ASCOBANS

AGREEMENT ON THE CONSERVATION OF SMALL CETACEANS OF THE BALTIC, NORTH EAST ATLANTIC, IRISH AND NORTH SEAS

ASCOBANS/MOP10/Doc.6.1.3b

3 June 2024

10th MEETING OF THE PARTIES
Odense, Denmark, 10-12 September 2024
Agenda Item 6.1.3

ASCOBANS CONSERVATION PLAN FOR HARBOUR PORPOISES IN THE NORTH SEA - 2024 REVISION

(Prepared by the North Sea Group)

1. The 10th Meeting of the ASOCOBANS North Sea Group (NSG10, 2022) requested the Secretariat to draft a tender for the update and revision of the *ASCOBANS Conservation Plan for Harbour Porpoises (*Phocoena phocoena L.*) in the North Sea* (or the 'North Sea Plan'). A call for Expressions of Interest was prepared in consultation with the Chair of the North Sea Group and published in June 2022. The contract was subsequently awarded to Atlantic Technological University. The consultants developed the revision in close collaboration with the North Sea Group and the Secretariat.

2. A draft was discussed at NSG11 (January 2023) and opened for online consultations in February-March 2023. A further peer review took place in July 2023. The draft revision was presented to the 28th Meeting of the ASCOBANS Advisory Committee in September 2023 (ASCOBANS/AC28/Doc.3.3) and the AC concluded that with additional text to the legend of Table 9, the document could be submitted to MOP10. The amended version is contained in Annex 1 of this document. The relevant draft Resolution is available in ASCOBANS/MOP10/Doc.6.1.3a.

Action requested:

3. The Meeting of the Parties is requested to review and adopt the 2024 Revision of the North Sea Plan contained in Annex 1.

Annex 1

ASCOBANS Conservation Plan for Harbour Porpoises (*Phocoena phocoena* L.) in the North Sea

(2024 Revision)

UNEP ASCOBANS

Table of Contents

Executive Summary

This revised Conservation Plan identifies the current pressures and threats affecting Harbour Porpoises in the Greater North Sea area, including an assessment of risk and priorities for actions. The Harbour Porpoise Greater North Sea management unit is facing ever increasing anthropogenic pressures, the most significant of which is bycatch. Also of importance are chemical pollution, noise disturbance and prey depletion. The Conservation Plan actions fall under the headings: Monitoring, Research and Mitigation, and are broken down into tasks to identify key activities that need to occur in order to achieve the action objectives. A public awareness policy for the Conservation Plan, detailing how the work and the progress will be communicated beyond ASCOBANS is also included. To be effective, the Conservation Plan must be managed such that the proposed actions are implemented effectively, which include provision of adequate funding by Parties as well as regular assessment and reporting of progress. There is a need for ASCOBANS Parties and Range States to collaborate on the actions identified in this plan, in order to achieve a strategic approach to Harbour Porpoise conservation in the Greater North Sea region.

Summary of Actions

Priority	Action	Code
Essential	Identify the priority bycatch issues and relevant stakeholders	RES-01
Essential	Improve estimates of bycatch rates to support development of conservation strategy	RES-02
Essential	Implement and assess pinger and other mitigation measures to reduce bycatch	MIT-01
High	Implement a wide-scale surveillance programme to monitor trends in distribution and abundance in the Greater North Sea	MON-01
High	Improve understanding of causes of seasonal and annual variation in abundance and distribution, particularly in relation to human activities and environmental change, to facilitate the consideration of the species within marine spatial plans	RES-03
High	Monitor health and nutritional status, diet, life history parameters, and causes of mortality	MON-02
Medium	Further our understanding on population structure	RES-04
Medium	Improve understanding of and develop mitigation for the risks of anthropogenic sound	MIT-02
Medium	Ensure screening and assessment of the occurrence and effects of hazardous substances	MON-03
Low	Monitor for potential increases in anthropogenic activities that lead to incidences of death, injury or adverse health effects	MON-04
Low	Monitor habitat quality, including protected sites, to ensure management is effective and that the ecological functions are maintained.	MON-05

1. Introduction

1.1. Necessity for a Conservation Plan

Harbour Porpoises (*Phocoena phocoena*, Linnaeus 1758) are widely distributed in shelf waters of the temperate North Atlantic and of the North Pacific Oceans and in some semi-enclosed seas, such as the Black and Baltic Seas. The Greater North Sea is an important habitat for Harbour Porpoises in the North-east Atlantic, a region where a large percentage of the North-east Atlantic population inhabits. Harbour Porpoises are exposed to a number of anthropogenic pressures, of which bycatch in commercial fisheries is considered the greatest threat. The mobile nature of both the species and the key threats across international borders means that an internationally agreed conservation plan provides the most effective way to achieve the conversation objectives for the population.

Following the 2019 Habitats Directive reporting round, the species is considered to have a 'Favourable' conservation status for the European Marine Atlantic region - improved from 'Unfavourable Inadequate' in the 2007 reporting round. Though for those countries neighbouring the North Sea, 2019 assessments ranged from 'Unfavourable-Inadequate' to 'Favourable'. In 2004, OSPAR listed the Harbour Porpoise as a threatened and declining species, with a focus on tackling bycatch. Support by both ASCOBANS and OSPAR will be key for conserving Harbour Porpoises, and will require co-operation by many stakeholders, ranging from local and national governments, through intergovernmental bodies to industry and NGOs.

ASCOBANS 'Conservation Plan for Harbour Porpoises (*Phocoena phocoena* L.) in the North Sea' was adopted in 2009. A full update and revision of the plan was required given the time-period since, which included a full revision of actions and re-designing the plan, following the structure of the more recent ASCOBANS conservation plans. This Conservation Plan follows the International Whaling Commission (IWC) conservation management plan template, also adopted by ASCOBANS. This should be considered a dynamic document, and changes will be undertaken periodically through an expert review process to enable the development of new or modified actions as appropriate.

1.2. Overall objective of the Conservation Plan

A conservation plan must have measurable objectives by which its success or failure can be evaluated regularly, and to ensure that required changes are identified and actioned promptly. Failure to monitor progress will result in inaction and subsequent failure of the Conservation Plan. Integral and essential to the plan are, therefore, monitoring of:

- regional and overall trends in the North Sea Harbour Porpoise management unit;
- human activities identified to pose potential risk to the species;
- implementation of mitigation measures; and
- the assessment of effectiveness of those measures.

ASCOBANS conservation objective aims to '*restore and/or maintain biological or management stocks of small cetaceans at the level they would reach when there is the lowest possible anthropogenic influence*' with a '*practical sub-objective to restore and/or maintain stocks/populations to 80% or more of the carrying capacity*' (ASCOBANS, 1997). To work towards achieving this goal, the Conservation Plan identifies the key pressures and threats facing the management unit, gaps in evidence and information, and proposes actions necessary to achieve the goal of maintaining the management unit and population at a favourable conservation status. These actions include coordination of monitoring programmes on direct and indirect pressures, including bycatch, marine pollution and anthropogenic noise, to allow a full assessment of the effects on the management unit. The actions in this Conservation Plan also complement and support wider measures for small cetaceans in the North-east Atlantic.

1.3. Development of the Conservation Plan

The revised Conservation Plan will be coordinated under a hierarchical structure clearly outlining roles and responsibilities (Figure 1), designed to ensure effective implementation. A Steering Group (SG) has been formed to drive implementation of the plan. Co-operation and complementarity with the work of other ASCOBANS working groups will be sought. Of particular relevance are the ASCOBANS/ACCOBAMS Joint Bycatch Working Group, ASCOBANS Pollution Working Group, ASCOBANS Working Group on Resource Depletion, the Joint ACCOBAMS/ASCOBANS Working Group on the Marine Strategy Framework and the ACCOBAMS/ASCOBANS Joint Noise Working Group.

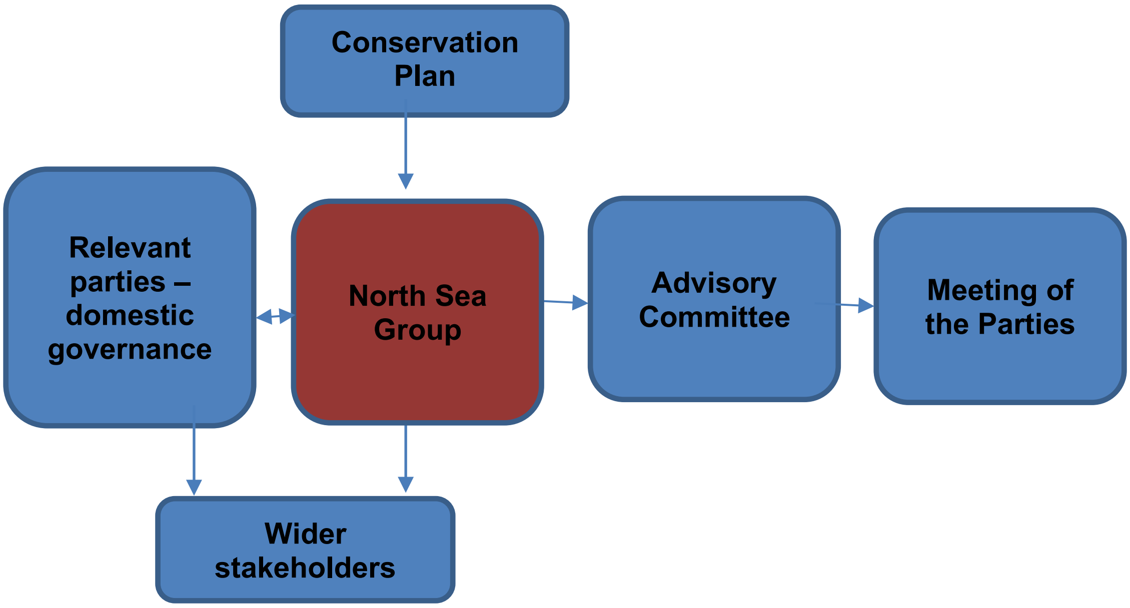

Figure 1: Conservation Plan communication structure.

1.4. Coordination and Governance of the Conservation Plan

The coordinator and SG will ensure cooperation between all stakeholders including national governments in the North-east Atlantic, European Commission, intergovernmental organisations including fisheries management authorities, ICES and OSPAR, Advisory Councils and other relevant bodies, such as NGOs, universities and institutes, and appropriate industry representatives. Their role specifically is to encourage countries to harmonise their national efforts, including allocation of funding.

To ensure efficiency and to drive the plan forward, the following tasks have been identified:

1. The SG has appointed a coordinator (or chair) to oversee implementation of the plan. The SG and coordinator will together:
    - develop and maintain the revised Terms of Reference for the SG to ensure that the actions are implemented;
    - coordinate and drive the implementation of the Conservation Plan (including assessing funding options where appropriate) and promote the Conservation Plan to relevant stakeholders;
    - collate reports on the progress of implementation, effectiveness and issues encountered and report annually to the Advisory Committee on the progress of the Conservation Plan, establish further implementation priorities and make appropriate recommendations;
    - encourage cooperation between ASCOBANS and Range States.
2. ASCOBANS Parties and Range States will report annually on implementation of the Conservation Plan.
3. The coordinator/SG will evaluate the Conservation Plan every six years and amend the Conservation Plan document where required as agreed by the Advisory Committee.

2. Legal framework

The 5th International Conference for the Protection of the North Sea (Bergen, Norway, 20-21 March 2002) called for a recovery plan for Harbour Porpoises in the North Sea to be developed and adopted (Paragraph 30, Bergen Declaration). This was subsequently taken forward by ASCOBANS with the publication of the Conservation Plan for Harbour Porpoises (*Phocoena phocoena* L.) in the North Sea (ASCOBANS 2009). Given the time period that has elapsed since, a full re-drafting of the plan was required, re-defining actions based on best available scientific evidence, or a lack thereof.

There is a broad list of drivers behind Harbour Porpoise conservation which aim to address all aspects of anthropogenic impact on the species, either specifically for Harbour Porpoise, or as part of a wider strategy for cetaceans or marine mammals. A summary of the legal framework relevant to Harbour Porpoise including conventions and agreements can be found in Annex 1. On 31 January 2021, the UK left the European Union whilst remaining a Party to ASCOBANS and OSPAR. Annex 2 contains the relevant national legislation for the UK pertaining to cetacean conservation. As a range state to the ASCOBANS area, a summary of Norway's national legislation has also been included in Annex 2.

3. Biology and status of Harbour Porpoise

3.1. Summary of biology and ecology

Within North-east Atlantic waters, one Harbour Porpoise population occurs ranging from French waters in the southern Bay of Biscay to Arctic waters of Norway and Iceland, and including the North Sea (Fontaine et al. 2007, Fontaine et al. 2010, Fontaine et al. 2014, Evans 2020). Although 'continuous' in distribution, significant isolation by distance was detected within the population, which was more apparent in the southern extent of their range (Fontaine et al., 2007). Separate (sub-) populations have been recognised in the Belt Sea and Baltic Proper (Wiemann et al. 2010, Galatius et al. 2012, Sveegaard et al. 2015, Lah et al. 2016), whereas a separate sub-species *Phocoena phocoena meridionalis*, of a larger-sized morphotype (Donovan and Bjorge, 1995), has been proposed to occur in Iberian and Mauritanian waters (Jung et al. 2009, Fontaine et al. 2014, Fontaine et al. 2017). On the basis of phenotypic and genetic divergence identified (e.g. Tolley et al., 1999; Andersen et al., 2001) an ASCOBANS-HELCOM Small Cetacean Population Structure Workshop held in 2007 suggested separation of the North Sea into two units, north-eastern North Sea and south-western North Sea[1]. However, it was recognized that further work was required to clearly differentiate any population structure. Whilst some work has been undertaken (e.g. De Luna et al., 2012), it is not yet possible to delineate population structure within the North Sea region.

ICES WGMME considered a range of parameters for defining management units /assessment units for Harbour Porpoises in the North-east Atlantic, including population structure as well as measurements of time-integrated ecological tracers and morphological differences, ICES areas/divisions boundaries, and the spatial extent of human activities (ICES WGMME 2013, 2014, IAMMWG 2015, OSPAR 2017, Murphy et al. 2020, Chehida et al. 2021). In 2018, the Joint IMR/NAMMCO Workshop undertook a comprehensive review of the status of Harbour Porpoises in the entire Atlantic Ocean that further considered information on structure, the results of which slightly re-defined some boundaries to ICES management units/ assessment units in the North-east Atlantic (IMR-NAMMCO 2019, see Figure 2a). The revised harbour porpoise units where then further reviewed and adopted by OSPAR for reporting on their marine mammal biodiversity indicators under OSPAR' 2023 Quality Status Report (Figure 2b; Geelhoed et al. 2022). For the current Conservation Plan, these boundaries will be employed for the Greater North Sea Harbour Porpoise management unit, and is defined as ICES divisions IVa, b, c, VIId and the northern part of IIIa.

[1] https://www.ascobans.org/en/document/report-ascobanshelcom-small-cetacean-population-structure-workshop-0

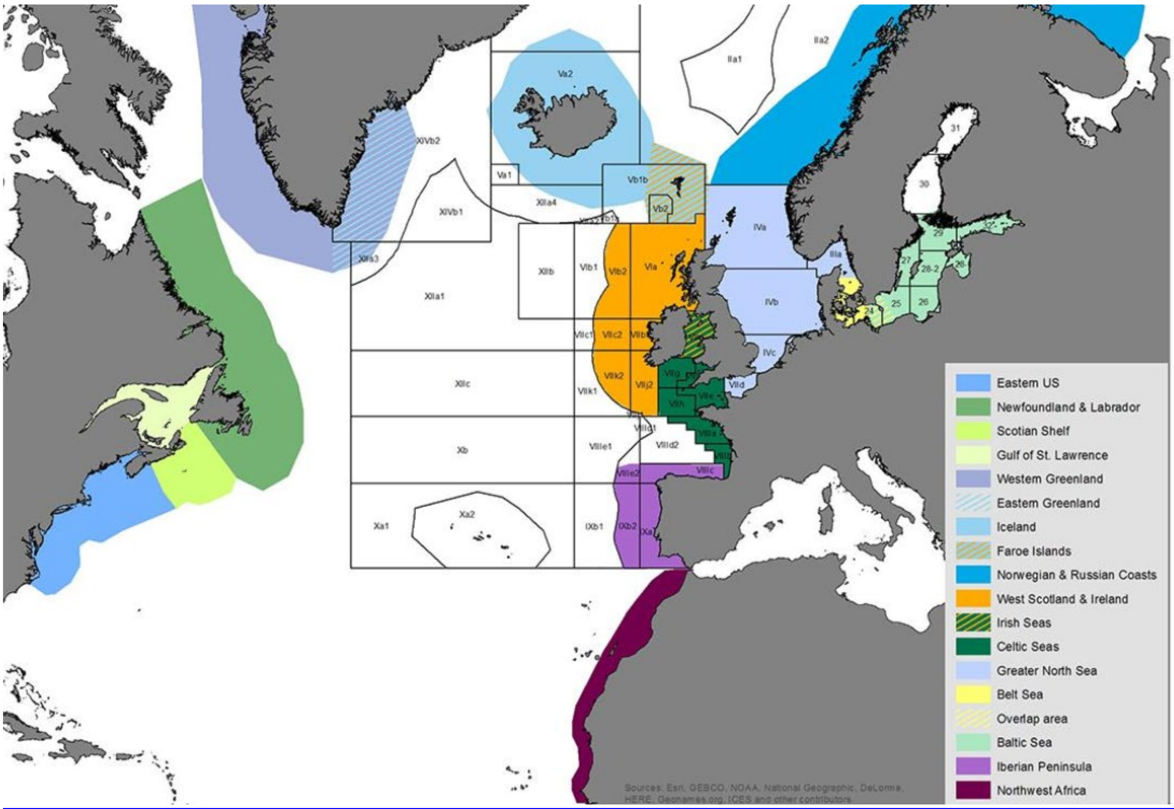

Figure 2a: Map of the assessment areas for Harbour Porpoise in the North Atlantic proposed by IMR/NAMMCO. Taken from IMR/NAMMCO (2019).

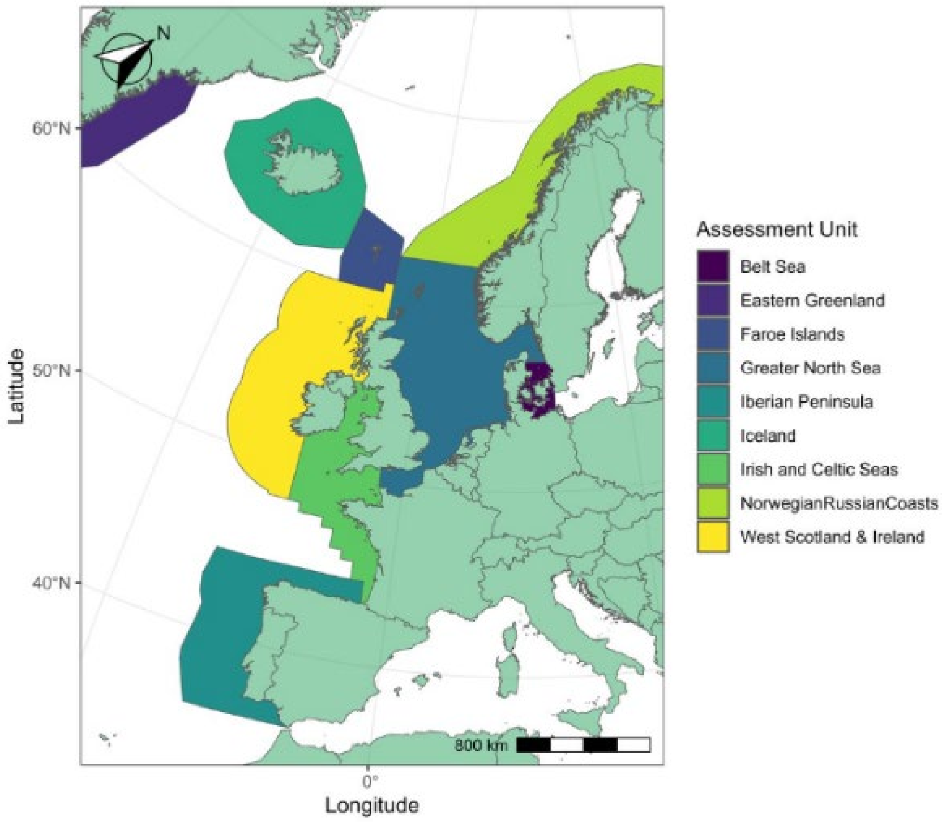

Figure 2b: Map of the assessment areas for Harbour Porpoise adopted by OSPAR for the European North Atlantic. Taken from Geelhoed et al. (2022).

The Harbour Porpoise is one of the smallest toothed whales (typically less than 1.6 m in size in the Greater North Sea) that inhabits coastal and continental shelf waters, including those of the ASCOBANS agreement area (Evans 2020). The lifespan of Harbour Porpoises varies between populations and geographic areas, although not significantly between sexes. They live for notably less time than most other marine mammal species, with an average lifespan of 8-13 years (Lockyer 2003) – though a maximum age of 24 years was previously reported for UK waters (Lockyer 1995). This shorter lifespan increases the sensitivity of the Harbour Porpoise population growth rate to fluctuations in other factors such as juvenile mortality or reproductive rates.

The Joint IMR/NAMMCO International Workshop on the Status of Harbour Porpoises in the North Atlantic undertook a full status review of Harbour Porpoises in the Greater North Sea in 2019 (Murphy et al. 2019). A summary of such is presented herein, along with more recent work, focusing on elements of their biology and ecology. While a number of historical and contemporary life history studies have been undertaken within the region, assessments at the scale of the management unit are lacking. A basin-wide assessment would substantially increase the statistical power of such studies, through increasing sample sizes of all age-sex groups.

Murphy et al. (2020) assessed demographic characteristics and determined key biological parameters in stranded and bycaught male and female Harbour Porpoises within UK waters, including undertaking an assessment of temporal variation in those parameters (Table 1). Harbour Porpoises inhabiting waters of the Greater North Sea management unit were significantly smaller in body size, both at attainment of sexual and physical maturity compared to porpoises within the Celtic and Irish Seas management unit (see Figure 2) (Murphy et al. 2020). The Celtic and Irish Seas management unit is viewed as a mixing or transition zone between the North-east Atlantic population and the larger morphotype Iberian sub-species (Murphy et al. 2019).

Table 1. Asymptotic length and age estimated using the Gompertz growth model, Length at 50% maturity (L50), and Age at 50% maturity (A50) for female and male harbour porpoises in the North Sea Management Unit (MU) and Celtic and Irish Seas MU sampled in UK waters for two time periods, 1990–1999 and 2000–2012. Adapted from Murphy et al. (2020).

MU	Sex	Time period	Asymptotic length (cm)	Asymptotic age (yrs)	L50 (cm)	A50 (yrs)
North Sea	Females	1990–1999	155.4	7.2	138.9	3.8
		2000–2012		11.7	139.2	4.8
	Males	1990–1999	140.9	5.7	133.3	3.6
		2000–2012		7.6	129.5	3.6
Celtic & Irish Seas	Females	1990–1999	162.9	7.2	146.6	3.8
		2000–2012		11.7	146.9	4.8
	Males	1990–1999	146.5	5.7	138.7	3.6
		2000–2012		7.6	133.5	3.6

Female and male Harbour Porpoises in the UK Greater North Sea were reported to attain physical maturity at 155.4 cm, and 140.9 cm, respectively (Murphy et al. 2020). An increase in the age at asymptotic length was observed in both sexes over the last few decades, along with a significant decline in the Gompertz growth rate parameter that was more apparent in the female data (Murphy et al. 2020). Females also significantly increased in their average age at attainment of sexual maturity (A50), while this parameter remained relatively stable for males (Table 1). Male Harbour Porpoises however, significantly declined in the average length attained at sexual maturity (L50), while no significant difference was observed for females. It was suggested that availability of suitable prey resources could possibly be a limiting factor and an explanation for the observed results, though a combination of other factors was not ruled out (Murphy et al. 2020). For Harbour Porpoises inhabiting the German North Sea, Kesselring et al. (2017) also reported that females attained sexual maturity at an older age (of 4.95 years) and were also dying, on average, at an older age than Baltic porpoises (5.70 (± 0.27) years vs 3.67 (± 0.30) years, respectively). It was estimated that only 54.66% of females in German North Sea would participate in reproduction (Kesselring et al. 2017).

Looking at contemporary reproductive rates for the Greater North Sea, Murphy et al. (2020) reported a reduced reproductive rate (29% pregnancy rate) in porpoises inhabiting UK waters, though the sample was heavily biased towards stranded animals that died of infectious disease, or other causes such as starvation. Earlier work using all available UK data estimated a pregnancy rate of 50% for a control group of 'healthy' females – females that died of traumatic causes of death such as bycatch, boat/ship strike, bottlenose dolphin attacks or dystocia - a pregnancy rate almost half that reported for other geographical regions (Murphy et al. 2015). Further, a noted increased incidence of reproductive pathologies, including reproductive failure, potentially associated with exposure to endocrine disrupting chemicals was observed (Murphy et al. 2015). Notably, all foetal death and abortion cases occurred during a females' second and third trimesters (12.6% of matures), with 86% of these mature females dying from infectious diseases and "other" causes of death, such as starvation or neoplasia (Murphy et al. 2015). While a recent study on Harbour Porpoises in Dutch waters using samples obtained between 2006 and 2019 reported that maternal nutritional status had a significant effect on foetal size, and females in poor health had a lower probability of being pregnant and were less likely to carry a foetus to term (IJsseldijk et al. 2021). Within the study, a pregnancy rate of 28% (51 of 180 mature females) was determined for the whole sample and a higher pregnancy rate of 58% (22 of 38 mature females) was determined for 'healthy' females, while the average age at attainment of sexual maturity was estimated as 4 years for females (IJsseldijk et al. 2021b).

Harbour Porpoises are opportunistic piscivore predators, with diet varying significantly according to prey availability (Murphy et al. 2019, Lambert 2020). A huge variety of prey taxa have been recorded from the stomachs of stranded Harbour Porpoise in the Greater North Sea. However, the diet of individuals tends to be dominated by 2-4 species at any one time (Pierce et al. 2007). The most commonly identified key prey groups are gadoids (mostly whiting), gobies, sandeels and cluepids (both herring and sprat) (Lambert 2020, Pierce et al. 2022). Table 2 includes a summary of studies assessing the diet of porpoises in the Greater North Sea.

Though the species is noted to be a generalist, it may be vulnerable to the depletion of key prey species, impacting survival and reproduction (MacLeod et al. 2007, Leopold 2015, Pierce et al. 2022), as their high metabolic rate (large surface body to volume ratio) requires efficient foraging including ultra-high capture rates of high energy density prey (Wisniewska et al. 2016, Wisniewska et al. 2018). Changing prey dynamics may have been responsible for the re-distribution of porpoises within the Greater North Sea since the 1990s, with the decline in sandeels (*Ammodytes marinus*) in the northern North Sea, and the re-invasion of the southern North Sea by sardine (*Sardina pilchardus*) (Mahfouz et al. 2017). Though, consumption of leaner gadoids and gobies were also reported in the stomachs of porpoises inhabiting the southern North Sea in animals that were in poorer body condition, associated with emaciation/starvation (Leopold 2015). Potential impacts from resource depletion are discussed in Annex 3.

Analysis of stranding records for the North Sea between 1990 and 2017 revealed that (along with increasing sightings in the region), incidences of strandings have also increased, with a sharp rise observed within the southern North Sea since 2005, and a higher density of neonatal strandings in the eastern North Sea (IJsseldijk et al. 2020) (see Figure 3). Incidences of unusual mortality events have also been reported in Danish (Wright et al. 2013), and Dutch waters (IJsseldijk et al. 2020, IJsseldijk et al. 2021a). Previously, Harbour Porpoises in the German North Sea were assessed to be in a poor general health status, with a higher incidence of severe pathological lesions, especially of the respiratory tract (with pneumonia considered the most common cause of death), compared to Harbour Porpoises inhabiting more northern waters, which may have been due to exposure to chemical pollutants (Siebert et al. 2006, Siebert et al. 2009) (see Annex 3). While infectious disease may be the leading cause of death in the region, fisheries interactions was the leading direct anthropogenic cause of death in porpoises stranded along Dutch and UK coastlines, with a lower number of cases of trauma due to vessel strikes being reported in recent years (Deaville and Jepson 2011, Deaville 2016, 2018, IJsseldijk et al. 2022). Incidences of trauma resulting from inter-species interactions have been reported at a higher occurrence than previously, notably from bottlenose dolphins (Deaville and Jepson 2011, Deaville 2018), as well as grey seals in more recent times (Leopold et al. 2015, IJsseldijk et al. 2022). In the light of work demonstrating acoustic trauma in porpoises due to explosions in the Baltic Sea (Siebert et al. 2022), the North Sea Group has expressed concern over similar activities occurring in the North Sea, as surviving animals might have impaired hearing which, among other things, could affect their ability to detect nets and find prey. Cases of starvation/emaciation have been increasing of late, among necropsied porpoises in (all) UK waters (Deaville 2018) and was also a leading cause of death among porpoises that died during an unusual mortality event in Dutch waters in 2011 (IJsseldijk et al. 2022).

Table 2. Harbour Porpoise diet inferred from stomach content analysis in the southern North Sea and adjacent areas (n = number of stomachs).

Area (year of stranding)	n	Main prey	Reference
Southern North Sea (2010−2013)	14	Gobies, whiting, sandeel	Mahfouz et al. 2017
Germany	34	Sandeels, sole	Benke and Siebert 1996
Germany	36	Sole, cod	Lick 1991
Belgian coast (1997−2011)	64	Gobies, sandeels, whiting, *Trisopterus* sp.	Haelters et al. 2012
Belgium coast (1997-2018)	180	Whiting, gobies, sandeels, herring and sprat	Lambert 2020
Dutch coast (2006)	64	Gobies, sandeels, sprat, herring, whiting, twait, shad	Leopold and Camphuysen 2006
Dutch coast (2003-2010)	229	Whiting, gobies, sandeels, sprat, herring, cod	Leopold et al. 2011
Dutch coast (2003-2010)	76	Whiting, gobies, lesser sandeels, sprat, herring, cod	Jansen 2013
Dutch coast (2003-2014)	600	Adults: gadoids, clupeids and sandeels Juveniles: Gobies	Schelling et al. 2014
Dutch coast (2006-2014)	824	Gadids, gobies, sandeels, clupeids	Leopold 2015
English Channel (1998−2003)	7	Pouting, gobies	De Pierrepont et al. 2005
East Scotland (1959−1971)	93	Herring, sprat, whiting	Rae 1965, Rae 1973
Scotland (1992-1996)	72	Whiting, sandeels, herring	Santos 1998
Scotland (1992−2003)	188	Whiting, sandeels, gadids, *Trisopterus* sp.	Santos et al. 2004
UK (1989−1994)	100	Gadids, sandeels, gobies	Martin 1996
Denmark, Sweden, Norway	197	Herring, gadids	Aarefjord et al. 1995

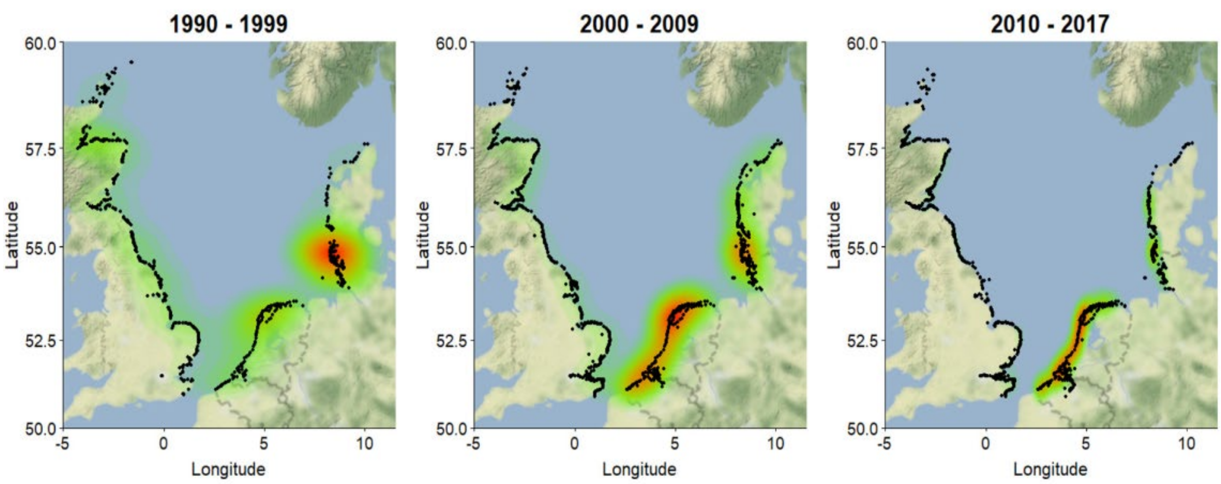

Figure 3. Study area showing the density of all recorded Harbour Porpoise strandings over three time periods. Taken from IJsseldijk et al. (2020).

3.2. Abundance and distribution

Abundance and occurrence of Harbour Porpoises have fluctuated over the last 100 years within the North-east Atlantic. A decline in both strandings and observations occurred in the southern North Sea, English Channel and off the French Atlantic coasts from the 1950s onwards (Smeenk 1987, Evans 1992, Addink and Smeenk 1999, Camphuysen 2004, Evans et al. 2008, Jung et al. 2009). Within the last two decades, porpoises started to return again to these waters, which included a re-distribution of animals from the northern to the southern North Sea, as well as the re-population of central English Channel and waters off the French Atlantic coast (Camphuysen 2004, Hammond et al. 2013, Hammond et al. 2017, Laran et al. 2017, Geelhoed et al. 2022).

Abundance estimates and trends are a key parameter in any population assessment and reliable estimates are required for sound scientific management of stocks. Methods have been developed for surveys targeting small cetaceans (e.g. Small Cetacean Abundance in the North Sea and adjacent waters (SCANS)) that have resulted in robust estimates of Harbour Porpoise abundance (Hammond et al. 2013). To date, four SCANS surveys have been undertaken that include the North Sea (1995, 2005, 2016 and 2022; Figure 4).

For reporting under the OSPAR's 2023 Quality Status Report, the Marine Mammal Expert group set thresholds for indicator M4 'Abundance and distribution of Cetaceans), based on generation criterion from the International Union for the Conservation of Nature. Both absolute and yearly thresholds were defined, where 'in each AU, the (localized) population size of each species will be maintained at or above baseline levels (the first abundance estimate available or the closest to the date of the Habitats Directive (Council Directive 92 / 43 / EEC)), with (i) no absolute decrease of more than 30% and (ii) a rate of decrease no greater than 30% over three generations'[2]. Results of the assessment which employed data from the first three SCANS surveys noted that while the design-based abundance estimates showed a slight increase between 1994 and 2016 (Table 3, Figure 5), the trend was not significant using the robust method for estimating trend on short time-series. As the estimated yearly change of 0.00% (p-value = 0.93) was larger than the annual threshold of -1.6%, the threshold was achieved (Geelhoed et al. 2022). Following SCANS IV, Gilles et al (2023) also concluded that the population was stable, estimating that there was sufficient power (80%) to detected declines of 0.88%.

Table 3. Abundance estimates of harbour porpoises in the Greater North Sea AU. Taken from Geelhoed et al. 2022 and Gilles et al. (2022).

Assessment Unit	Year	Survey	Platform	Abundance	CV*
Greater North Sea	1994	SCANS	Ship	289,200	0.14
Greater North Sea	2005	SCANS-II	Ship & plane	355,400	0.22
Greater North Sea	2016	SCANS-III	Ship & plane	345,400	0.18
Greater North Sea	2022	SCANS IV	plane	338,918	0.17

** Approximate confidence interval obtained from quantile of a lognormal distribution. Abundance estimates are rounded to the nearest hundred.*

While the abundance within the Greater North Sea has not change between the SCANS surveys, the distribution of Harbour Porpoises is not static in space or time. For instance, in records from 1979-1997, sighting rates in the southeastern North Sea, the southern Bight and the northern English Channel were substantially lower than in areas further north (Evans et al. 2003, Reid et al. 2003). Thereafter, surveys reported higher sighting (Brasseur et al. 2004, Scheidat et al. 2004) and strandings rates (Haelters et al. 2002, Jauniaux et al. 2002, Camphuysen 2004, Kiszka et al. 2004) in the southern North Sea and southern Bight. This increase in both sighting and stranding rates in these southern parts of the North Sea over a relatively short period of time suggested a redistribution of animals from other areas rather than a sudden and rapid increase in population growth in the southern North Sea. This redistribution appears to have been maintained in subsequent SCANS surveys (2016 and 2022), and has been attributed to changes in prey distribution or abundance (Hammond et al. 2013).

[2] https://oap.ospar.org/en/ospar-assessments/quality-status-reports/qsr-2023/indicator-assessments/abundance-distribution-cetaceans/

The most robust modelling of the distribution of Harbour Porpoise published for the North Sea is by Gilles et al. (2016), who generated modelled distributions for the period 2005-2016 for spring, summer and autumn, a period after the main re-distribution of the species within the Greater North Sea (Figures 6-8). The predicted distributions for all three seasons show higher density in the western North Sea off the coast of the UK and lower densities in the eastern North Sea closer to Denmark and Germany. In summer, the predicted higher density area appears to extend slightly further south in summer than in autumn and spring (Gilles et al. 2016). More recently Geelhoed et al. (2022) provided a comparison of the distribution of Harbour Porpoise in July the North Sea between 2005-2009 and 2010-2020 (Figure 9).

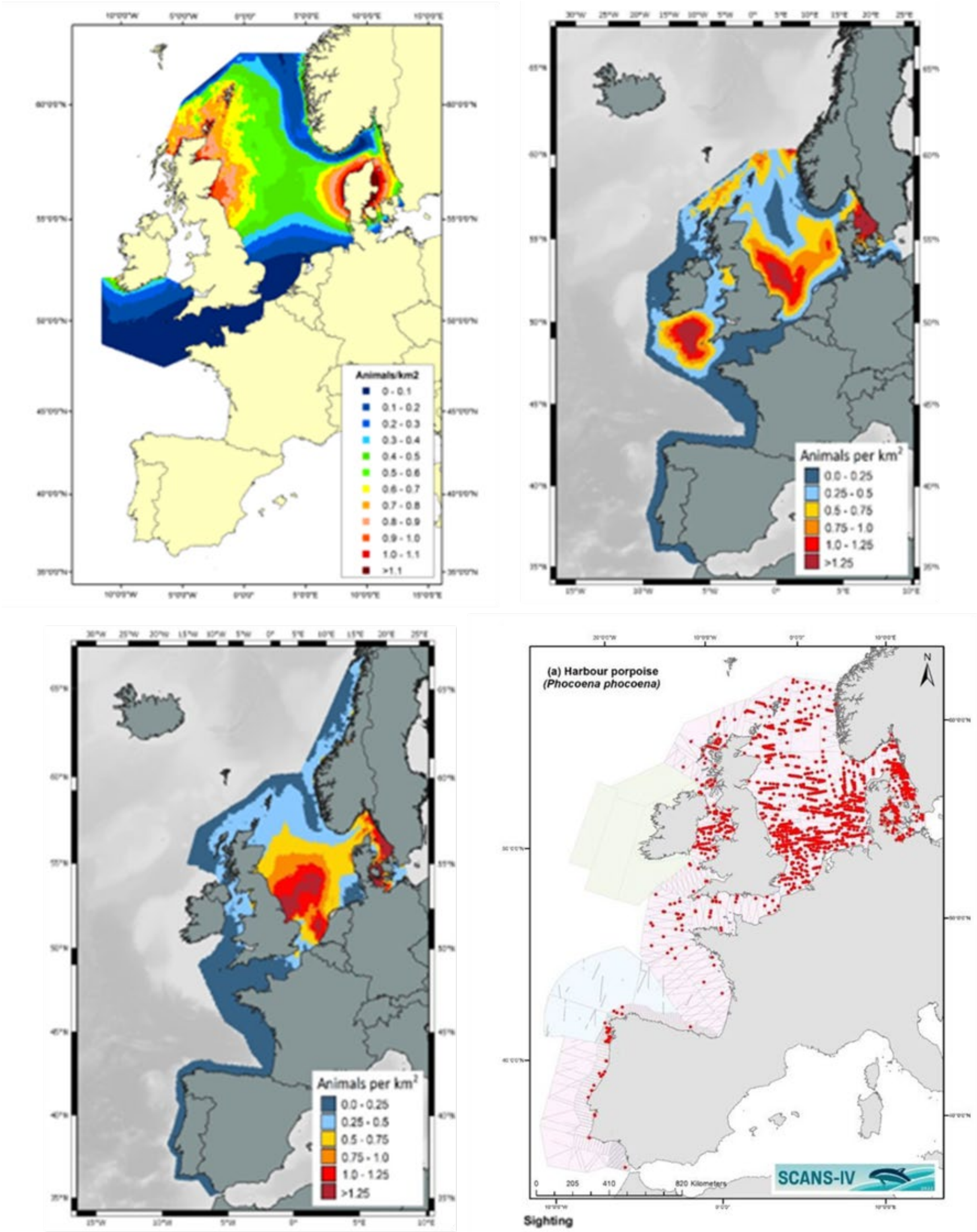

Figure 4: Density surface maps from the SCANS surveys 1994 (top left), 2005 (top right), and 2016 (bottom left), and sightings from 2022 (bottom right) (adapted from Hammond et al. 2013, Lacey et al. 2022 and Gilles et al. 2023).

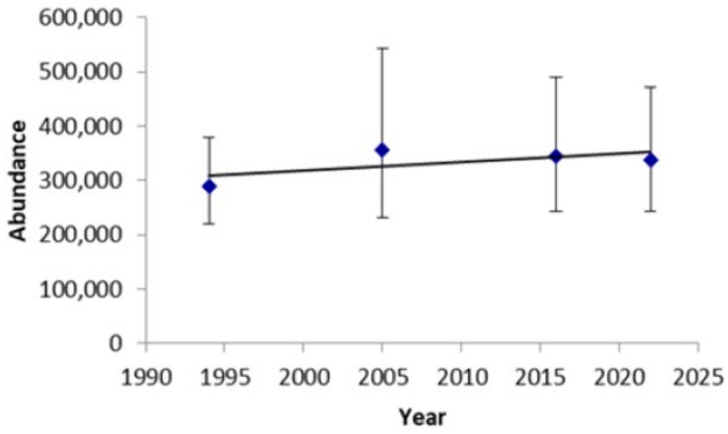

Figure 5: Trend in Harbour Porpoise abundance for the North Sea in 1994, 2005, 2016 and 2022. Estimated rate of annual change is 0.88% with 80% power to detect a decline. Taken from Gilles et al. (2023).

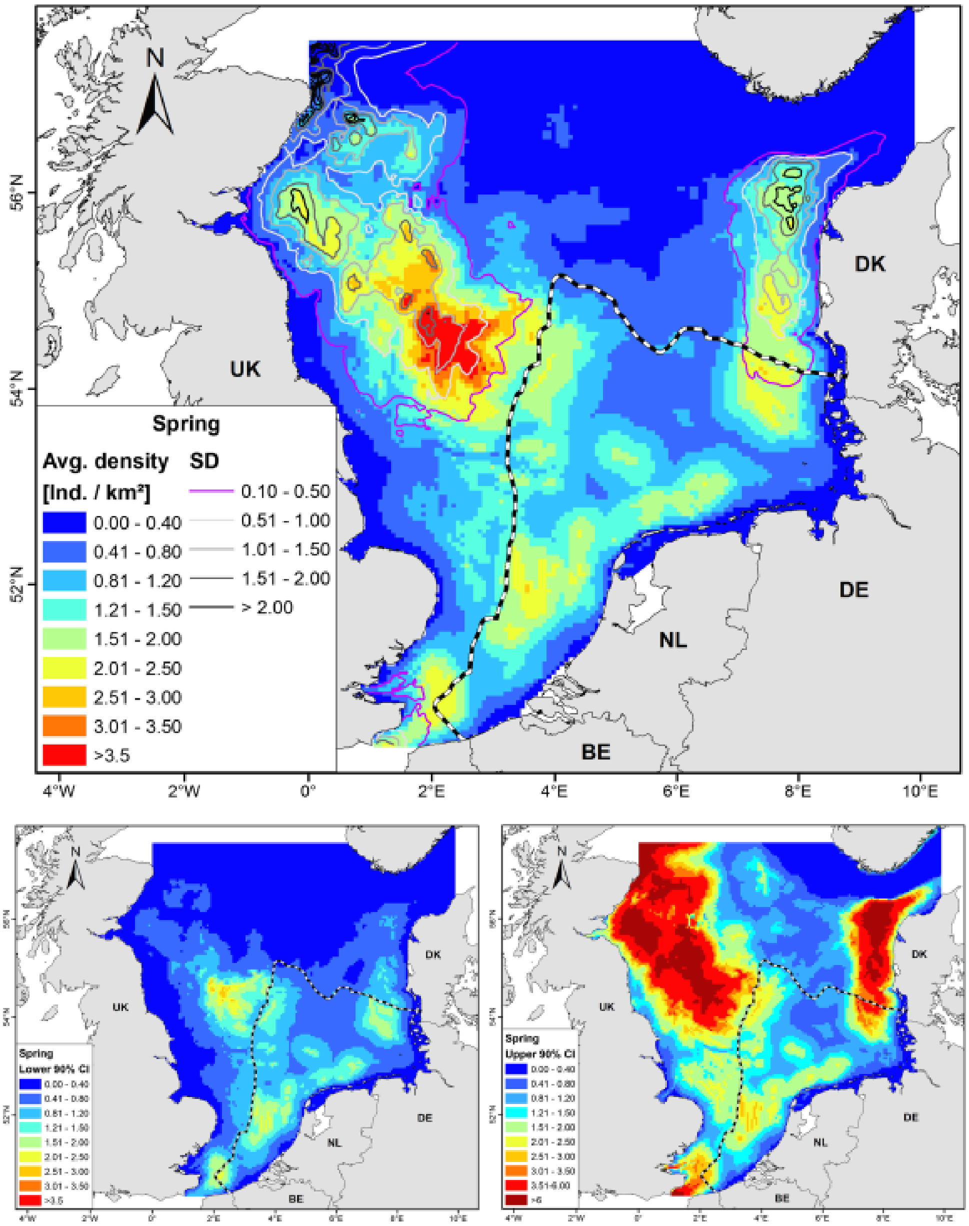

Figure 6: Predicted Harbour Porpoise densities in the North Sea in spring (March-May) 2005-2013. Upper panel: The overlaid contours are associated jackknife standard deviations (SD). The black and white dashed boundary depicts the sampling coverage in spring. Lower panel: Lower and upper lognormal 90% confidence intervals of predicted density. From Gilles et al. (2016).

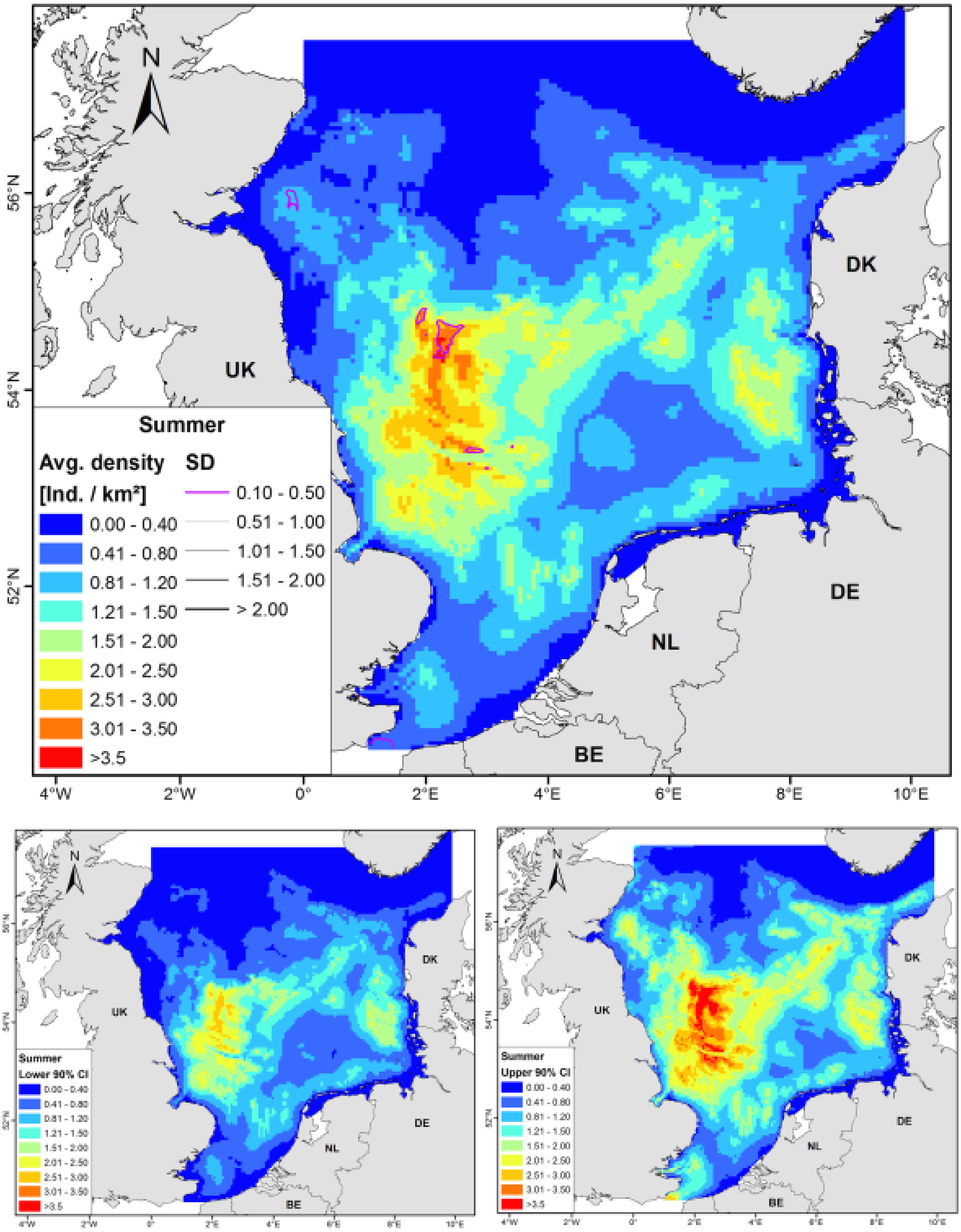

Figure 7: Predicted Harbour Porpoise densities in the North Sea in summer (June-August) 2005-2013. Upper panel: The overlaid contours are associated jackknife standard deviations (SD). Lower panel: Lower and upper lognormal 90% confidence intervals of predicted density. From Gilles et al. (2016).

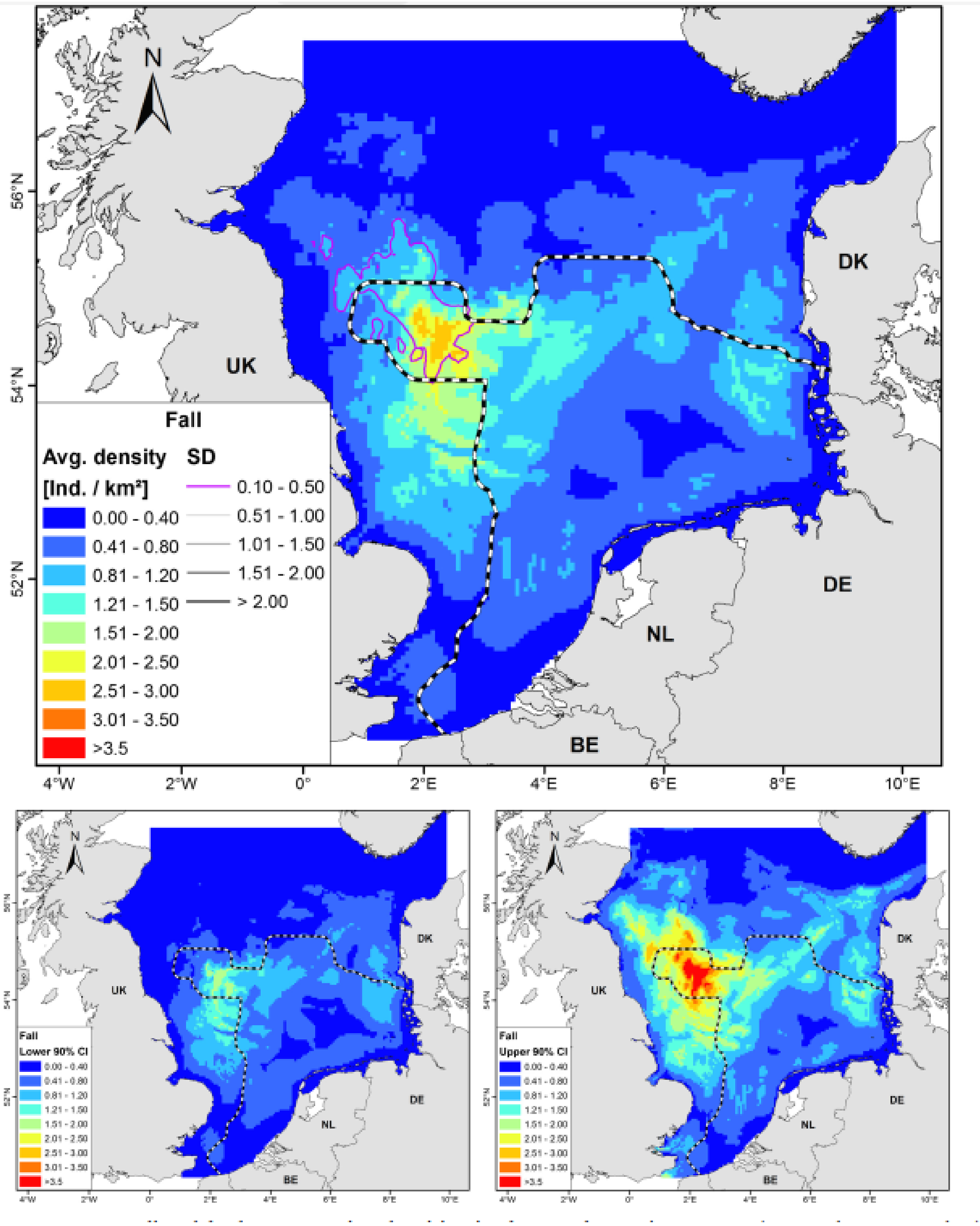

Figure 8: Predicted Harbour Porpoise densities in the North Sea in autumn (September-November) 2005-2013. Upper panel: The overlaid contours are associated jackknife standard deviations (SD). The black and white dashed boundary depicts the sampling coverage in spring. Lower panel: Lower and upper lognormal 90% confidence intervals of predicted density. Taken from Gilles et al. (2016).

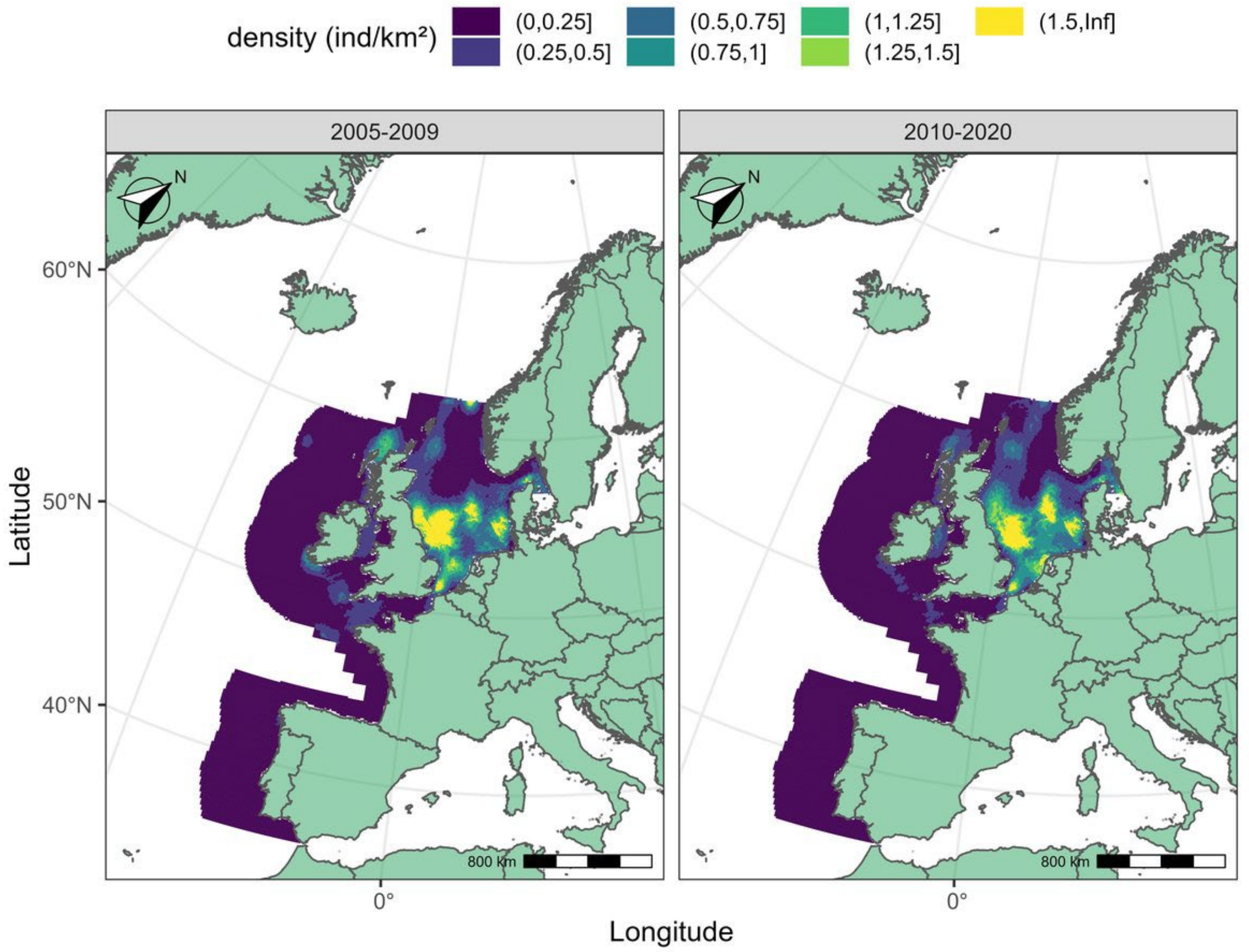

Figure 9. Average map of predicted distribution of Harbour Porpoise in July between 2005 and 2020. Taken from Geelhoed et al. (2022).

4. Pressures

4.1. Summary of pressures

As Harbour Porpoise occurs throughout the European continental shelf waters, the species can be affected by a range of human activities occurring in the same waters (IAMMWG 2015, ICES WGMME 2015, IMR-NAMMCO 2019, WGMME 2019). A detailed summary of information on pressures including evidence gaps, can be found in Annex 3.

The single most significant anthropogenic threat to Harbour Porpoises is bycatch in bottom-set static nets (Read et al. 2006, Bjørge et al. 2013, Scheidat et al. 2013, ICES Advice 2014, Nabe-Nielsen et al. 2014, van Beest et al. 2017, FAO 2018, Northridge 2018, STECF 2019, Evans et al. 2021, ICES Advice 2021b, Moan and Bjørge 2023). The ICES Workshop on estimation of Mortality of Marine Mammals due to Bycatch (WKMOMA) in 2021 addressed the special request from OSPAR regarding the bycatch mortality in marine mammals, including Harbour Porposies in the Greater North Sea (ICES 2021). The workshop was tasked with generating bycatch rates (e.g. specimens per day at sea) and associated confidence intervals for static and towed gears (at least Métier Level 4) (Table 5), in addition to generating assessment unit and métier specific bycatch mortality estimates. Highest bycatch rates were observed in gillnet metiers, particularly those deployed from large vessels over the period 2015 to 2020 (see Table 6). Effort data from Norwegian vessels and small German vessels were not available for the assessment. Further, there was a potential bias in the dataset as for one member country, vessels with high bycatch rates were targeted for monitoring, increasing bycatch rates by a factor of up to 5 in set gill nets (GNS) and drift nets (GND), and 3.5 in trammel nets (GTR) (ICES Advice 2021b).

For reporting under the 2023 Quality Status Report, OSPAR's Marine Mammal Expert Group employed a quantitative interpretation of the ASCOBANS conservation objective when setting thresholds for the M6 indicator 'Marine Mammal Bycatch' where cetaceans are concerned 'a population should [be able to] recover to or be maintained at 80% of carrying capacity, with 0.8 probability, within a 100-year period'[3]. For Harbour Porpoises in the Greater North Sea, the Removal Limit Algorithm (RLA) management framework approach was employed. This is a population model that simulates population dynamics but with a control rule that estimates the mortality limit given a series of estimates of abundance and anthropogenic mortality (relying upon mortality estimates from bycatch) and their uncertainties. A number of caveats and assumptions had to be made, and the Anthropogenic Removals Limit = N_{best} x r x max (0, depletion – IPL), where N_{best} is the best available abundance estimate and IPL is the internal protection level assumed to be 0.54 (i.e. 54% of the carrying capacity K). If the estimated depletion level of the population is below the IPL, the removals limit is automatically set at zero. OMMEG tuned the RLA to the conservation objective by considering different quartiles of the posterior distribution of the RL, so as to better take account of estimation uncertainty in parameters r and depletion, and concluded by selecting the 30% quartile in order to guard against possible underestimation of anthropogenic mortality estimates (including by-catch). Based on this approach, bycatch of Harbour Porpoises in the Greater North Sea for the year 2020, was found to exceed the annual anthropogenic removal threshold value by a more than a factor of three (see Table 4).

Table 4: Threshold value estimated using the RLA approach and estimated by-catch as per Greater North Sea Harbour Porpoise OSPAR Assessment Unit. Abundance estimates are rounded. Approximate 95% Confidence intervals were computed assuming a log-normal distribution. Nbest is the best available abundance estimate. Taken from Taylor et al. (2023).

OSPAR Region	Abundance estimate	Threshold value (anthropogenic removal via bycatch)	Bycatch estimate (2020)
II	Nbest = 345 000 CV = 0,18 (239 000 – 483 000)	1622	5974

Other anthropogenic activities that may affect Harbour Porpoise include:

- underwater noise – both impulsive (e.g. as generated by pile driving, seismic surveys, detonation of explosives and acoustic deterrent devices) and continuous (e.g. as generated by shipping, operation of wind farms), (Todd et al. 1999, Stone and Tasker 2006, Bailey et al. 2010, Brandt et al. 2011, Dähne et al. 2013, Dähne et al. 2017, Stone et al. 2017, Wisniewska et al. 2018, Roberts et al. 2019));
- pollution (particularly persistent organic pollutants such as polychlorinated biphenyls [PCBs]) (Jepson et al. 2005, Murphy et al. 2015, Jepson et al. 2016, Williams et al. 2020a,b, van den Heuvel-Greve et al. 2021, Williams et al. 2023),
- collision risks (IAMMWG 2015, Robbins 2022)
- prey depletion (Santos and Pierce 2003, Pierce et al. 2022),
- marine debris (Unger et al. 2017); and
- environmental change (Learmonth et al. 2006, IAMMWG 2015).

A summary of pressures, related activities, and current levels of evidence for pressures associated with Harbour Porpoise is presented in Table 7 - based on ICES threat matrices (ICES WGMME 2015, WGMME 2019). The pressures have been split into the following categories after Authier et al. (2017):

- **Primary** (direct mortality);
- **Secondary** (health degradation, with indirect effect on demography); and
- **Tertiary** (behavioural disruption, with indirect effect on health and therefore demography).

Some pressures are identified as medium or low priority in terms of action required when assessed in isolation. However, it should be noted that when acting in combination with other pressures, the risk to the species could increase. A strategic approach to conservation should be considered to account for the cumulative impacts of non-lethal (secondary and tertiary) pressures acting on the individuals and the combined demographic effects of all pressures on the population.

[3] https://oap.ospar.org/en/ospar-assessments/quality-status-reports/qsr-2023/indicator-assessments/marine-mammal-bycatch/

Table 5. The bycatch rate per ICES subarea and métier level 4 for the Harbour Porpoise Greater North Sea AUs with data from 2015 to 2020. Both the estimated frequency of bycatch events and the estimated number of individuals per bycatch event is shown. (GNS = gill net, GND = drift net, GTR – trammel net, OTB = bottom otter trawl and OTT = multirig bottom otter trawl) Taken from ICES (2021).

					Bycatch event/DaS			Number of individuals/bycatch event		
AU	Subarea	Métier L4	Vessel size	Ob-served DaS	mean	lower	upper	mean	lower	upper
NORTHSEA	27.3	GNS	small	1647	0.05	0.05	0.06	1.19	1.04	1.37
NORTHSEA	27.3	GNS	large	1782	0.40	0.27	0.55	1.16	0.99	1.35
NORTHSEA	27.3	GTR	small	82	0.05	0.05	0.06	1.19	1.04	1.37
NORTHSEA	27.3	GTR	large	0	0.40	0.27	0.55	1.16	0.99	1.35
NORTHSEA	27.3	OTB	All	21907	0.00	0.00	0.00	1.10	0.90	1.35
NORTHSEA	27.3	OTT	All	7486	0.00	0.00	0.00	1.10	0.90	1.35
NORTHSEA	27.4	GND	small	288	0.08	0.06	0.11	1.38	1.16	1.64
NORTHSEA	27.4	GND	large	3.91	0.02	0.01	0.05	1.33	1.15	0.46
NORTHSEA	27.4	GNS	small	1747	0.08	0.06	0.11	1.38	1.16	1.64
NORTHSEA	27.4	GNS	large	3.91	0.02	0.01	0.05	1.33	1.15	0.46
NORTHSEA	27.4	GTR	small	1073	0.08	0.06	0.11	1.38	1.16	1.64
NORTHSEA	27.4	GTR	large	3.91	0.02	0.01	0.05	1.33	1.15	0.46
NORTHSEA	27.4	OTB	All	50951	0.00	0.00	0.00	1.10	0.90	1.35
NORTHSEA	27.4	OTT	All	6392	0.00	0.00	0.00	1.10	0.90	1.35
NORTHSEA	27.7	GND	small	67	0.01	0.01	0.01	1.06	0.94	1.19
NORTHSEA	27.7	GND	large	0	0.03	0.02	0.05	1.18	0.94	1.49
NORTHSEA	27.7	GNS	small	4789	0.01	0.01	0.01	1.06	0.94	1.19
NORTHSEA	27.7	GNS	large	0	0.03	0.02	0.05	1.18	0.94	1.49
NORTHSEA	27.7	GTR	small	6068	0.01	0.01	0.01	1.06	0.94	1.19
NORTHSEA	27.7	GTR	large	322	0.03	0.02	0.05	1.18	0.94	1.49
NORTHSEA	27.7	OTB	All	16842	0.00	0.00	0.00	1.10	0.90	1.35
NORTHSEA	27.7	OTT	All	567	0.00	0.00	0.00	1.10	0.90	1.35

Table 6. Estimated bycatch of Harbour Porpoise in the Greater North Sea assessment unit and métier level 4 in 2019 and 2020. Numbers of individuals taken as bycatch are obtained by multiplying the average bycatch rates (animals caught per day-at-sea) by the annual fishing effort. Lower and upper values represent 95% confidence intervals. Adapted from ICES Advice (2021b). *Evidence of non-random sampling.

Métier level 4	Estimated bycatch rate 2015–2020 (95% CI)	Number of individuals taken as bycatch 2019 (95% CI)	Number of individuals taken as bycatch 2020 (95% CI)
Gill and drift nets*	0.240 (0.137–0.409)	5696 (3021–10391)	5327 (2845–9637)
Trammel nets*	0.247 (0.142–0.418)	690 (399–1178)	479 (277–821)
Bottom otter and multi-rig otter trawls	0.001 (0.0005–0.003)	145 (64–331)	123 (54–281)

Table 7: Summary of actual and potential pressures on the population.

Actual / Potential Threat	Cause or related activity	Evidence	Possible Impact	Priority for Action
Primary pressures				
Bycatch – lethal entanglement in fishing gears	Commercial and recreational static nets and trawls	Strong	Mortality	High
	Marine debris (including ghost nets)	Weak	Mortality and morbidity	Low
Serious/fatal injury (not bycatch)	Ship strikes from commercial and recreational vessels	Weak	Mortality or compromising injury	Low
	Collision with wet renewables	Moderate	Mortality or compromising injury	Low
	Use of explosives	Moderate	Mortality or compromising injury	Low
Secondary pressures				
Mechanical destruction of habitat	Bottom trawls	Weak	Reduction in prey species	Low
	Infrastructure construction, oil and gas development			
	Gravel extraction			
Prey depletion	Overfishing	Moderate	Loss of body condition/ reduced nutritional status, suppression of reproduction, mortality	Low (further evidence required)
	Habitat degradation due to pollution			
Chemical pollution	Atmospheric transportation, terrestrial industrial development, landfill, terrestrial run-off, harbours, ships, aquaculture, sewer discharges, aerial transport, oil spill	Strong	Immuno- suppression, increased disease risk, reproductive failure and dysfunction	Medium
Environmental change	Further environmental changes are likely to affect marine conditions	Moderate	Change in distribution, and availability of prey and habitat	Medium

Cumulative impacts	The cumulative impact of pressures will increase risk to the population	Moderate	Reduced resilience to pressures due to combined impacts	Medium
Tertiary pressures				
Noise Disturbance	Fishing vessels, maritime traffic, recreational activities	Moderate	Displacement or injury, impaired communication, navigation and foraging, direct mortality, increased stress.	Medium
	Acoustic deterrent devices at fish farms, e.g. pingers			
	Military activities			
	Infrastructure construction, oil and gas development (including seismic)			
	Aggregate extraction			
Boat-based dolphin watching and other recreational activities		Moderate	Reduced foraging	Low

4.2. Attributes of the population for monitoring, mitigation and research

To address the pressures summarised above, there is a requirement for monitoring, mitigation and/or research. For example, bycatch has been identified as the greatest anthropogenic pressure on this species. There remains however, a degree of uncertainty in the assessment of population bycatch rates due to ambiguities in recording fishing effort, biases and unrepresentative sampling by gear type, and a lack of statutory reporting from some major fishing nations (Advice 2016, ICES Advice 2021a, b). Other pressures in the region include marine pollution, underwater noise and prey depletion, with major knowledge gaps in the extent of their effects which hinder the provision of robust scientific assessments.

The attributes that have been identified as requiring monitoring, mitigation or research are listed in Table 8. Measures by which to assess the success of actions will be developed alongside each action by the Steering Group.

Table 8: Attributes for monitoring, mitigation and research.

Attribute	Relevant actions
Conservation status: Population structure, demography and viability	RES-02; MON-01; RES-03; RES-04; MON-05
Bycatch: Bycatch rates in high and medium risk fisheries and gear types, effectiveness of mitigation measures including gear modifications	RES-01; RES-02; MIT-01; MON-01; RES-03; RES-04
Health: Health and nutritional status, life history parameters and contaminant levels (and possible sources)	MON-02; MIT-02; MON-03; MON-04; RES-04
Noise pollution: Levels, risks and impacts of underwater noise including renewable energy developments	MON-01; RES-03; MIT-02; MON-04
Evolving pressures: Environmental change and overfishing, pollutants of emerging concern	MON-01; RES-03; MON-02; MON-04
Cumulative impacts: Impact of activities in combination	MON-04; RES-02; RES-03; MON-02; MON-03

5. Conservation Status

Assessment of conservation status requires consideration of changes in distribution and abundance, as well as habitat preferences and availability. The assessment also requires an understanding of the main pressures and threats to the species that may impact mortality or longer-term survival and also the population context against which the effectiveness of management of those pressures can be judged. Table 9 summarises the conservation status assessments for Harbour Porpoise.

Because the range of the Harbour Porpoise extends beyond the Greater North Sea, this element of the assessment is largely unchanging. Fluctuations in the population (i.e. abundance and trends) are therefore the more important determinant of conservation status, particularly where links can be made to anthropogenic activities that may cause declines. Changes in distribution within range can also be important. For example, by the 1940s the Harbour Porpoise had become rare in the southern North Sea and English Channel probably as a result of overfishing, bycatch and/or local changes in environmental and oceanographic conditions leading to changes in pelagic assemblages including dominant fish populations, with reoccupation only beginning in the 1990s (Reid et al. 2003, Hammond et al. 2013, Murphy et al. 2013, IAMMWG 2015, Evans 2020).

Table 9: Conservation status conclusions for Harbour Porpoise in the European Marine Atlantic biogeographic region derived from a collation of the national reports by European Environment Agency (EEA) and European Topic Centre on Biological Diversity (ETC/BD). Adapted from Pinn et al. (2021).

Country	Assessment period		
	2001-2006	2007-2012	2013-2018
Belgium	Unfavourable bad	Unfavourable inadequate	Unknown
Denmark	Unfavourable bad	Favourable	Favourable
France	Unknown	Unfavourable bad	Unfavourable inadequate
Germany	Unfavourable inadequate	Unfavourable inadequate	Unfavourable inadequate
Ireland	Favourable	Favourable	Favourable
Netherlands	Unfavourable bad	Unfavourable inadequate	Favourable
Portugal	Unfavourable inadequate	Unfavourable inadequate	Unfavourable bad
Spain	Unknown	Unfavourable inadequate	Unfavourable inadequate
Sweden	Unfavourable bad	Unfavourable bad	Favourable
United Kingdom	Favourable	Favourable	Unknown
Overall conclusion by EEA and ETC/BD for European Marine Atlantic region	Unfavourable-inadequate (80% of population in a favourable condition)	Favourable (89% of population in favourable condition)	Favourable (64% of population reported as favourable. UK assessment of unknown, covering 27% of population, was considered overly precautionary).

5.1. Critical Habitats

Through the Habitats Directive, EU Member States have a commitment to identify Special Areas of Conservation (SACs) for Harbour Porpoise. Article 4(1) notes that the designation of SACs for wide ranging aquatic species such as Harbour Porpoise '*will be proposed only where there is a clearly identifiable area representing the physical and biological factors essential to their life and reproduction*'.

Annex III of the Directive sets out general criteria for selecting SACs:

- '*Criterion a. Size and density of the population of the species present on the site in relation to the populations present within the national territory;*
- *Criterion b. Degree of conservation of the features of the habitat which are important for the species concerned and restoration possibilities;*
- *Criterion c. Degree of isolation of the population present on the site in relation to the natural range of the species; and*
- *Criterion d. Global (overall) assessment of the value of the site for the conservation of the species concerned*.'

By 2020, 232 sites had been designated in European Union waters for Harbour Porpoise (EEA, 2020, Figure 10). Although now no longer part of the EU, the UK has retained their designated SACs, which have also been listed as part of the Emerald Network under the Bern Convention.

The designation of SACs places specific duties on public authorities to manage activities they are responsible for in a way that avoids site deterioration and ensures protection of important species habitat. However, the value of such areas is severely diminished if the threats to the species are not tackled appropriately. Notably, for members of the EU, the management of fisheries has been delegated to the European Commission. As a result, whilst Member States' have a responsibility to manage their own SACs, they are unable to impose fisheries measures. Instead, if fisheries measures are required to achieve the conservation objectives of the SAC, they must be requested and implemented through the Common Fisheries Policy (CFP).

For the Greater North Sea, any fisheries measures are negotiated and agreed via the Scheveningen Group, which comprises the Fisheries Directors of the North Sea Member States. Once agreed, the proposed fisheries measures are then submitted to the Scientific, Technical and Economic Committee for Fisheries (STECF) for assessment. STECF either return the measures to the Scheveningen Group for revision or can advise that the measures are adopted and implemented through the CFP. Following over a decade of negotiations, in December 2022, the European Commission finally adopted fisheries measures banning the use of gillnets to protect Harbour Porpoise in six SACs in the North Sea. These are the German sites Sylt Outer Reef, Borkum Reef Ground, Dogger Bank and Eastern German Bight; and the Dutch sites Cleaver Bank and Frisian Front[4].

Since leaving the EU, the UK is now in a unique position and is able to implement fisheries measures within its protected sites with immediate effect. The Trade and Cooperation Agreement[5] between the UK and EU allows for this, provided that the measures are based on best available scientific evidence and that the same measures are applied to both UK and EU vessels. Initially the UK focus has been on the fisheries measures required to protect habitat features within its SAC network. It is expected that consideration will be given to the need for fisheries measures in the Harbour Porpoise SACs in 2024/5.

[4] https://oceans-and-fisheries.ec.europa.eu/publications/c2022-8918_en

[5] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/982648/TS_8.2021_UK_EU_EAEC_Trade_and_Cooperation_Agreement.pdf

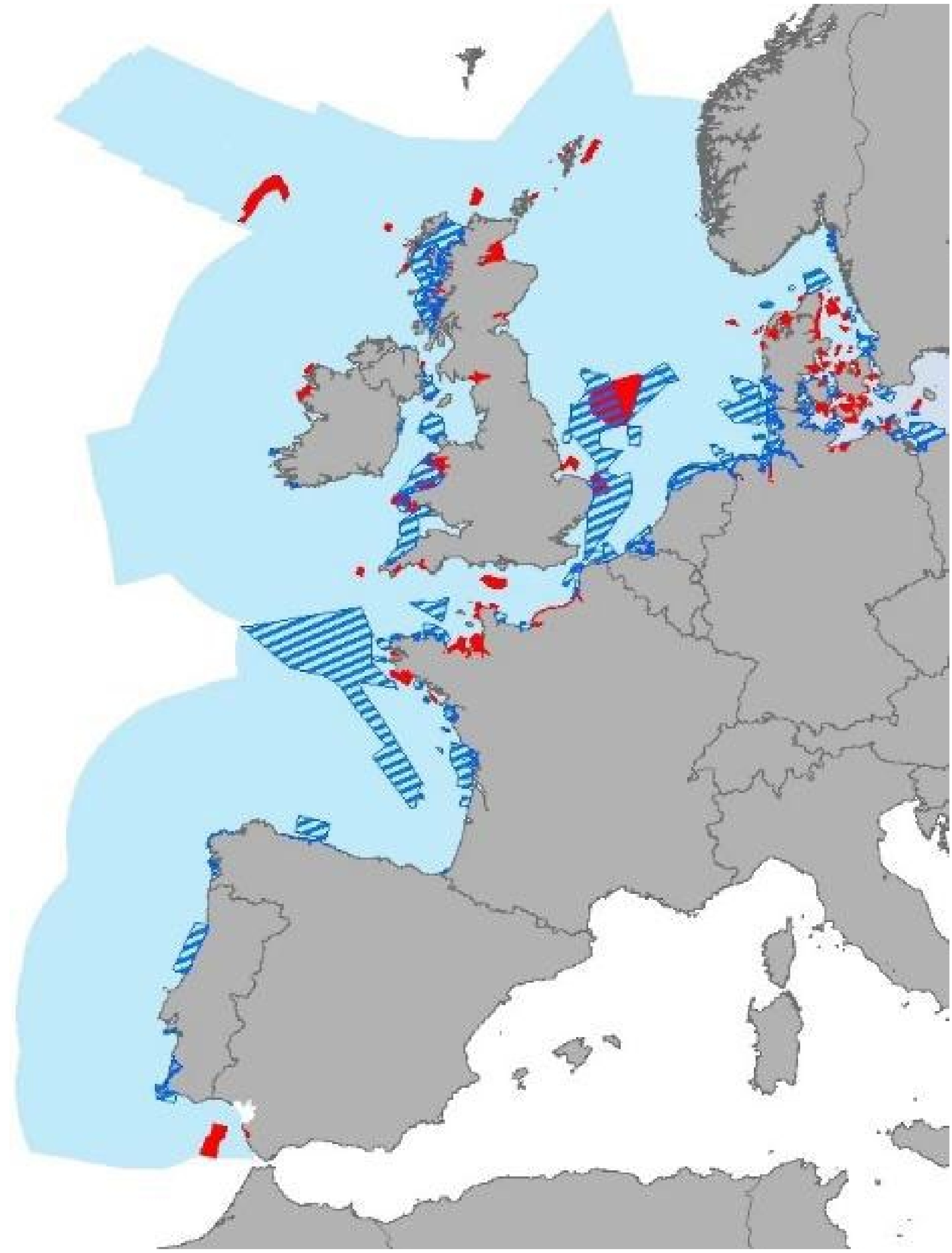

Figure 10: Marine Atlantic regional network of Special Areas of Conservation for Harbour Porpoise to end of 2019. Sites with Harbour Porpoise as a qualifying feature (grades A–C) are shown with blue stripes and those where the species is a non-qualifying feature (grade D) in red. The Marine Atlantic biogeographic region is shown in pale blue. Taken from Pinn et al. (2021).

5.2. Dealing with inadequate data

While ideally, all conservation plans and associated management actions are based on full and adequate scientific data, there are occasions when the potential conservation consequences of waiting for confirmatory scientific evidence may mean that it is better to take action in the short term whilst collecting further evidence. This has become known as following the Precautionary Principle[6]. However, application of the precautionary principle must be carefully considered and adequately justified. One of the main challenges encountered in the process of developing the original version

[6] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Al32042

of the Conservation Plan (ASCOBANS, 2009) was the lack of data available on which to base some decisions. This issue still persists today.

The actions, therefore, include a number of research and monitoring actions which work towards obtaining the necessary information for the establishment of adequate scientifically-based management actions. These actions need to be given some priority to ensure management or mitigation is based on robust data and therefore likely to be effective.

6. Actions

6.1. Summary of Actions

Below is a list of the identified actions, with an indication of priority and likely constraints of achieving each. Actions are categorised under Monitoring (MON); Mitigation (MIT) and Research (RES) codes.

Priority	Action	Code	Constraints
Essential	Identify the priority bycatch issues and relevant stakeholders	RES-01	Political, will be influenced by societal desire to support
Essential	Improve estimates of bycatch rates to support development of conservation strategy	RES-02	Metrics used to record fishing effort; ambiguous definitions for some gear types; insufficient funding to support the extent of monitoring needed for robust estimates
Essential	Implement and assess pinger and other mitigation measures to reduce bycatch	MIT-01	Cooperation from fishing industry; enforcement measures
High	Implement a wide-scale surveillance programme to monitor trends in distribution and abundance in the Greater North Sea	MON-01	Commitment of funding
High	Improve understanding of causes of seasonal and annual variation in abundance and distribution, particularly in relation to human activities and environmental change, to facilitate consideration of the species within marine spatial plans	RES-03	Although this is one of the most surveyed regions in the North-east Atlantic, the spatial temporal coverage is still inadequate, thus there are difficulties in mapping some human activities/impacts
High	Monitoring of health and nutritional status, diet, life history parameters, and causes of mortality	MON-02	Commitment of funding; access to samples; development of suitable methods
Medium	Further our understanding of population structure	RES-04	Development of non-invasive sampling methods; discrimination ability of different techniques.
Medium	Improve understanding of and develop mitigation for the risks of anthropogenic sound	MIT-02	Difficulty in attributing sound exposure to physical or behavioural consequences at both the individual and population level

Priority	Action	Code	Constraints
Medium	Ensure screening and assessment of the occurrence and effects of hazardous substances	MON-03	Effective identification of emerging hazards; addressing impacts on Harbour Porpoises specifically
Low	Monitor for potential increases in anthropogenic activities that lead to incidences of death, injury or adverse health effects	MON-04	Availability and accessibility of information
Low	Monitor habitat quality, including protected sites, to ensure management is effective and that the ecological functions are maintained.	MON-05	Political will, influenced by societal desire to support

6.2. Actions and Tasks

The actions are detailed below setting out the priority tasks and constraints to achieving the action objectives, and who is responsible. Monitoring actions identify key tasks in developing monitoring programmes for the species, similarly with Mitigation actions. Research actions identify tasks essential for providing adequate management advice. The tasks identified within each action will formulate the basis on which countries will report progress to ASCOBANS.

The Conservation Plan Steering Group (North Sea Group, NSG) will be responsible for developing detailed plans for tasks where required to coordinate implementation and identify a way forward. The NSSG will collate reports on the progress of implementation, effectiveness and issues encountered and report annually to the Advisory Committee on the progress of the Conservation Plan, identifying further implementation priorities and make appropriate recommendations. The reporting will be concise and efficient to reduce burden and maintain up to date information on application and progress of tasks.

Action RES-01: Identify the priority bycatch issues and relevant stakeholders

Priority: ESSENTIAL **Research action**

Constraints: depends on political will, influenced by public support.

Description of action

Static net fisheries are recognised as being the greatest (anthropogenic) risk to Harbour Porpoise. There is a need to identify those of highest risk in terms of temporal and spatial extent, in order to effectively direct monitoring and mitigation effort. There is then opportunity to:

- prioritise management and innovation to address ASCOBANS conservation objectives, including implementation of programmes of measures (for bycatch mitigation).
- facilitate implementation of the management framework procedure and indicators of bycatch developed by OSPAR to support collaborative approaches at an appropriate spatial scale.
- improve understanding of the factors which influence bycatch levels; e.g. age, sex, time of day of capture, season, location, hydro-meteorological condition, associated prey species, gear specifications and usages etc.;

Attention is needed to revise the current ASCOBANS conservation objectives to incorporate a timeframe for their achievement and level of certainty, and to take into account of the long-term objective to drive anthropogenic removals towards zero mortality.

Engagement with other relevant stakeholders, including fishers and fisheries Regional Coordination Group North Atlantic, North Sea and Eastern Arctic (NANSEA), as well as scientists, NGOs and government managers, is required to reach common solutions and to fulfil conservation objectives.

Tasks

1. Implement the management framework procedure developed through OSPAR's M6 Biodiversity Common Indicator 'Marine Mammal Bycatch', and progress development of suitable indicators of bycatch for the Harbour Porpoise with other fora, which will aid EU Member States in meeting requirements of the MSFD as well as agreed objectives of Resolution 8.5 (Rev.MOP9).
2. Collaborative on the development of programmes of measures under the MSFD, to ensure that suitable indicators of bycatch achieve their stated objective.
3. Facilitate the identification of factors influencing bycatch rates; including an assessment of temporal (seasonal) and spatial, gear characteristics, fishing practices and target/non-target species.
4. Facilitate research in order to assess evidence of bycatch selectivity of age-sex groups in different fishing operations (e.g. gears, target species, seasons), with the inclusion of those data within a population viability analysis.
5. Monitor causes of death in the population through strandings programmes for aiding assessments of spatio-temporal relationships and trends in bycatch, aiding implementation of the agreed objectives of Resolution 8.10 (Rev.MOP9).
6. Represent ASCOBANS and the North Sea Plan at meetings of NANSEA and the North Sea Regional Advisory Council, as well as engagement with Parties' fisheries administrations.

Actors

Conservation Plan Coordinator/Steering Group, ASCOBANS-ACCOBAMS JBWG, national authorities, other stakeholders including OSPAR and scientists (e.g. ICES WGBYC), NANSEA, and North Sea Regional Advisory Council.

Action RES-02: Improve estimates of bycatch rates to support development of conservation strategy

Priority: ESSENTIAL **Research action**

Constraints: Potential constraints are the current metrics used to record fishing effort, ambiguous definitions for some gear types, insufficient funding or inefficient use of available funding to support the extent of monitoring needed for robust estimates.

Description of action

Bycatch estimates across the Agreement area are hampered by low sampling effort (both for vessels >12m but particularly so for the smaller inshore <12m vessels) as well as the difficulties in quantifying effort adequately due to the format of recorded information from relevant fisheries. Currently, effort is logged as days at sea rather than more accurate measures that take account of net dimensions and soak times (e.g. ICES, 2022). Bycatch rates are determined from visual observers aboard a small fraction of active vessels, as well as some remote electronic monitoring (REM). Although EU Range States are requested by ICES to report bycatch rates on an annual basis, some do not, or data submissions are incomplete. Efforts are needed at international, regional, and national levels to improve the level and frequency of provision of information. There still remains great uncertainty around all bycatch estimates for the Harbour Porpoise in the Greater North Sea.

Tasks

1. Drive coordination of bycatch monitoring observer programmes across Parties and non-Party Range States, ensuring that monitoring programmes have been designed appropriately, with a sufficient level of monitoring to produce robust and unbiased estimates of bycatch with confidence intervals. Because bycatch is a relatively rare event, there is also a need to agree how best to design and implement effective monitoring programmes.
2. Identify and monitor bycatch rate in medium-to-high-risk static net and other fisheries with a medium-to-high risk of Harbour Porpoise bycatch in order to ascertain more accurate assessments of bycatch rates to meet the agreed objectives of Resolution 3.3, Resolution 8.5 (Rev.MOP9).
3. Increase reliability of fishing effort data including for small vessels (<12 m)[7] and recreational fisheries and continue evaluating appropriate fishing effort metrics for calculating bycatch rates, supporting the wider work of ICES. This involves, working nationally (e.g. through work plans) and regionally (through Regional Coordination Groups) to improve quality and availability of fishing effort data (e.g. by region, gear type, net length, vessel size category, season, and country).
4. Support innovative monitoring methods, e.g. REM, particularly for use on smaller vessels (<12 m) where the placing of onboard observers is not feasible, and liaise with ICES WGBYC on how best these data should be collated and assessed as different monitoring methods will have different levels of uncertainty.

Actors

Conservation Plan Coordinator/Steering Group and ASCOBANS-ACCOBAMS JBWG, with support from Range States/Parties to ASCOBANS and ICES.

[7] This is required by the Habitats Directive where bycatch from small vessels is thought to have a negative impact on conservations status. It is also required by the EU Data Collection Framework Regulation 2017/1004 (https://datacollection.jrc.ec.europa.eu/legislation/current/obligations) and the EU Implementing Regulation 2019/1241.

Action MIT-01: Implement and assess pinger and other mitigation measures to reduce bycatch

Priority: ESSENTIAL **Mitigation Measure Action**

Constraints: Political will, socio-economic cost and willingness of industry.

Description of action

The use of pingers in certain static net fisheries was mandated through EU Regulation 812/2004. This regulation has since been repealed and the requirements incorporated into EU Data Collection Framework Regulation 2017/1004[8] and the EU Implementing Regulation 2019/1241[9]. Today, the legislative emphasis is on international commitments for protected species, incorporating all fisheries that may have a negative impact. This also reflects the requirements of the EU Habitats Directive for monitoring of bycatch and implementing mitigation measures where there is a negative impact on conservation status. The UK requires the use of pingers in those fisheries where it was originally mandated. Any other vessel (e.g. all inshore vessels) is required to obtain a license to use pingers. In contrast, all coastal gillnet vessels are required to use pingers in Norway to reduce bycatch.

Since their introduction, it has become clear that pingers are very effective in some fisheries but not in others (ICES WGBYC 2020, Lusseau et al. 2023). There is also a need to further understand the contradictory evidence on the possible effects of habituation and habitat exclusion in relation to pinger deployment. Given these concerns, the use of alternative gear types is often advocated (Leaper and Calderan 2018, Read 2021). However, due to the cost of switching gear, relicensing a vessel and learning to fish using a different technique, this approach is unviable for many smaller vessels (Ryan et al. 2022). A focus on gear adaptation has therefore been advocated by industry.

The ultimate aim for the development of any mitigation measure is to ensure universal acceptance by all stakeholders (and hence better implementation) of mitigation measures to reduce Harbour Porpoise bycatch.

Tasks

1. Implement mitigation measures that have shown to produce a significant bycatch reduction and that are appropriate to the nature of the vessels and their size, with subsequent monitoring to ensure effectiveness and the ongoing need to meet the agreed objectives of Resolution 8.5 (Rev.MOP9). It may be necessary to undertake an Environmental Risk Assessment for the implementation of pingers *en masse*.
2. Collaborate with the industry to develop and test mitigation measures (including modifications to fishing gear and fishing practices; pinger-related technology and deployment (e.g. interactive pingers, less pingers per length of net), and alternative porpoise alerting passive and active devices) and develop a framework for the critical evaluation of pinger, gear modification and other mitigation measures to identify effectiveness in the reduction of bycatch to meet the agreed objectives of Resolution 8.5 (Rev.MOP9).
3. Support research evaluating the behaviour of Harbour Porpoises around fishing gear, especially static nets, including their sensory capabilities and auditory health, for a better understanding of factors leading to bycatch.
4. Prevent, retrieve, and recycle derelict (“ghost”) fishing gear, with focus on high-density areas of Harbour Porpoises as agreed by Resolution 9.3. This will require authorities to provide appropriate facilities to ensure gear is recycled and to prevent disposal of at sea.

Actors

Conservation Plan Coordinator/Steering Group and ASCOBANS-ACCOBAMS JBWG, with support from Range States and Parties to ASCOBANS, fisheries authorities and scientists.

[8] https://datacollection.jrc.ec.europa.eu/legislation/current/obligations
[9] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019R1241

Action MON-01: Implement a wide-scale surveillance programme to monitor trends in distribution and abundance in the Greater North Sea

Priority: HIGH **Monitoring Action**

Constraints: Availability of funding which may be driven, in part, by political will and support for the Conservation Plan.

Description of action

Information on trends in abundance and distribution is essential for the contextualisation of the majority of the actions associated with this Conservation Plan. Without such monitoring, it will be impossible to evaluate the success or otherwise of the Conservation Plan and to determine whether any modifications are required.

The fundamental basis for determining changes in Harbour Porpoise conservation status within the Greater North Sea is a programme of regular broad-scale standardised surveys. Given the cost, the term 'regular' would need to be identified based on sufficiency for reporting trends. Recent work has deemed that SCANS-types surveys should be undertaken at a six-year frequency. However, these surveys provide 'snapshots' of the abundance and distribution within the area surveyed, typically being carried out over a one-month period during the summer. Given the temporal limitations, complimentary coordinated regional data collection is also required to ascertain long-term and seasonal changes in distribution at a North Sea-wide scale and the examination of potential explanations for any observed changes.

Tasks

1. Encourage Parties and non-Party Range States to collaborate and fund regular systematic North Sea-wide and regional surveys to establish trends in abundance and distribution, and undertake density surface modelling, to meet the agreed objectives of Resolution 4.7 and Resolution 5.7.
2. Encourage Parties' and non-Party Range States' active participation with the ICES Working Group on the Joint Cetacean Data Programme (WGJCDP) which has developed a mechanism for collation of all relevant, standardised data at a relevant spatial scale, collected through ship-based and aerial methodologies, and aims to develop analyses and data products in line with identified priorities across the cetacean research and policy community. Such work would enable seasonal trends to be evaluated to meet the agreed objectives of Resolution 4.7.
3. Ensure Parties and non-Party Range States that the outputs of this action provide a suitable mechanism to enhance transboundary reporting of conservation status and good environmental status, as well as contributing to the assessment of OSPAR's M4 Biodiversity Common Indicator 'Abundance and Distribution of Marine Mammals', evaluating temporal trends and any further re-distribution of individuals within the Greater North Sea.

Actors

Conservation Plan Coordinator/Steering Groupwith support from Range States/Parties to ASCOBANS, OSPAR, scientists and managers especially those involved in the monitoring component of SCANS and other surveillance work.

Action RES-03: Improve understanding of causes of seasonal and annual variation in abundance and distribution, particularly in relation to human activities and environmental change, to facilitate the consideration of the species within marine spatial plans

Priority: HIGH **Research action**

Constraints: Although this is one of the most surveyed regions in the North-east Atlantic, the spatial temporal coverage is still inadequate, thus there are difficulties in mapping some human activities/impacts.

Description of action

A wide variety of anthropogenic activities occur in the Greater North Sea region that may potentially affect Harbour Porpoises. It is necessary to be able to determine the occurrence and temporal/geographical distribution of these activities, and any changes over time, to be able to identify potential areas of risk for the species.

Analyses should investigate relationships between the distribution and trends regarding relevant human activities (linking to Action RES-01: Identify the priority bycatch issues and relevant stakeholders and Action MIT-02: Improve understanding of and develop mitigation for the risks of anthropogenic sound). Consideration of indirect impacts of environmental change (e.g. availability and re-distribution of preferred prey) should be considered where possible. This may be of particular importance for Harbour Porpoise SACs that likely encompass important foraging areas (see MON-05 Monitor habitat quality, including protected sites, to ensure management is effective and that the ecological functions are maintained).

Tasks

1. Continued collection and collation of appropriate standardised data on anthropogenic activities with the aim of supporting implementation of the MSFD and assessment of Good Environmental Status through OSPAR.
2. Complete fine-scale seasonal risk assessment/risk mapping of relevant human activities and Harbour Porpoise distribution to meet the agreed objectives of Resolution 4.7, Resolution 5.7, and Resolution 8.5 (Rev.MOP9).
3. Collate and monitor data on important prey species of Harbour Porpoises to identify spatial areas of concern for fisheries management measures, to meet the agreed objectives of Resolution 4.7, Resolution 5.7 and Resolution 9.4.
4. Through collaboration with other ASCOBANS working groups, such as the Resource Depletion Working Group, regularly review of evidence for potential impacts of environmental change on Harbour Porpoises to inform on appropriate mitigation measures.

Actors

Range States/Parties to ASCOBANS; scientists and managers especially those involved in the monitoring component of SCANS, Data collectors, fisheries authorities, OSPAR, ICES, policymakers, Conservation Plan Coordinator/Steering Group, contractors.

Action MON-02: Monitoring of health and nutritional status, diet, life history parameters and causes of mortality

Priority: HIGH **Monitoring Action**

Constraints: Funding; access to sufficient samples across the region.

Description of Action

Our knowledge of the qualitative and quantitative effects of a range of human activities on Harbour Porpoises is incomplete. This impacts our ability to fully determine their conservation status and implement relevant good environmental status indicators.

This action is designed to improve this by collecting and reviewing information on causes of mortality, health and nutritional status, diet, as well as life history parameters. Types of data also required for population dynamics modelling.

Information on diet and various health and life history parameters has historically been obtained from dead animals that have stranded, or in some cases been recovered as bycatch, which remains the primary source of these data.

Tasks

1. Fund national stranding and bycatch observer programmes and undertake full necropsies on a representative sample of carcasses (considering sex, age and season), for assessing cause of death, health status, diet, life history parameters, and genetic population assignment to meet the agreed objectives of Resolution 8.10 (Rev.MOP9).
2. Ensure implementation of the joint ASCOBANS and ACCOBAMS 'Best Practice on Cetacean Post-mortem Investigation and Tissue Sampling'[10] to achieve standardized, comparable datasets.
3. Encourage collaboration between stranding networks in the event of an unusual mortality event to identify potential causes of death, as well encouraging collaborative research on the extent and potential reasons for grey seal predation, starvation/emaciation and acoustic trauma observed in Harbour Porpoises.
4. Support strandings programmes to enable the analysis of diet, including tissue samples for fatty acid, stable isotope, stomach contents, and prey DNA analysis.
5. Support North Sea-wide monitoring of life history parameters through the collection and analysis of teeth and gonadal samples from stranded and bycaught animals, to assess evidence of temporal changes in life history parameters and explore links to anthropogenic drivers.
6. Support expansion of drift prediction modelling capabilities for determining the origin of stranded Harbour Porpoises, e.g. MOTHY (Peltier et al. 2013, Peltier et al. 2018) to identify potential bycatch high risk areas/seasons, as well aiding genetic assignment.
7. Support the development of a biodiversity 'population condition' indicator for the region.

Actors

Range States, EC, International Whaling Commission Scientific Committee, ASCOBANS, Conservation Plan Coordinator/SG, other stakeholders including OSPAR, scientists and strandings programme coordinators.

[10] https://www.ascobans.org/en/document/small-cetacean-stranding-response-0 , Annex 1.

Action RES-04: Further our understanding of population structure

Priority: MEDIUM **Research action**

Constraints: Potential constraints are the discrimination ability of different techniques, practicalities of introducing a well-designed sampling procedure, and development of acceptable non-invasive methods to collect the appropriate information.

Description of action

Information on population structure may be obtained by a variety of means, including, amongst others, DNA analysis (mtDNA, microsatellite, MHC (Major Histocompatibility Complex) and SNP (single nucleotide polymorphism) markers, whole genomic studies by new generation technologies), morphometric studies, stable isotope signatures, fatty acid profiles, and comparisons of life history parameters.

Each is characterised by having different powers of discrimination over different time scales. Traditionally, most information on the population has come opportunistically from strandings, though bycaught animals have been extensively sampled through European observer programmes. Strandings data offer valuable insight, however, have limitations. Therefore, methods to reduce these limitations (e.g. improved drift modelling) and methods of collecting more representative samples should be explored. Combining relevant approaches, such as population genetics, ecological tracers (e.g. contaminants, stable isotopes), and trends in life-history parameters, would provide a comprehensive picture of the multifarious dimensions of the ecology and evolution of Harbour Porpoises in the region (Murphy et al. 2019).

Tasks

1. To identify funding and develop a programme of research to further elucidate the population structure of Harbour Porpoises in the region. Strategic sampling approaches (i.e. temporal and spatial) and statistical power analysis should be undertaken to determine level of sampling required to detect appropriate units to conserve.
2. Facilitate the provision of dead bycaught animals for population structure assessment and other appropriate studies. This may require repeal of national legislation or the issuing of licenses to facilitate landing of bycaught Harbour Porpoise for research.
3. Actively support and encourage development of suitable techniques for discriminating population structure, as agreed in Resolution 5.7.

Actors

Range States, Conservation Plan Coordinator/SG, other stakeholders including scientists, fisheries authorities and strandings programme coordinators.

Action MIT-02: Improve understanding of and develop mitigation for the risks of anthropogenic sound

Priority: MEDIUM **Mitigation Measure Action**

Constraints: Difficulty in attributing sound exposure to physical or behavioural consequences at both the individual and population level.

Description of action

A wide variety of anthropogenic activities introduce sound into the marine environment, e.g. vessels, construction and operation of windfarms, general construction works, hydrocarbon exploration, military activities including removal of munitions, pingers, and other acoustic harassment devices. However, the actual or potential effects of such sounds on Harbour Porpoises in the short-term or long-term has not been fully quantified. Individual based modelling frameworks, such as iPCoD (Mortensen and Thomsen 2019) and DEPONS (Nabe-Nielsen et al. 2018), have been developed that further our understanding of the impacts of noise on vital parameters, though they require accurate and relevant input data.

GES indicators for noise have been developed which require substantial monitoring and reporting of noise activities. These are, however, limited to loud impulsive sounds (e.g. pile driving and underwater explosions), and continuous noise (e.g. shipping traffic). Through the JOMOPANS project, soundscape maps of ambient noise are being developed as a GES Tool to enable marine managers to quantitatively and graphically assess the risk of impacts on indicator species in the North Sea[11].

Tasks

1. Parties and Range States should introduce precautionary guidance on measures and procedures for all activities surrounding the development of renewable energy production and other noise-producing industry to minimise risks to the species and mitigate possible effects following current best practice as agreed in Resolution 6.2, and Resolution 8.11 (Rev.MOP9).
2. Parties to make every effort to mitigate the effects of activities involving explosions of munitions (see Resolution 8.8).
3. Parties and Range States should coordinate and support research on the effects of underwater noise on Harbour Porpoises, including further development of individual based modelling frameworks, to meet the agreed objectives of Resolution 5.4, Resolution 6.2, Resolution 8.6, Resolution 8.8, Resolution 8.9, and Resolution 8.11 (Rev. MOP9).
4. Annually monitor and assess knowledge of the effects of anthropogenic sound through review of literature, including acoustic capabilities of Harbour Porpoises, behavioural responses of Harbour Porpoises and the effectiveness of mitigation technologies as agreed in Resolution 6.2, Resolution 8.6.
5. Support the work of EU MSFD Common Implementation Strategy Technical Group on Underwater Noise (TG-NOISE), and for Parties to implement agreed thresholds as they are developed (e.g. common methodology for assessment of impulsive underwater noise and continuous noise).

Actors

EU TG-NOISE, Conservation Plan Coordinator/Steering Group, national authorities, other stakeholders including OSPAR and scientists.

[11] https://northsearegion.eu/jomopans/

Action MON-03: Ensure screening and assessment of the occurrence and effects of hazardous substances

Priority: MEDIUM **Monitoring Action**

Constraints: Identifying new products as hazardous; assessing impacts that apply specifically to the Harbour Porpoise.

Description of action

Programmes currently exist in the Agreement Area that monitor a suite of hazardous chemicals. However, the direct and indirect effects that some of these may have specifically on Harbour Porpoises are still not completely understood. This is particularly pertinent for those pollutants identified as endocrine disrupting chemicals, which are known to effect health status (Law et al. 2012, Murphy et al. 2015, Jepson et al. 2016, Murphy et al. 2018, Williams et al. 2020a, b, van den Heuvel-Greve et al. 2021, Williams et al. 2023). In addition, data on exposure to contaminants listed on the EU Watch List for emerging pollutants is lacking (Commission Implementing Decision (EU) 2015/495).

Tasks

1. Continue collecting, archiving and analysing representative samples of porpoise tissues for relevant contaminants, with associated data on cause of death, health and nutritional status, and life history (linked to Action MON-02: Monitoring of health and nutritional status, diet, life history parameters, and causes of mortality; and RES-04: Further our understanding of population structure). Further work is required to understand the effects of confounding factors, such age, body condition, reproductive activity, and health status, on individual pollutant loads.
2. Continue to monitor and assess emerging chemical pollutants and marine litter (including macro-, micro- and nanoplastics) in Harbour Porpoises through review of literature to progress agreed objectives of Resolution 7.4, Resolution 5.7, Resolution 8.7, and Resolutions 9.3 and 9.4. Such work should devise a North Sea-based risk list of priority pollutants for monitoring in the species.
3. Monitor effects from exposure to legacy pollutants on immune, endocrine and reproductive functions in Harbour Porpoises against agreed toxicity thresholds, through continued analysis of mortality samples to meet agreed objectives of Resolution 8.7.
4. Encourage Parties and non-Party Range States to further develop thresholds to be employed for contaminants of concern, including the continued development of dose-response relationships between contaminants and physiological (reproductive and immunological) endpoints for the Harbour Porpoise.
5. Encourage Parties and non-Party Range States to work through OSPAR and other relevant fora to aid the development of a marine mammal persistent chemical contaminants indicator of GES to meet Criteria D8C2, in order to ascertain that the health of the species is not adversely affected due to contaminants, including cumulative and synergetic effects. For such work, collection of a sufficient number of stranded and/or bycaught Harbour Porpoises is required to assess trends and status of persistent chemicals in the Harbour Porpoise Greater North Sea assessment unit (linked to RES-04 Further our understanding of population structure).

Actors

Range States, other stakeholders including scientists, Conservation Plan Coordinator / Steering Group.

Action MON-04: Monitor for potential increases in anthropogenic activities that lead to incidences of death, injury or adverse health effects including cumulative effects

Priority: LOW **Monitoring Action**

Constraints: Availability of and access to the necessary information.

Description of action

Where current exposure of some pressures may be viewed as sustainable with regards to the Harbour Porpoise in the Greater North Sea, increases in exposure of either a single pressure, or cumulative increases, may have a negative impact and requires monitoring to enable early detection of risk, and subsequent development of management. A number of human activities known to have negative impacts upon marine mammals can be monitored from information gathered as part of other surveillance and monitoring programmes and, therefore, a strategic approach to data collection should be explored. Frameworks are being developed by other fora, such as OSPARs cumulative effects assessment[12], and assistance in such work is encouraged.

Tasks

1. Encourage Parties and Range States to continue to give their full support to the activities related to applying an ecosystem approach to the management of human activities under the frameworks of OSPAR, HELCOM, the European Union and the Convention in Biological Diversity as agreed in ASCOBANS Resolution 8.9, Resolution 8.11 (Rev.MOP9) and 9.3.
2. As part of the annual reporting for the Conservation Plan, collect and review information to monitor changes in exposure to key anthropogenic pressures, and the effects arising from such, to support OSPAR's cumulative effects assessment work.
3. Requests that Parties and Range States ensure that cross-sectoral and transboundary consultations take place early within marine spatial planning activities, with the aim of identifying potential impacts and minimising or mitigating such impacts effectively as agreed in Resolutions 8.6 and 8.9, particularly where such work occurs within or adjacent to protected sites of the Harbour Porpoise (see Action MON-05: Monitor habitat quality, including protected sites, to ensure ecological functions are maintained).
4. Identify emerging pressures (e.g. offshore wind, wet renewables and ecotourism) and ensure monitoring is in place to establish risk. These emerging pressures need to be considered in the context of those already existing, and to take impacts into account cumulatively.

Actors

Range States national authorities, OSPAR, International Maritime Organisation (IMO), International Whaling Commission (IWC), Conservation Plan Coordinator/Steering Group.

[12] https://www.ospar.org/news/cumulative-effects-assessment

Action MON-05: Monitor habitat quality, including protected sites, to ensure management is effective and that the ecological functions are maintained

Priority: LOW **Monitoring Action**

Constraints: Depends on political will.

Description of action

The designation of Special Areas of Conservation (SACs) is required for the Harbour Porpoise by Article 4 of the Habitats Directive. Although no longer part of the EU, the UK have still retained their designated SACs, which have also been listed as part of the emerald network under the Bern Convention.

SACs aim to safeguard the species at critical locations for their lifecycle, whether they are used for feeding, breeding, resting or other activities (although details of their behaviours in these areas are not well understood). Because Harbour Porpoises are highly mobile, SACs have an important role in safeguarding the inherent ecological conditions required.

The SAC network within the North Sea is considered to be largely complete. The focus is now on implementing appropriate management of these sites in order to achieve their conservation objectives. It is also recognized that in order for these sites to be effective, it will be necessary to implement management and mitigation of anthropogenic pressures outside/within the SACs.

Tasks

1. As part of the annual reporting for the Conservation Plan, collect and review information on habitat quality and protected area condition, both which have yet to be defined, within the Greater North Sea.
2. Review conservation objectives and the implementation of management measures for SACs, assessing whether the conservation objectives are fit for purpose and that the management is effective.
3. Collect and review information on anthropogenic activities within and adjacent to SACs, and whether they have a significant impact on harbour porpoises at those sites (Action RES-03: Improve understanding of causes of seasonal and annual variation in abundance and distribution, particularly in relation to human activities and environmental change, to facilitate the consideration of the species within marine spatial plans).
4. Encourage Parties and Range States to identify the location of any further suitable sites for the establishment of protected areas, and to implement appropriate management actions in these areas on their own or in the context of other intergovernmental bodies to ensure the protection of Harbour Porpoise as agreed in Resolution 5.7.

Actors

Coordinator/Steering Group, national authorities, other stakeholders including OSPAR and scientists.

7. Public awareness and capacity building

This Conservation Plan has been developed to collate knowledge and information on the species and develop a set of relevant actions to implement to conserve the species with an aim to maintain and, where necessary, restore the North Sea management unit to favourable conservation status.

Wider awareness of both the pressures and the activities which cause them, and also any successes of the plan, will support achievement of the aims. Education and awareness may also contribute to better reporting of sightings and impacts, leading to better data for decision making.

There is the capacity for misinformation through media following events such as strandings; bycatch discard and other impacts such as vessel strikes. The outreach proposed for this plan could be effectively undertaken by better use of the media, including the internet (e.g. through ASCOBANS and Range State webpages), and activities such as public lectures and education programmes. It is important to continue communication particularly with stakeholders who have an impact on the species (e.g. through activities such as fishing, and renewable development, etc.) to maintain communication channels and support action of relevant tasks, as well as work with other interested parties to publicise the work ongoing to conserve the species.

7.1. Public awareness tasks

1. All key milestones (e.g. timetables for actions; assessment of progress against objectives etc.) to be publicised through ASCOBANS and Range State media outlets in a coordinated manner agreed through the SG.
2. ASCOBANS webpages to host key documents and updates, to be publicised by SG members.
3. Presentation of the progress at relevant events and conferences.
4. Identification and publication of papers through journals and list servers/webpages to publicise lessons learned and successes.
5. Wider circulation of articles and news items through the media/social media to support the dissemination of factual information to the wider public.
6. Coordination with relevant NGOs with an interest in Harbour Porpoise, to join up approaches for public information campaigns.

Annex 1: International Conventions and Agreements

In the North-east Atlantic, Harbour Porpoise are incorporated into a wide variety of legislation including national, European and international statutes and conventions, all with aims to protect, conserve, manage and study the species. In addition, there is other international legislation aimed at specific industries.

Full Title	Acronym/shorthand
United Nations Convention on the Law of the Sea	UNCLOS
Convention on Biological Diversity	CBD
Convention on International Trade in Endangered Species of Wild Fauna and Flora	CITES
The Convention on the Conservation of Migratory Species of Wild Animals & the Agreement on the Conservation of Small Cetaceans of the Baltic, NE Atlantic, Irish and North Seas	CMS & ASCOBANS
Convention on the Protection of the Marine Environment of the NE Atlantic	OSPAR
The Bern Convention	
European Directive of Natural Habitats and Wild Fauna and Flora (92/43/EEC)	Habitats Directive
International Convention for the Regulation of Whaling	IWC
Common Fisheries Policy	CFP
Marine Strategy Framework Directive	MSFD
Environmental Impact Assessment Directive	EIA
Strategic Environmental Assessment Directive	SEA

United Nations Convention on the Law of the Sea (UNCLOS)

UNCLOS governs all aspects of ocean space: Specifically, the convention states that contracting parties “shall cooperate with a view to the conservation of marine mammals and in the case of cetaceans shall in particular work through the appropriate international organisations for their conservation, management and study” and that signatories must take measures “necessary to protect and preserve rare or fragile ecosystems as well as the habitat of depleted, threatened or endangered species and other forms of marine life” (United Nations, 2001).

Convention on Biological Diversity (CBD)

The aim of CBD is conservation of biological diversity, the sustainable use of the components of biological diversity and a fair and equitable sharing of the benefits arising out of the utilization of genetic resources. Kunming-Montreal Global Biodiversity Framework, adopted in 2022, aims to halt and reverse biodiversity loss, implementing the three aims of CBD in a balanced manner. The framework also contributes to the achievement of the 2030 Agenda for Sustainable Development. The framework uses the theory of change, which recognizes that urgent policy action is required globally, regionally and nationally to achieve sustainable development so that the drivers of undesirable change that have exacerbated biodiversity loss will be reduced and/or reversed to allow for the recovery of all ecosystems and to achieve the Convention's Vision of Living in Harmony with Nature by 2050.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

CITES aims to regulate international trade in species that are endangered or may become endangered if their exploitation is not controlled (CITES, 2012). CITES is implemented within Europe through two EC regulations (338/97 and 865/06 as amended). Species covered under CITES are listed in three appendices, with Harbour Porpoise listed in Appendix 2. This means that trade in the species is permitted as long as the authorities have ascertained that it will not be detrimental to the survival of the species; that the specimen was not obtained in contravention of the laws of that state for the protection of fauna and flora; and that any living specimen will be so prepared and shipped that it minimizes the risk of injury, damage to health or cruel treatment.

The Convention on the Conservation of Migratory Species of Wild Animals (CMS) and the Agreement on the conservation of small cetaceans of the Baltic, NE Atlantic, Irish and North Seas (ASCOBANS)

The Convention on Migratory Species (CMS), or Bonn Convention, sets out general provisions for the protection and conservation of certain migratory marine mammals (CMS Secretariat, 2012). Harbour Porpoise in the North Sea are listed in Appendix II. Appendix II includes species that have an unfavourable conservation status and that require international agreements for their conservation and management, as well as those that have a conservation status that would significantly benefit from the international cooperation that could be achieved by an international agreement.

One such agreement is the Agreement on the Conservation of Small Cetaceans in the Baltic, NE Atlantic, Irish and North Seas (ASCOBANS) and another the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS).

Convention on the Protection of the Marine Environment of the NE Atlantic (OSPAR)

The OSPAR Convention (replacing the Oslo and Paris Conventions) is the mechanism by which 15 governments of the coastal states of NW Europe, together with the European Commission, cooperate to protect the marine environment of the NE Atlantic with a particular focus on marine pollution, as well as providing for the conservation and protection of habitats and species.

Article 2(1)(a) states "the Contracting Parties shall, in accordance with the provisions of the Convention, take all possible steps to prevent and eliminate pollution and shall take the necessary measures to protect the maritime area against the adverse effects of human activities so as to safeguard human health and to conserve marine ecosystems and, when practicable, restore marine areas which have been adversely affected".

Harbour Porpoise are listed by OSPAR as a threatened and declining species, with a focus on tackling bycatch. OSPAR is also providing the oversight for the regional sea assessments of Good Environmental Status required for the Greater North Sea and the Celtic Seas by the Marine Strategy Framework Directive (see section 1.10). These assessments incorporate Good Environmental Status (GES) indicators covering trends in Harbour Porpoise distribution and abundance (Indicator Abundance and Distribution of Cetaceans), as well as bycatch (Indicator Marine Mammal By-Catch) and pollution (Pilot Indicator Trends and Status of Persistent Chemicals in Marine Mammals). Full, updated indicator assessments have been published within OSPARs Quality Status Report in 2023[13].

[13] https://oap.ospar.org/en/ospar-assessments/quality-status-reports/qsr-2023/indicator-assessments/

The Bern Convention

The Convention on the Conservation of European Wildlife and Natural Habitats (or the Bern Convention) is covers most of the natural heritage of the European continent and extends to some states of Africa (European Union 1979). Harbour Porpoise in the North Sea are listed in Appendix 2 'strictly Protected Fauna Species', for which the following activities are prohibited:

- all forms of deliberate capture and keeping and deliberate killing;
- the deliberate damage to or destruction of breeding or resting sites;
- the deliberate disturbance of wild fauna, particularly during the period of breeding, rearing and hibernation, insofar as disturbance would be significant in relation to the objectives of this Convention;
- the possession of and internal trade in these animals, alive or dead, including stuffed animals and any readily recognisable part or derivative thereof, where this would contribute to the effectiveness of the provisions of this article.

There is also a requirement for contracting parties to coordinate "efforts for the protection of the migratory species specified in Appendices II and III whose range extends into their territories". For Member States of the European Union, the provisions of the Bern Convention are largely taken up in the 1992 Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC), otherwise known as the 'Habitats Directive'.

European Directive of Natural Habitats and Wild Fauna and Flora (92/43/EEC) (commonly known as the Habitats Directive) 1992

The Habitats Directive transposes the Bern Convention in EU law. Harbour Porpoise are listed in Annex IV of the Habitats Directive as 'Animal and Plant Species of Community Interest in Need of Strict Protection'. Article 11 requires Member States to monitor the conservation status of the habitats and species listed in the annexes; Article 17 requires an assessment of conservation status to be sent to the European Commission every 6 years. In the Directive, conservation status is defined as "the sum of the influences acting on the species that may affect the long-term distribution and abundance of its populations". Conservation status can be considered favourable if:

- population dynamics data indicate that the species is maintaining itself on a long- term basis as a viable component of its natural habitats;
- the natural range of the species is neither being reduced nor is likely to be reduced in the foreseeable future; and,
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Under Article 12, Member States shall take the requisite measures to establish a system of strict protection for the animal species listed in Annex IV(a) in their natural range, prohibiting: (a) all forms of deliberate capture or killing of specimens of these species in the wild (i.e. bycatch); (b) deliberate disturbance of these species, particularly during the period of breeding, rearing, hibernation and migration; and (d) deterioration or destruction of breeding sites or resting places. Member States are required to undertake further research or introduce conservation measures to ensure that incidental capture and killing does not have a significant negative impact on the species concerned. This is specifically relevant for Harbour Porpoise.

Under Articles 3 and 4, Member States contribute to an ecologically coherent network of protected areas known as Special Areas of Conservation (SACs) for those species listed in Annex II if suitable sites can be identified. This includes Harbour Porpoise.

Annex III of the Directive sets out general criteria for selecting SACs:

- Criterion a. Size and density of the population of the species present on the site in relation to the populations present within the national territory;
- Criterion b. Degree of conservation of the features of the habitat which are important for the species concerned and restoration possibilities;

- Criterion c. Degree of isolation of the population present on the site in relation to the natural range of the species; and
- Criterion d. Global (overall) assessment of the value of the site for the conservation of the species concerned'.

Since the introduction of the Habitats Directive, Member States have had difficulties identifying suitable SACs for Harbour Porpoise, particularly in meeting the criterion covering the size and density of the population largely due to the mobility of the species.

International Convention for the Regulation of Whaling 1946

The International Whaling Commission (IWC) was set up under the International Convention for the Regulation of Whaling, which was signed in Washington, D.C., in December 1946 (IWC, 2012). The purpose of the convention is to "provide for the proper conservation of whale stocks and thus make possible the orderly development of the whaling industry". Each year, the IWC Scientific Committee, through its Sub-Committee on Small Cetaceans, identifies priority species/regions for consideration by a review. Topics considered include distribution, stock structure, abundance, seasonal movements, life history, ecology, and directed and incidental takes.

EU Common Fisheries Policy (CFP)

One of the objectives of Regulation EU 1380/2013 of the European Parliament and of the Council on the Common Fisheries Policy (CFP) is that the CFP shall implement the ecosystem-based approach to minimize negative impacts of fishing activities on the marine ecosystem. Such requirements are detailed in the Technical Measures Regulation (EU) 2019/1241, and Article 3, Paragraph 2(b) notes '*ensure that incidental catches of sensitive marine species, including those listed under Directives 92/43/EEC and 2009/147/EC, that are a result of fishing, are minimised and where possible eliminated so that they do not represent a threat to the conservation status of these species*'. For this purpose, conservation measures such as modifications or additional devices to reduce incidental capture of endangered, threatened and protected species, or limitations on the use of certain fishing gears, shall be adopted. Also, highly relevant is the request that Member States should collect data on fleets and their fishing activities under the data collection framework (DCF) to support the CFP. Member States should manage the collected fisheries data and make them available to end-users and other interested parties. These data include biological, environmental, technical and socio-economic aspects, for example data on the impact of fisheries on biological resources and the marine ecosystem.

In December 2022, the European Commission adopted fisheries measures to protect Harbour Porpoise in six SACs in the North Sea. These are the German sites Sylt Outer Reef, Borkum Reef Ground, Dogger Bank and Eastern German Bight; and the Dutch sites Cleaver Bank and Frisian Front[14].

EU Marine Strategy Framework Directive (MSFD) 2008

The Marine Strategy Framework Directive (MSFD, Directive 2008/56/EC) requires Member States of the European Union to develop marine strategies that apply an ecosystem-based approach to the management of human activities while enabling a sustainable use of marine goods and services. Priority should be given to achieving or maintaining good environmental status in the community's marine environment, continuing its protection and preservation, and preventing subsequent deterioration[15]. To determine Good Environmental Status (GES), 11 qualitative descriptors have been selected. In 2017, OSPAR published its intermediate assessment for the 11 Descriptors which included Harbour Porpoise in Biodiversity Indicators M4 Cetacean Abundance and Distribution and M6 Marine Mammal Bycatch. The first EU-wide limit for underwater noise have been developed by

[14] https://oceans-and-fisheries.ec.europa.eu/news/fisheries-and-nature-conservation-increased-protection-natura-2000-sites-north-sea-2022-12-08_en

[15] https://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/marine-strategy-framework-directive/index_en.htm

the MSFD Technical Group on Underwater Noise. The threshold limit clarifies that to be in a "tolerable" status, no more than 20% of a given marine area can be exposed to continuous underwater noise over a year; and no more than 20% of a marine habitat can be exposed to impulsive noise over a given day, and no more than 10% over a year[16].

EEU Environmental Impact Assessment (EIA) Directive (85/337/EEC) 1985

The EIA Directive (85/337/EEC) calls for assessment of the impacts on the environment of certain public and private projects which are defined in Annexes I and II of the Directive. A mandatory EIA is required of all projects listed under Annex I, which are considered to have significant effects on the environment. Projects listed under Annex II are at the discretion of Member States and subject to consideration by the national authorities as to whether an EIA is required, taking criteria detailed in Annex III into account. The majority of projects that may impact common dolphins, such as offshore renewable development, are listed under Annex II.

EU Strategic Environmental Assessment (SEA) Directive (2001/42/EC) 2003

The SEA Directive calls for an environmental report in which the likely significant effects on the environment and the reasonable alternatives of the proposed plan or programme are identified. The public and the environmental authorities are informed and consulted on the draft plan or programme and the environmental report prepared. As regards plans and programmes which are likely to have significant effects on the environment in another Member State, the Member State in whose territory the plan or programme is being prepared must consult the other Member State(s).

The SEA and EIA differ as follows:

- the SEA requires the environmental authorities to be consulted at the screening stage;
- scoping (i.e. the stage of the SEA process that determines the content and extent of the matters to be covered in the SEA report to be submitted to a competent authority) is obligatory under the SEA;
- the SEA requires an assessment of reasonable alternatives (under the EIA the developer chooses the alternatives to be studied);
- under the SEA Member States must monitor the significant environmental effects of the implementation of plans/programmes to identify unforeseen adverse effects and undertake appropriate remedial action.
- the SEA obliges Member States to ensure that environmental reports are of a sufficient quality.

The SEA Directive applies to a wide range of public plans and programmes. An SEA is mandatory for plans/programmes which are:

- prepared for agriculture, forestry, fisheries, energy, industry, transport, waste/ water management, telecommunications, tourism, town & country planning or land use <u>and</u> which set the framework for future development consent of projects listed in the EIA Directive.

OR

- have been determined to require an assessment under the Habitats Directive.

Broadly speaking, for the plans/programmes not included above, the Member States have to carry out a screening procedure to determine whether the plans/programmes are likely to have significant environmental effects. If there are significant effects, an SEA is needed. The screening procedure is based on criteria set out in Annex II of the Directive.

[16] https://environment.ec.europa.eu/news/zero-pollution-and-biodiversity-first-ever-eu-wide-limits-underwater-noise-2022-11-29_en

Annex 2: UK and Norway National Legislation

United Kingdom

On 1 January 2021, the UK ceased to be a member of the European Union. Whilst much of the European legislation already in place through the national legal system was rolled over, with two new key pieces of national legislation introduced: the Fisheries Act 2020 and the Environment Act 2021.

From 1 January 2021, the UK took responsibility for fisheries management within its Exclusive Economic Zone (EEZ) when it left the European Union and the Common Fisheries Policy ceased to apply.

Fisheries Act 2020

The Fisheries Act 2020 established the legal commitment to fish sustainably, to achieve maximum sustainable yield for each stock and to regulate fishing in order to protect the marine environment. The Fisheries Act notes that the UK will take an ecosystem-based approach to ensure that any negative impacts on marine ecosystems are minimised and, where possible, reversed, and to ensure that incidental catches of sensitive species are minimised and, where possible, eliminated. The Fisheries Act provides the framework for fisheries management in UK waters, including the need for a Joint Fisheries Statement and the development of Fisheries Management Plans.

Fisheries management is devolved to each of the UK administrations. The Joint Fisheries Statement (JFS) outlines the strategies adopted across the nations to meet sustainability and other objectives of the Fisheries Act. The development of the JFS and subsequent Fisheries Management Plans provide an important opportunity for fisheries and marine conservation science communities to work together with neighbouring states to positively shape the future management of fisheries. The JFS reiterates the commitment to minimise and where possible eliminate the bycatch of sensitive species such as cetaceans.

Since March 2022 all fishing vessel licences now contain a mandatory requirement to report the occurrence any marine mammal bycatch within 48 hours of return to port.

Environment Act 2021

Environment Act includes marine and coastal environments within its definition of environment. However, thereafter there is no explicit consideration. The Act introduces the concept of legally binding targets against which implementation progress can be measured. The UK Government have indicated that these targets will include marine biodiversity through a focus on protected areas, resource productivity and plastic pollution. Key indicators for the marine environment, however, are those originally developed under the UK Marine Strategy.

UK Marine Strategy

The UK Marine Strategy and the achievement of Good Environmental Status also emphasises the urgent need to reduce bycatch. The UK Governments have agreed that the same indicators that have been adopted through OSPAR will be utilised in UK waters. This includes indicators M4 Cetacean Abundance and Distribution and M6 marine Mammal Bycatch.

Marine Wildlife Bycatch Mitigation Initiative

The Marine Wildlife Bycatch Mitigation Initiative (BMI) has also been introduced, which outlines how the UK will achieve its ambitions to minimise and, where possible, eliminate the bycatch of sensitive marine species such as Harbour Porpoise.

The BMI brings together existing work and commits to work that will enable the UK to meet its national and international obligations. Five policy objectives have been identified:

- Improve our understanding of bycatch and entanglement of sensitive marine species through monitoring and scientific research.
- Identify "hotspot" or high-risk areas, gear types and/or fisheries for bycatch and entanglement in the UK in which to focus monitoring and mitigation.
- Develop, adopt and implement effective measures to minimise and, where possible, eliminate bycatch and entanglement of sensitive marine species.
- Identify and adopt effective incentives for fisheries to implement bycatch and entanglement mitigation measures.
- Work with the international community to share best practice and lessons learned to contribute to the understanding, reduction and elimination of bycatch and entanglement globally.

Addressing bycatch whilst simultaneously ensuring productive commercial fisheries is complex and challenging. There is no "one size fits all" approach, instead there needs to be focused, local solutions for each fishery where the bycatch of marine wildlife has been identified as an issue.

This initiative acknowledges the need for fisheries policy authorities to work closely with stakeholder groups across the actions identified to minimise and, where possible, eliminate bycatch of sensitive marine species. These stakeholders include the fishing industry, Non-Government Organisations (NGOs), scientists, experts and innovators.

Norway

The Nature Diversity Act 2009

The purpose of this Act is to protect biological, geological and landscape diversity and ecological processes through conservation and sustainable use, and in such a way that the environment provides a basis for human activity, culture, health and well-being, now and in the future, including a basis for Sami culture.

The Act implements Norway's various international commitments, including those of the Bern Convention and the Convention on Biological Diversity. The Act makes provisions for species and habitat protection. It's implementation in the marine environment is supported by fisheries acts.

The Marine Resources Act 2017

This Act makes provision with respect to the management and conservation of marine living resources. The Act also provides rules relative to marine fishing, with the principal responsibility for administration and control being held by Fisheries Directorate.

Pinger Mandate 2020

This mandate requires all gill net vessels operating in the Vestford to use pingers from 1 January 2021. The mandate has been extended to incorporate over 5000 coastal gill net vessels in an effort to ensure that the USA Marine Mammal Protection Act requirements are being met, enabling the continuation of fisheries exports.

Annex 3: Summary of pressure information

Primary Pressures

Primary pressures result in direct additional mortality to the population.

Bycatch

Entanglement and subsequent fatality in commercial and recreational fishing gears, predominantly static nets

Evidence base: STRONG

Bycatch is recognised as being the most significant anthropogenic threat to harbour porpoise through its range (Bjørge et al., 2013; Reeves et al., 2013; Brownell et al., 2019; Calderan & Leaper, 2019; Evans et al., 2021; Maeda et al., 2021; Moore et al., 2021; Rogan et al., 2021; Scottish Government, 2021; Königson et al., 2022).

Monitoring of marine mammal bycatch has been incorporated within the Common Fisheries Policy Data Collection Framework (DCF) following the repeal of Regulation (EC) 812/2004. While progress was made in the reporting of bycatch by Member States since Regulation 812/2004 was implemented, the quality of data on bycatch rates of harbour porpoise from some countries was poor, which hindered accurate estimates of population bycatch rate (STECF, 2019). This was due to a lack of reliability in fishing effort data, poor (low) coverage of relevant fisheries, and a lack of reporting for vessels <10m and for recreational fisheries (ICES, 2021). With the incorporation of marine mammal bycatch monitoring within the DCF, the overall suitability and appropriateness of this approach needs to be continuously assessed and monitored, particularly in fisheries where there are no dedicated marine mammal observers.

Member States of the European Union have obligations under Article 12 of the Habitats Directive to monitor the impact of bycatch to determine whether it is having a negative impact on conservation status. With the possible exception of the UK, such monitoring has rarely been implemented and nor has the legal requirement been enforced (Read *et al*., 2017; Pinn et al., 2021). This is however changing, with the EU having commissioned work to ascertain where key risk areas exist. This work concluded that potential areas of concern in the Greater North Sea area was the use of gillnets in the eastern part of the English Channel (year-round), and seasonally in parts of the Skagerrak and German Bight (Evans et al., 2021; Figure A1). Although not part of the Greater North Sea conservation plan area, concerns were also raised with regard to gillnet use the western English Channel between July and September. It is possible that individual porpoise in this area may also use the Greater North Sea plan area.

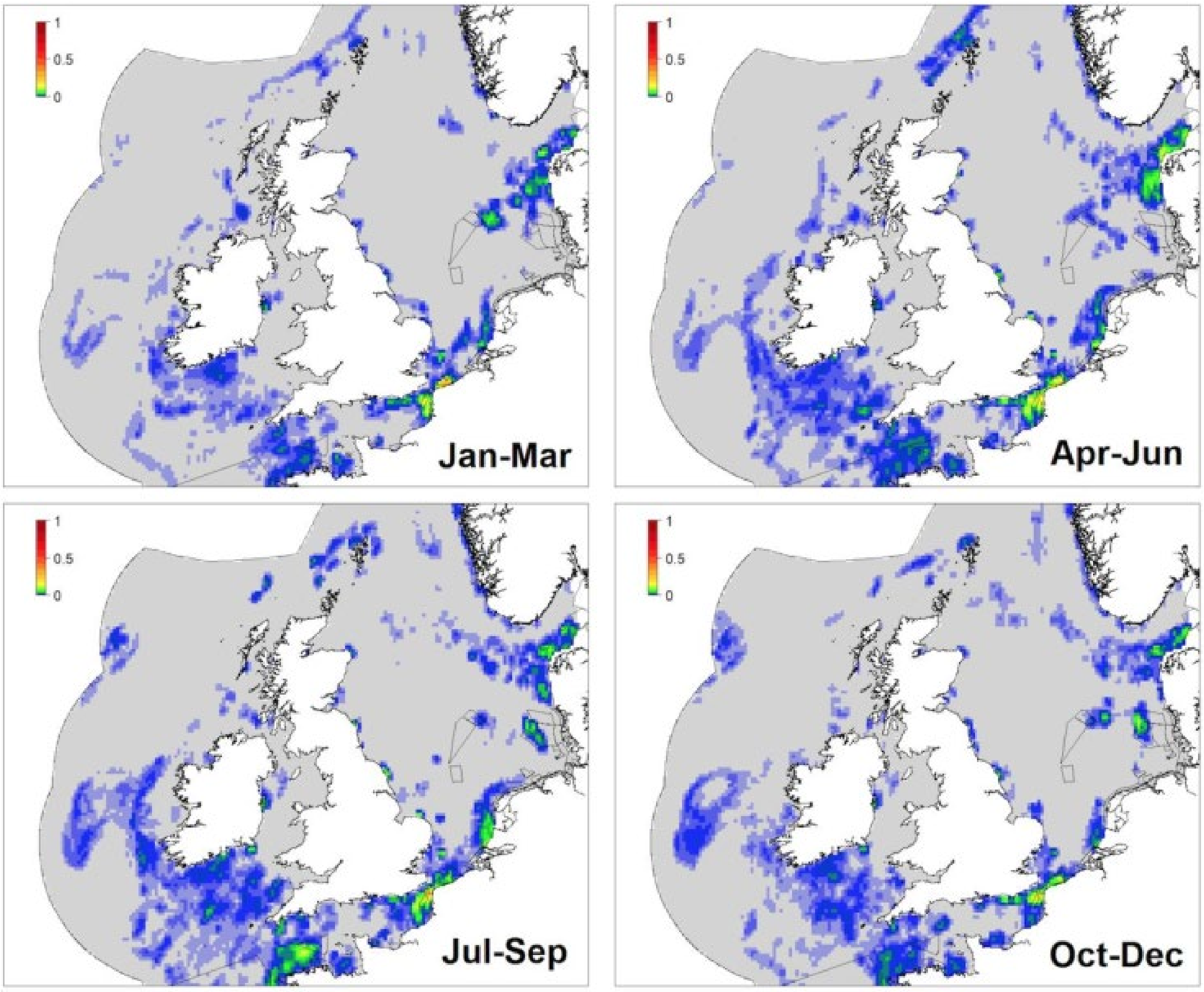

Figure A1: Risk map for the interactions between harbour porpoise and gillnets by season. Taken from Evans et al. (2021).

Evidence gaps:

The legal requirements to monitoring bycatch outlined in the Habitats Directive have been poorly implemented by most Member States. This has hampered the accurate assessment of bycatch as there has been little monitoring of bycatch on smaller static net fishing vessels. More comprehensive information on fishing effort (e.g. soak time and net length) in relevant fisheries is required to more accurately estimate bycatch rates and thus enable an effective assessment to be carried out to inform management (ICES, 2022).

Within the MSFD, OSPAR have developed a common bycatch indicator for marine mammals, including harbour porpoise. Bycatch estimates are derived from annual fishing effort (days at sea) and observations made of bycaught animals and/or remote electronic monitoring on commercial fishing vessels (> 12m).

In 2009, ICES advised the European Commission that a Catch Limit Algorithm management framework approach is the most appropriate method to set limits on the bycatch of harbour porpoise, depending on data availability. However, in order to adopt such an approach, specific conservation objectives are required and work on defining these conservation objectives was not progressed, hampering the further development of the MSFD bycatch indicator.

In 2019, a joint HELCOM/OSPAR workshop proposed an interim management objective: "The mortality rate from incidental catches should be below levels which threaten any protected species, such that their long-term viability is ensured". Based upon the recommendations from this workshop, the following operational objective was included in OSPAR's North-East Atlantic Environment strategy 2030 (NEAES 2030): *OSPAR will work with relevant competent authorities and other stakeholders to minimise, and where possible eliminate, incidental by-catch of marine mammals, birds, turtles and fish so that it does not represent a threat to the protection and conservation of these species and will work towards strengthening the evidence base concerning incidental by-catch by 2025* (operational objective S7.O6). The current parameterisation of this objective was decided to provide a conservation objective against which future projections of populations could be compared when exposed to different levels of by-catch, in order to define thresholds. OSPAR agreed on parameterisation for the ASCOBANS conservation objective "*a population should be able to recover to or be maintained at 80% of carrying capacity, with probability 0.8, within a 100-year period*". The assessment concluded that bycatch levels were exceeding the conservation thresholds in the Greater North Sea, the Irish and Celtic Seas, West Scotland and Ireland, and the Iberian Peninsula (Taylor et al., 2022).

Management and mitigation:

Further development of the conservation objectives and the framework approach for determining bycatch thresholds is required. Such approaches allow the development of robust triggers and limits to enable the ASCOBANS specified conservation objectives to be met by allowing the impact of anthropogenic removal within and across Member States to be more fully assessed and effectively managed.

These approaches can determine anthropogenic removal (bycatch) triggers (signaling a need for more urgent and stronger management action) and anthropogenic removal (bycatch/environmental) limits (i.e. 'critical' or 'unacceptable' point) using a population-dynamics integrated modelling framework (ASCOBANS 2015).

Research and monitoring programmes are required to obtain the scientific information necessary to inform management - e.g. assessment of the existence of management units and estimation of bycatch rates, abundance and life history parameters, and development of bycatch mitigation measures. In order to facilitate these approaches:

I. Continued and improved data collection is required through the relevant OSPAR and ICES data calls to strengthen the datasets, particularly where significant gaps are identified in order to obtain:
   - improved understanding of level of bycatch and subsequent risk to management unit/ population levels, informing the anthropogenic removal limits for the species and triggers for management/mitigation;
   - information to identify trends in abundance and establish if the current level of management is appropriate;
   - more detailed information on static net soak times and placement and where these gears are operating in order to effectively target management of bycatch (e.g. ICES 2022).

II. Dedicated observer programmes are required to monitor bycatch levels for informing the required level of management. Remote Electronic Monitoring (REM) has also been identified as a useful tool in monitoring/predicting bycatch rates when used in combination with other data such as fishing effort and population density (Scheidat and Königson, 2015; Kindt-Larsen et al., 2016; STECF, 2019).

III. Strandings analysis data indicate cause of death and identify possible risk of bycatch in relation to risk of other identified causes. The UK strandings programme has consistently identified bycatch as a major cause of death in harbour porpoise (Pinn, 2008; CSIP, 2011, Deaville et al., 2018). Notably, the use of these data have limitations due to the nature of the sample population and therefore should be used in conjunction with other monitoring methods.

IV. Acoustic deterrent devices (pingers) may be required in fisheries identified as medium-to-high risk (e.g. Pinn, 2023). These have generally proven very effective (Dawson et al., 2013; Larsen & Eigaard, 2014; Kyhn et al., 2015, Kindt-Larsen et al., 2019; McGarry et al., 2020; Brennecke et al., 2022; Königson et al., 2022; Moan & Bjørge, 2023). However, a balance needs to be met between efforts to reduce bycatch and the need to avoid disturbance and exclusion from important feeding areas.

V. Monitoring harbour porpoise abundance in relation to stock assessments of important prey species for inclusion of data in spatial-based bycatch risk assessments, i.e. identify spatial areas of concern for fisheries management measures (e.g. Ransijn et al 2019; Ransijn et al., 2021).

Level of Risk: Given the good evidence for this pressure and the risk of population level impact, this pressure should have **VERY HIGH PRIORITY**.

Serious or fatal injury (not bycatch)

Ship strike from commercial and recreational vessels

Evidence Base: WEAK

Data are gathered through strandings analysis and observation. There are relatively few records of vessel strike as a cause of death (IAMMWG et al., 2015). For example, they account for <2% of the causes of death determined through post-mortem in the UK (Deaville et al., 2018). Vessel strikes are perhaps not likely to occur frequently due to the avoidance behaviour of porpoises (Polachek and Thorpe, 1990; Camphuysen and Siemensma, 2011). However, small species such as harbour porpoise may have a low probability of stranding following a vessel strike depending on where it occurs in relation to land, and the other driving forces such as wind and current which determine where they end up.

Evidence gaps:

As the evidence base is weak, further research is required in order to identify the risk and establish the parameters which are likely to increase the risk of collision with vessels. Relying on strandings data limits the conclusions which may be drawn, given the limitations of sampling the population.

Management and mitigation:

Speed restrictions, area avoidance and onboard observers have been considered for larger species (e.g. Vanderlaan *et al*., 2008; Vanderlaan & Taggart, 2009; David *et al.*, 2011; Silber *et al*., 2013). However, evidence of risk is lower for smaller cetaceans such as harbour porpoise. There are examples of mitigation for smaller cetaceans, such as the Aberdeen Harbour (UK) Code of Conduct[17] for bottlenose dolphins, but without more evidence to support the need, these types of mitigation are less likely to be implemented or enforced effectively.

Level of risk: Given the scale of evidence for vessel collision, this is considered to be **LOW PRIORITY.**

Collision with sub marine structures such as wet renewables

Evidence Base: MODERATE

Modelling work has suggested that interactions between tidal turbines and harbour porpoises could

[17] http://d80a69bd923ff4dc0677-b849429a75dd6216be63404a232a877c.r8.cf3.rackcdn.com/Dolphin_Code_Leaflet.pdf

be common, assuming porpoises occur in tidal-stream areas at densities similar to other coastal habitats (Wilson et al., 2014). Subsequently, where installations have occurred, porpoises were found to avoid the structures with no collisions recorded (Gillespie et al., 2021; Palmer et al., 2021).

Evidence gaps:

As the evidence base is restricted to Scottish waters, further research may be required in other locations to determine the transferability of the results.

Management and mitigation:

Currently a 'deploy and monitor' approach has been adopted for the further development of wet renewables by some Member States, for example the Scottish- commissioned guidance on monitoring of wet renewables in situ[18].

Level of risk: Given the scale of evidence for wet renewable collision, this is considered to be **LOW**.

Unexploded ordnance and use of explosives

Evidence Base: MODERATE

Conventional ammunition has been discarded in waters all over the world. Dumping in coastal waters and on the High Seas represented a "quick and dirty" method to get rid of surplus material and problematic waste. For the North Sea, demilitarization of existing arsenals following WW II was almost exclusively achieved by dumping at sea, and large amounts of legacy unexploded ordnance are still present (Koschinski & Kock, 2015). This ordnance could present a significant risk to individual harbour porpoises, causing death or permanent hearing loss, although the population-level consequences could not be judged (von Benda-Beckmann et al., 2015).

Evidence gaps:

The scale of the threat posed by blasting and the decay of underwater unexploded ordnance has not been quantified. This is in part because even the military possess little information on the exact location of disposal sites, their contents and the risks they pose to the environment. In addition, ammunitions were also often dumped in transit to dumping sites.

Management and mitigation:

Guidelines and mitigation options for minimising the risk of injury to marine mammals from using explosives should be followed. An example of which are the JNCC guidelines for minimising the risk of disturbance and injury to marine mammals whilst using explosives (JNCC, 2021[19]). These outline measures to minimise potential injury from the use of explosives from activities such as harbour construction, well-head or platform decommissioning and unexploded ordinance clearance.

There are also a variety of techniques for handling and removing ammunition including freezing, the use of robotic equipment, Water Abrasive Suspension cutting, disposal in a Static Detonation Chamber and photolytic destruction of explosive substances. If underwater detonations cannot be avoided, suitable mitigation measures need to be introduced. Test detonations demonstrated that it was possible to reduce the danger area by over 98 % when using a double bubble curtain.

Level of risk: Given the frequency of explosive use, this is considered to be **LOW**.

[18] https://www.nature.scot/professional-advice/planning-and-development/renewable-energy-development/types-renewable-technologies/marine-renewables/wave-and-tidal-energy

[19] https://hub.jncc.gov.uk/assets/24cc180d-4030-49dd-8977-a04ebe0d7aca

Secondary pressures

Secondary pressures result in health degradation, with indirect effect on demography.

Chemical pollution

Introduction of chemical pollution to the marine environment through terrestrial industrial development, terrestrial run-off, and from harbours, ships, aquaculture, sewer discharges, re-suspension, etc.

Evidence Base: STRONG

There is clear evidence that polychlorinated biphenyls (PCBs) and other endocrine disrupting chemicals are an issue for cetaceans within the North-east Atlantic (Law *et al.*, 2012; Jepson *et al.,* 2016). Endocrine disrupting chemicals (EDCs) (e.g. chemicals with hormone-like properties) have the ability to act at low doses, show delayed effects (of sexual dysfunction and physical abnormalities) that are not evident until later in life or until future generations, and have the potential to show combination effects when exposed to multiple pollutants (Bergman *et al*., 2013; Ingre-Khans *et al*., 2017; Murphy *et al.*, 2018).

Exposure to pollutants, namely organochlorines such as PCBs, has been suggested to induce immune-suppression (Hall et al. 2006, Yap et al. 2012), as well as impact thyroid function (Schnitzler et al. 2008) and potentially foetal and newborn survival (Murphy et al. 2015) in North Sea porpoises (reviewed in Murphy et al. 2019). Case-control epidemiological studies reported that the risk of mortality from infectious disease in harbour porpoises in UK waters increased in a dose-dependent manner with increasing blubber PCB concentration, with a 50% increase in relative risk of infectious disease mortality at concentrations of total PCBs >25 mg/kg lipid in the blubber (Jepson et al. 2005, Hall et al. 2006, ICES WGMME 2010). Female porpoises with high pollutant burdens were more likely to die from ill health, as 93% (14 of 15) of mature females with ΣPCB burdens ≥30 mg/kg died as a result of infectious disease or “other” causes such as starvation, and these cause of death groups also comprised 92% (23 of 25) of the pollutant sample ≥20 mg/kg (Murphy et al. 2015). Nutritional stress in mature female harbour porpoises led to a higher offloading to offspring of lipophilic PCBs, causing a greater potential for toxicity in those calves (van den Heuvel-Greve, et al. 2021). Gestational and lactational transfer of more toxic congeners has been reported due to their chemical makeup, e.g. lower chlorinated (van den Heuvel-Greve, et al. 2021, Williams et al. 2020b, Williams et al. 2023).

Although harbour porpoises carry lower levels of PCBs than some other fish-eating species in European waters, such as the bottlenose dolphin and striped dolphin (Jepson *et al*., 2016), the effects of exposure to lower doses of EDCs may not be of a magnitude less, particularly when exposure occurs during critical periods of development (Murphy *et al*., 2015; 2018). While there is evidence that PCBs in harbour porpoises have declined over time, at least in UK waters including the North Sea, a high proportion of animals were exposed to concentrations deemed to be a toxicological threat (Williams et al. 2023).

Evidence gaps:

The effects from exposure to legacy and emerging pollutants on health and reproductive status (in both sexes) should be extended to cover the Greater North Sea. So far, investigations into the effects of pollutants on reproduction in male harbour porpoises is lacking.

OSPAR is developing a common marine mammal persistent chemicals indicator (see management and mitigation). In order to further develop this indicator for monitoring, continued time-series analysis of trends in PCBs and other contaminants, as well as assessments of power to detect trends (i.e. annual sampling required), wherever possible using stranded and bycaught animals, is required. Indicator development also requires key dataflow from strandings networks across the ASCOBANS range, which includes standardising sampling and data collection protocols for pollutants from stranded and bycaught animals, and biopsy of free-living animals, as well as the development of a standardised reporting methodology, and employment of international standardisation protocols for chemical analysis (Williams et al. 2023). Further work on the development of thresholds for the contaminants of concern is required, including continued exploration of dose-response relationships, as well as the additive and synergistic effects of exposure to multiple pollutants, including new emerging pollutants (Williams et al. 2023). In addition to, further assessments of confounding factors such as age, body condition, reproductive activity and health status on individual pollutant loads.

Management and mitigation:

A number of conventions and directives address aspects of chemical pollution (e.g. Stockholm Convention) which need to be fully implemented. The effectiveness of the Stockholm Convention was re-evaluated, the results of which were published in 2023 and based on current rates of elimination, the Convention will not achieve its 2025/28 targets, notably for PCBs[20]. Within Europe, production of PCBs ceased in the 1980s and the main uses of PCBs in products were banned in 1986, with disposal being targeted (OSPAR, 2010). Despite this, there is a need for renewed steps to reduce PCB inputs into European marine environments (addressed by the revised EU Regulation 2019/1021 on persistent organic pollutants) as well as the continued monitoring of their toxic effects on species, including top predators (Jepson et al. 2016, Stuart-Smith and Jepson, 2017, Williams et al. 2023).

Descriptor 8 under the MSFD 'concentrations of contaminants are at levels not giving rise to pollutant effects', necessitates the development of a marine mammal contaminants indicator with associated thresholds (Williams et al. 2023), work that was proposed by the ICES WGMME (2014), and further developed by OSPAR. For the OSPAR 2023 quality status report a 'pilot assessment of status and trends of persistent chemicals in marine mammals' was conducted which created a database of pollutant levels, based on national input, to review potential species and chemicals for the assessment, discussed assessment criteria, as well as knowledge gaps and next steps (Pinzone et al. 2023)[21]. To aid such, work was undertaken to develop appropriate methodological standards using data collected by the established UK marine mammal pollutant monitoring programme to assess the trends and status of PCBs in harbour porpoises (Williams et al. 2023). The study further outlined recommendations for improving the quality of the assessment going forward, both for the harbour porpoise and other potential marine mammal species and persistent chemicals, including detailing monitoring requirements for the successful implementation of such an indicator.

To date, monitoring of pollutants in Harbour Porpoises has been largely restricted to legacy pollutants, and toxic trace elements (e.g. Mendez-Fernandez et al. 2022). A European-based risk list of priority pollutants for monitoring specifically in marine mammals should be devised. Screening of contaminants of concern on the updated EU surface water watchlist for emerging pollutants (EU 2015/495), particularly those pollutants identified as endocrine-disrupting chemicals, needs to be undertaken (Murphy et al. 2021).

Level of risk: Given evidence to suggest some contaminants are still posing an issue for Harbour Porpoise, this pressure has **MEDIUM PRIORITY**.

[20] https://chm.pops.int/Implementation/EffectivenessEvaluation/Outcomes/2023Outcomes/tabid/9559/Default.aspx
[21] Pilot Assessment of Status and Trends of Persistent Chemicals in Marine Mammals (ospar.org)

Prey depletion

Reduction in availability of prey species due to overfishing, habitat degradation from pollution or destruction, or potential effects of environmental change.

Evidence Base: **MODERATE**

For any species, there is a balance between the energy expended in acquiring food, the energy provided by that food and its subsequent expenditure to maintain body processes, such as thermoregulation, growth, and reproduction (Pierce et al. 2022).

Harbour Porpoises, which are also known as the aquatic shrew, have a large body surface to volume ratio and thus, individuals need to consume relatively large amounts of food to sustain their high metabolic rate. This leads to the need for ultra-high foraging rates and ultra-high capture rates of high energy density prey (Wisniewska et al 2016, 2018). Harbour Porpoises in the Greater North Sea have shown a preference for energy rich sandeels, based on habitat modelling, and dietary, telemetry and fisheries survey data (Gilles et al. 2016, Ransijn et al. 2019). They have re-distributed within the region from northern to southern waters, leaving areas that were previously rich in sandeels to waters where their diet can be dominated by lower quality prey such as leaner gobies and gadoids (Leopold 2015). As noted previously, incidences of starvation in Harbour Porpoises have increased within the Greater North Sea in recent years. Stranded porpoises that were found to die from starvation in Dutch waters had fewer prey remains in their stomachs, and these prey were, on average, of lower quality (Leopold 2015), which may have been easier to catch for porpoises in poor health (IJsseldijk et al. 2021).

Maternal nutritional status in the region has been found to significantly affect foetal size, whereas globally it was reported that pregnancy rates were best explained by the energy density of prey eaten – though the global assessment did not fully consider health status of porpoises as such data were not available, and sampling biases between studies existed, e.g. bycaught vs. stranded animals (IJsseldijk et al. 2021).

Evidence gaps:

Research is required to strengthen evidence regarding the contemporary feeding ecology of Harbour Porpoise, through continued collection of stomach contents and tissue samples for fatty acid/stable isotope analysis, in addition to a regular review of changes in key prey species distribution and abundance. Continued ongoing evaluation of the impacts of fishing activities on Harbour Porpoise through inclusion of those species in ecosystem models, and an evaluation of their functional role in the ecosystem, are also required. Investigations need to be undertaken into how activities may change favoured habitats and subsequently impact prey species, to establish the level of risk to Harbour Porpoise.

Management and mitigation:

Further evidence is required to understand the complex relationship between Harbour Porpoise feeding ecology, spatial and temporal distribution of prey species and the effects of activities resulting in prey depletion. Effective fishery regulations based on good science may be the most effective management tool as opposed to mitigation of habitat change, unless risk is established.

In order to facilitate and improve our understanding, a multi-method approach is required to assessing Harbour Porpoise diet, its variation over time, and its relationships with health and reproductive success. Diet and body condition assessments should be routinely determined for on stranded animals. Studies on health status are also essential to help interpret information of diet and condition, e.g. to determine whether apparent starvation has a pathological cause. An appropriate frequency of abundance and distribution data collection of predator and prey will enable identification of correlation with prey and cetacean distributions to help inform management priorities.

Level of risk: Attention to this threat should have **MEDIUM PRIORITY**.

Mechanical destruction of habitat

Reduction in quality or availability of habitat through destructive activities such as bottom trawling, infrastructure construction including offshore windfarm platforms, oil and gas development, gravel extraction, etc.

Evidence Base: **WEAK**

There is no direct evidence of the impact of habitat destruction on Harbour Porpoise although there is for other species (Evans, 2017). However, there is understanding of the general impact activities cause to habitat integrity (Harwood, 2001), which can be used to make some judgements on how activities may indirectly affect Harbour Porpoise.

Evidence gaps:

Research has not yet been prioritised towards assessing the impacts of destruction of habitat on the Harbour Porpoise, and thus research into establishing the level of risk of habitat change (deterioration) regarding the species is required. Further work considering how Harbour Porpoises use their habitat, e.g. feeding, reproduction, etc., is required to inform how activities may impact these behaviours, and will enable management discussion.

While impacts of noise exposure from offshore renewable energy developments have been considered within the Greater North Sea, including displacement of individuals during construction phases (see Vallego et al. 2017 and references therein), the alternation to habitats on a largescale from future planned renewable energy developments and impacts on the species has not been addressed. Some positive effects may be observed for Harbour Porpoises such as increased food availability due to reduced fishing, artificial reef effects, and the absence of vessels. However, to fully evaluate, an ecosystem approach to assessing any impacts of habitat degradation from such activities needs to be undertaken (Galparsoro et al. 2022).

Management and mitigation:

As the direct risk is considered low, any management of this threat will depend on evidence of the need. Restriction of activities and/or adaptation of methods based on Environmental Impact Assessments may be an option if evidence of an increased risk is forthcoming.

Level of risk: Given the weak evidence for this pressure (and therefore a need for further research) and the uncertainty as to its effects on the species, attention to this threat should have **LOW PRIORITY**.

Environmental change

Changes to ocean temperatures, conditions and therefore species movements which has knock on effects to predator/prey interactions and ecosystem function.

Evidence Base: **MODERATE**

There is clear evidence that environmental change is occurring and will impact the North-east Atlantic. Such changes have significant impacts on marine ecosystems including fluctuations in ocean temperature and chemical composition, primary productivity and the distribution and abundance of species (Bryndum-Buchholz et al., 2019; Albouy et al., 2020; Pinsky et al., 2020). Through a combination of changes in oceanic conditions and prey distribution and abundance, apex predators such as cetaceans are also impacted (Figure A2). However, the details of possible impacts upon cetaceans generally remain speculative.

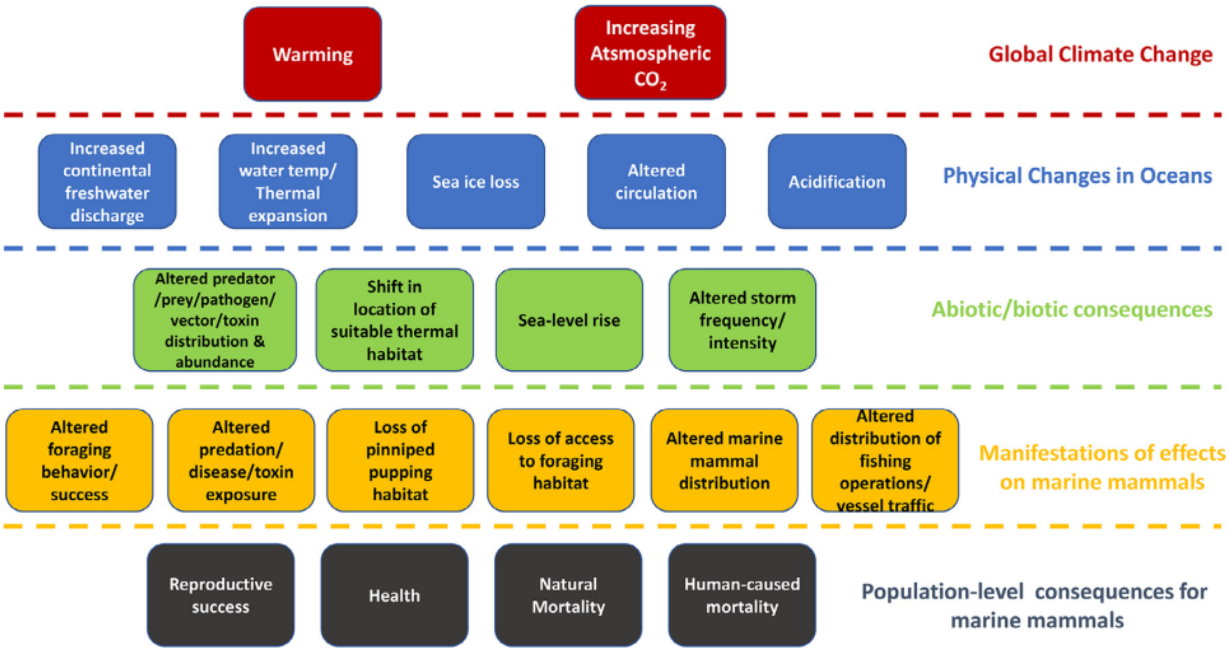

Figure A2: Schematic representation of climate change impacts on marine mammal populations. Taken from Gulland et al. (2022).

The challenge is to relate changes in distribution and occurrence to the impacts of anthropogenic caused climate change as there are many confounding effects, including natural climate variability, human exploitation of the prey resources, etc. and any changes observed could simply be the result of the cetacean species responding to short-term regional variability in the prey resource rather than long-term anthropogenically driven climate change.

Environmental change has the potential to result in a range expansion for harbour porpoise (MacLeod, 2009; van Weelden et al., 2021). Changes in prey distribution associated with the change in seawater temperature is considered to be the key driver of such change. For example, Sadykova et al. (2020) demonstrated that a change in the sandeel distribution when combined with the physiological requirements of harbour porpoise could result in a large shift in porpoise distribution, whilst the effects of changes in the herring population indicated little change in porpoise distribution.

Climate change may also result in an increase in fatal interactions with bottlenose dolphins (Gulland et al., 2022). Climate change is expected to lead to a northward expansion of the bottlenose dolphin range (van Weelden et al., 2021), leading to an increase in the distributional overlap between the two species. Where the two species are more likely to encounter one another, there will be an increased risk of fatal interactions occurring (Wilson et al., 2004; Haelters et al., 2011; Cotter et al., 2012). Based on post-mortem analysis between 2011 and 2017, bottlenose dolphin attack was the most common cause of death of harbour porpoise stranded in the UK (Deaville et al., 2018).

Evidence gaps:

Understanding of the effects of anthropogenic caused climate change on the global natural environment is poor due to the large number of variables and limitations of data from which to extract conclusions. Application of all relevant data and trends observed in harbour porpoise will need to be assessed against reported changes in climate, both anthropogenic and naturally induced, in order to begin to identify links and potential risks regarding the species viability. Parties should maintain a watching brief on range shifts (e.g. through the monitoring of sightings and strandings) in the species in relation to the impacts of climate change.

Management and mitigation:

A number of international and intergovernmental organisations and conventions are dealing with climate change and considering approaches to mitigate the potential effects on our marine environment.

Level of risk: This pressure is considered **MEDIUM PRIORITY**.

Cumulative impacts

The combined impact of pressures reduces resilience to any one pressure and is therefore an important consideration when developing management approaches

Evidence Base: **MODERATE**

Multiple activities affect the marine environment simultaneously, yet current management primarily considers activities independent of one another. A shift towards a more comprehensive management of these activities requires a means for evaluating their interactive and cumulative impacts (Halpern *et al.*, 2008; Nabe-Nielsen *et* al., 2014; National Academies of Science, Engineering and Medicine, 2017). This therefore calls for communication between Member States on pressures operating over a wider spatial extent, both at a national and international level. Such collaborative work on assessing cumulative impacts on Harbour Porpoises has been initiated by OSPAR, an update of which is expected as part of the 2023 Quality Status Report.

Evidence gaps:

In European waters, studies of cumulative impacts of pressures on the species have largely focused upon attempts to integrate sublethal effects relating to disturbance (mainly through noise) on physiological and behavioural changes (e.g. King et al., 2015, Booth et al. 2020, Keen et al. 2021). Often however, due to lack of empirical data such approaches assessing the population consequences of disturbance have weighed on expert judgment.

Due to the relatively small body size of the Harbour Porpoise, available empirical data suggest that moderate disturbance to foraging or increased energy expenditure could have severe fitness consequences (Wisniewska et al. 2016, Keen et al. 2021), though individuals may have some elasticity in recovery where only short lost foraging opportunities occur (Booth et al. 2019). If disturbance to foraging was severe however, this may impact survival (Rojano-Donate et al. 2018). Results of individual-based models highlighted that Harbour Porpoises in Danish waters were more sensitive to mortality from by-catch in commercial gill-net fisheries, the speed of food recovery following depletion, and presence of ships compared to wind turbine generated noise (Nabe-Nielsen *et* al., 2014). Further work is required to fill the evidence gaps in empirical data of the impacts of different human pressures upon Harbour Porpoises, including estimating exposure rates to key pressures and the dose-response relationship of each, as well as how those pressures interact, impacting not only foraging, but also homeostasis, growth, reproduction and survival (National Academics of Science, Engineering and Medicine 2017).

Management and mitigation:

A pre-requisite to any management proposals is the mapping of human activities believed to impact upon Harbour Porpoise so as to establish the extent to which they overlap dolphin abundance spatially and temporally, and to investigate further the conservation implications so that appropriate action can be taken.

Further development of OSPAR's systematic cumulative effects assessment for the species, an assessment that is integrated with the OSPAR common Indicator assessments and their associated data, will aid in the understanding of the consequences of cumulative effects. As defined by OSPAR, cumulative effects assessment is a systematic procedure for identifying and evaluating the significance of effects from multiple human activities. It can also provide an estimate of the overall expected impact in order to inform management decisions. Analysis of the causes, pathways of exposure and consequences of these effects on ecosystem components is an essential and integral part of the process[22].

Level of risk: This pressure is considered **MEDIUM PRIORITY.**

Tertiary pressures

Tertiary pressures result in behavioural disruption, with indirect effect on health and therefore demography.

Noise disturbance

Disturbance/displacement or damage due to noise disturbance in the marine environment

Evidence Base: MODERATE

Noise can be generated by a variety of different sources including oil and gas development (including seismic), fishing vessels and other maritime traffic, military activities, infrastructure construction (including pile driving for renewable energy developments), aggregate extraction, acoustic deterrent devices and recreational activities.

Sound sources can be categorised as continuous or impulsive. Most continuous noise at sea is caused by multiple sources, with shipping one of the most dominant sources (Kinneging, 2022). Impulsive sounds are of short duration and with a rapid onset (e.g., explosions, pile driving, seismic surveys, sonar), while continuous sounds are long lasting and do not have pulse characteristics (e.g., shipping, dredging). Impulsive sounds may be repeated at intervals (e.g., pile driving), and at distance will become diffused and may have a more continuous nature. High frequency sounds propagate less well in the marine environment than low frequency sounds, which can travel far in waters that are sufficiently deep.

Under the Marine Strategy Framework Directive (MSFD), there is a commitment through Descriptor 11 to ensure that 'introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment'. This is being assessed via two Criteria of Good Environmental Status (GES):

- D11C1 on "Anthropogenic impulsive sound in water" and
- D11C2 on "Anthropogenic continuous low-frequency sound in water"

There is general evidence regarding the impact of noise on small cetaceans including harbour porpoise (e.g. Dähne *et al*., 2013, Bergström *et al*., 2014; Williams *et al*., 2015; Culloch *et al*., 2016). Strandings analysis is the primary source of information regarding auditory damage, and offshore industry impact assessment reports for displacement and behavioural changes.

Evidence gaps:

Impulsive sound sources are capable of causing permanent hearing damage and blast injuries, and have been observed to cause temporary displacement of harbour porpoise. While effects on individual animals (Williams *et al*., 2015), there is uncertainty over whether and how the effects of sound on individuals are translated to the population or ecosystem scale (Nabe-Neilson et al., 2014; Merchant et al., 2022a; Lusseau et al., 2023). For example, between 2015 and 2019, there has been an increase in impulsive noise, with seismic activity being the dominant sound source and most

[22] https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/chapter-6-ecosystem-assessment-outlook-developing-approach-cumul/

reported activity occurring in the North Sea (Merchant et al., 2022b). This equated to 13% of harbour porpoise habitat being exposed to impulsive noise, but at this time it is not possible to say what proportion of the population was exposed (Merchant et al., 2022a). Monthly analysis across the five years indicated that exposure was greatest in August-October, with approximately 2% of the population density being exposed for 50% of the time. For the December-February period, the daily exposed habitat area was <2.5%, while during the March-October, it was typically <5%.

Overall, there is a need to develop more effective and consistent regulations for noisy activities at a European level, including but not limited to seismic surveys, pile driving, dredging, military activities, and to ensure the effective application of guidance and legal requirements at an appropriate spatial scale, taking into account cumulative impacts.

Parties and non-Party Range States should participate in the further development and maintenance of the MSFD Descriptor 11 to collate data on marine noise generation to inform management of cumulative stressors. Currently the indicator does not make an explicit assessment of the risk of population consequences, which must also take into account other stressors in addition to disturbance from anthropogenic impulsive sound. In addition, the Joint ASCOBANS/ACCOBAMS Noise Working Group should be maintained in order to better understand and collaborate on mitigation of noise impacts at suitable spatial scales.

Management and mitigation:

The scale of offshore wind installation in the OSPAR Maritime Area is expected to increase significantly over the next decade and beyond (OSPAR, 2023). Effort needs to be directed towards better assessments of impact of noise sources on harbour porpoises.

A number of mitigation measures have been identified to reduce the impact of activities producing noise e.g. for mitigating noise from pile driving for windfarms (Thompson *et al*., 2010; JNCC, 2010a, b; Bellmann, 2014; Nehls et al., 2016) and JNCC published guidelines for minimising the risk of injury and disturbance to marine mammals from geophysical surveys (JNCC, 2017). There is evidence to suggest that a soft-start approach to acoustic operations can reduce the impact on cetacean species, including common dolphins (Stone, 2015). The use of noise abatement systems in some pile driving operations in German, Danish, Dutch, and Belgian waters is thought to have successfully reduced exposure (Merchant et al., 2022a). Monitoring of any measures is essential to ensure effectiveness in meeting the objectives.

Level of risk: Given concerns over introduction of noise with regards to impacts on communication, navigation and displacement, this pressure has **MEDIUM PRIORITY**.

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