ENERGINET

ENERGY ISLAND BORNHOLM

ENVIRONMENTAL BASELINE NOTE
WP-F MARINE MAMMALS

05-09-2022

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Bright ideas. Sustainable change.

ENERGY ISLAND BORNHOLM

ENVIRONMENTAL BASELINE NOTE WP-F MARINE MAMMALS

ENERGINET

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CONTENTS

Abbreviation	Explanation
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas
Bern Convention	Convention on the Conservation of European Wildlife and Natural Habitats
Bird SPA	New bird SPA (Rønne Banke F129/DK00FC373) for long-tailed duck located between the two wind farm areas.
CC	Overlapping area in cable corridors
CC1	Cable corridor from Bornholm I wind farm area to Bornholm
CC2	Cable corridor from Bornholm II wind farm area to Bornholm
Client	Energinet
CMS	Convention on Migratory Species (Bonn Convention)
CR	Critical
DE	Germany
DCE	Danish National Center for Environment and Energy (Nationalt Center for Miljø og Energi)
DK	Denmark
dp10m	Detection positive ten minutes
dpd	Detection positive days
dph	Detection positive hours
DW	Dry weight
EEZ	Exclusive Economic Zone
EIB	Energy Island Bornholm (includes Bornholm I nord, Bornholm I syd and Bornholm II)
EU	European Union
GW	Giga watt
HELCOM	Helsinki Commission
Ind.	Individuals
IUCN	International Union for Conservation of Nature
LC	Least Concern
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
OWF	Offshore Wind Farm
OWF1 nord	Bornholm 1 nord
OWF1 syd	Bornholm 1 syd
OWF2	Wind Farm Area 2
C-POD	Cetacean and Porpoise detector
Pre-investigation area	Gross area for the survey including the wind farm areas (Bornholm I nord, Bornholm I syd and Bornholm II) and the area in between in Danish waters
SWE	Sweden
SAC	Special Areas of Conservation
SAMBAH	Static Acoustic Monitoring of the Baltic Harbour porpoise (research project)
SEA	Strategic Environmental Assessment
VO	Variation order
VU	Vulnerable

1 INTRODUCTION

The energy islands mark the beginning of a new era for the generation of energy from offshore wind, aimed at creating a green energy supply for Danish and foreign electricity grids. Operating as green power plants at sea, the islands are expected to play a major role in the phasing-out of fossil fuel energy sources in Denmark and Europe.

After political agreement on the energy islands has been reached, the Danish Energy Agency plays a key role in leading the project that will transform the two energy islands from a vision to reality. The energy island projects are pioneer projects that will necessitate the deployment of existing knowledge into an entirely new context.

In the Baltic Sea, the electrotechnical equipment will be placed on the island of Bornholm, where electricity from offshore wind farms will be routed to electricity grids on Zealand and neighbouring countries. The offshore wind farms will be constructed approximately 15 km south-southwest of the coast of Bornholm (Figure 1-1) and have a capacity of 3 GW.

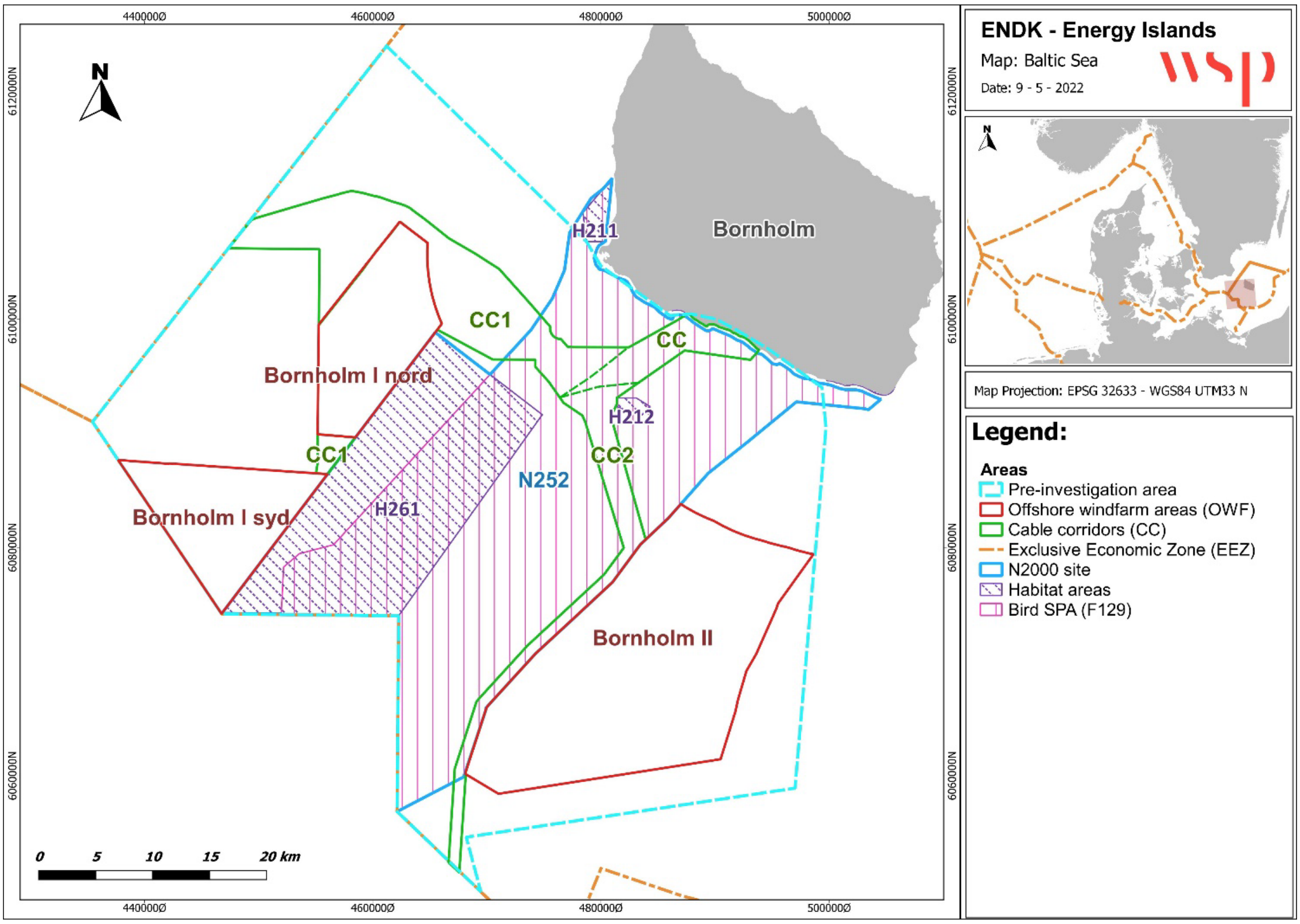


Figure 1-1. Energy Island Bornholm.

The environmental baseline note concerns the pre-investigation area, including the two planned windfarm areas (OWF1 and OWF2) and the cable corridors from the two OWFs to Bornholm (CC, CC1 and CC2) (Figure 1-1). Furthermore, the Natura 2000 site between the two wind farm areas as well as habitat areas within N252 are shown. Cable corridors to Zealand and neighbouring countries are not included in this environmental baseline note.

This document provides a description of existing data of the following parameters:

- Harbour porpoise (*Phocoena phocoena*)
- Harbour seal (*Phoca vitulina*)
- Grey seal (*Halichoerus grypus*)

Although other marine mammal species may on rare occasions visit the area, their occurrence can be neglected as the area will not have any importance for these species at the population level (soo for example results from the SCANS I, II and III surveys in Hammond et al. 2002, 2013 and 2017). Therefore, this report only reviews available information on these three species relevant for an assessment of potential impacts of the planned wind farm.

2 METHODOLOGY

The purpose of this note is to give a brief overview on the conservation status and biology of the three marine mammal species, regularly occurring in the Energy Islands Bornholm (EIB) pre-investigation area, namely the harbour porpoise (*Phocoena phocoena*), the harbour seal (*Phoca vitulina*) and the grey seal (*Halichoerus grypus*). This report is based publicly available literature (peer-reviewed journals as well as non-peer-reviewed reports) relevant to describe the spatial and seasonal presence of these three marine mammal species in and around the EIB pre-investigation area. Finally, first inferences about the potential importance of the EIB pre-investigation area for each of these three species will be discussed.

3 EXISTING DATA

Existing data for the three relevant marine mammal species in the pre-investigation area for EIB are presented below.

3.1 HARBOUR PORPOISE (*PHOCOENA PHOCOENA*)

3.1.1 CONSERVATION STATUS

Whilst the global status of the harbour porpoise is classified by the IUCN as least concern (LC, Braulik et al. 2020), the European population of the harbour porpoise is considered threatened and classified as vulnerable (VU), and the Baltic Proper population is classified as critically endangered (CR), which is the highest threatened status (IUCN 2007, Hammond et al. 2008). The European population and the Baltic Proper population are considered to be decreasing. The HELCOM (Helsinki Commission) Red List lists the Baltic Sea subpopulation as CR and the Western Baltic subpopulation as VU (HELCOM 2013). The national Danish Red List lists the harbour porpoise as VU. The German Red List lists the harbour porpoise as highly threatened (Meinig et al. 2020), the Swedish Red List as VU (HELCOM 2013).

Like all cetacean species, the harbour porpoise is included in Annex II and IV of the European Union (EU) Habitats Directive (92/43/EEG), meaning that it requires strict protection, including the designation of Special Areas of Conservation (SACs) by the European member states. EU member states are required to maintain a “favourable conservation status” of harbour porpoises. All whale species are also covered by the EU Marine Strategy Directive, where distribution, number and bycatch must be reported and evaluated according to descriptor 1.

The harbour porpoise is listed in Appendix II of the Bern convention (Convention on the Conservation of European Wildlife and Natural Habitats), meaning that it is strictly protected in member states. The harbour porpoise populations of the North and Baltic Seas are included in Appendix II of the Convention on the Conservation of Migratory Species of Wild Animals (CMS), also known as the Bonn convention. The CMS daughter agreement ASCOBANS (Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas) hosts a recovery plan for the Baltic harbour porpoise and a conservation plan for the harbour porpoise in the Western Baltic, Belt Sea and Kattegat (https://www.ascobans.org/en/documents/action-plans). Furthermore, the Baltic Sea states have agreed in HELCOM Recommendation 17/2 to protect the harbour porpoise in the Baltic Sea. For summary see Table 3-1.

The Danish National Center for Environment and Energy (DCE) assessed the conservation status of the harbour porpoise in Habitat Directive Article 17 from 2019 (Fredshavn et al. 2019) as follows: The population in the marine Atlantic region is considered as being of favourable conservation status. In the Baltic area the Belt Sea population is considered as having a favourable and the Baltic Proper population a highly unfavourable conservation status. However, in the DCE Marine areas report from 2021 (Hansen and Høgslung 2021) it is stated that the entire Belt Sea population of harbour porpoises has halved since previous counts in 2012 and 2016 to only about 17,301 individuals. On the other hand, acoustic monitoring in the Flensborg Fjord; Bedgrund and the waters around Als and Lillebælt revealed an increase in acoustic detections of harbour porpoises from 2013 to 2020 (Hansen and Høgslung 2021).

Table 3-1. Listing of the harbour porpoise in international and regional conservation agreements and international and national Red Lists.

Species	IUCN (2017)	HELCOM Red List	National Red Lists	EU Habitats Directive	Bern Convention	Bonn Convention
Harbour porpoise *(Phocoena phocoena)*	Global: LC Europe: VU Baltic Proper: CR (Hammond et al. 2008a)	Baltic Sea: CR Western Baltic: VU	DK: VU DE: highly threatened SWE: VU	Appendix II and IV	Appendix II	Appendix II

3.1.2 BIOLOGY, DISTRIBUTION AND ABUNDANCE

The harbour porpoise (*Phocoena phocoena*) inhabits temperate to cold waters throughout the northern hemisphere and is the only cetacean species resident in the Baltic Sea (Kinze 1994, Benke et al. 1998). Harbour porpoise habitat use shows seasonal differences, and often the winter distribution is not known due to lack of survey data (e. g. Gilles et al. 2016). For some regions, offshore movement of harbour porpoises has been demonstrated during winter (Nielsen et al. 2018), but so far this was not found for harbour porpoises in the North and Baltic Seas. In general, harbour porpoise habitat use is considered to largely depend on prey availability, and harbour porpoise habitat use was shown to correlate with strong currents and the occurrence of fronts and eddies (e. g. Johnston et al. 2005, Pierpoint 2008), where prey usually concentrates.

Harbour porpoises in Danish waters (North Sea and Baltic Sea combined) may live up to about 23 years, however, fewer than 5 % seem to live longer than 12 years (Lockyer & Kinze 2013). Based on the study of bycaught and stranded individuals in Danish waters, Lockyer & Kinze (2013) reported both sexes to reach sexual maturity at about three years of age, with corresponding body sizes of about 143 cm in females and 135 cm in males. Ranges of mean body weight of bycaught individuals were 34-47 kg in females and 27-35 kg in males with only little seasonal variation (Lockyer & Kinze 2013). More recent data from bycaught and stranded harbour porpoises in German waters (North and Baltic Sea), however, showed that female harbour porpoises show first signs of ovulation only at a mean age of about 5 years, while average age at death was 5.7 years in the North Sea and only 3.7 years in the Baltic Sea (Kesselring et al. 2017). Newborn calves in the Belt Sea may be seen from April to October. The percentage of calves in the Belt Sea increased from May to June and reached a peak in July and August (Lockyer & Kinze 2013). The peak in mating seems to occur in July and August (Schulze 1996, Koschinski 2002, Lockyer & Kinze 2013). The gestation period is about 10.5 months, and the lactation periods spans from 8 to 10 months, such that many harbour porpoise females are pregnant and lactating at the same time (Schulze 1996, Koschinski 2002, Lockyer & Kinze 2013). The majority of the female harbour porpoises in the Baltic were found to have a reproduction rate between 0.7 and 0.8, so mature females would produce about two calves in three years (Koschinski 2002).

The most recent published information on harbour porpoise diet in the Baltic Sea is based on stomach content analysis of 339 harbour porpoises stranded and bycaught in the Danish and German Baltic Sea between 1980 and 2011 (Andreasen et al. 2017). The authors reported the diet of adult harbour porpoises to consist of mainly Atlantic cod (*Gardus morhua*, 36 %) and herring (*Clupea harengus*, 34 %), but also of gobies (*Gobiidae*, 25 %), eelpout (*Zoarces viviparus*, 7 %), sandeels (*Ammodytidae*, 5 %), sprat (*Sprattus sprattus*, 2 %), whiting

(*Mearlangius merlangus*, 2 %) and some other fish species (8 %) (Figure 3-1). Juveniles were found to take a much higher proportion of gobies than adults (25 %), which made up almost as much as cod (26 %) and substantially more than herring (18 %). Whitening (7 %) and sprat (6 %) were also taken at a slightly higher proportion than in adults, while sandeels made up only about 1 % of juvenile diet (Figure 3-1). Other fish species contributed about 11 % to juvenile diet. There was considerable seasonal variation in the diet composition of adults with cod and herring clearly dominating the winter diet (>80 %), while eelpout and sandeel only made up a significant proportion of the adult diet in summer (Figure 3-1). The more diverse juvenile diet also showed seasonal variation, but less so than in adults (Figure 3-1). These findings are mainly in line with earlier studies that also found cod, herring and gobies to make up the majority of prey items in Baltic harbour porpoises, however, some found a higher proportion of cod (e. g. Aarefjord et al. 1995, Benke et al. 1998, Lockyer & Kinze 2013). The diet of Baltic Sea harbour porpoises was found to be quite similar to harbour porpoises from the North Sea, except for sandeels and whiting appearing to be more important in the North Sea (Benke et al. 1998, Santos & Pierce 2003, Leopold 2015). In summary, harbour porpoises mainly live of pelagic fish species like herring and whiting and of semi-pelagic living cod. However, during the summer and especially for juvenile harbour porpoises, demersal fish species such as gobies and sandeels also play a significant role as prey.

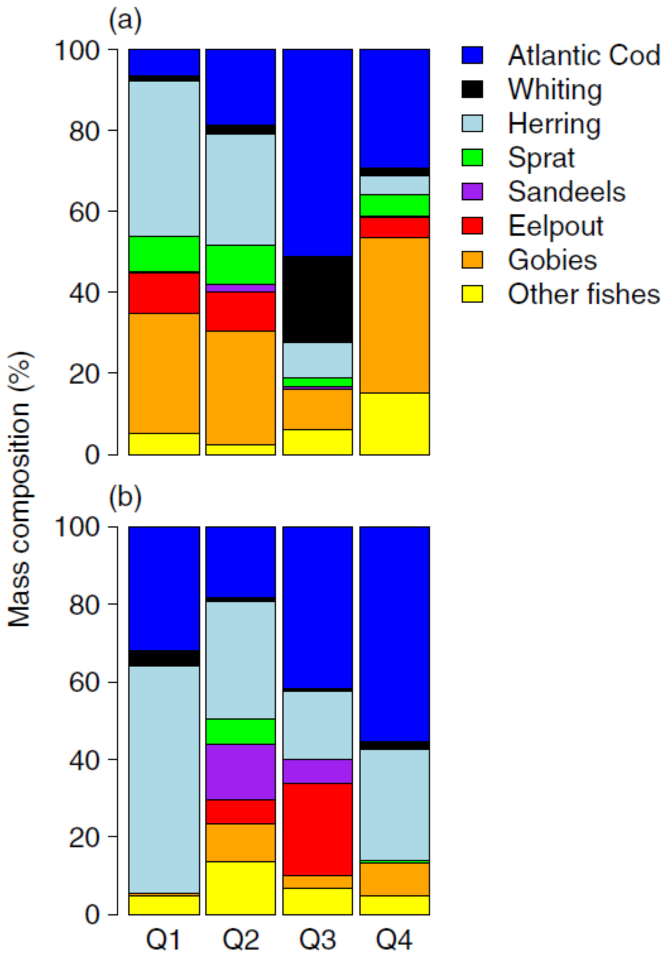


Figure 3-1. Quarterly prey mass composition in the diet of juvenile (a) and adult (b) harbour porpoises in the western Baltic Sea in the period 1980-2011. From: Andreasen et al. (2017).

Incidental information on harbour porpoise sightings, strandings and catches suggest that the historic distribution of harbour porpoises in the Baltic area once extended into the easternmost and northernmost parts of the Baltic Sea (Koschinski 2002). Still, in the early 20th century sightings were reported from Estonia and Latvia (Greve 1909 cited in Koschinski 2002) as well as from the northern Gulf of Bothnia (Levander 1905 cited in Koschinski

2002), but it is unclear whether these were vagrant animals or regular inhabitants. However, reports exist of mass deaths of harbour porpoises during icy winters in the Baltic Proper in the last century, and harbour porpoises were caught in gillnets under a bounty scheme for harbour porpoise catches in the Gdansk Bay area between 1922 and 1933. A report of five pregnant females bycaught in the Gdansk Bay and reports of traditional use of harbour porpoise oil along the Polish coast also exist. All this provides evidence that harbour porpoises were abundant at least as far east as Polish waters and in Danish waters around Bornholm (Koschinski 2002). According to Koschinski (2002), many studies and even a crude examination of sighting and stranding data support the generally held view that the number of harbour porpoises have declined and their distributional range in the Baltic has narrowed extensively.

Danish catch statistics reviewed by Kinze (1995) showed that in the Belt Sea region, a consistently increased catch of harbour porpoises occurred in the second half of the 19th century when the catch rate doubled in the Little Belt area. This may have led to an overexploitation initiating the decline of the Baltic harbour porpoise population. Mean annual catch rates in the Little Belt finally decreased from 1,195 harbour porpoises between 1871 and 1892 to only about 327 harbour porpoises during the second world war (Kinze 1995).

Catch statistics suggest that harbour porpoises in the Baltic Sea used to show strong migration patterns from the Baltic Proper into the Belt and Kattegat area during autumn and back into the Baltic Proper in spring (see Koschinski (2002) for review). Such strong migration patterns are no longer evident today, possibly because the present population in the Baltic Proper is so much smaller.

Harbour porpoises occurring in the Baltic Sea are thought to belong to three different (sub)populations (Skagerrak/North Sea, Belt Sea and Baltic Proper). Genetic and morphological evidence suggest that harbour porpoises inhabiting the Baltic Proper belong to a different (sub)population than harbour porpoises in the Skagerrak (which probably belong to the North Sea population of harbour porpoises) and harbour porpoises from the Belt Sea (sub)population, inhabiting the Kattegat, Sound, Belt Sea and western Baltic Sea (Wiemann et al. 2010, Benke et al. 2014, Lah et al. 2016, Tiedemann et al. 2017). Based on survey and acoustic monitoring data, Benke et al. (2014) suggested a management border for the Baltic Proper population around the Darss ridge. Sveegaard et al. (2015) provide a map with suggested overlapping zones between these populations based on survey and telemetry data. This suggested distributional border for the Baltic Proper population around the Darss ridge is west of the area where the Energy Island Bornholm is being planned (this area is called EIB pre-investigation area from now on). More recently, based on the distribution of harbour porpoise detections in the Baltic region, it was suggested that animals from the Belt Sea and Baltic Proper are separated during the summer from May to October (so including the breeding season) but have overlapping distribution patterns from November to April (Carlén et al. 2018). The seasonal management border proposed for the Baltic Proper population of harbour porpoises by Carlén et al. (2018) lies east of the Odra Bank (running from the Swedish mainland north of the island of Bornholm in south-eastern direction at a distance of about 30 km east of the island of Bornholm) and is thus further east than the one suggested by Benke et al. (2014). It lies about 80 km to the east of the EIB pre-investigation area. This means that detections within the EIB pre-investigation area would originate mainly from harbour porpoises belonging to the Belt Sea population during the summer months (May to October), whereas harbour porpoise detections during the winter months (November to April) could originate from both the Belt Sea and the Baltic Proper population. Figure 3-2 taken from Sveegaard et al. (2018) shows the suggested management areas for the separate populations, their transition areas as well as the suggested summer management border for the Baltic Proper population.

From passive acoustic monitoring data collected during the SAMBAH project (for more detail see chapter **Fejl! Henvisningskilde ikke fundet.**), the number of individuals of the Baltic Proper population was estimated at approx. only 500 animals during summer. Regardless of the special protection status, any disturbance or even removal of animals from this small population can lead to severe consequences for the well-being of this population. The Belt Sea population of harbour porpoises is estimated to consist of more than 20,000 individuals (SAMBAH 2016).

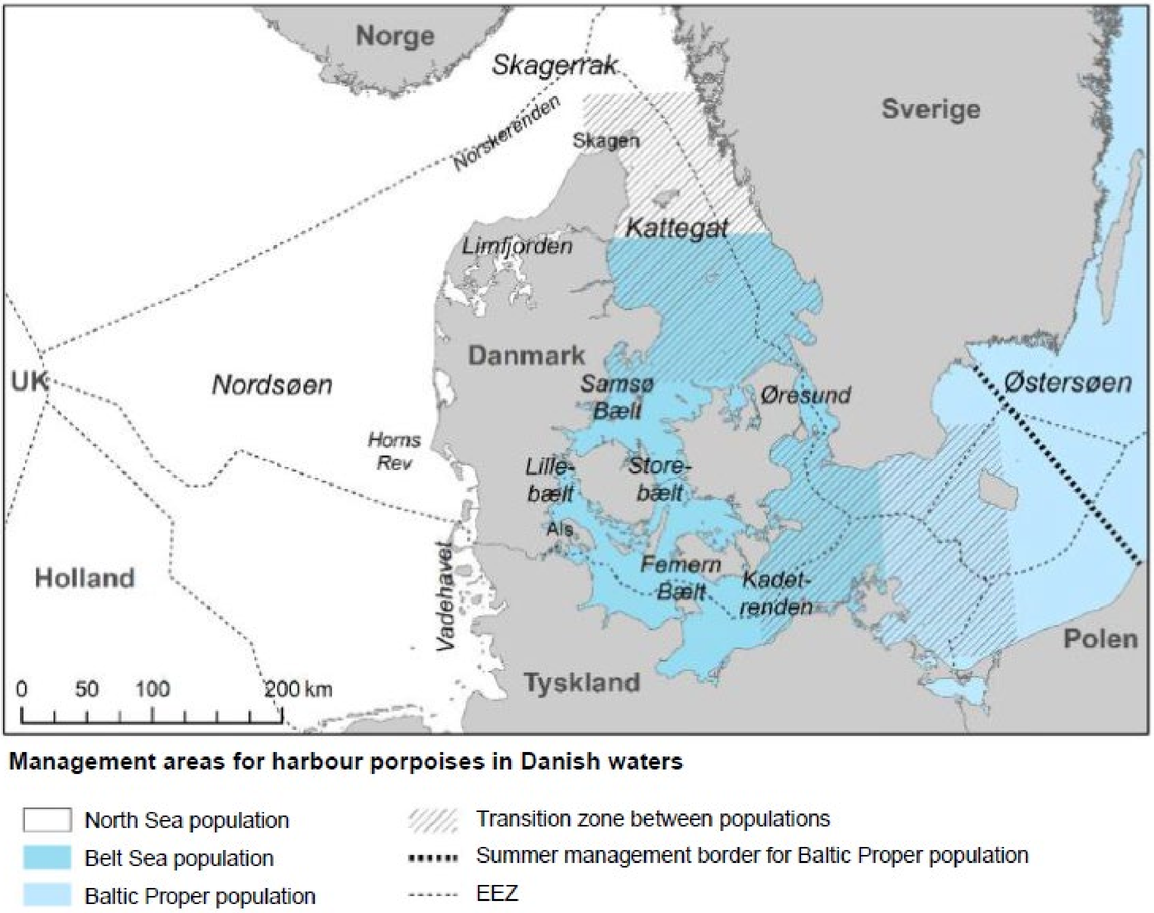


Figure 3-2. Map showing suggested management areas for the three harbour porpoise populations in Danish waters and neighbouring countries. Taken from: Sveegaard et al. 2018.

3.1.3 ABUNDANCE AND DENSITY AROUND THE ENERGY ISLAND BORNHOLM (EIB) PRE-INVESTIGATION AREA BASED ON VISUAL SURVEYS

Information on density and abundance of harbour porpoises in the Baltic Sea exists from several different sources: visual and acoustic surveys covering different parts of the Baltic Sea. Because of differences in methodology and in the area covered, it is not so easy to understand these estimates and follow what exactly they refer to, let alone compare them when looking at different studies. This is especially the case for the visual aerial based and ship-based surveys. In this chapter we present data from visual surveys in the Baltic Sea region. We start by summarising estimates originating from the large-scale SCANS and smaller-scale Mini-SCANS visual surveys, and then go on to present estimates stemming from more regional surveys around the EIB pre-investigation area conducted during national monitoring programs and for impact assessment studies of OWF development in adjacent German waters. Acoustic surveys will be covered in the next section 3.1.4.

SCANS and MINI-SCANS visual survey data

The first systematic surveys for harbour porpoise density in the Baltic Sea was the "Small Cetacean Abundance survey in the North Sea and adjacent waters" (SCANS-I survey) in July 1994 (Hammond et al. 2002), followed by the SCANS-II survey in July 2005 (Hammond et al. 2013) and SCANS III in 2016 (Hammond et al. 2017). During this study, the Baltic Sea area was covered from the Skagerrak in the north to Rügen in the east with ship-based surveys. Density and abundance estimates of harbour porpoises in the Baltic Sea based on the 2016 survey were 73,573 individuals with a density of 1.15 ind./km². Estimates for 2005 and 1994 were lower but considering the large confidence intervals associated with these calculations, no clear changes in abundance could be detected (Hammond et al. 2017; blue error bars in Figure 3-3).

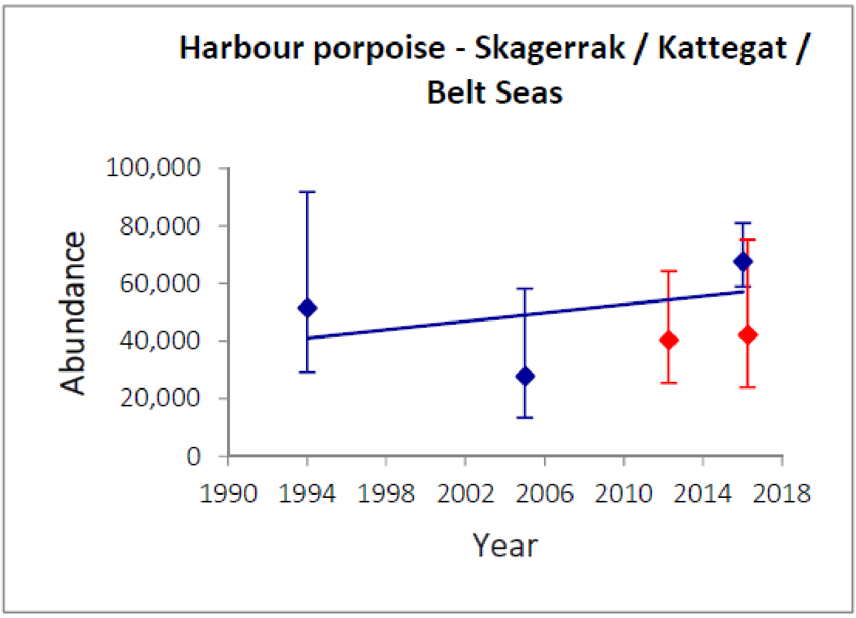


Figure 3-3. Estimates for harbour porpoises in the Skagerrak/Kattegat/Belt Seas area (blue) and for the Kattegat/Belt Sea population area (red). From: Hammond et al. (2017).

The area for which these estimates were calculated also includes the Skagerrak region and is therefore not only focused on the Belt Sea population. However, due to ongoing discussions about different populations of harbour porpoises in the Baltic Sea (see chapter 3.1.2) it is important to define a discrete management unit for each population (also see chapter 3.1.2). This means that the area that is used by animals from one population needs to be carefully defined and abundance estimates need to be calculated for this management unit (in this management area) and their development monitored over time in order to assess the populations conservation status. Therefore, in between large-scale SCANS surveys, two Mini-SCANS surveys were conducted in 2012 and 2020, especially focusing on the Belt Sea population of harbour porpoises, and some studies re-analysed data from the SCANS surveys to make them comparable to estimates calculated from Mini-SCANS surveys for the Belt Sea (sub)population of harbour porpoises. Defining such a management area (and thus a reference area for the calculation of abundance estimates) for the Belt Sea population of harbour porpoises is not trivial, however. Consequently, suggestions for such a management area also underwent some changes based on current scientific findings (also see chapter 3.1.2).

All this makes it a bit complicated to follow published harbour porpoise abundance estimates for the Baltic region and comparisons between these studies. To aid the understanding of the different areas used for surveys and calculations of published abundance estimates, we include in Figure 3-4 maps showing the different areas covered during different surveys. The areas covered during SCANS I, II and III are shown in Figure 3-4 a, b and d (light blue areas), while Figure 3-4 c and f show the area covered during two Mini Scans surveys in 2012 and 2020, and Figure e shows only a part of the SCANS III survey that was used to calculate abundance estimates for the Belt Sea population of harbour porpoises by Hammond et al. (2017). The dark blue hatched areas in Figure 3-4 a-f indicate the area that was suggested by Sveegaard et al. (2015) as a management unit for the Belt Sea population of harbour porpoises.

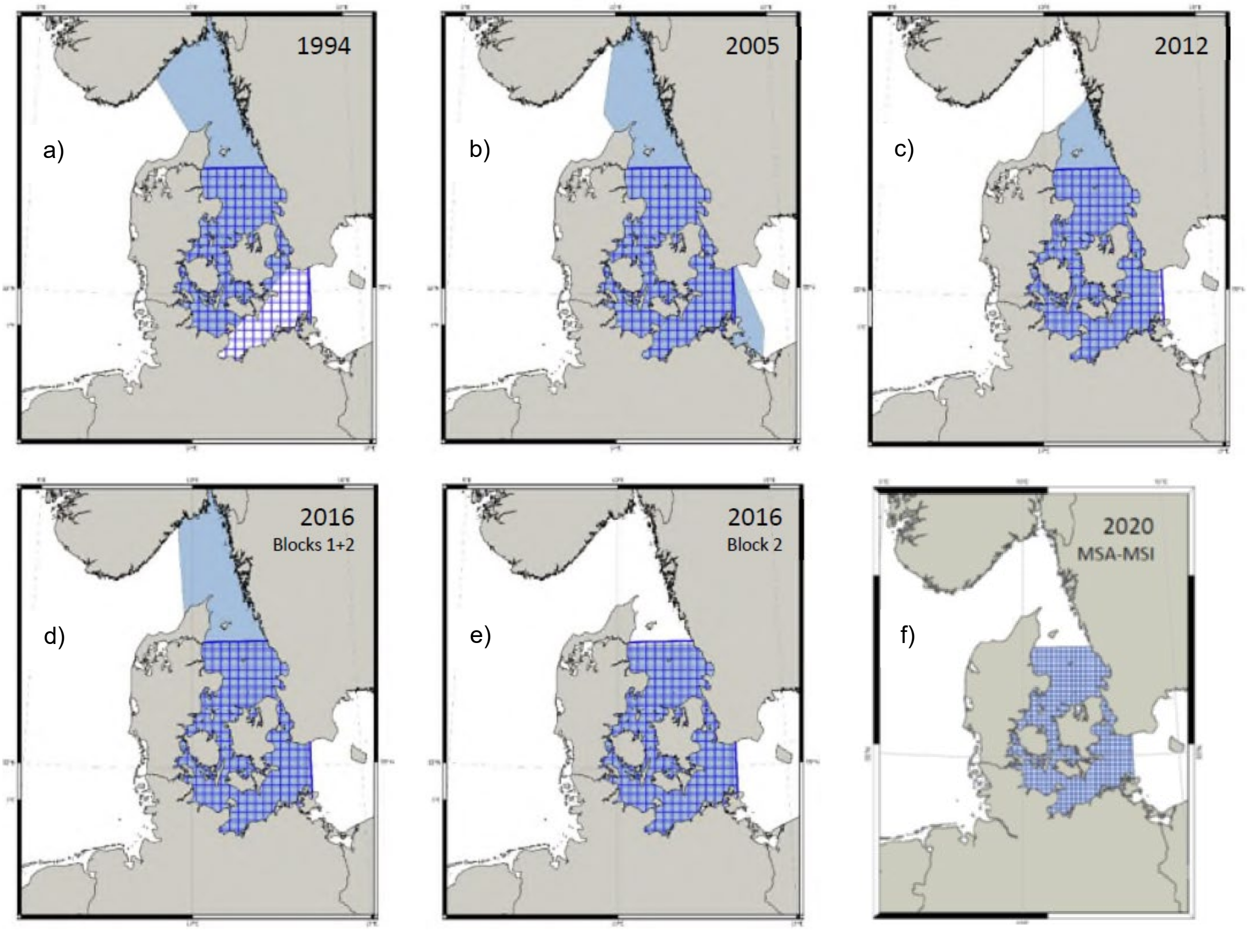


Figure 3-4. Area (light blue) covered during the three SCANS surveys in 1994, 2005 and 2016 and the MINISCANS surveys in 2012 (Viquerat et al. 2014) and 2020 (Unger et al. 2021) compared to the area (dark blue hatched) Sveegard et al. (2015) proposed as the area to represent the Belt Sea population; a) to e) from: Hammond et al. (2017) and f) from Unger et al. (2021).

In order to gain abundance estimates for the Belt Sea population of harbour porpoises, not including animals from the Skagerrak, Sveegaard et al. (2013) reanalysed the SCANS I and II data only including data from the Belt Sea/Kattegat area and also including data from the first MINI-SCANS survey in 2012 (coverage shown in Figure 3-4c). Based on this analysis the Belt Sea population was estimated to consist of 27,923 individuals (density: 1.13 ind./km²) in 1994, 10,614 individuals in 2005 (density: 0.35 ind./km²) and 18,495 individuals in 2012 (density: 0.61 ind./km²) (Figure 3-5), suggesting a decline in the Belt Sea population (Benke et al. 2014). However, as the authors state themselves, these density estimates also have large and overlapping confidence intervals (Sveegaard et al. 2013), indicating a considerable uncertainty in an assumed population trend.

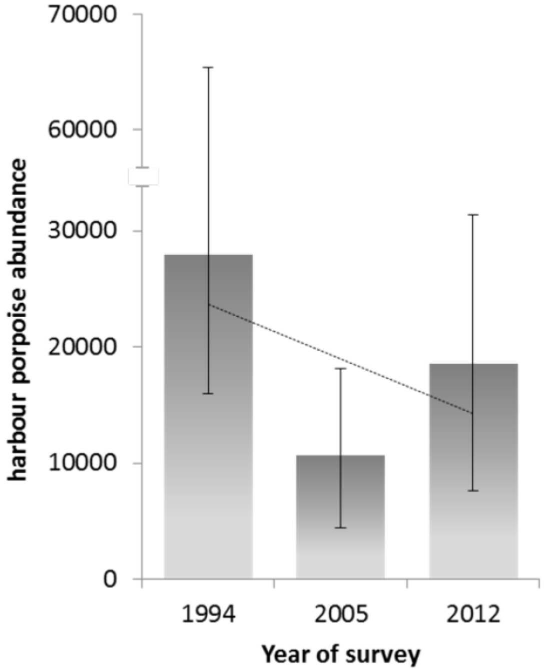


Figure 3-5. Estimated abundance for the Belt Sea population of harbour porpoises for three years based on aerial survey data. From: Sveegaard et al. (2013).

Hammond et al. (2017) also divided data from the SCANS III survey from the Baltic into two areas, with Block 2 (see Figure 3-4c for area covered) covering the Belt Sea. This area is not comparable to the subarea defined by Sveegaard et al. (2013), as it does not reach as far north and, unlike the area used by Sveegaard et al. (2013), includes the Sound and the area of the Kadet trench. Instead, they used the area definition proposed by Sveegaard et al. (2015) as the management unit for the Belt Sea population (dark blue hatched areas in Figure 3-4 a-f). Estimates for the Belt Sea population of harbour porpoises in 2016 in Block 2 were 42,324 harbour porpoises (density: 1.04 ind./km²) and were basically comparable to data from the MINISCANS survey in 2012, covering a similar area and giving abundance estimates of 40,475 animals (density: 0.79 ind./km²) (red bars in Figure 3-3). Given the large confidence intervals, no population change could be detected based on these two estimates (Hammond et al. 2017). Power calculation conducted by Hammond et al. (2017) stated that the annual decline in the harbour porpoise population in the Skagerrak/Kattegat/Belt Sea that could be detected with 80 % power would be 3.7 %. This means that any decline lower than 3.7 % in this population would only be detectable with a chance of below 80 %. This was calculated to give an impression about the chances of actually detecting population changes in this population.

However, such an estimate on the detectability of harbour porpoise population changes for the Belt Sea region alone is still missing. Also, as stated earlier, there is still an ongoing debate about the area that should be used as a management unit for the Belt Sea population (see Carlén et al. 2018). Most recently, Unger et al. 2021 presented data from a MINI Scans II survey, specifically designed to get an update abundance estimate for the Belt Sea population of harbour porpoises. They calculated an average harbour porpoise density of only 0.41 ind./km² (95 % CI: 0.28-0.61) and a resulting abundance of 17,301 harbour porpoises. This is the lowest density estimate for this population since the first SCANS survey in 1994 (Figure 3-6) and raises some concern as to the development and status of this population. However, as the authors state themselves, the variance of these new estimates and of especially the earlier ones is high and a dedicated trend analysis is still missing (Unger et al. 2021).

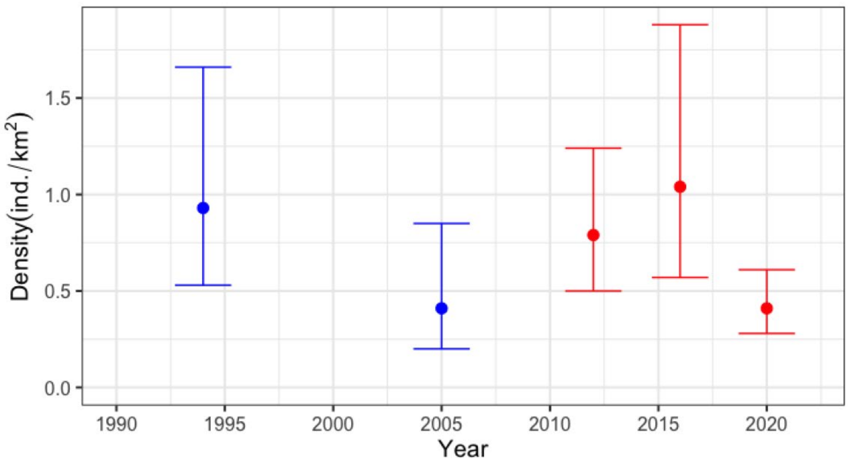


Figure 3-6. Harbour porpoise mean density estimates for surveys in the Belt Sea population region including the recent MiniSCANS II survey in 2020. Red error bars indicate estimates for the Belt Sea population only (see also Figure 3-3), blue bars include the Skagerrak to different extents. From: Unger et al. (2021).

German national monitoring data

While these large-scale SCANS surveys are useful for detecting general trends in harbour porpoise abundance within the Baltic, they provide only limited information about harbour porpoise habitat use around the EIB pre-investigation area, as their focus on large coverage comes with a lack of detail in sub-areas as transect lines are widely spaced. Also, potential seasonal changes cannot be detected, and for a region with harbour porpoise density as low as in the Baltic Proper, these surveys are not suitable for calculating densities. More regional estimates around the EIB pre-investigation area are available from aerial surveys conducted in German waters south of the EIB pre-investigation area between 2002 and 2006 (Scheidat et al. 2008) and from aerial surveys conducted as baseline investigations for offshore wind farm development in these German waters between March 2016 and February 2018 (IBL Umweltplanung et al. 2020).

From national monitoring data collected in the German part of the Baltic Sea, Scheidat et al. (2008) calculated harbour porpoise abundance estimates based on ten aerial surveys (covering between 1,921 and 3,400 km and lasting between 2 to 25 days) between 2003 and 2006 during the months March to September. They found harbour porpoise abundance to range from 1,352 harbour porpoises in March-April 2005 to 4,610 harbour porpoises in May 2005, not including one survey in March 2003 yielding an unusual low abundance of only 457 harbour porpoises. For the calculation of harbour porpoise density, they subdivided the survey area into three sub-areas (Figure 3-7), of which sub-area G represents the Pomeranian Bay from about the Darss ridge in the west to the northern and eastern borders of the German EEZ, which thus covers an area directly south of the EIB pre-investigation area. Other than in the more westerly sub-areas, where harbour porpoise density ranged between 0.01 and 0.64 ind./km² in sub-area E (Kiel Bight) and between 0.04 and 0.35 ind./km² in sub-area F (Mecklenburg Bight), estimated harbour porpoise density in the Pomeranian Bight (sub area G) was very low with 0 to 0.06 ind./km². Only during one survey in 2002 an unusual large aggregation of harbour porpoises was detected in the most easterly area, leading to an unusual high density estimate of 1.02 ind./km², which should be treated as an outlier (Scheidat et al. 2008). Also, the estimate of 0.06 ind./km² was only observed once in April 2005, while all other 11 surveys resulted in densities of only 0-0.008 ind./km² (Scheidat et al. 2008). All harbour porpoise sightings conducted during these surveys are summarised in Figure 3-7 and seasonal densities per grid cell corrected for survey effort are shown in Figure 3-8.

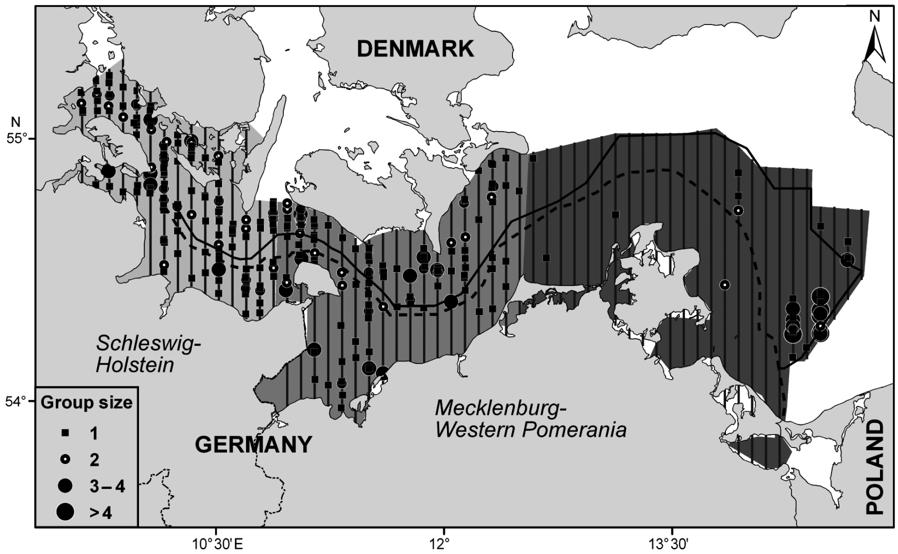


Figure 3-7. Map showing the area in the German Baltic Sea and its division into subareas for calculating harbour porpoise density estimates from aerial surveys between 2003 and 2006. Black squares and points indicate harbour porpoise sightings. Note that sightings in the easterly area originate from one survey only with an unusual high aggregation of harbour porpoises. From: Scheidat et al. (2008).

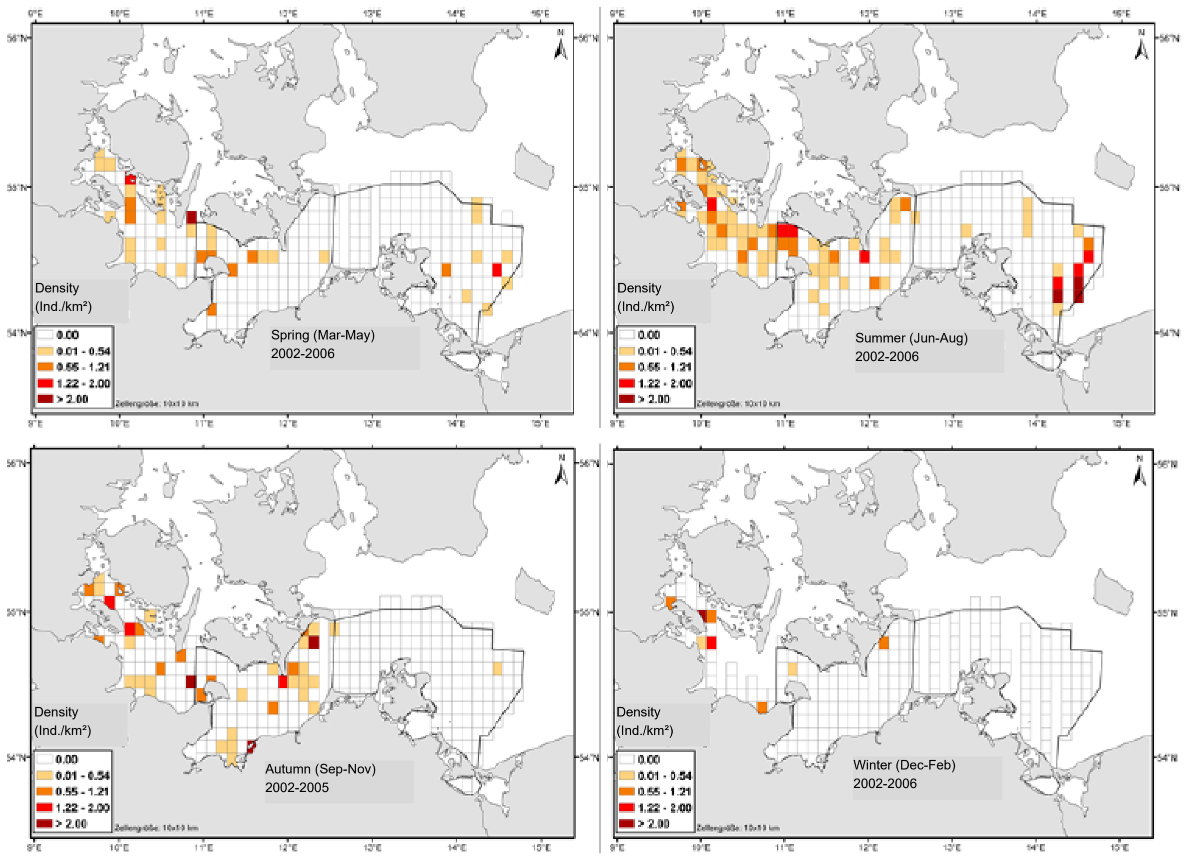


Figure 3-8. Map showing seasonal occurrence of harbour porpoises in the German area of the Baltic Sea based on sightings during aerial surveys between 2002 and 2006 (see Figure 3-7). Shown are density estimates per grid cell corrected for survey effort. From: Gilles et al. (2007a b).

Data from German OWF impact assessment studies

The most recent and detailed publicly available data on harbour porpoise occurrence around the EIB pre-investigation area originates from the environmental monitoring conducted in the offshore windfarm development area O-1.3 in the German EEZ directly south of the EIB pre-investigation area (IBL Umweltplanung et al. 2020). Here digital aerial (HiDef) and ship-based surveys were conducted in combination with passive acoustic monitoring. The transect lines used during digital aerial surveys (Figure 3-9) and those used for ship-based surveys (Figure 3-10) mainly cover the German area south of the EIB pre-investigation area, but also a small part of the north-western EIB pre-investigation area. A total of 20 digital aerial surveys (5,238 km of transect line) were conducted between April 2016 and February 2018 covering all months of the year. Between March 2016 and February 2018, 24 ship-based surveys were conducted with one survey every month and a total transect line of 3,051 km.

During the 20 aerial surveys, a total of eight harbour porpoise individuals were spotted during six sightings including one mother-calf pair (five individuals in 2016 and three individuals in 2017). All sightings but one occurred between June and September. Apart from one sighting in March, no sightings occurred between April and February (Table 3-2). All but one harbour porpoise sighting (which was at the north-western edge of the survey area) occurred in the southern third of the survey area (Figure 3-9). Seasonal densities calculated based on these data were 0.009 ind./km² in spring 2016, 0.003 ind./km² in summer 2016, 0.002 ind./km² in spring 2017 and 0.007 ind./km² in summer 2017 (Table 3-3). As no sightings were obtained during the other seasons, densities were 0 ind./km² in both years.

These data match well with density estimates presented by Scheidat et al. (2008) for the earlier surveys in the Mecklenburg Bight and show that the EIB pre-investigation area lies within an area where harbour porpoise density seems not to be substantially different from that in the rest of the Mecklenburg Bight region, which in general is a low harbour porpoise density area within the Baltic Sea.

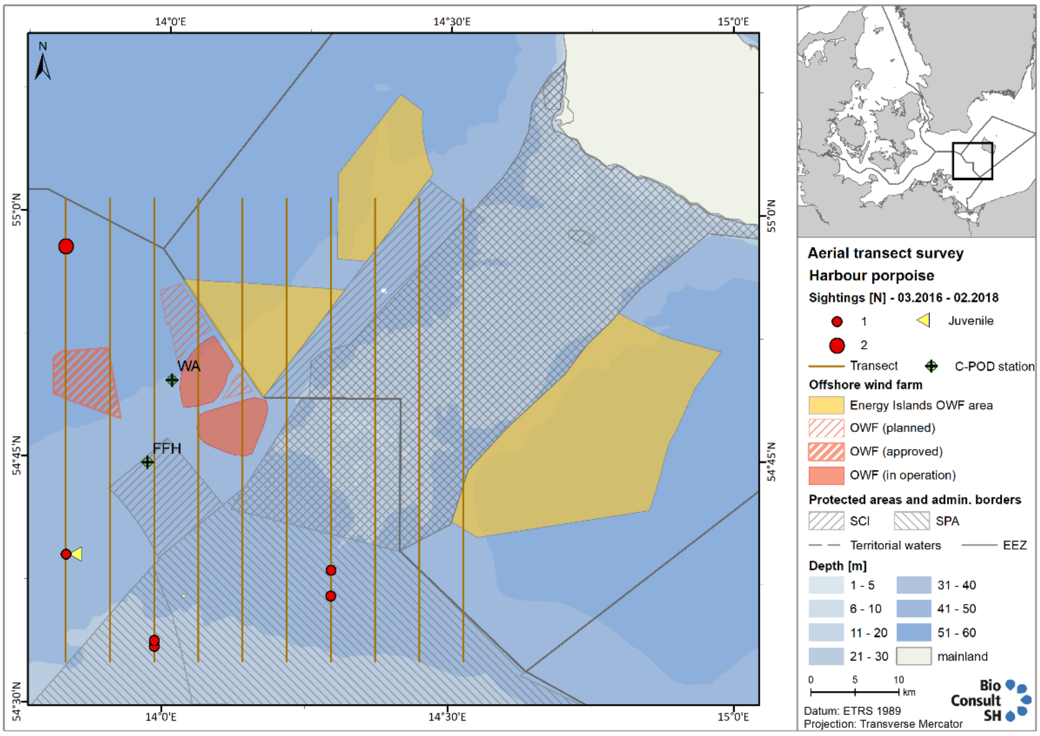


Figure 3-9. Transect design of aerial monitoring of marine mammals in the OWF planning area O-1.3 in the German EEZ between March 2016 and February 2018. Red points indicate harbour porpoise sightings during surveys between April 2016 and February 2018 (10 surveys). Black crosses indicate the two C-POD positions WA and FFH used for acoustic monitoring of harbour porpoises. From: IBL Umweltplanung et al. (2020).

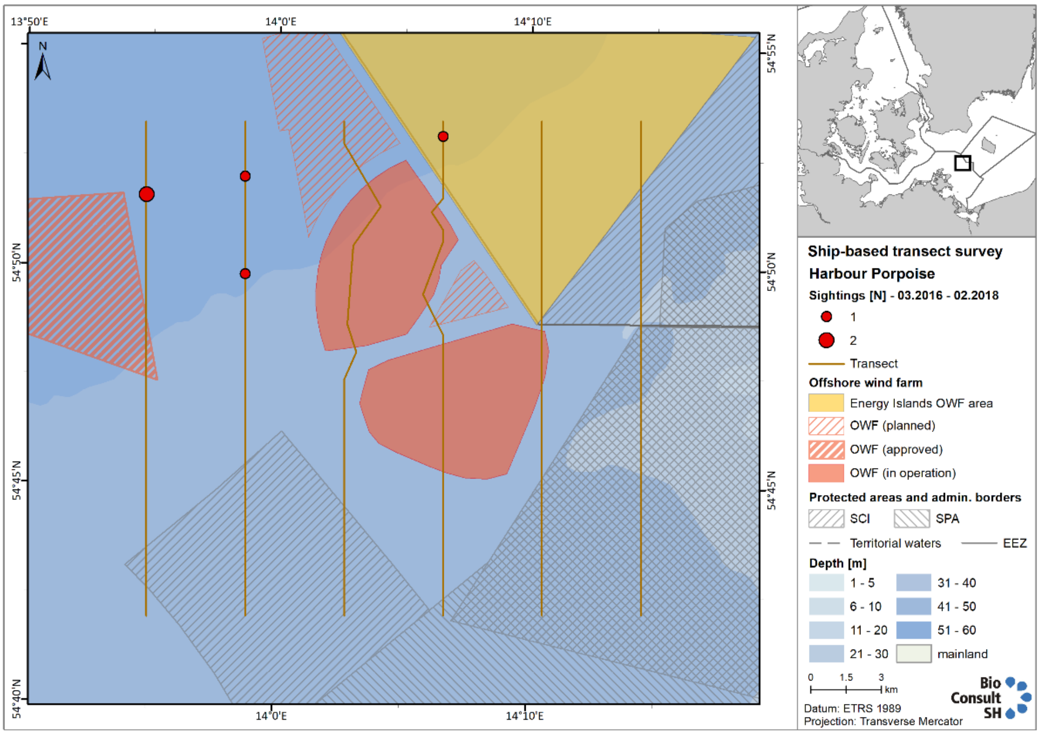


Figure 3-10. Transect design of the ship-based surveys in the OWF planning area O-1.3 in the German EEZ between March 2016 and February 2018. Red points indicate all harbour porpoise sightings made during the 24 ship-based surveys. Sightings only occurred during two surveys in July and November 2016. From: IBL Umweltplanung et al. (2020).

Table 3-2. Summary of the 20 digital aerial HiDef surveys conducted between April 2016 and February 2018 in the German OWF planning area O-1.3 including effort, number of harbour porpoises and harbour porpoise calves sighted and harbour porpoise density estimates calculated using correction factors provided by Teilmann et al. (2013). From: IBL Umweltplanung et al. (2020).

Date	Effort [km²]	Porpoises sighted (including calves) [n]	Porpoise calves [n]	Porpoise density [ind./km²]
20.04.2016	284.77	0	0	0
03.05.2016	284.83	0	0	0
26.06.2016	255.92	1	0	0.008
22.07.2016	285.26	2	1	0.012
26.08.2016	284.38	1	0	0.007
10.09.2016	283.09	1	0	0.008
30.10.2016	285.43	0	0	0
13.11.2016	285.08	0	0	0
28.01.2017	279.07	0	0	0
24.02.2017	285.17	0	0	0
11.03.2017	284.98	1	0	0.007
10.04.2017	285.00	0	0	0
12.05.2017	284.83	0	0	0
15.07.2017	284.12	0	0	0
07.08.2017	284.40	2	0	0.014
27.09.2017	284.53	0	0	0
31.10.2017	285.44	0	0	0
04.12.2017	285.34	0	0	0
27.12.2017	281.94	0	0	0
07.02.2018	283.68	0	0	0
Total	**5657.26**	**8**	**1**	**0.0028**

Table 3-3. Seasonal harbour porpoise density estimates for the German OWF planning area O-1.3 calculated from digital aerial HiDef surveys conducted between April 2016 and February 2018. (spring: March-May, summer: June-August, autumn: September-November, winter: December-February). From: IBL Umweltplanung et al. (2020).

Season	Mean harbour porpoise density [ind./km²]	Range [ind./km²] (min-max)	Surveys [n]
spring 2016	0	0	2
summer 2016	0.009	0.007 – 0.12	3
autumn 2016	0.003	0 – 0.008	3
winter 2016/2017	0	0	2
spring 2017	0.002	0 – 0.002	3
summer 2017	0.007	0 – 0.014	2
autumn 2017	0	0	2
winter 2017/2018	0	0	3

A total of four sightings with five harbour porpoise individuals were made at only two of 24 ship-based surveys. Three harbour porpoises were spotted in July 2016 and two in November 2016. It is obvious that harbour porpoise sightings only occurred during surveys under very calm weather conditions. These two surveys were conducted in July 2016 (3 ind.) and in November 2016 (2 ind.), and sightings were all located in the northern third of the survey area (Figure 3-10). Detecting elusive harbour porpoises from a ship requires very calm sea state conditions that are rarely present. Because these ship-based surveys mainly target bird species, they are conducted at a sea state up to 3, where birds swimming on or flying above the water can still be reliably detected. Such surveys thus provide only limited information on harbour porpoise abundance, and therefore, surveys without harbour porpoise sightings may not be taken as proof of absence in this case. Instead, a focus on aerial surveys and passive acoustic monitoring is recommended.

Summary

Aerial surveys undertaken to calculate density and abundance of harbour porpoises in the Belt Sea region are few and cover different areas, such that comparison of results is not trivial, and abundance estimates differ widely based on the area covered and the method used for calculation. Estimates for the Belt Sea population of harbour porpoises range from about 10,000 to 40,000 individuals. The most recent larger-scale survey conducted in 2020 concluded that the size of the Belt Sea population of harbour porpoises was about 17,301 individuals (with a density of 0.78 ind./km²), and that the population may have undergone a strong decline. The authors also state, however, that especially previous abundance estimates show large variance, and thus concluding on a population trend comes with high uncertainty.

No visual surveys exist for the calculation of abundance of the Baltic Proper population of harbour porpoises. Given the very low population size, such surveys are not appropriate, and thus acoustic monitoring was used instead (see next chapter).

Smaller-scale surveys do not exist from the EIB pre-investigation area itself but from adjacent German waters. These data indicate a harbour porpoise density of between 0.002 and 0.009 ind./km² in spring and summer while no sightings were obtained during the autumn and winter seasons.

3.1.4 ABUNDANCE AND DENSITY AROUND THE EIB PRE-INVESTIGATION AREA BASED ON ACOUSTIC DETECTIONS

Harbour porpoise sightings during ship-based surveys conducted during SCANS-I and II in Polish, Swedish and German waters of the Baltic Proper were so rare that it was not possible to calculate reliable abundance estimates (Gillespie et al. 2005). Therefore, no more visual surveys were conducted in this region during SCANS III. It was recommended to conduct passive acoustic monitoring in the Baltic Proper instead.

Such passive acoustic monitoring data of harbour porpoises in the Baltic Sea also exist from several different sources, which we will present in the following subchapters. We will start with data from the SAMBAH project that collected data all across the Baltic Proper over a two-year period. Then we continue with more regional data from the Danish and German NATURA 2000 monitoring in the vicinity of the EIB pre-investigation area. Finally, we present data from German OWF impact assessment studies, also conducted adjacent to the EIB pre-investigation area.

SAMBAH data

In the year 2011 the SAMBAH project was launched to gain reliable assessments of abundance, distribution and habitat preferences of the harbour porpoise population in the Baltic Proper (SAMBAH 2016). Due to low abundance of harbour porpoises in the Baltic Proper and the generally shy behaviour and thus low visual detectability of harbour porpoises, it was chosen to use the well-established method of passive acoustic monitoring rather than visual surveys to reach this goal. Over a study period of two full years, data were collected at 304 C-POD (Cetacean Porpoise Detectors) positions distributed all over the Baltic Proper between 2011 and 2013. These C-PODs are underwater hydrophones with self-contained data loggers within a water-proof casing powered by batteries included in the casing. These C-PODs are designed to detect the echolocation clicks of toothed whales, especially of harbour porpoises and can automatically collect data for up to about three months after being deployed. When C-PODs are recovered, the stored data are extracted and analysed with a standardised algorithm so that, as in the case of SAMBAH, it can be calculated on how many days porpoises were present around the hydrophone. From these passive acoustic monitoring data, the SAMBAH project then calculated harbour porpoise abundances and habitat use.

As already mentioned in chapter 3.1.2, based on these passive acoustic monitoring data from the SAMBAH study, the number of individuals of the Baltic Proper management unit during summer was estimated at approx. only 500 animals (SAMBAH 2016).

The distribution of harbour porpoise detections from the SAMBAH project showed a strongly decreasing pattern from the south-west to the north-east during the summer months (Figure 3-11). Detections were highest in the westernmost part of the study area, the Danish waters east of Lolland and Sjaelland and near the Darss ridge. They drastically declined towards the east, until no detections were found on the Estonian and Finnish coasts (Figure 3-11).

During winter, there was a relatively continuous decline from the south-west to the north-east, but harbour porpoise detections were found all along the Swedish and Polish coasts. Unlike the decreasing pattern of harbour porpoise detection rates from the south-west to the north-east, the distribution of detection rates in the eastern part of the study area was relatively continuous in winter, meaning that they did not differ much between stations.

During summer, highest detections were still found in the most western part. However, in the eastern part of the study area, there was now a concentration of harbour porpoise detections in the Swedish waters around the Hoburg and Midsjö banks south of Gotland and east of Øland (area indicated by a red circle in Figure 3-11). At the same time almost no detections were found further north or in Swedish, Estonian, Latvian or Lithuanian waters and also only very few were found along the Polish coast (Figure 3-11).

Based on these seasonal distribution patterns, it was argued that in winter, the Baltic Proper population of harbour porpoises shows a widespread distribution across the whole study area mixing with the Belt Sea population. During the summer breeding season, however, the two populations seem to be separated: The Belt Sea population moves further west and the Baltic Proper population concentrates in the detection hot spot in Swedish waters around the Hoburg and Midsjö banks south of Gotland and east of Øland (area indicated by a red circle in Figure 3-11). Hoburg and Midsjö banks are thought to represent a harbour porpoise nursery ground. A seasonal population management border that lies east of Bornholm was thus proposed (Figure 3-11). Harbour porpoise density estimates based on these detections yielded low numbers with about 0.07 ind./km² in the whole study area during winter and with about 0.63 ind./km² in the south-western part of the study area and about 0.004 ind./km² in the north-eastern part of the study area in summer (SAMBAH 2016). The EIB pre-investigation area lies on the eastern edge of the area with relatively high detection rates towards the Belt Sea and about 80 km away from the proposed summer management border.

Owen et al. (2021) recently presented further monitoring data from Swedish waters near the Northern Midsjö Bank south of Øland, so the area used by probably Baltic Proper harbour porpoises during the breeding season. They found a slight increase in detection rates in their study period 2017-2020 compared to the 2011-2013 SAMBAH study period when analysing detection rates during the seasonal peak in May-October and thus during the breeding season. While this may be indicating the start of population recovery, the rate of increase (2.4 %) is still very low relative to what is likely for this harbour porpoise population in the absence of threats (Owen et al. 2021).

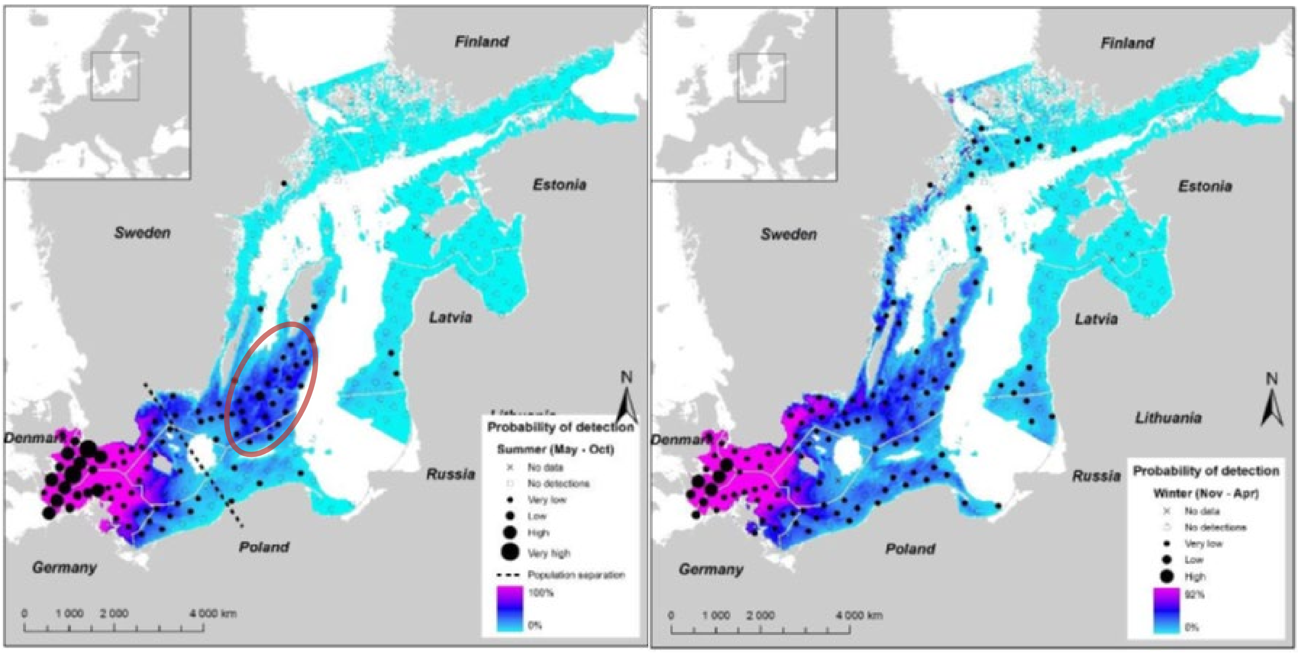


Figure 3-11. Probability of detection of harbour porpoises in the Baltic Sea in summer (May-October) and winter (November-April) as calculated from harbour porpoise detections at 304 C-POD stations deployed during the SAMBAH project between April 2011 and June 2013. The red circle indicates the high-density area around the Hoburg and Midsjö banks, which is suggested to be the breeding area of harbour porpoises from the Baltic Proper population. Taken from: SAMBAH (2016).

Mikkelsen et al. (2016) modelled harbour porpoise distribution patterns in the south-western Baltic Sea using satellite locations from 13 tagged harbour porpoises of the Belt Sea population and comparing it to harbour porpoise detections at C-POD stations in the same area used during the SAMBAH project. As satellite data were only sufficient during summer (June-August) and autumn (September-November), model results were restricted to these two seasons. A summary of C-POD data is shown in Figure 3-12, which clearly shows a decrease in harbour porpoise detections from west to east. The four stations closest to the EIB pre-investigation area (indicated by the blue circle in the figure) are already in the area with low harbour porpoise detections. While detections were still relatively high at station 7009 in summer, they were much lower at station 7010 further east and especially at stations 8009 and 8010, which are located closest to the EIB pre-investigation area in Danish waters (Figure 3-12). These data confirm results from the model calculated from satellite locations of the Belt Sea harbour porpoises that show high habitat suitability in the south-western part of the study area in summer and the western areas in autumn (Figure 3-13, Mikkelsen et al. 2016). The eastern area, where the EIB pre-investigation area is located, had relatively low importance during both seasons (Figure 3-13). However, it must be considered that these results do not allow conclusions about spring and winter, nor do they give information about the importance of the region for harbour porpoises from the Baltic Proper population, as only Belt Sea animals were tagged. However, given results from SAMBAH (2016), detections around the EIB pre-investigation area were also low in winter (Figure 3-11).

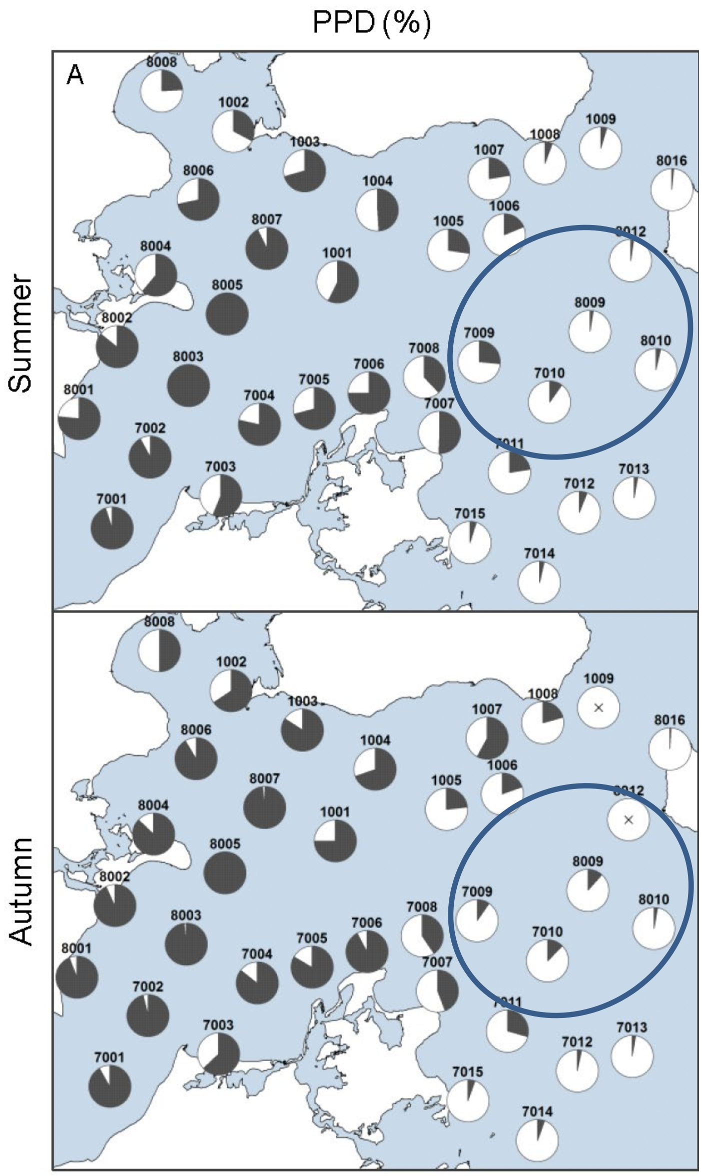


Figure 3-12. Shown is the percentage of harbour porpoise positive days (PPD %) by season (summer: June-August, autumn: September-November) at the C-POD stations used during the SAMBAH project between 2011 and 2013. Stations with an x mark indicate that no clicks were recorded at that station. The blue circle indicates the five stations closest to the EIB pre-investigation area. From: Mikkelsen et al. (2016).

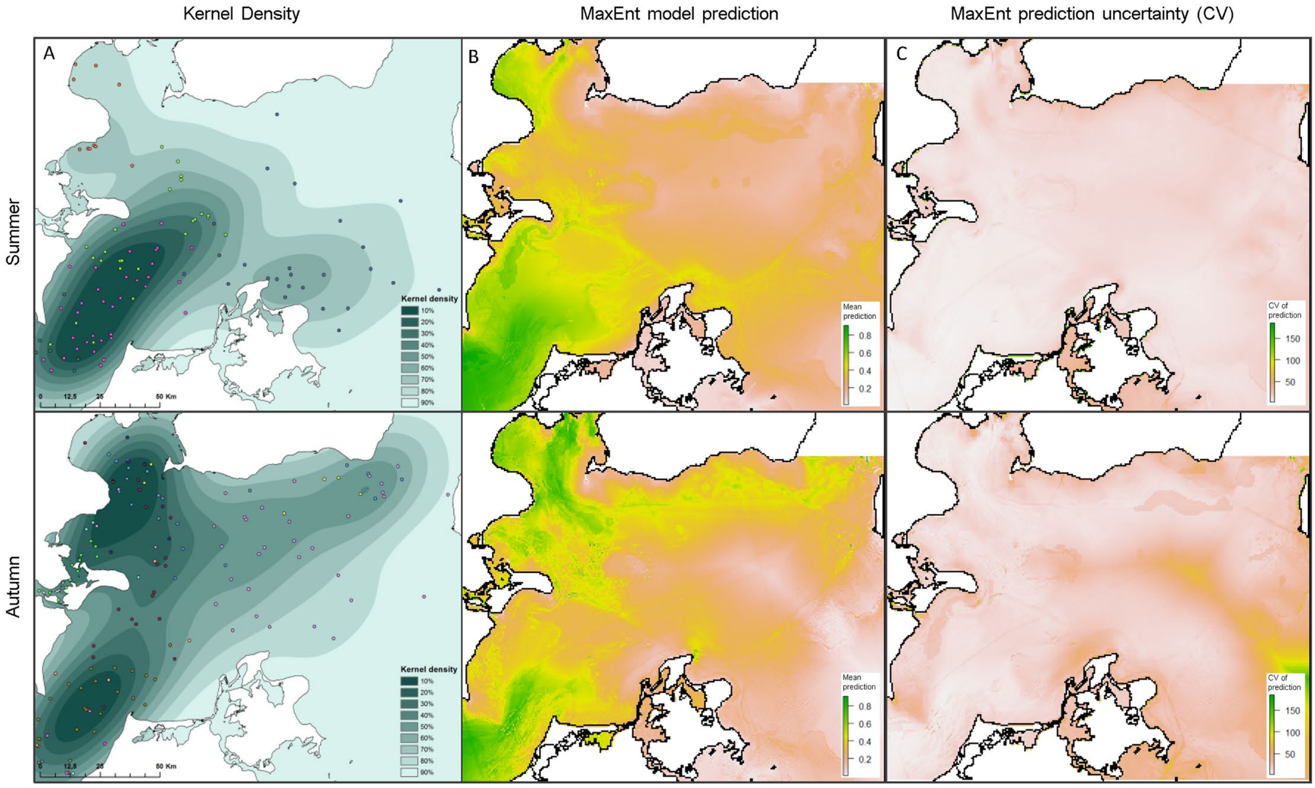


Figure 3-13. Kernel and MaxEnt results. (A) Kernel density results for summer (June-August, top row) and autumn (September-November, bottom row). (B) Mean prediction of the probability of presence of harbour porpoise based on 100 bootstrap models. The scale of the colouring can be interpreted as the relative probability of presence of harbour porpoise given the environment. (C) The uncertainty of the prediction expressed by the coefficient of variation (CV). From: Mikkelsen et al. (2016).

Danish National NATURA 2000 monitoring data

Acoustic monitoring in Danish waters around Bornholm was continued in 2018/19 using some of the C-POD positions from the SAMBAH project. Of these positions 8009, 8010, 8012 and 8013 are the ones most relevant for the EIB pre-investigation area (Fig.3-14). Position 8010 is located within the EIB pre-investigation area, and position 8009 is located within the NATURA 2000 site next to the EIB pre-investigation area. Only C-PODs at these two positions (8009 and 8010) collected relatively continuous data between June and November 2018 and between the end of February and June 2019 (Fig.3-15). These data were analysed by Sveegaard (2020) for a note from DCE, and results are summarised in Fig.3-16, which also shows detection rates at these stations during the SAMBAH project between 2008 and 2011. In 2008-2011 highest detections at these stations occurred during the winter months, which was mainly due to high detections between 0.2 and 0.5 dpd in November, December and January at station 8009. Only little porpoise activity was recorded during the summer. By contrast, during the 2018/19 study period, highest detections were found during the summer months, but this was mainly due to high detections between 0.2 and 0.9 at station 8010 between July and September 2018, which generally revealed much higher detection rates than any of the other seven stations that collected data. Comparisons between these two study periods is difficult, however, as no data exists for station 8009 in December and January in 2018/19, the months when detections at this station were high in 2008-2011. Provided that data were recorded during summer 2008-2011 at station 8010 (which is not entirely clear based on the data presented by Sveegard 2020), there was a remarkable increase in porpoise summer detections at station 8010 in 2018. Whether these detections belong to the Belt Sea or Baltic Proper population or whether such a summer increase is due to a shift in summer habitat usage by either population is presently impossible to determine.

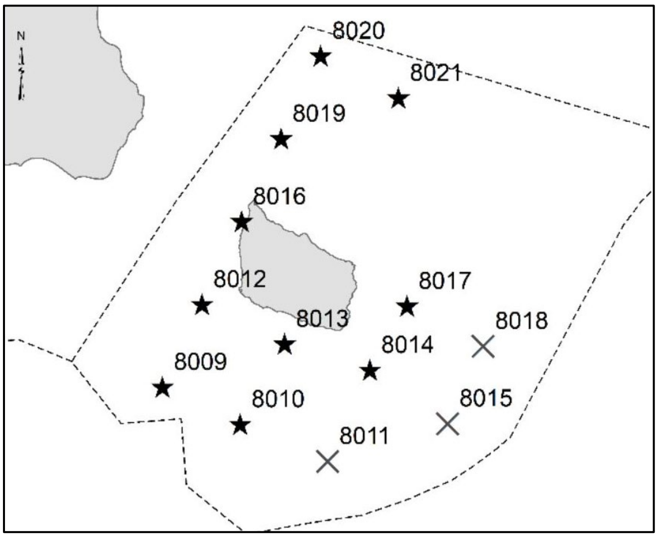


Figure 3-14. C-POD positions in Danish waters around Bornholm used during the SAMBAH project in 2008-2011 and during the 2018/19 monitoring period (crosses: stations only used during SAMBAH, stars: stations used during both study periods). Note that 8009 and 8010 are the ones most relevant for the pre-investigation area. From: Sveegaard 2020.

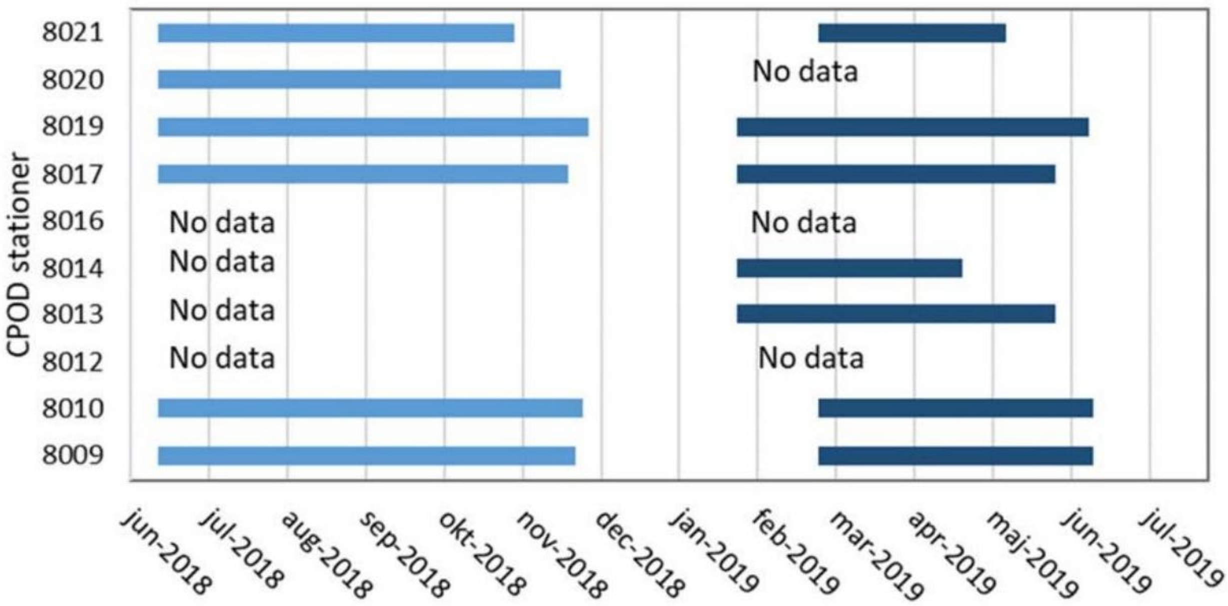
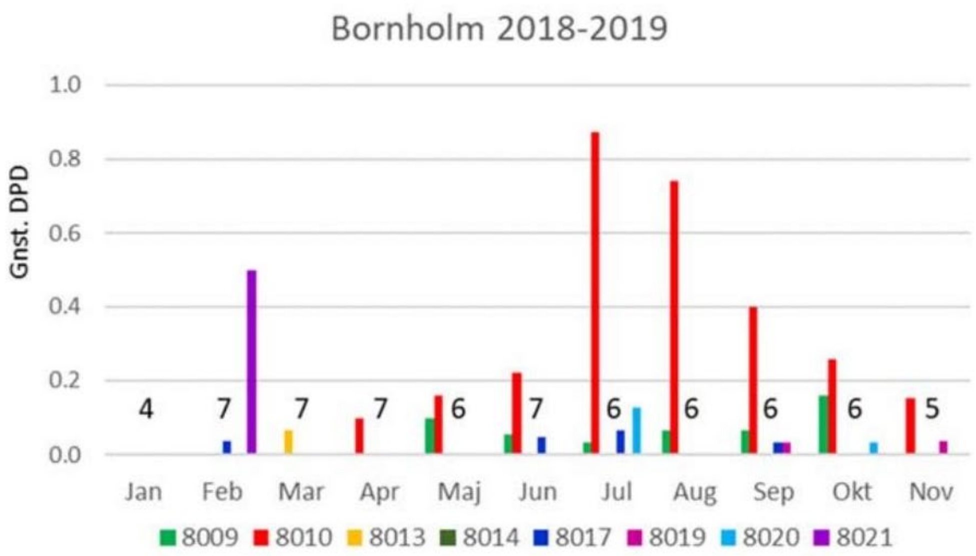


Figure 3-15. Periods with successful data recordings (indicated as blue bars) at C-POD positions during the monitoring period 2018/19 in Danish waters around Bornholm. Note that 8009 and 8010 are the ones most relevant for the pre-investigation area. From: Sveegaard 2020.



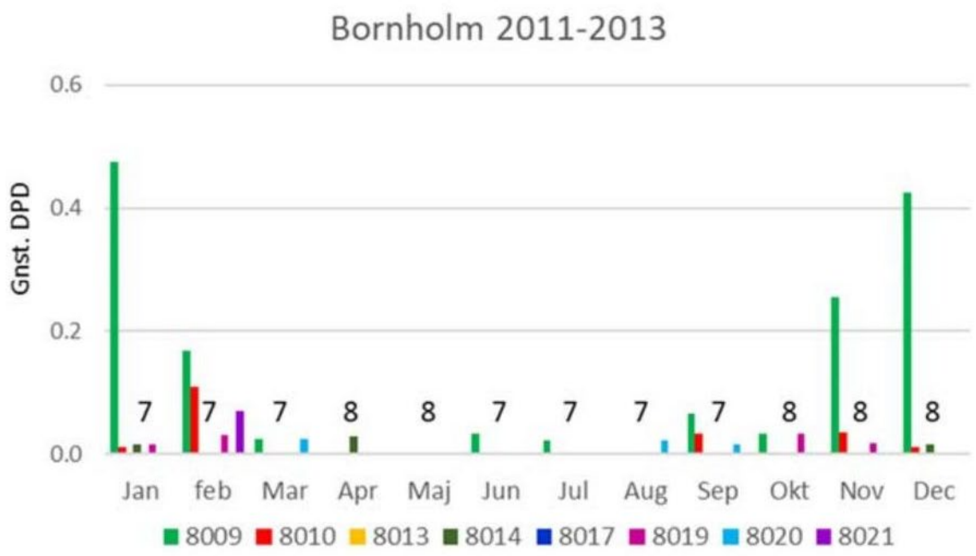


Figure 3-16. Summary of harbour porpoise detection positive days (DPD) per month at the eight monitoring stations in Danish waters around Bornholm during the monitoring period 2018/19 (upper figure) and the SAMBAH study period 2008-2011 (lower figure). Note that 8009 and 8010 are the positions most relevant for the pre-investigation area, but that data at 8009 did not exist in December and January and for the largest part of February in 2018/19. From: Sveegaard 2020.

German National NATURA 2000 monitoring data

Further C-POD data in the relevant area are available from the marine mammal monitoring project of the German Federal Agency for Nature Conservation (BfN). During this project, data were collected at C-POD stations in the eastern part of the German Baltic Sea. Gallus and Benke (2014) summarised results at these positions obtained between 2009 and 2013. Positions closest to the EIB pre-investigation area are position 7009, 7010, G28 and G25 indicated in Figure 3-17. Two of these (7009 and 7010) were also used during the SAMBAH project. Detection probability at these stations was relatively low with less than 18 % dpd/study period and even below 8 % dpd/study period at G25, the position closest to the EIB pre-investigation area. A summary of the seasonality of detections at these stations is given by Gallus and Benke (2014) and shown in Figure 3-18. Highest detections at these positions were found from July to October, lowest detections were found between February and June. Monitoring at some of these stations is continuing until today, but so far, data are only available from annual status reports (Gallus & Benke 2014, Gallus 2019b a, Gallus & Brundiers 2019, 2020). Figure 3-19 shows the monthly detection rates of harbour porpoises at station G25, which is closest to the EIB pre-investigation area, from 2015 to 2019. Seasonal detection rates were still quite similar each year with low detections at the beginning of the year, detections increasing in May or June, a peak between 20 and 30 % dpd/month in July and a second, usually lower peak between September and October. Detection rates were mostly far below 10 % dpd/month between November and May (Figure 3-19). By contrast, detection rates at station G28 (Figure 3-20) further south were constantly higher than at G25 in summer with detection rates of up to 80 % dpd/month. Detection rates increased in May, and there were usually two detection peaks, one in July/August and one in September/October. Between December and April, detection rates were also mostly below 10 % dpd/month, similar to the pattern at G25. As an example, Figure 3-20 shows the detection rates at G28 for 2018.

The seasonality of harbour porpoise detections at these stations between 2015 and 2019 is similar to what was described for station 8010 in Danish waters within the EIB pre-investigation area above. However, detection rates as high as 0.8 dpd as seen at the Danish station 8010 in summer 2018, could not be found at the nearest German position G25. Thus, it may be a very local phenomenon.

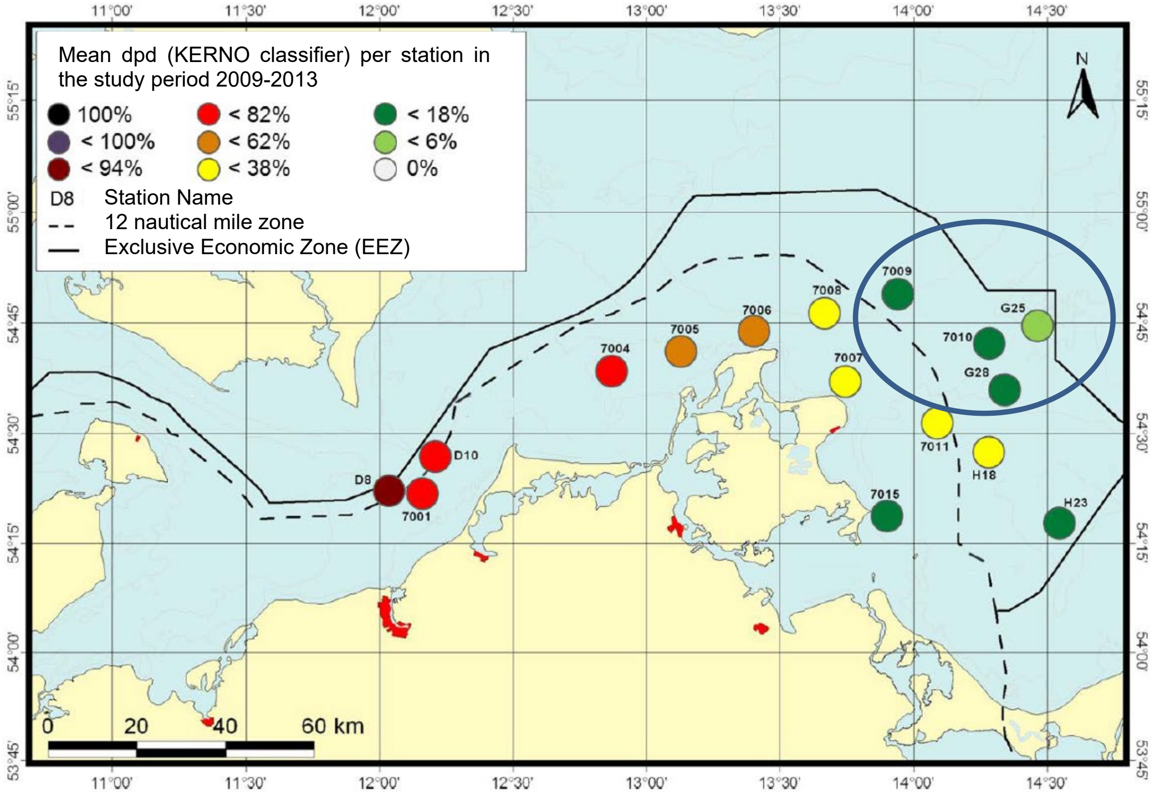


Figure 3-17. Coloured circles indicate the location of 16 C-PODs used for the marine mammal monitoring program by the German Federal Agency for Nature Conservation (BfN). Colours indicate the % detection positive days (dpd) between 2010 and 2013. The blue circle indicated the four C-POD stations closest to the EIB pre-investigation area, of which data are shown in more detail in Figure 3-18. From: Gallus & Benke (2014).

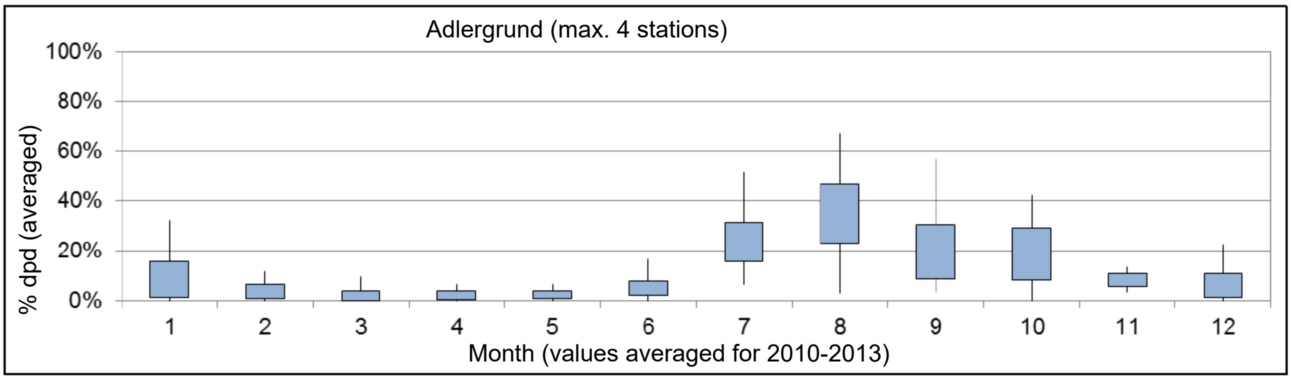


Figure 3-18. Percentage of detection positive days (dpd) averaged per months over the period 2010-2013 at C-POD stations in the "Adlergrund" (Positions 7009, 7010, G28 and G25 in Figure 3-17). From: Gallus & Benke (2014).

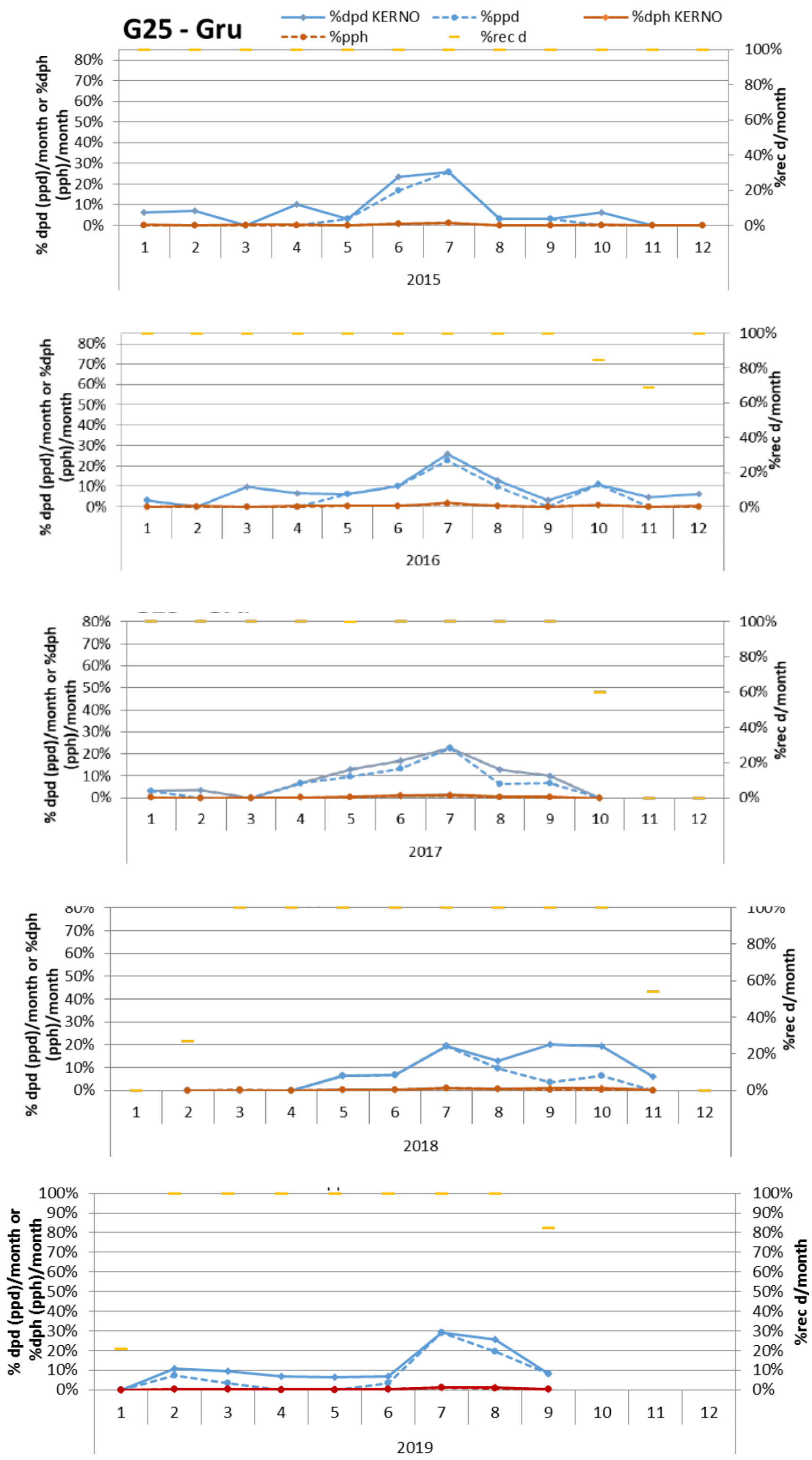


Figure 3-19. Percentage of detection positive days (dpd, blue line) and detection positive hours (dph, red line) per month and percentage of observed days per month (yellow) at C-POD station G25-Gru during 2015-2019. From: Gallus and Benke (2014); Gallus (2019b a); and Gallus and Brundiers (2019, 2020). Continuous lines and broken lines of one colour basically show the same data; Slight differences between them stem from using the standard or the Kerno classifier for identifying harbour porpoise clicks in the raw data.

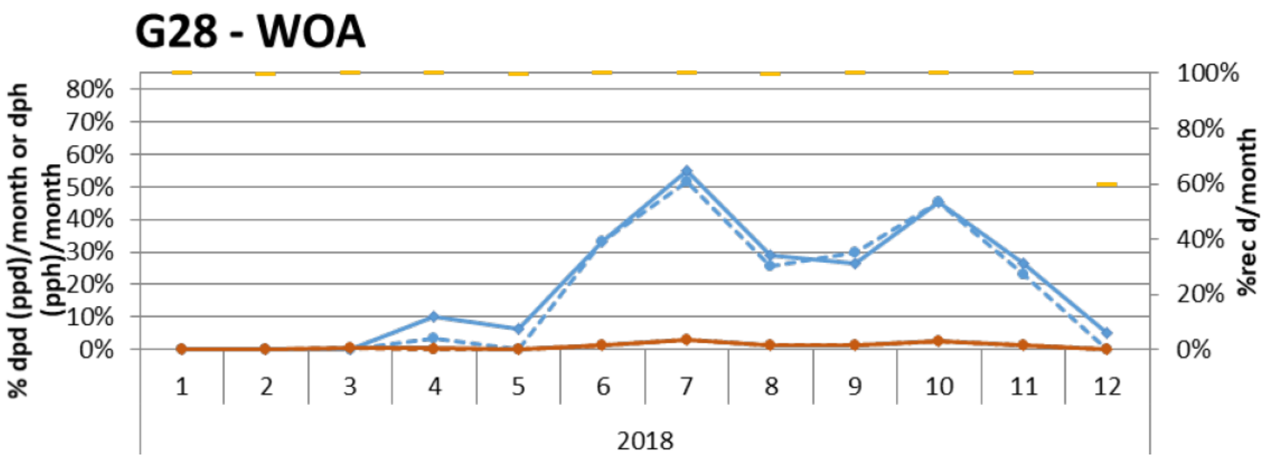


Figure 3-20. Percentage of detection positive days (dpd, blue line) and detection positive hours (dph, red line) per month and percentage of observed days per month (yellow) at C-POD station G28 - WOA during 2018. From: Gallus & Brundiers (2019). Continuous lines and broken lines of one colour basically show the same data; Slight differences between them stem from using the standard or the Kerno classifier for identifying harbour porpoise clicks in the raw data.

<u>Data from German offshore wind farm impact assessment studies</u>

Acoustic monitoring of harbour porpoises was also a major part of the investigations in the German OWF planning area O-1.3 directly south of the EIB pre-investigation area (IBL Umweltplanung et al. 2020). In addition to the aerial and ship-based surveys, data were collected at two passive acoustic monitoring stations where C-PODs were deployed (Figure 3-9). Station WA was located about 10 km and station FFH about 20 km to the south of the EIB pre-investigation area. Data at both positions were obtained continuously from March 2016 to February 2018 with between 355 and 359 days covered per year and station (Table 3-4). The seasonality of detections at these two stations is shown in Figure 3-21. Detections at the station FFH were higher than at station WA further north and closer to the EIB pre-investigation area, which corresponds to results from the SAMBAH and BfN monitoring project summarised above. The seasonality at these two stations was relatively similar with relatively low detections between December and April (always 0.1 dpd/month), detections steeply increasing in June/July and reaching a peak around July and another one around October. Detections were almost continuously higher in 2017 than in 2016, and especially the summer and autumn peaks were more than twice as high as in the preceding year (Figure 3-21).

Table 3-4. Summary of harbour porpoise detection data at the two C-POD stations WA and FFH used for acoustic marine mammal monitoring in the German OWF planning area O1.3 between March 2016 and February 2018. Given are the percentage detection positive days (% dpd/year), percentage detection positive hours per day (% dph/day) and percentage detection positive ten minutes per day (% dp10m/day). From: IBL Umweltplanung et al. (2020).

POD station	Time of investigation	Number of days analysed	% dpd/year	% dph/day	% dp10m/day
WA	March 2016 - February 2017	355	3.6	0.28	0.07
	March 2017 - February 2018	358	12.4	0.89	0.21
FFH	March 2016 - February 2017	359	17.5	1.13	0.24
	March 2017 - February 2018	359	31.7	2.63	0.63

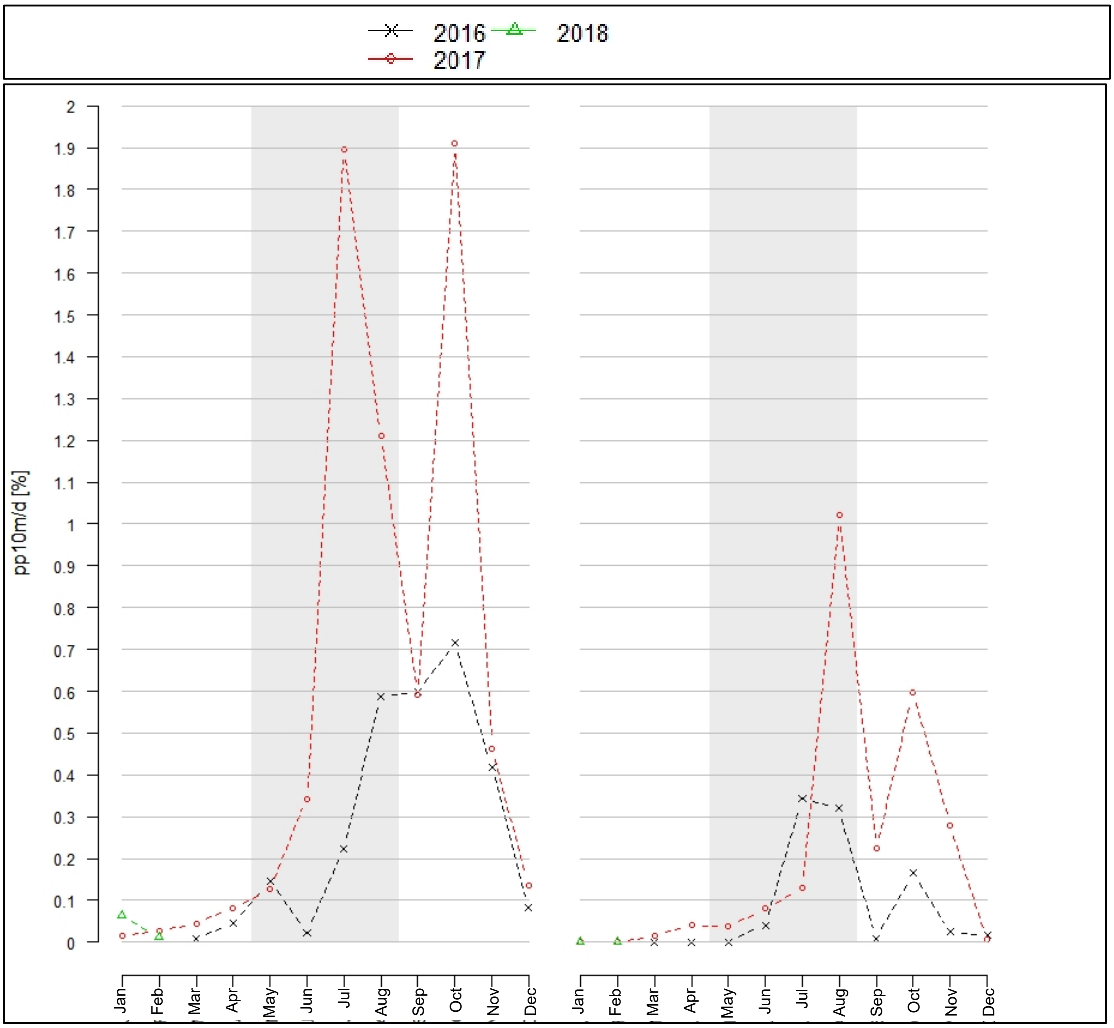


Figure 3-21. Mean monthly harbour porpoise detection rates (as % dp10m/day) at the C-POD stations FFH (left) and WA (right) between March 2016 and February 2018. From: IBL Umweltplanung et al. (2020).

Summary

Based on these passive acoustic monitoring data from the SAMBAH study, the number of individuals of the Baltic Proper management unit during summer was estimated at approx. only 500 animals (SAMBAH 2016).

Based on these seasonal distribution patterns, it was argued that in winter, the Baltic Proper population of harbour porpoises shows a widespread distribution across the whole study area mixing with the Belt Sea population. During the summer breeding season, however, the two populations seem to be separated: The Belt Sea population moves further west and the Baltic Proper population concentrates in the detection hot spot in Swedish waters around the Hoburg and Midsjö banks south of Gotland and east of Øland,thought to represent a harbour porpoise nursery ground. Based on these results a seasonal population management border was proposed that lies east of Bornholm and about 80 km east of the EIB pre-investigation area. Harbour porpoise density estimates based on these detections yielded low numbers with about 0.07 ind./km² in the whole study area during winter and with about 0.63 ind./km² in the south-western part of the study area and about 0.004 ind./km² in the north-eastern part of the study area in summer (SAMBAH 2016). The EIB pre-investigation area lies on the eastern edge of the area with relatively high detection rates towards the Belt Sea.

A model of harbour porpoise distribution patterns in the south-western Baltic Sea using satellite locations from harbour porpoises of the Belt Sea population shows a decrease in harbour porpoise abundance from west to east (so towards the EIB pre-investigation area) in summer and autumn, in line with acoustic detections from the same area obtained during the SAMBAH project.

Acoustic monitoring in Danish waters around Bornholm in 2018/19 revealed relatively high harbour porpoise detection rates between 0.2 and 0.5 dpd in November, December and January, but low detection rates in summer at station 8009, close to the EIB pre-investigation area. At station 8010 within the EIB pre-investigation area highest detections were found during the summer months, with between 0.2 and 0.9 between July and September 2018.

Acoustic monitoring in German waters next to the EIB pre-investigation area found lowest detection rates at the station closest to the EIB pre-investigation (G25) area with a maximum of between 0.2 and 0.3 dpd in July, a lower peak between August and October and detection rates mostly below 0.1 dpd/month during other times. Acoustic monitoring at two POD-station during an offshore windfarm project also found lower detection rates at the station closest to the EIB pre-investigation area than at a station further south.

3.1.5 HARBOUR PORPOISE IMPORTANCE MAP

In a recent HOLAS III report (Sveegaard et al. 2022) data from porpoise telemetry in the Belt Sea, SCANS, SAMBAH and other national data were revisited with the aim to create a map showing the importance of areas in the Baltic Sea for harbour porpoises. Not being solely based on density estimates, which would fail to highlight the areas that may be important for the Baltic Proper population of harbour porpoises, which only consists of about 500 individuals, it was created using several steps: Importance was estimated separately for the Belt Sea population and the Baltic Prober population of harbour porpoises, before joining it for a single map.

Importance for the Belt Sea population was estimated using telemetry data from 2007-2021, separately for summer and winter. With the Kernel Density tool in ArcGIS, contour lines (called isopleths) were created that encompassed 10, 50, 75 % and 100 % of harbour porpoise locations. The 50 % isopleth was then used to identify areas of high importance, the 75 % isopleth areas of medium importance, and areas outside these were categorized as being of lower importance. Then seasonal maps were merged, and this map was then compared with data from SCANS III (Lacey et al. 2022), the Belt Sea density surface model (period 2002-2016, ITAW / unpublished) and MiniSCANS II (Unger et al. 2021), after which some areas of importance were added to the map in the Kattegat and Little Belt / Kiel Bight, giving the map shown in Figure 3-22.

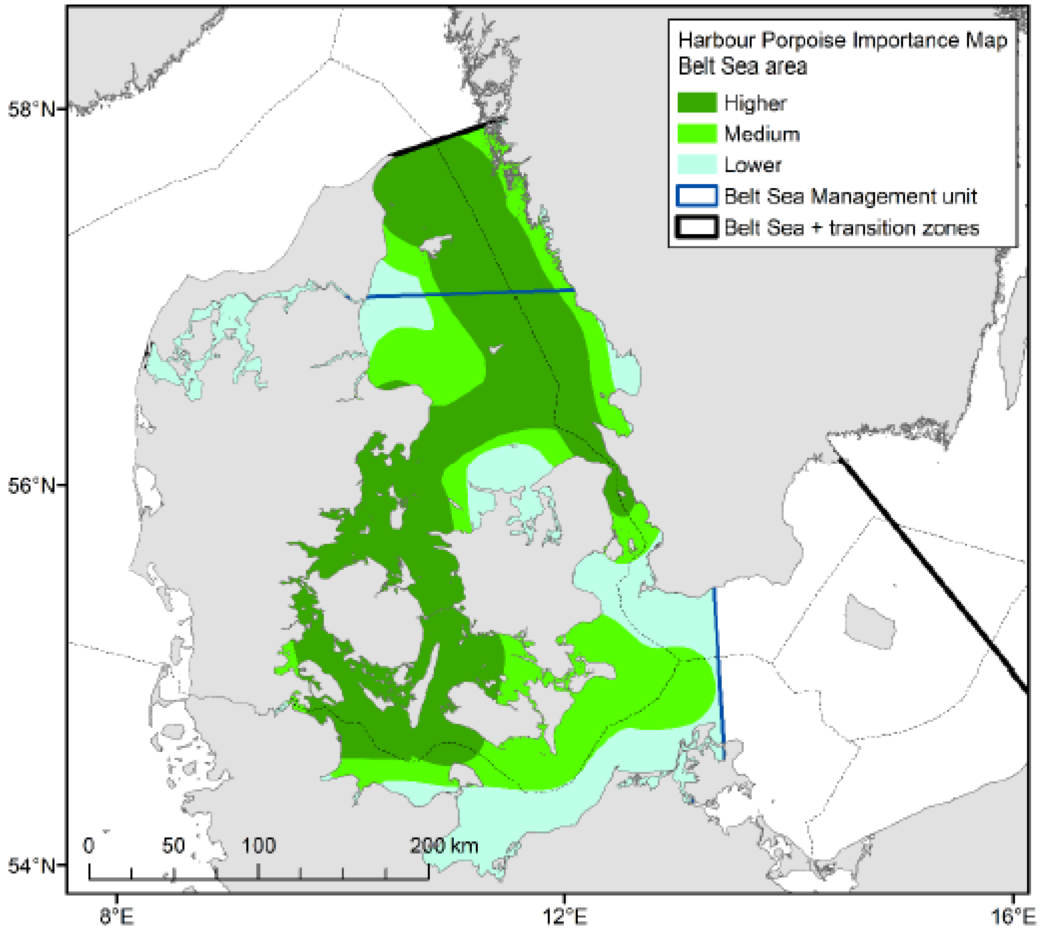


Figure 3-22. Map of the importance of different areas for the Belt Sea population of harbour porpoises. From: Sveegaard et al. (2022).

The importance map for the Baltic Proper population was based on probability of detection from SAMBAH, also first created separately for winter and summer and then merged. Areas of ≥ 20 % probability of detection were chosen to represent areas of higher importance, and areas between 10 % - 20 % of probability of detection were chosen to present areas of medium importance. A convex hull (smallest polygon containing all the 20 % (and then 10 %) detection probability areas was drawn to present the area of higher (≥ 20 %) and medium (10-20 %) importance for harbour porpoises of the Baltic Proper population. An area of high importance was added in Polish waters based on assessment of local PAM data and also an area of medium importance was added in Finnish waters, where national monitoring data indicated regular presence of harbour porpoises. Furthermore, information was added showing in what areas data are deficient, because no or only very little monitoring took place, giving the map shown in Figure 3-23. Note the summer and winter management borders that are also included in Figure 3-23.

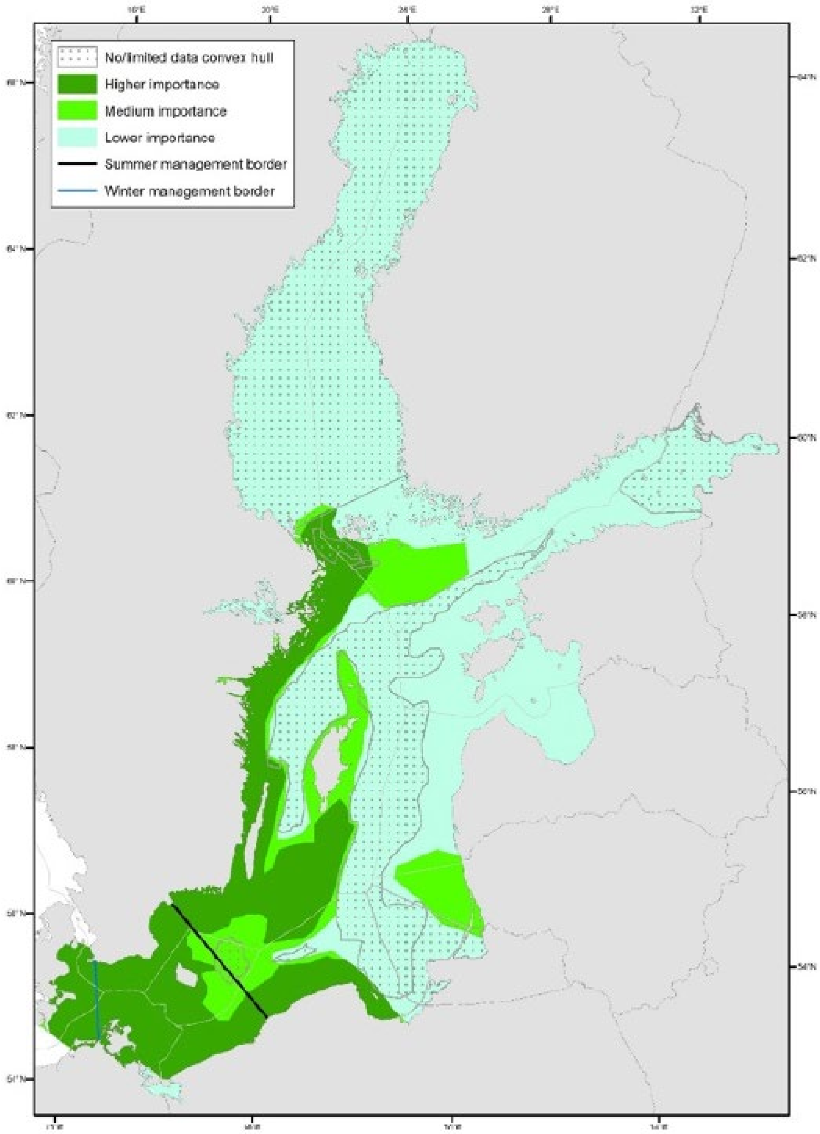


Figure 3-23. Map of the importance of different areas for the Baltic Proper population of harbour porpoises. From: Sveegaard et al. (2022).

These two maps were finally joined to gain one harbour porpoise importance map for the Baltic Sea, which is shown in Figure 3-24.

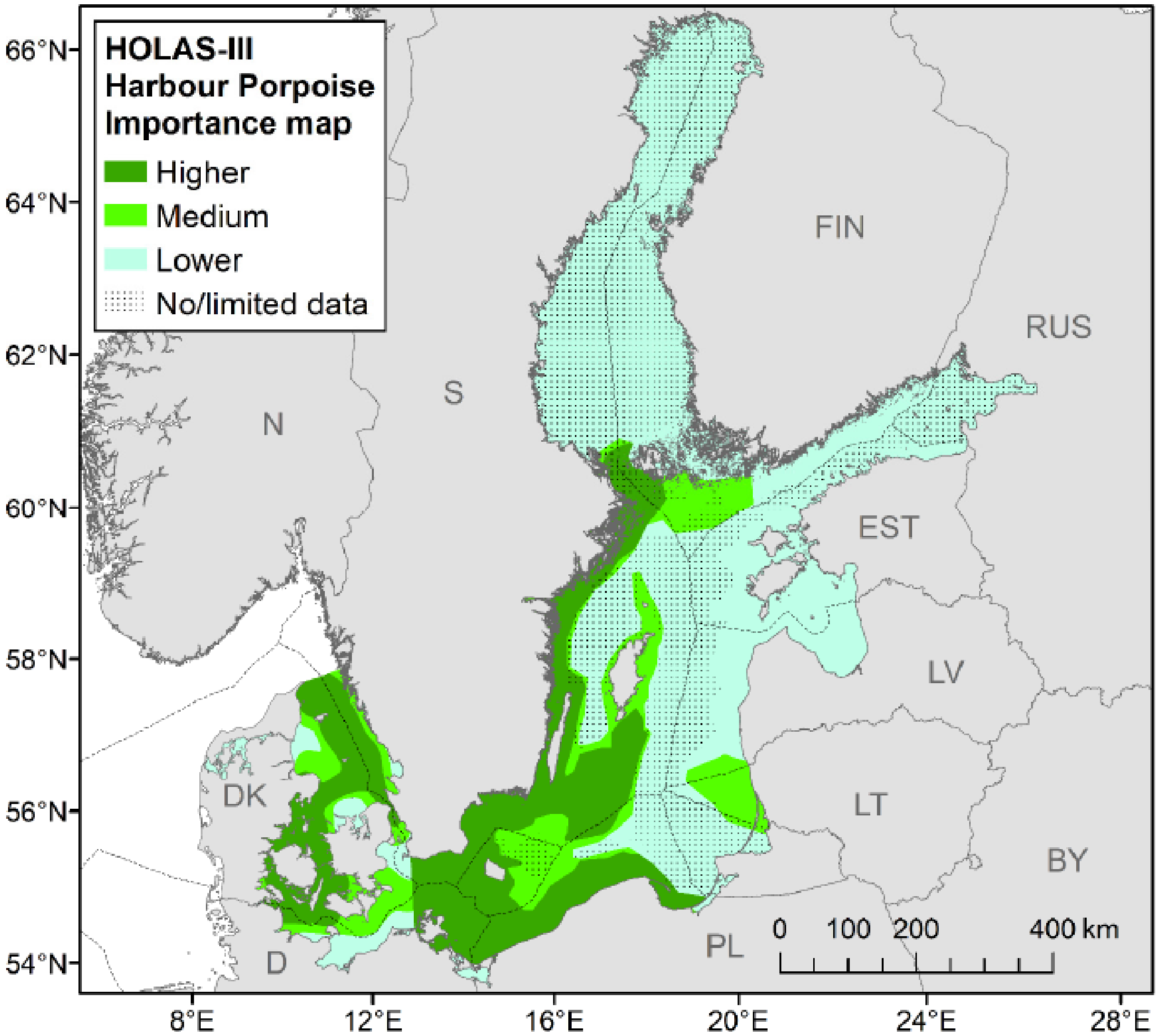


Figure 3-24. HOLAS III map of importance for harbour porpoises within the HELCOM area. From: Sveegaard et al. (2022).

3.1.6 SIGNIFICANCY OF THE EIB PRE-INVESTIGATION AREA FOR THE HARBOUR PORPOISE POPULATION

Based on the above summarised available information on harbour porpoise occurrence around the EIB pre-investigation area, it can be concluded that the area is used by harbour porpoises on a relatively regular basis but with strong seasonal differences: Harbour porpoise sightings and detections mainly occurred between late spring and early autumn, while only very little harbour porpoise presence was documented between late autumn and early spring. Summer detections probably mainly originate from animals belonging to the Belt Sea population, while winter detections may stem from both populations, the Belt Sea and the Baltic Proper population of harbour porpoises.

Harbour porpoise density in the area, even in summer, is very low compared to harbour porpoise occurrence further west, so the area is on the edge of the distribution area of the Belt Sea population of harbour porpoises with relatively low importance for this population. As calves were sighted near the EIB pre-investigation area, it cannot be ruled out that harbour porpoises occasionally also reproduce here. However, as density is far higher further to the west and thus calf sightings are also much more regular there, the significance as a breeding ground for animals from the Belt Sea population is probably low. The recently created HOLAS III map on the importance of areas in the Baltic Sea for the Belt Sea population of harbour porpoises does not assess the area of the EIB pre-investigation area, as it only considers the areas defined for the Belt Sea management unit, which does not include the transition zone between the two populations, in which the EIB pre-investigation area lies.

Estimates for the Belt Sea population of harbour porpoises range from about 10,000 to 40,000 individuals. The most recent larger-scale survey conducted in 2020 concluded that the size of the Belt Sea population of harbour porpoises was about 17,301 individuals (with a density of 0.78 ind./km²), and that the population may have undergone a strong decline. The authors also state, however, that especially previous abundance estimates show large variance, and thus concluding on a population trend comes with high uncertainty.

The Baltic Proper population of harbour porpoises is very low, calculated to consist of only about 500 individuals today. Winter detections around the EIB pre-investigation area, even though being generally low, could partly stem from individuals belonging to this population, as the EIB pre-investigation area lies within the suggested winter mixing zone of these two populations. As such, it may be of high importance as a wintering ground for these rare animals of the Baltic Proper population. As the EIB pre-investigation area lies about 80 km west of the recently proposed summer management border for the Baltic Proper population of harbour porpoises, it probably has no relevance as a breeding ground for animals from this population. Nevertheless, the recently created HOLAS III map on the importance of areas in the Baltic Sea for the Baltic Proper population of harbour porpoises categorises the area of the EIB pre-investigation area as being of high importance for these animals. It is also stated in the report, however, that during summer most of the animals encountered west of the summer management border for the Baltic Proper populations (indicated in Figure 3-23) will belong to the Belt Sea population.

Smaller-scale surveys do not exist from the EIB pre-investigation area itself but from adjacent German waters. These data indicate a harbour porpoise density of between 0.002 and 0.009 ind./km² in spring and summer while no sightings were obtained during the autumn and winter seasons.

3.2 HARBOUR SEALS (*PHOCA VITULINA*)

3.2.1 CONSERVATION STATUS

The status of the global population and the European population of the harbour seal are classified by the IUCN as least concern (LC). The HELCOM Red List lists the Southern Baltic population as LC, the population in the Kalmarsund as VU. The national Red List of Denmark lists the harbour seal as LC. The national Red List of Germany lists the harbour seal as being under threat of unknown extent, and the national Red List of Sweden lists it as VU. With regards to the hunting of harbour seals, in Denmark licenses are given to shoot a limited number of individuals each year when seals interfere with fishing gear. Regulation is not allowed between 1st of June and 31st of July and never in seal reserves (HELCOM Red List Marine Mammal Expert Group 2013). Hunting in Germany is forbidden, in Sweden it is forbidden unless allowed in other parts of the hunting legislation. For summary, see Table 3-5.

In EU waters, harbour seals are protected by the EU Habitats Directive and listed in its Annexes II and V. They are also covered by the EU Marine Strategy Directive, where distribution, number and bycatch must be reported and evaluated according to descriptor 1. The harbour seal is listed in Appendix II of the Bern Convention and in Appendix II of the Bonn Convention. For summary, see Table 3-5.

DCE assessed the conservation status of the harbour seals in Habitat Directive Article 17 from 2019 (Fredshavn et al. 2019) as favourable in both Danish marine regions. It also states that while stocks in the Wadden Sea and Kattegat are large and long-term viable, stocks in the Limfjord and the Baltic Sea are smaller and more vulnerable. In the DCE Marine areas report from 2021 (Hansen and Høgslung 2021) it is said that the population of harbour seals has shown a substantial increase from 1976 to 2020 as a result of the start of protection measures in 1977 and the establishment of a number of seal reserves with no access. Since 2015, the number of harbour seals in Denmark has fallen by 4 % each year in all four management units, indicating that the population is approaching or has reached ecological capacity or is pressured by unknown factors, such as a lack of food, disturbances or competition by grey seals (Hansen and Høgslung 2021).

Table 3-5. Listing of the harbour seal in international and regional conservation agreements and international and national Red Lists.

Species	IUCN (2017)	HELCOM Red List	National Red Lists	EU Habitats Directive	Bern Convention	Bonn Convention
Harbour seal ***Phoca vitulina***	LC (Lowry 2016)	Southern Baltic: LC Kalmarsund: VU	DK: LC DE: threat of unknown extent SWE: VU	Appendix II and V	Appendix III	Appendix II

3.2.2 BIOLOGY, DISTRIBUTION AND ABUNDANCE

Harbour seals (*Phoca vitulina*) are the most widely distributed species of all seals ranging from temperate to polar coastal regions all along the Northern Hemisphere. In the Baltic Sea, distribution is limited to Danish, Swedish, German and Polish waters.

Harbour seals can reach a maximum age of 36 years (Härkönen & Heide-Jørgensen 1990). Adult East Atlantic harbour seals were found to show an asymptotic length of 146 cm in females and 156 cm in males (Härkönen & Heide-Jørgensen 1990). Asymptotic weight was 67 kg in females and in 75 kg in males, but strong fluctuations depending on reproductive status and season were observed (Härkönen & Heide-Jørgensen 1990). Females were found to reach sexual maturity at an average age of 3.7 years and males about a year later (Härkönen & Heide-Jørgensen 1990). The overall pregnancy rate in 3- to 36-year-old females was 92 % (Härkönen & Heide-Jørgensen 1990). Females give birth on land, usually once a year, between May and June after a gestation period of about 11 months. Pups are usually weaned after about 4 weeks and are then left to fend for themselves. Pups shed their embryonic lanugo fur before birth and are able to swim and dive immediately after birth, but depend on undisturbed sites on land for suckling and resting. Mating occurs in the water after pubs are weaned in about July. Males perform an underwater display including specific vocalisations and are seek out by females for mating, a so-called lek-system (van Parijs et al. 1997). Moulting occurs between July and September, with a peak in August, and during this time animals also depend on undisturbed sites on land. This is because a good blood perfusion to the outer skin layers is necessary for moulting, which makes animals more prone to heat loss. Therefore, increased perfusion occurs on land, preferably with dry fur (Dietz et al. 2015). Because of the reproduction and moulting period, harbour seals are most sensitive to disturbance at haul-out sites during summer months between May and August. Harbour seals show no migration movements and instead they display high site fidelity to their haul-out sites, from where they make foraging trips into deeper waters. These trips are mostly confined to a radius of less than 50 km from the coast but can occasionally be as far as 100 km or further offshore (e. g. Thompson et al. 1994, Tollit et al. 1998, Cunningham et al. 2009, Dietz et al. 2013). Most of these studies found seasonal variation in harbour seal movement, with movements being more confined around haul-out sites during summer when breeding and moulting takes place. Also, juveniles were found to show further ranging movement patterns than adult individuals and sex-specific differences were also found during some of these studies. McConnell, Lonergan and Dietz (2012) tagged three adult and two juvenile harbour seals at Rødsand. The three adults generally stayed within 50 km of the haul-out site, but juveniles were found to travel to distant haul-out sites over 200 km away.

Harbour seals are opportunistic predators but show mainly benthic feeding and prefer small to medium sized benthic fish species. As such, they are mainly found to feed in areas with a water depth below 100 m (Tollit et al. 1998), although they were reported to dive to depths of up to 400 m (Teilmann et al. 2017). In the south-western Baltic Sea, 20 fish species were identified from otoliths found in 42 harbour seal samples (scat and digestive tracts) from two studies, with the greatest majority of prey items being made up of lesser sandeel (*Ammodytes tobianus*, 43 %), black gobies (*Gobius niger*, 15 %) and Atlantic cod (12 %) (Scharff-Olsen et al. 2019). Andreasen et al. (2017) analysed 13 harbour seal scats and 17 digestive tracts collected at the Rødsand lagoon and found a minimum of 20 prey species being consumed. Cod dominated both spring and autumn harbour seal diet (42 % and 43 % of weight consumed), but was less common in summer (22 %), when flounder and plaice together made up 52 % of the weight consumed (Andreasen et al. 2017).

In the Baltic Sea, harbour seals have probably been present since the last glaciation. Based on molecular data and satellite telemetry studies, harbour seals in the Baltic region can be split into three different subpopulations or management units: one in the Kalmarsund between Øland and the Swedish mainland (Härkönen & Isakson 2010), one in the south-western Baltic and one in the Kattegat (Goodman 1998, Andersen & Olsen 2010). As tagging studies have shown, there is no or only limited exchange between colonies separated by more than about 100 km due to generally limited movements (Dietz et al. 2013, 2015), and thus at least partial reproductive isolation between these three subpopulations.

Especially the population in the Kalmarsund is genetically quite distinct and different from the other harbour seal populations in the Baltic. Härkönen and Isakson (2010) conclude that this population was probably founded by animals that later became extinct elsewhere, while other animals re-entered the Skagerrak and Kattegat later. They stated that the population must once have comprised about 5,000 individuals but declined to only about 200 individuals in the 1960s due to heavy hunting and pollutants. In the 1970s, only about 30 harbour seals were counted, so the population experienced a severe bottleneck (Goodman 1998). After strict protection measures, the population increased and holds about 1000 individuals today (HELCOM 2015). According to the HELCOM indicator reports (HELCOM 2018 abc), this population has achieved good status with regards to the key indicator ”distribution”, but not good with regards to the key indicators ”population trends and abundance” and ”reproduction” (Figure 3-25).

The population in the Skagerrak, Kattegat and the Danish Straits exceeded 17,000 animals, but declined to only about 2,500 in 1930 due to intense hunting (Heide-Jørgensen & Härkönen 1988). Following the initiation of protection measures in the area, the population recovered in the 1960s. Two severe morbillivirus epidemics in 1988 and 2002 decreased the population size by about 50 % on both occasions (Härkönen et al. 2006), but the population had recovered afterwards. Then, a third epidemic caused by an unknown pathogen in 2007 killed about 3,000 harbour seals. However, the recovery rate in the Kattegat has been low ever since the 2002 epidemic (HELCOM Red List). The 2016 NAMMCO report stated an abundance of 1,000 animals in the south-western Baltic population and another 16,000 animals in the Skagerrak and Kattegat area (NAMMCO 2016). According to the HELCOM (2018) core indicator reports, the harbour seal subpopulation in the Kattegat has achieved good status with respect to the key indicators ”distribution” and ”population trends and abundance” but not with respect to ”reproduction”, while the Western Baltic subpopulation has failed to achieve a good status with respect to all these three indicators so far (Figure 3-25).

There are currently no breeding sites of harbour seals along the German coast, although they were historically known to exist. Harbour seal haul-out sites in the Baltic Sea can be seen in Figure 3-26. The ones closest to the EIB pre-investigation area are located about 100 km northwest at Falsterbo (Måkläppen) in Sweden, and in Denmark about 120 km northwest in the Øresund at Saltholm, about 140 km southwest on the Rødsand sand bar and about 150 km west on the eastern coast of Sjælland at Bøgestrømmen. The next closest haul-out site in easterly direction is located about 150 km to the northeast in the Kalmarsund south of Øland, where several haul-out sites exist in close proximity to each other. Haul-out sites at Måkläppen, Saltholm, Rødsand and in the Kalmarsund are also used by grey seals.

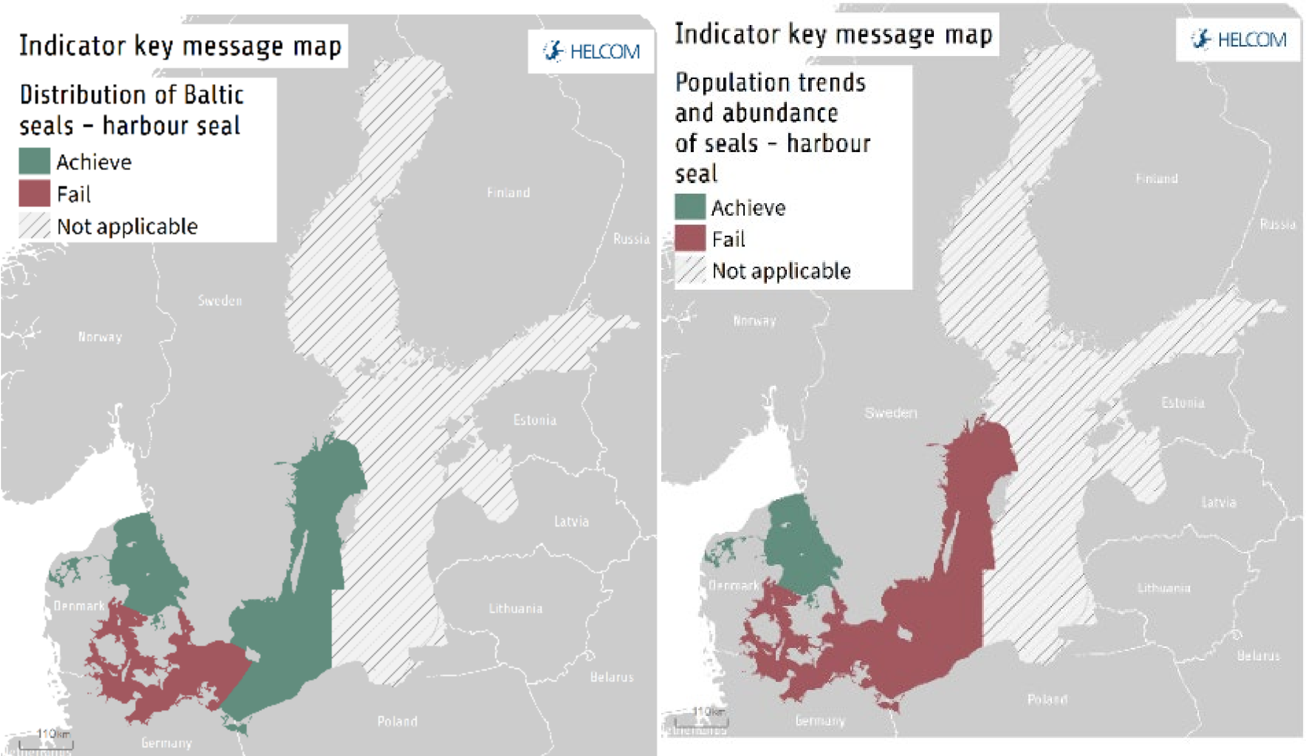


Figure 3-25. HELCOM status assessments of the harbour seal in the Baltic with respect to the key indicator ”distribution” (left panel) and ”population trend and abundance” (right panel) (HELCOM 2018).

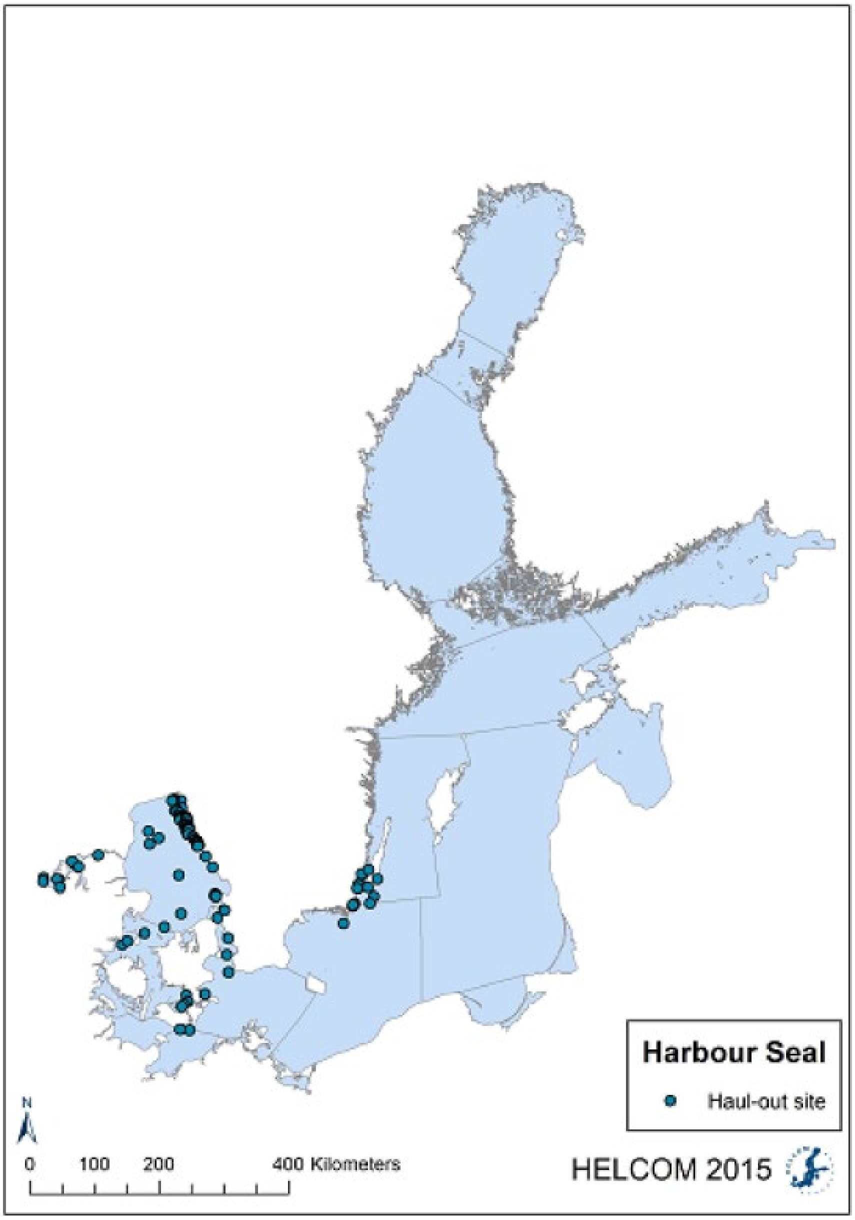


Figure 3-26. Haul-out sites of Baltic harbour seals. From: HELCOM (2018).

3.2.3 HABITAT USE AND DENSITY ESTIMATES AROUND THE EIB PRE-INVESTIGATION AREA

As harbour seals show high site fidelity at haul-out sites and aggregate there especially during the lactation and moulting period, estimates of population sizes are based on counts at haul-out sites during the moulting season. Such counts are carried out annually and thus, good knowledge exists on the individual numbers at haul-out sites. However, much less is known about harbour seal density in the surrounding waters and about harbour seal habitat use there. From tracking studies, it is known that harbour seals usually stay close to shore and make foraging trips that are rarely further than 50 km from their haul-out site (Thompson et al. 1994, 1996a, Tollit et al. 1998, Lowry et al. 2001, Cunningham et al. 2009). Most studies found some seasonal, age- and sex-specific differences in these movement patterns.

McConnell et al. (2012a) tagged three adult and two juvenile harbour seals at Rødsand. Adults generally stayed within 50 km of the haul-out site, but juveniles were occasionally found to travel to distant haul-out sites over 200 km away. Two examples of the tracks from adult harbour seals from the Rødsand lagoon are shown in Figure 3-27. Dietz et al. (2015) tagged ten harbour seals from Måkläppen. These also mainly stayed within 25 km of their haul-out sites, with juveniles ranging a little further than adults. There were some seasonal differences with animals being more stationary during the summer and showing more extensive movements during winter and spring. Migration routes and home ranges of these ten animals in autumn 2012 are shown in Figure 3-28, and seasonal differences in their Kernel home ranges are shown in Figure 3-29. As can be seen, the home range does not reach even near the EIB pre-investigation area at any time of the year.

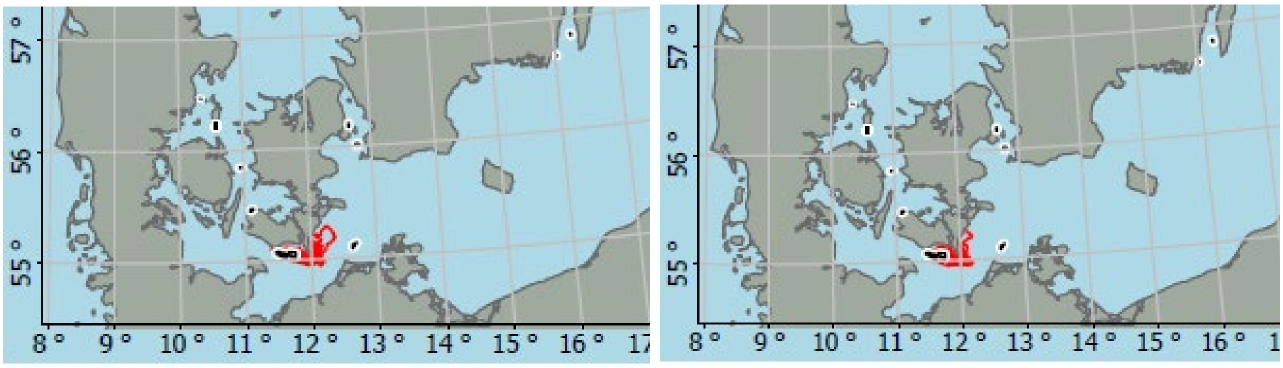


Figure 3-27. Map showing two typical examples of adult harbour seal movements obtained from satellite tracking. Harbour seals were tagged in the Rødsand lagoon. From McConnell et al. (2012b).

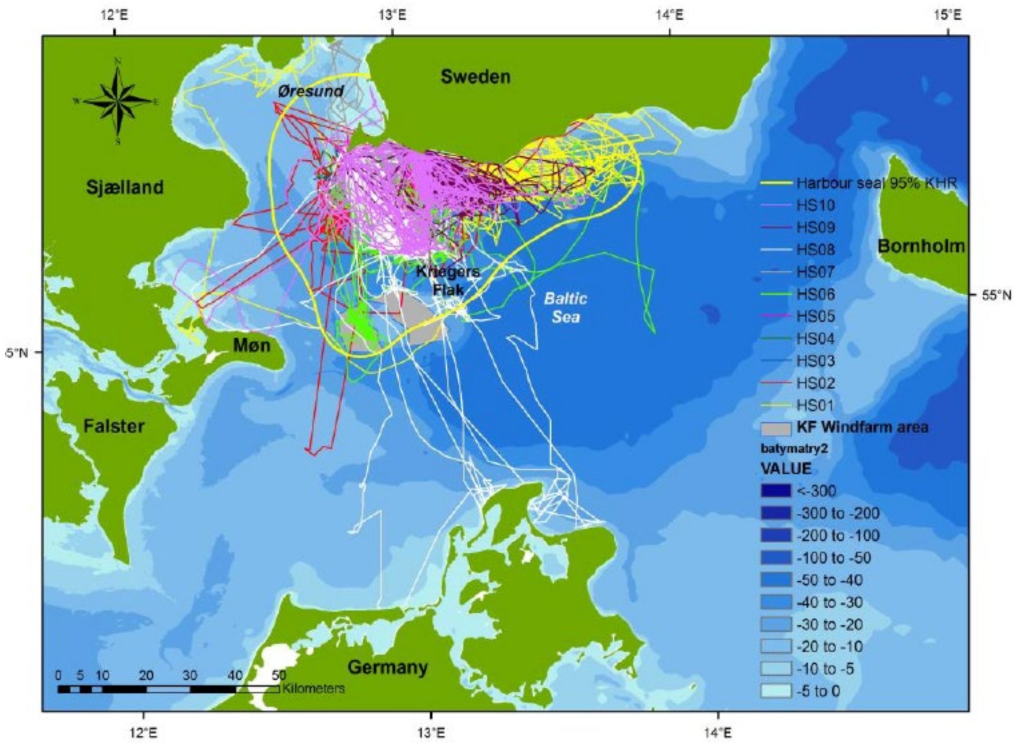


Figure 3-28. Map showing the migration routes and the 95 % Kernel ranges (yellow polygon) for 10 harbour seals tagged during the autumn 2012 at Måkläppen, Falsterbo. From Dietz et al. (2015).

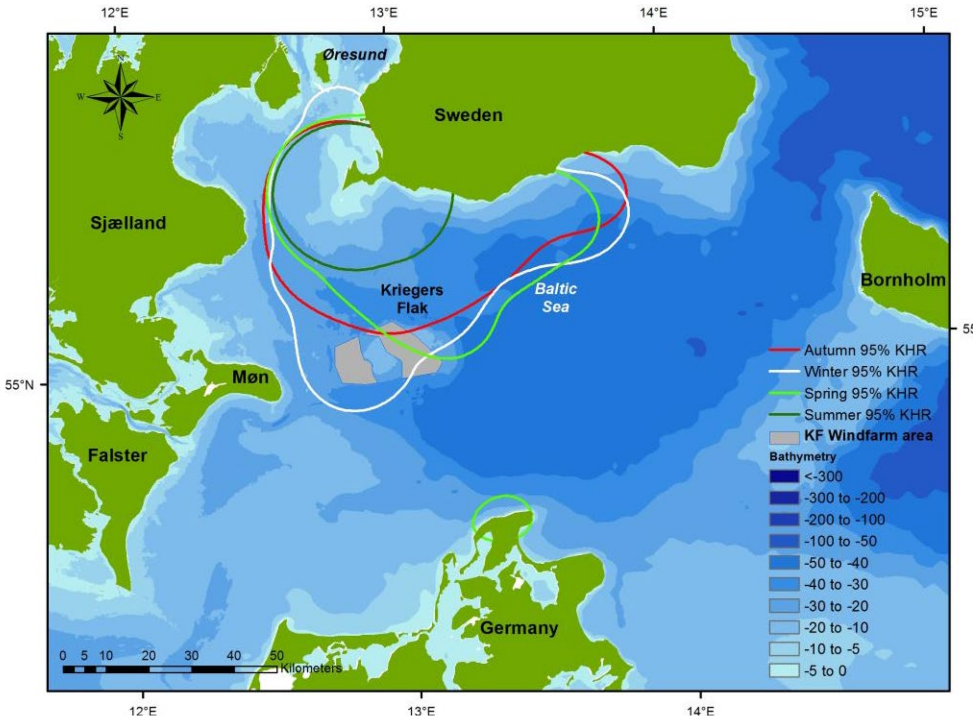


Figure 3-29. Map showing the 95 % Kernel home ranges for the four seasons of the 10 harbour seals tagged in autumn 2012 at Måkläppen, Falsterbo. From Dietz et al. (2015).

Further information on the occurrence of harbour seals in the EIB pre-investigation area can be taken from aerial and ship-based surveys conducted in the OWF planning site O1.3 in close proximity to the EIB pre-investigation area. Aerial surveys conducted at high altitude (as in this case) rarely allow identifying seals to the species level. However, seal detections in the area were generally very scarce with a total of only 13 seals detected during 20 aerial surveys conducted throughout the year between 2016 and 2018, each covering about 285 km² (Table 3-6). Of these 13 individuals, only one animal could be identified to species level, and this individual was a grey seal. Seal densities calculated from these data ranged between 0 and 0.01 ind./km² and were thus generally very low. Seal density calculated over all data would be 0.002 ind./km². During 24 ship-based survey in the same period, each with a total transect length of about 125 km, a total of nine seals could be detected (Table 3-7). Of these, seven were grey seals, one was a harbour seal, and one could not be identified to species level. One of the grey seals was a juvenile. Overall, the sighting rate was very low with 0.28 ind./100 km calculated over the total survey effort. Given that the great majority of seals detected during ship-based surveys were grey seals, it is most likely that this also applies to seals detected during aerial surveys, which cover the same study period. The seasonal (Figure 3-30, Figure 3-31) and geographical distribution (Figure 3-32, Figure 3-33) of sightings during both aerial and ship-based surveys show that sightings can occur throughout the year and throughout the study area. As such, no specific foraging ground could be identified.

Table 3-6. Number of seal sightings and calculated seal density (for all seal sightings combined) during the 20 digital aerial HiDef surveys conducted during the marine mammal monitoring program in the OWF planning area O1.3. From: IBL Umweltplanung et al. (2020).

Survey date	Effort [km²]	Harbour seals [n]	Grey seals [n]	Unidentified seal [n]	Seals/km²
20.04.2016	285	0	0	0	0
03.05.2016	285	0	0	2	0.007
26.06.2016	256	0	0	0	0
22.07.2016	285	0	1	0	0
26.08.2016	284	0	0	0	0
10.09.2016	283	0	0	1	0.004
30.10.2016	285	0	0	2	0.007
13.11.2016	285	0	0	0	0
28.01.2017	279	0	0	2	0.007
24.02.2017	285	0	0	0	0
11.03.2017	285	0	0	1	0.004
10.04.2017	285	0	0	0	0
12.05.2017	285	0	0	1	0.004
15.07.2017	284	0	0	0	0
07.08.2017	284	0	0	0	0
27.09.2017	285	0	0	0	0
31.10.2017	285	0	0	0	0
04.12.2017	285	0	0	0	0
27.12.2017	282	0	0	0	0
07.02.2018	284	0	0	3	0.011
Total	**5.657**	**0**	**1**	**12**	**0.002**

Table 3-7. Number of seal sightings and calculated sighting rate (for all seal sightings combined) during the 24 ship-based surveys conducted during the marine mammal monitoring program in the OWF planning area O1.3. From: IBL Umweltplanung et al. (2020).

Survey date	Distance [km]	Seastate (Petersen)	Harbour seal [n]	Grey seal [n]	Unidentified seal [n]	Sighting rate [n/100 km]
29.03.2016	126.7	1-3	0	1	0	0.79
23.04.2016	126.4	3	0	0	0	0
20.05.2016	128.8	2-3	0	0	0	0
10.06.2016	128.4	4	0	0	0	0
23.07.2016	126.1	0-1	0	2	0	1.59
15.08.2016	127.7	4	0	0	0	0
02.09.2016	128.1	4	0	0	0	0
19.10.2016	121.7	2-4	0	0	0	0
23.11.2016	128.7	0-1	0	2	1	2.33
16/17.12.2016	128.2	2-4	0	0	0	0
08./09.01.2017	127.6	2-4	0	0	0	0
14..02.2017	128.0	3	0	0	0	0
20.03.2017	127.8	0-3	0	0	0	0
01.04.2017	129.4	1-2	0	0	0	0
11.05.2017	129.0	2-3	0	1	0	0.78
10.06.2017	128.0	3-4	0	0	0	0
15.07.2017	127.5	1-3	0	0	0	0
23.08.2017	128.2	1-3	0	0	0	0
16.09.2017	127.6	3	0	0	0	0
10.10.2017	128.1	3-4	0	0	0	0
05.11.2017	127.9	3-4	0	0	0	0
02.12.2017	114.9	3-4	0	0	0	0
07./08.01.2018	128.7	1-3	1	1	0	1.55
17.02.2018	127.8	3	0	0	0	0
Total	**3.051**		**1**	**7**	**1**	**0.29**

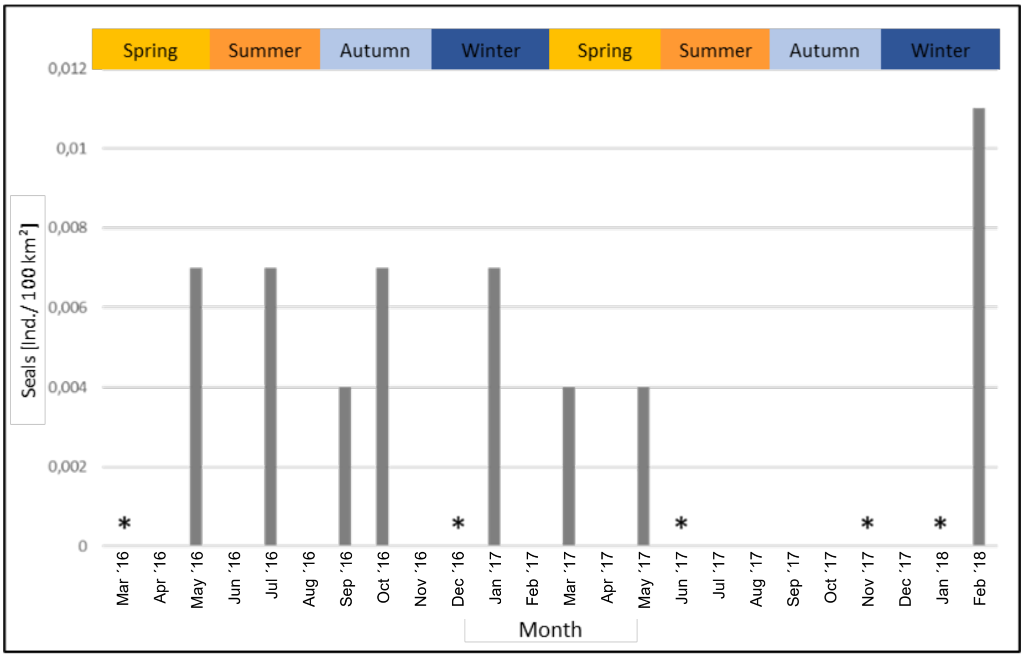


Figure 3-30. Seal densities per months as ind./km² between April 2016 and February 2018 calculated from digital aerial HiDef surveys (grey seals and unidentified seals were combined). * Months without aerial survey. From: IBL Umweltplanung et al. (2020).

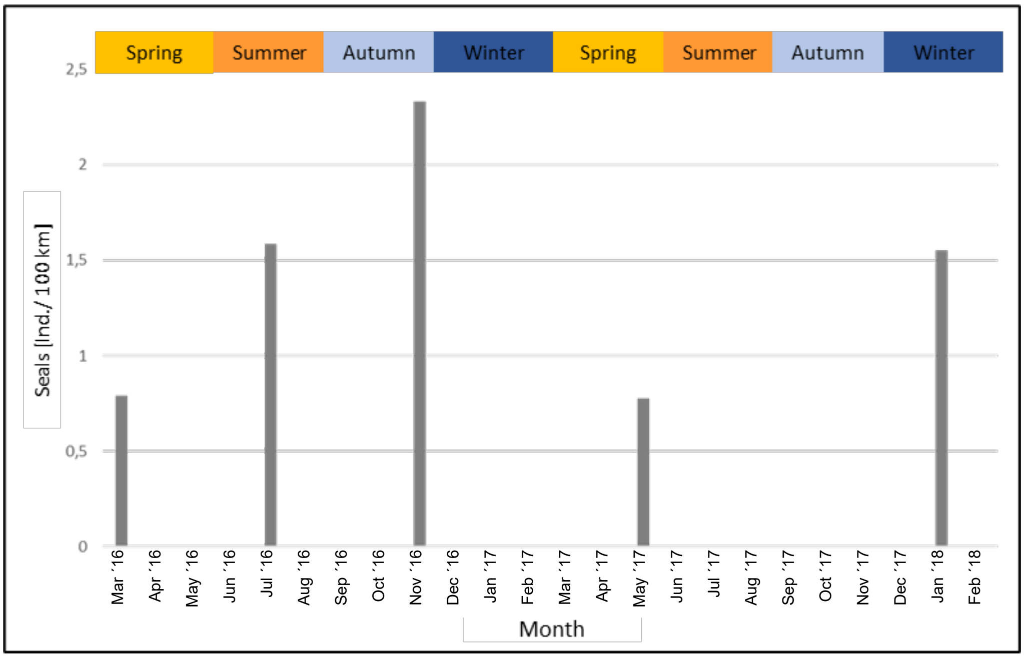


Figure 3-31. Seal sighting rates as Ind./100 km during ship-based surveys in the OWF planning area O-1.3 in the German EEZ between March 2016 and February 2018 (grey seals and unidentified seals were combined). From: IBL Umweltplanung et al. (2020).

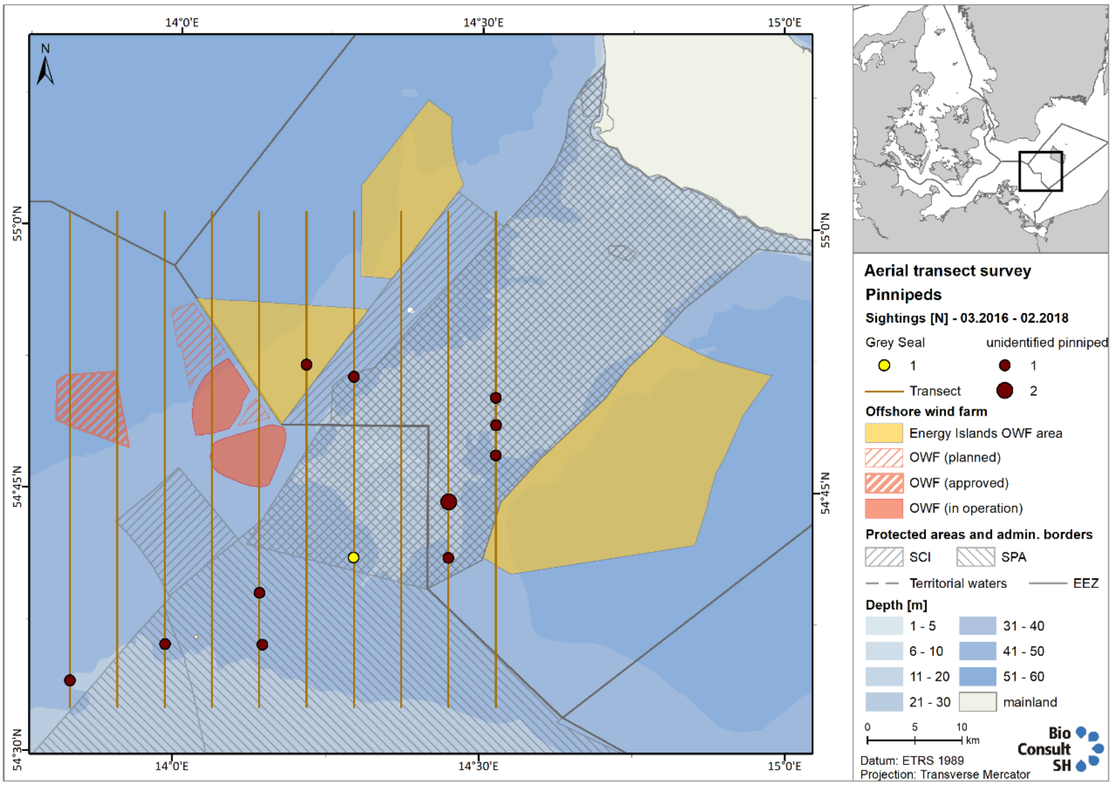


Figure 3-32. Seal sightings during digital aerial HiDef surveys from marine mammal monitoring in the OWF planning area FO-1.3 in the German EEZ between March 2016 and February 2018. From: IBL Umweltplanung et al. (2020).

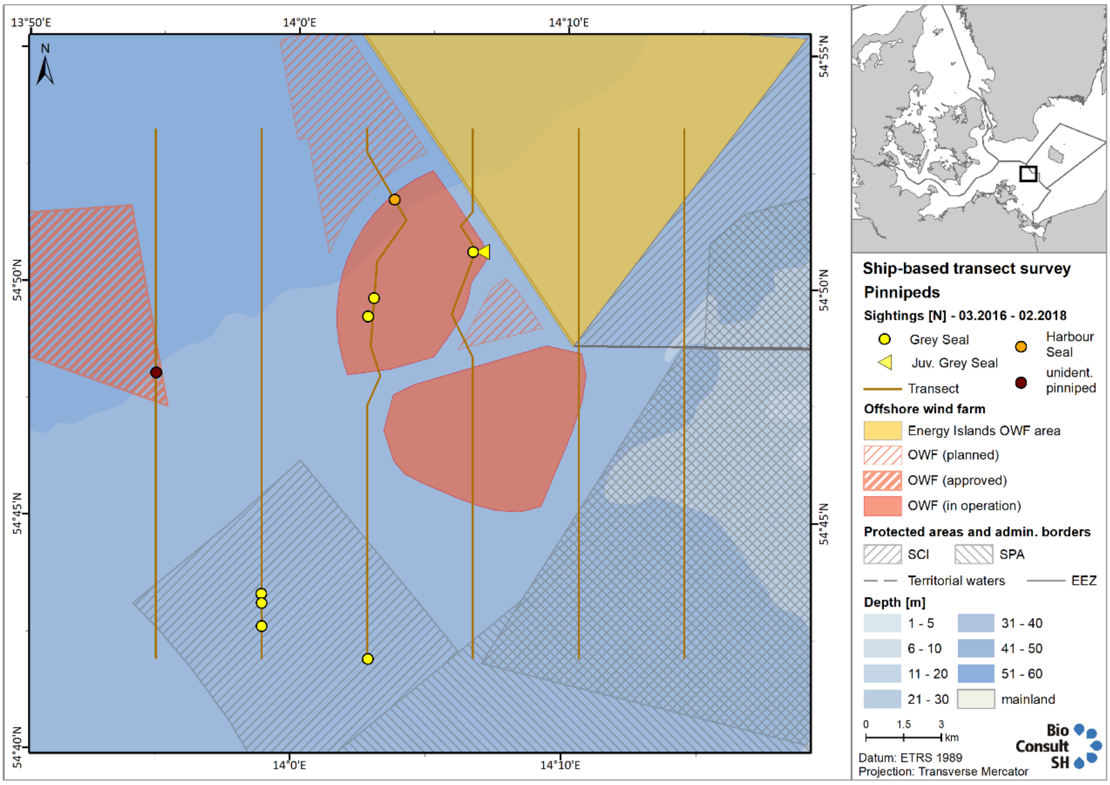


Figure 3-33. Seal sightings during ship-based surveys from marine mammal monitoring in the OWF planning area O-1.3 in the German EEZ between March 2016 and February 2018. From: IBL Umweltplanung et al. (2020).

3.2.4 SIGNIFICANCY OF THE EIB PRE-INVESTIGATION AREA FOR THE HARBOUR SEAL POPULATION

The EIB pre-investigation area is about 15 km away from the coast of Bornholm and about 40 km away from the Swedish mainland. However, the closest harbour seal haul-out is about 100 km away. Since telemetry studies have shown that harbour seals rarely make foraging trips further than 100 km away from haul-out sites, it is unlikely that the EIB pre-investigation area is used intensively as a foraging ground by harbour seals from either the Western Baltic Sea population (next haul-out about 100 km away) or the Baltic Proper population (next haul-out about 150 km away). Furthermore, the ten tracked animals from the nearest haul-out at Måkläppen never came near the EIB pre-investigation area. Quite extensive ship-based surveying of an area partly overlapping the EIB pre-investigation area only resulted in one detected harbour seal. While harbour seals may visit the area on rare occasions, these animals are probably mainly dispersing subadult individuals from the Western Baltic Sea population. The EIB pre-investigation area has thus no importance as a breeding ground or haul-out site to harbour seals and it also seems to be of no importance as a feeding area. The area may only be visited by travelling harbour seals on relatively rare occasions.

3.3 GREY SEALS (HALICHOERUS GRYPUS)

3.3.1 CONSERVATION STATUS

The status of the global population and the European population of the grey seal are classified by the IUCN as LC, and the status of the Baltic subspecies *Halichoerus grypus grypus* is assessed by the HELCOM Red List also as LC. The national Red List of Denmark lists the grey seal as VU. The Red List of Germany lists the grey seal as highly threatened in the case of the Baltic grey seal subspecies and as threatened in the case of the Atlantic subspecies (Meinig et al. 2020).The Swedish Red List lists the grey seal as LC. Hunting in Denmark and Germany is forbidden, in Sweden it is allowed but controlled through various regulations and restrictions (HELCOM Red List Marine Mammal Expert Group 2013).

In EU waters, grey seals are protected by the Habitats Directive and listed in its Annexes II and V. They are also covered by the EU Marine Strategy Directive, where distribution, number and bycatch must be reported and evaluated according to descriptor 1. Furthermore, grey seals are listed in Appendix III of the Bern Convention, while they are not listed by the Bonn Convention (Table 3-8).

DCE assessed the conservation status of the grey seals in Habitat Directive Article 17 from 2019 (Fredshavn et al. 2019) as highly unfavourable in both Danish marine regions because breeding activity is assessed to be very far from previous levels. It is also stated, however, that conditions are improving in both regions. In the DCE Marine areas report from 2021 (Hansen and Høgslung 2021) it is stated that the numbers of grey seals in Danish waters have increased over the last ten years. In 2020 1,098 grey seals were counted in the Baltic Sea. It is expected that the general increase in numbers will continue in all areas in the coming years. However, in the Baltic Sea only six pubs were observed at one out of four surveyed sites in 2020, which is a large decline compared to 2017 and worrying for a species of unfavourable conservation status (Hansen and Høgslung 2021).

Table 3-8. Listing of the grey seal in international and regional conservation agreements and international and national Red Lists.

Species	IUCN (2017)	HELCOM Red List	National Red Lists	EU Habitats Directive	Bern Convention	Bonn Convention
Grey seal ***Halichoerus grypus***	LC (Bowen 2016)	LC	DK: VU DE: highly threatened (Baltic grey seal) SWE: LC	Appendix II and V	Appendix III	Not listed

3.3.2 BIOLOGY, DISTRIBUTION AND ABUNDANCE

The grey seal (*Halichoerus grypus*) is a large seal species with a cold temperate to sub-artic distribution along the coasts of the North Atlantic. Two subspecies of the grey seal are recognised, which are morphologically and genetically (Boskovic et al. 1996; Graves et al. 2009; Fietz et al. 2013) differentiated: The Atlantic grey seal (*Halichoerus grypus atlantica*) inhabiting the Atlantic and the North Sea, and the Baltic grey seal (*Halichoerus grypus grypus*) inhabiting the Baltic Sea (Berta & Churchill 2012, Fietz et al 2016, Olsen et al. 2016). The Baltic grey seal is found throughout the Baltic Sea area with main concentrations in the northern and central parts of the Baltic Proper, but the population is expanding in numbers towards the south-western Baltic and Kattegat area (Scharff-Olsen et al. 2019, Galatius et al. 2020). The two sub-species show different breeding periods and differ in their choice of breeding habitat.

Adult male grey seals reach a body length of 1.95-2.5 m and a weight between 170 and 310 kg (up to 400 kg), female grey seals are smaller with 1.56-2.1 m body length and 103-180 kg weight (up to 250 kg) (Shirihai et al. 2008). West Atlantic grey seals are larger and heavier than East Atlantic grey seals. Baltic grey seals are still a bit smaller and usually reach a body length of 1.65-2.1 m and a body mass of 100-180 kg in females and over 300 kg in males (HELCOM 2013). The species shows distinct sexual dimorphism with males larger and heavier and a different shape of the muzzle, but this dimorphism is less pronounced in the Baltic subspecies. Grey seal females reach sexual maturity between 3 and 5 years, males between 4 and 6 years. After a pregnancy of about 11.5 months, grey seal pups are born in winter with a pupping period of February-March in the Baltic and October-December in the northeast Atlantic (Galatius et al. 2020).

Grey seals in the Baltic Sea breed mainly on drift ice, but where this is not possible, as in the southern Baltic Sea in most winters, they also breed on land. Grey seal pups are born with their lanugo coat, which is not waterproof, so pubs are not able to enter the water until they have shed it and attained their adult coat with about 2-4 weeks. Nursing lasts about 14 days, during which the females do not feed, and pups gain a lot of weight, increasing from a birth weight of about 10 kg to almost 50 kg at the time of weaning. Grey seals therefore highly depend on undisturbed haul-out sites above the high-water line in winter for successful reproduction. Baltic grey seals moult between April and June and during this time, they spend a lot of time hauled out.

Grey seals are like harbour seals, associated with coastal waters, but also make foraging trips at larger distances of the coast with occasional travelling distances of up to 2,000 km (e.g., Thompson et al. 1991, 1996b, McConnell et al. 1999, Dietz et al. 2015). Grey seals tagged in the Rødsand lagoon were found to move up to 850 km east into the Baltic (Dietz et al. 2015). Generally grey seals visit a larger number of haul-out sites than harbour seals and at greater distances (e.g., Thompson et al. 1996a).

Grey seals are generalist and opportunist feeders with a wide range of prey (Scharff-Olsen et al. 2019). The fish species consumed include a similar range as that of harbour seals, although grey seals can take larger fish due to their larger size and ability to tear large prey into pieces for consumption. Grey seal diet was found to consist of mainly sand eels (*Ammodytes* spec), flounder (*Platichthys flesus*), herring (*Clupea harengus*) and cod (*Gadus morhua*), depending on location and season (Thompson et al. 1991, 1996b). Additionally, seabirds as well as harbour porpoises may also be preyed upon (Jauniaux et al. 2014, Leopold et al. 2015). In the south-western Baltic Sea, 11 fish species were identified from otoliths found in 39 grey seal samples (scat and digestive tracts) from one study with the greatest majority of prey items being made up of black gobies (*Gobius niger*, 24 %), round gobies (*Neogobius. melanostomus*, 18 %), Atlantic cod (16 %) and plaice (*Pleuronectes platessa*, 12 %) (review by Scharff-Olsen et al. 2019).

The grey seal population in the Baltic Sea suffered from extensive hunting and environmental toxins during the 20th century and was reduced from about 100,000 individuals at the start of the 20th century to only about 3,000 individuals in the 1970s (Harding & Härkönen 1999). Following the abandonment of the use of several pollutants and the mitigation of their effects, as well as the introduction of a general culling and hunting ban, the population had increased exponentially since the 1980s (Harding & Härkönen 1999, Härkönen et al. 2007 200, HELCOM 2018). In the years 2014–2017, numbers were stagnating around 30,000 individuals counted in the Baltic Sea at the haul-outs during the moulting season in late May and early June (ICES 2019). After a period of stagnation, ca. 38,000 grey seals were counted in 2019 (ICES 2020). Today, grey seals are evaluated by HELCOM (2018) as having achieved “good status” with regard to the key indicator ”distribution” in the area east of Bornholm as the area of occupancy, breeding and moulting sites have all achieved a good status. In the area west of Bornholm including the Belt Sea, the key indicator failed to reach a “good status” because some sites formerly used for reproduction have not been recolonised (Figure 3-19, HELCOM 2018). In the southern Baltic, the grey seal population has been slower to recover until today. The grey seal became locally extinct in the southern Baltic Sea, Danish Straits and Kattegat in the early 1900s after prolonged culling campaigns. Grey seal occurrence has steadily increased since 2003 as evidenced by the coordinated Baltic Sea moult censuses (Galatius et al. 2020), but recolonisation is rather slow. At the first census in 2003, there were 146 grey seals along the southern Baltic coasts of Sweden and Denmark – ca. 1 % of the total Baltic Sea population count. Since 2015, this has increased to 2,000–2,600 grey seals making up about 7 % of the total population count (Galatius et al. 2020). Breeding sites formerly existed on the German and Polish coasts, but until today reproduction there only occurs very sporadically. The population increase observed in this region is therefore due to immigration rather than recruitment. With regards to the HELCOM key indicator ”abundance and population trend and abundance”, the grey seal population in the Baltic Sea was assessed as one unit and achieved ”good status” when evaluated against criteria for carrying capacity (with population decrease less than 10 % over a 10-year period) (Figure 3-19, HELCOM 2018)

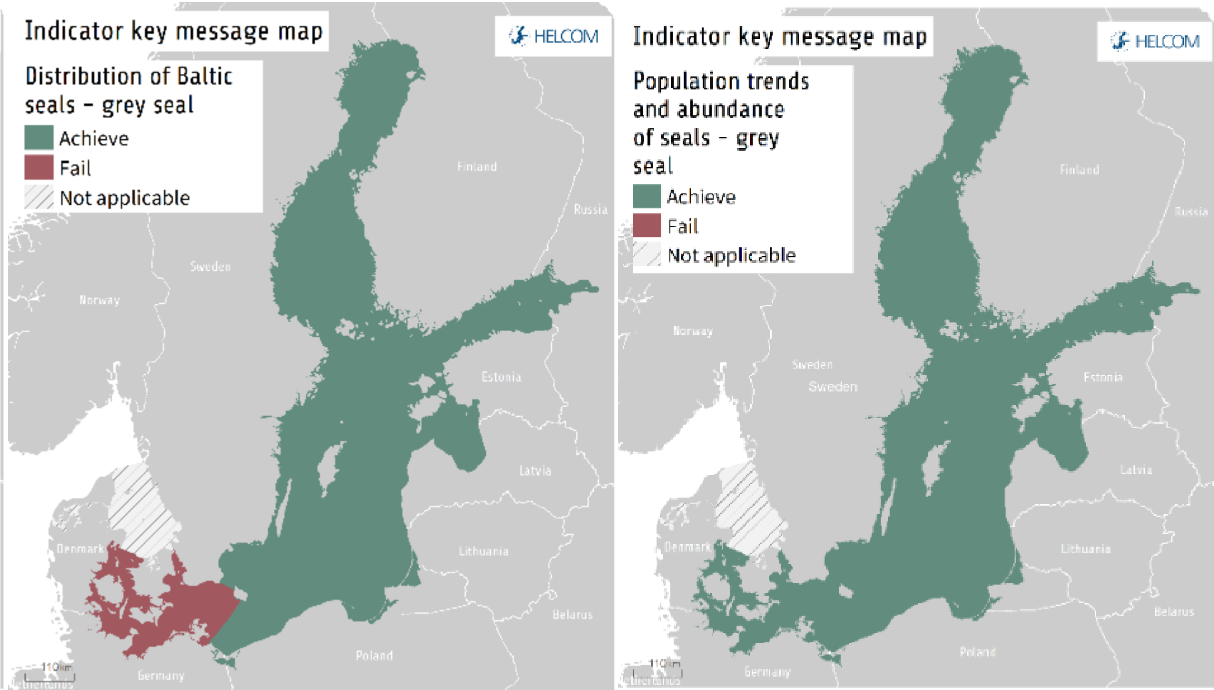


Figure 3-34. HELCOM status assessments of the grey seal in the Baltic with respect to the key indicator "distribution" (left panel) and "population trend and abundance" (right panel) (HELCOM 2018).

Grey seal haul-out sites in the southern Baltic area and in Kattegat as well as estimated occupancy over the last two decades are shown in Figure 3-35. Haul-outs closest to the EIB pre-investigation area are located 50 km south at Rügen and about 60 km northeast at Ertholmene. There is no breeding at Ertholmene, also not historically, probably because the skerries around these islands are prone to flooding by large waves and in windy conditions (Galatius et al. 2020). At Rügen, there are historic records of regular breeding activity, but since the recolonisation of this region by grey seals, only sporadic breeding events there were documented (Galatius et al. 2020). The next haul-out sites with breeding activity are Måkläppen 100 km to the northeast and Rødsand about 140 km to the west.

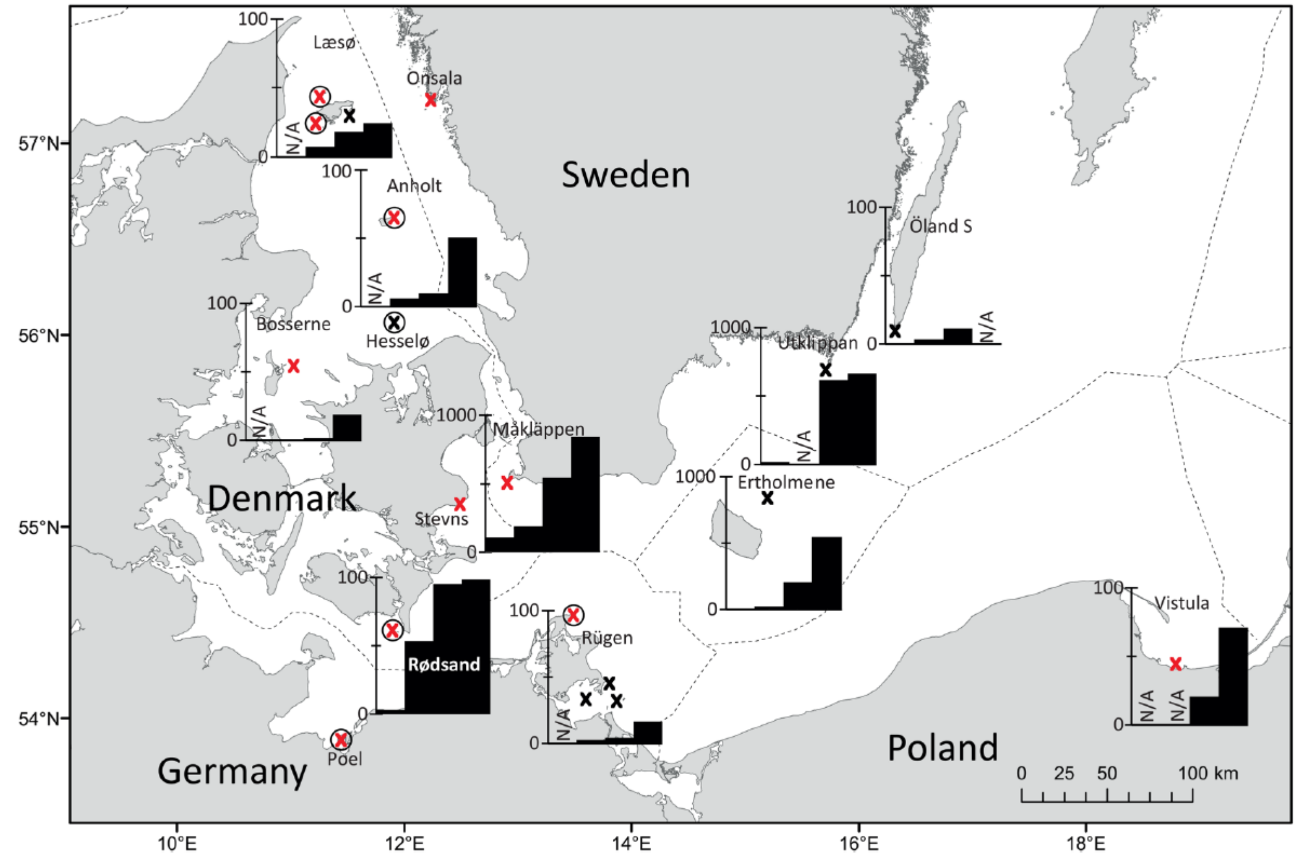


Figure 3-35. Map of important grey seal haul-out localities (crosses) in Kattegat and southern Baltic Sea. Column charts show moult abundance of grey seal haul-out with more than 10 grey seals recorded, or total counts of several haul-outs around the main island in the cases of Rügen and Laeso. First bar represents the average count during the years 2001-2005, second bar 2006-2010, third bar 2011-2015 and fourth bar 2016-2019. Red crosses denote haul-outs with and black crosses without breeding activity after 1990, circled crosses denote haul-outs with historic breeding activity. N/A means data are not available. From: Galatius et al.2020.

3.3.3 HABITAT USE AND DENSITY ESTIMATES AROUND THE EIB PRE-INVESTIGATION AREA

As already mentioned for harbour seals, good knowledge exists from the number of animals at haul-out sites, where they are mainly counted during the moulting period. Little is known about grey seal density and habitat use offshore. Some information comes from telemetry studies, which show that grey seals undertake longer foraging trips from their haul-out sites than harbour seals do, and they also show much larger dispersal distances. Grey seals in Scotland for example were reported to show movement patterns on two geographical scales: local, short and repeated trips between haul-out sites and discrete offshore areas about 40 km from the coast, similar to harbour seals, and longer distance travels to areas up to 2,100 km away (McConnell et al. 1999). McConnell et al. (2012b) also satellite tracked five grey seals in the Rødsand lagoon – one adult and four juveniles. They also showed local movement patterns as well as far distance trips, sometimes far up north into the Baltic Proper. Two such examples are shown in Figure 3-36. Both these animals as well as the other three did not spend much time near the EIB pre-investigation area, but just seemed to be travelling through on their way up to Øland, Gotland or beyond. Dietz et al. (2015) tagged five grey seals from Rødsand, five from Falsterbo and one from Ålandsøerne (Figure 3-37). These animals also showed some local movements as well as long distance trips to other haul-out sites. Movement was largely focused on local areas around haul-out sites, and the EIB pre-investigation area only seems to be used for travelling through (Figure 3-37).

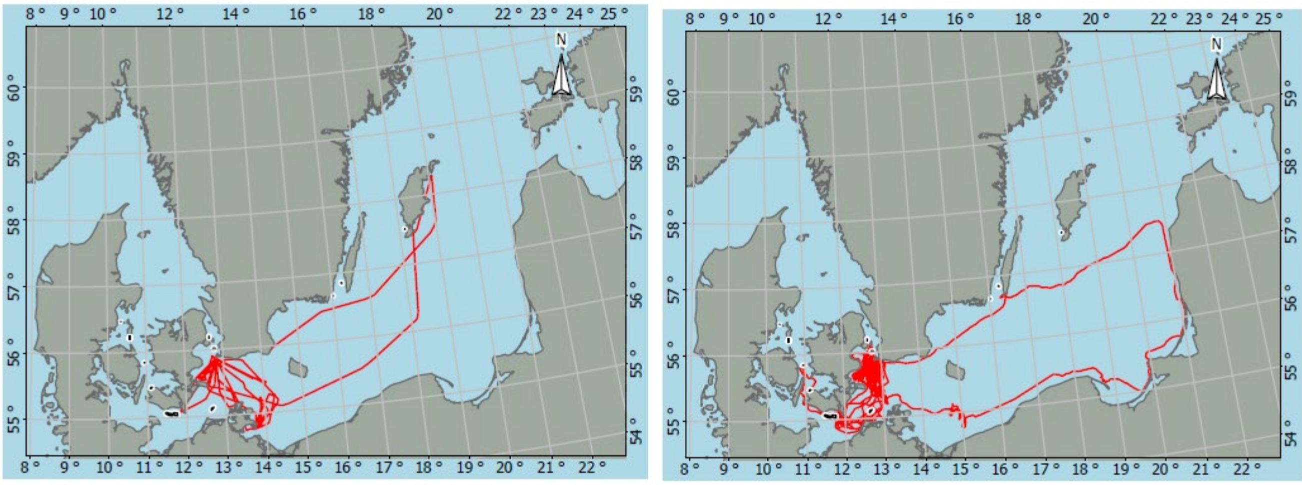


Figure 3-36. Example of tracks from two radio-tracked grey seals, captured and tagged in the Rødsand lagoon. From: McConnel et al. (2012b).

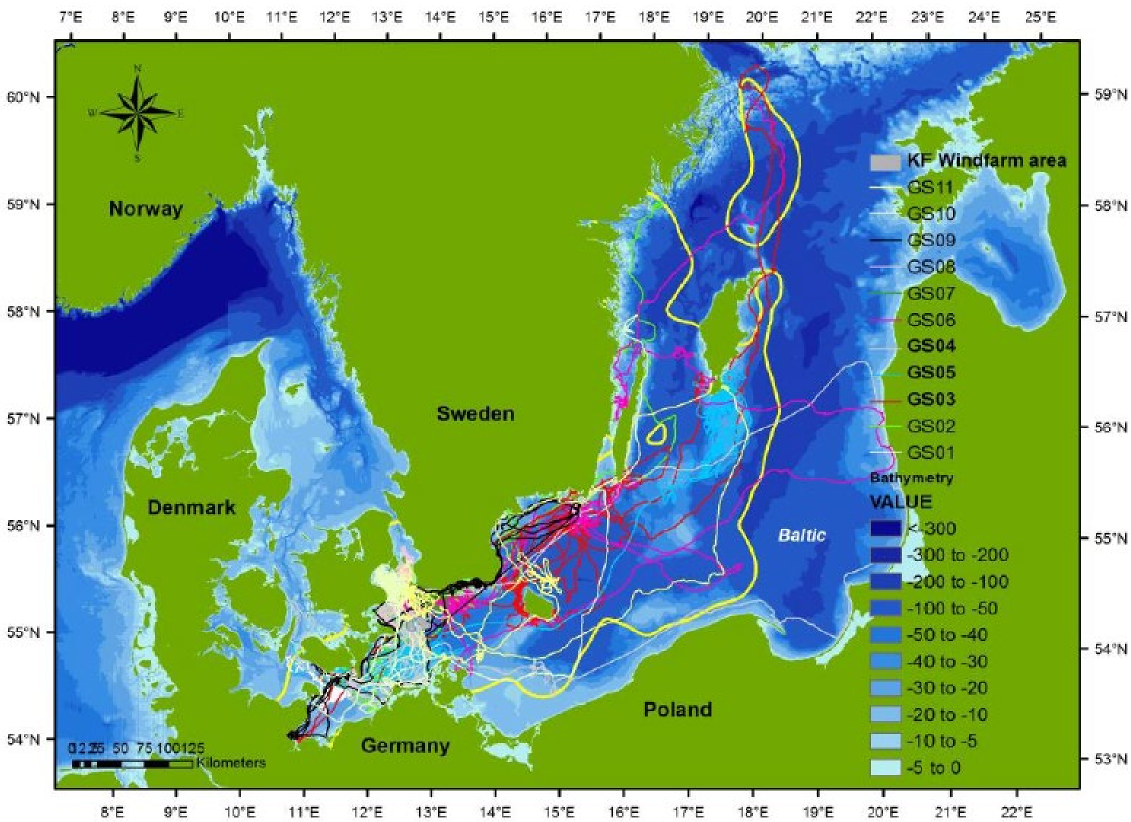


Figure 3-37. Map showing the migration routes and the 95 % Kernel ranges (yellow polygon) for 11 grey seals tagged between 2009 and 2012 at Falsterbo (n=5), Rødsand (n=5) and at Ålandsøerne (n=1). From Dietz et al. (2015).

Further information on the occurrence of grey seals in the EIB pre-investigation area can be taken from digital aerial and ship-based surveys conducted in the OWF planning site O1.3 in close proximity to the EIB pre-investigation area. Results from these surveys were already shown in the chapter on harbour seals above in 3.2.3, but are summarised in relation to grey seals again. A total of only 13 seals were detected during 20 aerial surveys conducted throughout the year between 2016 and 2018 (Table 3-6), of which one could be identified as a grey seal, while the others were unidentified seals. Seal densities calculated from these data ranged between 0 and 0.01 ind./km² and were thus generally very low. Seal density calculated over all data would be 0.002 ind./km². During 24 ship-based survey in the same period, a total of nine seals could be detected (Table 3-7). Of these, seven were grey seals, one was a harbour seal and one was unidentified, which led to the conclusion that also during aerial surveys, most seals were probably grey seals. This gave an overall sighting rate of only 0.28 ind./100 km during ship-based surveys. The seasonal (Figure 3-30, Figure 3-31) and geographical distribution (Figure 3-32, Figure 3-33) of sightings during both aerial and ship-based surveys showed that sightings can occur throughout the year and throughout the study area. As such, no specific foraging ground could be identified.

3.3.4 SIGNIFICANCY OF THE EIB PRE-INVESTIGATION AREA FOR THE GREY SEAL POPULATION

The EIB pre-investigation area lies within 50 km of grey seal haul-out sites, which are not used as breeding grounds, at least not on a regular basis. Combining knowledge from tracked seals and given some observations of grey seals in the area, it is possible that grey seals from these haul-out sites use the EIB pre-investigation area as an occasional foraging ground. However, most animals are probably only travelling through during far distance trips on their way to other haul-out sites. Haul-out sites with breeding activity are at least 100 km away, such that the EIB pre-investigation area is unimportant for breeding grey seals and pubs. It is also unlikely that the EIB pre-investigation area is used as a foraging ground on a regular basis because a distance of 50 km is at the maximum range that grey seals showed during their shorter regular foraging trips. Furthermore, the haul-out at Ertholmene is more than 50 km away, especially if looking at the needed travel distance rather than a direct line, as seals will have to swim around Bornholm to reach the EIB pre-investigation area. Also, grey seals, unlike harbour seals, made longer distance trips, and then used other haul-outs and associated feeding areas for a while. Tracked seals that moved through the EIB pre-investigation area or passed it nearby, did not stay there for longer periods, but only travelled through. The assumption that the EIB pre-investigation area is occasionally but rarely used by grey seals is supported by very low sighting rates in the German OWF planning area O-1.3 despite extensive aerial and ship-based surveying.

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