JOINT OSPAR/HELCOM/ICES WORKING GROUP ON SEABIRDS (JWGBIRD; OUTPUTS FROM 2022 MEETING)

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Contents

i Executive summary

This report summarises the outcomes of the Joint ICES/OSPAR/HELCOM Working Group on Seabirds informal consultation in 2022. The meeting consisted of a series of hybrid workshops, where in-person and online participants discussed the most pressing current issues for seabirds in the ICES, OSPAR, and HELCOM regions and addressed the Terms of Reference (ToR) of the working group.

One of the main objectives of the meeting was to summarise the results of the marine bird indicator assessments done within the regional assessments of the Northeast Atlantic and the Baltic Sea. The group also reviewed and discussed issues related to marine birds in relation to human activities at sea as well as the responses being made to protect marine birds. Based on the work of JWGBIRD, supported among others by two EU-funded projects (NEA PANACEA, HELCOM BLUES), the assessment of the status of marine birds in the OSPAR and HELCOM regions were successfully completed. The results of the assessments are summarised in this report. The often-observed poor status of marine bird populations is a cause for concern and is the starting point for a Regional Action Plan for Marine Birds in the Northeast Atlantic ("RAP-bird"), being developed as part of OSPAR's North East Atlantic Environment Strategy 2030, which was discussed during the meeting. The experts were asked for their opinion on which existing conservation measures being taken by OSPAR should be improved and which new ones should be introduced by RAP-bird. The Baltic Sea Action Plan (BSAP) will also benefit from the assessment results, although BSAP was not formally addressed at the meeting. Moreover, the group reviewed the progress of seabird surveys at sea at regional level, which is susceptible to become a major data source in seabird ecology in future assessments. Information from at-sea-surveys is collated in an associated database recently moved from JNCC to the ICES Data Centre. Among the most important risk factors for marine birds is incidental bycatch in fishing gear. The meeting discussed current initiatives brought forward by ICES and the Regional Sea Conventions. However, despite the need for action, the assessment of the situation is difficult because there are too few data on bycatch from many areas and often fishing effort is not well monitored. The group also discussed the role of stranded bird surveys in the interpretation of population status. The importance of storm events on the survival of birds was highlighted. Examples from Portugal and Norway were used to demonstrate how stranding data can indicate acute risk factors such as plumage oiling and bycatch. Finally, marine birds were much more severely affected by an outbreak of the Highly Pathogenic H5N1 Avian Influenza virus (HPAI) in the summer of 2022 than ever before. This led to very high losses of individuals in some species (especially sandwich tern, northern gannet, and great skua), with both breeding adults and nestlings variously affected. At the meeting, some spectacular examples were discussed and the overall situation in Europe was reviewed.

ii Expert group information

Expert group name	Joint OSPAR/HELCOM/ICES Working Group on Seabirds (JWGBIRD))
Expert group cycle	Multiannual fixed term
Year cycle started	2020
Reporting year in cycle	2/3
Chairs	OSPAR chair: Matt Parsons, United Kingdom
	HELCOM chair: Volker Dierschke, Germany
	ICES chair: Gildas Glemarec, Denmark
Meeting venue and dates	28 November – 2 December 2022, Ostend, Belgium, 53 participants

1 OSPAR and HELCOM indicators & future development of indicators

1.1 OSPAR and HELCOM indicator assessments review: summary of results and scientific discussion

As part of the status assessments of biodiversity in the Northeast Atlantic and Baltic Sea, OSPAR and HELCOM use indicators that address various seabird issues. These indicators have been developed to a large part by JWGBIRD. They are adapted to the needs of the status assessments under the MSFD and therefore address the criteria specified there, namely bycatch mortality (D1C1), abundance (D1C2), breeding success (D1C3), distribution (D1C4), and habitat (D1C5). With the exception of distribution, indicators are now available for all criteria, partly as established common or core indicators and partly as pilot assessments. Due to the development under the umbrella of the JWGBIRD, the indicators of OSPAR and HELCOM are almost identical for each criterion. Therefore, the results for both Regional Seas Conventions (RSCs) are summarised here together. At the time of reporting, the OSPAR indicator reports and the HELCOM indicator reports have already been published online, so that details on the results can be found there. The assessment areas are depicted in Figure 1 and Figure 2.

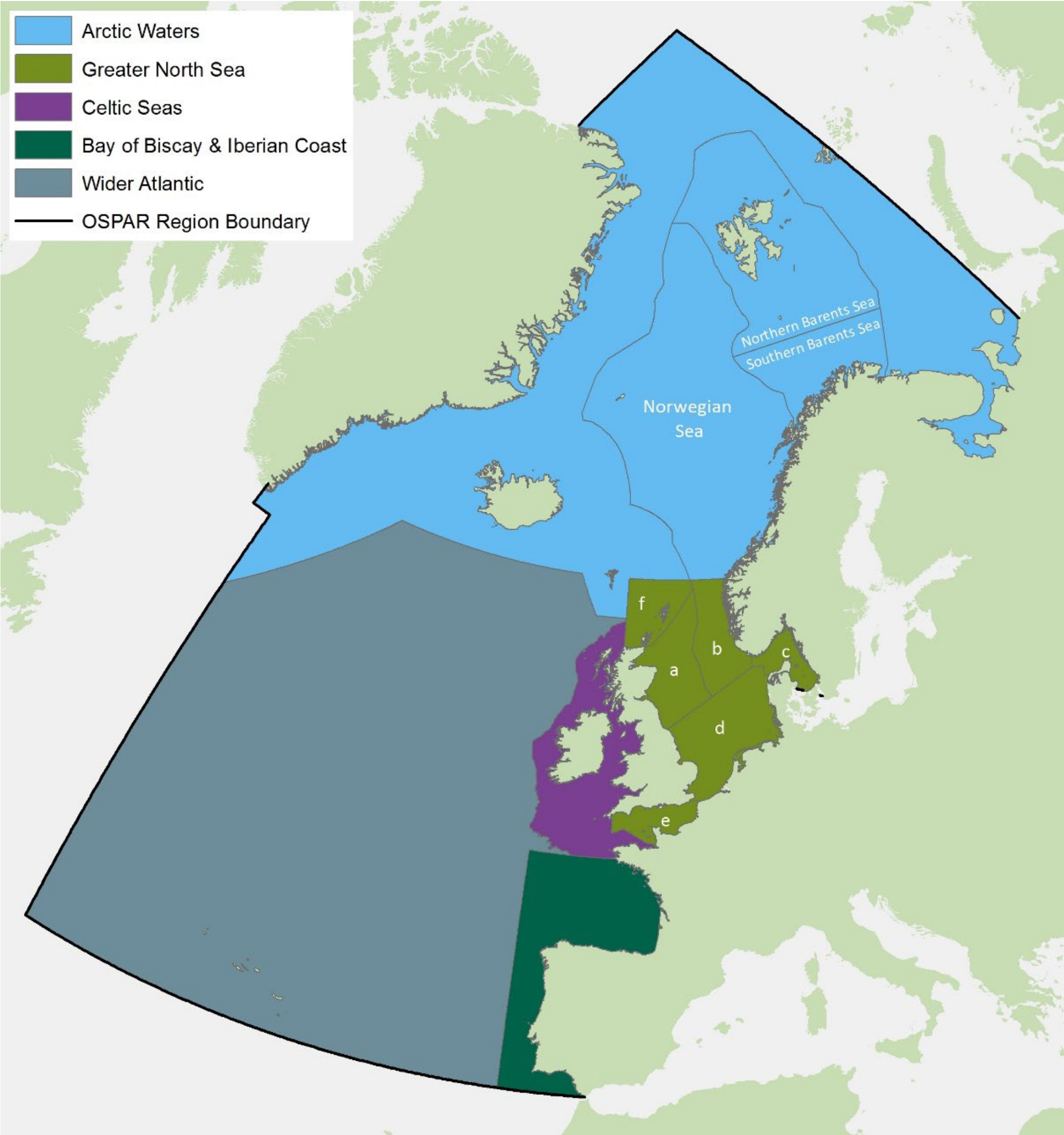

Figure 1. Marine bird assessment units in the NE Atlantic. Greater North Sea subdivisions: a) North-East coast of Britain, b) West coast of Norway, c) Skagerrak and Kattegat, d) Southern North Sea, e) English Channel, f) North coast of Scotland and the Northern Isles.

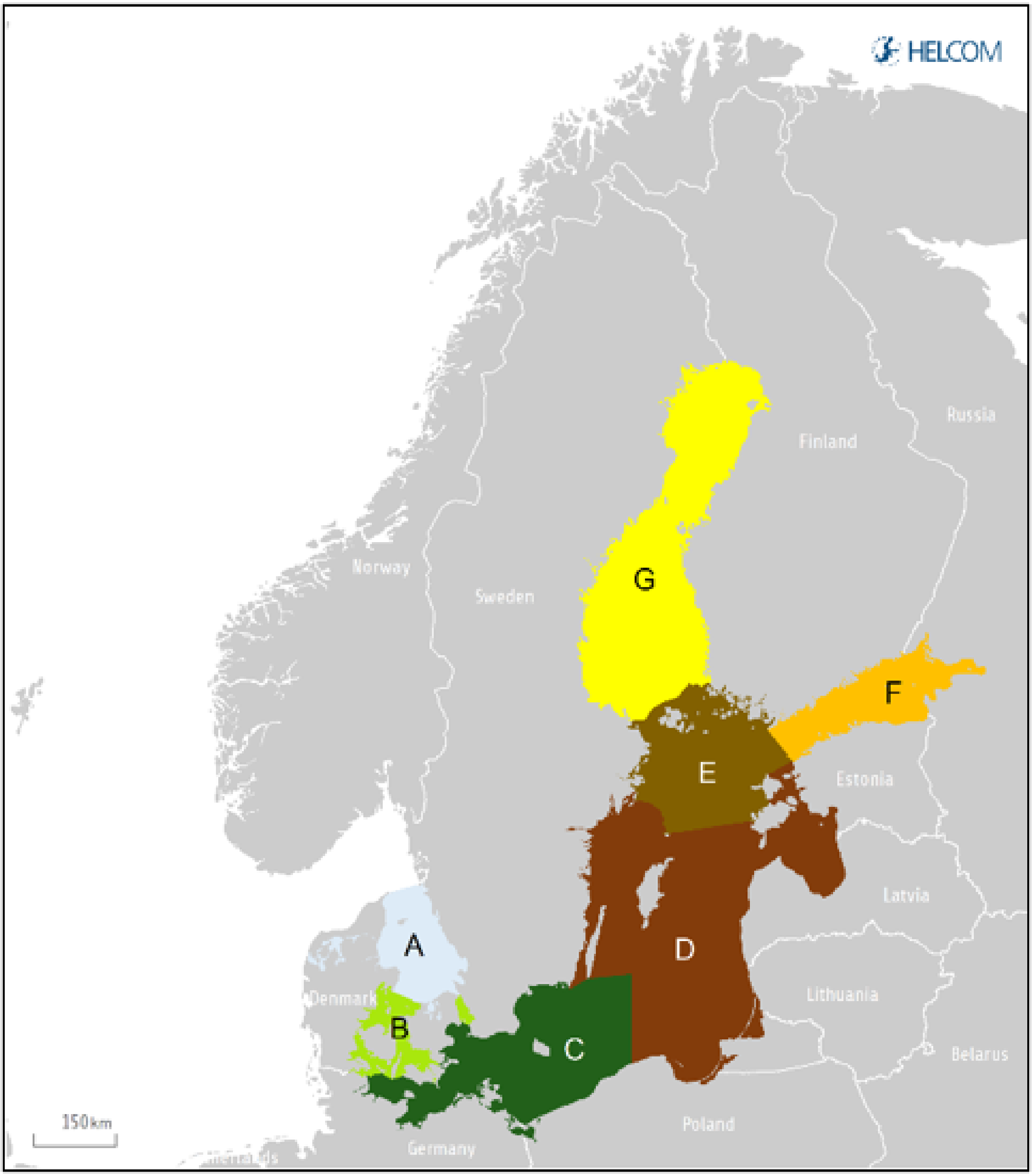

Figure 2. Waterbird assessment units in the Baltic Sea. A) Kattegat, B) Belt Group, C) Bornholm Group, D) Gotland Group, E) Åland Group, F) Gulf of Finland, G) Bothnian Group.

In the following sections the results of the indicator assessments are briefly displayed. Details of the methodology are accessible in the indicator reports themselves, and described in previous reports (e.g., ICES 2020).

Abundance (MSFD criterion D1C2)

Bird abundance is assessed in the OSPAR Common Indicator *B1 Marine bird abundance* (dealing with both breeding and non-breeding birds) and in the HELCOM Core Indicators *Abundance of waterbirds in the breeding season* and *Abundance of waterbirds in the wintering season*. They share the same method, i.e., the mean abundance of the last six years of the time series is compared against a baseline value derived from the years 1991–2000. The baseline is either the mean abundance in these years or (OSPAR only) the predicted value for 1991 if there is a significant trend in these ten years. Time series extend to 2021 (HELCOM) or any year between 2016 and 2020, depending on data availability (OSPAR). A species is in good status if the abundance in the assessment period is at least 70% of the baseline value (80% in species laying only one egg per year). A species group is in good status if at least 75% of the species assessed are achieving the threshold. Breeding and non-breeding populations are assessed separately and enter the integration to species group independently. The integration from species to species-group on the level of an indicator is not part of MSFD assessments, where first species status is integrated across criteria (European Commission 2022).

In both OSPAR and HELCOM, abundance is assessed on two spatial scales. In OSPAR (Figure 1), the Regions I to V represent the higher level (but no assessment is available for Region V: the Wider Atlantic), while subdivisions are assessed in Regions I (Arctic Waters) and II (Greater North Sea). Assessments in the HELCOM indicators (Figure 2) refer to the entire Baltic Sea, but also to seven subdivisions within (merged subbasins).

The assessments are based on surveys of breeding pairs (in some cases number of breeding birds) and on land-based counts of non-breeding birds (in the Baltic Sea, only wintering birds), with the exception of an included assessment for long-tailed ducks in the offshore parts of the German Baltic Sea. A pilot assessment for seven species wintering in the southern North Sea (Belgian, Dutch, and German sections) is used for demonstration rather than entering the abundance assessment. Example results for breeding and non-breeding species are shown in Figure 3 to Figure 8.

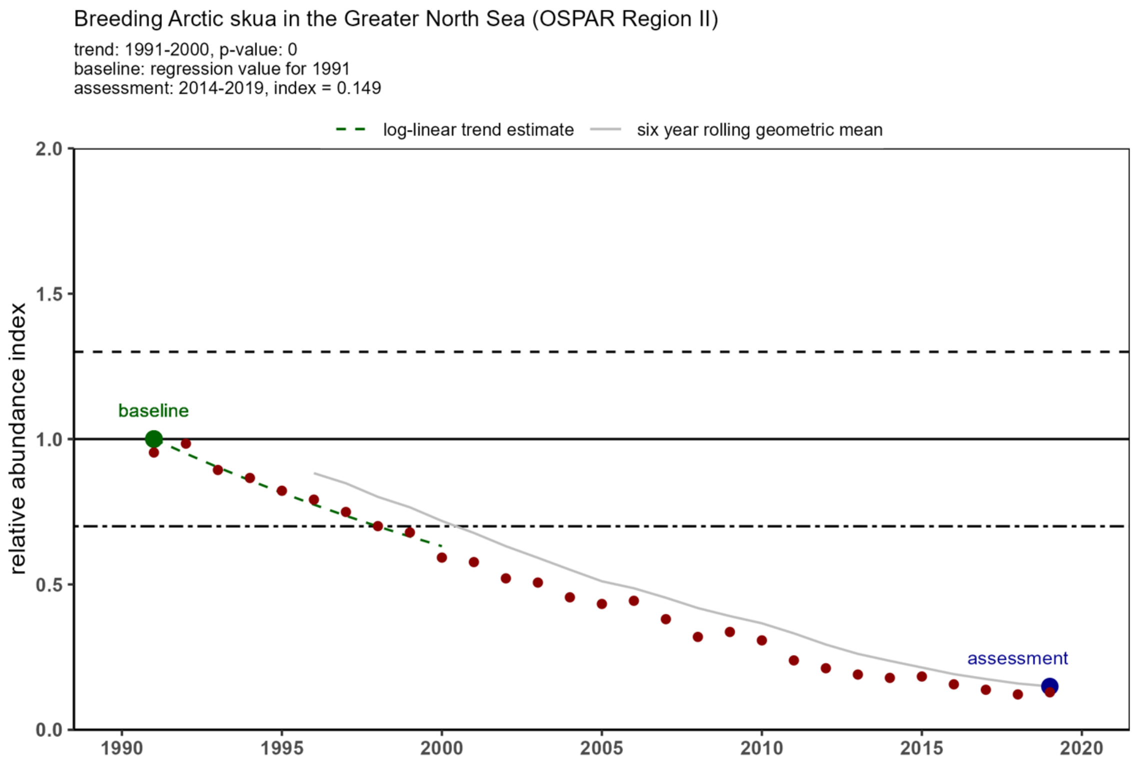

Figure 3. Temporal trend in relative abundance of the Arctic skua in the Greater North Sea obtained from breeding data. Datapoints represent yearly relative abundance values and the grey line represents the six-year rolling relative abundance geometric mean. The black line indicates the baseline, which is calculated from the first ten years of data. The black dotted line indicates the lower threshold value of 0.7 (for species that lay >1 egg); the black dashed line indicates the upper threshold value of 1.3. In this example, the value obtained from the last six years of the time series (blue dot) is below the threshold value, indicating "not good" status.

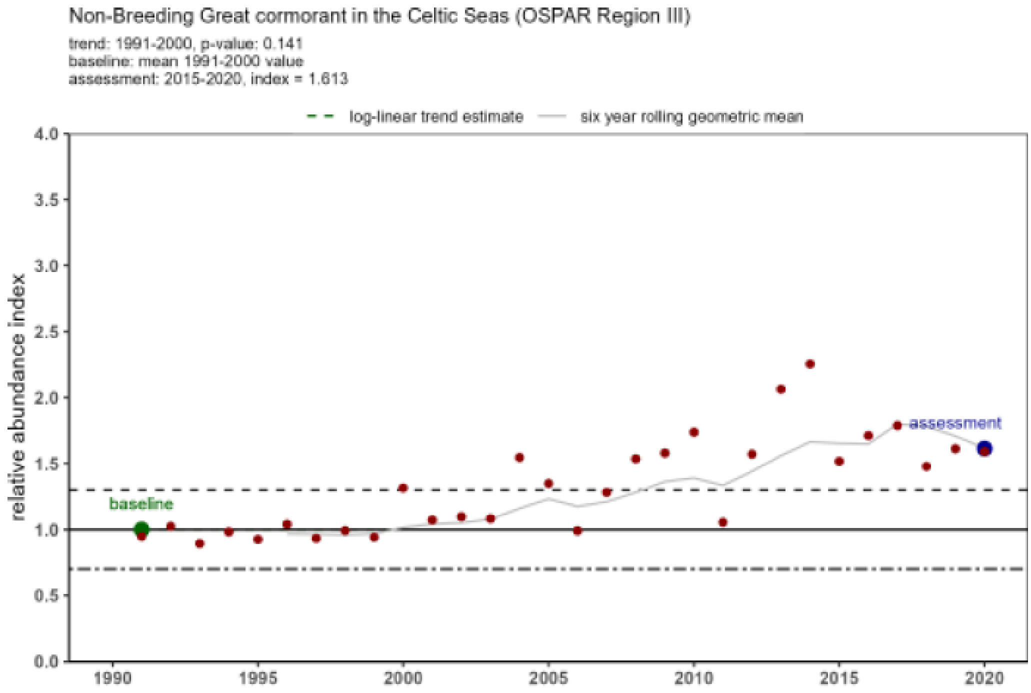

Figure 4. Temporal trend in relative abundance of the great cormorant in the Celtic Seas obtained from wintering data. As in Figure 3, but due to the lack of a significant trend 1991–2000, the mean of that period is used as baseline. In this example, the value obtained from the last six years of the time series (blue dot) is above the threshold value, indicating "good" status.

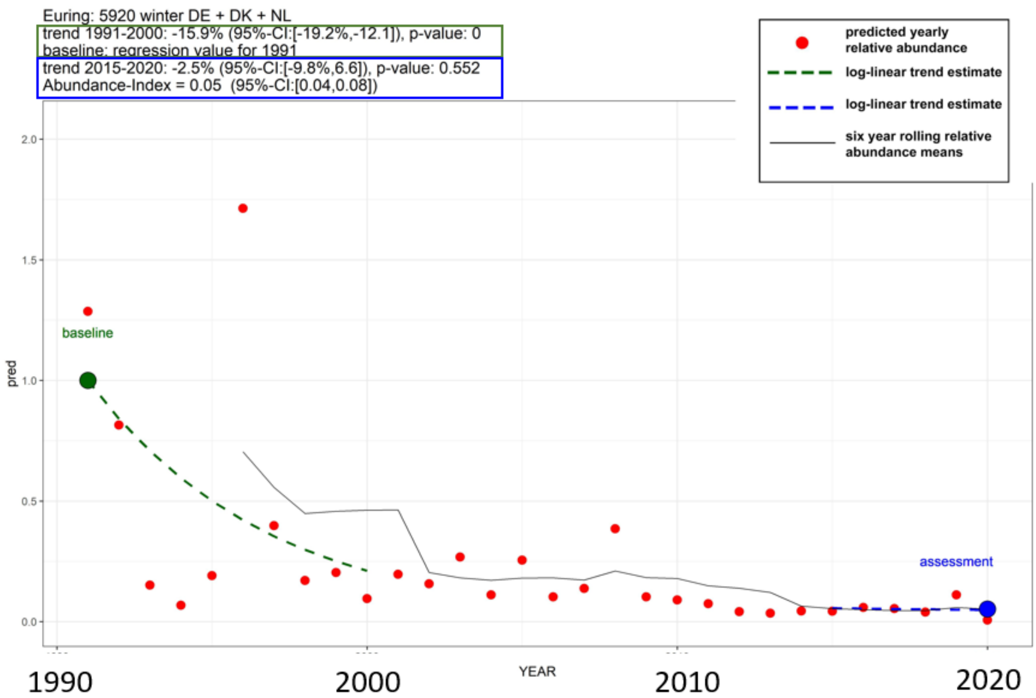

Figure 5. Annual index numbers for at-sea abundance and the respective six-year rolling mean for herring gull in the Belgian-Dutch-German North Sea in winter, 1991–2020. The threshold value is the index value of 0.7 in relation to the value predicted for 1991 from the significant regression over the years 1991–2000, which was set to 1. In this example, the value obtained from the last six years of the time series (blue dot) is below the threshold value, indicating "not good" status.

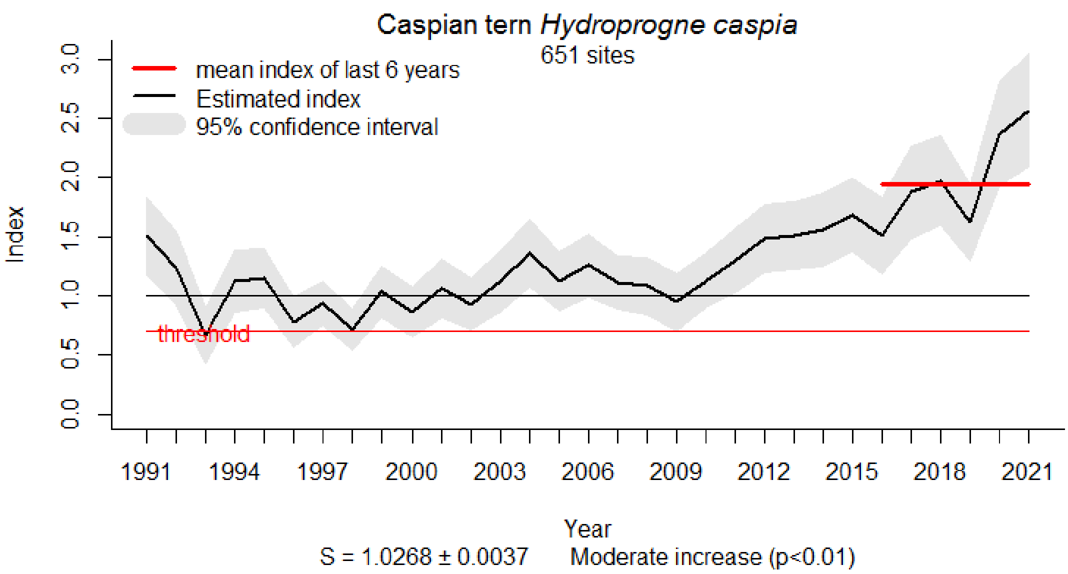

Figure 6. Temporal trend in relative abundance of the Caspian tern in the Baltic Sea obtained from breeding data. The thick black line represents yearly relative abundance values. The horizontal grey line indicates the baseline which is calculated as the geometric mean of the first ten years of data. The red line indicates the lower threshold value of 0.7 (for species that lay >1 egg). In this example, the geometric mean of the last six years of the time series (thick red line) is above the threshold value, indicating "good" status.

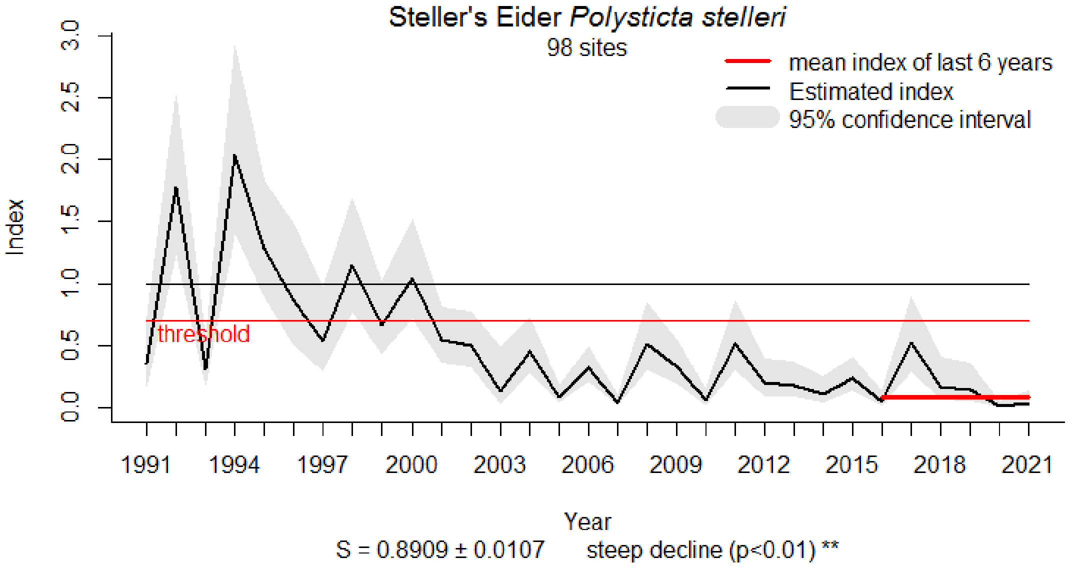

Figure 7. Temporal trend in relative abundance of the Steller's eider in the Baltic Sea obtained from wintering data. As Figure 6. In this example, the geometric mean of the last six years of the time series (thick red line) is below the threshold value, indicating "not good" status.

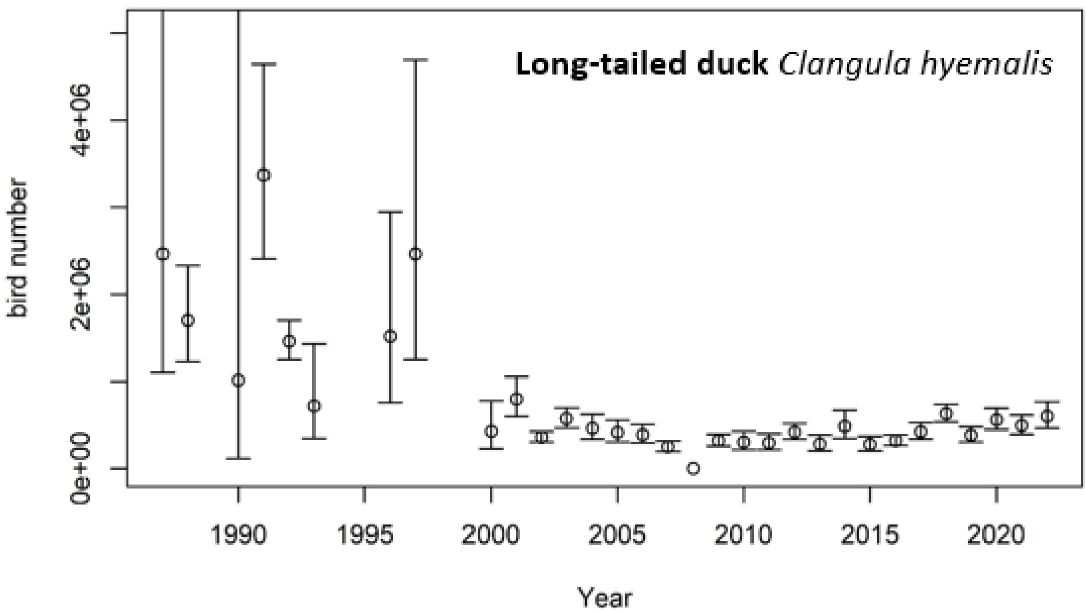

Figure 8. Annual abundance estimates and 95% confidence intervals for the long-tailed duck wintering in the German section of the Baltic Sea (Bornholm Group). The geometric mean of the period 1986–1997 (1 532 179 birds) is used as the baseline. In the assessment period 2016–2021 the geometric mean is 491,957 birds, which is 32% of the baseline value (and thus below the threshold of 70%), indicating "not good" status.

Applying the threshold of 75% of species in good status for treating a species group in good status (in line with the guidance for assessing the status of species groups by European Commission 2022), the abundance assessments indicate that most species groups are in "not good" status across most of the regions (Table 1). Good status is only achieved by breeding surface feeders in the Bay of Biscay and Iberian Coast and in the Baltic Sea, by water column feeders in the Greater North Sea, the Baltic Sea (both breeding and non-breeding birds), and the Celtic Seas (breeding birds only), by non-breeding wading feeders in the Baltic Sea (only represented by Eurasian teal), and by grazing feeders in nearly all assessments except for wintering grazers in the Baltic Sea. “Not good” status is observed in most assessments for surface feeders and wading feeders, and in all assessments of benthic feeders. Across all species groups, the 75% threshold is only achieved by breeding birds in the Baltic Sea, and in the Bay of Biscay and Iberian coast, the latter being based on only eight species assessments of surface feeders.

Table 1. Percentage of species assessed that had a relative abundance above the threshold values in each functional group. Calculations are based on the whole set of species assessed within each region, thus including species observed in different subdivisions. Number in parenthesis is the number of species in each grouping. No assessments are available for the Wider Atlantic.

	Arctic Waters		Greater North Sea		Celtic Seas		Bay of Biscay and Iberian Coast		Baltic Sea	
Functional group	**bree-ding**	**non-bree-ding**	**bree-ding**	**non-bree-ding**	**bree-ding**	**non-bree-ding**	**bree-ding**	**non-bree-ding**	**bree-ding**	**non-bree-ding**
Surface feeders	67% (6)	67% (3)	36% (14)	60% (5)	58% (12)		75% (8)		90% (10)	67% (3)
Water column feeders	50% (8)	25% (4)	86% (7)	75% (4)	100% (6)	33% (3)			100% (7)	100% (9)
Benthic feeders		50% (4)	0% (1)	33% (3)		0% (2)			25% (4)	33% (9)
Wading feeders			40% (5)	63% (24)		47% (17)			67% (6)	100% (1)
Grazing feeders		100% (1)	100% (1)	100% (5)		80% (5)			100% (3)	71% (7)
Total	**57% (14)**	**50% (12)**	**50% (28%)**	**66% (41)**	**72% (18)**	**48% (27)**	**75% (8)**		**80% (30)**	**69% (29)**
Overall	**54% (26)**		**59% (69)**		**58% (45)**		**75% (8)**		**74% (59)**	

Marine bird abundance data as used for the indicators are available from at least year 1991 onwards. Although decreases, stability, and increases can be observed across the numerous species dealt with in the abundance indicators, there are also more general trends. Figure 9 to Figure 11 show the percentages of breeding and non-breeding species achieving the threshold based on six-year running means (OSPAR Regions) or single-year values. It is very obvious that there are severe overall declines in marine birds in all assessed OSPAR Regions, with breeding and non-breeding birds in Arctic Waters, Greater North Sea, and Celtic Seas (mostly far) below the multi-species threshold value of 75% of species indicating “good” status. In the Bay of Biscay and Iberian Coast, the percentage of species is exactly at the threshold value, but in that region the assessment is only based on a small fraction of all marine bird species occurring there. In the Baltic Sea, the proportion of breeding species in good status is declining, but still above the threshold value of 75%. A lot of fluctuation is seen in the wintering waterbirds, perhaps reflecting environmental conditions in winter (including population declines after severe winters).

Comparisons between assessments are less meaningful because they are only a few years apart. Table 2 addresses such comparisons for species groups and regions. For the OSPAR Maritime Area, the Quality Status Report (QSR) 2010 did not assess the status of marine birds. Therefore, the analyses done for QSR 2023 were used for a retrospective assessment for the year 2010. In the Baltic Sea, waterbird results from the holistic assessments HOLAS 2 and HOLAS 3 can be compared. In most species groups and regions, the percentages of species achieving the threshold and the resulting status of the species groups did not change much, but it is worth highlighting three cases of strong decline – water column feeders in the Arctic Waters and wading feeders in both the Greater North Sea and the Celtic Seas (Table 2).

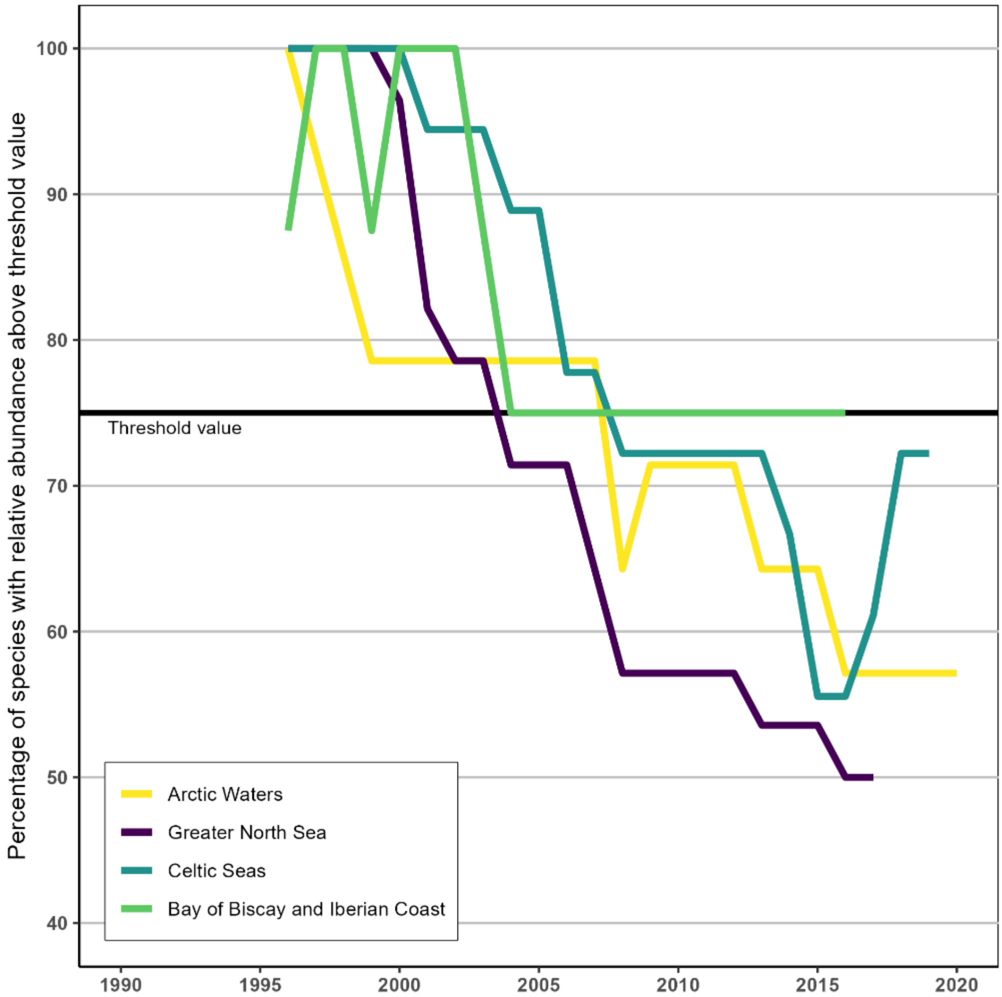

Figure 9. Change in the annual proportion of all species achieving threshold values for the relative breeding abundance of marine birds in the Norwegian part of the Arctic Waters (14 species), the Greater North Sea (28 species), the Celtic Seas (18 species) and the Bay of Biscay and Iberian Coast (eight species). The black line denotes the multi-species threshold value of 75%. Values shown are six-year running means.

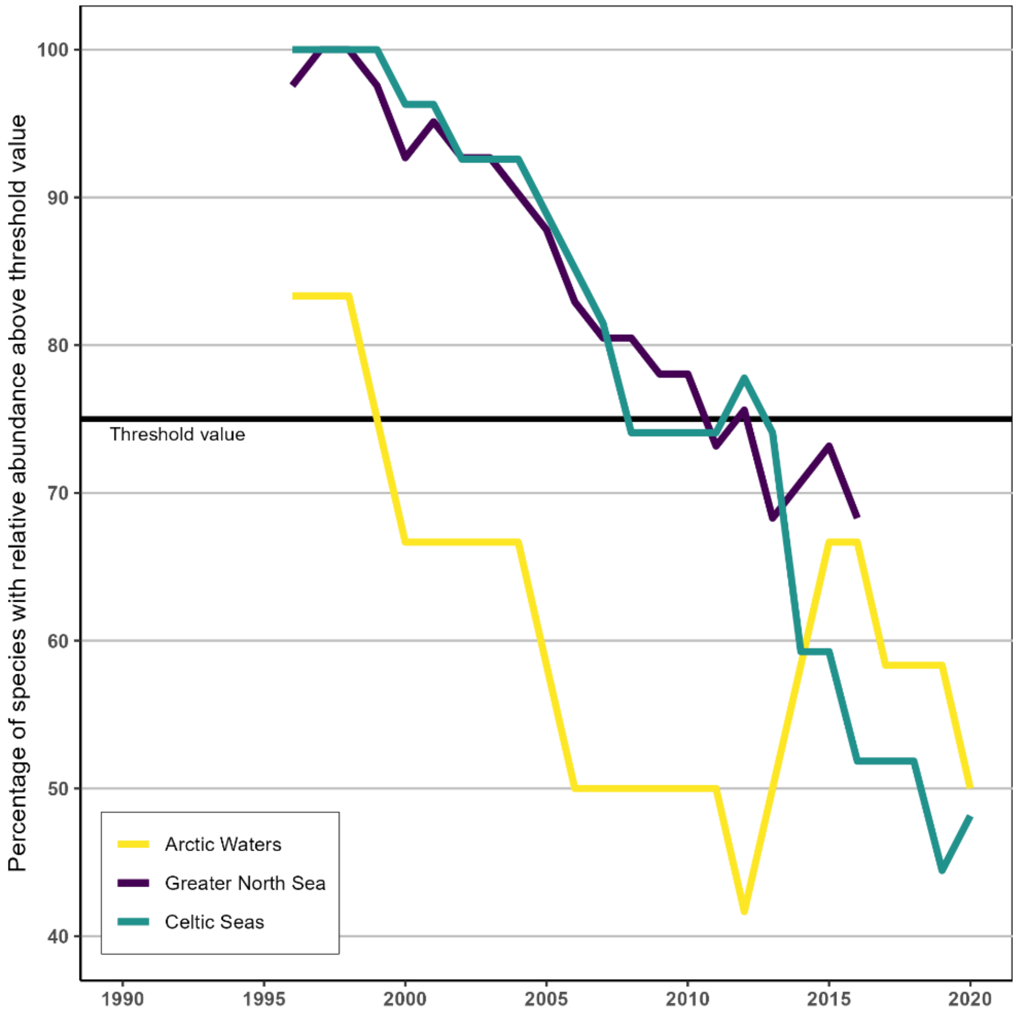

Figure 10. Change in the annual proportion of all species exceeding threshold values for relative non-breeding abundance of marine birds in the Norwegian part of the Arctic Waters (12 species), the Greater North Sea (41 species) and the Celtic Seas (27 species). The black line denotes the multi-species threshold value of 75%.

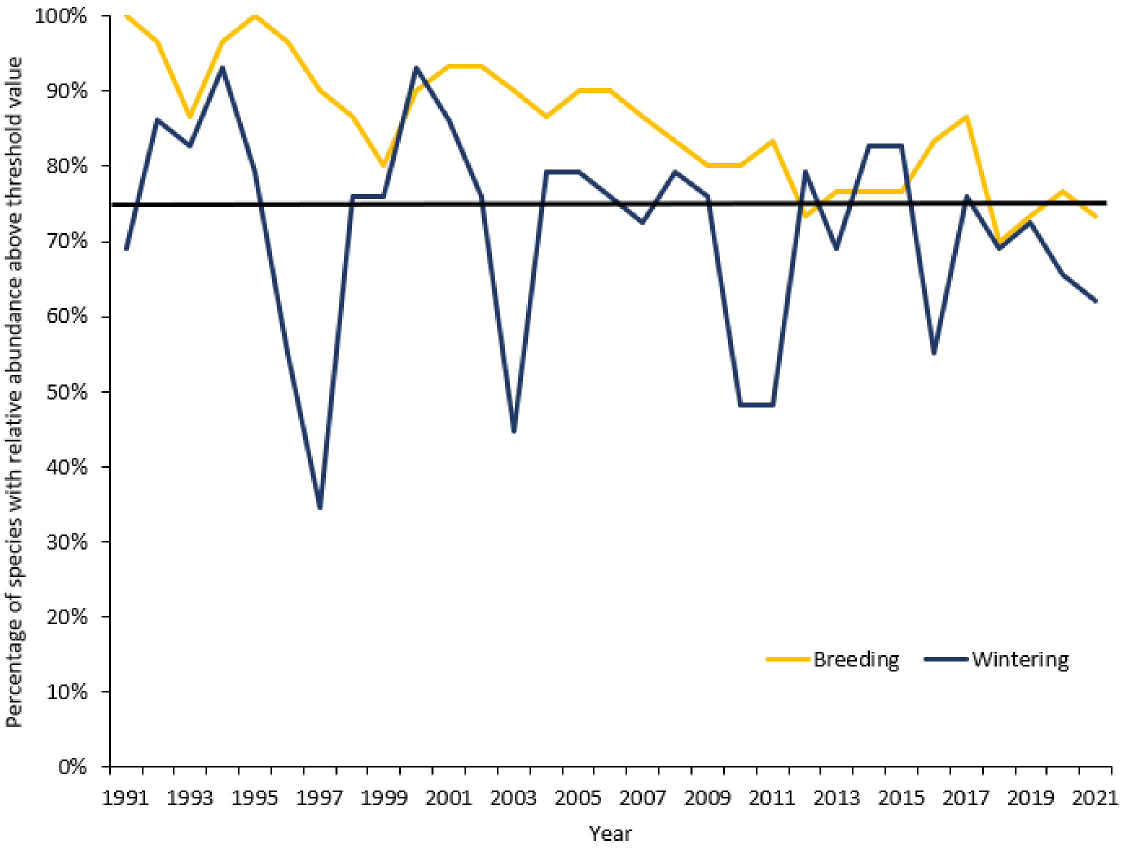

Figure 11. Change in the annual proportion of all species exceeding threshold values for relative breeding abundance (30 species) and non-breeding abundance (29 species) of waterbirds in the Baltic Sea. The black line denotes the multi-species threshold value of 75%. Values shown are single-year values.

Table 2. Percentages of marine bird species in good status (achieving the relative abundance threshold value) and the resulting status of species groups (green: achieving the 75% threshold value, red: not achieving this threshold value) in OSPAR Regions and the Baltic Sea. For OSPAR, the QSR 2023 assessments are compared to a retrospective assessment for 2010. For the Baltic Sea, assessments for HOLAS 2 and HOLAS 3 are compared. The trend column shows whether the proportion of species in good status has increased, decreased, or remained stable.

Species group Region	**last year of assessment period**	**percentage of species in good status**	**last year of assessment period**	**percentage of species in good status**	**trend**
surface feeders					
Arctic Waters	2010	56% (9)	2020	67% (9)	▲
Greater North Sea	2010	47% (19)	2020	42% (19)	▼
Celtic Seas	2010	58% (12)	2019	58% (12)	=
Bay of Biscay and Iberian Coast	2010	71% (7)	2016	75% (8)	▲
Baltic Sea	2016	93% (14)	2021	85% (13)	▼
water column feeders					
Arctic Waters	2010	67% (12)	2020	42% (12)	▼
Greater North Sea	2010	82% (11)	2020	82% (11)	=
Celtic Seas	2010	89% (9)	2020	78% (9)	▼
Baltic Sea	2016	100% (12)	2021	100% (16)	=
benthic feeders					
Arctic Waters	2010	50% (4)	2020	50% (4)	=
Greater North Sea	2010	50% (4)	2020	25% (4)	▼
Celtic Seas	2010	50% (2)	2020	0% (2)	▼
Baltic Sea	2016	67% (9)	2021	31% (13)	▼
wading feeders					
Greater North Sea	2010	76% (29)	2020	59% (29)	▼
Celtic Seas	2010	71% (17)	2020	47% (17)	▼
Baltic Sea	2016	57% (7)	2021	71% (7)	▲
grazing feeders					
Arctic Waters	2010	100% (1)	2020	100% (1)	=
Greater North Sea	2010	100% (6)	2020	100% (6)	=
Celtic Seas	2010	80% (5)	2020	80% (5)	=
Baltic Sea	2016	78% (9)	2021	80% (10)	▲

Breeding productivity (MSFD criterion D1C3)

Following a completely new development in JWGBIRD since 2018, breeding productivity is assessed in the OSPAR Common Indicator *B3 Marine bird breeding productivity*, replacing the indicator *Marine bird breeding success/failure*. The methods of the B3 indicator were adopted by the HELCOM candidate indicator *Breeding success of waterbirds*, which produced a pilot assessment for common guillemots breeding near Gotland (see below).

The indicator investigates the impact of observed breeding productivity on population growth rates, projected into the future (three times generation length, variable among species). The threshold for good status is set at the species-specific growth rate which would cause a population decline of 30% over the next three generation, assuming an average breeding productivity as observed in the last six years of the time series, but also using other demographic data (including mortality rates) from literature and trends in population size from the abundance indicator. The threshold value is based on the IUCN red list criterion that a population is "Vulnerable" if the decline in population size exceeds 30% over three generations (IUCN 2012). The methods used in this indicator were submitted as a scientific paper (Frederiksen et al. 2023).

Using the kittiwake as an example, Figure 12 and Figure 13 show the results that can be achieved with the indicator: the annual and six-year mean levels of productivity and derived from this the expected population growth rate.

Across all species groups, breeding productivity is not sufficient in the Arctic Waters and the Greater North Sea, though better status is observed in surface feeders in Arctic Waters and water column feeders in the Greater North Sea (Table 3). Current breeding productivity is in many species not enough to achieve the indicator threshold but below levels equivalent to the IUCN category Endangered (>50% decline over three generations) or even falling into the category Critically Endangered (>80% decline over three generations). The latter species include black-legged kittiwake in the Arctic Waters, northern fulmar in the Celtic Seas, and Arctic skua, herring gull, common gull, black-headed gull, common tern, Arctic tern, and Eurasian oystercatcher in the Greater North Sea. The few assessments in the Bay of Biscay and Iberian Coast (common tern, sandwich tern) and the Baltic Sea (common guillemot) indicated good status, i.e., no strong declines are expected from the current productivity levels.

Over the past 20-30 years, productivity has been constantly too low to maintain population size for water column feeders in the Arctic Waters and for surface feeders in the Greater North Sea and the Celtic Seas (Figure 14). The situation is relatively good for surface feeders in the Arctic Waters and for water column feeders in the Greater North Sea and the Celtic Seas, though there are many years where the threshold for species groups was not achieved. The strongest decline in the percentage of species producing well enough is seen in surface feeders in the Greater North Sea.

In the Baltic Sea pilot assessment, productivity of common guillemots breeding at Stora Karlsö has been above the threshold level throughout the period 2010–2021 (Figure 15). Model output indicates that with the mean levels of survival inferred for the study period, a breeding productivity success of only 0.21 fledged chicks/pair would be required to hold the population stable, while actually an average of 0.71 fledged chicks/pair were observed in the assessment period. This population benefits from very high survival rates of young and adult birds due to reduced bycatch in fishing gear, the ban on hunting, fewer oil spills, and decreasing concentrations of contaminants (Olsson & Hentati-Sundberg 2017).

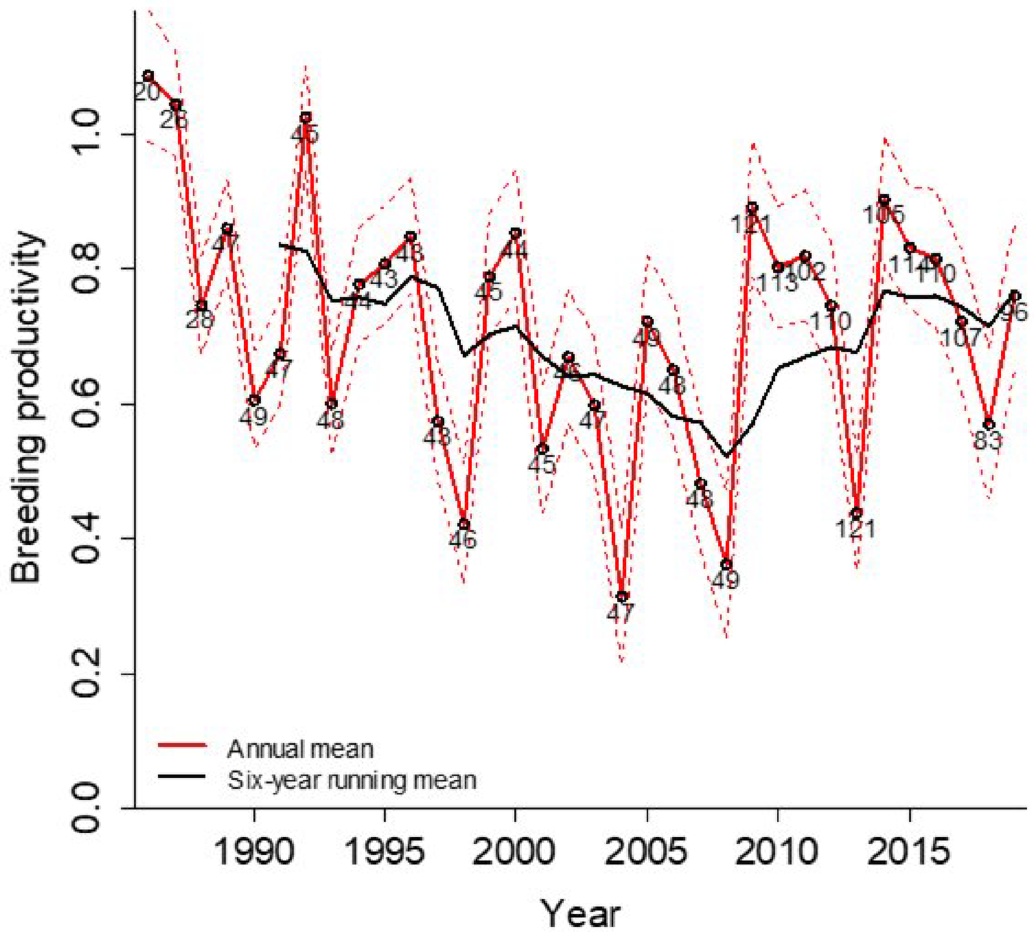

Figure 12. Mean annual breeding productivity (fledged chicks/pair) of black-legged kittiwake in the Greater North Sea (1986–2019). The solid red line shows the estimated marginal means for each year (dashed lines: 95% confidence limits). Labels below the data points show the number of survey plots with available data for each year. The solid black line shows the retrospective six-year running mean, with the most recent value (mean of 2014–2019) being 0.767 fledged chicks/pair.

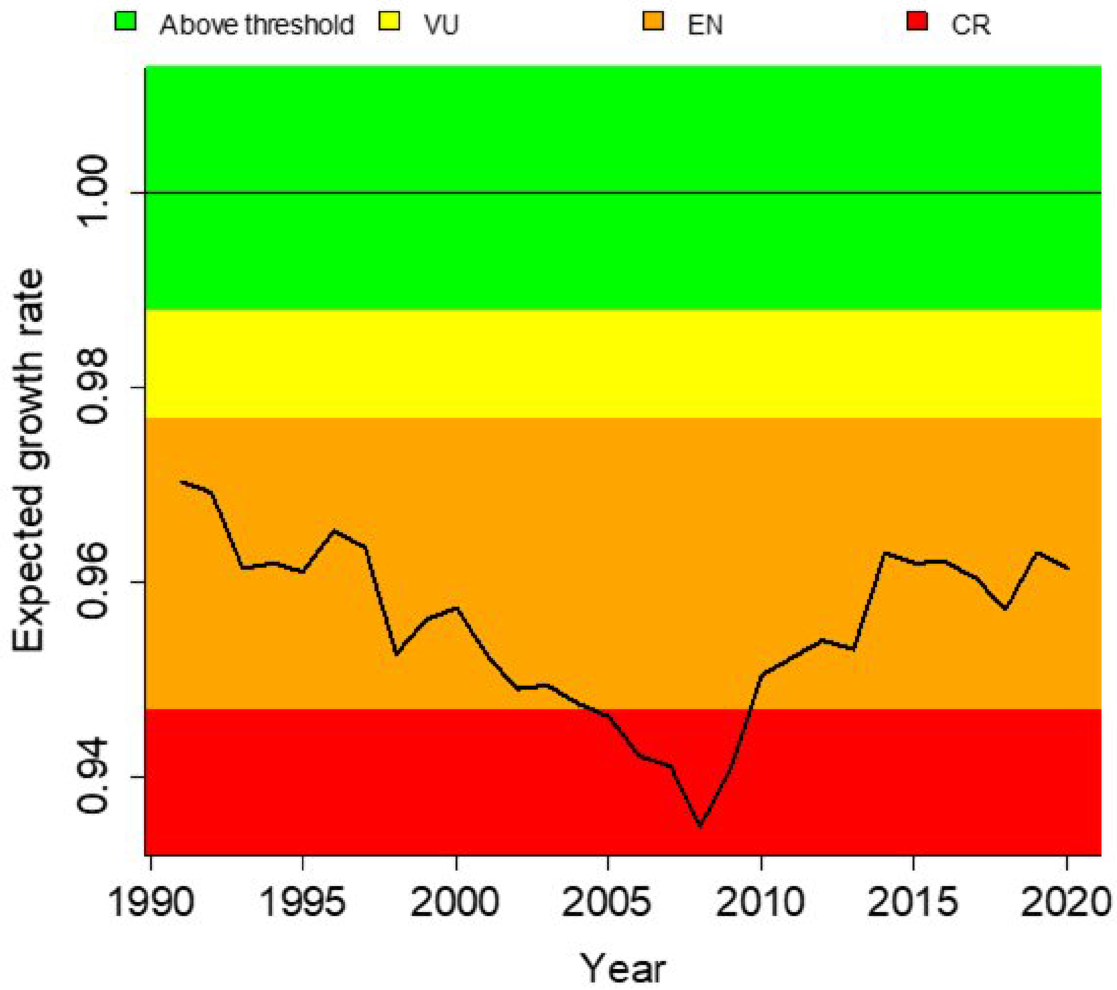

Figure 13. Expected annual population growth rate of black-legged kittiwake in the Greater North Sea 1991–2020 (black line). The colour-coded background shows the threshold values; values in the green zone are above the threshold, whereas values in the other zones are below. For illustration, the figure also shows a breakdown for the red list categories of Vulnerable (VU), Endangered (EN) and Critically Endangered (CR) following IUCN (2012). Here, the assessment value (the value for 2019 on the black line) is 0.963, which is well below the threshold value of 0.988. This corresponds to an expected decline of 3.7% per year, or 67% over three generations (29.5 years for black-legged kittiwake). Current levels (six-year retrospective mean) of breeding productivity in black-legged kittiwakes in the Greater North Sea are thus too low to prevent the population from declining towards extinction and correspond to the red list category Endangered. Model output indicates that with the mean levels of survival inferred for the study period, a breeding productivity of 1.15 fledged chicks/pair would be required to stabilise the population.

Figure 14. Change over time in the proportion of marine bird species achieving the threshold value (≥ 30% expected decline over 3 generations), in three OSPAR Regions. The maximum number of species included per year in each group shown in brackets in the figure legend. The number of species varied each year depending on data availability.

Table 3. The proportion of all marine bird species achieving the threshold that breeding productivity is sufficient to avoid population declines, per region and species group. The assessment refers to the period 2014–2019, except for the Bay of Biscay and Iberian Coast (2011–2016) and the Baltic Sea (2010–2021). Cells are highlighted red if <75% and green if ≥75% of species are achieving the threshold.

Functional group	Arctic Waters	Greater North Sea	Celtic Seas	Bay of Biscay and Iberian Coast	Baltic Sea
Surface feeders	80% (5)	21% (14)	58% (12)	100% (2)	
Water column feeders	43% (7)	83% (6)	60% (5)		100% (1)
Wading feeders		33% (3)			
All	**58% (12)**	**39% (23)**	**59% (17)**	**100% (2)**	**100% (1)**

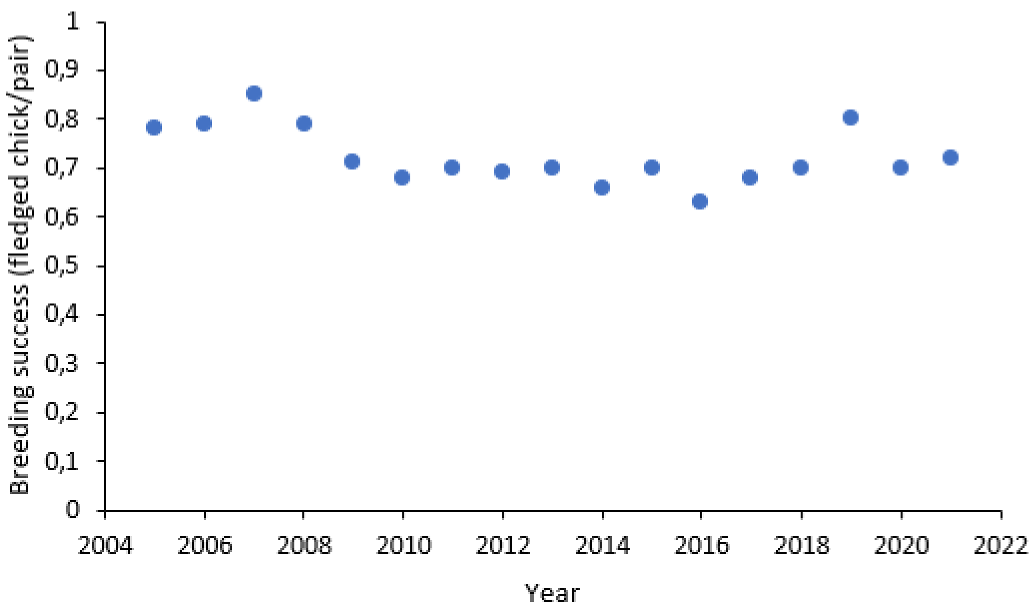

Figure 15. Annual breeding success of common guillemot at Stora Karlsö in the Baltic Sea, 2010–2021. Only 0.21 fledged chicks/pair would be required to hold the population size stable.

Bycatch (MSFD criterion D1C1)

Following the recommendations of the *OSPAR-HELCOM workshop to examine possibilities for developing indicators for incidental by-catch of birds and marine mammals* (OSPAR & HELCOM 2019), indicators addressing the bycatch of marine birds in fishing gear were developed in both RSCs. The candidate indicator *B5 Marine bird bycatch* (OSPAR) and the core indicator *Number of drowned mammals and waterbirds in fishing gear* (HELCOM) use the same concept (Figure 16). In Assessment Method 1, bird bycatch rates are combined with bird demographic data and fishing effort data to investigate whether bycatch mortality "threatens the long-term viability of populations, using population modelling (e.g., a Population Viability Analysis, PVA).". If data are insufficient to conduct a PVA, then two fallback methods are proposed to assess this indicator for species included on the *OSPAR List of Threatened and / or Declining Species and Habitats* or on the *HELCOM Red List of Baltic Sea species in danger of becoming extinct* (HELCOM 2013). Assessment Method 2 compares the estimated number of birds bycaught annually with the number of birds representing 1% of annual adult mortality. If even this is impossible due to lack of data, then Assessment Method 3 investigates whether there is any bycatch occurring in these threatened species – either from reported bycatch or from the spatio-temporal overlap of marine birds and fisheries known to cause bycatch in the respective species.

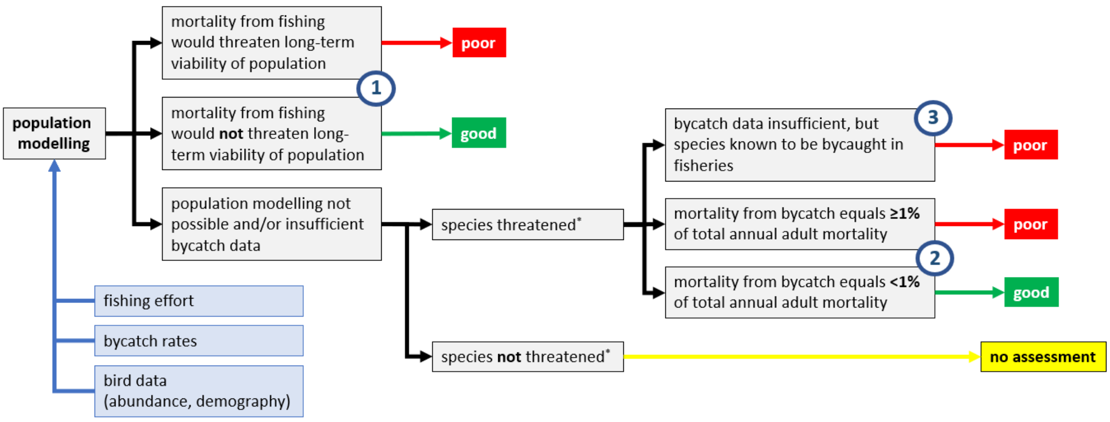

Figure 16. Schematic illustration of the evaluation of bird bycatch in fishing gear OSPAR and HELCOM assessments. Numbers denote the sequence of applicable Evaluation Methods 1, 2 and 3, depending on data availability. * Threatened species are those listed as "threatened and declining" by OSPAR and classified as vulnerable, endangered, or critically endangered by HELCOM, respectively.

Though the general applicability of Assessment Method 1 was shown on population level for greater scaup in the Baltic Sea (Marchowski et al. 2020), the wide-ranging lack of data on both bird bycatch and fishing effort prevented the use of this method in the indicator assessments. The only exception is the Cory's shearwater population in the Berlengas Archipleago off the Portuguese mainland coast, where a PVA showed that a 10% increase in mortality due to bycatch would lead to a population decline of 33% over three generations time (see also Oliveira 2021). As this means an annual bycatch of only 8-10 birds (which is currently exceeded), this population was assessed as being in "not good" status. The same method was applied to the common guillemot in the Celtic Seas, but it proved to be difficult to assess bycatch mortality at population level since at least three distinct populations of that species occur in that area (Oliveira 2021).

Assessment Method 2 could be used in Polish waters (in two assessment units) with the help of bird count and bycatch data. The four seaduck species assessed were found to be in poor status because the number of bycaught birds was much higher than 1% of annual adult mortality. Further, two species from the *OSPAR List of Threatened and / or Declining Species and Habitats* were assessed as being in good status in the OSPAR Maritime Area, because no bycatch had been reported (Table 4).

Assessment Method 3 was applied to some HELCOM red-listed species based on reported bycatch or the concurrent occurrence of birds and bycatch-causing fisheries (Table 4). The latter was also done for Steller's eider in northern Norway. All these assessments failed to achieve the threshold for good status (Table 4).

Table 4. Bycatch species assessments in five OSPAR Regions and the Baltic Sea. Numbers denote the Assessment Methods 1, 2 and 3. For the Baltic Sea letters indicate the subdivision covered (A Kattegat, B Belt Group, C Bornholm Group, D Gotland Group, see Figure 2). Red colour indicates failure and green colour achievement of threshold for good status).

Species	Arctic Waters	Greater North Sea	Celtic Seas	Bay of Biscay and Iberian Coast	Wider Atlantic	Baltic Sea
Greater scaup						2^{CD}, 3^{CD}
Common eider						3^{ABC}
Steller's eider	3					
Velvet scoter						2^{CD}, 3^{BCD}
Common scoter						2^{CD}, 3^{BCD}
Long-tailed duck						2^{CD}, 3^{CD}
Red-breasted merganser						3^{CD}
Red-necked grebe						3^{CD}
Slavonian grebe						3^{C}
Roseate tern		2	2		2	
Black guillemot						3^{C}
Red-throated diver						3^{CD}
Black-throated diver						3^{BCD}
Cory's shearwater				1		
Barolo shearwater					2	

Habitat quality (MSFD criterion D1C5)

The newly developed indicators B7 Marine bird habitat quality (OSPAR) and Waterbird habitat quality (HELCOM) assess the disturbance of marine birds from human activities by comparing the observed quantitative distribution with a model distribution from which the effects of the activities are removed. This allows one to identify, cumulatively, where and by which activity the birds are disturbed (Mercker et al. 2021) and therefore can help to plan targeted measures. The indicator was applied to six marine bird species in the southern North Sea sections of Belgium, the Netherlands and Germany, but did not enter the integrated assessment of OSPAR's marine bird thematic assessment. In HELCOM, the indicator was not adopted for HOLAS 3, but results from a pilot study (Mercker et al. 2021) are used descriptively in the bird thematic assessment.

Applying integrative regression techniques (namely species-distribution generalized additive models, sdGAMs, for details see Mercker et al. 2021) to bird data from offshore surveys and considering environmental variables (water depth, distance to coast, chlorophyll A concentration, sea surface temperature), the effects of bottom trawling fisheries, offshore wind farms and shipping on bird distribution were analysed. Negative effects (avoidance) were found for offshore wind farms in three species (red-throated diver, common guillemot, black-legged kittiwake) and for shipping in four species (red-throated diver, northern gannet, common guillemot, great black-backed gull), while positive effects (attraction) of bottom-trawling were indicated for five of the six species (Table 5). The assessment value D_{global}, which combines the effects of the three activities and stands for the percentage of disturbed individuals in the population of the assessment area, is highest in red-throated divers (41%), relatively low in the three gull species (0-5%) and intermediate in northern gannet (20%) and common guillemot (10%). The indicator does not have an agreed threshold yet; therefore, it cannot be used in an integrated assessment.

The pilot assessment for long-tailed duck and herring gull in the German section of the Baltic Sea showed significant avoidance of areas used for offshore wind farms (herring gull), shipping (long-tailed duck), and bottom-trawling (long-tailed duck), while herring gulls were attracted to bottom-trawling areas. The cumulative disturbance as expressed by the D_{global} value is 6% in the long-tailed duck and 1% in the herring gull (Mercker et al. 2021).

Avoidance and attraction found for the species in the indicators is largely in line with studies addressing avoidance of offshore wind farms and shipping lanes and the attraction of seabirds using discards from fishing vessels (e.g., Garthe & Hüppop 1994, Schwemmer et al. 2011, Vanermen et al. 2019).

Table 5. Habitat quality in terms of disturbance from human activities for six marine bird species in the southern North Sea. The value D_{global} represents the proportion of birds of a species disturbed by human activities. Positive (+) and negative (-) effects of the three activities are shown (significant cases printed in colour); in empty cells the respective covariate was not selected during model selection and thus not included in the model.

Species	D_{global} [C.I.]	Offshore wind farms	Shipping	Bottom-trawling fishery
red-throated diver	41% [22%, 59%]	**- (p=0,000)**	**- (p=0,000)**	**+ (p=0,007)**
northern gannet	20% [1%, 53%]	+ (p=0,152)	**- (p=0,000)**	**+ (p=0,004)**
common guillemot	10% [2%, 27%]	**- (p=0,005)**	**- (p=0,019)**	- (p=0,059)
black-legged kittiwake	1% [0%, 8%]	**- (p=0,000)**		**+ (p=0,000)**
great black-backed gull	5% [0%, 26%]		**- (p=0,000)**	**+ (p=0,000)**
herring gull	0% [0%, 0%]	+ (p=0,362)		**+ (p=0,000)**

1.2 Future development of indicator work

Based on the current indicator results, the future of the indicators or the status assessment as a whole was discussed. Although the existing indicators were applied successfully and some have already been used for the second time for the regional status assessments, there is room for improvement in various respects. The methods used so far in the indicators would be more validated if they were published in a peer-reviewed journal. This is already the case for the habitat indicator (Mercker et al. 2021) or is imminent for the breeding success indicator (Frederiksen et al. 2023).

It has become apparent that data aggregation by means of a data call is not optimal or even efficient, as some data were submitted very late, or were not usable for the indicators. It is suggested to improve the aggregation of data, for example by making example files available. The aim should be to automate the data flows so that data calls are no longer necessary. An open question is: how often the status assessments should take place? As the law currently stands, an assessment every 6 years is the minimum to meet the requirements by MSFD, but more frequently would be possible and perhaps justified.

In some cases, the thresholds cannot be derived scientifically, but are rather arbitrary determinations. In the future, more uniformity could be achieved if all bird indicators were aligned with the threshold value for the breeding success indicator, which represents a more sophisticated method of assessment. On the other hand, it should be examined to what extent the threshold values can be oriented towards other relevant conventions (e.g., AEWA). Confidence intervals should also be taken more into account in order to be able to represent the probability of threshold values being reached.

So far, missing assessments have been dealt with inconsistently. According to the new GES Guidance (European Commission 2022), a species group is only in good status if 75% of all species (not 75% of assessed species) are in good status. However, in some cases assessments are still not useful, e.g., because the required data cannot be collected or because some species are too rare, or their occurrences are not representative. It should therefore be examined - for regions and subregions - which species should be included in future assessments.

Finally, the question arises whether, instead of several indicators, a single indicator can be developed in which the various aspects such as mortality, reproduction, and population size are integrated, for example in the framework of an Integrated Population Model. There would be trade-offs: for example the likely requirement for more data parameters than is currently required. On the other hand, even now not all criteria required by the MSFD are covered by indicators, especially because there is no indicator for distribution (criterion D1C4) in either OSPAR or HELCOM.

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2 Interactions between seabirds and fisheries, including bycatch

Through a series of experts' presentations and focussed discussions, the working group was presented with some of the major current initiatives on seabird bycatch in HELCOM/ICES/OSPAR areas, then defined the requirements for existing and future models to evaluate the impact of seabird bycatch mortality on affected populations and finally outlined the needs for supporting ICES advisory services in the coming years.

2.1 Initiatives on seabirds within ICES

JWGBIRD integration to the ICES workflow

In line with an ecosystem approach to fisheries management, the primary role of ICES is to inform fisheries authorities with expert knowledge and to recommend the most adequate course of action based on scientific data. The work stemming from JWGBIRD is essential in order to incorporate considerations of seabird ecology, including the interactions between seabird populations and fisheries, into fisheries management decisions. JWGBIRD is notably tasked with assembling data on seabirds for the Working Group on Bycatch of Protected Species (WGBYC), which evaluates bycatch data/information from multiple sources for advisory purposes (ICES, 2022). To this end, JWGBIRD can identify and describe all potential new data sources and propose options for improving data availability and quality (e.g., through monitoring), either directly in the annual working group reports, or by answering specific requests from ICES.

At regional level, ecosystem overviews and fisheries overviews summarise all relevant knowledge on the pressures exerted on ecosystems for each ICES ecoregion. In particular, incidental captures of seabirds in fishing gears and impact of litter on seabirds are considered specifically, following inputs from *inter alia* JWGBIRD. The ICES Advisory Committee (ACOM) is then responsible for translating the scientific outputs stemming from the ICES network into advice on the sustainable use, provision of services, and protection of marine ecosystems. With regards to seabird conservation, it is therefore crucial that JWGBIRD delivers sound and timely information in order to incorporate this knowledge into ecosystem-based management advice.

Other initiatives in ICES

Direct contributions from JWGBIRD experts to the ICES network enhance the work outputs of other working groups, including but not limited to WGCATCH, WKRARE, or WKGEOSSF. Although not directly related to ICES, the four Regional Coordination Groups (RCGs) – which facilitate cooperation and coordination between countries (both European Union [EU] Member States and third countries in the same marine region) in terms of data collection and reporting – are closely interlinked with the work produced by the ICES expert network. This coordination is essential to understand and eventually act upon the decline of many seabird populations affected by anthropogenic activities (e.g., pollution, incidental captures, competition with fisheries for prey), increased mortality from diseases like avian flu, or the consequences of climate change (e.g., habitat loss, extreme weather, regime shifts).

Moreover, the Directorate-General for Maritime Affairs and Fisheries of the European Commission (DG-MARE) requires ICES to deliver annual advice on PETS bycatch in EU fisheries. A WGBYC annual data call collates and reports information on bycatch observations per metier and area and estimates the corresponding multiannual bycatch rates (as individuals/Days at Sea observed). JWGBIRD can help increase the precision of these estimates of bycatch rate for selected species/areas of particular bycatch concern by sharing its expertise with WGBYC and recommending suitable mitigation measures, where appropriate. The group agreed to establish a short list of species of priority concern intersessionally and to communicate that list to WGBYC ahead of its annual meeting. The definition of the criteria to use for prioritisation was left to the judgement of JWGBIRD.

Support ICES advisory service

To answer a request from the Directorate-General for Environment of the European Commission (DG-ENV) and following a preliminary workshop (ICES, 2019), ICES planned a series of workshops in 2023 on bycatch of protected, endangered, and threatened species (PETS) in fisheries. These workshops ("WKPETSAMP2" in April 2023 and "WKPETSAMP3" in November 2023) aim to create guidelines and tools to help fisheries managers decide on the most appropriate sampling schemes to monitor PETS bycatch (including seabirds), based on factual data and on simulations. In parallel, another workshop on seabird bycatch monitoring in the NEAFC Regulatory Area ("WKBB") took place in May 2023, focussing on seabird bycatch in the North East Atlantic Fisheries Commission (NEAFC) Regulatory Areas (RA). With the support of JWGBIRD experts and other external experts, WKBB aimed to highlight the current knowledge gaps and data deficiencies in the region in terms of fishing effort and seabird ecology. A preliminary draft of the ToRs was presented to JWGBIRD and discussed more in-depth during the informal meeting in Ostende in December 2022. In January 2023, a summary business report was published by ICES, highlighting the gaps in knowledge and data that currently impede the elaboration of management advice to NEAFC (ICES, 2023). Building upon this report and the results of the first of the two WKPETSAMP meetings, the WKBB workshop elaborated actions to monitor NEAFC fisheries effectively and assess the magnitude of seabird bycatch in the NEAFC RA.

2.2 Other initiatives on seabird bycatch in HELCOM/ICES/OSPAR

Summary of seabird bycatch estimates in EU waters

Daniel Mitchell from BirdLife Europe was invited to present the preliminary results of a large review of seabird bycatch in European waters, covering all bird species and all gear types. The aims of this study were to review all the available published data on seabird bycatch in Europe, compile country level bycatch assessments and compare these with previous estimates (where these are available), identify locations of concerns for seabird bycatch, and highlight data gaps and priorities for action to reduce bycatch of seabirds in European waters. The supporting manuscript was still unpublished at the time of the meeting. The main conclusions of this review were that there were at least 192 000 birds captured in fishing gears yearly in Europe. Yet, at the time of writing, there were still no seabird bycatch estimate in 12 out of the 33 European coastal states included in the study, while for those countries with available estimates these were generally not covering the entire national fishing fleet, i.e., only some métiers or areas are monitored for bycatch, so that these figures are likely an underestimation.

Data needs for future PVA assessments

Nuno Oliveira presented the results of the (yet unpublished) JNCC report on B5 Marine Bird Bycatch indicator testing in the OSPAR region. In particular, this presentation re-emphasised the importance of collecting comprehensive data on seabird population ecology, and on fishing effort and bycatch data for all fisheries in every OSPAR region to be able to estimate the long-term effects of incidental captures for individual populations using population viability analyses (PVA). Subsequently a sub-group worked on establishing the data needs for future PVA assessments. The discussion centred on some of the inherent caveats of this type of stochastic model that – in the cases presented by N. Oliveira – predicts the changes in population (structure and/or numbers) using predetermined values for the population demographics and bycatch levels. Notably, in the absence of "real" bycatch data, simulations were used to predict the state of a population 50 years in the future, by forcing a constant annual bycatch mortality rate on that population (respectively, comparing the effects of 1%, 5%, and 10% annual bycatch mortality). As pointed out by several experts, such a situation (i.e., a fixed percentage of the population taken annually in fishing gears) is highly unlikely in reality. Although arguably more complex to develop, a modelling approach taking account of possible changes in fishing effort intensity and patterns could be more informative. This suggests that instead of PVAs, Integrated Population Models (IPM; (Riecke *et al.*, 2019)) could be developed specifically to examine the response of seabird population to bycatch for selected populations of seabirds.

The data needs for modelling population effects of bycatch were also discussed in plenary. The group agreed to create and maintain a database listing the scientific publications in English and grey literature (in national languages) on seabird bycatch in the HELCOM and OSPAR regions to support and facilitate access to these data sources (Table 6 in Annex). JWGBIRD's interest in a similar compendium of information on seabird population demographics was also discussed, but several experts pointed out that such list would be more difficult to establish and maintain and that instead, JWGBIRD could focus on creating such dataset for a short list of priority species.

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3 OSPAR Marine Bird Recovery Action Plan

3.1 Background

This session comprised an introduction to the Marine Bird Recovery Plan ("RAP-Bird" for short), followed by discussions designed to help scope the forthcoming RAP development process.

The North-East Atlantic Environment Strategy (NEAES) 2030 is the means by which OSPAR's 16 Contracting Parties will implement the OSPAR Convention until 2030. It sets out collective objectives to tackle the triple challenge facing the ocean: biodiversity loss, pollution, including marine litter, and climate change. Its 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*".

NEAES 2030 contains a number of Strategic Objectives, but the most relevant one in the context of the RAP-Bird is No 5: "*Protect and conserve marine biodiversity, ecosystems and their services to achieve good status of species and habitats, and thereby maintain and strengthen ecosystem resilience*."

There is a specific action for marine birds: S5.O4: *By 2025 at the latest OSPAR will take appropriate actions to prevent or reduce pressures to enable the recovery of marine species and benthic and pelagic habitats in order to reach and maintain good environmental status as reflected in relevant OSPAR status assessments, with action by 2023 to halt the decline of marine birds".*

The RAP will:

- Recommend the actions to be taken by Contracting Parties to action by 2023 to halt the decline of marine birds in Northeast Atlantic.
- Identify the main pressures and activities impacting on marine birds and recommend action to reduce these impacts and eliminate them where possible.
- Consolidate those actions already in operation through OSPAR Recommendations for the nine Threatened and Declining bird species (see Table x) and through existing species action plans under the EU, CAFF and AEWA and through national strategies.

The RAP's evaluation criteria have been specified as:

- The plan is adopted by all Contracting Parties in all OSPAR Regions.
- The actions in the plan are achievable and have clear deliverables and timelines.
- The plan contains a mechanism for assessing how successfully it is implemented.
- The plan is clearly linked to ongoing actions under other mechanisms.

As regards governance, the RAP will be overseen by ICG-POSH (Protection of Species & Habitats) and Biological Diversity Committee (BDC). It is to be led by a Task and Finish Group comprising United Kingdom, Norway, the Netherlands, and Spain. Delivery deadline is June 2024, although, recognising that this is later than the S5.05 target of 2023 OSPAR is keen to be able to demonstrate progress on marine bird conservation sooner than 2024.Table 6. Collective actions for OSPAR's Threatened and Declining bird species. Note the lack of wading species in this list, despite QSR2023 identifying that many are in "not good" status.

Species	Regions	Specific Collective actions	Collective action lead	Does QSR2023 contain indicator?
Black-legged kittiwake	all			Y
Roseate tern	II, III, IV, V	43	ES, PT	Y
Balearic shearwater	III, IV, V	43	ES, PT	N
Iberian guillemot	IV	32	ES	N
Steller's eider	I	39	NO	N
Ivory gull	I	32	NO	N
Brünnich's guillemot	I	44	NO	Y
Lesser black-backed gull	I	45	none	N
Macaronesian shearwater	V			N

3.2 Discussion: ideas to help scope RAP development

Breakout groups discussed five questions designed to assist the development of the RAP. Answers to questions asked of JWGBIRD are summarized in the following tables.

What kind of actions would you like to see in an action plan?

What	Why
Bycatch ("easy win" to adopt EU NPoA or national plans for non-EU countries on bycatch – all gear types) - with an overall target of minimise and reduce (adopted/in prep. in UK, IS, and NO?) - include mitigation explicitly	Current T&D actions on bycatch do not cover all regions where bycatch (from nets) is applicable. We already have an OSPAR indicator to monitor progress! EU fisheries action plan may update and implement the NPoA on bycatch.
Windfarms	Mortality and disturbance currently missing from T&D actions (need to consult ICG-ORED). Impact currently assessed in a vacuum of cumulative assessment.
Food supply (over-exploitation)	Currently missing from T&D actions, but maybe outside scope of OSPAR?
Disturbance	At colonies – already covered for roseate tern but could be expanded to other ground nesting species.
Avian influenza - surveillance	This emerging threat could exacerbate impacts of existing pressures.
Mix of "collective" and "national" actions required	To respond to the geographic spread of species and the required type of action to address declines.
Filling information gaps	Status of many species in Wider Atlantic is unknown but we should not conclude that "need" there is low.
Compensatory measures	Some pressures contributing to bird declines may not be readily reduced; while others (that can be reduced) might provide compensation. Controversial, however.
Conservation objectives for MPAs	Particularly addressing fishing pressures. Without functioning conservation objectives that deliver for marine birds, MPAs risk being "paper parks".
Approval procedures of Environmental Impact Assessments	Should be directed at all activities (except fisheries) that lead to habitat loss/disturbance.
Invasive mammal predation – expand current actions	Limited in its current application to certain regions – needs to be expanded to all regions and more species. Consider an indicator on biosecurity effectiveness?

How can the plan "add value" to existing actions?

What	Why
Extend to other species in 'not good' status in each region (not just OSPAR Threatened and Declining species).	Actions applied to T&D species may already affect other species or could be if expanded. Reduces "administrative burden" by adding multiple species to a plan rather than adding each separately to T&D list.
For MPA objectives – help to specify threats to seabird species.	to help target objectives
Use of "flagship" species	Migratory species which span the entire OSPAR region can be used to demonstrate the value of "flyways scale" conservation approaches and collective action.
Focus on thematic issue and pressures (e.g. windfarm development), rather than species	Action applied only to T&D species might not be most efficient at addressing marine bird declines, whereas thematic (e.g. legislation/monitoring/assessment/research/site protection) and pressure-focussed measures might.

Can we identify any "quick wins"?

What	Why
NACES MPA – Agree Conservation objectives for Seabirds (e.g. on bycatch)	Designated (595,000km^2) in 2021 based on seabird tracking data. Current 2-year road map to develop conservation objectives. Could we agree objectives specifically for seabirds earlier in 2023??
Bycatch - adopt EU NPoA (or national plans for non-EU countries) – all gear types - with an overall target of "minimise and reduce" (adopted/planned in UK, IS and NO?) - include mitigation explicitly	Current T&D actions on bycatch do not cover all regions where bycatch (from nets) is applicable. We already have a (candidate) OSPAR indicator to monitor progress! EU fisheries action plan may update and implement the NPoA on bycatch.

Existing initiatives that the RAP should align with/contribute to, and therefore who should be consulted (not exhaustive)

What	Why
Cet Ambition (EMFF)	Project focussed on cetacean bycatch in Bay of Biscay (but other taxa, incl. seabirds were considered)
EU Biodiversity Strategy 2030	Maybe align goals re. protection of MPAs
CiBBRiNA 2 (LIFE bid on bycatch understanding/reduction)	Led by NL. Decision Apr 2023.
Horizon Europe call on bycatch - call in Dec 22	Horizon Europe is the EU's key funding programme for research and innovation, tackling climate change and helping to achieve the UN's Sustainable Development Goals
Seabird+ (bid Biodiversa+ EU)	Focusing on standardising monitoring for seabird indicators.
ICG-ORED	On offshore renewables disturbance and mortality

What	Why
LIFE PAN Puffinus	Tackling Balearic shearwater bycatch (also in Atlantic) and colony predation in Mediterranean
National seabird plans (UK, NO, NL, Azores)	Also a Balearic shearwater plan in France and a Barolo Shearwater actions in Azores

How can JWGBIRD contribute to the development of the plan?

What	Why
Commenting on draft RAP as it emerges, but less so on drafting	JWGBIRD capacity is limited (though this varies), and their time is focussed on its annual meeting (little capacity for intersessional contributions)
JWGBIRD would value a follow-up session after the meeting	Limited time available during the annual meeting and many only just been briefed about the work, so need time to consider
JWGBIRD comprises a mix of evidence specialists (majority of the group?) but only sometimes those with close or direct links to government/Contracting Parties and policy.	Means that JWGBIRD can provide input on the scientific evidence and rationale for the RAP, but this is not a substitute for consideration by CPs at a policy level. This isn't a problem however: CP policy leads routinely take recommendations from JWGBIRD experts (they "know where to go").

4 Additional work

4.1 Oil spills and extreme weather

Maite Louza from AZTI presented some of the work her research group conducted on the consequences of extreme weather events on seabird mortality in the Bay of Biscay (Louzao *et al.*, 2019). Using stranding data collected on the Spanish Basque coast between 2004 and 2014, this work demonstrates that there is a measurable threshold above which the number of days with extreme wind events in the winter period (December to February) generate large increases in seabird mortality, leading to occasional mass mortality events – and subsequent mass stranding events – like in the winter 2013–2014. Measuring the frequency of such extreme events in the winter could help predic mass strandings of seabirds and thus accelerate the rescue of the beached individuals that are still alive.

In the study presented here, approximately half of the carcasses were juvenile or first-year common guillemots *Uria aalge*. Besides the regional interest of this work to understand the underlying mechanisms leading to mass mortality events in seabird populations in the Bay of Biscay, this method could be replicated in other regions using other datasets, including citizen-collected data, to evaluate the causes and the incidence of mass mortality events in other areas for seabird populations in general or for a subset of priority species. Although JWGBIRD does not currently have the capacity to replicate such analysis elsewhere, the working group could provide an overview of the existing datasets that might support a similar analysis. For instance, on the southern coast of the North Sea, Belgium, the Netherlands, and Germany have collectively been collecting beached bird carcasses since the 1960s. In this case, the cause of death is not always known, but traces of oil on the feathers is systematically recorded.

4.2 Stranding data collection and usage

For many decades, dead seabirds washed up on the coast have been closely observed and, in many cases, regularly recorded in monitoring projects. The examination of the birds found (often including necropsy) supports not only purely biological questions but can also provide indications of problems in the marine environment and be the starting point for management measures to mitigate them. Building on the treatment of mass mortalities (Section 4.1), JWGBIRD continues to discuss how stranding data can be usefully integrated into ongoing work. Two presentations covered aspects of such work.

Nuno Oliveira reported on the monitoring of stranded seabirds in Portugal, for which an "app" has now been developed to collect data. Yellow-legged gulls, razorbills and gannets are primarily found there, most often in winter. In many cases, the birds are in a decomposed state, so that the cause of death can no longer be determined. As far as can be determined, bycatch in fishing gear is the most common likely cause of death, partly in gillnets (e.g. razorbills), partly on longlines (e.g. gannets).

Signe Christensen-Dalsgaard reported on mass mortalities of gulls (especially herring gulls) on the coast of Northern Norway. Veterinary examination of the dead birds showed that they most likely drowned and therefore probably died in fishing gear. It transpired that the Purse Seine fishery was most likely responsible. These findings were the starting point for monitoring projects and mitigation.

While it has been shown that the species composition of the washed-up birds is not representative of the presence of seabirds in the corresponding sea area, the findings can provide important clues for various aspects of seabird research. This mortality is an important factor in assessing the status of populations, especially if an integrative indicator is developed for this purpose. In conjunction with this, mitigation measures can be better managed. It should be noted that the absence of strandings is not synonymous with the absence of problems for seabirds, as drifting due to currents or predators on the beaches may mask the true extent of mortality. It appears that citizen science has the potential to support knowledge around stranding, but biosecurity considerations, not least in the frame of current avian flu outbreaks, need to be addressed in this context.

4.3 ESAS database / offshore surveys

The international cooperation referred to as European Seabirds at Sea (ESAS) database has its origin in the 'Seabirds at Sea' project that was initiated as early as 1979, and a first European-wide data assembly in 1991 gave birth to the ESAS database as we know it today. After decades of joint activities and data sharing between ESAS contributors no more updates of the ESAS database occurred after 2011. Also, very few aerial surveys appeared to be included, due to incompatibility of aerial survey data with the ESAS database format. Together with the need for updated knowledge on the offshore distribution of seabirds (considering the many spatial claims for wind farming), these issues found their way to the agenda of JWGBIRD, which ultimately resulted in the ESAS revitalization project as part of the Dutch WOZEP research program. Among other tasks, work package 3 of this project aimed for a migration of the ESAS database, formerly managed by JNCC, to the ICES Data Centre.

The ESAS database migration to an internationally established data host was first discussed in 2016, at a meeting among ESAS contributors in Büsum, resulting in explorative meetings with the ICES Data Centre in the course of 2017. Within the ESAS revitalization project, discussions were picked up again and monthly meetings were organised between the project group and the ICES Data Centre from October 2020 onwards.

The database migration was achieved in several steps:

- Discussions among ESAS contributors about the requirements of a future-proof ESAS database
- Aligning vocabularies between ESAS contributors and updating the database with Belgian, German and Dutch data
- Discussions between the project group and the ICES Data Centre to achieve a fully revised data model that complies to ICES Data Centre standards (see https://esas-docs.ices.dk/)
- Discussions on setting up an application at the ICES data portal, with modules for data validation, data upload and data download (see https://esas.ices.dk)
- The actual database migration

The migrated ESAS database now holds almost three million observations of birds and marine mammals, most of which were collected in the North Sea. Data were delivered by 14 institutes from 7 countries and over 90% of the data is flagged as open access. Restricted data can be accessed after approval of the data rights holder, and contact persons are automatically notified through email following the online request.

However, in order to keep the database alive, continued efforts to promote and facilitate data uploads will be necessary. A governance group representing data owners and managers will be established to oversee future database actions. During the meeting several candidates within JWGBIRD were prepared to take part in future discussions on how to proceed, these being (in no specific order) Ib Krag Petersen, Ainārs Auniņš, Nele Markones, Nicolas Vanermen, Eric

Stienen, Nuno Oliveira, Tim Dunn, and Frederik Haas from JWGBIRD next to Neil Holdsworth from the ICES Data Centre.

4.4 Consequences of the avian flu on European seabirds

Periodic outbreaks of Highly Pathogenic H5N1 Avian Influenza (HPAI) have occurred in recent decades, but until 2022 mortalities were generally confined to waterbirds. However, in 2022 significant mortalities were observed in seabirds such as gulls, terns, skuas, gannets and auks, (as well as many other avian taxa and also some mammals) marking a "step-change" in the profile of the virus and its prevalence in wild bird populations. Putting aside the ecological consequences, this raises a number of challenges for those who study and conserve them, including: obtaining accurate estimates of mortality and any consequent population-level impacts; monitoring and assessment requirements; understanding of epidemiology and transmission routes; contingency planning and emergency response (e.g. carcass removal). With migratory populations breeding and intermixing across large geographical areas, involving many different administrations, the need for standardised approaches and international coordination is heightened.

JWGBIRD heard from case-studies of seabird mortalities around the HELCOM and OSPAR region, including in Netherlands, Belgium, France, Denmark and the United Kingdom. However, it is currently beyond the remit (or capacity) of JWGBIRD to act as a formal or comprehensive mechanism by which mortality estimates are gathered, collated or reported.

Belgium and Netherlands

Eric Stienen presented an overview of occurrence of mortality in Sandwich terns in Belgium and Netherlands. Approximately 13% of the breeding population in Belgium died, with smaller proportions of the following species affected: Mediterranean gull, common tern, black-headed gull and lesser black-backed gull. In the Netherlands 8000 adult sandwich terns were found dead out of a population of 17 000 breeding pairs = 24%. Properties of this species which are likely to exacerbate spread and infection include: dense colonies, guano production and propensity to move between colonies (often between countries) within a breeding season.

The following are a preliminary set of recommendations that emerge from Eric's and his colleagues' experiences -so far - in Netherlands and Belgium:

- Fill knowledge gaps on the characteristics of the affected sites (environmental variables).
- Virus transmission routes to sandwich terns and the role of other species.
- Immunity development, as well as the underlying mechanism of the observed age-class differences in mortality.
- Precaution should be taken when entering colonies, collecting dead birds or collecting environmental samples (e.g., guano, infected water) due to potential zoonotic viral properties and risks of disseminating virus with contaminated fomites. Measures should include wearing glasses, masks, gloves, coveralls and carefully cleaning and disinfecting clothes and shoes following colony visits.
- The current data suggest that removing carcasses at an early stage of the outbreak can significantly reduce the mortality of both adults and chicks.
- Demographic model is needed.
- Standardized data collection procedures should be developed and followed as far as possible.
- Enhanced cooperation between different disciplines such as demography, immunology, population dynamics, chemistry, and modelling.

- Need to mobilize the necessary funding and strengthen the network for better exchange of information and preparation for the future.

Germany

Volker Dierschke summarised impacts on northern gannets breeding on the island of Helgoland. Breeding success was estimated at 0.14 chicks per pair in 2022; this compares with a value of 0.35, derived from population modelling, which is required to maintain a level population size in the long term (OSPAR indicator B3). In terms of mortalities of gannets overall on Helgoland: 508 adults/immatures were collected dead, plus 689 chicks, of a breeding population of 1485 pairs in 2022 (E. Ballstaedt pers. comm.). Aerial seabirds-at-sea surveys in the German Bight over two days in late July 2022, using transect counts, identified mean at-sea density of dead birds of 7.18 dead gannets/100 km^2. Extrapolated to the whole North Sea this would equate to >40 000 floating dead gannets, >5000 of which were estimated to be in the German Bight (DDA unpublished).

France

Antoine Chabrolle gave an overview of aspects of HPAI mortality in France. Many gulls were affected in the north of France, at levels not seen previously. For example, 1670 Sandwich terns dead from a colony of 3000 individuals; 250 common terns from a colony of 1000 individuals; more than 1000 gulls on 100 km of beaches over a period of two months. As regards northern gannets, 815 dead birds were collected from beaches and tested for H5N1, of which 143 were positive. Mainly adults were affected. Herring gull was the species with the largest number of dead birds collected; of 162 herring gulls tested around 130 tested positive, the highest proportion of all species that were sampled. As regards northern gannets, there is a single breeding colony in France (Sept-Iles), of some 20 000 or more pairs. Of a sample of 102 nests monitored only 8 young might have survived, as a maximum.

United Kingdom

Liz Humphreys outlined the UK response plans for the 2023 seabird breeding season, particularly with regard to monitoring under the UK's Seabird Monitoring Programme, which is an annual sample of observations (mainly of abundance and productivity). She referred to the draft report of a workshop on monitoring, research and intervention options, which was held in early November 2022 (now published: Pearce-Higgins et al. 2023). Estimates of mortality based on birds recovered from beaches or elsewhere are subject to huge uncertainties (for a number of reasons); therefore, the more reliable way to understand population impacts is to census or monitor samples of colonies in the field. Monitoring prioritisation for 2023 was based on need according to species that showed increased mortality. Breeding abundance is considered to be the critical parameter to monitor, because it more directly and rapidly reflects changes in adult mortality - from HPAI - than does breeding success data, the latter being more likely to reflect local food availability.

Overview of key characteristics of HPAI

Wouter Langhout from Birdlife International was invited by co-chairs to present his perspective of HPAI, in particular to highlight the areas of work that collectively the international community should address.

Key recommendations from Wouter included:

- Redress currently severe gaps in monitoring: there is no reporting of outbreaks and while there is the WAHIS database that collates cases of HPAI in wild birds, information in it more usually comprises only positive tests and doesn't contain information about negatives -this biases the information and limits the interpretation of the data available. Species information is often poorly documented in WAHIS, including incorrect species for a given geographical area, or insufficient precision as regards taxon (e.g., use of "gull").
- Testing capacity is too low – which hampers early detection of outbreaks, among other problems.
- Sequencing of virus genomes is important -helps in identifying how an infection develops.
- Beached bird surveys are important in detecting unusual numbers of dead birds, especially in the early stages of an outbreak.
- Susceptibility of birds varies between species.
- Young and old birds are equally susceptible (but older birds tend to have greater potential exposure as they are present in dense colonies more than young birds).
- Some birds are not showing symptoms but can still spread the virus.
- Immunity has developed during the current outbreak in some species (not yet seabirds).
- Conservation impacts: these are poorly understood but might include: risks of extinction in small populations, loss of genetic diversity, combination effects with other pressures; in species with low reproductive output (as in most seabirds), recovery from outbreaks can be very slow.
- Removal of dead birds appears to reduce the development of outbreaks, rather than leaving them in situ.

4.5 References

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Annex 2: Additional documents

Table 7. List of data sources on bycatch in the OSPAR and HELCOM regions. Key to HELCOM subbasins: SEA-001: Kattegat, SEA-002: Great Belt, SEA-003: The Sound, SEA-004: Kiel Bay, SEA-005: Bay of Mecklenburg, SEA-006: Arkona Basin, SEA-007: Bornholm Basin, SEA-008: Gdansk Basin, SEA-009: Eastern Gotland, SEA-010: Western Gotland Basin, SEA-011: Gulf of Riga, SEA-012: Northern Baltic Proper, SEA-013: Gulf of Finland, SEA-014: Åland Sea, SEA-015: Bothnian Sea, SEA-016: The Quark, SEA-017: Bothnian Bay.

Name	Organization / Journal	Type of publication	Spatial coverage	HELCOM subbasins	OSPAR Region	Temporal coverage	Fishing gear	Bycatch evidence	Total bycatch estimates	Bycatch rates
EU Fisheries Data Collection	European Commission	Data tables	EU	SEA-001, SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017	I, II, III, IV, V	2004-now	all	All seabirds (in theory)	no	
ICES WGBYC Reports	ICES	Technical report	ICES areas	SEA-001, SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017	I, II, III, IV, V		all	All species	no	
By-catch of seals, harbour porpoises and birds in Swedish commercial fisheries. Fiskeriverket informerar 2004/8, Öregrund, Göteborg, Sweden	Fiskeriverkets kustlaboratorium	Technical report	Sweden (Kattagat, the Sound, Arkona Basin, Bornholm Basin, Western Gotland Basin, Eastern Gotland Basin, Northern Baltic Proper, Åland Sea, the Quark, Bothnian Bay)	SEA-001, SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-009, SEA-010, SEA-012, SEA-014, SEA-015, SEA-016, SEA-017	II	2002	GNS, FPO, FYK, FPN	*Gavia* spp., *Phalacrocorax carbo, Aythya fuligula, Somateria mollissima, Melanitta fusca, Bucephala clangula, Clangula hyemalis, Mergus* spp., *Uria aalge, Alca torda*	*Gavia* spp., *Phalacrocorax carbo, Aythya fuligula, Somateria mollissima, Melanitta fusca, Bucephala clangula, Clangula hyemalis, Mergus* spp., *Uria aalge, Alca torda*	
The incidental catch of seabirds in gillnet fisheries: A global review	Biological Conservation	Paper	World with a regional focus (incl. Baltic, Norwegian, and North Seas, Atlantic Iberia, Iceland, and Faroe Islands)	SEA-001, SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017	I, II, III, IV, V	1990–2002, 2009–2010	GNS	*Clangula hyemalis, Somateria mollissima, Aythya marila, Uria aalge, Polysticta stelleri*	All seabirds	

Name	Organization / Journal	Type of publication	Spatial coverage	HELCOM subbasins	OSPAR Region	Temporal coverage	Fishing gear	Bycatch evidence	Total bycatch estimates	Bycatch rates
Bycatch of marine mammals and seabirds: Occurrence and mitigation	National Institute of Aquatic Resources, Technical University of Denmark	Technical report	Denmark	SEA-001, SEA-002, SEA-003	II	2010–2018	GNS	Alcidae, Anatidae, *Gavia* spp., *Phalacrocorax carbo, Podiceps spp., Larus* spp.	All seabirds	
Assessing seabird bycatch in gillnet fisheries using electronic monitoring	Biological Conservation	Paper	Denmark (Øresund)	SEA-003		2014–2018	GNS	*Somateria mollissima, Melanitta spp., Phalacrocorax carbo, Uria aalge, Alca torda, Larus spp., Gavia* spp., *Podiceps cristatus, Podiceps grisegena*	no	
Bycatch in Baltic Sea commercial fisheries: High-risk areas and evaluation of measures to reduce bycatch	HELCOM	Technical report	Baltic Sea	SEA-001, SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-009, SEA-010, SEA-012, SEA-014, SEA-015, SEA-016, SEA-017	II	2018	GNS	*Somateria mollissima, Melanitta nigra, Melanitta fusca, Phalacrocorax carbo*	Anatidae, *Phalacrocorax carbo*	
Miljøskånsomhed og økologisk bæredygtighed i dansk fiskeri	National Institute of Aquatic Resources, Technical University of Denmark	Technical report	ICES areas IV and III	SEA-001, SEA-002, SEA-003	II	2001–2004 and 2010–2019	GNS	*Somateria mollissima, Melanitta nigra, Phalacrocorax carbo, Clangula hyemalis, Melanitta fusca, Podiceps* spp., *Uria aalge*	*Somateria mollissima, Phalacrocorax carbo, Uria aalge*	
Mortality of waterfowl on the Polish Baltic seashore in the 1998/1999 season	Uniwersytet Gdanski	Technical report	Poland	SEA-007, SEA-008, SEA-009		1998–1999	GNS	*Clangula hyemalis, Larus argentatus, Melanitta fusca, Larus ribidundus, Gavia arctica, Larus canus*		

Name	Organization / Journal	Type of publication	Spatial coverage	HELCOM subbasins	OSPAR Region	Temporal coverage	Fishing gear	Bycatch evidence	Total bycatch estimates	Bycatch rates
Auswertung landesweiter Datenquellen (International Beached Birds Survey, Pathologie des LALLF M-V, Ringwiederfunde)	Naturschutz und Geologie Mecklenburg-Vorpommern	Technical report	German Baltic	SEA-004, SEA-005, SEA-006		1992–2006	GNS	*Gavia arctica, Gavia stellata, Podiceps cristatus, Podiceps grisegena, Phalacrocorax carbo, Aythya ferina, Aythya fuligula, Aythya marila, Somateria mollissima, Clangula hyemalis, Melanitta fusca, Melanitta nigra, Mergus merganser, Mergus serrator, Cepphus grylle, Uria aalge*	no	
Beached bird surveys in Lithuania reflect oil pollution and bird mortality in fishing nets	Marine Ornithology	Paper	Lithuania	SEA-007, SEA-008, SEA-009		1992–2003	GNS	*Polysticta stelleri, Gavia* spp., *Mergus* spp., *Clangula hyemalis, Melanitta fusca, Podiceps cristatus, Alcidae*	no	
Seabird bycatch in a Baltic coastal gillnet fishery is orders of magnitude larger than official reports	Avian Conservation and Ecology	Paper	Lithuania	SEA-009, SEA-011, SEA-012, SEA-013		2015–2020	GNS, FPO, FYK, FPN	*Gavia arctica, Gavia stellata, Podiceps cristatus, Podiceps grisegena, Phalacrocorax carbo, Aythya marila, Bucephala clangula, Clangula hyemalis, Melanitta fusca, Melanitta nigra, Mergus* merganser, *Mergus serrator, Larus argentatus, Uria aalge, Alca torda*	Clangula hyemalis, Melanitta fusca	

Name	Organization / Journal	Type of publication	Spatial coverage	HELCOM subbasins	OSPAR Region	Temporal coverage	Fishing gear	Bycatch evidence	Total bycatch estimates	Bycatch rates
Fugle som bifangst i garnfiskeriet. Estimat af utilsigtet bifangst af havfugle i garnfiskeriet i området omkring Ærø	National Institute of Aquatic Resources, Technical University of Denmark	Technical report	Denmark (Great Belt)	SEA-002		2011–2003	GNS	*Somateria mollissima, Melanitta nigra, Phalacrocorax carbo, Clangula hyemalis, Melanitta fusca, Podiceps spp., Uria aalge*	no	
Bycatch in gillnet fisheries – An overlooked threat to waterbird populations	Biological Conservation	Paper	Baltic Sea	SEA-001, SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-009, SEA-010, SEA-012, SEA-014, SEA-015, SEA-016, SEA-017	II	1926–2009	GNS	*Uria aalge, Phalacrocorax carbo, Somateria mollissima, Cepphus grylle, Gavia stellata, Alca torda, Clangula hyemalis, Gavia* spp., Melanitta fusca, Aythya marila, Aythya fuligula, Aythya ferina, Mergus serrator, Melanitta nigra, Podiceps cristatus, Bucephala clangula, Mergus merganser, Mergus serrator	*Uria aalge, Phalacrocorax carbo, Somateria mollissima, Clangula hyemalis, Gavia spp., Melanitta fusca, Polysticta stelleri, Melanitta nigra, Bucephala clangula, Aythya fuligula, Aythya marila, Aythya ferina*	
Decreasing but still high: bycatch of seabirds in gillnet fisheries along the German Baltic coast	Aquatic Conservation: Marine and Freshwater Ecosystems	Paper	Germany	SEA-004, SEA-005, SEA-006		2006–2009	GNS	*Melanitta nigra, Melanitta fusca, Mergus serrator, Podiceps cristatus,* Podiceps *grisegena, Gavia stellata, Clangula hyemalis*	All seabirds	

Name	Organization / Journal	Type of publication	Spatial coverage	HELCOM subbasins	OSPAR Region	Temporal coverage	Fishing gear	Bycatch evidence	Total bycatch estimates	Bycatch rates
Bycatch of seabirds in the Polish part of the southern Baltic Sea in 1970–2018: a review	Acta Ornithologica	Paper	Poland	SEA-007, SEA-008, SEA-009		1970–2018	GNS	*Aythya marila, Clangula hyemalis, Mergus merganser, Melanitta fusca, Aythya fuligula, Melanitta nigra, Bucephala clangula, Somateria mollissima, Gavia arctica, Uria aalge, Gavia stellata, Mergellus albellus, Aythya ferina, Alca torda, Mergus serrator, Podiceps cristatus, Fulica atra, Podiceps grisegena, Phalacrocorax carbo, Cepphus grylle, Podiceps auritus, Larus argentatus, Somateria spectabilis, Gavia immer, Gavia adamsii, Alle alle, Tachybaptus ruficollis, Larus canus*	All seabirds, *Aythya marila, Clangula hyemalis, Melanitta fusca*	
Opracowanie podstaw racjonalnego monitorowania przyłowu ptaków w celu zrównoważonego zarządzania rybołówstwem przybrzeżnym na morskich obszarach NATURA 2000	Morski Instytut Rybacki - Państwowy Instytut Bad	Technical report	Poland	SEA-007, SEA-008, SEA-009			GNS			
Untersuchung und Bewertung des Beifangs von Seevögeln durch die		Technical report	Germany	SEA-004, SEA-005, SEA-006						

Name	Organization / Journal	Type of publication	Spatial coverage	HELCOM subbasins	OSPAR Region	Temporal coverage	Fishing gear	Bycatch evidence	Total bycatch estimates	Bycatch rates
passive Meeresfischerei in der Ostsee										
Fangtechnische Möglichkeiten zur Reduzierung des Beifangs von Meeresenten in der Dorschfischerei mit stationären Fanggeräten		Technical report	Germany	SEA-004, SEA-005, SEA-006						
Wissenschaftliche Grundlagen für ein ökosystemgerechtes Fischereimanage-ment in der deutschen AWZ Erprobung und Weiterentwicklung alternativer, ökosystemgerechter Fanggeräte zur Vermeidung von Beifängen von Seevögeln und Schweinswalen in der Ostsee		Technical report	Germany	SEA-004, SEA-005, SEA-006						
Pilotstudie zur Dokumentation von Seevogel- und Meeressäugerbeifängen in der Stellnetzfischerei der Fischereigenossenschaft Freest im Gebiet um Rügen		Technical report	Germany	SEA-004, SEA-005, SEA-006						
Untersuchungen von Vogelbeifängen in der deutschen Küstenfischerei der Ostsee durch eine Umfrage zur Stellnetzfischerei		Technical report	Germany				GNS, GTR, LLS, FPO, OTB	*Phalacrocorax carbo, Gavia stellata, Podiceps cristatus, Cepphus grylle, Aythya farina, Aythya fuligula, Bucephala clangula, Somateria mollissima, Melanitta fusca, Clangula*		

Name	Organization / Journal	Type of publication	Spatial coverage	HELCOM subbasins	OSPAR Region	Temporal coverage	Fishing gear	Bycatch evidence	Total bycatch estimates	Bycatch rates
								hyemalis, Mergus serrator, Mergus merganser, Fulica atra		
Meissner, W, A Staszewski, and M Ziółkowski. "Mortality of waterfowl on the Polish Baltic seashore in the 1998/1999 season." *Notatki Ornitologiczne* 42 (2001): 56–62.		Paper	Poland							
Collection of by-catch data for seabirds and marine mammals and by-catch and population densities for non-commercial fish	National Institute of Aquatic Resources, Technical University of Denmark	Technical report	Denmark	SEA-001, SEA-002, SEA-003	II	2010–2020	GNS	Alcidae, *Somateria mollissima, Gavia* spp., *Fulmarus glacialis, Phalacrocorax carbo, Larus* spp., *Melanitta* spp.	All seabirds, Alcidae, *Somateria mollissima, Gavia* spp., *Fulmarus glacialis, Phalacrocorax carbo, Larus* spp., *Melanitta* spp.	
Fugle som bifangst i garnfiskeriet. Estimat af utilsigtet bifangst af havfugle i garnfiskeriet i området omkring Ærø	National Institute of Aquatic Resources, Technical University of Denmark	Technical report	Denmark	SEA-002		2001–2003	GNS	*Somateria mollissima, Melanitta nigra, Phalacrocorax carbo, Clangula hyemalis, Melanitta fusca, Podiceps* spp., *Uria aalge*	All seabirds, *Somateria mollissima, Melanitta nigra, Phalacrocorax carbo, Clangula hyemalis, Melanitta fusca*, Podiceps spp., Uria aalge	All seabirds, *Somateria mollissima, Melanitta nigra, Phalacrocorax carbo, Clangula hyemalis, Melanitta fusca*, Podiceps spp., Uria aalge
Assessing incidental bycatch of seabirds in Norwegian coastal commercial fisheries: Empirical and methodological lessons	Global Ecology and Conservation	Paper	Norway		I, II	2009	GN, LL	*Fulmarus glacialis*, Alcidae, *Cepphus grylle*, Phalacrocoracidae, Laridae, Anatidae, *Morus bassanus*	All seabirds, *Fulmarus glacialis, Cepphus grylle*	All seabirds

Name	Organization / Journal	Type of publication	Spatial coverage	HELCOM subbasins	OSPAR Region	Temporal coverage	Fishing gear	Bycatch evidence	Total bycatch estimates	Bycatch rates
Spatial and temporal variations in seabird bycatch: Incidental bycatch in the Norwegian coastal gillnet-fishery	PLoS One	Paper	Norway		I, II	2006–2015	GN	All seabirds	All seabirds	All seabirds
What's the catch with lumpsuckers? A North Atlantic study of seabird bycatch in lumpsucker gillnet fisheries	Biological Conservation	Paper	Norway		I, II		GN	All seabirds, *Gavia immer, Morus bassanus*, Phalacrocoracidae, *Clangula hyemalis, Somateria mollissima, Melanitta fusca, Rissa tridactyla, Alca torda, Uria aalge, Uria lomvia, Cepphus grylle, Fratercula arctica*, Alcidae	*Cepphus grylle, Somateria mollissima, Phalacrocorax carbo, Gulosus aristotelis*	All seabirds, Gavia immer, Morus bassanus, Phalacrocoracidae, Clangula hyemalis, Somateria mollissima, Melanitta fusca, Rissa tridactyla, Alca torda, Uria aalge, Uria lomvia, Cepphus grylle, Fratercula arctica, Alcidae
Utilsiktet bifangst av sjøfugl i norske kystfiskerier med garn og line	NINA	Technical report	Norway		I, II	2006–2014	GN, LL	All seabirds	All seabirds	no