JOINT OSPAR/HELCOM/ICES WORKING GROUP ON SEABIRDS (JWGBIRD; outputs from 2019 meeting)

VOLUME 2 | ISSUE 80

ICES SCIENTIFIC REPORTS

RAPPORTS SCIENTIFIQUES DU CIEM

ICES INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA
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ISSN number: 2618-1371 I © 2020 International Council for the Exploration of the Sea

ICES Scientific Reports

Volume 2 | Issue 80

JOINT OSPAR/HELCOM/ICES WORKING GROUP ON SEABIRDS (JWGBIRD)

Recommended format for purpose of citation:

ICES. 2020. Joint OSPAR/HELCOM/ICES Working Group on Seabirds (JWGBIRD; outputs from 2019 meeting).
ICES Scientific Reports. 2:80. 101 pp. http://doi.org/10.17895/ices.pub.7466

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i Executive summary

Following the tradition of the preceding meetings, the objectives of the Joint ICES/OSPAR/HELCOM Working Group on Seabirds 2019 meeting were to develop and implement indicators for seabirds under the Marine Strategy Framework Directive (MSFD), as well as to review and discuss seabird-related issues relevant for human uses of the sea. The meeting consisted of a series of interconnected workshops, where subgroups with floating membership discussed Terms of Reference. Report chapters were drafted by Term of Reference leads and collated by the chairs.

The group reviewed the national reporting of seabird status according to Article 8 MSFD by EU Member States at the NE Atlantic and the Baltic Sea. Compiled information included the use of OSPAR and HELCOM indicator outcomes, the addition of assessments from national monitoring schemes, the methods of integration and which EU Commission Decisions (Com Dec 2010/477 or the revised version 2017/848) were followed.

To achieve more coverage of the five MSFD criteria, a proposal for an indicator for the criterion D1C5 (habitat for the species) was presented. This indicator shall compare the occurrences of e.g. shipping, offshore windfarms, aggregate extraction, bottom trawling and gillnet fishing with the spatio-temporal distribution of seabirds and assess the amount of seabird habitat lost or used to a lower degree due to disturbance from these human activities.

The group reviewed timelines, status and demands of bird assessments within OSPAR and HELCOM, with reference to the next holistic assessments, OSPAR QSR2023 and HELCOM HOLAS III. The review included coverage, status and development needs of indicators as well as integration methods.

Further refinements of the existing indicator for breeding productivity in OSPAR were discussed. The suggested approach uses matrix population models to assess the impact of the observed level of breeding productivity on population growth rate, and relates the projected growth rate to IUCN criteria for species red-listing.

Inclusion of at-sea data in future bird assessments was further prepared by updating information on existing monitoring programmes delivering the necessary baseline data, supporting networking activity, preparing a joint data management and investigating opportunities for a pilot assessment.

A combined mid-winter survey of the offshore Baltic Sea was carried out in early 2016. The group reviewed first results of the data collation and discussed next steps of the joint analyses. The group collated information on participation in the next joint mid-winter offshore survey in Baltic Sea and North Sea in early 2020 and discussed details of survey design.

JWGBIRD provided input to the multi species model SMS of the Working Group on Multispecies Assessment Methods (WGSAM), to the HELCOM workshop on migratory waterbirds in November 2018 and to the Joint OSPAR-HELCOM bycatch workshop in May 2019, the HELCOM indicator workshop and the HELCOM Sufficiency of Measures (SOM) workshop in October 2019. The group revised the ICES Ecosystem Overview of the Oceanic North Atlantic, the proposed road map for ICES bycatch advice as well as the WGBYC data call.

ii Expert group information

Expert group name	Joint OSPAR/HELCOM/ICES Working Group on Seabirds (JWGBIRD)
Expert group cycle	Annual
Year cycle started	2018
Reporting year in cycle	2/3
Chair(s)	Volker Dierschke, Germany (HELCOM co-chair)
	Ian Mitchell, UK (OSPAR co-chair)
	Nele Markones, Germany (ICES co-chair)
Meeting venue and date	30 September – 4 October 2019, Tartu, Estonia (17 participants)

1 Review 2018 MSFD Article 8 national assessments of birds

1.1 Introduction

This chapter investigates how EU Member States within the NE Atlantic and Baltic Sea have used the OSPAR Intermediate Assessments (IA2017) and the Holistic Assessment II of HELCOM (HOLAS II) of marine birds in their national assessments of Good Environmental Status (GES) under Marine Strategy Framework Directive (MSFD -2008/56/EC).

According to Article 8 of MSFD, EU Member States shall assess the status of their marine waters and report on progress made towards achieving GES. Marine birds form a component of marine biodiversity and GES is therefore assessed against Descriptor 1 (Annex 1 of the MSFD): "Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions." The most recent reports under Art 8 for the assessment period 2011-2016, were due in 2018. The Regional Sea Conventions (RSC) OSPAR and HELCOM have supported the 2018 Art 8 assessments by developing indicators and assessment methodologies that are consistent across the NE Atlantic and Baltic Sea, respectively. The marine bird indicators were primarily developed for regional assessments of the sea, lastly applied for the Intermediate Assessment 2017 of OSPAR (2017) and the Holistic Assessment II of HELCOM (2018). Their development started in expert groups (OSPAR) and projects (HELCOM), but was finally in the hands of experts in the Joint OSPAR/HELCOM/ICES Working Group on Marine Birds (JWGBIRD and predecessors) since 2012. This paper presents the results of a comparison of how Member States used the OSPAR IA2017 and HELCOM HOLAS II marine bird indicator assessments in their MSFD Article 8 reporting in 2018. The comparison was undertaken by JWGBIRD to inform the further development of the marine bird indicators.

A key factor in determining how member states have used the OSPAR and HELCOM marine bird assessments is their interpretation of the two Commission Decisions published on MSFD. The assessment of GES for each Descriptor was prescribed by a Commission Decision in 2010 (EC/2010/477) which listed a series of criteria and indicators that would be measured. For the assessment of marine birds under Descriptor 1 (biodiversity), indicators should be used to assess three criteria (Table 1). In 2017, Com Dec 2010/477 was superseded by Com Dec 2017/848, which specified five possible criteria for marine bird assessments. Com Dec 2017/848 also specified that the criteria should be used to assess the status of each species, in a similar way that Favourable Conservation Status is assessed for other marine species under the Habitats Directive (92/43/EEC). These species assessments should then be integrated using regionally agreed rules, to assess GES in each of five marine bird species groups (e.g. surface-feeders, water-column feeders etc.). Com Dec 2017/848 was published just over a year before the Art 8 assessments needed to be submitted. Thus, some Member States continued to use the former Com Dec 2010/477, because they had developed approaches that were in line with it more than the new Com Dec 2017/848.

Table 1. OSPAR and HELCOM seabird indicators in relation to MSFD criteria.

MSFD criterion (under Com Dec 2017/848)	MSFD criterion (under Com Dec 2010/477)	OSPAR indicators	HELCOM indicators
D1C1 bycatch	1.3 Population Condition	Marine bird bycatch (candidate)	Number of drowned mammals and waterbirds in fishing gear (core)
D1C2 abundance	1.2 Population size	Marine bird abundance (common)	Abundance of waterbirds in the breeding season (core) Abundance of waterbirds in the wintering season (core)
D1C3 demography	1.3 Population Condition	Breeding success/failure of marine birds (common) Breeding success of kittiwake (candidate)	
D1C4 distribution	1.1 Species distribution	Distribution of marine birds (candidate)	
D1C5 habitat for the species	Not required	Non-native/invasive mammal presence on island seabird colonies (candidate)	

1.2 Approach used to compare Member States' reporting

In September 2019, a questionnaire was sent to JWGBIRD experts from all EU Member States having marine waters in OSPAR and HELCOM Regions, asking the following:

- On which Commission Decision has the national assessment been based: Com Dec 2010/477 or Com Dec 2017/848 (see above)?
- Which of the OSPAR and HELCOM common, core and candidate indicator assessments have been used for the national assessment? If they were used, on which geographical scale: region or subdivision?
- Have results from national monitoring programmes added to the RSC assessments or even used instead of them?
- What integration methods have been used, if any?
- Which species groups were assessed regarding GES?

Responses to the questionnaire were received from 11 out of 15 EU Member States in the OSPAR and HELCOM Maritime Areas. For the remaining four Member States, information was extracted from published national reports under MSFD Art 8 (sources are listed in Table 2). Detailed information about national assessments can be approached at https://water.europa.eu/marine/data-maps-and-tools/msfd-reporting-information-products/msfd-reporting-data-explorer .

Table 2. References to the national MSFD Article 8 reporting of EU Member States with marine areas in the OSPAR and HELCOM Areas. Note that all reports are in the respective national language, mostly without an English summary.

Country	Responded to questionnaire?	Link to national MSFD Article 8 report
Macaronesia	not applicable	https://www.miteco.gob.es/es/costas/participacion-publica/mrr_2018_en_tcm30-486692.pdf
Spain	Yes	https://www.miteco.gob.es/es/costas/temas/proteccion-medio-marino/documentomarcoeemm_tcm30-498317.pdf
Portugal	Yes	http://cdr.eionet.europa.eu/pt/eu/msfd_art17/2018reporting/textreport/
France	Yes	http://www.oiseaux-manche.org/upload/iedit/1/pj/298_1692_2018_Evaluation_2018_OM_20180318_PATRINAT_Vf.pdf
Ireland	No	Consultation document (Dec 2019): https://www.housing.gov.ie/sites/default/files/public-consultation/files/msfd_public_consultation_report_december_2019.pdf
United Kingdom	Yes	https://moat.cefas.co.uk/biodiversity-food-webs-and-marine-protected-areas/birds/
Belgium	Yes	https://odnature.naturalsciences.be/downloads/msfd/DCSMM_Art8_2018.pdf https://odnature.naturalsciences.be/downloads/msfd/KRMS_Art8_2018.pdf
The Netherlands	No	https://www.parlementairemonitor.nl/9353000/1/j9vvij5epmj1ey0/vkpihggebqx6
Germany	Yes	https://www.meeresschutz.info/berichte-art-8-10.html
Denmark	No	https://mfvm.dk/fileadmin/user_upload/MFVM/Natur/Havstrategi/HSII_foerste_del_-_endelig_udgave.pdf
Sweden	Yes	https://www.havochvatten.se/download/18.5b07be29168ba461a9846f4a/1549542287388/rapport-2018-27-marinstrategi-for-nordsjon-och-ostersjon-2018-2023.pdf
Finland	Yes	no published report
Estonia	Yes	https://www.envir.ee/et/eesmargid-tegevused/merekeskkonna-kaitse/merestrateegia
Latvia	Yes	http://www.lhei.lv/attachments/article/573/Juras_vides_novertejums_2018.pdf
Lithuania	No	http://cdr.eionet.europa.eu/lt/eu/msfd_art17/2018reporting/textreport/envxt_nuq/Lietuvos_jAros_rajono_ekologinAs_bAklAs_vertinimas_ir_gamtosaugin-iai_tikslai.pdf
Poland	Yes	http://rdsm.gios.gov.pl/images/aktualizacja_wstepnej_oceny_stanu_srodowiska_wod_morskich.pdf

1.3 Comparison of Member States´ Reporting

The reporting by each EU Member State (referred hereafter as 'MS') is summarised in Annex 3. Overall, the national Article 8 MSFD assessments and reporting for marine birds in 2018 were very different across the MS. Furthermore, the extent to which MS used the OSPAR and HELCOM assessments varied greatly. In this section we compare the MS reports under each of the questions posed in the previous section and in the questionnaires sent to bird assessment leads.

The three countries which have marine waters in both OSPAR and HELCOM Regions varied with respect of allocating assessments to the regions: Germany treated the North Sea and Baltic Sea completely separately, whereas Denmark assessed its marine waters as one unit, regardless of which region they belong to. Sweden treated the non-breeding birds like Germany, but the breeding birds like Denmark. The United Kingdom assessed its two OSPAR Regions (Greater North Sea, Celtic Seas) separately as did Spain with OSPAR Region IV and its sections of the Mediterranean Sea (the latter not addressed here) and Portugal for its continental waters (OSPAR Region IV), the Azores (OSPAR Region V) and Madeira (mostly outside OSPAR Regions).

Finally, it has to be mentioned that not all countries could assess all species groups simply because not all of them occur in their country. The HELCOM core indicator "White-tailed Eagle productivity" is not part of this review, because it was not developed by JWGBIRD. However, some countries included the respective assessments in their national bird assessment.

1.3.1 On which Commission Decision has the national assessment been based?

Most MS followed Com Dec 2017/848 and only two MS (United Kingdom, Belgium) based their assessments on Com Dec 2010/477.

1.3.2 Which of the OSPAR and HELCOM assessments have been used and at what scale?

There was variation concerning the use of OSPAR and HELCOM indicator assessments, whether they were used at all, whether they were augmented or not by other national data, and whether they were actually part of the GES assessment or only reported. The latter was not always clear from the reports. Table 3 shows which indicator assessments were included in the respective national Article 8 MSFD reports.

Six out of the ten MS in the OSPAR area (Spain, Portugal, France, Denmark, Sweden and Ireland), did not use any of the OSPAR common indicator assessments in their assessments of GES under MSFD (Table 3). In the case of Spain, Portugal and France, there were no OSPAR indicator assessments in OSPAR Region IV for them to use. There were also no French data included in the OSPAR assessments in Regions II and III. However, both Spain and France did use similar methods and thresholds to those used in the OSPAR indicators. Portugal, Ireland, Sweden and Denmark used their national data and indicators to assess GES of marine birds in their respective waters (which for Sweden and Denmark included both the North Sea and Baltic Sea). Sweden also included the OSPAR assessment results for the Greater North Sea in their report.

Of the four MS that did use the OSPAR assessments, only the United Kingdom adopted the OSPAR regional scale assessments of both indicators. Belgium reported the regional assessment of abundance but did not use the indicator on breeding success/failure. Germany used the OSPAR sub-divisional assessments of both indicators for the southern North Sea and the Netherlands used the sub-divisional assessment for abundance, but used the regional assessment of breeding success/failure.

For the Baltic Sea, none of the MS could use content from the core indicator on marine bird bycatch, because the indicator was only tested with old data and owing to the lack of data on both bycatch rates and fishing effort no assessment was possible. Except for Sweden, all the other MS used the results of the two HELCOM bird abundance indicators to assess GES or at least reported them (Table 3). While five MS referred to the results of sub-divisions of the Baltic Sea (aggregations of HELCOM sub-basins), Finland, Estonia and Lithuania reported the results for the entire Baltic Sea.

Table 3. Overview of OSPAR and HELCOM bird indicators and their use or disregard in the national Article 8 MSFD assessment and/or reporting. [1] Applied to region (Greater North Sea, Celtic Seas, Baltic Sea), [2] applied to subdivisions (e.g. OSPAR IId, HELCOM aggregated sub-basins).

RSC	indicator status	indicator name	EU MS using and/or reporting indicator	EU MS not using and/or reporting indicator
OSPAR	common	Marine bird abundance	UK[1] BE[1] NL[2] DE[2] DK[1]	ES PT FR SE IE
OSPAR	common	Marine bird breeding success/failure	UK[1] NL[1] DE[2] DK[1]	ES PT FR BE SE IE
HELCOM	core	Number of drowned mammals and waterbirds in fishing gear		DE DK SE FI EE LV LT PL
HELCOM	core	Abundance of waterbirds in the breeding season	DE[2] DK[2] FI[1] EE[1] LV[2] PL[2]	SE LT
HELCOM	core	Abundance of waterbirds in the wintering season	DE[2] DK[2] FI[1] EE[1] LV[2] LT[1] PL[2]	SE

1.3.3 Use of national datasets and assessments

Com Dec 2017/848 allows referring to assessments done in the frame of Birds Directive (though for BD only reporting rather than an assessment is required) and in the frame of national monitoring programs. Five EU Member States augmented the OSPAR or HELCOM assessment of abundance with national data. Germany added breeding success data from the Dutch/German/Danish Trilateral Monitoring and Assessment Programme of the Wadden Sea to its assessment of demography (Table 4).

Seven MS exclusively relied on national data for their assessments (Table 4). In case of Spain, Portugal and France this is self-evident, because no OSPAR indicator assessments are available for OSPAR Region IV.

Some Member States took the opportunity to assess criteria for which no indicators are operable, notably bycatch, demography and distribution (Table 4). It is worth mentioning that only four MS (Portugal, France, Belgium, Germany) incorporated at-sea data in their abundance assessments, although most other countries are also running monitoring programs with ship-based and/or aerial surveys (Annex 4). Portugal and Ireland reported on the current distribution of seabirds at sea. The UK used the methods of three OSPAR candidate indicators to assess kittiwake breeding success, marine bird distribution (pilot assessment) and Non-native/invasive mammal presence on island seabird colonies. This was because the UK originally proposed and developed these indicators, which have not been adopted by other OSPAR CPs.

Table 4. MSFD seabird assessments conducted only or augmented by data from national monitoring (including BD reporting).

Criterion - Com Dec 2017/848 (Com Dec 2010/477)	Assessment only with national data	Used an OSPAR common indicator or HELCOM core indicator assessment augmented with national data
D1C1 - bycatch	ES PT IE	Not applicable
D1C2 (1.2) - abundance	ES PT FR SE DK LT IE	BE NL DE FI EE
D1C3 (1.3) - demography	ES PT FR UK[1]	DE
D1C4 (1.4) - distribution	ES PT FR UK[2] DK FI IE	Not applicable
D1C5 - Habitat for species	UK[3]	Not applicable

[1]used the OSPAR candidate indicator - Breeding success of kittiwake

[2]used the OSPAR candidate indicator - Distribution of marine birds

[3]used the OSPAR candidate indicator - Non-native/invasive mammal presence on island seabird colonies

1.3.4 What integration has been used?

There was variation in how assessments were integrated (Table 5). This was partly due to the absence of any regionally agreed integration rules and because MS followed different Commission Decisions. JWGBIRD (ICES 2018a) and ICES (ICES 2018b) have been developing integration rules that follow the assessment framework set out in Com Dec 2017/848. Three MS (Spain, Germany, Finland), implemented these rules to integrate assessments of different criteria to assess the status of individual species. Germany, which had many more species to assess than Spain, then integrated the species status assessments to assess GES for each species group (e.g. surface feeders, water-column feeders) as required by Com Dec 2017/848. Lithuania, which only assessed wintering waterbirds, integrated in the same way for water-column and benthic feeders.

The other MS integrated within criteria across species, including those MS, which applied the integration for different groups (e.g. breeders, non-breeders) separately within the abundance criterion. Integration from multiple criteria to species group was only done by one MS (United Kingdom).

In many cases, integration was impossible owing to assessments restricted to one criterion only or because the number of species assessed was too low to obtain meaningful results.

Table 5. Methods applied by EU Member States for integration in their MSFD Article 8 assessments 2018.

Com Dec	Integration method	EU Member States
2017/848	criteria to species	ES DE FI
2017/848	species to species group	DE LT
2010/477	within criteria, across species *	FR UK BE NL SE EE LV PL
2010/477	from multiple criteria to species group	UK
	no integration	PT DK IE

*** Includes separate integration for different groups (e.g. breeders, non-breeders) within a criterion**

1.1.1 Which species groups were assessed regarding GES?

Most MS in OSPAR assessed achievement of GES in each marine bird species group listed in Com Dec 2017/878, as long as there were species from those groups occurring in the assessments. Spain and Ireland reported on the status of each species because there were too few species assessed in each of the groups. France and the United Kingdom reported on the proportion of species in each group that had met thresholds for each indicator, but did not carry out an integrated assessment of GES for each group. The United Kingdom assessed GES separately for non-breeding waterbirds and breeding seabirds.

1.4 Implications for future OSPAR and HELCOM assessments of marine birds

This review has shown that less than half of the ten MS in OSPAR had used the OSPAR assessment results in their MSFD assessments of GES in marine birds. One reason is that France, Portugal and Spain had no OSPAR assessment for Region IV to use. However, these three countries demonstrated that they do have data to perform assessments and used methods and thresholds that were similar or identical to the OSPAR indicators. The HELCOM assessments for marine bird abundance were used or at least reported by seven out of eight MS.

Both Sweden and Denmark did not use the OSPAR and HELCOM assessments in the Greater North Sea and in the Baltic Sea because their MSFD assessments were conducted for their respective national waters, encompassing both the North Sea and Baltic. As such the OSPAR and HELCOM assessments could not be disaggregated to meet these requirements. However, both the OSPAR marine bird indicators in the IA2017 were assessed at the scale of five sub-divisions within the Greater North Sea Region. These proved useful to the Netherlands and Germany who both used the assessments for the southern North Sea in their MSFD reporting. Sub-division assessments in the Baltic Sea were considered by four MS.

The MSFD assessments also showed variation in how the OSPAR indicators have been used in an integrated assessment of GES for marine bird species groups as required under Com Dec 2017/878. This was partly due to some Member States using the previous Com Dec 2010/477 to structure their assessments and to the lack of a regionally agreed method for integration. JWGBIRD has been developing a method for integrating assessments of marine birds (ICES 2018a). If this method is adopted by OSPAR CPs, it can be used in the Thematic Assessment of marine birds in the QSR2023. This could lead to greater consistency in how Member States produce integrated assessments of GES in marine birds under Article 8 reporting in 2024. In the HELCOM Area integration was not applicable because assessments were available for criterion D1C2 – abundance only, but Finland included national data for D1C4 – distribution into its assessment (method of integration not known).

There are currently no OSPAR and HELCOM common/core indicators for Members States to use to assess criteria D1C1 – bycatch, D1C4 – distribution and D1C5 – habitat for the species, and HELCOM is even lacking an indicator to feed criterion D1C3 – demography. The UK used candidate indicator methods to fill some of these gaps and other Member States, such as Spain, used their own national indicators. JWGBIRD is planning to address some of these gaps through the further development of some existing candidate indicators (e.g. distribution and bycatch) and of a new indicator on D1C5 (see revised JWGBIRD QSR2023 work plan, chapter 4).

References

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2 Develop an indicator of offshore habitat disturbance under MSFD criterion D1C5 – habitat for species

2.1 Introduction

The European Union has launched the Marine Strategy Framework Direction (Directive 2008/56/EC, MSFD) with the aim to conserve its marine ecosystems. In order to enable and direct measures to improve the marine environment (Article 13), Article 8 of MSFD requires the assessment of various components in the marine waters of the Member States. Within the Descriptor 1 – biodiversity, according to the new Commission Decision 2017/848 seabirds shall be assessed by the help of five criteria: bycatch in fisheries (D1C1), abundance (D1C2), demography (D1C3), distribution (D1C4) and habitat for the species (D1C5).

In the framework of holistic assessments of the Northeast Atlantic (lastly OSPAR 2017) and the Baltic Sea (lastly HELCOM 2018), JWGBIRD and its predecessors have been engaged in the development of indicators. So far, the regional seabird assessments have used indicators dealing with abundance (OSPAR and HELCOM Regions) and breeding success (OSPAR Region) only. These assessments were also used by a number of EU Member States for reporting the status of their national marine areas according to Article 8 MSFD, supplemented by data from national monitoring programmes (see chapter 1). Some of these national assessments were augmented by information about criterion D1C4 – distribution, but most were purely based on one or two of the five criteria (D1C2, D1C3). While the HELCOM core indicator for criterion D1C1 – bycatch could not be applied owing to the lack of data of both fishing effort and seabird bycatch rates, no regional applicable indicators were available for the criteria D1C4 and D1C5. Therefore, during its 2018 meeting, JWGBIRD has explored possibilities to create additional indicators in order to fill gaps currently existing in the MSFD bird assessments (ICES 2018). The meeting favoured an indicator for D1C5 – habitat for the species, which aims to assess the disturbance of seabirds by human activities at sea and formulated a task for the 2019 meeting to develop a concept for such an indicator.

2.2 Background

The performance of seabirds is affected from numerous human activities, of which some are acting for long time (such as shipping, fisheries), whereas others have arisen within the last decades only (such as marine aggregate extraction and offshore wind farms). How seabirds cope with pressures arising from activities has been described extensively. Therefore, it is out of the scope of this chapter to review both the extent of human activities and their effects on seabirds. JWGBIRD has addressed these issues in earlier meetings and reports. This chapter concentrates on activities and seabirds in marine areas off the shore. Table 6 summarizes for some important seabird species in the North Sea and the Baltic Sea the effects of activities on them. However, the indicator concept to be developed shall also be applicable to the coastal breeding sites and other activities occurring there, for example tourism with beaches occupied by humans, coastlines with summer houses and various sports such as wind surfing, kite surfing, canoeing etc.

Table 6. At-sea seabird occurrence (x) in the North Sea and Baltic Sea during the breeding and non-breeding seasons and vulnerability to some major disturbing human activities. Scores indicate the estimated magnitude of effects on the individual species (0 – very little or no effect, 1 – little or intermediate effect, 2 – strong effect). Major references: shipping: Schwemmer *et al*. 2011, Fliessbach *et al.* 2019; offshore wind farms: Dierschke *et al*. 2016, Vanermen & Stienen 2019; gillnet fishing: Sonntag *et al*. 2012,

Bradbury *et al*. 2017, ICES 2018); estimates concerning aggregate extraction and bottom trawling based on food preferences of species in relation to deterioration and recovery of seabed habitats.

scoring of effects: 0 very little/no effect 1: little/intermediate effect 2: strong effect	North Sea breeding	North Sea non-breeding	Baltic Sea breeding	Baltic Sea non-breeding	shipping	offshore wind farm	aggregate extraction	bottom trawling	gillnet fishing
Common Eider	x	x	x	x	1	1	2	2	2
Velvet Scoter		x	x	x	2	?	2	2	2
Common Scoter		x		x	2	1	2	2	2
Long-tailed Duck		x		x	2	1	2	2	2
Red-throated Diver	x	x		x	2	2	1	1	2
Black-throated Diver		x		x	2	2	1	1	2
Northern Fulmar	x	x			0	1	0	0	1
Slavonian Grebe		x		x	2	?	1	1	2
Northern Gannet	x	x			1	2	1	1	0
Black-legged Kittiwake	x	x	x		1	1	0	0	0
Little Gull		x		x	1	1	0	0	0
Great Black-backed Gull	x	x	x	x	0	0	0	0	0
Herring Gull	x	x	x	x	0	0	0	0	0
Lesser Black-backed Gull	x	x	x	x	0	0	0	0	0
Sandwich Tern	x	x	x	x	0	1	1	1	0
Great Skua	x	x			0	1	1	1	0
Arctic Skua	x	x	x	x	0	?	1	1	0
Common Guillemot	x	x	x	x	1	1	1	1	2
Razorbill	x	x	x	x	2	1	1	1	2
Black Guillemot	x	x	x	x	2	?	1	1	2
Atlantic Puffin	x	x			?	?	1	1	?

2.3 Indicator concept

The reactions of seabirds on human activities are manifold and differ strongly between species (Table 6). Therefore, any attempt to assess the impact of activities on seabirds has to address specific combinations of species and activity rather than using more general approaches, e.g. to look at the occurrence of activities only. The basic concept is to compare the distribution of species with the distribution of activities known to disturb that species and to identify the amount of overlap. This means that in a first step the habitat of a species has to be identified either by analysing recent distribution or by modelling biotic and abiotic characteristics, the latter indicating kind of "pristine" distribution (i.e. where the species would occur if no human activities are disturbing it). In a second step, we need to identify disturbing human activities for the species and to estimate the degree of impact (e.g. total avoidance, partial avoidance, no impact). Finally, it has to be quantified how much of the species' habitat is not used by it any more or to a lower degree, i.e. the proportion of disturbed habitat has to be calculated. This metric needs a threshold allowing to differ between GES and sub-GES (Figure 1).

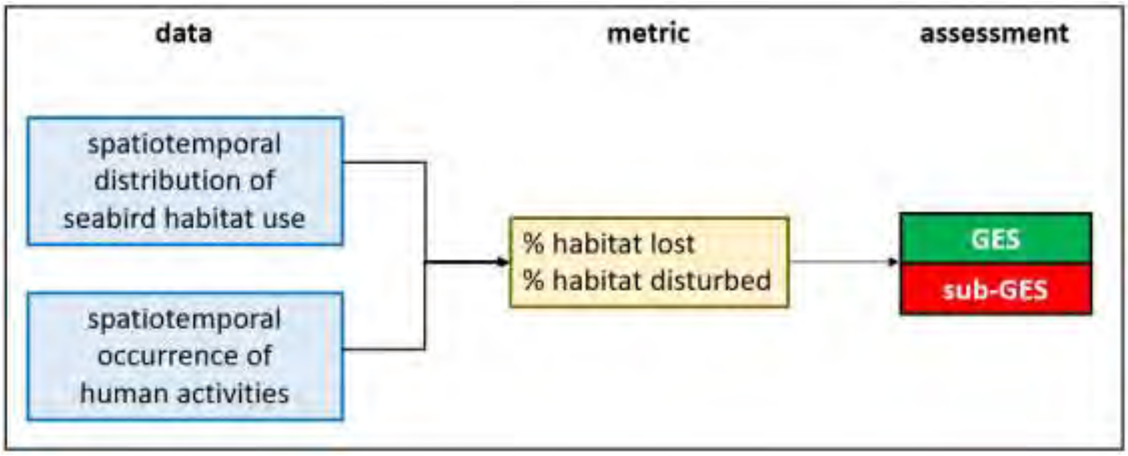

Figure 1. Schematic of data, metric and assessment for the proposed D1C5 indicator "Marine birds habitat quality".

2.3.1 Input data (seabirds)

Based on ship-based, aerial and digital surveys, the distribution of seabirds is quite well known in some parts of European marine areas, whereas in others, especially those locate far offshore, knowledge is scarce. The distributions of species living closer to shorelines and restricted to certain habitat characteristics, for example seaducks concentrating in shallow waters, are often much better known than those of species ranging widely across oceans, for example fulmar and shearwaters. In general, data collected for the seabird abundance indicators of OSPAR and HELCOM can also be used to illustrate distribution. Recently, the use of tracking data more and more supports exploring the distributions of certain species (e.g. http://www.seapop.no/en/seatrack/).

However, seabird distributions derived from surveys in recent decades already incorporate disturbance from human activities. For example, shipping lines and more recently offshore windfarm footprints are visible in distribution maps of species avoiding the respective source of disturbance (Burger *et al*. 2019, Mendel *et al*. 2019). Therefore, modelling the distribution not influenced by disturbance may be a way to solve this problem and to approach kind of "pristine" distribution. This may be more important for species with a narrow niche, again seaducks with preferences for shallow water and the occurrence of suitable bivalve food as an example. In contrast, for wide ranging species in which the distribution is more opportunistic, a modelling approach does not appear to be necessary.

2.3.2 Input data (human activities)

For some of the activities affecting seabirds, there is good knowledge about where and when they are applied. Static offshore installations such as wind farms have exactly defined locations, and the same applies to areas where aggregate is extracted. Ships as mobile sources of disturbance can nowadays be tracked by the help of Automatic Identification System (AIS), and this includes larger vessels used for bottom-trawling or other ways of fishing. More difficult to track are smaller vessels used for fishing (especially gillnet fishing in the Baltic Sea) and sailing boats, which are not obliged to use AIS. In case studies, the distribution of such boats has been analysed with data collected during seabird surveys (Sonntag *et al*. 2012, Bildstein *et al*. 2017), but locally radar has been applied to record the activity of recreational shipping (Petersen *et al.* 2017).

In some cases, other OPSAR and HELCOM indicators may support the assessment of habitat quality for seabirds. For example, seafloor integrity is assessed by the OSPAR common indicator "Extent of physical damage to predominant and special habitats", which addresses surface and subsurface abrasion from bottom-trawling (OSPAR 2017).

2.3.3 Metric

The metric for an indicator investigating the degree of seabird habitat disturbed would be the proportion of habitat disturbed (or even lost) compared to the total amount of habitat potentially available for the species. Despite this very simple approach, there are a number of uncertainties in the implementation.

First, it needs to define what is meant with seabird distribution or seabird habitat. One option is the use of species-specific density values (birds/km^2), above which a given marine area can be treated as being inhabited by the species. This approach can be modified by using a percentile (e.g. 75%) of the whole population as proposed for a Baltic Sea seabird distribution indicator earlier (HELCOM 2012). It has to be ensured that sporadic or isolated records of a species do not lead to misinterpretation as a regularly visited area or habitat. Given the high variability in seabird distributions, either annually, seasonally or even from day to day, it is recommended to use multiannual averages of distribution. If data from several or many years are available, the frequency of occupancy may be another option to check a given area (or grid cell) for regular occurrence.

Second, definitions are also needed for human activities. Above which level of disturbance (frequency, intensity) would we treat a given area as being disturbed? In contrast to the loss of individuals, which is not primarily addressed here, the loss or degradation of habitat is more difficult to translate into the impact on a population level. This is especially true for disturbance from activities in connection with mobile vehicles. For instance, disturbance from ships causing displacement may include the energetic cost of flying to another patch of habitat. This may be negligible as long as a few short-distance flights are involved, but may add up in case many flights are necessary because of frequent disturbance from many ships. Thus, if not applying a conditional rule such as One-Out-All-Out, a threshold connected to the frequency of disturbance has to be defined.

The frequency of disturbance can be a metric when the impact on the habitat itself is in the focus. For bottom-trawling, it is possible to calculate a swept area ration (SAR), which relates the area of seafloor touched by fishing gear to the total area of e.g. a grid cell. It could be meaningful to set the threshold for disturbance at least at 1, meaning that in average the total grid cell is affected in one year. However, it can be expected that the habitat is already strongly degraded with a lower SAR, because already then parts of the area lost their bivalve prey for benthic-feeding seaducks.

In static offshore installations such as wind farms, the footprint size in combination with avoidance behaviour of seabirds can be used for setting thresholds. Interspecific differences in the avoidance of wind farms have to be considered. For example, red-throated divers show an almost complete avoidance of the wind farm footprint and several kilometres beyond (Mendel *et al*. 2019). This is more difficult to quantify in the case of long-tailed ducks, which do not show complete avoidance, but only reduced densities in and around wind farms (Fox & Petersen 2019).

Apart from finding species-specific thresholds for the different human activities, it is important to restrict the assessment to the period of seabird presence in the annual cycle. However, longer lasting effects of activities such as the degradation of seafloor habitats would not need a restriction.

2.3.4 Cumulative assessment

The advantage of the indicator is that various human activities and their effects on seabirds can be assessed cumulatively. Figure 2 shows the example of Common Guillemot distribution in the North Sea in January overlain with the distribution of human activities supposed to disturb the species. As for the individual activities (see above), a threshold has to be found in order to allow a given marine area or seabird habitat to be treated as being disturbed.

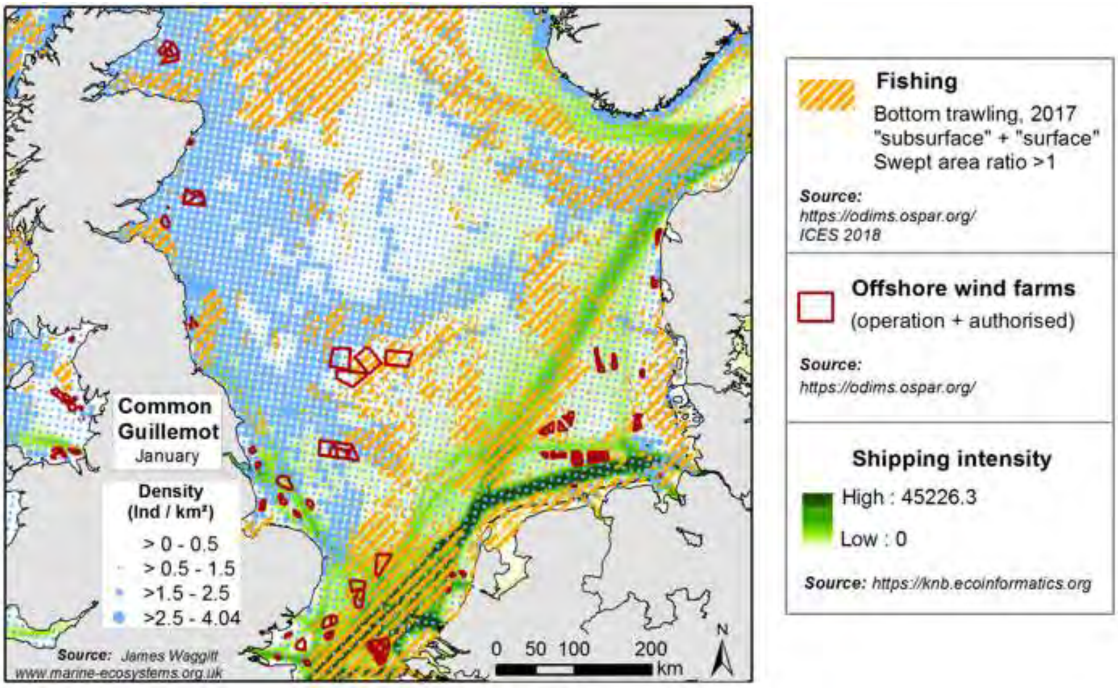

Figure 2. January distribution of Common Guillemot and extent of bottom trawling, offshore windfarming and shipping in the North Sea.

2.3.5 Threshold for GES

According to Com Dec 2017/848, the MSFD criterion D1C5 "habitat for the species" does not require a threshold. However, there needs to be agreement about the level of disturbance in a seabird habitat, which can be set as a threshold for deciding whether GES is achieved or not. The Com Dec phrases this as "The habitat for the species has the necessary extent and condition to support the different stages in the life history of the species". This sounds like a population approach, but as mentioned above, it is very difficult to translate increased energy expenditure (from flight reactions) and the amount of habitat loss (because of avoidance) into impact on a population. Moreover, seabird populations are ranging very widely, therefore assessments would need to be conducted on a large geographic scale.

The Com Dec addresses the extent of habitats. Given that many seabirds range in the scale of oceans during the annual cycle, it appears unlikely to assess the extent of habitats, except for very specialised species. But even the bivalve specialists, the seaducks, are widely distributed migratory birds, for which it would be difficult to assess the extent of habitats.

Therefore, it appears more promising to look at the condition of habitats, which after the Com Dec shall be sufficient "to support the different stages in the life history of the species". In seabirds, the term "support" can be translated into the general conclusion that individuals of the species can encounter a food supply for themselves (and during the chick-rearing period for their offspring) and can use the habitat for undisturbed staging (e.g. wintering, moulting). But how much disturbance can seabirds tolerate until a habitat cannot support them anymore?

As there is no meaningful approach on the level of population biology, expert opinion would be a possible way to go. Species by species experts would estimate which intensity and frequency of a given human activity would trigger falling below GES. If more than one activity is disturbing in an area, than there has to be a way to combine the effects of them. Finally, it has to be decided which proportion of habitat is acceptable to be disturbed for remaining in GES. The latter has to be combined for all habitats of a species in a given assessment unit, e.g. in an OSPAR subregion or in a HELCOM sub-basin.

2.4 Perspective

A D1C5 indicator assessing habitat loss and disturbance would nicely fit into the set of indicators assessing the status of seabirds, because it directly addresses pressures acting on the birds and allows identifying where measures are needed in order to achieve GES in the species concerned. This indicator can benefit from coordinated data calls for benthic habitats, bycatch and habitat disturbance, for example in relation to VMS or AIS data.

Details of the indicator concept, including definitions and threshold setting, will be developed intersessionally. Meanwhile, the idea of this indicator shall be brought into the relevant bodies of OSPAR and HELCOM, i.e. COBAM and STATE&CONSERVATION in order to advertise its utility for holistic assessments in the frame of the Regional Sea Conventions as well as in MSFD.

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3 Marine bird assessment for HELCOM HOLAS III

The next holistic assessment of the Baltic Sea (HOLAS III) is currently being planned and the preparations for the assessment (e.g. further development and infrastructure) will commence in early 2020, including development of indicators. The preliminary plan for the assessment is expected to be approved in the first half of 2020, with the assessment itself commencing in the beginning of 2022. The following information is taken from the HOD 57-2019 paper 4-19 “Draft Provisional Timeline and Preliminary Plan for HOLAS III”.

The intention is for HOLAS III to follow the general structure of HOLAS II, however to encompass only one iteration of assessment. The process consists of two distinct phases, of which the first is preparatory. This phase focusses on the consolidation and development of indicators and runs until late 2021, meaning that any indicators not fully operable by this time cannot be used for HOLAS III. The assessment phase consisting of data collection, indicator evaluations, integrated assessments and report production is proposed to run from late 2021 to late 2023, but results shall be available already late 2022. For details of the draft HOLAS III timeline see Table 7.

The proposed assessment period is 2016-2021, which means that for some data strands the data for 2016 will have been used twice (as 2016 was already included for some datasets in HOLAS II). It has been recognised that including data from 2021 would be challenging, given the time lag between monitoring and reporting. JWGBIRD will have to plan data flows in a way that seabird data of 2021 can be incorporated in the analyses. This includes data calls in time.

Table 7. Provisional draft timetable for HOLAS III.

			2020				2021				2022				2023			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
HOLAS III Preparatory phase	Indicator development/consolidation																	
	Establishing and ensuring dataflows																	
	Refining and further developments of assessments																	
HOLAS III Assessment Phase	Indicators	Data collection																
		Data approval																
		Indicator evaluations																
		Approval of indicator evaluation results																
		Update indicator reports																
		Updating indicator report metadata and maps																
		Approval of indicator reports																
		Prepare supplementary information																
		Approval of report content																
	Indicator based integrated assessments	Run integrated assessments																
		Validating and approving results																
		Prepare supplementary information																
		Approval of report content																
	Cumulative impacts assessment	Data collection																
		Data approval																
		Running indices																
		Metadata descriptions																
		Validating and approving results																
		Prepare supplementary information																
		Approval of report content																
	Economic and social analysis assessment	Data collection																
		Data approval																
		Analysis																
		Validation and approval																
		Prepare supplementary information																
		Approval of report content																
	Report	Collate and write summary report text																
		Create synthezised figures																
		Approval of report content																
		Website production																
		Layout																
		Publication																

3.1 Species and species groups

The HOLAS II assessments, which were restricted to bird abundance due to the availability and operability of indicators, were covering a total of 41 bird species. In the HELCOM usage they are called waterbirds, but also can be called seabirds, marine birds or – if restricted to coastal habitats – coastal birds.

JWGBIRD has grouped waterbird species into five species groups, which are defined as functional groups according to the place and mode of foraging (Table 8). This species groups were not only used in HOLAS II, but also in the OSPAR Intermediate Assessment and for MSFD assessments. For HOLAS III it is envisaged to increase the number of species considered, especially by including species wintering at sea and not accessible by land-based counts (see below).

The following sections outline the subjects addressed for birds in HOLAS III by depicting the state of indicators already existing and under development. The description is related to the criteria used for biodiversity assessments in the MSFD, not least because the assessment results from HOLAS III will flow into MSFD assessments, as has been the case with HOLAS II results (see chapter 1).

3.2 Waterbird bycatch in fisheries (MSFD criterion D1C1)

Though a core indicator had been developed ("number of drowned mammals and waterbirds in fishing gear", HELCOM 2018a), waterbird bycatch in fishing gear could not be assessed in HOLAS II. The reason for this was that neither bycatch data nor fishing effort data were available. A joint OSPAR/HELCOM workshop held in September 2019 in Copenhagen addressed waterbird bycatch assessments and recommended a method how to do it (see chapter 8). As soon as the recommendations are agreed within both OSPAR and HELCOM, the HELCOM bycatch indicator will be adjusted to the proposed methods and thresholds. Since widespread bycatch monitoring is still lacking, it is unlikely that a full and operational assessment can be conducted for HOLAS III. However, the proposed method would allow assessments in subdivisions of the Baltic Sea, so possibly parts of the Baltic may be assessed based on available data. Another possible avenue for assessment for HOLAS III, in the absence of information on bycatch rate, could be focusing on risk assessment, e.g. identifying high risk species, areas and possible temporal aspects.

3.3 Waterbird abundance (MSFD criterion D1C2)

HOLAS II has seen assessments of the abundance of breeding and wintering waterbirds. The two respective core indicators ("Abundance of waterbirds in the breeding season" and "Abundance of waterbirds in the wintering season") were applied to all five species groups on two geographical scales, i.e. the entire Baltic Sea and seven subdivisions, which were created by aggregating up to four of the 17 sub basins (HELCOM 2018b, 2018c). The HOLAS III assessments will be conducted in a similar way, but the assessment for wintering birds shall be extended to species mostly staying too far from the shore to allow land-based counts. JWGBIRD has developed a method to combine land-based counts with aerial and ship-based at-sea surveys (ICES 2016). At-sea monitoring is under way in most countries in the Baltic Sea and will allow extending the assessment to offshore species (see chapter 6).

Further recommended amendments refer to more precision in data deliveries concerning the naming of sites and refreshing the species list by including for example Ruff, Redshank and Terek Sandpiper. An increased coverage would be attained if pre-analysed data can be used when copyright issues prevent from using the original raw data. The quality of results would increase if the separation of coastal and inland sites is better defined in case of the breeding birds. For both abundance indicators, JWGBIRD recommends to subdivide the aggregated subdivisions in a meaningful way, for example into eastern and western or northern and southern parts, in order to better explain the subregional situation of waterbirds. An improved understanding and linkage between observed results/trends and the causative factors will also be developed.

3.4 Waterbird demography (MSFD criterion D1C3)

So far, no indicator covering waterbird demography has been developed in HELCOM. Breeding success has been a component of the indicator on breeding bird abundance, but after having the character of giving additional information on the breeding birds (Herrmann *et al*. 2013) was not considered anymore in the more recent versions of the indicator report (HELCOM 2018b). JWGBIRD is currently developing a new indicator concept for assessing breeding success (see chapter 5), and this concept should be well applicable to breeding waterbirds in the Baltic. JWGBIRD has to explore possibilities to adapt this indicator to the conditions in the Baltic and if applicable to prepare an indicator to be used in future. It is not likely that a breeding success indicator will be available for HOLAS III, unless long-term data such as the productivity of alcids from Stora Karlsö (Sweden) can be used. In general, a breeding success indicator is of high value for assessing the state of the Baltic, because it points to problems for breeding birds immediately rather than after only a couple of years in the abundance indicator. The latter is reacting more slowly on environmental changes, because waterbirds are long-lived and start reproduction only at an age of several years.

3.5 Waterbird distribution (MSFD criterion D1C4)

The distribution of waterbirds was not part of the HOLAS II assessment. Though an indicator concept was prepared for the distribution of wintering birds in the early stage of HELCOM indicator developments (HELCOM 2012), this idea was not followed in the subsequent years. JWGBIRD has rated the assessment of distributional changes as of relatively low value (ICES 2018). Especially when focussing on wintering birds, there are overriding effects of climate change rather than effects of human activities directly. For example, several duck species are shifting their winter distribution northwards due to warmer winters in the Baltic and the Arctic (e.g. Fox *et al*. 2019). The UK has developed a concept for a distribution indicator (Humphreys *et al*. 2012), which is considered to be an option in the OSPAR Region and which will be tested by JWGBIRD (see chapter 4.6.3). Given successful testing in the OSPAR Region, HELCOM may consider to adopt this approach and adapt it to the conditions in the Baltic. However, most likely no indicator will be in place to serve HOLAS III.

3.6 Habitat quality (MSFD criterion D1C5)

This MSFD criterion has not found admission to any HELCOM, OSPAR or MSFD waterbird assessment so far. JWGBIRD has started to develop an indicator addressing habitat disturbance from human activities (see chapter 2) to be used in both HELCOM and OSPAR Regions. The concept is to compare distributions of waterbirds and disturbing activities, allowing to quantify the proportion of habitat not available for waterbirds at least temporarily. As an initial step, Germany is going to produce a pilot assessment for part of the Baltic Sea (German waters). It is likely that the indicator will be ready in 2021, allowing it to be included in the HOLAS III assessment, in particular to provide contextual support for the overall assessment.

3.7 Integrated assessment

The waterbird indicator results will feed into the integrated assessment of HOLAS III, for which the refinement of assessment tools is due 2021. In HOLAS II, integration from species to species groups was applied for waterbirds within each indicator, i.e. for breeding and wintering birds separately, but not across indicators. A proportional rule was applied, with a species group being in good status when 75% or more of the species in a group are in good status (HELCOM 2018b, 2018c). So far, no other steps of integration are envisaged for waterbirds in HOLAS III, but would be applied when the HELCOM waterbird indicator assessments are used for MSFD assessments. MSFD assessments require integration across criteria on the species level first, followed by integration from species to species groups. The exact mode of integration has not been determined, but JWGBIRD has submitted a proposal how to do it (ICES 2018).

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4 Marine bird assessment plan for the OSPAR QSR2023

4.1 Overall vision for future regionally coordinated assessment of Marine birds

To provide robust assessments of the status of marine bird species, of species groups and of marine birds as a whole, for each OSPAR region. We will also conduct cross-species assessments of OSPAR Common Indicators, to explore the key factors affecting the observed changes in status. The status of OSPAR Threatened and Declining bird species will also be quantitatively assessed, where data make this possible.

These status assessments can be used for reporting under the MSFD, in accordance with the 2017 Commission Decision (EU 2017/848). The national data on abundance and distribution used in the OSPAR assessment can also be used in reports on Regularly Occurring Migratory Species and Annex1 species under the Birds Directive. All data used in the OSPAR Thematic Assessment of Marine Birds can be used in the Thematic Assessment of Foodwebs.

The development of Candidate indicators and new indicators will focus on measuring impacts from human activities, such as bycatch and from habitat loss due to offshore activities.

4.2 List of species, habitats or trophic guilds

JWGBIRD produced a list of 99 species of marine bird that could potentially be assessed in the OSPAR area, although not all species are present in every region. Species were selected for the IA2017 common indicators based solely on data availability and robustness (lists are tabulated in each common indicator assessment). This approach will be continued, with the aim that as many species as possible can be included in the assessment of each species group. The more species in a group, the more robust the assessment of that group is likely to be. There is nothing to be gained by leaving species out of an assessment.

The marine bird species groups used in the IA2017 will be continued (Table 8). These groupings were developed by JWGBIRD and are based on feeding behaviour. They have proved useful to identify key ecological differences in the existing common indicators for birds, which have also been evident in the HELCOM assessment of the Baltic.

Table 8. Marine bird species groups.

Functional group	Typical feeding behaviour	Typical food types	Additional guidance
Wading feeders	Walk/wade in shallow waters	Invertebrates (molluscs, polychaetes, etc.)	None
Surface feeders	Feed within the surface layer (within 1 to 2 m of the surface)	Small fish, zooplankton and other invertebrates	"Surface layer" defined in relation to normal diving depth of plunge-divers (except gannets)
Water column feeders	Feed at a broad depth range in the water column	Pelagic and demersal fish and invertebrates (e.g. squid, zooplankton)	Include only species that usually dive by actively swimming underwater; but including gannets. Includes species feeding on benthic fish (e.g. flatfish).
Benthic feeders	Feed on the seafloor	Invertebrates (e.g. molluscs, echinoderms)	None
Grazing feeders	Grazing in intertidal areas and in shallow waters	Plants (e.g. eelgrass, saltmarsh plants), algae	Geese, swans and dabbling ducks, coot

4.3 How does the availability of data affect what is possible for QSR 2023?

Data availability determines which species can be included in the existing marine bird common indicators and in which regions. Details of data limitations are provided in the IA2017 assessments. In our long-term vision below, we explain what could be achieved if some of these data gaps can be filled.

4.4 Short-term Vision - Possible indicator assessments for QSR2023

The short-term vision for indicators to be included in the QSR2023 and for indicator development (including possible pilot assessments) is laid out in Table 9. Firstly, the OSPAR Marine Bird Database will be updated (see details of data call below). The existing Common Indicators will be updated, with the same threshold used for abundance, but the breeding success indicator will be assessed differently to fill a knowledge gap highlighted in the IA2017 (see below and Table 10). Another knowledge gap, for the abundance indicator will be filled by performing an additional pilot assessment of data on seabird abundance at sea.

In contrast to the IA2017, the marine bird Common Indicators will be disaggregated into individual species trends of abundance (breeding and /or non-breeding) and breeding success. These trends will be assessed and then integrated to determine the status of each species and each species group. These species-specific status assessments follow the approach required under the 2017 MSFD Commission Decision. Methods for integration have been proposed by JWGBIRD (ICES 2018) and are outlined below.

Breeding and non-breeding populations of the same species will be assessed separately. This is because non-breeding populations (i.e. present in an area during migration or over-winter) may be made up of individuals originating from different sub-populations to those breeding in the same area. Breeding and non-breeding populations may use different habitats at different times of year and therefore may be affected by different activities and pressures. It is therefore useful for the interpretation of assessment results and would help management advice, if a distinction is made between the two populations. This approach would also be consistent with how breeding and non-breeding populations of the same species are reported separately under the Birds Directive.

Value will be added to the species-specific assessments by also comparing trends in both indicators across species, as was done in the IA2017. These cross-species comparisons are not required explicitly for MSFD reporting, but are very useful for providing insight in into the likely causes of change. Figure 3 shows how the species assessments could be presented alongside the cross-species comparisons of each common indicator in the OSPAR Assessment Portal.

Development of Candidate Indicators on bycatch and on distribution will continue and pilot assessments may possibly be included in the QSR2023, depending on whether a CP is able to lead and on data availability (details below). Likewise a pilot assessment may be possible for a new indicator proposed by JWGBIRD on marine bird habitat loss.

Table 9. Short-term vision for OSPAR marine bird indicators.

MSFD Criteria	Indicator name		Indicator type	Lead	To be used in QSR2023	Vision for QSR 2023
D1C1 Incidental bycatch rates (Primary)	B5	Marine bird bycatch	Candidate	DE/?	Possible PILOT	A pilot assessment of any available bycatch data to test and demonstrate assessment methodologies.
D1C2 Population abundance (Primary)	B1	Marine bird abundance	Common	UK/DE	YES	Update IA2017 assessment using more recent data and the same thresholds (Table 10), but aim to use more objective baselines where possible.
	B1	Marine bird abundance – seabirds at sea	Common	DE/BE	PILOT	Additional pilot assessment of Seabirds at Sea, led by DE & BE, using data from the southern North Sea (NL/BE/DE).
D1C3 Population demographics (secondary)	B3	Breeding success of marine birds	Common	UK/DE	YES	Update IA2017 assessment using more recent data, but use different thresholds (see text and Table 10).
	B2	Breeding success of kittiwake	Candidate	UK	NO	This is currently a national indicator for UK part of the North Sea (Mitchell *et al*. 2018a). There are no plans to extend beyond the UK because there are insufficient data from elsewhere in the North Sea.
D1C4 Species distributional range and pattern (secondary)	B6	Distribution marine birds	Candidate	--	Possible PILOT	JWGBIRD recommends a Pilot assessment, but is dependent on a lead to take forward development, which has so far been undertaken in the UK (Mitchell *et al*. 2018b).
D1C5 Habitat for the species (secondary)	B4	Non-native/invasive mammal presence on island seabird colonies	Candidate	--	NO	No progress planned. There has been little appetite in JWGBIRD to further develop this indicator beyond UK, where it is included in a national assessment (Mitchell *et al*. 2018c).
		Marine bird habitat loss indicator	NEW	DE	Possible PILOT	Lead to be confirmed. JWGBIRD recommends a pilot assessment using at-sea data from DE, NL and BE in the southern North Sea.

Table 10. Marine bird common indicators and thresholds to be used in the QSR2023.

MSFD Criteria	Common Indicator	Regions					Thresholds
		I	II	III	IV	V	
*D1C2 Population abundance (Primary)	B1 – Marine bird abundance (common indicator)	*	X	X	X		Relative abundance should be greater than 0.8 for species that lay one egg; or 0.7 for species that lay more than one egg. 'Relative abundance' = annual abundance as a proportion of baseline abundance. Baseline abundance in IA2017 was taken from the start of the time series (1992), but JWGBIRD recommends using more objective baselines were possible in QSR2023.
D1C3 Population demographics (secondary)	B3 – Breeding success of marine birds (common indicator)	*	X	X	X		Current threshold (IA2017) - 'Widespread' breeding failure occurs if the percentage of colonies failing per year is more than 5% (or, for tern species: the mean percentage of colonies failing over the preceding 15 years). Breeding failure is when almost no chicks (0.1 or less chicks per pair,) are produced at a seabird colony in a year. Widespread failure is considered to occur 'frequently' if it occurred in more than three years out of six. Current threshold may be replaced by a new threshold under development, which is set for each species at a level of breeding success (average number of chicks fledged per pair) that is required to sustain or grow the population.

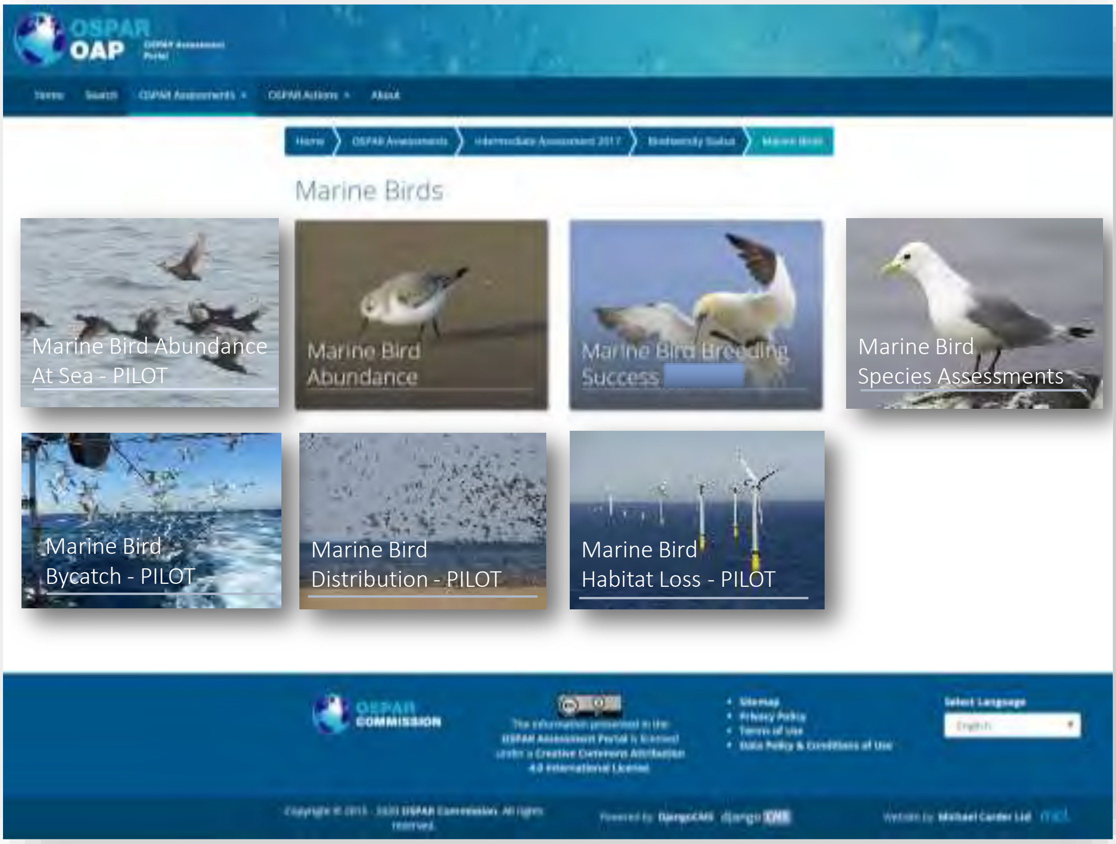

Figure 3. Mock-up of how the marine bird assessments could be presented for the QSR2023. This shows the existing tabs for the common indicators on abundance and breeding success and the proposed PILOT assessments. The Species Assessment Status tab is new and will contain pages showing the integrated assessment of status of each species included in the common indicators

(derived from integration of abundance and breeding success) and assessments of each Threatened & Declining Species (using the ICG-POSH guidelines).

4.5 Common indicator assessments

4.5.1 B1 - Marine bird abundance

This indicator will be assessed using the same thresholds used in IA2017 (Table 10). However, there will be slight amendments to the assessment methods: multi-year mean values from the most recent 6-year period will be compared against thresholds, rather than a single value from the most recent year, as used in the IA2017. This will ensure that year-to-year variations in the quality of annual estimates of abundance do not affect the assessment. HELCOM used this approach in their HOLAS II bird indicator assessments. Changes to how baselines are derived will also be considered.

The baselines used in the IA2017 abundance assessment were assigned to the start of the data series being assessed. In order to address a knowledge gap highlighted in IA2017, JWGBIRD proposes to set more objective baselines for as many species as possible in the QSR2023. Objective baselines include 'historical reference levels', which reflect abundance at a point in the past long before the time series began, or 'reference levels', where anthropogenic impacts on population size are assumed to be negligible. However, identifying more objective values is challenging because the length of the time series available are limited, as is our knowledge of pressure-state relationships. A call for baseline data will be issued in Spring 2020, in advance of JWGBIRD in October 2020, at which baselines for species in each region will be proposed for agreement at BDC 2021.

Data on seabirds at sea, collected from boats or planes, were not included in the abundance indicator in the IA2017. This was highlighted as knowledge gap because the current indicator tells us nothing about the trends in species that occur in substantial numbers offshore. At present, several Contracting Parties carry out, or plan to carry out, national at-sea monitoring programmes. Elsewhere, there are either no at-sea surveys or those that do exist are very limited in spatial and temporal coverage. JWGIRD has been working to instigate some coordination of surveys (e.g. regarding timing) between countries, which was previously lacking. JWGBIRD has also been working with ICES to develop a new European Seabirds At Sea Database. Following this progress, DE and BE will lead a pilot assessment of seabirds at sea data in the southern North Sea, which are currently being collated from Belgian, Dutch and German waters. This pilot assessment will help to develop a methodological approach for spatially aggregating and analysing data and assessing trends. The pilot assessment will be presented to COBAM 2020 and then potentially be considered by BDC 2021 to be included in the QSR 2023. This pilot assessment is intended to encourage greater co-ordination between CPs for the joint monitoring and assessment of seabirds at sea.

4.5.2 B3 - marine bird breeding success

The assessment of breeding success will follow a different method to that used in IA2017, if the changes are approved by CPs. The assessment of the indicator in the IA2017 acknowledged some limitations. The assessment methods currently focus on the extreme events of almost no chicks being produced by a colony, on average, per year. In doing so, they fail to identify other years where poor breeding success could still have significant negative impacts on the population in the longer term.

However, it is not straightforward to categorise annual breeding success as 'good' or 'poor'. The reason breeding has not been directly assessed as 'good' or 'poor' in this indicator is because the number of chicks that need to be produced each year to sustain a population or cause it to grow, varies substantially as other demographic parameters (e.g. survival rates) also vary in space and time. Information on demographics such as survival rate, age at first breeding and immature survival rates are more resource demanding to measure owing to the need to monitor individual birds from year to year. For well-studied species and at a few intensively studied sites these data do exist. Recently JWGBIRD has developed a simple modelling approach that combines breeding success data with estimates of survival and other demographics to predict whether the population would grow or remain stable or decline (ICES 2018). The proposed new approach predicts how observed levels of breeding productivity may impact on the long-term population growth rate of a species. Thresholds are set to indicate when breeding productivity is low enough to lead to population declines, using IUCN red list criteria to provide context to the extent of the predicted declines (See Figure 4). The new approach uses simple population models for each species that are validated using the trends in breeding abundance from the OSPAR Common Indicator on Marine Bird Abundance.

The proposed changes to B3 will be presented to BDC2020. Once approved, the next step will be to expand the method to more species.

Both marine bird common indicators will be assessed in the regions where they are already adopted (Table 9), depending on data being available from contracting parties in those regions. It is worth noting that the Bay of Biscay and Iberian Coast which was not included in IA2017 due to data not being made available by Contracting Parties. An assessment of Arctic Waters, where the indicator is not adopted, could be repeated using Norwegian data (as used in the IA2017) and could be expanded to other parts of the region if more data are made available by other contracting parties. The assessment of breeding success in the Greater North Sea will be expanded to include the Danish and German Wadden Sea, which were not included in IA2017 because the data time-series was too short.

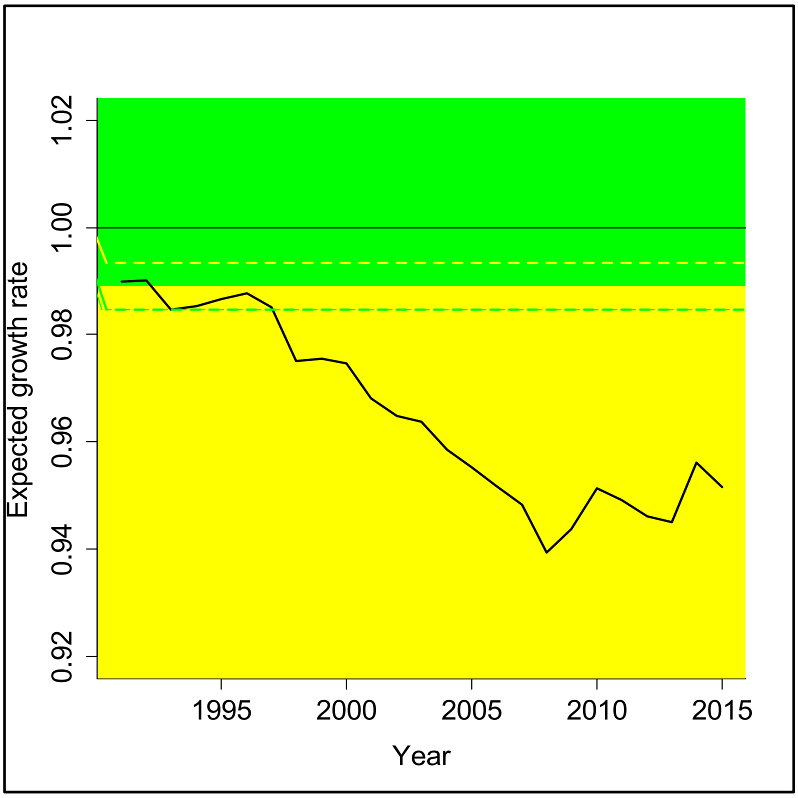

Figure 4. Proposed new indicator of breeding success (e.g. Kittiwake, Greater North Sea): the expected long-term population growth rate (black line), given the six-year retrospective running mean breeding productivity, and assuming that survival remains constant. A growth rate of 1.0 (horizontal black line) indicates that the population is stable. Green background indicates when the population is growing, is stable or is declining by less than 30% over three generations. Yellow back-ground indicates when the population is declining by more than 30% over three generations. The dashed lines denote the 95% confidence interval around the threshold growth rate that is equivalent to a decline of 30% over three generations.

4.6 Development of new and candidate indicators

JWGBIRD has considered the possible development of existing and new indicators (ICES, 2018, 2019 and summary in Table 10).

4.6.1 B2 – Kittiwake breeding success

This has been successfully assessed at kittiwake colonies on the North Sea coast of the UK (Mitchell *et al*. 2018a). However, a lack of data on kittiwake breeding success data from elsewhere in the Greater North Sea means that this indicator will not be adopted as a common indicator in the short-term.

4.6.2 B5 - Marine Bird Bycatch (D1C1)

So far, there has been no progress on developing OSPAR's candidate indicator on marine bird bycatch, due to a lack of bycatch monitoring data, despite the adoption of a European Plan of Action on Seabird Bycatch in 2010. However, momentum for the development of a regional indicator on bycatch has increased with the inclusion of the primary criterion D1C1 on Incidental bycatch rates in the 2017 MSFD Commission Decision. JWGBIRD recently completed a review of the current state of knowledge around seabird bycatch in European waters (ICES 2018), which fed into a Joint HELCOM/OSPAR workshop on marine mammal and seabird bycatch, held in Copenhagen in September 2019. The workshop proposed the following high-level objective in OSPAR's draft North East Atlantic Environment Strategy (NEAES) 2030 Part II: *Minimise and where possible eliminate incidental catches of marine birds, such that they do not represent a threat to the conservation status of the species.* (NB. This has not yet been adopted by OSPAR).

In a proposal to BDC 2020 JWGBIRD used outputs from the workshop to propose threshold setting methods for the indicator B5 to assess whether or not the proposed NEAES Objective above is met.

If data on seabird bycatch are made available by those contracting parties currently collecting it, then there is potential for running a pilot assessment of bycatch mortality in order to test and demonstrate assessment methodologies. Germany have offered to co-lead such a pilot. A more detailed proposal for the pilot assessment, with draft outputs, would need to be delivered to BDC 2021 for inclusion in the QSR2023.

4.6.3 B6 - marine bird distribution (D1C4)

The candidate indicator on marine bird distribution was developed in the UK (Humphreys *et al*. 2015) and presented as a pilot assessment in the recent UK Marine Strategy assessment update (Mitchell *et al*. 2018b). The approach was mainly based on coastal counts of breeding and wintering birds, looking at changes in distributional range and pattern. HELCOM (2012) also developed an approach to assessing changes in distribution of seabirds in offshore areas. JWGBIRD considered the future of the distribution indicator at its annual meeting in 2019 (ICES 2019). JWGBIRD welcomed the progress made by the UK in developing a simple, robust and tried and tested method. They also recognised problems with the indicator; e.g. it is difficult to get clear messages from changes in distribution with respect to the status of seabird species and it may not provide much additional information to the abundance indicator.

JWGBIRD concluded that a pilot assessment of distribution using the same data that will be provided in the data call for the existing common indicators would test the usefulness of the indicator at an OSPAR regional level. This pilot assessment currently does not have a lead. A more detailed proposal for the pilot assessment, with draft outputs, would need to be delivered to BDC 2021 for inclusion in the QSR2023.

4.6.4 B4 - Non-native/invasive mammal presence on island seabird colonies (D1C5)

This indicator was considered by JWGBIRD to potentially assess a new criterion, D1C5 - habitat for the species, under the revised Commission Decision 2017. Predation by non-indigenous or invasive native predatory mammals can cause severe damage to seabird breeding colonies and can also impact on non-colonial seabirds. The presence of invasive predatory mammals can effectively reduce the amount of safe breeding habitat available to certain species, particularly those that nest on the ground. OSPAR's candidate indicator addresses this impact on availability of habitat for a species and has so far, been assessed on protected seabird islands in the UK. JWGBIRD has explored more general approaches for this indicator earlier (ICES 2015), but failed to agree on an approach that could be applied over the diverse spectrum of seabird breeding sites found across the OSPAR area. While it may be straightforward to monitor presence and absence of predators in many breeding colonies, this appears to be difficult or even impossible at other breeding sites, especially in extensive archipelagos. Therefore, for assessing habitat quality in terms of presence or absence of predators, JWGBIRD recommends Contracting Parties adopt national approaches, rather than developing a Common Indicator for an entire region.

4.6.5 NEW indicator on marine bird habitat disturbance (D1C5)

In the absence of any other indicator that assesses MSFD criterion D1C5, JWGBIRD recommends developing a **new indicator on marine bird habitat disturbance** (see chapter 2 of this report). Many human activities are disturbing seabirds in their marine habitats in a way that they cannot use part of their habitat for some time. This impact can be long-lasting, e.g. when benthic habitats are disturbed from bottom-trawling fisheries or aggregate extraction (Dayton *et al*. 1995, Cook & Burton 2010) or when seabirds avoid offshore wind farms (Dierschke *et al*. 2016, Mendel *et al*. 2019), but can also be temporary in the case of ship traffic with birds returning to disturbed locations after minutes or hours (Schwemmer *et al*. 2011). The proposed new indicator on marine bird habitat disturbance relates the amount of habitat of a given species disturbed by human activities to the amount of habitat available for that species naturally, i.e. by calculating the proportion of habitat lost / not useable in the assessment period. The baseline extension of a species' habitat could either refer to a "pristine" distribution pattern (i.e. the occurrence before disturbing activities started), but could also be attained from modelling (based on known habitat preferences). Such an indicator would be strongly pressure-related, could even address the cumulative impact of various activities and appears to suit MSFD requirements well, because it allows deriving management measures precisely related to kind and location of activities having impact on seabirds. Germany propose to lead the development of this indicator and will submit a more detailed proposal for the pilot assessment, with draft outputs, to BDC 2021 for inclusion in the QSR.

4.7 Long-term vision

Looking beyond the QSR2023, the assessments of common indicators on **B1 - abundance** and on **B3 - breeding success** could be expanded to OSPAR Region V – Wider Atlantic, since these common indicators are also applicable to seabirds breeding in the Azores. The assessment of the abundance indicator could also be expanded to include more data on seabirds and waterbirds collected at sea, where this is available (e.g. in the southern North Sea). The recent redevelopment of the European Seabirds at Sea database can provide an established dataflow for this indicator (see ICES, 2017, chapter 6).

B5 – seabird bycatch mortality is likely to be adopted at some point as a Common Indicator because CPs are obliged to assess bycatch under MSFD and under the EU PoA on seabird bycatch or under their national POAs. It is potentially applicable to all regions. But adoption and further development of this indicator is reliant on seabird bycatch data being collected in longline and gill-net fisheries, which are most likely to catch birds.

The adoption of the candidate indicator **B6 – marine bird distribution** and the new indicator on **marine bird habitat loss** will depend on the success of the pilot assessments that may be undertaken during the QSR2023.

4.8 Integration methods

JWGBIRD reviewed the advice on integration from ICES (2018b). JWGBIRD agreed with most of the advice, but have proposed a slightly different conditional rule for integrating criteria to assess the status of each species (ICES 2018). Breeding and non-breeding populations of the same species should be assessed separately in order to aid interpretation and management advice. JWGBIRD's proposed integration framework is shown in Figure 5 and contains the following rules:

Species status is assessed as follows (see Figure 6):

i. If an assessment of D1C1 bycatch or of D1C2 – abundance is below target, then the status of the species is 'poor', regardless of assessment outcomes for secondary criteria C3-C5.
ii. If both D1C1 bycatch and D1C2 – abundance is on target, status will be dependent on the weighted average of the normalised criteria D1C2-C5; where D1C2 is double the combined weight of D1C3-C5.
iii. A group of bird species will achieve GES if 75% or more species or populations are in 'good' status (or all species in groups of five or less).
iv. Marine birds will have achieved GES if all five bird species groups have achieved GES (assumes each group is equally well represented in terms of species composition and assessment quality).

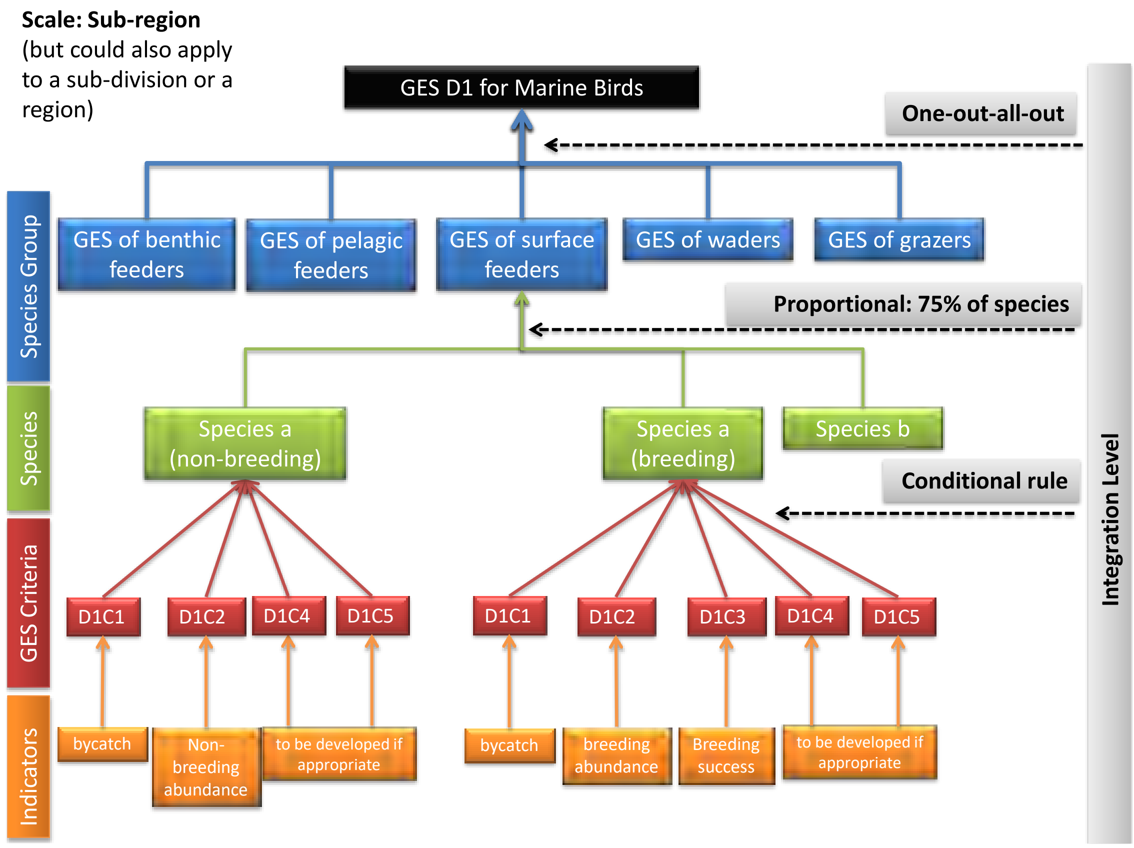

Figure 5. JWGBIRD proposed integration framework for assessing GES in marine birds (ICES 2018).

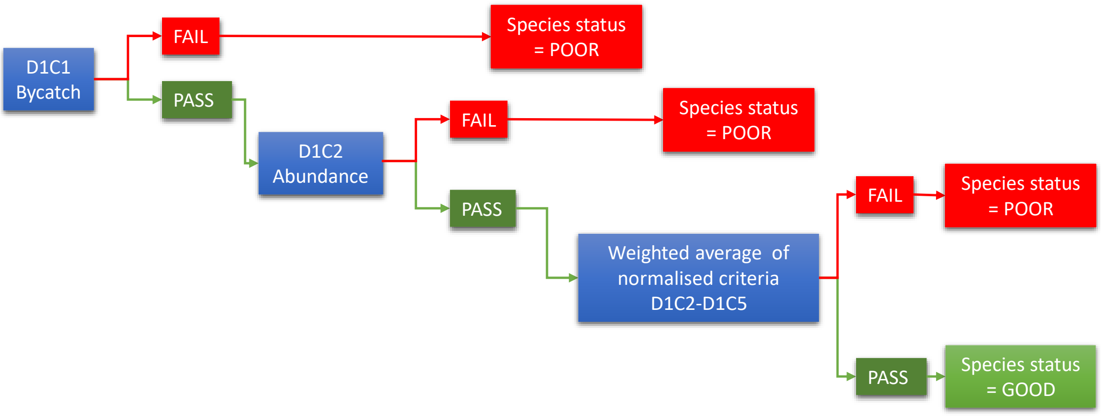

Figure 6. JWGBIRD proposed rules for integrating criteria to assess the status of a marine bird species (ICES 2018).

4.9 Assessments of Threatened and Declining Species

ICG-POSH has produced a plan for assessing the status if OSPAR-listed threatened and declining (T&D) species and habitats, which includes nine species/sub-species of marine bird. ICG-POSH's proposal (Table 11) is for each species assessment to be led by the same contracting party that is responsible for implementing the collective actions for that species. JWGBIRD can support assessment leads and provide critical review of the assessments before they are submitted to BDC. The basis for JWGBIRD's involvement is provided by action #36 in ICG_POSH road map for collective actions on T&D species and habitats, which is also captured in JWGBIRD's joint OSPAR/ICES/HELCOM workplan 2018-2021.

In 2018 the UK, assisted by Norway and JWGBIRD, produced a pilot assessment of black-legged kittiwake in order to test the proposed reporting format for the assessments of T&D species. The assessment of status of kittiwakes used outputs from the IA2017 assessments of the two marine bird common indicators (see above). The assessment of kittiwakes will be finalised in 2021/22 when the common indicators are updated with the latest data for the QSR2023. Two other species, Brünnich's guillemot and roseate tern will also be assessed in 2021/22 because they are also included in the common indicator assessments. For kittiwake, Brünnich's guillemot and roseate tern, data will be collated as part of the data call for the QSR 2023 common indicator assessments (see below) and the status of the species in each region will be assessed using the integration rules described above. This process can be largely managed by JWGBIRD, but will feed the status assessments to the relevant species lead (Table 11), who can then add the necessary additional information on threats and measures.

None of the six other species are included in the common indicators, due to different reasons (see Table 11), so their status cannot be assessed as part of the QSR2023 process described above. Quantitative assessments of these species are therefore more challenging and will rely more on third party data and expert judgement.

Table 11. ICG-POSH assessments of threatened and declining bird species.

Species	Regions	Specific Collective action and lead	Included in QSR 2023 indicator	Next assessment	Assessment lead	Notes
Black-legged kittiwake	all		Y	2021/2022	UK/Norway	Trial conducted in assessment in 2018/19.

Species	Regions	Specific Collective action and lead	Included in QSR 2023 indicator	Next assessment	Assessment lead	Notes
Roseate tern	II, III, IV, V	43; ES, PT	Y	2021/2022	Spain	
Balearic shearwater	III, IV, V	43; ES, PT	N	2020/2021	Spain	This species breeds in Mediterranean and spends only part of its annual lifecycle at sea in the NE Atlantic, from where there is little data on distribution and abundance. Requires links with Barcelona Convention.
Iberian guillemot (*Uria aalge ibericus*)	IV	32; ES	N	2020/2021	Spain	Subspecies of common guillemot, confined to a few pairs breeding in northern Spain and Portugal.
Steller's Eider	I	39; NO	N		Norway	
Ivory gull	I	32; NO	N		Norway	
Thick-billed murre	I	44; NO	Y	2021/2022	Norway or Denmark?	Aka Brünnich's Guillemot
Lesser black-backed gull, (*Larus fuscus fuscus*)	I	45	N	2020/2021	Norway	Refers only to the *fuscus* sub-species of Lesser black-backed gull. The common indicators include this and other sub-species, but do not distinguish between them so cannot provide the information needed to conduct an assessment of the *fuscus* sub-species. Cross-border assessment with HELCOM may be required.
Little shearwater (*Puffinus baroli)*	V		N			Recently speciated from a sub-species of little shearwater, aka 'Macaronesian shearwater'. Breeds on islands in the wider Atlantic Region.

4.10 Timeline for delivery of the QSR 2023

The timeline in

Table 12 assumes that the assessments for the QSR2023 need to be completed by the end of 2021 in time for submission to BDC 2022. The timeline includes pilot assessment in 2020. The final assessment will be conducted in 2021 following a data call issued at the end of 2020. The production of assessments of threatened and declining seabird species is also included because this is closely linked with the work required for the QSR.

4.10.1 Data calls for QSR 2023

A preliminary call for baseline abundance data will be issued in Spring 2020, in advance of JWGBIRD in October 2020. Using these data at the meeting, OSPAR experts identify appropriate baselines for species in each region. These baselines can be agreed by CPs at BDC 2021.

In the mean-time, the baselines will be requested from CPs during the major data-call to all Contracting Parties in November 2020. The data-call will be almost identical to the one issued in 2016 prior to the IA2017. Contracting Parties will be required to complete data forms which will be uploaded to the OSPAR Marine Birds database, hosted by ICES. As in 2016, a call will be made for the following data:

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; and counts of young fledged (preferably or fail that counts of young hatched), per species per colony per year.

b) **wintering and passage waterbirds (incl. waders) –** numbers of birds per species per site per year that are counted from land. Data will be requested for two time periods, depending on availability: a) max count in January; and b) mean count during July to June.

c) **Baselines (all species)** - The appropriate baseline for each species will have been identified at JWGBIRD in October 2020. Ideally these will 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. If such baselines are not available for a species, the population size at start of the time-series will be used as a default baseline.

d) **Regional weightings (all species)** - size of the population of each species in each subdivision of OSPAR Regions I and II, and each Region.

In addition DE, BE and NL will be requested to supply data on counts of seabirds at sea for the pilot assessment of abundance of seabird at sea, to be included as part of the Common Indicator on Marine Bird Abundance.

Table 12. Timeline for delivery to the drafting of the QSR 2023.

Feb/Mar 2020	**BDC 2020 consider proposals for adoption of changes to B3 – marine bird breeding success.**
Apr-Sep 2020	DATA-CALL – abundance baselines TBC – draft proposals for a pilot assessment of B5 seabird bycatch mortality TBC - draft proposals for a pilot assessment of B6 Marine Bird Distribution DE/BE - draft proposal for a pilot assessment of at-sea abundance data in southern North Sea
Oct 2020	JWGBIRD annual meeting
	JWGBIRD identifies baseline abundances for each species in each region JWGBIRD review progress on pilot assessments
	JWGBIRD agrees on format of final data call JWGBIRD Start preparing Thematic Assessments incl. structure, measures assessments
Nov 2020	COBAM 2020: reviews proposals for pilot assessment for marine birds and format of final data call
Nov 2020 -March 2021	DATA-CALL - all data from all contracting parties
March 2021	BDC 2021 – consider proposals for pilot assessments and agree which will be included in QSR2023 BDC 2021 – consider and approve proposed abundance baselines
Apr-Oct 2021	UK & DE indicator leads carry out a final assessment of B1 and B3 using new data from final data call and integrate results where necessary to produce species specific status assessments T&D species assessment leads draft assessments for black-legged kittiwake, Brünnich's guillemot and roseate tern and revise species status assessments.
Oct 2021	JWGBIRD annual meeting
	JWGBIRD review final assessments for birds JWGBIRD review T&D assessments of black-legged kittiwake, Brünnich's guillemot and roseate tern
Nov 2021	COBAM 2021: review final assessments POSH 2021: review T&D assessments of black-legged kittiwake, Brünnich's guillemot and roseate tern
Dec 2021	Bird assessments completed for submission to BDC 2022

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5 Further development of the indicator of breeding productivity

5.1 Introduction

This chapter proposes changes to the assessment methods and assessment thresholds of the OSPAR Common Indicator on marine bird breeding success. These changes, if agreed, could be adopted during the assessment of marine birds in the OSPAR Quality Status Report (QSR) in 2023. These proposals are the culmination of work by JWGBIRD, which started in 2017 (ICES 2017, 2018). The aim was to address limitations in the method that were highlighted as Knowledge Gaps in the IA2017 assessment of the indicator 'Marine bird breeding success/failure' in the (OSPAR 2017). While the assessment of breeding success/failure provided a valuable insight into the breeding performance of marine birds and the factors that affect it (e.g. food availability), the new approach provides an indication of how observed levels of breeding productivity may affect the rate of future population increase or decline.

As long-lived species with delayed maturity, changes in the productivity (number of fledged young per nesting pair) of seabirds are expected to reflect changes in environmental conditions long before these are evident as changes in population size. Breeding success in marine birds can be a valuable indicator of population health. Therefore, an indicator of breeding productivity can add value to assessments of the status of species by helping to identify possible causes of population decline and by acting as an early warning of possible future declines and of changes in the marine environment.

5.2 Current approach

5.2.1 Overview

The assessment of the indicator on marine bird breeding success/failure in the OSPAR Intermediate Assessment (IA2017) was based on how many chicks are fledged (having wing feathers that are large enough for colony departure) annually, per pair, clutch or nest (OSPAR 2017). In the absence of any method to assess how many fledglings were required each year to maintain the population of a species, the assessment described changes in breeding failure rates across breeding colonies. Breeding failure is the extreme event of almost no chicks being produced by a seabird colony in a single breeding season. Successive years of breeding failure will have a detrimental effect on the growth rate of a population and may lead to declines. Failure can be indicative of changes in food availability, impacts of human disturbance, predation by invasive mammals or poor weather conditions, amongst other factors.

5.2.2 Current thresholds

Thresholds for failure rate were set to define when the proportion of colonies failing in a region would be considered widespread (following Cook *et al*., 2014). For tern species, widespread breeding failure occurs when the percentage of colonies failing per year exceeds the mean percentage for the preceding 15 years. For all other species, widespread breeding failure occurs when the percentage of colonies failing per year exceeds 5%. Frequent breeding failure is when breeding failure occurs for four years or more out of six (during the period 2010-2015 in the IA2017).

5.2.3 Limitations

The IA2017 assessment of breeding success/failure acknowledged some limitations to the approach used (OSPAR 2017). By focussing on the extreme event of colony failure, the assessment methods failed to identify other years where poor breeding productivity could still have significant negative impacts on the population in the longer term.

However, it is not straightforward to categorise annual breeding productivity as 'good' or 'poor', because the number of chicks that need to be produced each year to sustain a population or cause it to grow varies substantially as other demographic parameters (e.g. survival rates) also vary between years and between species. Information on demographics such as adult survival rate, age at first breeding and immature survival rates are more resource demanding to measure owing to the need to monitor individual birds from year to year. These data exist for only well-studied species and at a few intensively studied sites. Previous work by JWGBIRD considered using published demographic rates to make inferences about the likely levels of breeding productivity that could and could not sustain a population (ICES 2017). However, the method proposed below develops a population model that is not totally reliant on empirical demographic data.

5.3 Proposed new approach

5.3.1 Overview

The proposed new approach predicts how observed levels of breeding productivity may impact on the long-term population growth rate of a species. Thresholds are set to indicate when breeding productivity is low enough to lead to population declines, using IUCN red list criteria to provide context to the extent of the predicted declines. The new approach uses simple population models for each species that are validated using the trends in breeding abundance from the OSPAR Common Indicator on Marine Bird Abundance.

5.3.2 Data requirements

The data requirements of the new approach are exactly the same as the approach used in the IA2017. The new approach does not require any additional data collection. The relevant part of the data call is as follows:

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; and counts of young fledged from a specified number of monitored pairs or nests (preferably or fail that counts of young hatched), per species, colony, pair and year.

These data will be used to produce for each species in each region, trends in annual average breeding productivity from estimates of annual breeding success at each colony that is monitored, using the same analytical methods as in the IA2017 (see OSPAR 2017).

Breeding success per colony = number of young fledged / number of nests (or breeding pairs) monitored

Examples of trends in breeding productivity of black-legged kittiwake and common guillemot in the Greater North Sea are shown in Figure 7. A six-year running mean of breeding productivity is used to smooth the trend (see Figure 7). These smoothed values are used to calculate the new indicator metric – population growth rate (see below).

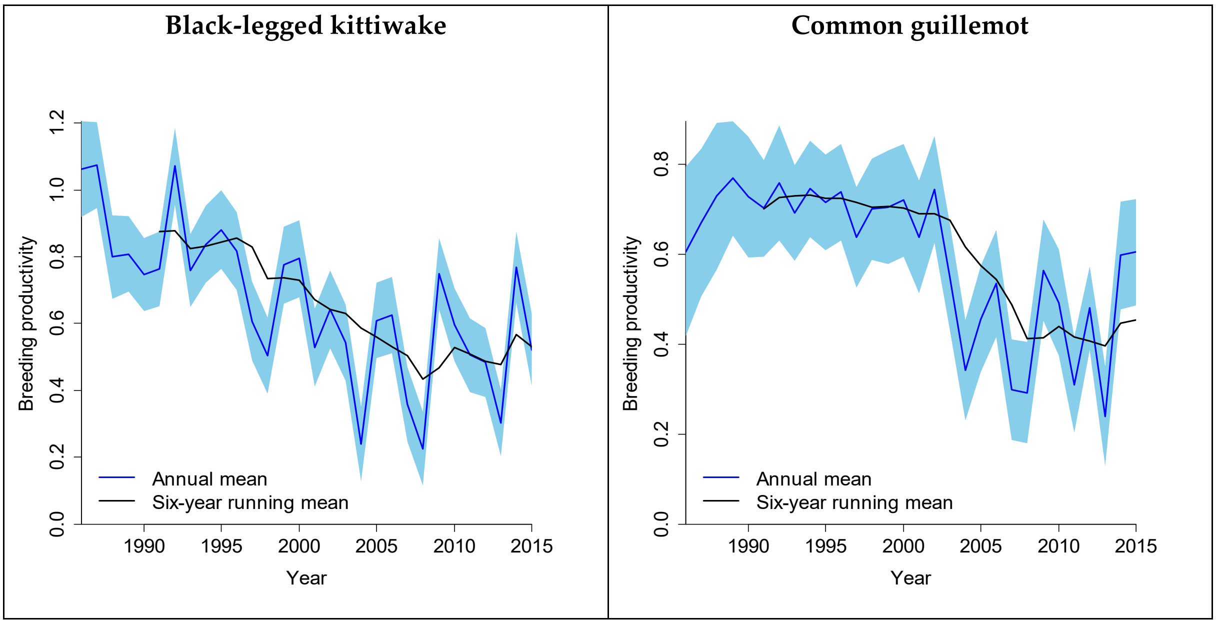

Figure 7. Trends in breeding productivity of black-legged kittiwake (left) and common guillemot (right) in the Greater North Sea. The blue line shows the annual mean breeding productivity, with 95% confidence limits. The black line shows the six-year retrospective running mean.

5.3.3 New metric

Population growth rate – is defined as the factor by which the population grows per year (the ratio of population size in one year compared to population size in the previous year t). This is also known as the finite growth rate and often denoted using the Greek letter λ (lambda). A stable population has a growth rate of 1, a growing or increasing population has a growth rate of greater than 1 and a declining population has a growth rate of less than 1.

5.3.4 Calculation of the new metric

The indicator, for each species, consists of estimates of population growth rate calculated from each six-year running mean of annual mean breeding productivity in each region. The steps required to calculate the metric and then assess the indicator are detailed in section 5.3.7 below. In summary, the population growth rate is calculated using a simple population model, which is constructed for each species. The values of the parameters in the model, other than productivity (i.e. number of age classes and survival rates of each age class), are initially based on expert knowledge and/or values published in the literature (e.g. Horswill & Robinson 2015). The model also makes some basic assumptions that are detailed in section 5.3.7 below. The values of the parameters in the model are then adjusted so that the population growth rate predicted by the model mirrors the observed trend in population abundance over the same period, as calculated for the same species in the OSPAR Common indicator on marine bird abundance (see section 5.3.7 below).

The values of the 6-year running mean breeding productivity (in Figure 7) are then entered into the population model, in order to calculate for each year the expected (asymptotic) growth rate. These values represent the expected long-term annual growth rate of the population, if breeding productivity was maintained at the mean level observed in the most recent six-year period (see Figure 7).

5.3.5 New threshold

A threshold is set uniquely for each species in each region to define the growth rate which, if sustained, would lead to a decline in population size of ≥ 30% over three generations, which is consistent with the IUCN red-listing criteria for species that are 'Vulnerable' (IUCN 2012). Generation time is calculated for each species using the population models used to calculate population growth rate (details in section 5.3.7 below). Generation time is then used in a simple equation (see section 5.3.7 below) to calculate the threshold population growth rate equivalent to a 30% decline in population size over 3 generations (see examples in Figure 8). The threshold for population growth rate will vary between species because of differences in generation time (Figure 8).

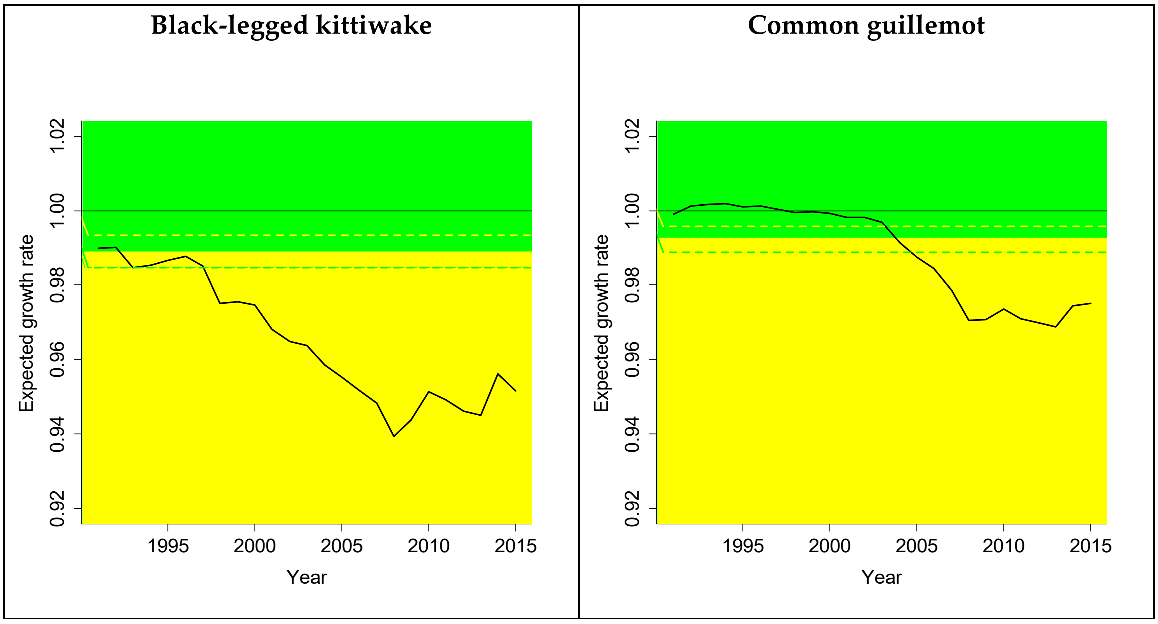

Figure 8. Proposed new output: the expected long-term population growth rate (black line), given the six-year retrospective running mean breeding productivity (shown in Figure 7), and assuming that survival remains constant. A growth rate of 1.0 (horizontal black line) indicates that the population is stable. Green background indicates when the population is growing, is stable or is declining by less than 30% over three generations. Yellow background indicates when the population is declining by more than 30% over three generations. The dashed lines denote the 95% confidence interval around the threshold growth rate that is equivalent to a decline of 30% over three generations.

5.3.6 Predicting future prospects

Growth rates lower than the threshold described above can be put into context of the likely future prospects of the population by using coloured bands showing the growth rates equivalent to the other IUCN red-list criteria (IUCN 2012), as shown in Figure 9:

CR (critically endangered):	≥ 80 % decline
EN (endangered):	≥ 50 % decline
VU (vulnerable):	≥ 30 % decline

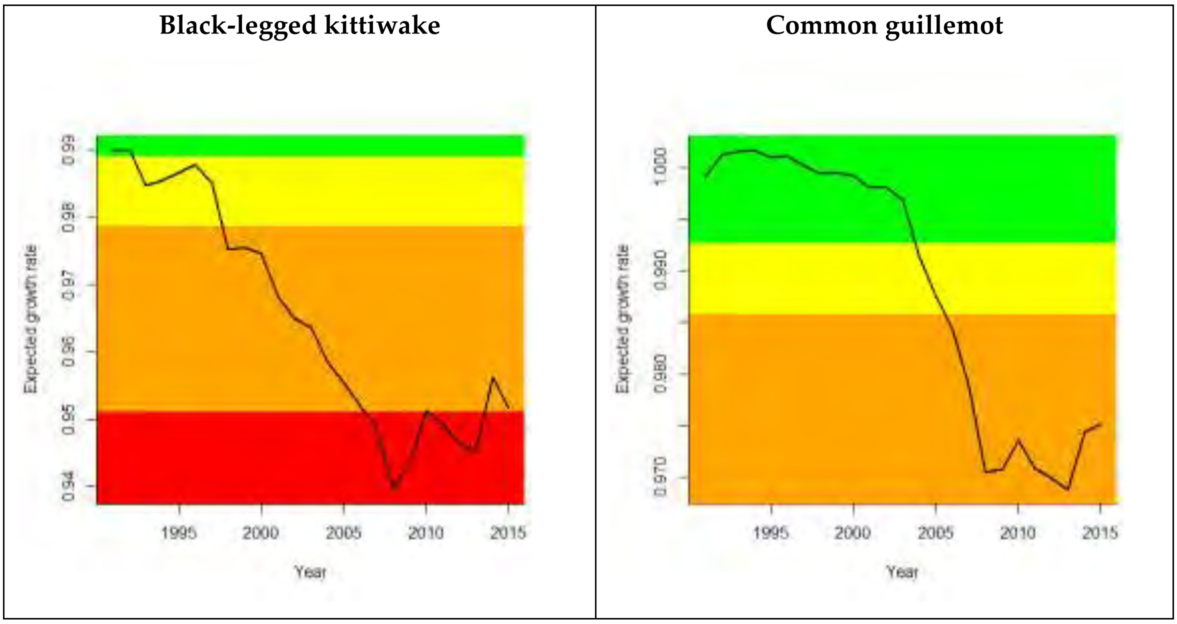

Figure 9. Predicted future prospects: the expected long-term population growth rate (black line), in the context of IUCN Red list categories. The background colours show the IUCN red list category corresponding to the expected growth rate, given the calculated generation time. Green: Least Concern/Near Threatened, yellow: Vulnerable (≥ 30% decline over three generations), orange: Endangered (≥ 50% decline over three generations), red: Critically Endangered (≥ 80% decline over three generations).

5.3.7 Detailed assessment methods

This section lists the steps required to assess the indicator for each species and in each region. Population growth rate is defined as the factor by which the population grows per year (the ratio of population size in year t+1 to population size in year t). This is also known as the finite growth rate, and often denoted using the Greek letter λ (lambda). A stable population has a growth rate of 1.

1. Estimate annual mean breeding productivity (number of chicks fledged per pair), and its standard error. The method takes account of missing data in individual colonies and generates a reproducible time series.
2. Calculate a six-year retrospective running mean breeding productivity (e.g. the value for 2015 is based on the years 2010-2015).
3. Construct a simplified baseline demographic matrix model (female-based) for the species. The number of age classes in the model, and the starting values for survival of the different age classes, are based on expert knowledge and/or literature reviews (e.g. Horswill & Robinson 2015). The model assumes that all individuals start to breed at a given age, that breeding productivity and survival are unchanged after this age (i.e. no senescence), that 90% of all adults attempt to breed each year and thus are included in the estimates of breeding productivity, and that sex ratio is 1:1.
4. Tune the baseline model to the observed abundance trend (D1C2 indicator), for the period 2000-2014 (see Figure 10). This involves:
   a) Estimate the mean observed population growth rate for the period by regressing the log-transformed abundance indicator against year, and back-transforming the estimated regression slope.
   b) Construct a stochastic version of the matrix model (10,000 simulations), by substituting values drawn from normal distributions defined by annual mean breeding productivity and its standard error into the baseline model, and run it for the period 1986-2016. For each simulation, estimate the stochastic population growth for the years 2000-2016.

c) Compare observed population growth rate to the simulated mean stochastic growth rate, and adjust values of survival for the different age classes until the two measures of population growth rate are the same. There is no unique solution, and some trial and error is necessary.

d) Further tune the baseline model by adjusting breeding productivity to obtain a stable population (i.e. growth rate = 1). Use matrix algebra to calculate the generation time (i.e. mean age of reproducing females) of the population based on this version.

5. Calculate the growth rate corresponding to the IUCN red list thresholds of 30% decline over three generations (using the generation time calculated in the previous step) or 10 years, which indicates a species is Vulnerable (IUCN 2012).
6. For seabirds, three generations is always more than 10 years. To derive threshold values of λ (the annual asymptotic growth rate) for a specific species or population, we use the baseline demographic model to assess generation time (Caswell 2001). We then calculate λ^{T} as $\sqrt[3*GT]{(1-T^{IUCN})}$, where GT = generation time and T^{IUCN} = IUCN threshold value for Vulnerable species = 0.3).
7. Substitute the values of running mean breeding productivity [breeding productivity indicator] into the baseline model, and run it for 1991-2016. Calculate for each year the expected (asymptotic) growth rate using matrix algebra. These values represent the expected long-term annual growth rate of the population, if breeding productivity was maintained at the mean level observed in the most recent six-year period.
8. Plot this time series against year, and compare against the threshold as calculated in step 6.
9. For species that have a predicted growth rate below the threshold, it can be compared against other thresholds that correspond to other IUCN red-list categories:

EN (endangered):	≥ 50 % decline
CR (critically endangered):	≥ 80 % decline (IUCN 2012)

The thresholds for Endangered and Critically Endangered are calculated as in Step 6 above, by changing values of T^{IUCN} to 0.5 or 0.8, respectively.

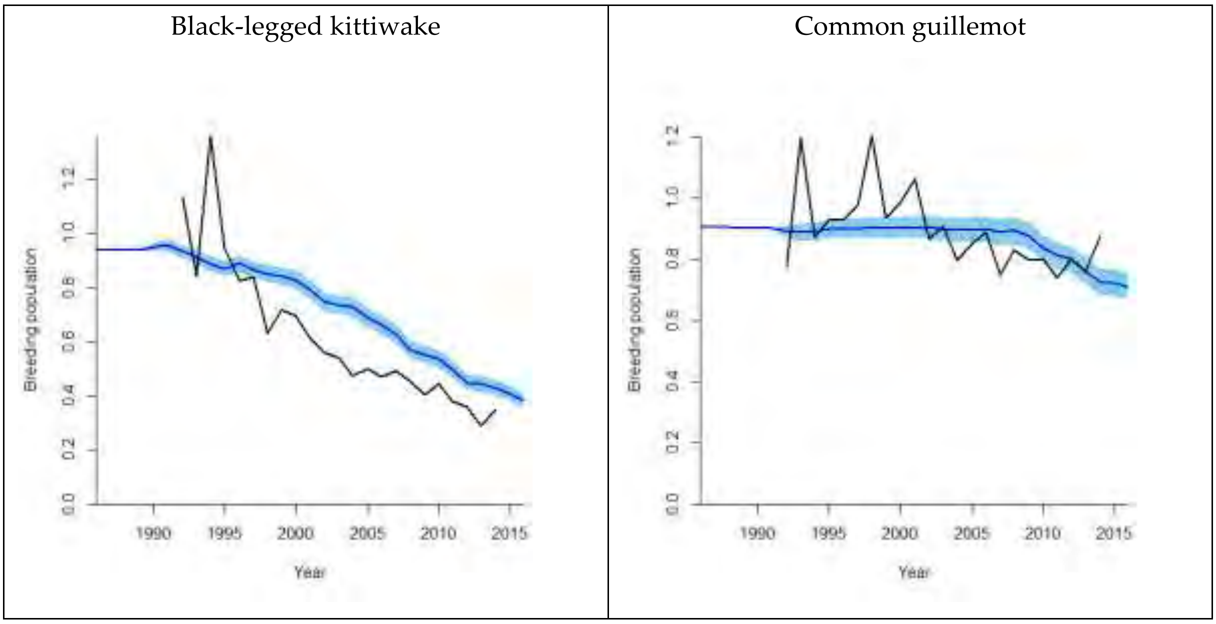

Figure 10. Results from step 4. The blue line shows the simulated population trajectory as the mean of 10,000 simulations, with 5th and 95th percentiles. The black line shows the observed population trajectory (abundance indicator). Absolute values of both are arbitrary. The simulated population trajectory has been tuned to have the same mean growth rate (i.e. slope) for the period 2000-2016/14 as the abundance indicator.

5.4 Next steps

The proposals in this chapter were presented to OSPAR's ICG-COBAM in November 2019, who submitted them to the OSPAR Biological Diversity Committee (BDC). These will be discussed by BDC at a web conference in September 2020. If OSPAR contracting parties agree to the changes in the assessment methods, these will be used to produce the assessment of breeding success in the QSR2023.

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6 Inclusion of at-sea data in future assessments

OSPAR & HELCOM bird abundance indicators are built on data from breeding bird surveys and from coastal surveys of non-breeding birds. The validity of conclusions from the latter surveys is clearly restricted to coastal marine areas. In the case of breeding birds, it is less clear to which specific marine area seabird trends are connected, mainly because many of the species are wide-ranging even during the breeding season. Thus, the abundance indicators in their current versions cannot directly assess the environmental state of offshore sections of the marine regions, which is required e.g. by EU Marine Strategy Framework Direction (MSFD). It is therefore considered highly relevant to include data from at-sea surveys into the seabird abundance indicators.

The JWGBIRD 2016 report provided first steps of the process leading to an inclusion of these data by compiling existing monitoring programs in the OSPAR and HELCOM regions and presenting concepts for large-scale surveys and ways for analysing the resulting data. During the 2017 and 2018 meetings, JWGBIRD progressed further by agreeing on leading an update of the existing European Seabirds at Sea (ESAS) database in collaboration with ICES datacentre and stimulating a network of European Seabirds at Sea experts.

The Seabirds at Sea network aims to convene experts involved in national seabird survey schemes in the North-East Atlantic region to join forces for tackling the following tasks:

- coordinating, synchronizing and harmonizing of national survey efforts,
- standardization of survey design and data collection methods,
- development of a long-term approach for coordinated international monitoring,
- development and application of adequate procedures for joint analysis of combined data,
- compiling data for seabird abundance estimates in joint database for seabirds at sea,
- updating seabird population numbers and trends,
- creating seabird distribution maps and sensitivity maps,
- identification of drivers, threats and knowledge gaps,
- feeding into development of policy relevant seabird indicators to measure changes in marine environment.

Currently, networking activities are covered by the ESAS subgroup of the JWGBIRD group as they form the prerequisites for the essential inclusion of at sea data in the abundance indicators. For the long term, a separate specific platform would be beneficial, preferably attached to other groups working on bird monitoring and conservation issues and with the possibility to apply for and administer funding for joint data collection and analysis. JWGBIRD has previously agreed that an adequate platform might be the European Bird Census Council (EBCC, ICES 2016) or a research group at a university. The previously discussed option of linking up with work under the African-Eurasian Waterbird Agreement (AEWA) will in the future be possible within the African-Eurasian Waterbird Monitoring Partnership AEWMP. JWGBIRD has received an invitation from AEWMP (Szabolcs Nagy) for JWGBIRD to join the Strategic Working Group of the AEWMP. The Strategic Working Group is focusing on synergies and coordination between different initiatives and aims to ensure that international waterbird monitoring provides some coordinated input into policy processes. Members discuss the timing of different surveys in relation to reporting timetables and produce various guidance on population and site monitoring primarily linked to AEWA and the EU Birds Directive (https://europe.wetlands.org/our-network/waterbird-monitoring-partnership/). Primary links of JWGBIRD to this group consist in the HELCOM and OSPAR wintering bird abundance indicator work. In response to the invitation, JWGBIRD nominated Nele Markones as JWGBIRD delegate/contact point for the AEWMP Strategic WG. The next meeting of the AEWMP SWG will take place 17-18 Sep 2020 at Wetlands International HQ in Ede, The Netherlands.

JWGBIRD discussed recent activities and defined next steps needed for achieving an inclusion of at-sea data in future assessments. Major effort still has to be put into the development and implementation of coordinated at-sea survey schemes providing the necessary baseline data for future indicator analyses and into a supporting data management. Besides enabling joint analyses for comprehensive indicator assessments, the envisaged data collection and management scheme will also meet other requirements of conservation and management work, e.g. by allowing updates of population estimates and first assessments of large-scale trends as well as the generation of distribution and sensitivity maps.

Progress was tracked by updating information on national at-sea survey schemes based on the overview of existing national at-sea monitoring programs previously compiled by JWGBIRD in 2016 (Annex 4). The updated review will provide input for HELCOM STATE & CONSERVATION 12-2020 as requested by HELCOM S&C 10 3MA.33.

The group emphasized the importance of harmonized synoptic large-scale census surveys like the Joint Survey 2016 (chapter 7) and the subsequent Joint Survey scheduled for Jan/Feb 2020. These Joint Surveys are based on national survey activities, mostly carried out to fulfil Natura2000 monitoring commitments, amended by joint international coordination efforts to ensure optimal harmonization of survey methodology, survey design and timing as well as data management and analysis. The group noted the previously agreed optimal sampling strategy consisting of full coverage census surveys every 3 years and annual index counts. The group further pointed out that an optimal large-scale transect design should include both the retention of the established national transect designs as well as specific extensions, e.g. of previously not covered hotspots and of the generally undersurveyed offshore waters of the central Baltic Sea. The group recalled previous discussions on survey methodology and further progressed on harmonization of data collection protocols. Results of the recurring discussions will be recorded in the future HELCOM Seabirds at Sea monitoring guidelines to be developed by April 2020 following a resolution by HELCOM STATE & CONSERVATION (HELCOM S&C 10 3MA.34; see also chapter 8).

In preparation of the migration and major updating of the ESAS database, the group reviewed the documents that had been prepared intersessionally by the ESAS db task group in detailed technical discussions. These covered the revision of the draft data sharing agreement as well as the final alignment of the revised data model (Annex 5) and a respective collation of coding lists and a first set of validation protocols. All relational lookup tables need to be collated and agreed upon (e.g. FTZ and INBO use new codes for association of birds with wind turbines). Special attention will have to be given to the species code lists that differ nationally and from the revised EURING species code list. As far as possible, EURING species codes need to be linked to codes of Catalogue of Life (which includes World Register of Marine Species). Note that EURING allows for coding of taxonomic groups other than species level (e.g. diver sp. = 00059) and the ESAS species code list even allows for identification uncertainties at a higher resolution e.g." black-backed gulls". The EURING code list manager, Chris du Feu, expressed support about including new codes for taxonomic 'uncertainty' groups or further species of marine megafauna.

The group took note of the comprehensive compilation of ESAS data from Belgium, The Netherlands and Germany for the Southern North Sea that has been collated, harmonized and cleaned by INBO. Progressing towards the inclusion of at-sea data in future indicator assessments JWGBIRD propose to undertake a pilot assessment for the OSPAR abundance indicator based on this data compilation. The pilot assessment will be led by Belgium and Germany and will develop a methodological approach for spatially aggregating and analysing data and assessing trends. The pilot assessment will be presented to COBAM 2020 and then potentially be considered by BDC 2021 to be included in the QSR 2023.

References

ICES. 2016. Report of the OSPAR/HELCOM/ICES Working Group on Marine Birds (JWGBIRD), 10–14 October 2016, Thetford, UK. ICES CM 2016/ACOM:29. 124 pp.

7 Review of results from offshore (at-sea) surveys of the Baltic and planning future work

Status assessments of marine health as well as of single species depend on accurate knowledge of population numbers and trends. To obtain up-to-date information on population size a coordinated seabird survey was conducted across large parts of the Baltic Sea in winter 2015/16 (Figure 11), incorporating researchers from most HELCOM Contracting Parties and applying distance sampling from aircraft and ships (Table 13).

Figure 11. Coverage of offshore (at-sea) surveys in the Baltic Sea in winter 2015/16. The grey lines represent the surveyed areas.

Table 13. Overview of Baltic Sea countries providing the winter 2015/16 data.

Country	Survey platform	Survey method
Germany	Plane + Ship	Line transect
Denmark	Plane	Line transect
Sweden	Plane	Strip transect
Finland	Plane	Line transect
Estonia	Plane	Line transect
Latvia	Plane	Line transect
Lithuania	Ship	Line transect
Poland	Ship	Line transect

To date, all countries in Table 13 have submitted the data for the joint analysis. Surveys took place from January 9 to March 19 with the main survey effort lying between February 10 and March 3 (Figure 12).

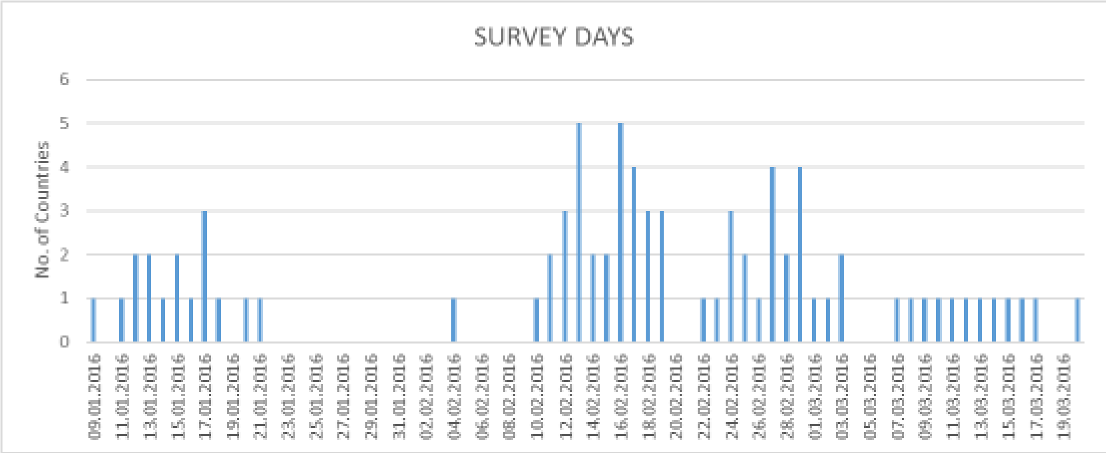

Figure 12. Offshore survey dates in the Baltic Sea in winter 2015/16.

The data has been restructured from the native formats to fit the standard database structure, except Danish and Finnish datasets that did not fit into the ESAS format. The raw observations were plotted on the map of the surveyed areas to obtain dot maps showing apparent species distributions (example of species with wide distribution is given in Figure 13 and species with localised distribution is given in Figure 14). Such maps for 27 species or species groups are provided in Annex 6. Note that the data included in the maps are observations from plane and ship line transects and do not include the ground-based International Waterbird Count (IWC) data.

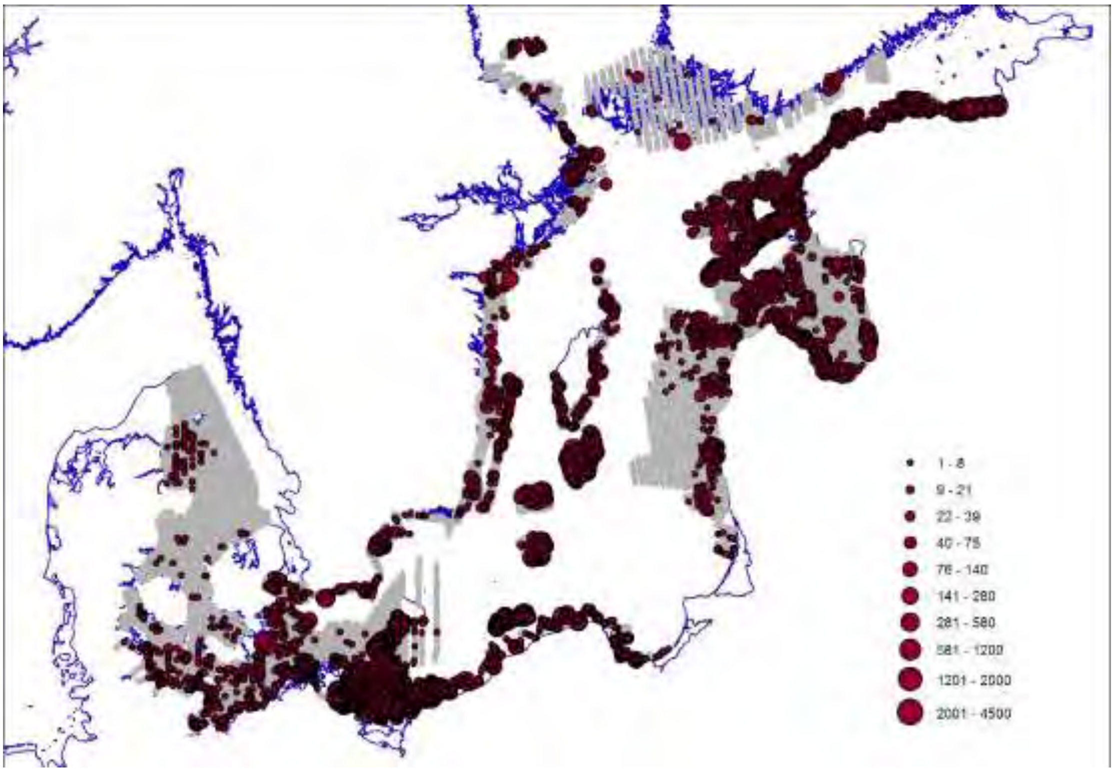

Figure 13. Distribution of the Long-tailed Duck *Clangula hyemalis* in the Baltic Sea in winter 2015/16.

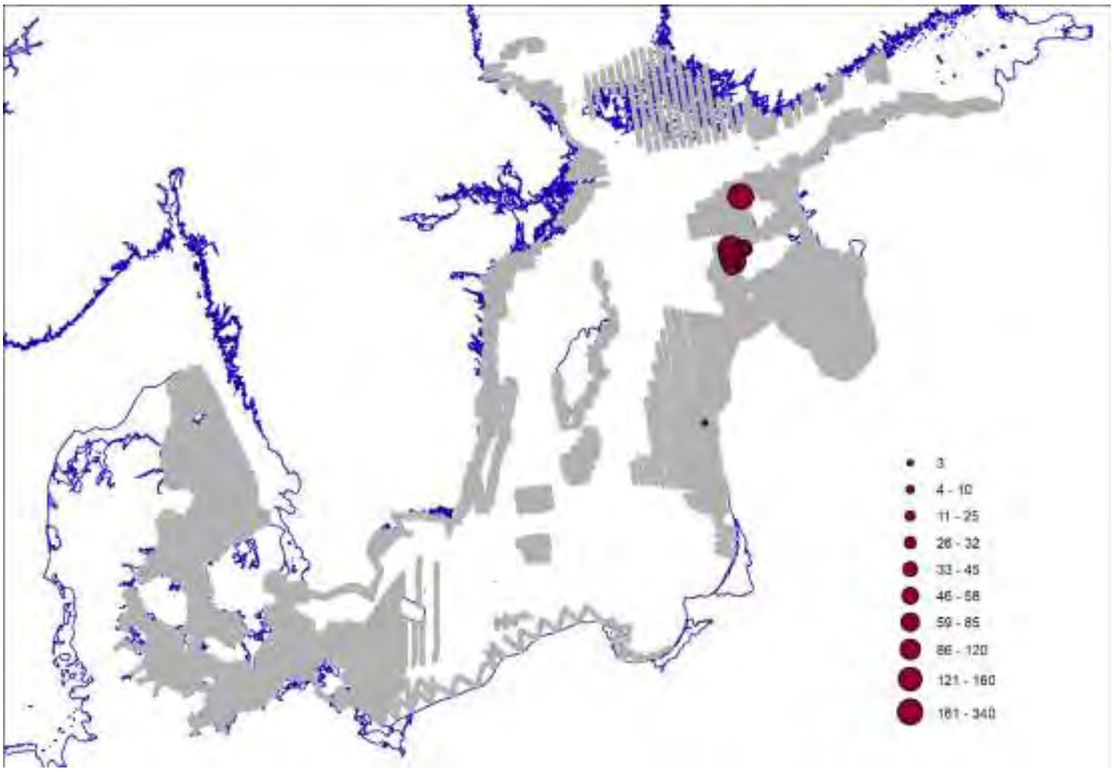

Figure 14. Distribution of the Steller's Eider *Polysticta stelleri* in the Baltic Sea in winter 2015/16.

The aim is to carry out spatial distribution modelling for those species having sufficient data relating the bird observations to spatial covariates. The obtained models will be used to predict bird densities over a prediction grid representing the Baltic Sea and calculate population sizes.

We created a prediction grid with 1x1km cells, using EU coastline dataset to extract the cells representing the Baltic Sea. To prepare the analyses, we obtained the available datasets from public data sources covering the Baltic Sea:

Copernicus Marine Environment Monitoring Service (http://marine.copernicus.eu/services-portfolio/access-to-products/) for each day the surveys were taking place:

- Temperature
- Salinity
- Sea Ice coverage
- Current velocity
- Mixed Layer Thickness
- Chlorophyll α

From the EMODnet portal (https://www.emodnet.eu/):

- Substrate type of the sea bottom
- Bathymetry

EU coastline dataset was used to calculate the distance from the coast for each grid cell.

The modelling work is still in progress.

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8 Intersessional tasks JWGBIRD 2019

8.1 HELCOM workshop on bird migration

From 10–22 November 2018, a HELCOM workshop on migration of waterbirds was held in Helsinki and attended by 14 experts (mostly JWGBIRD members) from six HELCOM Contracting Parties. The aim was to produce maps with migration routes of waterbird species (e.g. seabirds, ducks, waders) covering the entire Baltic Sea Region. Such maps shall provide background for the HELCOM Recommendation 34E/1 "Safeguarding important bird habitats and migration routes in the Baltic Sea from negative effects of wind and wave energy production at sea". It turned out that the necessary information, i.e. tracking data, are available only for some selected species. Mainly based on tracking data, but also referring to counts of migrating and staging birds, draft maps of ten species were compiled and presented to HELCOM State & Conservation in May 2019. So far, the maps produced by the workshop are not specific enough to be used for planning purposes. The ultimate goal is to produce detailed maps which also represent the sensitivity of a given area to e.g. wind power construction. It was considered to form a subgroup of JWGBIRD and other experts that continues to work on bird migration maps intersessionally. In future, planning and conservation shall be brought together in order to identify what is needed and what is possible. An issue to be addressed is the identification of species vulnerable to offshore wind farms regarding collision risk and habitat loss, allowing to produce sensitivity maps.

8.2 Support HELCOM conservation initiatives and assessments

Between its 2018 and 2019 meetings, JWGBIRD supported work of HELCOM State & Conservation by supplying relevant information about seabirds according to inquiries intersessionally.

HELCOM aims to concentrate its conservation efforts on threatened and declining bird species (see HELCOM Red List of 2013) in a way not duplicating work done under other conventions. JWGBIRD compiled information from SPA standard data forms showing the coverage of threatened species by EU Birds Directive. Two species (Long-tailed Duck, Velvet Scoter) are covered by AEWA action plans, which are not legally binding. National action plans are adopted in Sweden for threatened waders on seaside meadows (Black-tailed Godwit, Ruff, Kentish Plover), southern Dunlin and Caspian Tern. JWGBIRD suggests promoting conservation measures also for the remaining species threatened in the Baltic.

JWGBIRD supported HELCOM indicator workshop by suggesting solutions for indicator problems in preparation of the holistic assessment of the Baltic Sea (HOLAS III). Further, JWGBIRD offered suggestions to the HELCOM Science Agenda. In December 2019, JWGBIRD proposed two new actions for the update of the Baltic Sea Action Plan (BSAP) related to the monitoring of bird bycatch in fisheries and the production of sensitivity maps for threatened breeding, migrating and wintering birds.

More support to HELCOM will be given by JWGBIRD in the near future by compiling an overview of at-sea bird monitoring conducted in the Contracting Parties. JWGBIRD experts take part in the HELCOM Sufficiency of Measures (SOM) project, which started at its Tartu meeting in October 2019. In addition, two JWGBIRD experts are part of EN CLIME, an expert network of HELCOM and Baltic Earth compiling information and preparing key messages about the effects of climate change in the Baltic Sea environment.

8.3 Guidance on best practices, methods and reporting for at-sea monitoring of seabirds in the Baltic Sea

For years JWGBIRD has been engaged in improving the validity of seabird abundance indicators by highlighting the importance of at-sea monitoring, performed by observers based on ships or aircrafts, but more recently to a growing extent also using digital imagery. Though some countries in the OSPAR and HELCOM regions are still lacking an at-sea monitoring, JWGBIRD has already developed an approach to combine results from land-based seabird counts with at-sea data to improve the explanatory power of the abundance indicators (ICES 2016). Based on earlier work within JWGBIRD (ICES 2016), results from the HELCOM BALSAM project and the JNCC VSAS survey protocol, monitoring guidelines for at-sea monitoring will be prepared by JWGBIRD.

8.4 Joint OSPAR-HELCOM workshop to examine possibilities for developing indicators for incidental bycatch of birds and marine mammals

JWGBIRD members attended this workshop, which was held in Copenhagen, Denmark on 3–5 September 2019. The objective of the workshop was to develop methods to assess, for conservation purposes, the pressure of incidental bycatch of birds and marine mammals. The focus was on the identification of cost-effective approaches for assessment and data collection. In preparation of the workshop, JWGBIRD compiled background information on seabird bycatch during their 2018 meeting (ICES 2018).

For birds, the workshop proposed an assessment method related to the conservation objective to "minimise and eliminate where possible incidental catches of marine birds", in line with the prohibition of deliberate killing or capture of birds according to Article 5 of EU Directive 2009/147/EC (Birds Directive). It is also aligned with the conservation target of the EU "Action Plan for reducing incidental catches of seabirds in fishing gears" (COM(2012) 665), which requests Member States to "minimize and, where possible, eliminate the incidental catches of seabirds". The proposed threshold comprises a mortality rate from incidental bycatch equivalent to 1% of natural annual adult mortality of the species (Figure 15). The 1% level is an approximation of zero mortality (derived from legal interpretations in European courts of 'small numbers' stemming from the EU Birds Directive). It was recommended it shall be tested with PVA modelling, whether or not 1% of adult annual mortality would affect the population trajectory. It was further suggested that for data-poor species with known bycatch problems the assumption is that the species is not in GES unless the opposite is proven by monitoring data.

The workshop also discussed data requirements (bird bycatch and fishing effort) and underlined the need of respective monitoring programs. Further, possible approaches for identifying areas of bycatch risk were discussed.

OSPAR ICG-COBAM has prepared a proposal for threshold setting methods for seabird bycatch mortality, based on the conclusions of the workshop. This proposal will be discussed by the OSPAR Biological Diversity Committee (BDC) at a web conference in September 2020. If OSPAR contracting parties agree to the proposals, they will be used to produce a pilot assessment of seabird bycatch in the QSR2023 (see chapter 4).

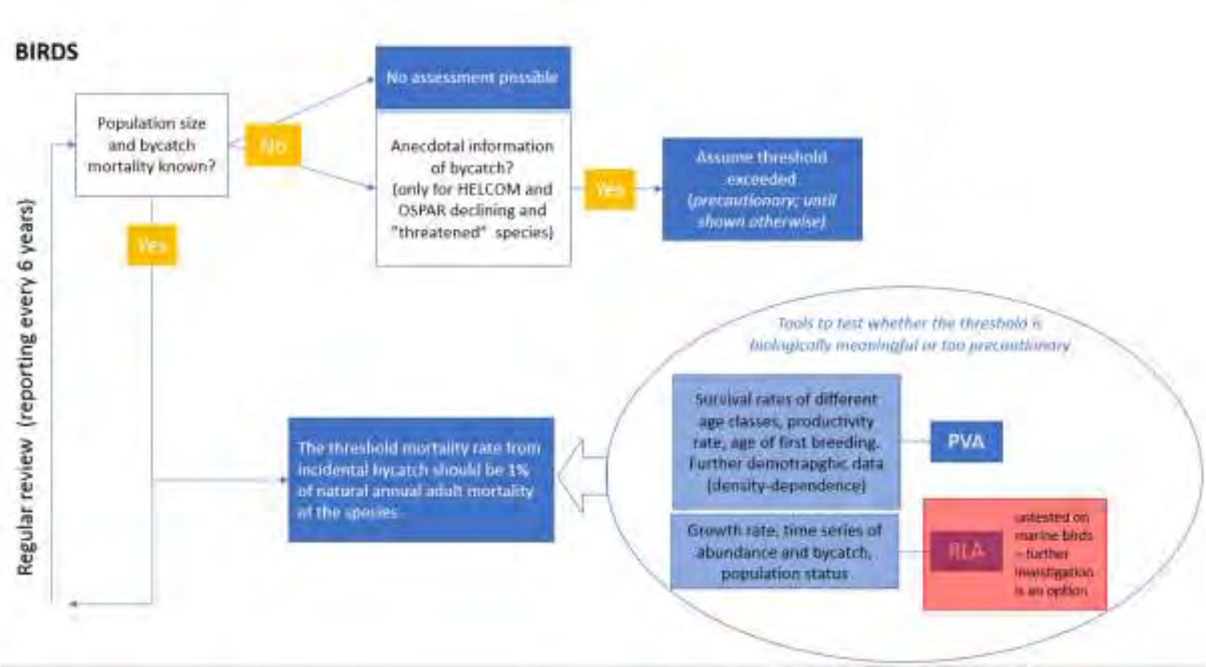

Figure 15. Schematic assessment approach and tools for testing ecological relevance of the proposed threshold. Taken from "Outcome of the OSPAR-HELCOM workshop to examine possibilities for developing indicators for incidental by-catch of birds and marine mammals" (OSPAR and HELCOM, unpublished).

8.5 Response to requests from other ICES groups

Intersessional work of JWGBIRD in 2019 included response to various requests from other ICES working groups. JWGBIRD provided input for the multi species model SMS of the Working Group on Multispecies Assessment Methods (WGSAM), revised the chapters concerning seabirds in the ICES Ecosystem Overview of the Oceanic North Atlantic and commented on the proposed road map for ICES bycatch advice. Furthermore, JWGBIRD is collecting background information and input for the revision of the WGBYC data call to support future extrapolations of seabird bycatch numbers from observed effort to total fishing effort for a certain fishing gear.

References

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Annex 2 JWGBIRD terms of reference for the next meeting

The **Joint Working Group on Marine Birds** (JWGBIRD), chaired by Volker Dierschke, Germany, Nele Markones, Germany, and Ian Mitchell, UK, had initially been scheduled to meet on the island of Helgoland, Germany, 28 September–2 October 2020. The face-to-face meeting later had to be cancelled. 2020 tasks will be implemented remotely or deferred to the next meeting.

Meeting tasks and justifications

a) Impacts on populations of extreme events incl. oil spills and extreme weather. Lead: Maite Louzao

Most studies of the impacts of external drivers on the demography and population dynamics of seabirds are concerned with annual variation in e.g. climate or food abundance, or in some cases a gradual trend over time. However, impacts of extreme events (e.g. prolonged winter storms, summer storms and tidal surges, pollution events such as oil spills) may in some cases be more important. Extreme events are by their nature rare and therefore difficult to study using traditional correlative approaches. This task will review the available literature and summarise the information on observed impacts of various types of extreme events on seabird populations.

b) Impacts of litter on seabirds (i.e. ingestion, entanglement) – reviewing evidence and proposing further research priorities. Lead: David Fleet

Impacts of litter (mainly litter made of artificial polymers = "plastics") on seabirds through entanglement, ingestion and possibly the transfer of chemicals from ingested plastic items are widespread. Entanglement has been recorded in 25% and ingestion in 40% of all seabird species. Whereas harm through entanglement is evident, harm through ingestion is not so obvious and is likely to be underestimated. Research on this topic, especially into ingestion of plastics by seabirds, has expanded greatly over the last few years and continues to expand rapidly. Species-specific regional monitoring programmes for ingestion of plastics by seabirds have been implemented (e.g. OSPAR Common Indicator on the ingestion of plastics by fulmars in the North Sea). Further monitoring programmes for ingestion as well as entanglement are under development for MSFD purposes. A review of the present literature on the impacts of litter on seabirds and proposals for further research and monitoring would assist in this process and in similar processes in other marine areas.

c) Plan bird assessments for OSPAR QSR2023 Lead: Ian Mitchell

The OSPAR co-chair of JWGBIRD submitted a revised plan to OSPAR's Biological Diversity Committee in March 2020 on how marine birds will be assessed for OSPAR's Quality Status Report in 2023 (QSR2023). The plan states that the OSPAR Common Indicator on marine bird abundance will be updated and the Common Indicator on marine bird breeding success/failure will be amended following developments by JWGBIRD and subject to agreement by OSPAR Contracting Parties. It also contains proposals for pilot assessments of at-sea data on abundance, of existing candidate indicators on distribution and bycatch and of a new indicator on offshore habitat disturbance. All assessments will need to be drafted by the end of December 2021. In 2020 JWGBIRD will carry out preparatory work for these assessments, which includes drafting proposals for the four proposed pilot assessments, that will be considered by OSPAR's Biological Diversity Committee in March 2021.

i. Agree format of data call. Lead: **Ian Mitchell**

A data-call will be issued to all Contracting Parties in November 2020. The data-call will be almost identical to the one issued in 2016 prior to the IA2017. Contracting Parties will be required to complete data forms which will be uploaded to the OSPAR Marine Birds database, hosted by ICES. As in 2016, a call will be made for data on breeding seabirds, breeding waterbirds and wintering and passage waterbirds (incl. waders)

ii. Set baseline values for B1 marine bird abudnance indicator. Lead: **Ian Mitchell**

A preliminary call for baseline abundance data will be issued in Spring 2020, in advance of JWG-BIRD in October 2020. Using these data at the meeting, experts will identify appropriate baselines for species in each region. These baselines can be agreed by CPs at BDC 2021. Ideally these will 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.

iii. Draft proposals for a pilot assessment of at-sea abundance data in southern North Sea. Leads: **Nele Markones & Eric Stienen**

JWGIRD has been working to instigate some coordination of surveys (e.g. regarding timing) between countries, which was previously lacking. JWGBIRD has also been working with ICES to develop a new European Seabirds At Sea Database. Following this progress, DE will lead a pilot assessment of seabirds at sea data in the southern North Sea, which are currently being collated from Belgian, Dutch and German waters. This pilot assessment will help to develop a methodological approach for spatially aggregating and analysing data and assessing trends. The pilot assessment will be presented to COBAM 2020 and then potentially be considered by BDC 2021 to be included in the QSR 2023. This pilot assessment is intended to encourage greater co-ordination between CPs for the joint monitoring and assessment of seabirds at sea.

iv. Review progress on revising indicator B3 marine bird breeding success. Leads: **Morten Frederiksen and Tycho Anker-Nilssen, Ian Mitchell**.

Proposals for a revision of the methods for assessing breeding success data were submitted to OSPAR BDC in March 2020. If Contracting Parties adopt these proposals and sufficient resources are available, work will start in 2020 on developing the new methods to produce updated assessments in 2021.

v. Draft proposal for a pilot assessment of B5 seabird bycatch mortality. Lead – TBC

If data on seabird bycatch are made available by those contracting parties currently collecting it, then there is potential for running a pilot assessment of bycatch mortality in order to test and demonstrate assessment methodologies. Germany have offered to co-lead such a pilot. A more detailed proposal for the A draft pilot assessment, with draft outputs, would need to be delivered to BDC 2021 for inclusion in the QSR2023.

vi. Draft proposal for a pilot assessment of B6 Marine Bird Distribution. Lead – TBC

The candidate indicator on marine bird distribution was developed in the UK and presented as a pilot assessment in their MSFD assessment update. In 2019, JWGBIRD concluded that a pilot assessment of distribution, using the same data that will be provided in the data call for the existing common indicators, would test the usefulness of the indicator at an OSPAR regional level. This pilot assessment currently does not have a lead. A more detailed proposal for the pilot assessment, with draft outputs, would need to be delivered to BDC 2021 for inclusion in the QSR2023.

vii. Draft proposal for a new candidate indicator and pilot assessment of offshore habitat disturbance. Lead: **Volker Dierschke**

In the absence of any other indicator that assesses MSFD criterion D1C5, JWGBIRD recommended in 2019 the development of a new indicator on marine bird habitat disturbance. Germany propose to lead the development of this indicator and will submit a more detailed proposal for the pilot assessment, with draft outputs, draft pilot assessment to BDC 2021 for inclusion in the QSR.

viii. Start preparing OSPAR Thematic Assessment of marine birds. Lead: **Ian Mitchell**

The OSPAR 2023 will contain a series of Thematic Assessments, including one on marine birds. This will contain an integrated assessment of marine bird status in all OSPAR Regions, using indicator assessments where available. It will also contain an assessment of pressures, impacts and the effectiveness of OSPAR management measures. Guidance on the content of the Thematic Assessments is still being developed by the appropriate groups in OSPAR. In 2020, JWGBIRD will consider the guidance available and produce a plan of how the Thematic Assessment on Marine Birds will be produced during 2021 (by end December 2021).

d) Plan bird assessments for HELCOM HOLAS III. Lead: Volker Dierschke

In a row of workshops, HELCOM has been discussing future holistic assessments and the indicators supporting them. As in the last assessment produced in 2018 (HOLAS II), JWGBIRD is responsible to develop or amend indicators for HOLAS III, which is preliminary scheduled for 2023. As these assessments shall also be used for MSFD assessments and reporting, JWGBIRD is to prepare indicators applicable for both purposes.

i. Agree procedures for waterbird abundance indicators.

So far, assessments of waterbirds in the Baltic Sea have built on abundance only, supported by two indicators (one for breeding and wintering birds each). Based on experiences in HOLAS II and in preparation of HOLAS III JWGBIRD has to discuss how these indicators could be amended (e.g. setting baselines, geographic scaling). Further, the timeline of HOLAS III requires the planning of the steps in the assessments, i.e. data calls, analyses and reporting.

ii. Discuss possibilities to expand waterbird assessments to other MSFD criteria

As waterbirds in the Baltic Sea have been assessed by abundance alone, it shall be explored how other MSFD criteria can be covered in order to give the assessments a broader fundament. An indicator for waterbird bycatch has been developed, but could not be applied due to the lack of both bycatch and fishing effort data. The indicator could be re-structured according to recommendations of a joint OSPAR/HELCOM workshop in September 2019. While the criterion "habitat for the species" is approached already (see iii.), JWGBIRD has to discuss whether indicators developed for OSPAR in the criteria "demography" and "distribution" would be applicable in the Baltic Sea as well.

iii. Draft proposal for a new candidate indicator and pilot assessment of offshore habitat disturbance.

In parallel to the development of an indicator serving the MSFD criterion D1C5 (habitat for the species) for the NE Atlantic in OSPAR, it is aspired to use the same approach of indicating the extent of disturbance in marine waterbird habitats of the Baltic Sea. A pilot assessment for at least part of the Baltic Sea will be prepared and discussed, allowing submission to HELCOM State & Conservation and, given acceptance, evaluation of application in HOLAS III.

e) Review of results from offshore (at-sea) surveys of the Baltic and planning future work. Leads: Ainars Aunins and Ib Krag Petersen

In winter 2015/16, a coordinated seabird survey was conducted across large parts of the Baltic Sea, incorporating researchers from most HELCOM Contracting Parties and applying distance sampling from aircrafts and ships. Further results will be presented and discussed, including the revision of the midwinter 2020 survey and planning of future coordinated surveys.

f) Develop methods for measuring and communicating confidence in OSPAR & HELCOM assessments. Lead: TBC

During the production of the OSPAR and HELCOM assessments, it became apparent that there are multiple ways of assessing confidence. This task will review existing methods and propose the most appropriate to use in future assessments of marine birds. Confidence will be assessed for individual species within each indicator, for cross species assessments of each indicator and for integrated assessments of species status using multiple criteria.

Intersessional Tasks

a) Support HELCOM conservation initiatives and assessments

JWGBIRD is supporting work of HELCOM State & Conservation by supplying relevant information about seabirds according to inquiries, occasionally at short notice. Ongoing HELCOM activities supported by JWGBIRD are, for example, the update of the Baltic Sea Action Plan and the compilation of climate change effects within the expert network EN CLIME, a joint initiative of HELCOM and Baltic Earth.

b) Publish guidance on best practices, methods and reporting for at-sea monitoring of seabirds in the Baltic Sea

For years JWGBIRD has been engaged in improving the validity of seabird abundance indicators by highlighting the importance of at-sea monitoring, performed by observers based on ships or aircrafts, but more recently to a growing extent also using digital imagery. JWGBIRD 2016 has developed an approach to combine results from land-based seabird counts with at-sea data to improve the explanatory power of the abundance indicators. Based on earlier work in JWGBIRD 2016, results from the HELCOM BALSAM project and the JNCC VSAS survey protocol, monitoring guidelines for at-sea monitoring will be prepared by JWGBIRD and submitted to HELCOM State & Conservation for publication.

c) Review assessments of OSPAR Threatened and Declining Species

JWGBIRD will review status assessments of three OSPAR-listed threatened and declining (T&D) species/sub-species of seabird: Balearic shearwater (*Puffinus mauretanicus*), Iberian guillemot (sub-species: *Uria aalge ibericus*) and lesser black-backed gull (subspecies: *Larus fuscus fuscus*). The assessments will be drafted by lead contracting parties of OSPAR (to be confirmed) and will follow the format that was tested on black-legged kittiwake by JWGBIRD in 2018.

The basis for JWGBIRD's involvement is provided by action #36 in the OSPAR Road Map for collective actions on T&D species and habitats, which is also captured in JWGBIRD's joint OSPAR/ICES/HELCOM workplan 2018–2021. The reviews will support the leads in submitting the assessments to OSPAR's Intersessional Correspondence group on Protected Species and Habitats (ICG-POSH)

None of these three species/subspecies are included in the OSPAR common indicators, so their assessments will likely rely more on third party data and expert judgement. Balearic shearwaters breed in the western Mediterranean and spend only part of their annual lifecycle at sea in the NE Atlantic, from where there is little data on distribution and abundance. The Iberian guillemot is a subspecies of common guillemot and is confined to breeding along northern coast of Spain and Portugal where only a few pairs remain. The OSPAR list of T&D species refers only to the *L. f. fuscus* sub-species of lesser black-backed gull, which is confined to northern Scandinavia in Norway, Sweden and Finland. The OSPAR Common Indicators includes this and other sub-species of lesser black-backed gull, but does not distinguish between them so cannot provide the information needed to conduct an assessment of the *L. f. fuscus* subspecies. Crossborder assessment with HELCOM may be required: the subspecies is also on the HELCOM Red List.

Annex 3 Details of Member States' MSFD reports on marine birds

In the following sections, the approach of MSFD seabird assessments of EU Member States are briefly described (only OSPAR and HELCOM Regions, not including the Mediterranean Sea and the Black Sea); an overview is given in Table 14. The aim is to highlight the approaches used, whereas the assessment results (status of seabirds) are not part of this review.

Table 14. Overview of the components and methods used in the MSFD Article 8 assessments of OSPAR and HELCOM Contracting Parties. Reg: regional indicator assessments, sub: subregional indicator assessments; cond: conditional rule integration, prop: proportional rule integration.

	OSPAR Region										HELCOM Region							
Contracting Party	ES	PT	FR	IE	UK	BE	NL	DE	DK	SE	DE	DK	SE	FI	EE	LV	LT	PL
Assessment method																		
based on Com Dec	2017	2017	2017	2017	2010	2010	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017	2017
Regional assessment with OSPAR indicators																		
abundance	no	no	no	no	**reg**	**reg**	**sub**	**sub**	**reg**	no	*not applicable*							
breeding success	no	no	no	no	**reg**	no	**reg**	**sub**	**reg**	no								
Kittiwake breeding success	no	no	no	no	**reg**	no	no	no	no	no								
distribution	no	no	no	no	**reg**	no	no	no	no	no								
invasive mammals	no	no	no	no	**reg**	no	no	no	no	no								
Regional assessment with HELCOM indicators																		
bycatch	*not applicable*										no	no	no	no	no	no	no	no
abundance breeding											**sub**	**sub**	no	**reg**	**reg**	**sub**	no	**sub**
abundance wintering											**sub**	**sub**	no	**reg**	**reg**	**sub**	no	**sub**
National assessment																		
bycatch	**yes**	**yes**	no	yes	no	no	no	no	no	no	no	no	no	no	no	no	no	no
abundance	**yes**	**yes**	**yes**	**yes**	no	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**	no	**yes**	no
demography	**yes**	**yes**	**yes**	no	no	no	no	**yes**	no	no	no	no	no	no	no	no	no	no
distribution	**yes**	**yes**	**yes**	yes	no	no	no	no	**yes**	no	no	**yes**	no	**yes**	no	no	no	no
habitat	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no	no
Integration methods																		
criteria to species (Com Dec 2017)	**cond**	no	no	**cond**	no	no	no	**cond**	no	no	**cond**	no	no	**cond**	no	no	no	no
species to species group (Com Dec 2017)	no	no	no	no	no	no	no	**prop**	no	no	**prop**	no	no	no	no	no	**prop**	no
within criteria, across species (Com Dec 2010)	no	no	**prop**	no	**prop**	**prop**	**prop**	no	no	**prop**	no	no	**prop**	no	**prop**	**prop**	no	**prop**
across criteria, across species (Com Dec 2010)	no	no	no	no	**cond**	no	no	no	no	no	no	no	no	no	no	no	no	no
Integration results for species groups																		
surface feeders	no	no	**yes**	no	**yes**	**yes**	**yes**	**yes**	no	no	**yes**	no	no	**yes**	**yes**	**yes**	no	**yes**
water column feeders	no	no	**yes**	no	**yes**	**yes**	**yes**	**yes**	no	**yes**	**yes**	no	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**
benthic feeders	no	no	no	no	no	**yes**	**yes**	**yes**	no	**yes**	**yes**	no	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**
wading feeders	no	no	no	no	no	**yes**	**yes**	**yes**	no	no	**yes**	no	no	**yes**	**yes**	**yes**	no	**yes**
grazing feeders	no	no	no	no	no	**yes**	**yes**	**yes**	no	no	**yes**	no	no	**yes**	**yes**	**yes**	no	**yes**
other	no	no	**yes**	no	**yes**	**yes**	no	no	no	no	no	no	no	no	no	no	no	no

Macaronesia (Portugal, Spain)

Archipelagos in the Northeast Atlantic belonging to the EU Member States Portugal (Azores, Madeira) and Spain (Canary Islands), some of them located in OSPAR Region V, were examined commonly with respect to MSFD biodiversity assessments, which used the criteria from the Com Dec 2017/848. The assessments for ten species (five pelagic feeders and five surface feeders, mostly procellariformes) are based on compilations from the projects MISTIC SEAS I and II (Saavedra *et al*. 2018). Because Macaronesian archipelagos have unique seabird populations based on genetics and morphometric differences (Almalki *et al*. 2017), species assessments are based on management units (often individual archipelagos) rather than aggregating information to a general statement regarding GES.

The seabird species composition in Macaronesia is dominated by procellariformes and differs much from the OSPAR Regions I to III. Therefore, indicators developed for northern Europe are not always fitting the requirements in Macaronesia, where GES assessments used deviant indicators and thresholds consequently (Table 15). There was no integration across criteria, if assessments were available for more than one criterion.

Table 15. MSFD assessments for Macaronesian seabirds. Criteria assessed in seabirds, indicators and GES definitions used (taken from Saavedra *et al*. 2018).

Criteria	Indicators	GES definitions
D1C1	Bycatch	Bycatch of seabirds does not increase and/or is infrequent.
D1C2	Population abundance	The average population size in a 6-year-period does not show significant decrease compared to the previous 6-year-period (taken into account natural oscillations).
D1C3	Breeding success	The breeding success cannot be significantly lower compared to the average of the last 10 years, at least in 3 out of 5 years.
D1C3	Survival rate	The average survivals rate is not significantly lower than 0.9.
D1C4	Range	The distribution range (number of colonies) is maintained.

Spain

In OSPAR Region IV, Spain assessed two sub-divisions: Noratlántica and Sudatlántica. The Canary Islands subdivision of OSPAR V is treated separately (see above). Spain followed the approach of Com Dec 2017/848 and in its assessment addressed four of the five biodiversity criteria, i.e. D1C1-C4 but not D1C5, which was difficult to assess and set thresholds for.

Although no indicator is existing for bycatch mortality, criterion D1C1 was assessed based on expert opinion. In the OSPAR part of Spanish seas this was applied only to the Shag, but to four species in the Mediterranean Sea.

For abundance (D1C2), Spain followed the approach of the OSPAR common indicator B1, but used data from national monitoring programs (no seabird assessment was conducted for OSPAR Region IV in the Intermediate Assessment, OSPAR 2017). It is highlighted that for some species (especially procellariformes) abundance data are less informative and less reliable than demographic parameters, which then are better suited to assess the species' status. In order to assess criterion D1C3, both productivity and survival were considered, if available. All demographic parameters needed to be favourable for the species to be in good status. Spain did not follow the approach of the OSPAR common indicator B3 to assess breeding success data, as used in IA2017. Rather than assessing the occurrence of frequent and wide-spread breeding failure, they assessed the effect of breeding success on the population growth rate, by comparing levels of breeding success against reference values. This approach is very similar to that being developed by JWGBIRD (ICES 2018, chapter 5) and is being proposed as an alternative method to assessing the Common Indicator B3 – marine bird breeding success (see COBAM Paper 19/03/XX).

Distribution (D1C4) was not assessed in most species because of a lack of available information. Further, some species are highly mobile and often change colony sites between years. However, poor status was allocated to Common Guillemot and Black-legged Kittiwake due to their disappearance as breeding species.

Integration from criteria to species was done mostly in the style of the procedure recommended by JWGBIRD (ICES 2018), meaning that not achieving good status in a primary criterion would lead to a poor assessment of the species. As information about demographics is considered as being more meaningful for procellariformes, in Spain D1C3 was given priority in the assessments of these species. There was no integration from species to species groups, because i) the classification of functional groups does not fit appropriately the species present in Spain (some species that would be grouped together have very different life history traits and respond to different pressures) and ii) because assessment elements merit specific attention, regardless of the status of the whole species group.

Portugal

In OSPAR Region IV Portugal assessed the marine waters above its continental shelf and those associated to the adjacent slope. The results of this assessment are included in MSFD reporting for the area "Continente". Marine waters around the Azores (in OSPAR Region V) and those around Madeira (south of the OSPAR area) were also assessed under MSFD but results are submitted in separate reports (but also included in the Macaronesian Roof Report, see above).

The approach of Com Dec 2017/848 was considered in the Portuguese assessments. Reporting for the mainland (Continente) did address three of the five biodiversity criteria (D1C1, D1C2 and D1C4) and these were assessed.

Bycatch mortality was considered an important issue in OSPAR Region IV and may have a significant effect in the long-term demography of some seabird species that occur there. Factual evidence is often lacking, bycatch episodes are often unpredictable and they still keep mostly unreported. Therefore, criterion D1C1 was assessed mostly based on expert opinion.

An important part of the information about seabirds included in the report has been obtained by one campaigning NGO (SPEA) which is affiliated to BirdLife and has been involved for many years in conservation work related to the Habitats Directive (92/43/EEC) and the buildup of marine protected areas under EU Natura 2000. Conversion of the existing data to suit the format required in MSFD analysis is not straightforward and expert judgement is required in many cases.

Assessment for seabird abundance (D1C2) in Portugal did follow the approach of the OSPAR common indicator B1, but data used in the analysis did come from national monitoring programs and from international census associated to EU-funded and similar projects (FAME, Life MARPRO, LIFE+Berlengas and other). It should be noted that no joint seabird assessment was ever conducted for OSPAR Region IV in the Intermediate Assessment (OSPAR 2017).

In relation to criterion D1C3, there were no major studies based on both productivity and survival considered by Portugal in OSPAR Region IV, because most of the seabirds there are available mostly on migration or wintering at sea.

Distribution (D1C4) was assessed at sea tentatively but for a few species only, because there is a most noticeable lack of reliable information available. Further, some species included in the analysis are highly mobile and their numbers often change quite noticeably between years, in the absence of any obvious cause that may relate to their local habitat.

In this assessment, integration from criteria to species was not attempted for most of the 23 species assessed, but was done for four species (great skua, northern gannet, Balearic shearwater, Cory's shearwater). There was no integration from species to the three species groups considered.

France

France did not contribute data to the OSPAR assessments of Regions II and III. Data from various national monitoring programs were used in order to assess the status of seabirds in four sections of its Atlantic waters (the Mediterranean Sea is not considered here). The northernmost section (Manche – mer du Nord) is part of the OSPAR subregion IIe, followed to the south by a section belonging to OSPAR Region III (Mers celtique) and two sections being part of OSPAR Region IV (MRU nord Golfe de Gascogne, MRU sud Golfe de Gascogne).

Criteria D1C1 and D1C5 were not assessed due to the lack of data and indicator development. Criterion D1C2 used French data stemming from breeding bird surveys, coastal wader counts and at-sea data from ship-based and aerial surveys (the latter also feeding the assessment of criterion D1C4). Depending on the survey method, different indicators were applied. Besides three national indicators for the abundance of coastal waders and seabirds at sea, the OSPAR common indicator B1 was used for the assessment of breeding birds. However, the results calculated without French data for the Intermediate Assessment (OSPAR 2017) are not referred to. A national approach was used also for the assessment of distributional changes of seabirds at sea (criterion D1C4). The assessment of breeding success (D1C3) followed the methodological standards of the OSPAR common indicator B3, but again with French data only and without considering subregional results from the Intermediate Assessment (OSPAR 2017).

Though the French MSFD seabird assessment in general followed Com Dec 2017/848, the integration of indicator results resembles the earlier procedure of Com Dec 2010/477. For many species only one criterion could be assessed quantitatively, so they did not integrate criteria to assess the status of each species. Instead, integration was done for each species group across species within criteria, treating breeding and non-breeding birds separately. The proportional rule from the OSPAR common indicator B1 was applied, meaning that GES is attained when 75% of the species in a group are in good status. There were 19 assessments (Table 16), which cover only two out of five species groups (surface feeders, water column feeders), because too few species in the other groups could be assessed.

Table 16. MSFD seabird assessments for four sections of French waters in the OSPAR Area. Integration was conducted within species groups, across species for each criterion (breeding and non-breeding birds treated separately). Any other combination of species group – criterion – section of French sea was not assessed. Adopted from Simian *et al.* (2018).

Species group	Manche – mer du Nord	Mers celtique	MRU nord Golfe de Gascogne	MRU sud Golfe de Gascogne
surface feeders				
D1C2 – breeding	GES	sub-GES	GES	GES
D1C2 – at sea	n.a.	n.a.	GES	GES
D1C3	n.a.	GES	GES	n.a.
D1C4 – at sea	n.a.	n.a.	sub-GES	sub-GES
pelagic feeders	n.a.	n.a.	n.a.	n.a.
D1C2 – breeding	sub-GES	sub-GES	GES	GES
D1C2 – at sea	n.a.	n.a.	GES	GES
D1C3	n.a.	n.a.	GES	n.a.
D1C4 – at sea	n.a.	n.a.	GES	GES

Ireland

Details of Ireland's MSFD assessment were taken directly from their consultation document (Dec 2019) and not from the questionnaire.

Only three species were included in Ireland's assessment of marine birds: gannet, kittiwake and fulmar. No reasons for their selection were provided, except that they are "comparatively well-studied species". However, it is acknowledged that the three species are cliff-nesters and therefore "less vulnerable to human interference and mammalian predators than the breeding habitat of other seabird species." Additional representative species may be added to future assessments "as the scientific knowledge base, data quality and understanding of their ecology and role in our marine ecosystems improves."

The status of each species was assessed separately as being 'compatible with GES', or not, or unknown. Each species assessment followed the Com Dec 2017/848 and was based on information on its breeding abundance (D1C2), summer and winter distribution at sea (D1C4) and on bycatch mortality (D1C1). The OSPAR assessments or methods were not used. For abundance, four estimates of total breeding population size between 1969 and 2018 at approximately 15-year intervals were presented (see Cummins *et al*. 2019). The % change in abundance was assessed qualitatively (e.g. as 'stable') but not assessed against a threshold. Predicted summer and winter at-sea distribution in Irish waters were presented, as modelled from aerial survey data gathered in 2015 and 2016 by the ObSERVE Programme (Rogan *et al*. 2018). No measure of change in distribution was presented, but all three species were assessed as having "an extensive distributional range at sea". In contrast to the other two criteria, the assessment of bycatch mortality did not present any data. It referred to the incidence of bycatch in Irish-registered vessels but did not cite sources of evidence. No integration rule was specified for assessing species status from the three criteria, but a conditional rule was implied by the narrative presented.

United Kingdom

The MSFD seabird assessment of the United Kingdom followed the framework of Com Dec 2010/477 with regard to the layout of criteria and the way of integration.

GES was assessed separately for non-breeding waterbirds and for breeding seabirds in each of the regions: the Greater North Sea and the Celtic Seas. In each region the OSPAR IA2017 common indicator assessments were used for B1 - abundance and B3 -breeding success/failure, without sub-dividing the assessments into UK waters. The only modification to the common indicator assessments was the removal of species that do not occur regularly in the UK.

GES for non-breeding waterbirds was assessed using only one criterion – 1.1 population size – and one common indicator – B1 abundance. GES was achieved when 75% or more species has exceeded thresholds for abundance.

GES of breeding seabirds was assessed using two criteria – 1.1 population size and 1.3 population condition. Both criteria had to be in good status for breeding seabirds to achieve GES. Population size was assessed across species as above for non-breeding waterbirds. Population condition was assessed primarily using the OSPAR assessment of B3 – breeding success/failure, with the 75% threshold applied to the proportion of species meeting thresholds for the indicator. In addition, the UK also included two candidate indicators in its assessment of population condition of breeding seabirds: B2 - Kittiwake breeding success (North Sea only - see Cook *et al*. 2014 and Mitchell *et al*. 2018a) and B4 - Non-native/invasive mammal presence on island seabird colonies (Mitchell *et al*. 2018b). The UK also conducted a pilot assessment of the candidate indicator B6 - Distribution of marine birds (Humphreys *et al*. 2012) for wading feeders only on non-estuarine coasts (Mitchell *et al*. 2018c). These candidate indicators have been developed by UK for the use in both OSPAR and MSFD assessments, but so far UK has been the only country to apply them.

Belgium

The Belgian seabird assessment was based on abundance data alone. For breeding seabirds, the results of the OSPAR common indicator B1 were used for the whole of the Greater North Sea (OSPAR Region II), with special reference to the abundance trends of seabirds (terns and gulls) breeding in Belgium. A nationally developed indicator was applied to the abundance of seabirds present in the Belgian marine waters. Integration was done for breeding birds and birds at sea separately, i.e. it was integrated across species to species groups for the two indicators separately. This was done for the five functional groups (see Com Dec 2017/848) in breeding birds, whereas the integration for birds at sea was directed to scavenging and non-scavenging species. Both integrations followed the proportional rule of OSPAR common indicator B1, meaning that GES for the species group is achieved when the proportion of species in good status is 75% or more.

The Netherlands

Details of the Dutch MSFD assessment were taken directly from their consultation document and not from the questionnaire.

The Dutch seabird assessment is based on the results of two OSPAR common indicator assessments. It uses the criteria from the Com Dec 2017/848, but does not follow the same integration framework, in that GES was assessed for each criterion across species.

For D1C2 (abundance), GES was assessed using the IA 2017 assessment of the OSPAR common indicator B1 – abundance, for the sub-division OSPAR IId – the southern North Sea. GES was achieved for D1C2 in each species group if 75% or more of species had met thresholds for abundance (breeding and breeding populations of the same species where treated as separate 'species' for the purposes of the integration). Assessments of abundance from the entire OSPAR Region II – Greater North Sea and from the Dutch breeding bird survey were also reported.

GES for criterion D1C3 was also assessed across species using the same species groups and integration rules as for D1C2 above. However, in contrast to D1C2, they used the OSPAR assessment of B3- breeding success/failure, for whole of OSPAR Region II - Greater North Sea.

Germany

The German Article 8 assessments for its sections of North and Baltic Sea followed Com Dec 2017/848 and largely used the common/core indicator assessments of OSPAR and HELCOM on the geographical scale of sub-divisions (southern North Sea OSPAR IId, HELCOM aggregation of sub-basins containing Kiel Bay, Bay of Mecklenburg, Arkona Basin, Bornholm Basin).

Criterion D1C2 was assessed with the regional abundance indicators, but in addition results from national monitoring (at-sea surveys) and the Trilateral Wadden Sea Monitoring (TMAP, breeding and non-breeding birds) were used. In each species, regional assessments were given priority, but national/trilateral monitoring stepped in, when no regional assessment was available (e.g. for all non-breeding birds offshore). Within D1C2, integration on the species level followed the conditional rule One-Out-All-Out, i.e. breeding and non-breeding birds of one species were treated commonly.

For criterion D1C3, an indicator was only available for the North Sea, and results from the OSPAR sub-region IId were used for species breeding in Germany. Again, the TMAP added to the assessment in species not covered by the OSPAR common indicator B3. The lack of indicators for D1C3 in the Baltic Sea as well as for D1C1, D1C4 and D1C5 in both seas prevented from assessing those criteria.

As D1C2 was the only criterion assessed in the Baltic Sea, abundance alone decided about good or poor status there. In the North Sea, for species that had assessments for both D1C2 and D1C3, status was assessed using conditional rule One-Out-All-Out. GES of each species group was achieved if each 75%

or more of species were in good status. Though not required by MSFD, an overall seabird assessment was obtained by integrating across species groups by applying One-Out-All-Out.

Denmark

Details of Danish MSFD assessment were taken directly from their consultation document and not from the questionnaire.

In general, the Danish MSFD seabird assessment follows Com Dec 2017/848. The assessment of GES is based on a single criterion – D1C2 abundance. The assessment used national data and indicators to assess GES in Danish waters (including both North Sea and Baltic), but results of indicators from the OSPAR and HELCOM assessments are presented and discussed.

The preliminary assessment of bycatch in fisheries (criterion D1C1), which has been conducted by HELCOM (2018) with old data for three species (Long-tailed Duck, Greater Scaup, Common Guillemot), was not considered by Denmark because the thresholds used and the estimates of birds bycaught are regarded as unreliable. Results of a Danish bycatch study are shortly reported and assessed insofar as it is stated for Common Eider that the loss of individuals from hunting is much larger than from bycatch. The monitoring of bycatch in gillnets is currently not sufficient to allow an assessment.

Regarding the abundance of seabirds, Denmark stressed its aim to attain a maximum extent of correlation between the implementations of MSFD and Birds Directive. Therefore, rather than adopting the results of the OSPAR and HELCOM bird abundance indicators, trends calculated for the Birds Directive reporting in 2013 were used for the MSFD assessment. These trends of the species were integrated following the rules of OSPAR/HELCOM abundance indicators, i.e. GES is achieved if 75% or more of species were in good status (following the OSPAR/HELCOM threshold). This was done for breeding birds and wintering birds separately, but for the North Sea and Baltic Sea jointly. Despite not being used for the assessment, the indicator results of the Regional Sea Conventions are reported: For the Baltic Sea, the assessments of species groups are shown for three subdivisions of the Baltic Sea, which include parts of the Danish marine waters (Kattegat; Belt Group with the Great Belt and the Sound; Bornholm Group with Kiel Bay, Mecklenburg Bay and Arkona Basin). For the OSPAR Area the species group results for the common indicator assessment of B1 – abundance, are given for the Greater North Sea (for breeding and non-breeding birds separately).

Criterion D1C3 was not used in the assessment of GES, but the results of the OSPAR common indicator B3 for the Greater North Sea were reported. It is stressed that this assessment contains data not stemming from Denmark. In relation to criterion D1C4, the change in distribution of breeding seabirds is reported, but not assessed due to the lack of a threshold.

Sweden

Sweden followed Com Dec 2017/848 for the Article 8 MSFD reporting. The assessment of GES is for Swedish waters only and is entirely based on criterion D1C2 – abundance and uses data from national monitoring programs. Wintering birds are dealt with for North Sea and Baltic Sea separately, whereas breeding seabirds were assessed in Swedish waters as a whole. For each of these three groups, the results from species are integrated to the level of species groups using the proportional rule that 75% of the species have to be in good status to achieve GES. The existence of HELCOM and OSPAR abundance indicators is mentioned, but their results are not reported.

Finland

Finland assessed seabirds according to Com Dec 2017/848. HELCOM indicator assessments were used for assessing the abundance of breeding and non-breeding birds, considering the results obtained for the entire Baltic Sea. The Finnish assessment was augmented by national monitoring results for abundance and distribution.

Estonia

Estonia used the assessments for breeding and wintering seabirds from the HELCOM core indicators on the level of the entire Baltic, but in addition some status information confined on Estonia is given. The integration from species to species groups followed the proportional rules of these indicators and therefore is in line with Com Dec 2017/848, but was applied for breeding and wintering birds separately. The criteria D1C1, D1C3, D1C4 and D1C5 were not considered, i.e. there was no treatment of any national seabird data apart from those feeding into the HELCOM indicators.

Latvia

The Latvian assessment is restricted to the criterion D1C2 – abundance, for which the results of the two HELCOM abundance indicators are reported for the entire Baltic Sea and for all its subdivisions (aggregated sub-basins). Integration was not applied on a species level, and the integration across species was done separately for breeding and wintering birds, just as in the HELCOM indicators. Neither were data from national offshore surveys considered for D1C2 nor is there any reference to other criteria.

Lithuania

In Lithuania, the assessment was restricted to wintering seabirds. The status of pelagic and benthic feeders was assessed using national data only, but comparison was made to the Baltic wide assessment of HELCOM, using the test assessment with data from 2011-2015. In line with Com Dec 2017/848, the status of the two species groups was obtained by integration across species for the only criterion used with application of the proportional rule.

Poland

The assessment of seabirds in Poland followed Com Dec 2017/848, including the way of integration (first criteria to species, then species to species group). However, D1C2 – abundance was the only criterion considered. Breeding and wintering birds were treated separately (no aggregation of the respective results) just as recommended by JWGBIRD (ICES 2018), but also the integration across species to species groups was done separately. The assessments of the two HELCOM abundance indicators were adopted and reported on two geographical scales, on the level of the entire Baltic and on the level of aggregated sub-basins. The latter level was reported twice, because the Polish marine waters fall into two of these subdivisions (Bornholm Group including Kiel Bay, Bay of Mecklenburg, Arkona Basin and Bornholm Basin; Gotland Group including Gdansk Basin, Eastern Gotland Basin, Western Gotland Basin and Gulf of Riga).

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Annex 4 Review of offshore seabird monitoring programs in the HELCOM and OSPAR regions: status and previous studies in the single contracting parties

The following section gives a review of monitoring programs and relevant archived data from previous studies in the OSPAR and HELCOM regions as of December 2019 (see Table 17 for an overview of the most important details and Figure 16 for an overview of spatial coverage).

Finland

The monitoring programme comprises aerial surveys that cover the regularly ice-free areas during winter.

Previous studies: Four routes in the Åland Sea and Archipelago Sea are regularly covered by ship. Three of the routes have started in the early 1970s and have been carried out yearly since 1996. The total length of these three routes is ca. 200 km. The fourth route is placed in the middle of the Archipelago Sea along the ship route from mainland to Åland. This has been carried out regularly since 1994 and is ca. 80 km long.

Contact: Pekka Rusanen, Markku Mikkola-Roos

Estonia

The national monitoring programme started with the full coverage aerial survey in winter 2015/2016. Monitoring surveys will be carried out by plane in spring, summer (moulting period, August) and winter. A full coverage survey is scheduled once per six year period in winter (next: 2019/2020). Geographically floating partial coverage surveys will be carried out in the remaining years.

Previous studies: ESTMAR (2011), GORWIND (2011/2012), MARMONI (2014), NEMA (2016), PÕÕSAS-PEA migration (2004-2019),

Contact: Leho Luigujõe

Latvia

The national monitoring programme started with the full coverage aerial survey in winter 2015/2016. Monitoring surveys are planned to be carried out by plane in autumn and winter and by ship in spring. Full coverage surveys are scheduled two times per six year period in autumn (October/November) and three times per six year period in winter (next winter survey probably 2017/2018). Ship-based surveys in spring will cover SPA sites two times per six year period.

Previous studies: Aerial surveys have been carried out in the Gulf of Riga in spring, summer, autumn and winter in GORWIND project (2011/2012) and in winter in MARMONI project (2014). Most parts of the Latvian territorial waters have been covered in different seasons by ship surveys in Baltic MPA project (2006–2008).

Notes: The biodiversity monitoring programme has been underfunded, so there is no guarantee to have funding for the planned activities.

Contact: Ainars Aunins

Lithuania

Starting in 2017, a new State environment monitoring programme has come into force that includes surveys of seabirds in marine Natura 2000 sites. Three ship-based surveys should be carried out in December–March period, once in three years. However, the first surveys are finally planned for the wintering season 2019–2020, with the tendering procedure still ongoing as of mid-December 2019. No separate monitoring of wintering seabirds under the implementation of MSFD requirements is currently foreseen – it is expected that monitoring of marine Natura 2000 sites will satisfy the needs of MSFD as well.

Previous studies: Aerial surveys (sort of total counts) were carried out since the late 1980s (for several years also included the Russian waters of the Kaliningrad Region), but they covered only coastal waters and ended in the early 2000s. Offshore areas were surveyed from various ships by G. Vaitkus in 1993–1997 for his doctoral thesis. Another offshore ship-based survey was carried out in March 1999.

Notes: The monitoring programme is known to be underfunded so there is no guarantee to have funding for the planned activities.

Contact: Mindaugas Dagys

Russia

At present no official fixed seabird monitoring scheme (ship/plane) is carried out in the Kaliningrad region and the Gulf of Finland.

In the Gulf of Finland, two aerial surveys have been carried out in spring 2016 for “Nord Stream 2 AG”. These have been the first surveys of that kind for the region.

In the Kaliningrad region, seabird monitoring was conducted in previous years to evaluate the impact of oil extraction by "Lukoil - Kaliningradmorneft". Currently, these works are not carried out and are not planned. The database and Geographic Information System «Ecomorneft» for the study period from 2003 to 2015 is owned by “Lukoil - Kaliningradmorneft”. A further study was carried out in summer 2016 (June-September) for “Lukoil - Kaliningradmorneft”.

Contact: Julia Bublichenko (Gulf of Finland), Gennady Grishanov (Kaliningrad region 2003-2015), Julia Loshchagina (Kaliningrad region 2016 to present)

Poland

The national monitoring programme started in 2011. It comprises yearly ship-based surveys in January along a constant route. Most of the important areas for wintering seabirds are covered. The polish part of Southern Middle Bank is not covered by monitoring, which is partly in the Polish EEZ and was indicated by Skov *et al*. 2011 as an important wintering site e.g. for long-tailed duck.

Contact: Włodzimierz Meissner, Dominik Marchowski

Sweden

Sweden has no long-term strategy for air- or ship-based seabird surveys of offshore areas. In 2016 Sweden participated in the joint Baltic Sea survey, and it is very likely that Sweden will take part in the survey 2020 as well. However, financial issues are still to be solved.

Data are at the moment in a Paradox database but it will be changed into another format as Paradox is no longer supported. The development of a new database structure will be influenced by what exchange formats that will be available for international reporting.

Previous studies: Offshore surveys with differing coverage have been carried out since 2007 (large-scale in 2009 and 2016).

Contact: Fredrik Haas, Leif Nilsson

Denmark

The national monitoring programme started in the year 2000. It currently comprises a full coverage of inner Danish waters and a good part of the North Sea every third winter as well as reduced parts in summer every six years for moulting surveys. In addition, annual total counts and line transect surveys are derived for a subset of areas for trend analyses (three days of aerial surveys plus land-based counts).

The monitoring schedule for the coming six years has recently been settled. This means that the present monitoring scheme for wintering and moulting waterbirds will continue with minor changes. Monitoring requirements in relation to the MSFD are also carried out, but under a different scheme.

In Denmark there is access to seabird monitoring data from a number of offshore wind farms. Such data, collected in restricted areas, but with a high temporal frequency, has proven valuable in combination with more large-scale surveys at lower temporal frequency.

In a new approach, survey data are used to calculate bird days per area in selected SPAs, allowing to estimate food consumption of benthic feeding seaducks and thus relate bird occurrence more closely to management requirements (Petersen *et al.*, 2016).

Contact: Ib Krag Petersen

Germany

The national Natura 2000/MSFD offshore monitoring programme started in 2008 (in 2004 in the Schleswig-Holstein offshore area). Large-scale aerial surveys are complemented by ship-based surveys (dedicated surveys as well as usage of ships of opportunity). Full-coverage aerial surveys are carried out 2–3 times per six year period in winter and late summer and autumn in the Baltic Sea and the North Sea. A subset of the most important areas is covered in the years between as well as during other seasons. The monitoring programme comprises digital surveys for covering windfarm areas and surroundings. Performance of digital survey methods is currently evaluated and compared to observer-based surveys.

Previous studies: A comprehensive dataset comprising ship-based survey data from 1990 onwards for the German North Sea and from the year 2000 onwards for the German Baltic Sea as well as large-scale aerial survey data of both seas from 2002 onwards is maintained using an ESAS compatible data structure.

Contact: Nele Markones, Stefan Garthe

Norway

SEAPOP has participated with seabird observers on the annual Ecosystem Survey (August–October) in the Barents Sea since 2004. All seabird species are monitored according to the standard ESAS procedure. Data are used for 1) habitat modelling, 2) monitoring changes in abundance at sea and 3) monitoring changes in at-sea distribution. The data series is long and very interesting as synoptic measures from the entire ecosystem are available. The dataset is particularly useful for monitoring spatial displacements of the ecosystem due to climate change. The last ten years, SEAPOP has also conducted several surveys in the Norwegian Sea (spring and summer) and in the Barents Sea (summer and winter). In the North Sea, however, there has not been conducted any Norwegian seabirds at sea surveys since 2006, and SEAPOP would appreciate a joint effort to update the North Sea datasets.

Contact: Per Fauchald, Tycho Anker-Nilssen

Iceland

There are no immediate plans for systematic surveys of offshore waterbirds in Iceland. Knowledge of winter distribution of selected species (for instance long-tailed duck and divers) for selected areas would be very desirable. The expertise for conducting such surveys is there, but at the moment no signs of the necessary funding for the purpose.

Contact: Yann Kolbeinsson, Ib Krag Petersen

The Netherlands

The national seabird monitoring programme has been running since 1984, yet in 2014 the methodological set-up was revised. The most important reason for this was to get a better spatial coverage of (proposed) marine Natura 2000 sites, but also for example survey height was reduced to allow better species recognition for similarly looking species such as guillemot/razorbill. In 2020 the survey plan will be revised again to increase the sampling effort in the coastal zone, and in spring and summer. From 1984 until 2013, the Dutch sector of the North Sea was surveyed along standard transects every two months. From 2020 onwards, the new programme comprises two modules:

1. Dutch Continental Shelf (DCS). Aerial surveys; line transect counts. Survey of the whole Dutch North Sea in August, November, January, February, April and June, with increased sampling effort in the narrow coastal zone (up to 4 nm), Frisian Front and Brown Ridge. The April and June surveys of the entire DCS took place in 2019 and will at least take place until 2021.
2. Dutch Wadden Sea and Coastal Zone Netherlands. Aerial survey; integral count special for seaducks. In November and January, occasionally in March (2019-21, possibly extended).

Ship-based surveys no longer cover the entire Dutch EEZ (only wind farm studies, and dedicated Natura 2000-site surveys of Frisian Front and Brown Ridge have been done, lately), but this would still be possible, also in an international setting, e.g. by joining the IBTS surveys (not yet planned, unfortunately).

Contact: Floor Arts, Ruben Fijn, Mardik Leopold

Belgium

Belgium has been carrying out regular seabird counting for a long time (2001 to present) and less frequently during 1992–2000. However, survey routes, observers and research vessels changed a lot during this period. The programme consists of monthly ship-based surveys of all seabirds and sea mammals following ESAS standard. For the moment the money for the monitoring comes from the wind industry. For this reason the monitoring is biased to those parts of the Belgian marine waters where wind farms are operational or planned. From 2000 onward parts of the western waters known to hold particularly high densities of protected species were irregularly visited during non-dedicated campaigns. These visits could serve as a baseline for future monitoring, although plans for dedicated monitoring of Natura 2000 or MSFD species are currently lacking. There is, however, a dedicated and long-term (1986-present) aerial survey programme running that monitors seaducks but no other seabird species.

Contact: Eric Stienen

Great Britain

JNCC has been coordinating the Volunteer Seabirds at Sea (VSAS) programme since 2018. The VSAS project recruits and trains volunteers to collect high quality seabirds at sea data, using European Seabirds at Sea (or ESAS) methods. Surveys can be conducted using 'ships of opportunity' e.g. ferries, merchant ships, research vessels, cruise ships, etc. Survey work began in April 2019, with three ferry routes on the west coast of Scotland being covered at a monthly frequency until September 2019. Training will continue, with an aim of increasing the pool of volunteer surveyors to 80 by April 2020, when survey work will recommence. It is likely that an additional ferry route will be added in 2020 and there are plans to increase survey frequency and extend the survey period into the winter months. The aim of the programme is to extend survey coverage to all suitable ferry routes in UK waters and also utilise other ships of opportunity. Acquisition of private sector data from the marine renewable energy sector could be used to improve the utility of the UK SAS dataset.

Notes:

- VSAS survey data are captured in real time using a bespoke app. installed on a rugged waterproof tablet.
- JNCC currently administer the ESAS database and aim to publish a VSAS survey manual in late 2019/early 2020.

Contact: Tim Dunn, Mark Lewis

Ireland

Until recently there was no national, co-ordinated, scheme for offshore seabird monitoring in Ireland. In 2019 the National Parks and Wildlife Service (NPWS) began a programme where seabird observers are placed on certain Marine Institute pelagic surveys. These surveys have been assessed as having the most suitable and largest coverage of Ireland's EEZ (temporal and spatial). The transect-design of the surveys, allows ESAS methodology to be used.

Prior to 2019, seabird observations in Ireland were on an ad-hoc basis, with several separate commercial and research projects taking place in Irish waters.

The majority of the offshore seabird data collected since 2009 was done so on RV Celtic Explorer and RV Celtic Voyager by BirdWatch Ireland and Marine and Freshwater Research Centre GMIT through use of berths offered up during fisheries surveys (ongoing) and also during the six 'Cetaceans on the Frontier' trips (2009–2014), in which targeted surveying for cetaceans and seabirds was undertaken.

In recent years UCC/MaREI have been involved in aerial seabird surveys through various projects taking place in the Irish EEZ, including ObSERVE Aerial (Data available at https://www.dccae.gov.ie/en-ie/natural-resources/topics/Oil-Gas-Exploration-Production/observe-programme/project-data/Pages/default.aspx). Recent Trans-Atlantic research surveys (2014–2016) from Ireland to Newfoundland have involved a collaboration between UCC/MaREI and MFRC GMIT.

Contact: Graham Johnston (2019 to present) Niall Keogh (2009-2018).

France

The overall MSFD monitoring programme for seabirds comprises at-sea surveys and land-based counts that are carried out by several different survey teams.

Large scale marine surveys consist of two main actions:

1. Once every six years it is planned to have an aerial survey in summer and in winter for cetaceans, seabirds, and other marine megafauna across the Channel, the Bay of Biscay and the northwest Mediterranean. Surveys with such an extent were for the first time carried out in winter 2011–2012 and summer 2012 (SAMM surveys). The next survey, as far as possible, will be coordinated with survey programme of other countries. The second winter survey in the Northwest Mediterranean has been conducted in the winter 2018-2019, following the aerial component of the ACCOBAMS Survey Initiative conducted in the summer 2018.
2. Besides, there is a yearly monitoring of cetaceans and seabirds distributions by dedicated observers embarking on fish stock surveys in the Channel (IBTS, January), Bay of Biscay (PELGAS,

May; EVHOE, November), Gulf of Lions (PELMED, July), and western Channel (CGFS, September).

Contact: Aurélie Blanck, Vincent Ridoux, Jerome Spitz, Olivier Van Canneyt

Spain

Every year, seabird surveys are carried out on different oceanographic surveys covering the Bay of Biscay and the northern Spanish coast (including Galicia), the Gulf of Cadiz and the Mediterranean Iberian Shelf. During most surveys the seabird counts are supplemented by systematic recording of marine mammals, human activities and marine debris. Every year, the following surveys are performed:

- Northern Spanish continental shelf: PELACUS oceanographic cruise (March–April) since 2007. Responsible: Spanish Institute of Oceanography (Begoña Santos, Camilo Saavedra, Xulio Valeiras, Salvador García-Barcelona).
- Northern Spanish continental shelf: DEMERSALES oceanographic cruise (September–October) addressed to evaluate demersal fish stocks (trawling survey), organized by the Spanish Institute of Oceanography (IEO). Transect surveys for seabirds were conducted in 2006 and again from 2010 to present. Responsible: SEO/BirdLife and Spanish Institute of Oceanography (Pep Arcos).
- Bay of Biscay: BIOMAN oceanographic cruise (May) since 2016. Responsible: AZTI (Maite Louzao).
- Bay of Biscay: JUVENA oceanographic cruise (September) since 2012. Responsible: AZTI (Maite Louzao).
- Gulf of Cádiz: ECOCADIZ oceanographic cruise (June–August) from 2006–2010 and since 2013 to present. Responsible: University of Cádiz and Spanish Institute of Oceanography (Gonzalo Muñoz/Fernando Ramos).
- Mediterranean Iberian shelf (early summer): MEDIAS oceanographic cruise. Responsible: SEO/BirdLife and Spanish Institute of Oceanography (Pep Arcos).

In addition, a new survey collected seabird counts in the northern Bay of Biscay taking advantage of the TRIENAL surveys in March 2016. This survey is conducted every three years and the idea is to collect seabird and marine mammal counts in the future surveys. Responsible: AZTI (Maite Louzao).

A more comprehensive MSFD monitoring programme is in preparation, pending only due to administrative difficulties. All the five Spanish MS subregions ("demarcations") include a monitoring programme to count seabirds at sea by boat. There are no detailed specifications in terms of effort and coverage/type of survey. The philosophy is to take profit of oceanographic surveys already in place, or initiated to meet other requirements of the MSFD. Thus, the specific coverage will depend on the availability of oceanographic cruises. Data will be collected on all species, though key ones might be shearwaters (Balearic, Cory's, Sooty and Great), storm-petrels, gannets and auks.

Previous studies: In previous years (2004–2012) a wider area of Spanish waters was covered within the scope of two LIFE projects that aimed at the identification of marine IBAs and their designation as SPAs. All the subregions were covered at relevant times of year by taking profit of ongoing cruises. An overview of the work done during the last LIFE project (INDEMARES) is given in the project report (see specifically pp. 6–17). In the Gulf of Cadiz, transect band surveys for seabirds were conducted in 2010–2011 in the frame of the ARSA oceanographic cruise (November–December) addressed to evaluate demersal fish stocks (trawling survey), organized by the Spanish Institute of Oceanography (IEO). On the Galician Bank diverse cruises in the area allowed to conduct seabird transect surveys between 2006 and 2012. Responsible for these surveys: SEO/BirdLife, in collaboration with the Spanish Institute of Oceanography and CEMMA (Pep Arcos).

Contact: Pep Arcos, Maite Louzao, Begoña Santos, Gonzalo Muñoz

Portugal

The national monitoring started 14 years ago and consists of an annual ship-based survey in (winter/) spring and a second survey every two years in October/November. These surveys cover the Portuguese coastal waters up to 20 miles offshore. Transects lines are placed 8 miles apart perpendicular to the coast. Surveys are targeting the evaluation of the sardine stock. Dedicated observers record seabird occurrence following ESAS methodology. In addition, monthly land-based counts are carried out. More details are given in the Portuguese Seabird Atlas. Extra effort is being done in order to fill some lacks of data, depending on species and/or areas (e.g. within an SPA or targeting Balearic Shearwater non-breeding season) and on available funding.

Other areas that should be regularly monitored, namely the marine IBAs in the Azores and Madeira as well as some other sites identified by the marine IBA project, see also https://maps.birdlife.org/marineIBAs/default.html.

Contact: Pedro Geraldes, Joana Andrade, Nuno Oliveira

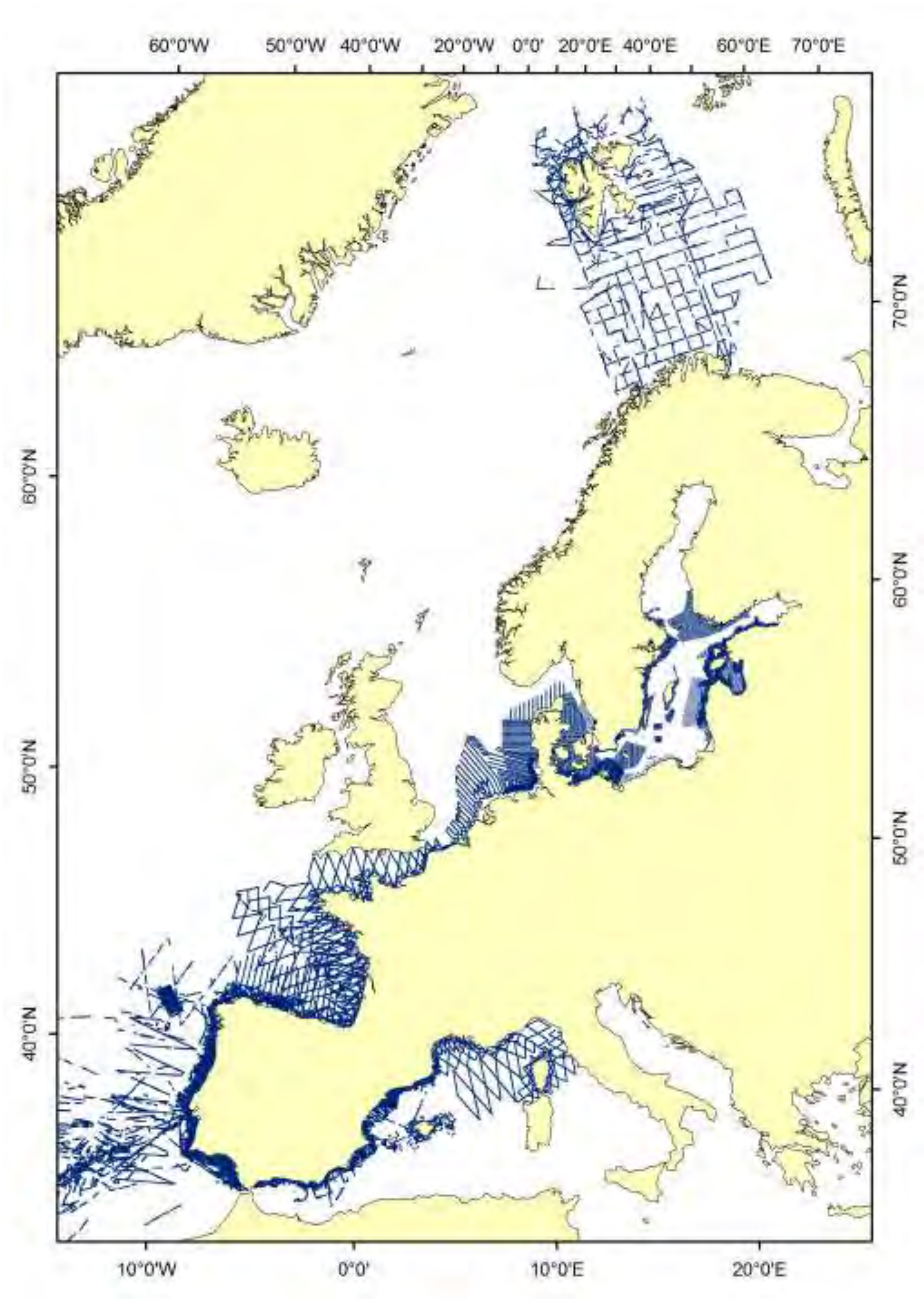

Figure 16. Survey design of running Seabirds-at-Sea monitoring programmes and (in the case of Norway, Spain and Portugal) survey effort of recent years respectively in the OSPAR and HELCOM regions. Not yet depicted are recent monitoring efforts of Ireland. Portugal covered large areas during the years of 2004–2018. Major parts are not shown in the map as they probably do not correspond to future monitoring efforts.

Table 17. Overview of national offshore seabird monitoring programmes in the HELCOM and OSPAR regions as of December 2019.

	FI	EE	LV	LT	RU	PL	SE	DK	DE	NO	NL	BE	UK	IE	FR	ES	PT	IS
Status monitoring programme (running **R**; in prep. + survey concept available **PC**; in prep. + no formal plans yet **PN**; no plans **N**; other **O**)	R	R	R	R	N	R	R	R	R	R	R	PN	O	O	R	PC	R	PN
Start year monitoring	2016	2016	2016 (2011)	2019 (2012)	-	2011	(2007)	2000	2008 (2002)	2004	2014 (1984)	2001 (1986)	2019	-	2011	-	2005	
Does monitoring include **winter surveys?** (**NO / FULL** coverage **/ PART**s covered)	PART	PART	FULL + PART	PART	NO	PART	FULL (al-most)	FULL + PART	FULL + PART	PART	FULL	FULL + PART	NO (but plan to in 2020)	PART	FULL + PART	NO	PART	
Interval of winter surveys (No. of surveys per 6 year period)	1	1	FULL: 1, PART: 5	2	0	6	FULL: 1?	FULL: 2, PART: 6	FULL:2, PART: 4	6	12	FULL: 18 PART6	0	4	FULL: 1, PART: 6	0	3	0
Other seasons during which monitoring takes place (spring **SP**, summer **SU**, autumn **AU**)		SP, SU, AU	(SP, AU)	SP				SU	SP, SU, AU	SP, SU	SP, SU, AU	SP, SU, AU	SP, SU, AU	SP, SU, AU	SU, AU	SP, SU, AU	SP, AU	
Platform (ship **S**, plane **P**)	P (S)	P (S)	P (S)	S	S/P	S	P	P	P (S)	S	P	S (P)	S	S (P)	P (S)	S	S	
Line transect **LT** / strip transect **ST** / other **O**		LT	LT	LT		LT	ST	LT	LT	LT	LT	ST(LT)	LT	LT	ST	LT, ST	ST	
Shape of transect lines or study area available? (**Y/N**)	Y	Y	Y	Y		Y	Y	Y	Y		Y	Y	Y	Y	Y		Y	
Archived data of earlier Seabirds at sea studies available? (**N/** give sampling years)	1970-now	2011/ 2012, 2014	2011/ 2012 2014 2016 2019 plane; earlier ship data	1993-1997 1999 2006–2008 2012–2013 2016	2003–2016		2007–2016, …		NS: 1990–now, BS: 2000–now		1984–now	1992–now	1979–2014	1999–2010	…	1999–2013	2005–now	
Database management system / data format		*xls*	xls mdb	xls, mdb		xls	Para-dox		Oracle; csv, xls,…		any	csv	Post-Gres/SQL	xls		Acess, xls, …	Csv, xls, corel para-dox file	
Data structure? (compatible with **ESAS** / Other **O**)		ESAS	ESAS	ESAS			ESAS?		ESAS	ESAS	ESAS	ESAS	ESAS	ESAS	O	ESAS, O	ESAS	
Data is / will be transferred to ESAS / HELCOM db (**Y/N**)	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	OBIS-SEAMAP	No plans yet	Y	

Annex 5 ESAS database – draft data model

Below is a draft database model (tables with datatype, relation and description) developed by BalticBOOST based on BALSAM guidelines and updated with JWG Bird meeting 2018 & 2019 outcome as of 31 October 2019.

The database is based on the structure of the original ESAS database along with the extensions to it used in the FTZ database.

Additions to the original ESAS structure (including those used in FTZ database) are printed red. **The mandatory fields are marked bold.**

Trip data table: contains the main characteristics of each survey reported.

Column	Data type	Relation	Description	Comments
Tripkey	LongInteger	Primary Key	Unique number to identify each record in the trip tables. Range of Tripkey values to use (or use a code assigned to your organization by ESAS): 500,000,000 – 509,999,999 FI 510,000,000 – 519,999,999 EE 520,000,000 – 529,999,999 LV 530,000,000 – 539,999,999 LT 540,000,000 – 549,999,999 PL 550,000,000 – 559,999,999 DE 560,000,000 – 569,999,999 DK	If you have multiple observers producing independent data streams, use a separate Tripkey for each of them. (E.g. for the classical plane survey setup with 2 observers on each side of plane independently recording their observations, there should be 2 separate Tripkeys)
Year	Integer		The year, four digits	
Month	Integer		The month (1 - 12)	
Day	Integer		The day of the month (1 - 31)	
Base_type	Integer	Foreign key (list)	The platform used for carrying out observations (1 Ship, 2 Helicopter, 3 Aeroplane).	
Platform_code	Integer	Foreign Key?	Ship name if the Base type = 1 The call sign (the unique identifier of the aircraft) if the Base call = 2 or 3 The names and call signs appear in a separate relational table. The structure of the relational table should be: Platform code (the link) Platform type (the same as Base type)	

Column	Data type	Relation	Description	Comments
			Platform name (the name od ship, or code of plane or helicopter) Use with precursor: 3 digit code for data provider with 5 digit code for platform	
Transect_width	Number		The width of the strip transect in metres	
Campaign key	LongInteger	Foreign Key?	Aggregates parts of a survey, i.e. different sides of the platform and/or counts in different parts covered of an area on different days or by different platforms. Tripkey of the 1st entry of the particular cruise	
Route	Text		Short description of area covered or route followed	
Count_type	Integer	Foreign Key (list)	The type of observation being carried out in an observation period. 1 Full ship transect method with snapshot for flying birds and distance estimation; 2 On water transect, no snapshot for flying birds; 3 All observations, but no transect operated; 4 Presence / absence data; 5 Full ship transect, but no scan data for outside the transect 6 Ship based strip transect (no distance estimation, no snapshot) 7 Ship based strip transect with snapshot but no distance estimation 8 Visual aerial survey line transect method with distance sampling 9 Visual aerial survey strip transect (no distance estimation) 10 Visual aerial survey total counts 11 Digital aerial – video 12 Digital aerial - stills	
Species_observed	Integer	Foreign Key (list)	The species groups which were being observed in this observation session. 1 All species recorded (standard), 2 All species except Larus Gulls, 3 All species except Fulmars, 4 All species except Larus Gulls, Fulmars and Kittiwakes, 5 Auks only, 6 Auks and Seaduck only,	Each observation session means a unique Tripkey. There could be several Tripkeys for the same survey, but normally they should not be many. In general, the list is open for future additions but there should be an aim at keeping it short.

Column	Data type	Relation	Description	Comments
			7 All species except Eiders and Gulls, 8 All species except Gannets, 9 Auks and unusual seabirds only 10 all species except auks and divers 11 all species except small gulls (Little, Black-headed, Common, Kittiwake) 12 all species except Lesser Black-backed Gulls 13 all species except sea ducks and divers (loons) 14 all species except Gannets, Fulmars and Kittiwakes 99 other	
Use_of_binoculars	Integer	Foreign Key (list)	The extent to which binoculars were used to detect birds 1 No binoculars used for detection of birds ; 2 Binoculars used for detection of birds far ahead of the ship (e.g. for seaduck and diver surveys); 3 Binoculars used extensively for scanning ahead and to the side, naked eye used for close observations)	
Behaviour_type	Integer?	Foreign Key (list)?	Indicates if behaviour has been recorded: 0 Behaviour not recorded 1 Detailed behaviour recording 2 Typical airplane activity (behaviour) recording 999 No information on behaviour recording	
Base_side	Integer?		Side of platform used for survey (ship) or seat of the observer (plane). For ship counts (Base_type = 1): 999 No record, 1 Port side, 2 Starboard For plane counts (Base_type = 3): 1 Co-pilot=right front 2 Behind the pilot=left back 3 Behind the co-pilot = right back 9 Observers both left and right producing single datastream 10 Left front	
Observer_role	Integer		Indicates the role of the observer. Important for surveys using the double observer platform.	

Column	Data type	Relation	Description	Comments
			Default is 1 (Primary). 1 Primary (the only observer(s) on the side of the platform or if double observer approach used, the observer whose recordings should be used in the data analyses 2 Secondary (the additional observer to the primary observer in the double observer platform) If there are more than 2 observers used (e.g. triple observer approach), each additional observer is assigned an increasing integer (3, 4, etc.)	
Origin	Text		Origin of data (e.g. data owner or supplier)	
Access_level	Number		1 Open access 2 Restricted access (via request to data owner)	Note: Restricted data will nevertheless be used for presence-absence products or aggregated data products
Direction_of_travel_type	Text		The way how directions of ships and birds is recorded: U unknown A absolute, R relative (to direction of platform), Z number, P arrow, K none	
Number_of_observers	Number		Number of observers producing the data stream under this Tripkey The number of observers does not include the other observers if each of them record his/her observations separately (= produce different data streams that are included in the database under different Tripkey(s)). Count in only the additional observers assisting to the 1st observer (Observer1).	
Observer1	Text		Observer name	
Observer2	Text		Observer name Report only the observers assisting the Observer1 in the fields Observer2 and Observer3. Do not report the other observers producing their own data streams.	
Observer3	Text		Observer name See description of the Observer2	See Observer2

Column	Data type	Relation	Description	Comments
Notes	Text		Additional details related to the survey	

Position data. Position data table contains all locations visited during the survey (GPS records) and their attributes. Has many-to-1 relationship with Trip data table and 1-to-many relationship with Species data table. Separate table has to be submitted for each survey. The table structure includes the relevant position specific parameters including the code to link with the Trip table:

Column	Data type	Relation	Description	Comments
Poskey	Number	Primary Key	A unique number to identify each record in the Position table	
Tripkey	Number	Foreign Key to Trip-key.Trip table	The link to the trip information for the position record	
Time_hour	Number		The hour component of the time (0 - 23)	Each position recorded during the survey is reported in the Position table. For plane surveys this usually means a position for each second of the survey. For ship surveys this means a position for each minute of the survey.
Time_minute	Number		The minutes component of the time (0 - 59)	See above
Time_second	Number		The seconds component of the time (0 - 59)	See above
Latitude	Double		The latitude of the position in the middle of the observation period in decimal degrees (geographic coordinate system WGS84; EPSG code: 4326) using maximum precision as recorded by GPS or calculated.	
Longitude	Double		The longitude of the position in the middle of the observation period in decimal degrees (geographic coordinate system WGS84; EPSG code: 4326) using maximum precision as recorded by GPS or calculated.	To be discussed: Include the old ESAS Column POSMARK? This column was used to indicate how positions were derived in times when they were not permanently recorded. It gives a measurement of precision.
Transect_ID	Text	Foreign Key? Link to an attribute in a GIS dataset	Name or number of the transect with a leading 2-letter country code. Format: XX_YYYYYYYYYY, where XX is a 2-letter country code and YYYYYYYYYY is a transect ID according to the national classification.	This field serves as a link (Foreign key) to the GIS dataset with the monitoring transects. This is not a mandatory field, however, it is recommended for the monitoring surveys using predefined transects.For the surveys not using the monitoring transects, this field should be left blank.

Column	Data type	Relation	Description	Comments
				The national monitoring programmes have a layout of transects with their nomenclature. Each transect reported in this database should have a unique code across the countries.
Area_surveyed	Double		The area of sea surveyed (km²) during the observation period in km².	Optional, can be calculated by multiplying km_travelled with „transect_width" (from the TRIP-Table)
km_travelled	Double		The distance travelled during the observation period in km (as recoded by GPS)	
Seastate	Number	Foreign key (list)	Sea state according to Beaufort scale. Default = 9 (for entries with no value in this field) 0 Sea like mirror; 1 Ripples with appearance of scales, no foam crests; 2 Small wavelets, crests of glassy appearance, not breaking; 3 Large wavelets, crests begin to break, scattered whitecaps; 4 Small waves becoming longer, numerous whitecaps; 5 Moderate waves, many whitecaps, some spray; 6 Larger waves, whitecaps everywhere, more spray; 999 No data	
Visibility	Text	Foreign key (list)	Visibility code 999 No data; A Poor; B Fair / moderate; C Good / very good; D Excellent / infinity; 0.1 - 9.9 visibility in km; 10 visibility >= 10 km)	
Glare	Number	Foreign key (list)	Glare affecting the observer: 0 no glare, 1 weak glare, 2 medium glare, 3 strong glare 999 No data	
Sun_angle	Number	Foreign key (list)	Angle of the sun in relation to the observer (angle)	

Column	Data type	Relation	Description	Comments
			Value 0 to 360 999 No data	
Cloud_cover	Integer		Cloud cover expressed as x/8 (the eights; octas) Value 0 – 8 999 No data	
Precipita-tion	Num-ber?	Foreign key (list)	Precipitation: 0 none, 1 rain, 2 snow, 3 fog 999 No data	
Ice	Integer		Ice cover of survey area: 999 No data, 0 no ice, 1 – 100 – Ice cover in % (only full numbers, no decimals) 999 No data	
Notes	Text		Additional details related to the po-sition	

Species data. Separate table containing all observations of birds at the particular survey has to be submitted for each survey. This table should contain only the sites with observations, no entries for sites without observations are needed as the survey effort is already given in the Position data table. The table structure includes the relevant observation specific parameters:

Column	Data type	Relation	Description	Comments
Species_key	Integer	Primary Key	A unique number for each record in the species files	
Poskey	Integer	Foreign Key to Poskey.Position_table	The link to the position table for a species record. Note that each position record may relate to a number of species records, but that each species record may relate to only one position record.	
Transect	Integer		States whether the observation is in transect 1 Out of transect; 2 In transect - also used when no birds are seen during an observation period	
Euring_species_code	Integer	Foreign key?	The species code. Relational lookup table with EURING species codes, their English and Latin names as well as other commonly used codes	A list of 'uncertainty codes' used by partners will be collated into a rationalised list to be used in this new column by all partners, and this will form the primary source of 'species data' within the dataset. Zero birds will no longer be used
WoRMS code	Integer		Standard WoRMS codes will be used in the original field with additional codes for 'non marine species' and 'identification uncertain'.	Standardised species codes preferred by ICES. In addition to our Euring codes, as WoRMS does not accommodate any uncertainty in ID
Number_of_birds	Integer		The number of birds counted or estimated for each record. This should be the number of birds without correction for distance sampling!	
Distance	Text	Foreign key?	This is the distance at which birds were observed. Different codings used for ship and plane surveys: For Ship surveys (Base_type = 1): A 300m transect is assumed for codes A-E, which are for birds on the water only. If other transect widths have been used, code this field as Blank. W – Bird on the water in transect, but distance not recorded; 999 No data; A 0 - 50m;	

Column	Data type	Relation	Description	Comments
			B 50 - 100m; C 100 - 200m; D 200 - 300m; E > 300m; F Use for Flying birds, both in and out of transect U unknown (whether flying or sitting on the water) For Plane surveys (Base_type=3): V 0 – 44 m G 44 – 163 m L 44 – 91 m M 91 – 163 m J 163 – 432 m K 432 – 1000 m R > 1km 9 In transect, no band given U unknown (but always outside transect) T - total counts	
Activity (behaviour)	Integer	Foreign key?	What the species was doing when observed: 999 – no data 1 – on water/swimming 2 – diving 3 – flushing 4 – flying 5 – completely submerged (marine mammals) 6 – breaching surface (marine mammals) 7 – on artificial piece of something (platform, pole…)	E.g. used as covariate for detection probability
Age_class	Text?		A Adult, I Immature J Juvenile N Not adult X Primary moult (only fulmar, auks, divers, seaduck) Y Definitely no active primary moult (use only for fulmar, auks, divers and seaduck)	Examples: A second calendar year bird should be coded as Age-class = I and Age-year = 2. An adult bird in winter plumage should be coded as Age_class = A and Age_year = W.

Column	Data type	Relation	Description	Comments
Age_year	Integer		Age (calendar-year) of immature birds	
Plumage	Text		Plumage types: B breeding/summer plumage, T transient plumage, W winter plumage, L Normal light morph of Fulmar (typical for North Sea birds), C coloured morph of Fulmar, L light morph of skuas, I intermediate morph of skuas, D dark morph of skuas	
Sex	Text		Sex class: M male, F female	
Group	Integer		Marking of aggregations of individuals of one or several species. Number assigned to each group is unique among all observations from the same Tripkey	
Direction_of_travel	Integer		The code represents the direction in which the bird is travelling.	
Prey	Foreign key		Default=999. Relational table with codes and descriptions	
Association	Integer		A field that allows coding associations between observed birds/cetaceans and other vessels/structures/floating matter	
Behaviour (detailed)	Text		Relational lookup table with double-digit codes from ESAS+FTZ additions Or 999 if no data	
Notes	Text		Additional details related to the observation	

Annex 6 Preliminary distribution maps of seabird species and species groups in the surveyed areas of the Baltic Sea in January 2016

The data plotted in the maps are raw observation data from plane and ship line transects and do not include the ground-based IWC survey data.

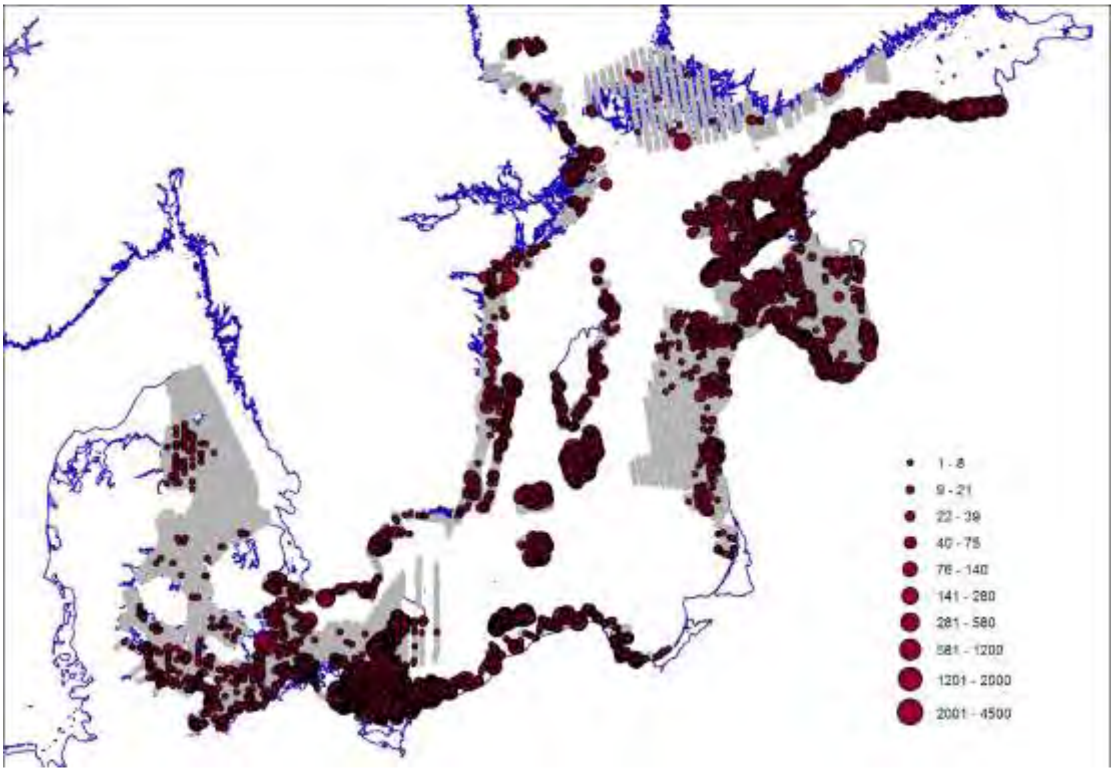

Figure 17. Distribution of the Long-tailed Duck *Clangula hyemalis* in the Baltic Sea in winter 2015/16.

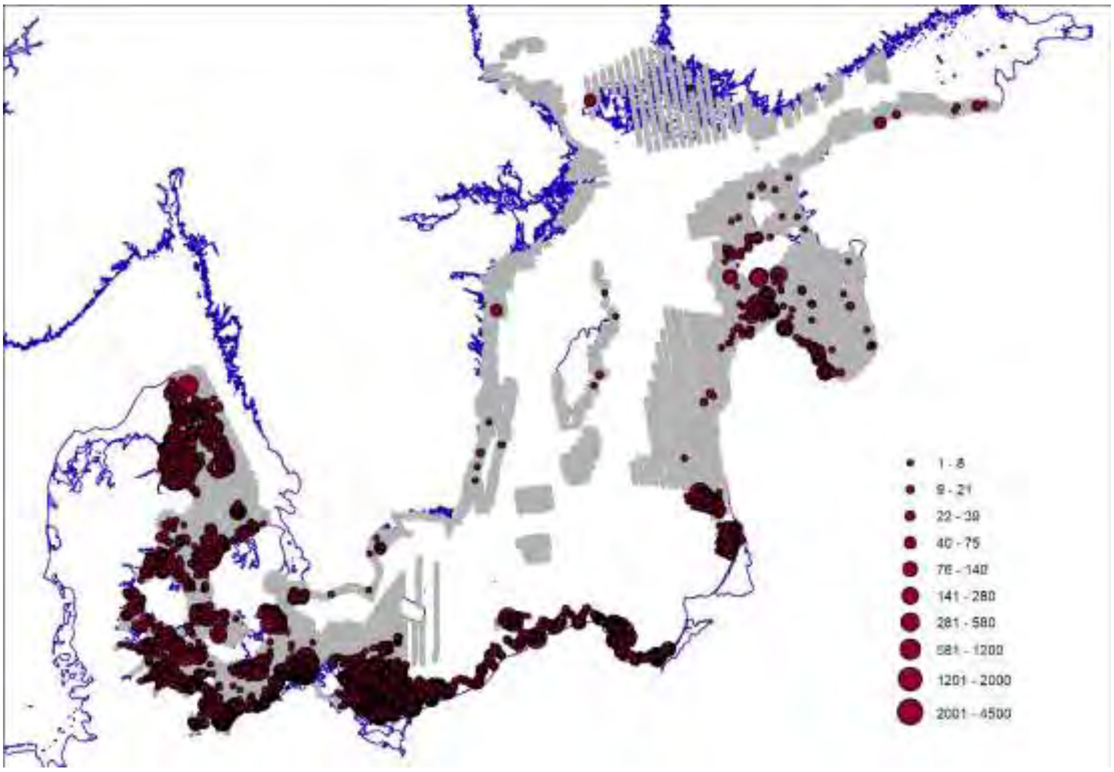

Figure 18. Distribution of the two scoter species *Melanitta sp.* in the Baltic Sea in winter 2015/16.

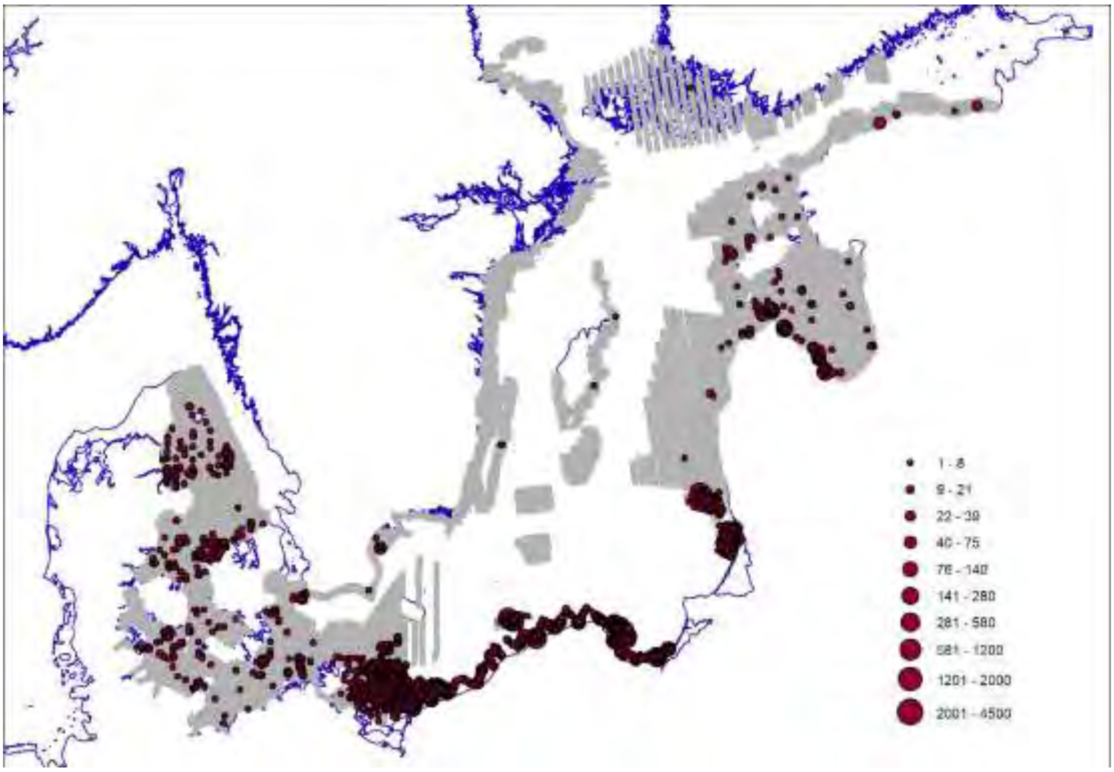

Figure 19. Distribution of the Velvet Scoter *Melanitta fusca* in the Baltic Sea in winter 2015/16.

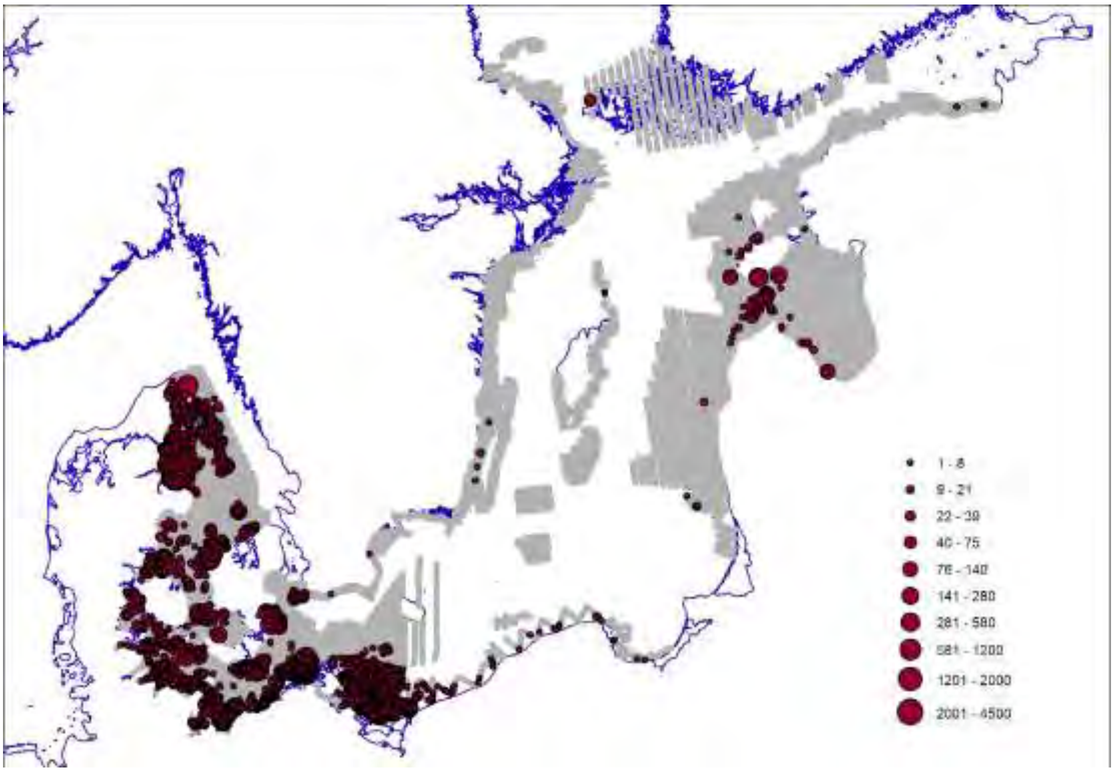

Figure 20. Distribution of the Common Scoter *Melanitta nigra* in the Baltic Sea in winter 2015/16.

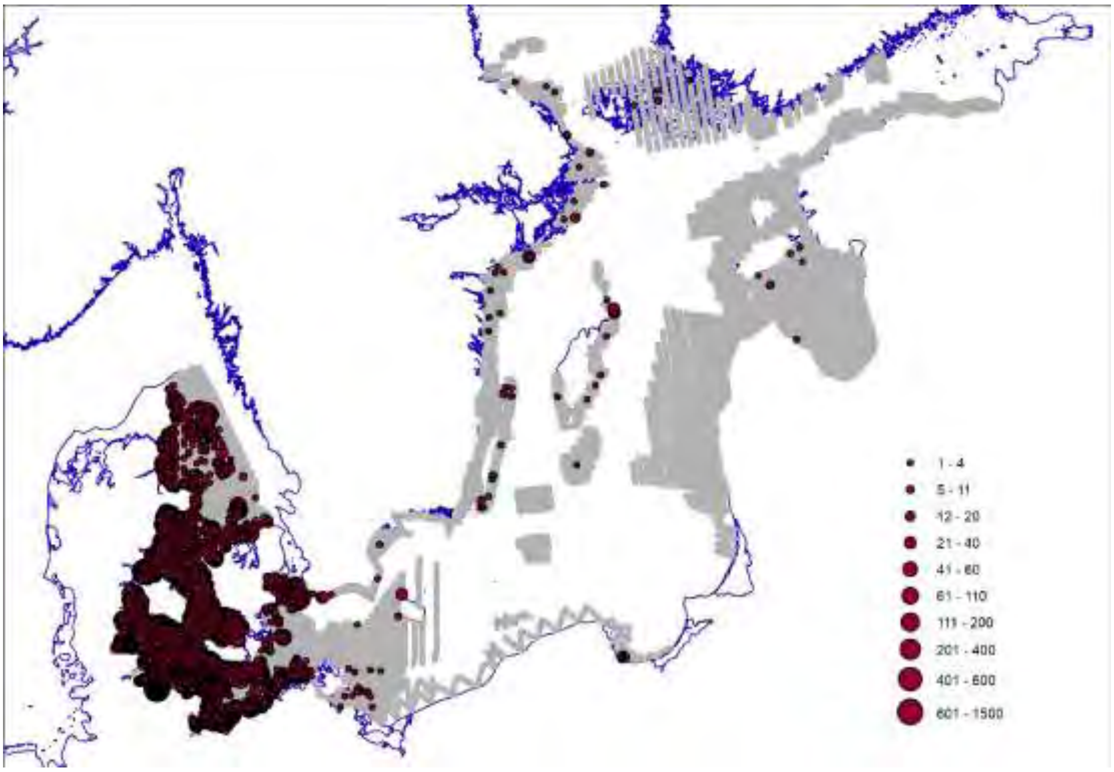

Figure 21. Distribution of the Common Eider *Somateria mollissima* in the Baltic Sea in winter 2015/16.

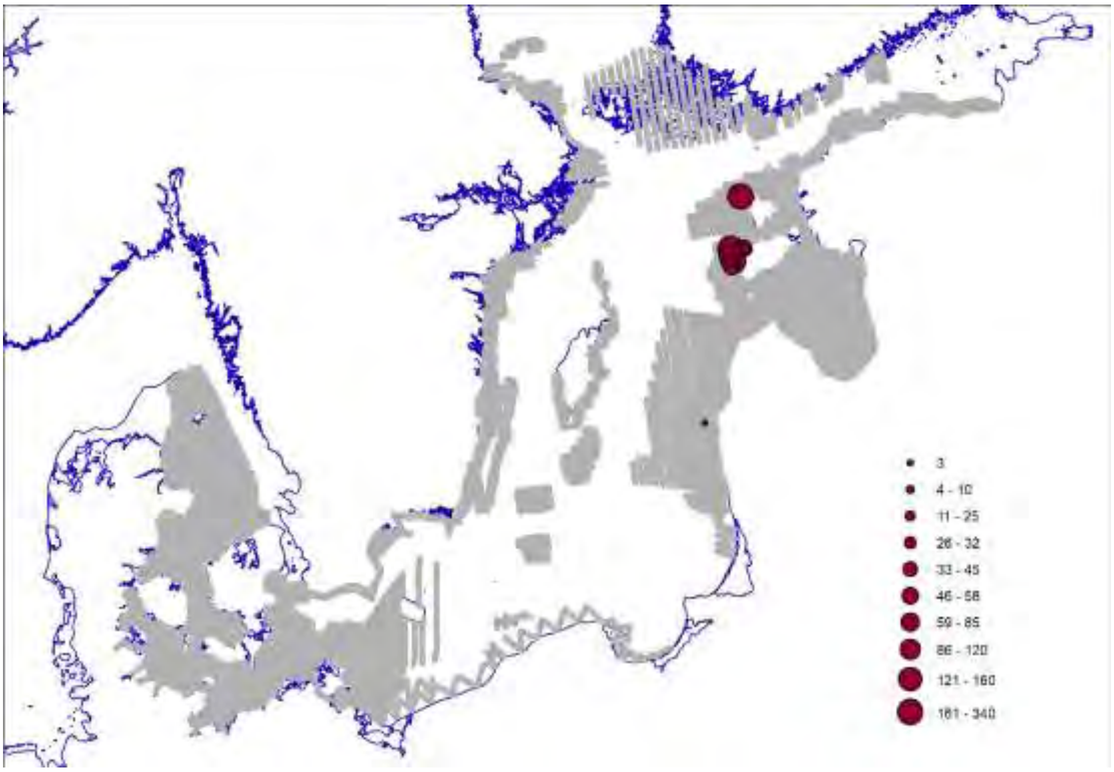

Figure 22. Distribution of the Steller's Eider *Polysticta stelleri* in the Baltic Sea in winter 2015/16.

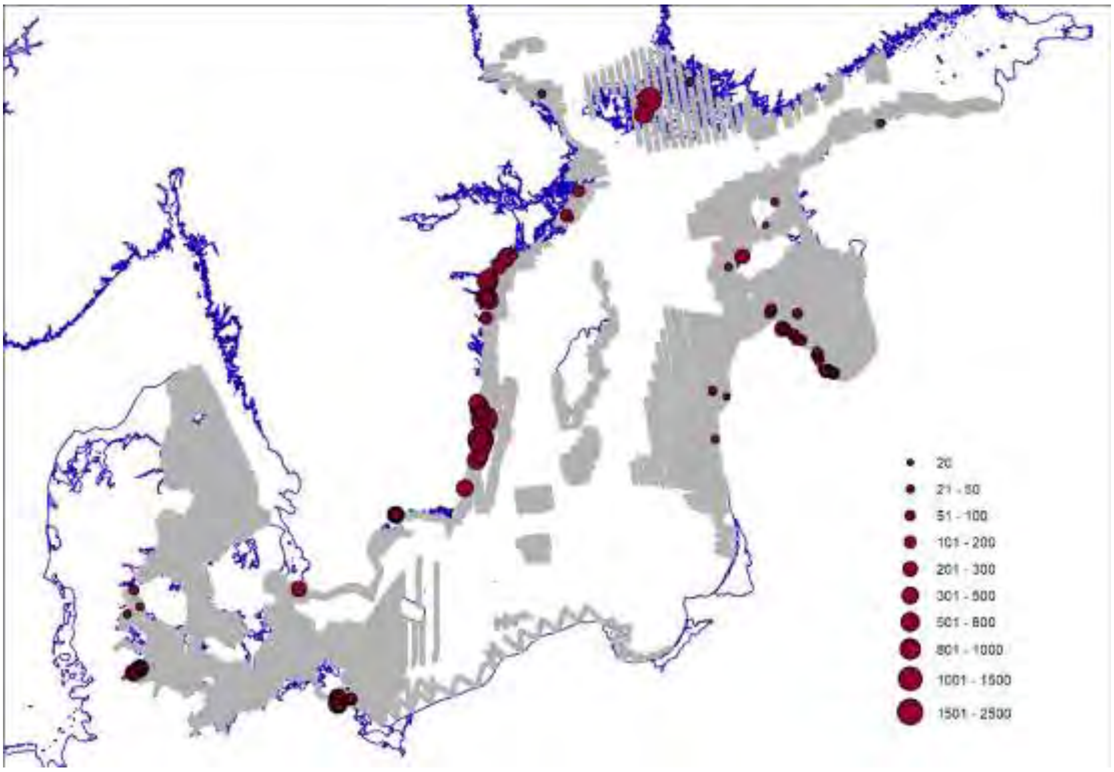

Figure 23. Distribution of the Tufted Duck *Aythya fuligula* in the Baltic Sea in winter 2015/16.

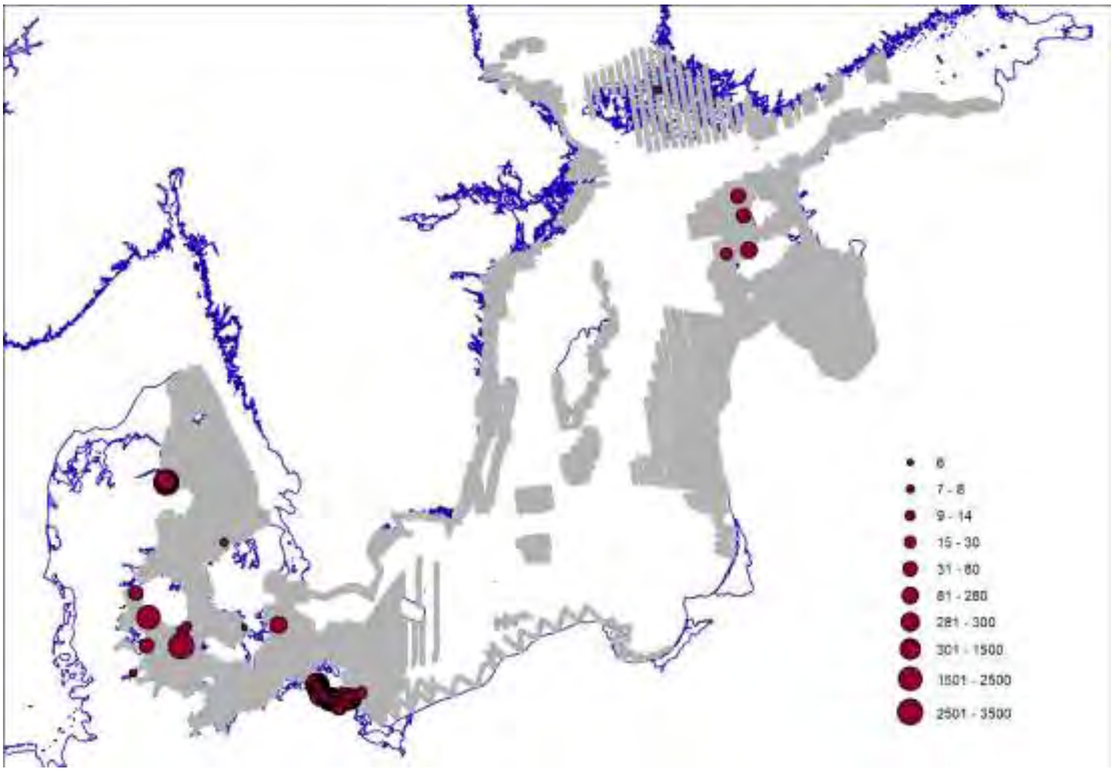

Figure 24. Distribution of the Greater Scaup *Aythya marila* in the Baltic Sea in winter 2015/16.

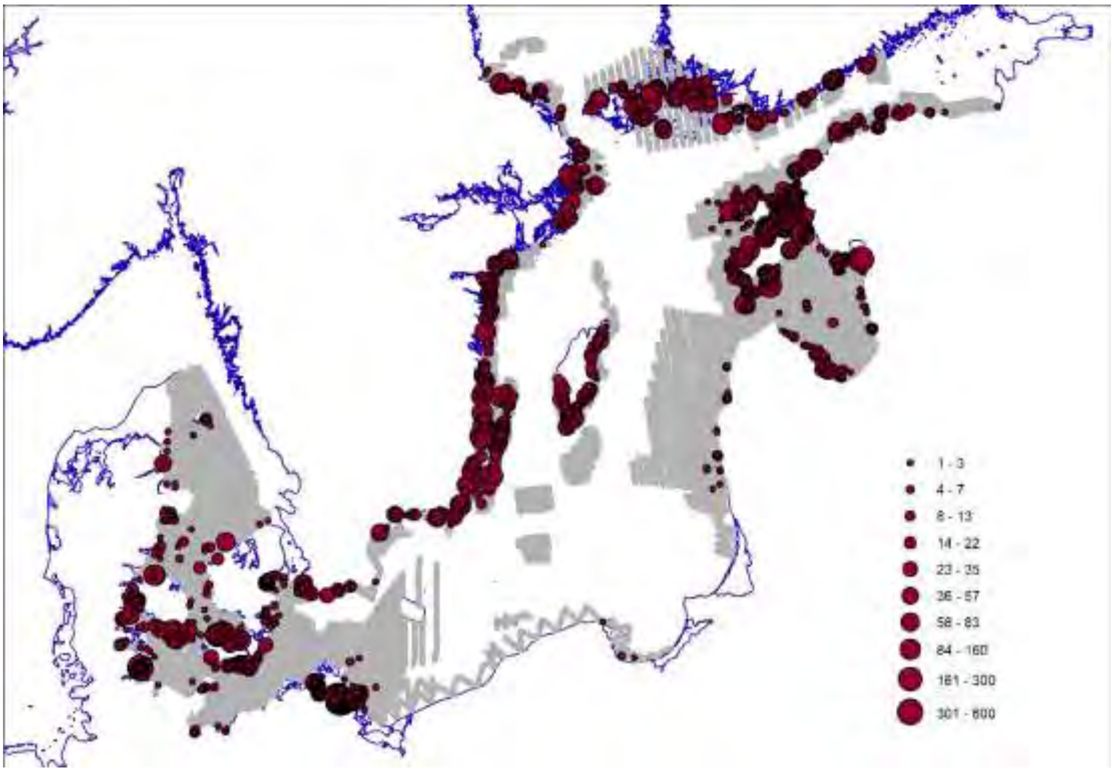

Figure 25. Distribution of the Common Goldeneye *Bucephala clangula* in the Baltic Sea in winter 2015/16.

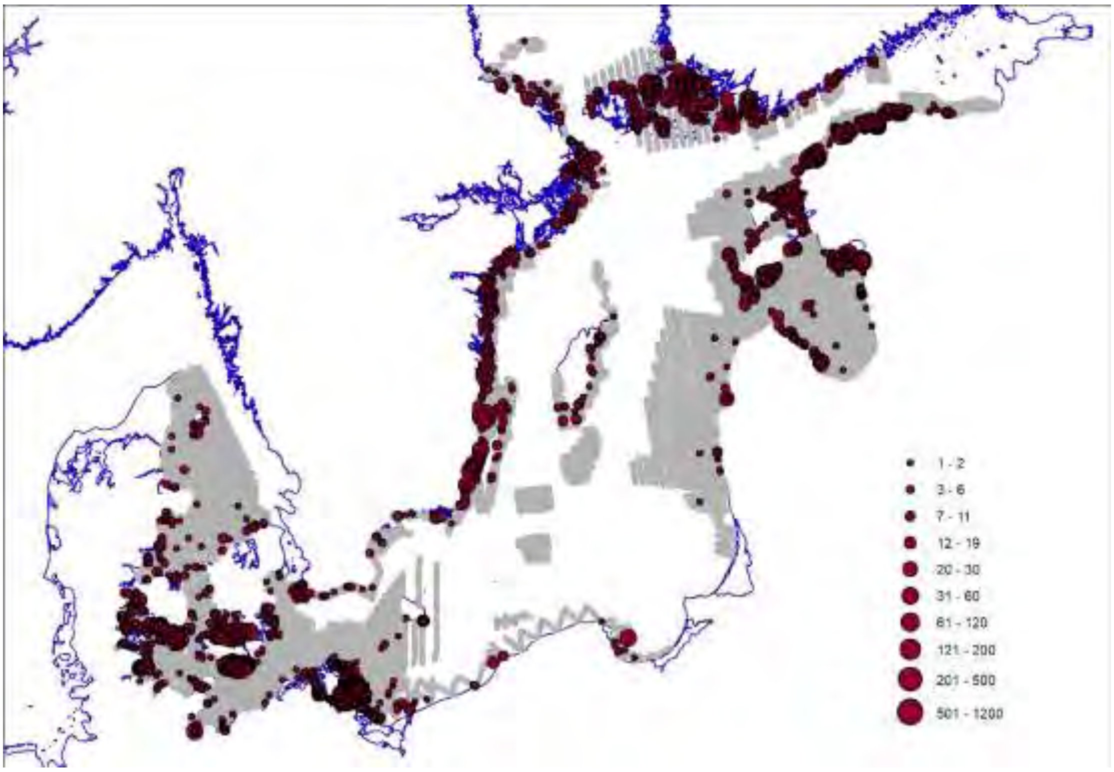

Figure 26. Distribution of merganser species *Mergus sp.* in the Baltic Sea in winter 2015/16.

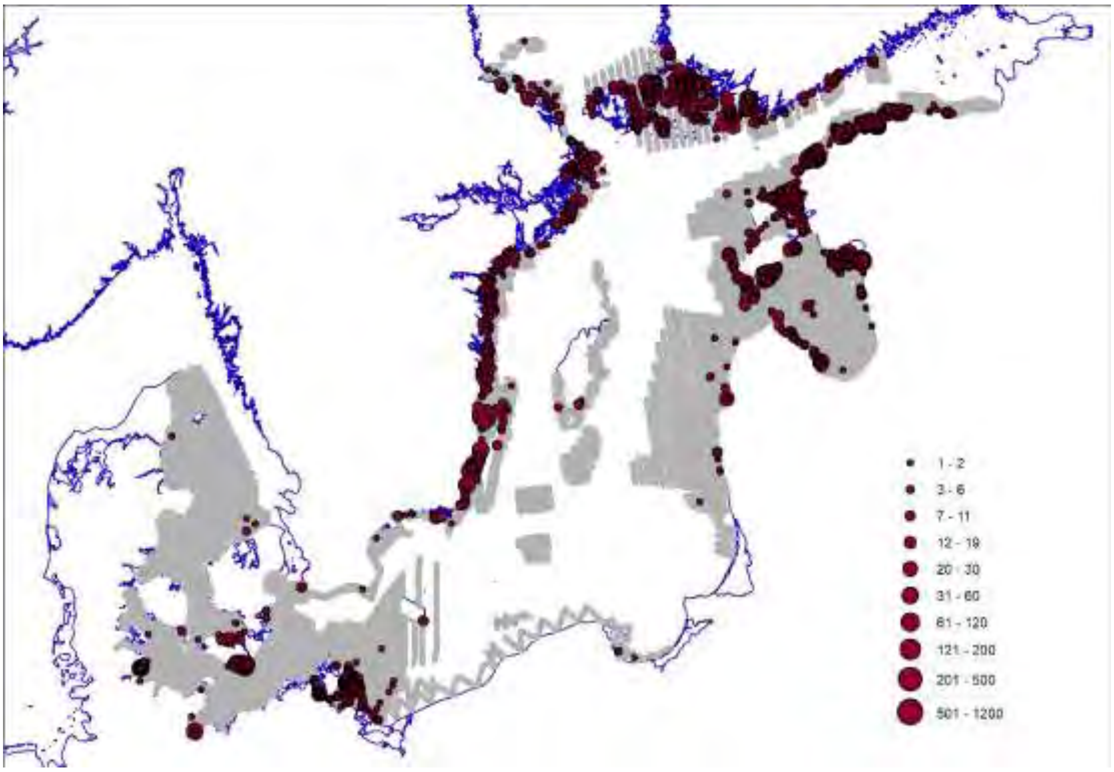

Figure 27. Distribution of the Goosander *Mergus merganser* in the Baltic Sea in winter 2015/16.

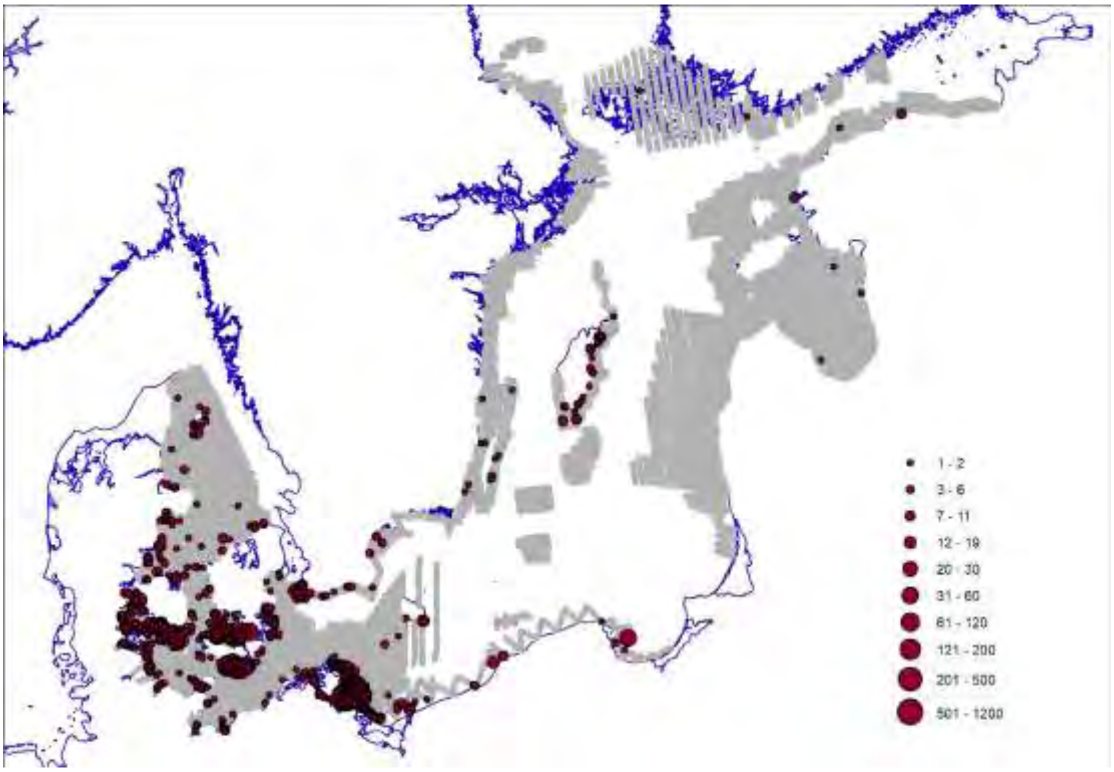

Figure 28. Distribution of the Red-breasted Merganser *Mergus serrator* in the Baltic Sea in winter 2015/16.

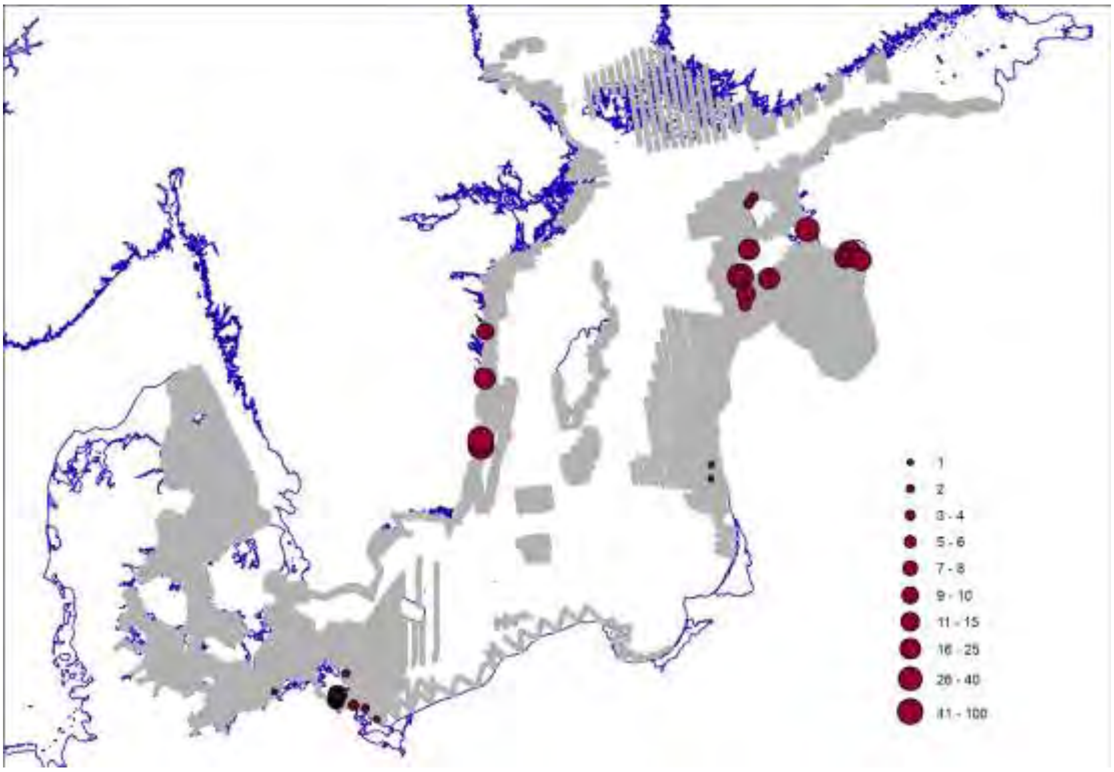

Figure 29. Distribution of the Smew *Mergellus albellus* in the Baltic Sea in winter 2015/16.

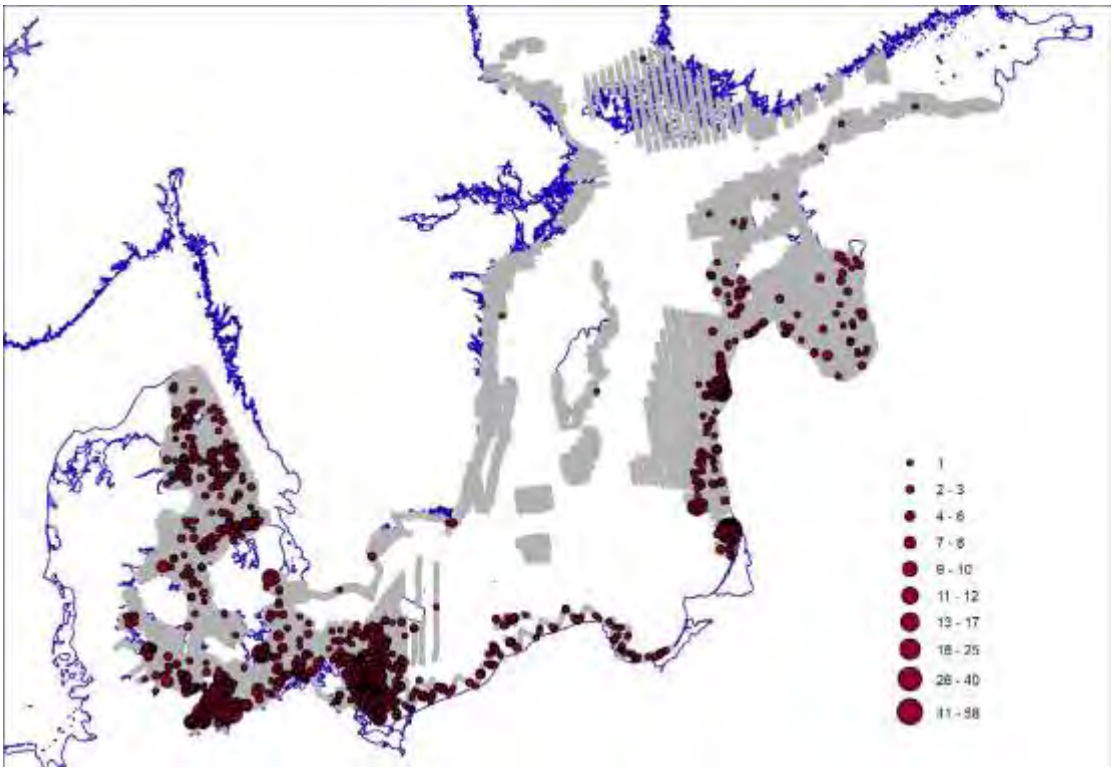

Figure 30. Distribution of the diver species *Gavia sp.* in the Baltic Sea in winter 2015/16.

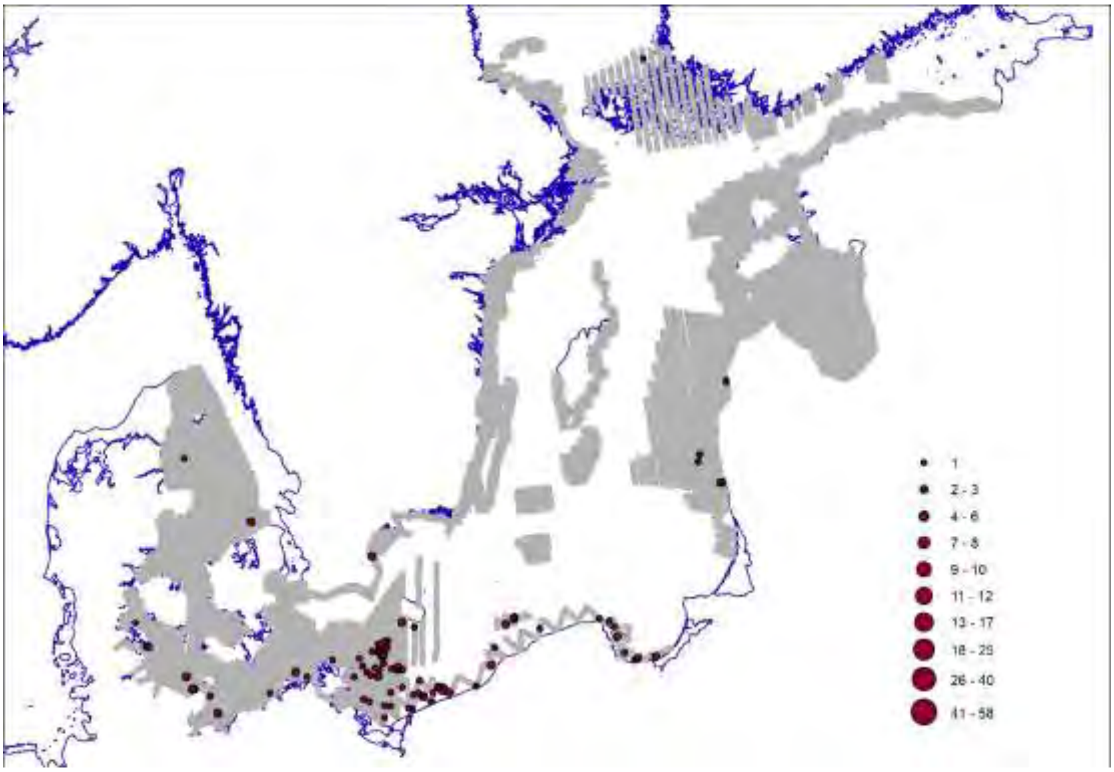

Figure 31. Distribution of the Black-throated Diver *Gavia arctica* in the Baltic Sea in winter 2015/16.

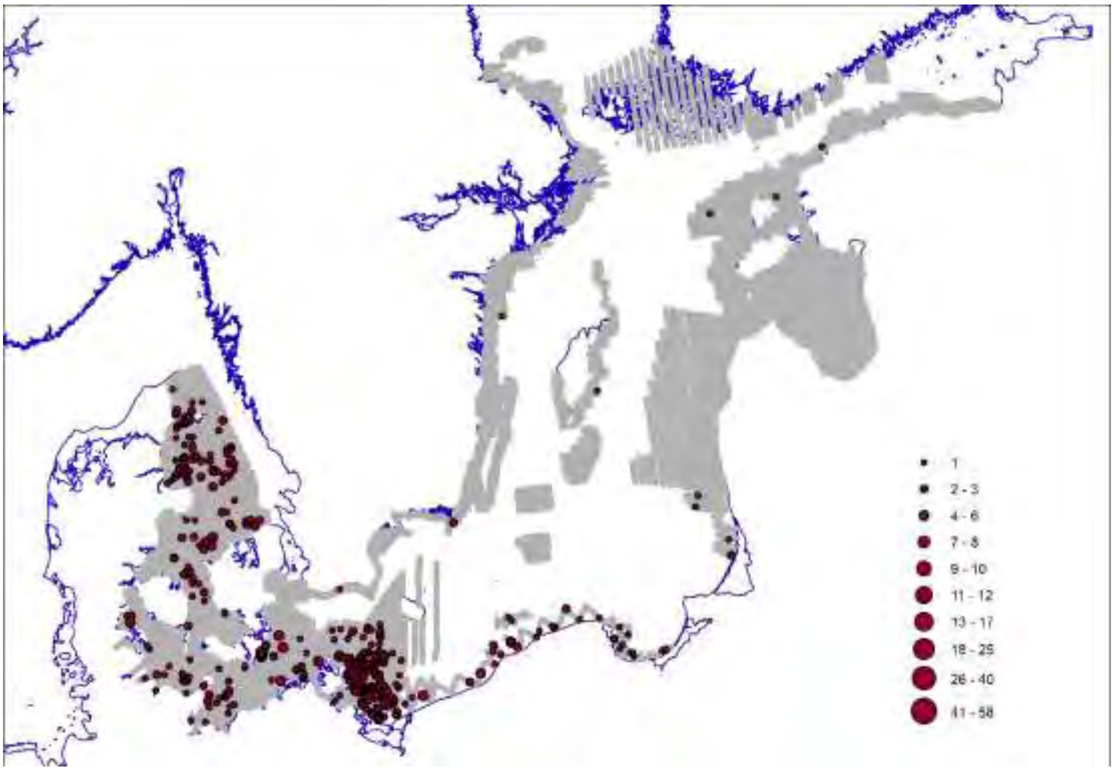

Figure 32. Distribution of the Red-throated Diver *Gavia stellata* in the Baltic Sea in winter 2015/16.

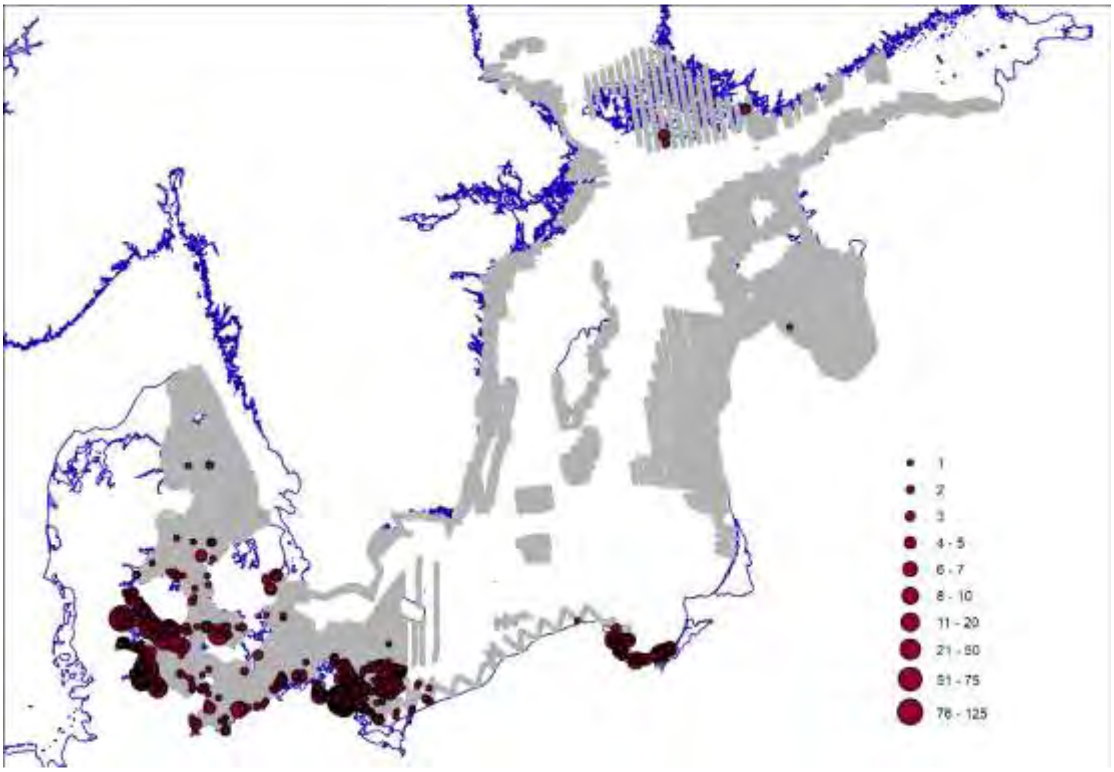

Figure 33. Distribution of grebe species *Podiceps sp.* in the Baltic Sea in winter 2015/16.

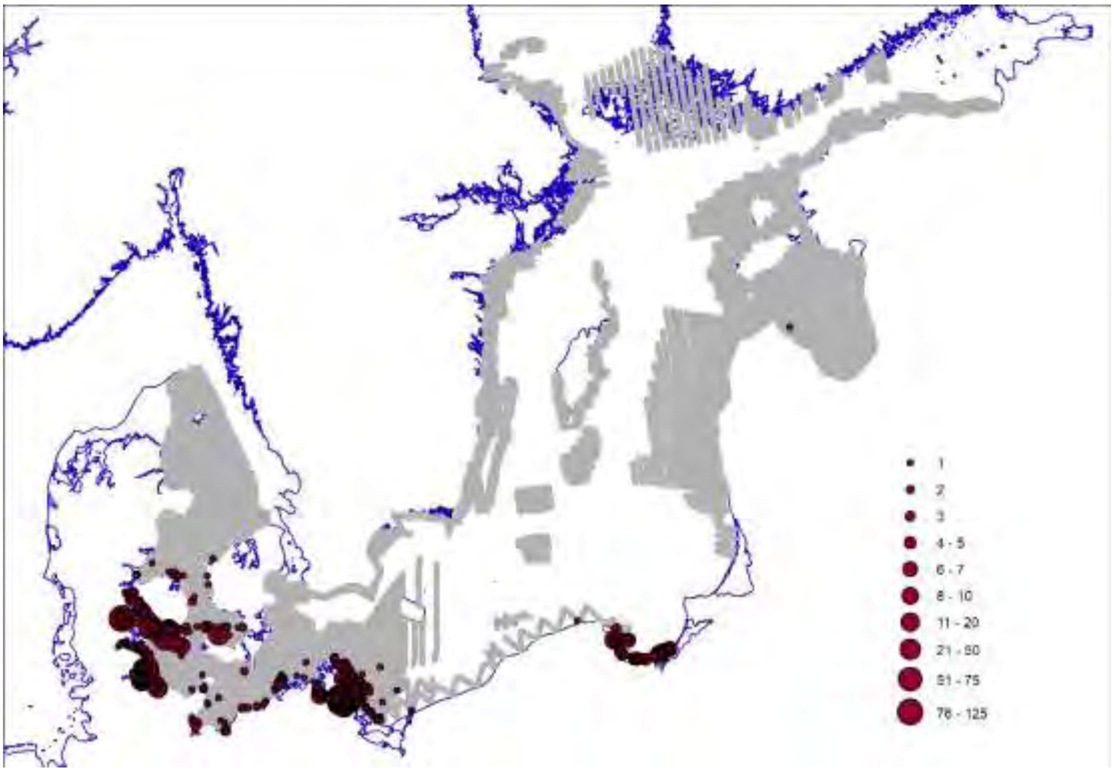

Figure 34. Distribution of the Great Crested Grebe *Podiceps cristatus* in the Baltic Sea in winter 2015/16.

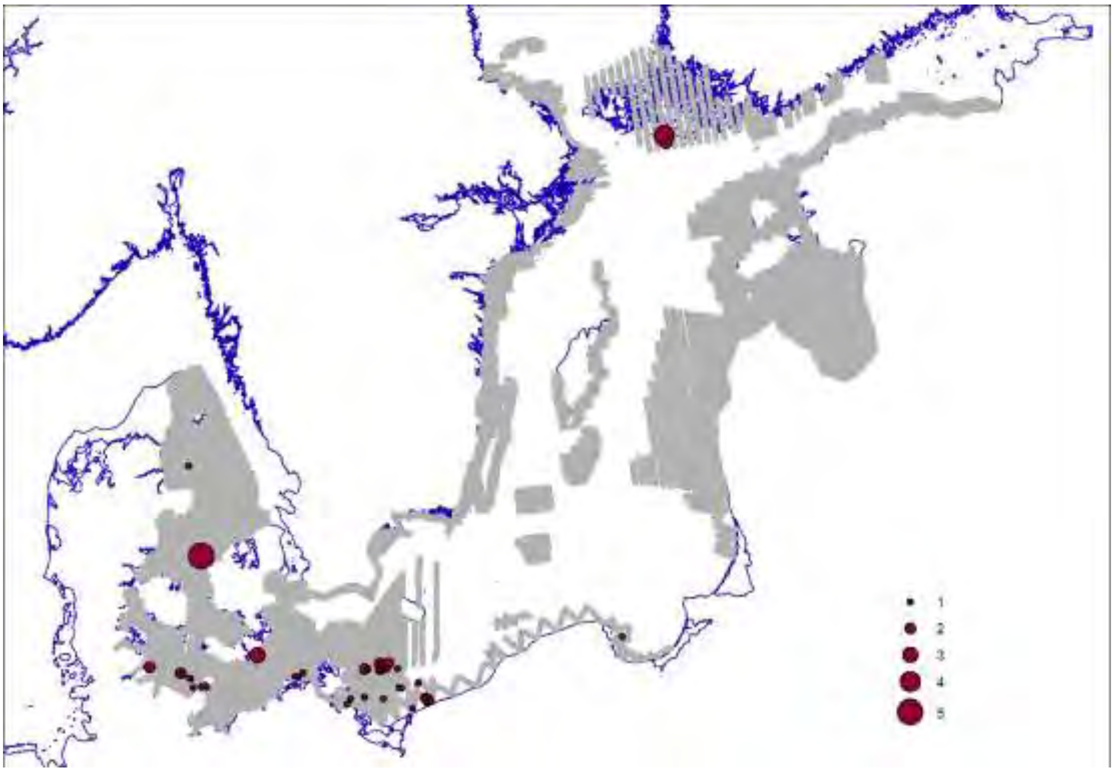

Figure 35. Distribution of the Red-necked Grebe *Podiceps grisegena* in the Baltic Sea in winter 2015/16.

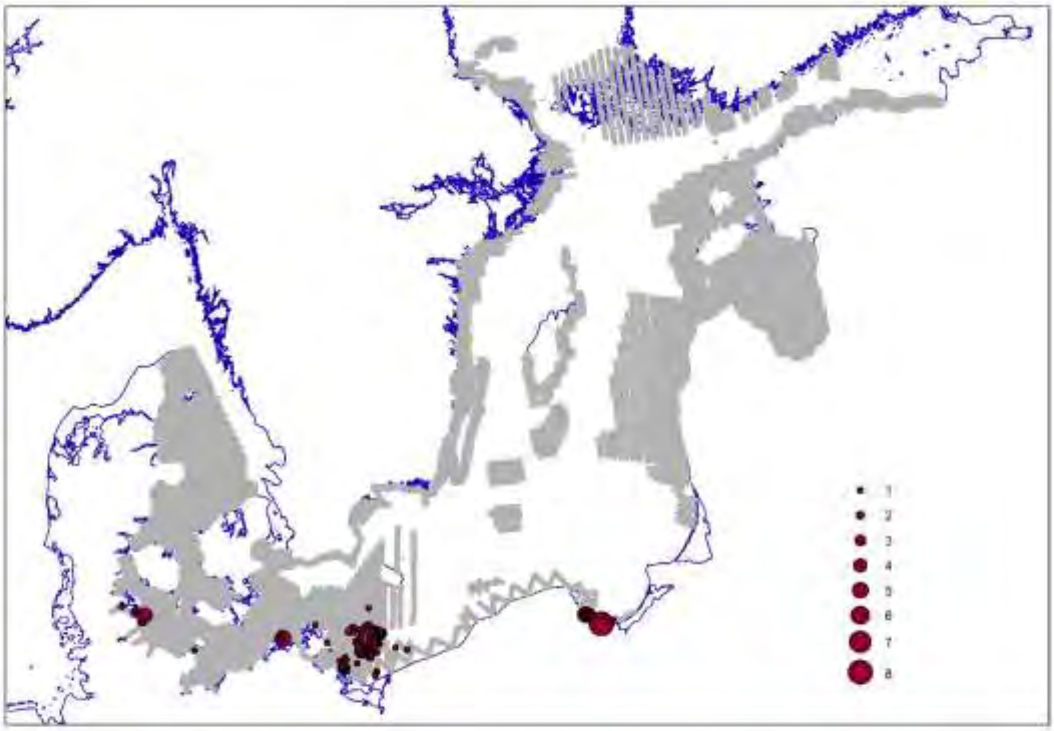

Figure 36. Distribution of the Slavonian Grebe *Podiceps auritus* in the Baltic Sea in winter 2015/16.

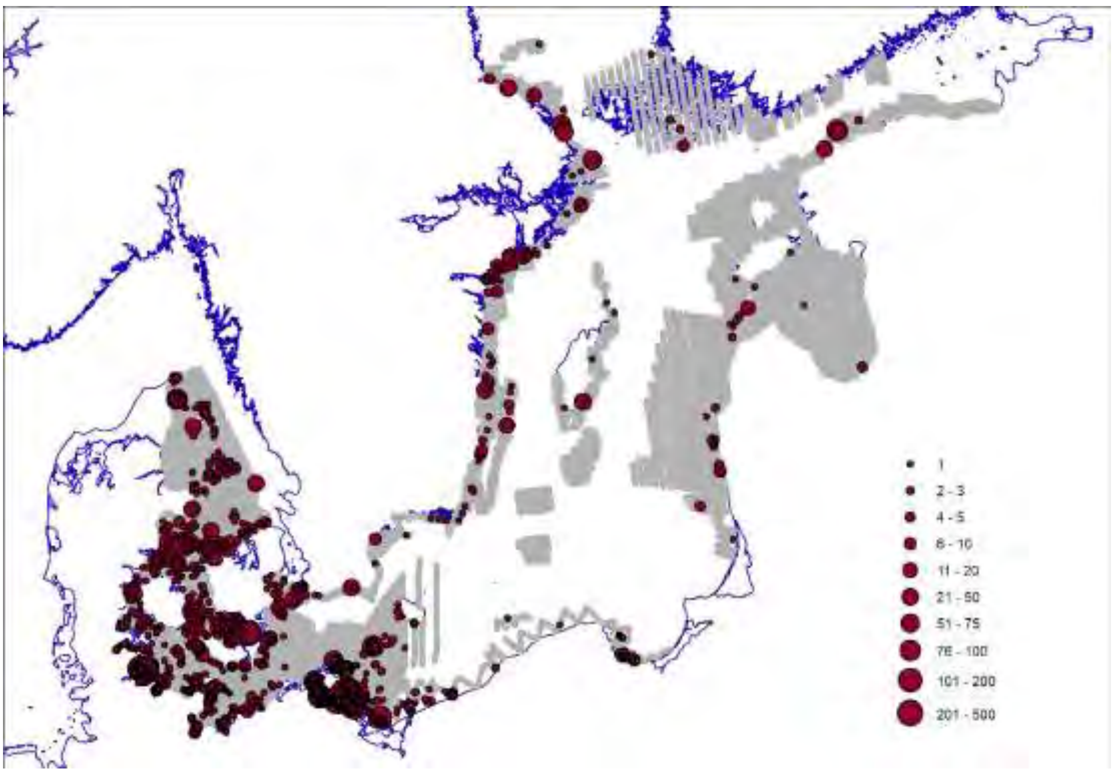

Figure 37. Distribution of the Cormorant *Phalacrocorax carbo* in the Baltic Sea in winter 2015/16.

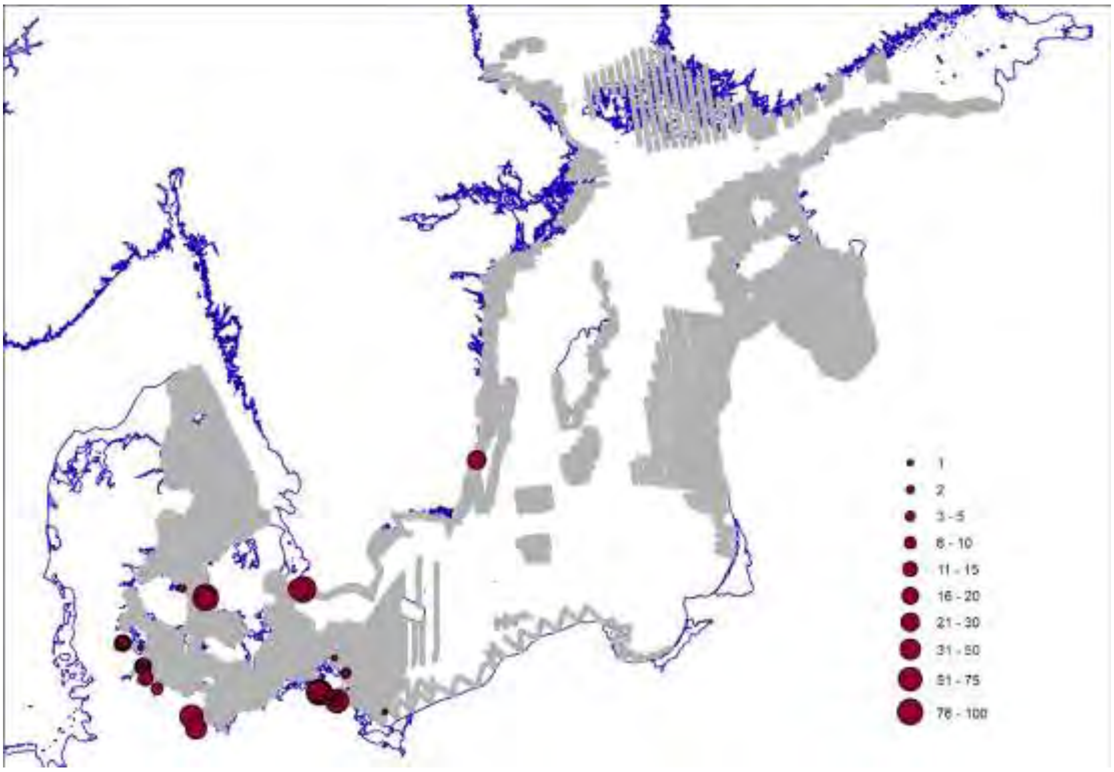

Figure 38. Distribution of the Coot *Fulica atra* in the Baltic Sea in winter 2015/16.

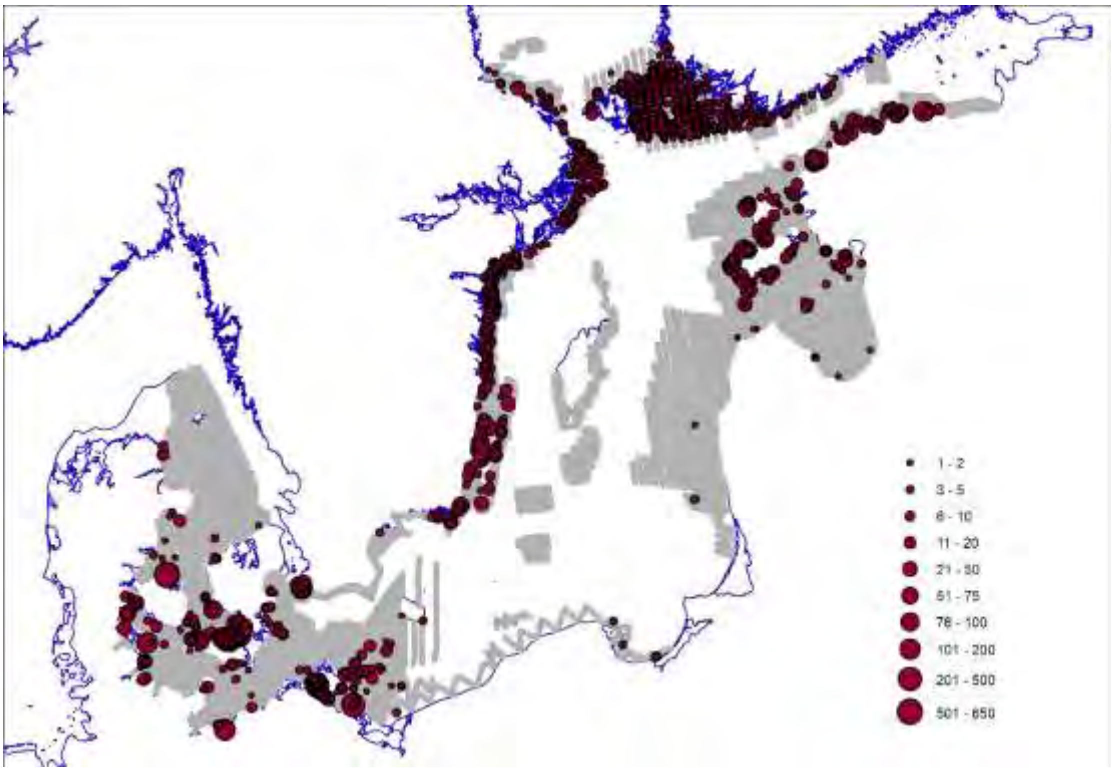

Figure 39. Distribution of swan species *Cygnus sp.* in the Baltic Sea in winter 2015/16.

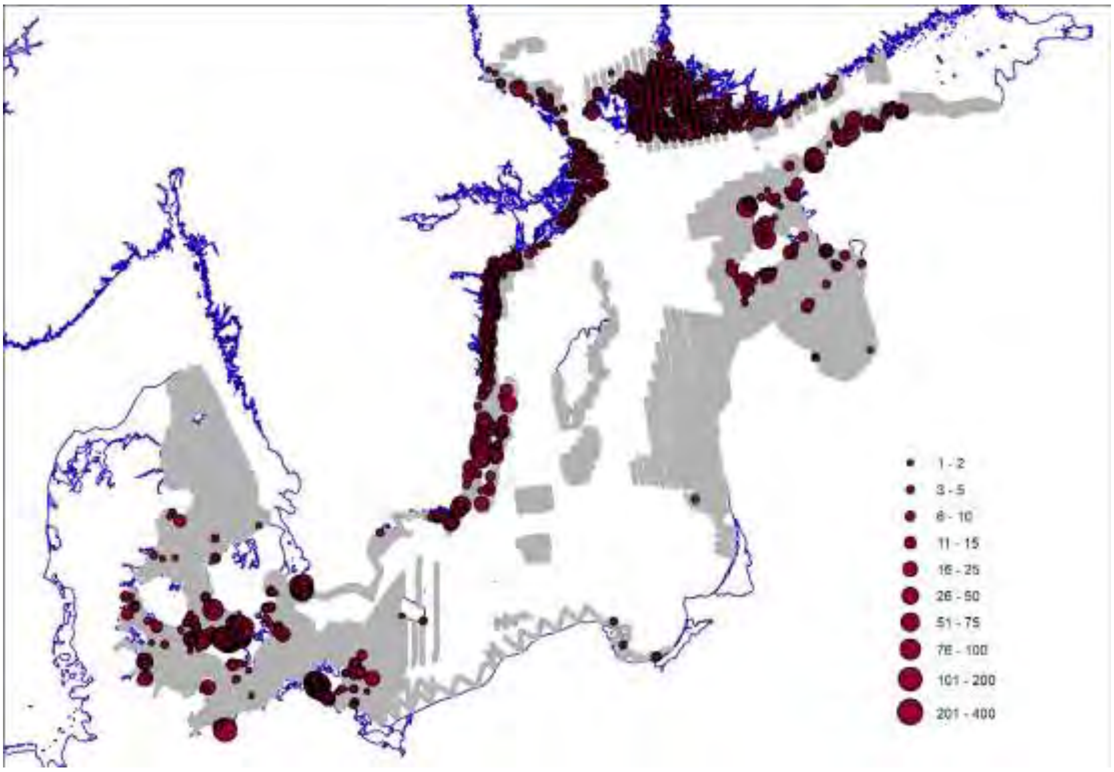

Figure 40. Distribution of the Mute Swan *Cygnus olor* in the Baltic Sea in winter 2015/16.

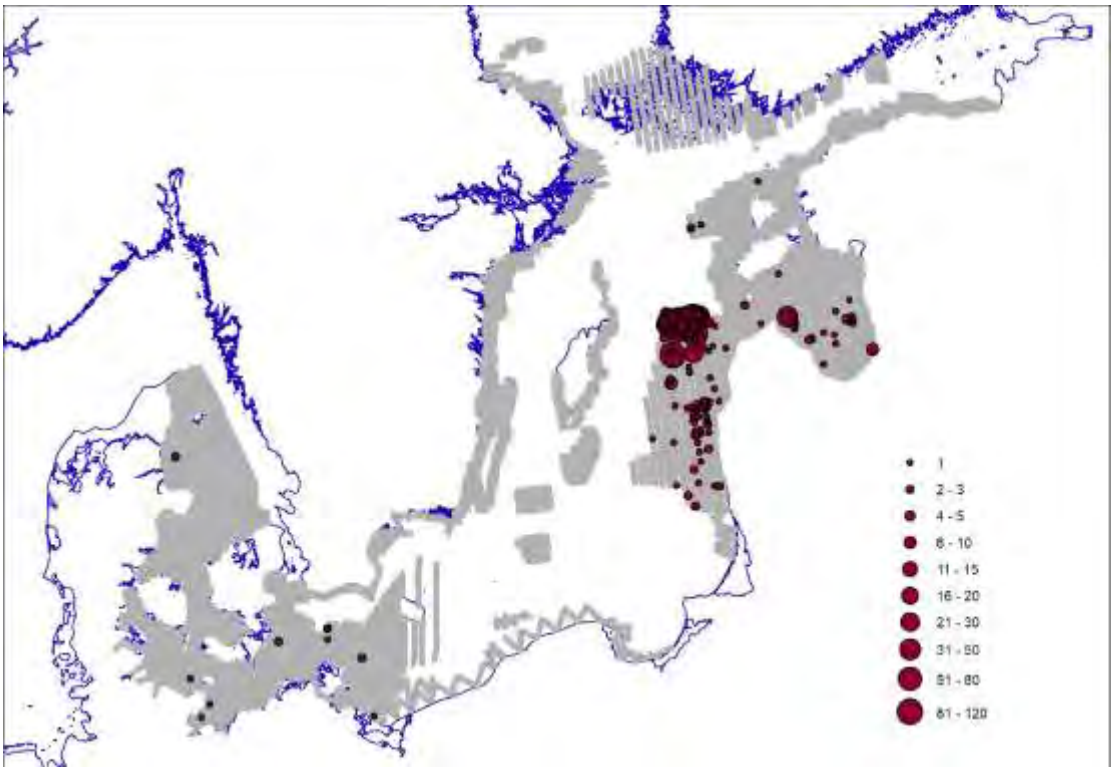

Figure 41. Distribution of the Little Gull *Hydrocoloeus minutus* in the Baltic Sea in winter 2015/16.

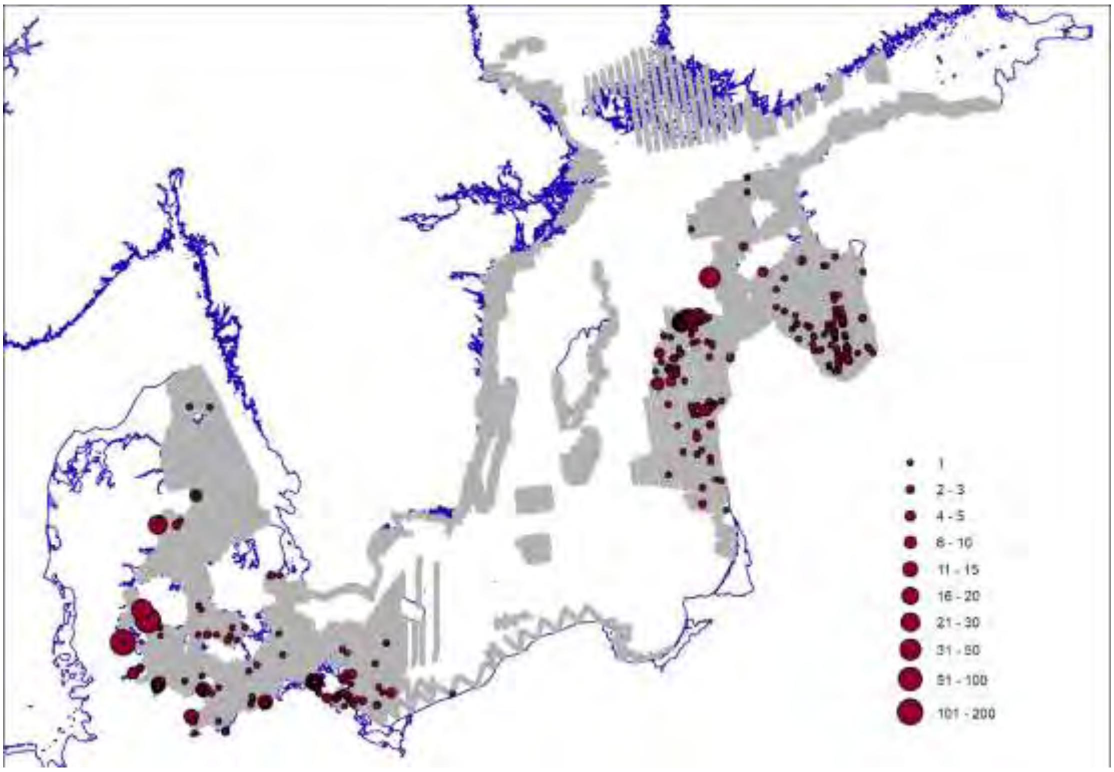

Figure 42. Distribution of the Black-headed Gull *Croicocephalus ridibundus* in the Baltic Sea in winter 2015/16.

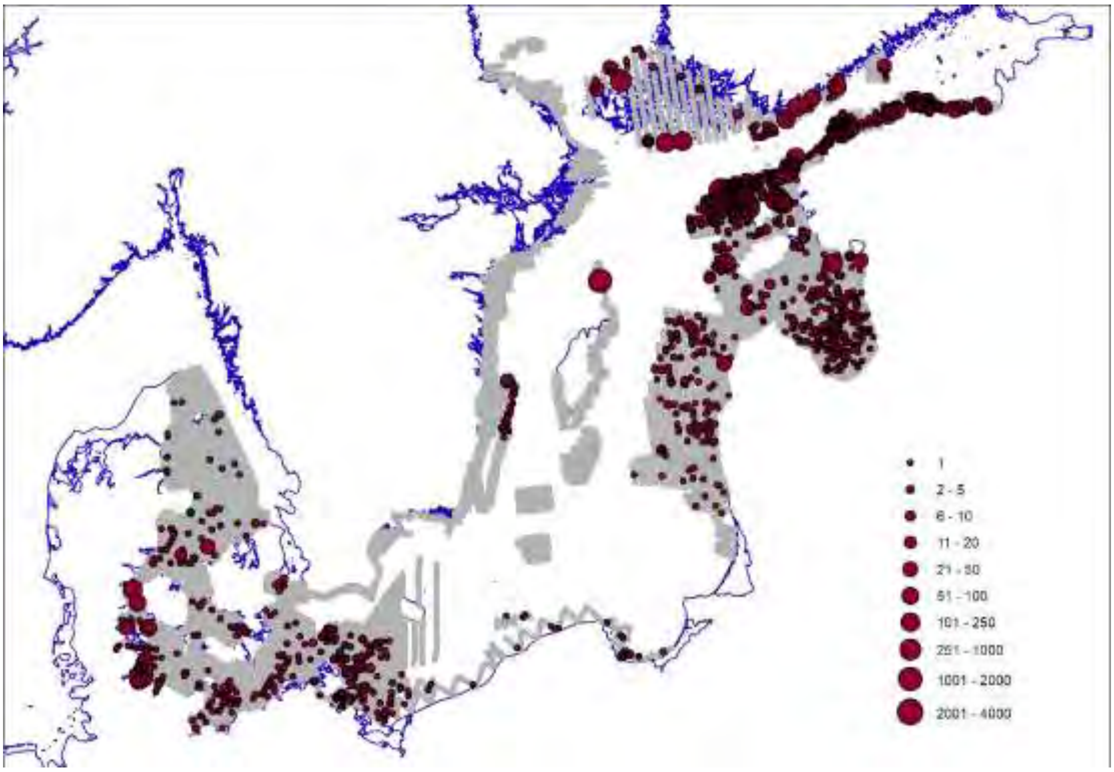

Figure 43. Distribution of the Common Gull *Larus canus* in the Baltic Sea in winter 2015/16.