VATTENFALL / ØRSTED

NATURA 2000-SCREENING AND ANNEX IV SPECIES ASSESSMENT

OPERATIONAL LIFETIME EXTENSION, HORNS REV 1

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CONFIDENTIAL

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1 SUMMARY

This report includes a Natura 2000-screening and an assessment of species listed in Annex IV of the Habitat Directive according to the Habitats Directive (92/43/EEC). The assessment is conducted to support an application for lifetime extension for Horns Rev 1 with up to 15 years, i.e. until 2042. The lifetime extension of the Wind Farm is an extension of the electricity production permit, without any technical or physical changes.

Relevant Annex IV species includes bats (Nathusius pipistrelle, Serotine bat and Particoloured bat) and whales (harbour porpoise, white-beaked dolphin and minke whales).

There is a low number of bat recordings at Horns Rev 1. The bats occur during strong easterly winds, which indicates that the project area is not a major migration route for any bat species, but rather that the bats occasionally blow into the project area. There is no indication that the project area is an important feeding ground for any bat species. The data indicates that few individual bats may be present in the project area, but the number is expected to be very low and will not impact the population of Nathusius pipistrelle, Serotine bat or Particoloured bat.

Harbour porpoise is the only whale that frequently occur in the project area. It is assessed that continued operation of the Wind Farm will not lead to displacement of harbour porpoises.

Overall, it is assessed that the lifetime extension of Horns Rev 1 will not affect Annex IV species and hence, the protection according to Article 12 of the Habitat Directive will continue to be maintained. Furthermore, it is assessed that the lifetime extension of the windfarm is following the general provisions of the EU Bird Directive.

The Wind Farm is situated within SPA 113, Sydlige Nordsø (part of Natura 2000 site N246). Furthermore, SAC 255 is close to the Wind Farm (3.8 km). It is assessed that the lifetime extension of Horns Rev 1 will not significantly impact the conservation objectives for the marine mammals, habitats and most birds, designated to be protected by the Natura 2000 site N246 (SAC 255/SPA 113). However, some uncertainties are identified for the red-throated diver in terms of possible cumulative displacements effects with other offshore windfarms in the vicinity.

Accordingly, elaboration of an Appropriate Natura 2000 Assessment according to Article 6 of the Habitat Directive is assessed to be necessary.

2 INTRODUCTION

Horns Rev 1 offshore windfarm (hereafter Horns Rev 1) in the southeastern North Sea (see Figure 2-1) was constructed in 2002 and has been operational since December 11, 2002.

This report includes a Natura 2000-screening and an assessment of annex IV species according to the Habitats Directive (92/43/EEC). The objective is to support the application for lifetime extension of the Wind Farm with up to 15 years, i.e. until 2042.

The lifetime extension of Horns Rev 1 is an extension of the electricity production permit, without any technical or physical changes of the windfarm.

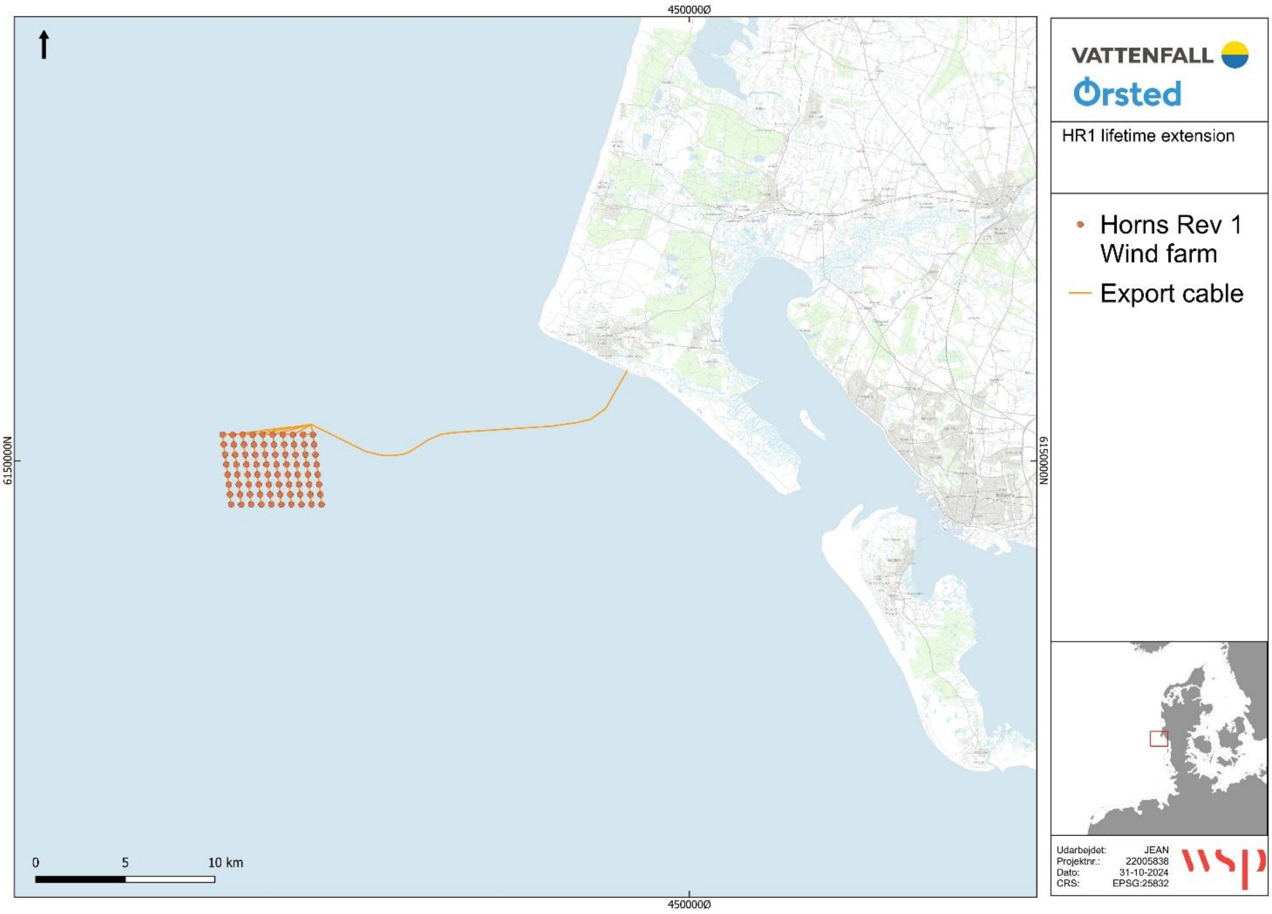

Figure 2-1 Location of Horns Rev 1 and the export cable which connects the substation to the onshore transmission grid.

3 DESCRIPTION OF THE WIND FARM

Horns Rev 1 is located approximately 14-20 km from the Danish west coast on relatively shallow water (6.5-13.5 m). Layout and description of the continued operation of the Wind Farm is described in the application for operational lifetime extension of Horns Rev 1.

3.1 ENVIRONMENTAL MONITORING

Environmental investigations and surveys have been conducted on various species groups before, during and after the construction of the Wind Farm to assess any significant environmental effects (Fox, Christensen, Desholm, Kahlert, & Petersen, 2006). Table 3-1 provides an overview of the environmental monitoring conducted. Details on findings for relevant species are presented in chapter 6 (Potential impacts from lifetime extension) and chapter 8 (Assessment of Annex IV species).

Table 3-1 Investigations and surveys carried out at Horns Rev 1. The Wind Farm was commissioned in 2002. Note that there is not monitoring data after 2011 for species groups other than for bats (data collected in 2024). Source: (Fox, Christensen, Desholm, Kahlert, & Petersen, 2006). Information on monitoring data after 2006 has been provided by Vattenfall.

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2024-2025
Benthic flora and fauna	X	X	X		X	X	X							
Fish	X			X		X					X	X		
Harbour porpoises	X	X	X	X	X	X	X	X		X				
Seals	X			X	X	X	X							
Birds	X	X	X	X	X	X	X		X	X	X	X		
Bats														X

4 LEGAL FRAMEWORK

4.1 HABITAT DIRECTIVE ANNEX IV SPECIES

Annex IV species are strictly protected species that are particularly threatened or vulnerable. The species are listed in Annex IV of the EU Habitats Directive. The protection of Annex IV species has been implemented in Danish law by, among other the Executive Order on the Administration of International Nature Conservation Areas and the Protection of Certain Species Regarding Projects on the Establishment, etc., of Electricity Production Facilities and Electricity Supply Networks at Sea (BEK 588 of 26/05/2025) and executive order on species protection (BEK 521 of 25/03/2021).

All cetacean and bat species are listed in Annex IV of the EU Habitats Directive (see also chapter 6). The Habitats Directive requires all member states to introduce strict protection for certain species covered by the Habitats Directive's Article 12 and Annex IV, regardless of whether these occur within or outside a Natura 2000 site.

The regulations provide a system of strict protection for the animal species listed in Annex IV in their natural range, prohibiting:

a) Deliberately capture or kill any specimen of these species in the wild.

b) Deliberately disturb these species particularly during the periods of breeding, rearing, hibernation and migration.

d) Damage or destroy a breeding site or resting place of such an animal.

If the assessment concludes that the applied project may involve disturbance, damage or destruction, as mentioned above, a permit cannot be granted.

4.2 NATURA 2000

Natura 2000 is a network of nature protection sites established under the EU Habitats Directive (92/43/EEC) and the Birds Directive (2009/147/EC). The purpose of Natura 2000 sites (SAC/SPA)[1] is to ensure or restore favourable conservation status for the species and habitat types for which the site has been designated. The basis for designation of Natura 2000 areas is regularly updated to comply with the directives and the Environmental Objectives Act[2]. Denmark is obliged to include species and habitats designated to protect the site if the country holds significantly important occurrences.

For offshore electricity generation facilities, the Habitat Directive is implemented in Danish law through Executive Order on the Administration of International Nature Conservation Areas and the Protection of Certain Species Regarding Projects on the Establishment, etc., of Electricity Production Facilities and Electricity Supply Networks at Sea (BEK 812 of 21/06/2024). When applying for a lifetime extension, a Natura 2000-screening is required according to BEK 812 of 21/06/2024.

In DEA's guideline for lifetime extension without any technical and physical changes to the existing facility it is furthermore stated that the owner of the offshore wind farm must submit a Natura 2000-screening ("væsentlighedsvurdering"), as well as an assessment of Annex IV species when applying for an extension of the electricity production permit (lifetime extension) (Danish Energy Agency, 2024).

A Natura 2000-screening is carried out to determine whether the project individually, or in combination with other plans and projects, is likely to have significant negative effects on Natura 2000 sites.

The Natura 2000-screening should be sufficient to support the competent authority in determining whether a project will significantly affect the conservation objectives and the integrity of Natura 2000 sites.

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[1] Natura 2000 sites include Special Areas of Conservation (SAC) for habitats and species (Danish: habitatområder) and Special Protection Areas (SPA) for designated birds (Danish: fuglebeskyttelsesområder).
[2] Miljømålsloven. Bekendtgørelse af lov om miljømål m.v. for internationale naturbeskyttelsesområder (Miljømålsloven). LBK nr. 692 of 26/05/2023.

If significant impacts are considered likely, a complete Natura 2000-assessment should be undertaken. The assessment may involve additional calculations or collection of new data. Where it cannot be excluded that adverse effects may occur, mitigating measures should be considered.

4.2.1 CONSERVATION OBJECTIVES

The overall conservation objective for Natura 2000 sites is to maintain a "favourable conservation status" for the habitat types and species that the site has been designated to protect (the designation basis).

According to the Habitats Directive, the following criteria must be met to achieve favourable conservation status:

- Habitat types cannot decline in spatial extend – the natural range of areas and the spaces the habitat type covers within the area must be stable or increasing in spatial extent.
- The structures and functions necessary to obtain the nature types must be continuously present.
- As for species, including birds, populations and the area of their preferred habitats must be stable or increasing in order to obtain a favourable conservation status.

4.2.2 SIGNIFICANCE

The Natura 2000-screening is following the Danish guidance document from the Ministry of Environment, where it is stated that *"The assessment of whether a plan or a project has a significant impact on the conservation objectives of a Natura 2000 site is aimed at the impact on the characteristics and environmental conditions that characterise the specific Natura 2000 site, and in particular the specifically determined conservation objectives for the species and habitat types that are on the Natura 2000 site's designation basis"* (Danish Ministry of Environment, 2020).

The European Court of Justice has ruled that it must be considered a significant impact if a plan or project risks harming the conservation objective of the Natura 2000 site. The European Court of Justice has thus emphasised that the impact must be assessed on the basis of whether it is so significant that the conservation objectives set out in the Natura 2000 plan cannot be achieved, according to which the habitat types and species must be stable or increasing.

4.3 GENERAL BIRD PROTECTION

The general provisions of the EU Bird Directive, contained in the Directive's Article 4 and Article 5, focus on avoiding deterioration of habitats as well as intentional killing, destruction or damage to nests, collection, disturbances during the breeding season, etc.

It follows from Article 4 that the Member States shall take the requisite measures to establish a general system of protection for all species of birds referred to in Article 1 (all species of naturally occurring birds in the wild state in the European territory), prohibiting in particular:

- Deliberate killing or capture by any method.
- Deliberate destruction of, or damage to, their nests and eggs or removal of their nests.
- Taking their eggs in the wild and keeping these eggs even if empty.
- Deliberate disturbance of these birds particularly during the period of breeding and rearing, in so far as disturbance would be significant having regard to the objectives of this Directive.
- Keeping birds of species the hunting and capture of which is prohibited.

In Article 5, it is stated that the Member States shall take appropriate steps to avoid pollution or deterioration of habitats or any disturbances affecting the birds. The Member States shall also strive to avoid pollution or deterioration of habitats.

Member States can only derogate from these provisions, where there is no other satisfactory solution, for the following reasons:

- In the interests of public health and safety, in the interests of air safety, to prevent serious damage to crops, livestock, forests, fisheries and water, for the protection of flora and fauna.
- For the purposes of research and teaching, of re-population, of re-introduction and for the breeding necessary for these purposes.
- To permit, under strictly supervised conditions and on a selective basis, the capture, keeping or other judicious use of certain birds in small numbers.

APPENDIX

The general provisions of the Birds Directive have been implemented in Danish legislation through the Species Protection Order (BEK no. 521 of 25/03/2021) §4, which concerns the prohibition of intentional killing of birds, as well as the Hunting and Wildlife Management Act (LBK no. 639 of 26/05/2023) §7 subsection 2, which concerns the prohibition of intentional disturbance of birds.

5 POTENTIAL EFFECTS FROM LIFETIME EXTENSION

Potential impacts from the proposed lifetime extension of the Wind Farm is assessed to include:

1. Collision risk (birds and bats).
2. Displacement and barrier effects (birds).
3. Electromagnetic fields (marine mammals).
4. Underwater noise from service vessels (marine mammals).
5. Noise from turbines (birds, bats and marine mammals).
6. Incidents, accidents and spill (screened out in section 5.6).

5.1 COLLISION RISK FOR BIRDS AND BATS

For both birds and bats there is a potential risk of collision when the blades are rotating. Potential impact on birds from collision is assessed in chapter 8 - Natura 2000-screening. Potential impact on bats from collision is assessed in chapter 6 - Assessment of Annex IV species.

5.2 DISPLACEMENT AND BARRIER EFFECTS

Potential impact on migrating and resting birds from displacement and barrier effects are assessed in chapter 8 - Natura 2000-screening. For birds, "*displacement*" refers to the fact that some species tend to avoid areas with offshore wind farms, resulting in an indirect habitat loss. The displacement is caused by the visual presence of the turbines, noise during operation and the presence of service vessels.

Additionally, the presence of the wind farm can potentially constitute a barrier for migratory birds. As a result, these birds may need additional energy resources during their migration. As a derivative effect, the barrier effect causes the birds to avoid the project area, which reduces the risk of birds colliding with the operating turbines.

Potential impact on bats from avoidance response and/or displacement is assessed in chapter 6 - Assessment of Annex IV species.

5.3 ELECTROMAGNETIC FIELDS

The inter array cables connecting all the individual wind turbines are three-phased alternating current (AC). The inter array cables are further connected to a transformer platform (owned and operated by Energinet), where the electricity produced at the Wind Farm is converted to 150 kV before the electricity is transported onshore.

When electricity is transmitted through the cables, a magnetic field arises around the cables. Additionally, the magnetic field can induce a weak electric field. Several organisms orient using magnetic fields, and others can detect electric fields around prey, as the animals that move using the Earth's magnetic field also create a weak electric field. Thus, there is a possibility that various organisms can be affected by the electromagnetic fields around the cables.

The existing cables will remain in place without any change. Therefore, there is no risk of increased electromagnetic fields in the project area.

Impacts related to electromagnetic fields are assessed for marine mammals (see section 6.3.2, 8.5.2 and 8.5.3).

5.4 UNDERWATER NOISE FROM SERVICE VESSELS

In connection with maintenance, there will be limited ship traffic around the wind turbines for short time periods. Service vessels produce underwater noise which may lead to avoidance response and displacement of marine mammals.

Vessel noise is typical for the shipping that traverses the Danish EEZ and harbour porpoises and seals that are present in the area are assumed to be adapted to the shipping traffic that already exist in the area.

Potential impact from avoidance response and displacement on cetaceans is assessed in chapter 6 - Assessment of Annex IV species. Potential impacts on other marine mammals (seals) are assessed in chapter 8 - Natura 2000-screening.

5.5 NOISE FROM WIND TURBINES

Both underwater- and airborne noise are produced from the turbines when in operation. The underwater noise derives primarily from mechanical vibrations of the rotating parts in and around the nacelle (blades, gearbox, generator etc.), which are transmitted through the tower and radiated into the surrounding water (Bellmann, Müller, Scheiblich, & Betke, 2023). The noise may lead to displacement and barrier effects of marine mammals (whales and seals), birds and bats.

5.6 INCIDENTS, ACCIDENTS AND SPILL

Each wind turbine contains hydraulic fluid, coolants, lubricating and gear oil that in rare occasions may spill into the marine environment. In addition, pollution events can occur from accidents with service vessels during maintenance.

Instructions and contingency plans are put in place that include practices for avoiding and limiting accidents and consequences for human health and the environment. With this in mind, and the low likelihood of severe spill, this aspect will not be further assessed.

5.7 SUMMARY

Table 5-1 summarises the potential sources of impact from the Wind Farm. The assessments are made in chapter 6 (Assessment of Annex IV species) and chapter 8 (Natura 2000-screening).

Table 5-1 Summary of effects that will be assesses in the Natura 2000-screening and the assessment of Annex IV species.

IMPACT	EFFECT	IMPACTED GROUP
5.1. Operating turbines	Collision	Birds and bats
5.2. Visual presence of the turbines	Displacement / avoidance response	Birds
5.3. Electromagnetic fields	Displacement	Marine mammals
5.4. Underwater noise from service vessels	Displacement	Marine mammals
5.5. Noise from turbines (airborne and underwater noise)	Displacement	Birds and bats (airborne noise) Marine mammals (underwater noise)

APPENDIX

6 ASSESSMENT OF ANNEX IV SPECIES

Majority of species listed in the Annex IV of the EU Habitats Directive are species exclusive connected to onshore habitats and therefore not relevant for this assessment. Only three categories are found in the Marine environment: This includes the Whitefisk (Snæbel) (*Coregonus oxyrhynchus*) a salmon-like fish, all cetacean (whales) and bat species are listed in Annex IV of the EU Habitats Directive. The Whitefish is rare in Danish Waters and only occurring in the Wadden Sea and in a number of streams running into this and therefore not considered relevant for the location of this project. This chapter therefore includes only an assessment of whales and bats as these two animal groups are the only ones with possible presence in the project area.

Harbour porpoise is the only resident cetacean species relevant to this project. White-beaked dolphin and minke whales are also relevant to include, as they occur regularly in the open part of the North Sea. Bats may also occasionally be present in the area during their foraging or migration.

6.1 METHOD

6.1.1 SCOPING OF RELEVANT ANNEX IV SPECIES

Denmark has 39 species that are listed on annex IV of the Habitat Directive. Of these, only bats and cetaceans are likely to occur in the Horns Rev 1 area. Relevant bat and cetacean species are scoped in the following sections.

BATS

The knowledge on bats over open sea is still limited. Surveys from the pre-investigation area for offshore wind farms in the Danish part of the North Sea (project North Sea I) (Niras, 2024) show that only few bats were observed more than 10 km from the coast. Most frequent species observed were Nathusius' pipistrelle (*Pipistrellus nathusii*), followed by a group of un-identified larger bats, most likely including Common noctule (*Nyctalus noctule*), Serotine bat (*Eptesicus serotinus*) and Parti-colored bat (*Vespertillio murinus*). Beside these species the survey (Niras, 2024) also recorded single observations of Soprano pipistelle (*Pipistrellus pygmaeus*) and Myotis species (*Myotis* sp.).

In 2024 a survey of bat was carried out on the turbines in Horns Rev I offshore wind farm. This survey will continue in 2025. However, preliminary data from the first season are presented in chapter 6.2. The 2024 data collection did not start until early May. Though current knowledge on bat-occurrence in the central North Sea also suggests that bats may be present in second half April (e.g. Hüppop & Hill (2016), Niras (2024)) and further south in the North Sea even in March (Lagerveld et. al 2016). Bat migration and activities are however very weather dependent. Weather in Denmark during April 2024 was however very poor in terms of bat activities. Weather fronts battling between extremely warm weather in central Europe and very cold weather over Southern Scandinavia gave extremely much precipitation (150 year record for April) and moreover weather in second half April had wind-directions between South-East and North with East as most dominant direction and night temperatures mainly between 2-6 Degrees Celcius (DMI Vejr-arkiv for Esbjerg). Based on current knowledge on bat migration and activities in relation to weather bat migration across the North Sea seem mainly to take place with some element of tail-wind and at temperatures above 10 Degrees Celcius (Lagerveld) This suggests that most likely no significant bat activities should have taken place during April this year, and thereby missed.

CETACEANS

Many species of cetaceans have been registered in Danish waters. However, only a few occur regularly and thus are relevant to this project (Tougaard, Sveegaard, & Galatius, 2021).

The Marine Ecosystems Research Program (MERP) has produced monthly distribution maps for cetaceans in the North-East Atlantic (Waggitt, et al., 2019). These distribution maps were generated from species distribution models using survey data collected between 1980 and 2018. The distribution maps produced by Waggitt et al. (2019) suggest that harbour porpoise

(*Phocoena phocoena)* is the most abundant species in the project area (see Figure 6-1). White-beaked dolphin (*Lagenorhynchus albirostris),* Atlantic white-sided dolphin *(Lagenorhynchus acutus),* common dolphin *(Delphinus delphis*), minke whale (*Balaenoptera acutorostrata*) and killer whale (*Orcinus orca*) may also be present in the region but will occur in lower numbers. Figure 6-1 displays the maximum yearly distribution of these species across the North Sea based on data from Waggitt et al. (2019).

The JNCC has compiled an atlas of cetacean distribution in Northwest European waters (Reid, Evans, & Northridge, 2003). Data in Reid et al. (2003) show that harbour porpoise and minke whale have been sighted in the project area, whereas white-beaked dolphins have not been sighted here but further offshore. However, data from Waggitt et al. (2019) (which includes newer data than in Reid et al. (2003)) show observations of minke whales and white-beaked dolphins in the vicinity of the Wind Farm. White-sited dolphins, common dolphins and killer whales have not been sighted here. Thus, harbour porpoise, minke whale and white-beaked dolphins are included in the assessment and species included is furthermore based on the recommendations by Tougaard et al. (2021).

APPENDIX

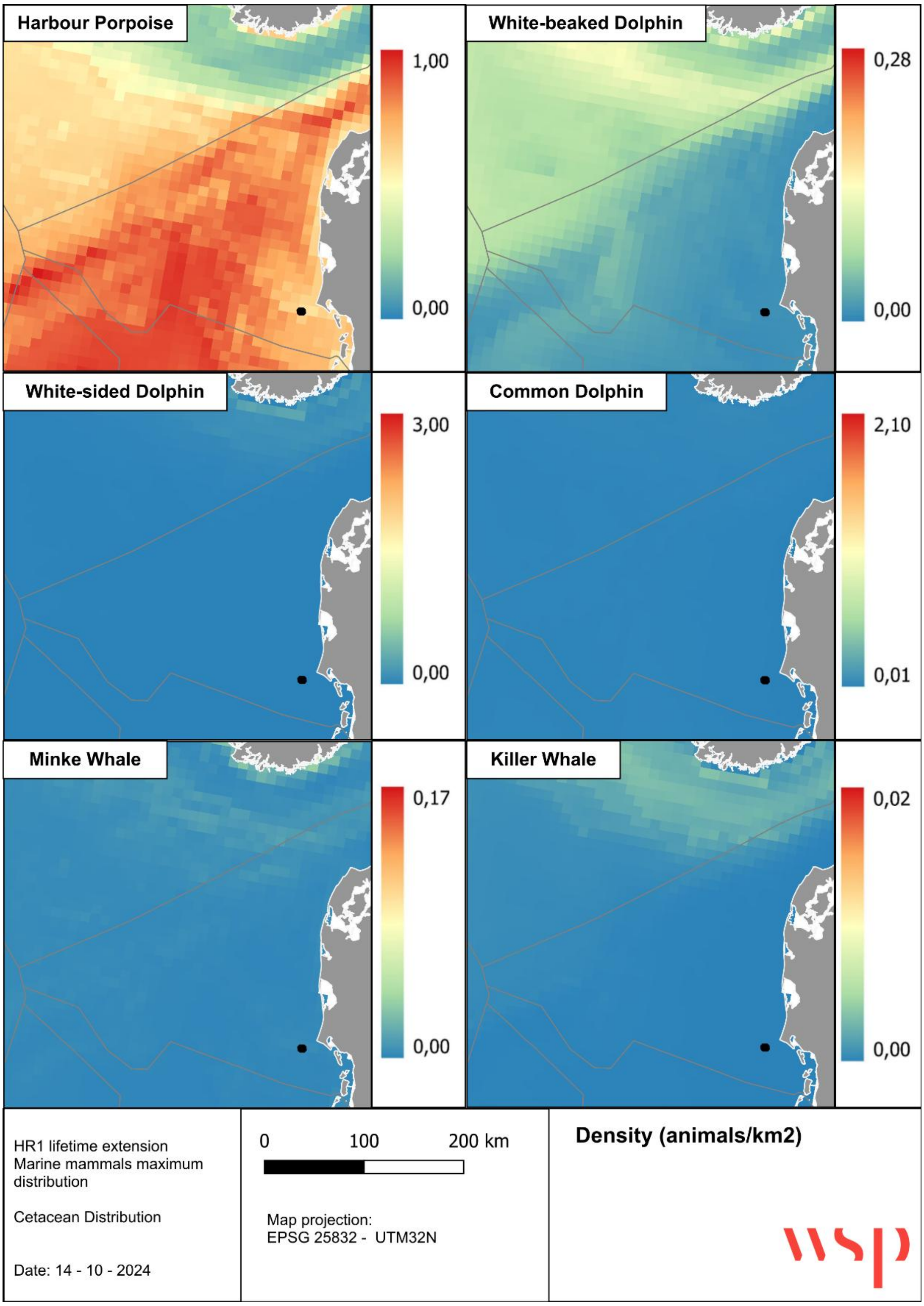

Figure 6-1 Maximum yearly distribution and densities (animals/km²) of selected cetacean species in the North Sea. Densities are derived from a species distribution model based on collated data (Waggitt, et al., 2019). The maximum density month was chosen as the one with the highest density within the survey area and not in the entire North Sea. The month with the highest density within the survey area is not necessarily the same month as the month with the highest density in other parts of the north area or for other species. Note different density scales between species. The Wind Farm is marked with a black dot on the six maps.

6.2 EXISTING CONDITIONS

6.2.1 BATS

In 2024, the bat activity at Horns Rev 1 was monitored by using ten detectors placed on ten of the wind turbines, and this monitoring will continue in 2025. The preliminary conclusions are based on the collected data from May to October 2024.

In total there were 98 bat recordings distributed in the Wind Farm (Figure 6-2 and Figure 6-3). 94 recordings are from *Nathusius pipistrelle* (Figure 6-2) and 4 are from Serotine bat or Parti-coloured bat (Figure 6-3).

Most bat recordings are from the turbines closest to the coast of Jutland. The number of bat recordings are significantly lower than for a similar survey on Kriegers Flak (Christensen M. , 2024). On ten wind turbines at Kriegers Flak more than 1800 bat recordings were made in April to October 2023 (Christensen M. , 2024). However, the number of recordings at Horns Rev 1 was higher than reported from Horns Rev 3 (Niras, 2024) where 0-3 bats were recorded on six surveyed turbines. A likely explanation for the low number of recordings, is distance to the coast and the position of Horns Rev 1, south of Blåvand.

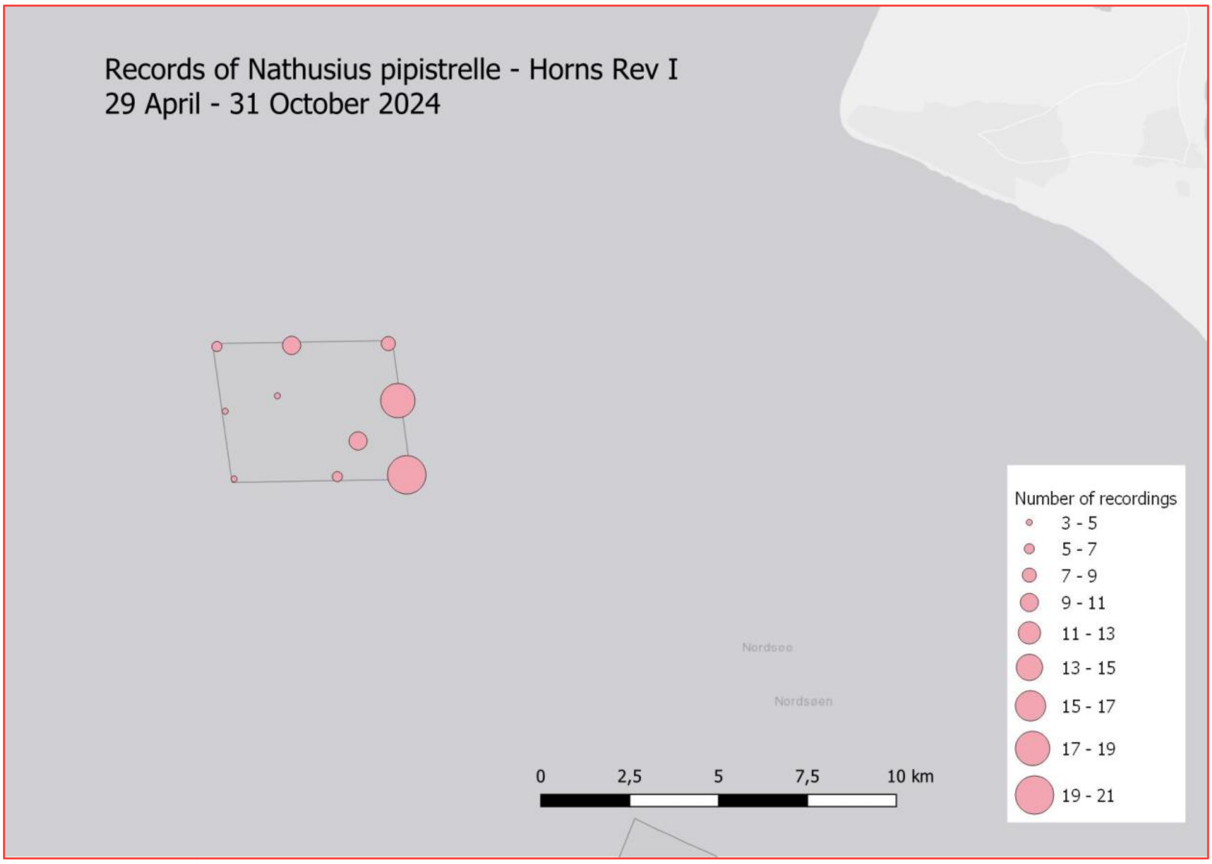

Figure 6-2 Number of *Nathusius pipistrelle* records per wind turbine.

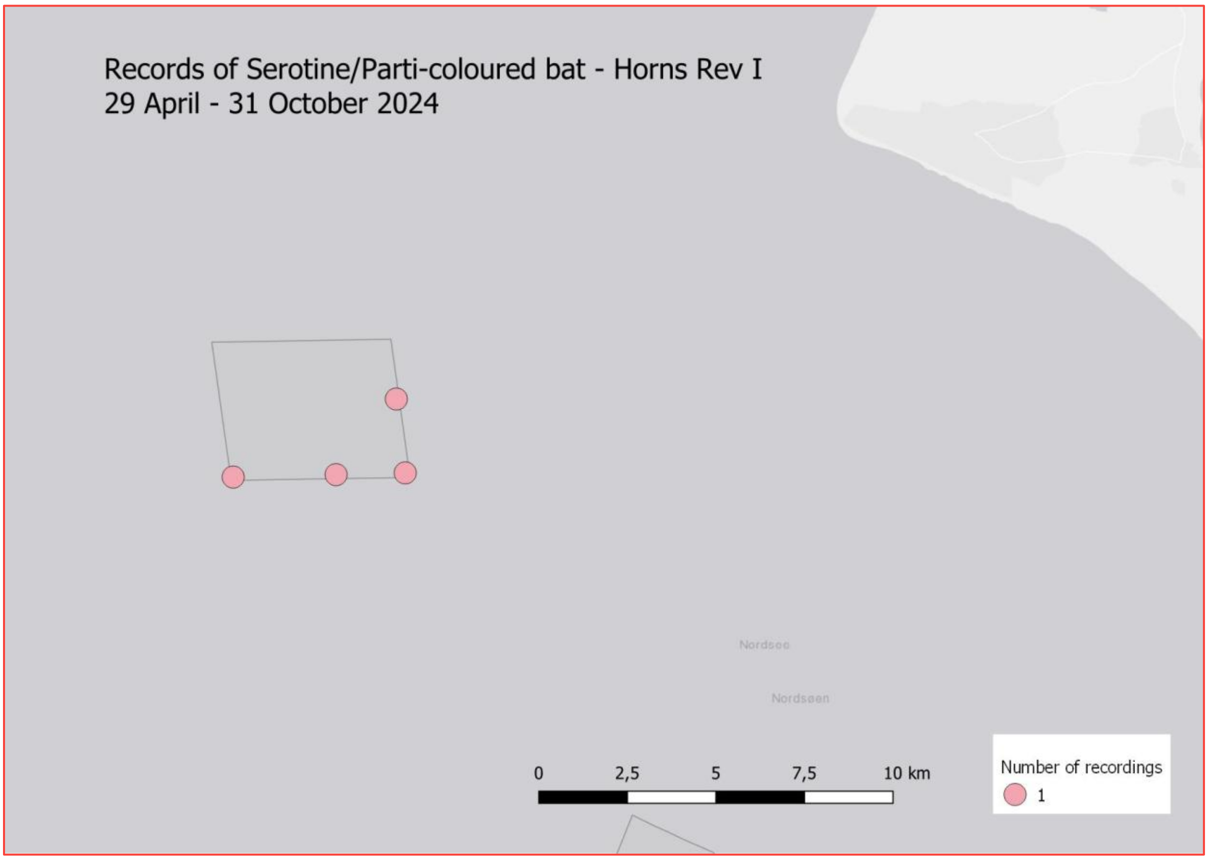

Figure 6-3 Number of Serotine/Particoloured bat records per wind turbine.

Bats vere recorded during 16 (=18%) of 90 nights between August 1st. and October 30th. The recordings of bats are almost exclusively from late August to late September (Figure 6-4). Only a single recording is made during spring (in May) and one recording is from summer (early August). This pattern indicates that bats primarily occur in the Wind Farm during the autumn migration in August and September.

From the 16 nights where bats have been recorded a total of 40 turbine-night with bats were detected. Of these 40 turbine-nights with bat activity recorded in total 24 (60%) was only with one detection during the entire night and 7 with two detections (18%). Only two turbine nights (5%) was with 14 and 17 recordings from one turbine during one nights. This suggests that vast majority of bats are not staying around turbines to forage but briefly pass the turbine. Only at two nights a relative high number of recordings indicate bats staying around for longer period (3 and 7 minutes respectively). It is difficult to draw any conclusions on number of individuals involved but it seems that usually single or few individuals are recorded simultaneously This may suggest that collision exposure overall is low and risk of intentional killing of individuals equally.

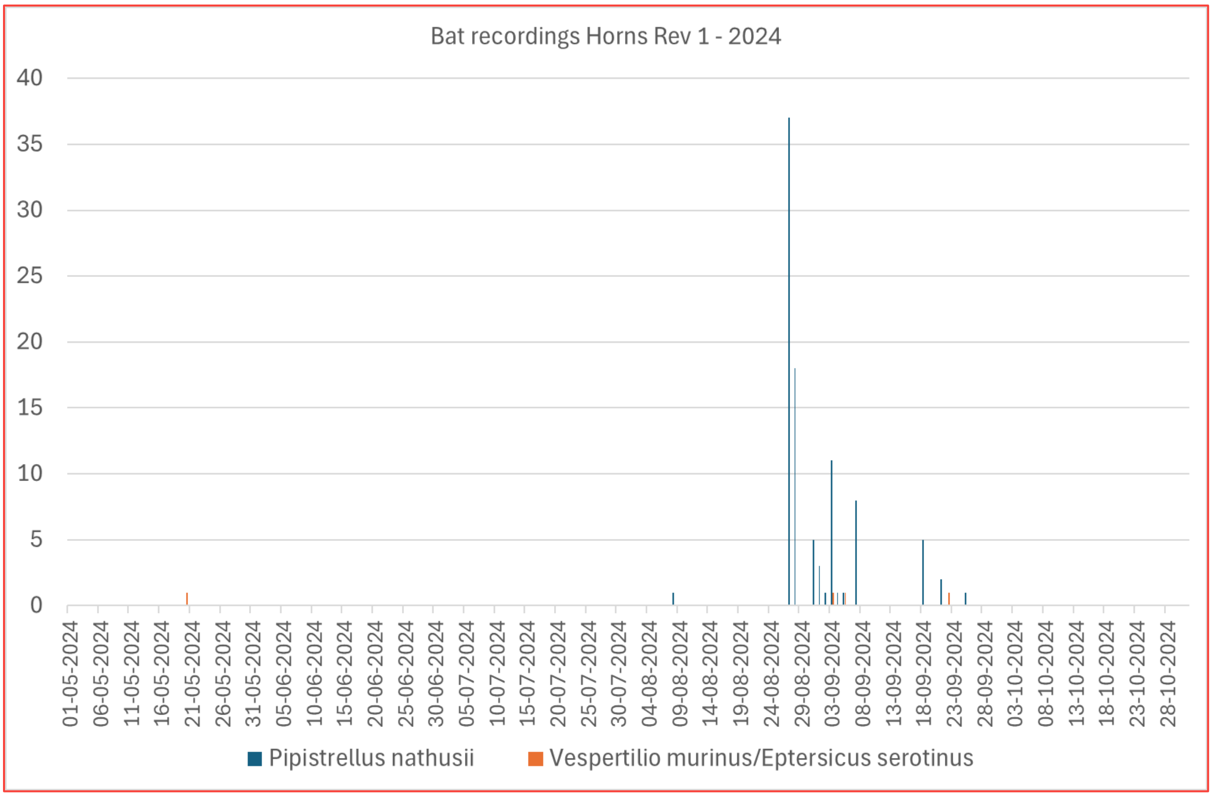

Figure 6-4 Number of records per night.

Bats are only recorded in easterly or southeasterly wind. This is interesting because of the prevailing wind in this region is from southwest.

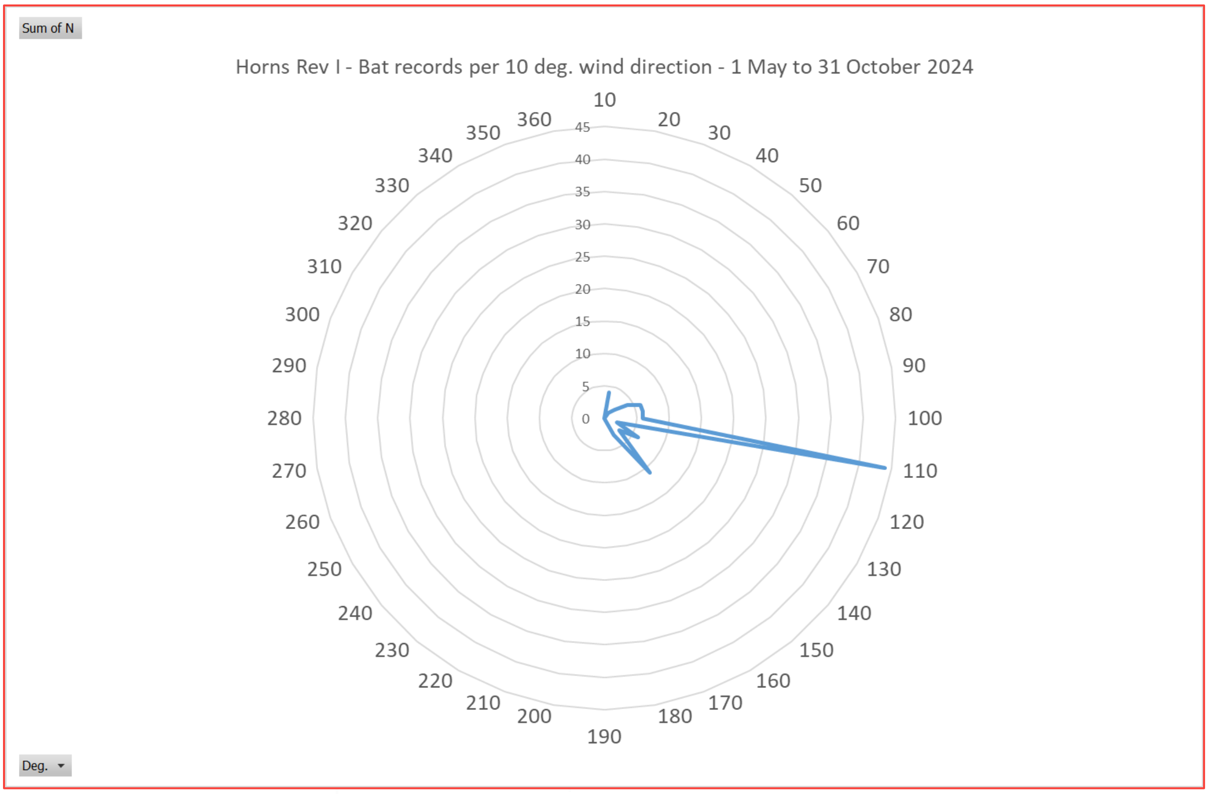

Figure 6-5 Number of bat recordings per 10-degree wind directions.

The relation between the time of the bat recordings and the wind speed shows a larger number of recordings when the wind speed is high (8-9 m/s) compared with data from Kriegers Flak Offshore Windfarm in the Baltic Seawaters (Christensen M. , 2024). A suggested explanation could be that the bat reaching Horn Rev I are drifted away from the coast by strong easterly winds and not there to purposefully migrate through and/or to forage in the Wind Farm.

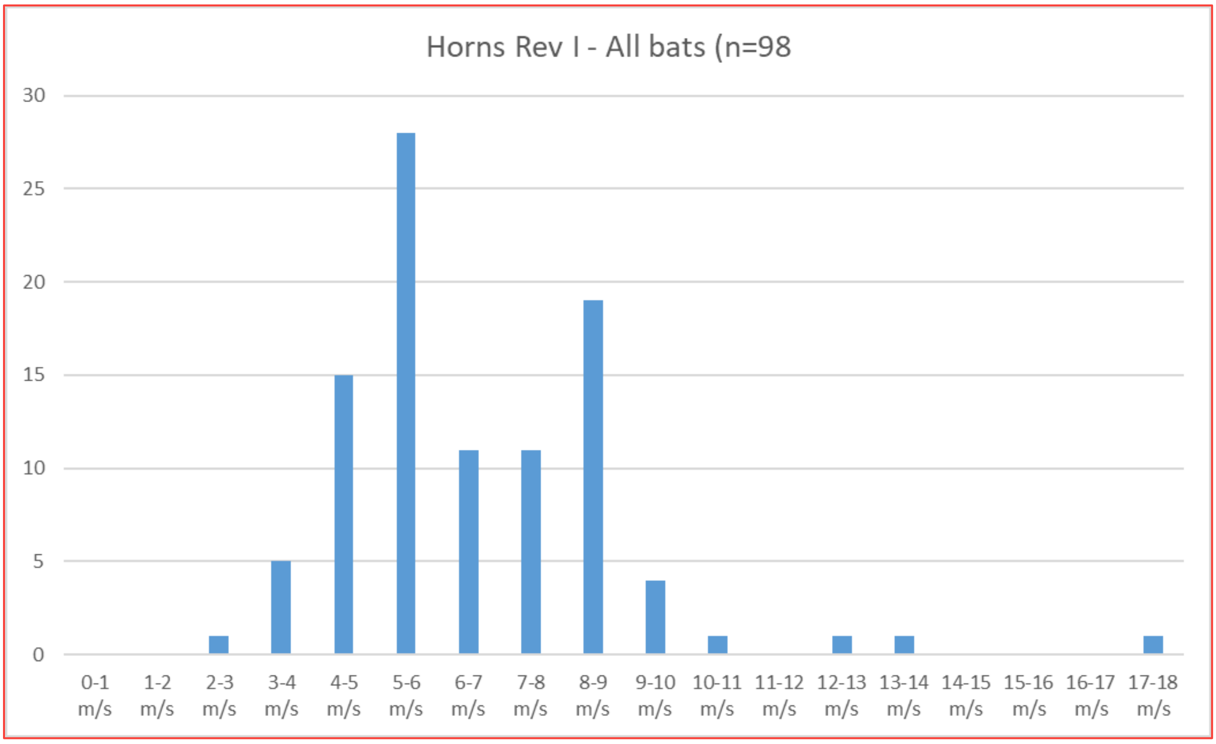

Figure 6-6 – Number of bat recordings in relation to average wind speed (measure from the nacelle of WTG 1).

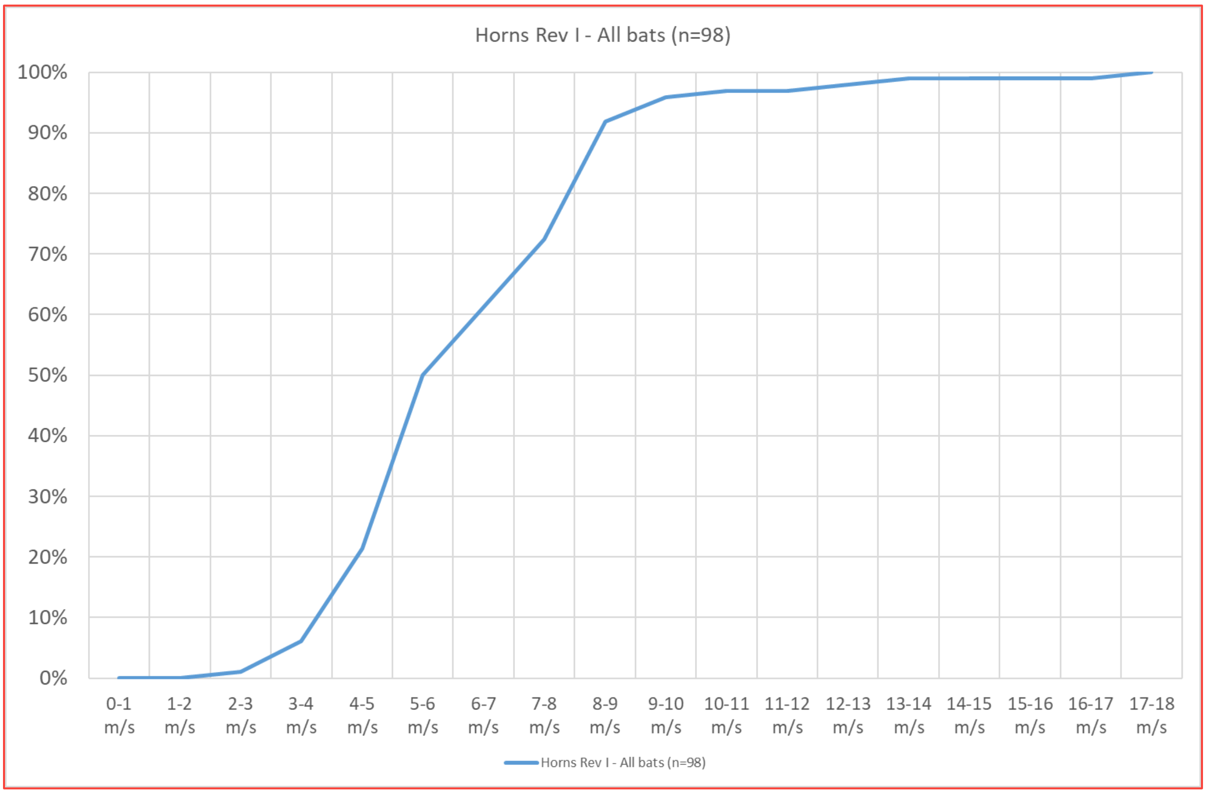

Figure 6-7 Summarised bat activity in relation to wind speed (measure from the nacelle of WTG 1).

6.2.2 CETACEANS

HARBOUR PORPOISE (PHOCOENA PHOCOENA)

Harbour porpoises are listed on the Habitat Directive Annex IV and are thus a strictly protected species regardless of whether present inside or outside of a protected area (e.g. Natura 2000). Harbour porpoises are the most common and the only breeding whale in Danish waters.

Harbour porpoise has most recently been assessed for the IUCN Red List of Threatened Species in 2023 and is listed as Least Concern (LC) (Sharpe & Berggren, 2023). Further, the status for harbour porpoises in the Atlantic region was based on counting's in the North Sea in 1994, 2005 and 2016 assessed as favourable in the Habitats Directive Article 17 report (Fredshavn, et al., 2019a).

The main threats to the harbour porpoise population are according to the IUCN Red List categories 1) Fishing: bycatch in nets, reduced food availability and habitat destruction, 2) Pollution from industry and agriculture, 3) Noise pollution, 4) Climate and habitat changes, 5) Recreational activities: physical disturbances and noise.

Based on studies of morphology, genetics and satellite tagging, porpoises in Danish waters are divided into three populations: 1) The Baltic Sea population – the waters around the island Bornholm and eastward into the Baltic Sea, 2) The Belt Sea population – the inner Danish waters (including the Baltic Sea, the Sound, southern Kattegat and western Baltic Sea) and 3) the North Sea population – northern Kattegat, Skagerrak and the North Sea (Hansen & Høgslund, 2023; Sveegaard, et al., 2015; Galatius, Kinze, & Teilmann, 2012; Wiemann, et al., 2010).

Porpoises present in and around the project area are expected to be individuals from the North Sea population. The estimated size of the North Sea population (including the North Sea, Skagerrak, and northern Kattegat) has been very stable from 1994 to 2022 with approximately 300,000-350,000 individuals, with the latest estimate in 2022 being approximately 338,000 individuals (Gilles, et al., 2023) (Figure 6-8).

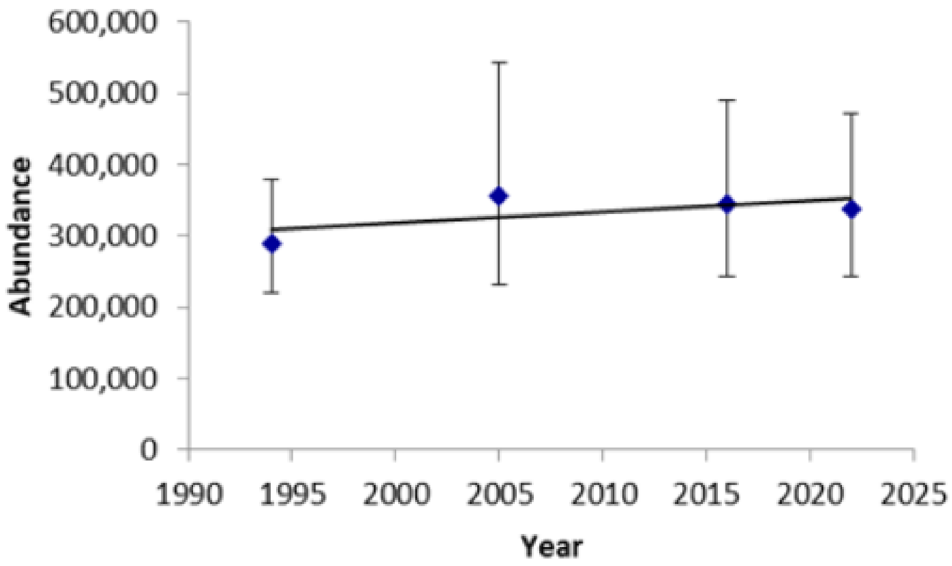

Figure 6-8 Trend lines fitted to time series of four abundance estimates for harbour porpoise in the North Sea from 1994 to 2022 (Gilles, et al., 2023).

A series of Small Cetacean Abundance in the North Sea (SCANS) surveys have been conducted to obtain an estimate of cetacean densities in the North Sea and adjacent waters; the most recent being SCANS-IV from 2022 (Gilles, et al., 2023). Compared to SCANS-III data from 2016 (Hammond, et al., 2021), the density of harbour porpoises in the project area (Block NS-I in Figure 6-9 (in 2016, this Block was named M (Hammond, et al., 2021)) has increased from 0.277 individuals/km^2 to 0.616 individuals/km^2.

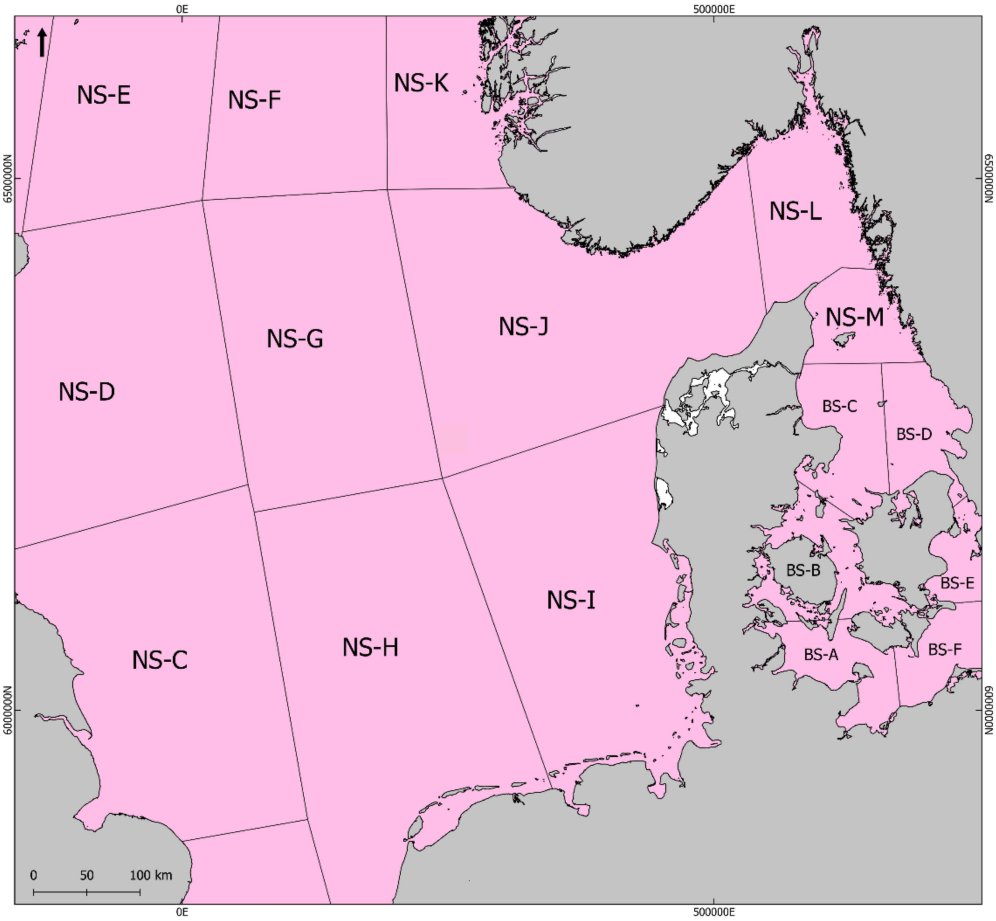

Figure 6-9 Location of the SCANS Survey Blocks. The Wind Farm is located within Block NS-I (Gilles, et al., 2023), which is the same area as Block M in 2016 (Hammond, et al., 2021). Map from (Gilles, et al., 2023).

As can be seen from Figure 6-10, the density of harbour porpoises is higher further offshore compared to the areas closer to the coast, including the project area.

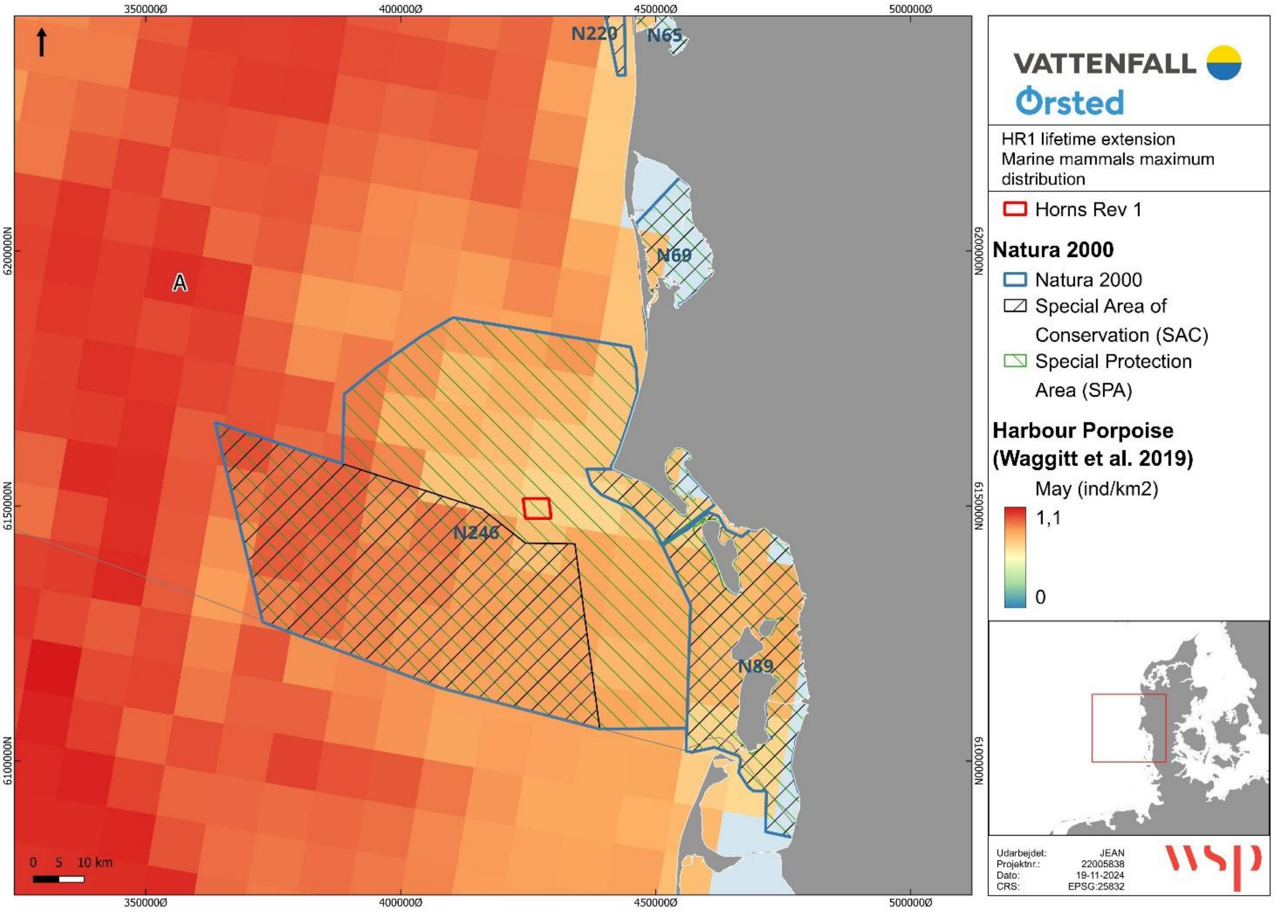

Figure 6-10 Maximum densities (animals/km^2) of harbour porpoises from 1980-2018 in the project area (marked by a red square). Modelled density of harbour porpoises in the project area is 0.59 individuals/km^2. Data from (Waggitt, et al., 2019).

Prior to the construction of the Wind Farm, baseline studies were conducted to establish the initial state of the environment, including the presence and activity of harbour porpoises (Fox, Christensen, Desholm, Kahlert, & Petersen, 2006). In addition, studies were conducted during and after the construction of the Wind Farm to assess any impacts on the harbour porpoise population. Studies included satellite tagging, visual ship-based surveys and acoustic monitoring with T-PODs (dataloggers). During the construction work, harbour porpoises were found to leave the area, but after the construction was completed, harbour porpoise activity gradually returned to normal levels within the project area. The disturbance effects were short-lived, with porpoises resuming their usual patterns within a few days to weeks after the cessation of pile driving. Long-term studies indicated that the presence of the Wind Farm did not have a lasting negative impact on the harbour porpoise population. Harbour porpoise activity levels within the project area were comparable to those in surrounding areas, and there was not any significant effect on harbour porpoise abundance in the area before and after the Wind Farm was constructed (Fox, Christensen, Desholm, Kahlert, & Petersen, 2006).

WHITE-BEAKED DOLPHIN (LANENORHYNCHUS ALBIROSTRIS)

White-beaked dolphins are found in open waters in the North Sea, the Skagerrak, and north and west of the British Isles (Galatius & Kinze, 2016). They are rarely seen by the coast (Hammond, et al., 2021).

White-beaked dolphin has most recently been assessed for the IUCN Red List of Threatened Species in 2023 and is listed as Least Concern (LC) (Sharpe & Berggren, 2023).

The main threats to the population of white-beaked dolphins are according to the IUCN Red List categories; 1) Fishing: bycatch in nets, reduced food availability and habitat destruction, 2) Pollution from industry and agriculture, 3) Noise pollution, 4) Climate and habitat changes, 5) Recreational activities: physical disturbances and noise.

The white-beaked dolphin population have been counted four times in Danish waters and adjacent waters under SCANS surveys in 1994, 2005, 2016 and 2022 (Hammond, et al., 2021; Gilles, et al., 2023) and show that there is a stable population (~20,000-~40,000 individuals) (Gilles, et al., 2023) (Figure 6-11). Even though there has been a doubling in the estimates of white-beaked dolphins from 2016 to 2022, this increase is still not significant due to poor precision (Gilles, et al., 2023). The carrying capacity of the area is unknown as the first counts were undertaken in 1994. The white-beaked dolphins in Danish waters belong to the

North Sea population, which cannot be divided into separate populations. There is limited knowledge on the behaviour and distribution of white-beaked dolphins in Danish waters.

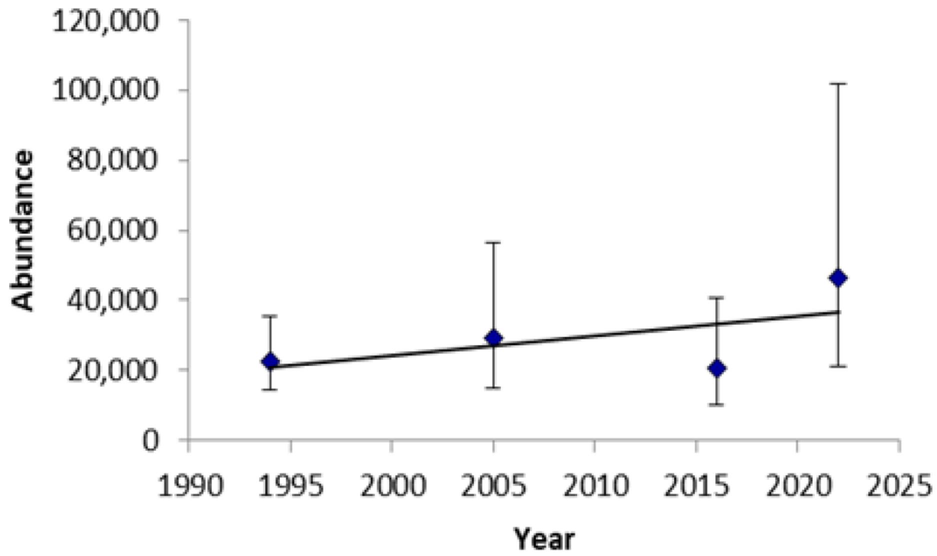

Figure 6-11 Trend lines fitted to time series of four abundance estimates for white-beaked dolphin in the North Sea from 1994 to 2022 (From (Gilles, et al., 2023)).

Figure 6-12 shows a maximum distribution model for white-beaked dolphin based on collated and standardised data from 1980-2018 (Waggitt, et al., 2019). The modelled distribution on white-beaked dolphin indicates that the project area is of low importance with 0.011 ind./km^2 (Waggitt, et al., 2019). Furthermore, no white-beaked dolphins were sighted during SCANS-III and SCANS-IV surveys in the project area (SCANS Block) (Gilles, et al., 2023; Hammond, et al., 2021).

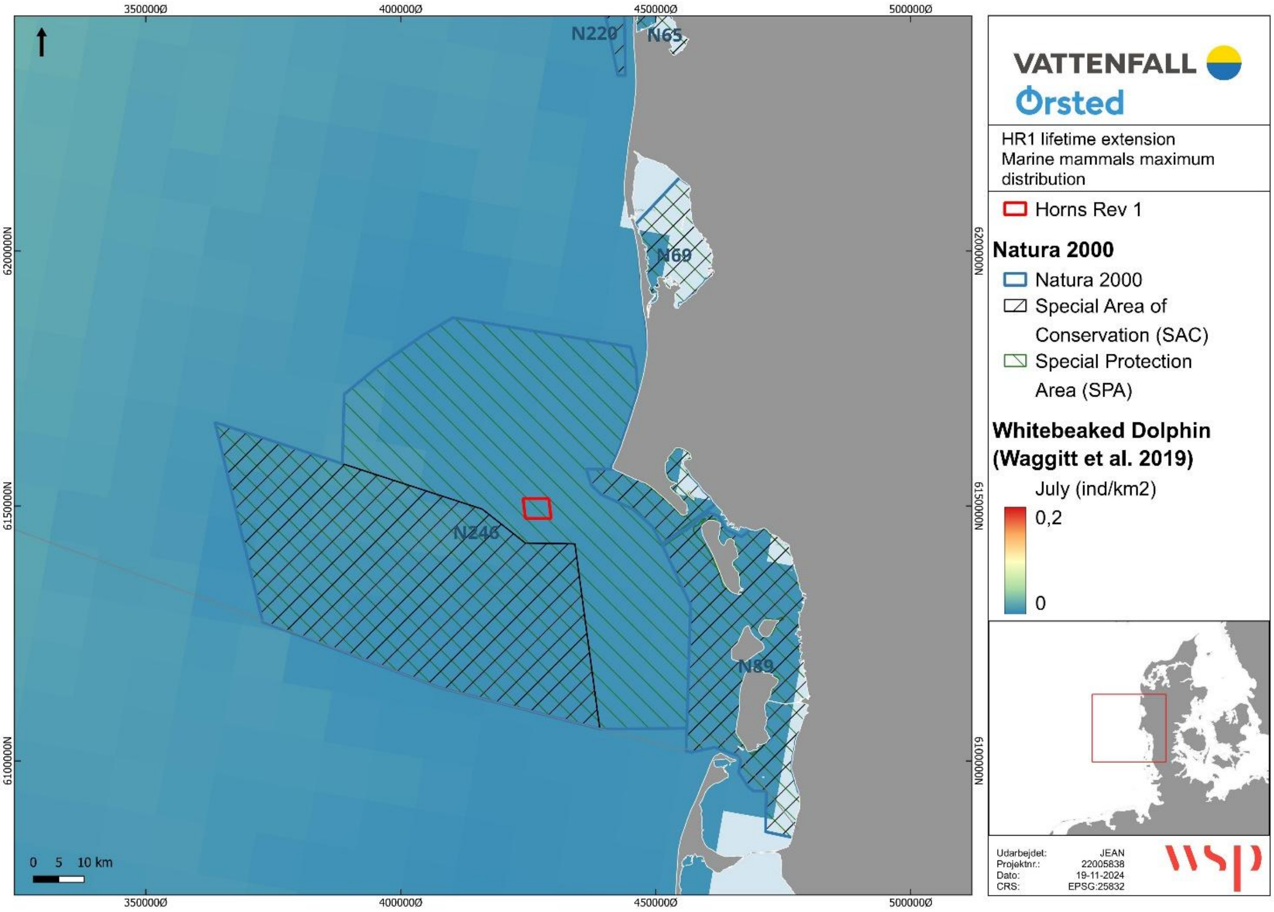

Figure 6-12 Maximum densities (animals/km²) of white-beaked dolphins from 1980-2018 in the project area (marked by a red square). Modelled density of white-beaked dolphins in the project area is 0.011 individuals/km². Data from (Waggitt, et al., 2019).

MINKE WHALE (BALAENOPTERA ACUTOROSTRATA)

Minke whales are widely distributed in all oceans except 0–30° latitude, around the equator. They are mainly associated with the temperate and arctic zones of the oceans (Perrin, Mallette, & Brownell Jr., 2018). The minke whale lives in the open water in the North Sea and Skagerrak and occurs irregularly in inner Danish waters (Hammond, et al., 2021). Minke whales in the North Sea are probably part of a larger population in the Northeast Atlantic.

Minke whale has most recently been assessed for the IUCN Red List of Threatened Species in 2023 and is listed as Least Concern (Sharpe & Berggren, 2023).

The main threats to the population of common minke whale are according to the IUCN Red List categories; 1) Fisheries: reduced food availability and habitat destruction, 2) Pollution from industry and agriculture, 3) Noise pollution, 4) Climate and habitat changes.

Minke whale populations have been monitored four times in July-August in the Danish and adjacent waters during SCANS surveys in 1994, 2005, 2016 and 2022 (Hammond, et al., 2013; Hammond, et al., 2002; Hammond, et al., 2021; Gilles, et al., 2023). Furthermore, minke whales have been monitored six times in connection with the Norwegian Independent Line Transect Surveys (NILS) (see references in (Gilles, et al., 2023)). The counts indicate a stable population of approximately 10,000 individuals (Figure 6-13). The minke whales that occur in Danish waters belong to the population in the North Sea, which probably also uses a larger part of the North Atlantic. There is limited knowledge on the behaviour and distribution of minke whales in Danish waters. Individuals have been tagged with satellite transmitters at Skagen and both times they swam north of the British Isles and then south around the Canary Islands during the autumn and winter (Fraija-Fernandez, et al., 2015). Thus, there is no evidence of an independent stock in Danish waters.

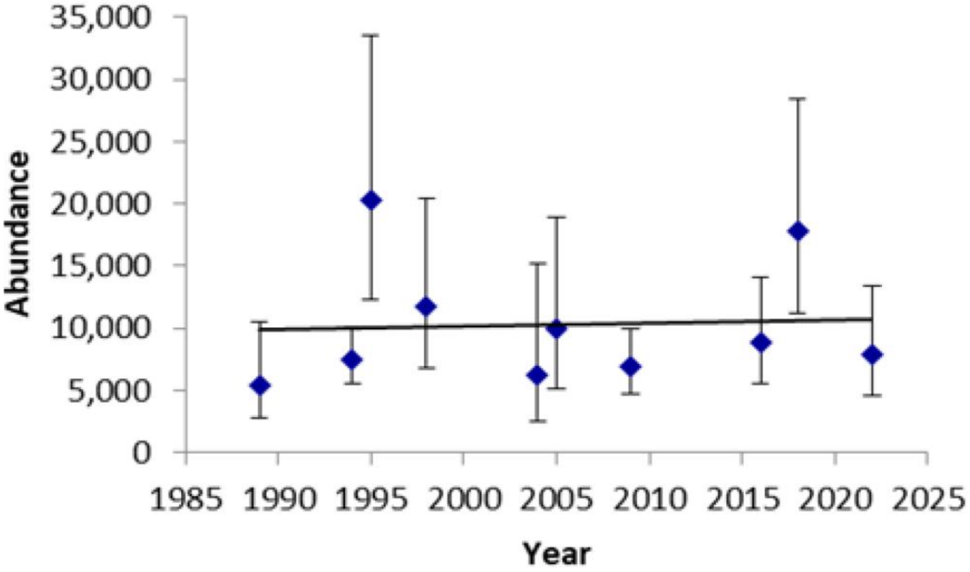

Figure 6-13 Trend lines fitted to time series of four abundance estimates for minke whales in the North Sea (Gilles, et al., 2023).

Knowledge about minke whale population size, variation in numbers over the year and behaviour in Danish waters is limited. The modelled distribution on minke whales indicates that the survey area is of low importance to minke whales with 0.0051 ind./km^2 (Waggitt, et al., 2019) (see Figure 6-14). Furthermore, no minke whales were sighted during SCANS-III and SCANS-IV surveys in the project area (SCANS Block) (Gilles, et al., 2023; Hammond, et al., 2021).

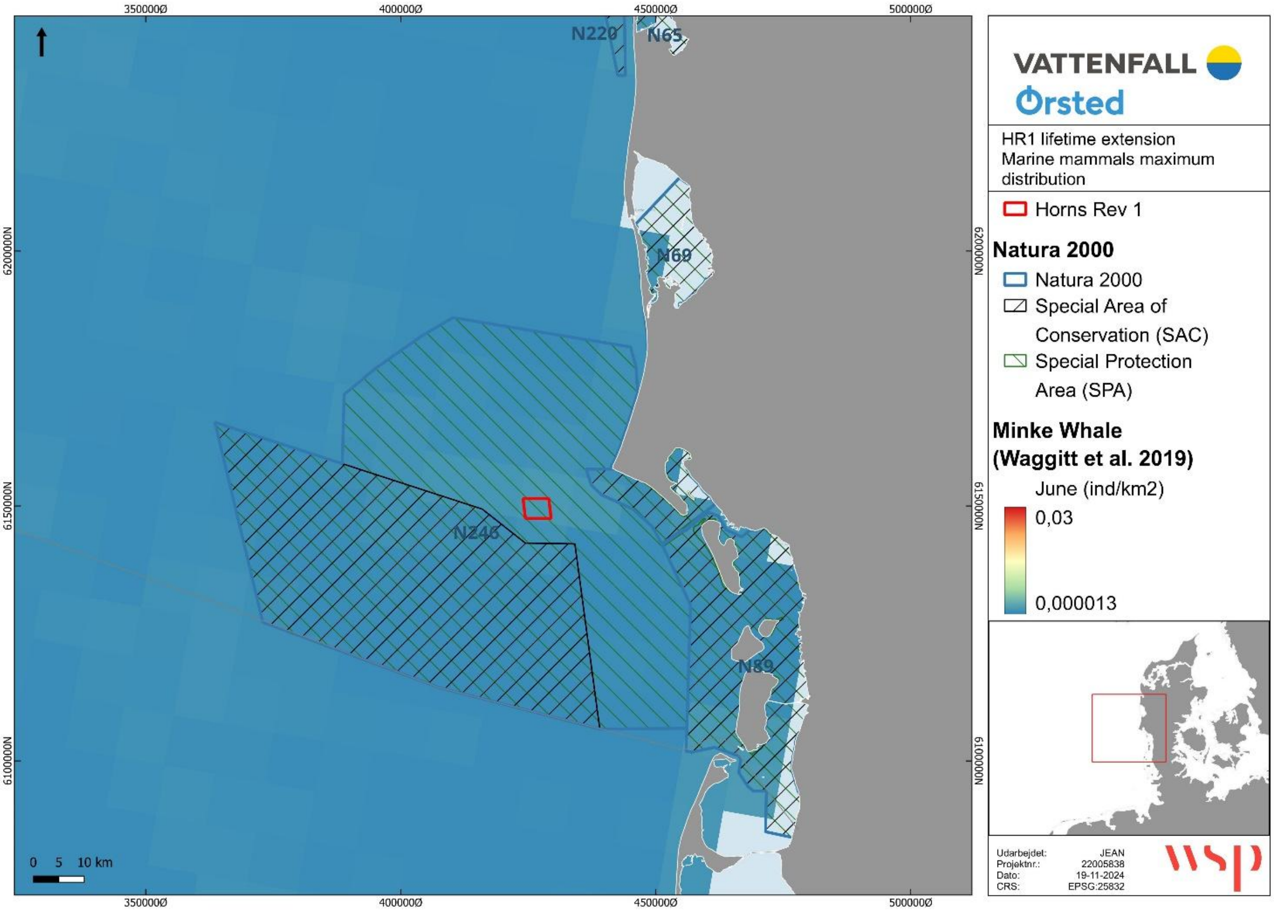

Figure 6-14 Maximum densities (animals/km²) of minke whales from 1980-2018 in the project area (marked by a red square). Modelled density of minke whales in the project area is 0.0051 individuals/km². Data from (Waggitt, et al., 2019).

6.3 ASSESSMENT OF IMPACT

6.3.1 BATS

The result from the 2024 bat survey at Horns Rev I from May to October indicates low bat activity. During spring, only one record from May has been made. Lacking surveys in April where bats in some year is not considered critical during spring 2024. This assessment is based on the weather conditions with head-winds, much precipitation and relatively low temperatures during large parts of April is considered likely not to have been appropriate for bat-movements during this period.

Out of 98 recordings, 94 were Nathusius pipistrelle (Figure 6-2). The remaining four recordings were either Serotine bat or Parti-coloured bat. These species can be difficult to separate from their ultrasound navigation signals. All bat recordings, except twos, were made in late August or early September (Figure 6-4), suggestion no feeding activities takes place from nearby breeding populations during summer-period.

Compared to similar bat activity measured at Kriegers Flak, the numbers at Horns Rev I are low to very low. On ten wind turbines at Kriegers Flak more than 1800 bat recordings were made in April to October 2023 (Christensen M. , 2024).

The recordings of bat activity at Horns Rev I shows a strong preference for easterly or southeasterly winds, whereas no bats are recorded during nights with west or southwesterly wind, despite this is the dominant wind direction at Horns Rev I.

The relation between the time of recording and the wind speed is considerably different from patterns found in similar surveys in inner Danish waters, such as Kriegers Flak (Christensen M. , 2024) or Nysted OWF (Unpublished recording from 2024). At Horns Rev 1, almost no bat activity is recorded at very low wind speeds, with most of the activity occurring at wind speeds between 4 and 7 m/s (Figure 6-6).

The combination of easterly winds and relatively strong wind speeds suggests that the bat activity recorded at Horns Rev I are likely there by mistake and not by choice. The primary migration route is likely to be a broad fronted southward migration through Jutland, constrained by the North Sea coast. Blåvandshuk is a critical l point in this context due to the coastal configuration. Under low wind speeds, bats can easily follow the coast southwards over Skallingen and Fanø. However, as flight speed and migration speed of Nathusius Pippistrelle typically is around 6,5-7,5 m/s (Troxell SA, 2019). Bats are not able to fly against wind speeds beyond this and therefore in strong winds, some bats may be blown southwest over the sea. These bats are likely to be lost due to daylight exposure and predation risk. The considerable distance to England (>500 km) and the difficulty of changing direction against strong wind pose significant challenges for small bat. Moreover, bats will during high winds likely not be able to stop and forage around turbines which will further reduce collision risks. Instead, they will just pass through at high-speed giving very low exposure time. This is also suggested by the 2024 data from HR1 where 78% of all nights with turbines with records of bats only 1 or 2 recordings were made. Dutch researcher (Lagerveld, 2024) has shown up til 16,8 m/s flight-speed during strong tailwinds. It is speculated that the detection range for bats is relatively short compared to the height of turbines. However, current knowledge on acoustic measured activities offshore indicates that bat activities (Nathusius pipistrelle) is highest at low height (Brabant, 2019). In Belgian part of the North Sea researcher found that activity at 93 meters were on 10% of the activity at 16 meter (Brabant, 2019). Same trend is suggested at Kriegers Flak (WSP/Vattenfall, unpublished data).

Study by Lagerveld et al. (2024) suggests that migration of Nathusius pippistrelle in favourable winds (tailwinds) reaches heights from several hundred meter up till 2500 meter altitude. This would if relevant at Horns Rev 1 be significantly above rotor-height.

Based on data from 2024, the low number of bat recordings at the Horns Rev 1 and the occurrence only during strong easterly wind, it can be concluded that this is not a major migration route for any bat species. There is no indication that the area is an important feeding ground for any bat species. The data indicates that few individual bats may potentially be killed unintentionally, but the number is expected to be very low and will not impact the population of Nathusius pipistrelle, Serotine bat, or Parti-coloured bat.

Based on the arguments above it is assessed that the lifetime extension of Horns Rev 1 will not lead to capture or killings of bats. Nor will it not cause deliberate disturbance on bats in their natural range or damage or destroy of breeding or resting areas for bats. Hereby, the protection according to Annex IV will continue to be maintained.

Moreover the very low level of bat-activity suggested from current studies, the fast passages of majority of individuals and thus low exposure time to turbine rotors in combination lead to assessment that risk of deliberate killings of individuals of bats are extremely low.

6.3.2 CETACEANS

Based on the presence of cetaceans around the project area (see existing conditions in section 6.2.2), only harbour porpoises will be assessed in the following. White-beaked dolphins and minke whales are not further assessed as they occur in very low densities (0.011 respectively 0.0051 individuals/km^2) in the project area (see Figure 6-10 and Figure 6-12). Harbour porpoises occur in densities of 0.59 individuals/km^2.

Impacts on harbour porpoises from a lifetime extension of the Wind Farm may be:

- Displacement due to electromagnetic fields from the cables that connects the wind turbines.
- Displacement due to underwater noise from service vessels.
- Displacement due to underwater noise from the wind turbines.

Impacts from the mentioned sources are assessed in the following.

ELECTROMAGNETIC FIELDS

There is very little knowledge on marine mammals' responses to electromagnetic fields (Normandeau, Tricas, & Gill, 2011). However, there is no indication that marine mammals have problems orienting themselves in areas with submarine cables (Russell, et al., 2014), and the limited data available do not suggest that migrations are affected by electromagnetic fields from submarine cables (Gill et al., 2014). Furthermore, investigations conducted within the project area before and after commissioning of Horns Rev 1, did not find any significant effect on harbour porpoise abundance in the area before and after the construction (Fox, Christensen, Desholm, Kahlert, & Petersen, 2006). Since data show that harbour porpoises are still present in the project area, it indicates that the existence of the Wind Farm and thus potential electromagnetic fields from the cables, did not cause displacement of harbour porpoises.

Based on this, it is assessed that electromagnetic fields from continued operation of Horns Rev 1 will not lead to killings of harbour porpoise. Nor will it cause deliberate disturbance on harbour porpoise in their natural range or damage or destroy of breeding or resting areas for this species. Hereby, the protection according to Article 12 will continue to be maintained.

UNDERWATER NOISE FROM SERVICE VESSELS

Underwater noise from service vessels may have a behavioral impact on harbour porpoises by avoidance responses and changes in their foraging patterns (Richardson, Greene, Malme, & Thomson, 1995). In cases where porpoises are dispersed and leave the area, individuals are expected to seek alternative areas during the period when the vessels are present, and then return quickly after the disturbance ceases (Diederichs et al, 2010; Todd et al., 2020).

Vessel noise is typical for the shipping that traverses the Danish EEZ and harbour porpoises that are present in the area are assumed to be adapted to the shipping traffic that already exist in the area. Service vessels are thus unlikely to have a significant impact on marine mammals, and it is assessed that there is no significant impact from underwater noise from service vessels.

Based on this, it is assessed that under water noise from service vessels from continued operation of Horns Rev 1 will not lead to killings of harbour porpoise. Nor will it cause deliberate disturbance on harbour porpoise in their natural range or damage or destroy of breeding or resting areas for this species. Hereby, the protection according to Article 12 will continue to be maintained.

UNDERWATER NOISE FROM WIND TURBINES

Underwater noise from wind turbines can possibly lead to avoidance of the area. The noise from the turbines in operation is expected to be primarily at low frequencies (below 1 kHz, which is outside of the most sensitive auditory/hearing area of harbour porpoises (Southall, et al., 2019)), and with a sound level below that of ship noise (Tougaard, Hermannsen, & Madsen, 2020).

Long-term studies indicate that the presence of Horns Rev 1 did not have a lasting negative impact on the harbour porpoise population. The study found that harbour porpoise activity levels within the project area were comparable to those in surrounding areas, and there was not any significant effect on harbour porpoise abundance in the area before and after the construction (Fox, Christensen, Desholm, Kahlert, & Petersen, 2006).

Based on this, it is assessed that underwater noise from turbines due to continued operation of Horns Rev 1 will not lead to killings of harbour porpoise. Nor will it cause deliberate disturbance of harbour porpoise in their natural range or damage or destroy of breeding or resting areas for this species. Hereby, the protection according to Article 12 will continue to be maintained.

CONCLUSION

It is assessed that the lifetime extension of Horns Rev 1 will not affect the protection of Annex IV species (cetaceans and bat species) according to Article 12 of the Habitat Directive. This means that the lifetime extension will not:

1) lead to capture or killings of any annex IV species
2) deliberately disturb annex IV species during the periods of breeding, rearing, hibernation and migration.
3) damage or destroy a breeding site or resting places of annex IV species.

7 GENERAL BIRD PROTECTION

7.1 METHOD

The assessment according to the general bird protection involves the following:

- Identification of relevant species (existing conditions)
- Assessment of likely effects (direct, indirect and cumulative).

In the case of deterioration of habitats as well as intentional killing, destruction or damage to nests, collection, disturbances during the breeding season, etc., it may be necessary to implement measures to avoid, reduce or neutralize the harmful impacts on birds. These measures will typically be attached to the later permit as conditions.

7.2 EXISTING CONDITIONS

Horns Rev 1 is located within SPA 113, which is designated to protect four species of migratory waterbirds: the Red-throated and Black-throated diver, the Common scoter and the Little gull. SPA 113 serves to protect these species during the non-breeding period of their annual cycle by offering important resting and staging grounds.

Other marine bird species such as terns and gulls, from more remote SPA' s or breeding sites onshore pass through the area on migration or stage over an extended period to feed inside or in the vicinity of Horns Rev 1 wind farm.

Descriptions of abundance, status and distribution of these four designated marine birds and other potentially relevant species are given in more detail in the assessment chapter 8.5.1.

Divers
The most common diver species in the Horns Rev area are the Red-throated and Black-throated divers. In the aerial surveys carried out by DCE, no distinction is made between the Red-throated and Black-throated diver as it is not possible to differentiate between these two species from an aircraft. However, it is assessed that the Red-throated diver is by far the most abundant species in the area. The species is estimated to comprise at least 90% of all observed divers in the area (Petersen I. , Nielsen, R.D., & Clausen, 2019a).

The abundance and distribution of divers in Denmark was previously modelled for the Inner Danish Waters and for high density areas in the Danish North Sea by (Petersen & Nielsen, 2011). The majority of divers recorded during these aerial surveys were Red-throated, especially in the North Sea and in Kattegat. The modelling confirms that divers are also present in the Horns Rev 1 area.

A spring count in the North Sea in 2019 (Petersen, Sterup, & Nielsen, 2019b) extending from the Danish-German border to Skagen resulted in a model estimate of approx. 12,500 birds (lower and upper bounds: 7,032 – 22,238). A count in 1987-1989 in the area off the Wadden Sea, including Horns Rev, resulted in abundance estimates increasing from 1,700-2,200 birds in autumn to 28,500 birds in spring (Laursen, et al., 1997).

Seaducks
Aerial surveys carried out by DCE have revealed that Common scoters occur in very large numbers in the Horns Rev area, which holds the largest concentrations of this species in Denmark (Petersen I. , Nielsen, R.D., & Clausen, 2019a). The area is of international importance for Common scoters, with regular occurrences of about 20 % of the flyway population.

A total of 14,354 Common scoters were observed in the southern part of the Danish North Sea during counts of waterfowl in winter 2013. The Common scoters were mainly located on Horns Rev and relatively far from the coast in the waters west of Fanø and Rømø. The Common scoter was also by far the most abundant waterfowl species in the area during the baseline surveys conducted prior to the establishment of the Horns Rev 1 offshore wind farm.

Moreover, the Velvet scoter also occurs in the Horn Rev 1 area during winter but in much lower numbers and densities compared to the Common scoter. The Common eider occurs infrequently and in insignificant numbers (Nielsen, Holm, & Clausen, 2024).

Gulls

At least two species of gulls occur regularly in the Horns Rev area. The Kittiwake, being designated as a resting/migrating bird in marine NATURA 2000 areas in the German part of the North Sea, is a pelagic feeder with large foraging ranges, known to visit the Horns Rev 1 area for a shorter or longer period of time during the non-breeding season (Christensen, Clausager, & Petersen, 2001).

Migrating Little gulls from populations in Sweden, Finland, Baltica and Russia pass through Denmark in spring and autumn, mainly in the southern and south-eastern parts of the country and primarily through the Baltic Sea. In winter, birds may gather at sites along the west coast of Jutland between Hanstholm and Blåvands Huk and in the Baltic Sea (Christensen, et al., 2022).

Other gull species, e.g. Herring gull and Lesser black-backed gull are also likely to occur regularly in the Horns Rev 1 area.

Terns

Several species of terns are designated as breeding birds within multiple SPA's located along the West-coast of Jutland. Among these, the Little tern, the Arctic tern and the Sandwich tern, in particular, are closely associated with the marine environment. Birds from such relatively remote breeding sites may occasionally feed in or near the Horns Rev area.

Other species of terns, including the Common tern and Black tern also pass through the Horns Rev area during their yearly long-distance migratory flights between winter quarters in Africa or Antarctica and breeding areas in North-west Europe.

Other seabirds

Long-distance migratory seabirds with large foraging ranges, including the Northern gannet, the Long-tailed skua, the Arctic skua and the Great skua all occasionally occur in the Horns Rev area.

7.3 ASSESSMENT OF POTENTIAL IMPACTS

7.3.1 BIRDS

The main potential negative effects to birds from wind farms have been identified to include:

- Disturbance leading to displacement or exclusion of migrating and resting birds, including barriers to movements.
- Collision mortality from operating turbines.
- Loss of, or damage to, habitats and associated changes in food supply resulting from the footprints of the wind turbines.

Impacts from the mentioned sources are assessed in the following, including existing knowledge on relevant birds in the project area and surrounding areas.

7.4 ASSESSMENT

DISPLACEMENT AND BARRIER EFFECT

As part of the Natura 2000 screening (chapter 8) it is concluded that there is no data collected so far that indicates that the (Horns Rev 1) project area is of any special importance to the seabirds' ecological exploitation.

Hereby, lifetime extension of Horns Rev 1 is assessed not to cause significant disturbance leading to displacement or exclusion of migrating and resting birds, including barriers to movements.

COLLISION

The potential impact on birds from collision is assessed in chapter 8 - Natura 2000-screening. It appears that the number of collisions is extremely low in relation to the flyway-populations of all relevant species, and it is assessed that there will be no significant impact on designated species in the surrounding SPA's as a result of collision with the wind turbines at Horns Rev 1. It is assessed that this will also apply to non-designated species. Consequently, it is assessed that the lifetime extension, regarding the risk of birds colliding with the operating turbines at Horns Rev 1, is in accordance with the general provisions of the EU Birds Directive.

HABITAT CHANGES

As part of the Natura 2000 screening (chapter 8) it can be assessed that habitat changes caused by the presence of the Horns Rev 1 has not significantly changed the birds' foraging opportunities in the area.

7.5 CUMULATIVE EFFECTS ASSESSMENT

In case of activities in nearby wind farms, project areas, resource extraction sites and dumping grounds, there is a possibility of cumulative effects on the marine environment.

There are several resource extraction sites within a range of ~5 km from Horns Rev 1 (Figure 8-18). The closest dumping ground is > 8 km away. Due to the distance from Horns Rev 1, it is not expected that there will be any cumulative effects from activities related to the Horns Rev 1 and the resource/dumping sites, respectively.

The closest offshore wind farm, besides Horns Rev 1, is Horns Rev 2 located ~5 km from Horns Rev 1.

Based on the current knowledge of simultaneous and sequential projects, no significant cumulative impacts on marine mammals and bats are expected because of the lifetime extension of Horns Rev 1.

As for birds, the assessment of cumulative impacts is first and foremost relevant for red-throated diver, as there is considerable evidence that this species is particularly sensitive to the presence of offshore wind farms. This species is assessed as part of the Natura 2000 screening (see chapter 8).

7.6 CONCLUSION

Based on the requirements of the general provisions of the Birds Directive and the expected very limited impact on birds from Horns Rev 1, it is assessed that the life extension is following the general provisions of the EU Birds Directive.

8 NATURA 2000-SCREENING

8.1 METHOD

The Natura 2000-screening involves the following:

- Identification of relevant Natura 2000 sites (SAC/SPA) and compilation of the designation basis.
- Assessment of likely effects (direct, indirect, and cumulative).
- Summary statement with conclusions.

In the case of significant impacts, it may be necessary to implement measures to avoid, reduce or neutralize the harmful impacts on the environment. These measures will typically be attached to the later permit as conditions.

8.1.1 DEFINITION OF SIGNIFICANT IMPACT

The EU Court of Judgement has ruled that a small, but permanent and irreversible reduction of a prioritised habitat type can constitute a significant impact and thus be considered as damage to the integrity of a Natura 2000 site. For the designated species, impacts can be considered significant if they involve habitat loss or degradation, levels of disturbance affecting the normal behaviour of the species or pollution and deterioration of habitats.

On the other hand, it must be assumed that an impact is not significant, if:

- the impact is estimated to involve negative fluctuations in population sizes that are smaller than the natural fluctuations considered to be normal for the species or habitat type.
- it is assessed that the protected habitat type or species is deemed to quickly recover without human intervention. The probability that the impact will occur is medium, high or definite.

Relevant species of birds and marine mammals are described including their patterns of occurrence inferred from existing data and scientific literature. The assessments are furthermore based on existing knowledge about disturbance effects and collision risk of birds and injury and behavioural thresholds for underwater noise of marine mammals.

8.2 IDENTIFICATION OF NATURA 2000 SITES

The nearest marine Natura 2000 sites to the Wind Farm are shown in Figure 8-2. These include both Danish and German Natura 2000 sites. The Wind Farm is situated within the marine Natura 2000 site SPA 113, Sydlige Nordsø (part of N246). Furthermore, SAC 255 (also part of N246) is close to the Wind Farm (3.8 km). Since the lifetime extension does not involve any technical or physical changes or construction works, sites at further distances are not assessed to be relevant. The assessment only includes N246 (SPA 113 and SAC 255). However, as for birds, also species designated in Natura 2000-site N89 is addressed.

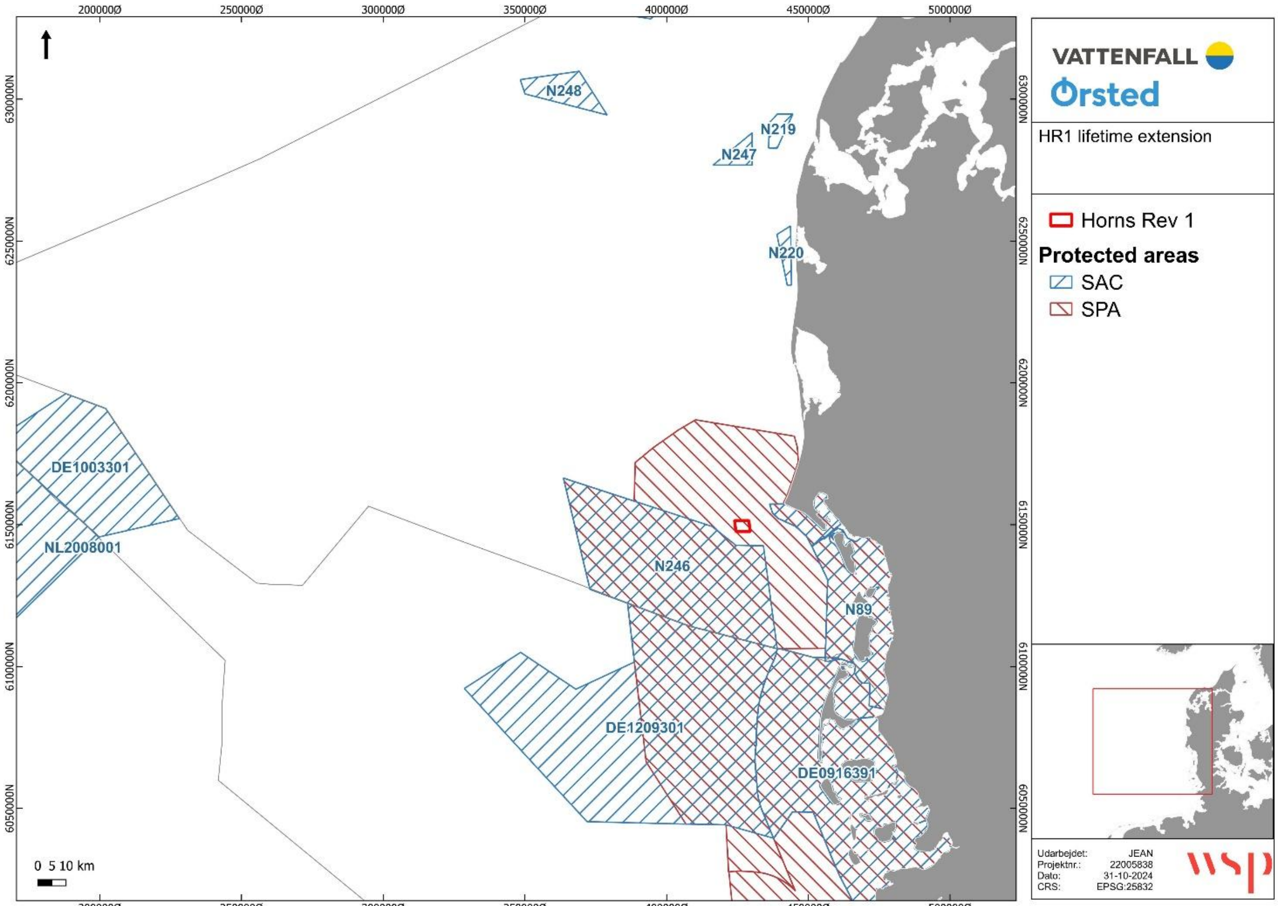

Figure 8-1 Marine Natura 2000 sites (Special Area of Conservation, SAC; Special Protection Area, SPA).

8.3 DESIGNATION BASIS

Horns Rev 1, which was set into operation in Dec 2002, is situated within the marine Natura 2000 site N246 (SPA 113, Sydlige Nordsø). SPA 113 "Sydlige Nordsø" (Southern North Sea) was established in 2004 (247.314 hectares) and expanded to the north in 2023 based on a review and evaluation of the Danish important bird areas (for more details, see 8.3.1). Furthermore, SAC 255 (also part of N246) is close to the Wind Farm (3.8 km) (Figure 8-2). Sydlige Nordsø (SAC 255) is designated for the Annex I habitat 1110 "*Sandbanks which are slightly covered by sea water all the time*'. The SAC also lists the Habitats Directive Annex II species harbour porpoise (see chapter 6), grey seal, and harbour seal as qualifying features and a list of birds. Table 8-1 provides an overview of the designation basis for N246.

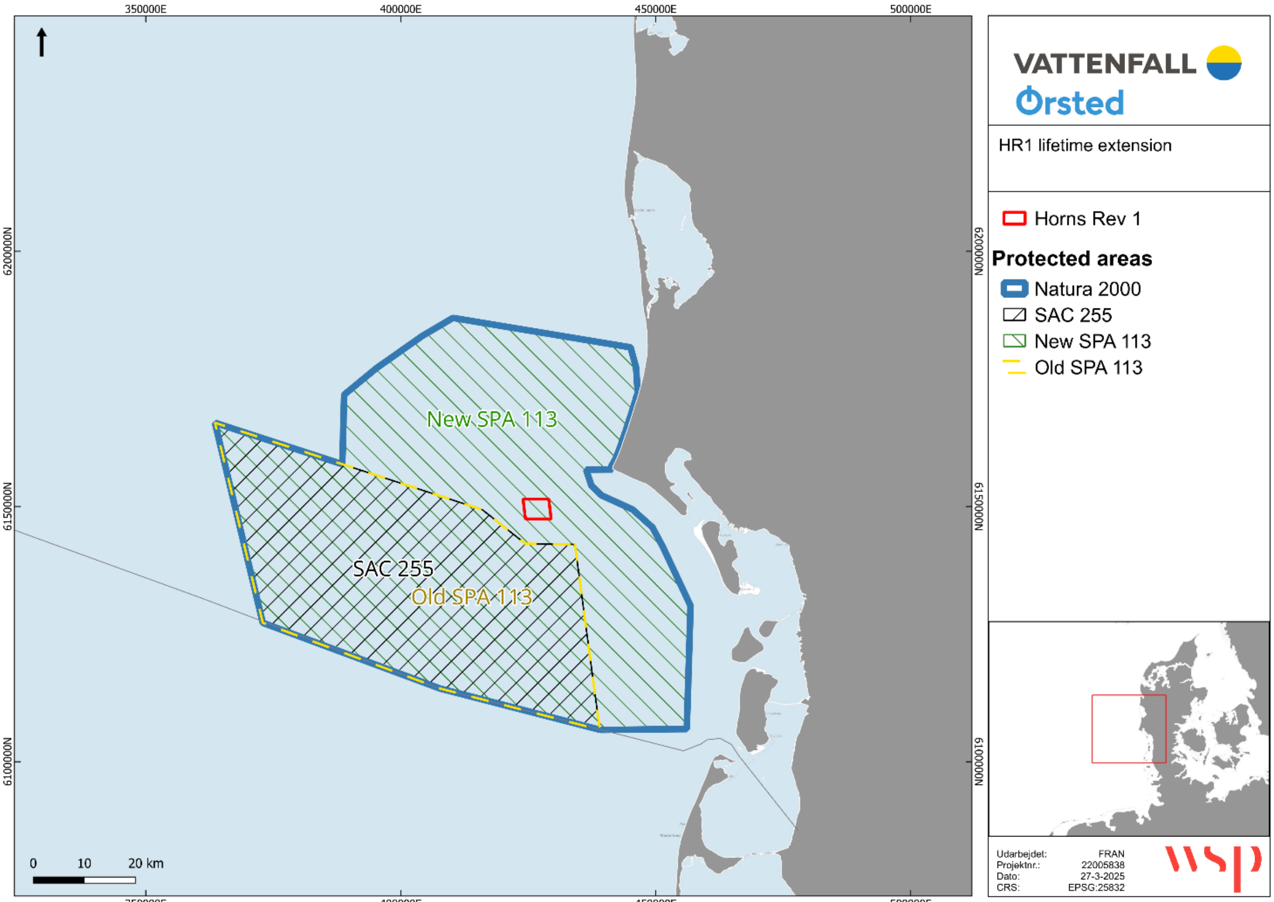

Figure 8-2 Natura 2000 sites (Special Area of Conservation, SAC; Special Protection Area, SPA) overlapping or bordering the project area (marked with red square).

Seabirds and marine mammals are, based on their high mobility and potential sensitivity to the presence of offshore wind farms, the only designation basis for the relevant Natura 2000 sites that are assessed to be relevant for the screening (Table 8-1).

The potential impact on seabirds, harbour porpoise and seals are assessed in section 8.5.1, 8.5.2 and 8.5.3. Harbour porpoises are furthermore listed as Annex IV species of the EU Habitats Directive and is assessed in section 6.3.2.

APPENDIX

Table 8-1 Designation basis of SAC and SPA sites which border or overlap with the project area. Both sites are part of the Marine Natura 2000 site N246. *Harbour porpoise is also listed as Annex IV species of the EU Habitats Directive and is assessed in section 6.3.2. Note: SPA's from further distances are included on a general level in the assessment, if designated birds migrate through the project area. Conservation status based on (Fredshavn, et al., 2019b) and provided for a) the short-term (2007 – 2018) population trend in Denmark and b) population trend inside Danish SPA's. Coding "=" stable, "+" 0-100% increase, "-" 0-30% decrease, "--" 30-50% decrease, "?" uncertain, "<>" fluctuating.

Natura 2000 area	Natura 2000 site	Distance	Designation basis	Code	Conservation status (a / b)	Relevance (X)
N246	SPA 113	0 km	Resting/migrating birds:			
			Red-throated diver	(A001)	= / x	X
			Black-throated diver	(A002)	x / x	X
			Little gull	(A177)	? / -	X
			Common scoter	(A065)	--/ x	X
N246	SAC 255	3.8 km	Marine habitats:			
			Sandbanks	(1110)		
			Species listed under Annex II:			X
			Grey seal	(1364)	Not favorable	X
			Harbour seal	(1365)	Favorable	X
			Harbour porpoise	(1351)*	favorable	
N89	SPA 49[1], 51[2], 52[3], 53[4], 55[5], 57[6], 60[7], 63[8], 65[9], 67[10]	8.8 km	Breeding birds:			
			Bittern[2,3,4,7,8,9,10]	(A021)		
			White stork[2,7]	(A031)		
			Spoonbill[5]	(A034)		
			Marsh harrier[2,3,4,7,8,9,10]	(A081)		
			Montagu's harrier[1,2,7,8,9,10]	(A084)		
			Spotted crake[2,7,9]	(A119)		
			Corncrake[1,2,7,8,10]	(A122)		
			Avocet[2,3,4,6,7,9]	(A132)		
			Kentish plover[4,6,7,9]	(A138)		
			Black-tailed godwit[3,7]	(A156)		
			Mediterranean gull[2,5]	(A176)		
			Gull-billed tern[3,4,5,6,9]	(A189)		
			Common tern[2,3,5,6,7,9,10]	(A193)		
			Arctic tern[3,4,5,6,9]	(A194)	= / =	X
			Black tern[7,8]	(A197)		
			Short-eared owl[2,3,5,6,7,8,9,10]	(A222)		
			Common nightjar[4,9]	(A224)		
			Redbacked shrike[8]	(A338)		
			Dunlin[4,9]	(A466)		
			Bluethroat[1,2,3,4,6,7,9,10]	(A480)		
			Ruff[2,3,7,9,10]	(A861)		
			Sandwich tern[5,6,9]	(A863)	-/ <>	X
			Little tern[4,5,6,9]	(A885)	- / +	X

*

			<u>Resting/migrating birds:</u> Bewick's swan[2,6,7] Whooper swan[6,7,10] Spoonbill[2] Pink-footed goose[2,5,6,7,10] Greylag goose[6,7] Barnacle Goose[2,3,6,7,10] Dark-bellied Brent goose[3,5,6,9] Light-bellied Brent goose[4,6] Greater White-fronted Goose[2,6,7,10] Shelduck[6,7,9] Pintail[1,5,6,7] Teal[6,7] Mallard[6] Shoveler[6,7] Wigeon[5,6,7] Gadwall[7] Common scoter[6] Common eider[6] White-tailed Eagle[6,7] Hen harrier[6] Peregrine falcon[3,4,6] Oystercatcher[4,5,6] Avocet[1,6,7] Kentish plover[6,7] Golden Plover[2,6,7,9,10] Grey plover[4,6,7] Red knot[4,6,7,9] Sanderling[4,6,9] Dunlin[4,6,7,9] Bar-tailed godwit[6,7,9] Spotted redshank[6,7] Redshank[6,7] Greenshank[6,7] Curlew[6,7] Dotterel[2] Sandwich tern[4,5,6] Little gull[6]	(A037) (A038) (A034) (A040) (A043) (A045) (A046) (A674) (A394) (A048) (A054) (A052) (A053) (A057) (A855) (A889) (A900) (A063) (A075) (A082) (A103) (A130) (A132) (A138) (A140) (A141) (A143) (A144) (A149) (A157) (A161) (A162) (A164) (A768) (A727) (A863) (A862)		
DE1003301 **DE1209301** **DE0916491**		196 36 42	Kittiwake*	(A188)	= /	X

Kittiwakes have a decreasing population trend in Northwest Europe (Christensen, et al., 2022).

8.3.1 BIRDS

In Denmark, in accordance with the EU's Bird Protection Directive, a total of 125 Special Protection Areas (SPA's) has been established, their number and boundaries being updated on a regular basis. SPA 113 "Sydlige Nordsø" (Southern North Sea) was established in 2004 (247.314 hectares) (see the change in boundaries for SPA 113 on Figure 8-3). Horns Rev 1 which was set in operation in 2002, is located at the northern edge of the SPA.

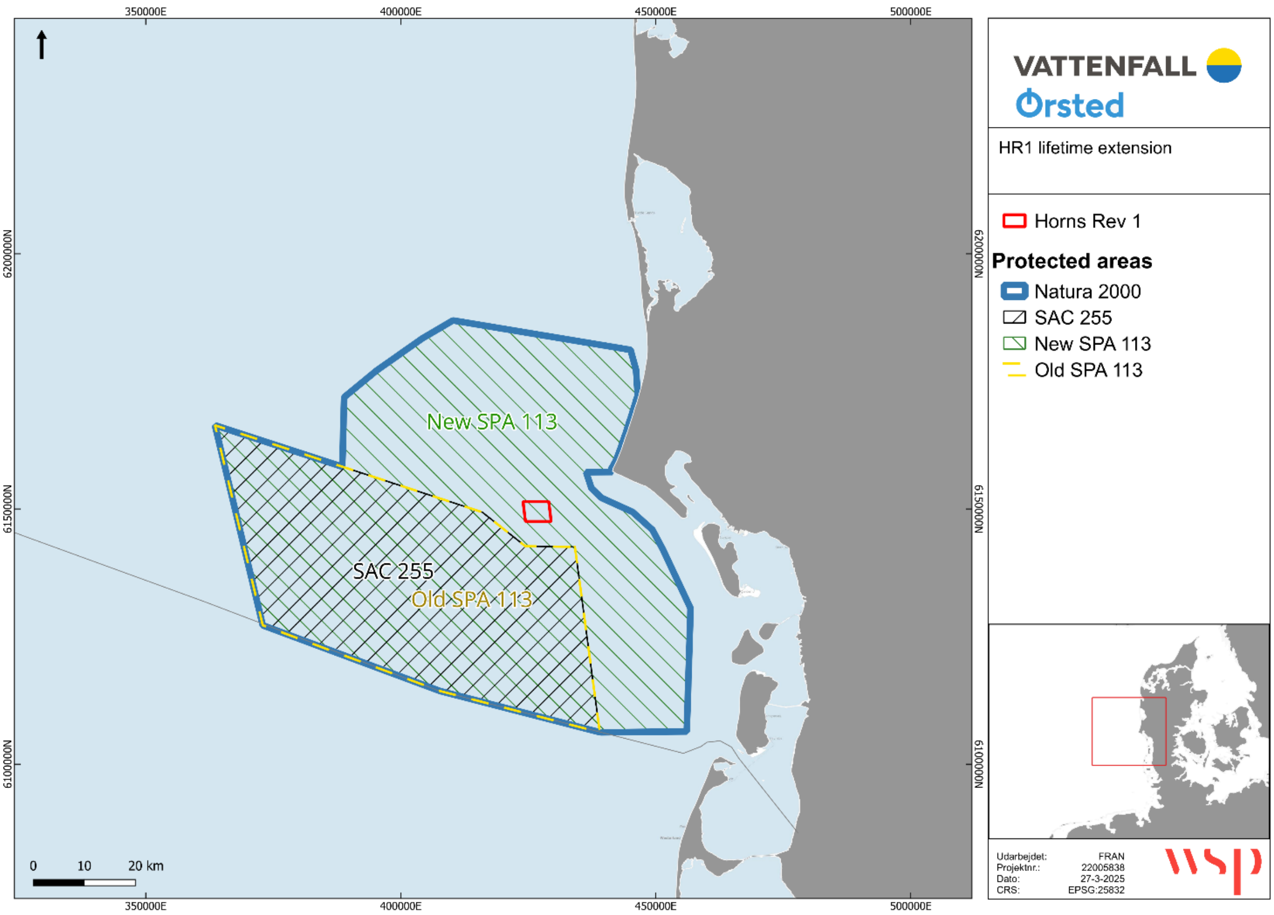

Figure 8-3 Boundaries for SPA 113 when Horns Rev 1 was set in operation in 2002 and the boundaries for SPA 113 in 2025.

In 2015, the Danish Ornithological Association (DOF) published a report entitled "*Status and development trends for Denmark's internationally important bird areas (IBA' = "Important Bird Areas*", Vikstrøm et al. 2015).

In 2016, DCE (Aarhus University) initiated an evaluation of the report with a view to assess the need to designate new Danish SPA' s (Petersen et al. 2019). One of the conclusions from the evaluation was that there was evidence supporting the expansion of SPA 113 Southern North Sea. As a result, in 2021, SPA 113 was expanded to the north, now overlapping with an Important Bird Area (IBA 123) that was previously identified by BirdLife International (Vikstrøm et al. 2015). SPA 113 overlaps with the project area.

The designation bases for the Danish Natura 2000 sites are updated regularly on the basis of data collected in the Danish national nature monitoring programme NOVANA.

SPA 113 is designated in order to protect four species of migrant waterbirds: The Red-throated diver, the Black-throated diver, the Common scoter and the Little gull. However, the Black-throated diver and the Little gull are expected to be removed from the basis for designation during the next revision, as they only occur in low numbers (Miljøstyrelsen 2022: opdateret UPG for fuglebeskyttelsesområder 2023-11-06 med nye F-omr fra 2021+2023.xlsx).There are no formal or legally binding guidelines specifying the number or selection of Natura 2000 sites that should be considered in a preliminary Natura 2000 assessment. For instance, there is no defined distance from a project area within which Natura 2000 sites should be included in the assessment. Therefore, the assessment is also addressing the fact that birds from more remote SPA's, may either pass through on migration or stage to feed either inside or in the vicinity of Horns Rev 1. As an example, this includes e.g. terns from SPA' s in the Wadden Sea region which breed onshore but may fly out to feed in the project area at sea. Consequently, the Natura 2000-screening focuses on SPA 113 Southern North Sea but also considers bird species designated in other SPA's, which can potentially experience an impact due to the lifetime extension of Horns Rev 1. The assessment includes bird species designated under the NATURA 2000 network of Special Protection Areas (SPA's), which occur regularly in the marine environment either during migration or during the breeding season.

RED- AND BLACK-THROATED DIVER (MIGRANTS)

The Red-throated diver breeds in lakes in arctic areas around the North Pole, south to temperate areas in e.g. Scandinavia. The Black-throated diver breeds in lakes from the northern part of the British Isles, Scandinavia and further into Russia.

The two species feed on fish and winter primarily in shallow and fishing-rich areas at sea. In Denmark, Red-throated divers are found in the largest numbers in the North Sea, Aalborg Bay and Kattegat, while Black-throated diver occurs in greatest numbers in the eastern parts of the country. Divers are known to be sensitive to human disturbance in the marine environment (DCE Homepage: Lommer).

COMMON SCOTER (MIGRANT)

The Common scoter is a seaduck which is not breeding in Denmark but occurs in Danish waters most of the year, both as wintering, passing through and moulting. It is a frequent visitor to Danish Sea areas from late summer, through autumn and winter until departure for the breeding grounds in the spring. The species occurs in shallow areas at sea, where they can be found in high densities. The species overwinters in Danish waters primarily in Aalborg Bay, Sejerø Bay and in the southern part of the Danish North Sea, from north of Blåvands Huk to the Danish-German border. Common scoter feeds primarily on mussels (DCE Homepage: Sortand), (BirdLife Denmark Homepage: Danmarks Fugle - Sortand).

LITTLE GULL (MIGRANT)

For many years, the Little gull has made breeding attempts in Vejlerne in North Jutland. The species is breeding at meadows near lakes rich on mosquito and mosquito larvae. Little gull is a migrant which winters in the marine environment, both far out to sea and in coastal areas in e.g. the Mediterranean, Africa, the Black Sea, etc. It can also be seen during migration and wintering in Denmark in e.g. the Blåvands Huk area and the Wadden Sea (DCE Homepage: Dværgmåge).

Descriptions of abundance, status and distribution of the four designated species is given in more detail in the assessment chapter 8.5.1.

TERNS (MIGRANT AND BREEDING)

Several species of terns are designated as breeding birds within multiple SPA's located along the West-coast of Jutland. Among the designated species, the Little tern, the Arctic tern and the Sandwich tern are closely associated with the marine environment. These species typically breed on remote stretches of coastline or small islets with a sparse vegetation cover (DCE Homepage: Dværgterne, Havterne, Splitterne). All three species of terns tend to breed in colonies located onshore but in immediate connection to the sea, whereto the terns perform regular feeding visits. An extensive review reported a maximum foraging range of Little terns of 11km, whereas the maximum range for Arctic and Sandwich terns, were reported to be as high as 30 and 54km, respectively (Thaxter, et al., 2012). However, the mean foraging range reported by the same study was much lower; 2.1 km for Little terns, 7.1 km for Arctic terns and 11.5 km for Sandwich terns. These three tern species are designated as breeding birds in multiple SPA' s within the NATURA 2000 site 89; the Wadden Sea, located closer to the project area than the species' maximum foraging ranges (Thaxter, et al., 2012). All three species of terns perform long-distance migratory flights between winter quarters in West Africa or Antarctica and breeding areas in North-west Europe.

KITTIWAKE

The Kittiwake is designated as a resting/migrating bird in marine NATURA 2000 areas in the German part of the North Sea including Dogger Banke Table 8-1. Kittiwakes are pelagic feeders with large foraging ranges. Therefore, Kittiwakes from the marine SPA's in the North Sea may visit the Horns Rev 1 area for a shorter or longer period of time during the non-breeding season. Presence of Kittiwakes in the Horns Rev area was also confirmed by the baseline investigations of Horns Rev 1with 783 birds recorded in total during the 2000/2001 season, 579 of them on a single survey in August 2000 (Christensen, Clausager, & Petersen, 2001).

MARINE HABITATS

The nearest habitat type is a sandbank in the Natura 2000 site N246/SAC 255. The distance from the project area to the habitat type is 4.9 km. Given the significant distance, it is assessed that none of the habitat types will be impacted. Consequently, they are not described and assessed further.

8.3.2 HARBOUR PORPOISE

Existing knowledge on harbour porpoises in the North Sea, including Horns Rev 1 is described under section 6.2.2.

8.3.3 SEALS

HARBOUR SEAL (PHOCA VITULINA)

Harbour seals are widespread in Danish waters, except around Bornholm (Søgaard, et al., 2018). It is the only seal species that has been observed regularly in the Danish sector of the central part of the North Sea.

Based on genetics and migration data, four geographically separated stocks have been identified in Denmark: The Wadden Sea (shared with Germany and the Netherlands), the Limfjord, the Kattegat (shared with Sweden) and the Western Baltic Sea (shared with Sweden) (Olsen et al., 2014).

Twenty-two marine SACs are designated for harbour seals in Denmark (Figure 8-4). There are permanent colonies of harbour seals in 17 of these areas, while the remaining areas are important for their foraging and movements (Hansen & Høgslund, 2023). The population has increased since Denmark initiated national protection of harbour seals and established seal reserves in 1977. The population has been significantly affected by epidemics, including the Phocine Distemper Virus (PDV) epidemics in 1988 and 2002, which resulted in the death of up to half of the individuals in the populations (Härkönen, et al., 2006). Further impacts were seen in 2007 due to an unknown disease (Härkönen, et al., 2008) and in 2014 due to a bird flu epidemic (Søgaard, et al., 2018). In recent years, the population has stabilized, suggesting the carrying capacity of the environment has been reached (Kyhn, et al., 2021).

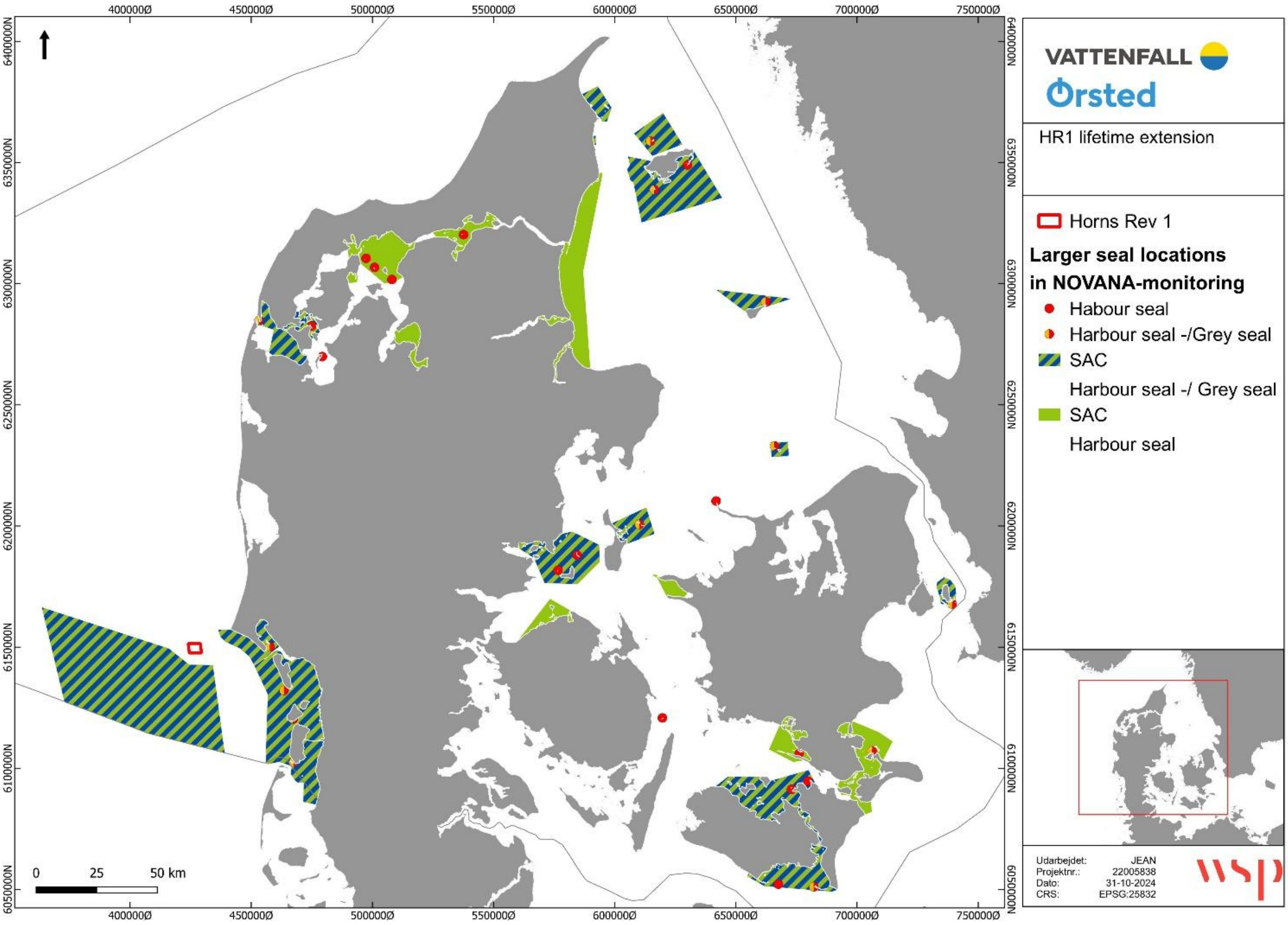

Figure 8-4 Map of SAC for harbor seals and grey seals in Danish waters. Larger harbour seal colonies and localities where grey seals are regularly observed, are shown with red and yellow circles, respectively, or a red/yellow combination if both species are found in the same locality. (Adjusted according to Hansen & Høgslund (2023)).

Harbour seals are found along the entire stretch of the Wadden Sea, including the Danish, German, and Dutch parts. In 2022, an average of 2,500 harbour seals were counted in the Danish part of the Wadden Sea during the August surveys. The population in the Danish Wadden Sea was severely impacted by the PDV epidemics in 1988 and 2002. Following the 2002 epidemic, the population grew at an average annual rate of 13% until 2012, which is the theoretical maximum growth rate for harbour seals (Härkönen, Harding, & Heide-Jørgensen, 2002). Since 2012, the population in the Danish Wadden Sea has declined, with the number of seals on land estimated at 2,090 in 2022, down from 2,909 in 2012. The overall population in the Wadden Sea, including Germany and the Netherlands, was stable at 26,654 seals in 2022, indicating that the population may have reached the ecological carrying capacity of the environment. In 2022, 538 pups were counted in the Danish Wadden Sea, slightly below the average of 636 since 2012. The counted pups represent 26% of the moulting seals in the Danish Wadden Sea (Hansen J.W. & Høgslund S. (red.), 2024).

Harbour seals do not generally venture more than 20 km offshore. However, GPS tagging using satellite tracing have indicated that harbour seals may undertake foraging migrations far out into the North Sea from their core areas along the coast (Kyhn, et al., 2021) (see Figure 8-5). It is though noted by Kyhn et al. (2021) that there is only a very limited number of seals marked and that it is uncertain to what extent these data are representative of the harbour seals use of the different areas. As can be seen from the satellite tracking, the nearest resting places for harbour seals, in relation to the use of the project area, is the Wadden Sea.

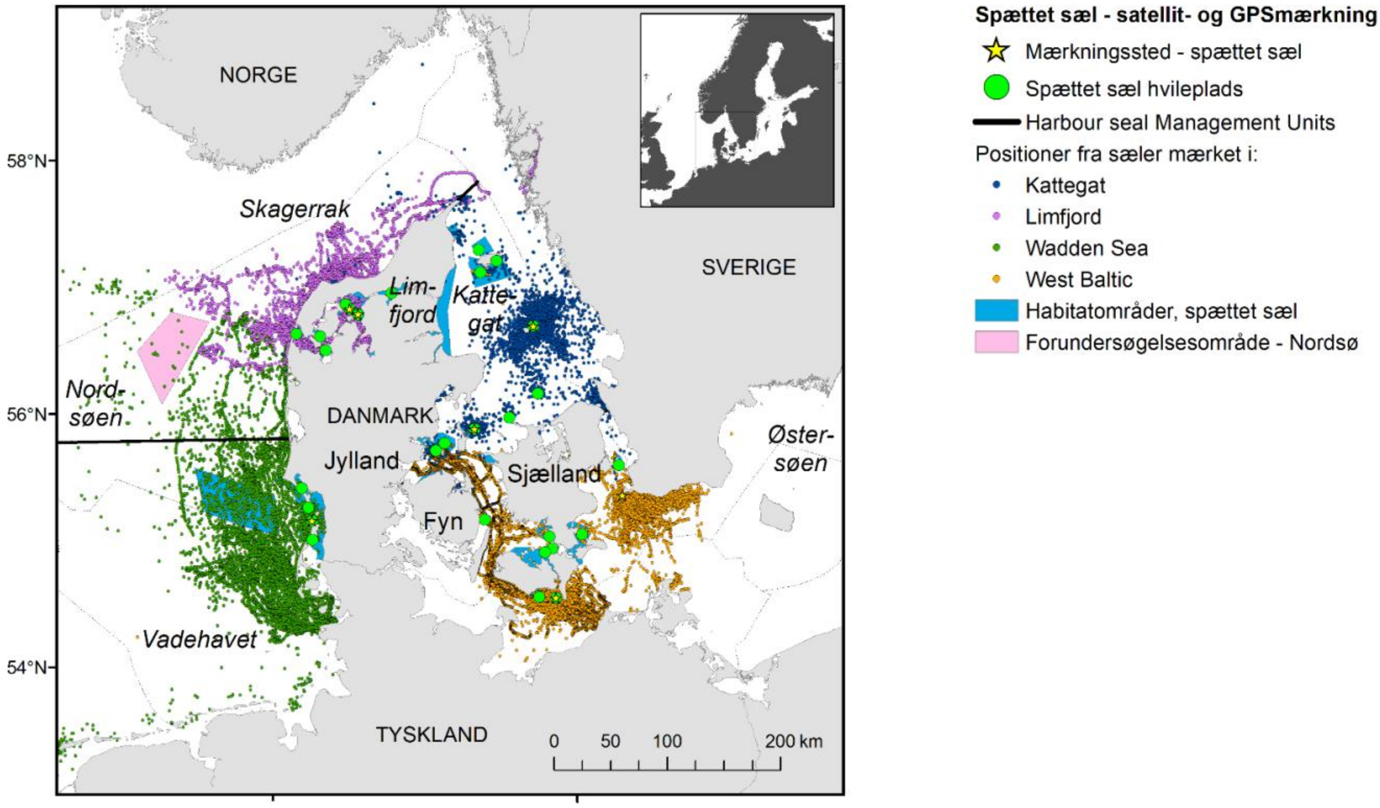

Figure 8-5 Distribution of harbour seals from the four populations where individuals have been tagged with GPS/satellite loggers in Danish waters (n=126). Seals tagged in the Wadden Sea are using the offshore area, including the area of Horns Rev 1(seal positions marked with dark green dots). Light green circles mark resting grounds in Denmark and yellow stars indicates locations of the tagged seals. Approximate location of Horns Rev 1 is marked by a red square. Figure modified from (Kyhn, et al., 2021). Note that "Forundersøgelsesområde – Nordsø" is in relation to the study done by Kyhn et al. (2021) and is not relevant for the current assessment.

Prior to the construction of the Horns Rev 1, baseline studies were conducted to establish the initial state of the environment, including the presence of harbour seals in the area (Fox, Christensen, Desholm, Kahlert, & Petersen, 2006). In addition, studies were conducted during and after the construction of the Wind Farm to assess any effects from the Wind Farm on harbour seals. At Rømø (ca. 50 km away from Horns Rev 1), 21 individuals of harbour seals were tagged with satellite transmitters in order to follow their swimming patterns. Data showed, that before Horns Rev 1 was constructed, harbour seals used the area for foraging and furthermore, that the area was part of a larger foraging range extending up to 50-100 km from the coast. After construction, harbour seals continued to use the area of Horns Rev 1 for foraging and satellite tracking data showed no significant avoidance of the project area (Fox, Christensen, Desholm, Kahlert, & Petersen, 2006).

Harbour seals give birth to their young on land in June. The pups can follow their mothers into the water shortly after birth. They use resting places for lactation during the first month. In August, the seals molt and require calm resting places. Mating occurs in the water, where male seals maintain territories and attract females with underwater sounds (Boness, Bowen, Buhleier, & Marshall, 2006). Harbour seals are most vulnerable around the resting areas from June to August.

Harbour seals face several threats, including bycatch in fishing nets, reduced food availability, and habitat destruction due to fishing activities. Pollution from industry and agriculture, noise pollution, climate and habitat changes, and physical disturbances and noise from recreational activities also pose significant risks (IUCN Red List).

Harbour seals are listed as Least Concern on the IUCN Red List.

GREY SEAL (HALICHOERUS GRYPHUS)

Thirteen marine SACs are designated for grey seals (Figure 8-4) in Denmark. Grey seals are regularly occurring on land in nine of these areas, while the remaining areas are important for their foraging and movements (Hansen & Høgslund, 2023). The largest concentrations of grey seals in Denmark are found at Rødsand near Gedser and Ertholmene northeast of Bornholm. The grey seal became locally extinct in Denmark after extended culling (Galatius, et al., 2020). The re-population of Danish waters started around the year 2000, with numbers increasing in the Wadden Sea, the Kattegat, and the Baltic Sea (Søgaard, et al., 2018).

Grey seals are found in various regions, including the Danish sector of the North Sea. They breed in several colonies on islands on the east coasts of Great Britain and in the German Bight, where colonies exist on the islands of Sylt, Amrum, and Helgoland. In 2020, the population in the Wadden Sea was estimated to be approximately 300 individuals (Kyhn, et al., 2021). Grey seals occurring in the Danish sector of the North Sea are non-breeding seals from the large populations in the UK and German/Dutch sectors of the Wadden Sea and are primarily searching for food.

Counts of moulting grey seals in the Wadden Sea began in 2015, with 126 individuals recorded in April of that year. The number has since shown an increasing trend, with an average of 216 seals counted in 2022.

Based on satellite tracking of grey seals in Limfjorden and the German part of the Wadden Sea (Kyhn, et al., 2021), it is evident that none of the tagged individuals uses the area close to Horns Rev 1 Wind Farm (Figure 8-6). However, only very few grey seals were tagged and furthermore, seals were tagged far away from Horn Rev 1, and thus, it is difficult to conclude whether these data are representative of the grey seals use of the different areas.

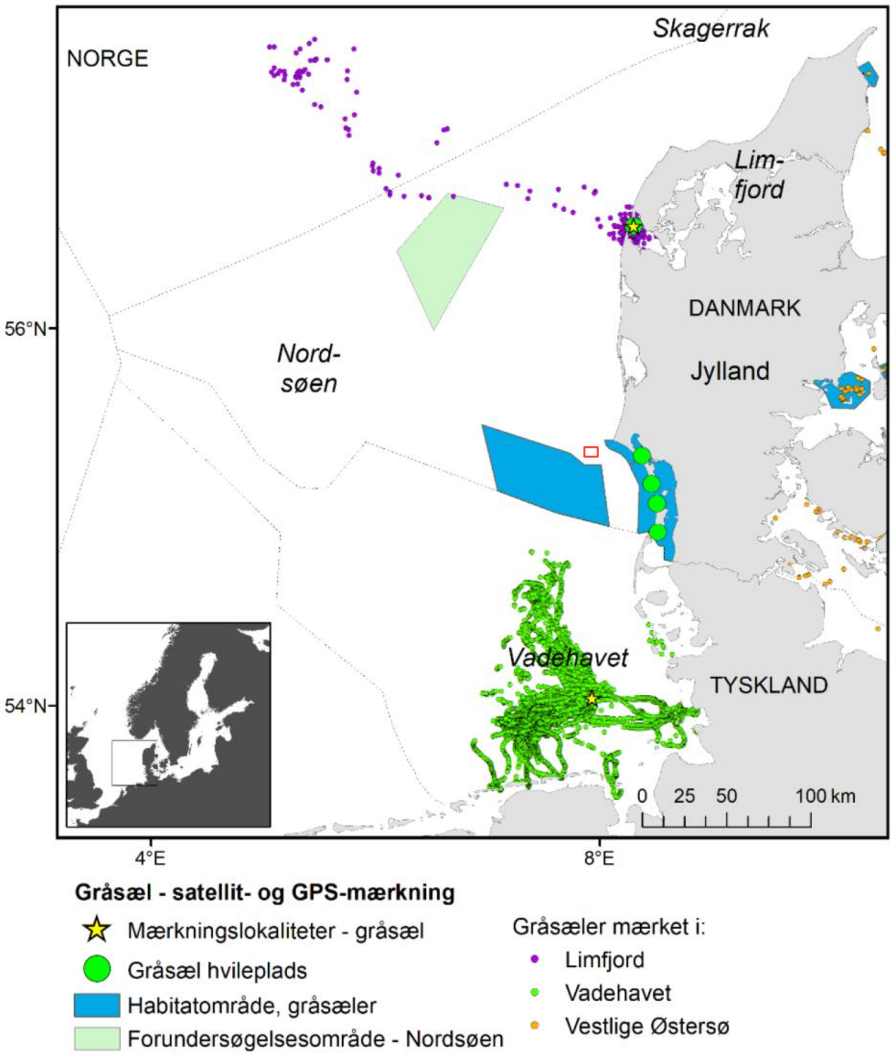

Figure 8-6 Data from grey seals tagged with satellite transmitters in Limfjorden and the German part of the Wadden Sea. Light green circles mark resting grounds in Denmark and yellow stars indicates locations of the tagged seals. Purple and green dots mark tracking of tagged seals. Approximate location of Horns Rev 1 is marked by a red square. Figure modified from (Kyhn, et al., 2021). Note that "Forundersøgelsesområde – Nordsø" is in relation to the study done by Kyhn et al. (2021) and is not relevant for the current assessment.

No grey seals were tagged with satellite transmitters as part of the baseline studies for Horns Rev 1 (Fox, Christensen, Desholm, Kahlert, & Petersen, 2006) (see details in section 8.3.3 - Harbour seals).

Grey seals are most vulnerable when they are about to give birth to their young and during mating. The female seal gives birth to one pup in an undisturbed place and nurses the young for three weeks. If mother and pup are disturbed during this period, there is a risk that the mother will abandon the pup (Kyhn, et al., 2021). The North Sea population gives birth in December-January, with mating starting approximately three weeks after the nursing period. Grey seals from the North Sea molt in March-April. Grey seals are most vulnerable around their resting places during December-January and March-April (Kyhn, et al., 2021).

Grey seals face threats from bycatch in fishing nets, reduced food availability, and habitat destruction due to fishing activities. Pollution from industry and agriculture, noise pollution, climate and habitat changes, and physical disturbances and noise from recreational activities also pose significant risks (IUCN Red List).

Grey seals are listed as Endangered on the IUCN Red List.

8.4 OBJECTIVES

Below are listed the overall objectives for the Natura 2000 site N246, including habitats and species, cf. the Danish Environmental Protection Agency (2023). Note that for the extended SPA 113, a plan is not yet available and therefore the objectives stated below is based on the latest available Natura 2000 plans for the area (The Danish Environmental Protection Agency, 2023).

8.4.1 OVERALL OBJECTIVES FOR THE NATURA 2000 SITE N246

The habitats and species listed in the designation basis should contribute to achieving a favorable conservation status at the biogeographical level, and the birds listed in the designation basis should help ensure population sizes at the national level. The goal is to ensure that the area's marine habitats support a rich diversity of plant and animal life, including the characteristic species of the designation basis.

The overall objectives for the Natura 2000 site N246 are furthermore:

- The marine habitat type sandbank (1110), which has an unfavorable conservation status, should be ensured a well-developed fauna and bottom vegetation.
- The area should be secured as a good habitat for harbour porpoises, grey seals, harbour seals, red-throated divers.

8.4.2 SPECIFIC OBJECTIVES FOR HABITATS AND SPECIES

Within Natura 2000 areas, there should be opportunities for nature management that utilizes nature's own dynamics. In connection with management, consideration should be given to whether habitats, species, or birds listed in the designation basis may be sensitive to such management, for example, those mentioned under the overall objectives.

The specific objectives are based on groupings of habitats, habitat species, and birds. See Table 8-1 for an overview of which habitats, species, and birds the different groups contain.

GENERAL

- The overall occurrence of habitats, species, and bird habitats in the Natura 2000 area, whether mapped or not, should be stable or improving, provided that natural conditions allow for it.

SPECIES

- For species without a condition assessment system, the goal is to contribute to achieving a favorable conservation status at the biogeographical level. The condition of the habitats (assessed in terms of occurrence and distribution) and the total area should be stable or improving.

MIGRATORY BIRDS

- For migratory birds that may appear in nationally significant numbers in the bird protection area, their resting and overnight areas should be secured or improving, so that the area can continue to support a population of national importance.

8.5 ASSESSMENT OF POTENTIAL IMPACTS

8.5.1 BIRDS

The main potential negative effects to birds from wind farms have been identified to include:

- Disturbance leading to displacement or exclusion of migrating and resting birds, including barriers to movements.
- Collision mortality from operating turbines.
- Loss of, or damage to, habitats and associated changes in food supply resulting from the footprints of the wind turbines.

Impacts from the mentioned sources are assessed in the following, including existing knowledge on relevant birds in the project area and surrounding areas.

DISPLACEMENT AND BARRIER EFFECT

It is a well-known fact that some species of birds tend to avoid areas with offshore wind farms. Such physical displacement is a result of individuals avoiding feeding in the vicinity of turbines. As a result, the species suffers an effective habitat loss, even though the habitat and even the food supplies may remain intact.

Additionally, the presence of the Horns Rev 1 during the operational phase can potentially constitute a barrier for migratory birds. As a consequence, migrating birds may need additional energy resources during their migration. The magnitude of the impact depends on the bird species in question and its behavior.

The barrier effect refers to changes in preferred migration routes, i.e. the birds fly along alternative routes instead of flying through the Wind Farm. Such a detour can lead to increased consumption of energy. Considering the location of the wind farm more than 14 km off the coast, it is obvious that the turbine area is not an extension of landscape "bottlenecks", where bird migration is typically concentrated.

As the majority of the migration is also expected to take place near and parallel with the coast, the barrier effect from the continued presence of the Horns Rev 1 turbines is assessed to be extremely limited.

Additionally, as the ”project” implies a lifetime extension for the already existing Horns Rev 1, it is a reasonably assumption that birds migrating through the area are already adapted to such a possible minor barrier effect. Overall, the impact of the barrier effect is therefore assessed to be negligible for all relevant species and will not be further assessed.

In order to assess the potential impact from Horns Rev 1 on bird abundance and distribution, the National Environmental Research Institute (NERI), carried out the baseline studies that were needed to assess the possible impact of the Wind Farm on birds (Noer, Christensen, Clausager, & Petersen, 2000).

In Noer et al. (2000) it was assumed, that if the proportion of a species inside the turbine area is higher than 1%, the species has a higher preference for the area than its surroundings. Conversely, the birds show a reduced preference for the area if the proportion of birds within the project area is lower than 1%.

Within the project area itself, divers were the only species that occurred in proportions greater “than expected”. However, it should be noted that this observation corresponded to 8 out of 554 individuals and was not statistically significant. This led Noer et al. (2000) to conclude:

- No data collected so far indicate that the (Horns Rev 1) project area is of any special importance to the seabirds’ ecological exploitation.

Red- and black-throated divers

Divers are known to be sensitive to human disturbances in the marine environment. It has been demonstrated that birds respond to disturbances from vessels up to more than 1 km distance (Schwemmer, Mendel, Sonntag, Dierschke, & Garthe, 2011)). Offshore wind farms have also been shown to influence distribution and numbers of divers at distances up to 15 km (Petersen, Nielsen, & Mackenzie, 2014), (Mendel, 2019) whereas a recent evaluation of diver displacement in the area of the three operating Horns Rev wind farms indicate a mixed evidence and likely dependence on environmental conditions and physical layout characteristics of the wind farm (NIRAS, 2024).

The total wintering population of the Red-throated diver in northwest Europe is estimated to be between 210,000 and 340,000 birds. The total wintering population of the Black-throated diver is estimated to be between 390,000 and 590,000 birds (Wetlands International, 2022)

The winter population of Red-throated/Black-throated diver in Denmark is estimated to 10,000-15,000 individuals (of which 6,000 are wintering in nearshore waters), while the population during the spring migration was estimated to about 20,000 birds (Petersen & Nielsen, 2011). A spring count in the North Sea in 2019 (Petersen, Sterup, & Nielsen, 2019b) extending from the Danish-German border to Skagen resulted in a model estimate of approx. 12,500 birds (lower and upper bounds: 7,032 – 22,238). A count in 1987-1989 in the area off the Wadden Sea, including Horns Rev, resulted in abundance estimates increasing from 1,700-2,200 birds in autumn to 28,500 birds in spring (Laursen, et al., 1997).

The total from the nationwide census made in 2020 was 5,400, and the population of wintering divers is therefore presumably steady. Unfortunately, the Southern North Sea was not covered in the last two nationwide midwinter counts in 2016 and 2020, which is due to the fact that the weather in the area in winter is rarely good enough for aerial surveys, and that the military has relatively large training areas, which significantly restricts access (Nielsen, et al., 2023).

The abundance and distribution of divers in Denmark was previously modelled for the Inner Danish Waters and for high density areas of the Danish North Sea in (Petersen & Nielsen, 2011) The model for the North Sea was based on survey data from a combined marine mammal and seabird census in the southern parts of the Danish North Sea in April 2008 and a survey made by NERI in April 2009. Coarse-scale aerial survey data from the northern North Sea were not included in the model, as only very few divers were observed in that area.

The majority of divers recorded during these aerial surveys were Red-throated, especially in the North Sea and in Kattegat. The modelling confirms that divers are also present in the Horns Rev 1 area (Figure 8-7).

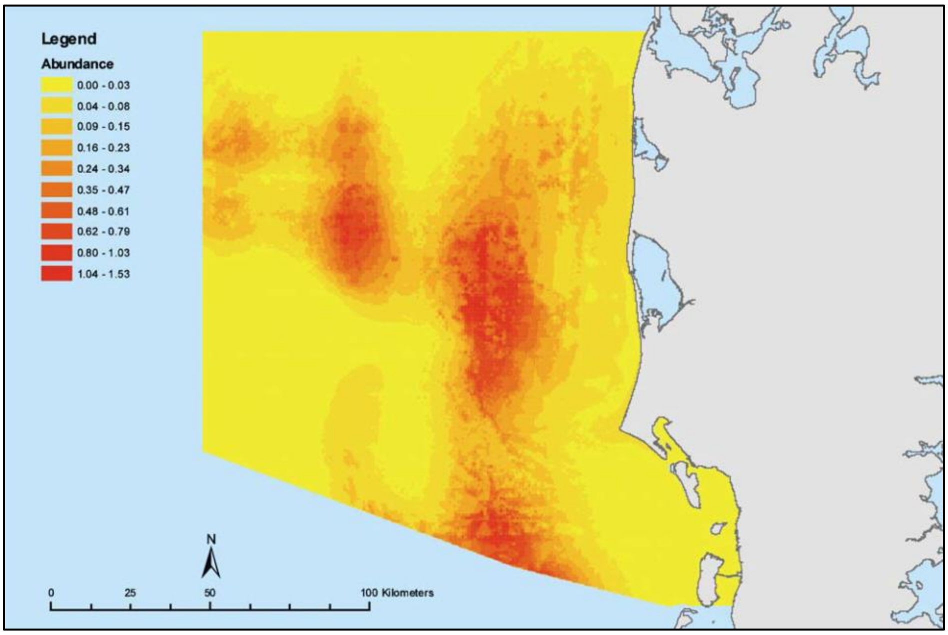

Figure 8-7. The modelled distribution of 10,212 Red-throated/Black-throated divers in the south-eastern parts of the Danish North Sea (Petersen & Nielsen 2011).

In the period from 1999 to 2011, DCE/Aarhus University carried out around 50 aerial surveys of birds in the project area. The surveys were carried out as part of either EIA baseline or follow-up studies for the Horns Rev 1 and Horns Rev 2 (Christensen, Petersen, & Fox, 2006; Petersen, Nielsen, & Mackenzie, 2014). Additionally 6 surveys were conducted between November 2023 to April 2024, at which time all three Horns Rev wind farms were in operation (NIRAS, 2024).

The geographical extent of these surveys did not cover the entire IBA area, and only partially covered SPA 57 and SPA 113.

The Horns Rev area has also been covered by aerial surveys under the NOVANA program's nationwide counts for waterfowl in the winters of 2008 and 2013, as well as individual counts in early spring following the same survey transects. Altogether, these counts are considered a sufficient basis to assess the abundance and distribution of divers in the project area.

The aerial counts performed under the NOVANA program as well as the baseline and follow-up investigations presented in (NIRAS, 2024) showed a scattered distribution pattern of divers in the survey area with the highest abundance of divers in the central and southern parts of the area as well as in the near-coastal area off Blåvands Huk. Of the total 6,192 individuals observed, 34% were registered inside the surrounding SPA's.

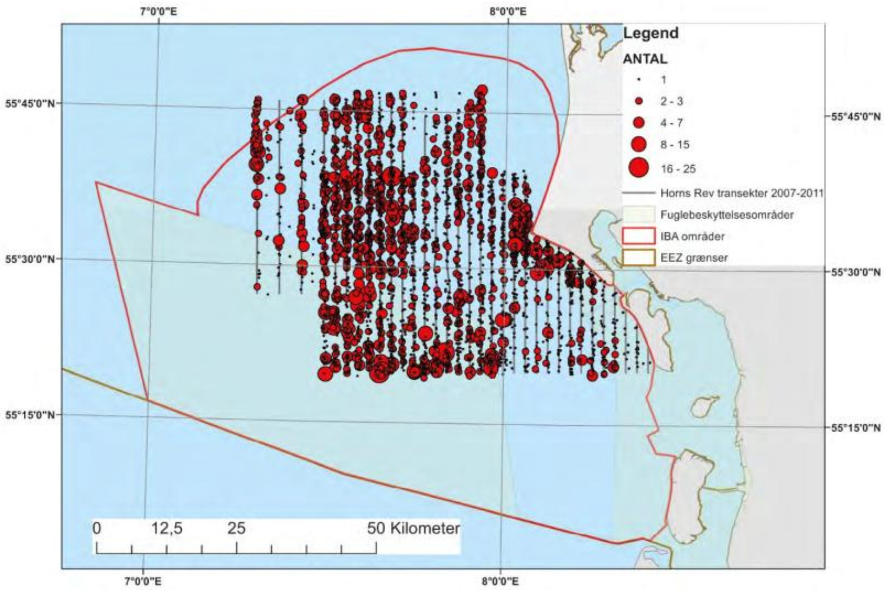

Figure 8-8. The distribution of 6.192 divers in the waters in and around Horns Rev on a total of 50 aerial surveys in the period 1999-2011. It is assessed that at least 90% of the observations are of Red-throated divers (Petersen I. , Nielsen, R.D., & Clausen, 2019a).

During two spring surveys in April and May 2019, a total of 517 divers, almost all of them were observed in the Danish part of the North Sea. The vast majority of the birds were located in the southerly and easterly part of the Danish North Sea, and it was estimated that more than 25.000 divers were present in the study area (Petersen, Sterup, & Nielsen, 2019b), Figure 8-9.

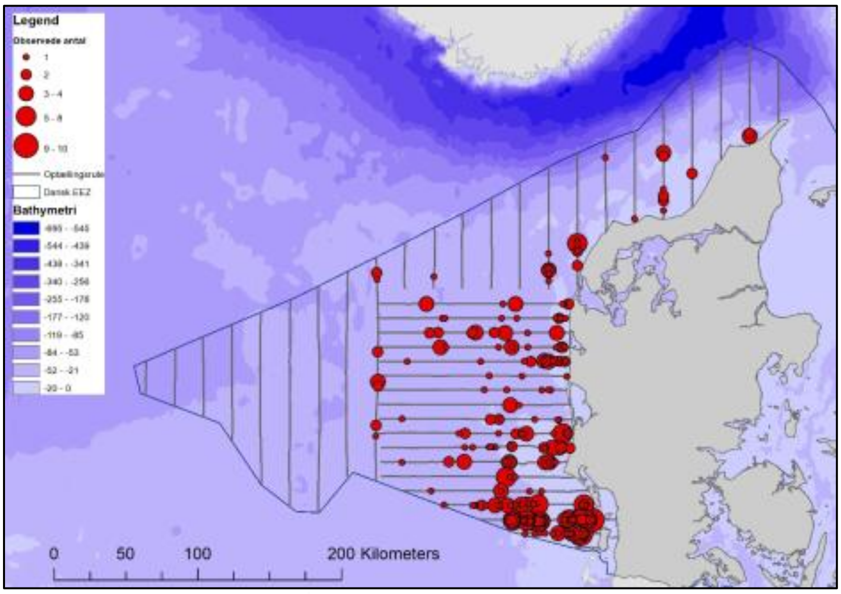

Figure 8-9. Distribution of 517 observed divers in the Danish part of the North Sea in April and May 2019 (Petersen, Sterup, & Nielsen, 2019b),

In the aerial surveys carried out by DCE, no distinction was made between Red- and Black-throated diver, as it is not possible to distinguish the two species from an aircraft. However, it is assessed that the Red-throated diver is by far the most abundant species in the area. The species is estimated to comprise at least 90% of all observed divers in the area (Petersen I. , Nielsen, R.D., & Clausen, 2019a).

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It is concluded in (Petersen I. , Nielsen, R.D., & Clausen, 2019a) that a designation of an additional Bird Protection Area or expansion of existing areas will significantly increase the proportion of divers registered within Denmark's SPA' s.

It is assessed in (Petersen I. , Nielsen, R.D., & Clausen, 2019a) that the Horns Rev area, with its concentrations of divers, qualifies for the designation of a SPA, and that IBA 123 regularly holds more than 3,000 Red-throated divers, which is the 1% biogeographic population criterion for the species.

The overall conclusion from the initial monitoring programme presented in (Fox, Christensen, Desholm, Kahlert, & Petersen, 2006) was that although divers were seen inside the footprint area of the Horns Rev 1 wind farm, there was also clear indications of displacement. In 2007, no divers were observed inside the project area and only one bird was seen within the 2 km zone of potential displacement around the wind farm (Petersen & Fox, 2007).

The recent study evaluating the long-term distribution of divers in and around the Horns Reef (HR) I, II and III OWF's in Denmark (NIRAS, 2024) classified the 56 surveys into four phases according to the development stage of the three Horns Rev wind farms:

Phase 0: 15 surveys prior to any wind farm construction.

Phase 1: 25 surveys post-construction Horns Rev 1and pre-construction Horns Rev 2 and Horns Rev 3.

Phase 2: 10 surveys post-construction Horns Rev 1 and Horns Rev 2, but pre-construction Horns Rev 3.

Phase 3: six surveys post-construction of all three OWF's.

The long-term monitoring revealed that the distribution pattern of divers in the survey area as well as within and around the three wind farm footprints changed throughout the four phases. Overall, the lowest density of divers was found inside the Horns Rev 1 footprint + 1-2 km buffer Figure 8-10.

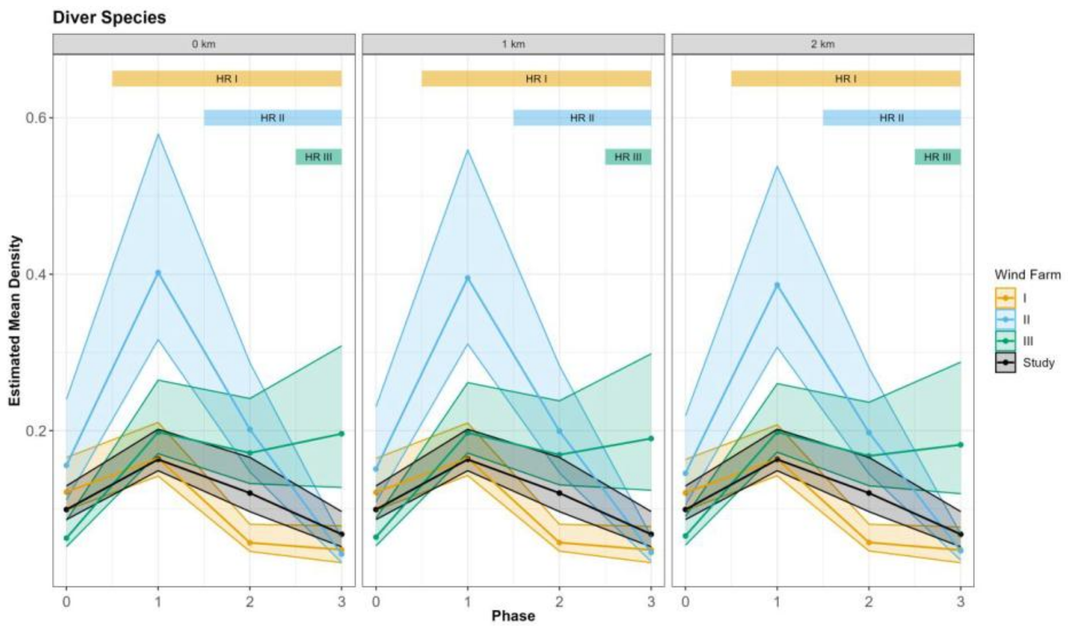

Figure 8-10. Estimated mean density of divers in the footprint, footprint + 1 km buffer and footprint + 2 km buffer of each wind farm for all phases. The bars at the top show the post-construction periods for each wind farm. Note that survey coverage in Horns Rev 3 (HR III) during phase 0 was limited (NIRAS, 2024).

This extensive study found equivocal evidence for displacement of divers after the construction of the first wind farm Horns Rev 1 perhaps because of changes in distribution inside the study area and low densities within and around Horns Rev 1. The consecutive construction of the three Horns Rev wind farms as well as the changing distribution patterns of divers in the survey area makes it difficult to assess the potential displacement impact from Horns Rev 1 in isolation. However, given the low density of divers within and around the Horns Rev 1 footprint only few individuals are likely to become displaced due to the lifetime extension of the Horns Rev 1 wind farm.

Therefore, it can be assessed that the lifetime extension of Horns Rev 1 will not inflict a significant negative impact on divers in the Natura 2000 site N246 or in more remote SPA's.

Common scoter

The Northwest European population of the Common scoter is estimated to 687,000-815,000 birds (Wetlands International, 2022). In the regular Article 17 reporting from Denmark in 2019 (Fredshavn, Nygaard, Ejrnæs, Damgaard, & Therkildsen, 2019), the development in the Danish winter population in the long period 1987-2016 is assessed as "uncertain" and "decreasing" in the short period 2004-2017. In the shorter time horizon, data indicate that the wintering population in the inner Danish waters has declined from 400,000 birds in 2008 to less than 200,000 in both 2013 and 2016 and to around 200,000 individuals in 2020.

However, part of the variation may be due to the fact that the birds move around and are not limited by national borders. For example, birds from the large population of the southern North Sea are partly located in German waters, which are not covered by the Danish censuses (Holm, 2021).

Aerial surveys carried out by DCE have shown that the Common scoter occurs in very large numbers in IBA 123, which holds the largest concentrations of the species in Denmark (Petersen I. , Nielsen, R.D., & Clausen, 2019a). The area is of international importance for the species, with regular occurrences of about 20 % of the flyway population.

At a survey in the winter of 2008, Common scoters were mainly observed relatively close to the coast, although with a concentration also on Horns Rev. Of the total of 37,552 Common scoters observed in the southern part of the Danish North Sea during this survey, 99% of the birds were located within the boundary of IBA 123, while 66% were located within SPA's in the area.

A total of 14,354 Common scoters were observed in the southern part of the Danish North Sea during counts of waterfowl in the winter of 2013. The birds were mainly located on Horns Rev and relatively far from the coast in the waters west of Fanø and Rømø.

Of all observed birds, 99% were located within the boundary of IBA 113, while 42% were located within SPA's (Petersen I. , Nielsen, R.D., & Clausen, 2019a).

Common scoter was by far the most abundant waterfowl species in the area during the surveys carried out in relation to the establishment of offshore wind turbines on Horns Rev. In the approximately 50 counts carried out from 1999 to 2011, a total of close to 1,900,000 Common Scoters were observed Figure 8-11).

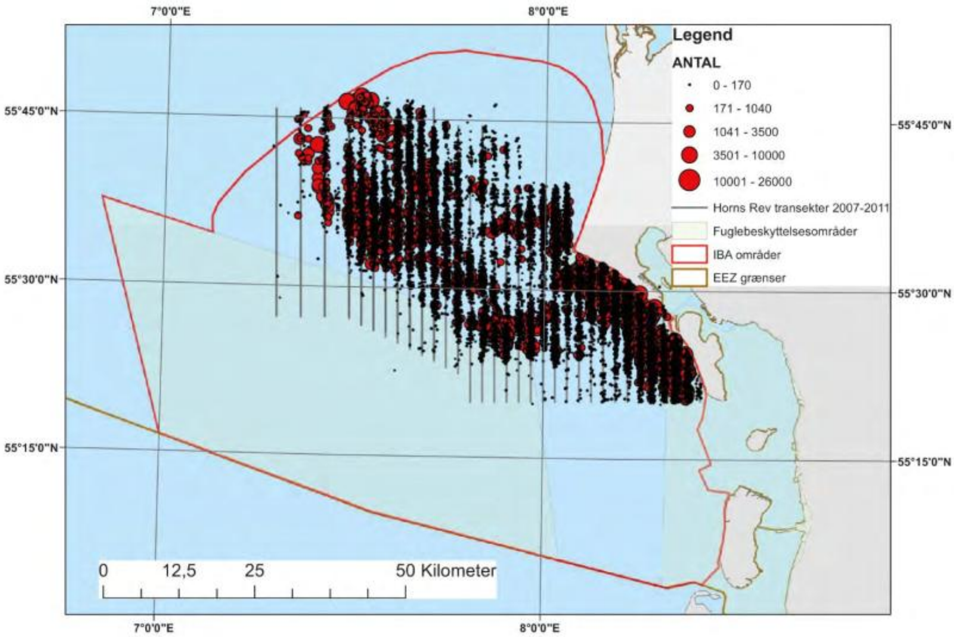

Figure 8-11. Distribution of 1,9 million observed Common scoters in the waters in and around Horns Rev on a total of 50 aerial surveys in the period 1999-2011 (Petersen I. , Nielsen, R.D., & Clausen, 2019a)**.**

The number of observed Common scoters in the study area exceeded 20,000 individuals annually at one or more times during the year, and much higher numbers were regularly recorded. The largest number was observed in a count in March 2011, where 186,765 birds were registered.

In the parts of IBA 113 that in 2011 were not part of the SPA 123, numbers equivalent to 20% of this flyway population of the Common scoter occur regularly, with the highest concentrations found on Horns Rev.

During two spring surveys in the Danish part of the North Sea in April and May 2019, a total of 14,158 Common scoters were observed along the west coast of Jutland. The vast majority of the birds were observed near the coast (Petersen, Sterup, & Nielsen, 2019b).

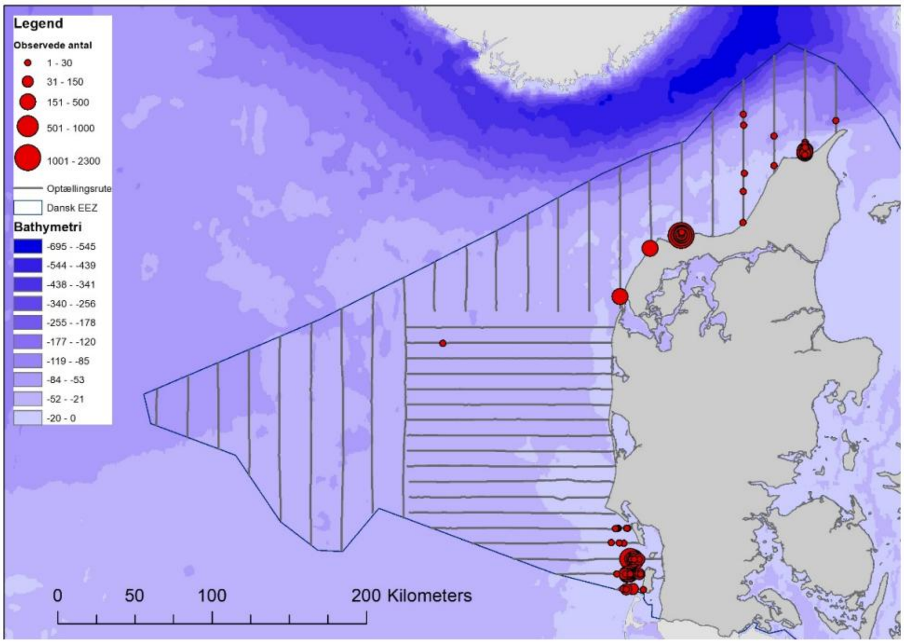

Figure 8-12. Distribution of 14,158 observed Common scoters in the Danish part of the North Sea in April and May 2019 (Petersen, Sterup, & Nielsen, 2019b).

A count of moulting Common scoters was carried out in the eastern part of IBA 123 in August 2018. A total of 21,575 scoters were observed on the count. Based on these data, a conservative estimate would be that there were more than 80,000 scoters in the area this time of year; 93% of the observed Common scoters were registered within the boundary of SPA 57, Wadden Sea (Petersen I. , Nielsen, R.D., & Clausen, 2019a).

A count of moulting scoters in the Horns Rev area on 19 August 2012 showed a westerly distribution of the birds. At this count, 1,624 scoters were observed, of which 56% were observed within the boundaries of SPA 57. On this count, Common scoters were seen on Horns Rev itself and, to a lesser extent, in the waters west of SPA 57 (Petersen I. , Nielsen, R.D., & Clausen, 2019a).

The exploitation of Horns Reef itself has changed since 1999, as the number of scoters on the reef itself has increased significantly, and the reef is now an important habitat for the species. It is believed that changes in distribution and presence of the two preferred prey species in the project area, the cut trough shell *(Spisula subtruncata)* and the American razor clam *(Ensis directus)*, are thought to affect the distribution patterns of common scoters in the area (Petersen I. , Nielsen, R.D., & Clausen, 2019a; Danish Energy Agency, 2013).

Also, the presence of the offshore wind farms on Horns Rev may affect the distribution of birds in the whole area, and the observed distribution of Common scoters in the area is therefore assessed to be caused by a combination of the quality of the habitat and the level of human activities (Petersen & Fox, 2007).

It is concluded in (Petersen I. , Nielsen, R.D., & Clausen, 2019a) that a designation of an additional SPA or expansion of existing areas will significantly increase the proportion of wintering Common scoters located within the Danish SPA's. However, for moulting Common scoters, an expansion of the SPA 113 will make no significant difference.

It is assessed in (Petersen I. , Nielsen, R.D., & Clausen, 2019a) that IBA 123 regularly holds the highest densities of Common scoters in Denmark with regular occurrences of up to 20% of the flyway population.

In the study also referred to above (NIRAS, 2024), the distribution and abundance of Common scoters in the survey area was evaluated over several phases of wind farm development at in the Horns Rev area:

Phase 0: 15 surveys prior to any wind farm construction.

Phase 1: 25 surveys post-construction Horns Rev 1 and pre-construction Horns Rev 2 and Horns Rev 3.

Phase 2: 10 surveys post-construction Horns Rev 1 and Horns Rev 2, but pre-construction Horns Rev 3.

Phase 3: six surveys post-construction of all three OWF's.

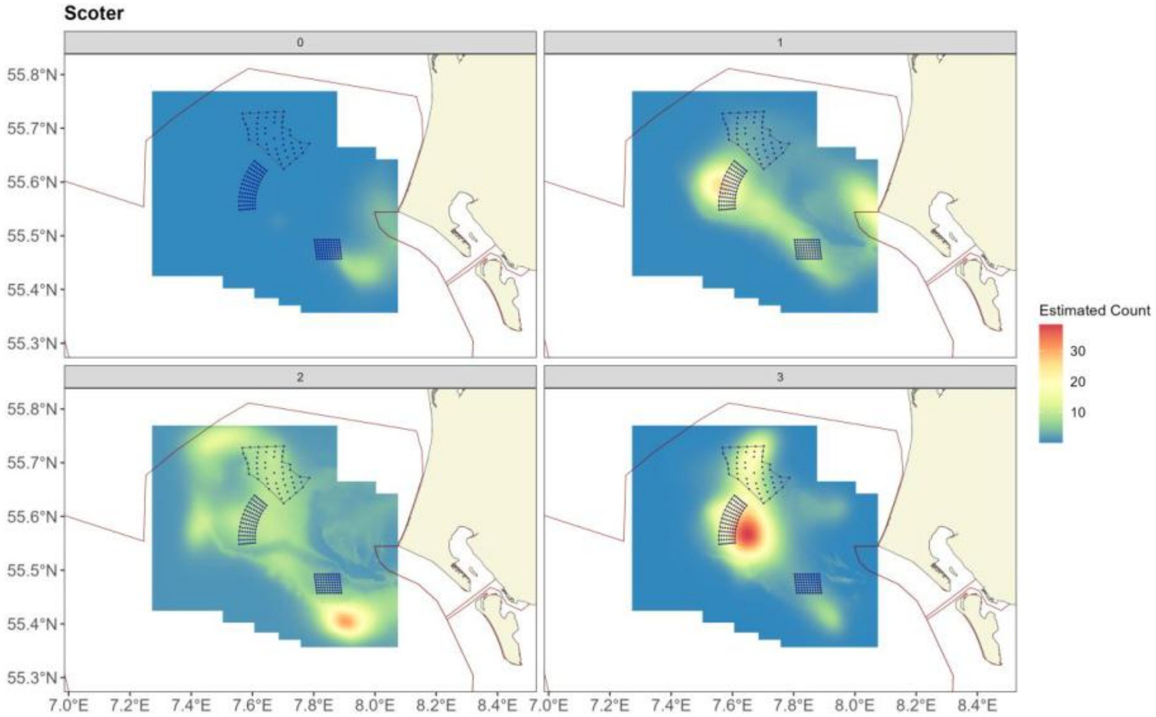

Figure 8-13. Common scoter abundance (predicted) across the study site for each of the surveys from Phase 0 to Phase 3 (NIRAS, 2024).

The study showed that the number of Common scoters increased markedly between Phase 0 and Phase 2 i.e. from pre- to post-construction of Horns Rev 1 and Horns Rev 2 and spread out to a larger area further offshore Figure 8-13. Because of a general shift in the distribution of Common scoters in the survey area over the first years of the survey period, with birds gradually moving further west into the area, it was difficult to assess the displacement impact of Horns Rev 1 in isolation. An impact of displacement around Horns Rev 2 was more evident (Figure 8-14) and occurred out to a distance of 5 km from the wind farm footprint.

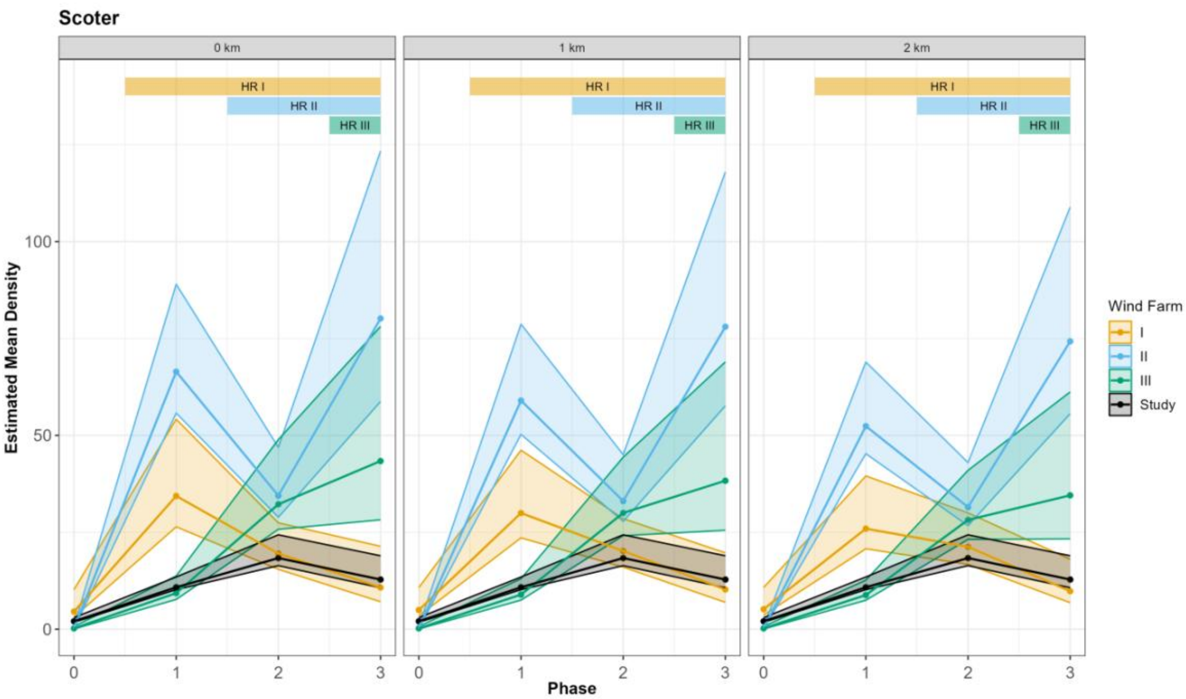

Figure 8-14. Estimated mean density of Common scoters in the footprint, footprint + 1 km buffer and footprint + 2 km buffer of each wind farm for all phases. The bars at the top show the post-construction periods for each wind farm. Note that survey coverage in Horns Rev 3 during phase 0 was limited (NIRAS, 2024).

Although the potential impact from Common scoter displacement due to Horns Rev 1 is difficult to assess despite the extensive number of surveys, the lower densities found within and around Horns Rev 1 relative to other areas at Horns Rev (see Figure 8-13) does not highlight the Horns Rev 1 area as a local hotspot for resting scoters. Based on the extensive survey results presented in (NIRAS, 2024) there is likely to be some impact of displacement for Common scoters due to the lifetime extension of Horns Rev 1, however, the results also indicate that potentially displaced individuals will be able to relocate to neighboring areas within SPA 113 for resting and feeding.

Therefore, it can be assessed that the lifetime extension of Horns Rev 1 will not inflict a significant negative impact on Common scoters in the Natura 2000 site N246 or in more remote SPA's. Accordingly, the displacement effect caused by the lifetime extension of Horns Rev 1 will not prevent maintenance/achievement of favorable conservation status for the Common scoter nor prevent fulfillment of the conservation objectives for the birds inside the Natura 2000 site N246.

Little gull

Migrants from populations in Sweden, Finland, Baltica and Russia are passing through Denmark in spring and autumn, mainly in the southern and south easterly parts of the country and primarily through the Baltic Sea. In winter, birds may gather at sites along the west coast of Jutland between Hanstholm and Blåvands Huk and in the Baltic Sea (Christensen, et al., 2022).

The occurrence of Little gulls in IBA 123/SPA 113 is not well described. According to BirdLife International Denmark (Vikstrøm, Fenger, Brandtberg, & Thomsen, 2015) up to 2,900 Little gulls have been registered in the IBA, but this estimate also includes individuals from the German part of the North Sea. Petersen et al. (2019a) found no evidence that the Little gull occurs in the area in internationally important numbers. According to the Natura 2000 plan, the Little gull is "not present" in the SPA (Danish Agency of Environment, 2023), and it is expected to be removed from the basis for designation during the next revision (Miljøstyrelsen 2022: opdateret UPG for fuglebeskyttelsesområder 2023-11-06 med nye F-omr fra 2021+2023.xlsx).

In 2019, in a study area in the North Sea, stretching approximately 70 km from approximately 15 km north of Blåvandshuk to a line west of the entrance to Limfjorden, Little gull was only observed during a single survey conducted on 7th April 2019, where a total of 43 birds was recorded. The birds were found on the northern parts of Horns Rev and close to the Jutland coast in the northern parts of the study area (Petersen & Sterup, 2019).

During two spring surveys in April and May 2019, a total of 24 Little gulls were observed in the whole Danish part of the North Sea (Petersen, Sterup, & Nielsen, 2019b).

During the Horns Rev 1 baseline surveys, only 8 (November 1999) and 5 (March 2000) birds were observed during the surveys (Noer, Christensen, Clausager, & Petersen, 2000).

In 2007, a total of 116 Little gulls were recorded in the Horns Rev area, most of which were seen on 1 April (79 individuals). Little gull was mainly recorded in the western parts of the study area, both south and north of the reef. Few birds were seen on the reef, and a single observation was done inside the project area (Figure 8-15). Little gull expressed signs of avoidance towards the Wind Farm. However, the avoidance was less when including the 2 km zone around the wind farm footprint but weakened out to 4 km (Petersen & Fox, 2007).

Provided that Little gull is not occurring in significant numbers in the project area only few individuals are likely to become displaced due to the lifetime extension of the Horns Rev 1 wind farm.

Therefore, it can be assessed that the lifetime extension of Horns Rev 1 will not inflict a significant negative impact on Little gull in the Natura 2000 site N246 or in more remote SPA's.

Accordingly, the displacement effect caused by the lifetime extension of Horns Rev 1 will not prevent maintenance/achievement of favorable conservation status for the Little gull nor prevent fulfillment of the conservation objectives for the birds inside the Natura 2000 site N246.

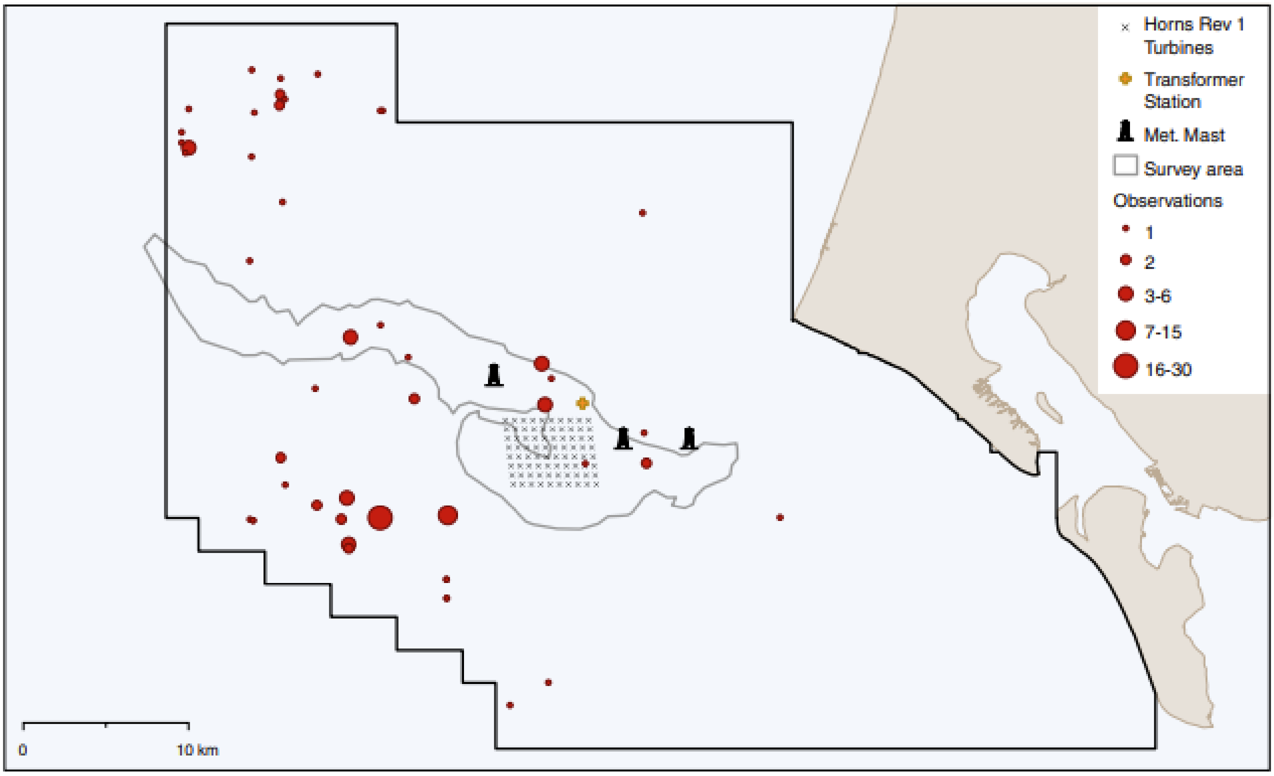

Figure 8-15. Distribution map of 116 Little gulls observed in the study area during four surveys, 25 January, 15 February, 3 March and 1 April 2007. Turbine positions and the extension of the reef with water depth of less than 10 m are shown (Petersen & Fox, 2007).

Terns

Populations of Common, Arctic, Little and Sandwich terns from a wide distribution range in Northern Europe and Siberian Arctic pass through Denmark on a relatively broad front in spring and autumn. Main migration paths towards winter quarters in West Africa and Antarctica, tend to follow coastlines but migration may also occur over the open sea. Migrating terns from both local as well as from more remote SPA's are therefore likely to pass through the Horns Rev area, following a route along the west coast of Denmark (Christensen, et al., 2022). This is supported by regular observations and migration peaks of several thousand birds per day reported from Blåvands Huk.

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During the baseline investigations of Horns Rev 1, 13 aerial surveys were conducted between August 1999 to August 2001, during which several species of terns were recorded (Christensen, Clausager, & Petersen, 2001).
In these inventories, observations of Arctic/Common terns were scattered throughout the entire survey area (Figure 8-16). In August however, the majority of Arctic/Common terns were observed near the coast off Blåvands Huk (Christensen, Clausager, & Petersen, 2001).

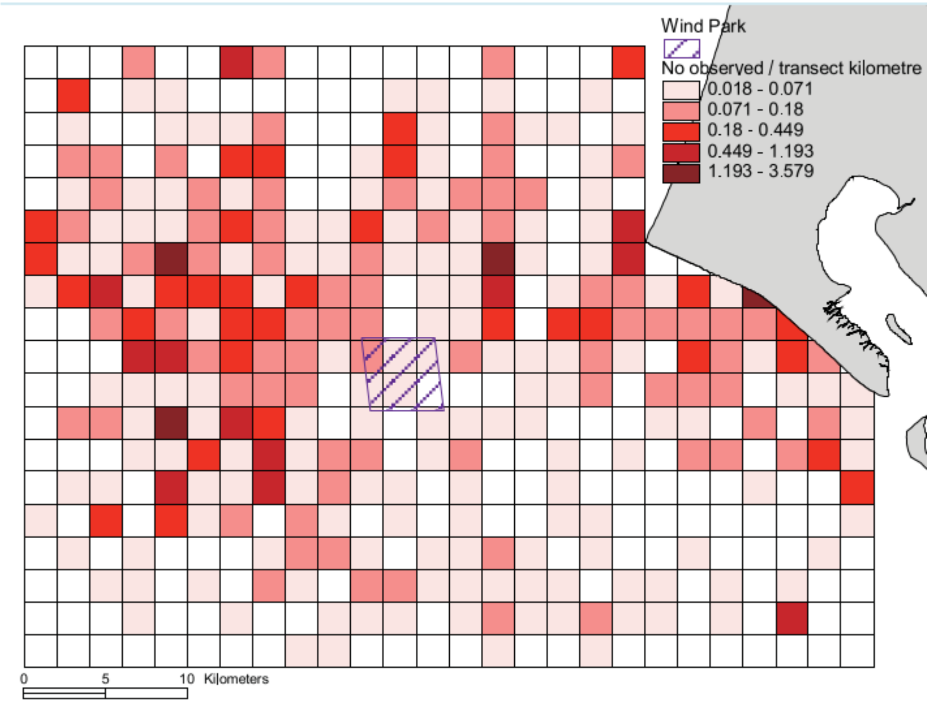

Figure 8-16. Distribution map of 1,560 Arctic/Common terns recorded in 13 aerial counts between August 1999 to April 2001. The Horns Rev 1 project area is indicated with a purple polygon (Christensen, Clausager, & Petersen, 2001).

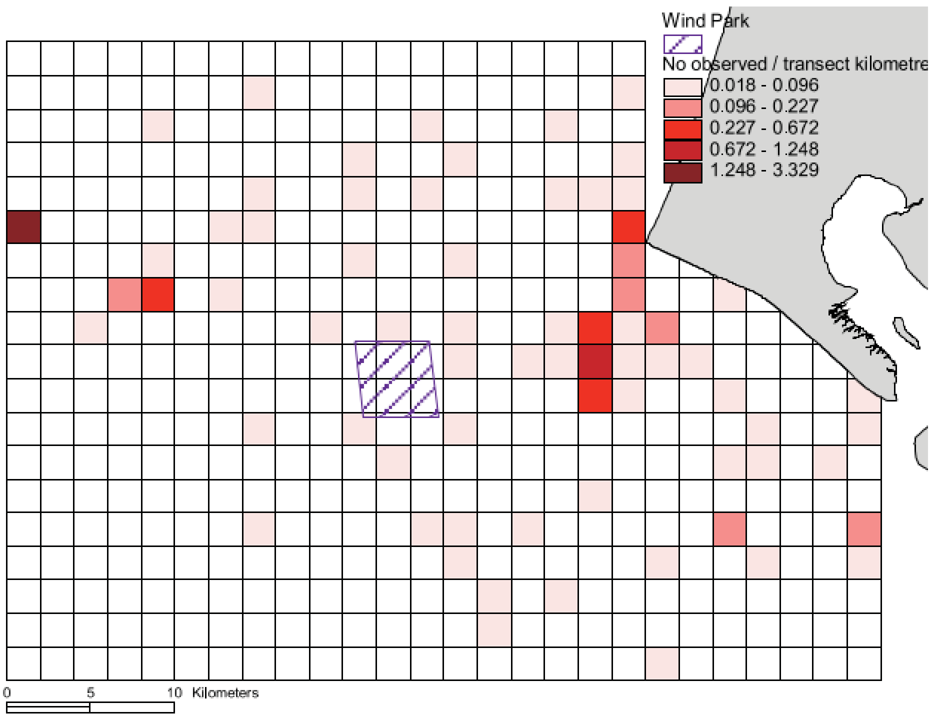

Figure 8-17. Distribution map of 371 Sandwich terns recorded in 13 aerial counts between August 1999 and April 2001. The Horns Rev 1 footprint area is indicated with a purple polygon (Christensen, Clausager, & Petersen, 2001).

A scattered pattern of observations over the open sea was also evident for Sandwich terns however, observations of this species was to an even higher extent (compared to Arctic/Common terns) recorded near the coast off Blåvands Huk (Figure 8-17). In constast, vessel-based investigations for migrating waterbirds performed in spring 2008 were performed from two anchoring points located on the south-western corner of Horns Rev 1 and Horns Rev 2, respectively, and from one onshore station at Blåvands Huk. During these investigations the vast majority (> 3,400 individuals) of terns were recorded offshore from the Horns Rev 1 and Horns Rev 2 locations, whereas much fewer terns were recorded from the onshore observation station at Blåvands Huk (Piper, Kulik, Durinck, Skov, & Leonhard, 2008). Among the tern species, Sandwich terns were by far the most frequently recorded species from the two offshore locations at Horns Rev. The observed flights of Sandwich terns indicated localised resting or feeding behavior rather than linear migratory flights. No clear avoidance response of Sandwich terns towards the Horns Rev 1 wind farm was detected as resting and foraging flights occurred in all directions.

Terns also occur as designated breeding birds in local SPA's located in the Wadden Sea (see Figure 8-1) as well as in more remote SPA's. During the breeding period, terns fly shorter or longer distances away from their colonies to forage. Given maximum foraging ranges of Little terns of 11km, and 30 and 54 km range of Arctic and Sandwich terns (Thaxter, et al., 2012), respectively, breeding birds are capable of flying out to forage inside or near the Horns Rev 1 wind farm. Although, mean foraging ranges of 2.1 km for Little terns, 7.1 km for Arctic terns and 11.5 km for Sandwich terns suggest that breeding terns from local SPA's tend to forage closer to land, the baseline investigations undertaken in spring 2008 suggest that Sandwich terns do utilize the area around Horns Rev 1 wind farm for feeding and resting. However, the observed lack of behavioural response of the Sandwich terns towards Horns Rev 1 indicate an ability to coexist, as the terns were observed resting or feeding in the vicinity of the wind farm footprint with movements in all directions. Hence, the behavioural response of the terns observed during the baseline investigations in spring 2008 do not indicate any significant impact of displacement or barrier effects on terns. Therefore, the lifetime extension of Horns Rev 1 is not likely to inflict a significant negative impact on terns from local or more remote Natura 2000 sites.

Kittiwakes

Kittiwakes have a circumpolar distribution. The largest breeding colonies are found in Siberia, Svalbard, Alaska, Canada and Greenland, whereas smaller colonies inhabit the coasts of Norway, Iceland, Faroe Islands and The British Isles. In Denmark, Kittiwakes breed in smaller numbers in a few places in Northern Jutland (Christensen, et al., 2022). Breeding birds from across the Northern Hemisphere mix during the winter in the North Sea, the Atlantic Sea and off the coast of North America. Birds wintering in the North Sea originate primarily from colonies in the British Isles and Norway.

The European population size is estimated to between 1,600,000 – 2,100,000 pairs with the largest colonies in Iceland, Norway (including Svalbard) and the British Isles.

During the moulting and migration seasons, Kittiwakes can appear in large numbers, sometimes reaching several thousand birds per day, particularly along the west coast of Jutland and Skagerrak during westerly storms.

Given the circumpolar distribution and very large wintering range, Kittiwakes feed and rest within marine SPA's in which the species is designated as well as anywhere outside at the open sea. Kittiwakes from SPA's in the North Sea may therefore well rest and feed in the Horns Rev 1 area from time to time, both during late summer and throughout the winter season. Provided the numbers counted during the baseline investigations, there are however, no indications that the Horns Rev 1 area constitute an important feeding or resting site for Kittiwakes. If smaller numbers of Kittiwakes become displaced due to the lifetime extension of Horns Rev 1, they will be able to find equally attractive feeding or resting grounds elsewhere in the North Sea.

Therefore, it can be assessed that the lifetime extension of Horns Rev 1 will not inflict a significant negative impact on Kittiwakes in the marine Natura 2000 sites in the North Sea.

COLLISION RISK

"Collision risk" refers to the risk of birds colliding with the wind turbines in operation and getting killed. The Horns Rev - Blåvandshuk area is internationally known for its concentrations of migrating, staging and wintering birds. In relation to the

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Horns Rev 1, these concentrations can be split into two subgroups, i.e. species that moult, stage and winter in the project area, i.e. exploit the habitat for foraging, and species that mainly pass over the project area during their yearly migration.

The collision risk is assessed at a generic level, as it is not possible to “link” birds that are potentially affected to specific Natura 2000-sites in Denmark or elsewhere in Europe.

The reason that migrating birds concentrate at Blåvands Huk is that birds follow the coastline as a migration guide, particularly during autumn migration.

In the EIA for Horns Rev 1, the collision risk for resting and migrating birds is only dealt with at a relatively overall level and no collision risk modelling applying for instance the Band-model (Band, 2012) was carried out.

Collision risk modelling based on data on migrating birds and the Band-model (Band, 2012) was carried out for an early scenario of Vesterhav Syd offshore wind farm approximately 50 km north of Horns Rev 1 (Energinet.dk, 2015). Compared to Horns Rev 1, this wind farm scenario consisted of fewer (66) but larger (3 MW) wind turbines.

It appears from these calculations that the number of collisions is extremely low in relation to the flyway-populations of all relevant species, and it is assessed that there will be no significant impact on designated species in the surrounding SPA’s as a result of collision with the wind turbines (Energinet.dk, 2015).

This assessment is confirmed by a number of case studies that demonstrate that the collision risk of wind turbines in most cases is very limited. This is due to the fact that most species of birds avoid collision by changing their direction of flight, thus avoiding coming into close contact with the turbines. Such avoidance behavior takes place on three levels:

1. By changing course at a great distance, avoiding the entire wind farm (macro avoidance).
2. By adjusting the course in the horizontal and/or vertical plane, avoiding individual turbines (meso avoidance)
3. By performing last-minute ("emergency") maneuvers, avoiding being hit by a rotor blade (micro avoidance).

Sea bird species, however, are so closely associated with the sea surface, that they only occasionally fly at altitudes where they are at risk of colliding with the rotor. In the environmental impact assessment (EIA) for Horns Rev 1it assessed that divers and common scoter in their movements during migration and foraging activity are generally not expected to occur at altitudes that may result in collisions with the turbine rotors (Noer, Christensen, Clausager, & Petersen, 2000).

Looking at the radar traces of the routes taken by migrating waterbirds during post-construction at Nysted offshore wind farm shows that individuals or flocks of water birds are flying along and around the periphery of the wind farm. The very few birds flying between the turbines did so equidistant between turbine rows (and always low over the sea and usually taking the shortest possible routes out of the wind farm), (Fox & Petersen, 2019).

Such responses clearly reduce the risk of collision posed to otherwise large numbers of birds passing through this potentially dangerous area. Furthermore, if this avoidance occurs only twice each year travelling between breeding and wintering areas, the extra energetic costs that result from this detour is assessed to be biologically trivial (Fox & Petersen, 2019).

From the monitoring program at Nysted offshore wind farm it was calculated that the general risk of collision for e.g., waterbirds passing the wind farm was between 0.018% and 0.020% (Petersen, Christensen, Kahlert, & Deshom, 2006).

The collision risk varies greatly from species to species. Seagulls are often seen flying and their flight height overlaps to a greater extent than other bird species with the rotor height of the turbines (Cook, Johnston, Wright, & Burton, 2012; Furness, Wade, & Masden, 2013; Johnston, Cook, Wright, Humphreys, & Burton, 2014). However, based on the existing data, it is assessed that when it comes to little gulls, there are so few birds in the area, that the risk of collision is very low.

The fact that only very few birds are expected to collide with the turbines in Horns Rev 1 is reflected in the species-specific avoidance rates that are applied in the Band-model (Band, 2012) and recommended in the standard guidance document from Scottish Natural Heritage (Scottish Natural Heritage, 2018).

There is no recommended avoidance rate for Common scoter or Little gull, but for species groups as skuas and gulls, recommended avoidance rates are 99,5% and for geese 99,8%. The recommended default avoidance rate for species not listed is 98%. These rates reflect that birds only very rarely collide with operating turbines.

The fact that birds only rarely collide with wind turbines in operation is also confirmed by DCE's extensive monitoring at Østerild Wind Turbine Test Centre. In these surveys, which took place over two counting seasons (2013/14 and 2015/16), no birds were found that had definitely collided with the wind turbines (Elmeros & Therkildsen, 2017). However, in a few regrettable cases, the risk of collision can be much higher, which was the case at Zeebrugge, Belgium, where 25 medium-sized turbines were established on an eastern port breakwater encircling a breeding colony of Common terns, Sandwich terns and Little Terns. Post construction studies revealed that a mean of 6.7 terns collided per turbine per year for the whole wind farm with the highest collision rates at turbines closer to the breeding colony. Many gulls were also recovered dead underneath the turbines confirming the need to avoid constructing wind turbines close to any important tern, gull or other sea bird colonies, especially those associated with frequent foraging flight paths of these species (Everaert & Stienen, 2006).

In comparison to the wind farm at Zeebrugge, the Horns Rev 1wind farm is located much further offshore (> 14 km) and therefore also much further away from any tern or gull colony, and consequently, the risk of collision for breeding terns, especially Sandwich terns, undertaking foraging flights offshore will be much lower. However, during the baseline investigations in 2008 (Piper, Kulik, Durinck, Skov, & Leonhard, 2008) resting and foraging Sandwich terns were frequently recorded flying just west of the Horns Rev 1 wind farm performing flights in all directions and not showing any clear avoidance response towards the Horns Rev 1 wind farm. Although Sandwich terns actively rest and feed inside or near the Horns Rev 1 footprint, their exposure to collision with turbine blades can be assessed as low, since the vast majority of flights were recorded below the reach of the rotors (< 20 m). Low flight heights, predominantly below 20 m, of foraging Sandwich Terns were confirmed by another baseline study off Frederikshavn, close to the large Danish breeding colony at Hirsholmene (Orbicon, 2008). The risk of collision for both migrating and resting/foraging terns can be assessed as low, partly due to the low flight height distribution and partly because of high overall avoidance rates for terns, reported in the literature (Piper, Kulik, Durinck, Skov, & Leonhard, 2008). Similarly, Kittiwakes from the marine SPA's in the North Sea are likely to occur inside the Horns Rev 1 footprint area, the potential impact of collision is assessed to be negligible because of the species' high level of avoidance towards offshore wind turbines (Tjørnløv, et al., 2023).

Therefore, the lifetime extension of Horns Rev 1 is not likely to inflict a significant negative impact due to collision on terns or Kittiwakes visiting the area from more remote Natura 2000 sites.

Overall, it is assessed that the collision risk as a result of the lifetime extension of the Horns Rev 1 is so small for all relevant species that it is not likely to have a significant negative impact on the conservation status of protected bird species in the surrounding SPA's.

HABITAT CHANGES

Habitat changes inside the project area can potentially affect feeding opportunities for resting sea birds in the area.

The presence of 80 wind turbines in an offshore area may affect birds in several ways. Firstly, the turbines will reduce the available area by their physical presence. Secondly, the foundations of the turbines may create a new type of sublittoral habitat that may provide additional substrate for invertebrates that birds can feed on. Although not totally insignificant, the areas over which such effects are manifest constitute a biologically trivial proportion of the total area

However, the foundations will only cover a very limited area and compared to the extent of the surrounding sea areas, the direct habitat loss caused by the footprint from the turbines is of no significance. The loss of bottom fauna was estimated to approximately 600 kg wet weight. Therefore, the direct habitat loss caused by the presence of the turbines is expected to be negligible to birds (Noer, Christensen, Clausager, & Petersen, 2000).

The foundations are likely to provide substrate for the settlement of larvae of marine invertebrates, thus acting as an 'artificial reef'. It is predicted that settlement will mainly involve Balanoids and possibly some Polychaetes, but it is unlikely to include mussels due to impact from waves (Noer, Christensen, Clausager, & Petersen, 2000). Even in that case, however, the extent of the food resource that might result for birds is assessed to be far too small to serve as a basis for attracting larger numbers of e.g. common scoters.

For the fish-eating species (red- and black-throated diver), which are the most relevant in this context, numbers and distributions of fish in the project area seemed to be rather low before establishment the Wind Farm (Noer, Christensen, Clausager, & Petersen, 2000).

Fish abundance and diversity have subsequently been monitored. The study showed only few effects on the fish fauna. A number of fish species showed attraction towards the wind turbine foundations, and this has now resulted in a higher number of species inside the project area compared to areas outside the Wind Farm (Danish Energy Agency, 2013).

Overall the studies showed that the Horns Rev 1 has not got a negative impact on fish abundance. Several species appears to use the foundation and associated scour protection as refuge areas for hide and forage. The positive effect may be enhanced by exclusion of commercial fishing inside the project area and thus function as a small marine protected area (Danish Energy Agency, 2013).

In summary, it can be concluded that habitat changes caused by the presence of the Horns Rev 1 has not significantly changed the birds' foraging opportunities in the area.

Accordingly, the habitat changes caused by the lifetime extension of Horns Rev will not prevent maintenance/achievement of favorable conservation status for designated bird species nor prevent fulfillment of the conservation objectives for the birds inside the Natura 2000 site N246.

8.5.2 HARBOUR PORPOISE

A direct impact on harbour porpoises from a lifetime extension of Horns Rev 1 can be:

- Displacement due to underwater noise from the wind turbines.
- Displacement due to electromagnetic fields from the cables that connects the wind turbines.
- Displacement due to underwater noise from service vessels.

An assessment of harbour porpoise as an Annex IV species is carried out in section 6.3.2. In section 6.3.2 it is assessed that any impacts on harbour porpoises from the lifetime extension of Horns Rev 1 can be rejected.

Special Areas of Conservation (SAC) site SAC 255 (Natura 2000 area N246) is located 3.8 km from the project area and has harbour porpoises as designation basis. Any potential disturbance effects on harbour porpoises listed above, are expected to occur within the project area and not outside.

It is thus assessed that the lifetime extension of the Wind Farm will not prevent maintenance/achievement of favorable conservation status for harbour porpoises, nor prevent fulfillment of the conservation objectives for harbour porpoises inside the Natura 2000 site N246. Based on this it is assessed that the lifetime extension for Horns Rev 1 will not have a significant impact on the conservation objectives for harbour porpoise.

8.5.3 SEALS

As for harbour porpoises, a direct impact on harbour seals and grey seals from a lifetime extension of Horns Rev 1 can be:

- Displacement due to underwater noise from the wind turbines.
- Displacement due to electromagnetic fields from the cables that connects the wind turbines.
- Displacement due to underwater noise from service vessels.

Details on possible impacts from underwater noise and electromagnetic fields are presented in details in section 6.3.2 (assessment of impact on harbour porpoises as Annex IV species) and will also be valid for seals.

Special Areas of Conservation (SAC) site SAC255 (Natura 2000 area N246) is located 3.8 km from the project area and has harbour seals and grey seals as designation bases. Any potential disturbance effects on seals listed above, are expected to occur within the project area and not outside.

It is thus assessed that the lifetime extension of Horns Rev will not prevent maintenance/achievement of favorable conservation status for harbour seals and grey seals, nor prevent fulfillment of the conservation objectives for harbour seals and grey seals inside the Natura 2000 site N246. Based on this it is assessed that the lifetime extension for Horns Rev 1 will not have a significant impact on the conservation objectives for harbour seals and grey seals inside the Natura 2000 site N246.

8.5.4 CUMULATIVE EFFECTS ASSESSMENT

In case of activities in nearby wind farms, project areas, resource extraction sites and dumping grounds, there is a possibility of cumulative effects on the marine environment.

There are several resource extraction sites within a range of ~5 km from Natura 2000 area N246 (Figure 8-18). The closest dumping ground is > 8 km away. Due to the distance from the Natura 2000 area, it is not expected that there will be any cumulative effects from activities related to the Horns Rev 1 and the resource/dumping sites, respectively.

The closest offshore wind farm, besides Horns Rev 1, is Horns Rev 2 located ~5 km from Natura 2000 area N246 (see Figure 8-18).

Based on the current knowledge of simultaneous and sequential projects, no significant cumulative impacts on marine mammals and bats are expected because of the lifetime extension of Horns Rev 1.

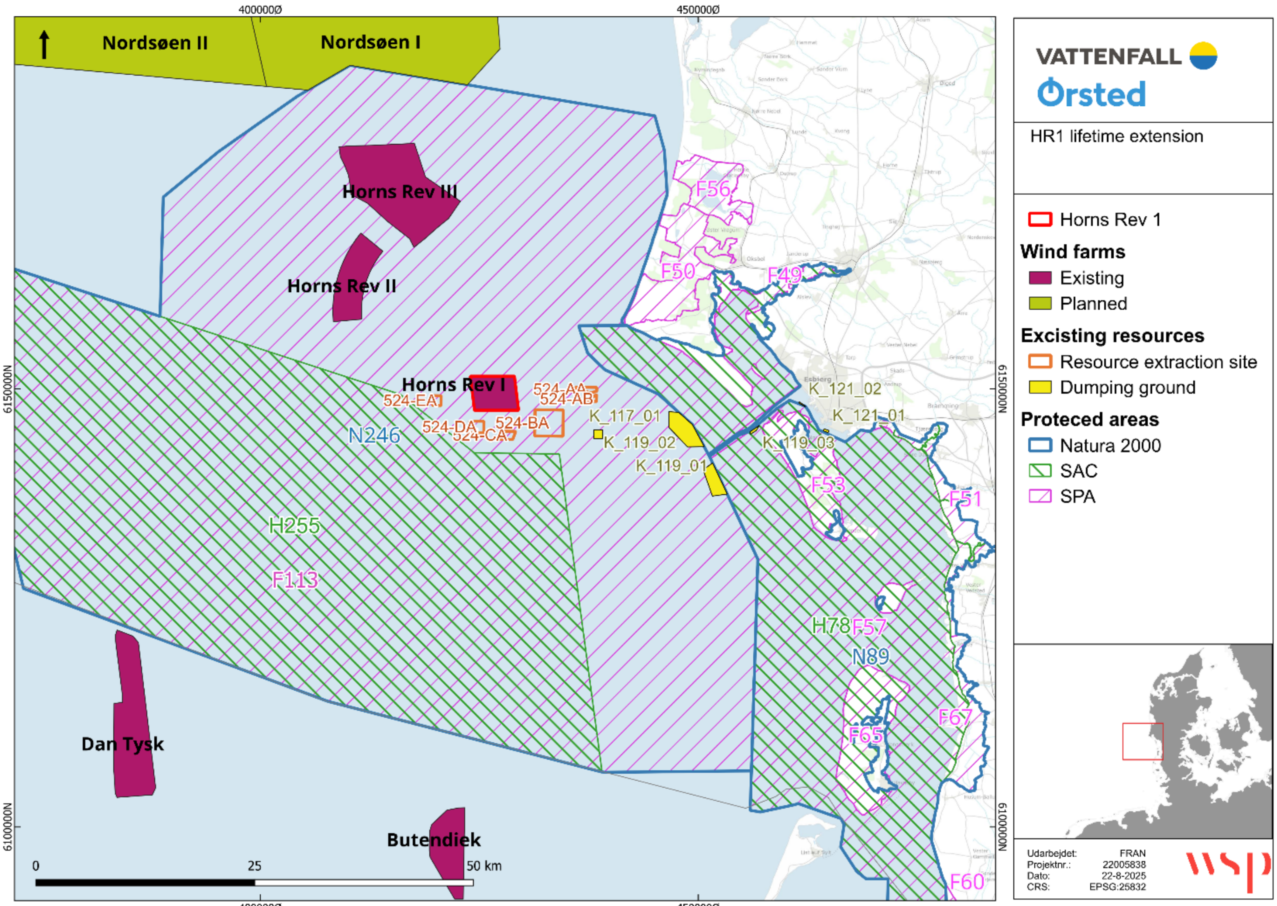

Figure 8-18 Location of Horns Rev 1 and surrounding resource extraction sites and dumping grounds.

As for birds, the assessment of cumulative impacts is first and foremost relevant for red-throated diver, as there is considerable evidence that this species is particularly sensitive to the presence of offshore wind farms.

In Denmark, only two SPA's are designated in order to protect red-throated diver: SPA 113 Southern North Sea and SPA 127 Northwesterly Kattegat. The southern border of SPA 127 is about 6 km north of Anholt offshore wind farm (AOWF) that was set into operation in 2013, eight years before a considerable expansion of the SPA in 2021.

As part of the follow-up studies in the Horns Rev area, a follow-up study aiming at modelling the cumulative disturbance effects on red-throated divers of large-scale wind farm development in Danish and Baltic waters were carried out (Danish Energy Agency, 2013).

The aim of the study was to evaluate to which extent displacements could potentially impact the species at the population or subpopulation level. For that purpose, a model was designed to evaluate the impact of marine wind farms on red-throated divers migrating through or overwintering in inner Danish waters. By developing an 'agent-based model', it was possible to assess how much the red-throated diver population of the Baltic flyway may be affected by loss of foraging habitat due to their avoidance of offshore wind farms.

Existing and planned wind farms, including Horns Rev 1, 2 and 3, were predicted to reduce red-throated diver numbers by only 0.1%.

Even under the extreme case of maximum likely future development of offshore wind farms in Danish waters and throughout the Baltic, the model suggested that red-throated diver numbers would decline by only 1.7%.

This is also supported by the fact that IBA 123/SPA 113 already holds internationally important numbers of divers (and common scoter), also under the existing conditions, where Horns Rev 1 has been in operation for more than 20 years. Comparisons between pre- and post-construction surveys also indicate that the total abundance of divers in the whole area off the Wadden Sea has not significantly changed. Moreover, the recent study by (NIRAS, 2024) covering 56 aerial waterbird surveys at Horns

Rev collected over 24 years and covering all phases from pre- to post-construction, conclude that there is no evidence of a decrease in the number of divers as a result of the Horns Rev 1 wind farm.

The continued development of offshore windfarms in the North Sea also has to be taken into account when assessing the cumulative effects of a lifetime extension of Horns Rev 1. Denmark have plans to develop two more areas for offshore wind farms within the Nordsøen I area north of Horns Rev 1. At the same time neighboring countries like Germany also have plans for new developments of offshore wind farms and also specific projects in the development or construction phase. The Natura 2000 screening and the Appropriate Natura 2000 assessment of the plan for Nordsøen I concludes that damage from displacement effects on red-throated and black-throated divers cannot be excluded (Danish Energy Agency, 2024). This especially goes for the south eastern part of the plan area, which is closest to Horns Rev 1. The Appropriate Natura 2000 assessment also concludes that damage on SPA113's integrity cannot be ruled out.

Despite the studies concluding that the numbers of red-throated divers have not significantly changed, the ongoing development of offshore wind farms sheds some uncertainties upon the cumulative effects of a lifetime extension of Horns Rev 1. It is therefore the conclusion, out of the precautionary principle, that damage from displacement effects on red-throated and black-throated divers cannot be excluded, and that damage on the SPA113's integrity cannot be ruled out in advance. Therefore, an appropriate Natura 2000 assessment focusing on SPA113 and it's designated species is therefore necessary to carry out.

8.6 CONCLUSION

It is assessed that the lifetime extension of Horns Rev 1 is unlikely to have a significant impact on the conservation objectives for marine mammals in the North Sea and most birds in local or more remote SPA's. This implies that the conservation objectives for most designated bird species or other relevant bird species from the surrounding SPA's are not likely to be affected by the lifetime extension of Horns Rev 1. However, due to the continued development of offshore wind farms in The North Sea, damage on red-throated divers from displacement effects cannot be excluded, and an appropriate Natura 2000 assessment has to be performed.

The lifetime extension of Horns Rev 1 will not significantly affect the conservation objectives for individual marine mammals (harbour porpoises and seals) or -populations in the North Sea. Hence, it is assessed that the lifetime extension of Horns Rev 1 will not prevent maintenance/achievement of favorable conservation status for marine mammals and most birds, nor prevent fulfillment of the conservation objectives for marine mammals and most birds inside the Natura 2000 site N246 (SAC 255/SPA 113) and in more remote SPA's. However, based on the principle of precaution, an appropriate Natura 2000 assessment has to be performed due to the previously mentioned uncertainties of cumulative effects from displacement effects on red-throated diver.

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