OSPAR
COMMISSION

Marine Bird Abundance – Non-Breeding Offshore Birds

Pilot Assessment

OSPAR

QUALITY STATUS REPORT 2023

2022

OSPAR's Quality Status Report 2023

Pilot Assessment of Marine Bird Abundance – Non-Breeding Offshore Birds

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. The Contracting Parties are Belgium, Denmark, the European Union, Finland, France, Germany, Iceland, Ireland, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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. Les Parties contractantes sont l´Allemagne, la Belgique, le Danemark, l´Espagne, 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, la Suisse et l´Union européenne

Contributor

Volker Dierschke

Citation

Dierschke, V. 2022. *Pilot Assessment of Marine Bird Abundance – Non-Breeding Offshore Birds*. In: OSPAR, 2023: The 2023 Quality Status Report for the North-East Atlantic. OSPAR Commission, London.

Contents

Key Message

The indicator shows the abundance of seven marine bird species wintering at sea in the North Sea sections of Belgium, the Netherlands and Germany in the assessment period 2015 to 2020 compared against the baseline years (1991 to 2000). The status differed between the seven species assessed and is not related to the functional species group these species belong to.

Message clé

L'indicateur montre l'abondance de sept espèces d'oiseaux marins hivernant en mer dans les zones de la mer du Nord de la Belgique, des Pays-Bas et de l'Allemagne au cours de la période d'évaluation 2015-2020 par rapport aux années de référence (1991-2000). L'état diffère entre les sept espèces évaluées et n'est pas lié au groupe d'espèces fonctionnelles auquel ces espèces appartiennent.

Background (brief)

Apart from incubation and chick care, marine birds spend the great majority of their life at sea where they are top predators and thus have a key role in the marine ecosystem. In the non-breeding season, many species live well away from the coast in offshore waters and cannot be assessed by land-based counts. In contrast, aerial and ship-based surveys, which have been conducted in the OSPAR Maritime Area for more than 40 years, provide the opportunity to monitor marine bird numbers throughout the annual cycle and to cover species not accessible by land-based counts.

At-sea abundance provides comprehensive information about the population sizes and their change, because in addition to the adult breeding birds (mainly counted by land-based counts at breeding colonies) the immature age classes, which can comprise up to nine cohorts and typically make up around half of the total population, are also covered. Further, the assessment of a marine area can be informed beyond the range of breeding colonies and for other seasons than the breeding season. To align offshore bird assessments with those conducted inshore, winter is the season in focus in this extension of the marine bird abundance indicator.

The indicator has relevance for bird species included in the *OSPAR List of Threatened and / or Declining Species and Habitats*.

Figure 1: Common scoters – (courtesy of M. Ellermaa)

Background (extended)

This indicator includes information on marine bird species that, at some point in their annual life cycle, are reliant on offshore marine areas. The indicator is constructed from species-specific trends in annual abundance and supplements the Common Indicator B1 *Marine Bird Abundance* that uses information on breeding abundance and winter abundance of coastal marine birds with information on the status of marine birds living at the open sea during the non-breeding season.

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

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

The scope of the offshore extension of the Common Indicator B1 covers surface, water column and benthic feeding birds, whereas the species groups restricted to coastal habitats (wading and grazing feeders) are not addressed.

Benthic feeders are represented by seaducks feeding on bivalves and other invertebrate benthos they dive for. All other marine birds, including some gulls, feed on prey living within the water column (i.e. plankton, fish and squid) or pick detritus from the sea surface. Divers, grebes, cormorants, gulls and terns tend to be confined to relatively shallow inshore waters, whereas petrels, shearwaters, gannets, skuas and auks venture further offshore and beyond the shelf break. Part of the species in this assessment breed inland and in areas outside the OSPAR Maritime Area, but spend the non-breeding season at sea, where they are monitored by the help of aerial and ship-based surveys.

The assessment values used in the Common Indicator B1 were developed for breeding seabird abundance data in order to assess the OSPAR Ecological Quality Objective (EcoQO) on seabird population trends as an index of seabird community health (ICES, 2008, 2010, 2011, 2012). The Common Indicator B1 supersedes the EcoQO as it incorporates data on more species, including waterbirds and also uses data on non-breeding abundance, with the extension to species wintering offshore dealt with here. The indicator has gone through extensive testing and development (see ICES, 2013a,b,c,d, 2015) and was applied in the Intermediate Assessment 2017 for breeding seabirds and wintering waterbirds at the coast. This extension for marine birds wintering at sea follows the same assessment methods.

This indicator has relevance for five seabird species included in the *OSPAR List of Threatened and / or Declining Species and Habitats* (OSPAR Agreement 2008-06): Balearic shearwater (*Puffinus mauretanicus*), Barolo shearwater (*Puffinus baroli*) Black-legged kittiwake (*Rissa tridactyla*), Roseate tern (*Sterna dougallii*) and Brünnich's guillemot (*Uria lomvia*), although only one, the Black-legged kittiwake, is addressed by this pilot assessment. The OSPAR List was developed on the basis of the Texel-Faial criteria for identifying species and habitats in need of protection (OSPAR Agreement 2003-13). Assessments of abundance distribution and condition of the seabird species on the OSPAR List were prepared for the Quality Status Report 2010 and are included in its supporting documentation, but no comparable quantitative assessment was prepared.

Assessment Method

Overview

This pilot indicator assessment begins by constructing a time series of annual estimates of 'relative non-breeding at-sea abundance' of selected species in the Southern North Sea (Sub-Region d) of the Greater North Sea (Region II, see **Figure a)**. Though the offshore extension of the B1 indicator is generally applicable in all Regions, this pilot assessment was restricted to the North Sea sections of Belgium, the Netherlands and Germany, where data availability is particularly good. Relative abundance is the number of birds estimated each year as a proportion of a baseline (see section *Parameter / Metric* below).

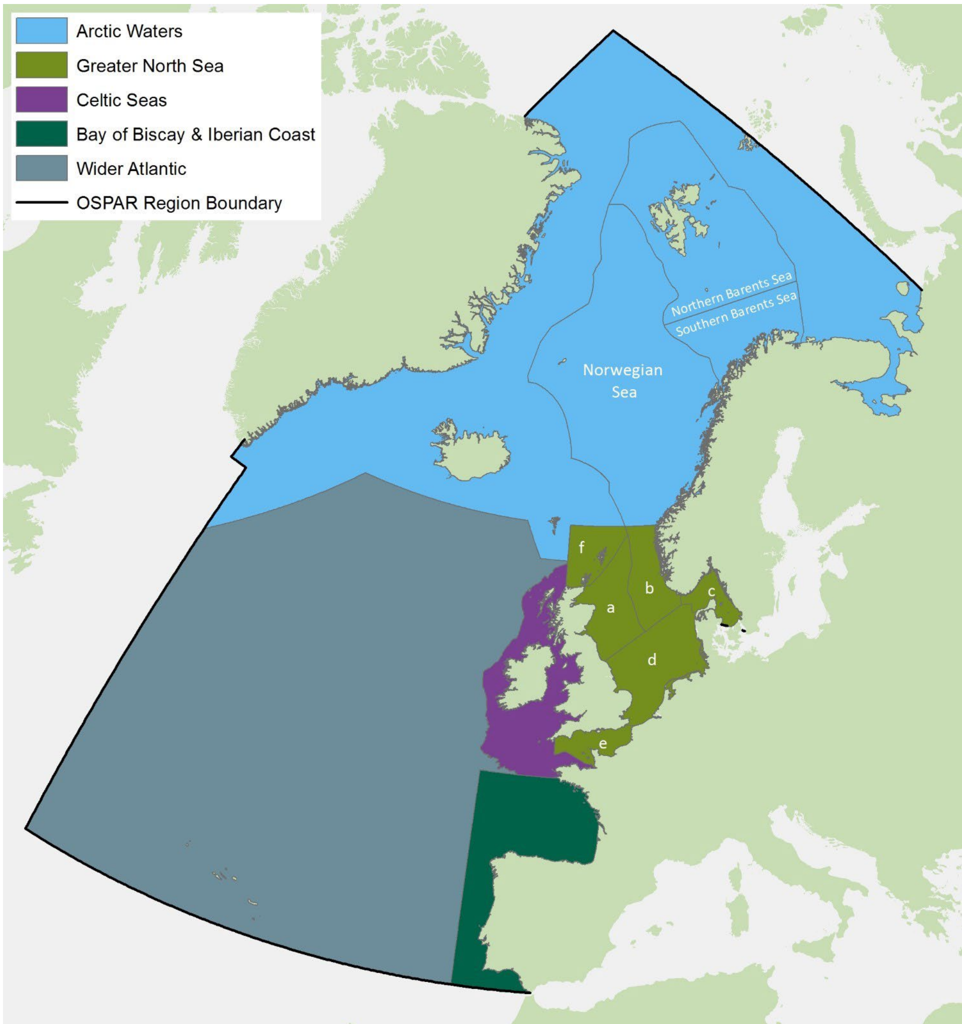

Figure a: Marine bird assessment units

Greater North Sea Sub-regions: a) Northeast coast of Britain, b) West coast of Norway, c) Skagerrak and Kattegat, d) Southern North Sea, e) English Channel, f) North coast of Scotland and the Northern Isles

Species-Specific Indicators of Relative Abundance

Data Acquisition

In 2021, the data from marine bird surveys were requested from the European Seabirds at Sea (ESAS) database for the wintering period (December to February) of the years 1991 to 2020.

Data used in this Assessment

This pilot assessment is based on bird data from aerial and ship-based bird surveys which use standardised methods described by Camphuysen *et al.* (2004) and which were conducted in the North Sea sections of Belgium, the Netherlands and Germany (OSPAR Region II, Sub-region d) in the years 1991 to 2020 in winter. Data were restricted to counts within the standardized transects. For each method separately (aerial and ship-based surveys), data have been corrected for distance-dependent visibility bias (Mercker *et al.,* 2021).

Figure b: Observers in a ship-based survey - (courtesy of K. Borkenhagen)

Trend Analysis

Trend analysis was based on modern regression methods (species-distribution generalised additive models – sdGAMs – with appropriate autocorrelation structures) applied to spatio-temporally pooled bird count data. In particular, underlying data have been pooled in such a way that an optimal compromise was found between a moderate autocorrelation and a high spatio-temporal resolution of the data. The optimal trend model (with respect to additional predictors as well as the probability distribution) has been selected (separately for each species) based on AIC-based model selection procedures. More technical details are given in Mercker *et al.* (2021).

Trend models were not applied to a series of single annual numbers / estimates, but directly to underlying count data with a much higher spatio-temporal resolution. Thus, trend estimates consider (and correct for) possibly varying survey effort or covariates (methods, locations, weather) in different years. Trend estimates were obtained by considering a log-linear trend. For further validation and visualization of trend results, two alternative model were fitted to the data: one allowing a nonlinear trend (based on cubic regression splines), and another treating the year as a factor variable ("yearly model").

Parameter / Metric

To compare the state of species that have very different population sizes, estimates of abundance were converted to an indicator metric that uses a single scale (i.e. a proportion) for all species. The indicator metric is *relative abundance*, which is annual abundance expressed as a proportion of the baseline:

relative abundance = annual abundance / baseline abundance

For supplementary information, a log-linear regression over the last six years of the time series shall indicate whether very recent positive or negative trends need to be considered.

Baselines

Baseline values were obtained based on predictions using the appropriate log-linear respective yearly trend model for the first ten years of the observed period (1991 to 2000). All p-values and confidence intervals were calculated based on resampling techniques of posterior distributions of model-parameters as described in Wood (2017). In case of a significant regression over these ten years, the predicted value for the first year (1991) was used as the baseline value, otherwise the mean of the first ten years served as baseline value. The mean of the last six years (2015 to 2020) was assessed against the baseline value. The threshold value for good status is 70% of the baseline value (80% in species laying only one egg per year). Thus, the assessment method is the same as for breeding birds and birds wintering inshore in the Common Indicator B1.

Species Selection and Aggregation (Functional Groups)

Although there would have been sufficient data to assess all species wintering at sea in the Southern North Sea, the pilot assessment was restricted to selected species for financial and capacity reasons. The selection included species from different species groups and different distribution patterns. At sea, three functional groups of marine birds occur (**Table a**), and the pilot assessment includes three surface feeders (great black-backed gull, herring gull, black-legged kittiwake), three water column feeders (red-throated diver, northern gannet, common guillemot) and one benthic feeder (common scoter). This selection further includes species wintering along the coastal strip (red-throated diver, common scoter) and / or further offshore (northern gannet, herring gull, black-legged kittiwake, common guillemot). Grazing and wading feeders do not use the open sea (other than for flying over during migration and local movements) and thus are not targeted by this indicator.

Table a: Marine bird functional groups relevant for species wintering at sea.

Functional group	Typical feeding behaviour	Typical food types	Additional guidance
Surface feeders	Feed within the surface layer (within 1–2 m of the surface)	Small fish, zooplankton and other invertebrates	'Surface layer' defined in relation to normal diving depth of plunge-divers (except gannets)
Water column feeders	Feed at a broad depth range in the water column	Pelagic and demersal fish and invertebrates (e.g. squid, zooplankton)	Include only species that usually dive by actively swimming underwater; but including gannets. Includes species feeding on benthic fish (e.g. flatfish)
Benthic feeders	Feed on the seafloor	Invertebrates (e.g. molluscs, echinoderms)	

Assessments

Species-Specific Threshold Values

This assessment uses two different threshol values that are designed to reflect the resilience of different species to declines in their population (see ICES, 2008, 2010, 2011). It is desirable for the annual relative abundance of a species to be above, either:

- 0,8 (i.e. 80% of the baseline) – for species that lay one egg per year; or
- 0,7 (i.e. 70% of the baseline) – for species that lay more than one egg per year.

The reason for having two threshold values is that species laying only one egg are expected to recover more slowly from declines in population size than species that can potentially produce more than one chick per year. If relative abundance is below the appropriate threshold value, it is considered to indicate 'poor' status and further research and / or management is recommended, depending on what is appropriate.

Integration of Species-Specific Assessments

An integration of species assessments on the level of species groups is not intended in this pilot assessment, because only selected species are assessed.

In future, species-specific assessments for non-breeding offshore abundance and non-breeding coastal abundance shall be aggregated. For doing this, a method has been developed which weights to the outcomes of offshore and coastal assessments according to the proportion of the population covered by each of the two assessments (ICES 2016, Mercker *et al.,* 2021).

Results (brief)

For the first time, winter abundance at sea could be assessed in the North Sea of Belgium, the Netherlands and Germany (Southern North Sea, Region II, Sub-region d) based on 30 years of offshore bird surveys. While the threshold was achieved in red-throated diver, northern gannet, common guillemot and black-legged kittiwake, assessment values far below the threshold value were observed in common scoter, great black-backed gull and herring gull.

With only seven species assessed it is not appropriate to generalise the results in terms of functional groups.

There is high confidence in the data coverage and high confidence in the methodology used.

Results (extended)

Species-specific Assessments

The individual species that did not achieve threshold values are shown in red in **Table b**. Threshold values were clearly not met with strong differences in abundance between baseline and assessment periods in herring gull (decline by 95%), common scoter (decline by 72%) and great black-backed gull (decline by 62%). All of them did not show a significant trend in the last six years of the time series. Hence, the abundance decrease that resulted in missing the threshold value had already taken place before the assessment period. Species achieving the threshold values are shown in green (if index value ≥0,7 / 0,8). Compared to the baseline period, northern gannets and common guillemots have increased about threefold, black-legged kittiwakes increased by 30%, while red-throated dives achieved the threshold despite decreasing by 9%. A significant decline in the last six years was recorded in red-throated diver and northern gannet, while the winter population of common guillemot was increasing significantly (**Table b**).

Annual index values of abundance and their six-year rolling mean as well as regressions for the periods 1991-2000 (to find the baseline) and for 2015 to 2020 (to show the latest trends) are shown in **Figures c-i**.

Key for **Table b**.

Species assessment	Functional groups
Relative abundance 2015-2020 <0.7 or <0.8 (depending on clutch size)	**benthic feeders**
Relative abundance 2015-2020 ≥0.7 or ≥0.8 (depending on clutch size)	**water column feeders**
	surface feeders

Table b: Species-specific assessment of relative winter offshore abundance for marine birds for the North Sea section of Belgium, the Netherlands and Germany (falling in Region II, Sub-Region d) in the period 2015 to 2020.

Species	Baseline value	Status 2015 to 2020	Trend 2015 to2020
common scoter	mean 1991 to 2000	index 0,28	Not significant
red-throated diver	predicted 1991	index 0,91	-17,7% (p<0,001)
northern gannet	mean 1991 to 2000	index 3,08	-19,3% (p<0,001)
common guillemot	mean 1991 to 2000	index 2,74	+11,9% (p<0,001)
black-legged kittiwake	mean 1991 to 2000	index 1,30	Not significant
great black-backed gull	predicted 1991	index 0,38	Not significant
herring gull	predicted 1991	index 0,05	Not significant

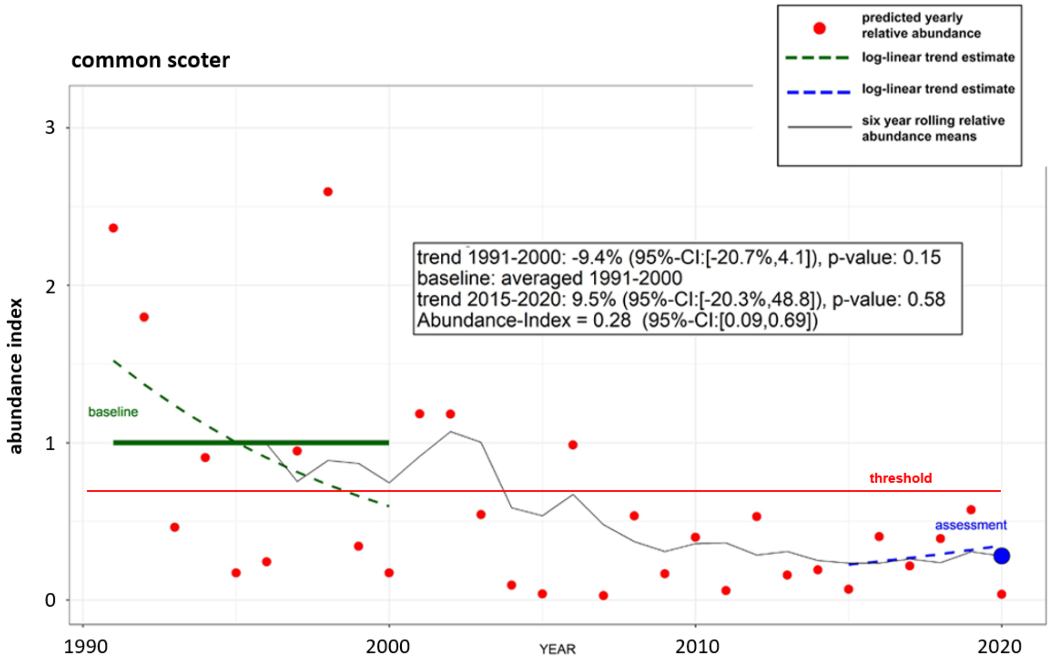

Figure c: Annual index numbers for at-sea abundance and the respective six-year rolling mean for common scoter in the Belgian-Dutch-German North Sea in winter, 1991 to 2020. The threshold value is the index value of 0,7 in relation to the mean relative abundance in 1991 to 2000, which was set to 1. The mean 1991 to 2000 was used because the regression over these years is not significant.

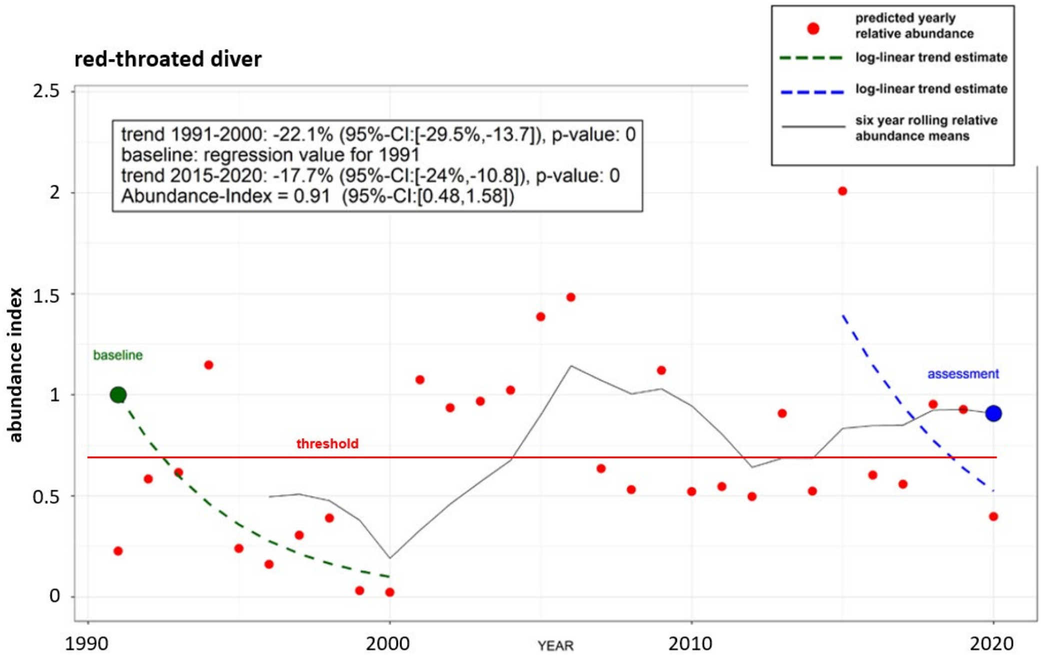

Figure d: Annual index numbers for at-sea abundance and the respective six-year rolling mean for red-throated diver in the Belgian-Dutch-German North Sea in winter, 1991 to 2020. The threshold value is the index value of 0,7 in relation to the value predicted for 1991 from the significant regression over the years 1991 to 2000, which was set to 1.

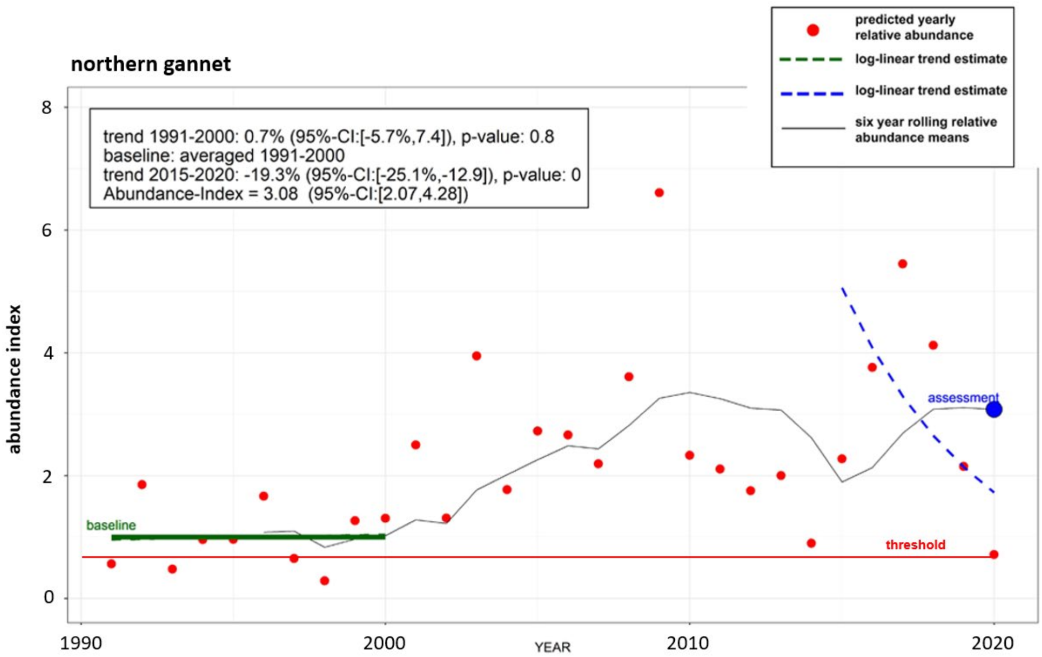

Figure e: Annual index numbers for at-sea abundance and the respective six-year rolling mean for northern gannet in the Belgian-Dutch-German North Sea in winter, 1991 to 2020. The threshold value is the index value of 0,7 in relation to the mean relative abundance in 1991 to 2000, which was set to 1. The mean 1991 to 2000 was used because the regression over these years is not significant.

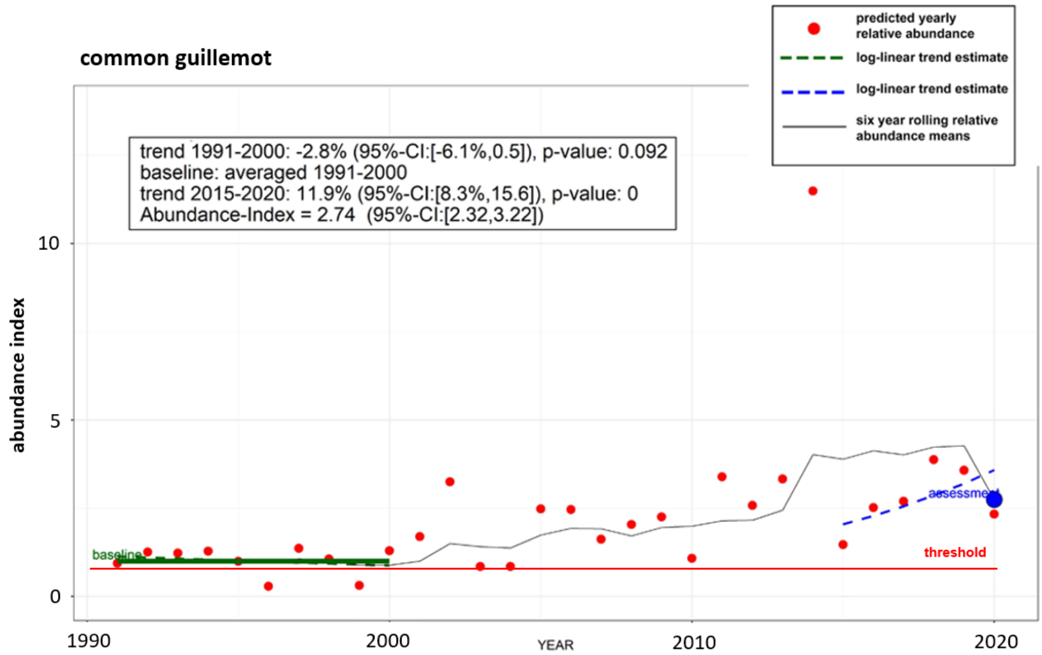

Figure f: Annual index numbers for at-sea abundance and the respective six-year rolling mean for common guillemot in the Belgian-Dutch-German North Sea in winter, 1991 to 2020. The threshold value is the index value of 0,8 in relation to the mean relative abundance in 1991 to 2000, which was set to 1. The mean 1991 to 2000 was used because the regression over these years is not significant.

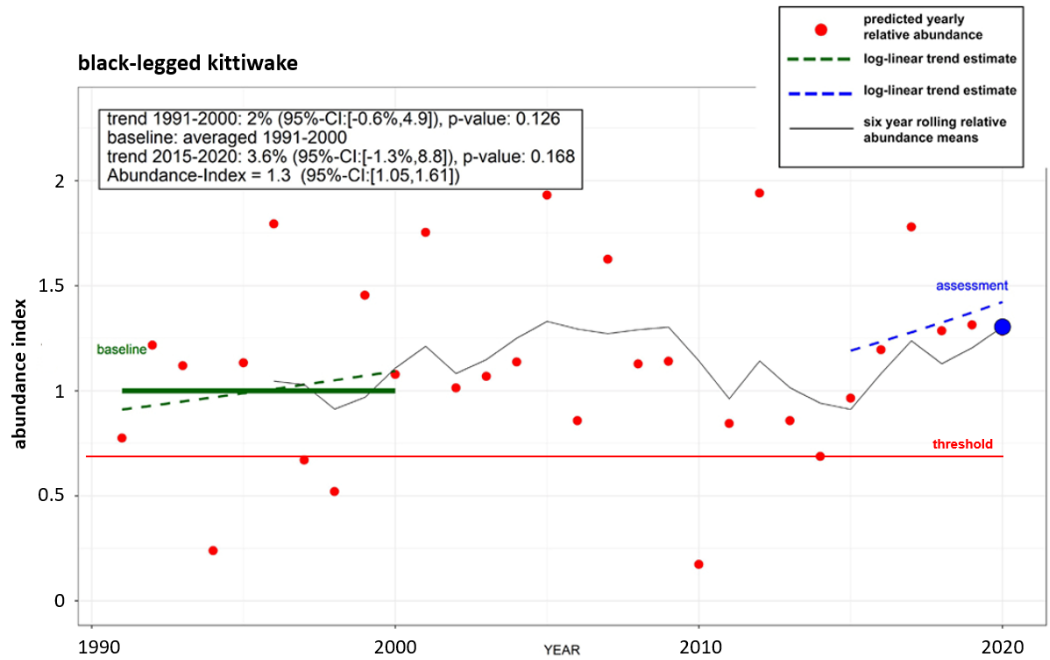

Figure g: Annual index numbers for at-sea abundance and the respective six-year rolling mean for black-legged kittiwake in the Belgian-Dutch-German North Sea in winter, 1991 to 2020. The threshold value is the index value of 0,7 in relation to the mean relative abundance in 1991 to2000, which was set to 1. The mean 1991 to 2000 was used because the regression over these years is not significant.

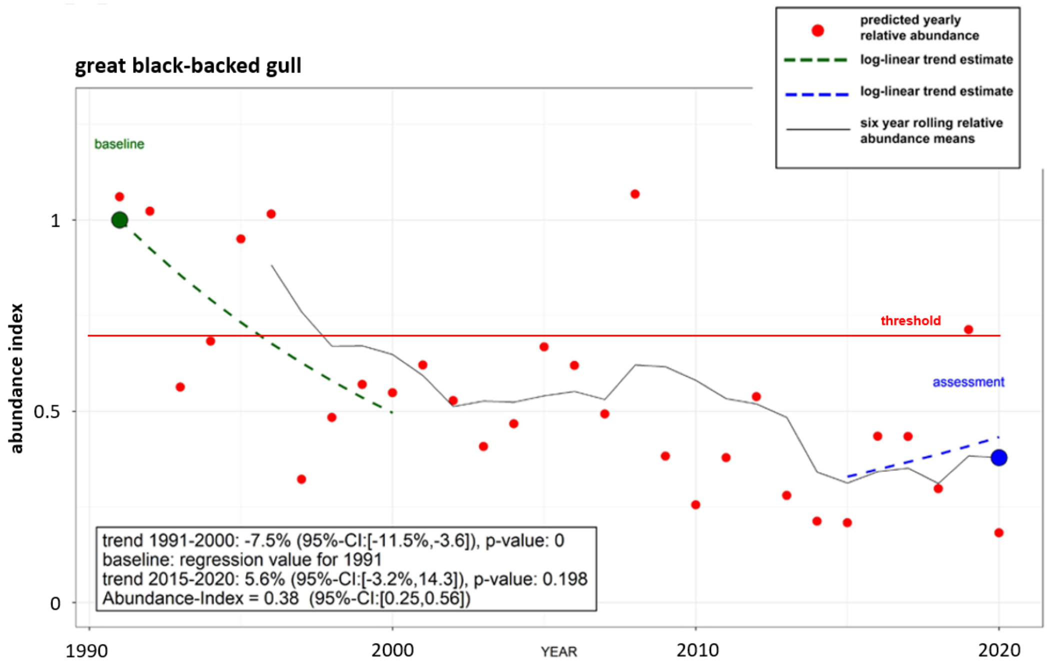

Figure h: Annual index numbers for at-sea abundance and the respective six-year rolling mean for great black-backed gull in the Belgian-Dutch-German North Sea in winter, 1991 to 2020. The threshold value is the index value of 0,7 in relation to the value predicted for 1991 from the significant regression over the years 1991 to 2000, which was set to 1.

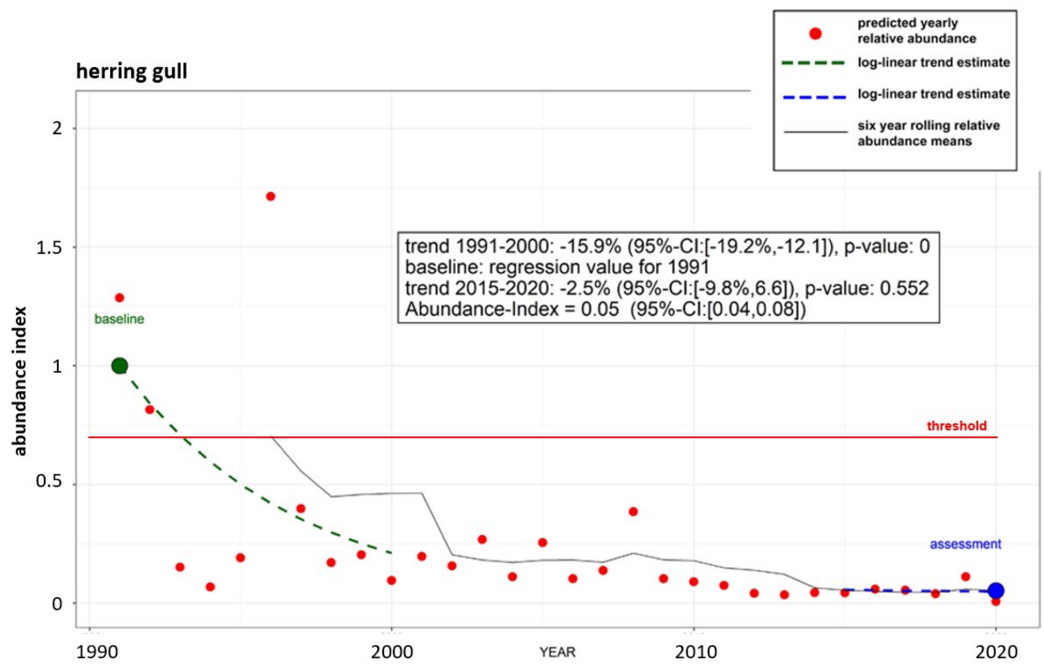

Figure i: Annual index numbers for at-sea abundance and the respective six-year rolling mean for herring gull in the Belgian-Dutch-German North Sea in winter, 1991 to 2020. The threshold value is the index value of 0,7 in relation to the value predicted for 1991 from the significant regression over the years 1991 to 2000, which was set to 1.

Confidence Assessment

There is strong consensus within the scientific community regarding this methodology, which was developed for a range of scientific and applied studies. Therefore, the confidence in the methodology is high. The assessment is undertaken using data with sufficient spatial coverage within the area being assessed. Therefore, the confidence in data coverage is high.

Conclusion (brief)

The methodological approach used in this indicator has proven suitable for assessing the population size of marine birds wintering in a sea area that extends beyond the immediate coastal area. It has the potential to address the suitability of the marine area as a habitat for wintering marine birds. Regarding the abundance of marine birds, this offshore extension of the B1 Common Indicator helps to get a more comprehensive picture of marine bird population, which so far was limited to breeding birds in spring / summer and the coastal strip only in winter. It also allows to include species which could not be assessed earlier because they do not breed in the marine area under consideration and / or are inaccessible in the surveys used in the B1 Common Indicator before. Therefore, it meets the requirements of environmental assessments in the frame of OSPAR Quality Status Reports and the EU MSFD.

Knowledge Gaps (brief)

Monitoring of marine birds at sea is conducted by several Contracting Parties, mostly in their territorial waters and their EEZ. This will allow to conduct assessments for forthcoming status reports with coverage of additional marine areas compared to this pilot assessment. However, the great expanse of the North-East Atlantic impedes an overall good coverage by ship-based and aerial surveys, given the logistic and financial effort to be taken for such surveys. Therefore, surveys focusing on representative sub-samples rather than a complete overview and advances in predictive modelling might help increasing effectiveness of assessments.

References

Camphuysen, C.J., Fox, T.J., Leopold, M.F. & Petersen, I.K. 2004. Towards standardised seabirds at sea census techniques in connection with environmental impact assessments for offshore wind farms in the U.K. NIOZ, Den Burg.

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.

ICES 2012. ICES advice on EcoQO for seabird populations in OSPAR regions II and III. In Report of the ICES Advisory Committee, 2012. ICES Advice 2012, Book 1, Section 1.5.5.1. Also available as a separate advice sheet at: http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2012/Special%20Requests/OSPAR_EcoQO_for_seabird_populations.pdf

ICES 2013a. OSPAR request on ecological quality objective for seabird populations in OSPAR Region III (Celtic seas). In Report of the ICES Advisory Committee, 2013. ICES Advice 2013, Book 1, Section 1.5.6.1.

Pilot Assessment of Marine Bird Abundance – Non-Breeding Offshore Birds

Also available as a separate advice sheet at:
http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2013/Special%20requests/OSPAR_EcoQO_region_III.pdf

ICES 2013b. Report of the ICES Ad hoc Group on Seabird Ecology (AGSE), 28–29 November 2012, ICES Headquarters, Copenhagen, Denmark. ICES CM 2012/ACOM:82. 30 pp.

ICES 2013c. Report of the Joint ICES/OSPAR Expert Group on Seabirds (WGBIRD), 22–23 October 2013, ICES Headquarters , Copenhagen, Denmark. ICES CM 2013/ACOM:78. 24 pp.

ICES 2016. Report of the OSPAR/HELCOM/ICES Working Group on Marine Birds (JWGBIRD), 10-14 October 2016, Thetford, UK. ICES CM 2016/ACOM:29, 124 pp.
Mercker, M., Markones, N., Borkenhagen, K., Schwemmer, H., Wahl, J. & Garthe S. 2021.

An integrated framework to estimate seabird population numbers and trends. *Journal of Wildlife Management* 85: 751-771

Wood, S.N. 2017. Generalized Additive Models: An Introduction with R. Chapman & Hall/CRC.

Assessment Metadata

Field	Data Type	
Assessment type	List	Pilot Assessment
SDG Indicator	List	14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans
Thematic Activity	List	Biological Diversity and Ecosystems
Date of publication	Date	2022-06-30
Conditions applying to access and use	URL	https://oap.ospar.org/en/data-policy/

OSPAR's Quality Status Report 2023

OSPAR Secretariat
The Aspect
12 Finsbury Square
London
EC2A 1AS
United Kingdom

t: +44 (0)20 7430 5200
f: +44 (0)20 7242 3737
e: secretariat@ospar.org
www.ospar.org

Our vision is a clean, healthy and biologically diverse North-East Atlantic Ocean, which is productive, used sustainably and resilient to climate change and ocean acidification.

Publication Number: 853/2022