and Forestry (Isle of Man), Department of Environment, Heritage and Local Government (Republic of Ireland) States of Guernsey Government, Joint Nature Conservation Committee, Manx Birdlife, Manx National Heritage, The National Trust, National Trust for Scotland, Natural England, Northern Ireland Environment Agency, The Royal Society for the Protection of Birds, Scottish Natural Heritage, The Seabird Group, Shetland Oil Terminal Environmental Advisory Group and Scottish Wildlife Trust; plus other organisations and volunteers throughout Britain and Ireland.

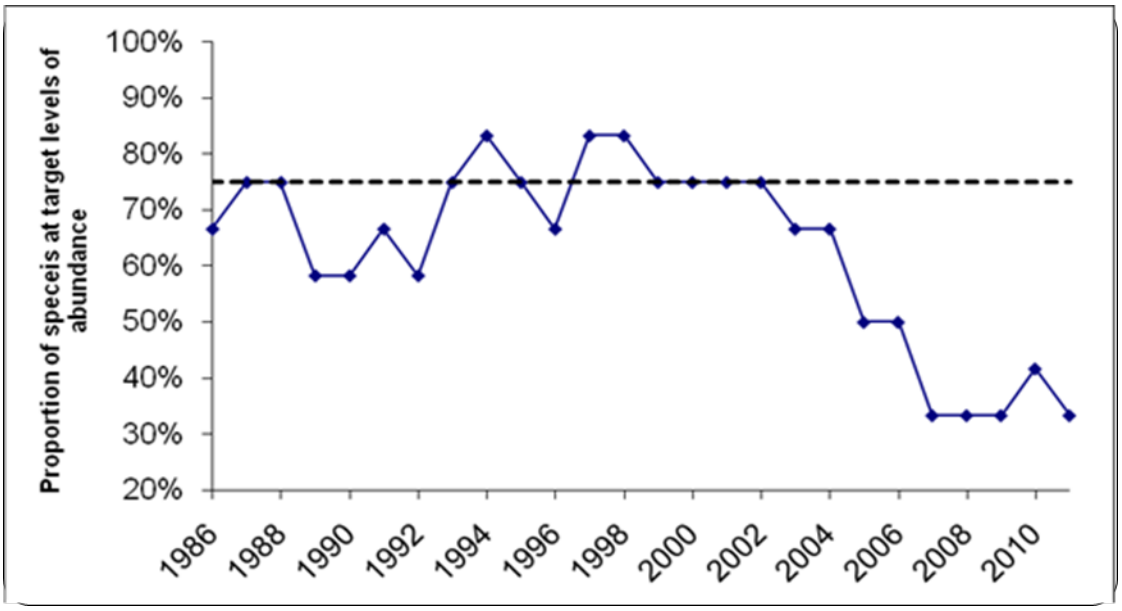
Table 2. Species-specific reference levels for OSPAR III.

Species Name		OSPAR III Reference levels		Proportion of regional population in sample	source	Justification for reference level
English	Scientific	abundance[1]	year			
Northern fulmar	*Fulmarus glacialis*	192 295	1998–2000	7%	a	Numbers increased and range expanded throughout most of 20th Century, but plateaued during Seabird 2000 in NW Scotland where there are the largest colonies in OSPAR III; though appears to be still increasing in Wales and possibly in SW England and Ireland.
Arctic Skua	*Stercorarius parasiticus*	193	1986–1987	62%	b	The counts during 1986–1987 provided the first comprehensive estimate of numbers breeding throughout the Region. More recently censused in 2001–2002. But severe declines in breeding numbers in neighbouring OSPAR II from late 1990s onwards, suggest large negative anthropgenic impact on food supply that has been exacerbated by increased predation and competition from great skuas *Stercorarius skua*. Population estimate in 1986–1987 is therefore less influenced by anthropogenic impacts than more recent estimate.
Great cormorant	*Phalacrocorax carbo*	9074	1999–2001	76%	a	Majority of coastal breeding cormorants in OSPAR III are thought to be nominate sub-species. OSPAR III holds almost one fifth of world population of P.c.carbo, so opted for higher population estimate as reference level. Note: following this estimate, in 2003, the maximum number of licences issued per year for culling cormorants in England and Wales increased from 200 to 2–3000.
European shag	*Phalacrocorax aristotelis*	22 362	1986–1988	59%	b	Numbers were increasing throughout most of Britain and Ireland, until large mortality event (or 'wreck') as a result severe weather during the winter of 1992/1993 severely reduced breeding numbers. Therefore, the SCR provides the best reference level.
Herring gull	*Larus argentatus*	106 415	1986–1987	59%	b	Numbers were probably artificially elevated during the 1960s by uncontrolled discarding and offal discharge by fisheries. Subsequent controls were probably responsible for a large decrease during the 1970s and early 1980s. During the 1990s numbers in Ireland were severely reduced during outbreaks of botulism. The population size during the SCR was probably the least impacted by human pressures.
Great black-backed gull	*Larus marinus*	10 261	1986–1988	53%	b	Similar scenario to the herring gull.

Species Name		OSPAR III Reference levels		Proportion of regional population in sample	Source	Justification for reference level
English	Scientific	abundance[1]	year			
Black-legged kittiwake	*Rissa tridactyla*	118 222	1985–1987	57%	b	Increased in number between the censuses in 1969/70 and 1985–1988, but subsequent food shortages in NW Scotland may have reduced numbers there. Therefore, the SCR provides the best reference level.
Common tern	*Sterna hirundo*	7447	1985–1987	74%	b, c	Increases in predation by introduced mink in NW Scotland during the 1980s and 1990s are well documented. Active control subsequently has helped numbers recover.
Little tern	*Sternula albifrons*	648	1986–1987	78%	b, c	The number of birds attempting to breed are highly variable from one year to the next and greatly affected by local conditions (e.g. predation). Little change in numbers breeding in the Region between mid 1980s and 2000, so opted for slightly higher estimate in 1986–1987.
Sandwich tern	*Sterna sandvicensis*	4610	1987–1988	95%	b, c	However, mortality of birds on wintering grounds in W. Africa appears to have increased in late 1980s and early 1990s, partially through trapping. Therefore, the SCR and All-Ireland tern survey (1984) appear to provide the best reference levels.
Roseate tern	*Sterna dougallii*	2700	1967–1968	100%		Huge declnes in breeding numbers during 1970s and 1980s mainly due to high mortality of birds on wintering grounds in W. Africa resulting from trapping. Therefore 1967–1968 population estimates provide the best reference level, prior to these substantial anthropogenic impacts.
Common guillemot	*Uria aalge*	616 975	1998–2000	74%	a	Numbers have steadily increased throughout the 1970s, 1980s and 1990s, and continue to do so throughout most of OSPAR III. Seabird 2000 provided the most recent population estimate, but depending on future changes in population size, subsequent censuses may provide a more appropriate reference.
Razorbill	*Alca torda*	135 663	1998–2001	62%	a	As for common guillemot

Source: a) Seabird 2000 (Mitchell *et al.*, 2004), b) Seabird Colony Register Census (Lloyd *et al.*, 1991, Mitchell *et al.*, 2004), c) All-Ireland Tern Survey (Whilde, 1985). [1]Unit of abundance is pairs for all species except *Alca torda* and *Uria aalge*, which are listed as the number of birds.

a) 'Old targets' option



b) 'New targets' option

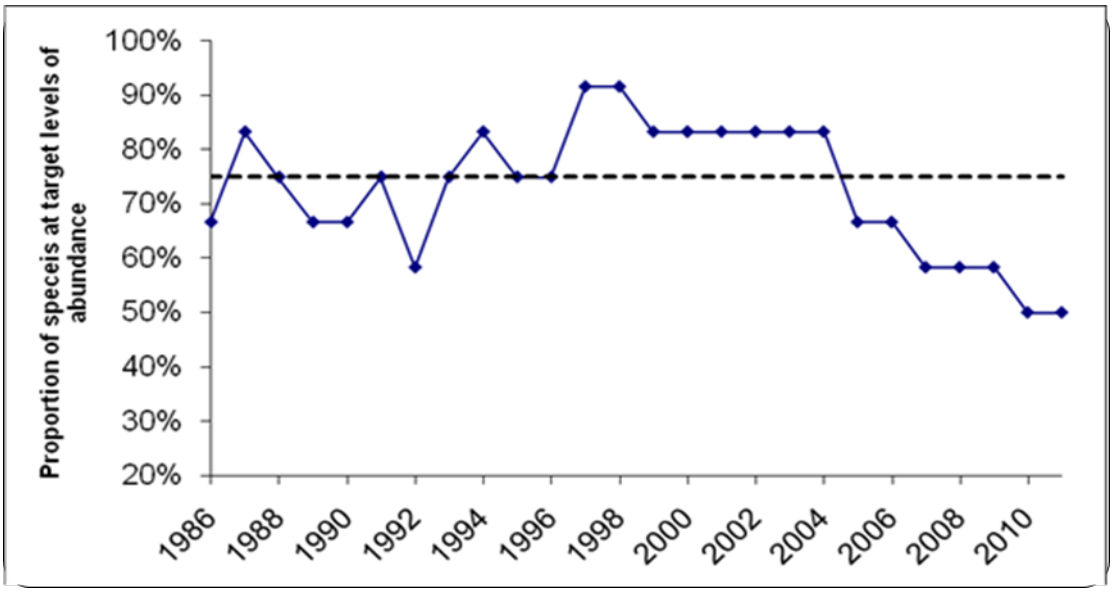


Figure 1. The proportion of species in OSPAR III that were within target levels of abundance during 1986–2011. The EcoQO was not achieved in years when the proportion dropped below 75%.

a) 'Old targets option': this was applied to previous iterations of the EcoQO (ICES 2008, 2010, 2011) – intraspecific annual abundance should be less than or equal to 130% of the baseline and more than or equal to 80% of the baseline, for species that lay only one egg, or more than or equal to 70% for species that lay more than one egg.

b) 'New target option': as above, but an upper target threshold of 130% was not applied to any species.

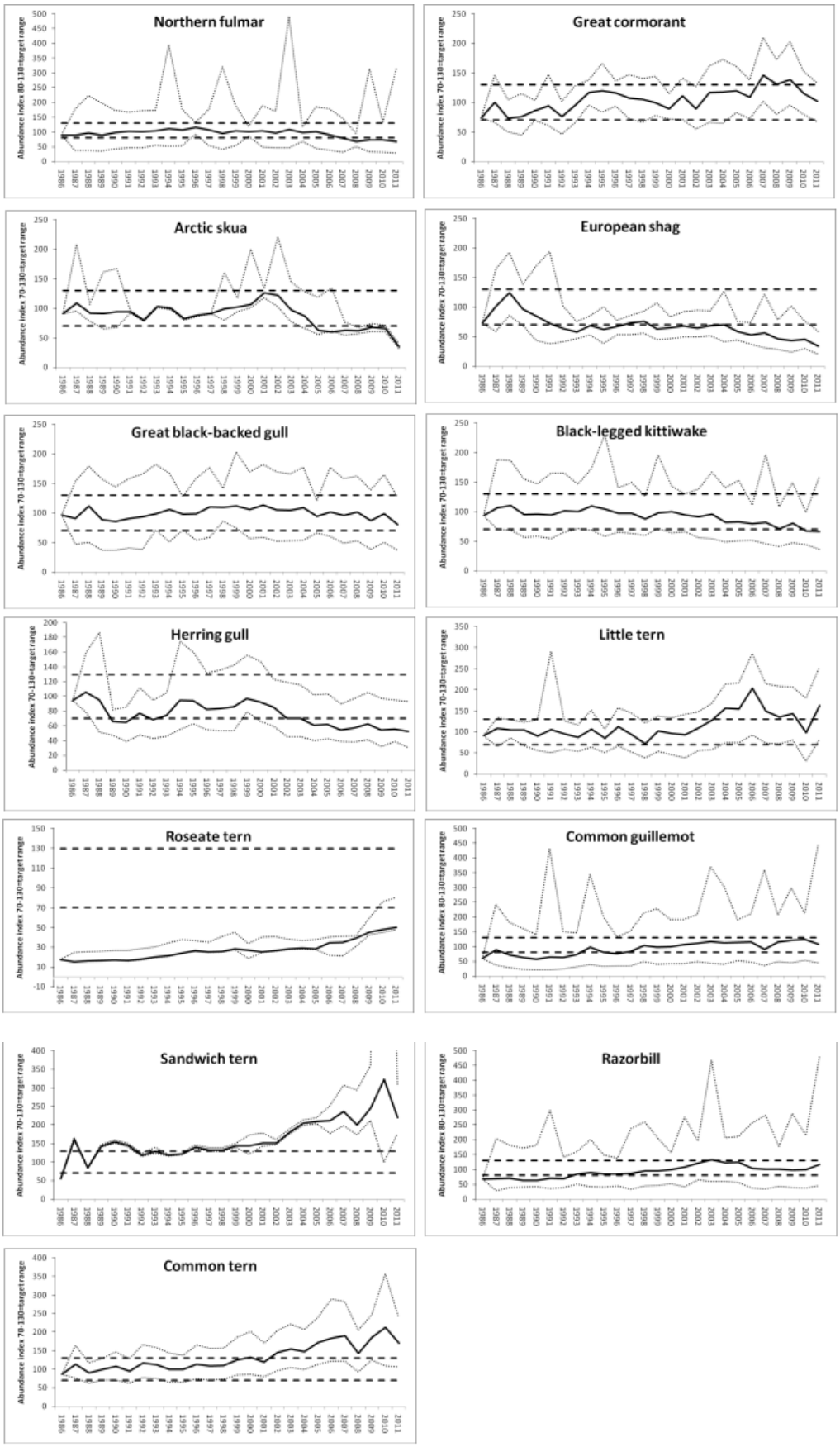


Figure 2. Trend in abundance of individual species in OSPAR Region III 1986–2011.

Fine dotted lines indicate upper and lower boot-trapped confidence limits. Bold dashed lines indicate upper and lower target levels; 100= reference level (baseline). For Fulmars only colonies with minimum five years data are used.

Annex 5: Technical specification of biodiversity indicators: Birds – Common Indicator #25

1. Indicator

Species-specific trends in relative abundance of non-breeding and breeding marine birds

The indicator and its target are derived from the OSPAR EcoQO on *Seabird population trends as an index of seabird community health*.

2. Reasoning for the development of this indicator

CRITERION: 1.2 Population Size; 4.3. Abundance/distribution of key trophic groups/species.

INDICATOR: Population abundance (1.2.1); Abundance trends of functionally important selected groups/species (4.3.1).

This indicator is constructed from information on marine bird species, which at some point in their annual lifecycle, are reliant on coastal and offshore areas under the jurisdiction of MSFD. These areas compose non-estuarine shores below HAT, including coastal lagoons and saltmarsh; inshore non-transitional waters and offshore waters.

In this context, 'marine birds' include the following taxonomic groups that are commonly aggregated as 'waterbirds' and 'seabirds':

> Waterbirds: shorebirds (order Charadriiformes); ducks, geese and swans (Anseriformes); divers (Gaviiformes); and grebes (Podicipediformes);
>
> Seabirds: petrels and shearwaters (Procellariiformes); gannets and cormorants (Pelecaniformes); skuas, gulls, terns and auks (Charadriiformes).

Shorebirds, some duck species and some gulls feed on benthic invertebrates in soft intertidal sediments and on rocky shores. Geese mostly graze on exposed eelgrass beds (i.e. *Zostera* spp.). Diving duck species feed on invertebrate benthos in shallow inshore waters. All other marine birds, including some gulls, spend the majority of their lives at sea, feeding on prey living within the water column (i.e. plankton, fish and squid) or picking detritus from the surface. Divers, piscivorous ducks, grebes, cormorants, gulls and terns tend to be confined to inshore waters; whereas petrels, shearwaters, gannets, skuas and auks venture much further offshore and beyond the shelf-break.

The indicator and its target are derived from the OSPAR EcoQO on *Seabird population trends as an index of seabird community health*. The EcoQO on seabird population trends was adopted by OSPAR's Biodiversity Committee (BDC) in 2012 (see OSPAR 2012). When adopting the EcoQO on seabird population trends, the OSPAR BDC agreed that it, along with the other EcoQOs, should be taken forward as part of the implementation of the EC Marine Strategy Framework Directive (MSFD) (OSPAR 2012). Subsequently, OSPAR's ICG-COBAM[2] identified the EcoQO as an appropriate target for assessing the achievement of Good Environmental Status (GES) under MSFD.

[2] Intersessional Correspondence Group on the Co-ordination of Marine Biodiversity Assessment and Monitoring.

The indicators for the EcoQO were intraspecific trends in abundance. Abundance is used as an indicator of seabird community health because:

- Abundance is measured widely and relatively easily;
- a good indicator of long-term changes in seabird community structure;
- likely to change slowly under 'natural' conditions, so rapid changes in their numbers might indicate human-induced impacts, thereby providing a cue for immediate management actions.

The EcoQO has so far been applied only to trends in breeding numbers of colonial seabird species. In the context of MSFD, abundance indicators could be constructed from time-series data of other groups of marine birds and from data collected at sea.

3. Parameter/metric

This indicator is generated using time-series of annual estimates of abundance of individual species. The indicator metric is relative abundance: Annual abundance as a percentage of the baseline.

Species-specific indicators have so far been generated for

a) 13 species of breeding seabird in the Celtic Seas (ICES 2010, 2011);

b) 16 species of breeding seabird in the Greater North Sea (ICES 2011);

c) seven species of non-breeding shorebirds (i.e. in non-estuarine intertidal areas outside the breeding season) in each of the UK parts of the Celtic Seas and Greater North Sea (Humphreys *et al*., 2012).

The breeding seabird indicator could be constructed for other subregions. ICES (2008) noted that there were sufficient data from colonies in the Azores to construct an indicator, but further data collation was required in the Bay of Biscay.

The non-breeding shorebird indicator, so far developed only for the UK, could easily be applied to other countries and should be expanded to other seasons. For instance, the Wadden Sea is of minor importance for wintering shorebirds, but of eminent importance for spring staging and moult. Separate indicators may be required for wintering, staging and moulting birds using intertidal areas. Furthermore, such indicator would benefit from inclusion of other waterbirds that use intertidal areas (e.g. Brent Goose, Wigeon, Pintail); which could also be inserted into an additional indicator.

Humphreys *et al*. (2012), constructed an indicator of coastal-breeding waterbirds in the UK (i.e. species of waterbird (incl. Shorebirds) breeding close to the shoreline and dependant on intertidal and inshore areas for feeding), but data proved sufficient to include just one species – Oystercatcher (*Ostralegus haematopus*). The inclusion of data from other countries could expand the indicator to more species, e.g. Avocet, Ringed Plover, Kentish Plover, Redshank and Common eider.

Indicators could be generated for non-breeding ducks, divers and grebes (i.e. in inshore waters outside the breeding season) and seabirds at sea (i.e. seabird species in inshore and offshore waters throughout the year). Considerable development of such indicators is required. Similar work is being undertaken by HELCOM and a preliminary trend analysis has been conducted on time-series data from German waters (Garthe, unpubl.). Such indicators may give an early warning of declines in some breeding populations.

4. Baseline and reference level

The **baseline** for each species should be set at a population size that is considered desirable for each individual species within each geographical area. Baselines should be set as follows:

a) At a point in the past when, based on expert judgement, anthropogenic impacts are likely to have been relatively minimal compared to the rest of the time-series; the baseline needs to reflect prevailing climatic conditions. It may prove difficult to set a baseline that meets both criteria.

b) The mean value of the time-series. This method carries the risk of a shifting baseline e.g. if a population is in long-term decline, the baseline will also decline as time goes on; so much so that target may eventually be met, without the population recovering.

c) Where no previous data are available: set baseline at the start of the new time-series and amend in due course; see (a) and (b).

It is preferable to set baselines objectively (i.e. (a) or (b)) than arbitrarily (i.e. (c)). Option (a) potentially provides the most objective baseline, but the limited length of the time-series available may mean some assumptions are made in setting them. A set of criteria for setting baselines in the past would help to steer and standardise expert judgement.

5. Target setting

The criterion level target for Population Size (1.2) should be identical to the EcoQO on seabird population trends: **'Changes in abundance of marine birds should be within individual target levels in 75% of species monitored'.**

Humphreys *et al*. (2012) recommended a target threshold of 75% for non-breeding shorebirds and coastal breeding waterbirds in the UK, because it is comparable to the thresholds used for shorebirds by the WeBS Alerts system (http://www.bto.org/volunteer-surveys/webs/publications/webs-alerts).

The supporting targets attached to each species-specific indicator of trends in relative abundance are set on the magnitude of change relative to baselines: **species-specific annual breeding abundance should be more than 80% of the baseline for species that lay one egg, or more than 70% of the baseline for species that lay more than one egg (ICES 2008, 2010, 2011).**

These different lower thresholds were set according to the resilience of populations to decline. These species-target thresholds could be changed or set individually for each of the species-specific trends.

An upper target threshold has previously been applied to indicators of the EcoQO on seabird population trends (ICES 2008, 2010, 2011), so that annual abundance **should not be greater than 130% of the baseline.** This upper threshold was used to flag up potentially disruptive increases in some species that might impact on other species. However, this may mean that the EcoQO or GES is not achieved if some species recover to levels in excess of the baseline, without having a detrimental impact on other species. It appears that GES is not clearly indicated by the upper threshold, but it could provide a useful trigger for action (research and/or management).

When reporting on the annual results of the species-specific indicators, species that have exceeded 130% of the baseline should be highlighted as shown in Table 1.

6. Spatial scope

The EcoQO on Seabird population trends was adopted in 2012 (OSPAR 2012). The indicator for the EcoQO has so far been constructed from trends in the numbers of seabirds at breeding colonies within the Celtic Seas (ICES 2008, 2010, 2011) and the Greater North Sea (ICES 2011). Further work is required to collate breeding seabird data in the Bay of Biscay and to construct the indicator for there and also for Macaronesia.

The Waddensea should not be considered as 'transitional waters' and its populations of marine birds should be included in the assessment for MSFD because of its ecological connections with the Greater North Sea sub-region. The Waddensea could be assessed as a subdivision of the Greater North Sea.

For indicators of non-breeding bird abundance (e.g. during winter, staging or moulting), the scale of assessment needs to be larger than the subregion i.e. region or flyway. For some species there may need to a combined assessment across regional borders e.g. between North Sea and Baltic. More work is needed to define the appropriate assessment scale for each species. This work should benefit from the increasing amount of evidence on bird migration routes, obtained from tagging studies.

7. Monitoring requirements

Further work is required to construct indicators from other types of marine bird data (as listed above). There may be sufficient data to construct indicators on coastal-breeding waterbirds throughout the NE Atlantic. Indicators of non-breeding ducks, divers and grebes, and of seabirds at sea are likely to be more restricted geographically, given that monitoring is currently confined to certain parts of the Greater North Sea i.e. the waters of DE, BE, DK, NL, SE, (FR?) and NO. The UK is currently scoping a monitoring scheme for inshore waters. Indicators based on numbers of seabirds using deep offshore areas should not be included as representative data at the necessary temporary and spatial scales would be very difficult and expensive to collect. Moreover, most species using these are more easily measured at colonies and good time-series data already exist. Monitoring of non-breeding shorebirds in the Greater North Sea and Celtic Seas is concentrated in transitional waters, so additional monitoring of non-estuarine coasts may be required to construct the indicator for these species.

The frequency at which data should be collected,	annually
The monitoring method,	aerial and boat line transects
Who is responsible for the monitoring,	National Monitoring Schemes
The frequency at which the indicator should be updated and assessed against its target (i.e. is it necessary to carry out assessments more frequently than every six years and why?),	Preferably annually to inform management measures but at least in line with MSFD and Birds Directive reporting
Minimal required amount of monitoring locations.	?

8. Appropriateness of the indicator

Indicator	Code	Sensitivity to specific pressures	Relevance to management measures	Practicable	Applicable across region	Representative of COM and ecosystem	Consensus among CPs	Operational [3]	To propose to BDC [4]
Species-specific trends in relative abundance of non-breeding and breeding marine bird species in all functional groups.	25	Low Non-specific – indicator of state that responds to multiple pressures	Low	Target & indicator adopted as an EcoQO on seabird population trends can be applied to other species. At sea monitoring increase needed.	Yes	1.2.1 [4.3.1] Marine birds	High	2	Core

9. Reporting

Data collected by CPs, need to be collated centrally (probably at a subregional scale), pooled and then analysed to produce annual species-specific indices of relative abundance. The assessment can then be conducted and based on the resultant subregional trends. ICES WGSE can be used to provide an expert review of the assessment and make recommendations for management and provide any amendments to the analytical and assessment process.

Issues that need to be resolved to build subregional collation and reporting process:

i) Need to nominate data custodians and analysts – could be one CP per subregion. Different CPs could be nominated for different indicators.

ii) Need to draft agreements on data sharing and address any issues around data ownership.

iii) Need to agree on a format for data submission.

iv) Need to resolve how and where data will be stored.

Figure 1 shows how the trends and target assessment for individual species indicators can be presented. Figure 2 provides an example of a subregional assessment of the criterion target for population size. Table 1 shows how the species-specific assessments in the different subregions can be presented side by side and visually interpreted via a traffic light system.

[3] 1=further development needed – time horizon 2018, 2= further development needed – time horizon 2014, 3= already fully operational 2012.

[4] ICG-COBAM categorised proposed common indicators as “core” or “candidate”. Both core and candidate indicators are highly relevant as assessed by the criteria for common indicators while the candidate indicators need significantly more work before becoming operational.

10. Costs

Monitoring costs should be met by individual CPs. But there needs a centrally funded annual collation and analysis of data collected by each CP.

11. Further work

i) Construct indicators for Bay of Biscay and Macaronesia derived from time-series data on numbers of seabirds at breeding colonies.

ii) Investigate the feasibility of constructing, for each subregion, indicators of the abundance of: i. coastal-breeding waterbirds; ii. non-breeding waterbirds; iii. seabirds at sea; and iv. non-breeding shorebirds.

iii) Construct new indicators for bird groups and subregions where data are available. The development of indicators for marine birds at-sea in the NE Atlantic can learn from ongoing work by HELCOM and the Marmoni project that are constructing such indicators in the Baltic. Some preliminary indicators have been constructed on at-sea data from German waters in the North Sea. A larger funded project may be required.

iv) Development of baselines – objective baselines, set at time when anthropogenic impacts on the population were thought to be relatively minimal, are preferable to arbitrary baselines e.g. set at the beginning of a time-series. A set of criteria is required to steer and standardise expert judgement.

v) Spatial scale – what is the most useful scale to aggregate data for assessment of each of the abundance indicators and their targets?

vi) Presentation of assessment results for breeding Marine Birds and intertidal non-breeding birds: How to define whether an indicator is decreasing, increasing or stable (see Table 1).

vii) Functional groups definition of inshore/offshore: these need to be reassessed as new indicators are constructed. Are the existing functional groups appropriate or are alternatives required.

viii) Coordinate across CPs within each subregion, the collation of data, trend analysis, assessment against targets and reporting.

References

Humphreys E. M. Risely K. Austin G. E. Johnston A. and Burton N. H. K. 2012. Development of MSFD Indicators, Baselines and Targets for Population Size and Distribution of Marine Birds in the UK. BTO Research Report No. 626.

ICES. 2008. Report of the Workshop on Seabird Ecological Quality Indicator, 8–9 March 2008, Lisbon, Portugal. ICES CM 2008/LRC:06. 60 pp.

ICES. 2010. Report of the Working Group on Seabird Ecology (WGSE). 15–19 March 2010, Copenhagen. ICES CM 2010/SSGEF:10. 81 pp.

ICES. 2011. Report of the Working Group on Seabird Ecology (WGSE). 1–4 November 2011, Madeira, Portugal. ICES CM 2011/SSGEF:07. 77 pp.

OSPAR Commission. 2012. Summary Record of the Meeting of the Biodiversity Committee (BDC) in Brest: 13–17 February 2012. OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic, BDC 12/8/1-E.

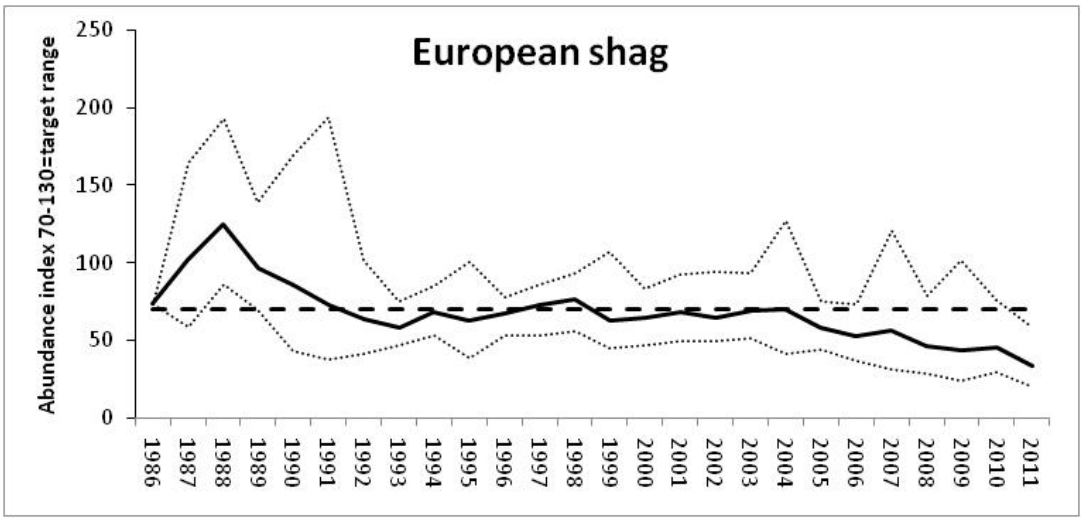


Figure 1. Trends in annual relative abundance of breeding European shag in the Celtic Seas during 1986–2011. Fine dotted lines indicated upper and lower boot-strapped confidence limits. Bold dashed line indicates target threshold of 70% of the baseline; 100%= baseline.

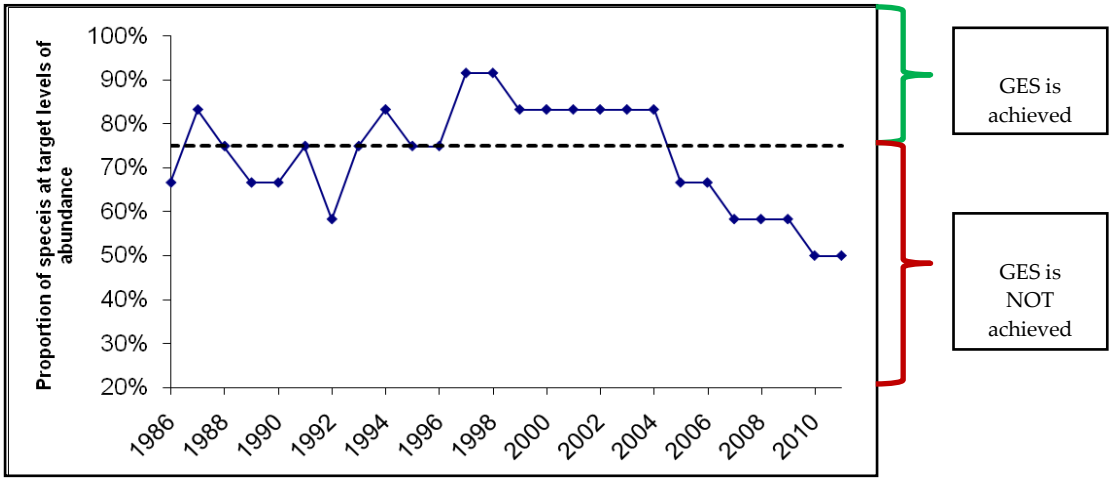


Figure 2. Annual assessments of the criterion target: 'Changes in abundance of marine birds should be within individual target levels in 75% of species monitored'; based on 13 species – specific indicators of trends in relative abundance (e.g. see Figure 1) for the whole subregion of the Celtic Seas during 1986–2011.

Table 1. Species-specific assessment of relative breeding abundance in the Celtic Seas and the Greater North Sea in 2010. Green cells indicate that species-specific target has been met; orange cells indicate that species-specific target has been met but that relative abundance has exceeded 130%; red cells indicate that species-specific targets have not been met. Arrows indicate recent trend in relative abundance.

Species	Celtic Seas	North Sea
Fulmarus glacialis	↓	
Carbo aristotelis	↓	↔
Carbo carbo	↔	↔
Stercorarius parasiticus	↓	↓
Sterna sandvicencis	↑	↑
Sternula albifrons	↑	↔
Sterna dougalii	↑	
Sterna paradisaea		↓
Sterna hirundo	↑	↔
Larus ridibundus		↓
Larus melanocephalus		↑
Larus argentatus	↓	↓
Larus canus		↓
Larus fuscus		↑
Larus marinus	↓	↓
Rissa tridactyla	↓	↓
Uria aalge	↔	↔
Alca torda	↓	↔

Relative abundance:

>130%

>70 or >80%, and ≤130%

≤70% or ≤ 80%

Annex 6: Technical minutes from the Seabird Review Group

- RGBIRD
- 17 December 2012
- Participants: Henrik Skov (Chair), Henrik Österblom and Claus Hagebro (ICES Secretariat)
- Expert Group: AGSE; Comments on ICES WGSE Information Paper: Update on EcoQO for Seabird Population Trends in OSPAR Region III-Celtic Seas, 1986–2011, by Ian Mitchell, Annabel Knipe and Roddy Mavor, JNCC, UK, November 2012.

Seabird Review Group dealing with

i) Review a draft Ecological Quality Objective (EcoQO) on Seabird Population Trends in OSPAR Region III (Celtic Seas), including assessment of the inclusion of the Seabird EcoQO into the MSFD common indicator on marine bird abundance as drafted by AGSE; and

ii) Review of WGSE recommendations regarding data collection and storage for seabirds.

Reviewer comments

The EcoQO on seabird population trends was adopted by OSPAR's Biodiversity Committee (BDC) in 2012, and this report from WGSE gives the results of updated trend assessments for 13 seabird species for OSPAR Region III – Celtic Seas for the 26-year period 1986–2011. The reviewers acknowledge that good progress with the indicator has been made, and that the recommendations of ICES regarding the statistical methods applied have largely been followed. Especially, the use of the Seabird Trend Wizard and species-specific baselines have provided for a robust statistical treatment of the seabird colony counts, and the results in terms of graphics showing mean and confidence intervals are immediately useful. The reviewers found it useful to include both the old and new indicator approach (i.e. with and without the +130% level).

When reporting on this indicator the reviewers recommend further details to be conveyed with respect to the inherent uncertainties of the recorded (mean) trends. Disregarding uncertainty when reporting the EcoQO, limits the usefulness of the results. The results in terms of meeting the target thresholds are interpreted mainly from the mean trends. Accordingly, the uncertainty of the trends is not assessed in relation to the targets for species-specific trends in abundance and the target for the proportion of species meeting species-specific targets (e.g. 75% or more) used in the EcoQO. As an example, both target settings (with/without upper thresholds) showed that lower target levels were not achieved by six species; northern fulmar, arctic skua, European shag, herring gull, black-legged kittiwake and roseate tern. By inspection of the upper confidence levels, however, only arctic skua and shag did not meet the species-specific thresholds in 2011. The report does stress the importance of the trends for these two species and recommends further research into the causes driving their decline. Yet, the confidence intervals are not explicitly used when making conclusions neither on these two species, nor on the four species of seabirds for which the declines are dubious. As a result, the failure to meet the overall target of the EcoQO in Region III is not questioned by the report.

Although the Seabird Trend Wizard has provided reliable confidence intervals computed by bootstrapping the count data, the confidence intervals are rather wide for most species. Obviously, sources of variation exist in the data which influence the uncertainty of the estimated trends. In addition, the Wizard does not smooth the count data which makes it suboptimal for reproducing long time-series, with alternating periods of increases and declines. Both issues may be addressed in the further application of the EcoQO. It is recommended to test the application of alternative statistical methods like TrendSpotter, Generalised Additive Models and Bayesian time-series models capable of smoothing the time-series and including co-variables, which may reduce the amount of residual 'noise' present in the data.

Further development is recommended to take account of ICES Advice (January 2012) with respect to complementary quality objectives based on parameters such as breeding success, development of interpretation models in relation to foodwebs (information on relevant prey trends), arranging trend data into functional groups of seabirds and inclusion of data regarding relevant sea duck species. In addition, the reviewers believe that the EcoQO reports would gain from adding more information about monitoring sites and count methods, including information on geographical positions (maps) of locations surveyed and methods used for respective survey.

The reviewers found the recommendations for data collection and storage a bit vague, with the following questions remaining unanswered. Is the database intended to be an open access database including all parameters stated in the table of "Data collection", i.e. what constitutes "Relevant data"? How are the colony numbers used in the analysis stored and by whom? Will ICES (or lead country alluded to) take a role in collecting all relevant data in an (open access?) database?

With respect to the draft specifications for including the Seabird EcoQO into the MSFD common indicator on marine bird abundance the reviewers recommend that technical assessments be made regarding the potential for transferring the indicator to time-series data of other groups of marine birds and from data collected at sea. Specifically, non-trivial issues related to the provision of unbiased regional population estimates of seabirds from line transect surveys at sea require much work. In addition, the current lack of coordinated survey efforts of seabirds at sea challenges the application of the EcoQO outside the breeding season. Equally important, analytical methods have to be developed for enhancing the low power inherent to seabird at sea survey data (MacLean *et al*., 2012).

Reference

Maclean, I.M.D., Rehfisch, M.M., Skov, H. and Thaxter, C.B. 2012. Evaluating the statistical power of detecting changes in the abundance of seabirds at sea. Ibis 155: 113–126.