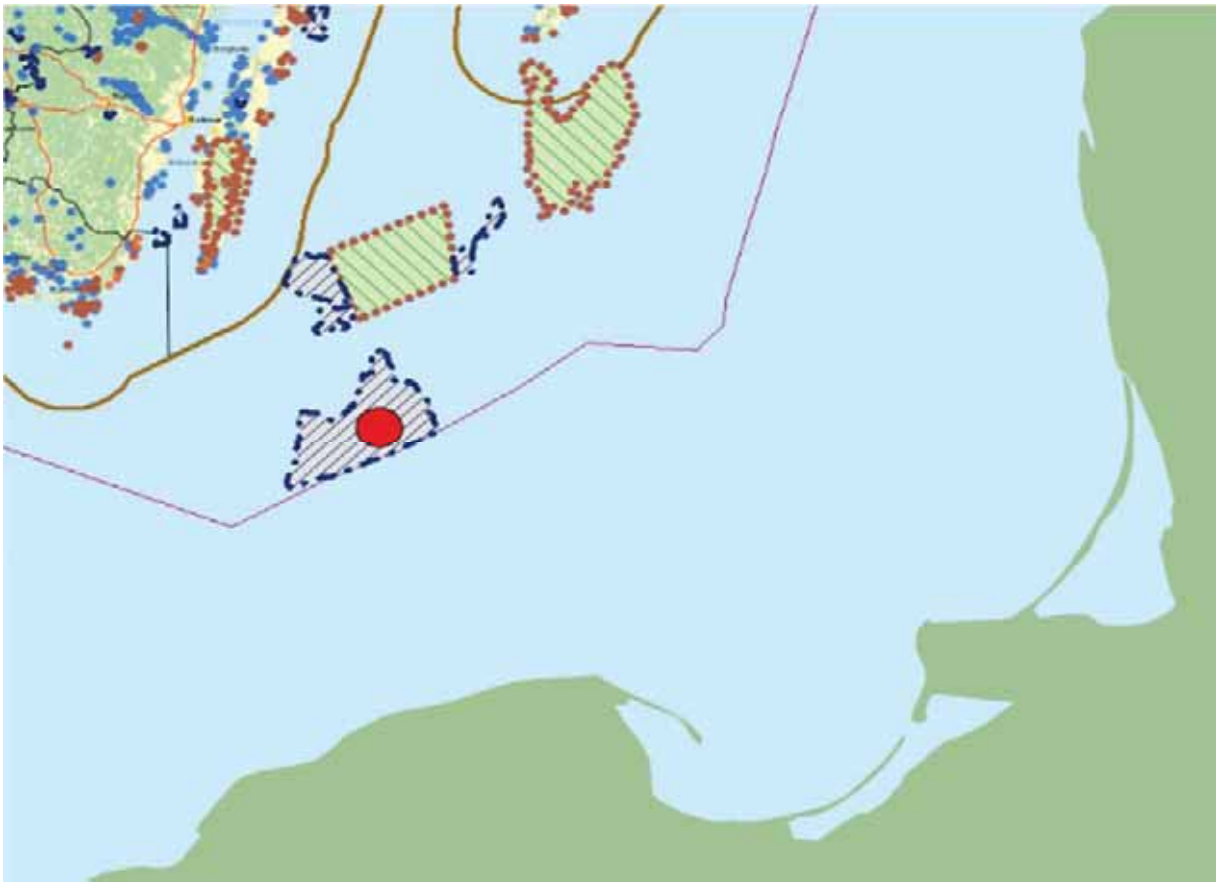
Södra Midsjöbanken Offshore Wind Farm

Permit application documents for the ESBO consultation process.



Project area
Area of national interest for wind power development
Nature 2000 protection area för birds (SPA)
Nature 2000 protection area for habitats (SCA)

E.ON Wind Sweden AB
31/8/2015

Södra Midsjöbanken Offshore Wind Farm

Documents translated for the ESBO consultation process (*)

Tab	Document
1	**Overview**
2	**Amendment II for SEZ application (20/12/2013)**
3	**Memo to amendment II (16/12/2013)**
4	**Appendix to Memo about migrating bats (Autumn 2012)**
5	**Memo to amendment I regarding EIA (5/9/2012)**
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Södra Midsjöbanken Offshore Wind Farm

Overview of permit application documents and translations available for the ESBO consultation process

Document	Tab	Translations	Digital doc ID	Pages
Amendment II for SEZ application (20/12/2013)	**2**	**x**	**A0**	**3**
Memo to amendment II (16/12/2013)	3	x	A1	27
App to Memo about migrating bats (Autumn 2012)	4	x	A2	17
Amendment I for SEZ application (5/9/2012)			**B0**	
Memo to amendment I regarding EIA (5/9/2012)	5	x	B1	8
Map to amendment I regarding development areas (5/9/2012)	6	x	B2	1
SEZ application_extract (17/2/2012) - only proposed conditions (3 pages)	**7**	**x**	**C0**	**3**
EIA to application (31/1/2012)	**8**		C1	76
Administrative information		x		
Summary		x		
Background and purpose		x		
Description of the planned project		x		
Scope		x		
The zero alternative and its environmental consequences		x		
Environmental effects		x		
Conditions, effects, consequences and measures		x		
Nature protection areas		x		
International Conventions		x		
Assessment of env. quality standards and the fulfilment of env. goals		x		
General rules of consideration in the Environmental Code		x		
Consultation		x		
Cross-border effects and consequences		x		
Cumulative effects		x		
Control programme		x		
Project-specific background reports and field surveys ordered by E.ON Vind		x		
Source references		x		
Maps	**9**	x	C2	3
Consultation Statement (31/1/2012)	**10**	x	C3	27
Technical description (31/1/2012)				
Appendices to Technical description				
Weather and ocean statistics at Södra Midsjöbanken (SMHI report)				
Environmental survey (July 2011)			C7	
Inventory of seabirds at Södra Midsjöbanken 2011				
Possible occurence of Bats at Södra Midsjöbanken				
Preliminary analysis of effects on bats				
Fish harvesting inventory for at Södra Midsjöbanken				
Chemical analysis of sediments				
Geophysical and Geotechnical Survey (MMT)				
Evaluation of sediment spread				
Risk analysis				
Cultural heritage Reports				
Current knowledge on birds				
The use of Södra Midsjöbanken by horned puffin				

Södra Midsjöbanken Offshore Wind Farm

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To

The Ministry of the Environment

SUPPLEMENT II OF THE APPLICATION

Ref. no. M2012/714/Ma/M; concerning the application for a permit according to Sweden's Economic Zone Act, regarding the construction and operation of a group station for wind power at Södra Midsjöbanken

E.ON Vind Sverige AB has implemented an internal legal restructuring, whereby parts of the operation that have previously been run by E.ON Vind Sverige AB have been transferred to the newly established company E.ON Wind Sweden AB ("E.ON Wind"). E.ON Wind is therefore a new applicant in the case. E:ON Wind invokes and supports that which has previously been stated by the applicants, and its inclusion in the case does not alter any of the circumstances to which the case relates.

Furthermore, the lawyer Per Molander is entering the process as a new representative in place of the lawyer Bo Hansson. Authorisation documents (power of attorney and certificate of registration) are enclosed, see Appendix 1.

In their submission dated 5 September 2012, the applicants have supplemented their application, and in their submission dated 6 September 2013 they have undertaken, prior to the end of 2013, to provide assessments and information resulting from the occurrence of new circumstances in the project.

E.ON Wind now states the following.

1. Altered conditions

The application and supplement dated 5 September 2012 were based on the conditions that the planned wind farm at Södra Midsjöbanken would be connected to the grid out

in the economic zone, more specifically at the direct current connection that is planned between Sweden and Lithuania (NordBalt). As stated in the submission dated 6 September 2013, Svenska Kraftnät has notified that it will not be possible to connect the wind farm to NordBalt.

E.ON Wind has therefore considered other alternatives for connecting the wind farm, and come to the conclusion that it should be connected directly to the Swedish national grid. Investigations show that such a connection is possible and that a suitable connection point would be Svenska Kraftnät's station in Nybro, i.e. the same connection point as NordBalt.

A connection directly to the grid means that the wind farm project is no longer restricted by NordBalt's planned capacity of 700 MW. As a result, Södra Midsjöbanken's full potential for renewable energy production, i.e. up to 2.1 GWh, can be utilised. However, this requires certain modifications to the application documents.

2. Supplement II

The modifications to the application occasioned by the altered conditions are presented in greater detail in a memo drawn up by SWECO, which is enclosed as Appendix 2. In order to keep the assessment documentation together and to make things easier for the reader, the memo is comprehensive in that it also covers responses and comments on previously received referral statements. As a result, Supplement II refers to and replaces that which is stated in the previous supplement, where applicable. The biggest change from a consistency perspective is the fact that the construction period may be slightly longer, as a result of the wind farm's increased output.

As regards the electrical connection to the Swedish national grid, E.ON Wind has initiated preparatory work prior to the planning and assessment of a suitable cable route, both on land and at sea, and in respect of the latter both within territorial waters and within the economic zone. As set out in Appendix 2, several possible alternatives will be considered within the framework of the preparatory work. The impact on the surrounding area that may result from the laying of the cable is considered in principle to be the same as in the case of NordBalt, where the potential environmental effects of

the cable route within the territorial waters have been identified and impact analyses performed within the framework of the recently conducted permit assessment according to the Environmental Code and the concession assessment according to the Electricity Act.

3. Request for speedy handling

The continued investigation and planning work for the more detailed design of the wind farm, as well as for a suitable cable route for the connection to land, is costly. For E.ON Wind, the permit that is now being applied for constitutes a fundamental precondition for proceeding with these investigations and planning work. As a result of this, E.ON Wind requests that the application now be subject to referral and that this be handled as speedily as possible.

Stockholm, 20 December 2013

E.ON WIND SWEDEN AB, though

Per Molander
(according to power of attorney)

Therese Strömshed
(according to power of attorney)

Södra Midsjöbanken Offshore Wind Farm

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MEMO

E.ON WIND SWEDEN AB

Södra Midsjöbanken

ASSIGNMENT NUMBER 2210024000

SUPPLEMENT TO E.ON'S APPLICATION FOR A PERMIT ACCORDING TO SWEDEN'S ECONOMIC ZONE ACT, REGARDING THE CONSTRUCTION AND OPERATION OF A GROUP STATION FOR WIND POWER AT SÖDRA MIDSJÖBANKEN

16/12/2013

PAVEL SENSKY **MARTIN LJUNGSTRÖM**

Summary

In February 2012, E.ON has submitted an application according to Sweden's Economic Zone Act (SEZ) to construct a group station for wind power at Södra Midsjöbanken in the southeastern Baltic Sea. The application was supplemented on 5 September 2012 as a result of the opinions put forward by the referral bodies. However, the supplement was not processed any further as a result of the information set out below, which is why this document replaces the supplement.

The original application was based on a possible connection to the NordBalt cable between the Baltic States and Sweden, which is planned to pass close to Södra Midsjöbanken.

As the connection to NordBalt is no longer relevant, E.ON has amended the project to include a shore connection cable specifically for the Södra Midsjöbanken wind farm. As a result, the capacity restriction entailed by the connection to NordBalt no longer applies. This makes it possible to alter the wind farm so that it can be utilised to its full potential. Rapid technological developments have also meant that wind turbines with higher electrical output may be feasible, compared to what had originally been planned.

This document describes the technical changes in the project pursuant to that described above. In addition, previously conducted environmental assessments are reviewed, and in those cases where required by the technical changes, the environmental assessments have been revised.

The use of new technology with higher electricity production, depending on the foundation technique, can result in increased sediment spread and a number of other minor changes to the environmental impact. These are not considered to change previous environmental impacts assessments significantly. In addition, the increased wind power production that is made possible by the changes will increase the farm's positive environmental effects regarding several of the Swedish Parliament's environmental objectives.

Contents

1 INTRODUCTION

1.1 BACKGROUND

In February 2012, E.ON submitted to the Government applications regarding permits according to Sweden's Economic Zone Act (SEZ) for the construction and operation of a group station for wind power at Södra Midsjöbanken, and according to the Continental Shelf Act (KSL) for the laying of underwater cables etc. on the continental shelf beyond Sweden's territorial border in association with the above group station.

As a result of the opinions submitted by the referral bodies, these applications were supplemented at the start of September 2012 with a supplement to the application according to SEZ submitted to the Ministry of the Environment, as well as with a statement to the Geological Survey of Sweden (SGU) which is preparing the KSL case.

One important factor that governed the design of both the wind farm and the associated underwater cables was the possibility of connecting the facility to the planned NordBalt connection between Sweden (Svenska Kraftnät) and Lithuania (LitGrid), see Figure 1-1. Meetings regarding this were initiated at an early stage in a constructive spirit. E.ON's formal request to Svenska Kraftnät in respect of this connection was submitted on 1 March 2012.

Figure 1-1 Previously planned connection of the Södra Midsjöbanken wind farm to NordBalt

The response from Svenska Kraftnät was received at the start of September 2012, in which it was explained that a connection was not possible. At the same time, it was recommended that a wind farm constructed at Södra Midsjöbanken should be connected directly to the Swedish or the Lithuanian grid, and that both Svenska Kraftnät and LitGrid should prioritise such a connection. As a result of this, E.ON has conducted a general

investigation into alternative connections of the wind farm to the Swedish national grid, Figure 2-1.

The supplement to the application that was submitted by E.ON to the Ministry of the Environment at the beginning of September 2012 has, at E.ON's request, not been processed further pending the results of the requested study regarding migrating bats at Södra Midsjöbanken, which have now been received.

During September 2013, E.ON requested the opportunity to submit a supplement to the permit application to the Ministry of the Environment. This supplement will encompass information about new conditions and changes to the design of the facility, as well as necessary impact analyses resulting from these.

1.2 PURPOSE

This memo is intended to supplement the Environmental Impact Assessment and Technical Description associated with E.ON's application for a permit according to Sweden's Economic Zone Act in the following respects:

1) Adjusted technical description arising from changes in the project compared to the original application.
2) Supplement to the Environmental Impact Assessment as a result of the comments by the referral bodies regarding the original application (replaces the previously submitted, but at E.ON's request not further processed, supplement to the Environmental Impact Assessment dated 5 September 2012).
3) Checked and in certain cases adjusted environmental impact assessments arising both from changes to the project, as well as from new information that has emerged after the original application.

This memo is intended to be used together with the original Technical Description and Environmental Impact Assessment. The altered technical descriptions and environmental impact assessments are described. Unaltered technical descriptions and environmental impact assessments are only presented with reference to the original Technical Description/Environmental Impact Assessment or, if necessary, with an explanation of why the original assessment is not changed.

2 TECHNICAL DESCRIPTIONS

2.1 PREVIOUSLY APPLICABLE TECHNICAL DESCRIPTION

Among the conditions included in the previously submitted applications, the following can be seen:

- The farm will be connected to the NordBalt cable, which will be routed just to the north of the farm.
- The connection, which is governed by NordBalt's capacity, was limited to an output of 700 MW.
- The above connection entails the construction of an AC-DC converter station located directly adjacent to the planned NordBalt connection.
- To assess the consequences of the facility, a development of the farm with 300 turbines each producing 3.6 MW has been assumed, as a worst-case scenario based on NordBalt's capacity.
- The development is assumed to take place in two stages, over two summer periods.
- The above scenario means that the total sea bed area that will be used for foundations and associated erosion protection would amount to 190,000 m^2, or approx. 0.06% of the farm's seabed.

2.2 ADJUSTED TECHNICAL DESCRIPTIONS

As a result of altered preconditions, it is proposed that the farm be connected directly to the Swedish national grid (instead of via NordBalt as previously proposed). An investigation of alternative connections and consultation with Svenska Kraftnät (SVK) indicate that the most favourable connection point is SVK's facility in Nybro, i.e. the same connection as is planned for NordBalt.

Possible routes for the farm's connection to the Swedish national grid in Nybro are presented in Figure 2-1.

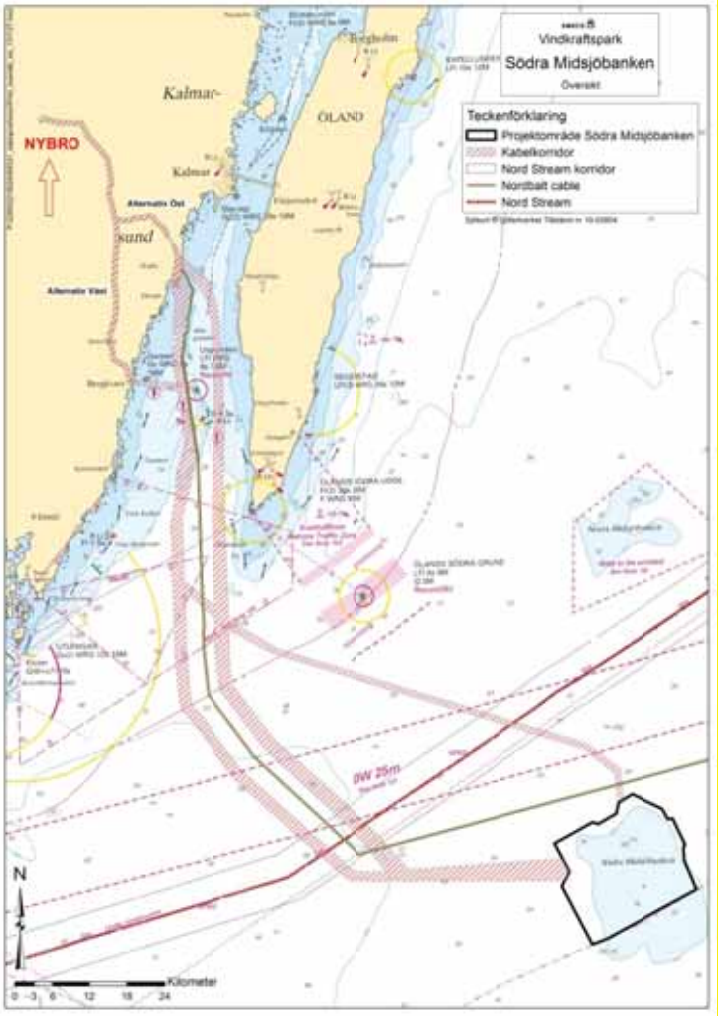

Figure 2-1 Possible routes for the farm's connection to the Swedish national grid

The total length of the alternatives amounts to between 175 and 182 km. Between 39 and 52 km of the alternatives' routes comprise buried cables which, as far as possible, will be located directly in connection with one of E.ON's existing overhead line routes.

Whichever alternative is selected, the laying of the cables will in the first instance take place with high-pressure flushing or ploughing. However, excavation or blasting in limited sections cannot be ruled out. The cable-laying methods described above are based on information available from adjoining projects, e.g. the NordBalt cable connection between Sweden and the Baltic States. E.ON therefore judges that none of the presented alternatives for shore connection will result in any significant impact. A more detailed report will be provided in conjunction with future assessments according to KSL, the Electricity Act and the Environmental Code.

The following also applies:

- The connection's capacity is no longer restricted to 700 MW.
- The wind farm's total capacity is not expected to exceed 2.1 GW, and the total length of the buried cables in the farm will be as previously reported or slightly shorter.
- The farm will include between 200 and 300 turbines.
- An output of 2.1 GW requires 2 AC-DC converter stations and double (two) direct current cable pairs, which will connect the farm to the mainland.
- The output of the turbines does not affect the maximum height of the turbines in question (< 200 m), but does entail a slight increase in the rotor blades' sweep area.

Wind turbines with an output of 7 MW and a total of 300 turbines produce the following worst-case scenario:

- The size of the turbines means that the development rate must be reduced compared to the previous application; it is now assumed that the development of the farm will take place over at least a three-year period, with a dredging period of 150 days each year during the summer months.
- The total volume of dredged material will amount to approx. 200,000 m^3/year.
- Neither the spill volume, 5% of the dredging volume, nor the composition of the dredged material will change.
- Calculations of the sediment spread indicate that the greatest sediment concentration of suspended clay and silt during the dredging period will amount to max. 3 mg/l at a distance of 1 km from the dredging site.
- The altered size of the turbines also means an increase in the total seabed surface that is used for foundations and associated erosion protection. This area will increase to 540,000 m^2 or 0.17% of the farm's seabed.
- The average amount of sediment that will be deposited in the wind farm area over a three-year period during the construction of the entire farm is expected to amount to between 50–60 g/m^2, compared to 11.1 g/m^2 according to the original application, which related to wind turbines with an output of 3.6 MW.

The highest sediment concentrations according to the 2012 application, as well as those that will arise during the construction phase based on the new conditions as set out above, are presented in Figure 2-2 and Figure 2-3.

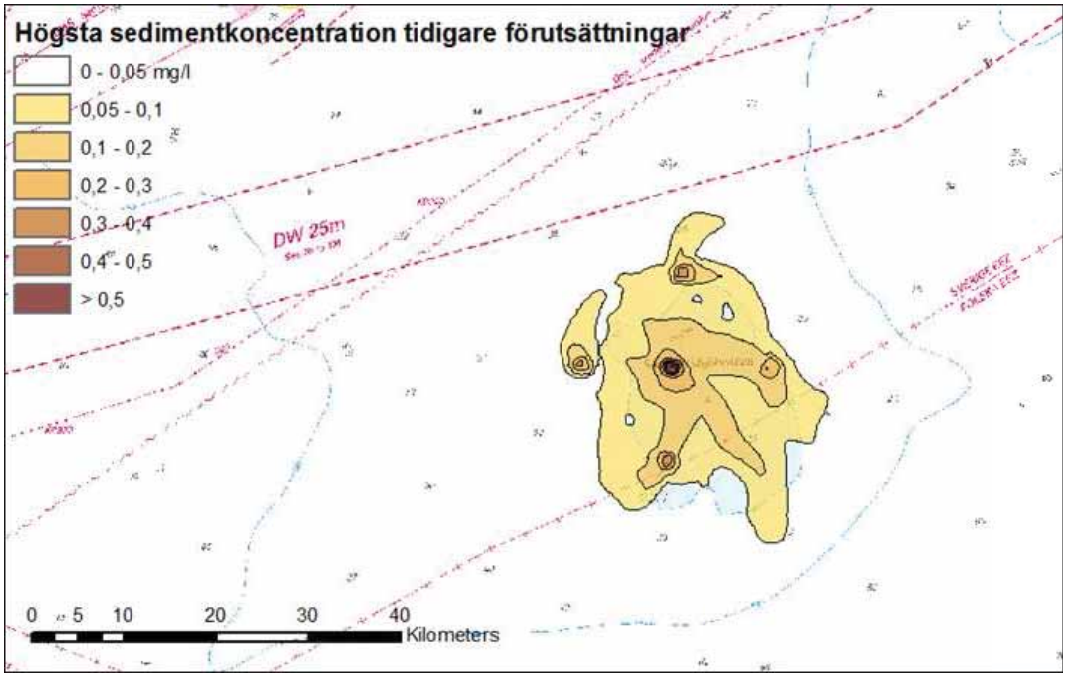

Figure 2-2 Sediment concentrations according to previous conditions

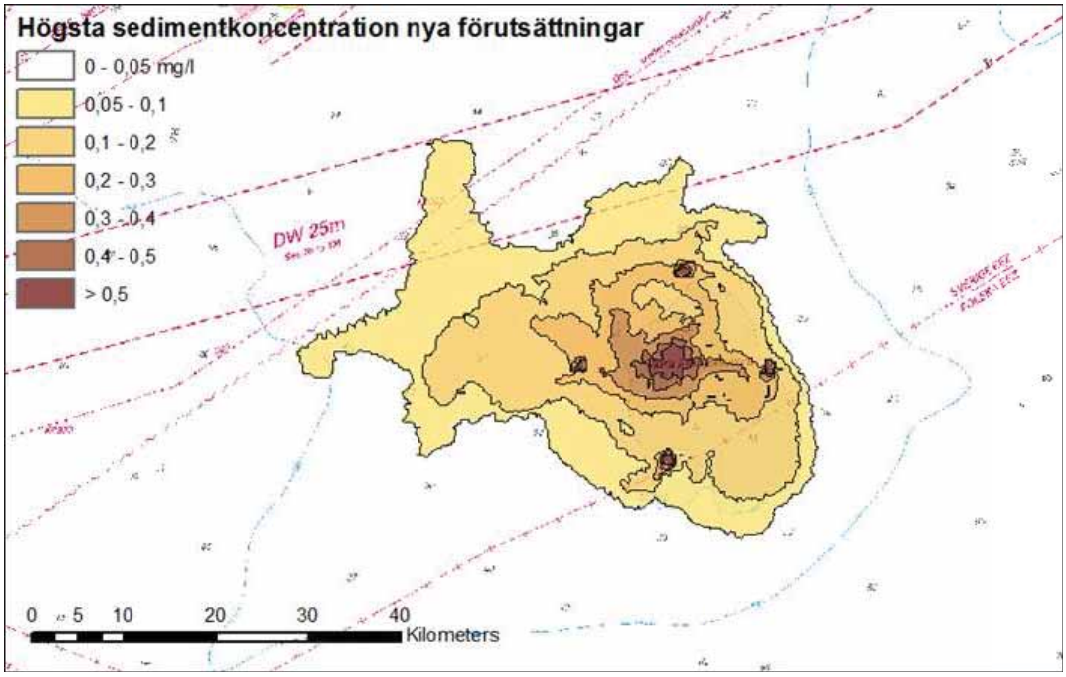

Figure 2-3 Sediment concentrations according to new conditions

2.2.1 **TIMETABLE**

The altered conditions and the current market situation are resulting in changes to the timetable presented in the 2012 applications. The timetable has now been adjusted as presented in Figure 2-4.

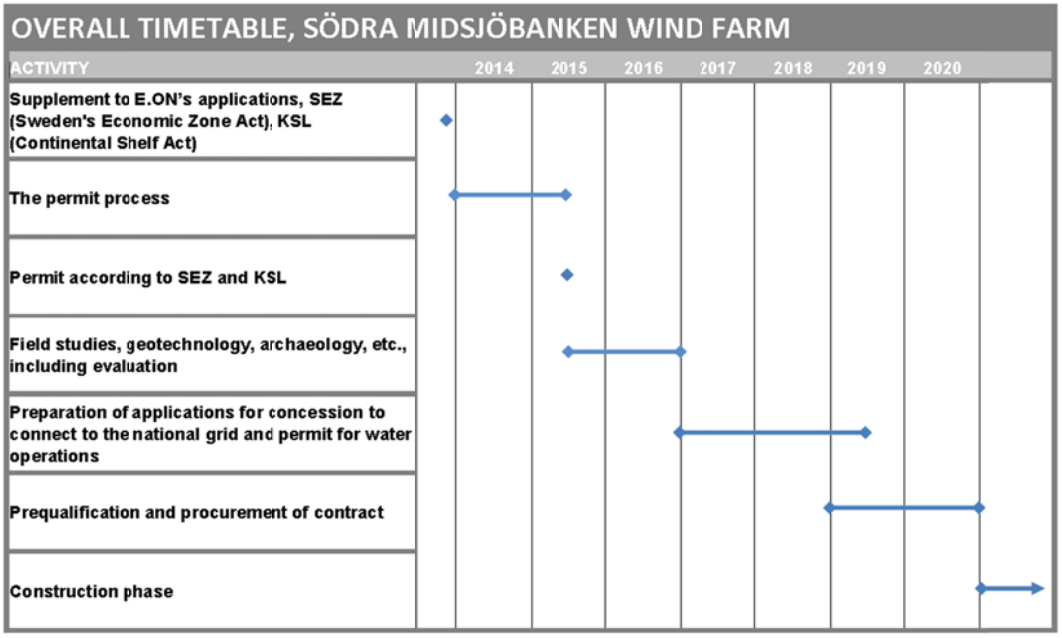

Figure 2-4 Timetable

3 ENVIRONMENTAL IMPACT ASSESSMENT

Presented below is a supplement to the assessments that were made in the project's original Environmental Impact Assessment, dated February 2012. Table 3-1 presents the changes that give rise to checks and minor adjustments of environmental assessments previously presented in the project's Environmental Impact Assessment.

Table 3-1 Altered conditions for the Environmental Impact Assessment of the Södra Midsjöbanken project.

PREVIOUS	CURRENT
The farm is connected to NordBalt just north of the farm	The farm is connected to the Swedish national grid, SVK's facility in Nybro (Figure 2-1)
The connection's capacity is restricted to an output of max. 700 MW	The connection's capacity is no longer restricted to 700 MW
The farm includes 300 x 3.6 MW turbines (1.08 GW installed power)	The farm's installed power will amount to max. 2.1 GW through the installation of 300 x 7 MW turbines, or a smaller number of turbines with a larger output. This produces an environmental impact that is less than the worst-case scenario (Figure 2-3)
Development in two stages, over 2 summer periods	Development in three stages, over 3 summer periods
Dredging during the summer in 2 different years.	Dredging during the summer in 3 different years.
	The volume of dredged material will increase to max. approx. 200,000 m^3/year
Spill max. 5% of the dredged volume	Spill max. 5% of the dredged volume
	Sediment concentration of suspended clay and silt during the dredging period, max. 3 mg/l, 1 km from the dredging site
1 AC-DC converter station directly adjacent to the NordBalt connection	2 AC-DC converter stations directly adjacent to the farm, and double (two) direct current cable pairs that will connect the farm to the mainland
< 1% of the farm's bottom surface will be used for foundations and associated erosion protection (approx. 190,000 m^2 or approx. 0.06% of the farm's seabed)	< 1% of the farm's bottom surface will be used for foundations and associated erosion protection (approx. 540,000 m^2 or approx. 0.17% of the farm's seabed)
Deposited sediment over a two-year period max. 11.1 g/m^2	Deposited sediment over a three-year period max. 60 g/m^2
Max. height 200 m including rotor	Max. height 200 m including rotor

3.2 ENVIRONMENTAL IMPACT (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 7)

The presentation below follows the headings in the original Environmental Impact Assessment and should be read together with this.

3.2.1 ENVIRONMENTAL IMPACT DURING THE CONSTRUCTION PERIOD (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 7.1)

It can be seen from section 7.1 of the Environmental Impact Assessment that the activities that are considered capable of causing significant environmental impact during the construction phase are:

- noise from piling and other construction activities,
- vessel transport (risks, leaks),
- limited accessibility/exclusion,
- handling of fuels, oils, materials and chemicals,
- excavation (flushing, ploughing) and sediment spread
- waste and sewage handling

The current changes in the project (Table 3-1) affect the extent of excavation and sediment spread (Environmental Impact Assessment, Chapter 7). Vessel transport during the construction period is also affected to some extent. Effects and consequences of this are presented later in this document.

Other environmental impact during the construction period is not expected to be affected, compared to that previously presented in the project's Environmental Impact Assessment.

3.2.2 ENVIRONMENTAL IMPACT DURING THE OPERATING PERIOD (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 7.2)

It can be seen from section 7.2 of the Environmental Impact Assessment that the elements that are considered capable of causing significant environmental impact during the operating phase are:

- limited accessibility for marine traffic for various purposes,
- navigation collision risks,
- vessel transport in conjunction with operation and maintenance (risks, leaks),
- visual impact, visibility, lighting,
- noise and vibrations,
- biotope loss above and below water,
- electromagnetism,
- handling of physical resources,
- waste and sewage handling,
- new structures in the marine environment that form a substrate for the growth of organisms (reef effect),

The current changes in the project (Table 3-1) affect the extent of noise and vibrations, biotope loss above and below water, and electromagnetism. Effects and consequences of this are presented later in this document.

Other environmental impact during the operating period is not expected to be affected to a significant extent, compared to that previously presented in the project's Environmental Impact Assessment

3.2.3 .ENVIRONMENTAL IMPACT WHEN PHASING OUT THE FARM (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 7.3)

It can be seen from section 7.3 of the Environmental Impact Assessment that the environmental impact during the phasing out work is similar to that experienced during the construction period. The elements that can also have a significant environmental impact during the phasing out period are considered to be the following:

- recycling or reuse of materials
- sediment spread in conjunction with the lifting of cables
- remaining parts of the foundations underground, possibly with the filling of cavities

The current changes in the project (Table 3-1) do not affect the extent of the environmental impact when phasing out the farm compared to that previously presented in the Environmental Impact Assessment.

3.2.4 NOISE (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 7.4)

Section 7.4 of the Environmental Impact Assessment gives a background description of the conditions for underwater noise affecting various organisms. These conditions have not changed.

3.2.5 SEDIMENT SPREAD (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 7.5)

Section 7.5 of the Environmental Impact Assessment briefly presents the project's sediment spread and sediment deposits, based on a more exhaustive memo that is also included in the application, in which more detailed analyses and calculations of sediment spread are presented.

The current changes (Table 3-1) entail that the dredging volume will increase somewhat, as will the accumulation of material on the seabed. The dredging work will be spread over three summer periods instead of two. This entails both a dilution of the dredging volume in terms of time, as well as additional time for the removal of sedimented material through erosion.

Amounts of suspended material and the size of sedimented material will increase slightly, yet still remain at levels that will not have lasting adverse effects on the ecosystem's organisms.

3.3 CONDITIONS, EFFECTS, CONSEQUENCES AND MEASURES (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 8)

This section analyses whether changes in the project according to Table 3-1 will entail an altered environmental impact assessment for various matters (ecosystem components).

The headings follow Chapter 8, heading level 2, of the Environmental Impact Assessment.

3.3.1 GENERAL CONDITIONS (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 8.1)

The current changes do not affect existing conditions that have been described in general terms in the Environmental Impact Assessment regarding geography and the nature of the seabed.

3.3.2 WATER QUALITY AND HYDROGRAPHY (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 8.2)

In the original application's Environmental Impact Assessment, it was assumed that there could be 300 turbines each producing up to 7 MW. The assessment that the wind turbines will not give rise to any quantitatively significant effects compared to the natural variations in the current, vertical stratification and mixing conditions is therefore not affected.

Random samples have been taken of sediment within the wind farm in respect of the sediment's chemical contamination load. The samples consistently show that the excavated material is not contaminated. The release of contaminants therefore does not entail any additional environmental impact, despite the fact that the excavated volume has increased.

3.3.3 BOTTOM FLORA AND FAUNA (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 8.3)

The altered conditions entail an increase from 0.06 to 0.17% (Table 3-1) of the bottom surface that will be used by the wind farm's installations, out of the total area of the farm.

This does not change the conservative assumption that formed the basis for the original assessment of the wind farm's consequences for bottom flora and fauna, i.e. that installations including cable trenches will cover < 1% of the farm's total bottom surface.

The conclusions from the Environmental Impact Assessment remain. The bottom surface that the farm takes up does not entail any significant negative effect on bottom flora and fauna.

3.3.4 THE FISH COMMUNITY (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 8.4)

The previous assessment of effects and consequences for the fish community is based on the fact that high levels of sediment will only occur in the vicinity of the dredging sites, and that low levels will not be exceeded at greater distances from the dredging site (see section on sediment spread above).

The most important conclusions are presented in brief below.

During the construction period, sediment spill can have an adverse effect on fish eggs and fish fry, for example by means of fish eggs being weighed down and sinking. The project will give rise to a limited amount of sediment spill, mostly of relatively coarse material (sand or coarser), which means that the extent of these adverse effects will be small.

There will be temporary disruptions during the construction period, and fish may be scared away from the sites where intensive work is being conducted. The conditions will return to normal soon after the completion of the work.

The following-up of wind farms at Nysted and Horns Rev in Danish waters, as well as Lillgrund in the Öresund, has not demonstrated any significant adverse effects on fish populations. The distances from Södra Midsjöbanken to sensitive areas, such as the spawning areas for cod, are relatively large.

The new condition, i.e. a concentration of suspended clay and silt during the dredging period of max 3 mg/l, 1 km from the dredging site, does not affect the above assessment. However, the disruption to the fish community will be extended to three seasons instead of two.

3.3.5 COMMERCIAL FISHING (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 8.5)

Compared to the previous application and the Environmental Impact Assessment, the construction period has been extended to 3 years.

Fishing on parts of the bank will be prevented entirely during the construction period, as shipping will be excluded from the area in stages. Fishing on those parts of the bank where shipping has not been excluded may be disrupted indirectly during these periods due to temporary increased turbidity, which can both scare off fish and disrupt the effectiveness of the fishing equipment.

Disruptions that lead to demonstrable losses for commercial fishing will be compensated.

3.3.6 MARINE MAMMALS (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 8.6)

Studies of Denmark's Nysted and Horns Rev wind farms have shown that seals and porpoises can adapt to the wind farms during the operating period. During the construction period, the mammals may be temporarily scared off by disruptive building activities, but return after a short period. The increased construction period will entail an extension of the time during which marine mammals are disturbed.

3.3.7 BIRDS (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 8.7)

A comprehensive review of the bird-life at Södra Midsjöbanken, as well as effects and consequences, have been presented in the Environmental Impact Assessment. The presentation and its conclusions are not affected by the current changes to the project. Compared to the previously presented development proposal, a development with 7 MW wind turbines will mean that the total sweep area for the rotor blades will increase.

However, as the maximum total height of 200 m is being retained, this is expected to have a negligible effect on bird movements. In the event turbines larger than 7 MW should be installed, the sweep area for each turbine will be extended. However, as the number of turbines would decrease, the total sweep area would not increase and consequently nor would the impact on the bird-life.

3.3.8 BATS (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 8.8)

The Environmental Impact Assessment judges that migrating bats may occur at Södra Midsjöbanken, which could also result in bat mortality. During the referral round, a need emerged to further investigate the occurrence of bats in the area. Results from the automatic registration of bats that has been carried out at the wind measurement tower that E.ON established in the area confirms that bats are found at Södra Midsjöbanken. This definitely applies to Nathusius' pipistrelle bats (*Pipistrellus nathusii*) and in all likelihood to parti-coloured bats (*Vespertilio murinus*), and possibly also to some other bat species. These measurements only indicated a few individuals, but the measurement process was restricted by technical problems and did not include the month of August, when most bat migrations across the sea are expected. This is new information that was not available at the time of the original Environmental Impact Assessment. The report from the study of migrating bats at Södra Midsjöbanken is enclosed in its entirety in **Appendix 1.** When it comes to the impact, the same argument as presented for birds in Chapter 3.3.7 applies.

3.3.9 ANGLING AND RECREATIONAL DIVING (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 8.9)

The Environmental Impact Assessment's conclusions are not affected by the current changes to the project.

3.3.10 MARINE ARCHAEOLOGY (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 8.10)

The Environmental Impact Assessment's conclusions are not affected by the current changes to the project.

3.3.11 SHIPPING AND RISKS (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 8.11)

The risk analysis for the project that has been produced previously and is summarised in the Environmental Impact Assessment relates primarily to the operating period. The conclusions are not significantly affected by the current changes to the project. One difference, however, is that the construction period is being extended to 3 seasons, with the result that risks associated with marine transport and operations during the construction period will be spread over a longer time.

3.3.12 AVIATION (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 8.12)

The Environmental Impact Assessment's conclusions are not affected by the current changes to the project.

3.3.13 NATURAL RESOURCES (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 8.13)

The Environmental Impact Assessment's conclusions are not affected by the current changes to the project.

3.3.14 VISUAL IMPACT (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 8.14)

The Environmental Impact Assessment's conclusions are not affected by the current changes to the project.

3.3.15 NATURE CONSERVATION AREAS (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 9)

The Environmental Impact Assessment's conclusions are not affected by the current changes to the project.

3.3.16 INTERNATIONAL CONVENTIONS (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 10)

The Environmental Impact Assessment's conclusions are not affected by the current changes to the project.

3.3.17 ASSESSMENT OF ENVIRONMENTAL QUALITY STANDARDS AND FULFILMENT OF ENVIRONMENTAL GOALS (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 11.1)

The Environmental Impact Assessment's conclusions are not affected by the current changes to the project.

3.4 FULFILMENT OF ENVIRONMENTAL OBJECTIVES (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 11.2)

3.4.1 REDUCED CLIMATE IMPACT (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 11.2.1)

The changes in relation to the previously submitted application entail an improvement to the project's impact in respect of the climate objective. The wind resource at Södra Midsjöbanken can be utilised more than would have been the case had it been restricted by NordBalt's capacity, which means that the need for electricity production from fossil fuels is reduced.

The planned wind farm at Södra Midsjöbanken, with an installed power corresponding to the currently planned level, means that the annual electricity production will increase from

approx. 2.8 TWh to 8.4 TWh[1]. This will contribute towards a reduction in CO_2-emissions from Sweden's electricity production.

3.4.2 CLEAN AIR (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 11.2.2)

The changes in relation to the previously submitted application entail an improvement to the project's impact in respect of the *Clean air* objective. The wind resource at Södra Midsjöbanken can be utilised more than would have been the case had it been restricted by NordBalt's capacity, which means that the need for electricity production from fossil fuels and their associated emissions of air pollutants are reduced.

3.4.3 NATURAL ACIDIFICATION ONLY (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 11.2.3)

The current changes in relation to the previously submitted application entail an improvement to the project's impact in respect of the *Natural acidification only* objective. The wind resource at Södra Midsjöbanken can be utilised more than would have been the case had it been restricted by NordBalt's capacity, which means that the need for electricity production from fossil fuels and their associated emissions of acidification substances are reduced.

3.4.4 A NON-TOXIC ENVIRONMENT (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 11.2.4)

The Environmental Impact Assessment's conclusions are not affected by the current changes to the project.

3.4.5 A PROTECTIVE OZONE LAYER (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 11.2.5)

The Environmental Impact Assessment's conclusions are not affected by the current changes to the project.

3.4.6 A SAFE RADIATION ENVIRONMENT (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 11.2.6)

Radioactive substances

The current changes in relation to the previously submitted application entail an improvement to the project's impact, as it means an expansion of alternatives to electricity produced by nuclear power.

The project will improve the potential to reduce the spread of radioactive substance in connection with the operation of nuclear power stations, the extraction and transport of nuclear fuels, as well as the transport and final storage of nuclear waste. The project will contribute to the fulfilment of this part of the environmental objective.

[1] Based on the assumption, derived from experience, that the facility's production will correspond to 4,000 full load hours per year

Electromagnetic radiation

The conclusion in the Environmental Impact Assessment is based on the assumed preconditions that

1) the exposure of the population at Södra Midsjöbanken to alternating magnetic fields (the cables within the wind farm) is negligible, and in addition the negative effects of alternating magnetic fields of this type and extent have not been scientifically proven.

2) the cable technology (HVDC) that will be used in the project for the shore connection, with positive and negative cables close to each other, means that the strength of the magnetic field will be much lower than equivalent fields around existing direct current cables (for example for the Gotland cable, the Fenno Skan cable, Baltic Cable, SwePol Link). Studies have shown that the magnetic field from the Baltic Cable does not have any significant impact on the migration patterns of eels or salmon. As a result, it is considered that the Södra Midsjöbanken project will not counter the fulfilment of this part of the objective regarding *A safe radiation environment* either.

Even bearing in mind the current change to the Södra Midsjöbanken project's installed power and shore connection, the conclusion remains that the strength of the magnetic field is less than that which could cause problems for fish navigation.

In summary, it is considered that the Södra Midsjöbanken project will contribute positively to the objective of A safe radiation environment, based on the fact that it can form part of a long-term strategy for reducing the use of nuclear power without giving rise to negative effects on health and biological diversity as a result of fluctuating or static magnetic fields.

The Environmental Impact Assessment's conclusions are not affected by the current changes to the project.

3.4.7 ZERO EUTROPHICATION (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 11.2.7)

The current changes in relation to the previously submitted application entail an improvement to the project's impact in respect of the *Zero eutrophication* objective. The wind resource at Södra Midsjöbanken can be utilised more than would have been the case had it been restricted by NordBalt's capacity, which means that the need for electricity production from fossil fuels and their associated emissions of eutrophication substances are reduced.

3.4.8 FLOURISHING LAKES AND STREAMS (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 11.2.8)

A strong contributory negative factor regarding the fulfilment of the environmental objective is that almost all major watercourses are affected by the development of hydroelectric power. Bearing in mind this objective, it is not desirable to meet the increasing demand for electricity with the continued development of hydroelectric power.

The relevant changes in relation to the previously submitted application entail in improvement to the project's impact in relation to the objective of *Flourishing lakes and streams* by further reducing the need to regulate watercourses for electricity production.

3.4.9 GOOD-QUALITY GROUNDWATER (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 11.2.9)

The Environmental Impact Assessment's conclusions are not affected by the current changes to the project.

3.4.10 A BALANCED MARINE ENVIRONMENT, FLOURISHING COASTAL AREAS AND ARCHIPELAGOS (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 11.2.10)

The Environmental Impact Assessment's conclusions are not affected by the current changes to the project.

3.4.11 THRIVING WETLANDS (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 11.2.11)

The Environmental Impact Assessment's conclusions are not affected by the current changes to the project.

3.4.12 SUSTAINABLE FORESTS (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 11.2.12)

The Environmental Impact Assessment's conclusions are not affected by the current changes to the project.

3.4.13 A VARIED AGRICULTURAL LANDSCAPE (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 11.2.13)

The Environmental Impact Assessment's conclusions are not affected by the current changes to the project.

3.4.14 A MAGNIFICENT MOUNTAIN LANDSCAPE (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 11.2.14)

One possible threat to the fulfilment of this environmental objective is large-scale wind power development in mountainous areas. The relevant changes in relation to the previously submitted application entail in improvement to the project's impact in relation to the objective of *A magnificent mountain landscape* by reducing the need for wind-based electricity production in mountain landscapes.

3.4.15 A GOOD BUILT ENVIRONMENT (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 11.2.15)

The planned wind farm at Södra Midsjöbanken contributes positively to the fulfilment of the environmental objective *A good built environment* through a significant contribution to renewable energy supplies. The current changes in relation to the previously submitted application entail an improvement to the project's impact in respect of the objective.

3.4.16 A RICH DIVERSITY OF PLANT AND ANIMAL LIFE (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 11.2.16)

The Environmental Impact Assessment's conclusions are not affected by the current changes to the project.

3.4.17 GENERAL RULES OF CONSIDERATION IN THE ENVIRONMENTAL CODE (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 12)

The Environmental Impact Assessment's conclusions are not affected by the current changes to the project.

3.4.18 CONSULTATION (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 13)

As a result of the current changes in the project, an additional consultation meeting has been held with the County Administrative Board in Kalmar on 22/10/2013.

This consultation is a continuation of the consultation that began in 2010 regarding the construction of a wind farm at Södra Midsjöbanken, including the laying of cables etc. The Country Administrative Board is not required to adopt a formal stance as a result of the consultation, although it is probable that the Board will receive the supplement on referral from the Ministry of the Environment. The project has a significant environmental impact according to the criteria in the Ordinance on Environmental Impact Assessments (1998:905), which is why no separate decision is required regarding this.

The consultation that has now been carried out will support E.ON in the assessment of which supplements to the Environmental Impact Assessment are required for the supplement to the application set out in the heading. The minutes and presentation material from the meeting are enclosed in Appendix 2.

3.4.19 CROSS-BORDER EFFECTS AND CONSEQUENCES (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 14)

The Environmental Impact Assessment's conclusions are not affected by the current changes to the project.

3.4.20 CUMULATIVE EFFECTS (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 15)

The Environmental Impact Assessment's conclusions are not affected by the current changes to the project.

3.4.21 CONTROL PROGRAMME (ENVIRONMENTAL IMPACT ASSESSMENT, CHAPTER 16)

The control programme that is described in general terms in the Environmental Impact Assessment is, for the most part, not affected at all by the current changes in the project. The control programme does need to be reviewed in one respect. This relates to the proposed limitation of the sediment concentration to 10 mg/l > 200 m from the dredging site. As a result of the new conditions, it is proposed that the control programme should refer to a limitation in sediment concentrations of < 3 mg/l at a distance of ≥ 1 km from the dredging site.

The originally proposed limitation (10 mg/l > 200 m) is deemed to be too narrow, both bearing in mind the increased dredging, and because the sediment concentration can vary significantly as little as 200 m from the dredging site. It is easier to control and follow up dredging against a lower limit at a greater distance from the dredging site, and the low value of 3 mg/l 1 km from the dredging site is still considered to prevent lasting harmful sediment concentrations from occurring in connection with the construction work.

3.5 SUPPLEMENT RESULTING FROM THE OPINIONS OF THE REFERRAL BODIES

Below is a repetition of the supplement to the Environmental Impact Assessment dated 5 September 2012, which has previously been submitted by E.ON as a result of the opinions of the referral bodies. Its reception has been reviewed as a result of the changes to the project that now apply, with no adjustments to the supplement having been required.

3.5.1 REGARDING THE CONCLUSION THAT LONG-TAILED DUCKS TO A LESSER EXTENT AVOID WIND FARMS WITH A GREATER DISTANCE BETWEEN THE TURBINES ETC. (COUNTY ADMINISTRATIVE BOARD IN KALMAR)

The calculation (Environmental Impact Assessment, section 14.2.2) of the possible number of dislocated long-tailed ducks is based on the results from the following up of Nysted wind farm *(Final results of bird studies at the offshore wind farms at Nysted and Horns Rev, Denmark NERI Report Commissioned by DONG energy and Vattenfall A/S, 2006, Figure 90, s 81)* as well as the Nordic Council of Ministers' seabird assessment (*Nordic Council of Ministers (2011) Waterbird Populations and Pressures in the Baltic Sea, TemaNord 2011:550*).

At Nysted, the frequency of long-tailed ducks observed within the wind farm during the operating period fell by 90% compared to before the farm was commissioned (*NERI Report, 2006*).

According to the Nordic Council of Ministers (2011), the density of long-tailed ducks at the Midsjö banks was > 75 individuals per km^2 (similar densities were reported by Durinck et al 1994). For the calculation of the number of dislocated birds from Södra Midsjöbanken, the figure of 75 individuals per km^2 (the lower limit in the highest range, Nordic Council of Ministers, 2011) has been multiplied by 0.9 (based on the *NERI Report, 2006)*.

In nature, individuals normally spread out spatially in relation to a resource, such that the density of individuals is higher where the resources are richer. The Midsjö banks have high densities of wintering long-tailed ducks due to the abundant availability of the staple food, blue mussels. The density of wintering long-tailed ducks at Nysted wind farm is lower than at the Midsjö banks, probably due to the poorer supply of food there. According to ecological literature, when there are declining populations, habitats with poorer resources (marginal habitats) are abandoned first and richer habitats (core habitats) later.

Based on the hypotheses 1) that the Midsjö banks are a core habitat and Nysted is a marginal habitat, and 2) that the greater distance between the turbines compared to Rödsand (1,000 m and 500 m respectively) could mean that the *stimuli* causing the long-tailed ducks to avoid the wind farm are weaker at Södra Midsjöbanken compared to Nysted, the assumption was formulated in the Environmental Impact Assessment that long-tailed ducks may avoid Södra Midsjöbanken to a lesser extent than has been the case at Nysted. In this case, this would mean that the dislocation factor of 0.9 is too negative an assumption.

For the calculation of the possible number of dislocated long-tailed ducks presented in the Environmental Impact Assessment, the dislocation factor of 0.9 was applied despite the fact that both of these hypotheses argue for a factor of 0.9 being too negative an assumption.

If the above hypothesis regarding the distance between the turbines could be confirmed through the control programme for Södra Midsjöbanken, this would be of great positive significance for the impact assessment regarding wind farms in the Baltic Sea. The control programme should therefore focus in part on this question. The programme's details should be formulated in consultation with the supervisory authority and experts.

3.5.2 THE WIND TURBINES' EFFECTS ON MARINE LIFE AND BIRDS – REPORTS THAT MAY BE RELEVANT FOR THIS ESTABLISHMENT (SWEDISH ENERGY AGENCY)

The knowledge compilations within the framework of Vindval, which were not available at the time of the work on the Environmental Impact Assessment for Södra Midsjöbanken, have demonstrated some, barely significant effects of wind turbines on migrating birds and marine life, which are in line with the conclusions from Södra Midsjöbanken's Environmental Impact Assessment.

3.5.3 LACK OF DATA FOR ASSESSING THE IMPACT ON THE LARGE MUSSEL BANK IN THE AREA (HAV)

The threat to the mussels can comprise sedimented or suspended particles, cable trenches and the area that is taken up by the wind turbines' foundations (see sections 7.5 & 8.3.2). Sediment levels and sediment accumulations will be relatively short-term and very localised. The total bottom surface that is utilised constitutes < 1% of the wind farm's area. Based on these facts, it is concluded that the impact on the mussel bank will be

insignificant. Indirect adverse effects on organisms that have mussels as their food base (primarily long-tailed ducks and other diving ducks) are not anticipated, in any case not to any appreciable extent.

3.5.4 OCCURRENCE OF PORPOISES (SWEDISH ENVIRONMENTAL PROTECTION AGENCY, COUNTY ADMINISTRATIVE BOARD IN BLEKINGE COUNTY)

The Södra Midsjöbanken project has been in contact with the SAMBAH project on 23 September 2011. No results were available at this time. Information about the presence of porpoises in the Environmental Impact Assessment (8.6, 14.4) has been obtained in part from HELCOM's website, which was recommended by Julia Carlström (project manager for the SAMBAH project).

The Environmental Impact Assessment reports some 10 porpoise observations within 100 km of Södra Midsjöbanken. The basis for the Environmental Impact Assessment's estimate of the presence of porpoises is presented in section 8.6.1. Other assessments of porpoises are well founded in literature studies from the following up of Horns Rev and Nysted. The Environmental Impact Assessment has not assumed that there are no porpoises in the area, merely related facts about the presence of porpoises in the Baltic Sea.

In renewed contacts with Julia Carlström by e-mail in July and August 2012 and November 2013, there are still no published results from SAMBAH, although the following information has been obtained:

"SAMBAH's field period is in full swing, and porpoise clicks are being registered in several participating countries. It is still too early to say anything about porpoise densities, as we need to analyse data from two full years, but so far we can say that the method is working and that there are porpoises within the study area."

SAMBAH's study area covers the whole of the southern Baltic Sea, and the details set out above therefore provide no specific information about the presence of porpoises in and around Södra Midsjöbanken. The Södra Midsjöbanken project considers that there is insufficient evidence for the presence of porpoises at Södra Midsjöbanken for it to be meaningful (and reasonable with regard to environmental benefit) to completely refrain from the construction work during the reproduction period. However, it is reasonable for noisy work to increase gradually at the start, so that any porpoises present have the opportunity to move out of the danger zone.

3.5.5 QUESTIONS ABOUT UNDERWATER NOISE CAN BE FURTHER HIGHLIGHTED (SWEDISH ENVIRONMENTAL PROTECTION AGENCY, HAV)

In Vindval's report 6485, "Effekter av en havsbaserad vindkraftpark på fördelningen av bottennära fisk - En studie vid Lillgrunds vindkraftpark i Öresund" ("Effects of an offshore wind farm on the distribution of benthic fish - A study of Lillgrund wind farm in Öresund"), January 2012, the following was stated regarding the effects of noise on fish: "The relatively strong links that were noted between the number of fish and the distance to wind turbines for a number of fish species suggest that the wind turbines in the first

instance attract fish, and that any adverse effects on the presence of fish, caused for example by electromagnetic fields or the external noise environment, are probably of minor significance in the context."

In Vindval's report 6481 "Effekter av havsbaserad vindkraft på pelagisk fisk" ("Effects of offshore wind power on pelagic fish"), February 2012, no clear and significant adverse effects from noise on pelagic fish were demonstrated.

In Vindval's report 6436 "Ljud från vindkraftverk i havet och dess påverkan på fisk" ("Noise from offshore wind turbines and its impact on fish"), July 2011, it is noted that it is only within around 100 metres of a turbine and at high wind speeds that the noise levels are sufficiently high for there to be a risk of fish being adversely affected, in the form of escape behaviour or possible masking of communication. There is currently nothing to indicate that just because the noise is audible, this will be associated with any negative consequences for the fish at population level.

In Vindval's report 6488 "Vindkraftens effekter på marint liv - En syntesrapport" ("Effects of wind power on marine life - A synthesis report"), March 2012, adverse effects due to noise from piling work are observed.

Cod and herring can potentially perceive sound from piling work at a distance of 80 kilometres. Physical damage and death can occur a few metres from the construction site. During all types of work that entail noise, escape reactions among fish can be expected within a distance of around a kilometre from the source.

"Among marine mammals, porpoises are the species that have been shown to suffer both impaired hearing and disturbed behaviour due to noise in conjunction with piling."

However, the Environmental Impact Assessment for Södra Midsjöbanken cites follow-up results from the Danish wind farms at Horns Rev and Nysted (section 8.6.2) showing that porpoises that avoid the farm area during the construction work return within a few hours and that they also remain in the farm area during the operating period.

Vindval's report 6488 also observes that there are no studies to indicate long-term adverse effects on any of Sweden's seal species.

3.5.6 THE IMPACT ON MIGRATING FISH CAN BE FURTHER HIGHLIGHTED (SWEDISH ENVIRONMENTAL PROTECTION AGENCY, HAV)

In Vindval's report 6479 "Blankålsvandring, vindkraft och växelströmsfält, 2011" ("Silver eel migration, wind power and alternating current fields, 2011"), February 2012, it is observed that neither Lillgrund wind farm in Öresund nor the alternating current cable across Kalmar Strait constituted definitive obstacles to migration. A certain delay effect (< 1 h) could be observed at the Kalmar Strait, and deviating behaviour on the part of certain individuals could be observed at Lillgrund.

In Vindval's report 6488 "Vindkraftens effekter på marint liv - En syntesrapport" ("Wind power's effects on marine life - A synthesis report"), March 2012, it is observed e.g. that during the operating phase, the cables from a wind turbine generate a magnetic field that

diminishes as the distance from the cable increases. The anticipated effect on most fish species is low, but as the impact continues throughout the operating phase, the risk should be considered in areas that are of significance for migrating fish species. In the Environmental Impact Assessment (section 8.4.2), an assessment is made of the farm's effects and consequences for migrating fish species at Södra Midsjöbanken, which is not considered to constitute an area of particular importance for sensitive migrating fish species.

3.5.7 CONCLUSION REGARDING THE CONDITIONS FOR A GOOD ENVIRONMENTAL STATUS ACCORDING TO EU DECISION 2010/477 (KAMMARKOLLEGIET)

On the basis of the Environmental Impact Assessment and this supplement, the conclusion that the project will not affect the conditions for a good environmental status is supported below, based on criteria in the EU decision 2010/477/EU – part B.

Descriptor 1: Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climate conditions.

The impact on e.g. the area's marine organisms has been described in the various sections of the Environmental Impact Assessment as well as background reports (Table 2).

Table 2 Reference to the section in the Environmental Impact Assessment that deals with the impact on biological diversity

Ecosystem components	Environmental Impact Assessment section	Enclosed background report
Water quality and hydrography	8.2	Folder 2, Tab 6
Bottom flora and fauna etc.	8.3	
Fish	8.4, 14.1	Folder 2, Tab 11
Marine mammals	8.6	
Birds	8.7, 14.2	Folder 2, Tab 8
		Folder 2, Tab 17
		Folder 2, Tab 18
Bats	8.8, 14.3	Folder 2, Tab 9

Ecosystem components	Environmental Impact Assessment section	Enclosed background report
		Folder 2, Tab 10

From this it can be seen how biological diversity is affected, and that the extent of the adverse effect is small.

Descriptor 2: Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystem.

Södra Midsjöbanken is situated between heavily trafficked shipping routes and fishing waters.. The wind power operation (construction, operation, maintenance and decommissioning) is not considered to contribute to or alter the occurrence of non-indigenous species. It can be observed (Environmental Impact Assessment section 8.3.1) that the brackish water hydroid *Cordylophora caspia*, which migrated into the area in the 19th Century, is common at Södra Midsjöbanken and elsewhere in the Baltic Sea.

Descriptor 3: Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock.

Knowledge about and conclusions regarding the impact on the area's commercially exploited fish can be seen, as far as is relevant for the project, from the Environmental Impact Assessment, sections 8.4 and 14.1, as well as from the enclosed background report, Folder 2, Tab 11. The project does not contribute to the over-exploitation of fish and shellfish populations.

Descriptor 4: All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.

The Environmental Impact Assessment presents, as far as possible and as far as is known, the project's impact in relation to descriptor 4 (see e.g. Environmental Impact Assessment sections 14.2.1 & Table 2 above), for example through the fact that the impact on organisms from various trophic levels has been described and assessed. The project will not affect the marine food webs' energy flows or structure to a significant extent.

Descriptor 5: Human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algal blooms and oxygen deficiency in bottom waters.

The project will not contribute to eutrophication. This matter has been deemed to be of low relevance for the project. However, the matter has been covered in section 11.2.7.

Descriptor 6: Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected.

It can be seen from the Environmental Impact Assessment (section 8.3.2) that the project's installations affect < 1% of the sea-floor area within the overall wind farm area. This is not considered to constitute a significant threat to the structure and functions of the ecosystems.

Descriptor 7: Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems.

It can be seen from section 8.2 of the Environmental Impact Assessment that the project does not affect the hydrographical conditions for the marine ecosystems.

Descriptor 8: Concentrations of contaminants are at levels not giving rise to pollution effects.

The project does not affect the concentration of contaminants. This can be seen from section 11.2.4 as well as Chapter 12, paragraph 6.

Descriptor 9: Contaminants in fish and other seafood for human consumption do not exceed levels established by Community legislation or other relevant standards.

The project does not affect contaminants in fish and shellfish. The matter has not been deemed to be relevant for the project's Environmental Impact Assessment.

Descriptor 10: Properties and quantities of marine litter do not cause harm to the coastal and marine environment.

It can be seen from the Environmental Impact Assessment, section 12, in particular paragraphs 6 & 8, how the project will restrict marine litter.

Descriptor 11: Introduction of energy, including underwater noise, is at a level that does not adversely affect the marine environment.

Noise is covered in section 7.4 in the Environmental Impact Assessment, as well as in this supplement memo under the heading "Questions about underwater noise can be further highlighted (Swedish Environmental Protection Agency, HaV)".

Electromagnetic radiation is covered in sections 8.4.2 paragraph 3 (eel migration) and 11.2.6 in the Environmental Impact Assessment, as well as in this memo under heading 7 "Impact on migrating fish can be further highlighted (Swedish Environmental Protection Agency, HaV)".

The project's supply of thermal energy is negligible and has therefore not been covered in this Environmental Impact Assessment.

The project's supply of thermal energy is negligible and has therefore not been covered in this Environmental Impact Assessment.

4 APPENDICES

APPENDIX 1: Study of migrating bats at Södra Midsjöbanken, autumn 2012 - Ecocom AB 2013.

APPENDIX 2: Minutes and presentation material from the consultation meeting with the County Administrative Board in Kalmar, 22/10/2013

Södra Midsjöbanken Offshore Wind Farm

Documents translated for the ESBO consultation process (*)

Tab	Document
1	**Overview**
2	**Amendment II for SEZ application (20/12/2013)**
3	**Memo to amendment II (16/12/2013)**
4	**Appendix to Memo about migrating bats (Autumn 2012)**
5	**Memo to amendment I regarding EIA (5/9/2012)**
6	**Map to amendment I regarding development areas (5/9/2012)**
7	**SEZ application (17/2/2012) -extract regarding proposed conditions**
8	**EIA to SEZ application (31/1/2012)**
9	**Maps to EIA (31/1/2012)**
10	**Consultation Statement to SEZ application (31/1/2012)**

*) E.ON has engaged a professional company for the translation of selected application documents from Swedish to English, Polish, Estonian and Finnish . However , in case of any discrepancy or misleading formulation the Swedish version shall prevail.

ecocom

Study of migrating bats at Södra Midsjöbanken, autumn 2012

Impact assessment prior to establishment of wind farm

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PHOTOGRAPHY	Petra Bach, Amie Ringberg
REFERENCE	Ecocom AB 2013. Study of migrating bats at Södra Midsjöbanken, autumn 2012 – Impact assessment prior to establishment of wind farm.
FRONT COVER	Helicopter photo of the wind measurement platform at Södra Midsjöbanken. Photography: E.ON Vind Sverige AB
DECOR	View, close to the beach, looking towards land from the Baltic Sea. Photography: Ecocom AB.

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Assignment

Working in collaboration with Bach Freilandforschung, Ecocom AB has carried out a study of migrating bats at Södra Midsjöbanken at the request of E.ON Vind Sverige AB. The study constitutes supplementary data to an environmental impact assessment conducted in conjunction with the development of a planned wind farm with a maximum of 300 wind turbines.

The following individuals have participated in field work and/or the writing of the report: Alexander Eriksson, Petra Bach, Johnny de Jong, Lothar Bach and Amie Ringberg. A large number of people have also taken part in the sound analysis work, including Ingemar Ahlén and Ivo Niermann who, in addition to the individuals named above, have been of great help.

Purpose

The purpose of the study was to establish whether migrating bats cross the Baltic Sea, and if so whether they pass the planned wind farm at Södra Midsjöbanken

The study is the first of its kind in the Nordic region, where nothing was previously known about bat behaviour and migrations routes far out at sea. The purpose of the study has been to investigate the following questions:

- Which species of bats occur and with what frequency
- When during the season the migration begins, when the peak occurs and when the migrations finishes
- Whether migrating bats fly high or low

Background

About Södra Midsjöbanken

Södra Midsjöbanken is a shallow area in the southern Baltic Sea which used to be an island. The shallow area is located approximately 100 km southeast of the southern tip of Öland, at the boundary between the Swedish and Polish economic zones. On the Swedish side, the shallow area measures more than 300 km^2 and is between approx. 12 and 30 metres deep. The bedrock in the area is sedimentary, rising up as a level elevation which drops away relatively steeply towards lower levels. Above the bedrock are soil types in the form of glacial clay, moraine, post-glacial fine sand, post-glacial sand-gravel, glaciofluvial depots and mixed sediment.

Along with other shallow areas in the Baltic Sea, Södra Midsjöbanken is important for seabirds for much of the year, due to the rich occurrence of mussels (figure 1).

Figure 1. Location of the wind measurement tower on the platform at Södra Midsjöbanken.

The planned wind farm

The planned establishment comprises <300 wind turbines situated approximately 1,000 metres apart. The wind farm is expected to cover an area of approximately 326 km^2. The height of the wind turbines, including the rotors, is estimated to be around 200 metres.

Previous knowledge about migrating bats

It has long been known that bats migrate over long distances, thanks to ringing studies (Gerell 1987, Petersons 2004, Hutterer et al 2005). Bats from Sweden or the Baltic States can migrate to the Continent and winter in e.g. Germany and France (Petersons 2004, Gerell 1987). The extent to which the bats migrate varies from species to species. Species such as the common noctule, the lesser noctule, Nathusius' pipistrelle and the parti-coloured bat often migrate long distances, whereas species within the *Plecotus* (long-eared bats) and *Myotis* (e.g. whiskered bat) genuses are more stationary. In addition, a certain amount is known about which flight paths the bats choose. Bats gather in the autumn along cer-

Figure 2. The platform at Södra Midsjöbanken. Photography: Amie Ringberg, Ecocom.

tain flight routes, and whether the bats fly out over the sea can be studied at headlands, such as at Ottenby, Torhamns Udde, Falsterbo and Fehmarnbelt (Ahlén 1997, Ahlén et al 2009, Meyer 2011, Bach & Bach 2011, Bach et al 2013). Studies conducted from boats at sea, including from the west coast of Sweden, Öresund, Bornholm, the Kalmar Strait and Fehmarnbelt, as well as studies from Germany, confirm that bats do not only cross the sea, but also regularly fly out over the sea to hunt during early autumn (Ahlén 2009, Baagøe & Jensen 2007, Meyer 2011, Seebens et al 2013a, b). Migration over the North Sea is also known, as a result of bats having been found on drilling rigs (Stansfield 1966), exploration platforms (Hüppop et al 2005, Hüppop 2009, Hüppop & Hill 2013) and Helgoland (Vauk 1974). There have not been any previous studies from a platform in the middle of the Baltic Sea, although theoretical calculations for Nathusius' pipistrelles, which have been ringed in large numbers in Latvia, have shown that the most beneficial flight path from an energy perspective when migrating is to cross the Baltic Sea, roughly in the vicinity of Södra Midsjöbanken (Hedenström 2009).

Impact of wind power on bats

Onshore wind power can affect bats by destroying or impairing their habitat, or by the bats being killed in collisions with wind tur-

bines (Rodrigues et al, 2008). Over water, there is no risk of an impact on habitat. As there is also no potential for natural colonies at sea, disruption is also not a relevant factor. The factors that could affect bats at sea are the risk of collisions with the wind turbine's rotor blades when hunting or migrating, as well as possible disorientation (Cryan & Brown 2007) resulting in fatigue. It is also known that bats often investigate the area around the nacelle on the turbine, possibly looking for resting places or colony environments (Ahlén et al 2009).

It is now undisputed that bats are killed at wind turbines. Bats are killed both through direct collisions with the wind turbine's rotor blade, as well as because of sudden changes in pressure close to the rotor blade (Trapp et al, 2002; Baerwald et al, 2008). However, bats do not normally collide with fixed installations, such as overhead power lines and radio masts. The reason for bats colliding with wind turbines is probably that the high speed of the rotor blade means that the bats do not manage to detect it in time to take evasive action.

Not all bat species run the same risk of colliding with wind turbines. The risk of collisions is linked to the species' flight behaviour and the tendency to search for food by wind turbines (Rydell et al, 2011). The high-risk species include the *Nyctalus, Pipistrellus*, the *Vespertilio* and to some extent the *Eptesicus* genuses. Rydell et al (2011) consider the *Myotis* and *Plecotus* genuses to be low-risk species.

The majority of the surveys are in agreement that the absolute majority (approx. 90%) of bats that lose their lives at onshore wind turbines do so during August and September. A small peak in accident frequency (approx. 10%) has also been observed during May and June. (Rydell et al, 2011). Brinkmann et al (2011) have presented results that agree in part with this, but also that bats are killed at onshore wind turbines during other parts of the activity period. Both studies refer to onshore wind power, however. Out at sea, the risks should be highest during the spring and autumn migrations, i.e. April-May and August-October.

The weather has significant impact on the bats' activity at wind turbines. The highest level of activity and the most accidents occur at wind speeds lower than 4 m/s (Ahlén et al 2009). The level of activity declines with increasing wind speeds. Very few bats are killed at wind speeds above 8 m/s.

The height of the wind turbine also seems to be important as regards the number of collision victims. The taller the tower, the more bats are killed. This link appears to be exponential (Rydell et al, 2011). Another factor that affects the frequency of accidents is the rotor blade's sweep area, which often co-varies with increased tower height (Arnett et al, 2008, Barclay et al, 2007). However, the number of wind turbines in a wind farm is not considered to be of importance for the number of bats killed at each turbine.

Protection for bat fauna

Nineteen species of bats are found in Sweden. Six species are included on the Swedish red list from 2010, while four species are on the global red list (IUCN) from 2009. The fact that a species is red listed does not entail any formal protection, but only describes the species preservation status, i.e. the risk of the species disappearing from the Swedish fauna.

All bat species are protected by law under § 4 of the Species Protection Ordinance, which entails a general prohibition on intentionally catching, killing, injuring or disturbing the animals. The ban in the Species Protection Ordi-

nance also includes damage to the animals' habitats. Dispensation from the rules set out in § 4 of the Species Protection Ordinance must be applied for from the county administrative board in the county in question.

The Habitat Directive includes an agreement between the EU Member States regarding establishing special conservation areas to protect those species and habitats included in Annex II. Four Swedish bat species are included in this Annex: barbastelle, pond bat, greater mouse-eared bat and Bechstein's bat. Rydell et al (2011) propose that the establishment of wind farms be avoided in conservation areas for these four species, and that a buffer zone of approx. two kilometres be applied as a protective zone for the relevant conservation areas.

Sweden has also signed up to the European Bat Agreement, or EUROBATS. Guidelines as to how studies should be conducted at wind turbines according to the EUROBATS agreement have also been drawn up at a European level (Rodrigues et al, 2008). The agreement is far-reaching and also protects the bats' hunting environments.

Method

At Södra Midsjöbanken, bats have been registered through acoustic monitoring using two separate recording systems, Avisoft and Anabat.

The Avisoft system is a real-time system with full-spectrum resolution, which provides a high recording quality and hence a better opportunity for more accurate species identification. The system also makes it possible to store very large amounts

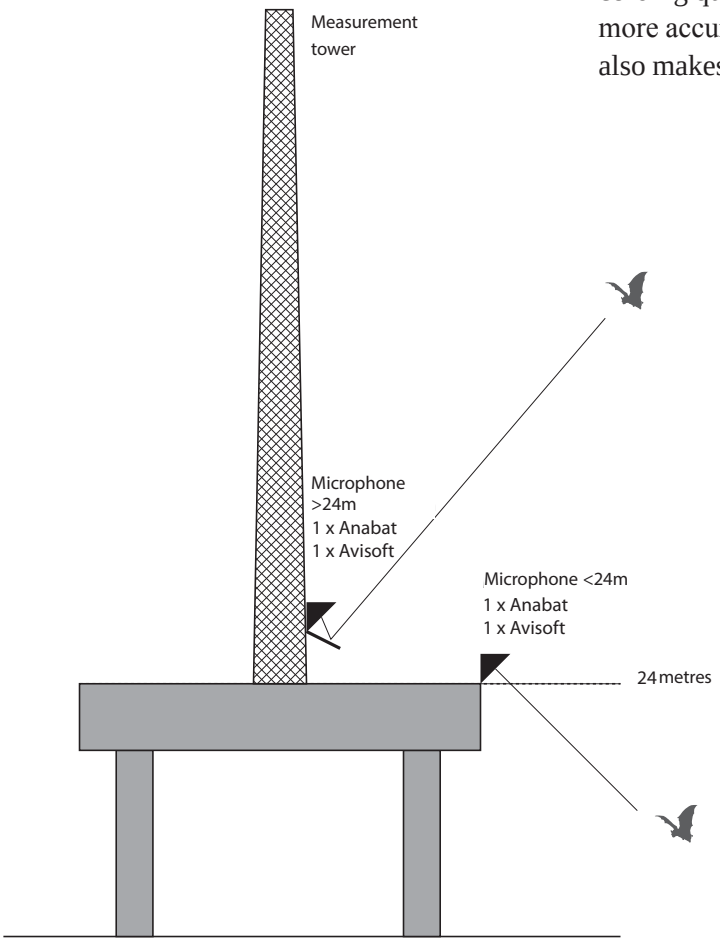

Figure 3. Outline diagram indicating the location of microphones on the measurement platform.

Table 1. Used systems and the microphones' recording areas, the active time period and the period during which the monitoring equipment has been turned on: Time (on) - Time (off). At other times, the equipment has been in sleep mode.

Unit	*Sys. type*	*Recording height*	*Start*	*Stop*	*Time (on)*	*Time (off)*
A	Avisoft	>24 m	12/09/2012	06/12/2012	15.30	08.30
B	Avisoft	<24 m	12/09/2012	24/09/2012	15.30	08.30
C	Anabat	>24 m	12/09/2012	23/01/2013	15.30	08.30
D	Anabat	<24 m	12/09/2012	23/01/2013	15.30	08.30

of data. However, it was difficult to predict how stable the Avisoft system would be under the prevailing conditions at the measurement tower. For this reason, a supplementary system was also used, Anabat, a frequency distribution system with a lower recording quality and limited memory capacity, but which is very stable, even in harsh weather conditions. The potential for species identification using this system is limited, however, which is one of the reasons for the supplementary Avisoft system having been used. The study has therefore built to some extent on redundant systems with the aim of safeguarding the gathering of data.

Each system, Anabat and Avisoft, was connected to two microphones (figures 4 and 5). One microphone was supplied with a reflector plate that screened of sound coming from below, but accepted sound from above. The other microphone was facing down and only accepted sound coming from below. (figure 3).

The relevant method was selected to facilitate comparisons of the number of recordings of bats at high (>24 m) and low (<24 m) heights.

The study was originally intended to begin in August, in order to allow monitoring of the bats' entire autumn migration period (August-October), but due to the weather conditions and logistics, it was not possible to put out the equipment until the middle of September. In reality, the study was conducted between 15 September and 6 December 2012 using the Avisoft system, which subsequently stopped working, although the Anabat system was active from the start until the equipment was taken down on 23 January 2013. All the units were set to record bat sounds during the interval 15.30–08.30.

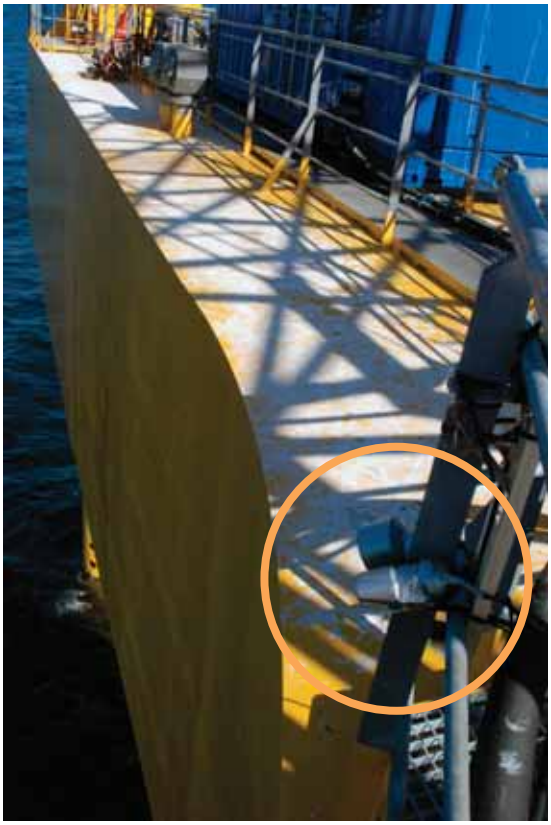

Figure 4. Picture of the Avisoft and Anabat microphones that have gathered sound from below, i.e. at a height of < 24 metres. Photography: Petra Bach.

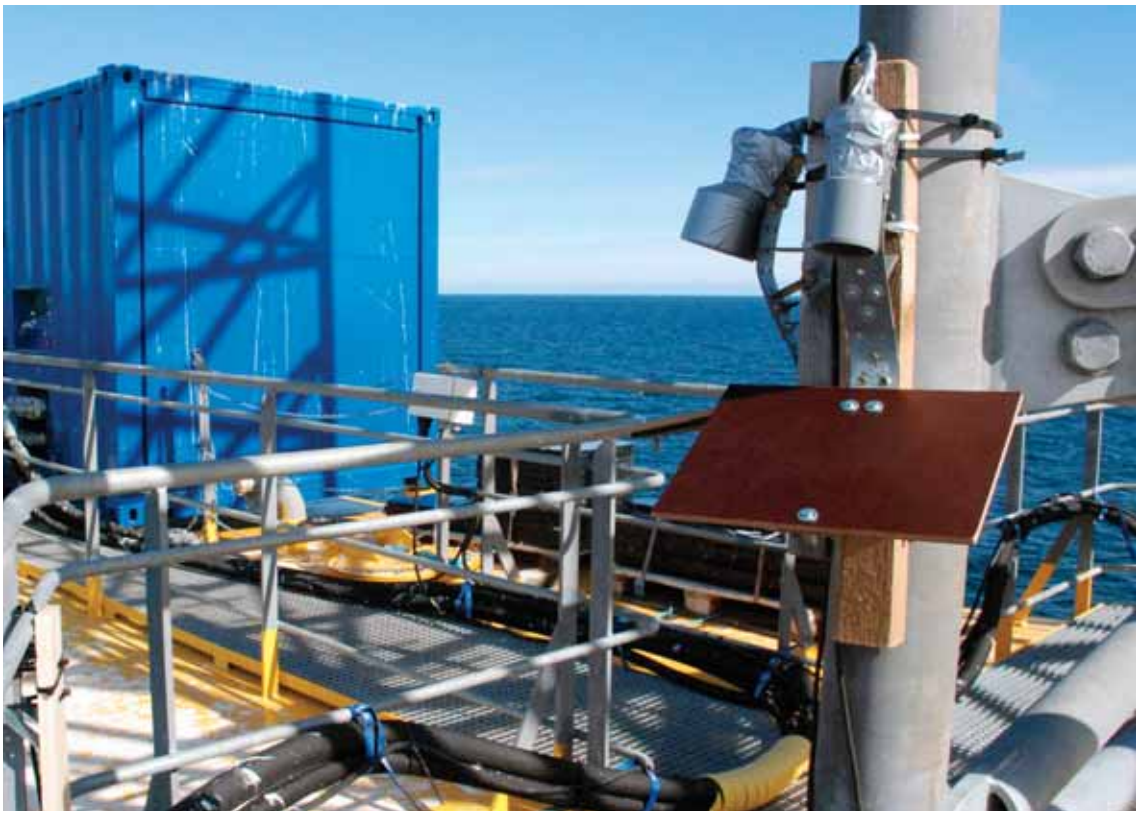

Figure 5. Microphones that gathered sound from above The sound bounces off the reflector plate into the microphone. This is a tried and tested technique. Photography: Petra Bach.

Results

Bat species found

Among the recorded sounds, there are 42 recordings of Nathusius' pipistrelle (*Pipistrellus nathusii*). The recorded sounds are very clear and there is no other species it could be confused with. It is striking that all the Nathusius' pipistrelles were registered at the start of the study period. According to previous studies, however, the species' migration starts as early as August. The study's final recording of Nathusius' pipistrelle was made at the beginning of October.

A number of recordings have been made of a species that is almost certain to be the parti-coloured bat (*Vespertilio murinus*).

In addition to the recordings of Nathusius' pipistrelles and parti-coloured bats, there are great many recordings where it has not been possible to identify the species, despite the fact that a number of experts from both Sweden and Germany had studied the sounds meticulously. However, there is agreement that the recordings are of the common noctule (*Nyctalus noctula*), the lesser noctule (*Nyctalus leisleri*), the parti-coloured bat (*Vespertilio murinus*), the serotine bat (*Eptesicus serotinus*) or the northern bat (*Eptesicus nilssonii*). It is most likely, however, that the majority of unidentified recordings are parti-coloured bats.

One recording has also been made of a species that is very reminiscent of a long-eared bat (*Plecotus* spec.) (Ahlén pers. comm.). This identification may be considered unsafe, how-

Table 2. Observations of bats in all systems and at investigated heights, as well as assessment of the number of individuals present. Recordings that have been judged to belong to the same individual have been marked in colour. For many of the recordings, it has not been possible to identify the species for certain, although they belong to one of the *Vespertilio*, *Nyctalus* or *Eptesicus* genuses. As the overall assessment is that these recordings are most probably of *Verspertilio murinus* (parti-coloured bats), the observations in the identification material from the Avisoft system have been marked with Vmur?. The potential to identify the species in the Anabat system is not as good due to the lower recording quality, and the identifications in this case have been restricted to the notation NVE (*Nyctalus*/*Vespertilio*/*Eptesicus*). However, it can be assumed that the same individuals have been noted at the same time in both systems. Abbreviations: Pnat = *Pipistrellus nathusii* – Nathusius' pipistrelle, Nlei = *Nyctalus leisleri* – lesser noctule, Nnoc = *Nyctalus noctula* – common noctule, P sp. = *Plecotus sp*. = Plecotus genus, i.e. either brown long-eared bat – *Plectotus auritus*, or grey long-eared bat – *Plecotus austriacus*. Nyctalus sp. = *Nyctalus* genus, i.e. either Nnoc or Nlei. *Eptesicus* sp. = *Eptesicus* genus, i.e. either *Eptesicus nilssonii* (northern bat) or *Eptesicus serotinus* (serotine bat).

Date	***Period***	***Species Anabat***		***Species Avisoft***		***Comments***
		>24 m	***<24 m***	***>24m***	***<24m***	
14/09/2012	06:00	Pnat				Individual 1 – definite species identification of Nathusius' pipistrelle
25/09/2012	05:55	Pnat				Individual 2 – definite species identification of Nathusius' pipistrelle
25/09/2012	05:55	Pnat				
25/09/2012	05:55	Pnat				
26/09/2012	06:00		Pnat			
26/09/2012	06:01		Pnat			
26/09/2012	06:01		Pnat			
26/09/2012	05.51			Pnat		
26/09/2012	05.51			Pnat		
26/09/2012	05.52			Pnat		
26/09/2012	05.52			Pnat		
01/10/2012	19:50	Pnat				Individual 3 – definite species identification of Nathusius' pipistrelle
01/10/2012	19:50	Pnat				
01/10/2012	19:50	Pnat				
01/10/2012	19:50	Pnat				
01/10/2012	19:51	Pnat				
01/10/2012	19:51	Pnat				
01/10/2012	19:52	Pnat				
01/10/2012	19:55		Pnat			
01/10/2012	19:56		Pnat			
01/10/2012	19:56		Pnat			
01/10/2012	19:56		Pnat			
01/10/2012	19:56		Pnat			
01/10/2012	19:57		Pnat			
01/10/2012	19:58		Pnat			
01/10/2012	19.46			Pnat		
01/10/2012	19.46			Pnat		
01/10/2012	19.46			Pnat		
01/10/2012	19.46			Pnat		
01/10/2012	19.46			Pnat		
01/10/2012	19.47			Pnat		
01/10/2012	19.47			Pnat		
01/10/2012	19.47			Pnat		

Date	*Period*	*Species Anabat*		*Species Avisoft*		*Comments*
		>24 m	*<24 m*	*>24m*	*<24m*	
01/10/2012	19.47			Pnat		
01/10/2012	19.47			Pnat		
01/10/2012	19.47			Pnat		
01/10/2012	19.47			Pnat		
01/10/2012	19.48			Pnat		
01/10/2012	19.48			Pnat		
01/10/2012	19.48			Pnat		
01/10/2012	19.48			Pnat		
01/10/2012	19.48			Pnat		
23/10/2012	21:53	NVE				Individual 4. Probably *Vespertilio murinus* (parti-coloured bat), although Nyctalus sp. or *Eptesicus* sp. also possible. One recording (at 21:53) has very strong similarities with *Plectous* sp., which is a phenomenon that can also occur among other species in the event of sharp manoeuvres (Presence of *Plecotus* sp. seems unlikely)
23/10/2012	21:55	NVE				
23/10/2012	21:56	NVE				
23/10/2012	21:56	NVE				
23/10/2012	21:57	NVE				
23/10/2012	21:58	NVE				
23/10/2012	21:58	NVE				
23/10/2012	21:59	NVE				
23/10/2012	22:02	NVE				
23/10/2012	22:03	NVE				
23/10/2012	21:59		NVE			
23/10/2012	22:00		NVE			
23/10/2012	22:04		NVE			
23/10/2012	22:04		NVE			
23/10/2012	22:05		NVE			
23/10/2012	22:07		NVE			
23/10/2012	22:09		NVE			
23/10/2012	21.48			Vmur?		
23/10/2012	21.48			Vmur?		
23/10/2012	21.48			Vmur?		
23/10/2012	21.48			Vmur?		
23/10/2012	21.50			Vmur?		
23/10/2012	21.50			Vmur?		
23/10/2012	21.50			Vmur?		
23/10/2012	21.50			Vmur?		
23/10/2012	21.50			Vmur?		
23/10/2012	21.50			Vmur?		
23/10/2012	21.51			Vmur?		
23/10/2012	21.51			Vmur?		
23/10/2012	21.51			Vmur?		

Date	*Period*	*Species Anabat*		*Species Avisoft*		*Comments*
		>24 m	*<24 m*	*>24m*	*<24m*	
23/10/2012	21.51			Vmur?		
23/10/2012	21.51			Vmur		
23/10/2012	21.51			Vmur?		
23/10/2012	21.52			Vmur?		
23/10/2012	21.52			Vmur?		
23/10/2012	21.52			Vmur?		
23/10/2012	21.53			Vmur?		
23/10/2012	21.53			Vmur?		
23/10/2012	21.54			Vmur?		
23/10/2012	21.54			Vmur?		
23/10/2012	21.54			Vmur?		
23/10/2012	21.54			Vmur?		
23/10/2012	21.54			Vmur?		
23/10/2012	21.54			Vmur?		
23/10/2012	21.54			Vmur?		
23/10/2012	21.54			Vmur?		
23/10/2012	21.56			Vmur?		
23/10/2012	21.56			Vmur?		
23/10/2012	21.56			Vmur		
23/10/2012	21.57			Vmur?		
23/10/2012	21.57			Vmur?		
23/10/2012	21.57			Vmur?		
23/10/2012	21.57			Vmur?		
23/10/2012	21.57			Vmur?		
23/10/2012	21.57			Vmur?		
23/10/2012	21.57			Vmur?		
23/10/2012	21.57			Vmur?		
23/10/2012	21.57			Vmur?		
23/10/2012	21.57			Vmur?		
23/10/2012	21.58			Vmur?		
23/10/2012	21.58			Vmur?		
23/10/2012	21.58			Vmur?		
23/10/2012	21.58			Vmur?		
23/10/2012	21.58			Vmur?		
09/11/2012	16:54		NVE			Individual 5. Probably *Vespertilio murinus* (parti-coloured bat), although *Nyctalus* sp. or *Eptesicus* sp. also possible.
09/11/2012	16.42			Vmur?		
09/11/2012	16.42			Vmur?		
09/11/2012	16.42			Vmur?		
09/11/2012	16.42			Vmur?		
09/11/2012	16.43			Vmur?		
09/11/2012	16.43			Vmur?		
09/11/2012	16.43			Vmur?		

ever, as the species is not known to move such long distances and it seems unlikely to find it so far out to sea.

Number of individuals and overall species assessment

It is normally impossible to see any difference between different individuals in recorded material. When assessing of the number of individuals, the simplest assumption to explain data is to work on the basis that observations close to each other in time belong to the same individual. This assumption is supported by the fact that the recordings are unclear, which suggests that the bats have been manoeuvring and flying around the mast. In the event of straight, purposeful flight, the bats normally "sing" out and the sound is clearer and more typical of the species.

Following a careful examination, it has been judged that the activity can be explained by the presence of two species (table 2).

Three individual Nathusius' pipistrelles (*Pipistrellus nathusii*). The first turned up on 14 September, the second individual was observed on 25-26 September and the third was recorded on 1 October.

Two individuals of an unidentified species were observed on 23 October and 9 November. Most of the evidence points to these being parti-coloured bats (*Vespertilio murinus*).

A third species may be a long-eared bat, although this seems unlikely. However, the sound is not of sufficiently good quality that a definite species identification can be made.

Behaviour

It is clear from the material that the bats do not avoid the measurement tower and that they do not continue their flight path unaffected. If that had been the case, the material ought to have shown only a few observations within the time period, and the recorded sounds ought to have been much more distinct and typical of the species. Most of the evidence indicates instead that the bats discover the mast at a longer distance and approach it in order to investigate or to rest. This explains the relatively large number of observations, gathered together, of what are probably the same species within a period of time. The recording times (time of day) in table 2 suggest that the majority of individuals remain at the measurement tower for approx. 2-10 minutes. They probably circle around during this period, possibly taking short rests. Recordings from both microphones suggest that they fly at heights both <24 metres and >24 metres over the sea.

Discussion

Several of the aims of the study have been achieved. The study has shown which species occur at Södra Midsjöbanken. As the study began later than intended, the full migration season has not been included, although information about the latter part of the migration season has been gathered. Bats that pass the studied location have been observed to fly at both low and high heights. Due to the low number of observations (assumed individuals), however, it has not been considered meaningful to analyse weather parameters.

The study has shown that bats cross the sea in conjunction with their migration southwards. This conclusion corresponds with earlier studies (Ahlén et al 2009), which have indicated a significant number of bats heading out from headlands during the late summer and autumn. When it comes to individuals migrating from the Baltic States, however, there

has previously been uncertainty regarding whether the bats really continue over the sea after heading out, or whether they turn off and follow the coast down to the Continent.

The number of bat observations at Södra Midsjöbanken is very small, however, which can be explained by the fact that the bats move across a broad front. The study does not provide support for the existence of specific migration routes, or at least there is no indication of such a migration route crossing Södra Midsjöbanken, but as the studies did not cover August and early September, such a migration route cannot be ruled out.

On the basis of current data, it is assessed that five individual bats of at least two different species have flown past the measurement tower at Södra Midsjöbanken. If we assume that observations at the wind mast correspond with the activity at a future wind turbine, and that the plan is to construct around 300 wind turbines, the total number of bats at risk of coming into contact with the wind farm would be 5 x 300 = 1,500 individuals during the study period. This figure must be considered a very rough estimate, however, although still the best that can be done at present. For the entire migration period, which also includes August and the early part of September, it is probable that the figure is significantly higher, as it can be assumed that the number of migrating individuals is much greater earlier in the season. Most studies show that the majority of the bats that migrate during the autumn do so from the middle of August to the middle of September (Ahlén et al 2009).

Most evidence also indicates that the bats stop at and investigate the measurement tower, and on this basis it can be assumed that the same will apply to the wind turbines. In conjunction with this behaviour, the bats risk being injured or killed by the wind turbines to a greater extent than if they had just flown by. There is also some support for the theory that, on calm nights, bats stop and hunt the insects that accumulate in locations that are protected from the wind, e.g. behind wind turbines (Ahlén et al 2009).

A large wind farm could thereby act as a barrier, despite being situated in the middle of the sea and not adjacent to clear migration routes.

The bats that have migrated down to Germany and Poland during the autumn, and from there further south on occasions, return in the spring to their reproduction areas in Sweden or the Baltic States. It is likely that the bats follow the same route as when migrating to the south, although there is no definite support for this assumption. If the bats should return by the same route, this probably means that the same number of bats (at least 1,500) would return during the spring and run the same risk of being killed or injured by the wind turbines as during the autumn. The bats that have been observed also belong to species that are known to be at risk of collisions (Rydell et al 2011). None of the observed bats are on the red list, however. All bat species are, however, included on the Habitat Directive's Annex IV.

The Nathusius' pipistrelle is a known migrant, and experiences from studies on the Continent show that the species normally moves in large numbers during the middle of August and the first half of September (Bach et al 2013, Petersons 2004, Seebens 2013a,b). As the study did not commence until 12 September, it is consequently probable that individuals that migrate early have not been registered within the framework of the conducted study. It is thereby also probable that the actual number of individuals that have flown past

Södra Midsjöbanken is greater for e.g. Nathusius' pipistrelles than has been measured in this study.

Parti-coloured bats are also known for migrating long distances, and the possibility of this species crossing the Baltic Sea during the relevant period is in accordance with previous theories, including ringing recoveries.

Risk-reducing measures

The risk of bats colliding with wind turbines can be significantly reduced by the turbines being turned off during certain periods. The turbines only need to be turned off at night and for a limited part of the year. (Rydell et al 2011). Turning off the wind turbines at wind speeds from 4–6.5 m/s has been shown in several studies to reduce accident frequency by as much as 70-90%. The annual loss of energy in this event was 0.3–1%. Temporarily turning off the wind turbines is estimated by Rydell et al (2011) to almost completely eliminate the risk of collisions if the starting wind (i.e. the wind strength at which the turbine starts producing electricity) is set at 6 m/s and the rotor blades are braked at lower wind speeds.

Conclusions

The study of bats at Södra Midsjöbanken has shown that migrating bats occur even in remote sea areas. This is an anticipated result, although the current study has confirmed this empirically for the first time in the Baltic Sea.

The number of passing bats has been roughly estimated at a minimum of 1,500 during the investigation period, although the number is probably significantly higher during the autumn as a whole, as this investigation did not cover the period from August to the middle of September. It is also reasonable to assume that approximately the same number of bats that pass southwards in the autumn also return northwards in the spring.

The fact that the bats stop and investigate the wind turbines creates an accentuated risk situation compared to if the bats were simply to pass by.

In conclusion, we consider that the inventory data is insufficient to perform a secure risk assessment. One option for gaining a better understanding of the risks is to carry out an extended inventory. However, it is not certain that the gathered data from extended inventories prior to establishment will be sufficient to forecast the wind farm's effects on the bat fauna. For this reason, it is recommended that the construction of the wind farm should be permitted, but that effects should be followed up within the framework of a monitoring programme. In order to facilitate comparisons with the zero alternative in the control programme, investigations should also be carried out during both the spring migration and the autumn migration, prior to the establishment of the wind farm.

If the level of bat activity observed in the control programme should be so great that there is a risk of major effects on the bat fauna, the potential exists to perform risk-reducing measures in the form of stop regulation.


ecocom

Södra Midsjöbanken Offshore Wind Farm

Documents translated for the ESBO consultation process (*)

Tab	Document
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APPENDIX 1 TO SUPPLEMENT TO THE APPLICATION, SEZ

E.ON VIND SVERIGE AB

SÖDRA MIDSJÖBANKEN

MALMÖ, 05/09/2012

Contents

1 Regarding the conclusion that long-tailed ducks to a lesser extent avoid wind farms with a greater distance between the turbines etc. (County Administrative Board in Kalmar)

The calculation (Environmental Impact Assessment, section 14.2.2) of the possible number of dislocated long-tailed ducks is based on the results from the following up of Nysted wind farm *(Final results of bird studies at the offshore wind farms at Nysted and Horns Rev, Denmark NERI Report Commissioned by DONG energy and Vattenfall A/S, 2006, Figure 90, s 81)* as well as the Nordic Council of Ministers' seabird assessment (*Nordic Council of Ministers (2011) Waterbird Populations and Pressures in the Baltic Sea, TemaNord 2011:550*).

At Nysted, the frequency of long-tailed ducks observed within the wind farm during the operating period fell by 90% compared to before the farm was commissioned (*NERI Report, 2006*).

According to the Nordic Council of Ministers (2011), the density of long-tailed ducks at the Midsjö banks was > 75 individuals per km^2 (similar densities were reported by Durinck et al 1994). For the calculation of the number of dislocated birds from Södra Midsjöbanken, the figure of 75 individuals per km^2 (the lower limit in the highest range, Nordic Council of Ministers, 2011) has been multiplied by 0.9 (based on the *NERI Report, 2006)*.

In nature, individuals normally spread out spatially in relation to a resource, such that the density of individuals is higher where the resources are richer. The Midsjö banks have high densities of wintering long-tailed ducks due to the abundant availability of the staple food, blue mussels. The density of wintering long-tailed ducks at Nysted wind farm is lower than at the Midsjö banks, probably due to the poorer supply of food there. According to ecological literature, when there are declining populations, habitats with poorer resources (marginal habitats) are abandoned first and richer habitats (core habitats) later.

Based on the hypotheses 1) that the Midsjö banks are a core habitat and Nysted is a marginal habitat, and 2) that the greater distance between the turbines compared to Rödsand (1,000 m and 500 m respectively) could mean that the *stimuli* that cause the long-tailed ducks to avoid the wind farm are weaker at Södra Midsjöbanken compared to Nysted, the assumption was formulated in the Environmental Impact Assessment that long-tailed ducks may avoid Södra Midsjöbanken to a lesser extent than at Nysted. In this case, this would mean that the dislocation factor of 0.9 is too negative an assumption.

For the calculation of the possible number of dislocated long-tailed ducks presented in the Environmental Impact Assessment, the dislocation factor of 0.9 was applied despite the fact that both of these hypotheses argue for a factor of 0.9 being too negative an assumption.

If the above hypothesis regarding the distance between the turbines could be confirmed through the control programme for Södra Midsjöbanken, this would be of great positive significance for the impact assessment regarding wind farms in the Baltic Sea. The control programme should therefore focus in part on this question. The programme's details should be formulated in consultation with the supervisory authority and experts.

2 The wind turbines' effects on marine life and birds – reports that may be relevant for this establishment (Swedish Energy Agency)

The knowledge compilations within the framework of Vindval[1] , which were not available at the time of the work on the Environmental Impact Assessment for Södra Midsjöbanken, have demonstrated some, barely significant effects of wind turbines on migrating birds and marine life, which are in line with the conclusions from Södra Midsjöbanken's Environmental Impact Assessment.

3 Lack of data for assessing the impact on the large mussel bank in the area (HaV)

The threat to the mussels can comprise sedimented or suspended particles, cable trenches and the area that is taken up by the wind turbines' foundations (see sections 7.5 & 8.3.2). Sediment levels and sediment accumulations will be relatively short-term and very localised. The total bottom surface that is utilised constitutes < 1% of the wind farm's area. Based on these facts, it is concluded that the impact on the mussel bank will be insignificant. Indirect adverse effects on organisms that have mussels as their food base (primarily long-tailed ducks and other diving ducks) are not anticipated, in any case not to any appreciable extent.

4 Occurrence of porpoises (Swedish Environmental Protection Agency, County Administrative Board in Blekinge County)

The Södra Midsjöbanken project has been in contact with the SAMBAH project on 23 September 2011. No results were available at this time. Information about the presence of porpoises in the Environmental Impact Assessment (8.6, 14.4) has been obtained in part from HELCOM's website, which was recommended by Julia Carlström (project manager for the SAMBAH project).

The Environmental Impact Assessment reports some 10 porpoise observations within 100 km of Södra Midsjöbanken. The basis for the Environmental Impact Assessment's estimate of the presence of porpoises is presented in section 8.6.1. Other assessments of porpoises are well founded in literature studies from the following up of Horns Rev and Nysted. The Environmental Impact Assessment has not assumed that there are no porpoises in the area, merely related facts about the presence of porpoises in the Baltic Sea.

[1] Vindval is a national Swedish research programme studying the effects of wind power on the environment.

In renewed contacts with Julia Carlström by e-mail in July and August 2012, there are still no published results from SAMBAH, although the following information has been obtained:

Quote

"SAMBAH's field period is in full swing, and porpoise clicks are being registered in several participating countries. It is still too early to say anything about porpoise densities, as we need to analyse data from two full years, but so far we can say that the method is working and that there are porpoises within the study area."

End quote

SAMBAH's study area covers the whole of the southern Baltic Sea, and the details set out above therefore provide no specific information about the presence of porpoises in and around Södra Midsjöbanken. In the same dialogue, Julia Carlström agrees with our conclusion that porpoises can co-exist with wind farms during the operating period.

We consider that there is insufficient evidence for the presence of porpoises at Södra Midsjöbanken for it to be meaningful (and reasonable with regard to environmental benefit) to completely refrain from the construction work during the reproduction period. However, it is reasonable for noisy work to increase gradually at the start, so that any porpoises present have the opportunity to move out of the danger zone.

5 Questions about underwater noise can be further highlighted (Swedish Environmental Protection Agency, HaV)

In Vindval's report 6485, "Effekter av en havsbaserad vindkraftpark på fördelningen av bottennära fisk - En studie vid Lillgrunds vindkraftpark i Öresund" ("Effects of an offshore wind farm on the distribution of benthic fish - A study of Lillgrund wind farm in Öresund"), January 2012, the following was stated regarding the effects of noise on fish: "The relatively strong links that were noted between the number of fish and the distance to wind turbines for a number of fish species suggest that the wind turbines in the first instance attract fish, and that any adverse effects on the presence of fish, caused for example by electromagnetic fields or the external noise environment, are probably of minor significance in the context."

In Vindval's report 6481 "Effekter av havsbaserad vindkraft på pelagisk fisk" ("Effects of offshore wind power on pelagic fish"), February 2012, no clear and significant adverse effects from noise on pelagic fish were demonstrated.

In Vindval's report 6436 "Ljud från vindkraftverk i havet och dess påverkan på fisk" ("Noise from offshore wind turbines and its impact on fish"), July 2011, it is noted that it is only within around 100 metres of a turbine and at high wind speeds that the noise levels are sufficiently high for there to be a risk of fish being adversely affected, in the form of escape behaviour or possible masking of communication. There is currently nothing to indicate that just because the noise is audible, this will be associated with any negative consequences for the fish at population level.

In Vindval's report 6488 "Vindkraftens effekter på marint liv - En syntesrapport" ("Effects of wind power on marine life - A synthesis report"), March 2012, adverse effects due to noise from piling work are observed.

Cod and herring can potentially perceive sound from piling work at a distance of 80 kilometres. Physical damage and death can occur a few metres from the construction site. During all types of work that entail noise, escape reactions among fish can be expected within a distance of around a kilometre from the source.

"Among marine mammals, porpoises are the species that have been shown to suffer both impaired hearing and disturbed behaviour due to noise in conjunction with piling."

However, the Environmental Impact Assessment for Södra Midsjöbanken cites follow-up results from the Danish wind farms at Horns Rev and Nysted (section 8.6.2) showing that porpoises that avoid the farm area during the construction work return within a few hours and that they also remain in the farm area during the operating period.

Vindval's report 6488 also observes that there are no studies to indicate long-term adverse effects on any of Sweden's seal species.

6 The impact on migrating fish can be further highlighted (Swedish Environmental Protection Agency, HaV)

In Vindval's report 6479 "Blankålsvandring, vindkraft och växelströmsfält, 2011" ("Silver eel migration, wind power and alternating current fields, 2011"), February 2012, it is observed that neither Lillgrund wind farm in Öresund nor the alternating current cable across Kalmar Strait constituted definitive obstacles to migration. A certain delay effect (< 1 h) could be observed at the Kalmar Strait, and deviating behaviour on the part of certain individuals could be observed at Lillgrund.

In Vindval's report 6488 "Vindkraftens effekter på marint liv - En syntesrapport" ("Wind power's effects on marine life - A synthesis report"), March 2012, it is observed e.g. that during the operating phase, the cables from a wind turbine generate a magnetic field that diminishes as the distance from the cable increases. The anticipated effect on most fish species is low, but as the impact continues throughout the operating phase, the risk should be considered in areas that are of significance for migrating fish species. In the Environmental Impact Assessment (section 8.4.2), an assessment is made of the farm's effects and consequences for migrating fish species at Södra Midsjöbanken, which is not considered to constitute an area of particular importance for sensitive migrating fish species.

7 Conclusion regarding the conditions for a good environmental status according to EU decision 2010/477 (Kammarkollegiet)

On the basis of the Environmental Impact Assessment and this supplement, the conclusion that the project will not affect the conditions for a good environmental status is supported below, based on criteria in the EU decision 2010/477/EU – part B.

Descriptor 1: Biological diversity is maintained. The quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climate conditions.

The impact on e.g. the area's marine organisms has been described in the various sections of the Environmental Impact Assessment as well as background reports (Table 1).

Table 1 Reference to the section in the Environmental Impact Assessment that deals with the impact on biological diversity

Ecosystem components	**Environmental Impact Assessment section**	**Enclosed background report**
Water quality and hydrography	8.2	Folder 2, Tab 6
Bottom flora and fauna etc.	8.3	
The fish community	8.4, 14.1	Folder 2, Tab 11
Marine mammals	8.6	
Birds	8.7, 14.2	Folder 2, Tab 8
		Folder 2, Tab 17
		Folder 2, Tab 18
Bats	8.8, 14.3	Folder 2, Tab 9
		Folder 2, Tab 10

From this it can be seen how biological diversity is affected, and that the extent of the adverse effect is small.

Descriptor 2: Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystem.

Södra Midsjöbanken is situated between heavily trafficked shipping routes and fishing waters. The wind power operation (construction, operation, maintenance and decommissioning) is not considered to contribute to or alter the occurrence of non-indigenous species. It can be observed (Environmental Impact Assessment section 8.3.1) that the brackish water hydroid *Cordylophora caspia*, which migrated into the area in the 19th Century, is common at Södra Midsjöbanken and elsewhere in the Baltic Sea.

Descriptor 3: Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock.

Knowledge about and conclusions regarding the impact on the area's commercially exploited fish can be seen, as far as is relevant for the project, from the Environmental Impact Assessment, sections 8.4 and 14.1, as well as from the enclosed background report, Folder 2, Tab 11. The project does not contribute to the over-exploitation of fish and shellfish populations.

Descriptor 4: All elements of the marine food webs, to the extent that they are known, occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species and the retention of their full reproductive capacity.

The Environmental Impact Assessment presents, as far as possible and as far as is known, the project's impact in relation to descriptor 4 (see e.g. Environmental Impact Assessment sections 14.2.1 & Table 1 above), for example through the fact that the impact on organisms from various trophic levels has been described and assessed. The project will not affect the marine food webs' energy flows or structure to a significant extent.

Descriptor 5: Human-induced eutrophication is minimised, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algal blooms and oxygen deficiency in bottom waters.

The project will not contribute to eutrophication. This matter has been deemed to be of low relevance for the project. However, the matter has been covered in section 11.2.7.

Descriptor 6: Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected.

It can be seen from the Environmental Impact Assessment (section 8.3.2) that the project's installations affect < 1% of the sea-floor area within the overall wind farm area. This is not considered to constitute a significant threat to the structure and functions of the ecosystems.

Descriptor 7: Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems.

It can be seen from section 8.2 of the Environmental Impact Assessment that the project does not affect the hydrographical conditions for the marine ecosystems.

Descriptor 8: Concentrations of contaminants are at levels not giving rise to pollution effects.

The project does not affect the concentration of contaminants. This can be seen from section 11.2.4 as well as Chapter 12, paragraph 6.

Descriptor 9: Contaminants in fish and other seafood for human consumption do not exceed levels established by Community legislation or other relevant standards.

The project does not affect contaminants in fish and shellfish. The matter has not been deemed to be relevant for the project's Environmental Impact Assessment.

Descriptor 10: Properties and quantities of marine litter do not cause harm to the coastal and marine environment.

It can be seen from the Environmental Impact Assessment, section 12, in particular paragraphs 6 & 8, how the project will restrict marine litter.

Descriptor 11: Introduction of energy, including underwater noise, is at a level that does not adversely affect the marine environment.

Noise is covered in section 7.4 in the Environmental Impact Assessment, as well as in this supplement memo under the heading "Questions about underwater noise can be further highlighted (Swedish Environmental Protection Agency, HaV)".

Electromagnetic radiation is covered in sections 8.4.2 paragraph 3 (eel migration) and 11.2.6 in the Environmental Impact Assessment, as well as in this memo under heading 7 "Impact on migrating fish can be further highlighted (Swedish Environmental Protection Agency, HaV)".

The project's supply of thermal energy is negligible and has therefore not been covered in this Environmental Impact Assessment.

Södra Midsjöbanken Offshore Wind Farm

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Tab	Document
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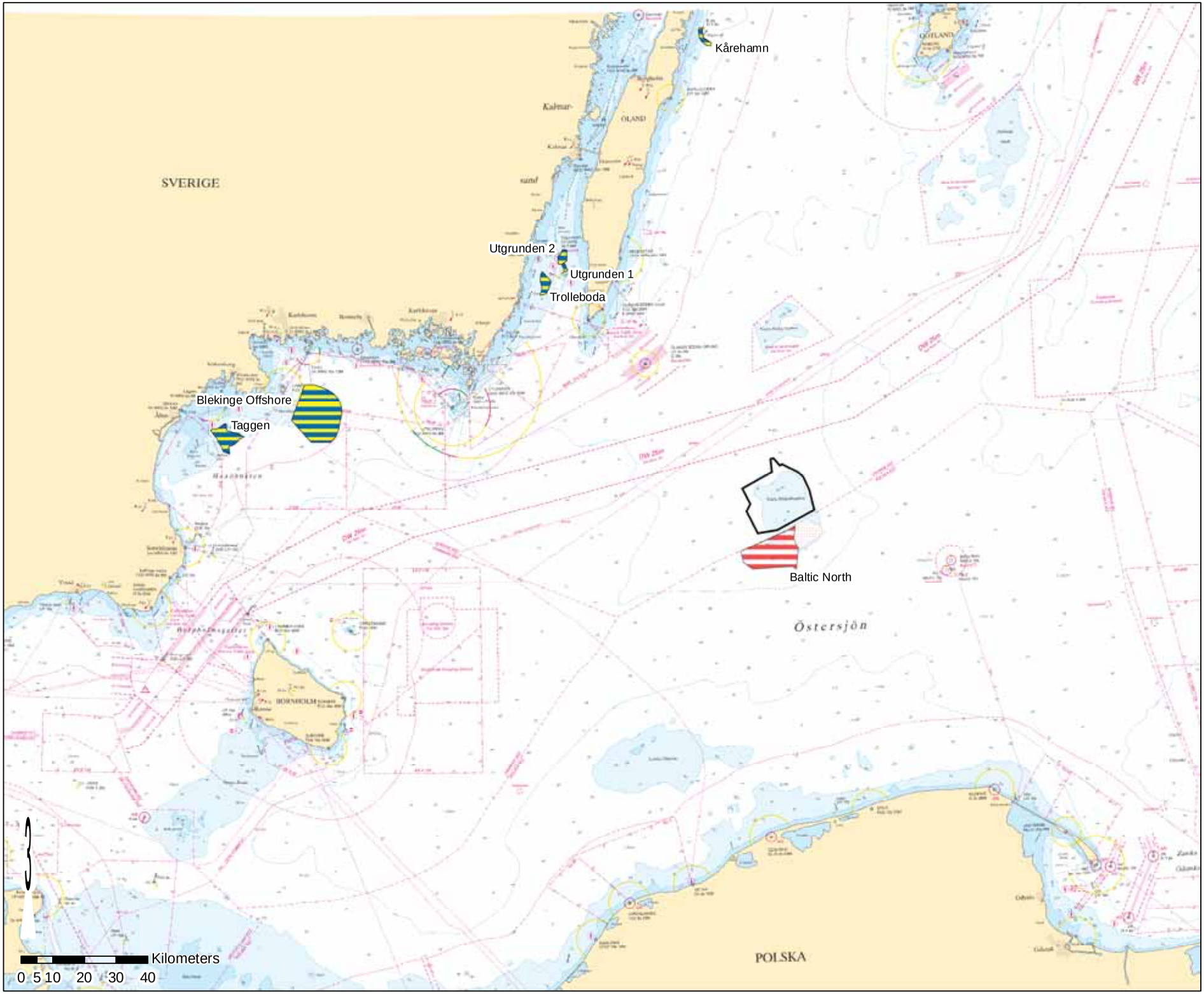
Wind farm
Södra Midsjöbanken

Establishment areas with possible cumulative effect



Explanation of symbols
(Possible wind farms etc.)

- Boundary of the Södra Midsjöbanken wind farm
- Area of interest for sand and gravel extraction
- Sweden
- Poland

Drawing name: SMB-120829-BPL
2012-09-05

SWECO

Södra Midsjöbanken Offshore Wind Farm

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Government
Ministry of Environment

APPLICATION FOR PERMIT ACCORDING TO THE LAW FOR THE SWEDISH ECONOMICAL ZONE (SEZ)

Applicant: E.ON Vind Sverige AB, org. nr 556294-9817
205 09 Malmö

Proxy: Attorney Bo Hansson and jur. cand. Sofia Nilsson
Mannheimer Swartling Advokatbyrå AB
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203 14 Malmö
Tfn: 040-698 58 00
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E-post: bha@msa.se och soni@msa.se

Issue: Permit according to the law (1992:1140) regarding the Swedish Economocal Zone for construction and operation of an offshore windfarm at Sodra Midsjobanken

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Extract from initial permit application.

Only proposed permit conditions translated

- Eventuella sprängningsarbeten kommer att föregås av skrämselljud eller motsvarande. Pålning kommer vid behov utföras så att slagkraften ökas gradvis.
- Störningar som leder till påvisbara förluster för yrkesfisket kommer att kompenseras.
- För att minimera risken för fartygskollisioner kommer E.ON Vind att verka för att en säkerhetszon inrättas runt varje vindkraftverk.

7. Proposed conditions

E.ON Vind proposes that the Government prescribes the following conditions for the permit.

1. Unless otherwise specified in the conditions below, the laying of underwater cables and the dredging work for foundations must primarily be carried out in accordance with that which E.ON Vind has finally undertaken in the application and the case in other respects. Minor alterations to the execution make be made, provided this does not increase the average sediment spill within the wind farm, does not increase the permanent encroachment that the installations entail, and does not damage public or private interests.
2. The total height of the wind turbines may not exceed 200 m above the average water level.
3. Work in the water must be carried out in a way that minimises turbidity.
4. Sediment spill during dredging may not exceed 5 per cent of the dredged volume. Dredged material must be reused to cover underwater cables within the farm.
5. The project must assist in the relocation of the Armed Forces' affected equipment.

6. The construction work must be carried out in such a way that the progress of shipping is not obstructed.

7. Blasting may only be conducted in exceptional cases and following consultation with e.g. the supervisory authority.

8. In the production of the foundations, the proportion of natural gravel may not exceed 20 per cent of the total gravel volume.

9. Sanitary wastewater that arises during the construction phase must be dealt with and handled in a manner that is approved by the supervisory authority.

10. Diesel engines that are used during the work must be powered by low-sulphur oil.

11. At workplaces, the potential to deal with waste and residual products must be created.

12. Prior to the construction phase, more meticulous and precise investigations will be carried out to protect underwater remains in the area. Finds will be reported in order that the necessary measures can be taken in consultation with the responsible authorities.

13. For the operation, there must be a control programme that covers the construction, operating and phasing out periods. The control programme, which will be drawn up in consultation with the supervisory authority, must include e.g. checking the impact that seabed cables and the wind farm's permanent installations have on flora and fauna, including reef effects.

14. When discontinuing the operation, restoration measures must be implemented. The operation will be considered to have been discontinued when no electricity production has been conducted for a continuous period of one year. The supervisory authority may decide on the extent to which the group station's installations, including foundations, must be removed, as well as what other measures are required to restore the seabed as close to its original condition as possible. The operator must pledge security for the cost

of demolition and restoration measures, as well as for any necessary hydrographic surveys in conjunction with discontinuing the operation. The pledged security must amount to SEK 1.5 million per installed wind turbine at 2012 price levels.

8. Tillåtlighet

8.1 Tillåtlighet enligt 2 kap. miljöbalken

8.1.1 Kunskapskravet

E.ON Vind har, som redovisats under avsnitt 1.1 ovan, en betydande erfarenhet av projektering samt drift av vindkraftparker till havs. E.ON Vind besitter den kunskap som behövs för att uppföra och driva den aktuella verksamheten och vidta de åtgärder som omfattas av bolagets yrkanden, allt för att i möjligaste mån skydda människors hälsa och miljön mot skada eller olägenhet. Utöver upprättad miljökonsekvensbeskrivning har det inom ramen för detta projekt gjorts naturvärdesinventeringar och andra undersökningar. E.ON Vind har för detta knutit ett flertal externa konsulter till projektet med viktiga specialkunskaper för just de unika förhållanden som råder vid Södra Midsjöbanken. Mot bakgrund härav får det anses uppenbart att kunskapskravet innehålles.

8.1.2 Försiktighetsprincipen och bästa möjliga teknik

Vindkraft till havs byggs nu i stor skala i Danmark, Storbritannien och Tyskland. De erfarenheter som hittills vunnits visar att vindkraft till havs uppvisar relativt sett blygsamma miljökonsekvenser. Genom lokalisering utanför territorialhavet undviks dessutom sådana olägenheter som sakägare brukar befara vid tillståndsprövningar rörande landbaserad vindkraft.

I Sverige byggs lite havsbaserad vindkraft jämfört med vad som sker i de tre nämnda länderna. Regeringen har vid två tillfällen medgivit tillstånd till vindkraftprojekt i Sveriges ekonomiska zon men inget av dessa projekt förefaller i nuläget komma att förverkligas. Samverkan innebär i regel

Södra Midsjöbanken Offshore Wind Farm

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ENVIRONMENTAL IMPACT ASSESSMENT

Södra Midsjöbanken

associated with the application for a permit, according to the Continental Shelf Act and Sweden's Economic Zone Act, to establish a wind farm at Södra Midsjöbanken, including the laying of cables, the construction of transformer installations, etc.

Extract from the Environmental Impact Assessment
Only chapter 2, 3, 4 and 14 translated

Malmö, 31/01/2012

Appendices

1. Map showing Areas of national interest for wind usage and fishing, fairways, etc.
2. Map showing the Natura 2000 areas and BSPA areas, etc.
3. The areas such as planning interests, which can contribute to cumulative effects

1 Administrative information

E.ON Vind Sverige AB (E.ON Vind) is responsible for the E.ON Group's planning and development of wind power in the Nordic region. The company currently has 122 wind turbines in operation in the Nordic region (October 2011), with a combined output of approximately 255 MW.

In August 2010, E.ON Vind completed an offshore wind farm in Denmark, called Rödsand 2, which comprises 90 wind turbines and is estimated to produce approximately 900 GWh per year. During 2011, four onshore facilities were completed in Sweden. A further 5 installations are in the construction phase at the start of 2012, including one offshore facility, Kårehamnsporten, northeast of Öland.

Name of the facility:	Södra Midsjöbanken Wind Farm
Applicant/principal:	E.ON Vind Sverige AB
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2 Summary

The Södra Midsjöbanken project refers to a wind farm comprising a maximum of 300 wind turbines with a maximum height of < 200 m including rotor. Each individual wind turbine will have an output of between 3.6 MW and 7 MW. The farm will cover an area of approx. 326 km2. In addition there will be a safety zone around the farm with a width of 500 m. Including the safety zone, the farm will have an area of 364 km2. The wind turbines are positioned in rows approx. 1,250 m apart. Within each row, the wind turbines are positioned at intervals of approx. 1,000 m. The turbines' foundations will be installed at depths ranging from around 12 m up to approximately 28 m.

The farm is located at Södra Midsjöbanken, approximately 70 km from the southern tip of Öland, approximately 90 km from the Torhamn´s point in Blekinge County, and approximately 90 km from the Polish coast. The main reason for the location is the fact that the water depth is sufficiently shallow for the cost of laying the foundations to be reasonable, yet at the same time the distance from the coast is sufficiently large for the project to be acceptable with regard to the visual impact and the impact on other public interests in the coastal area. Furthermore, the farm was positioned adjacent to the planned DC cable for the transfer of electricity between the Baltic States and Sweden (NordBalt). NordBalt is expected to be realised irrespective of the wind farm. The possibility of connecting the wind farm to NordBalt entails significant cost and environmental benefits for a location at Södra Midsjöbanken rather than other possible offshore banks.

At and in the vicinity of Södra Midsjöbanken there are relatively extensive natural values and strong commercial fishing interests. The combined permanent encroachment on the seabed in terms of area is < 1% of the surface of the area.

During the construction period, boats will be excluded from the area in two or three stages, which will make fishing and shipping in the area impossible. Small-scale, temporary disruptions may occur during the construction period and, to a certain extent, during the phasing out of the wind farm, primarily as a result of a small amount of sediment spill and noise from piling.

During the operating period, no significant adverse effects are anticipated on bottom flora and fauna, marine mammals, bats, migrating birds, archaeological remains or the fish community, either at the bank or in nearby sea areas. In addition, no significant adverse effects are expected in areas that are protected according to the Natura 2000 regulations or in other protected natural areas.

However, it is not possible to rule out the possibility of Södra Midsjöbanken diminishing in importance as a wintering location for some seabird species, of which the long-tailed duck is the most concentrated on just a few offshore banks. The long-tailed duck and other seabirds also winter in large numbers on other offshore banks in shallow areas closer to the shore. The exploitation of Södra Midsjöbanken is not expected to have any significant impact on bird populations. However, the effects are expected to be sufficiently great to

be able to affect the assessment of the cumulative impact of future wind farm establishments on offshore banks and nearby coastal areas.

Commercial fishing is conducted at Södra Midsjöbanken to a large extent using fixed equipment, and this could be conducted within the wind farm, at least theoretically. Large-scale fishing with trawls, which requires greater room to manoeuvre, will be made more difficult or impossible in the wind farm. The impact on commercial fishing is dependent on the extent to which fishing boat traffic is permitted, and if so, how the wind turbines affect the fishing boats' ability to navigate. E.ON Vind Sverige AB will apply for all marine traffic that is not related to the wind farm to be excluded from the farm.

Proposed measures of precaution include among other things scaring off seals and porpoises, if necessary, prior to particularly noisy work. Furthermore, considerable importance is attached to maritime safety (see Technical Description), environmental management during the construction period and recycling when phasing out the farm 25 to 30 years after its establishment.

A control programme is proposed regarding the impact on seabed flora and fauna, marine mammals, bats, the impact on bird life including on migrating birds, fish and fishing, archaeological remains and navigation risks.

3 Background and purpose

3.1 Background

The current planning framework for wind power in Sweden means that location plans for wind power corresponding to 30 TWh annual production by 2020 must be established, of which 20 TWh will be on land and 10 TWh at sea (in water areas) [22]. The municipalities are responsible for overview planning of coastal waters within Sweden's territorial boundary (see appendices 1 & 2) out to 12 nautical miles from the baseline.

E.ON Vind has, on business administration grounds, judged that the establishment of a large wind farm at Södra Midsjöbanken is a good long-term investment, providing the company with added value in the form of goodwill through the association with renewable energy and with long-term sustainable development. In addition, the operation will provide socio-economic benefits, for example as the construction, operation, maintenance and finally phasing out of the wind farm will create job opportunities, contribute to a sustainable energy supply and aid knowledge development in the field of offshore wind energy.

The Södra Midsjöbanken project will connect the farm to NordBalt, a planned DC cable between Sweden and Lithuania. This connection option entails major cost and environmental benefits for the farm in question at Södra Midsjöbanken, compared to a location at other possible offshore banks.

Against this background, E.ON Vind has decided to apply for a permit according to the Continental Shelf Act and Sweden's Economic Zone Act to establish and run a wind farm at Södra Midsjöbanken, as well as to lay the necessary cables between the turbines and from the wind farm to the NordBalt cable. In order to obtain a permit, an environmental impact assessment is required according to the Environmental Code.

This Environmental Impact Assessment associated with this application, according to the Continental Shelf Act and Sweden's Economic Zone Act, covers the wind turbines within the farm and whatever is required in the form of cables, converter and transformer stations as well as measurement towers for the connection to NordBalt and the operation of the farm.

3.2 Purpose

The work on the Environmental Impact Assessment is a process that is intended to develop and adapt the project so that its negative environmental consequences are prevented or minimised, so that they are compatible with public and individual interests and satisfy the general rules of consideration in the Environmental Code. In order to achieve this, the Environmental Impact Assessment assesses the project's environmental consequences in relation to public and individual interests. Measures for preventing, minimising or compensating for negative environmental consequences are proposed when considered necessary.

4 Description of the planned project

4.1 Scope and design

The Södra Midsjöbanken wind farm will encompass up to 300 wind turbines, each with an output of between 3.6 and 7 MW, transformer and converter stations and a number of measurement towers (Table 4-1). The farm will be constructed in stages, with an initial stage of approximately 150 turbines. A permit to erect a measurement tower has already been obtained[1]. The measurement tower will be installed in spring 2012. The farm will be connected to NordBalt via HVDC (High Voltage Direct Current) converter stations. From the HVDC converter station, the electricity is transferred to corresponding land-based stations.

Table 4-1 Facts about the scope of the wind farm

Properties	Dimensions/Quantities
Wind turbines' height above the surface of the sea	≤ 200 m incl. rotor
Number of turbines	< 300
Other installations	HVDC stations
Measurement towers	2-3
Turbine housings' height above the surface of the sea	approx. 100 m
Wind farm area	326 km^2 (364 km^2 including safety zone)
Distance from land	Approx. 70 km (Öland)
Water depth in the farm	12-30 m
Water depth at individual turbines	12-28 m
Distance between individual turbines	approx. 1,000 m
Output per individual turbine	between 3.6 and 7 MW
Cables within the farm – alternating current	between 350 km - 670 km
Excavation/dredging incl. land connection	Max. 80,000 m^3
Estimated construction cost	> SEK 20 billion

4.2 Location

During E.ON Vind's evaluation of a suitable area for establishing an offshore wind farm, the following factors have primarily been taken into consideration:

- Good wind conditions
- Limited distance to the electricity grid
- Sufficiently large area with limited water depth and favourable conditions for laying foundations
- Calm climate as regards waves and calm current conditions
- Sufficient distance from the cost to limit the visual impact and other disruptions to the general public
- Conflicts with other interests

[1] Government decision of 31/05/2011, M2010/4884/Ma/M

Possible alternative locations with the potential to achieve the same purpose in the local area might by Hoburgs Bank, Norra Midsjöbanken or shallow coastal areas with a depth ≤ approx. 30 m (Figure 4-1). These alternatives offer a sufficiently large area with a suitable water depth, a reasonable distance from the electricity grid and other favourable conditions.

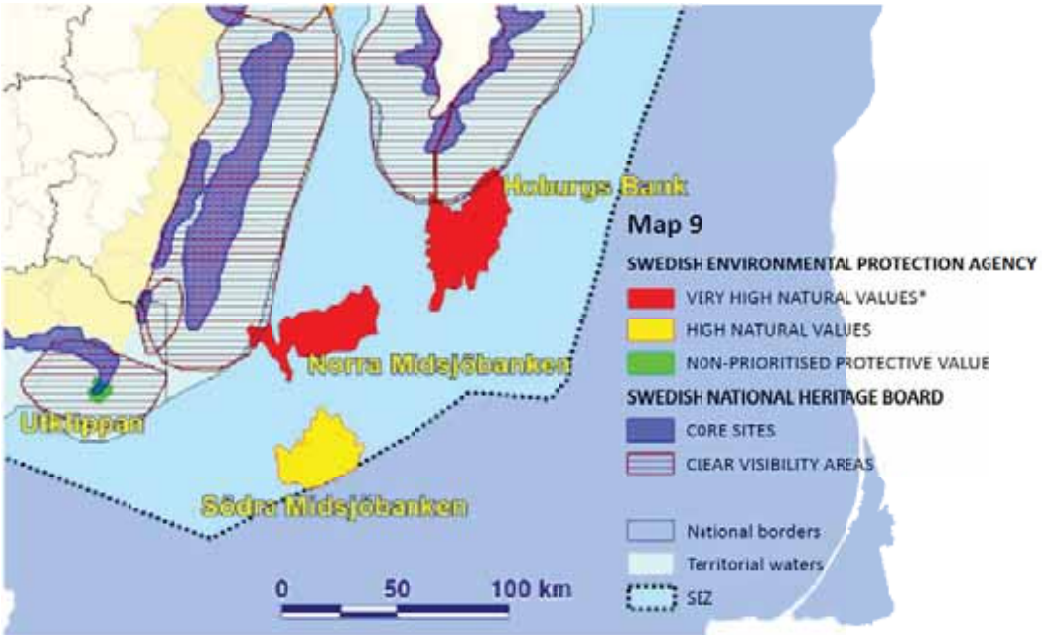

Figure 4-1 Extract from Sydhavsvind [44] information for planning offshore wind power. Possible alternative solutions have a higher degree of conflict with opposing interests compared to Södra Midsjöbanken which, like Norra Midsjöbanken, has been named an area of national interest for wind power production.

E.ON Vind has carried out an overall analysis of the opposing interests for the specified location alternatives (Table 4-2).

Table 4-2 Assessment of alternative locations based on various aspects for a wind farm of the same size as the farm in question at Södra Midsjöbanken. For each aspect, an assessment has been made as to whether the aspect argues in favour of (+) or against (-) location in the location alternative in questions. If a particular aspect is deemed to be of no importance as regards location in the areas in question, this is indicated with (0).

Potential conflicts of interest	Södra Midsjöbanken	Norra Midsjöbanken	Hoburgs Bank	Coastal
Protected nature (Natura 2000)	0	-	-	-
Areas with high natural values in the cultural landscape	0	0	0	-
Clear visibility areas	0	0	0	-
Areas of national				

Potential conflicts of interest	Södra Midsjöbanken	Norra Midsjöbanken	Hoburgs Bank	Coastal
interest Wind usage	+	+	0	0
Combined qualitative assessment	**+**	**0**	**-**	**- - -**

The two Midsjö banks have been highlighted by the Swedish Energy Agency as being of national interest as regards wind usage. The overview in Table 4-2 shows that there are fewer conflicts of interest at Södra Midsjöbanken compared to the other alternatives, and at the same time Södra Midsjöbanken does not have the strength of protection entailed by the Natura 2000 regulations.

In its referral of the overview of the areas of national interest (*Referral relating to selection of areas in respect of areas of national interest for wind usage at sea,* 19/07/2011, ref. no. 440-10-5138), the Swedish Energy Agency writes that the Natura 2000 areas are not automatically incompatible with the construction of offshore wind farms. However, it points out that the establishment of the Natura 2000 areas 1) imposes significant demands for studies that can demonstrate that a planned project does not tangibly damage the values that the Natura 2000 area is intended to protect, and 2) that it will be more difficult to obtain a permit for wind usage within these areas.

In addition to the above conditions, the location at Södra Midsjöbanken is very favourable due to the shorter distance, making it a better alternative than the others when it comes to the potential to connect to the NordBalt cable.

During the work on the application for the Södra Midsjöbanken project, the Polish authorities have published highlighted planning areas for offshore wind power in the Polish economic zone (Appendix 3).

The Polish authorities have exempted one area, located in the shallower parts of the section of Södra Midsjöbanken that lies in the Polish economic zone, from the planning area for wind power[2]. According to unpublished information from BaltSeaPlan[3] (working material), the corresponding area is covered by gravel and sand extraction interests. This is confirmed by the application for a location permit[4] for a wind farm in the Polish section of Södra Midsjöbanken from the Polish company Baltex, which has been published in Sweden via the Swedish Environmental Protection Agency according to the Espoo

[2] Maciej Stryjecki, FNEZ (2011) Poland – new off-shore wind energy market in Europe, brochure presented at the European Wind Energy Association (EWEA) conference in Amsterdam, 29 Nov – 1 Dec.

[3] BaltSeaPlan is an EU-financed INTERREG project for the Baltic Sea area, which will develop methods for integrated maritime planning and the sustainable use of the Baltic's resources. The Royal Institute of Technology and the Swedish Environmental Protection Agency, in close co-operation with the University of Gothenburg, are Swedish partners in the project. The project includes pilot studies, including for Södra Midsjöbanken. http://www.baltseaplan.eu/

[4] Offshore wind farm, Northern Baltic Sea, Project's information card Applicant: Baltex Power S.A.Ul. Krucza 24/26 00-526 Warszawa, June 2011

convention. From the application, it can be seen that Baltex has the "concession for extracting natural ore deposits", which is interpreted as a gravel and sand extraction permit.

The Polish authorities have also exempted the marine Natura 2000 areas in the Polish economic zone from the areas that have been designated for wind power planning (see Appendices 2 and 3). For example, this applies to PLC990001, Slupsk Bank, and PLB990003, Bay of Pomerania. Södra Midsjöbanken has not been designated a Natura 2000 area, either in the Polish or the Swedish economic zone.

In addition to the named alternative locations on nearby offshore banks, E.ON Vind has also considered the location of up to 300 wind turbines immediately adjacent to Södra Midsjöbanken at a depth of > 28 m. Such a location would 1) lead to a greater conflict with fishing interests, as the majority of fish are caught by trawl outside of Södra Midsjöbanken itself, 2) entail a greater risk of conflicts with shipping, as such a location would be getting closer to heavily used fairways, and 3) lead to increased costs for the wind turbines' foundations.

For the above reasons, E.ON Vind has chosen Södra Midsjöbanken as the most suitable location alternative for a major wind farm, from both an environmental and a technical perspective.

4.3 Design alternatives

The design of wind farms can vary in respect of several different parameters, the most important of which are presented in Table 4-3.

Table 4-3 Variables for design alternatives

Properties	Dimensions/Quantities	Impact/effect/consequence
Wind turbines' dimensions	Total height, rotor diameter, turbine housing height, colour	Visual impact depending on the position of the observer
Wind farm's external shape	Square, elliptical, etc.	Visual impact depending on the position of the observer
Distance between turbines	Distance between rows and individual turbines within rows	Will probably affect the tendency of wintering birds to avoid the farm to a greater or lesser extent
Turbines' placement pattern	Regularity	Visual impact
Number of turbines	N	Will affect the wind farm's area, the extent of sediment spread during excavation, the total cable length as well as bottom flora and fauna
Other installations	Number and location of e.g. HVDC stations and measurement towers	Limited impact within the farm
Wind farm area	Area of the region enclosed within the	Affects the utilisation of the sea area by e.g.

Properties	Dimensions/Quantities	Impact/effect/consequence
	line between the outermost turbines plus a protected zone of a certain width	wintering and migrating birds, fishing, marine traffic
Water depth at individual turbines	M	Governs the types of bottom flora and fauna that are affected
Cables within the farm:	Laying depth, joint laying in cable trenches, depth and length of cable trenches	Excavation/dredging volumes, which in turn affect turbidity with effects on *biota*, affecting temporary loss of habitat on the seabed at the depth in question.
Foundation laying method:	Monopile, gravity foundations, trusses, tripods, etc.	Excavation/dredging volumes, which in turn affect turbidity with effects on *biota*, affecting permanent loss of habitat on the seabed at the depth in question.

E.ON Vind has selected design parameters with the aim of making optimum use of the wind resource in the Södra Midsjöbanken area, at the same time as minimising the cost of the foundations. It is possible to reduce the environmental impact by reducing the number of turbines and the total area of the farm. This also means that the electricity production capacity will be reduced. The environmental gain entailed by this alternative is not considered to be equivalent to the loss of electricity production capacity. When developing a wind farm of the planned size at Södra Midsjöbanken, the benefits of power production that is profitable from a business economy perspective as well as environmentally friendly, are considered to outweigh the negative environmental consequences (see chapters 1, 1 & 11).

5 Scope

The location at Södra Midsjöbanken is explained in the previous section. The project's geographical area of influence varies for different environmental aspects. As regards the indirect impact, for example the effects on populations of migrating organisms, and cumulative effects, interacting effects of the construction project that can have an impact in the same area, no general geographical limitation has been applied, rather there has been an assessment of each environmental aspect, with the objective of ensuring that no significant environmental effects and consequences are ignored.

From a time perspective, the project encompasses a planning period, a construction period of 2-3 years, an operating period of 25-30 years and a phasing out period of 1-2 years. The development is planned to take place during the period 2017 - 2019.

The issues (skills areas) that have been deemed to be important to deal with can be seen from Chapter 8. As part of the work on the Environmental Impact Assessment, consultation with Swedish authorities and stakeholders has been taken into account, as have the opinions that have emerged in consultation with other countries according to the ESBO convention. The selection of matters covered is also supported by the Environmental Impact Assessment processes for other large offshore wind power projects at Horns Rev and Nysted in Denmark, as well as earlier planning for offshore wind power projects in Sweden (Lillgrund, Kriegers Flak and Stora Middelgrund).

6 The zero alternative and its environmental consequences

The zero alternative means that the sea area at Södra Midsjöbanken will remain open water, free from wind turbines and associated cables on the seabed, transformer and converter stations, etc.

The environmental consequences that arise during the construction, operation and phasing out of the farm do not arise in the case of the zero alternative, such as the visual impact and the effects on plant and animal life.

The zero alternative means that several positive effects linked to society's need for a renewable energy supply would be lost. The wind farm would entail a significant addition of renewable energy to the energy market. The size of the project may encourage suppliers to develop offshore wind power technology, benefiting the development towards an energy supply that is sustainable in the long term. These positive effects are lost in the case of the zero alternative.

The main alternatives to wind power with today's energy supply pattern are hydroelectric power, nuclear power and fossil fuel-fired power stations. The option of equivalent wind power production in a different location has been dealt with in the section on location.

In the case of fossil fuel-based electricity production, this causes increased emissions of carbon dioxide, which is a greenhouse gas. Nuclear power-based electricity production results in nuclear waste, the need to handle nuclear fuel and risks that place significant demands on handling in society from an environmental, health and safety perspective. This applies in particular to the transport and final storage of spent nuclear fuel. Water-based electricity production obstructs natural, living watercourses. As a result, the zero alternative counteracts the environmental goals of *Reduced climate impact*, *Flourishing lakes and streams* and *A safe radiation environment*.

7 Environmental effects

In order to assess the project's effects and consequences, activities during the construction, operation and decommissioning phases,that have an impact on the environment are used as a starting point. These activities have been taken into account in Chapter 8 during the assessment of effects and consequences for environmental quality in the area of influence.

7.1 Environmental impact during the construction period

The elements that can have a significant environmental impact during the construction phase are considered to be the following:

- noise from piling and other construction activities
- vessel transport (risks, leaks)
- limited accessibility/exclusion
- handling of fuels, oils, materials and chemicals
- excavation (flushing, ploughing) and sediment spread
- waste and sewage handling

7.2 Environmental impact during the operating period

The elements that can have a significant environmental impact during the operating phase are considered to be the following:

- limited accessibility for marine traffic for various purposes
- navigation collision risks
- vessel transport in conjunction with operation and maintenance (risks, leaks)
- visual impact, visibility, lighting
- noise and vibrations
- biotope loss above and below water
- electromagnetism
- operation and maintenance traffic, material handling, etc.
- waste and sewage handling
- new structures in the marine environment form a substrate for the growth of organisms (reef effect)

7.3 Environmental impact when phasing out the farm

The environmental impact during the phasing out work is similar to the impact during the construction period, insofar as the farm will also constitute a construction site during phasing out. The elements that can also have a significant environmental impact during the phasing out phase are considered to be the following:

- recycling or reuse of materials
- sediment spread in conjunction with the lifting of cables
- remaining parts of the foundations underground, possibly with the filling of cavities

7.4 Noise

The measurements and calculations that have been implemented for under water,noise generation from wind turbines show that the noise level at a distance of 100 metres, in the frequency range 1 – 50 Hz, is equivalent to that from e.g. a fishing boat. At higher frequencies, the noise level abates very quickly. When compared with hearing curves that have been measured for cod, salmon and dab, we find that at a distance of 200 metres, only cod will be able to perceive sound from wind turbines. At a distance of 50 metres from the wind turbines, all the investigated fish will theoretically be able to perceive noise or individual strong tones from the turbines. The strength of these tones is on a par with the noise levels from vessels [74, 15, 36].

The distance at which fish actually perceive sound depends on the hearing of the fish, the background noise level, wind speed, water depth and the nature of the seabed. Wind turbines have no damaging effect on the hearing of fish. It is estimated that fish are only scared away at distances of less than 5 metres, and only at high wind speeds (13 m/s). Scaring off effects and direct damage to the hearing organs can consequently be ruled out, although it is difficult to assess what effects the noise might have in terms of obstructing fish communication and orientation signals. In all circumstances, these effects are deemed to be restricted to the immediate vicinity of the turbines.

The marine mammals' best hearing is well above the frequency range in which the wind turbines emit disruptive noise. High frequencies are attenuated quickly and disappear in the background noise [68].

The control programmes at Horns Rev and Nysted have shown that both seals and porpoises were observed in the farms during both construction and operation. The effects on marine mammals that have been tangible in follow-up studies have been linked to noisy work during the construction period, principally piling. At Horns Rev, the porpoises returned very quickly. At Nysted there has been a reduction in the presence of porpoises in the farm during the operating period, although the cause of this is not clear [12]. After conducting follow-up work over a few years, the presence of porpoises has also recovered at Nysted.

7.5 Sediment spread

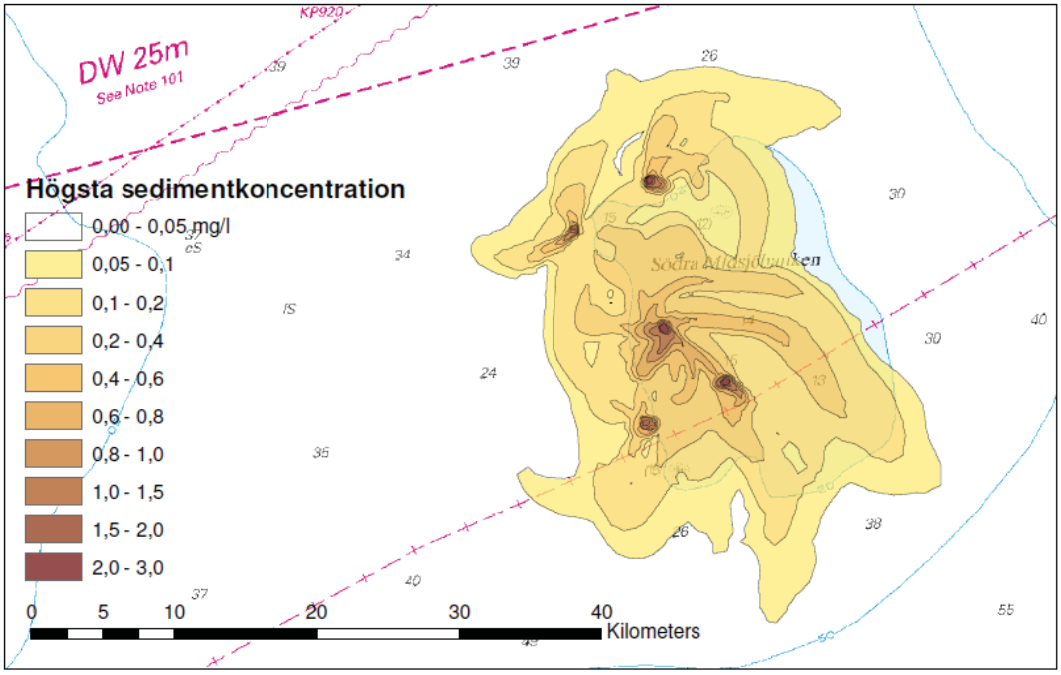

Figure 7-1 Maximum sediment concentration (clay and silt) during the dredging period (µg/l).

High concentrations of sediment spill (>25 mg/l) only occur in the vicinity of the dredging site, and consist primarily of sand which quickly (<2 h) drops to the bottom once dredging stops. The maximum transport distance for the sand is 1 km in the event of a strong, continuous wind. The sediment spill is deposited on the bottom and forms a layer that, within the 50 m immediately adjacent to the dredging site, can be 1–50 mm thick, and at a distance > 50 m is less than 1 mm.

Clay and silt can be spread much further (20 km), but due to the low proportion of these in the bottom material, the concentration of sediment spill from clay and silt is low (<1 mg/l).

8 Conditions, effects, consequences and measures of precaution

This chapter describes conditions, effects, consequences and measures for various matters (ecosystem components). The assessment of effects and consequences is based on the ecosystem's sensitivity in relation to the environmental impact described in Chapter 1.

8.1 General conditions

8.1.1 Geography

Södra Midsjöbanken is a shallow area situated in the middle of the southeastern Baltic Sea, approximately 70 km southeast of the southern tip of Öland and approximately 90 km northwest of the most northerly Polish coast (map appendix 1). The part of the bank that lies within the Swedish economic zone and that is of relevance for the establishment of wind power has an area of just over 320 km^2 (map appendices 2 & 3). The depth within the area in question varies between 12 and just over 30 m.

8.1.2 Nature of the seabed

Geophysical and geotechnical surveys indicate that the uppermost layer of the seabed comprises primarily sand, gravel and small stones. In certain areas there are some rocks and larger boulders. Below the sandy and gravelly surface layer (≥ 1 m) there are finer materials, primarily silt although also clay (*MMT (2011:1) Marine Survey Report, E.ON, Project Södra Midsjöbanken, Seabed Investigation, Geophysical and Geotechnical Survey*).

8.2 Water quality and hydrography

8.2.1 Preconditions

Shallow areas located away from the coast are known as offshore banks and are characterised by cleaner, clearer water than shallow areas closer to the coast, which are affected to a greater extent by sediment, nutrients and chemical contaminants from run-off water from the mainland. The transport of sediment and nutrients is in part a natural phenomenon, which is greatly affected by and increases as a result of human activities.

When different bodies of water meet, vertical layering is created. The boundary between bodies of water with different salinity levels (= different densities) is known as a *halocline*. The boundary between bodies of water with different temperatures is known as a *thermocline*. The mixing of bodies of water that are separated by a halocline and/or thermocline (known as vertical stratification) is limited. Colder and saltier bodies of water accumulate in deep areas. In the Baltic Sea, the conditions in deep areas are affected to a certain extent by saltwater intrusion, where saltier, heavier and better oxygenated water masses comes in from the Skagerrak and Kattegat at an irregular frequency (< 10 times per decade), often in conjunction with autumn and winter storms. Such episodes are

extremely important for the reproduction of cod, for example, helping to limit the extent of oxygen-poor, dead seabeds in the deepest parts of the Baltic Sea.

8.2.2 Effects and consequences

The turbines will cause extremely local slowing down of water movements. With a distance of approximately 1,000 m between the turbines and a low current speed, this effect is expected to be of no significance. The wind turbines will not give rise to any quantitatively significant effects compared to the natural variations in the current, vertical stratification and mixing conditions.

During the construction period, limited sediment spill may occur locally for limited periods of time. Dredging and excavation will be of low intensity, as the work is spread out over large areas of sea and over a long period of time. The same arguments apply to an even greater extent during the phasing out period, when there will be much less sediment spill than in the construction phase.

8.2.3 Measures

The dredging volumes are minimised by using flushing techniques as far as possible and by refilling with material as close as possible to the point where it was taken up, which means that cable trenches are covered with natural material from the area.

Random samples have been taken of sediment within the wind farm in respect of the sediment's chemical contamination load. The sediment samples were analysed with regard to heavy metals, organic tin compounds, oil and polyaromatic hydrocarbons. The samples consistently show that the excavated material is not contaminated (*Sweco (2011) PM Södra Midsjöbanken – tolkning av analysresultat 2011-06-20, Rev 2011-08-04*).

8.3 Seabed flora and fauna

8.3.1 Preconditions

The studies that E.ON Vind ordered from Marin Mätteknik covered the identification of locally occurring species with the aid of filmed transects and seabed samples, as well as the classification of habitat according to EUNIS and the Habitat Directive, Annex 1 (*MMT (2011:2) Marine Survey Report, E.ON, Project Södra Midsjöbanken, Environmental Survey*). The study encompassed 8 video transects and 7 bottom samples. The film transects were generally 100 m – 150 m in length, although one transect was 500 m long. In total, 1,250 m was filmed. The sampling was selective insofar as transects and bottom samples were chosen in order to represent the existing habitats as far as possible.

The studies identified 3 habitats according to EUNIS (Table 8-1) and judged that the dominant habitat should be classified as ”sandbank” (1110) rather than ”reef” (1170) according the Annex 1 of the Habitat Directive, despite the large-scale and extensive occurrence of blue mussels on the bank (Figure 8-1).

Table 8-1 Identified habitats at Södra Midsjöbanken according to the EUNIS classification system.

	Habitat according to EUNIS with description	Estimated area (km^2)	Area (%)
A5.211	Baltic level sandy bottoms of the infralittoral photic zone with little or no macrophyte vegetation	18	5
A5.411	Baltic level mixed sediment bottoms of the infralittoral photic zone with little or no macrophyte vegetation	91	26
A5.6271	Baltic mussel beds in the infralittoral photic zone with little or no macrophyte vegetation	239	69

Figure 8-1 The picture shows the dominant habitat at Södra Midsjöbanken, blue mussels in sand, small stones and gravel, EUNIS A5.6271.

This judgement is based on the fact that the mussels do not form continuous structures, but rather occur in a loose matrix of sand and small stones. Areas dominated by blue mussels are estimated to cover 69% of the surface of the bank. This estimate is based on an extrapolation of biological data from a limited number of filmed transects and biological sampling in association with these. The extrapolation is based on geophysical data from Södra Midsjöbanken. 19 species or taxa[5] were identified in the study (Table 8-2).

[5] General name for a systematic unit when classifying organisms, e.g. species, genus, family, order.

Table 8-2 Organisms encountered during field studies at Södra Midsjöbanken.

Class	Species/taxon
Rhodophyta/red algae	*Hildenbrandia* sp
	Rhodophyta undetermined
Cnidaria	*Hydrozoa* undetermined
Annelida/ringed worms	*Capitellidae*
	Hediste diversicolor
	Oligochaeta
	Pygospio elegans
	Spionidae
Mollusca/molluscs	*Bivalvia* undetermined
	Cerastoderma glaucum
	Hydrobia sp.
	Macoma balthica
	Mya arenaria
	Mytilus edilus
Arthropoda/arthropods	*Balanus improvisius*
	Bathyporeia pilosa
	Gammarus zaddachi
	Saduria entomon
Chordata – actinopterygii	*Gadidae*/cods

On the basis of random samples (video inventories) in conjunction with the offshore bank inventory [53], the Swedish Environmental Protection Agency has identified 11 species at Södra Midsjöbanken [55].

The Agency's report states the following regarding bottom flora and fauna at Södra Midsjöbanken:

- Seaweed was found down to a depth of just over 30 m. The most common species was *Rhodomela confervoides*, which occurred in more than 60% of the inventoried 10 metre intervals with up to 10% coverage. *Pylaiella littoralis* was also common, with a less widespread yet often higher degree of coverage in those locations where it occurred (up to 25%). The other seaweed species were *Sphacelaria arctica*, *Furcellaria lumbricalis*, *Phyllophora pseudoceranoides* and *Desmarestia viridis* (stringy acid kelp).
- As regards fauna, the area is clearly dominated by the brackish water hydroid *Cordylophora caspia* and the blue mussel (*Mytilus edulis*), which occurred in 50% and over 80% respectively of the inventoried ten metre intervals. *Electra crustulenta*, *Macoma balthica* (Baltic clam) and *Pygospio elegans* were also present.

8.3.2 None of these species are included in the Species Protection Ordinance or in Annex II of the Habitat Directive. Cod (*Gadus morhua*) is included on the

Swedish red list as endangered (EN yr 2010, classification changed to vulnerable VU yr 2015). Effects and consequences

The wind farm's installations, including cable trenches, cover < 1% of the farm's total bottom surface. The bottom surface that the farm takes up does not entail any significant negative effect on bottom flora and fauna. During the construction period, there will be a certain amount of sediment spill. The spill is expected to amount to small volumes compared to major projects that have been carefully followed up (Öresund Bridge, Safer Fairways to Gothenburg) and which have demonstrated negligible adverse effects.

The excavated volumes in the farm will be widely distributed in terms of time and space. A large proportion of the excavated material comprises relatively coarse sand and gravel that has been flushed clean. The excavated material therefore gives rise to limited spill of fine material that can be transported long distances.

The underwater parts of the wind turbines constitute a hard surface that can act as a substrate (surface) for algae, mussels and crustaceans. Erosion protection can also offer new habitats. The reef effect [61] can result in biological production and the composition of species being affected in the vicinity of the wind turbines. Exactly how new substrates are colonised depends in part on the water depth and the nature of the new structure.

At Horns Rev [61, 12], the turbines were colonised in the wash zone first (2003) by filamentous algae, followed by gutweed (*enteromorhpa*) (2004). The fauna on the turbines' monopiles was characterised by varying numbers of amphipoda species and the marine splash midge (*Telmatogeton japonicus*) between the first and second seasons. Further down there were blue mussels (*Mytilus edulis*) and barnacles (balanoids), which constituted a food source for the common starfish (*Asterias rubens*). Similar flora and fauna (with the exception of the starfish *Asterias rubens*) are expected to develop on Södra Midsjöbanken's wind turbines and foundations.

The introduction of erosion protection, which comprises large rocks, can provide a substrate in shallower areas that is suitable for seaweed and as a habitat for certain fish species, fry, etc. With a distance of ≥ 1,000 m between the turbines, this effect is not expected to give rise to any significant change in the habitats and the biological production conditions at Södra Midsjöbanken.

The reef effect will lead to increased habitat diversity and increased biological diversity. This will favour organisms that like hard, stony structures (erosion protection). Organisms that require hard substrates at shallower depths than are naturally found at Södra Midsjöbanken may become established, such as *enteromorpha* (gutweed), blue mussels and barnacles (balanoids).

8.3.3 Measures

The excavated volumes will be handled close to the bottom and be used to cover the cable trenches, which will counteract sediment spread.

As far as possible, natural materials from the locality will be used to cover the cable trenches. These will be recolonised by species that are typical for the depth and bottom substrate in question.

The relevant construction work will be carried out with stringent demands for environmental quality assurance to avoid the spillage of oils and other discharges. Other than this, no particular measures are required, as no significant negative consequences are anticipated for bottom flora and fauna.

8.4 The fish community

8.4.1 Preconditions

Occurrence of fish

E.ON Vind has ordered a study from Marine Monitoring regarding fish and fishing at Södra Midsjöbanken based on available data (*Marine Monitoring (2011) Sammanställning av fiskbiologiska aspekter samt yrkesfiskeintresse vid Södra Midsjöbanken - Underlagsmaterial inför samråd*).

Fish species that occur here, according to test fishing and information about catches landed by commercial fishermen, can be seen from the table (Table 8-3).

Table 8-3 Fish species found at Södra Midsjöbanken according to Marine Monitoring, 2011, based on test fishing and reported catches by commercial fishermen, with comments relating to threat status and lifestyle.

Species	Latin name	Lifestyle	Threat category according to the Swedish red list, 2010[6]
Anchovy	*Engraulis encrasicolus*	Pelagic[7]	No information
Fourbeard rockling	*Enchelyopus cimbrius*	Benthic, pelagic eggs	DD
Fourhorn sculpin	*Triglopsis quadricornis*	Benthic[8]	LC
Haddock		Benthic/pelagic	EN
Salmon	*Salmo salar*	Pelagic	LC
Atlantic mackerel	*Scomber scombrus*	Pelagic	No information
Smelt	*Osmerus eperlanus*	Pelagic	No information
Turbot	*Psetta maxima*	Benthic/pelagic[9]	LC
Plaice	*Pleuronectes*	Benthic/pelagic	No information

[6] The Swedish red list's categories: Critically endangered (CR), Endangered (EN) or Vulnerable (VU), Near threatened (NT), Regionally extinct (RE), Deficient data (DD). Species that are categorised as Least concern (LC) are not considered to be either threatened or redlisted.
[7] Species with a pelagic lifestyle move about in the open water (the pelagic zone)
[8] Species with a benthic lifestyle have a relatively stationary existence close to the seabed.
[9] Species can change their lifestyle depending on the stage of their life cycle, such as flatfish which have free-swimming (pelagic) fry and bottom-living (benthic) adult stages.

Species	Latin name	Lifestyle	Threat category according to the Swedish red list, 2010[6]
	platessa		
Shorthorn sculpin	*Myoxocephalus scorpius*	Benthic/pelagic	No information
Herring	*Clupea harengus*	Pelagic (eggs on the bottom)	No information
Lumpfish	*Cyclopterus lumpus*	Benthic/pelagic	NT
European sprat	*Sprattus sprattus*	Pelagic	No information
European flounder	*Platichthys flesus*	Benthic/pelagic	No information
Snake blenny	*Lumpenus lampretaeformis*	Benthic/pelagic	No information
Great sand eel	*Hyperoplus lanceolatus*	Benthic/pelagic	No information
Cod	*Gadus morhua*	Benthic/pelagic	EN
Whiting	*Merlangius merlangus*	Pelagic	VU
Sea trout	*Salmo trutta*	Pelagic	No information

In addition to the above species, gobies (*Pomatoschistus*), dab, twait shad (*Alosa fallax*), three-spined stickleback, ninespine stickleback and European eelpout have also been reported in nearby areas (ICES-boxes).

Spawning

European flounder (*Platichthys flesus*) are found throughout the Baltic Sea, with the exception of the eastern parts of the Gulf of Finland and the Gulf of Bothnia. The nearest known sea area around Södra Midsjöbanken where favourable spawning conditions exist is considered to be the Bornholm Deep, east of Bornholm. This fish species spawns during the period May–June at a depth of 20–100 metres.

The presence of plaice (*Pleuronectes platessa*) in the Baltic is primarily restricted to the southern parts. The species generally keeps to relatively shallow sandy and clay seabeds at depths of 0–50 metres. In the Baltic, plaice spawn primarily in the period December–February at depths of between 20–90 m. The Bornholm Deep is considered to be the nearest suitable spawning ground.

Turbot (*Psetta maxima*) remain on sandy bottoms close to the coast or on shallow offshore banks in order to eat and spawn. In the Baltic, they generally spawn on sandy bottoms shallower than 10 metres during the period April – August. During the winter, the fish migrate out to deeper water, although most individuals return to the same spawning ground each year. According to the Board of Fisheries (2006), Södra Midsjöbanken could potentially be of importance as a spawning area. The bottom depth at Södra Midsjöbanken is generally greater than is considered optimal for turbot spawning.

Cod (*Gadhus morhua*) of spawning age can be found in the southern Baltic all year round, but the highest concentrations of eggs are found during the period February – August. Eggs and fish larvae are primarily found in waters at a depth exceeding approx. 55 metres. The fry have a pelagic lifestyle for their first year, before moving down towards the bottom in areas shallower than 60 metres. Spawning takes place in the Baltic Sea's deep holes. Spawning areas have previously been found in the Gotland Deep, the Gdansk Deep and east of Bornholm. Of these, only the population near Bornholm is currently functioning. The cod in the Baltic Sea spawn in deeper water adjacent to the halocline (the vertical stratification with the saltier water) in order to ensure that the eggs float. The larvae head towards shallower water. Södra Midsjöbanken is not a potential spawning ground for this species.

The Baltic Sea is home to both spring-spawning and autumn-spawning herring populations (*Clupea harengus*). Some spawning can also take place during the summer and winter. Spring-spawning herring spawn near the coast and in very shallow water.

There is limited knowledge about autumn-spawning herring in the Baltic. According to research related by Marine Monitoring (2011), spawning herring gather in large shoals in shallow coastal waters as well as on banks further out to sea, which can include the Södra Midsjöbanken area.

The European sprat (*Sprattus sprattus*) is one of the most common fish species in the Baltic Sea. The species can be found throughout the Baltic. Its spawning grounds are situated further out from the coast and include the Södra Midsjöbanken sea area. Spawning takes place in the open water (the pelagic zone) at depths of between 10–40 metres. Eggs and larvae are planktonic and the spawning period extends from March to August.

Migration

Salmon (*Salmo salar*) migrate between freshwater for reproduction and saltwater for growth. In the sea, they have a pelagic lifestyle, living on herring and sprat, for example. Salmon, which are a pronounced migratory fish, use the Baltic Sea as a nursery area after leaving their rivers approx. 1–5 years after hatching. After one or more years in the sea, they return to their home rivers to reproduce. Spawning generally takes place during the period September – November. Fishing for salmon in the Baltic Sea is conducted at Södra Midsjöbanken, among other areas.

Trout (*Salmo trutta*), like salmon, are a pronounced migratory fish and use the Baltic Sea as a nursery area from the time they leave their watercourse approx. 1–5 years after hatching. After one and a half to approx. three years in the sea, they return to their watercourses or rivers to reproduce. Trout are not generally considered to move more than 200 km from the watercourse they originally left. Trout catches have been loggedbetween year 2000–2010 in the region around Södra Midsjöbanken.

Eels (*Anguilla anguilla*) have a complicated life cycle. Their larvae drift from the Sargasso Sea to the coasts of Europe. After this they grow up in coastal environments, watercourses and/or lakes (the yellow eel stage). After approx. 5–25 years, the eels turn

into silver eels, at which time they have put on a lot of weight and are mature for the migration back to the Sargasso Sea. A large number of trials involving marking the eels have been conducted, which show that the silver eels keep close to the coast. However, there are less frequented migration routes via the east coast of Gotland. From Gotland, theses migration routes continue either towards Rügen, east of Bornholm, or to the Swedish coast via Öland.

During their migration, the eels swim at night close to the surface, with brief dives to the thermocline or the seabed. During the day, the silver eels lie on the seabed to recover. The main migration period for silver eels is considered to be August – November.

Södra Midsjöbanken is deemed to lie partially within the lesser frequented migration routes for silver eels on their way out of the Baltic.

The life cycle of the sea lamprey (*Petromyzon marinus*) covers three different stages, of which the third, the adult stage, is spent in estuary areas, coastal waters and out at sea. At this time the species lives like a parasite on fish such as cod, herring and salmon. After 2–4 years, the sea lamprey reaches sexual maturity and begins its return to freshwater environments. Sea lampreys that are migrating in order to spawn have been noted during the period May – July. The species has been disadvantaged by the extensive development of hydroelectric power that has taken place in Sweden. The species is listed as near threatened (NT) on the Swedish Species Information Centre's red list. In Sweden, the sea lamprey is primarily considered to occur along the West Cost, Öresund and the Bight of Hanö. The species is considered very rare further into the Baltic Sea. Sea lampreys may potentially occur in the area around Södra Midsjöbanken during their adult stage, although the number of individuals is considered to be very small.

Atlantic mackerel (*Scomber scombrus*) winter in the North Sea and the Atlantic in deeper waters. They come to Swedish waters (Skagerrak, Kattegat, Öresund) from April to spawn in the surface water layer when the temperature reaches 10-11ºC, before returning to the North Sea and the Atlantic in the autumn. In the event of significant influxes of saltwater or an influx of warmer water, they can also be found in large parts of the Baltic.

Garfish (*Belone Belone*) migrate from the eastern Atlantic into areas such as the Baltic Sea in order to spawn. The roe are laid in shallow water in the egg belt. In the autumn, the garfish return to the Atlantic. It is considered that they might pass by or over Södra Midsjöbanken during their migrations.

Nursery areas

Södra Midsjöbanken constitutes a potential nursery area for cod and salmon. Other species that might possibly use Södra Midsjöbanken during their growth period include the flatfish species flounder, plaice and turbot, although the area's significance for these species is currently uncertain.

8.4.2 Effects and consequences

Fish spawning
During the construction period, sediment spill may have an adverse effect on fish eggs and fish fry, for example by means of fish eggs being weighed down and sinking if fine-grained sediment accumulates on them. The project will give rise to a limited amount of sediment spill, mostly of relatively coarse material (sand or coarser), which means that the extent of these adverse effects will be small.

Fish migration patterns
There will be temporary disruptions during the construction period, and fish may be scared away from the sites where intensive work is being conducted. The conditions will return to normal soon after the completion of the work.

Salmon (*Salmo salar*) move between Södra Midsjöbanken and freshwater watercourses, and may consequently be disturbed out at the bank while work resulting in turbidity is taking place during the construction period. Salmon that are disturbed during this period are expected to move to nearby areas that are not being disrupted, and then to migrate to their spawning waterways in the normal manner. The effects and consequences of disruptions to salmon are judged to be insignificant.

Trout (*Salmo trutta*) behave in a similar manner to salmon. The effects and consequences of disruptions to trout are judged to be insignificant.

The majority of eel migration (*Anguilla anguilla*) takes place close to the coast. The Board of Fisheries' (2001) trial period studies for the direct current Baltic Cable have shown that the migration of eels is not affected by the magnetic field found around the cable. Approx. 60% of tagged eels have passed the cable within 4 hours of being released. The eels' ability to navigate is not considered to be affected by the alternating current fields that are generated by the cables in the farm. If the eels' migration were to be affected by the wind farm in any respect, it is judged that this would lead to an adaptation of the migration route. The eels' migration is not considered to be affected to any significant extent by the wind farm.

The sea lamprey (*Petromyzon marinus*) migrates from the sea to spawning grounds in freshwater. As sea lampreys could potentially occur in the area around Södra Midsjöbanken, it is also possible that their migration might be affected by activities on the bank. It is judged that such an effect would lead to a minor adaptation of the migration route, but not to any significant impact on the species' migration.

Atlantic mackerel (*Scomber scombrus*) migrate between the spawning grounds in the Öresund, Skagerrak and Kattegat and the wintering areas in the North Sea and the Atlantic. Their appearance in the Baltic Sea is more sporadic, occurring in the event of significant influxes of saltwater or an influx of warmer water. Mackerel are extremely mobile fish, and are considered to be able easily to avoid affected areas such as Södra Midsjöbanken.

Garfish (*Belone belone*) migrate from the eastern Atlantic into areas such as the Baltic Sea in order to spawn. Like mackerel, garfish are extremely mobile fish that are not expected to be adversely affected by the wind farm at Södra Midsjöbanken.

8.4.3 Measures

The following-up of wind farms at Nysted and Horns Rev in Danish waters, as well as Lillgrund in the Öresund, has not demonstrated any significant adverse effects on fish populations. The distances from Södra Midsjöbanken to sensitive areas, such as the spawning areas for cod, are relatively large. No particular measures are considered necessary with regard to the fish populations.

8.5 Commercial fishing

8.5.1 Preconditions

A background report (Marine Monitoring 2011) presents catch data, both from Södra Midsjöbanken and from a larger sea area around the bank. The most important species in the area around Södra Midsjöbanken are sprat, cod and herring. These species constituted more than 99% of the total catch landed in Sweden. Within the local area around Södra Midsjöbanken, the catches have primarily comprised cod, sprat and turbot.

Of the total catch within the area around Södra Midsjöbanken that was landed in Sweden during the period 2000–2010 (327 tonnes), approx. 33% was landed by Sölvesborg fishing district, 18% by Karlshamn fishing district, 14% by Visby fishing district, 14% by Simrishamn fishing district, 12% by Gothenburg fishing district and 8% by Karlskrona fishing district. The other 6 fishing districts jointly landed approximately 1% of the total catch.

During the period 2008–2010, the number of fishing districts active within the local area around Södra Midsjöbanken fell to 9, compared to 12 during the period 2000–2010. Of the total catch from Södra Midsjöbanken that was landed in Sweden (39 tonnes), approx. 76% was landed by Karlshamn fishing district, 14% by Karlskrona fishing district, 4% by Simrishamn fishing district, 2% by Gothenburg fishing district, 2% by Norrköping fishing district and 1% by Sölvesborg fishing district. The other 3 fishing districts jointly made up approximately 1% of the total catch.

The fishing methods vary between the region and the immediate vicinity of Södra Midsjöbanken. Regionally, fishing takes place primarily using mobile equipment (trawls), of which pelagic trawls are the most common. In the immediate vicinity of Södra Midsjöbanken, passive equipment is mainly used (e.g. hook and line).

The areas of national interest for commercial fishing according to the Board of Fisheries' publication 2006:1 [30] can be seen from Table 8-4 and Appendix 1.

Table 8-4 Areas of national interest for commercial fishing that have been assessed with regard to the impact of the Södra Midsjöbanken project. The areas can be identified via the sequential numbers presented in the map appendix.

Sequential number according to Finfo 2006:1	Name	Purpose	Approximate distance to Södra Midsjöbanken wind farm (km)	Assessment
41	Rosenklintsgrunden, Utklippan westwards	Fishing ground, cod, Baltic herring European sprat	68	Not affected
34	Öland south, Ölandsrev southwards and eastwards	Fishing ground, cod	36	Not affected
35	Norra Midsjöbanken	Spawning area, turbot	33	Not affected
39	Syd Gotland	Fishing ground, cod, turbot	82	Not affected
40	Sydväst Hoburg	Fishing ground, Baltic herring, European sprat and cod	87	Not affected
31	Öland east, Kårehamn, Gårdby	Fishing ground, Baltic herring, European sprat and cod	86	Not affected
38	Gotland, southeast depth > 50 m	Fishing ground Baltic herring European sprat	139	Not affected
36	Gotland east, Fårö, Hoburgs Rev	Fishing ground, turbot, cod, Baltic herring, European sprat	133	Not affected
33	Kalmarsund, Långgrund, Rönneskär	Fishing ground, eel	91	Not affected
32	Kalmarsund, Oxelgrund, Horsö	Fishing ground, eel and cod	123	Not affected

8.5.2 Effects and consequences

It can be seen from Table 8-4 that the distance to the areas of national interest for commercial fishing is at least 30 km. These areas are not expected to be affected at all by activities at Södra Midsjöbanken.

Fishing on parts of the bank will be prevented entirely during the construction period, as shipping will be excluded from the area in stages. Fishing on those parts of the bank where shipping has not been excluded may be affected indirectly during these periods due to temporary increased turbidity, which can both scare off fish and hamper the

effectiveness of the fishing equipment. The construction period, which will vary greatly in intensity, will last for 2-3 years. Similar effects will occur to a lesser extent during the phasing out period.

During the operating period, anchoring will be prohibited within the farm. The turbines will constitute navigation obstacles, which can have a negative impact on fishing using mobile equipment. Fishing using fixed equipment can theoretically be carried out during the operating period. At Södra Midsjöbanken, commercial fishing is already carried out to a large extent using fixed equipment. E.ON Vind will apply to have unauthorised boat traffic excluded from the farm area in its entirety. In this event, it will not be possible to conduct any fishing within the wind farm.

8.5.3 Measures

Disruptions that lead to demonstrable losses for commercial fishing will be compensated.

8.6 Marine mammals

8.6.1 Preconditions

Four species of marine mammals regularly live in the Baltic Sea, namely the Baltic ringed seal (*Phoca hispida botnica*), the harbour seal (*Phoca vitulina*) and the grey seal (*Halichoerus grypus*), as well as the porpoise (*Phocoena phocoena*).

There are a few thousand Baltic ringed seals in the Gulf of Bothnia, where the population trend is increasing, as well as smaller populations in the Gulf of Finland and the Gulf of Riga. The population in the Gulf of Riga, which is closest to Södra Midsjöbanken, has displayed a declining trend and there are now around 800 individuals [49]. The Swedish Species Information Centre classifies the Baltic ringed seal as near threatened (NT). There is no information to indicate that the Baltic ringed seal is found at Södra Midsjöbanken.

The harbour seal occurs in large numbers in the Skagerrak and Kattegat, but there are only about 900 individuals in the Baltic, of which around 600 belong to a genetically isolated population in the Kalmar Strait. The species is classified as vulnerable (VU) in the Baltic Sea. The species eats a large number of fish species that are mainly caught in shallow areas where the seabed is free of vegetation. Studies from the Kattegat have shown that 75% of the total intake, calculated as a percentage by weight, comprised various species of flatfish [3].

Over the past two decades, the grey seal has recovered strongly after, like the other seal species, having been greatly affected by hunting and environmental toxins. The grey seal population was estimated at just over 20,000 individuals in the Baltic in 2009, which was slightly lower than the years immediately preceding, indicating that the strong increase is now levelling out. The most common causes of death among individuals that have been received for examination in recent years are hunting, drowning in fishing equipment and illness, in that order [4]. The Swedish Species Information Centre classifies the grey seal as Least concern (LC).

Porpoises are extremely rare in the Baltic Sea east of Danish waters. A study using electrode detectors along the Baltic coastlines of Skåne and Blekinge provinces in 2006 and 2007 showed very few porpoise observations, of which none were east of Hanö [2]. The population in the Baltic Sea is classified as Critically endangered (CR) [56]. On the basis of inventories performed from aircraft and vessels, the Baltic population (Swedish, Danish and German waters in the southwestern Baltic Sea, although excluding Polish waters) was estimated at around 600 animals in 1995 and barely 100 in 2002. The porpoise is protected by the EU's Habitat Directive. Environmental toxins and bycatch in fishing equipment are the greatest threats to the porpoise. Helcom's Map and Data Service presents some 10 reported cases of porpoise bycatch within approx. 100 km of Södra Midsjöbanken since 1990 [34].

8.6.2 Effects and consequences

Studies of Denmark's Nysted and Horns Rev wind farms have shown that seals and porpoises can adapt to the wind farms during the operating period [56]. During the construction period, the mammals may be temporarily scared off by disruptive building activities, but return after a short period.

Based on the above knowledge regarding the occurrence of seals and porpoises at Södra Midsjöbanken, as well as the experiences from large-scale Danish wind farms, it is judged that the construction and operation of a wind farm at Södra Midsjöbanken will not have any adverse effects on marine mammals.

8.6.3 Measures

During the construction work at Horns Rev and Nysted, precautionary measures were applied with regard to seals and porpoises. For example, audio devices were used to scare away seals and porpoises prior to piling work, the noise of which is assumed to be able to reach harmful levels.

Another precautionary measure was to gradually increase the force used during piling work, so that the animals have the opportunity to move away [70]. "Pingers" (audio devices that are used primarily to prevent marine mammals from becoming caught in fishing equipment) can also be used. Such precautionary measures must be thought through and properly weighed up, in part because seals can be attracted by "pingers" if they have learned to associat them with fishing equipment, and because porpoise can grow accustomed to them over time. Corresponding measures will be implemented if necessary, in consultation with experts, during the Södra Midsjöbanken project.

8.7 Birds

The chapter on birds is based on the following background reports ordered by E.ON Vind, in addition to generally available literature:

- JP Fågelvind (2011) En genomgång av kunskapsläget om fåglar på Södra Midsjöbanken och speciellt om vinterrastande alfåglar (*Clangula hyemalis*) Jan Pettersson, Färjestaden 2011-01-18

- Nilsson, Leif (2011:1) Inventering av sjöfåglar på Södra Midsjöbanken 2011, Lund 2011-01-27, rev 2011-05-15
- Nilsson, Leif (2011:2) Alkornas utnyttjande av Midsjöbankarna, Komplettering av rapport av 2011-01-27 (2011-02-27)

8.7.1 Preconditions

Generally speaking, the Baltic Sea's offshore shallows are important areas for many marine bird species (see also section 14.2). The offshore shallow areas, like coastal shallow areas, constitute important sites for many wintering marine species. The offshore shallows are also presumed to be important for other seasonal activities, such as the moulting of auks. It is possible that offshore shallows are also important for foraging during the breeding season for certain species, such as auks (Nilsson 2011:2). In addition to species that remain on the offshore bank, it can be assumed that a very large number of bird species pass Södra Midsjöbanken during their migration.

Birds that remain on the banks
Offshore banks, like coastal areas, are important wintering or resting areas for seabird species. The long-tailed duck (*Clangula hyemalis*) winters in large numbers on the Midsjö banks, according to inventories conducted in the area between 2009–2011 (Nilsson 2011:1). The number of wintering long-tailed ducks on the two Midsjö banks has been estimated at between 44,500 and 213,000, based on aerial inventories conducted between 2009–2011 (Table 8-5).

Table 8-5 Estimate of the number of long-tailed ducks at the Midsjö banks based on aerial inventories in 2009–2011.

		Number of long-tailed ducks per inventory date				
Midsjöbank		**03/03/2009**	**16/03/2010**	**07/03/2011**	**29/03/2011**	**20/04/2011**
	Norra	76,000	74,000	63,000	37,000	67,000
	Södra	137,000	132,000	22,000	75,000	16,500
∑ Midsjö banks		213,000	206,000	85,000	44,500	83,500
∑ Swedish Baltic Sea[10]		435,800	697,200		471,800	
Proportion (%) at Södra Midsjöbanken		31	19		8[11] (3-16)	

The results show a considerable variation in the number of long-tailed ducks on the two Midsjö banks. The inventories in 2009 and 2010 produced similar results, indicating that the wintering population in a normal winter is in the region of 200,000 individuals. With the aid of data from Nilsson's [57] aerial inventories of Swedish parts of the Baltic Sea, it is observed that between 3% and 31% (Table 8-5) of the inventoried Swedish winter population was found at Södra Midsjöbanken. This shows that the two Midsjö banks are extremely important for the wintering population of long-tailed ducks in Swedish Baltic waters.

[10] Data from Nilsson, L. (2010) Seabird inventories at sea in Swedish waters (Fågelåret 2010: 40-49
[11] Based on the average value from the three inventories in 2011 at Södra Midsjöbanken

In the assessment, it must be borne in mind that the inventories (Table 8-5) do not cover Polish and Baltic State waters, where there are also large numbers of wintering long-tailed ducks, for example in Polish waters at Slupsk Bank, Przybrzezne wody Baltyku and the Bay of Puck (see also Chapter 14.2). With guidance from data obtained from a joint EU website relating to the Natura 2000 areas (http://natura2000.eea.europa.eu/), it can be concluded that wintering long-tailed ducks occur to a lesser or greater extent in several Natura 2000 areas in coastal waters along the coasts of Poland, Finland and the Baltic States.

The number of long-tailed ducks was significantly lower in 2011 than in the two preceding years. The two banks also demonstrate significant differences from each other when it comes to the occurrence of long-tailed ducks. In 2009 and 2010, many more long-tailed ducks were noted at Södra Midsjöbanken than at Norra Midsjöbanken, while the situation was reversed in 2011. If we compare the three years, we find that the number of long-tailed ducks at Norra Midsjöbanken was roughly the same in the five inventories. The reduction in the number in 2011 compared to 2009 and 2010 was entirely restricted to Södra Midsjöbanken.

In the seabird inventories in 2009–2011 (Nilsson 2011:1), observed species were noted according to Table 8-6. The report in Table 8-6 shows species that were registered on one of the Midsjö banks. Table 8-6 presents individual observations and not estimates of the total number on the Midsjö banks (unlike the reporting of long-tailed ducks in Table 8-5). Several of the observed species are classified as vulnerable (VU) or near threatened (NT) according to the Swedish red list [3].

Table 8-6 Occurrence of species at Södra and Norra Midsjöbanken based on observations from aircraft in March/April. The table presents the number of observations at the Midsjö banks. There have not been enough observations to estimate the total population.

Species name	**Species name**	**Threat category** [12]	**Number of observed birds per inventory date**					∑
			03/03/2009	16/03/2010	07/03/2011	29/03/2011	20/04/2011	
Black-throated loon	*Gavia arctica*	-	0	0	0	0	2	2
Red-throated loon	*Gavia stellata*	NT	0	0	0	0	1	1
Great cormorant	*Phalacrocorax carbo*	-	0	0	0	35	0	35
Eurasian widgeon	*Anas penelope*	-	0	0	0	0	2	2
Greater scaup	*Aythya marila*	VU	0	0	0	0	15	15
Common scoter	*Melanitta nigra*	-	0	5	0	40	154	199
Velvet scoter	*Melanitta fusca*	NT	0	0	0	70	0	70
Common eider	*Somateria mollissima*	NT	0	0	0	2	39	41
Common merganser	*Mergus merganser*	-	0	0	10	0	0	10
Red-breasted merganser	*Mergus serrator*	-	0	5	4	0	0	9
Little gull	*Larus minutus*	-	0	0	0	0	5	5
Common guillemot	*Uria algae*	-	0	1	4	1	8	14
Razorbill	*Alca tordea*	-	0	0	0	6	0	6

The majority of the species reported in Table 8-6 were seen at Södra Midsjöbanken (Table 8-7). Only one species was only observed at Norra Midsjöbanken (the velvet scoter).

[12] The Swedish red list's categories: Critically endangered (CR), Endangered (EN) or Vulnerable (VU), Near threatened (NT), Regionally extinct (RE), Deficient data (DD). Species that are categorised as Least concern (LC) are not considered to be either threatened or redlisted.

Table 8-7 Occurrence of the species reported in Table 8-5 and Table 8-6 on one or both Midsjö banks.

Species name	Latin species name	Södra	Norra
Long-tailed duck	*Clangula hyemalis*	*x*	*X*
Black-throated loon	*Gavia arctica*	*x*	
Red-throated loon	*Gavia stellata*	*x*	
Great cormorant	*Phalacrocorax carbo*	*x*	*x*
Eurasian widgeon	*Anas penelope*	*x*	
Greater scaup	*Aythya marila*	*x*	
Common scoter	*Melanitta nigra*	*x*	*x*
Velvet scoter	*Melanitta fusca*		*x*
Common eider	*Somateria mollissima*	*x*	*x*
Common merganser	*Mergus merganser*	*x*	*x*
Red-breasted merganser	*Mergus serrator*	*x*	*x*
Little gull	*Larus minutus*	*x*	
Common guillemot	*Uria algae*	*x*	*x*
Razorbill	*Alca tordea*	*x*	
Total observed number of species		**13**	**8**

On the basis of the aerial inventories, Södra Midsjöbanken appears to have more species out of the two banks. The aerial inventories give an impression of the bird populations during a limited part of the year, based on a random sample. The long-tailed duck and the species reported in Table 8-6 have been noted during inventories conducted in March and April, and primarily represent birds that live at the Midsjö banks in winter.

In a supplement to the report on the aerial inventories, Nilsson (2011:2) has presented new results indicating that Södra Midsjöbanken lies within the range of guillemot from Stora Karlsö all year round.

Migrating birds

Significant numbers of birds pass the southeastern Baltic Sea during their autumn and spring migrations. The southern tip of Öland, which is home to Ottenby bird station, is very well known among ornithologists for its flight of migrating birds. Many of the species that pass Ottenby during the autumn or spring migrations (such as waders, birds of prey, cranes, brent geese and passerines) can be assumed to pass close to Södra Midsjöbanken on their flight path over the Baltic Sea.

Jan Pettersson (JP Fågelvind, 2011) reports a long list of migrating birds during a boat-based inventory at Södra Midsjöbanken over the course of four days in September 2001. Pettersson observed individual birds of prey and owls such as the honey buzzard, sparrowhawk, kestrel, short-eared owl and long-eared owl. He also observed flocks of ducks, including eider, widgeon and common scoter. In addition, he observed flocks of white wagtails (passerines) heading towards the southeast.

During the day, robins, chiffchaffs, willow warblers and meadow pipits, as well as the dominant species the white wagtail, rested on the boat. Pettersson reports that on the night of the 23-24 September, during nightly job in lighting of spotlights on the afterdeck for 1.5 hours in overcast weather and rain, at least several hundred small birds gathered on the boat, mostly white wagtails, robins, meadow pipits and redstarts, although also thrush nightingales, pied flycatchers, goldcrests, grasshopper warblers, sedge warblers, reed warblers, whitethroats, lesser whitethroats, song thrushes and wheatears. It is apparent that, during the migration period, many species of small birds pass over Södra Midsjöbanken in large numbers at night.

8.7.2 Effects and consequences

Birds that remain on the banks
A follow-up of the Danish wind farms at Horns Rev and Nysted up to 3 years after the farms were commissioned showed that loons, scoters and long-tailed ducks entirely or to a large extent avoided the wind farms during the operating period. In addition, no terns or auks were observed within the farm at Horns Rev after commissioning, despite the fact that they had been observed before [12]. Of these species that have demonstrated avoidance behaviour, long-tailed ducks, scoters, auks and occasional loons are found at Södra Midsjöbanken. One probable consequence of the establishment of a wind farm at Södra Midsjöbanken is consequently that access for these species to a sea area that is important to them could be reduced (habitat loss)

The distance between the turbines at Södra Midsjöbanken is approximately 1,000 m, which is significantly greater than the distance at the above Danish farms (approx. 500 m). The greater distance between the wind turbines could contribute to the habitat loss effect being less at Södra Midsjöbanken than at Horns Rev and Nysted.

Södra Midsjöbanken is an important wintering area for long-tailed ducks. There are additional important wintering areas at other offshore banks and along Baltic coasts. The effects of establishing a wind farm at Södra Midsjöbanken could result in increased pressure in other wintering areas, most immediately Norra Midsjöbanken, Hoburgs Bank, the coast of Öland and Slupsk Bank in the Polish economic zone.

Long-tailed ducks' wintering is dependent on access to a limited number of suitable sea areas, either coastal or offshore banks. Uncontrolled exploitation of such areas risks resulting in cumulative effects (the combined impact of several establishments creates an overall habitat loss) that affect the population of long-tailed ducks, for instance. Such consequences cannot be controlled through measures in one individual project.

Studies carried out within the framework of the control programme for the Lillgrund wind farm in Öresund also demonstrate avoidance behaviour among long-tailed ducks, whereas eider showed signs of growing accustomed [73].

Migrating birds
There have been episodes of mass deaths of small birds in connection with built structures such as the Öresund Bridge. Such episodes have been associated with the dark, poor visibility and facade lighting. The birds are dazzled and cannot find their way

back to the correct flight path (Leif Nilsson *pers. comm.*). Bearing in mind Jan Pettersson's report (2011) presented above (section 8.7.1), there is an obvious risk that the wind turbines, if they are lit, could put large numbers of migrating passerines in danger.

Birds that migrate past offshore wind turbines have proven to a large extent to detour around the turbines. Studies at Utgrunden in the Kalmar Strait [62], Nysted and Horns Rev in Denmark have demonstrated that the collision risk is low [12]. This also applies to flocks of seabirds that migrate at night. Despite extended observation periods, only occasional collisions have been noted.

A wind farm at Södra Midsjöbanken will give rise to avoiding manoeuvres among migrating birds. However, this effect is considered to be insignificant, as the birds soon resume their normal flight path.

8.7.3 Measures

The towers should not be lit, other than necessary obstacle marking with regarding to aircraft and shipping. Additional knowledge needs to be developed regarding the effects of wind turbines on migrating passerines at night in poor visibility. Episodes of high mortality could possibly be reduced if the wind turbines are turned off at night in the event of certain seasonal and weather criteria, based on knowledge both about the birds' migrating periods as well as experience of weather and visibility conditions that entail an increased risk of bird collisions.

It is proposed that the control programme should cover the mapping of the occurrence and behaviour of birds at Södra Midsjöbanken before and after the establishment of the farm, with particular focus on long-tailed ducks and auks. The control programme should be designed in consultation with bird experts, with particular focus on minimising the dislocation of long-tailed ducks and other species that remain at the bank. The control programme should also cover bird species that migrate at night in poor weather conditions and, if necessary, develop measures to minimise such risks.

Attention is also called to the cumulative effects associated with the granting of other permits, to ensure that wind farms are not established on all the offshore banks with large bird concentrations in winter.

8.8 Bats

The assessment of the effects and consequences of a wind farm at Södra Midsjöbanken with regard to bats is based on the following background reports:

- Hedenström, Anders (2011) Möjlig förekomst av fladdermöss vid södra Midsjöbanken i Östersjön och potentiella effekter av en utbyggnad av vindkraft, rapport 2011-04-25
- Naturvårdskonsult Gerell (2011) Planerad vindkraftspark på Södra Midsjöbanken - En preliminär analys av effekterna på fladdermusfaunan, Rapport 2011-09-28

8.8.1 Preconditions

Ring marking trials have established that some bat species migrate from Scandinavia to more southerly latitudes to winter. The majority of Swedish bat species gather at Ottenby and Falsterbo, which is indicative of migratory behaviour. It is reasonable to assume that bats that migrate to the Continent have to cross the sea to some extent, although it is not known which routes they follow. The gathering of migrating birds at places such as Falsterbo and Ottenby is interpreted as a leading-line effect, i.e. as far as possible the birds avoid long sea crossings and therefore follow the coastline as far as possible. Gatherings of bats could be interpreted in the same way.

Registered migration of bats at the southern tip of Öland, Utklippan and Karlskrona archipelago indicates westerly and southwesterly migration directions, which suggests that the bats are following the coast rather than heading out on long crossings of the Baltic Sea. Ringed Nathusius' pipistrelle bats recovered in the Baltic States, and the extensive occurrence of the species on Öland, provide scope for the possibility that Nathusius' pipistrelles might migrate over the sea, including in the vicinity of Södra Midsjöbanken.

Furthermore, studies in Kalmarsund and Öresund have shown that non-migrating bats sometimes head out over the sea to look for food (up to 14 km in the Kalmar Strait). Wind farms can result in accumulations of insects, which can attract bats close to the wind turbines.

8.8.2 Effects and consequences

It is possible that migrating bats are attracted to offshore wind turbines by the accumulations of insects. This could result in fatalities.

However, it seems less likely that non-migratory bats would head as far out to sea as Södra Midsjöbanken in order to find food.

8.8.3 Measures

The migration intensity of bats is low at wind speeds exceeding 5 m/s. Automatic bat detectors are being established as part of the control programme for registering the occurrence of bats at Södra Midsjöbanken before and after the construction of the wind farm. Any measures can subsequently be determined on the basis of registered occurrences as described above.

8.9 Angling and recreational diving

There is no indication that Södra Midsjöbanken would be of particular interest for angling or recreational diving. No specific measures are deemed justified.

8.10 Marine archaeology

8.10.1 Preconditions

Lars Einarsson, marine archaeologist at Kalmar County Museum, has examined the geophysical surveys carried out by MMT 2011 (*Einarsson, Lars (2011) Planerad vindkraftsetablering inom grundområdet Södra Midsjöbanken – synpunkter på dess konsekvenser för kulturmiljön under vatten. Marinarkeologiska enheten, Kalmar läns museum, rapport oktober 2011.)*

The report concludes that there are no obstacles to establishment with regard to negative consequences for shipwrecks. Nor have there been any indications of underwater Stone Age settlements.

8.10.2 Effects and consequences

No negative effects on shipwrecks are anticipated. There are no indications of the presence of settlements from the geophysical survey. As the method that has been used has not been adapted for the location of settlements, it is not possible to rule out their existence.

8.10.3 Measures

It is proposed that the control programme should encompass more targeted efforts to determine the possible existence of underwater Stone Age settlements. Archaeological experts will assess the need for archaeological measures during the construction period.

8.11 Navigation and risks

The section on Navigation and risks is based on (*Sweco (2011) Riskanalys för vindkraftetablering på Södra Midsjöbanken*).

8.11.1 Preconditions

According to the Swedish Maritime Administration's reporting system for AIS information, approximately 42,000 vessels passed between Öland and Södra in 2010, with the majority passing in the fairway nearest to Öland. A proportion of these (approx. 7,200 vessels/year) pass in the fairways nearer to Södra Midsjöbanken.

Fishing boat traffic travels both to and from as well as within the area. There is also a certain amount of leisure boat traffic.

8.11.2 Effects and consequences

Based on the description of the area, information about accidents in Swedish waters and disruptions to navigation, guidance from the Swedish Transport Administration and the Swedish Maritime Administration, as well as certain other literature, a number of hazards expressed as unwanted incidents have been identified. These incidents are of the type that, in various ways, can result in negative consequences for shipping and/or the wind

farm. Below is a brief description of what is meant by the various incidents, as well as an assessment of how they will be affected by a wind farm at Södra Midsjöbanken (Table 8-8).

Table 8-8 Potential risk incidents and an assessment in relation to the zero alternative.

Risk incident	Assessment
The wind farm leads to changes of course for vessels and the crowding together of traffic, which increases the risks associated with vessel collisions.	Not expected to result in any particular increase in the risk of vessel collisions
Vessels sail into the wind farm and collide with one or more towers or other equipment.	The location of the area, combined with the relatively limited number of vessels that currently sail through the area, mean that the wind farm will probably not result in any particular increase in risk.
A vessel that is not very manoeuvrable sails into the wind farm and collides with one or more towers or other equipment.	A collision can lead to serious damage and danger to people on the vessel.
The wind turbines make the potential to navigate more difficult by disrupting radar function or obscuring existing marking.	The wind farm will function as a clear navigation mark. Major disruptions to radar equipment occur in the vicinity of the farm.
Falling objects from a wind turbine damage vessels sailing through or close to the area.	Assuming that most vessels pass the wind farm at a distance greater than 800 metres, the likelihood of them being hit is considered to be very small.
The construction of the wind farm entails increased crowding and problems in and around the area, for example a possible collision between a vessel and a construction vessel.	By advising affected parties of the work at an early stage, it should be possible to avoid serious incidents.

8.11.3 Measures

Risk-reducing measures can be implemented to reduce unacceptable risks to an acceptable level or to further reduce acceptable risks.

Obstacle lights according to recommendations from the IALA (International Association of Marine Aids to Navigation and Lighthouse Authorities) will be used.

The wind farm will be clearly marked on marine charts and in other ways. Additional marking requirements in order to improve the radar signature from the wind farm are proposed in consultation with the Swedish Maritime Administration.

Vessels will probably be excluded from the wind farm area. In the exclusion area, there will also be a free area in the form of a safety zone around the outermost turbines. The area that is suitable for exclusion will be discussed with the Swedish Maritime Administration and other affected parties.

8.12 Aviation

The wind farm must be marked in accordance with the international regulations. Aviation must be notified via professional channels about the extent of the wind farm. Both personnel and materials will be transported between the farm and the mainland by helicopter.

E.ON Vind intends to mark out the farm according to the international regulations and the requirements of the Swedish Transport Agency.

8.13 Natural resources

8.13.1 Preconditions

Wind energy at sea is an increasingly interesting natural resource, as technological developments with regard to wind power are moving towards larger wind turbines that have been adapted to an offshore environment. Södra Midsjöbanken within the Swedish economic zone has been designated by the Swedish Energy Agency as being an area of national interest for wind usage.

The surface layer of Södra Midsjöbanken's seabed comprises sand and gravel. Within the Polish economic zone, there is interest in gravel extraction and wind usage.

The commercially interesting fish stocks are a natural resource covered under the heading Fish and Commercial fishing in this report.

8.13.2 Effects and consequences

The wind farm will utilise the wind resource, which is in line with the Swedish Energy Agency's designation of Södra Midsjöbanken as being an area of national interest. This in turn is based on considerations regarding potential conflicts between wind usage interests and opposing interests, such as the interest in preserving the natural values of offshore banks.

The potential to extract natural gravel within the wind farm during the lifetime of the farm is disappearing. It is not possible to allow the extraction of gravel within the farm area for safety reasons, bearing in mind both the wind turbines' foundations as well as the cables between the turbines within the farm. The natural gravel resource will be preserved for possible extraction after the phasing out of the farm.

The potential to extract natural gravel outside of the farm is not affected by the wind farm project.

8.13.3 Measures

No particular measures are proposed

8.14 Visual impact

8.14.1 Preconditions

The wind farm is located such a long distance, approximately 70 km, from the nearest land (the southern tip of Öland), that its highest points, the rotor blades, cannot even be seen in theory by a person standing on the beach. The turbines are entirely hidden by the horizon. The turbines may theoretically be visible from higher points on land or from aircraft. In practice, however, the turbines will not be visible from land, both because the visibility conditions seldom allow this, and because at such large distances the turbines will appear so small as to be imperceptible.

8.14.2 Effects and consequences

People travelling at sea as professionals, passengers or leisure sailors will perceive the wind farm as a tangible element in the visual experience when they are close enough for the farm to be visible. The farm will have obstacle marking according to the Swedish Transport Agency's regulations and general advice regarding the marking of objects that can constitute a hazard to aviation (TSFS 2010:155). At dusk, dawn and during the night, the turbines' obstacle marking will comprise a flashing, red, medium-intensity light. A wind turbine that, including the rotor, is more than 150 metres tall at its highest point, must be supplied with a high-intensity, white flashing light.

For a ferry passenger approximately 20 m above the water, the farm can start to become visible at a distance of around 60 km in extremely good visibility conditions. When travelling near the farm, this means that it will be visible for at most 120 km of the journey. If the ferry is travelling at approximately 20 knots, the farm would be visible for at most 3 hours 20 minutes. During this time, the experience of the farm would change from being barely discernible, via clearly visible, and back to barely discernible, before it disappears from sight. At night, the turbines' obstacle marking (steady red glow) will be visible.

8.14.3 Measures

Consideration is being given through the location of the farm a long distance from the coast. This avoids having a negative impact on the experience of locations where an undisturbed outlook is an important part of the experience. Flashing lights will be synchronised in accordance with advice in the Swedish Transport Agency's regulations (TSFS 2010:155).

9 Nature protection areas

9.1.1 Preconditions

Parts of the southern Baltic Sea and its coastal areas comprise nature protection areas according to national and international regulations (map appendix 2 presents the Natura 2000 and BSPA areas). BSPA areas (Baltic Special Protection Areas) are covered by the Helsinki Commission's agreement between the included countries regarding the protection of the Baltic Sea's natural values. The Natura 2000 areas are covered by the EU's regulations according to the Bird and Habitat Directives, which have also been implemented in national regulations.

The protected areas that have been considered in the Environmental Impact Assessment satisfy at least three of the following criteria (cf. Table 9-1):

1. Covered by protection as a Natura 2000 area
2. BSPA according to the Helsinki Commission
3. < 80 km from the wind farm's boundaries
4. Covers marine habitats

Certain areas at a distance of > 80 km have been included on request according to the Espoo Convention. Certain areas that do not constitute BSPA areas have been included, as they fall within the distance criterion < 80 km.

The areas that have been identified according to the above criteria can be seen from Table 9-1. The table sets out which habitats and species are covered in the relevant areas. The marine mammals (according to the Habitat Directive and its annexes) are covered in a separate chapter. Data about the protected areas has been obtained from the standardised data forms on the EU's website (http://natura2000.eea.europa.eu/).

Wintering seabirds, primarily the long-tailed duck (*Clangula hyemalis*), constitute the dominant category as regards organisms worthy of protection at the nearest offshore banks, i.e. Norra Midsjöbanken, Slupsk Bank and Hoburgs Bank. The long-tailed duck occurs in numbers ranging from thousands up to several hundred thousands at the offshore banks (cf. the chapter about birds), with some variation depending on the time of the inventory and the methods used, etc. Eider (*Somateria molissima*) are reported in large numbers from Hoburgs Bank.

In addition, auks including razorbills (*Alca tordea*) and guillemots (*Uria algae*) are found at the Midsjö banks, as well as some black guillemots (*Cepphus grylle*) at Slupsk Bank and Hoburgs Bank. Black-throated loons and red-throated loons (*Gavia arctica, Gavia stellata*) appear to occur regularly in small numbers at the offshore banks.

The Polish coastal area Przybrzezne wody Baltyku is a wintering ground for 100,000s of long-tailed duck (*Clangula hyemalis*), 10,000s of velvet scoters (*Melanitta fusca*), as well as thousands of loons, scoters and black guillemots (*Gavia arctica, Gavia stellata, Melanitta nigra, Cepphus grylle*).

In Swedish coastal areas, a number of species of terns and waders are reported, as well as grey and common seals.

In addition, auks including razorbills (*Alca tordea*) and guillemots (*Uria algae*) are found at the Midsjö banks, as well as some black guillemots (*Cepphus grylle*) at Slupsk Bank and Hoburgs Bank. Black-throated loons and red-throated loons (*Gavia arctica, Gavia stellata*) appear to occur regularly in small numbers at the offshore banks.

The Polish coastal area Przybrzezne wody Baltyku is a wintering ground for 100,000s of long-tailed duck (*Clangula hyemalis*), 10,000s of velvet scoters (*Melanitta fusca*), as well as thousands of loons, scoters and black guillemots (*Gavia arctica, Gavia stellata, Melanitta nigra, Cepphus grylle*).

In Swedish coastal areas, a number of species of terns and waders are reported, as well as grey and harbour seals.

Table 9-1 Protected areas that have been assessed in relation to indirect impact from the Södra Midsjöbanken wind farm.

Sitecode	Name	Distance (km)	Criterion (see text)				Habitat[13] (annex to EU directive)	Species (annex to EU directive)
			1	2	3	4		
SE0330273	Norra Midsjöbanken	26	+	+	+	+	1110 sandbanks 1170 reefs	*Cepphus grylle*, *Clangula hyemalis*
PLC990001	Ławica Słupska	65	+	+	+	+	1110 sandbanks 1170 reefs	*Gavia arctica, Gavia stellata, Cepphus grylle, Clangula hyemalis*
SE0330083 SE0330108	Ottenby & Ottenby nature reserve	70	+	-	+	+	1110 reefs 1140 exposed mudflats and sandflats 1160 inlets and bays	A large number of plant and animal species, including some marine bird species, as well as grey and common seals.
SE0330174	Sydöstra Ölands sjömarker	73	+	-	+	+	1140 exposed mudflats and sandflats 1160 inlets and bays	Waders, terns, etc., as well as grey and common seals

[13] Only marine habitats have been considered relevant in connection with an assessment of offshore wind power.

Sitecode	Name	Distance (km)	Criterion (see text)				Habitat[13] (annex to EU directive)	Species (annex to EU directive)
PLB990002	Przybrzezne wody Baltyku	77	+	+	+	+	The Birds Directive	*Gavia arctica* *Gavia stellata* *Cepphus grylle* *Clangula hyemalis* *Larus canus* *Melanitta fusca* *Melanitta nigra*
SE0340144	Hoburgs Bank	78	+	+	+	+	1110 sandbanks 1170 reefs	*Cepphus grille*, 100s *Clangula hyemalis*, 1,000,000s *Somatefria mollissima*, 10,000s
PLB220005	Zatoka Pucka	110	+	+	-	+	The Birds Directive 1130 estuaries 1160 inlets and sounds	Wide variety of wintering and migrating bird species, including thousands of *Clangula hyemalis*, as well as common seals and grey seals, etc.
PLH220032	Zatoka Pucka i P¢lwysep Helski	110	+	+	-	+		

9.1.2 Effects and consequences

The areas according to Table 9-1 are situated at considerable distances from the project. There is no chance of them being exposed to a direct physical effect from measures at Södra Midsjöbanken. The impact and consequence assessment therefore only relates to indirect effects. Indirect effects relate to the impact on organisms that, when migrating or searching for food, could possibly use both Södra Midsjöbanken and one of the areas in Table 9-1, or that are affected as a result of the project's measures in such a way that they move to one of these areas.

The nearest offshore banks, Norra Midsjöbanken, Lawica Slupska and Hoburgs Bank, are apparently very important wintering areas for very large numbers of long-tailed ducks, as well as loons, eiders and guillemots (auks, common guillemots, razorbills and black guillemots) in small to large numbers. The extensive scientific environmental monitoring programme conducted at the Danish offshore wind farms at Nysted and Horns Rev showed that loons, scoters and long-tailed ducks entirely or to a large extent avoided the wind farms during the operating period. Terns and auks also avoided the farms during the construction and operating periods.

Of these species that have demonstrated avoidance behaviour, long-tailed ducks, scoters, auks and occasional loons are found at Södra Midsjöbanken. One probable

consequence of the establishment of a wind farm at Södra Midsjöbanken is consequently that access for these species to a sea area that is important to them could be reduced (habitat loss) They might then go to one of the protected areas presented in Table 9-1.

The results from more than three years of following up the Danish wind farms are not currently available, and for this reason it is not possible to say anything about whether or not these species will grow accustomed to the farms in the long term. The distance between the wind turbines at Stora Midsjöbanken is approximately 1,000 m, roughly twice the distance between the turbines at Horns Rev and Nysted. This difference could theoretically (although this has not been established through studies) be assumed to mean a reduction in avoidance behaviour.

Based on that which is known to date about certain bird species' avoidance of offshore wind farms, it is judged that an important wintering area for long-tailed ducks and certain other seabird species would lose value. These bird species are also found at the surrounding offshore banks, Norra Midsjöbanken, Slupsk Bank and Hoburgs Bank, as well as in coastal Natura 2000 areas. Even if these birds are scared away from the Swedish parts of Södra Midsjöbanken, possible wintering habitats for these species remain in the remaining parts of Södra Midsjöbanken, Norra Midsjöbanken, Slupsk Bank and Hoburgs Bank, as well as along Baltic coastal areas.

If fewer wintering habitats remain for the same number of individuals, this will result in the increased utilisation of resources at the alternative offshore bank and coastal habitats, which is expected to result in a slight population adjustment (fewer individuals). This adjustment is considered so small that it will not significantly affect the overall populations of the bird species in question.

9.1.3 Measures

E.ON Vind will design its control programme so that the occurrence of birds at Södra Midsjöbanken before, during and after the construction period will be followed up carefully and for the necessary period of time, with the aim of acquiring knowledge about the possible readjustment to the wind farm of species that have been scared off. If necessary, it is proposed that the programme will include active attempts to entice back avoiding species and help them become accustomed to the farm area, if this can be done without unacceptable raised mortality levels. If such knowledge can be gained, this would be extremely important for the assessment of future offshore wind farms.

10 International Conventions

Through HELCOM, Sweden has approved the protection of coastal and sea areas, known as Baltic Sea Protected Areas (BSPA). Södra Midsjöbanken is not such an area. It can be seen from Table 9-1 which of the areas within the project's area of influence are such areas. Consultation has taken place through the Swedish Environmental Protection Agency as regards the environmental impact in other countries according to the ESBO Convention. As a result of relatively comprehensive opinions received, E.ON Vind has requested the opportunity to meet authorities from Åland and Finland to present the project and to gain a better understanding of the opinions submitted in writing. The request was accepted and the meetings took place in November 2011.

11 Assessment of environmental quality standards and the fulfilment of environmental goals

11.1 Environmental quality standards

Table 11-1 presents environmental quality standards (according to the Swedish Environmental Code) and an assessment of how these may be affected by the project.

Table 11-1 Assessment of the relevance of environmental quality standards for the project. If necessary, comments are made on the assessment.

Environmental quality standards	Relevant	Comments/Assessment
1. SFS 2010:477 Air Quality Ordinance (with associated regulation NFS 2010:8 Swedish Environmental Protection Agency's regulations regarding checking air quality)	Yes	The project contributes positively through electricity production with no air pollution.
2. SFS 2008:218 Bathing Water Ordinance (with associated regulation NFS 2008:8 Swedish Environmental Protection Agency's regulations and general advice regarding bathing water)	Yes	There is no bathing water within the project's area of influence.
3. SFS 2004:675 Ambient Noise Ordinance	No	Relates to traffic noise.
4. SFS 2004:660 Ordinance on Management of Water Quality (with associated regulations a) NFS 2008:18 Swedish Environmental Protection Agency's regulations regarding management plans for surface water, b) NFS 2008:1 Swedish Environmental Protection Agency's regulations and general advice on classification of and quality standards for surface water, c) NFS 2007:4 Swedish Environmental Protection Agency's regulations and general advice on programmes of measures for surface water according to ordinance (2004:660) on the management of the quality of the water environment, d) NFS 2006:11 Swedish Environmental Protection Agency's regulations on monitoring of surface water according to ordinance (2004:660) on the management of the quality of the water environment, e) NFS 2006:1 Swedish Environmental Protection Agency's regulations on mapping and analysis of surface water according to ordinance (2004:660) on the management of the quality of the water environment.) f) Geological Survey of Sweden's regulations	No	Refers to occurrences of surface and groundwater on land.

Environmental quality standards	Relevant	Comments/Assessment
(SGU-FS 2006:1) on the mapping and analysis of groundwater according to ordinance (2004:660) on the management of the water environment. g) Geological Survey of Sweden's regulations (SGU-FS 2006:2) on monitoring of groundwater according to ordinance (2004:660) on the management of the quality of the water environment.		
5. SFS 2003:65 Ordinance on national emissions ceilings for air pollutants	No	Refers to Sweden's reporting obligation to the EU
6. SFS 2010:1341 Marine Environmental Ordinance	Yes	The project does not affect the conditions for maintaining a good environmental status.

11.2 Fulfilment of goals

Sweden's electricity production is currently based overwhelmingly on nuclear power and hydroelectric power in roughly equal measure. Only a very small proportion, a few per cent, comes from other sources.

Sweden's Parliament has adopted 16 national environmental objectives„ which should provide guidance for the application of the Environmental Code, for instance. Below is an assessment of how the effects and consequences of the Södra Midsjöbanken wind farm will impact on the fulfilment of the environmental objectives. Information about the environmental objectives has been obtained from the Environmental Objectives Portal [46].

11.2.1 Reduced climate impact

This objective means that emissions of greenhouse gases must be reduced.

Electricity production from fossil fuels (natural gas, coal and oil) constitutes an alternative to wind power and is included to a certain extent and increasingly in Swedish electricity supplies, both through importing electricity from countries with a higher proportion of fossil electricity production, as well as through some electricity production in Swedish oil and natural gas-fired power stations, particularly in conjunction with peak loads. The service life of the wind farm will amount to at least 25 years. In this context, it should be mentioned that the energy that is required for the manufacture, installation and phasing out of a wind turbine, including the foundations, is earned back within 9–11 months.

The planned wind farm at Södra Midsjöbanken, with an installed power corresponding to the currently planned level, can reduce carbon dioxide emissions by 1–2.5 million tonnes of CO_2 per year compared to producing the same amount of electricity using fossil fuels.

The planned wind farm at Södra Midsjöbanken will contribute positively to the fulfilment of the environmental objective *Reduced climate impact*.

11.2.2 Clean air

The clean air objective is justified in part by the fact that levels of a number of air pollutants that can affect health, materials and cultural objects occur primarily in built-up areas. Fossil-based electricity production is a contributory cause of polluted air, even though other sources are more important, such as emissions from traffic.

The planned wind farm at Södra Midsjöbanken will contribute positively, although only to a small extent, to the fulfilment of the environmental objective *Clean air* by reducing the need for fossil-based electricity production.

11.2.3 Natural acidification only

Fossil fuels containing sulphur were previously the most important cause of the acidification of land, lakes and watercourses, in particular through the long-distance transport of air pollutants from other countries that used coal-fired power stations. The problem has now been reduced through improved cleaning techniques and the reduced use of sulphurous fossil fuels in Sweden and other countries. Nitrogen dioxide emissions from traffic and incineration also contribute to acidification.

Fossil-based electricity production can have a negative impact on the environmental objective, for example through increased demand for imported electricity from countries that still produce electricity with low-value, sulphurous fuels.

The planned wind farm at Södra Midsjöbanken will contribute positively, although only to a small extent, to the fulfilment of the environmental objective *Natural acidification only*.

11.2.4 A non-toxic environment

The overall objective is for the environment to be free from man-made or extracted substances and metals, which represent a threat to human health or biological diversity.

The Södra Midsjöbanken project will impose requirements on contractors and suppliers of materials and chemical products such that the supply of materials satisfies applicable regulations and restrictions. Ordering and performing organisations will have functions to ensure compliance.

The planned wind farm at Södra Midsjöbanken will therefore not have a negative impact on the fulfilment of the environmental objective *A non-toxic environment*.

11.2.5 A protective ozone layer

This objective relates to the ozone layer, high up in the stratosphere. Fulfilment of the objective *A protective ozone layer* is not affected by the Södra Midsjöbanken project.

11.2.6 A safe radiation environment

Radioactive substances

This environmental objective means that human health and biological diversity must be protected against the harmful effects of radiation in the external environment.

The levels of radioactive substances in the environment must be so low that human health and biological diversity are protected. The Södra Midsjöbanken project will have an installed power roughly the same as a nuclear reactor. The systematic expansion of large-scale electricity production through wind farms will make it possible to supply society with electricity that is based to a reduced extent on nuclear power compared to the current situation.

The project will improve the potential to reduce the spread of radioactive substances in connection with the operation of nuclear power stations, the extraction and transport of nuclear fuels, as well as the transport and final storage of nuclear waste. The project will contribute to the fulfilment of this part of the environmental objective.

Electromagnetic radiation

The environmental objective *A safe radiation environment* also includes the effects of electromagnetic radiation on health and biological diversity.

Both alternating and direct current cables give rise to electrical and magnetic fields. Electrical fields are shielded by the cable sheath and do not affect the surrounding environment.

The fluctuating magnetic field from alternating current cables has no known effects on migrating organisms, but there is a concern about the health effects on people [6, 75]. The scientific evidence for such a health effect is unclear. Negative health effects from magnetic fields around alternating current cables are not deemed to have been proved unambiguously.

Alternating current cables in the Södra Midsjöbanken project are only found within the farm itself. The transfer to land takes place using direct current.

As the exposure of the population at Södra Midsjöbanken is low, any health effects of alternating magnetic fields are not considered to influence the fulfilment of the objective *A safe radiation environment*. Exposure of people to fluctuating magnetic fields is much greater in densely populated urban environments [6].

The static magnetic field that arises around the direct current cable from the farm to the land is of the same type as the Earth's magnetic field. Static magnetic fields have no known negative health effects. However, there are concerns that such fields could affect the ability of organisms to navigate.

Studies have shown that the magnetic field from the Baltic Cable does not have any significant impact on the migration patterns of eels or salmon [24, 25].

The cable technology (HVDC) that will be used in the project, with positive and negative cables located close to each other, means that the strength of the magnetic field will be much lower than equivalent fields around existing direct current cables (for example for the Gotland cable, the Fenno Skan cable, Baltic Cable, SwePol Link). As a result, it is

considered that the Södra Midsjöbanken project will not obstruct the fulfilment of this part of the objective regarding *A safe radiation environment*.

In summary, it is considered that the Södra Midsjöbanken project will contribute positively to the objective of *A safe radiation environment*, based on the fact that it can form part of a long-term strategy for reducing the use of nuclear power without giving rise to negative effects on health and biological diversity as a result of fluctuating or static magnetic fields.

11.2.7 Zero eutrophication

This objective means that the nutrient levels in soil and water must not have an adverse effect on human health, the conditions for biological diversity or the possibility of varied use of land and water. The Södra Midsjöbanken project contributes to some extent to the objective *Zero eutrophication* by replacing incineration-based electricity production and its associated nitrogen oxide emissions.

11.2.8 Flourishing lakes and streams

This objective means that lakes and watercourses must be ecologically sustainable and their variety of habitats must be preserved. Natural productive capacity, biological diversity, cultural heritage assets and the ecological and water-conserving function of the landscape must be preserved, at the same time as recreational assets are safeguarded.

A strong contributory negative factor regarding the fulfilment of the environmental objective is that almost all major watercourses are affected by the development of hydroelectric power. Bearing in mind this objective, it is not desirable to meet the increasing demand for electricity with the continued development of hydroelectric power.

The planned wind farm at Södra Midsjöbanken will contribute positively to the fulfilment of the environmental objective *Flourishing lakes and streams* by reducing the need to further regulate watercourses for electricity production.

11.2.9 Good-quality groundwater

The overall objective is that the groundwater must provide a safe and sustainable supply of drinking water and contribute to viable habitats for flora and fauna in lakes and watercourses.

The project does not affect groundwater.

11.2.10 A balanced marine environment, flourishing coastal areas and archipelagos

The North Sea and the Baltic Sea must have a sustainable productive capacity, and biological diversity must be preserved. Coasts and archipelagos must be characterised by a high degree of biological diversity and a wealth of recreational, natural and cultural assets. Industry, recreation and other utilisation of the seas, coasts and archipelagos must be compatible with the promotion of sustainable development. Particularly valuable areas must be protected against encroachment and other disturbance.

This objective includes sub-objectives relating to marine environments worthy of protection, threatened species, noise and other disturbances, discharges of oil and chemicals. Many problems are observed in marine environments, such as the fact that biological diversity in coastal and sea areas is being damaged by eutrophication, environmental toxins and overfishing.

The Södra Midsjöbanken project does not affect the cultural heritage of the coast and the archipelago, due to its location far from the coast. Södra Midsjöbanken as a traditional fishing ground will be affected, although this is not expected to obstruct traditional small-scale fishing.

The project will apply and follow up environmental requirements for its contractors in conjunction with the construction, operation, maintenance and phasing out of the farm, including minimising the risk of oil and chemical spillages.

The planned wind farm at Södra Midsjöbanken will not adversely affect the fulfilment of the environmental objective *A balanced marine environment, flourishing coastal areas and archipelagos*.

11.2.11 Thriving wetlands

The Södra Midsjöbanken project will not affect *Thriving wetlands*.

11.2.12 Sustainable forests

The Södra Midsjöbanken project will not affect *Sustainable forests*.

11.2.13 A varied agricultural landscape

The Södra Midsjöbanken project will not affect *A varied agricultural landscape*.

11.2.14 A magnificent mountain landscape

The pristine character of the mountain environment must be largely preserved, in terms of biological diversity, recreational value, and natural and cultural assets. Activities in mountain areas must respect these values and assets, with a view to promoting sustainable development. Particularly valuable areas must be protected against encroachment and other disturbance.

Wind power production at sea affects the need for large-scale wind power production in mountain environments, which makes it easier to fulfil the objective of *A magnificent mountain landscape*.

11.2.15 A good built environment

This objective means that cities, towns and other built-up areas must provide a good, healthy living environment and contribute to a good regional and global environment. Natural and cultural assets must be protected and developed. Buildings and amenities must be located and designed in accordance with sound environmental principles and in

such a way as to promote sustainable management of land, water and other resources. In this context, it should be mentioned that the energy that is required for the manufacture, installation and phasing out of a wind turbine, including the foundations, is earned back within 9–11 months.

Among many sub-objectives, the majority of which only apply in built-up areas, it is observed that, at the latest in 2010, physical planning and social development must be based on programmes and strategies for the way in which renewable energy resources will be utilised, as well as how the development of production facilities for district heating, solar energy, biofuel and wind power will be promoted.

The planned wind farm at Södra Midsjöbanken contributes positively to the fulfilment of the environmental objective *A good built environment* through a significant contribution to renewable energy supplies.

11.2.16 A rich diversity of plant and animal life

This objective entails that biological diversity must be preserved and used sustainably for the benefit of present and future generations. Species habitats and ecosystems and their functions and processes must be safeguarded. Species must be able to survive in long-term viable populations with sufficient genetic variation. People must have access to a good natural and cultural environment rich in biological diversity, as a basis for health, quality of life and well-being

The planned wind farm is not expected to lead to any adverse effects on biological diversity with regard to bottom flora and fauna, fish, marine mammals or bats. Less than 1% of the bottom area will be lost. In addition, biotope loss will be compensated to some extent through the reef effect.

However, there is a risk that certain wintering seabird species, such as the long-tailed duck, will avoid the wind farm area and thereby lose part of their habitat. This is not expected to have a significant negative impact on the populations. The Södra Midsjöbanken project will not affect the proportion of threatened species or the preservation status of species.

The total bottom area that will be affected by the Södra Midsjöbanken project (< 1% of 326 km^2) corresponds to a square with sides measuring barely 2 km. The planned wind farm at Södra Midsjöbanken is not expected to adversely affect the fulfilment of the environmental objective *A rich diversity of plant and animal life*.

12 General rules of consideration in the Environmental Code

Knowledge about the project's conditions has been obtained through bathymetric, geophysical and marine biological surveys, aerial inventories of seabirds, assessment of geophysical surveys by archaeological experts, inventories of regulations and public interests, literature studies and desk research regarding e.g. fish and bats, and not least through studies of environmental surveys regarding the Nysted and Horns Rev wind farms.

The consequences of the project have been described and assessed, after which reasonable measures for limiting environmental disruptions have been proposed. As a result, the *knowledge requirement*, the *precautionary principle* and the *principle of equity* are fulfilled.

The project as a whole, including the Environmental Impact Assessment and proposed measures, will be paid for by the operator, E.ON Vind Sverige AB. As a result, the principle is fulfilled whereby the *polluter pays* for *reasonable measures* that are required to investigate and prevent or restrict environmental disruptions.

The location of the project is based on assessments, investigations and decisions, presented initially in the chapter on location. This shows that a suitable location has been selected, so that the *location principle* is satisfied.

Within the project, existing excavated material from cable trenches will be reused to cover the cable route. Erosion protection will comprise natural material. Bearing in mind consultation viewpoints from the County Administrative Board in Kalmar County, the provision of natural gravel for the project will be limited to less than 20% of the total gravel volume.

The procurement of the project will be formulated so that applicable regulations for chemical products are complied with, and so that there are incentives for contractors' and suppliers' good environmental choices with regard to chemical products as well as energy-efficient and material-efficient techniques. As a result, the *product choice principle* and the *principles regarding resource management* are satisfied.

The project provides a substantial supply of renewable energy compared to the above objectives [22]. The *principle of resource management* is consequently largely satisfied from a societal perspective.

The project will also be designed down to its smallest component parts in order to achieve good management of natural resources, for example through excavated material from cable trenches being reused to cover the cable route and by recycling material during dismantling. As a result, the *ecocycle principle* is satisfied.

13 Consultation

Initial consultations have been held with the County Administrative Board in Kalmar County in December 2010. Consultations with the County Administrative Boards in Kalmar and Blekinge counties, commercial fishermen, the general public and other authorities and organisations have been held in June 2011. Consultations with other countries according to the Espoo Convention have been conducted during autumn 2011 via the Swedish Environmental Protection Agency. At its own request, E.ON Vind has had the opportunity to meet environmental authorities from Åland and Finland in order to gain a better understanding of the opinions put forward. In addition, E.ON Vind has consulted wind power stakeholders in the Polish economic zone, in part in order to gain an understanding of possible cumulative effects, as well as to discuss possible co-ordination of control programmes, technical studies, etc. Accounts of the consultations are presented in a separate appendix to the application.

14 Cross-border effects and consequences

14.1 Fish and fishing

14.1.1 The information that is provided in Chapter 8.4 regarding the occurrence of fish at Södra Midsjöbanken is based on test fishing and reported catches within Sweden's economic zone (SEZ). These are also considered to be valid for the offshore bank and its surroundings outside of the Swedish zone (Chapter 8.4, Table 8-3). Species that migrate over larger distances, as well as species that are of commercial interest for fishermen regardless of where they come from, are considered to be of particular interest from a cross-border perspective.Occurrence of fish

Both salmon and trout have been caught at Södra Midsjöbanken. According to the website "Allt om fisk" ("Everything about fish"), young salmon that have been marked in Polish waters have been caught again in the waters near Blekinge, Öland as well as in Medelpad and Norrbotten. Salmon marked in Gdansk Bay have been caught in northern Finland. Long-distance migrations have also been documented for trout [37].

Experiments with marked eels (*Anguilla anguilla*) show that migrating silver eels mostly keep close to the coast. However, there are less frequented migration routes via the east coast of Gotland. From Gotland, the migration continues either towards Rügen, east of Bornholm, or to the Swedish coast via Öland. Some of these eels might possibly pass Södra Midsjöbanken heading towards Polish, Danish and German waters.

Garfish (*Belone Belone*) and mackerel (*Scomber scombrus*) migrate over much of the Baltic Sea, the latter temporarily during influxes of salt water, and during their migrations are considered to move through various countries' waters.

14.1.2 None of the above migrating species are expected to be adversely affected by a wind farm, other than by temporary, local disruptions during the construction period. Fishing

The species that are of commercial interest primarily include cod, herring, sprat and salmon, as well as the flatfish flounder, plaice and turbot.

The fishing methods differ between Södra Midsjöbanken itself and the surrounding waters. Outside of the bank, fishing takes place mainly using mobile equipment (trawls), with pelagic trawls being the most common. Cod, herring and sprat are mostly caught in this way. At Södra Midsjöbanken itself, passive equipment is mainly used (e.g. hook and line). Salmon, flounder, plaice and turbot are mostly caught in this way.

Data that has been supplied on request from the countries around the Baltic Sea shows that considerable numbers of fish are caught by fishermen from Poland, Germany and Sweden in the ICES-box 40G7, which encompasses Södra Midsjöbanken. In addition to these countries, all the Baltic Sea countries from which it has been possible to obtain information, directly or second-hand via Nordstream's environmental analyses, fish to

some extent in the waters around Södra Midsjöbanken. This applies to Finland, Denmark, Estonia, Latvia and Lithuania.

Swedish fishing is conducted on Södra Midsjöbanken itself. It is considered probable that several countries fish on Södra Midsjöbanken itself to some extent, primarily the countries closest to it. Special reporting of fishing on Södra Midsjöbanken itself (data only available from Sweden) shows that the catches in this area are dominated by cod, sprat and turbot, and that passive equipment (line, salmon line and hook) dominate fishing on the bank. This pattern is considered to apply to other countries as well.

E.ON Vind will request that all shipping be excluded from the wind farm area. If this happens, it will mean a reduction in fishing, primarily using fixed equipment that principally results in catches of cod, sprat and turbot. These species will consequently gain a protected zone, which is expected to benefit their populations to some extent.

14.2 Birds

14.2.1 Introduction

Section 8.7 describes the birds found at Södra Midsjöbanken, as well as the environmental impact, effects, consequences and possible measures.

Birds migrate regardless of national borders. Södra Midsjöbanken is located in the centre of the southeastern Baltic Sea, close to several countries' economic zones, territorial waters and coastal areas. This section supplements the picture provided in section 8.7 with information that facilitates an assessment of the effects and consequences for bird life from an overall perspective in the Baltic region, regardless of national borders.

In the central parts of the southeastern Baltic Sea, there are a collection of offshore banks with similar ecological conditions. The nearest offshore banks are Hoburgs Bank, Norra Midsjöbanken and Lawica slupska (Slupsk Bank) (Appendix 2). One important ecological factor is that this part of the Baltic Sea never ices over [59]. It therefore appears probable that there is an interaction between the offshore banks and the Baltic coastal areas, which to a greater or lesser extent are iced over in the winter, which affects the composition of species and the number of birds that remain at Södra Midsjöbanken and the other banks. It also appears probable that there is an interaction between the offshore banks themselves, with birds moving between the banks for example as a result of variations in the current situation as regards competition for food.

Another important ecological factor on these offshore banks is the presence of large numbers of blue mussels (*Mytilus edulis*), which constitute a link in the food chain between primary producers and primary consumers (zooplankton and phytoplankton) and secondary consumers, including diving ducks such as the long-tailed duck (*Clangula hyemalis*), eider (*Somateria molissima*), common scoter (*Melanitta nigra*) and velvet scoter (*Melanitta fusca*).

14.2.2 Impact on species that remain on the bank

For the project's calculations, aerial inventories have been carried out focusing on long-tailed ducks, which are by far the most numerous bird observed at Södra Midsjöbanken (Table 8-5). Table 8-6 presents other species that have been observed during the inventories carried out on behalf of the project. The status of these species in the Baltic Sea as a whole is set out below, along with an assessment of the project's effects and consequences.

Long-tailed duck (*Clangula hyemalis*),

The long-tailed duck breeds in circumpolar Arctic coastal areas, on mountain lakes and areas of tundra. The global population is estimated at between 6.2 and 6.8 million adult individuals. The western Siberian and northern European populations winter in the Baltic Sea. The species' status is considered to be viable from a global perspective [7]. The wintering population in the Baltic Sea is estimated to have fallen from just over 4 million to barely 1.5 million individuals between 1993 and 2009 [59]. The reasons for this decline are not clear.

In the Baltic, the highest densities and the largest number of wintering long-tailed ducks are found at Södra and Norra Midsjöbanken, Hoburgs Bank and Slupsk Bank, as well as in coastal areas in the Bay of Pomerania, the Gulf of Riga and the Irbe Strait. In large parts of these areas, including Södra Midsjöbanken, the density is estimated at > 75 individuals per square kilometre.

One result of the Nysted wind farm shows that the frequency of long-tailed duck observations (comparison of before and after commissioning) fell by approximately 90% compared to before the construction of the farm [47]. If experiences from Denmark's Nysted and Horns Rev wind farms, i.e. that long-tailed ducks avoid the wind farms during the operating phase, also apply at Södra Midsjöbanken, this might entail, as a rough estimate, that approximately 24,000 individuals (0.9 x 350 km^2 x 75 ind/km^2 = 23,625 individuals) will be dislocated (excluded from the area), corresponding to approximately 1.6% of the wintering population in the Baltic Sea.

Follow-ups in the Danish farms (Nysted, Horns Rev) extend up to a few years after the commissioning of the wind farms. It is not known whether the birds grow accustomed in the longer term. The Danish waters have lower densities of long-tailed ducks than Södra Midsjöbanken, which means that they are less attractive to the species. In the event of population declines, it is the poorer biotopes (marginal habitats) that are abandoned first. This could mean that the long-tailed ducks will not be scared away from Södra Midsjöbanken as easily.

The wind turbines at Nysted are positioned approximately 500 metres apart, while the turbines at Södra Midsjöbanken are planned to be at a distance of around 1,000 metres from each other. This is another factor indicating that the dislocation effect will be weaker at Södra Midsjöbanken than at Nysted.

The dislocation on its own is not expected to affect the Baltic population of wintering long-tailed ducks significantly.

Based on the arguments in the previous three paragraphs, the estimated dislocation (1.6% of the wintering Baltic population) is considered to be a worst-case scenario.

However, the anticipated effect cannot be considered insignificant if it is combined (cumulative effects) with additional habitat losses as a result of the establishment of wind turbines or other disruptions with equivalent effects within the most important parts of the long-tailed ducks' wintering area.

Black-throated loon and red-throated loon (Gavia arctica, Gavia stellata)

The two species of loons are very extensively distributed in northerly latitudes around the world. Birdlife International [7] gives a rough estimate of the number of individual adult black-throated loons at between 280,000 and 1,500,000, while the number of red-throated loons is between 200,000 and 590,000. In the winter, both species migrate to open water further south, including the Baltic Sea and Western European coastal waters. The winter population in northwestern Europe has been estimated at 250,000–500,000 individual black-throated loons and 150,000–450,000 red-throated loons, of which 1-2% (almost 9,000 individuals) are estimated to winter in the Baltic Sea [59].

The areas of the Baltic with the highest estimated densities of loons are the coastal areas in southern Estonia, Latvia (the Irbe Strait and the Gulf of Riga), Lithuania and the Bay of Pomerania [59], with densities of up to 3 individuals/km^2. Significant numbers of wintering loons are also found in southern parts of the Kalmar Strait (Kalmar sund), Laholm Bay (Laholmsbukten) and Skälder Bay (Skälderviken).

The Midsjö banks and Hoburgs Bank are relatively less important for wintering loons compared to the above areas, with an estimated density of up to 0.3 individuals/km^2 for Norra Midsjöbanken and Hoburgs Bank and 0.1 individuals/km^2 for Södra Midsjöbanken [59].

Control programmes and follow-ups have shown that loons entirely or to a large extent avoid offshore wind farms [59, 12, 47].

If the experiences from other offshore wind farm establishments also apply at Södra Midsjöbanken, this might entail, as a rough estimate, that approximately 35 individuals (350 km^2 x 0.1 ind/km^2 = 35 individuals) will be dislocated (excluded from the area), corresponding to < approx. 0.5 % of the wintering population in the Baltic Sea. Södra Midsjöbanken is not one of the most important areas for loons in the Baltic Sea. This dislocation on its own is not expected to affect the Baltic population of wintering loons significantly.

Great cormorant (Phalacrocorax carbo)

The great cormorant is very extensively distributed globally, with the number of individuals estimated roughly at between 1.4 and 2.9 million. The northwestern European population is estimated at around 500,000 individuals, of which approximately 54,000

winter in the Baltic Sea. The wintering population of cormorants in the Baltic largely comprises birds that migrate here from the west coast of Norway. The cormorants that breed in the Baltic region migrate to a large extent to the Mediterranean Sea in the winter. The species has increased significantly in recent decades. The largest numbers of wintering cormorants are found in Swedish, Danish, German and Polish coastal waters [59]. Södra Midsjöbanken does not stand out as an area of particular significance for wintering great cormorants.

Control programmes and follow-ups have shown that cormorants are also observed in wind farms during the operating phase [12, 47]. The great cormorant is not expected to be adversely affected by the establishment of a wind farm at Södra Midsjöbanken.

Eurasian widgeon (Anas penelope)

This species is extensively distributed, with a global population roughly estimated at between 2.8 million and 3.3 million individuals. They feed on algae and aquatic plants, and are normally found in shallower areas. They winter to the west of the Baltic Sea itself, in the Öresund and the Danish belts [59]. A few individuals were observed at Södra Midsjöbanken in 2011 during the inventories conducted on the project's behalf. Södra Midsjöbanken is considered to be of little importance as a wintering area for this species.

Greater scaup (Aythya marila)

This species mainly breeds in mountainous and tundra areas, although on rare occasions it also breeds along the Finnish and Swedish Baltic coasts. The global population is roughly estimated to comprise 1.2 million to 1.4 million individuals [7]. The winter population in the Baltic Sea has been estimated at 127,000 individuals, the majority of which winter in the southwestern parts, in Polish, German and Danish waters. Södra Midsjöbanken is considered to be of little importance for the wintering population.

Common scoter (Melanitta nigra)

The global population of the common scoter has been roughly estimated at between 2.1 million and 2.4 million individuals. The species breeds in mountainous and Arctic environments, including in Scandinavia and Russia. The wintering population in the Baltic Sea has been estimated at 412,000 individuals [59], with a declining trend. The largest numbers of wintering common scoters are found in the Kattegat, the Belts and the Bay of Pomerania. The species is considered to be sensitive to offshore wind power [7]. Södra Midsjöbanken is considered to be of little importance for the wintering population as a whole.

Velvet scoter (Melanitta fusca)

The global population of the velvet scoter has been roughly estimated at between 1.7 million and 3.0 million individuals. The species breeds on lakes and coasts in the coniferous forest region, including along the coast of the Baltic Sea (from Öland northwards) as well as the Swedish, Finnish and Baltic coasts of the Bothnian Sea and the Gulf of Bothnia. The wintering population in the Baltic Sea has been estimated at 373,000 individuals [59], with a declining trend. The largest numbers of wintering scoters

are found in the Bay of Pomerania, along the Polish coast, near Kaliningad and in the Gulf of Riga. The species is considered to be sensitive to offshore wind power [7]. Södra Midsjöbanken is considered to be of little importance for the wintering population as a whole.

Eider (Somateria mollissima)

This species is very extensively distributed in the Northern Hemisphere, and the global population is estimated at between 3.1 million and 3.8 million fully grown individuals [7]. The wintering population in the Baltic Sea is estimated to amount to 515,000 individuals [59], which is a decrease in the order of 50% compared to the previous estimate for the period 1988-1993.

The largest densities of wintering eider are found in the southwestern Baltic Sea, in Danish and German waters (Bay of Kiel, Little Belt, South Funen) [59]. Available studies show that eider do not avoid wind farms (Nysted, [47]) and are also found in wind farms [73] during the operating phase. As Södra Midsjöbanken is not one of the most important wintering areas for eider, and as there is no evidence of eider avoiding wind farms, the farm at Södra Midsjöbanken is not expected to affect the Baltic Sea's eider population.

Common merganser (Mergus merganser)

This species is extremely widely distributed in the Northern Hemisphere, with a global population roughly estimated at between 1.7 million and 2.4 million fully grown individuals [7]. The wintering population in the Baltic Sea is estimated to amount to 66,000 individuals [59]. The common merganser mostly winters in shallower, coastal sea areas. Södra Midsjöbanken is considered to be of little importance for the wintering population as a whole.

Red-breasted merganser (Mergus serrator)

This species is extremely widely distributed in the Northern Hemisphere, and the global population is roughly estimated at between 510,000 and 620,000 fully grown individuals [7]. The wintering population in the Baltic Sea is estimated to amount to 25,700 individuals [59]. The red-breasted merganser mostly winters in shallower, coastal sea areas, with the emphasis on the southwestern Baltic Sea. The species is displaying a declining trend in the southwestern parts, although a large increase in Swedish waters is being reported, particularly off the east cost of Gotland (8,200 individuals) [59]. A follow-up of the wind farm at Lillgrund shows that red-breasted mergansers do not avoid the farm [73].

The red-breasted merganser is not expected to be adversely affected by a wind farm at Södra Midsjöbanken.*Little gull (Larus minutus)*

This species is widely distributed in the Northern Hemisphere, including northern Scandinavia, Finland and the Baltic States. Outside of the breeding season, the species migrates to the south, including to the Mediterranean Sea, Western Europe' Atlantic coastline, the Black Sea and the Caspian Sea. The global population is roughly estimated at between 97,000 and 270,000 fully grown individuals [7].

The little gull normally winters further to the south and southwest. The Baltic Sea, possibly with the exception of the most southwesterly parts, is of little importance as a wintering area. Studies at Horns Rev and Nysted have not demonstrated that the little gull avoids the wind farms [47]. However, it is possible that a significant number of little gulls pass the Midsjö banks and the central parts of the southeastern Baltic during their migration. The little gull is not expected to be adversely affected by a wind farm at Södra Midsjöbanken.

Common guillemot (Uria algae)

The common guillemot breeds in colonies, and is found in Arctic and boreal areas around the entire Northern Hemisphere. The world population has been roughly estimated at 18 million individuals. They can undertake extremely long journeys to find food (100 km) and can dive to a depth of 230 m. Their primary food is small fish [7]. Large colonies can be found on the Karlsö Islands near Gotland (15,000 pairs). Half of the ringed birds recovered on Stora Karlsö originate from Gdansk Bay. Preliminary results from position logging (on Stora Karlsö) show that Södra Midsjöbanken is potentially within the guillemot's range for much of the year (Nilsson, L. 2011:2). Studies at Horns Rev and Nysted indicate that the guillemot avoids the wind farms [47].

The guillemot's main food is sprat, which moves around at depths of between 10 m and 50 m, which is why Södra Midsjöbanken is not deemed to be of exclusive importance for the guillemot. As guillemots spend time at and fly over Södra Midsjöbanken, and the bank is situated between significant colonies on the Karlsö Islands and important wintering areas in Gdansk Bay, a certain dislocation effect cannot be ruled out.

The dislocation on its own is not expected to have a significant adverse effect on the Baltic population of common guillemots. This effect must be viewed against the background of possible cumulative effects in combination with the establishment of more wind farms in the southeastern Baltic Sea.

Razorbill (Alca tordea)

This species breeds on nesting cliffs over large parts of Northern Europe and America. The global population has been roughly estimated at 1.5 million adult individuals. Razorbills appear to avoid offshore wind farms [47]. The southern Baltic Sea is one area where the razorbill winters.

The effects of a wind farm on Södra Midsjöbanken are assessed in the same way as for the common guillemot.

14.2.3 Impact on migrating species

Södra Midsjöbanken's location between the most southeasterly Scandinavian peninsula, the coast of the Baltic States and the north coast of continental Europe, make it likely that migrating birds of all categories will regularly pass the area. As can be seen from section 8.7, a large number of migrating birds of various categories have been observed at Södra Midsjöbanken (JP Fågelvind, 2011).

Several studies indicate that migrating birds are able to adapt their flight path through or past wind farms with no significant adverse effects arising [13, 62, 59, 47, 73].

14.2.4 Measures

See section 8.7.3.

14.3 Bats

The wind farm's potential effects on bats have been described in Chapter 8.8. Background reports that are cited in Chapter 8.8 also apply to section 14.3.

Recovered ringed individuals have shown that two species of bats (common noctule, Nathusius' pipistrelle) migrate seasonally from Scandinavia to the European Continent in the autumn [31]. During August–October there is an extensive gathering of bats, including species that are not considered to be migratory, along the southern coastlines of Sweden. It is not clear to what extent these species actually migrate over large distances, and in if so, whether they migrate across the open sea.

Ringing has demonstrated extensive migrations of Nathusius' pipistrelles from Latvia to southwesterly parts of Europe [31]. This provides scope for the possibility that Nathusius' pipistrelles may migrate across the sea in the vicinity of Södra Midsjöbanken.

It is probable that migrating Nathusius' pipistrelles and common noctules pass Södra Midsjöbanken to some extent during their migration. The possibility of other species also being found at Södra Midsjöbanken cannot be ruled out, hunting accumulations of wind-blown insects, particularly in the late summer/early autumn.

The measurement tower that will be installed in spring 2012 will be equipped to ascertain the presence of any bats at Södra Midsjöbanken, and if so the circumstances under which this occurs. Even if bats should be present, the wind farm is not expected to affect the species in question to such an extent that any impact on the population can be anticipated. As a result, significant cross-border consequences for bats can also be ruled out.

14.4 Marine mammals

Marine mammals have been described in Chapter 8.6, bearing in mind that effects and consequences for these animals are cross-border. In addition to that set out in Chapter 8.6, it can be worth noting from a cross-border perspective that Helcom's Map and Data Service [34] reports an accumulation of cases of stranded porpoises and porpoise bycatch, including several during the 2000s, above all in Gdansk Bay, but also in the northeastern, outermost parts of the Bay of Pomerania.

It is also known, in part from monitoring of the Danish wind farm at Nysted, that grey seals in particular make remarkably long migrations in the Baltic Sea, including from Danish waters to the Stockholm Archipelago and Estonian waters.

In summary, however, the studies of seals at Nysted do not indicate any adverse effects on seals from the wind farm [9, 14]. Seals and porpoises can adapt to the wind farms during the operating period [56].

It can be worth noting that an international research project (SAMBAH) is in progress, half-financed by the EU and half by national organisations, with the participation of all EU countries around the Baltic Sea, which is intended to chart and preserve the Baltic's porpoise population. The project has installed a large number of sound detectors that can register sound of the porpoises' echolocation. There may be opportunities for collaboration between the project and Södra Midsjöbanken's control programme. The project will probably generate results that can be used as a starting point for the detailed design of the control programme for Södra Midsjöbanken.

14.5 Protected areas

Protected marine areas, both in Sweden and in other countries, are dealt with in Chapter 0 and presented in map appendix 2. These areas could possibly be affected indirectly as a result of the bird species that have been dislocated from Södra Midsjöbanken going to other areas instead. It is judged that this effect could give rise to a slight negative adjustment of the population, as a result of a reduction in the combined resources for species that avoid wind farms (see sections 8.7 & 14.2). This applies primarily to wintering long-tailed ducks. It has not been possible to identify any other effects of significance for protected areas in other countries.

15 Cumulative effects

Cumulative effects refer to the impact from several different development undertakings affecting the same area, each of which may be insignificant on its own, but which together can be of significance. In the local area, known development companies and stakeholders are the planned NordBalt cable, the continued development of the Nordstream gas pipeline, oil extraction and gravel extraction. Effects and consequences of these developments are primarily considered to be local and not to give rise to significant cumulative effects during the operating period.

If an extraction operation in Södra Midsjöbanken's Polish zone should coincide from a time perspective with the construction of the wind farm, both projects' contribution to sediment spread could coincide and reinforce each other. In such cases, higher sediment concentrations could occur at greater distances compared to if the two projects were performed at different times. This is considered a short-term, transitory adverse environmental impact.

In the Polish part of Södra Midsjöbanken, an application has been submitted regarding a location permit according to Polish legislation for a wind farm of the same size as the project proposed by E.ON. There are also areas of interest in respect of wind power development within the Polish economic zone in the southern part of Södra Midsjöbanken, in those parts of Lawica Slupska (Slupsk Bank) that are not Natura 2000 areas, as well as in the outermost parts of the Bay of Pomerania. In Swedish waters, there are plans for a large wind farm at Hanö. Appendix 3 presents areas of interest known by E.ON Vind regarding the establishment of wind power in the relevant part of the Baltic Sea, with plans in varying degrees of completion.

Individual players (with business incentives) are not able to prevent cumulative effects that encompass other players. E.ON Vind is currently planning to construct more small-scale wind farms close to the coast within the relevant area of influence, both in the southern Kalmar Strait, Utgrunden II (approx. 90 MW), as well as east of northern Öland, Kårehamn (approx. 50 MW).

Another large wind farm in the Polish part of Södra Midsjöbanken risks causing a significant cumulative effect in the form of the further suppression of long-tailed ducks and other seabirds, with the result that the importance of Södra Midsjöbanken for wintering seabird populations could decline by more than would be the case if only the Swedishpart were developed. According to the documents that E.ON Vind has received, the Polish wind farm is planned at a greater depth, and for this reason its effects on plant and animal life will not be exactly the same as the effects of the farm that E.ON Vind is planning. This may mean that the shallower parts on the Polish side will not be utilised, and consequently can continue to serve as wintering grounds for long-tailed ducks and other species. There are also development interests of other types (sand extraction) in the shallower part of Södra Midsjöbanken's Polish section. Such a development, while it is in progress, could damage the bottom habitat to some extent and consequently the mussel-rich bottoms that constitute the long-tailed ducks' most important food resource.

Using co-ordinated planning to prevent natural assets being damaged to an unacceptable extent in the sea areas, at the same time as utilising the sea's useful resources such as wind energy in a sustainable manner, ought to be an important task for national authorities within the countries' coastal areas as well as for international collaboration.

16 Control programme

16.1 Environment

The purpose of the control programme is to ensure that the project's environmental consequences, with or without special precautionary measures, remain within acceptable limits as predicted in the Environmental Impact Assessment.

16.1.1 Bottom flora and fauna

Bottom flora and fauna will be inventoried before the construction of the wind farm. The inventory is planned so that transects can be followed up both before and after construction. The hypothesis is that bottom flora and fauna closest to the turbines will be greatly affected by the construction work and the introduction of new structures, but that the effects will rapidly diminish with distance and time.

16.1.2 Fish

Fish populations are charted through test fishing, according to the BACI principle (Before, After, Control, Impact) qualitatively and quantitatively prior to the construction work, using test fishing methods that are designed in such a way that they can be repeated when the wind turbines are in place. This charting process is repeated approximately 2 years after the turbines have been installed, once immediate disruptions from the construction period can be expected to have ceased.

In addition to the above general charting process, a targeted investigation is being formulated that is intended to chart the effect of introduced hard structures, in the form of foundations, erosion protection and the underwater parts of the turbines, on the fish populations' quantitative and qualitative composition and distribution, known as the "reef effect".

16.1.3 Marine mammals

The results from the charting of porpoises in the southern Baltic Sea should be taken into consideration before the detailed formulation of the control programme for marine mammals.

The presence of porpoises in the wind farm before and after the construction period will be monitored with the aid of special detectors, which trace the ultrasound that the porpoises use to locate their prey. If porpoises are present in the area before the construction period, the control programme should include following up the presence of porpoises during the construction and operating periods and during the phasing out of the farm. Preventive measures for turning away porpoises during the construction period will be implemented if necessary (Section 8.6.3).

16.1.4 Birds

Special studies are proposed in respect of wintering bird populations at Södra Midsjöbanken, including their movement patterns and behaviours within the farm area

both before and during the construction period as well as during the operating period. The reactions of birds migrating past the wind farm must also be studied during periods of intensive migration. The control programme's details will be formulated in consultation with experts.

16.1.5 Bats

A special inventory of bats will be carried out with the aim of establishing the possible occurrence of migratory bats or those searching for food. The inventory will be carried out during August–September one or two years before the start of construction, as well as two years after the farm has been put into operation. The inventory will be carried out with the aid of ultrasound detectors. The measurement tower that will be installed a few years before the construction of the farm will be equipped with bat detectors.

16.1.6 Marine archaeology

Marine archaeology experts will be invited to participate in the planning of supplementary geotechnical surveys, as well as to examine and assess the results of the surveys that will be carried out prior to the start of construction. The marine archaeologists' assessment will form the basis for decisions in consultation with the supervisory authority regarding any need for further marine archaeology studies.

16.1.7 Commercial fishing

Relatively extensive commercial fishing is carried out on and around Södra Midsjöbanken. Extent and methods of fishing for livelihood before and after the establishment of the farm will be charted as part of the control programme. Commercial fishermen will be compensated for losses they incur as a result of the project. Landed catches reported in Sweden and affected countries within the region (ICES-box 4062) will be followed up after the commissioning of the farm.

16.1.8 Sediment spill

Excavation/dredging for foundations must be carried out in such a way that the sediment concentration within the area 200 m outside of the dredging site does not exceed 10 mg/l.

16.1.9 Risk of collision

A control programme will be produced in consultation with the Swedish Transport Agency with the aim of ensuring that adequate measures are implemented to prevent accidents.

The content of the control programme will be governed by the requirements linked to permits issued by authorities.

The following measures may be assumed:

- Regulations regarding blocking off, safety zones and recommended shipping routes.
- Marking of the area and the wind turbines
- Information
- Traffic monitoring
- Contingency in the event of any accidents
- Traffic monitoring during the construction phase

The control programme will be drawn up in two or three editions, adapted according to assessed risks during the construction phase, during the operating phase and during phasing out.

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Södra Midsjöbanken Offshore Wind Farm

Documents translated for the ESBO consultation process (*)

Tab	Document
1	**Overview**
2	**Amendment II for SEZ application (20/12/2013)**
3	**Memo to amendment II (16/12/2013)**
4	**Appendix to Memo about migrating bats (Autumn 2012)**
5	**Memo to amendment I regarding EIA (5/9/2012)**
6	**Map to amendment I regarding development areas (5/9/2012)**
7	**SEZ application (17/2/2012) -extract regarding proposed conditions**
8	**EIA to SEZ application (31/1/2012)**
9	**Maps to EIA (31/1/2012)**
10	**Consultation Statement to SEZ application (31/1/2012)**

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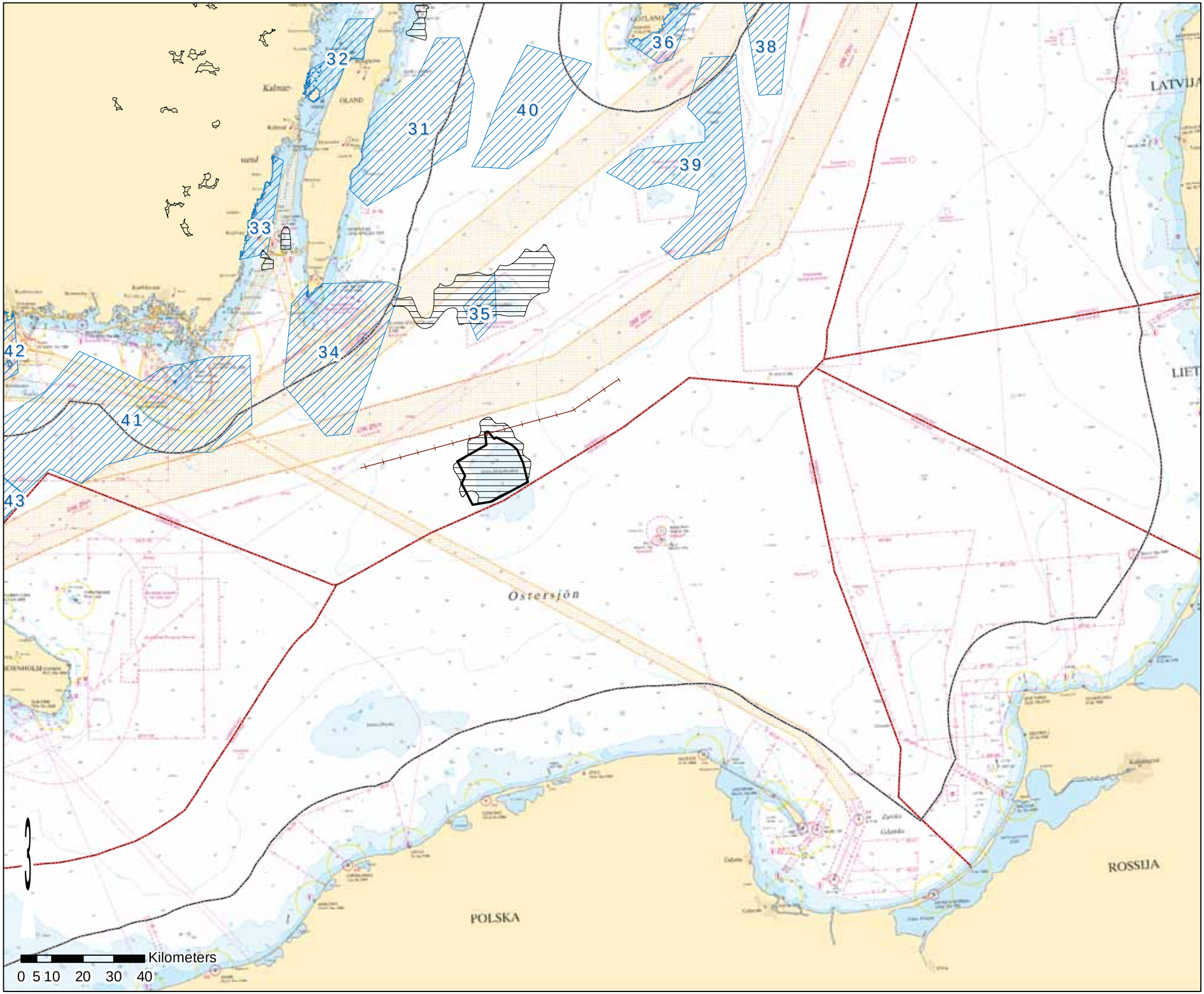
Wind farm
Södra Midsjöbanken

Areas of national interest
for wind usage and fishing,
fairways, etc.



Explanation of symbols

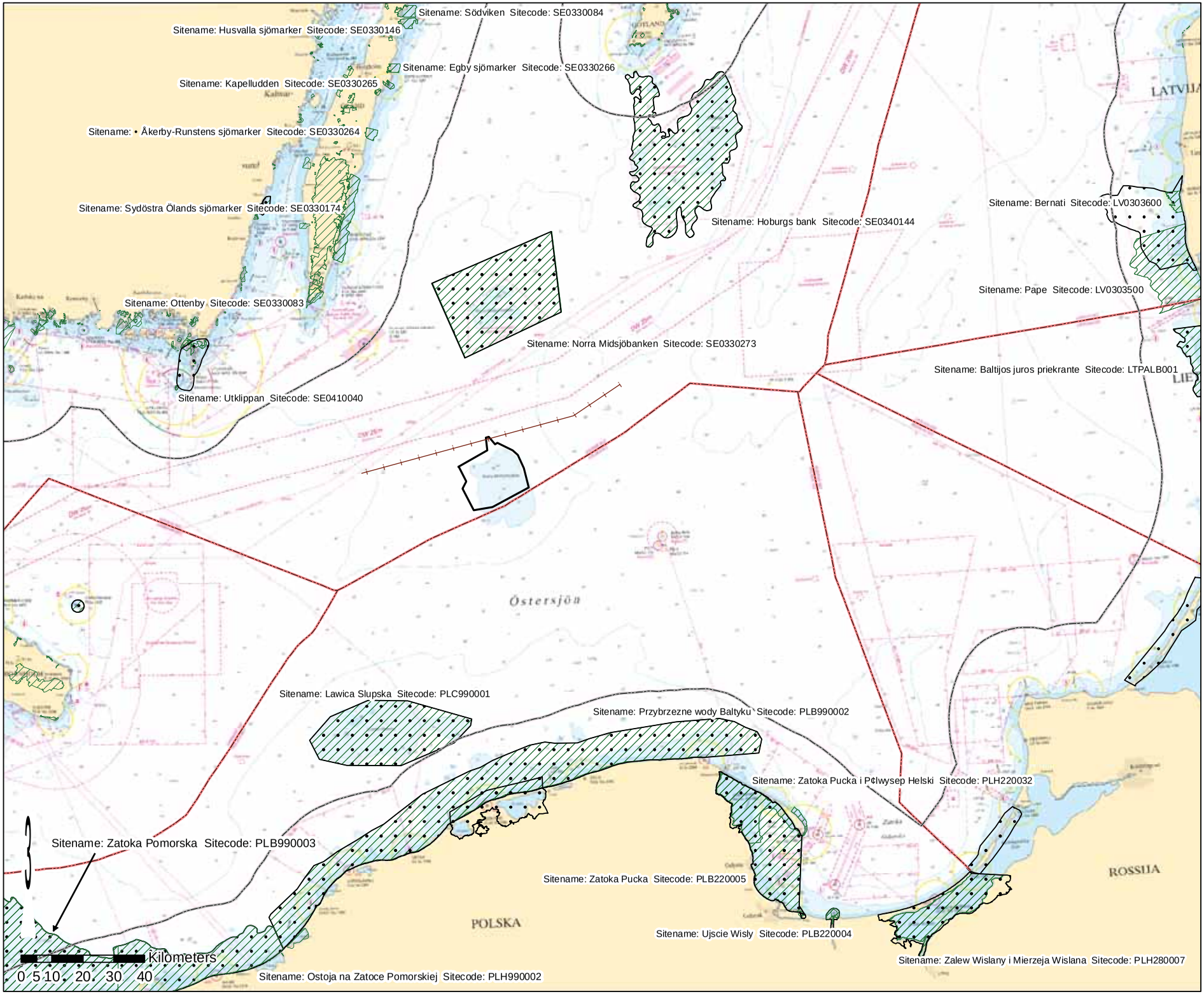
- Territorial boundary
- EEZ
- Planned NordBalt connection
- Area of national interest, wind usage
- 10 Area of national interest, commercial fishing
- Boundary of farm area
- Marked fairway

Drawing name: SMB-12131-VF
2012-01-31

SWECO

Wind farm
Södra Midsjöbanken

Natura 2000 areas
and BSPA areas, etc.

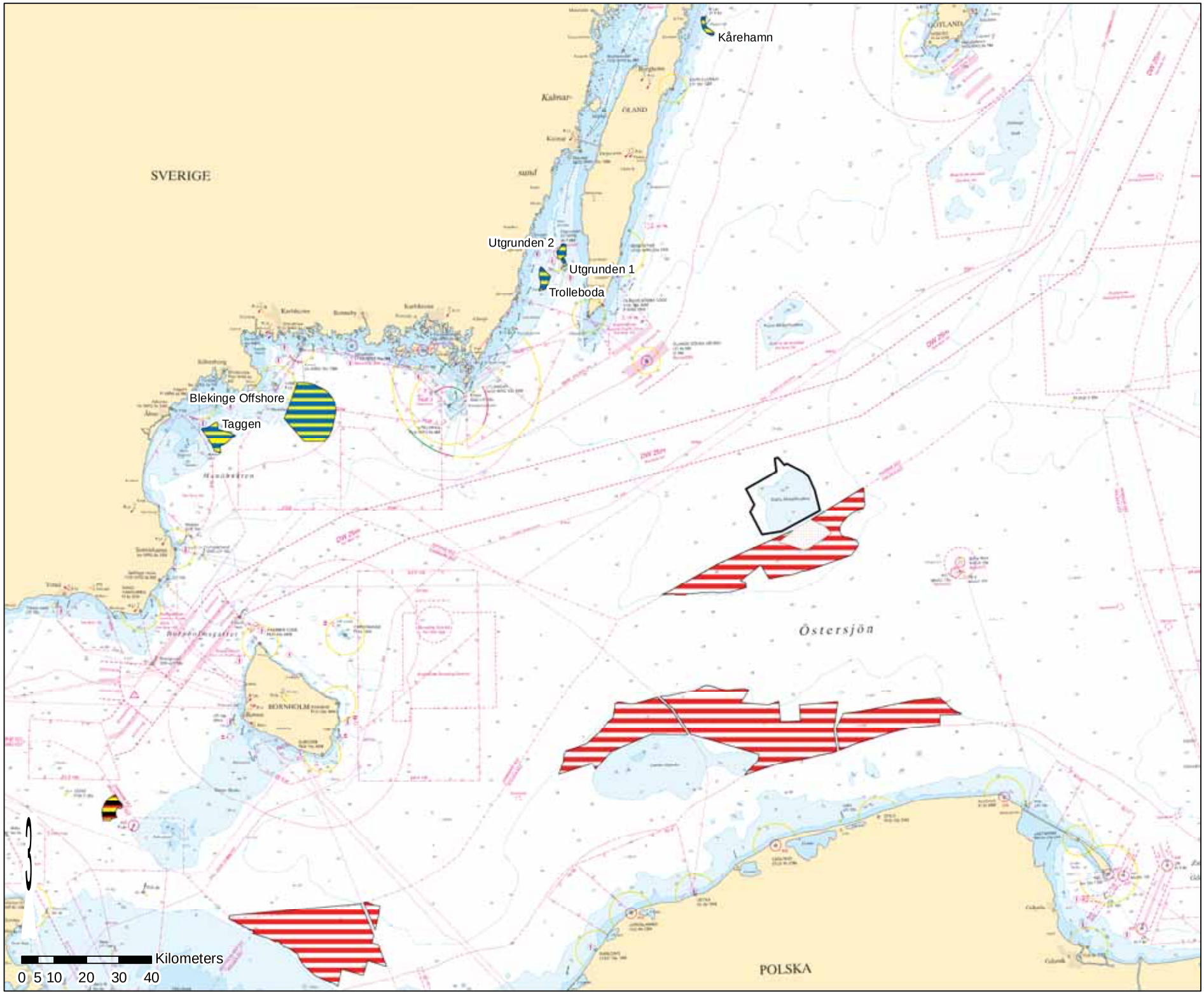


Explanation of symbols

- Territorial boundary
- EEZ
- Planned NordBalt connection
- BSPA
- Sitename — Natura 2000
- Boundary of farm area

Drawing name: SMB-12131-NB
2012-01-31

SWECO



Wind farm
Södra Midsjöbanken

Establishment areas with assessed cumulative effect

Explanation of symbols
(Possible wind farms etc.)

- Boundary of the Södra Midsjöbanken wind farm
- Area of interest for sand and gravel extraction
- Sweden
- Poland
- Germany

Drawing name: SMB-120209-BPL
2012-01-31

SWECO

Södra Midsjöbanken Offshore Wind Farm

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CONSULTATION STATEMENT

Södra Midsjöbanken

Consultation in accordance with Section 6 of the Environmental Code in respect of the construction and operation of the Södra Midsjöbanken wind farm, as well as the construction of the farm's connection to the planned NordBalt connection

Malmö, 31/01/2012

Appendices:

1 Administrative information

E.ON Vind Sverige AB (E.ON Vind) is responsible for the E.ON Group's planning and development of wind power in the Nordic region. The company currently has 122 wind turbines in operation in the Nordic region (October 2011), with a combined output of approximately 255 MW.

In August 2010, E.ON Vind completed an offshore wind farm in Denmark, called Rödsand 2, which comprises 90 wind turbines and is estimated to produce approximately 900 GWh per year. During 2011, four onshore facilities were completed in Sweden. A further 5 installations are in the construction phase at the start of 2012, including one offshore facility, Kårehamnsporten, northeast of Öland.

Name of the facility:	Södra Midsjöbanken Wind Farm
Applicant/principal:	E.ON Vind Sverige AB
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2 Foreword

This statement is a sub-appendix to the Environmental Impact Assessment, which constitutes an appendix to E.ON Vind's applications for

- a permit according to the Continental Shelf Act to lay and retain underwater cables for heavy current etc., which are required for the operation of an offshore wind farm that is planned to be established in the southern Baltic Sea, at Södra Midsjöbanken, including the farm's connection to the planned submarine cable between Sweden and Lithuania (the NordBalt connection) and
- a permit according to Sweden's Economic Zone Act to establish and run the Södra Midsjöbanken wind farm and its associated cables, transformer stations, etc., including an HVDC converter station, which will connect the farm to the planned NordBalt connection.

Early consultation

E.ON Vind began the consultations in December 2010 with an information meeting/introduction to an early consultation, which was held on 15 December 2010 at the County Administrative Board in Kalmar.

Continued consultation

The consultation then continued with the sending out of consultation documentation, a project description, dated 16 May 2011, see Appendix 1. The consultation documentation was sent out to around 50 authorities, stakeholders and affected parties, with a request for any opinions on the proposed establishment of the wind farm.

The invitation to the consultation meeting was published on 24 May 2011 in Barometern/Oskarshamns-Tidningen, in Blekinge Läns Tidning (BLT), in Karlshamns Allehanda, in Nyheterna, in Oskarshamns-Tidningen, in Sydöstran and in Östran. The newspaper advertisement is enclosed as Appendix 2.

Continued consultation was held on 7 June 2011 on two separate occasions, with the County Administrative Boards in Blekinge and Kalmar counties, with representatives from Mörbylånga Municipality and Kalmar County Museum, as well as with the general public including local fishermen, representatives from the Regional Council in Kalmar County, Karlskrona Municipality and a representative from BaltSeaPlan.

The Espoo Convention

In accordance with the Espoo Convention, the Swedish Environmental Protection Agency has initiated a written consultation with the countries around the Baltic Sea. At the end of June 2011, the Swedish Environmental Protection Agency sent a notification to Finland, Estonia, Latvia, Lithuania, Poland, Denmark and Russia, as well as an enquiry regarding any interest in participating in the consultation in respect of the establishment of an

offshore wind farm at Södra Midsjöbanken. Any opinions on this notification were requested by 9 September 2011.

Documentation

The questions and opinions that have emerged during the consultations are compiled in the following material:

"Memo, information meeting/introduction early consultation", dated 15/12/2010, Appendix 3, presentation Appendix 4

"Public authority consultation – memos"; consultation on 7 June 2011, Appendix 5, presentation Appendix 6

"Consultation with the general public – memos"; consultation on 7 June 2011, Appendix 7, presentation Appendix 8

Opinions and responses from 28 public authorities and stakeholders, received by E.ON Vind up to and including 12 October, Appendix 9

Opinions and responses received by the Swedish Environmental Protection Agency after the Agency's notification according to the Espoo Convention has been compiled in Appendix 10. (original documents and translations to English or Swedish).

3 Brief description of the project

Svenska Kraftnät has taken the decision to lay a submarine cable (NordBalt) between Sweden and Lithuania to integrate the Nordic electricity market with those in the Baltic States. The cable will be routed immediately adjacent to Södra Midsjöbanken, which is one of the marine areas that has been identified as being of national interest for wind use. The technique that will be applied for the transfer of electricity between Sweden and Lithuania is known as HVDC Light, i.e. the transfer of high voltage direct current. With today's technology, it is possible to connect a wind farm to a submarine cable in the middle of the sea. Connection of a wind farm to NordBalt would provide the potential to supply energy both to Sweden and the rest of the Nordic region as well as to the Baltic States. This solution is also attractive from an EU perspective.

The part of the Södra Midsjöbanken area that is located within the Swedish economic zone and which has been deemed suitable for the establishment of a new offshore wind farm, has a total area of approx. 320 km^2. This provides space for the construction of a facility comprising approx. 300 wind turbines and an installed power of up to 1,000 MW, which provides an annual electricity production of up to 3.8 TWh.

Applications cover the laying and operation of underwater cables for heavy current located within the farm area, as well as the farm's connection with underwater cables to the planned submarine cable between Sweden and Lithuania. Applications also include the construction and operation of the farm and associated transformer stations, measurement towers, etc., as well as the construction and operation of an HVDC converter station that will connect the farm to the planned NordBalt connection.

The farm is located beyond Sweden's territorial border, but within the borders of the Swedish economic zone. The application regarding the permissibility of the farm must therefore be made in accordance with both the Continental Shelf Act and Sweden's Economic Zone Act.

The farm and its associated installations are described in the Technical Description and the Environmental Impact Assessment.

4 Consultation

A general summary of the questions and opinions that have emerged during the consultations, and which are taken into consideration in other project documents, is provided below:

4.1 Early consultation, County Administrative Board in Kalmar County on 15 December 2010 (see Appendices 3 and 4)

During the consultation, it was confirmed that the Polish section of Södra Midsjöbanken is not affected by the proposed farm.

The meeting discussed the height of the wind turbines and obstacle marking. The matter was highlighted in detail in other documents belonging to the application.

Available natural resources, particularly natural gravel, were discussed at the meeting. It is desirable for crushed rock to be used in the project in the first instance, not natural gravel.

Changes to the natural environment with regard to e.g. the effects of artificial reefs were discussed at the meeting and will be highlighted in other documents (Environmental Impact Assessment).

The County Administrative Board wants the impact of the farm on the flow conditions to be taken into account.

The Board wants to see an overview of the southern part of the Baltic Sea, with a presentation of other valuable offshore shallows and coastal areas that are being exploited, in order to make an assessment of the impact on the natural environment caused by the establishment of the Södra Midsjöbanken wind farm.

The County Administrative Board refers to the Espoo Convention in respect of consultation with other countries.

It is observed at the meeting that the Swedish Armed Forces see problems with the new farm, although with no further clarification of what this relates to.

4.2 Continued consultation

4.2.1 Public authority consultation on 7 June 2011 – memos (Appendices 5 and 6)

The County Administrative Board would like the Environmental Impact Assessment to describe cumulative effects, the impact on nature, birds, etc., of the establishment of a wind farm, both at Södra Midsjöbanken and other nearby banks and shallow areas.

During the consultation, it was stated that it is desirable for the Environmental Impact Assessment to present the environmental impact of the material that is broken down, the noise impact, effects of electrical cables on migrating fish and the catches that are registered in other countries.

The Environmental Impact Assessment must also present positive effects, such as the effects of artificial reefs.

The consultation meeting also discussed the handling of excavated material and foundations for the wind turbines, as well as the use of material in the project. The County Administrative Boards consider that the use of natural gravel should be avoided.

Those present consider that the area is of interest from a marine archaeology perspective, which should be taken into consideration in conjunction with supplementary studies and investigations.

The matter of which County Administrative Board will be the supervisory authority was not clarified at the meeting. This matter will be discussed further by the County Administrative Boards in Blekinge and Kalmar counties.

4.2.2 Consultation meeting with the general public on 7 June 2011 – memos (Appendices 7 and 8)

The following information was provided by those present:

- Fishing at Södra Midsjöbanken takes place using passive equipment, i.e. hook and line. Bottom trawling is not performed in the shallows.
- The area is a known spawning area for sprat, herring and turbot. Cod and small fish are also found in the area. Grey seals are present to a significant extent. Porpoises are very rare.
- Polish, Danish and German fishermen are often seen at Södra Midsjöbanken.
- Leisure activities at Södra Midsjöbanken only occur to a limited extent.

Those present also stated the following:

- It is considered that the wind turbines entail a risk for commercial fishermen, for example in the event of a machine breakdown on a fishing boat.

- It is considered that the construction of wind turbines has an adverse impact on the environment for fish. After the development, the area will be unusable for fishing.

- It is wondered how much energy will be required to construct the wind farm, and it is considered that this should be presented in the Environmental Impact Assessment in order to demonstrate that the energy yield is sufficient to outweigh the environmental consequences. The profitability of the farm should be presented in the Environmental Impact Assessment.

- It is considered that the entire ecosystem will be affected, during both the construction and operating periods, for example through noise and vibrations, which must be described in detail in the Environmental Impact Assessment so that it is possible to assess the effects and consequences for fish stocks etc.

- It is pointed out that this is not the first time fishery have been affected by wind turbines. Reference is made to other offshore wind power projects, east of Hanö, Taggen, etc.

- It is wondered whether growth on foundations is positive. In Denmark, it can be seen that blue mussels etc. cover the foundations. This produces a positive effect with richer and more varied plant and animal life. However, there is some uncertainty as to how this will be assessed.

Commercial fishermen want confirmation that they will be compensated for lost catches. E.ON Vind will develop a suitable model for handling this. The model will be based on lost catches during the period 2013–2015. Compensation will be provided if it emerges that losses are actually occurring.

E.ON Vind notified the meeting that the farm is being planned at Södra Midsjöbanken because of the limited water depth, NordBalt and the wind conditions.

E.ON Vind notified the meeting that consultation will take place with other countries through the Swedish Environmental Protection Agency. The other countries will have the opportunity to give their opinions.

5 Opinions and responses from public authorities and stakeholders, received by E.ON Vind up to and including 8 July 2011 (Appendix 9)

5.1 SGU, Statement dated 07/07/2011

SGU states that those locations where the natural residual layer has been removed should be covered with suitable erosion protection, both to avoid erosion that can undermine the foundations, and to minimise recurring turbidity that can affect the conditions within the nearby Natura 2000 areas[1].

SGU recommends that the material be deposited in such a way that, as far as possible, it is not subjected to erosion, giving rise to turbidity. As an alternative, SGU proposes the depositing of the material so that it "builds up" the deeper parts of the bank's least exposed flanks and covers them with erosion-protection material.

5.2 Swedish Energy Agency, Message dated 24/05/2011

The Swedish Energy Agency has a positive view of the project, which when operational will provide a good supply of environmentally adapted electricity.

5.3 Swedish Transport Administration, Statement dated 29/06/2011

The Swedish Transport Administration states that, in respect of aviation, obstacle marking must take place in accordance with the Swedish Transport Agency's regulation TSFS 2010:155.

With respect to shipping, offshore wind turbines must be marked in consultation with the Swedish Maritime Administration in accordance with international recommendations. A "separate decision regarding a permit for marking that constitutes a safety device for shipping" must be issued by the Swedish Maritime Administration.

In the statement, the Administration also states that, in order to ensure a suitable distance from established shipping routes, the operator must be prepared to present a risk analysis.

5.4 The Swedish Post and Telecom Authority (PTS), Statement dated 18/05/2011 (see also point 3.28)

In certain cases, the erection of wind turbines can adversely affect the reception of radio signals, particularly when it comes to radio link connections. PTS therefore recommends that a consultation procedure be conducted between the wind power company (E.ON Vind) and the radio link operators that are affected by the establishment of the wind farm, in order to minimise the risk of disruptions. For this purpose, PTS contributes information about which radio link operators are affected.

[1] Note that the nearest Natura 2000 area, Norra Midsjöbanken, is located just over 30 km from Södra Midsjöbanken

5.5 County Administrative Board in Skåne County, Statement 06/07/2011

The County Administrative Board observes that the planned wind farm will not be visible from Skåne and also will not affect Skåne's water area.

The County Administrative Board also observes that the establishment area in question has been highlighted as a possible area for wind use and that the documentation presented for the upcoming application and the Environmental Impact Assessment appear to be relatively comprehensive, covering those aspects that should be dealt with in an application with an attached Environmental Impact Assessment.

5.6 Kammarkollegiet, Statement 06/07/2011 [2]

Kammarkollegiet observes that the area has high natural values and considerable similarities with other similar areas that enjoy protection according to Natura-2000.

In respect of the Environmental Impact Assessment, Kammarkollegiet considers that this should include an investigation of underwater noise and its impact on fish, primarily the critically endangered eel, during the construction, operating and phasing out periods, and that any future permit should be linked to a control programme in this respect.

Furthermore, Kammarkollegiet considers that the Environmental Impact Assessment should also include an investigation of possible cumulative effects from the establishment of the farm, compared to both planned and previously established farms.

In addition, Kammarkollegiet states that the Environmental Impact Assessment should include a description of the impact of the various alternatives, including the number of turbines, the height of the turbines and their maximum installed power. Details regarding the maximum number of turbines, their height and output should be able to be specified in any future permit.[3]

The Environmental Impact Assessment should also include a description of the impact of the positioning of the turbines in relation to each other. If the final positioning cannot be defined in the application, the permit should be subject to the condition that the final position must be determined in consultation with the supervisory authority, the Swedish Agency for Marine and Water Management and the Swedish Environmental Protection Agency.[4]

5.7 National Maritime Museums in Sweden, Statement 05/07/2011

National Maritime Museums in Sweden judges that ancient monuments may be present in the affected water area. They consider that the project should therefore commission an

[2] The statement is not entirely unambiguous, as it initially states that "any permit for establishing wind power at Norra Midsjöbanken should be combined with a catalogue of conditions similar to that used for Stora Middelgrund".
[3] Kammarkollegiet refers to the Land and Environmental Court's ruling at Växjö District Court dated 10 June 2011, case no. M 695-07.
[4] Kammarkollegiet cites the Land and Environmental Court's judgement of 23 June 2011, case no. M 8211-10, concerning the permit for the wind farm at Storgrundet.

archaeological investigation of the whole of the exploitation area in question, including work areas where e.g. anchored vessels can affect the bottom.

5.8 Swedish Civil Contingencies Agency, Statement 01/07/2011

Rakel

The Swedish Civil Contingencies Agency (MSB) has been commissioned by the Government to introduce, manage and develop Rakel, the radio communication system for protection and security. In order to ensure the wind farm does not become an obstacle to the radio communication system, consultation should take place with MSB's unit for infrastructure, Rakel, when planning the location of the wind turbines. Contact details for this unit are included in the statement.

Preventive measures during establishment and operation

MSB considers that it is important to conduct a full assessment of the risk and of which accident prevention and damage-limitation measures need to be implemented in advance.

MSB also considers that a plan for rescue efforts with clear responsibilities should exist during both the construction period and the operating period. The plan must be drawn up in consultation with the municipal rescue services, the Swedish Work Environment Authority, the public health authority and the county administrative boards.

It is finally pointed out that the holder of the right of use, to a reasonable extent, must keep equipment for extinguishing fires and for life-saving activities in the event of a fire or accident. Agreements in this respect can be entered into between the rescue service and the holder of the right of use.

5.9 The Swedish Coast Guard, Referral response 30/06/2011

The Swedish Coast Guard has nothing to say at this point with regard to the planned establishment, but is looking forward to being kept informed about and participating in the various phases of the project in future.

5.10 Swedish Transport Agency, Aviation Department, Undated response, received by E.ON Vind on 18/05/2011

The Swedish Transport Agency's Aviation Department points out that, since 1 April 2010, it is the Swedish Transport Administration that monitors aviation interests in municipal planning etc.

5.11 Swedish University of Agricultural Sciences, Statement 15/06/2011

The Swedish University of Agricultural Sciences (SLU) considers that there is no account of the possible alternative locations that have been assessed, nor of the supporting documentation against which these have been assessed, nor an account of the grounds on which these locations have been rejected.

SLU considers that, in the material that is presented as a basis for consultation, there is no clear presentation of the environmental impact of various alternative establishments, nor a choice of methods for laying the foundations, nor information on how these alternatives have been assessed against each other in an impact assessment that leads to an Environmental Impact Assessment of the company's (E.ON Vind's) main alternatives.

SLU also considers that a project of this importance and scope should be accompanied by more extensive consultation, with more methods than just large meetings being considered. As an alternative, an exhibition of the consultation documentation, supplemented as described above, will be available for the general public at suitable, well-frequented locations.

5.12 Swedish Environmental Protection Agency, E-mail dated 21/06/2011

The Swedish Environmental Protection Agency states that they do not have the potential to look into the matter in any greater depth in the immediate future. They point out that the areas is renowned for birds, including as a wintering area for seabirds such as the long-tailed duck, and that the birds' patterns in relation to staying and moving on must therefore be investigated in greater detail. They also point out that there is not much knowledge about the occurrence of bats in this area, and that this should therefore be charted.

Finally, they point out that, as from 1 July 2011, there will also be consultation with the new Agency for Marine and Water Management in Gothenburg, and that the issues that should generally be taken into consideration when establishing a wind farm can be seen from the Swedish Environmental Protection Agency's website and from the national website for wind power (www.vindlov.se). See also point 5.25.

5.13 Swedish Fishermen's Economic Association (SYEF), Statement 05/07/2011

SYEF considers that an environmental impact assessment must include the following:

- Test fishing for the fish species that use Södra Midsjöbanken as their reproduction and nursery area.
- An investigation of the potential consequences for fish populations and other bottom-living species, as well as the impact on water quality, of an environmental impact as extensive as that which will be caused by the work in question.[5]
- By assuming that, in all likelihood, no fishing will be permitted in the area in question once the wind farm has been brought into use, they request that the Environmental Impact Assessment should look at the issue of full financial compensation for SYEF's members, as this will entail loss of income for several years.

[5] SYEF makes an incorrect interpretation of the timetable that has been presented during the consultation, and therefore assumes that disruptions in the area will mean that there is a risk of five years of spawning being lost for the fish species that reproduce at Södra Midsjöbanken.

- Finally, they consider that an investigation should be conducted as to whether an EU Member State can impose a veto in such an issue, if this could affect access for commercial fishermen to areas like this that are intended for e.g. wind farms, thereby causing economic damage.[6]

5.14 Swedish Armed Forces, Statement 06/07/2011

According to an analysis that has been conducted, the development of a wind farm at Södra Midsjöbanken will entail very significant disruption to the Swedish Armed Forces' various technical systems.

However, it is stated that there could theoretically be a solution in the form of relocating the Swedish Armed Forces' installations and equipment, provided a new location can be found that will not be adversely affected in future by new offshore wind power projects. Financial compensation must also be paid. In this respect, a comparison is made with the Kriegers Flak project.

5.15 Swedish Meteorological and Hydrological Institute (SMHI), Statement 18/05/2011

In its statement, SMHI states that they have established a collaboration with the Swedish Armed Forces regarding weather radars, and that the Armed Forces are an early referral body, and a part of the national interest for total defence, regarding the establishment of wind turbines.

In respect of the statement concerning the Södra Midsjöbanken wind farm, consultation in accordance with Section 6 of the Environmental Code, and any disruption to the network of weather radars, please refer to the Swedish Armed Forces.[7]

5.16 Swedish Maritime Administration, Statement 20/05/2011

The Swedish Maritime Administration states that the planned establishment is expected to have negligible consequences with regard to extending the routes for shipping.

In order to create an establishment at Södra Midsjöbanken that is safe for shipping, the following are suggested:

- The developer is recommended to apply to the County Administrative Board to have shipping excluded from the area during the construction phase. The exclusion area should also encompass a 500 m safety zone beyond the farm's outermost towers.

[6] During the consultation meeting, there was no information about the Swedish Environmental Protection Agency's handling of the matter in accordance with the Espoo Convention, i.e. future contacts with the countries around the Baltic Sea.

[7] The statement also points out that at a distance of more than 20 km from the radar, no restrictions are required, as the impact (from wind turbines) is then deemed to be negligible.

- Wind turbines must be equipped with obstacle lights for shipping in accordance with international recommendations from the shipping organisation IALA. These should be designed in consultation with the Shipping Department within the Swedish Transport Agency. Special emphasis is placed on the marking of those turbines that constitute corner points.
- The Swedish Maritime Administration proposes that the wind turbines that are located adjacent to shipping routes, in addition to the prescribed obstacle lights, should be supplied with indirect facade lighting on the lower part of the tower.
- The cable connection to land should be presented and consultation should take place when route alternatives have been established.[8]
- The Swedish Maritime Administration wants both a clear and detailed chart image in a larger format, on which the location of the planned wind turbines is marked, as well as for this information to be presented digitally in shape format in order to be presented in GIS.
- The results of the marine surveys that have been carried out in the area should be reported to the Swedish Maritime Administration in order to update the depth database and charts.
- Before starting construction work that can affect shipping, this must be notified in plenty of time to the Swedish Maritime Administration, Chart Correction Office.
- Finally the Swedish Maritime Administration would like to issue a reminder, with the support of Section 3 § 4 of the Maritime Traffic Ordinance, that the wind power operator may be required to implement measures immediately if there is a risk of shipping being misdirected.

5.17 Swedish National Heritage Board, Statement 20/06/2011

The Swedish National Heritage Board considers that, prior to construction, it is necessary to determine whether any ancient monuments will be affected. The ancient monuments referred to here are shipwrecks where at least 100 years can be assumed to have passed since the ship became a wreck, as well as settlements[9] from the Palaeolithic Age. The Board considers that the results from the surveys should be included in the Environmental Impact Assessment that will be enclosed with the application to the Ministry of the Environment.

They point out that the survey that is carried out should provide 100 per cent coverage and that it should clearly present which areas will definitely be affected by the installation, as well as where construction sites and more temporary installations will be established.[10]

[8] Cable connection to land not relevant. The cable connection to the HVDC converter stations should be presented, however.
[9] According to the Swedish National Heritage Board, Södra Midsjöbanken can be viewed as a potential area for settlement and exploitation during the Palaeolithic Age.
[10] Completed investigations were performed with a 100 per cent coverage of the area.

The statement includes a proposal for a systematic process regarding an investigation and continued studying of Stone Age remains at Södra Midsjöbanken.[11]

5.18 Swedish Anglers Association, Statement 08/07/2011

The Swedish Anglers Association considers that it is important to assess what effects the installation could entail for the ecosystem and for existing species, as well as to try to adapt its execution in order to minimise the impact as far as possible. Regarding the construction work, they consider that it is important for this to be performed in such a way and at such a time that it has as little impact as possible on affected fish species' reproduction and growth in the area.

5.19 County Administrative Board in Blekinge County, Statement 06/07/2011

The County Administrative Board in Blekinge County considers that the following aspects are particularly important to consider in the Environmental Impact Assessment:

- The Environmental Impact Assessment and the entire application should cover all of the operation being applied for, which is necessary in conjunction with the construction, operation and phasing out of the wind farm.
- The zero alternative should be presented and its environmental consequences described. Alternative locations and designs for the installation should be investigated and presented in the Environmental Impact Assessment. This presentation should encompass environmental, practical and economic aspects of various locations for the installation.
- The Environmental Impact Assessment should describe the fish populations in the area and how these might be expected to be affected during the construction of the wind farm and when the farm is in operation. Particular attention should be paid to issues such as whether the area is an important spawning or nursery area for any fish species, as well as the area's significance for migrating fish species.
- The Environmental Impact Assessment should describe the fishing performed in the area. Which nations fish there, the scope, equipment, species, etc. The impact on the potential to conduct fishing during the construction and operation of the wind farm should be described.
- The matter of compensation for fishermen as a result of impaired potential to conduct fishing should be dealt with in the application for a permit according to Sweden's Economic Zone Act.
- The environmental effects of turbidity in conjunction with the construction work, as well as the measures that are required to limit inconvenience and damage as a result of work that causes turbidity, should be described in the Environmental Impact Assessment.

[11] Field aspects of the first stage proposed by the Swedish National Heritage Board, bathymetric analysis and seabed analysis, have now been conducted.

- The County Administrative Board considers that the wind farm at Södra Midsjöbanken will affect underwater prehistoric landscapes. For continued investigation work, contour lines (water depth) are required within this area.
- The County Administrative Board points out that the wreck located within the specified area is not an ancient monument.
- The Board considers that the bathymetric measurements that have been performed should be examined by marine archaeology experts[12], and if new measurements are performed, it would be good for this to be co-ordinated with a marine archaeologist in order to make cost-effective use of the equipment.
- The County Administrative Board considers that there may be a need to highlight the occurrence of migrating birds in the area. For example, the extent to which e.g. brent geese pass during the spring migration at the end of May/beginning of June, whether cranes that leave Öland in September pass the area, as well as the occurrence of loons, duck, geese and swans during the autumn migration in September-October, should all be clarified.
- The data should also highlight whether marine mammals (seals, porpoises) are affected.

Finally, the County Administrative Board states that it wants to be the supervisory authority for the planned wind farm, and that the County Administrative Board in Kalmar County has been notified of this.

5.20 Region Gotland, E-mail dated 24/05/2011

Region Gotland judges that the project will not affect their interests, and they therefore refrain from expressing an opinion.

5.21 Svenska Kraftnät, Referral response 17/06/2011

Svenska Kraftnät notifies that the issue regarding the potential to connect to NordBalt is currently being prepared, and that it is currently not possible to give a decision on this matter. Svenska Kraftnät anticipates being able to give a response regarding the connection issue in October 2011.

Furthermore, they state that as this (NordBalt) relates to an international connection between Sweden and Lithuania, the Lithuanian national grid operator Litgrid also needs to be given the opportunity to give its opinion regarding the connection issue.

5.22 Sven Larsson, fisherman, Statement 17/06/2011

Sven Larsson is a commercial fisherman who fishes on and around Södra Midsjöbanken at certain times of the year. He fishes for cod and turbot using fishing-net. As the

[12] The examination was performed on 30-31 August 2011.

development of the farm will affect his fishing, he would like to receive information about the progress of the project.

5.23 County Administrative Board in Kalmar County, Statement 06/07/2011

The County Administrative Board states that the opinions put forward at earlier meetings on 15 December 2010 and 7 June 2011 still remain.

The Board would like to supplement these with the following:

- Various alternatives for covering cables that are not laid in flushed or ploughed trenches should be highlighted. It should also be possible to cover them with cable protection, e.g. concrete.
- The County Administrative Boards observes that the latest reports indicate that populations of mussel-eating seabirds such as long-tailed ducks and eider have declined markedly over the past 20 years. They therefore consider it important for the consequences of the wind farm on these species to be described in the Environmental Impact Assessment.
- The County Administrative Board also wants the consequences for bottom-living fauna to be covered in the Environmental Impact Assessment.

The County Administrative Board would like to come back to the supervision issue at a later date.

5.24 Swedish Ornithological Society (SOF) *(in collaboration with the regional associations in Skåne, Blekinge, Östra Småland, Öland and Gotland)*, Statement 06/07/2011

SOF states that, in conjunction with the establishment of a wind farm at Södra Midsjöbanken, conditions exist that risk causing serious negative consequences, including for the wintering population of long-tailed ducks. SOF therefore strongly advises against proceeding with the current plans for the establishment of a wind farm.

They consider that there is limited knowledge about migrating and resting birds, and that the possibility of a considerable number of migrating birds regularly crossing or resting at Södra Midsjöbanken cannot be ruled out. This may require a more detailed investigation, even though there is already significant knowledge about Södra Midsjöbanken's importance for bird life and biological diversity in the Baltic Sea.

SOF refers e.g. to Leif Nilsson's report (date unclear), in which it is stated that "*Södra Midsjöbanken is important for seabirds. When it comes to long-tailed ducks, it is one of the most important anywhere in Eurasia. I have conducted inventories of the Midsjö banks in recent years, and in total there may be up to 250,000 individuals at the two banks. 200,000 have been seen at Södra Midsjöbanken*."

SOF observes that that Södra Midsjöbanken is not protected according to Swedish law, nor set aside as an SPA area (*Specially Protected Area*) according to the EU's Birds

Directive, but the gathering of long-tailed ducks during the winter definitely satisfies the criteria for this.

They also observe that there are indications that Södra Midsjöbanken is an important foraging area for common guillemots.

Finally, they mention that the Swedish Society for Nature Conservation is currently reviewing the criteria for wind-produced electricity that will be denoted with the "Good Environmental Choice" symbol, and that according to the proposal that has been developed, electricity that is produced at Södra Midsjöbanken will not be able to be classified as a Good Environmental Choice. They notify that SOF is participating in this review.

5.25 Swedish Agency for Marine and Water Management, Statement 17/08/2011

The Swedish Agency for Marine and Water Management supports the statement issued by Kammarkollegiet on 6 July 2011.

5.26 Swedish Fishermen's Association, Statement 06/07/2011

The Swedish Fishermen's Association (SFR) states the following:

The Association refers to the perceptions and opinions that were expressed by the fishermen who participated at the consultation meeting in Karlskrona on 7 June 2011. See Appendix 7.

SFR considers that the habitat loss that the wind farm entails for populations of herring, turbot and other species, including non-commercial species, must be clearly presented and analysed with regard to both the construction process and the operating period. This also applies to spawning fish and other fish remaining in the area in question.

SFR also considers that an analysis must be performed with regard to Swedish and other fishing that is conducted within the area in question.

Finally, SFR considers that the consequences of sediment spread to cod spawning areas and areas of national interest must be thoroughly analysed with regard to real conditions, e.g. the consistent westerly to southwesterly current.

5.27 OCEANA, Statement September 2011

(OCEANA is an international organisation that works to preserve the marine environment)

During September 2011, OCEANA submitted consultation opinions that are based in part on the organisation's own field studies carried out at Södra Midsjöbanken during April 2011.

The organisation's opinions include the following:

- Construction of an offshore wind farm will influence the surrounding environment, including flora and fauna. Several environmental aspects, such as loss of habitat, noise and vibrations, impact on flow conditions, creation of reef-like structures, sediment spread, etc., must therefore be taken into consideration. The project's construction and operating phases will result in various types of environmental impact.

- The construction phase entails underwater noise and vibrations, as well as encroachment on the seabed. The surrounding environment will be adversely affected, in particular by the encroachment on the seabed. Benthic organisms and plants may be covered by sand, which can result in reduced growth, reduced survival or death. The boulders that occur in the area many need to be handled in conjunction with the installation of cables. The movement or blasting of boulders in connection with this work will adversely affect the area's environment. The removal of hard bottom substrate will also cause an irreversible loss of the habitats containing organisms such as blue mussels.

- The impact on the environment also occurs during the operating phase. Noise from the turbines will probably affect the surroundings. Differing seabed types can influence the spread of noise, with soft seabeds that are rich in animal life damping the spread of noise, for example. The few studies that exist in this respect should be taken into consideration when planning the wind farm. The wind turbines will probably also influence the commercially important fishing sector as well as migrating birds. If human activities are excluded from the farm area, the lack of fishing will benefit the fish stocks. As the seabed at Södra Midsjöbanken is dominated by soft sediment, the foundations for the wind turbines will increase the area of hard bottom structures to a great extent. The foundations will create reef-like objects situated at various depths, which will benefit flora and fauna. In the long term, new species may become established in the area. This development and an increase in biological diversity on the bank will be positive. On the other hand, the establishment of the wind farm may have a negative effect on soft seabed communities, as the area of their habitat will decrease.

5.28 The Swedish Post and Telecom Authority (PTS), Statement 12 October 2011

In its response to E.ON Vind's enquiry, PTS confirms that there are currently no permit holders with radio link routes within 2 km of the positions specified by E.ON Vind.

PTS also notifies that the situation may be entirely different within a few months, and that PTS will not automatically provide updates of the information to E.ON Vind.

They also notify that three operators, TeliaSonera AB, Hi3G Access AB and Net4Mobility HB, have frequency permits for the use of radio links across the entire country, and that PTS does not have detailed information about where the radio links for these frequency permits are located.

6 The Espoo Convention

6.1 Opinions received

Opinions regarding the notification that was sent out by the Swedish Environmental Protection Agency at the end of June 2011 were provided by the countries that received the notification as follows:

- ***Poland***
  Opinions from Poland were received in the form of the General Directorate for Environmental Protection, "Generalna Dyrekcja Ochrony Srodowiska", document dated 9 September 2011. With reference to the Espoo Convention, Poland would like to participate in the upcoming process regarding the assessment of cross-border consequences that are relevant in connection with the planned establishment of the Södra Midsjöbanken wind farm.

  In their communication, they point out that the documentation that was enclosed with the notification sent out by the Swedish Environmental Protection Agency in June does not contain any information regarding possible cross-border consequences for the environment that could affect parts of the Polish territory. They also point out that this report is required in accordance with point 2, section 3 of the Espoo Convention.

  With reference to that set out above, representatives from the Republic of Poland consider that the Environmental Impact Assessment that will now be drawn up for the planned
  establishment of the Södra Midsjöbanken wind farm should also include a separate chapter regarding cross-border consequences and should satisfy the requirements specified in Annex II of the Espoo Convention.

  Finally, the communication defines a number of areas that need to be highlighted in the future Environmental Impact Assessment. These include the following:

  - Poland would like to see an analysis of possible areas in the Baltic Sea that are suitable for the establishment of wind farms, as well as a presentation of both planned and constructed farms in this area.
  - Presentation of the proposed farm on a map that extends as far as Poland and e.g. shows Poland's territorial border
  - Presentation the boundary of the area that will be affected by the planned installation
  - Presentation of the consequences that affect the use of the bank's Polish section from an economic perspective
  - The project's impact on Polish sea areas, with details defined in the communication

- The impact on affected water areas with regard to the EU's framework directive for water
- The farm's impact of fishing and maritime safety on the Polish side
- Analysis of the cumulative environmental impact caused by the proposed installation together with existing and other planned projects in the Baltic Sea, e.g. the Nord Stream gas project and the exploitation of natural resources such as sand
- Analysis of the cumulative environmental impact that is caused by the proposed installation, along with the planned connection between the farm and the shore connection

- ***Latvia***
  In accordance with the communication issued by the "Ministry of Environmental Protection and Regional Development", dated 20 August 2011, Latvia is waiving the opportunity to participate in the consultation regarding the establishment of an offshore wind farm at Södra Midsjöbanken.

  However, the above authority would like to receive the final Environmental Impact Assessment document that will be sent out for referral in Sweden.

- ***Estonia***
  The communication that was issued on 30 August 2011 by the "Ministry of the Environment" in Estonia confirms the country's interest in participating in the future Environmental Impact Assessment process regarding the Södra Midsjöbanken wind power project.

  They consider that the future Environmental Impact Assessment should take into account potential and significant effects on protected natural areas, as well as highlight the impact of various design alternatives for the farm.

- ***Lithuania***
  In a communication dated 9 September 2011, the "Ministry of Environment of the Republic of Lithuania" states that no concern was noted in respect any environmental impact from the project in conjunction with the consultation that was conducted in Lithuania.

  However, the "Ministry of Energy" stated that the farm's connection to the NordBalt link between Sweden and Lithuania will have an impact on the socio-economic environment in Lithuania. With reference to the farm's connection to the planned NordBalt link, the Lithuanian authorities would like to receive up-to-date information regarding the final assessment of the environmental consequences, as well as the continued measures that will be implemented by the developer.

- ***Russia***
  In an e-mail dated 9 September 2011, the "Ministry of Natural Resources and Environment" in Russia notified the Swedish Environmental Protection Agency that

Russia would not be participating in the consultation regarding the establishment of an offshore wind farm at Södra Midsjöbanken.

- ***Denmark***
  A consultation has been held in Denmark regarding Sweden's application regarding the construction of a wind farm at Södra Midsjöbanken.

  The Danish Shipping Authority has the following comments:

  - The Shipping Authority has no objections to the construction of the offshore wind turbines in question, provided they are positioned at least 3 nautical miles from established shipping routes and from those shipping routes that are presented on maritime charts, as well as at least 3 miles from common but unmarked fairways, which can be derived from signals from vessels of 300 gross registered tonnage and above according to AIS data (Automatic Identification System).

  - The Authority considers that it is very important for the foundations for planned wind turbines to be designed in a manner that minimises the risk of damage to vessels in the event of a collision.

  - The Danish Shipping Authority has also understood that, from the information available, consideration has been given to current vessel traffic in the areas, which should be taken into account in the future work.

- ***Finland***
  A consultation has taken place in Finland during which both the general public and affected authorities have had the opportunity to give their opinions on the project and the upcoming Environmental Impact Assessment. Received opinions are summarised in the Ministry of the Environment's communication dated 30 September 2011 as follows:

  The Ministry of Agriculture and Forestry (Skogs- och jordbruksministeriet)
  The Ministry has no opinions.

  The Ministry of Transport and Communications (Transport- och kommunikationsministeriet)
  The Ministry considers that participation in this process does not lie within their administrative remit.

  The Center for Economic Development, Transport and Environment for Southwest Finland (Sydvästra Finlands centrum för ekonomisk utveckling, transport och miljö)
  It is considered that the wind farm will probably have a significant impact on bird life in Finland. Some birds' migration routes cross the wind farm area, while the migrating birds that breed in Finland may spend the winter period or rest in the farm area. The Center would like the project's impact on bird life to be evaluated in a nuanced and exhaustive manner.

Metsähallitus (a state enterprise for state-owned land and water areas); [Verk för statsägda mark- och vattenområden]
The enterprise stresses the need for detailed information in respect of the project's impact on bird life. The Environmental Impact Assessment should present the cumulative impact on bird life as the affected area is exposed to varying threats. The assessment that will be carried out should present the impact that may occur within a large geographical area, which requires the charting of the birds' flight paths. The electromagnetic fields that arise around underwater cables may have an impact on migrating fish species. Finally, they consider that the farm may also effect seals, common porpoises and other marine mammals.

WWF Finland
The Worldwide Fund for Nature Finland considers that the farm will have an extensive impact.

The Finnish Association for Nature Conservation (Finsk förening för naturens bevarande)
The Association supports wind power, but considers that its impact must be controlled with the aid of localisation and permit conditions. According to the Association, Finland will primarily be affected in respect of birds and bats.

The Association considers that the documentation they have received is much more general than the impact assessments that are conducted in Finland, and that the restriction of the work to desk studies will not be sufficient. They also observe that no alternatives have been presented.

The Finnish Association for Commercial Fishermen (Suomen ammattikalastajaliitto SAKL ry); [Finsk förening för yrkesfiskare]
According to the Association, Södra Midsjöbanken is a spawning and migration area for financially important fish species (Baltic herring and flounder). According to the Association, it is possible that sediment spread during the construction period will reach the cod's important spawning areas. The Association also states that Finnish boats fish for herring, cod, flounder and salmon in the southern Baltic Sea, and that the project may therefore affect the activities of commercial fishermen.

Based on opinions received from the Finnish Environment Institute (SYKE), and bearing in mind its own opinions, the Finnish Ministry of the Environment will participate in the Environmental Impact Assessment in respect of the Södra Midsjöbanken wind power project.

The Ministry of the Environment provides a number of detailed opinions regarding the following:

- It is important that the project does not result in altered water conditions in the Baltic Sea, nor a large-scale, long-term impact on bird life or marine organisms.

- Turbid water during the construction period and sediment spread will affect the sea-birds' foraging areas as regards mussels, as well as temporarily reduce the areas that are currently available for Benthic organisms.

- Between 1,500 and 2,000 pairs of long-tailed ducks breed in Finland. It is assumed that these birds go to the southern Baltic Sea in the winter. The Ministry of the Environment observes that the long-tailed duck is already threatened at Södra Midsjöbanken, and that the establishment of wind power will only reinforce this threat. This is supported by the results of previous studies, according to which disruptions from wind power affect an area with a circumference of up to 2 km. This would mean that long-tailed ducks would be disturbed throughout the entire area where a wind farm is planned.

- The opinions received also specify the risk of collisions between the turbines' rotor blades and low-flying birds. In particular, the threat to common guillemots is mentioned in this respect, as there are only 35-70 breeding pairs of this species in the Gulf of Finland.

- The Ministry considers that protection for seabirds and their habitats, not only in Finland but in the entire Baltic Sea area, is threatened through the establishment of a wind farm at Södra Midsjöbanken.

- The project must pay particular attention to measures that will alleviate its impact, both when planning the wind turbines' location and during the construction of the facility, and when establishing the solutions that are being developed for the operation of the farm in relation to individual wind turbines, underwater cables and other structures.

- Finland possesses considerable knowledge and expertise regarding the above issues, and the Finnish Environment Institute (SYKE) can, according to the Ministry of the Environment, be contacted for assistance as a national expert body.

- ***The Government of Åland***
  In an announcement dated 19 September 2011, the Government of Åland notified the Finnish Ministry of the Environment that it considers that Finland should participate in the Environmental Impact Assessment procedure, both because Södra Midsjöbanken and the surrounding area is an important fishing area for cod fishermen from Åland, as well as because of the area's importance for wintering and resting birds, such as long-tailed ducks, and for migrating bats. The Government of Åland considers that it is necessary to collect sufficiently extensive and good quality basic material for the Environmental Impact Assessment, in order to highlight the planned wind farm's potentially more wide-ranging impact on migrating and wintering species in the Baltic Sea.

6.2 Consultation

The opinions that were put forward by countries located adjacent to the Baltic Sea are summarised in point 6.1 above.

In order to gain a better understanding of the opinions received, E.ON Vind requested the opportunity to consult with the parties that had submitted opinions as set out above, i.e. Åland, Finland, Poland and Estonia. Only the Government of Åland and the Finnish

authorities showed any interest in this consultation, which was conducted in November 2011.

In conjunction with these consultations, E.ON Vind's project presentation dated 14 November 2011 (Swedish version presented in Åland) and 16 November 2011 (English version presented in Finland) was presented. See Appendices 11 and 12. At these meetings, the various parties clarified the issues they wanted to have covered in the Environmental Impact Assessment that is now being prepared for the Södra Midsjöbanken wind farm.

The implemented consultations are summarised below.

6.2.1 Consultation with representatives from the Government of Åland was conducted on 14 November 2011

- The information that E.ON Vind received from Finland, e.g. regarding birds, also covers Åland.
- The Government of Åland wondered what information is available regarding the routes of migrating birds, and whether it is the case that the same birds pass several wind farms.
- They would like, if possible, to highlight the movements of smaller birds in the event of easterly winds.
- They consider the impact on long-tailed ducks to be a very important issue, and that the long-tailed duck population has probably been overestimated.
- E.ON Vind was notified that collated information regarding birds can be obtained from the organisation Bird Life.
- Sweden and Finland have long had a bilateral agreement regarding fishing.
- Södra Midsjöbanken is not a trawling area. Fishing is performed here using passive equipment.
- Finnish catches principally comprise cod and salmon. These are fished outside of the bank.
- The construction of a wind farm is not considered to constitute a direct threat to Åland's fishing.
- The Government of Åland wonders whether a wind farm could lead to a change to the fish composition and to existing species being forced out by new ones.
- They provide information about the planned farm near Dagö, Estonia, and the fact that the Government of Åland has now submitted a report regarding this farm.
- They wonder how the development of the farm will affect the area's existing mussel population.

- They consider that it would be good if the Environmental Impact Assessment could be supplemented with background knowledge regarding migrating bats.

6.2.2 Consultation with representatives from the Ministry of the Environment, the Ministry of Agriculture and Forestry, and the Finnish Environment Institute on 16 November 2011

- The Finnish authorities notified E.ON Vind that, at the most recent Espoo meeting in Poland, they have heard that there are plans for a larger wind farm, which will be located in connection with the Polish section of Södra Midsjöbanken, which was not known at the time, either by E.ON Vind or the Swedish Environmental Protection Agency. In this context, they consider that the project should present the cumulative effects, i.e. cumulative effects bearing in mind the construction of the Polish farm.
- They consider that the statistics that are available for EU countries ought to be able to provide a good picture of fishing in the Baltic Sea, including the area adjacent to Södra Midsjöbanken.
- They feel that a control programme in respect of fish and fishing actually ought to be implemented in part before the permit for the construction of the wind farm is granted. In this context, questions were asked regarding any impact on fish and the compensation measures that E.ON Vind is going to propose.
- They consider that it is important for there to be proper baseline data, i.e. the collected basic information that must exist before the start of the control programme. This data could possibly be produced in collaboration between Finland and Sweden.
- The issue of porpoises was raised at the meeting. The Government of Åland considers it important to summarise available information regarding the presence of porpoises and the impact on them due to the construction of the farm.
- They confirm that the fishing that is conducted by fishermen from Åland has been included in the data that was supplied from Finland.
- They confirm that there is no separate information regarding catches from Södra Midsjöbanken itself, as most of the fishing takes place outside the bank.
- They consider that the shallow parts of Södra Midsjöbanken are very important for its ecosystem and want the project to highlight the impact on the ecosystem due to the development of the farm. Common eider (*Somateria mollissima)* are particularly mentioned in this context. They also want the presence of and effects on other species to be highlighted.
- They consider that between 5–10% of the long-tailed duck population remains on Södra Midsjöbanken, and that long-tailed ducks will be greatly affected if they lose this area.
- They also wonder how the population of blue mussels will be affected and how long will take for these to recover once the construction work has been completed.

- They consider that the project should make further efforts to collect information from other countries.
- They would like the Environmental Impact Assessment to highlight the impact on migrating fish caused by the electromagnetic fields that will be present in the farm due to the large number of cables. They refer to the "Finnish National Institute", which has carried out studies that are relevant in this context.
- The Environmental Impact Assessment must also highlight noise disruption during the construction period for possible types of foundations.

They point out that it is extremely important for the Environmental Impact Assessment to include the following:

- Executive summary
- Project description including the methods that have been used to asses the impact (construction, operation, phasing out)
- Cross-border impact

They also point out that the project needs to describe the impact resulting from a development with larger wind turbines, e.g. 5 MW. However, the application should refer to a worst-case scenario.

They will want both paper copies and a digital version of the documents, including complete copies of all documents in Swedish.

The Finnish authorities also state that ongoing contacts must be channelled via Lasse Tallskog, Ministry of the Environment, and Heikki Lehtinen, Ministry of Agriculture and forestry.

Södra Midsjöbanken Offshore Wind Farm

Overview of permit application documents and translations available for the ESBO consultation process

Document	Tab	Translations	Digital doc ID	Pages
Amendment II for SEZ application (20/12/2013)	**2**	**x**	**A0**	**3**
Memo to amendment II (16/12/2013)	3	x	A1	27
App to Memo about migrating bats (Autumn 2012)	4	x	A2	17
Amendment I for SEZ application (5/9/2012)			**B0**	
Memo to amendment I regarding EIA (5/9/2012)	5	x	B1	8
Map to amendment I regarding development areas (5/9/2012)	6	x	B2	1
SEZ application_extract (17/2/2012) - only proposed conditions (3 pages)	**7**	**x**	**C0**	**3**
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Chemical analysis of sediments				
Geophysical and Geotechnical Survey (MMT)				
Evaluation of sediment spread				
Risk analysis				
Cultural heritage Reports				
Current knowledge on birds				
The use of Södra Midsjöbanken by horned puffin				

MMT

Marine Survey Report

e·on

Project Södra Midsjöbanken

Environmental Survey

2011

Final Report
July 2011

E.ON

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Marine Survey Report
Project Södra Midsjöbanken

Doc. No: 100829-EON-MMT-SUR-REP-ENVIRO01-A

Environmental Survey 2011

July 2011

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01	2011-05-25	Draft for Internal Review	DK	SP	-
02	2011-05-27	Draft Final Report	DK	SP	
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EXECUTIVE SUMMARY

The main objective with the entire project was to provide background information on the seabed features for Södra Midsjöbanken in the central Baltic Proper, with the purpose of finding a suitable location for the potential establishment of a wind farm for E.ON Vind Sverige AB.

The aim with the environmental sampling was to ground truth the seabed, classify habitats and identify possible sensitive areas. Habitats were classified using the EUNIS habitat classification codes and the environmental ground truthing was conducted using Drop Down Video camera and a Day grab.

Sampling sites were selected based on the characteristics of the seabed using information from the geophysical survey with side scan sonar, bathymetry and backscatter. Sampling sites were selected so that they would be representative of the surveyed area and the different habitats within.

A total of eight locations were selected for Drop Down Video survey (transects) with regular intervals. Seven transects were also selected for a benthic sample which was collected with a Day grabber. In addition each benthic sampling site was photo documented prior to sampling was conducted. The different techniques used for sampling were combined to obtain an as accurate as possible view of species and abundance distribution within the area.

In the three habitats classified within the survey area a total of 19 species were identified from grab sampling, photo and video identification. The most diverse group was within phylum Mollusca with six species and was followed by the phylum Annelida with five species. Two species were dominating for each of the phyla, *Macoma balthica* and *Pygospio elegans.*

Two sites were classified as mussel beds due to high presence of cobbles and boulders covered with *Mytilus edulis*. One site can be seen in transect 100829-DDV-006 and the second is found in transect 100829-DDV-008.

Water depth for the survey area ranged between 15 and 31 metres which is a significant factor in species distribution. The community composition depends on both biotic and abiotic factors i.e. physical characteristics such as seabed geology, wave exposure, tidal current, temperature and salinity together with species interaction.

The habitat classification along the route is displayed in a map as well as tables attached to this report.

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Appendix A Grab Sampling Field Protocol
Appendix B Grab Sampling Identification
Appendix C Video/Photo Transect Identification

LIST OF ILLUSTRATIONS

LIST OF TABLES

ABBREVATIONS

Annex 1	Annex 1 in EC habitat directive (COUNCIL DIRECTIVE 92/43/EEC)
AGDS	Acoustic Ground Discriminating System
ATR	Acceptance Test Report
CPT	Cone Penetration Test
DC	Direct Current
DDV	Drop Down Video
DPR	Daily Progress Report
DTM	Digital Terrain Models
E.ON	E.ON Vind Sverige AB
EUNIS	European Nature Information System
GIS	Geographic Information System
GPS	Global Positioning System
GRA	Gradiometer
Habitats Directive	A part in Europe's nature conservation policy for protected habitats
HSE	Health Safety Environment
kHz	kilo Hertz
KM	Kilometre
kN	kilo Newton
M/S	Meter(s) per Second
MBES	Multibeam Echo Sonar
MMT	Marin Mätteknik
MPa	Mega Pascal
MSL	Mean Sea Level
QA	Quality Assurance
QC	Quality Control
SAC	Special Areas of Conservation
SBP	Sub-Bottom Profiler
SSS	Side Scan Sonar
SPA	Special Protection Area
SVP	Sound Velocity Profile
USBL	Ultra-Short Base Line
UTC	Universal Time Coordinated
UTM	Universal Transverse Mercator
VC	Vibrocorer
WGS84	World Geodetic Spheroid 1984

CHART ENCLOSURE

The survey route habitat charts provide the results within the entire surveyed area of Södra Midsjöbanken.

The following chart types have been produced:
Charts: Habitat classification

Table 1. Charts Included

Chart	Horizontal Scale	Vertical Scale
100829-MMT-SUR-DWG-BIO00001	1:25000	

1. PROJECT INTRODUCTION

MMT was contracted by E.ON Vind Sverige AB to perform a marine site survey campaign in the area of Södra Midsjöbanken in the central Baltic proper. The purpose of the survey operations is to determine the ground conditions in the area for the permits application and design of a proposed wind farm.

Clients:	E.ON Vind Sverige
Project:	Södra Midsjöbanken
MMT Project no:	100829
Survey Type:	Geophysical, geotechnical and benthic survey
Purpose:	Determine ecological and ground conditions for a wind park
Survey Period:	February-April 2011
Survey Vessel:	M/V Icebeam
MMT Project Manager:	Angelina Olsson and Stina Palmeby
E.ON Vind Sverige AB Project Manager:	Anders Boklund and Bengt Wegemo
Client Representative (Sweco):	Pavel Sensky

1.1. Survey Area

The area of Södra Midsjöbanken is located in the central Baltic proper (Fig 1). The investigated site covers an area of 348 km^2 where a total of 172 lines were surveyed with 110 m line spacing. Two additional lines were surveyed to the west from site survey with 1 km spacing. The survey area was defined by four corners, see Table 2.

Table 2. The survey area was defined by four corners.

ID	WGS84 Latitude	WGS84 Longitude	UTM33 Easting	UTM33 Northing
1	55.5643'N	17.2814'E	643869	6159952
2	55.7086'N	17.1575'E	635558	6175757
3	55.7990'N	17.4328'E	652498	6186387
4	55.6377'N	17.5352'E	659572	6168673
WGS84 Coordinates are written in decimal form (DD.DDDD)				

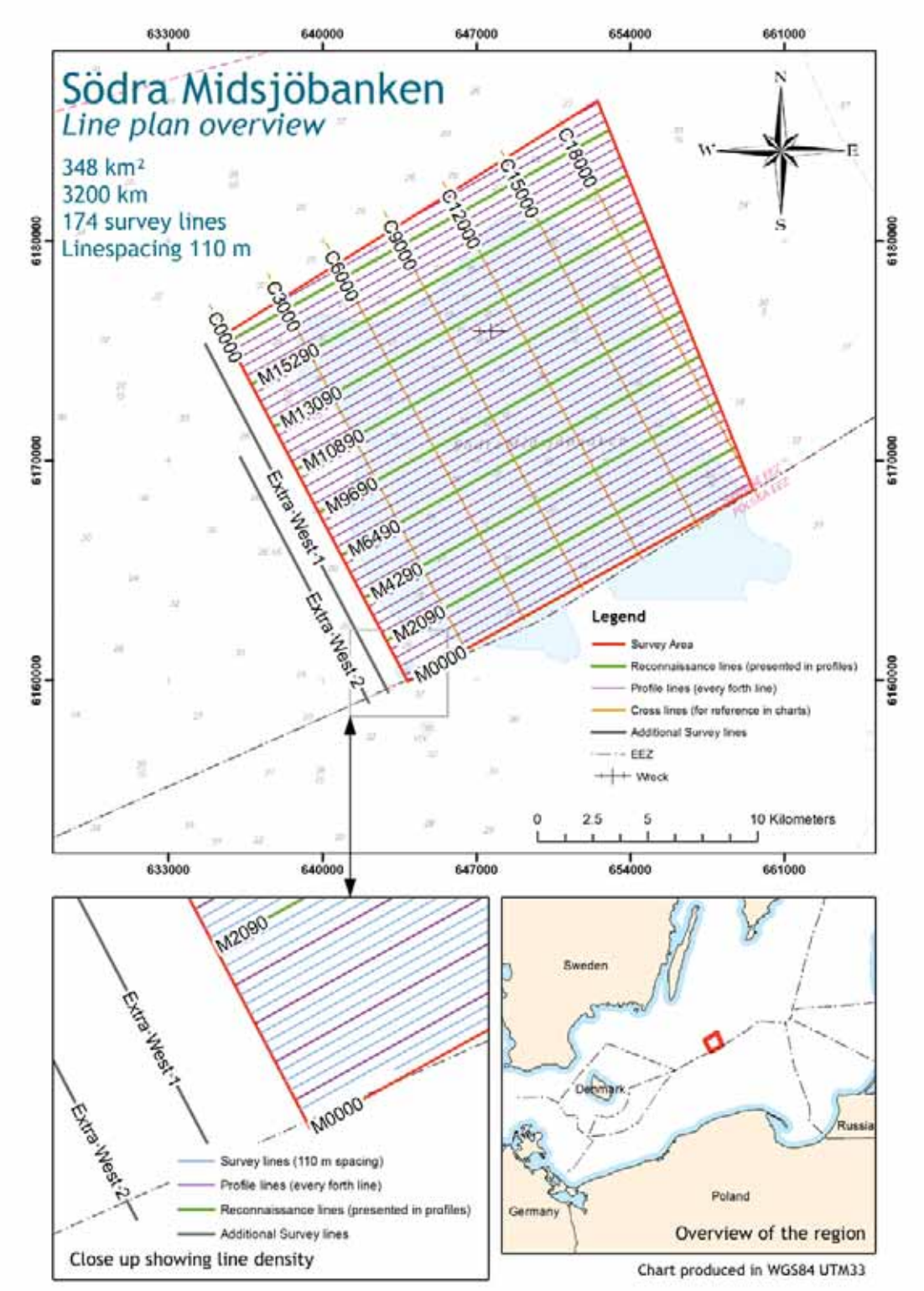


Figure 1 Index map of Södra Midsjöbanken.
Top image presents plan overview, lower left line density, and location of the area in the Baltic proper in the lower right picture.

1.2. Horizontal and Vertical Datum

All coordinates are presented in WGS 84, UTM zone 33 north. A specification of the datum is presented in Table 3 and Table 4.

Table 3. Horizontal Datum

Horizontal Datum	
Geodetic Datum	WGS84
Projection	UTM 33 North
Flattening	1/298.25722
Semi major Axis	6378137
Eccentricity Squared	0.00669437999
Central Scale Factor	0.9996
False Easting	500 000 m
False Northing	0 m
Latitude Origin	0°
Central Meridian	15° 00' 00"E

Table 4. Vertical Datum

Vertical Datum	
Water level Datum	Mean Sea Level (MSL)

1.3. Scope of Work – Entire Survey

The purpose of the marine site survey was to assist in the planning of an offshore wind park development site and to provide input to various permits and environmental analyses. It was also to provide data that was to be used for the installation operation.

Geophysical site survey:

The geophysical survey was used to plan the geotechnical and benthic survey program. This included MBES, SSS and SBP and for this the area was divided into 170 survey lines with 110 metres spacing. Information gathered provided a description of the area in terms of soil characteristics.

Geotechnical sampling programme:

The geotechnical investigation was used to confirm geophysical survey data and provide sufficient and accurate information about the soil within the area. Sampling was conducted using VC and CPT and grab sampler. Samples from the uppermost layers were analysed for chemical content.

Benthic sampling programme:

A grab sampler was used along with photo/video documentation. The locations for the benthic sampling were selected after review of the geophysical results, to cover all habitat types identified.

1.4. Scope of Work - Environmental Survey

Locations for the benthic sampling were selected after interpretation of the geophysical results. Stratified random sampling was implemented, which involved dividing the survey area into segments which are allocated a proportional or weighted number of randomly selected stations within the selected areas. The stratification is selected on the basis of environmental conditions, such as known geophysical and geological conditions or other variables, including known biotopes, water depth and distance from shore.

Samples were collected for infauna and sediment analysis. With ground truthing, the side scan sonar and backscatter data interpretation was confirmed with help of selected Drop Down Video and/or Grab samples. At each benthic sampling site, one grab was retrieved together with photo documentation and video transect.

Biotope mapping was made possible after interpretation of the geophysical survey and video/ photo transects were used to classify sea bed habitats and produce biotope maps.
The biotope habitat classification was performed according to Annex I habitat of EC Habitats Directive 92/43 Special Areas of Conservation (SACs) and in accordance with the EUNIS classification system.

1.5. Seabed Video and Photo

A drop down camera equipped with a combined video and photo camera was used for the environmental transect surveys offshore. Camera and video recording techniques have been used in a variety of applications and are appropriate for the identification of seabed habitats/biotopes as well as epibenthic flora and fauna.

Photo images were used to identified the epibenthic flora and fauna whereas the video records were used to asses locations for habitat changes but also to account for abundances and to provide information for a general overview of the area.

These techniques were also useful at hard bottom substrates where grab sampling was limited due to possible damage to equipment or due to the limitations of retrieving a sufficient sample.

1.6. Habitat Classification and Areas of Special Concern

The Marine Habitat Classification of communities within the different habitat types is based on physical characteristics such as benthic geology, wave exposure, tidal current, temperature and salinity together with key species for the area.

The intention with this report was to give an overview of the biota within the surveyed area and list habitats found. An imperative was also to identify habitats classified as Annex I areas in accordance with EUNIS or that were protected Natura 2000 areas.

Natura 2000 is comprised of the Habitats Directive and the Birds Directive. Special Areas of Conservation (SACs) are protected areas under the EC Habitats Directive. The listed habitat types and species are those considered to be most in need of conservation at a European level (excluding birds). SPAs are Special Protection Areas under the Bird Directive.

Special Areas of Conservation (SACs) is a network of areas identified to conserve biodiversity across the European Union. These areas are identified according to the Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, also called the Habitat Directive that came into force on 21 May 1992. The central aim of the

Habitat Directive is, through a coherent network of areas, to conserve the biodiversity in the European Union. In Annex 1 of the Directive seven marine habitat types are listed and Annex II specifies animals and plants whose conservation requires special areas of conservation. SACs together with 'Special Protection Areas' (SPAs) identified under the Birds Directive are areas described as 'Natura 2000'.

1.7. General Background Information

The Baltic Sea is an inland sea meaning that it covers a central area surrounded by landmass and is nearly a closed system without any significant tidal shifts. It is connected to the North Sea that is an extension to the North Atlantic by narrow Danish channels. Fresh water runoffs from the surrounding land areas.

Brackish waters are characteristic of the Baltic. Since saltwater is heavier than freshwater the freshwater will remain at the surface separated from the saltwater at the bottom by a strong halocline. When water from the North Sea does enter the Baltic, it will replace, with time, even the saltiest waters of the deepest parts of the southern Baltic proper.

The larger parts of the area are dominated of residual sand, gravel and cobbles because of erosion due to severe water movements that wipes away fine grained sediment. Södra Midsjöbanken is the largest shallow area in the Baltic proper and is very exposed and subject to harsh wind conditions that affect the shallow areas. Its lack of species diversity is a result of the salinity conditions and increases with shallower environment.

Hydrography has a major effect on sediment structure and concomitantly, the sediments are a major factor governing the benthic communities.

Sediment structure alone does not determine the benthic community. In addition to the influence of currents and its influence on the sedimentary factors, water temperature, wave exposure and salinity influence the type and distribution of the benthic communities in the littoral and sublittoral zone. The proper Baltic is characterised by a low diversity and this is mainly due to the fact that many of the marine species are not prevailing in brackish waters.

Södra Midsjöbanken has previously been classified as a Sublittoral sandbank, an Annex 1 habitat, EUNIS class 1110, by Naturvårdsverket (2006) and have been delimited at 34 metres depth. A general definition of EUNIS class 1110; Sandbanks which are slightly covered by sea water all the time:

“Sandbanks are elevated, elongated, rounded or irregular topographic features, permanently submerged and predominantly surrounded by deeper water. They consist mainly of sandy sediments, but larger grain sizes including boulders and cobbles, or smaller grain sizes including mud may also be present on a sandbank. Banks where sandy sediments occur in a layer over hard substrata are classed as sandbanks if the associated biota are dependent on the sand rather than on the underlying hard substrata.”

2. MATERIAL AND METHODS

2.1. Environmental survey

Prior to the environmental survey, the geophysical survey was completed and the data collected was used to select the biological sampling sites.

The positions of the sites were selected using geophysical and bathymetrical results to achieve a representative mapping method for the biological habitat where bottom substrate and depth was distinguished through the interpreted geophysical data. The bathymetrical data provided a high-resolution relief map (Figure 2), and the side scan gave information of sea bed structure (Figure 3).

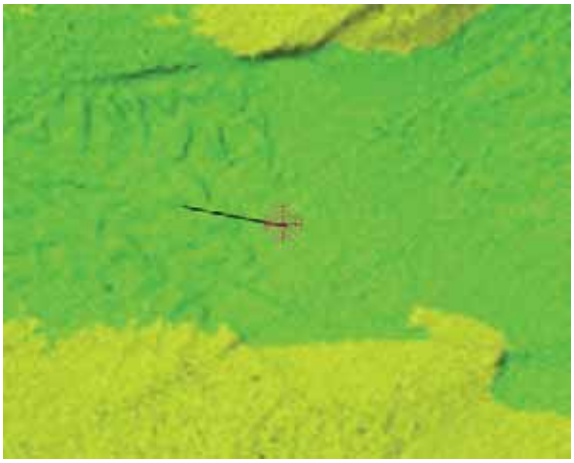


Figure 2. 100829-DDV-005 Bathymetry image

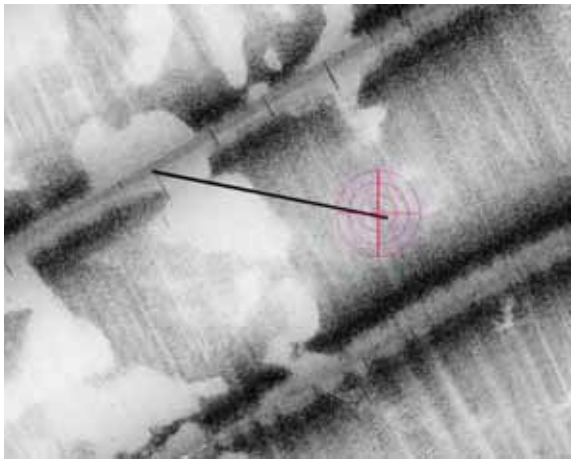


Figure 3 Corresponding Side Scan image at video transect 100829-DDV-005

The environmental survey included both grab sampling and video and still photography transects. In total, eight DDV and photo transects with a total length of 1250 metres and seven grab samples were surveyed.

The transect sites were spread across different sediment types and over several depths according to a stratified random sampling method. Stratified random sampling involves dividing the survey area into discrete sections which are allocated a proportional or weighted number of randomly selected sites within the selected areas.

The stratification was selected on the basis of environmental conditions, such as known geophysical and geological conditions or other variables, including known biotopes, water depth and distance from shore.

The aim was to provide a visual record of the fauna along sections of the area and to identify the presence of notable species or habitats.

In total 48 close-up photo images were taken and the position of each image was registered in data spread sheets. All photos were further analysed to identify species and the abundances of the biota.

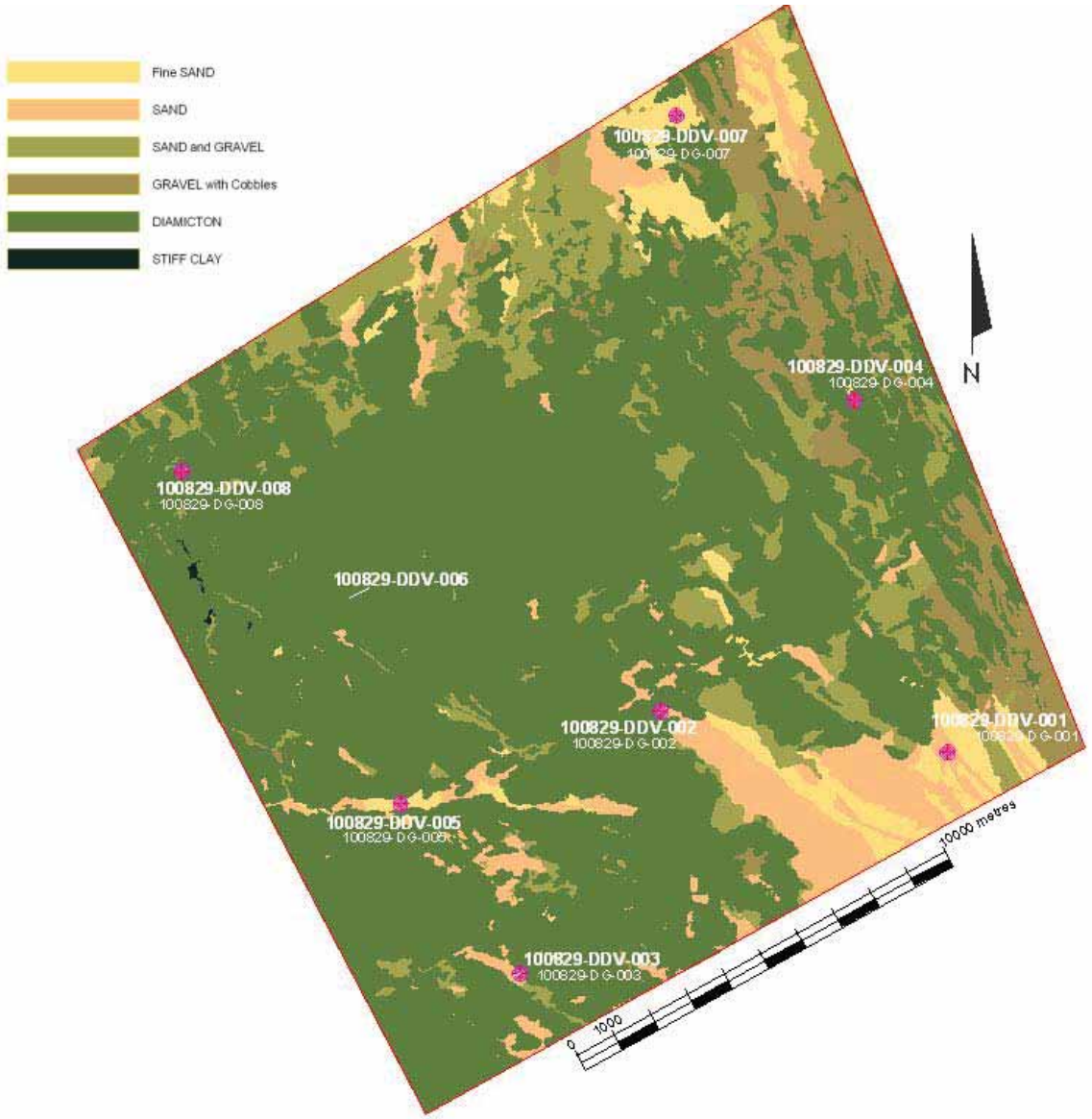


Figure 4. Interpreted surface geology of the entire route survey with sampling positions.

Table 5. Transect Position List

Transect ID	Start position		End position		Depth range (m)	Length (m)
	Easting	Northing	Easting	Northing		
100829-DDV-001	656304	6168564	656394	6168611	24-25	100
100829-DDV-002	649404	6169513	649492	6169560	14-16	100
100829-DDV-003	645978	6163229	646110	6163299	20-22	150
100829-DDV-004	654029	6176921	654120	6176969	26-27	100
100829-DDV-005	643167	6167363	643266	6167344	22-23	100
100829-DDV-006	642065	6172239	642510	6172470	19-22	500
100829-DDV-007	649744	6183672	649834	6183719	30-31	100
100829-DDV-008	638135	6175299	638047	6175252	22-26	100

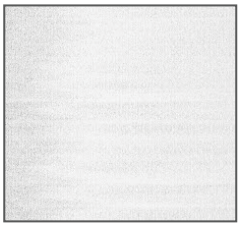
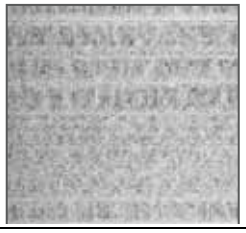
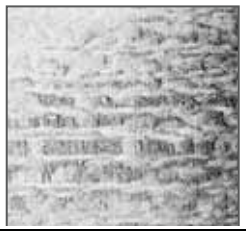
Table 6. Grab Position List

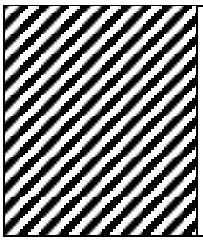
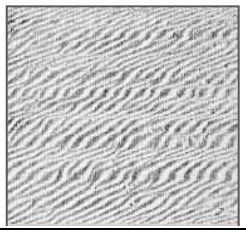
Grab ID	Easting	Northing	Depth (m)
100829-DG-001	656304	6168563	25
100829-DG-002	649461	6169543	15
100829-DG-003	646112	6163299	21
100829-DG-004	654078	6176946	27
100829-DG-005	643262	6167346	22
100829-DG-006	NO GRAB - instead a 500 m transect		
100829-DG-007	649833	6183719	31
100829-DG-008	638048	6175255	25

2.1.1. Sediment Classification

Sediments were classified from the side scan sonar data according to their acoustic description and associated lithological interpretation. The chart colour column indicates the specific sediment type as displayed in the chart. Particle sizes refer to the Atterberg scale as in British Standard (BS 5930, 1999).

Table 7. Sediment classification

Chart colour	SSS Image	Acoustic Description	Lithological Interpretation
		Low to medium acoustic reflectivity. In places slightly grainy texture.	Fine SAND
		Medium acoustic reflectivity. In places grainy texture and a slightly irregular surface.	SAND
		Medium acoustic reflectivity, slightly grainy to grainy texture	SAND and GRAVEL
		Medium to high acoustic reflectivity. Coarse texture, point source reflectors with associated acoustic shadow.	Sandy GRAVEL with Cobbles
		High acoustic reflectivity. Coarse texture, numerous point source reflectors with associated acoustic shadow	Diamicton
		High acoustic reflectivity.	Stiff CLAY

		Medium acoustic reflectivity, slightly grainy texture. In parts regular almost parallel lineation with lesser/higher reflectivity	Ripples formations

2.2. Survey Equipment

Detailed information about the equipment used within the entire survey is stated in the Operational Report.

2.3. Video and Still Camera System

Eight transects were selected for Drop Down Video (DDV) survey, a non destructive method for collecting information on epibenthic species and Annex 1 habitats. The transect lengths were in general 100 metres, but one transect was longer (500 metres) to compensate for an insufficient grab sample at DDV_006. Video was run with a speed of approximately 0.2-0.4 knots along transect lines at a distance of 0.5-1.5 metres from the seabed. Photographic images were taken at a fixed distance every 25 metres (50 metres for the 500 metres transect 100829-DDV-006).

The photos were taken while the deployment frame was standing on the seabed. Each photo covered an area of 0.57 square metres (0.91 metres x 0.63 metres). The scale was fixed for all still images as the camera cage was landed on to the seabed. Transect videos were analysed for the position of changes in habitats as well as biota.

The video and still camera system was mounted on a Box Deployment Frame with transponder mounted for positioning (Figure 5). The camera was a Canon EOS 5D Digital Still Camera System, 22 megapixels (Figure 6) with an integrated video system capable of performing full HD recordings with at least 5 megapixels resolution.

The video and stills were stored in the camera and a low definition video was streamed through a coax cable and recorded directly to the server with overlay presenting site, time and position, LED lights Newtsun NS600-S 5600 was used for illumination. (See Figure 4 and Table 5 for an overview of transect sites.)

Figure 5. Drop Down Video camera

Figure 6. Example resolution image from DDV

2.4. Day Grab

In addition to the eight video sampling sites, seven sites were selected for grab sampling (see Table 6). The sampling equipment used in the environmental seabed sampling included a 0.1 square metre Day grab with sample inspection flaps. The Day grab comprises of two stainless bucket sections mounted within a stainless steel frame. Dual tensioned bridles retain and trigger bars hold these buckets in the open position on deployment. On contact with the seabed, the trigger bar allows the buckets to close under the gravity of the unit. The Day grab has a very little disturbance effect on the sediment, leaving the sediment trapped within intact and thus minimise the risk of contamination of the chemical samples from the grab itself.

The samples were first photographed and then sieved using a 1 millimetre sieve. Any coarse and medium grained sand or gravel samples were sorted using a stereo-zoom microscope. A preliminary immediate identification and documentation of characteristic fauna and flora was performed before conservation and storage of samples in 70% ethanol.

Figure 7. Day grab

Figure 8. Retrieved sample on deck was photo documented

2.5. Laboratory Method

The objective of the laboratory analysis was to verify the biota present in the samples. The data analysis included identification to the lowest taxonomic level, species abundance and identification of habitats.

The biological material from preserved 1 millimetre mesh samples was sorted from the remaining sediment and shell matter, using stereo microscopes. Samples from each of the sampling sites were identified separately, with QC checks by a second biologist. For identification of benthic fauna both stereo-zoom microscope and compound microscope were used. The stereomicroscopes were the main instrument used for sorting and identification while the compound microscope with higher magnification was used for detailed studies of specimens.

Quantitative methods were used for the identification of biota in grab samples and still photographs. All data was presented in individuals per square metres and percentage cover for colonial species. The semi quantitative SACFOR abundance scale was used for the video analyses.

For the identification of species present in the grab samples both stereo-zoom microscope (Zeiss Stemi 2000-C) and compound microscope (Zeiss Axiostar plus Binocular) was used.

High-resolution data screens were used for the photo and video identifications. The photo images were analysed for substrate type and all identifiable species, different habitats and species abundance.

The result of the habitat classification is presented in maps covering the entire survey area. The abundances are expressed as S, superabundant; A, abundant; C, common; F, frequent; O, occasional; R rare; P, present.

Table 8. SACFOR abundance scale table

Growth form	Size of individuals/ colonies							
% cover	Crust/ meadow	Massive /Turf	<1 cm	1-3 cm	3-15 cm	>15 cm	Density	
>80%	S		S				>1 / 0.001 m^2 (1x1 cm)	>10,000 / m^2
40-79%	A	S	A	S			1-9 / 0.001 m^2	1000-9999 / m^2
20-39%	C	A	C	A	S		1-9 / 0.01 m^2 (10 x 10 cm)	100-999 / m^2
10-19%	F	C	F	C	A	S	1-9 / 0.1 m^2	10-99 / m^2
5-9%	O	F	O	F	C	A	1-9 / m^2	
1-5% or density	R	O	R	O	F	C	1-9 / 10m^2 (3.16 x 3.16 m)	
<1% or density		R		R	O	F	1-9 / 100 m^2 (10 x 10 m)	
					R	O	1-9 / 1000 m^2 (31.6 x 31.6 m)	
						R	<1 / 1000 m^2	

2.6. Habitat classification

MBES, Backscatter and SSS data together with the faunal composition from the Drop Camera was used to determine the extent of the habitats as well as sediment characteristics, and to identify potential Annex I habitats. The habitat classification was performed according to EUNIS Biodiversity Database.

To assess the extent of the classified habitat areas the borders between the habitats were established through video analyses and information from the geophysical data i.e. MBES, backscatter and SSS. The result of the habitat classification is presented in a map covering the entire Södra Midsjöbanken survey area.

EUNIS consists of a database together with explanatory documentation where habitats are arranged in a hierarchy starting at level 1, which is the highest level and reaches for marine habitats down to Level 6. At level 1 the marine habitats are divided from the coastal and terrestrial habitats. At Level 2, the biological zone and presence/absence of rock is a classification criterion and at Level 3 the softer substrata is divided into different sediment types. On these levels the classification is based on physical characters.

Level 4 references to specific taxa, from rocky substrates major epifauna are used and for softer substrates the classification relies on both zone distribution and physical attributes. Further at Level 5 the classification is based on both the physical and biological characters of the habitats. Classes are defined with both infauna and epifauna on different substrates. At the highest level, 6, the different characterizing taxa are associated with differing environmental characteristics of the habitat. For this report the classification was made down to the lowest possible level, generally Level 4 & 5 (see Figure 9 for example).

Level 1	Marine Habitats
Level 2	(A5) Sublittoral sediment
Level 3	(A5.4) Sublittoral mixed sediments
Level 4	(A5.41) Sublittoral mixed sediment in low or reduced salinity
Level 5	(A5.411) Baltic level mixed sediment bottoms of the infralittoral photic zone with little or no macrophyte vegetation

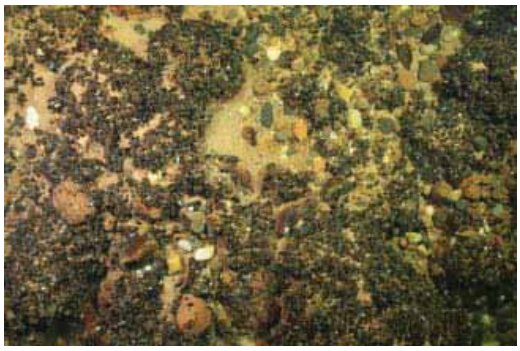
Figure 9 Habitat matrix example from EUNIS

3. RESULTS

3.1. Key Findings

A total of three habitats were classified in the survey area. The total number of species and higher taxa, identified from grab sampling, photo and video identification, were 19. The most diverse group was the molluscs with six species followed by the annelids with five species The most diverse grab sites were 100829-DG-001 followed by 100829-DG-005 with eight respectively seven species while grab sites 100829-DG-007 and 100829-DG-004 had the highest abundance (see Appendix B). Among transects, the highest diversity with five species, was found along transect 100-DDV-006 (see Appendix C).

Table 9. Habitat types found
(photos from the survey and text quoted from EUNIS biodiversity database homepage)

Example image	Habitat Type		Area km²	% of total area
	**A5.211**	Baltic level sandy bottoms of the infralittoral photic zone with little or no macrophyte vegetation.	18	5
	**A5.411**	Baltic level mixed sediment bottoms of the infralittoral photic zone with little or no macrophyte vegetation.	91	26
	**A5.6271**	Baltic mussel beds in the infralittoral photic zone with little or no macrophyte vegetation.	239	69

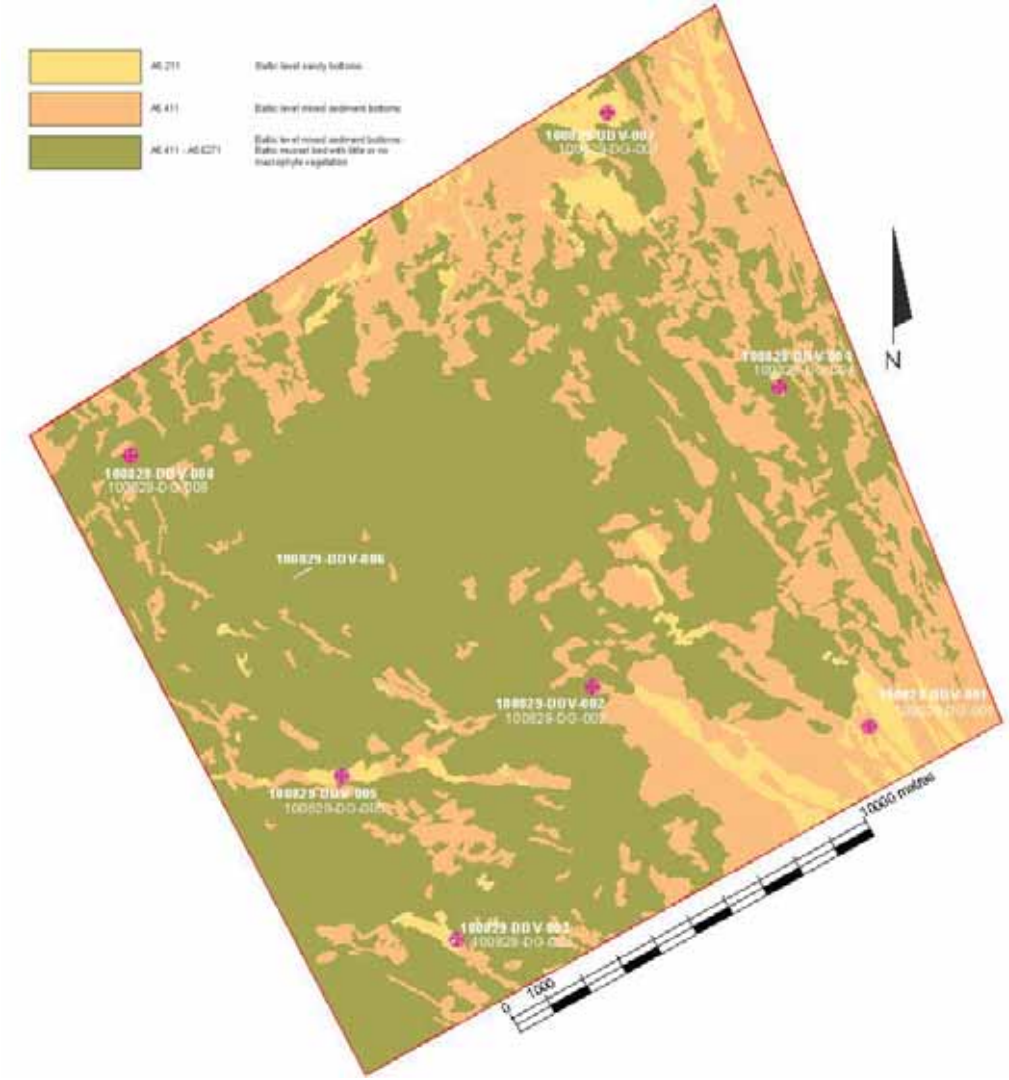


Figure 10 Interpreted surface biology of the entire route survey with sampling positions.

Table 10. Number of species in each higher taxon.

Taxon	Number of Species	% of Total Number of Species
Rhodophyta	2	10.5
Cnidaria	1	5.3
Annelida	5	26.3
Mollusca	6	31.6
Arthropoda	4	21.1
Chordata - Actinopterygii	1	5.3
Total	**19**	**100,0**

Table 11. List of species, including higher taxa, identified in the survey area.

Species		
RHODOPHYTA	*Pygospio elegans*	**ARTHROPODA**
Hildenbrandia spp.	Spionidae	*Balanus improvisus*
Rhodophyta indet	**MOLLUSCA**	*Bathyporeia pilosa*
CNIDARIA	Bivalvia indet	*Gammarus zaddachi*
Hydrozoa indet	*Cerastoderma glaucum*	*Saduria entomon*
ANNELIDA	*Hydrobia* sp.	**CHORDATA - ACTINOPTERYGII**
Capitellidae	*Macoma balthica*	Gadidae
Hediste diversicolor	*Mya arenaria*	
Oligochaeta indet	*Mytilus edulis*	

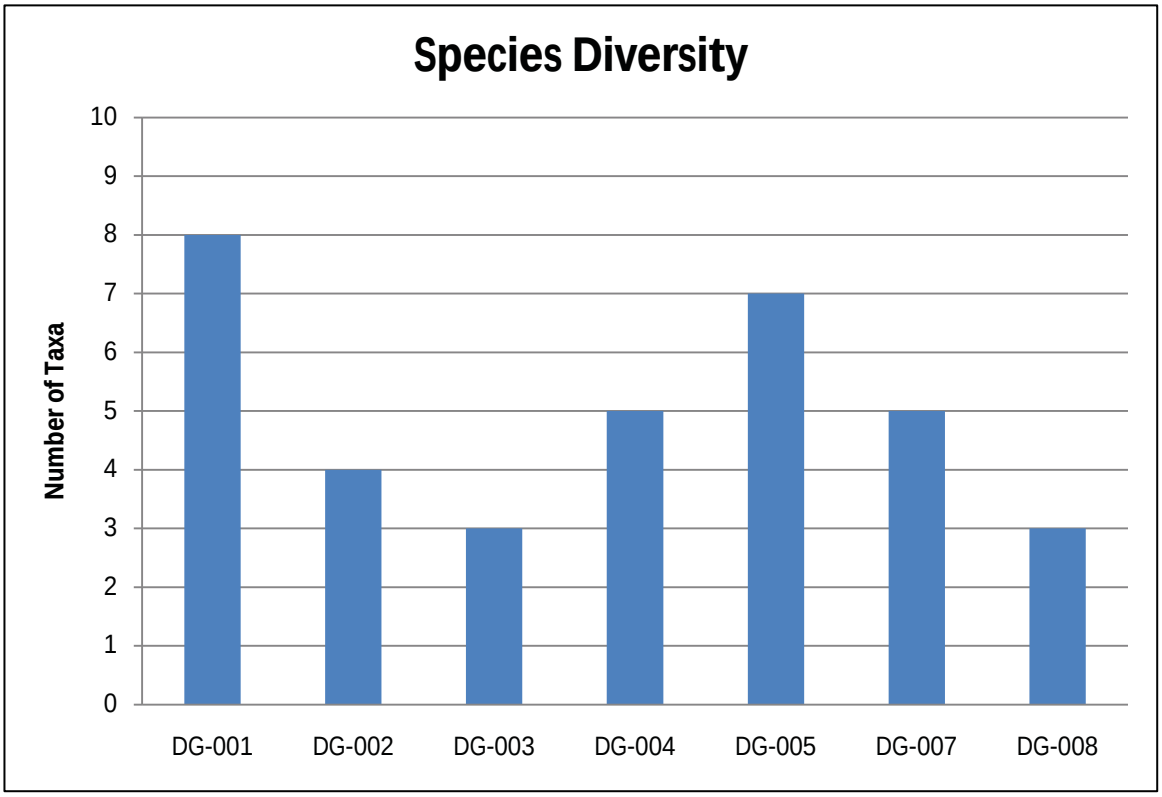


Figure 11. Number of species and higher taxa at each grab site.

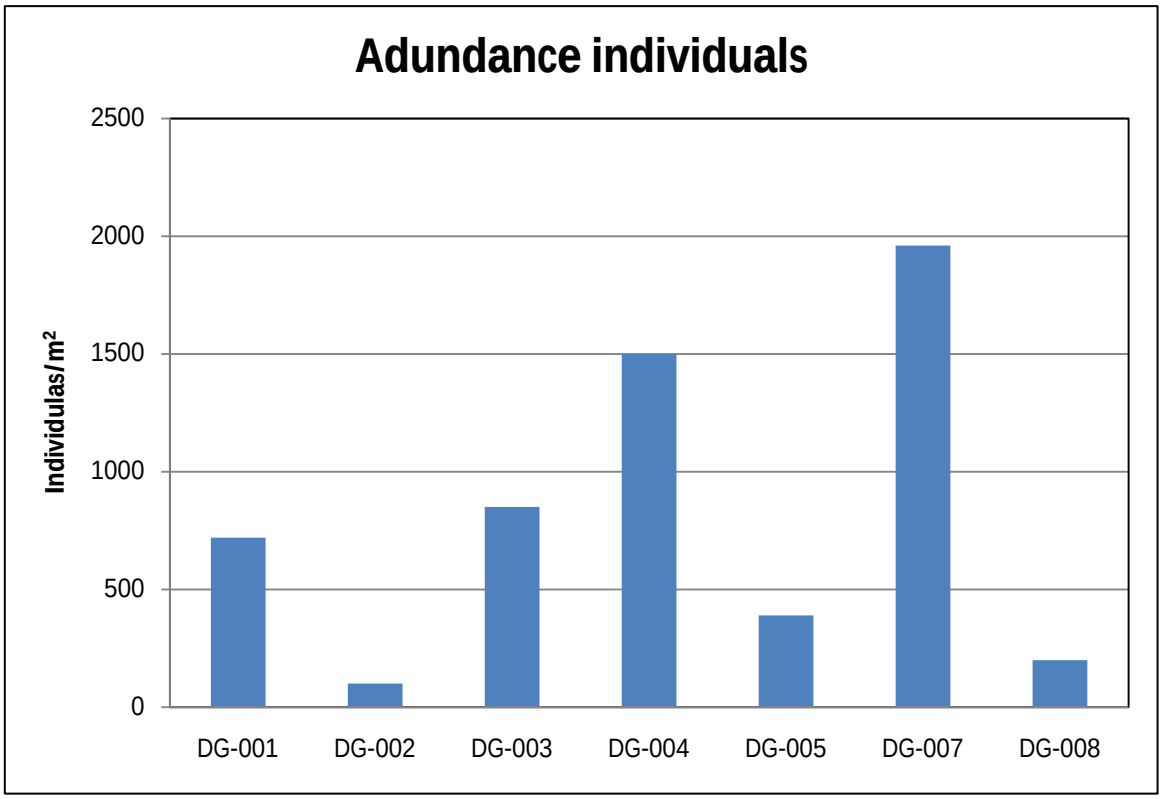


Figure 12. Abundance (individuals/m^2) of all species documented at each grab site.

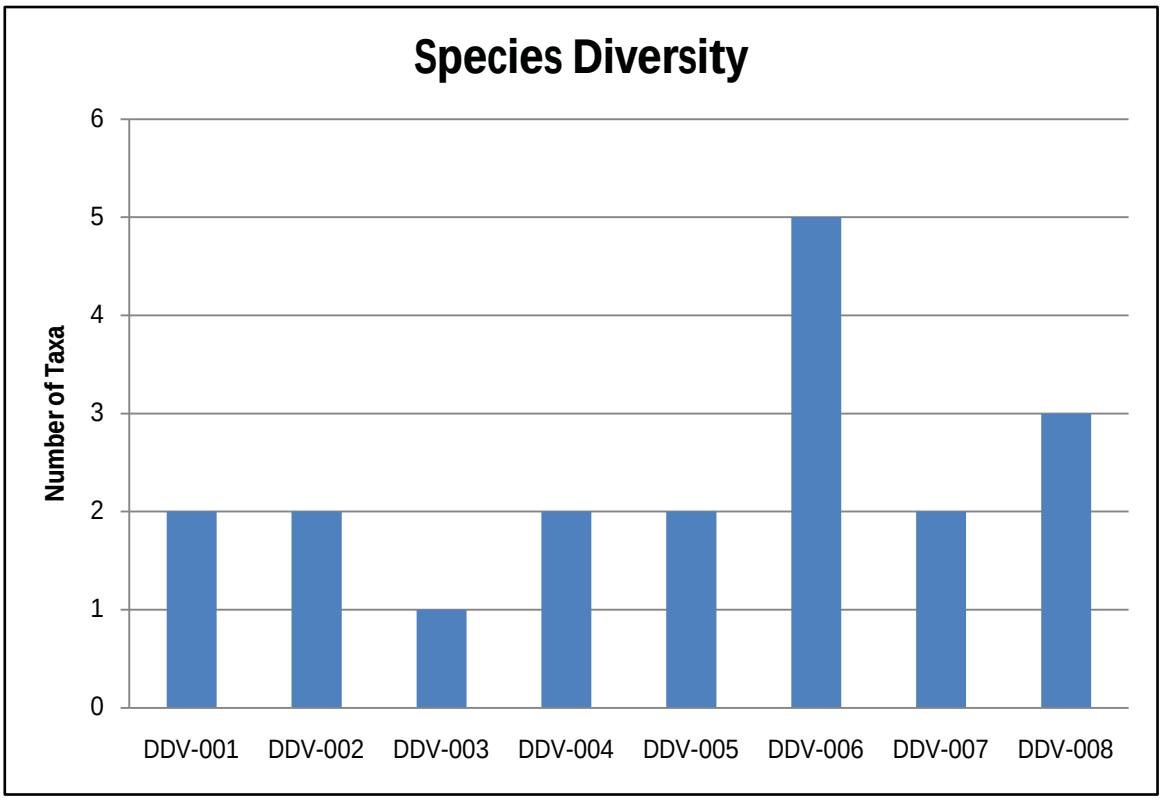


Figure 13. Number of species and higher taxa within each transect.

3.1. Benthic Fauna and Habitats

The two most common habitats found in the environmental survey are sandy bottoms (A5.211) and mixed sediment bottoms (A5.411). In the video transects in these areas the most common fauna seen are blue mussels, *Mytilus edulis,* scattered around cobbles and in the gravel in A5.411 habitat. Less *M. edulis* is seen in the sandy habitat.

The grab samples reveals that *M. edulis* is present in all grabs gathered in A5.411 but none in the A5.211 habitat. Instead another bivalve, *Macoma baltica,* occurs in that habitat. The dominating species in the grabs collected in habitat A5.211 is the polychaete *Pygospio elegans.*

In the third habitat present in the area, Baltic Mussel beds (A5.6271), *Mytilus edulis,* are the by far dominating species and are at the most estimated to 8700 ind./m^2 at photo "DDV 100829-DDV-008_003". Occasional bay barnacle, *Balanus improvisus*, is present at the boulders and cobbles characterizing the habitat. The lack of macrophyte vegetation connected to the mussel beds generates to the classification “Baltic mussel beds in the infralittoral photic zone with little or no macrophyte vegetation (A5.6271).

Rhodophyta was occasionally present as filamentous or loose drifting algae.

3.2. Annex 1 Habitats

A general definition of biogenic reefs was made by Holt et al*.* (1998).

“Solid, massive structures which are created by accumulations of organisms, usually arising from the seabed or at least clearly forming a substantial, discrete community or habitat which is very different from the surrounding seabed. The structure of the reef may be composed almost entirely of the reef-building organism and its tubes or shells or it may to some degree be composed of sediments, stones and shells bound together by the organism.”

Biogenic reefs have an impact on the environment in several ways. They play a major role in stabilising sand, gravel and stones. The shells provide substrate colonisation of sessile organisms and encourage a higher diversity.

Blue mussels, *Mytilus edulis* forms large reefs mainly on mixed sediments. The reefs are often in the mid and low intertidal zone. The accumulation of mussels and the bio deposition (through feaces e.g) contributes to a higher biological diversity through grazing and habitat formations.

Dense aggregation of *Mytilus edulis* was found in video transects DDV-006 and DDV-008. The area contains several boulders and cobbles on which the mussels settle (see Figure 15 and Figure 16). The extrapolated area, built on geophysical and geotechnical data, which could sustain such densities of *Mytilus edulis* are seen in Figure 10. An example image of the Side Scan Sonar information over such an area is shown in Figure 14.

The high densities of mussels are primary settled to solid substrata and less common in the sediment forming thick aggregations of mussels. Since the mussels merely carpet the substratum without building substantial mounds, the mussel aggregations could probably be considered beds rather than biogenic reefs (Holt et al. 1998).

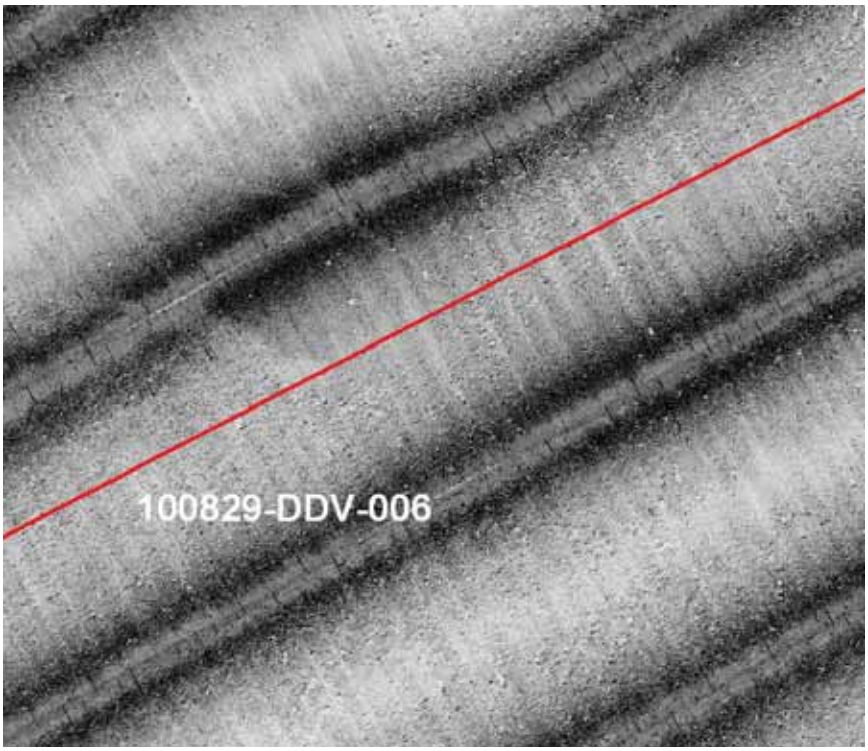


Figure 14 Side Scan Sonar image at video transect DDV-006

Figure 15 Baltic Blue Mussels seen in video transect DDV-006

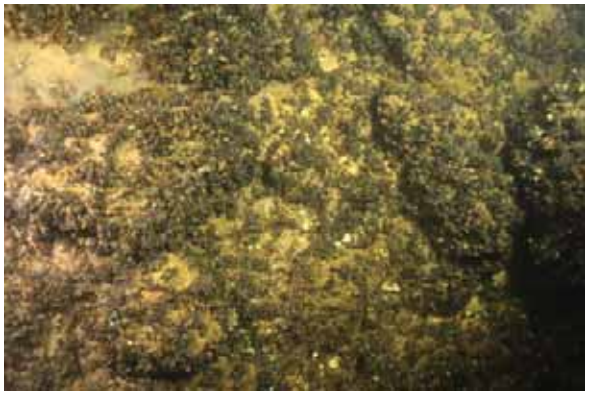


Figure 16 Baltic Blue Mussels seen in video transect DDV-008

4. CONCLUSION

The aim of this survey was to investigate the habitats at Södra Midsjöbanken with the emphasis on identifying and classifying habitats, biotopes and species diversity. The bottom substrates were investigated with a drop camera equipped with both video and still camera. In total 48 close-up photo images were taken along within total 1250 metres of video transect. In addition a total of seven grab samples were collected with a Day grabber. All photos and grab samples were further analysed identifying biota to lowest taxonomic level common in these areas. The result from the analyses of photo and video transects together with information from grab samples, bathymetry and side scan sonar is the base for the interpretation and classification of habitats of the entire surveyed area.

Three different habitats were identified. The eastern part of the surveyed area is dominated by sand mixed with cobbles and boulders (A5.411) and areas of sand (A5.211). In two of the video transects (DDV-006 and DDV-008) in the western part of the survey area the habitat A5.6271, Baltic mussel bed, is present where the cobbles and boulders are carpeted with blue mussel, *Mytilus edulis*. However, the lack of additional fauna and the fact that mussels primarily have a patchy distribution connected to the solid structures rather than affecting the structures in the gravel between the boulders the mussels could probably be considered a mussel bed rather than a reef.

Both video transects are positioned in sediments classified as Diamicton. The mussel bed habitat is mixed with habitat A5.411 (mixed sediment bottoms) along both transects. Habitat A5.411 is also present along DDV-002, also this transect positioned in the Diamicton area. This leads to the assumption that there is a mix of the two habitats in the area. The low number of video transects however, makes it difficult to set any spatial limits of the mussel beds within the Diamicton area.

The low number of transects and grabs in the survey area makes the interpretation to a large extent dependent on the geophysical and geotechnical survey. The differences within a determined sediment type are therefore difficult to find. To determine the depth limit on the mussel beds and to be able to make a more detailed habitat description additional sampling would be needed.

Södra Midsjöbankarna has previously been classified as an Annex 1 habitat, a sublittoral sandbank by Naturvårdsverket (2006). The sandbank has been stretched to a depth of 34 metres. This survey however has only been carried out at a depth shallower than that and doesn’t reach the boarders of the sublittoral sandbank.

One area in the western part of the survey area is classified as Stiff Clay. Since no grab or video transect were conducted in that area, a specific bio habitat classification has not been assigned. The area is classified as a part of the surrounding habitat, A5.411.

5. REFERENCES

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