OSPAR CEMP Guidelines

Common Indicator: Marine Bird Abundance (B1)

(OSPAR Agreement 2016-09)[1] [2]

This OSPAR biodiversity indicator is a result of iteration and learning, it is anticipated that there will be evolution of the methods and approaches documented in the CEMP guidelines. Version updates will be clearly indicated and be managed in a phased approach via ICG-COBAM through its expert groups and with the oversight and steer of BDC.

Contents

[1] This document exists in English only

[2] Update 2022

1 Introduction

The OSPAR Common Indicator: B1 – Marine bird abundance will contribute to assessments of the state of marine bird populations and assessments of Good Environmental Status under the Marine Strategy Framework Directive: MSFD Primary Criterion D1C2 *The population abundance of the species is not adversely affected due to anthropogenic pressures, such that its long-term viability is ensured* (Commission Decision EU 2017/848).

This indicator includes information on marine bird species, which at some point in their annual life cycle, are reliant on coastal or offshore areas. The indicator is constructed from species-specific trends in annual abundance. The monitoring and data collation described below concern marine birds when they are:

a. on land at breeding colonies or sites, nesting close to the coast and using the marine environment (e.g., for food); and/or
b. on land or at sea during migration or over-winter i.e., 'non-breeding': abundance is estimated from counts of birds in intertidal areas or close to the shore and counted from land or from the air.

In the context of MSFD, abundance indicators could also be constructed from time-series data collected at sea (see Annex 1).

In this context, the term 'marine birds' includes certain species in the following taxonomic groups that are commonly aggregated as 'waterbirds' and 'seabirds':

Waterbirds: shorebirds (order Charadriiformes); ducks, geese and swans (Anseriformes); divers (Gaviiformes); spoonbills and ibises (Pelecaniformes) 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.). 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), picking detritus from the surface or diving for invertebrate benthos (diving ducks). Divers, piscivorous and benthivorous ducks, grebes, cormorants, gulls and terns tend to be confined to inshore waters; whereas petrels, shearwaters, gannets, skuas and most auks venture much further offshore and beyond the shelf break.

This indicator and its assessment values (aka 'thresholds') are derived from the OSPAR EcoQO on *Seabird population trends as an index of seabird community health* (ICES, 2008, 2010, 2011, 2012), which was adopted by OSPAR's Biodiversity Committee (BDC) in 2012 (see OSPAR 2012). This indictor supersedes the EcoQO as it incorporates data on more species, including waterbirds and also uses data on non-breeding abundance.

This indicator has gone through extensive testing and development (see ICES, 2013a, b, c, d, 2015). OSPAR Quality Status Report 2023 indicator assessment values may be considered as equivalent to proposed European Union Marine Strategy Framework Directive (MSFD) criteria threshold values in that they can also be used for the purposes of their MSFD obligations by those Contracting Parties that wish to do so.

2 Monitoring

2.1 Purpose

Marine bird species represent a variety of feeding guilds. Abundance changes slowly under ‘natural’ conditions due to the long life-span of these species; thus, rapid changes in their numbers might indicate human-induced impacts.

This indicator will be affected by pressures that include those from fishing, predation by non-indigenous mammals, pollution and both habitat loss and disturbance by various human activities (including tourism and offshore wind farms). Fishing impacts include competition for food and mortality from bycatch. Conversely, many seabird species have benefited from food provided by the fishing industry through discards. This indicator may help us monitor the impact on seabird populations of the new EU Landings Regulations aimed at eliminating discards.

Abundance is used as an indicator of seabird community health because it is:

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

2.2 Quantitative Objectives

Temporal and spatial distribution for the monitoring programme

The monitoring required for indicator B1 is:

- breeding abundance: counts of breeding pairs or adult birds, ideally, annually repeated
- non-breeding abundance: number of birds per species per site per year that are counted from the land or air during migration and over winter.

Monitoring should be conducted on a site-by-site basis, so is usually a sample of the total population, but samples need to be representative of each sub-region and sub-division therein.

Data from at-sea monitoring (i.e. from boats and planes, observing sea areas beyond range of land-based observers) may be added to the indicator in future years once a joint large-scale survey programme has been developed and implemented (see Annex 1). A pilot assessment of such a candidate indicator (for the Southern North Sea) was produced as part of the OSPAR Quality Status Report 2023 (QSR 2023): see B1 Marine bird abundance – non-breeding birds offshore assessment.

The Marine Bird Abundance assessment is based on data from estuarine water bodies (so-called “transitional waters”) as well as coastal and marine, in order to provide a meaningful assessment of marine bird populations. Estuarine water bodies are generally not included by Member States as ‘coastal waters’ as defined by Article 3 (1) of the EU Marine Strategy Framework Directive. However, many such areas within the north-east Atlantic are internationally important for migrating or wintering aggregations of waterbirds. Excluding estuarine populations of migrating and wintering waterbirds would miss out a large and important part of the marine bird community in the north-east Atlantic. For instance, in the southern North Sea, the exclusion of data form estuarine sites would omit form the assessment hundreds of thousands of birds from around 10-15 species.

Marine birds are highly mobile and cross between sub-regions within a year. Monitoring should be representative of all sub-regions in order to identify impacts and threats.

Most countries in the OSPAR maritime area conduct annual monitoring of abundance of breeding and non-breeding marine birds. All these schemes need to continue in order to make the indicator B1 operational at appropriate spatial scales in all OSPAR Regions.

Monitoring in some countries may need to be enhanced in order to derive a more robust indicator. For example, monitoring of non-breeding waterbirds (including 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.

2.3 Monitoring Strategy

Monitoring of breeding and non-breeding abundance of marine birds is conducted in all OSPAR Regions and as part of nationally coordinated schemes. Most national schemes have a central data storage mechanism (e.g,. national database).

Most countries monitor a sample of their breeding colonies, with some but not all counted annually. Periodically, all colonies may be surveyed as part of a total census, sometimes carried out successively (area-by-area) over a number of years (e.g., 10-yr mapping scheme in Norway).

The intensity of monitoring (i.e., number of colonies and frequency) also varies depending on species. The minimum amount of monitoring locations depends on species and the inherent variability in trends between locations, and the magnitude of change that needs to be detected with statistical confidence. If a compromise between frequency and spatial coverage needs to be made, then the counts should be made less frequently but at more sites to better represent the distribution of birds within a sub-region.

Non-breeding birds are counted regularly (mostly annually), for example in mid January in the frame of the International Waterbird Census (IWC). International coordination is in place for high tide counts in the Dutch, German, Danish Wadden Sea.

2.4 Monitoring methods

Monitoring breeding abundance is more straightforward in some species than others, so species-specific methods have been designed and are widely used (see e.g., Walsh et al. 1995, Koffijberg et. al. 2011). Generally, the number of nests, pairs or individuals within an entire colony, or specially selected sub-sections or plots, are counted. This requires one or two observers visiting a colony one or a few times during the breeding season (i.e. usually May-Aug, but varies with species and latitude). Resources required for these visits are dependent on how accessible the colony is.

Monitoring non-breeding abundance is conducted by counting from land (sometimes from air) the numbers of birds in intertidal areas or close to the shore during migration or over the winter. These data mostly comprise maximum or single counts conducted in January (N.B. within the Arctic Circle counts are conducted in March when there is sufficient daylight to do so). Data from the Wadden Sea Trilateral (Germany, Netherlands and Denmark) Monitoring and Assessment Program (TMAP) and from the United Kingdom Wetland Bird Survey (WeBS) also comprised a mean of counts conducted throughout a one-year period, from July in one year to June in the next (Blew and Südbeck, 2005; Blew and others 2016).

The time required for data collection depends on the number of sites and types of marine bird being surveyed (e.g. breeding seabird at colonies on remote offshore islands or wintering waders along mainland stretches of coast). Each national monitoring programme currently manages time allocations.

Monitoring costs in most countries are minimized by using volunteer observers, but professional observers are sometimes used to monitor the less accessible colonies –especially in the north. Hence, monitoring costs will vary between countries depending on the number of colonies to be monitored, the accessibility of these colonies and on how much of the monitoring can be done by volunteers. During colony visits for abundance monitoring, some data on breeding success for common indicator Marine bird breeding productivity (B3) can also be collected. Monitoring costs for both indicators are thus not necessarily additive.

2.5 Quality assurance/ Quality Control

Each national monitoring scheme has QA/QC protocols, but European standards should be developed. A minimum standard should be to follow internationally recognised monitoring methods (e.g. Walsh et. al. 1995; Koffijberg et. al. 2011).

2.6 Data reporting, handling and management

Each national monitoring scheme has its own data storage mechanism. Within each sub-region and sub-division therein, indicator B1 is constructed from all available data from constituent CPs before being assessed. CPs are asked to submit their data in response to data-calls issued to OSPAR HoDs via a written procedure.

The frequency of OSPAR data-calls is to be decided, but will be no more frequent than annually. Data are stored in the OSPAR Marine Bird Database hosted by ICES Data Centre via the ICES Biodiversity Data Portal at https://www.ices.dk/data/data-portals/Pages/Biodiversity.aspx

Data undergo a series of validation checks during the uploading process.

Reporting format (Available via a link in the CEMP Appendices)

Data entry forms can be downloaded from https://www.ices.dk/data/data-portals/Pages/Biodiversity.aspx Guidance for submitting data is available at https://www.ices.dk/data/Documents/biodiversity/Birds_Reporting_Format_Guidance.pdf

3 Assessment

3.1 Data acquisition

The indicator is constructed from the following data which are periodically requested from Contracting Parties to support OSPAR Assessments.

a) breeding seabird colonies (incl. gulls and terns) and breeding waterbirds (incl. waders) nesting close to the coast and using marine environment (e.g. for food) – counts of breeding pairs (preferably) or (failing that) adults, per species, per colony, per year. If logistical constraints prevent whole colony/area counts, then representative plot samples can be used.
b) Non-breeding waterbirds (incl. shorebirds) – numbers of birds per species per site per year that are counted from land or from the air.

Note 1: data on seabirds or waterbirds at-sea, collected from boats or from planes are not generally required. Exception to this include data collected by aerial surveys in the Wadden Sea for Eider (January) and Shelduck (July/August - moulting). Data from at-sea monitoring (i.e. from boats and planes) comes into play for an extension of the B1 indicator that has been trialled for the OSPAR QSR23: “B1 Marine bird abundance – non-breeding birds offshore” assessment

Note 2: All data under a) and b) should preferably be broken down into individual colonies or sites rather than over large stretches of coastline; this allows comparability between years, especially where monitoring resources may vary between years. Abundance data CAN include previously modelled estimates that account for temporal and spatial gaps in data coverage. This information should be recorded in the dataset to allow to distinguish modelled and observed records.

Note 3: Data on non-breeding waterbirds will be requested for two time periods, depending on availability: a) maximum count in January; and b) mean count during July to June. (b) is currently used by TMAP in the Wadden Sea and by WeBS in the UK. Maximum January counts are more widely used (e.g. by International Waterbird Census) and will be used to construct indicators for each OSPAR Region.

c) Baselines (all species) - The baseline for each species, should be set at a population size that is considered desirable for each individual species within: i. the whole of the relevant OSPAR Region and ii. in each subdivision of OSPAR Regions I and II, where applicable (see Figure 1). In the absence of baseline values provided by CPs, baselines can be based on predictions using a generalised linear model to detect yearly trend for the first ten years of the observed period. If no significant trend is observed in the first ten years, then the arithmetic mean of these years serves a baseline (see section 3.5).

d) Regional weightings (all species) -size of the population of each species in the whole of the relevant OSPAR Region and in each subdivision of OSPAR Regions I and II, where applicable (see Figure 1). These data will be used to weight the annual estimates of abundance from the sample of sites monitored in each country (see below).

3.2 Preparation of data

This indicator is assessed for each OSPAR Region and sub-divisions therein (see Figure 1). The smaller sub-divisions may help to interpret the assessment results. The sub-divisional boundaries are based on a coarse assessment of the main oceanographic features such as currents and depth, and some relatively clear-cut differences in seabird / waterbird community structure and population trends (ICES, 2013c,d; Cook et al., 2011).

OSPAR Region II - the Greater North Sea - is divided into five subdivisions (Figure 1), defined as follows:

a) Northeast coast of Britain: Duncansby Head (in the north) to Staithes (in the south);
b) West coast of Norway: Northwest from Lindesnes;
c) Skagerrak/Kattegat area: all coasts east of Lindesnes (NO) and Hanstholm (DK), i.e. the Skagerrak and the Kattegat; equals ICES Area IIIa;
d) Southern North Sea: all coasts south of Teesmouth (UK) and Hanstholm (DK), and north of the Channel subdivision (e);
e) The Channel: all coasts of OSPAR II west of Dover (UK) and Calais (FR).
f) North coast of Scotland and the Northern Isles: OSPAR II/III North Boundary to Duncansby Head, plus Orkney and Shetland.

OSPAR Region I – Arctic Waters, encompasses several very different ecosystems in terms of key species and trophic interactions. It would be very difficult to set appropriate thresholds and reference levels for the population of a seabird species across such a large area, because in different ecosystems it may respond very differently to pressures and environmental factors. For this reason, while there is no subdivision in place for the Greenland Sea and Icelandic Waters, the Norwegian Arctic Waters were divided into three subdivisions:

- North Barents Sea
- South Barents Sea
- Norwegian Sea.

As data become available from other parts of the arctic, further subdivisions could be added which could be similar to the large marine ecosystems (LMEs) that have been recommended for the Arctic Council and are implemented for various assessment purposes in the work of Conservation of Arctic Flora and Fauna (CAFF).

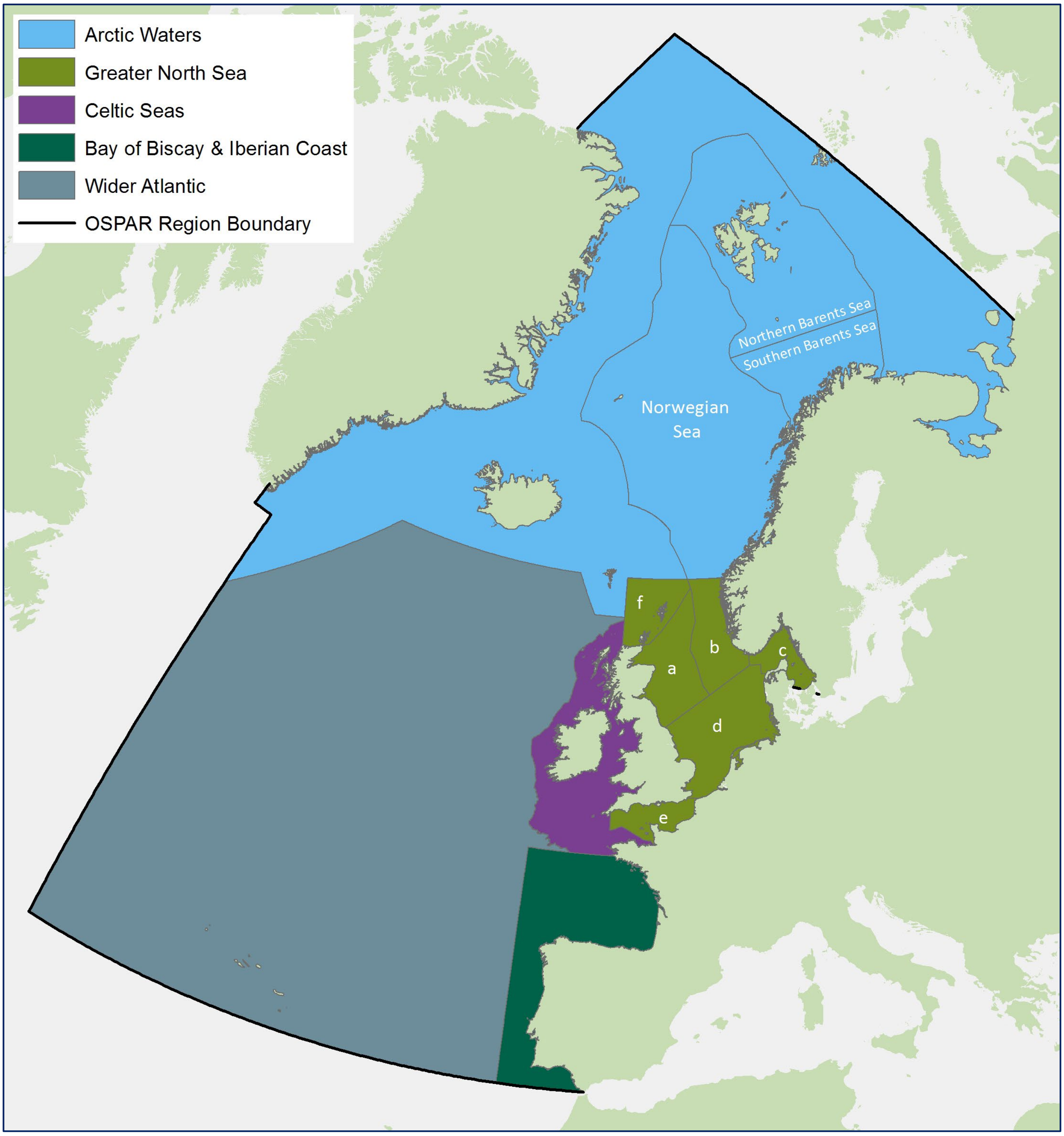

Figure 1. Marine Bird assessment units. {file name: Marine_Birds_AU_B1.jpg}

3.3 Species aggregation – functional groups

Species were assigned to the functional groups given in the Table 1. Detailed information on what species can be included in each functional group is given in the table in Annex 2. The table also lists additional species which could be brought into the indicator following inclusion of additional OSPAR sub-regions and/or if existing monitoring programmes were extended. These functional groups were proposed by JWGBIRD (ICES 2014) and have been adopted in the EU Commission Decision 2017/848[3]

Table 1: Marine bird functional groups {file name: B1 Table-b functional_groups 20220505.xlsx}

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 spp. 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)	
Grazing feeders	Grazing in intertidal areas and in shallow waters	Plants (e.g. eelgrass, saltmarsh plants), algae	Geese and dabbling ducks
Wading feeders	Walk/wade in shallow waters	Invertebrates (molluscs, polychaetes, etc.)	

3.4 Spatial Analysis and / or trend analysis

Trend Analysis

This indicator assessment requires for each species an annual estimate of either breeding or non-breeding abundance (depending on species) per site or colony (or subset thereof such as a plot). Not all the colonies and sites in the data provided will have been observed every year. Missing annual observations need to be interpolated from the observed data using statistical models. The minimum number of years of counts for a particular species required for a colony or site to be included in the analysis should be set at two for all species except northern fulmar (*Fulmarus glacialis*), which should be set at a minimum of five years (ICES, 2010, 2011).

[3] EU Commission Decision (2017/848) - laying down criteria and methodological standards on good environmental status of marine waters and specifications and standardised methods for monitoring and assessment, and repealing Decision 2010/477/EU

In some cases there may be no missing values in a dataset, for example where these had already been interpolated prior to submission, using tried and tested methods

If pre-interpolated data were not submitted (see section 3.4), missing annual observations are interpolated using General Additive Models (GAMs) Ward et al., 2014). These models require a minimum of 3 years of count per colony to converge. Colonies with less than 3 years of count need to be discarded from the imputation. The use of GAMs replaced the modified chain approach developed by Thomas (1993) that was used during the IA 2017 for imputation of missing data. The modified chain approach, also known as Thomas fit, estimates values of missing observations based on information in other years and sites. The advantage of this method is that it allows for site-specific variation, thereby avoiding the conventional assumption that changes in abundance at different sites occur synchronously. A further advantage of this approach is that it can easily incorporate counts of whole colonies and counts from smaller plots within the same colonies that are monitored more frequently than the whole colony. The Thomas estimation method has been used to construct trends in abundance for earlier iterations of this indicator and its OSPAR Ecological Quality Objective (EcoQO) predecessor. Details of the method are as reported by ICES (2008: Annex 3).

The imputation analysis developed by Thomas (1993) might not be appropriate in all cases. The Thomas fit method calculates a matrix of years count ratios that are used to imputed missing values along the time series. The method relies on the assumption that the trend over time at each colony is approximately the same as the trend over time within the wider region that colony belongs to.
The Thomas fit method may produce “outliers”, for example if:

a) there are very few colonies within the region over which it is being run,
b) some of these colonies are either new or going extinct, thus with rapid changes in numbers across the years and
c) the data coverage varies systematically with the type of colony (i.e., for example, new colonies having consistently better data coverage than existing stable colonies).

The use of GAMs is therefore recommended over the Thomas fit method to estimate missing values. The GAM method does not assume any *a priori* relationship between the dependent variable and the covariates and can be used to identify and estimate non-linear effects of the covariate on the dependent variable. It is therefore a more flexible method that permits to avoid the production of outliers during the imputation and to include in the assessment a higher number of species that would have been otherwise discarded due to unrealistic results produced by the Thomas fit method.

Applying Regional Weightings to Abundance Trends

Not all the colonies or sites in an assessment unit will be monitored and present in the dataset. The proportion of a population that is monitored varies between species and between countries. There is a resultant potential bias, in that those countries where few sites are monitored are under-represented in the trends for a given assessment unit, compared to those countries where a larger proportion of sites are monitored.

To mitigate against such bias, the annual estimates of breeding and non-breeding abundance in each country should be weighted according to the size of the total population in that country. Each Contracting Party is asked to provide recent estimates of total abundance for each species along their coastline within each of the assessment units in Figure 1. To apply a regional weighting, each annual estimate of abundance in each assessment unit was divided by a proportion p, where p is the proportion of the total population that is present within the sites or colonies that are included in the data provided. The total number of adult birds or pairs in an assessment unit are, in most instances, taken from national censuses.

As an example, the weighted annual breeding abundance of a species in the Celtic Seas region, yIII in year j, is calculated from annual estimates of abundance in each constituent country, i.e. the United Kingdom Celtic Seas coast (yUK) and France (yFR) as follows:

$$yIIIj = (yUKj / pUK) + (yFRj / pFR)$$

where pUK and pFR are the proportions of the respective populations in the United Kingdom (UK) and France (FR) that are contained in the sample of colonies that are monitored in each constituent country in the Celtic Seas region (for which data are available).

Regional weightings are not necessary where data contains all the colonies or sites in that area. In Belgium, all the breeding and non-breeding sites in the country are monitored, so no weightings are required for these data. Regional weighting is also not necessary for estimates of annual abundance that had been interpolated before submission. Where monitored samples represent a very small proportion of the total population estimate, the representativeness of the sample should be examined critically, (and if necessary, such cases removed from the assessment) to ensure that one potential bias is not replaced with another.

3.5 Assessment criteria

Parameter/metric

The indicator metric is *relative abundance*: annual abundance as a proportion of the baseline.

relative abundance = annual abundance / baseline abundance

Baseline 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) 'Historical reference': where it is known the abundance in a point in the past long before the time-series began; but is not known why it may have changed since.
b) Reference level: where it would be expected the population size to be if anthropogenic impacts were negligible (this can be derived from known population sizes either historically or from within time-series).
c) "Start level of time-series": run a generalised linear model using the first ten years of the time series. Set the baseline on the predicted value of the start point if a significant trend is present (regression p value ≤ 0.05), or using the mean of the first ten years, ignoring missing years, if no statistically significant trend is present.

It is preferable to set baselines objectively using options a) or b) rather than arbitrarily using option 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. The following criteria can be used to steer and standardise expert judgement when selecting baselines.

- Use historical population estimates that were recorded:
    i. before known human impacts; and /or
    ii. before other major declines in population; or
    iii. at known plateaus in population trends, following increases and peaks in population size.

- Use the highest known population estimate when the population has decreased in size, as a result of human impacts (e.g. periods of severe contamination) or following stochastic natural impacts (e.g. severe weather wrecks).
- Use start level of time-series when no historical data or reference level are available.
- Use recent population estimate (e.g. previous five year mean) when a species is colonising.

Note: few countries were able to supply baselines for the IA2017 and the COVID pandemic has hindered attempts by JWGBIRD to address this for the QSR 2023. Therefore, for QSR 2023 assessment, the baseline was calculated using method c) using the predicted value at the start of the time series (i.e. 1991) when regression analysis was significant or otherwise using the mean of the values observed during the first ten years of the timeseries

Species-specific Assessment values

The assessment values for each species-specific indicator of trends in relative abundance are set on the magnitude of change relative to a baseline set at 1.0 (ICES 2008, 2010, 2011).

Species-specific annual relative breeding or non-breeding abundance should, to meet "good status" be more than

- 0.8 for species that lay one egg per year, or more than
- 0.7 for species that lay more than one egg per year.

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

An upper assessment value of 1.3 (i.e., 130% of the baseline) is applied to the annual relative abundance of all species. This upper assessment value is used to identify potentially disruptive increases in bird some species that might impact on other bird species (ICES 2008), or indeed other components of the ecosystem. For instance, large predatory seabird species have benefited from the provision of food from fishery discards. The increase in numbers of species such as great black-backed gull and great skua have, in some areas, led to declines in species such as kittiwake that they prey on. However, this has the potential to wrongly identify a species as having a detrimental impact on other species when in fact it is in recovery to levels in excess of the baseline (ICES, 2010, 2011, 2013b). As a result, this upper assessment value is not used as an indicator of status and is only used to provide a trigger for further research and / or management, if increases in one species are likely to result in decreases in others. When reporting on the annual results of the species-specific indicators, species that have exceeded 130% of the baseline, should be highlighted.

Integration of species-specific assessments

The status of marine bird communities is assessed by calculating the proportion of species exceeding the lower assessment values, as previously used for breeding seabirds in the EcoQO on seabird population trends as an index of community health (ICES, 2008), according to the following integration rule:

Changes in abundance of marine birds should exceed species-specific assessment values in 75% or more of species that are assessed.

Humphreys et al. (2012) also recommended a value of 75% for non-breeding shorebirds and coastal breeding waterbirds in the United Kingdom because it is comparable to the assessment values used for shorebirds by the Wetland Bird Survey (WeBS) Alerts system (https://www.bto.org/our-science/projects/wetland-bird-survey/publications/webs-alerts).

Relative breeding abundance and relative non-breeding abundance are assessed separately in each Region. This is because most species in the breeding assessment are seabirds that use the wider marine environment and most species in the non-breeding assessment use intertidal and inshore areas. The breeding and non-breeding assessments therefore indicate impacts from different suites of pressures, operating in different parts of the marine environment. To provide further insight into causes of change, species-specific assessments of breeding abundance and non-breeding abundance are also integrated for each functional group (Table 1).

Spatial assessments and integration

To provide greater insight into the likely impacts operating on relative breeding abundance and on relative non-breeding abundance, species-specific assessments can be integrated at different spatial scales: for each OSPAR Region and (currently) for each sub-division of the Greater North Sea and Arctic Waters.

The following steps will be required in order to complete an assessment in e.g. OSPAR Region II or in other subregions that are subdivided:

1. Produce separate indicators for each subdivision of OSPAR Region II. This consists of a suite of species-specific trends in relative abundance; species composition may vary between subdivisions.
2. Assess each species-specific trend against its respective assessment value (i.e. ≥70% for species that lay >one egg and ≥80% for species that lay one egg).
3. Count the number of species in each subdivision that have met their respective assessment values. Assess proportion of species meeting assessment value against the 75% threshold in each subdivision.
4. Construct indicator for the whole of OSPAR Region II. This consists of a suite of species-specific trends in relative abundance that are weighted for the respective total population sizes in each subdivision.
5. Assess each OSPAR Region II species-specific trend against its respective assessment value (i.e. ≥70% for species that lay >one egg and ≥80% for species that lay one egg).
6. Count the number of species in OSPAR Region II that have met their respective assessment value. Assess proportion of species meeting assessment value against the 75% threshold in OSPAR Region II.

3.6 Presentation of assessment results

The indicator should be updated as frequently as possible; annually is preferable. The assessments of the indicator against its assessment value should be conducted and reported annually also. This will enable management measures to address impacts before the state of indicator declines too much, which may save considerable resources. Annual reports would also enable the effectiveness of the management measures to be frequently assessed and adjusted if required.

Figure 2 shows how the trends and target assessment for individual species indicators can be presented.

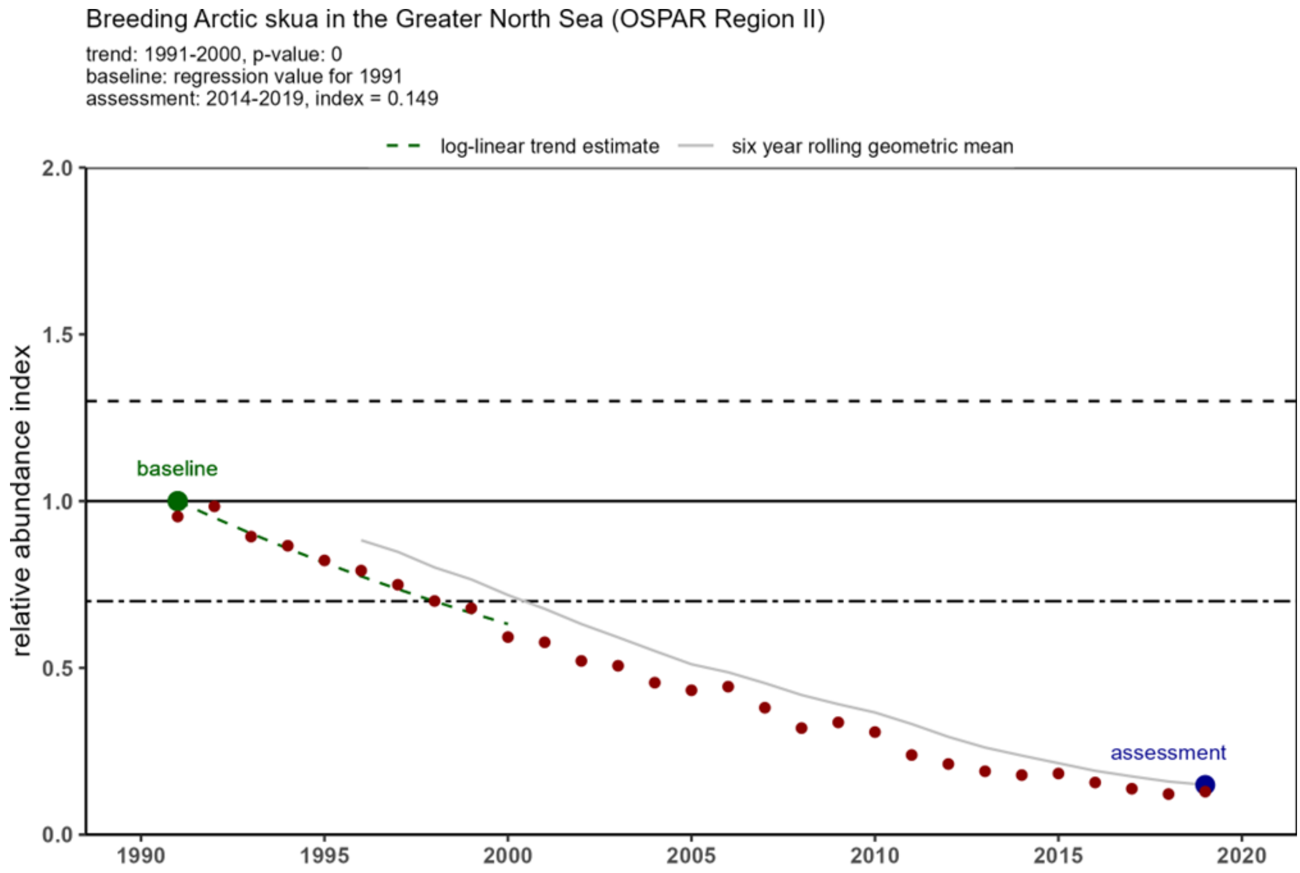

Figure 2: Example of a species-specific trend in relative breeding abundance: Arctic Skua in the Greater North Sea 1991–2019. Datapoints represent yearly relative abundance values and the grey line represent the six-year rolling relative abundance geometric mean. The black line indicates the baseline which is calculated from the first ten years of data (see "Assessment Method" for details). The black dotted line indicates the lower assessment value of 0.7 (for species that lay >1 egg, but would be 0.8 for species that lay 1 egg only); the black dashed line indicates the upper assessment value of 1.3. In this example, the value obtained from the mean of the last six years of the time series (blue dot) is below the baseline, meaning that the species has not met the assessment value. The green dotted line shows the log-linear regression over the first ten years of the time series, and the green dot represents the relative abundance predicted for the first year from that regression, set to 1 (Source OSPAR QSR 2023) {filename: B1_Fig-f_OSPARII_Arctic_Skua_breeding_20220505 }

Figure 3 provides an example of a regional assessment using an integration across species assessments and a multi-species assessment value of 75%.

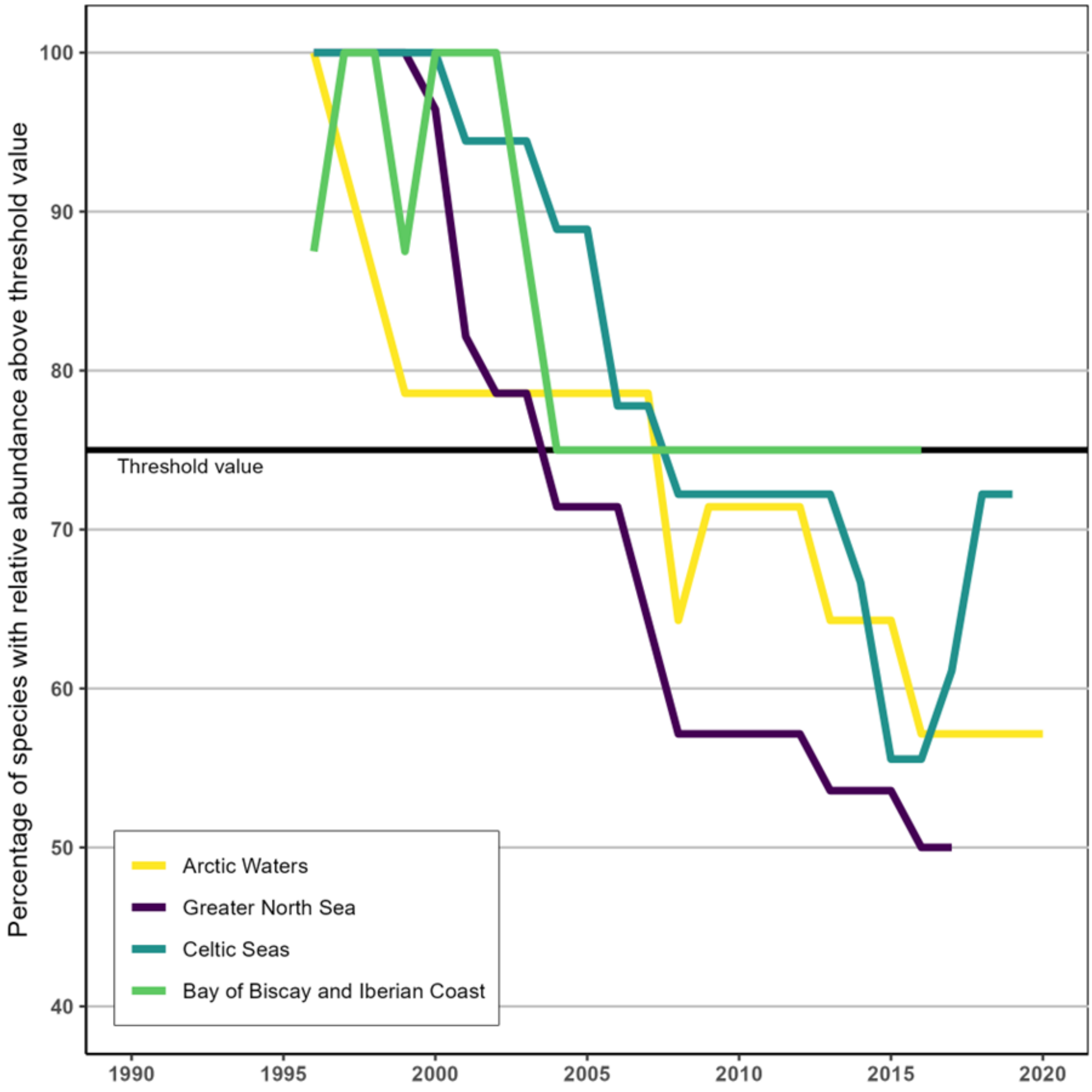

Figure 3: Change in the annual proportion of species exceeding assessment values for the relative breeding abundance of marine birds in the Norwegian part of the Arctic Waters, the Greater North Sea, the Celtic Seas and the Bay of Biscay and Iberian Coast. The black line denotes the multi-species assessment value of 75% (Source QSR 2023). {filename: B1_Fig-3_trends-breeding_20220530}

Figure 4 shows how the species-specific assessments in the different Regions can be presented side by side and visually interpreted via a traffic light system, using as assessment values the geometric mean relative abundance of the last six years for individual species. The colour coding in Figure 4 denotes if relative abundance has exceeded the lower assessment value (i.e. 0.7 or 0.8 depending on clutch size) or upper assessment value (i.e. 1.3). The arrows in Figure 4 illustrate recent direction of change (i.e. change of status between assessment periods) and are useful in identifying those species that are either recovering after being below target, or those species that are currently on target, but decreasing and may drop below the lower assessment value in the near future. The IA 2017 presented change between the most recent year and the preceding year. However, it is probably more informative to present the annual rate of change over a longer period, which could represent the length of time between successive assessments e.g. 6 years between each MSFSD Art 8 Assessment. The rate of change per annum, should be categorised as strong (>5% p.a.) or weak (2–5% p.a.) increases or decreases and no change (<2% p.a.) (following Blew *et al*., 2013). Note the imputation method use to estimate trends (see above) is non-parametric and cannot be used to determine if a change from one period to the next is significant or not.

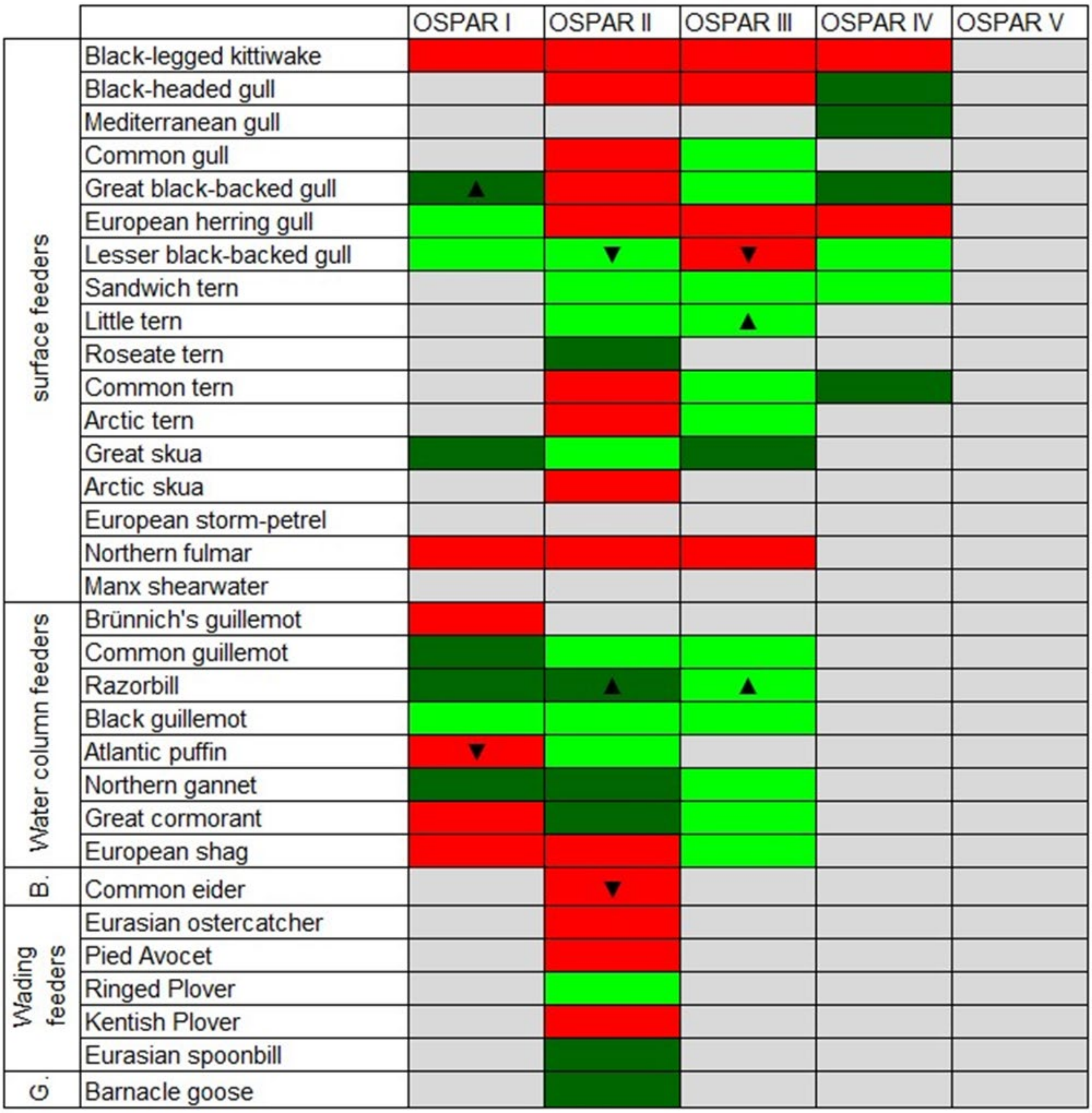

Figure 4 : Species-specific assessment of relative breeding abundance for marine birds. Arrows display change of status category compared to 2014 (upward: status improvement, downward: status decline). {filename: B1_Fig-d_species-breed-all_20220526}

Species assessment
Relative abundance ≥ 1.3
Relative abundance ≥ 0.7 or 0.8 (depending on clutch size)
Relative abundance < 0.7 or 0.8 (depending on clutch size)
Insufficient data/low confidence

4 Change Management

Change management of the indicator and the document is carried out by JWG BIRD which reports to ICG-COBAM that in turn is a group under BDC.

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Annex 1

Utilisation of at-sea data

Data on seabirds or waterbirds at-sea, collected from boats or planes using standardised methods (Camphuysen et al. 2004) - where land-based counters cannot effectively observe - were not included in the abundance indicator so far. However, this needs to be done in the future to obtain reliable results on trends of species that occur in substantial numbers in the offshore regions. Comprehensive indicators could then be generated for non-breeding ducks, divers and grebes during the non-breeding season (i.e. in the relatively sheltered inshore waters they favour, but beyond the range of land observation) and seabirds at sea (i.e. seabird species in inshore and offshore waters throughout the year). Such indicators may give an early warning of declines in some breeding populations and include species and populations not breeding in the area of assessment. In contrast to other supporting indicators of B1 (non-breeding shorebirds and waterbirds, breeding seabirds), which are more or less restricted to coastal waters, indicators for waterbirds and seabirds at sea would help to assess the status of inshore and offshore areas. Furthermore, bird data can be directly linked to environmental parameters, helping to interpret observed trends, and bird data themselves (e.g. biomass) can be incorporated into MSFD food web Descriptor D4 and relevant OSPAR indicators for the respective marine areas.

As a prelude to incorporating the assessment of seabirds at sea, a pilot assessment B1 Marine bird abundance – non-breeding birds offshore has been undertaken in the frame of QSR 2023. The pilot assessment used trend analysis based on modern regression methods (species-distribution generalised additive models – sdGAMs – with appropriate autocorrelation structures) applied to spatio-temporally pooled bird count data of seven marine bird species wintering in the Belgian-Dutch-German North Sea, which is part of the OSPAR Region IId. Baselines and threshold values were used in the same way as for breeding and non-breeding marine birds in this Common Indicator B1. A method to combine assessments of wintering birds counted along the coastline (this Common Indicator) and those surveyed at sea (the pilot assessment) by weighting the outcomes according to the proportions of the assessed populations wintering at the coast and at sea, respectively, is available (ICES 2016, Mercker et al. 2021).

The methodological approach used in the pilot assessment 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 should be integrated as a component linked to at-sea surveys into the Common Indicator B1 in future OSPAR Quality Status Reports.

The necessary data basis for the assessment of offshore abundance is ideally derived by joint coordinated surveys of all CPs at the level of the whole OSPAR area which are not currently available. At the moment several CPs carry out or are planning national at-sea monitoring programmes while there are no or only limited at-sea surveys in other countries (ICES 2020, Figure A1 1). Overall, coordination of surveys, e.g. with regard to timing, between countries is lacking or limited to smaller parts of the OSPAR maritime area (e.g. coordinated surveys of seaducks and other seabirds in winter 2016 in Germany, the Netherlands and Belgium). Consequently, there is a need to develop (a) a concept for survey efforts delivering the necessary data basis for the abundance indicator work, (b) implement this concept in the frame of national survey programmes in future years and (c) develop a methodological approach for aggregating and analysing the data. Similar work is being undertaken in the Baltic Sea by HELCOM.

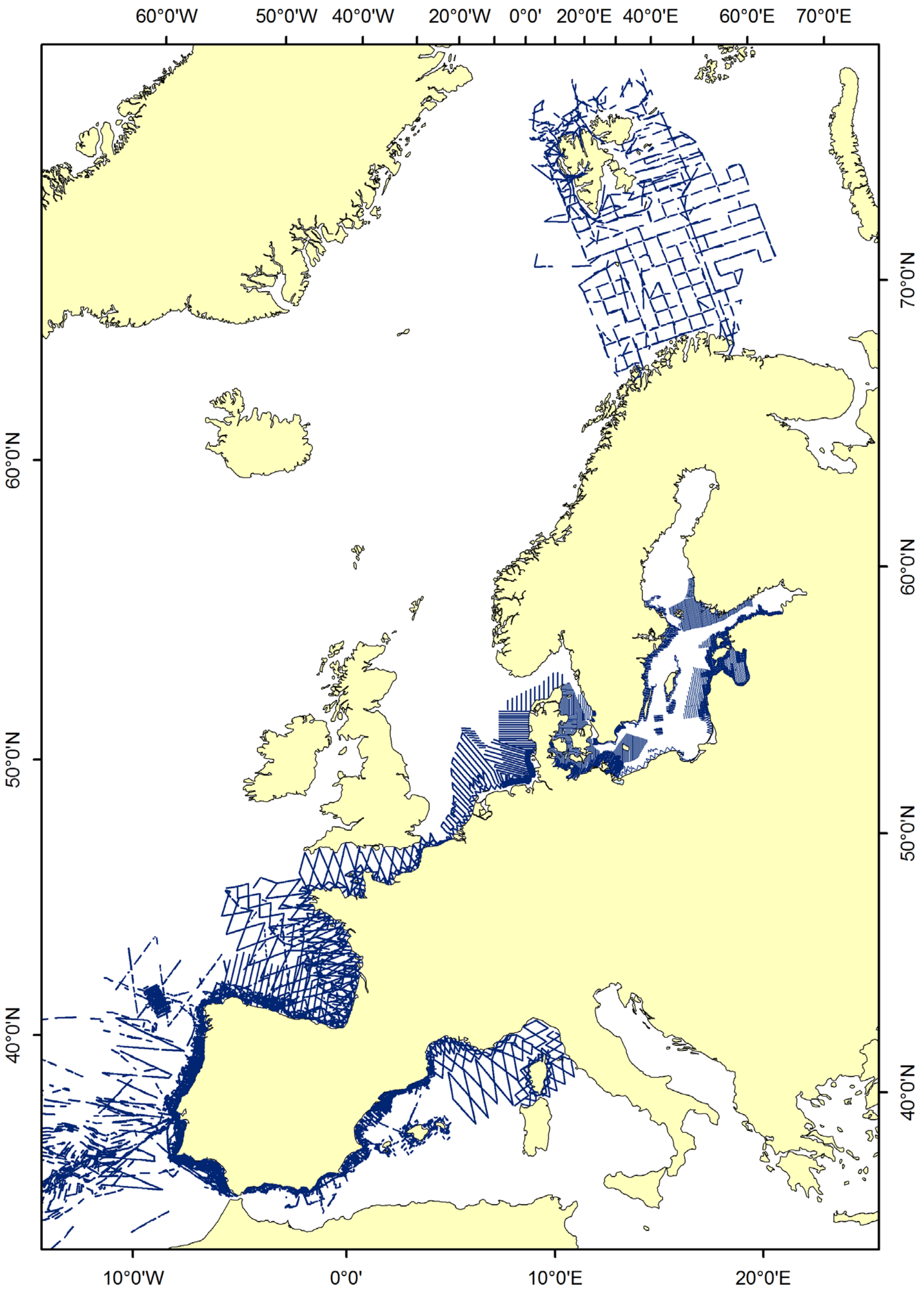

Figure A1 1: Survey design of running Seabirds-at-Sea monitoring programmes and (in the case of Norway, Spain and Portugal) survey effort of recent years respectively in the OSPAR and HELCOM regions. Not yet depicted are recent monitoring efforts of Ireland. Portugal covered large areas during the years of 2004–2018. Major parts are not shown in the map as they probably do not correspond to future monitoring efforts. Taken from ICES (2020)

Annex 2

Species List - B1 Marine bird abundance

The species that can be considered for B1 assessments of breeding and non-breeding marine birds and the functional groups to which they are assigned are given in the table below. This is a preliminary list that will be reviewed by JWGBIRD. Accepted scientific names from WoRMS are provided, the sequence of species follows the taxonomic order of Gill et al. (2022). {Filename: B1_CEMP_Annex2_species_list.xlsx}

Species		**Functional group**				
Extended English name	**Scientific Name**	**Grazing feeders**	**Wading feeders**	**Surface feeders**	**Water column feeders**	**Benthic feeders**
Brent goose	*Branta bernicla*	x				
Canada goose	*Branta canadensis*	x				
Barnacle goose	*Branta leucopsis*	x				
Greater white-fronted goose	*Anser albifrons*	x				
Mute swan	*Cygnus olor*	x				
Bewick's swan	*Cygnus columbianus*	x				
Whooper swan	*Cygnus cygnus*	x				
Common shelduck	*Tadorna tadorna*		x			
Northern shoveler	*Spatula clypeata*	x				
Eurasian wigeon	*Mareca penelope*	x				
Mallard	*Anas platyrhynchos*	x				
Northern pintail	*Anas acuta*		x			
Eurasian teal	*Anas crecca*		x			
Common pochard	*Aythya ferina*					x
Tufted duck	*Aythya fuligula*					x

Greater scaup	*Aythya marila*					x
King eider	*Somateria spectabilis*					x
Common eider	*Somateria mollissima*					x
Velvet scoter	*Melanitta fusca*					x
Common scoter	*Melanitta nigra*					x
Long-tailed duck	*Clangula hyemalis*					x
Common goldeneye	*Bucephala clangula*					x
Smew	*Mergellus albellus*				x	
Common Merganser	*Mergus merganser*				x	
Red-breasted merganser	*Mergus serrator*				x	
Eurasian coot	*Fulica atra*	x				
Red-necked grebe	*Podiceps grisegena*				x	
Great crested grebe	*Podiceps cristatus*				x	
Slavonian grebe	*Podiceps auritus*				x	
Eurasian oystercatcher	*Haematopus ostralegus*		x			
Pied avocet	*Recurvirostra avosetta*		x			
Northern lapwing	*Vanellus vanellus*		x			
European golden plover	*Pluvialis apricaria*		x			
Grey plover	*Pluvialis squatarola*		x			
Common ringed plover	*Charadrius hiaticula*		x			
Kentish plover	*Charadrius alexandrinus*		x			
Eurasian whimbrel	*Numenius phaeopus*		x			
Eurasian curlew	*Numenius arquata*		x			
Bar-tailed godwit	*Limosa lapponica*		x			
Black-tailed godwit	*Limosa limosa*		x			

Ruddy turnstone	*Arenaria interpres*		x			
Red knot	*Calidris canutus*		x			
Ruff	*Philomachus pugnax*		x			
Curlew sandpiper	*Calidris ferruginea*		x			
Sanderling	*Calidris alba*		x			
Dunlin	*Calidris alpina*		x			
Purple sandpiper	*Calidris maritima*		x			
Little stint	*Calidris minuta*		x			
Common redshank	*Tringa totanus*		x			
Spotted redshank	*Tringa erythropus*		x			
Common greenshank	*Tringa nebularia*		x			
Black-legged kittiwake	*Rissa tridactyla*			x		
Ivory gull	*Pagophila eburnea*			x		
Slender-billed gull	*Chroicocephalus genei*			x		
Black-headed gull	*Larus ridibundus*			x		
Little gull	*Hydrocoloeus minutus*			x		
Mediterranean gull	*Larus melanocephalus*			x		
Common gull	*Larus canus*			x		
Great black-backed gull	*Larus marinus*			x		
Glaucous gull	*Larus hyperboreus*			x		
European herring gull	*Larus argentatus*			x		
Yellow-legged gull	*Larus michahellis*			x		
Lesser black-backed gull	*Larus fuscus*			x		
Sandwich tern	*Sterna sandvicensis*			x		
Little tern	*Sternula albifrons*			x		

Roseate tern	*Sterna dougallii*			x		
Common tern	*Sterna hirundo*			x		
Arctic tern	*Sterna paradisaea*			x		
Great skua	*Stercorarius skua*			x		
Arctic skua	*Stercorarius parasiticus*			x		
Little auk	*Alle alle*				x	
Brünnich's guillemot	*Uria lomvia*				x	
Common guillemot	*Uria aalge*				x	
Razorbill	*Alca torda*				x	
Black guillemot	*Cepphus grylle*				x	
Atlantic puffin	*Fratercula arctica*				x	
Red-throated diver	*Gavia stellata*				x	
Black-throated diver	*Gavia arctica*				x	
Great northern diver	*Gavia immer*				x	
European storm-petrel	*Hydrobates pelagicus*			x		
Leach's storm-petrel	*Oceanodroma leucorhoa*			x		
Band-rumped storm-petrel	*Oceanodroma castro*			x		
Monteiro's storm-petrel	*Oceanodroma monteiroi*			x		
Northern fulmar	*Fulmarus glacialis*			x		
Cory's shearwater	*Calonectris borealis*			x		
Manx shearwater	*Puffinus puffinus*			x		
Barolo shearwater	*Puffinus baroli*			x		
Bulwer's petrel	*Bulweria bulwerii*			x		
Northern gannet	*Morus bassanus*				x	

Great cormorant	*Phalacrocorax carbo*				x	
European shag	*Phalacrocorax aristotelis*				x	
Eurasian spoonbill	*Platalea leucorodia*		x			
Little egret	*Egretta garzetta*		x			