

ECOREGION **General advice**
SUBJECT **EcoQO for seabird populations in OSPAR regions II and III**

Advice Summary

ICES collated and analysed the data for the EcoQO indicator on breeding seabird population trends in OSPAR regions II and III. A first assessment has been made for Region II. ICES estimates that the proposed EcoQO indicator was not achieved in 1991–1993, 2004, 2006, and 2008–2010. ICES advises that additional effort is required to collect and include additional breeding seabird data for this region, both for species already included in the EcoQO indicator and for several other species (Northern fulmar, Northern gannet, great skua, and Atlantic puffin). ICES advises that the trend analyses for Region II should not be limited to one method (e.g. TRIM); ideally several methods should be employed, including those used for Region III. For Region III, ICES estimates that the proposed EcoQO indicator was not achieved in 1986, 1989–1992, and in consecutive years during 2002–2010, with an increasing number of species failing to meet the target. ICES advises that special attention is given to a number of species such as Northern fulmar, Arctic skua, European shag, herring gull, black-legged kittiwake, and roseate tern.

Request

- *to review and make recommendations on a draft Ecological Quality Objective (EcoQO) on Seabird Population Trends in OSPAR Region II (Greater North Sea) (to be developed in the course of 2010), the processes that have derived it and that could be used to update values on the EcoQO indicator. The review should include (but not be limited to):*
 - (i) *the degree to which appropriate and available data have been used; and*
 - (ii) *the reliability that OSPAR might place on values derived from the EcoQO indicator;*
- *to provide an updated assessment of the seabird population trends in OSPAR Region III in relation to the draft EcoQO indicator on Seabird Population Trends in OSPAR Region III (Celtic Seas) and make any relevant recommendations. (OSPAR 2011/3).*

ICES Advice

Introduction

In 2008, ICES advised the development of a seabird EcoQO, based on trends in abundance of breeding seabirds. The draft EcoQO states that “Changes in breeding seabird abundance should be within target levels for 75% of the species monitored in any of the OSPAR regions or their sub-divisions”. The upper target levels for each monitored species are defined as 130% of the baseline/reference population size, and the lower target levels were determined as 80% of the baseline for species that lay one egg and 70% for species that lay more than one egg.

ICES recognises that breeding abundance represents only one aspect of seabird community health, and only partially reflects the state of the populations when they are not breeding. Insufficient data exist to estimate trends in non-breeding abundance.

Data on breeding abundance have been widely collected and trends can be estimated relatively easily. Breeding abundance is a good indicator of long-term changes in seabird community structures where density-dependent effects may reduce the usability of other population parameters. However, seabirds are generally long-lived and reproduce at a relatively old age. Thus, changes in their breeding numbers are a poorer indicator of short-term environmental change than are other breeding parameters (e.g. breeding success).

At present there is sufficient collated information to analyse the proposed EcoQO indicator for OSPAR regions II and III.

Region II

ICES collated and analysed the data for the proposed EcoQO indicator on Seabird Population Trends in OSPAR Region II (Figure 1.5.5.1.1).



Figure 1.5.5.1.1 OSPAR Region II.

In 2011 ICES conducted trend assessments for 16 of 20 seabird species with breeding ranges in OSPAR Region II for the 20-year period 1991–2010. These species included: great cormorant¹, European shag, Arctic skua, Mediterranean gull, black-headed gull, common gull, lesser black-backed gull, herring gull, great black-backed gull, black-legged kittiwake, Sandwich tern, common tern, Arctic tern, little tern, common guillemot, and razorbill. They did not include: Northern fulmar, Northern gannet, great skua, and Atlantic puffin due to a lack of representative population data throughout OSPAR Region II.

Population trends were analysed using TRIM version 3.53 (Statistics Netherlands). Annual trend indices were calculated for each of the 16 species in each of the 20 years. The intermediate year 2000 was set arbitrarily as the baseline index 100.

ICES notices that the proposed EcoQO was not achieved in 1991–1993, 2004, 2006, and 2008–2010 (Figure 1.5.5.1.2 and Annex 1). The number of species not reaching the proposed target levels increased recently from three (2007) to eight (2010), the lowest value seen within the 20-year period. Of the eight species that did not reach their respective target levels, three were above their upper targets (great cormorant, Mediterranean gull, and lesser black-backed gull) and five were below their lower targets (Arctic skua, common gull, great black-backed gull, black-legged kittiwake, and razorbill). The rest are well within or just at the target levels. ICES is unable at this time to advise OSPAR why some of these 16 seabird species reached their target levels and some did not.

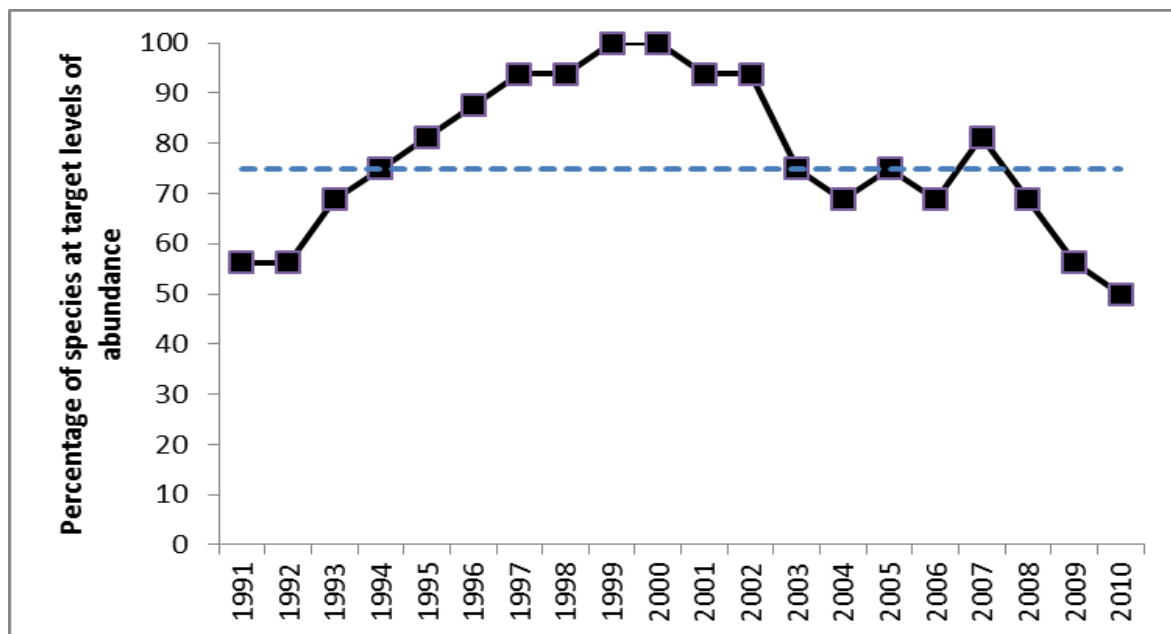


Figure 1.5.5.1.2 The proportion of species in OSPAR Region II that were within target levels of abundance during 1991–2010 (i.e. 75%), based on the population trends of the sixteen species shown in Annex 1. The EcoQO is not achieved in years when the proportion drop below 75%.

¹ The Latin names of bird species can be found in Table 1.5.5.1.1 (Annex II).

ICES recognizes that data used in this analysis represents the best information available from OSPAR member countries. The work represents a significant contribution toward the development of a seabird EcoQO for Region II. However, further improvements on the availability and quality of data used should be made. First and foremost ICES advises that effort be taken to collect additional seabird population data not only to improve the statistical reliability of data for species analysed here, but to include Northern fulmar, Northern gannet, great skua, and Atlantic puffin in future estimations of the seabird EcoQO for Region II.

ICES notes several issues related to statistical methodology that should be addressed before the EcoQO for Region II is considered fully developed. In particular, the trend analyses were undertaken using log-linear models in the software TRIM, whereas the Thomas method (Thomas, 1993) was used for Region III. Log-linear models like TRIM tend to be inappropriate for the seabird species included in the EcoQO indicator because their trends exhibit little or no spatial synchrony and, for species such as terns and cormorants, a substantial proportion of colonies have undergone extinction or colonization events.

The TRIM and Thomas methods produce very different trends from the same data; the main difference being that confidence intervals are estimated empirically by bootstrapping in the Thomas method. The trend analysis methods are discussed in annex III of ICES (2008). ICES advises that future analyses of these kinds of data should not use TRIM, or if they do, they should offer comparisons of the results of TRIM with those of the Thomas method (including the use of the seabird trend ‘wizard’ as used for Region III analyses) and with a range of other statistical methods which allow for imputation, smoothing, and integration of data sources with different levels of uncertainty (e.g. Generalised Additive Models, Trendspotter and Bayesian time-series models). Such comparative tests would be useful to show the robustness of the trends and associated confidence intervals estimated with the different methods, particularly where there is a general lack of consensus on statistical methods used for the determination of population trends and in the presence of a large variability of results produced by the different methods. Moreover, ICES advises similar statistical treatment for seabird population data sets across OSPAR regions, including any retrospective comparisons of statistical methods.

The use of a uniform baseline year (i.e. 2000) for all seabird species assessed (i.e. EcoQO indicator) served as an intermediate index point based upon the 20-year time frame. For future analyses, ICES advises that this index should be further elaborated at a species-specific level, as indicated in ICES (2010).

Region III

ICES (2011) collated and analysed the most recent data for the proposed EcoQO indicator on Seabird Population Trends in OSPAR Region III (Figure 1.5.5.1.3).

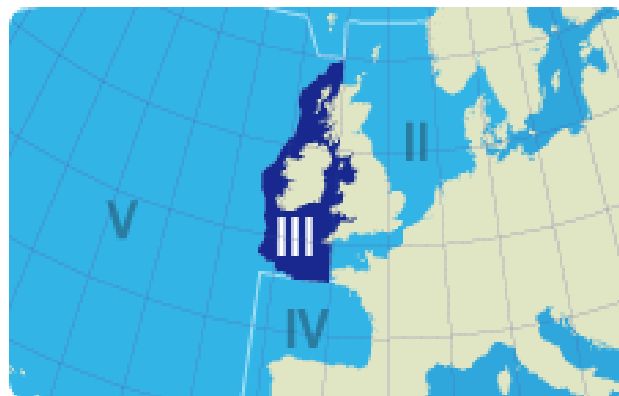


Figure 1.5.5.1.3 OSPAR Region III.

In addition to the eight species mentioned in the 2008 report (Northern fulmar, European shag, herring gull, great black-backed gull, black-legged kittiwake, Sandwich tern, common guillemot, and razorbill; ICES, 2008), ICES has included data from four additional species in this update (i.e. Arctic skua, great cormorant, little tern, and roseate tern).

In updating the EcoQO indicator (starting date 1986), ICES has added data from 2007 to 2010, including plot counts as well as whole colony counts. Most colonies in OSPAR Region 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 different to those used in ICES (2008). Instead of log-linear models a modified chain method developed by Thomas (1993) was used to estimate trends. For details see ICES (2010).

The proposed EcoQO was not achieved in 1986, 1989–1992, and in consecutive years between 2002 and 2010 (see Figure 1.5.5.1.4 and Annex II). ICES (2008) discussed possible reasons why the draft ECoQO was not achieved during the late 1980s and early 1990s. This update will concentrate on why it was not achieved in 2002–2010.

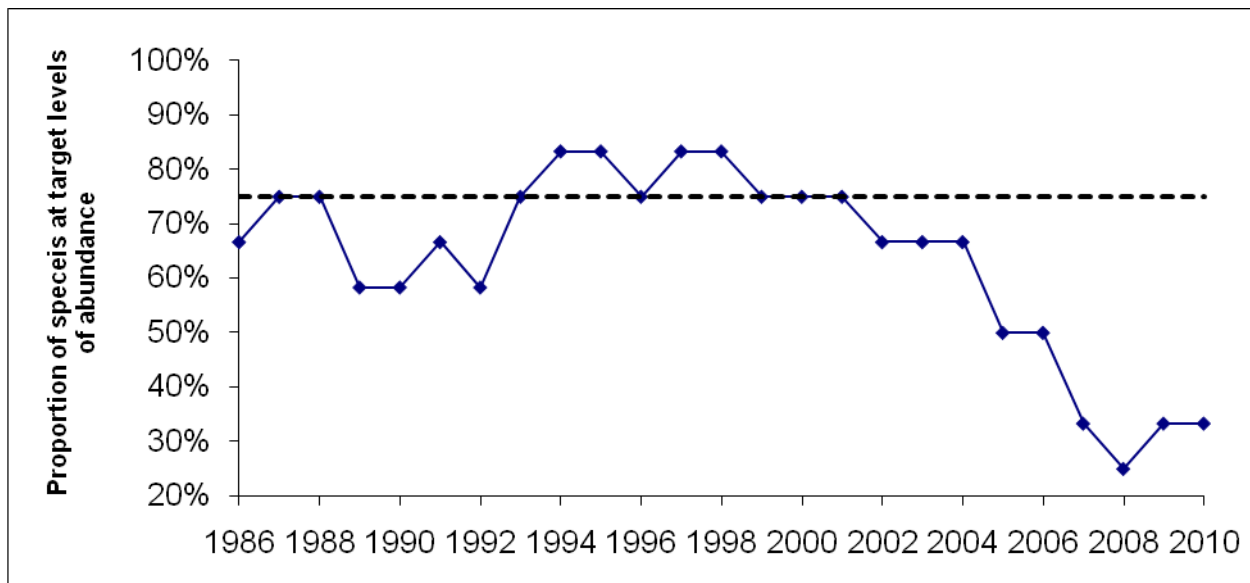


Figure 1.5.5.1.4 The proportion of species in OSPAR Region III that were within target levels of abundance during 1986–2010, based on the population trends of the twelve species shown in Annex II. The draft EcoQO is not achieved in years when the proportion drop below 75%.

The number of species not achieving targets during 2002–2010 increased from four to nine in 2008, 2009, and 2010 (i.e. Northern fulmar, European shag, Arctic skua, herring gull, great black-backed gull, black-legged kittiwake, roseate tern, razorbill, and common guillemot). In the last two years, the abundance of six species (i.e. Northern fulmar, European shag, Arctic skua, herring gull, black-legged kittiwake, and roseate tern) has been below their respective lower targets, while three species exceeded the upper targets (great cormorant, little tern, and Sandwich tern). If these three species had not exceeded their targets, the draft EcoQO would still not have been achieved in consecutive years between 2005 and 2010 because the abundance of four or more species fell below lower target levels.

It has been suggested to change the draft EcoQO for all species except herring gull and great black-backed gull by not applying the upper target level to species that do not affect other parts of the ecosystem. ICES advises that this suggested revision is taken into consideration for future assessments and implementation. Adoption of the changed EcoQO would still imply that the EcoQO for Seabird Population Trends in OSPAR Region III remains well below the proposed target level for the years 2005–2010.

The failure to achieve the EcoQO in OSPAR Region III in consecutive years between 2002 and 2010 does raise concern as six of the twelve species sampled (i.e. Northern fulmar, Arctic skua, European shag, herring gull, black legged kittiwake, and roseate tern) were all below lower target levels in 2008, 2009, and 2010, and five other species showed substantial declines. ICES advises that special attention is given to discovering the possible causes of decline of these species and to take appropriate action.

ICES noted that the low abundance of three of these species, i.e. roseate tern, Arctic skua, and herring gull, have already been highlighted by 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 (Eaton *et al.*, 2009). Even though still below the lower target, numbers of roseate tern have been increasing as a direct result of intensive management of colonies in Ireland. Arctic skuas might have been impacted by climate change and fishing and competition from great skuas. The cause of the decline in herring gulls throughout the UK and Ireland is less well understood and ICES advises on further research in this area.

ICES noted that the increase in Sandwich tern numbers represents the result of successful conservation action, following intensive management at most colonies to reduce the impacts of predators. ICES also advises that further research be made on the decline in shag numbers and continued monitoring and investigation of the recent decreases in kittiwake and fulmar numbers in OSPAR Region III.

ICES noted that since 2008 the proposed EcoQO targets on Breeding Seabird Populations have not been achieved in either of OSPAR regions II and III, but the percentages of species that do not reach target values is much higher in Region III (ICES, 2010).

General considerations

Standardization of input data

ICES encourages further work on the standardization of data collection over time and across geographical regions. Standardization of data collection will decrease confidence limits of the yearly estimates and increase the reliability of estimated trends of the number of breeding seabirds. Regional coordination should include agreements about which seabird species and breeding sites in the OSPAR region should be surveyed on a regular basis. Input data should include supplementary information about monitoring sites such as the geographical positions (maps) of locations surveyed and details on what survey methods were used for the respective surveys.

Prioritizing survey efforts

It may be important to evaluate whether more precise estimates of population changes in certain bird species are needed. For some species additional data can significantly increase the analytical power. Furthermore, population changes of common widespread seabird species such as the Northern fulmar, herring gull, kittiwake, common guillemot, razorbill, etc., could reflect large-scale changes in the marine ecosystem. This could be taken into account when improving monitoring programmes of breeding seabirds.

Complementary quality objectives

Because seabirds are long-lived and become sexually mature at a relatively old age, quality objectives based only on the number of breeding pairs may not be sufficient to predict population changes in the short term or to advise on appropriate management actions. Complementary quality objectives should therefore be developed, based on parameters such as breeding success at representative seabird breeding sites in the OSPAR regions. Such complementary quality objectives can be used as early warning systems of population change in seabirds.

Recognising that some seabird populations migrate between OSPAR regions and into OSPAR regions from other regions in the non-breeding seasons, it would be useful to also construct Quality Objectives which not only consider the number of breeding seabirds but also the number and trends of wintering seabirds.

Species-specific baselines and data on foodwebs

Future analyses should include an elaboration of species-specific baselines and a development of interpretation models in relation to foodwebs. Consistent with the ecosystem approach, future analyses would benefit from including information on relevant prey trends when prey species and their dynamics are known, especially concerning recent work related to the relationship between seabirds and associated forage species, where reliable information on trends is available (Cury *et al.*, 2011). Future analyses should also consider the spatial hierarchy of seabird–fish interactions during the breeding season (Fauchald *et al.*, 2011). The results of such analyses could affect the consideration of the Seabird EcoQO as being an appropriate device for implementation under the EC Marine Strategy Framework Directive (MSFD), in particular in relation to Descriptors 1 (biodiversity) and 4 (foodwebs).

In addition, the application of the Seabird EcoQO based on breeding populations alone might be worth further consideration as a large proportion of breeding seabirds feed themselves and their chicks on prey taken primarily in coastal waters (e.g. cormorants and shags, gannets, skuas, terns, gulls, and auks). As such, an EcoQO based entirely on data from breeding colonies may fail to provide useful information to feed into the general system of foodweb indicators envisaged under the MSFD.

Functional groups of seabirds

To better visualize possible relationships between seabirds and their food the trend data may be arranged into functional groups of seabirds, i.e. birds eating pelagic organisms offshore, birds feeding close to the coast, or birds feeding on benthic fauna. An example of a possible arrangement is given in Annex III (Figure 1.5.5.1.7). Furthermore, the trends of prey populations when available should be depicted on the same time scales.

Discard ban

ICES noticed that the new EU Common Fisheries Policy might include a discard ban on commercially exploited fish species. This ban could have an impact on bird populations (e.g. gulls and fulmars) that feed on these discards. ICES

advises to pay special attention to these populations, e.g. estimating their reference levels or their effect as predators of other birds.

Background

In 2008, the draft EcoQO on *Seabird population trends as an index of seabird community health* was suggested by ICES as follows:

“Changes in breeding seabird abundance should be within target levels for 75% of the species monitored in any of the OSPAR regions or their sub-divisions”.

ICES advised that there should be separate EcoQOs for each OSPAR region or sub-region. Each associated indicator will consist of species-specific trends in abundance for those species with good quality monitoring data.

ICES advised that the EcoQO on seabird population trends should aim to ensure the intrinsic health of seabird communities and to provide triggers for appropriate actions. Appropriate action would include both research and/or management, depending on how well the causes of change are understood at the time.

Upper and lower target levels for each monitored species were defined. An upper target level of 130% of the baseline/reference population size was selected, and lower target levels were determined as 80% of the baseline for species that lay one egg and 70% for species that lay more than one egg.

Sources

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Annex I

Ecological Quality Objectives on Seabird Population Trends in OSPAR Region II

Data and methods

Data on seabird breeding population trends were delivered for the following range of years by country:

Belgium:	1980–2010
Denmark (Wadden Sea area only):	1991–2008
Germany:	1991–2008
The Netherlands:	1980–2010
Norway:	1980–2010
Sweden:	2001–2010
United Kingdom:	1960–2010

Data were missing for France and for the non-Wadden Sea area of Denmark.

Based on these data it was decided to analyse seabird population trends for OSPAR Region II for the 20-year period 1991–2010.

Most national data sets covered all species but earlier analysis of data from the UK led to the omission of a few species for which data were not considered sufficiently representative. Hence, the following 16 species were selected as comprising sufficient data throughout their breeding range in OSPAR Region II:

Great cormorant, European shag, Arctic skua, Mediterranean gull, black-headed gull, common gull, lesser black-backed gull, herring gull, great black-backed gull, black-legged kittiwake, Sandwich tern, common tern, Arctic tern, little tern, common guillemot, and razorbill.

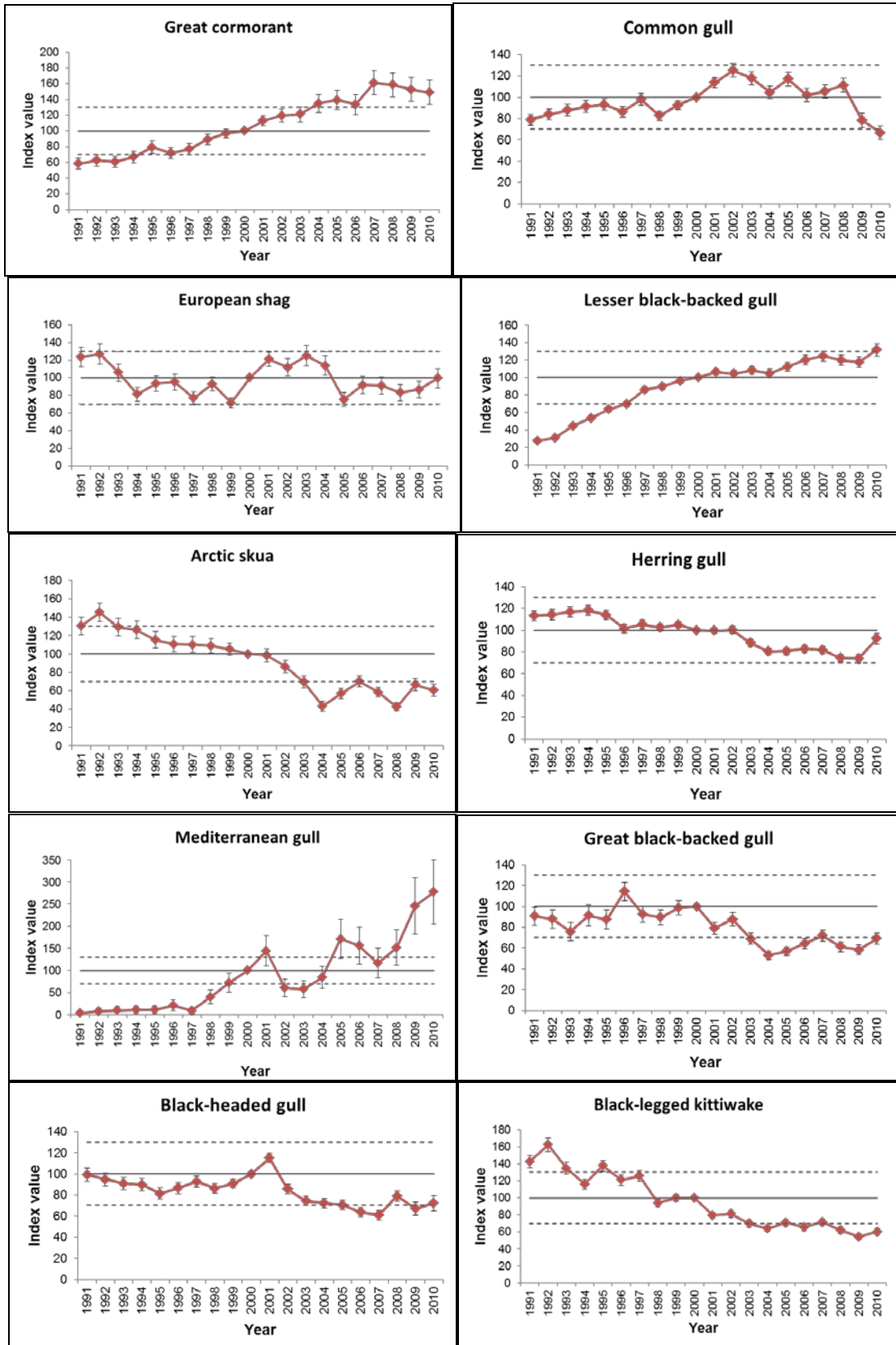
The species that have not yet been included due to insufficient representative data on an annual basis are Northern fulmar, Northern gannet, great skua, and Atlantic puffin. Future effort is needed to include these species as well.

Population trends were analysed using TRIM version 3.53 (Statistics Netherlands). Annual trend indices were calculated for each of the 16 species and each of the 20 years. As anthropogenic activities have influenced seabird populations over many decades, though to a different degree, it is impossible to state which period would be the one least influenced by humans. As a first approach, the year 2000 was taken as the baseline/reference year in relation to which population developments were analysed.

Based on ICES (2008) and later updates, the target levels for the trend indices were set to 130 (upper level), 80 (single-egg laying species), and 70 (species laying more than one egg), respectively. The proportion of species that were within target levels for the respective years provides the final output for this EcoQO.

Results

The populations of the 16 seabird species breeding in OSPAR Region II have developed differently. Some species have increased or decreased throughout the study period, other showed increases, followed by later decreases (Figure 1.5.5.1.5).



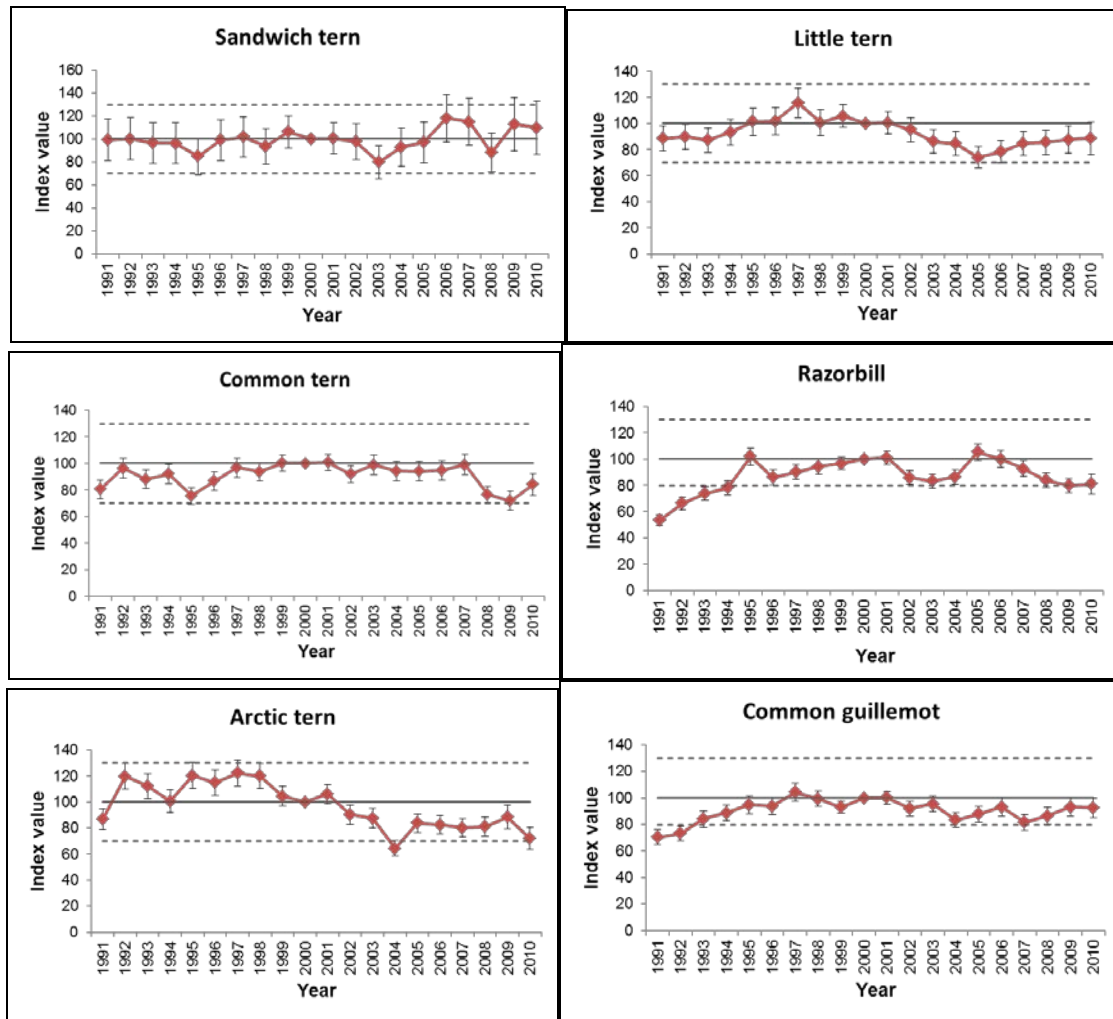


Figure 1.5.5.1.5 Population trends of sixteen seabird species breeding in OSPAR Region II (Greater North Sea) from 1991–2010. The year 2000 was chosen as baseline with the index value set to 100. The vertical lines of the index values show the standard errors. The dashed lines indicate the range for the target values.

Annex II

Ecological Quality Objectives on Seabird Population Trends in OSPAR Region III

Methods

Since the first assessment of the EcoQO (ICES, 2008), the Joint Nature Conservation Committee (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 resampling that makes only weak assumptions regarding the structure of the data.

For all species, data covering the period 1986–2010 from throughout OSPAR Region 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 for five years or more during 1986–2010. Data from all other species contained colonies that have been surveyed for two or more years during 1986–2010 (as in ICES, 2008, 2010). This reduced the sample size for fulmar to just 7% of the total number of pairs known to breed in OSPAR Region III (1998–2002 Census; Mitchell *et al.*, 2004), compared to over 50% in all other species (Table 1.5.5.1.1).

Baselines for each species are specified in Table 1.5.5.1.1. These baselines are the same as the ones used in ICES (2008, 2010).

The population trends of the twelve seabird species in OSPAR Region III (Celtic Sea) from 1986 to 2010 is shown in Figure 1.5.5.1.6.

Table 1.5.5.1.1

Species-specific reference levels for OSPAR Region III.

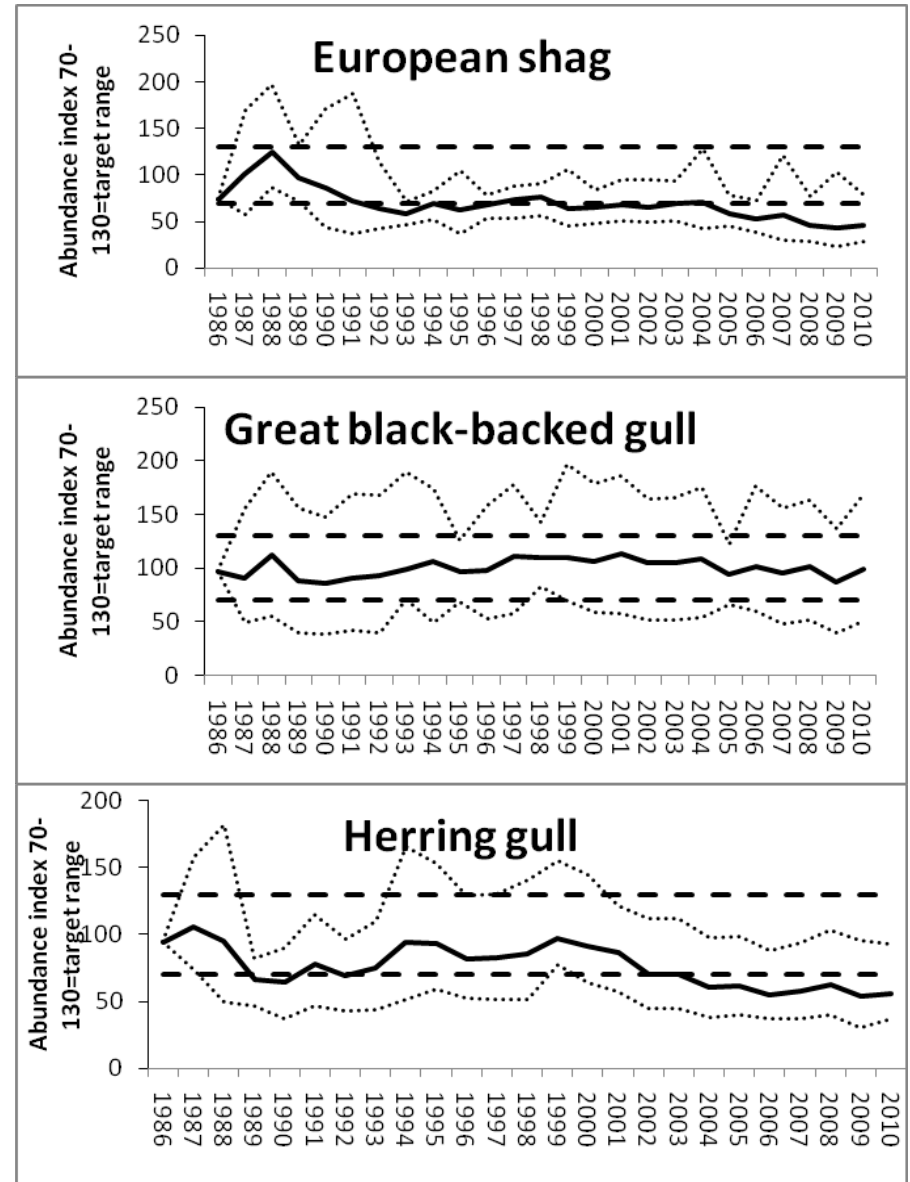
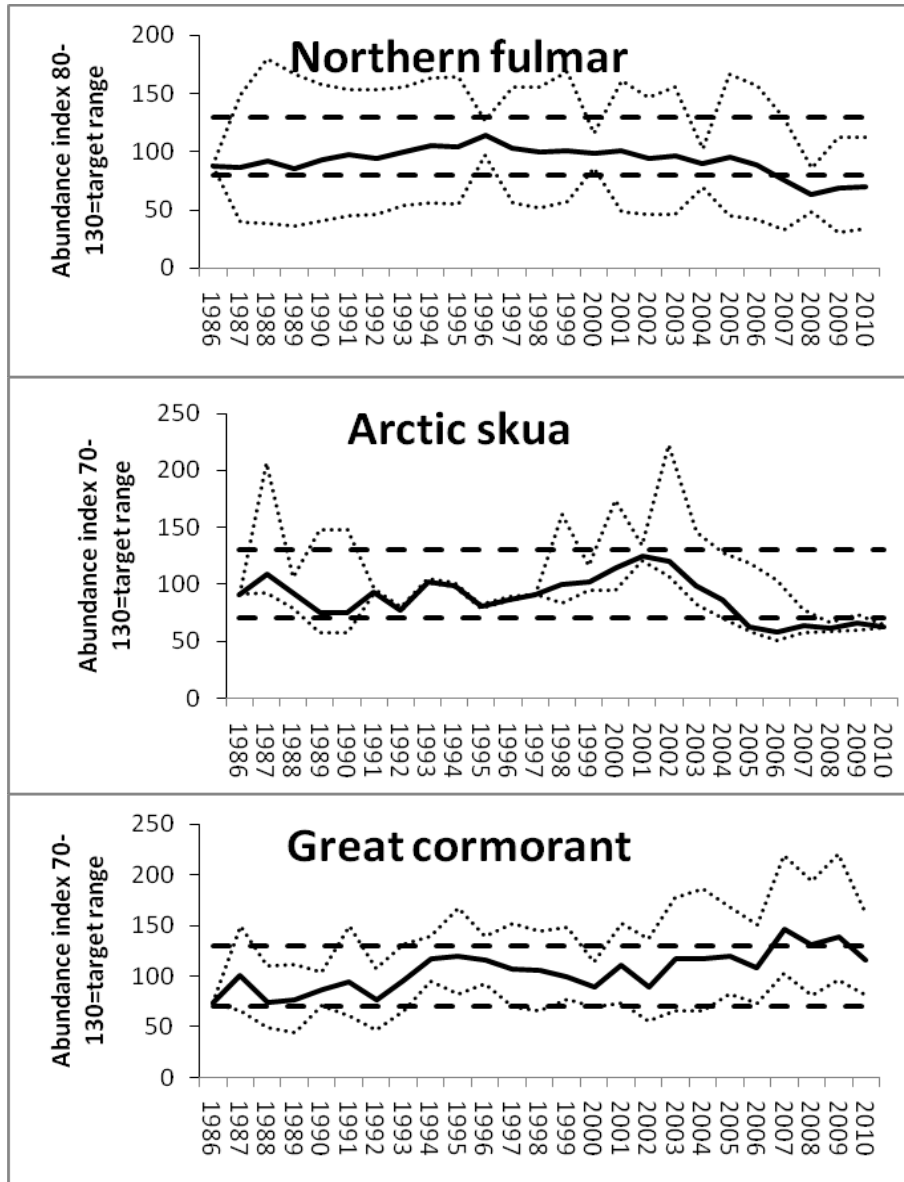
SPECIES NAME		OSPAR REGION III REFERENCE LEVELS		PROPORTION OF REGIONAL POPULATION IN SAMPLE	SOURCE	JUSTIFICATION FOR REFERENCE LEVEL
ENGLISH	SCIENTIFIC	ABUNDANCE ¹	YEAR			
Northern fulmar	<i>Fulmarus glacialis</i>	192 295	1998–2000	7%	a	Numbers increased and range expanded throughout most of the 20th century, but plateaued during Seabird 2000 in NW Scotland which holds the largest colonies in OSPAR III. However, numbers appear to be still increasing in Wales and possibly in SW England and Ireland.
Arctic skua	<i>Stercorarius parasiticus</i>	193	1986–87	62%	b	The counts during 1986–87 provided the first comprehensive estimate of numbers breeding throughout the region. More recently censused in 2001–02. But severe declines in breeding numbers in neighbouring OSPAR Region II from the late 1990s onwards suggest large negative anthropogenic impact on food supply that has been exacerbated by increased predation and competition from great skuas <i>Stercorarius skua</i> . The population estimate in 1986–87 is therefore less influenced by anthropogenic impacts than the more recent estimate.
Great cormorant	<i>Phalacrocorax carbo</i>	9 074	1999–2001	76%	a	The majority of coastal-breeding cormorants in OSPAR III are thought to be nominate sub-species. OSPAR III holds almost one-fifth of the world population of <i>P.c.carbo</i> , which opts for a 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	<i>Phalacrocorax aristotelis</i>	22 362	1986–88	59%	b	Numbers were increasing throughout most of Britain and Ireland, until a large mortality event (or ‘wreck’) due to severe weather during the winter of 1992/93 severely reduced breeding numbers. Therefore, the SCR provides the best reference level.
Herring gull	<i>Larus argentatus</i>	106 415	1986–87	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	<i>Larus marinus</i>	10 261	1986–88	53%	b	Similar scenario to that for the herring gull.
Black-legged kittiwake	<i>Rissa tridactyla</i>	118 222	1985–87	57%	b	Increased in number between the censuses in 1969/70 and 1985–88, but subsequent food shortages in NW Scotland may have reduced numbers there. Therefore, the SCR provides the best reference level.

SPECIES NAME		OSPAR REGION III REFERENCE LEVELS		PROPORTION OF REGIONAL POPULATION IN SAMPLE	SOURCE	JUSTIFICATION FOR REFERENCE LEVEL
ENGLISH	SCIENTIFIC	ABUNDANCE ¹	YEAR			
Little tern	<i>Sternula albifrons</i>	648	1986–87	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 the mid-1980s and 2000, which opts for a slightly higher estimate in 1986–87.
Sandwich tern	<i>Sterna sandvicensis</i>	4 610	1987–88	95%	b, c	The mortality of birds on wintering grounds in W. Africa appears to have increased in the late 1980s and early 1990s, partially through trapping. Therefore, the SCR and the All-Ireland tern survey (1984) appear to provide the best reference levels.
Roseate tern	<i>Sterna dougallii</i>	2 700	1967–68	100%		Huge declines in breeding numbers during the 1970s and 1980s, mainly due to high mortality of birds on wintering grounds in W. Africa resulting from trapping. Therefore, the 1967–68 population estimates provide the best reference level, prior to these substantial anthropogenic impacts.
Common guillemot	<i>Uria aalge</i>	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 Region 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	<i>Alca torda</i>	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).

¹Unit of abundance is pairs for all species except *Alca torda* and *Uria aalge*, which are listed as the number of birds.

Mediterranean gull	<i>Larus melanocephalus</i>
Black-headed gull	<i>Larus ridibundus</i>
Common gull	<i>Larus canus</i>
Lesser black-backed gull	<i>Larus fuscus</i>
Common tern	<i>Sterna hirundo</i>
Arctic tern	<i>Sterna paradisaea</i>



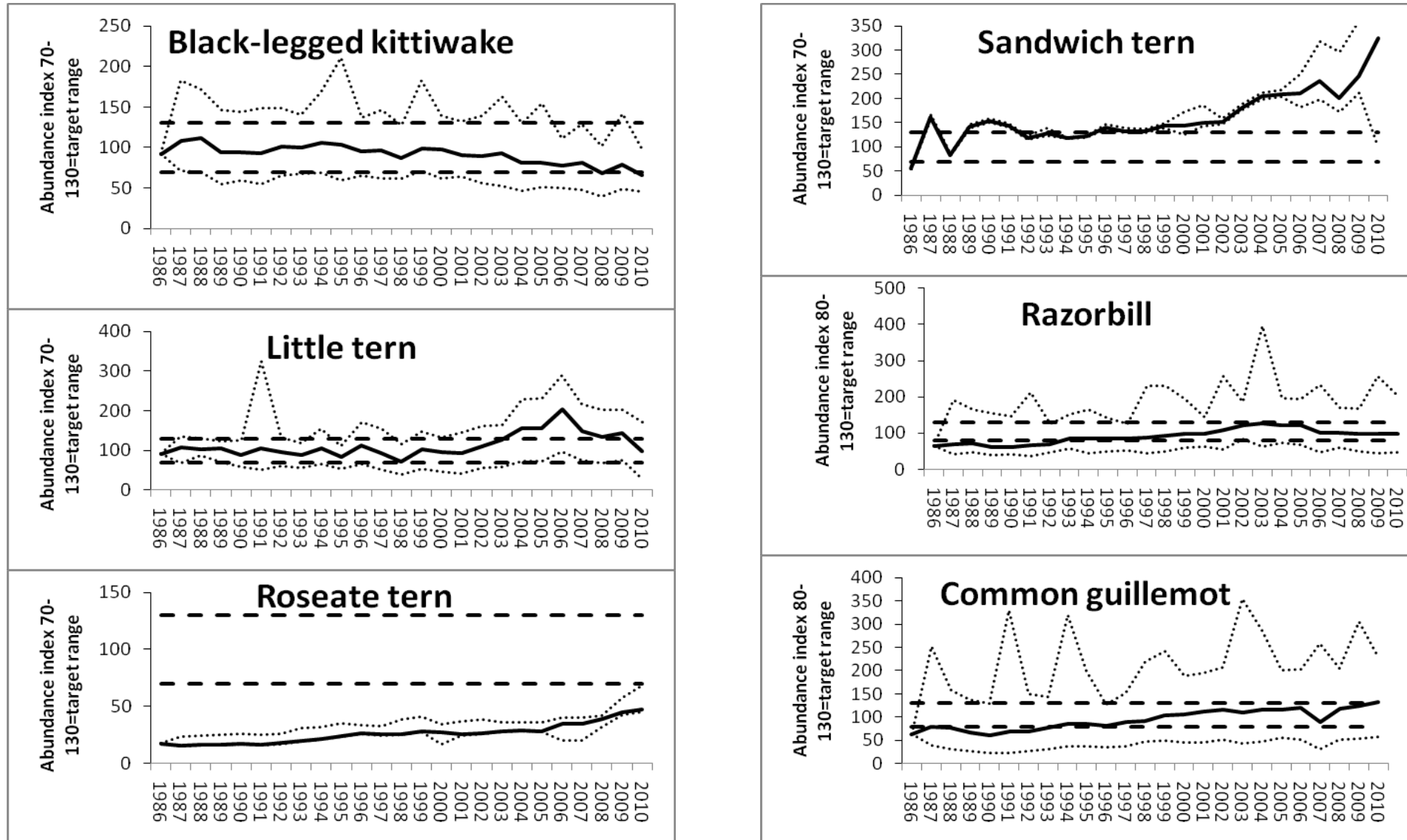


Figure 1.5.5.1.6 The population trends of the twelve seabird species breeding in OSPAR Region III (Celtic Sea) from 1986 to 2010. Fine dotted lines indicate upper and lower boot-strapped confidence limits. Bold dashed lines indicate upper and lower targets. 100 = reference level.

Annex III

EcoQO Breeding Seabirds Region II (North sea) overview

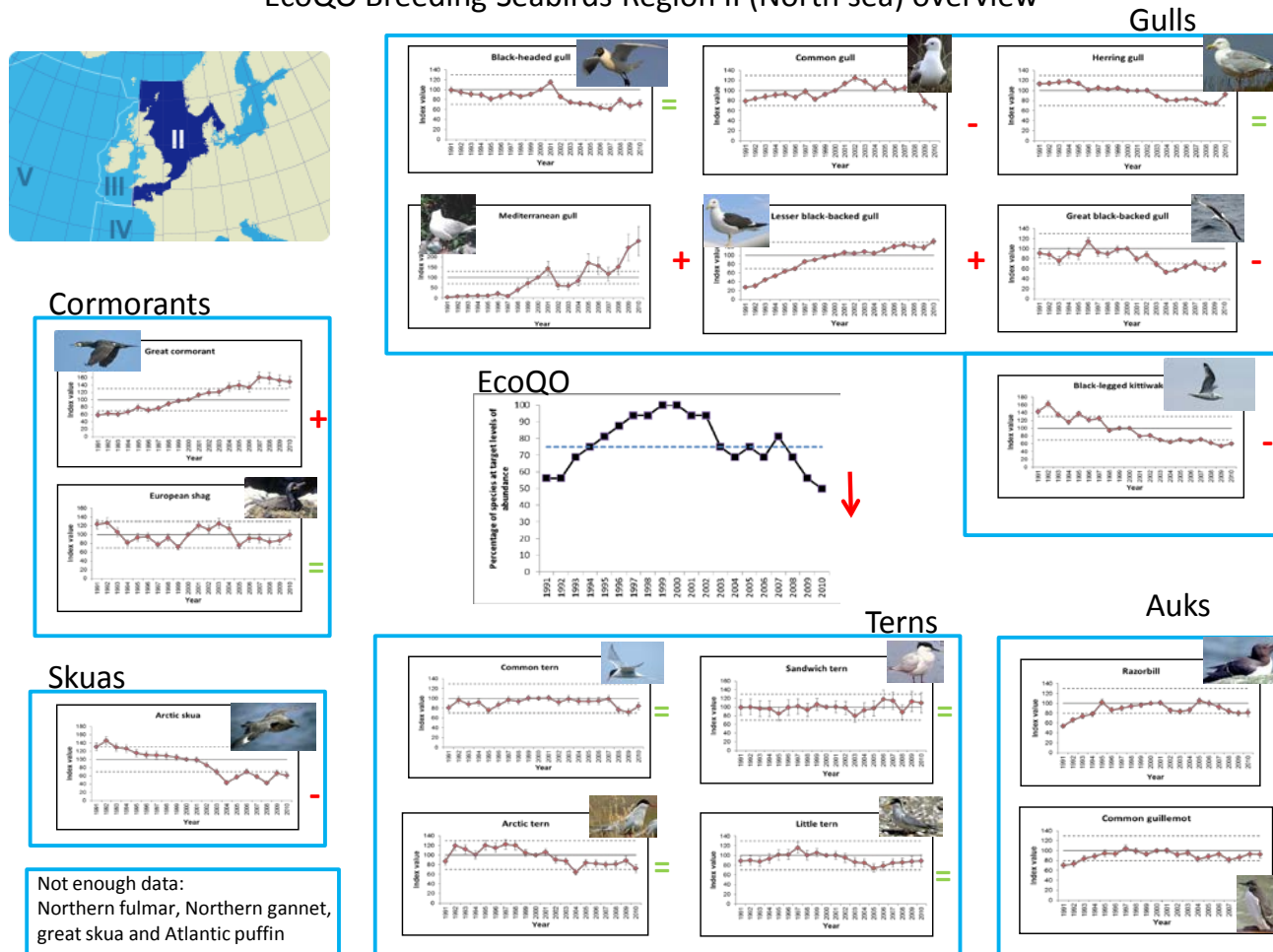


Figure 1.5.5.1.7 An overview of the EcoQO and different bird species for OSPAR Region II. +: level above target; -: level below target; =: level between targets. Bird pictures are taken from www.seaonscreen.org