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BRISK II

Environmental vulnerability mapping

D3.4

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This document is developed within the BRISK II project to analyse environmental vulnerability in the Baltic Sea and submitted by the Core Project team on 30.06.2026.

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BRISK II

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1 Introduction

1.1 Background

This data report is part of the long-term risk analysis for oil and hazardous and noxious substances (HNS) pollution from shipping accidents to the marine environment in the Baltic Sea, in short BRISK II. The BRISK II project comprises the following deliverables on the analyses:

1 Deliverables under work package 1 include project management related reports (e.g. progress reports).

2 Work package 2: Basic analysis
- 2.1 Method note
- 2.2 Data collection note
- 2.3 Traffic analysis
- 2.4 Cargo analysis
- 2.5 Accident and spill model
- 2.6 Probability of oil and HNS release

3 Work package 3: Future damage analysis
- 3.1 Traffic scenarios
- 3.2 Selection of risk reduction scenarios
- 3.3 Impact mapping of spilt oil and HNS
- **3.4 Mapping of environmental vulnerability (this report)**
- 3.5 Mapping of environmental damage due to oil
- 3.6 Mapping of environmental damage due to HNS

1.2 Scope

This report presents the vulnerability mapping and vulnerability scoring in terms of oil or HNS (behaving as oil) spill in the Baltic Sea. See the Figure 1- 1 showing the causal chain of the BRISK II model. All references to HNS in this report refer to HNS substances that behave similarly to oil in the marine environment. In this report, we present the process and the results of the vulnerability mapping and scoring of the selected environmental and socio-economic indicators. These results serve as an input to mapping of environmental damage due to oil.

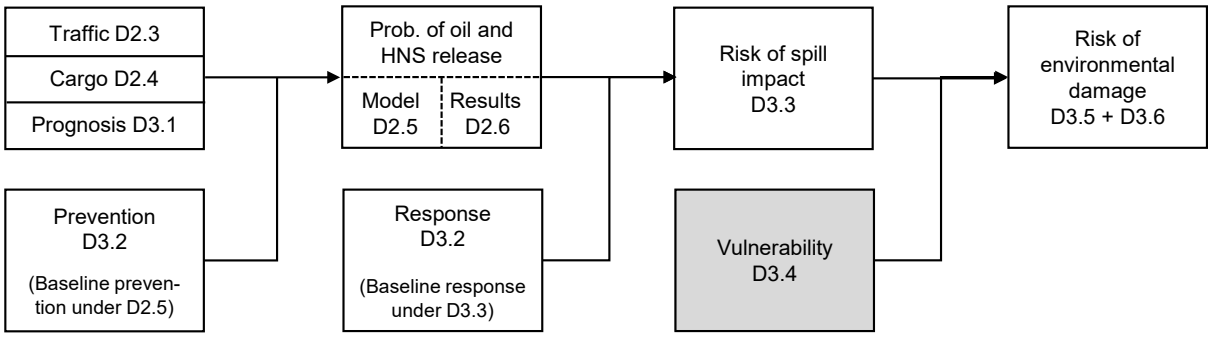


Figure 1-1 Causal chain of the BRISK II model and corresponding deliverables numbers (The present report is highlighted with grey background).

The sub-report on the mapping of environmental vulnerability is divided into the following chapters:

Chapter 2: Methodology and procedure
Chapter 3: Distribution and vulnerability of the indicators
Chapter 4: Vulnerability maps

2 Methodology and Procedure

2.1 Purpose of the vulnerability mapping

The oil or HNS spill vulnerability mapping is an integrated part of the mapping of risks of damage of spills in the Baltic Sea. Generally, the risk of environmental damage of spill in an area is perceived as the product of probability of oil spill and consequences of accident (vulnerability of the area to oil or HNS spill). Vulnerability mapping and scoring are means to structure damage reduction in advance of a spill. In addition, they can support the developing of response strategy and improving the current capacity for spills.

2.2 Baltic Sea ecosystem

The Baltic Sea is one of the largest brackish water bodies in the world. Due to its semi-enclosed nature and limited water exchange with the North Sea through the Danish Straits, the inflow of saline water is restricted. At the same time, rivers discharge large amounts of freshwater into the basin, resulting in a pronounced salinity gradient. These conditions create layers of water with different salinity and temperature, which limits mixing between surface and deep waters. As a result, oxygen levels in deeper areas can become low, making Baltic Sea ecosystem sensitive to environmental changes.

The Baltic Sea's unique conditions support a relatively low number of species adapted to its brackish environment, resulting in lower biodiversity compared to fully marine ecosystems. Furthermore, the sea is relatively shallow, making it vulnerable e.g. to pollution and eutrophication. Another distinctive characteristic of the Baltic Sea is the seasonal formation of sea ice, especially in its northern regions. Ice cover influences ecological processes and species distributions across the region. Finally, due to its special geographical, climatological, and oceanographic characteristics, the Baltic Sea is highly sensitive to the environmental impacts of human activities in its catchment area, which is home to some 85 million people (HELCOM BSEP87).

2.3 Overall procedure

The vulnerability mapping and scoring of environmental and socio-economic indicators in the Baltic Sea in terms of oil or HNS spill has been carried out by using the methodology developed in BRISK I (Brisk, 2012) and further modified in BE AWARE I and II (Beaware, 2015). The following steps were taken:

Step 1: The identification of environmental and socio-economic indicators to be mapped and scored according to vulnerability to oil or HNS spill

Step 2: The mapping of the identified environmental and socio-economic indicators

Step 3: The allocation of vulnerability scores to each identified indicator in different seasons

Step 4: Vulnerability mapping of the identified environmental and socio-economic indicators to oil or HNS spill

Step 5: Total seasonal vulnerability mapping

Step 1: The identification of environmental and socio-economic indicators to be mapped and scored according to vulnerability to oil or HNS spill

The indicators that have been mapped and scored in terms of vulnerability to oil or HNS spill have been selected in cooperation with the technical team of the BRISK II project and external experts. First, the list of the environmental indicators used in the BRISK I (Brisk, 2012) and the list of socio-economic indicators used in the BE AWARE II project (Beaware, 2015) were used as a starting point. Second, two workshops with external experts were organized to discuss about the indicators to be included. Third, the technical team presented the proposed indicator lists for several HELCOM Expert Groups (EGs) and Working Groups (WGs) to get comments from a wider group of experts.

Consulted HELCOM Groups:

- IC WG Biodiv (May 2025)
- IC EG Safe Nav (September 2025)
- IC EG Wildlife (September 2025)
- IC EG Shore (October 2025)
- IC WG Biodiv (October 2025)
- WG Maritime (October 2025)
- WG Response (November 2025)
- IC BSR Data ESG (March 2026)
- EG Wildlife (March 2026)
- EG Shore (April 2026)
- EG Benthic (April 2026)
- EG Surveillance (May 2026)
- EG AIS (May 2026)
- WG Response (June 2026)

Finally, 40 environmental and socio-economic indicators in total were selected and grouped under six categories:

- Benthic species: 9 indicators
- Birds: 4 indicators
- Fish: 8 indicators
- Marine mammals: 4 indicators
- Protected areas: 5 indicators
- Socio-economic indicators: 10 indicators

See the Tables 2-1 and 2-2 with a comprehensive list of the selected indicators.

During the process of identifying the indicators, some indicators were considered but eventually excluded. An indicator was excluded e.g. if experts did not consider it particularly vulnerable to spills, making it unnecessary to include in the analysis. This was the case, for example, with the sand and gravel extraction indicator.

Step 2: The mapping of the identified environmental and socio-economic indicators

Since BRISK II was only a two-year project, it was planned already beforehand not to collect separate data for the maps from each of the Baltic Sea countries but rather use already existing maps. Therefore, only those indicators for which comprehensive maps were already available for the entire Baltic Sea region could be included. The exception was the Swedish west coast, for which data were collected separately, as it is not part of the Baltic Sea and is therefore missing from many Baltic Sea maps. However, it is part of our study area like in the earlier BRISK I project and thus needed to be included. In addition, for the offshore wind farms indicator the data was already collected in the BRISK II project for traffic scenario purposes and thus the same data was used for mapping the “offshore wind farm” indicator.

Sometimes an indicator had to be excluded or replaced with another because comprehensive maps were not available for the entire Baltic Sea region. This was the case with the coastal habitat indicators. Several different sources (HOLAS 3, EMODNET, BISE, EIONET) were reviewed and multiple experts contacted to find comprehensive and reliable maps for coastal habitats, but despite all the efforts, the same problems persisted across the datasets: differences in coastal habitat classifications and/or missing data from certain areas. Using maps with these kinds of issues in spill vulnerability mapping would in the worst case, result in unreliable and biased outcomes. For the reliability of the results, it was important to use maps that do not overemphasize certain regions simply because of different classification methods.

The maps were downloaded and modified in GIS format. See the Tables 2-1 and 2-2 specifying the indicators and the data sources related to them. Note that, in all the maps presented in Chapters 3 and 4, the white colour in the Baltic Sea indicates a value of zero, unless white is defined differently in the map legend.

Table 2-1 The selected environmental indicators and the data sources used for the mapping.

Environmental indicator	Data Source for the Baltic Sea	Data source for the SWE West coast
Benthic species		
Callitriche	Protect Baltic	Protect Baltic
Charophytes and Najas	Protect Baltic	Protect Baltic
Fontinalis	Protect Baltic	Protect Baltic
Fucus	Protect Baltic	Protect Baltic
Furcellaria	Protect Baltic	Protect Baltic
Mytilus	Protect Baltic	Protect Baltic
Potamogeton and Myriophyllum	Protect Baltic	Protect Baltic
Zannichellia	Protect Baltic	Protect Baltic
Zostera marina	HOLAS 3	Protect Baltic
Birds		
Wintering areas for sea and shore birds	BRISK I	BRISK I
Staging areas for migrating sea and shore birds	BRISK I	BRISK I
Breeding areas for sea and shore birds	BRISK I	BRISK I
Moulting areas for sea birds	BRISK I	BRISK I
Fish		
Potential spawning areas for herring	PanBalticScope	Extrapolated
Potential spawning areas for Baltic flounder	PanBalticScope	NA
Potential nursery areas for flounder	PanBalticScope	NA
Potential recruitment areas for perch	PanBalticScope	NA
Potential recruitment areas for pikeperch	PanBalticScope	NA
Potential spawning areas for cod	PanBalticScope	NA
Potential spawning areas for sprat	PanBalticScope	Extrapolated
Potential spawning areas for European flounder	PanBalticScope	NA
Marine mammals		
Distribution map for grey seal	HOLAS 3	Extrapolated
Distribution map for ringed seal	HOLAS 3	NA
Distribution map for harbour seal	HOLAS 3	SMHI
Oil risk map for harbour porpoise	HOLAS 3, modified	modified with experts
Protected areas		
EBSAs	HELCOM MADs	CBD EBSA
HELCOM MPAs	HELCOM MADs	NA
Natura 2000 sites	HELCOM MADs	Swedish Environmental Protection Agency
Ramsar sites	HELCOM MADs	NA
UNESCO sites	HELCOM MADs	NA

Table 2-2 The selected socio-economic indicators and the data sources used for the mapping.

Socio-economic indicator	Data source for the Baltic Sea	Data source for the SWE West coast
Finfish mariculture	HOLAS 3	LST/ Swedish Geodatakatalogen
Shellfish mariculture and Furcellaria harvesting	HOLAS 3	LST/ Swedish Geodatakatalogen
Bathing sites	HOLAS 3	API Bathing areas and bathing water/Havs
Marinas and leisure harbours	HOLAS 3	NA
Harbours areas	HOLAS 3	HOLAS 3
Offshore wind farms	BRISK II	BRISK II
Water intakes of nuclear power plants	HOLAS 3	NA
Cod extraction landings	HOLAS 3	Extrapolated
Herring extraction landings	HOLAS 3	Extrapolated
Sprat extraction landings	HOLAS 3	Extrapolated

Step 3: The allocation of vulnerability scores to each identified indicator in different seasons

In BRISK II, the same score classification and four seasons that were applied in BRISK I (Brisk, 2012) were used. See Table 2-3 with the score and season definitions. All oils and HNS behaving as oil, were grouped together and only one vulnerability score was given for the entire Baltic Sea per indicator but a separate value for each season. This follows the procedure used in BRISK I (Brisk, 2012).

Table 2-3 The vulnerability score classification and seasons applied.

Scores	Seasons
Score 4 = Very high vulnerability	Winter: December, January and February
Score 3 = High vulnerability	Spring: March, April and May
Score 2 = Moderate/medium vulnerability	Summer: June, July and August
Score 1 = Low vulnerability	Fall: September, October and November
Score 0 = Not affected	

To assign vulnerability scores to each of the selected environmental and socio-economic indicators in different seasons, several workshops with external experts were organized. See the timing and the topic in Table 2-4. The external experts were invited in the workshops personally based on their expertise but also an open invitation was presented in several HELCOM WGs and EGs. As a starting point in the workshop discussions, the vulnerability scores assigned to the environmental indicators in BRISK I (Brisk, 2012) and to the socio-economic indicators in BE AWARE II (Beaware, 2015) were used. In addition to the workshops, vulnerability scores for certain socio-economic indicators were elicited directly from external experts through email consultations. Table 2-5 and 2-6 present all the scores assigned to the selected environmental and socio-economic indicators in different seasons.

Since our original aim was to consider six seasons (See BRISK II, D2.1 Method note), the external experts were encouraged to consider the impact of ice as well in the scoring process. However, the experts found

it hard to estimate whether ice increases or decreases the vulnerability. Thus, eventually four seasons were used similarly than in BRISK I.

Table 2-4 Organized vulnerability scoring workshops with external experts.

Time	**Topic**
November 2025	Fish
December 2025	Marine Mammals
January 2026	Socio-economic & Protected Areas
April 2026	Seabirds
May 2026	Benthic species

Similarly, to BRISK I (Brisk, 2012), the scoring of vulnerability was based on knowledge of the physical and biological character of the different indicators in terms of vulnerability to oil or HNS spill, i.e.

- The fate of oil/HNS i.e. the removal and degradation of oil in the particular ecosystem/environment
- Potential impacts of the oil/HNS on organisms and habitats and their recovery (e.g. population considerations)

However, when oil or HNS impacts on a socio-economic indicator, the damage will depend also on the sensitivity of the human activity to oil or HNS exposure and the potential for recovery of the activity. Therefore, for the socio-economic indicators the same two additional criteria used in BE AWARE I and II (Beaware, 2015) were added:

- Length of interruption of an activity or service
- Compensation

Table 2-5 *The vulnerability scores assigned to the selected environmental indicators in different seasons (W=winter, Sp=spring, Su=summer, F=fall).*

Environmental indicator	W	Sp	Su	F
Benthic species				
Callitriche	4	4	4	4
Charophytes and Najas	4	4	4	4
Fontinalis	4	4	4	4
Fucus	4	4	4	4
Furcellaria	4	4	4	4
Mytilus	3	3	3	3
Potamogeton and Myriophyllum	4	4	4	4
Zannichellia	4	4	4	4
Zostera marina	4	4	4	4
Birds				
Wintering areas for sea and shore birds	4	3	0	2
Staging areas for migrating sea and shore birds	2	4	2	4
Breeding areas for sea and shore birds	2	4	4	1
Moulting areas for sea birds	0	0	4	0
Fish				
Potential spawning areas for herring	3	4	4	4
Potential spawning areas for Baltic flounder	3	4	4	3
Potential nursery areas for flounder	3	4	4	3
Potential recruitment areas for perch	3	4	4	3
Potential recruitment areas for pikeperch	3	4	4	3
Potential spawning areas for cod	2	3	3	1
Potential spawning areas for sprat	2	2	3	1
Potential spawning areas for European flounder	3	4	4	3
Marine mammals				
Distribution map for grey seal	3	3	2	2
Distribution map for ringed seal	4	4	2	2
Distribution map for harbour seal	2	3	3	2
Oil risk map for harbour porpoise	3	4	4	3
Protected areas				
EBSAs	4	4	4	4
HELCOM MPAs	4	4	4	4
Natura 2000 sites	4	4	4	4
Ramsar sites	4	4	4	4
UNESCO sites	4	4	4	4

Table 2-6 The vulnerability scores assigned to the selected socio-economic indicators in different seasons (W=winter, Sp=spring, Su=summer, F=fall).

Socio-economic indicator	W	Sp	Su	F
Finfish mariculture	4	4	4	4
Shellfish mariculture and Furcellaria harvesting	3	3	3	3
Bathing sites	2	3	4	3
Marinas and leisure harbours	1	2	3	3
Harbour areas	2	2	2	2
Offshore wind farms	2	2	2	2
Water intakes of nuclear power plants	3	3	3	3
Cod extraction landings	3	3	3	3
Herring extraction landings	3	3	3	3
Sprat extraction landings	3	3	3	3

Step 4: Vulnerability mapping of the identified environmental and socio-economic indicators to oil or HNS spill

In this step we utilized the approach applied in BE AWARE II (Beaware, 2015). First, all the environmental and socio-economic indicators were grouped into four groups. The Table 2-6 presents all the indicators and their groups. The four groups are:

- Benthic species: 9 indicators
- Other species (birds, fish and marine mammals): 16 indicators
- Protected areas: 5 indicators
- Socio-economy: 10 indicators

Table 2-7 Environmental and socio-economic indicators divided into four groups.

Indicator	Group
Benthic species	
Callitriche	Benthic species
Charophytes and Najas	Benthic species
Fontinalis	Benthic species
Fucus	Benthic species
Furcellaria	Benthic species
Mytilus	Benthic species
Potamogeton and Myriophyllum	Benthic species
Zannichellia	Benthic species
Zostera marina	Benthic species

Birds	
Wintering areas for sea and shore birds	Other species
Staging areas for migrating sea and shore birds	Other species
Breeding areas for sea and shore birds	Other species
Moulting areas for sea birds	Other species
Fish	
Potential spawning areas for herring	Other species
Potential spawning areas for Baltic flounder	Other species
Potential nursery areas for flounder	Other species
Potential recruitment areas for perch	Other species
Potential recruitment areas for pikeperch	Other species
Potential spawning areas for cod	Other species
Potential spawning areas for sprat	Other species
Potential spawning areas for European flounder	Other species
Marine mammals	
Distribution map for grey seal	Other species
Distribution map for ringed seal	Other species
Distribution map for harbour seal	Other species
Oil risk map for harbour porpoise	Other species
Protected areas	
EBSAs	Protected areas
HELCOM MPAs	Protected areas
Natura 2000 sites	Protected areas
Ramsar sites	Protected areas
UNESCO sites	Protected areas
Socio-economic indicators	
Finfish mariculture	Socio-economy
Shellfish mariculture and Furcellaria harvesting	Socio-economy
Bathing sites	Socio-economy
Marinas and leisure harbours	Socio-economy
Harbours areas	Socio-economy
Offshore wind farms	Socio-economy
Water intakes of nuclear power plants	Socio-economy
Cod extraction landings	Socio-economy
Herring extraction landings	Socio-economy
Sprat extraction landings	Socio-economy

Next, separate vulnerability maps for each group in every season were prepared in GIS format. Each of the vulnerability maps was prepared by summing up individual vulnerability scores of all the indicators. Since there were different number of indicators in each group the total sum of the vulnerability scores of each group were normalised to make them comparable and to prevent any group receiving greater weight solely due to a larger number of indicators. To do the normalisation, the total vulnerability weight of each group was calculated. This was done by summing up the vulnerability scores of all 2 × 2 km grid cells in the project area. This sum was subsequently normalised to 1.

After summing up the vulnerability scores, the total scores were reclassified into five different total vulnerability classes:

- Very high vulnerability
- High vulnerability
- Medium vulnerability
- Low vulnerability
- Very low vulnerability

Step 5: Total seasonal vulnerability mapping

Finally, integrated total vulnerability maps were prepared from a combination of the four groups of seasonal vulnerability maps (benthic species, other species, protected areas and socio-economy).

In BE AWARE II (Beaware, 2015) they tested different weight ratios for different groups to see how it impacts on the results if some of the groups receive more weight than others. However, differences of major consequences were not found between the maps of the different ratio combinations. In addition, they could not provide a quantitative and objective argumentation about why the concept of equality between the groups should not be used. Therefore, they ended up using equal weight for all the four groups. We also discussed the weight ratio, but we could not make an objective reasoning either why one of the groups should get more weight than others. Based on these discussions and the results of BE AWARE II (Beware, 2015), it was decided to use equal weight for each of the four groups.

3 Distribution and vulnerability of the indicators

3.1 Benthic species

The vegetation of the Baltic Sea includes freshwater and brackish water species. The vegetation provides both food and shelter for a wide range of animals, including fish and benthic invertebrates. They also absorb nutrients, produce oxygen, store carbon, and reduce erosion by helping to stabilize bottom sediments through their root systems. Invertebrates can live in the sediment, on the sediment surface or attached to substrates. Blue mussels dominate the epifaunal communities in the Baltic Sea.

As explained earlier, it was decided to replace the coastal habitat indicators used in BRISK I (Brisk, 2012) with benthic species. With the assistance of an external expert, we selected benthic species groups that form habitats in the Baltic Sea and therefore play an important role in the Baltic Sea ecosystem. Many of them are key species and can be found in the coastal habitats listed in the Habitat Directive. The species groups selected are also the same that were used in HELCOM HOLAS 3 assessment (HOLAS 3, 2023). The nine species groups include eight macrophyte groups and one invertebrate group. Each group contains a different number of species varying from one species to 13 species. The comprehensive species list is provided in Table 3-1. The distribution maps of all species within each group were combined into a single distribution map showing the absence and presence of the species:

- Combined predicted modelled distribution of Callitriche
- Combined predicted modelled distribution of Charophytes and Najas
- Combined predicted modelled distribution of Fontinalis
- Combined predicted modelled distribution of Fucus
- Predicted modelled distribution of Furcellaria
- Predicted modelled distribution of Mytilus
- Combined predicted modelled distribution of Potamogeton and Myriophyllum
- Combined predicted modelled distribution of Zannichellia
- Predicted modelled distribution of Zostera marina

In BRISK II, we aim to use the best available data for all indicators within the given timeframe. Many previous maps have been based on observational data only, resulting in some areas being underrepresented. This can directly affect the results of environmental vulnerability mapping for oil/HNS spills by making vulnerability appear lower than it is in certain areas. Therefore, it is important to use maps that are as accurate and reliable as possible to avoid underestimating.

The SDMs (species distribution maps) produced in the Protect Baltic project (Protect Baltic, 2026) currently represent the most up-to-date data available on benthic species. In contrast to earlier maps, they are not based on observations only but also incorporate probability modelling.

The Protect Baltic SDMs were used for all the benthic species indicators except for Zostera marina. The SDM for Zostera marina was the only selected SDM that did not receive sufficient confidence in the Protect Baltic. Based on expert review within the Protect Baltic, the Zostera marina SDM was assessed as having lower confidence. It showed underpredicted values in the northern Baltic Sea and false positive occurrences in the southern Baltic Sea at depths greater than 10 m. Therefore, for Zostera marina, HOLAS 3 map was used. However, since the Swedish west coast is missing from the HOLAS 3 map, we used the Protect Baltic SDM to fill in this missing area by combining the two maps.

Table 3-1 All the selected benthic species.

Callitriche	**Fontinalis**	**Potamogeton and Myriophyllum**
Callitriche hermaphroditica	Fontinalis antipyretica	Potamogeton berchtoldii
Callitriche palustris	Fontinalis dalecarlica	Potamogeton crispus
	Fontinalis hypnoides	Potamogeton friesii
Charophytes and Najas		Potamogeton gramineus
Chara.aspera	**Fucus**	Potamogeton natans
Chara.baltica	Fucus serratus	Potamogeton obtusifolius
Chara.braunii	Fucus vesiculosus/Fucus radicans	Potamogeton perfoliatus
Chara.canescens		Potamogeton praelongus
Chara.connivens	**Furcellaria**	Potamogeton pusillus
Chara.horrida	Furcellaria lumbricalis	Myriophyllum alterniflorum
Chara.tomentosa		Myriophyllum sibiricum
Chara.virgata	**Mytilus**	Myriophyllum spicatum
Najas marina		Myriophyllum verticillatum
Nitella flexilis		
Nitella wahlbergiana		**Zannichellia**
		Zannichellia major
		Zannichellia palustris
		Zostera marina

Callitriche

Callitriche species grow as submerged aquatic plants in a variety of water bodies, including the shores of brackish water bays. They can be found in coastal habitats like coastal lagoons. The combined predicted modelled distribution of Callitriche is shown in Figure 3-1.



Figure 3-1 The combined predicted modelled distribution of Callitriche (Protect Baltic, 2026)

Charophytes and Najas

Charophytes are relatively large green algae that typically occur in shallow coastal bays with soft sediments, where they can form dense underwater meadows. These habitats provide important living and feeding areas for a variety of aquatic organisms. Charophytes also play a role in improving water clarity by efficiently taking up nutrients from the water column. The genus *Nitella* is primarily associated with freshwater environments and is therefore found in parts of the Baltic Sea where salinity is close to zero.

Najas marina is an aquatic plant that commonly occurs in sheltered bays. Charophytes and najas can been found in coastal habitats like coastal lagoons. (Marine Finland, 2026a). The combined predicted modelled distribution of Charophytes and Najas is shown in Figure 3-2.



Figure 3-2 The combined predicted modelled distribution of Charophytes and Najas (Protect Baltic, 2026).

Fontinalis

Mosses are commonly known from marshes, rocks, and forests, but there are numerous underwater mosses species in the Baltic Sea as well. Many water mosses are adapted to fresh water, but some species have also adapted to brackish water. Thus, in the Bay of Bothnia with low salinity, water mosses grow more prominent and are the most significant species forming biomass on rock reefs. Water mosses are a relatively unknown group thus far. They are perennial species that overwinter under sea ice and use

sunlight efficiently, allowing them to occur at depths of up to nearly ten meters. (Marine Finland, 2026b). The combined predicted modelled distribution of Fontinalis is shown in Figure 3-3.



Figure 3-3 The combined predicted modelled distribution of Fontinalis (Protect Baltic, 2026).

Fucus

Fucus species are brown algae forming bush-like growths attached to hard substrates. Fucus can been found in coastal habitats like reefs, esker islands and boreal Baltic islets. In favorable conditions, fucus species can become massive. They have often gas-filled bladders at the tips of their fronds, which help support them and keep them upright in the water. Fucus species are important for the Baltic Sea underwater biodiversity. They provide shelter and food for both juvenile and adult fish, as well as a wide range of invertebrates. (Marine Finland, 2026c). The combined predicted modelled distribution of Fucus is shown in Figure 3-4.

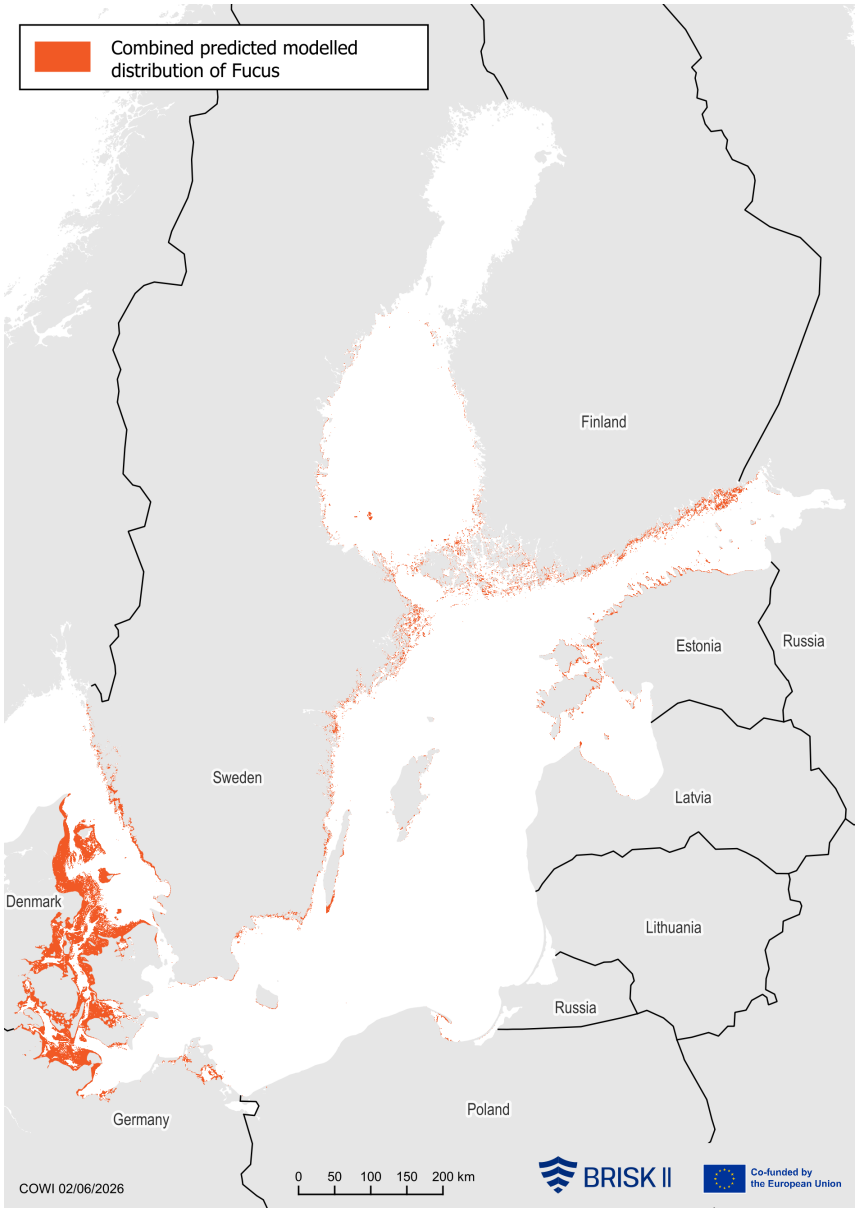


Figure 3-4 The combined predicted modelled distribution of Fucus (Protect Baltic, 2026).

Furcellaria

Red algae occur on almost every rocky surface within the sunlit zone. They can utilize the light penetrating deeper into the water and thus are able to grow at greater depths than other algae. *Furcellaria lumbricalis* is one of the largest species of red algae. Furcellaria can been found in coastal habitats like reefs, esker islands and boreal Baltic islets. It forms branching structures on hard substrates, providing habitat and food resources at depths where most other algae are largely absent. A wide range of invertebrates find shelter among the fronds *Furcellaria lumbricalis* and, smaller red algal species often grow on its surface as epiphytes. (Marine Finland, 2026d). The predicted modelled distribution of Furcellaria is shown in Figure 3-5.



Figure 3-5 The predicted modelled distribution of Furcellaria (Protect Baltic, 2026).

Mytilus

In the Baltic Sea, the blue mussel often occurs in dense communities in areas ranging from a few square meters to hectares. The highest densities are typically found below the photic zone where algae are scarce. However, mussel communities associated with hard substrates can occasionally occur on sand and gravel, and even on soft-bottom sediments. The blue mussel of the Baltic Sea is a hybrid of two oceanic species, i.e. *Mytilus trossulus* and *Mytilus edulis*. Blue mussels are considered as one of the key species in the Baltic Sea, and their communities form key habitats. Dense colonies provide both food and shelter for numerous invertebrates. In addition, mussel aggregations form small niches on the bottom filled with soft deposits in which soft-bottom clam species can survive. (Marine Finland, 2026e). The predicted modelled distribution of Mytilus is shown in Figure 3-6.

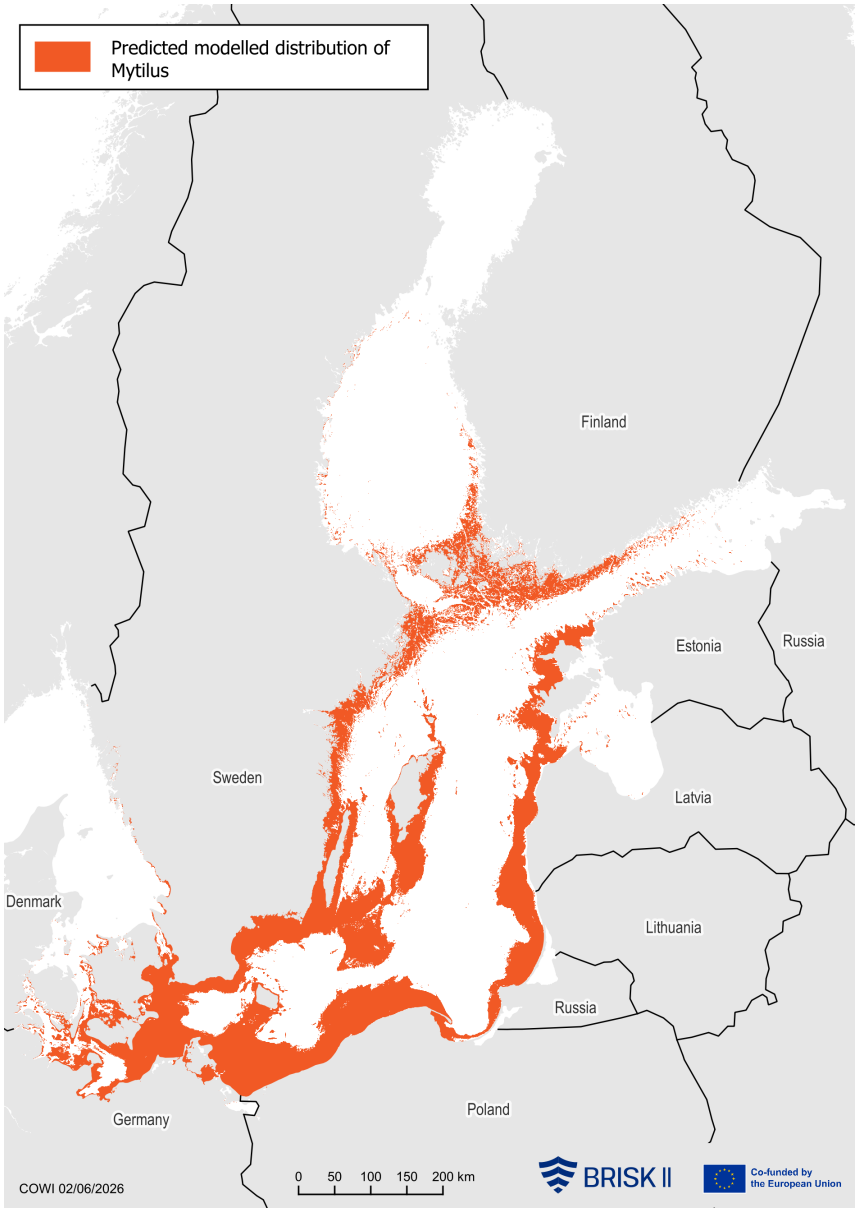


Figure 3-6 The predicted modelled distribution of Mytilus (Protect Baltic, 2026).

Potamogeton and Myriophyllum

Potamogeton species can be found in coastal habitats like large shallow inlets and bays, estuaries, and coastal lagoons. They can grow in both clear and turbid waters, as well as on soft and mixed sediment substrates. When other environmental conditions are suitable, even relatively small patches of soft sediment can support their establishment and growth. In shallow coastal ecosystems, these plants are highly important because they stabilize bottom sediments, reduce resuspension, and take up and retain nutrients from the water column as well as through photosynthesis, contribute to oxygen production in the shallow waters. They also create sheltered habitats that offer protection for fish and invertebrates and provide food resources for organisms. (Marine Finland, 2026f).

Myriophyllum species are fast-growing, resilient aquatic plants with flexible stems. They can thrive in relatively turbid water. They provide shelter and food resources for fish and small invertebrates. (Marine

Finland, 2026g). The combined predicted modelled distribution of Potamogeton and Myriophyllum is shown in Figure 3-7.



Figure 3-7 The combined predicted modelled distribution of Potamogeton and Myriophyllum (Protect Baltic, 2026).

Zannichellia

Zannichellia, the vascular plant species, can be found in coastal habitats like sand banks. They grow often close to the beach and the shoreline among the seagrasses. (Marine Finland, 2026h). The combined predicted modelled distribution of Zannichellia is shown in Figure 3-8.



Figure 3-8 The combined predicted modelled distribution of Zannichellia (Protect Baltic, 2026).

Zostera marina

Zostera marina can be found in coastal habitats like large shallow inlets and bays, sand banks and estuaries. As a species adapted to large, saline seas, Zostera marina called as common eelgrass, typically grows on sandy seabed, which may also contain gravel or mud. In mobile sandy environments shaped by

wave action, eelgrass anchors itself firmly using strong roots. This root system stabilizes the substrate within seagrass beds. Shoots emerging from these roots form extensive meadows that create complex three-dimensional structures in an otherwise relatively uniform seafloor landscape.

Common eelgrass meadows are usually found in moderately exposed areas at depths of approximately one to five meters. Dense, meandering meadows provide shelter and food for many fish species and small invertebrates. As a result, seagrass meadows are among the key underwater habitats in the Baltic Sea. (Marine Finland, 2026h). The predicted modelled distribution of Zostera combined with the Zostera distribution map is shown in Figure 3-9.



Figure 3-9 The predicted modelled distribution of Zostera (Protect Baltic, 2026) combined with the Zostera distribution map (HOLAS 3).

Vulnerability scoring of benthic species

All the benthic species were estimated to be very vulnerable to oil/HNS spills. Therefore, the highest vulnerability, score 4, for all the macrophytes in every season, has been allocated. However, Mytilus (blue mussel) has relatively fast reproduction and thus a bit lower vulnerability, score 3, has been allocated for Mytilus in every season.

- Scores to macrophytes: Winter: 4, Spring: 4, Summer: 4, Fall: 4
- Scores to Mytilus: Winter: 3, Spring: 3, Summer: 3, Fall: 3

3.2 Birds

Seabirds are among the most visibly affected organisms during marine oil spills, with well-documented impacts and significant mortality reported in many incidents (see Brisk, 2012 for more details). Seabirds are particularly vulnerable because oil adhering to their feathers compromises both insulation and buoyancy. Once contaminated, the feathers lose their protective properties, leaving birds exposed to hypothermia. As a result, birds may die from cold exposure, starvation, or drowning. Even minor oil contamination can be fatal, especially in winter conditions.

Species that spend much of their time resting or feeding on the sea surface, such as auks, ducks, cormorants, and divers, are especially at risk, although all seabird groups can be affected. In addition to external fouling, birds may also suffer from toxic effects through ingestion of oil during preening, consumption of contaminated prey, inhalation of oil vapor, or absorption through the skin or eggs.

Large amounts of bird data are available, but updated and comprehensive ready-made maps for the whole Baltic Sea were missing at the time when mapping was performed. Despite our extensive search, the best available maps for representing these indicators were still those produced in BRISK I (Brisk, 2012). In the workshop organized for bird experts, they agreed that both the maps and vulnerability scores produced in BRISK I (Brisk, 2012) can still be used in BRISK II, although based on their expert evaluation some areas are underrepresented in the maps compared with the present-day situation.

Wintering areas for sea and shore birds

The Baltic Sea is a very important wintering area for seabirds that breed in the northern part of Scandinavia, in northern Siberia and the Arctic region as well as for individuals breeding locally in the Baltic Sea (Brisk, 2012). The location of wintering areas is shown in Figure 3-10.



Figure 3-10 Location of wintering areas for sea and shore birds in the study area.

Staging areas

During spring and fall migration, to and from their breeding grounds in the arctic, tundra waterfowl, geese and waders are encountered on resting sites on the shores bordering the Baltic Sea (Brisk, 2012). Figure 3-11 shows the location of staging areas.

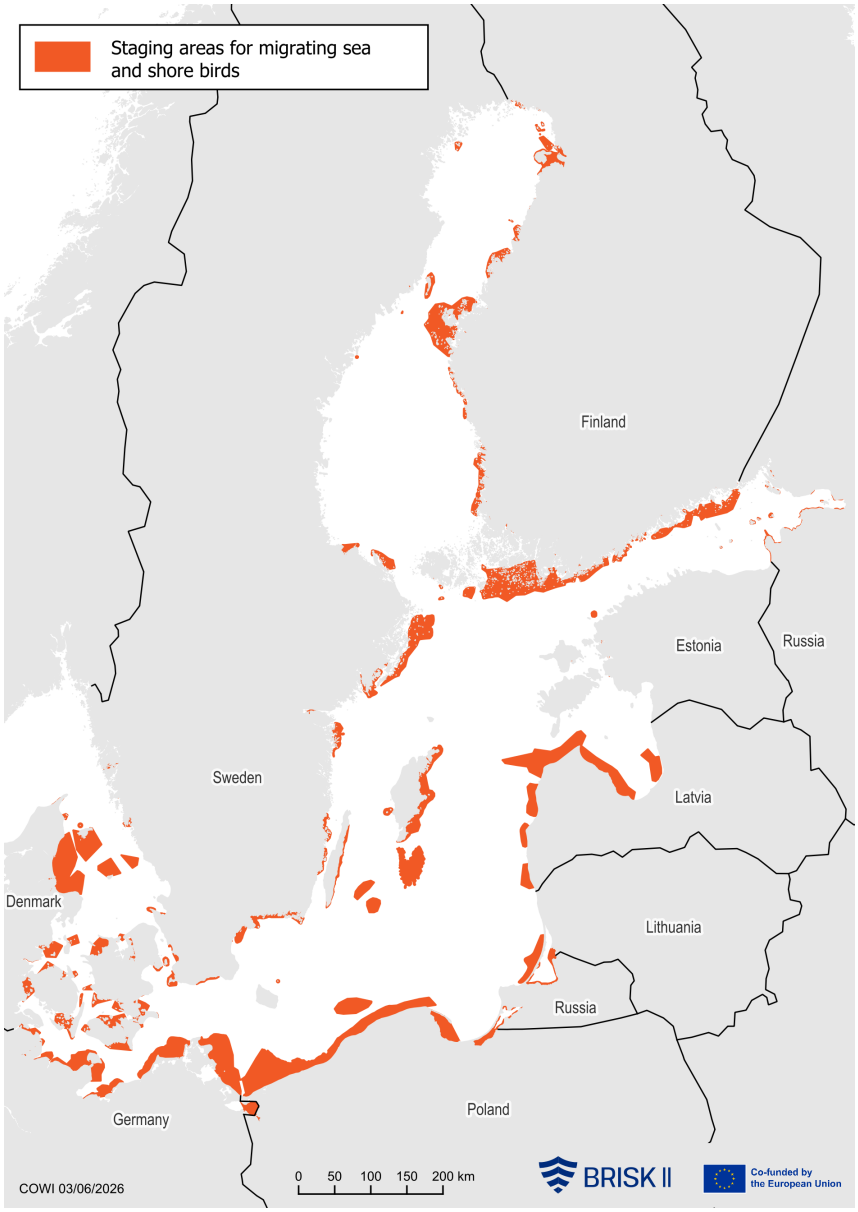


Figure 3-11 Location of staging areas for migrating sea and shore birds in the study area.

Breeding areas for sea and shore birds

Close to 60 coastal and marine bird species breed along the Baltic Sea coast (HELCOM BSEP 130 BB). The locations of the breeding sites are shown in Figure 3-12.

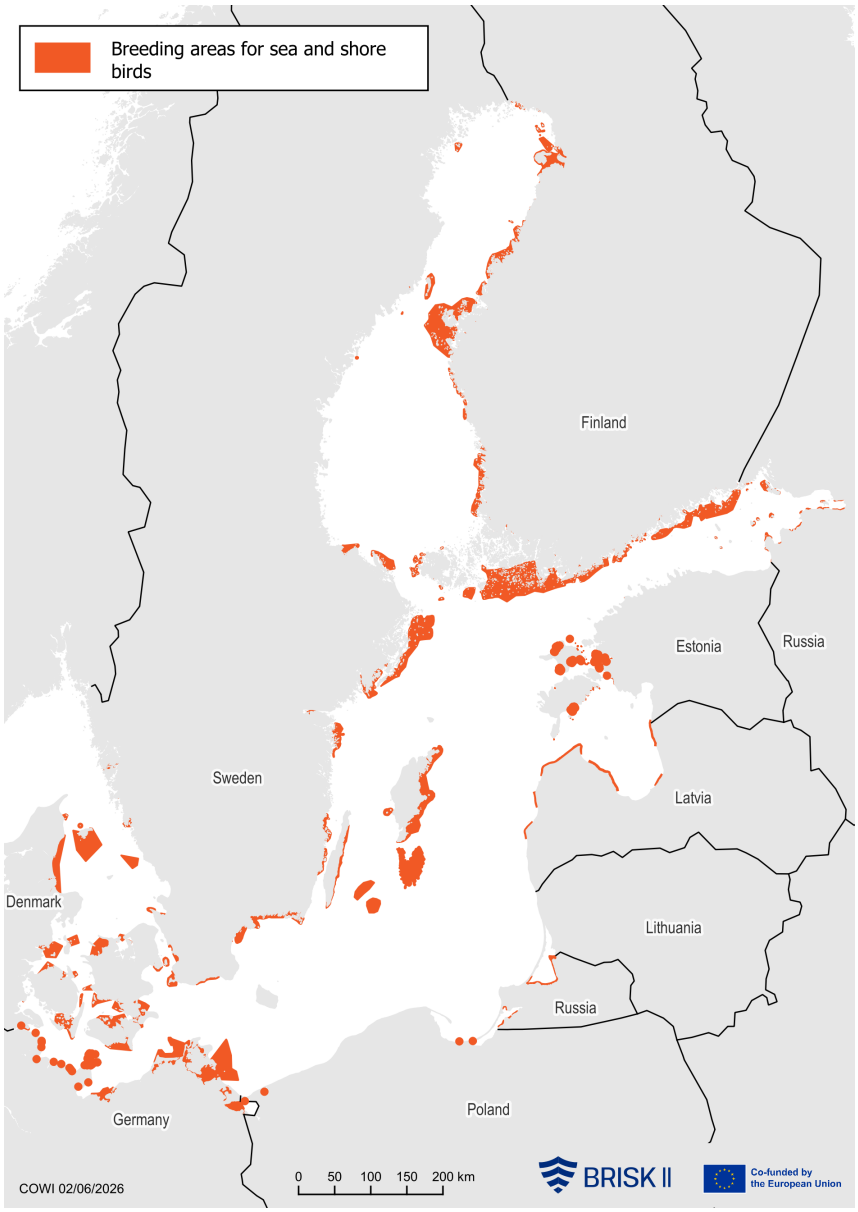


Figure 3-12 Location of breeding areas for sea and shore birds in the study area.

Moulting areas for sea birds

During the non-breeding season, seabirds undergo moult at sea and replace feathers by shedding old feathers and producing new ones. Moulting areas for seabirds are shown in Figure 3-13.



Figure 3-13 Location of moulting areas for seabirds in the study area.

Vulnerability scoring of birds

Based on the observed impacts and the seasonal behavior of birds, the following vulnerability scores allocated to birds in BRISK I (Brisk, 2012) have been used also in BRISK II. Wintering areas for sea and shore birds have been allocated score 4 for winter and score 3 for spring because there may still be some "wintering" birds in the areas in spring. In summer there are none but during fall some individuals have

started to arrive. Therefore, score 0 (not affected) was allocated for summer and 2 for fall. Staging areas for migrating birds have been allocated a score of 4 in spring and fall when the peak numbers are encountered.

- Scores to wintering areas for sea and shore birds: Winter: 4, Spring: 3, Summer: 0, Fall: 2
- Scores to staging areas for migrating birds: Winter: 2, Spring: 4, Summer: 2, Fall: 4
- Scores to breeding areas for sea and shore birds: Winter: 2, Spring: 4, Summer: 4, Fall: 1
- Scores to moulting areas for seabirds: Winter: 0, Spring: 0, Summer: 4, Fall: 0

3.3 Fish

Fish species in the Baltic Sea can be broadly classified into two groups based on their spawning strategy: demersal spawners, which deposit their eggs on the seabed and pelagic spawners, whose eggs remain suspended in the water column. Most fish species in the Baltic Sea, including herring, perch, pike and pikeperch, are demersal spawners that lay their eggs in shallow coastal waters where they are very vulnerable to oil spills. In contrast, cod and sprat produce pelagic eggs and spawn in offshore areas. Their spawning grounds are generally less vulnerable to oil spills because floating oil typically remains near the water surface, above the depths where eggs and larvae are. The nursery areas of most Baltic Sea fish species are in shallow coastal waters. These habitats are very vulnerable to oil spills.

Figure 3-14 shows the potential spawning areas for herring, Figure 3-15 shows potential spawning areas for Baltic flounder, Figure 3-16 shows potential nursery areas for flounder, Figure 3-17 shows potential recruitment areas for perch, Figure 3-18 shows potential recruitment areas for pikeperch, Figure 3-19 shows potential spawning areas for cod, Figure 3-20 shows potential spawning areas for sprat and Figure 3-21 shows potential spawning areas for European flounder. For some maps, like potential nursery areas for flounder, it is reported in the data source that data is missing from some areas like Denmark, Germany, Poland and Russia and therefore the prediction are uncertain along the south coast. In addition, the map showing the potential spawning area for European flounder was also reported missing information for the western Baltic Sea including Kattegat. Therefore, these maps should be considered rough estimations. See more information on the HELCOM map and data service (HELCOM Map and data service).

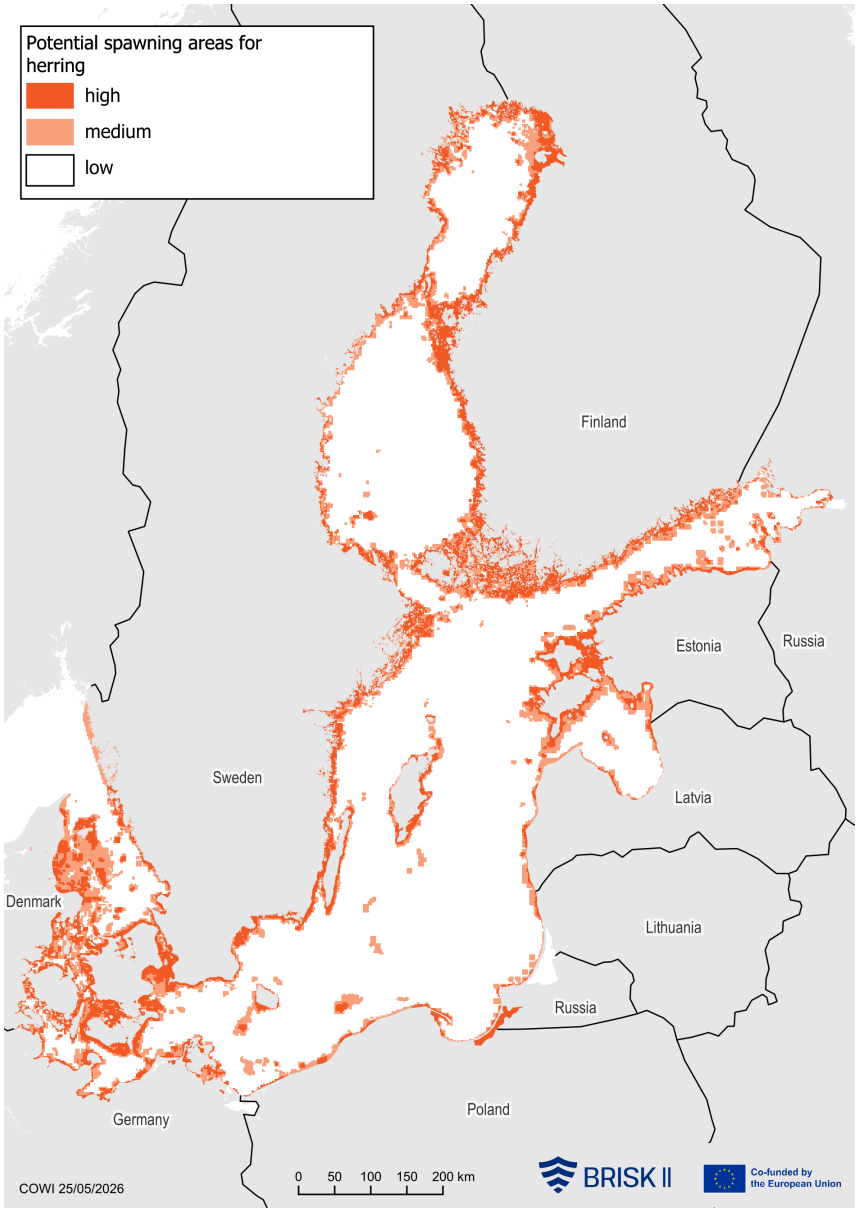


Figure 3-14 Location of the potential spawning areas for herring in the study area.

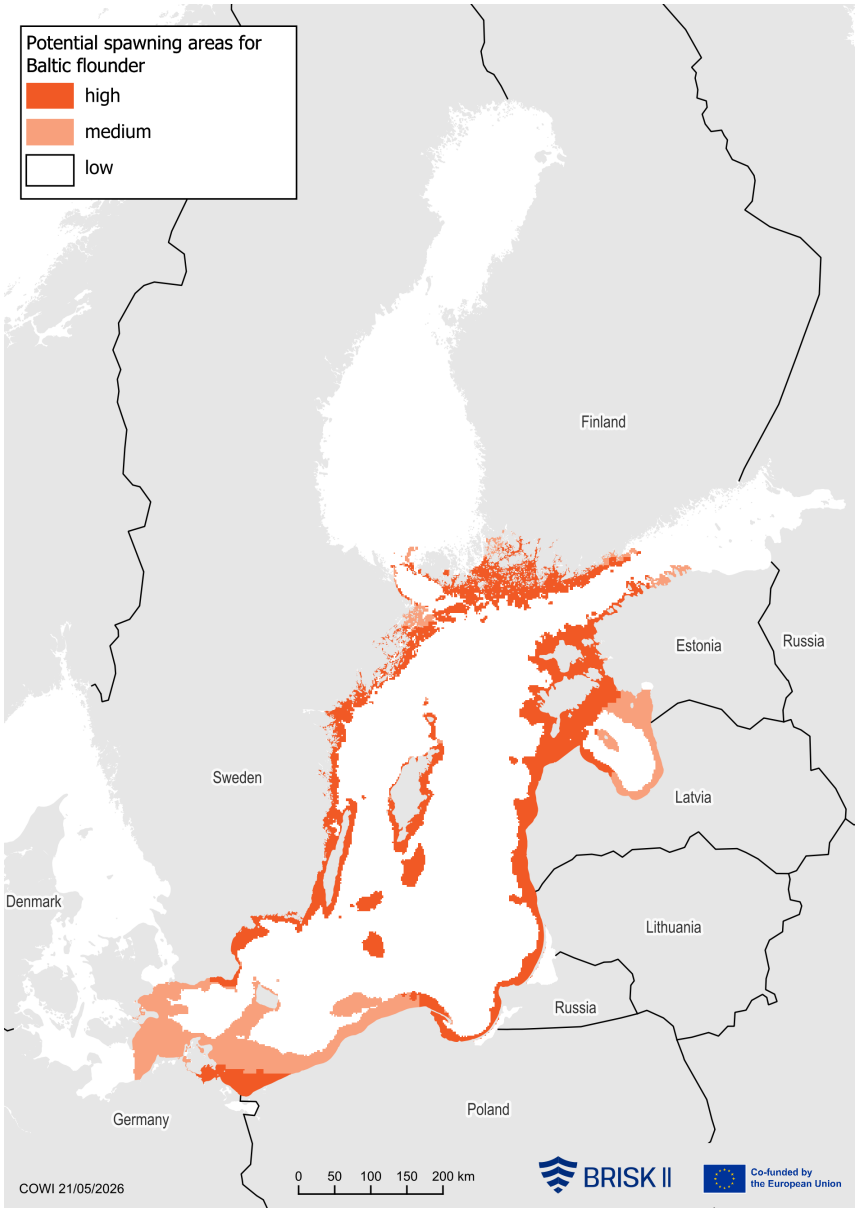


Figure 3-15 Location of the potential spawning areas for Baltic flounder in the study area.



Figure 3-16 *Location of the potential nursery areas for flounder in the study area.*



Figure 3-17 Location of the potential recruitment areas for perch in the study area.



Figure 3-18 Location of the potential recruitment areas for pikeperch in the study area.

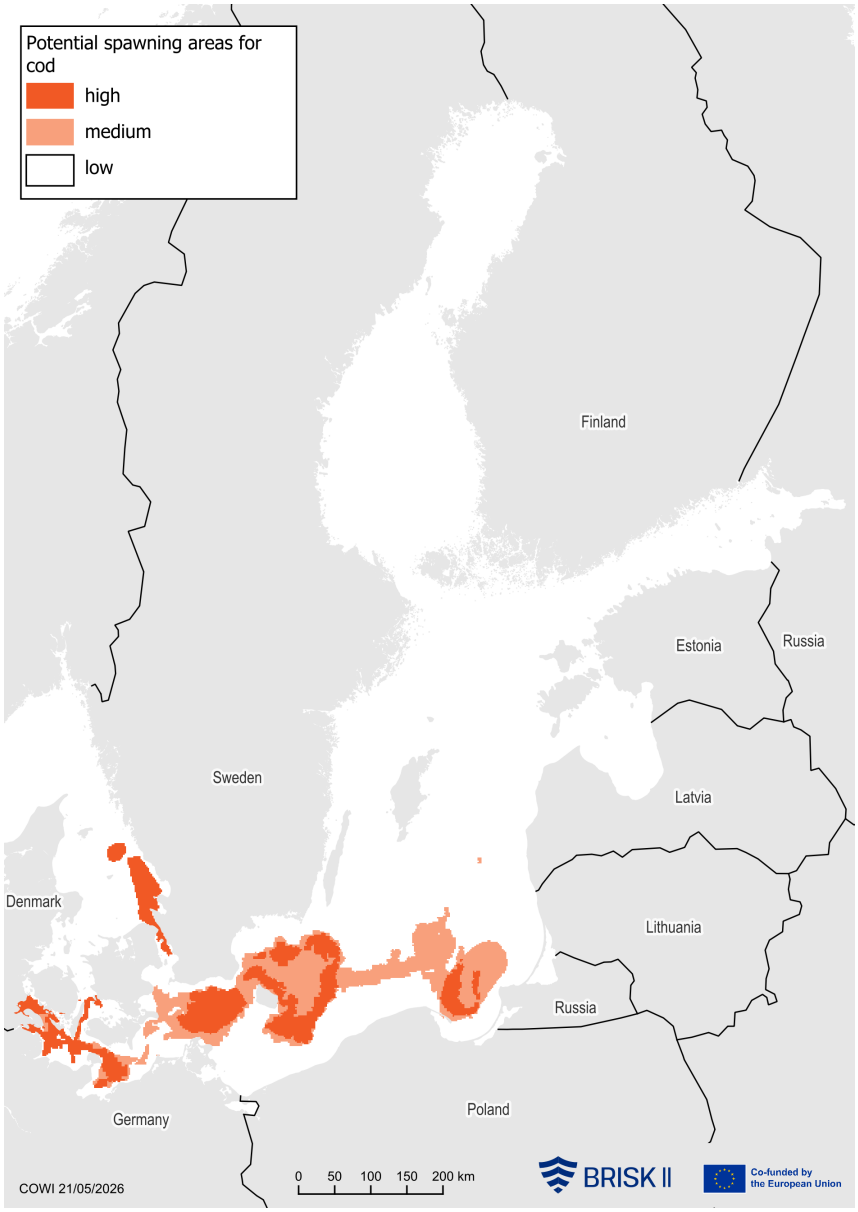


Figure 3-19 Location of the potential spawning areas for cod in the study area.

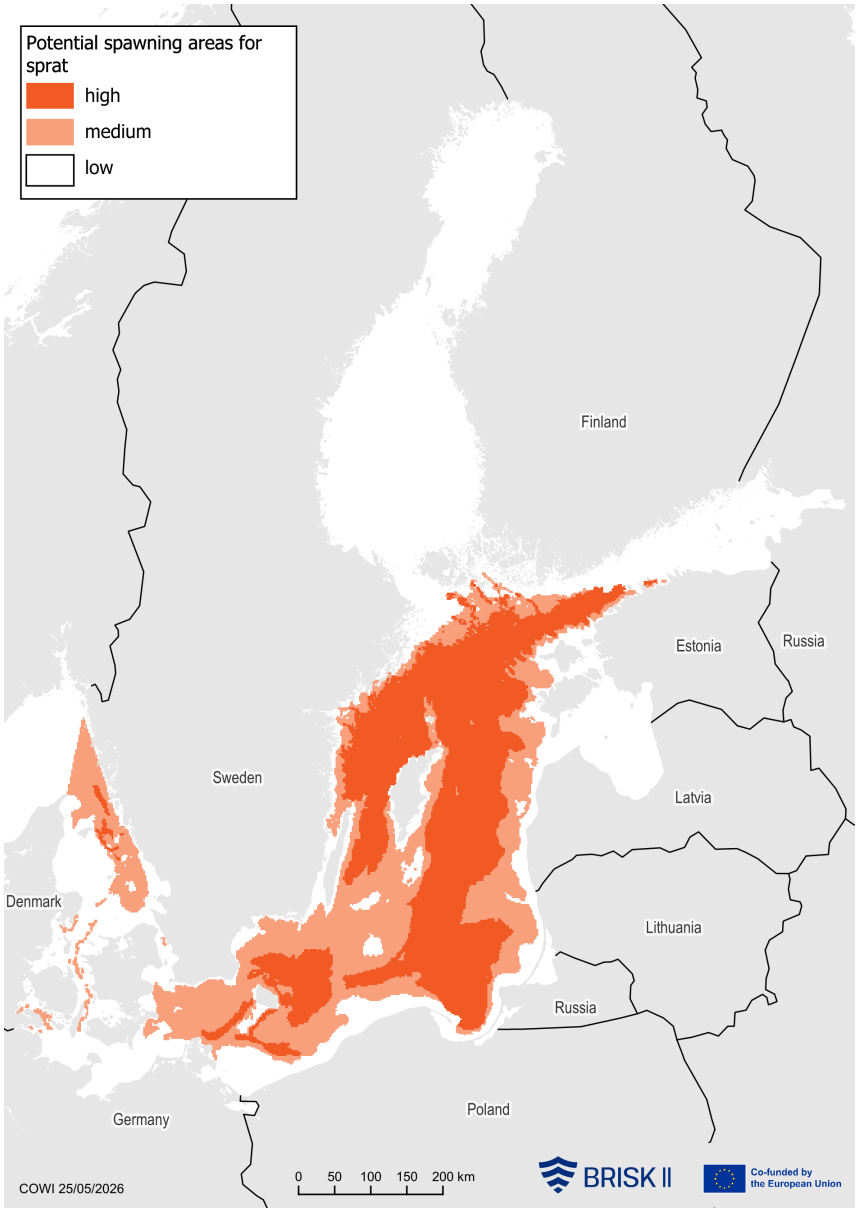


Figure 3-20 Location of the potential spawning areas for sprat in the study area.



Figure 3-21 Location of the potential spawning areas for European flounder in the study area.

Vulnerability scoring of fish

- Scores for potential spawning areas for herring: Winter: 3, Spring:4, Summer: 4, Fall: 4
- Scores for potential spawning areas for Baltic flounder: Winter: 3, Spring: 4, Summer: 4, Fall: 3
- Scores for potential nursery areas for flounder: Winter: 3, Spring: 4, Summer: 4, Fall: 3
- Scores for potential recruitment areas for perch: Winter: 3, Spring: 4, Summer: 4, Fall: 3
- Scores for potential recruitment areas for pikeperch: Winter: 3, Spring: 4, Summer: 4, Fall: 3
- Scores for potential spawning areas for cod: Winter: 2, Spring: 3, Summer: 3, Fall:1

- Scores for potential spawning areas for sprat: Winter: 2, Spring: 2, Summer: 3, Fall:1

- Scores for potential spawning areas for European flounder: Winter: 3, Spring: 4, Summer: 4, Fall: 3

3.4 Marine mammals

Four marine mammal species are encountered in the Baltic Sea: the grey seal, ringed seal, harbour seal, and harbour porpoise. Harbour porpoises and seals may be less vulnerable to oil spills than seabirds because their thermal insulation is provided by a layer of blubber rather than by feathers. In addition, they may be able to avoid oily areas, although it is not well understood to what extent they can do so, particularly while foraging. Young animals, especially pups, are more vulnerable than adults. Marine mammals may be especially vulnerable during the first few days following a spill, when toxic chemicals evaporate.

Figures 3-22, 3-23 and 3-24 show the grey, ringed and harbour seal distributions in the study area. Figure 3-25 shows the oil risk map for harbour porpoise in the study area. The map was prepared with the help of external marine mammal experts.

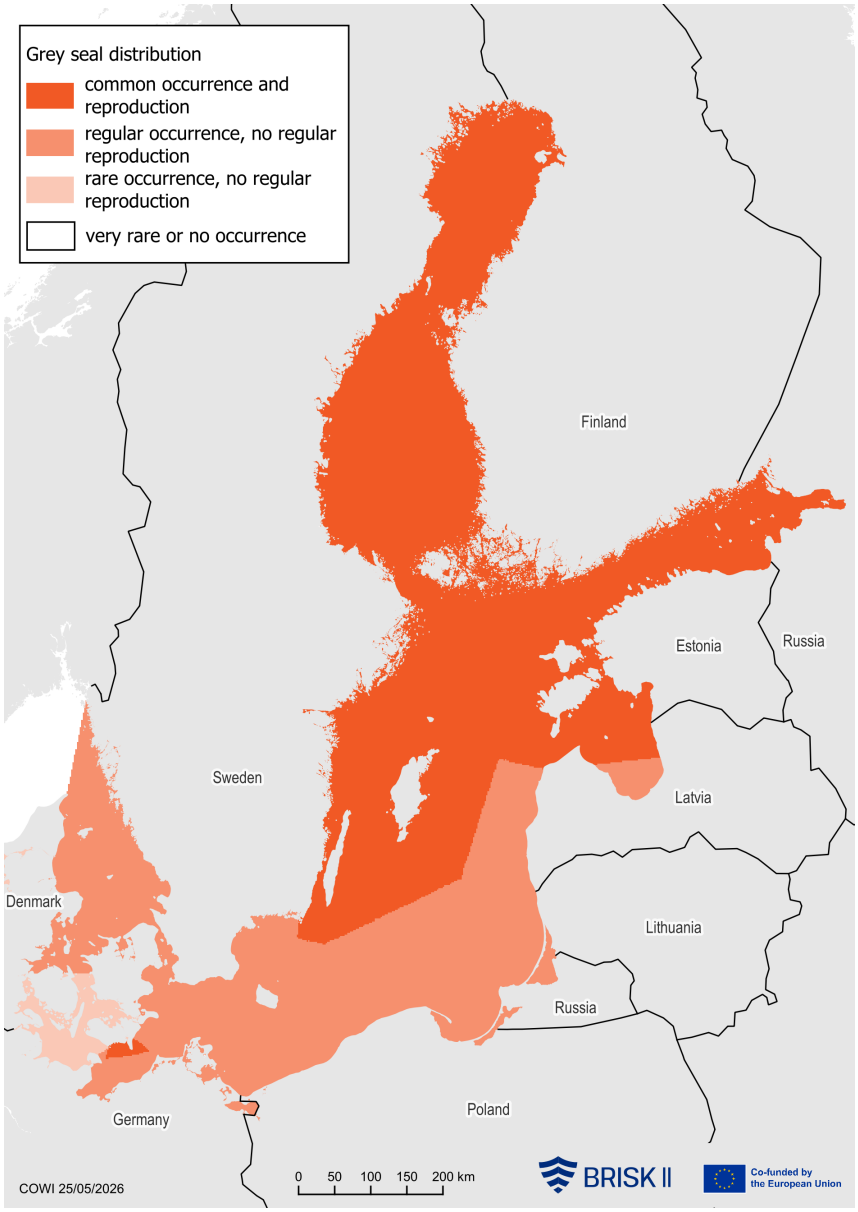


Figure 3-22 Grey seal distribution map in the study area.

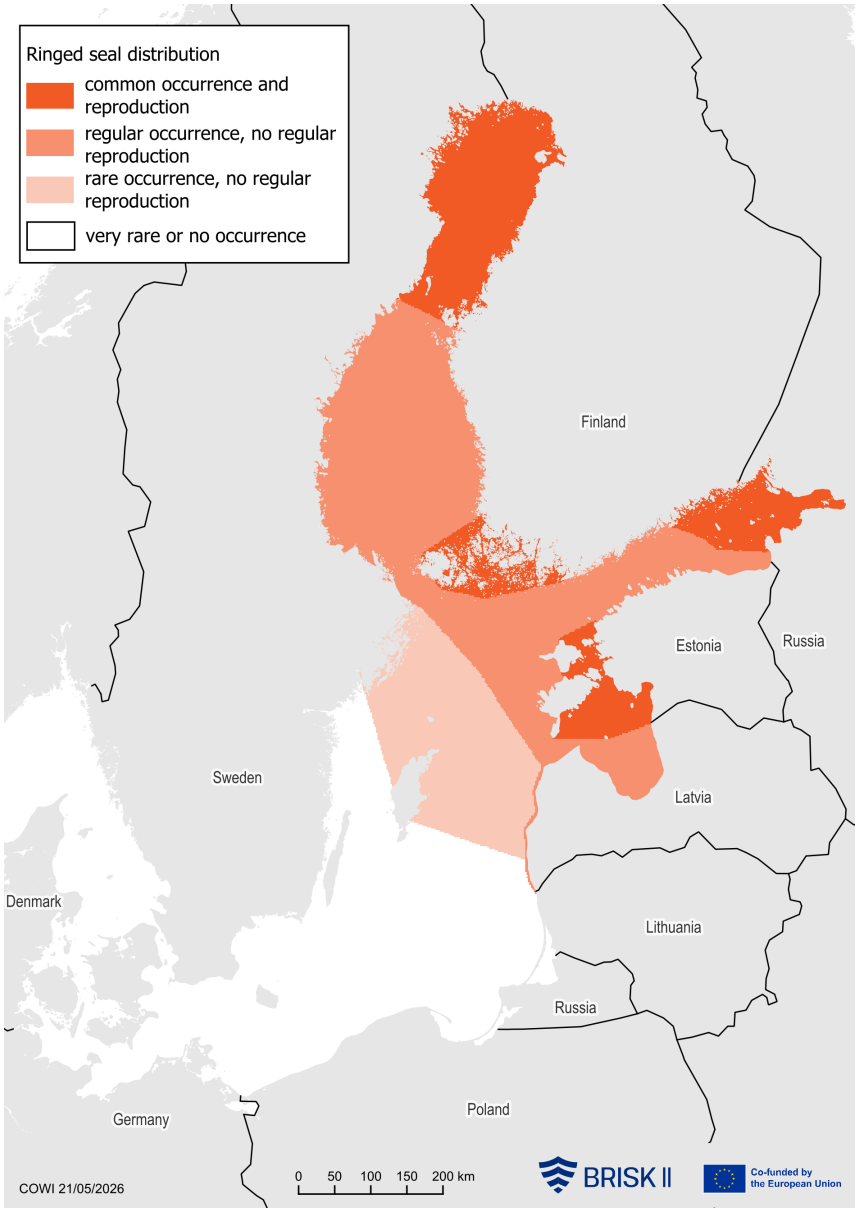


Figure 3-23 Ringed seal distribution map in the study area.

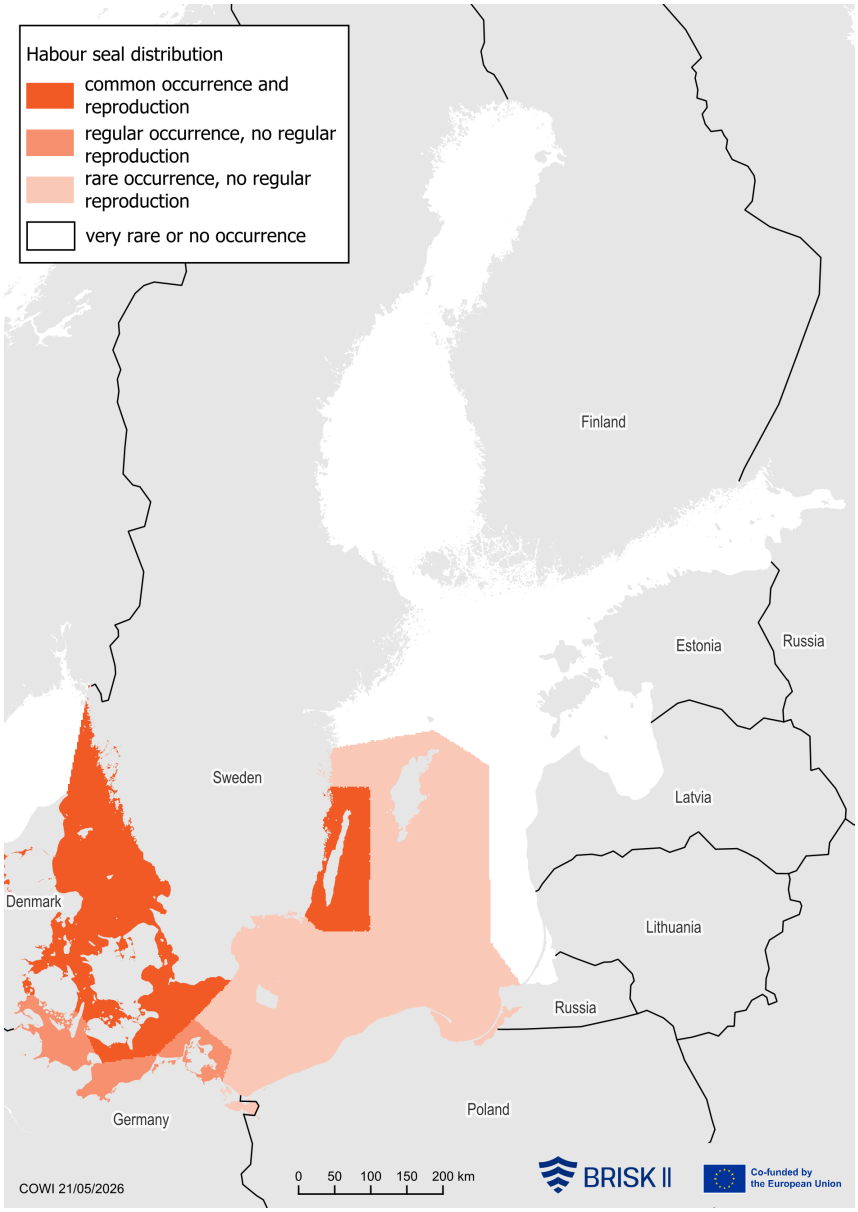


Figure 3-24 Harbour seal distribution map in the study area.

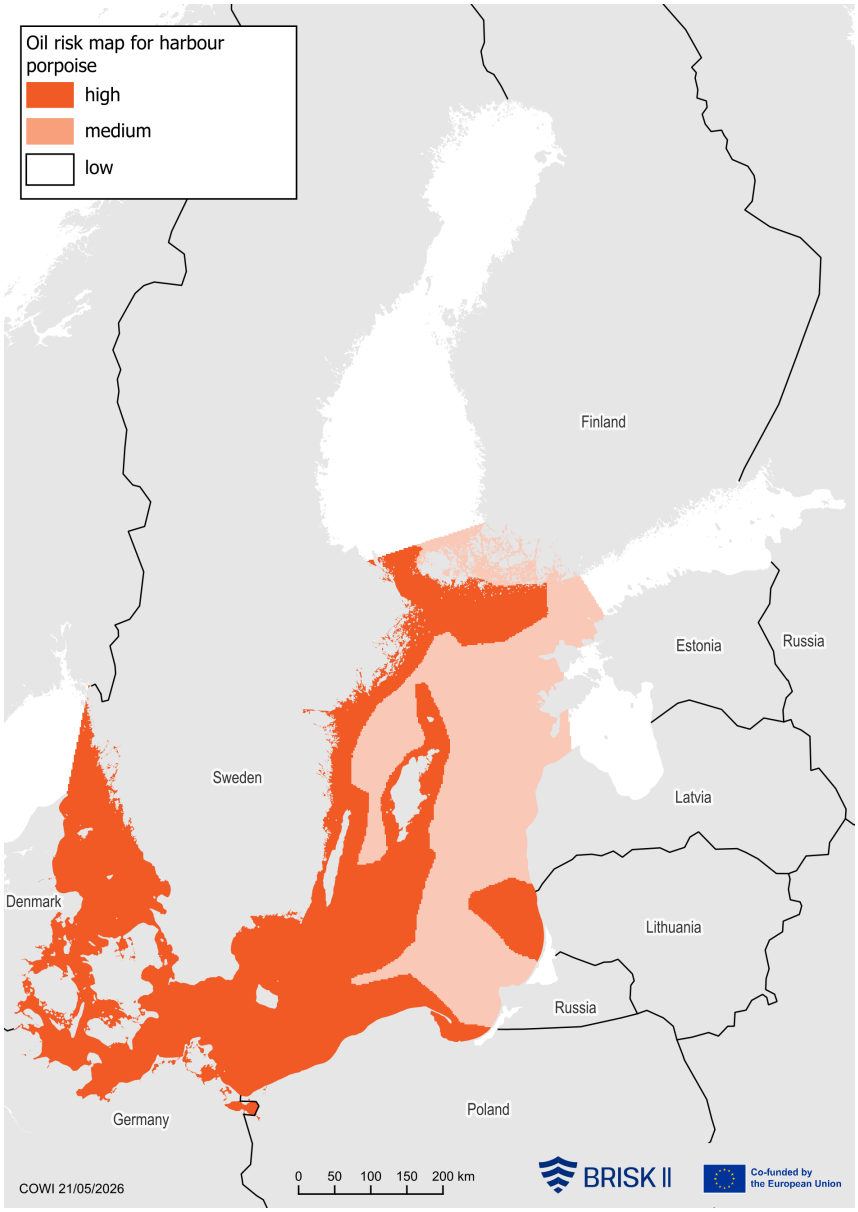


Figure 3-25 Oil risk map for harbour porpoise in the study area.

Vulnerability scoring of marine mammals

Due to the critically endangered status of the harbour porpoise, the highest score 4 for spring and summer and score 3 for winter and fall have been allocated for them. The southern populations of ringed seals are also critically endangered and thus a score 4 is assigned for them in winter and spring.

- Scores for grey seal: Winter: 3, Spring: 3, Summer: 2, Fall: 2
- Scores for ringed seal: Winter: 4, Spring: 4, Summer: 2, Fall: 2
- Scores for harbour seal: Winter: 2, Spring: 3, Summer: 3, Fall: 2
- Scores for harbour porpoise: Winter: 3, Spring: 4, Summer: 4, Fall: 3

3.5 Protected areas

EBSAs

EBSAs (Ecologically or Biologically Significant Marine Areas) are special areas in world's oceans that support the healthy functioning of oceans and the many services they provide. Figure 3-26 shows the EBSAs in the study area.

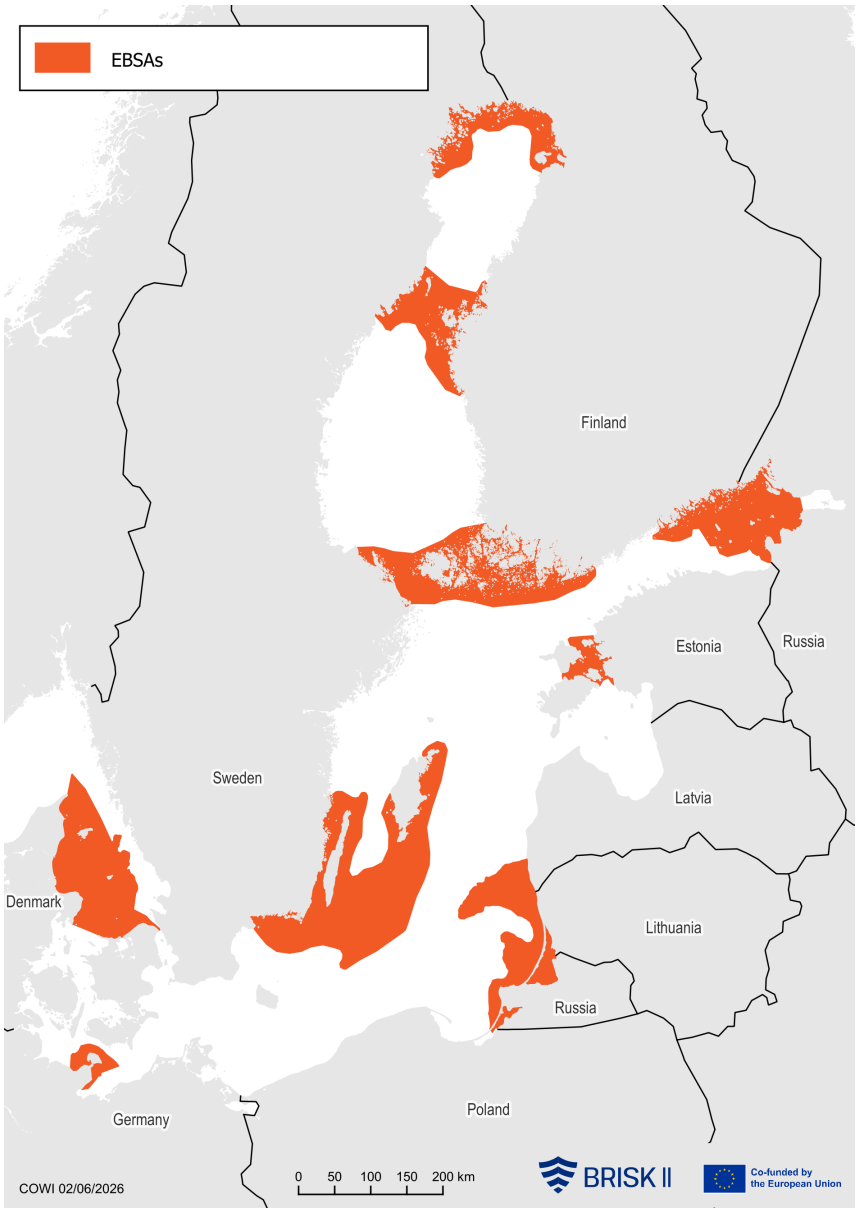


Figure 3-26 Location of the EBSAs s in the study area.

HELCOM MPAs

HELCOM MPAs (marine protected areas) (former Baltic Sea Protected Areas (BSPAs)) includes all designated or managed MPAs as officially reported to HELCOM by the respective Contracting Party. (http://mpas.helcom.fi.) Figure 3-27 shows the HELCOM MPAs in the study area.

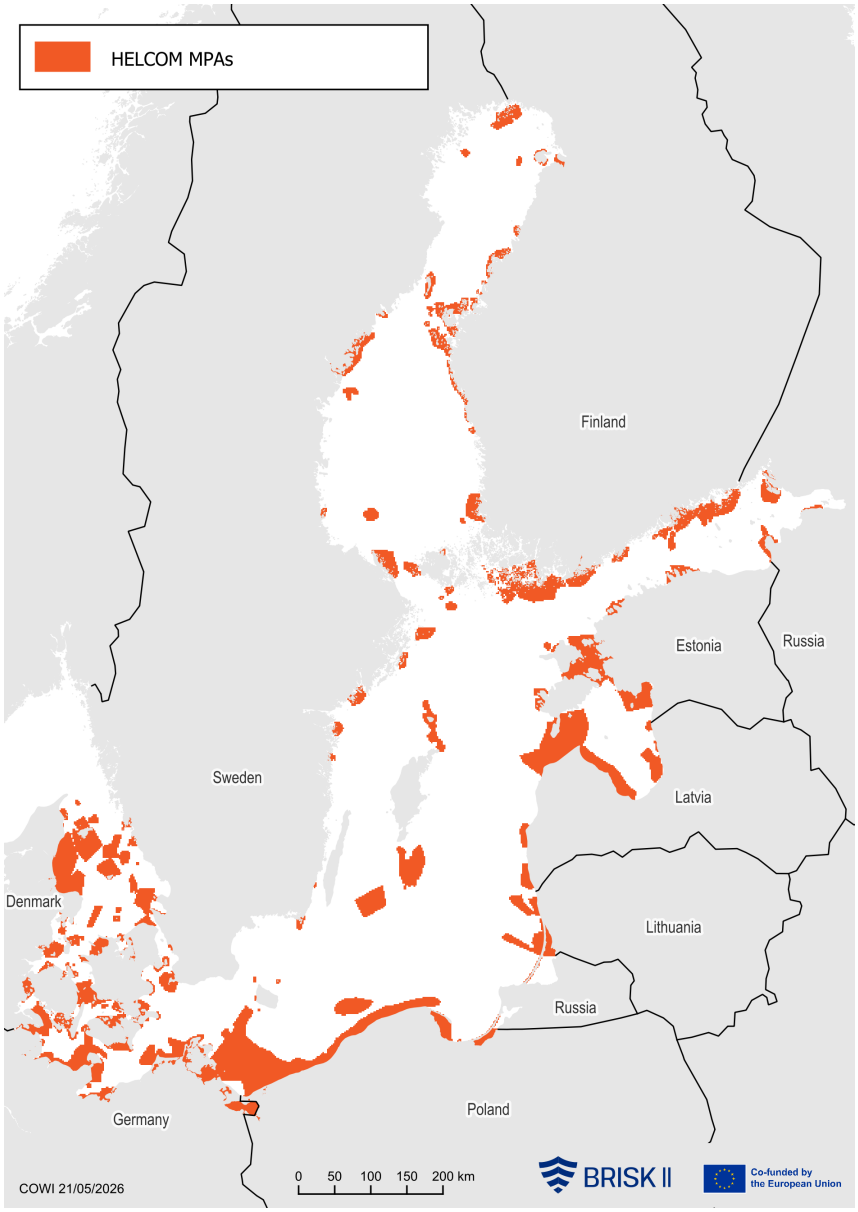


Figure 3-27 Location of the HELCOM MPAs in the study area.

Natura 2000 sites

Natura 2000 is a network of protected areas, set up to ensure the survival of Europe's most valuable species and habitats and to protect the biodiversity in EU. Natura 2000 is based on the 1979 Birds Directive and the 1992 Habitats Directive. Figure 3-28 shows the Natura 2000 sites in the study area.

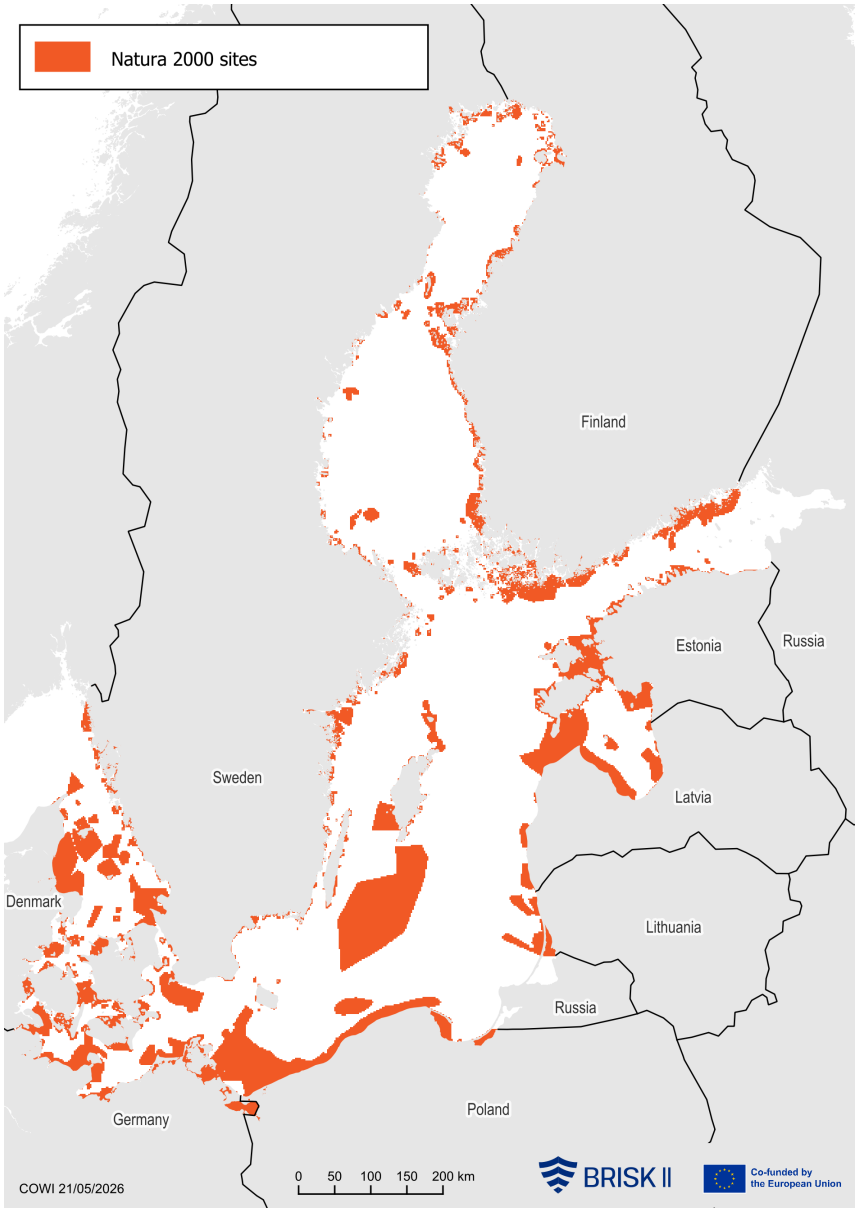


Figure 3-28 Location of the Natura 2000 sites in the study area.

Ramsar sites

The Ramsar Convention is an international treaty that promotes the conservation and sustainable use of wetlands. It recognizes the essential ecological functions of wetlands. Figure 3-29 shows the Ramsar sites in the study area. Notice that some Ramsar sites are so small that they are not visible on the scale.

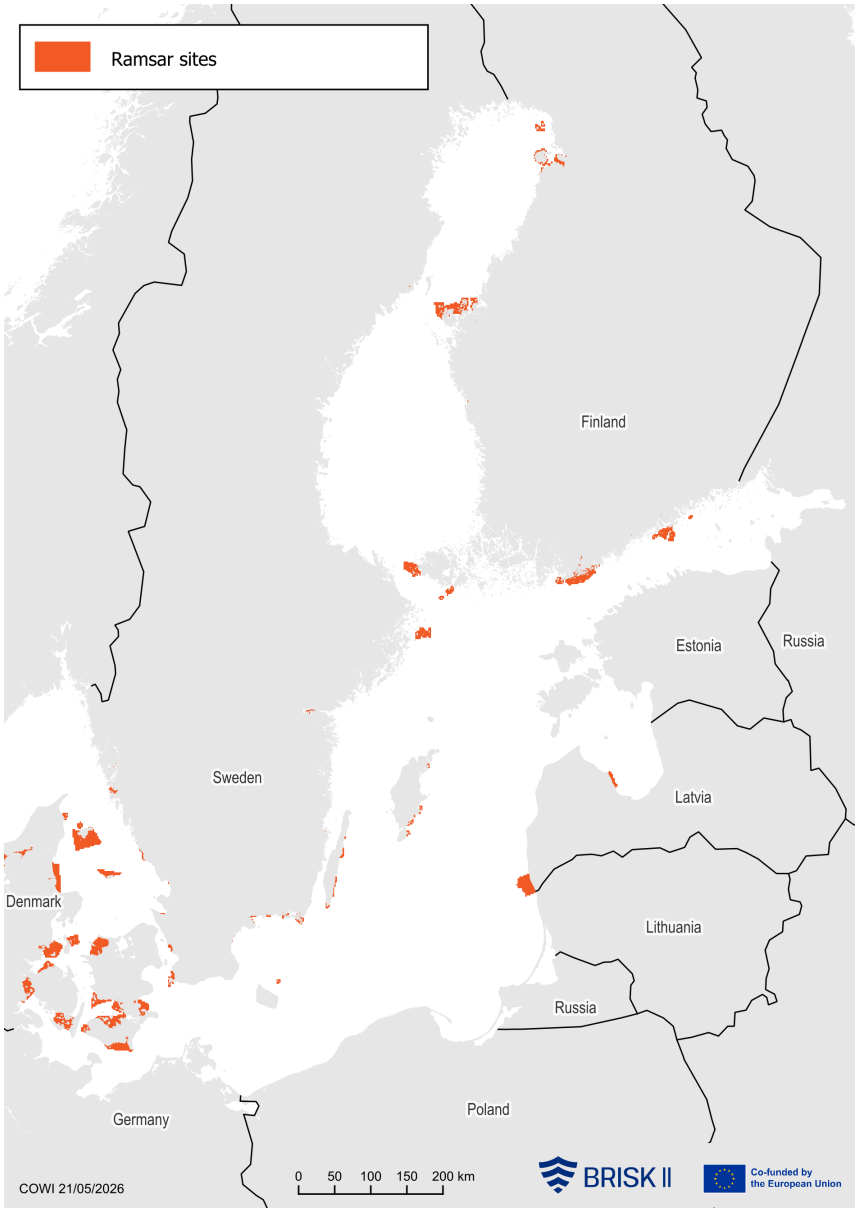


Figure 3-29 Location of the Ramsar sites in the study area.

UNESCO sites

Unesco Man and the Biosphere (MAB) reserves are areas of terrestrial and coastal ecosystems promoting solutions in the Baltic Sea area and UNESCO World Heritage Sites have special cultural or physical significance. Figure 3-30 shows both these sites called here as the UNESCO sites in the study area.



Figure 3-30 Location of the UNESCO sites in the study area.

Vulnerability scoring of protected areas

Since the protected areas house sensitive species and habitats or sensitive historical, cultural and natural sites, the highest vulnerability score 4 have been allocated for them in every season.

- Scores for protected areas: Winter: 4, Spring: 4, Summer: 4, Fall: 4

3.6 Socio-economic indicators

Finfish mariculture, Shellfish mariculture and Furcellaria harvesting

Major oil spills can have serious impacts on fish farms, leading to substantial economic losses. Finfish and shellfish exposed to crude oil or petroleum products may become contaminated, making them unsuitable for sale. This contamination occurs when oil-derived compounds accumulate in their tissues, causing unpleasant odors and flavors. Cultivated species are particularly vulnerable to tainting, as even very low concentrations of oil can affect product quality. Unlike wild fish, caged fish and immobile shellfish cannot escape contaminated waters, increasing their risk of exposure.

Major oil spills may also affect algae harvesting. Oil contamination can reduce the quality and marketability of harvested algae. As a sessile species, algae cannot avoid contaminated waters, making it particularly vulnerable to prolonged exposure following an oil spill. Algae harvesting is still quite limited in the Baltic Sea, but its importance is expected to increase in the future. Figure 3-31 shows the location of finfish mariculture, and Figure 3-32 shows the location of shellfish mariculture and furcellaria harvesting in the study area.

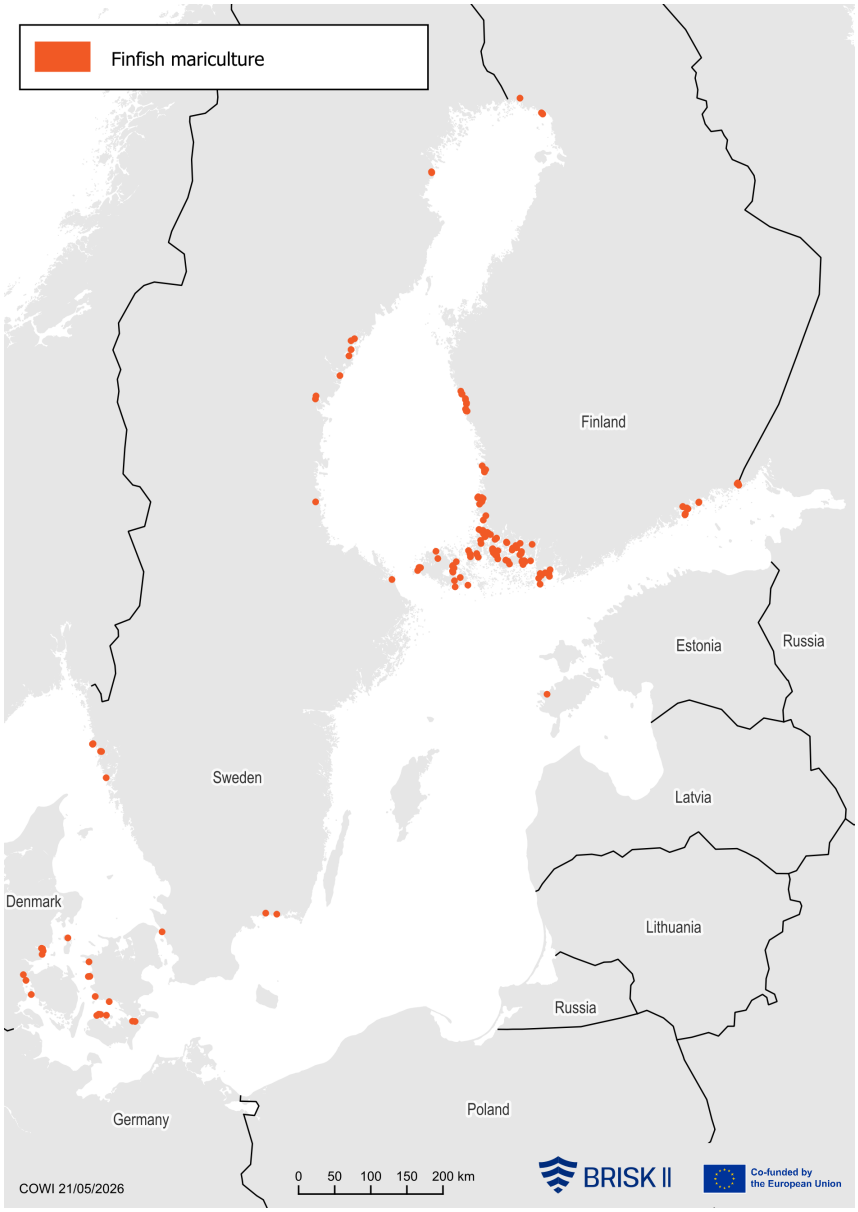


Figure 3-31 Location of finfish mariculture in the study area.

Vulnerability scoring of finfish mariculture

- Scores for finfish mariculture: Winter: 4, Spring: 4, Summer: 4, Fall: 4



Figure 3-32 Location of shellfish mariculture and furcellaria harvesting in the study area.

Vulnerability scoring of shellfish mariculture and furcellaria harvesting

- Scores for shellfish mariculture and furcellaria harvesting: Winter: 3, Spring: 3, Summer: 3, Fall: 3

Bathing sites

Oil contamination will impact the recreational use of the beaches such as sunbathing, boating, diving, and swimming. Bathing sites may have to be closed during the clean-up. In addition, tourism-related businesses close to the bathing sites may suffer economically. However, typically bathing sites are relatively easy to clean since they are often composed of fine grain sand with good access to the roads. Figure 3-33 shows the location of bathing sites in the study area.

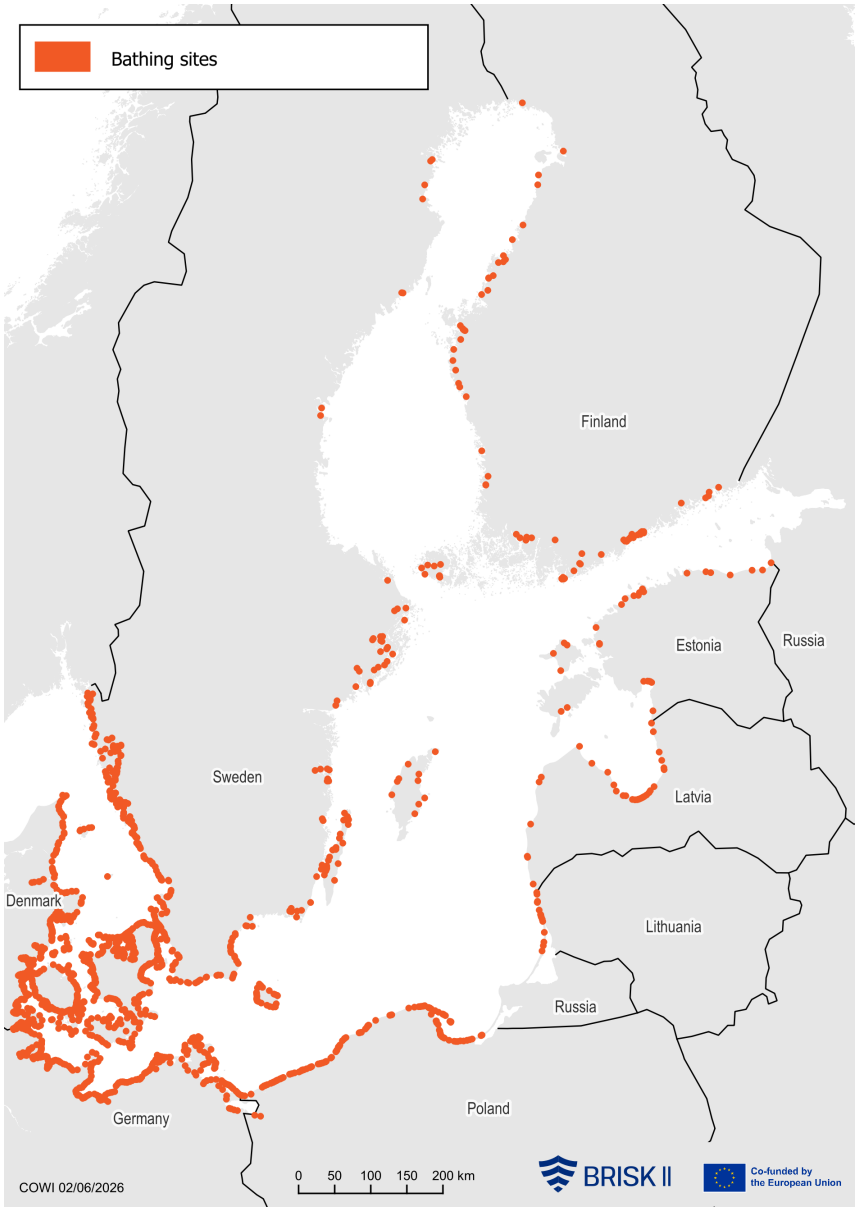


Figure 3-33 Location of bathing sites in the study area.

Vulnerability scoring of bathing sites

- Scores for bathing sites: Winter: 2, Spring; 3, Summer: 4, Fall: 3

Harbour areas and Marinas and leisure harbours

An oil spill occurring near a harbour or marina area can significantly disrupt their normal activities. Vessels, berths, pontoons, and mooring equipment may be oiled. In addition, the presence of floating oil can create safety hazards, potentially restricting vessel movements as well as loading and unloading activities. Oil spill response measures, such as the deployment of booms, may further limit access and impede harbour operations. This can cause economic losses for port operators, shipping companies, and businesses that depend on harbour services. In severe cases, prolonged interruptions may also lead to temporary job losses among personnel. On the other hand, harbours and marinas can often be effectively protected from oil by deploying booms across their relatively narrow entrances. Harbours are vulnerable throughout the year, but marinas are typically less vulnerable outside the main boating season. Figure 3-34 shows the location of marinas and leisure harbours in the study area, and Figure 3-35 shows the location of the harbours in the study area.

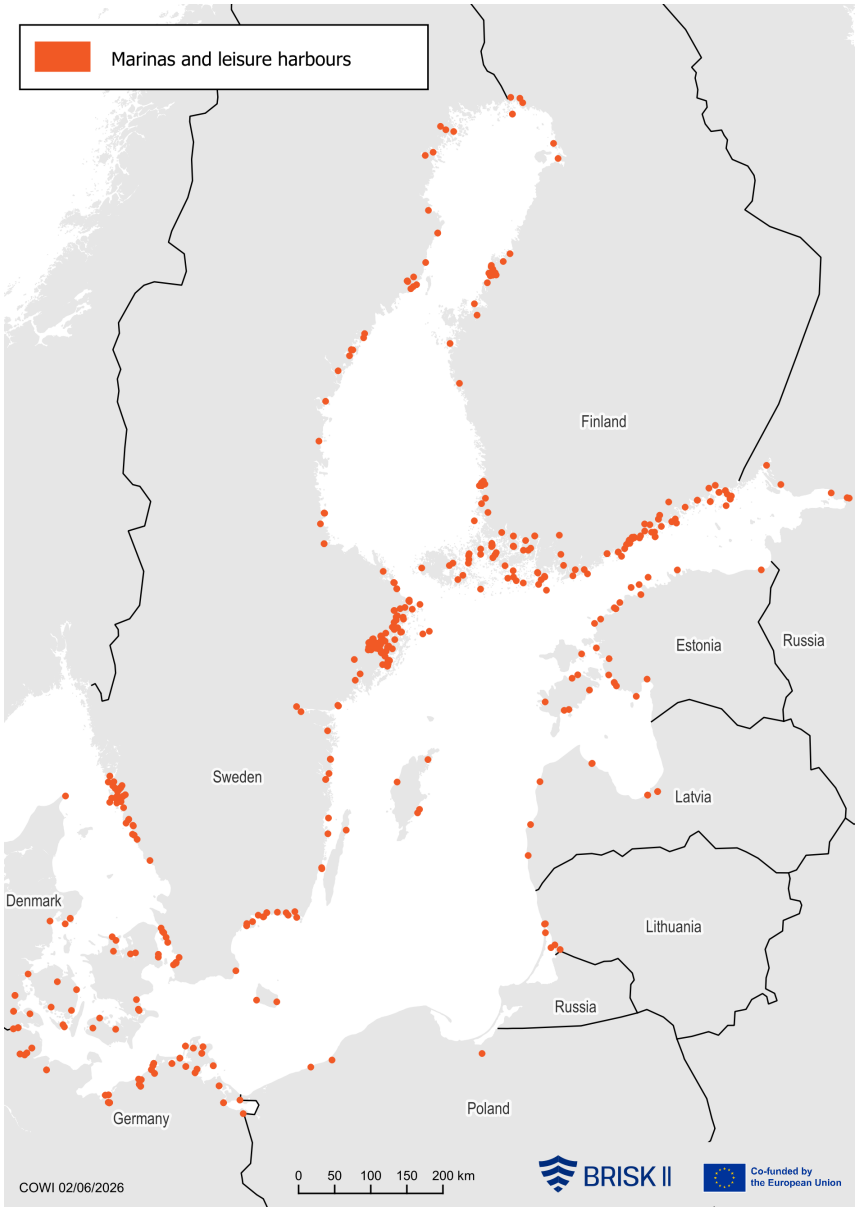


Figure 3-34 Location of marinas and leisure harbours in the study area.

Vulnerability scoring of marinas and leisure harbours

- Scores for marinas and leisure harbours: Winter: 1, Spring; 2, Summer: 3, Fall: 3

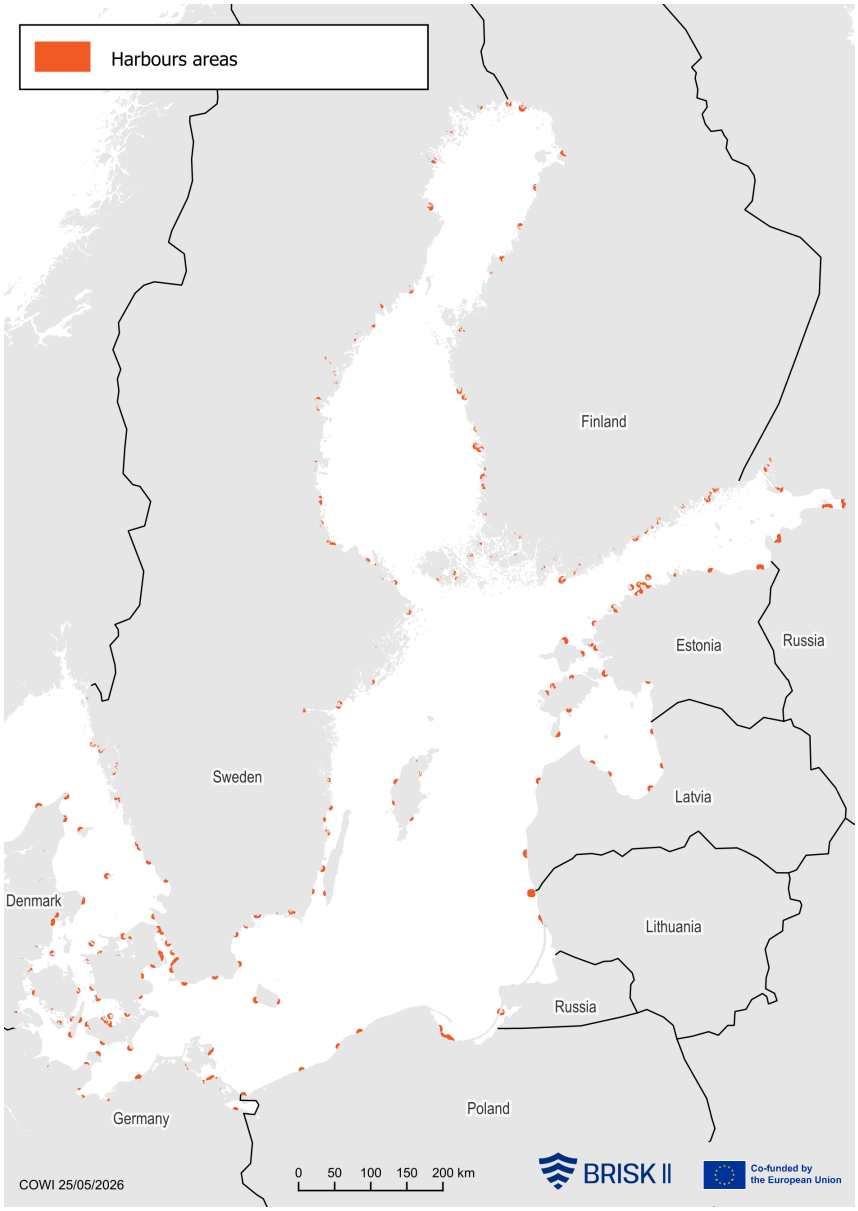


Figure 3-35 Location of harbour areas in the study area.

Vulnerability scoring of harbour areas

- Scores for harbours: Winter: 2, Spring; 2, Summer: 2, Fall: 2

Offshore wind farms

In case an oil spill occurs close to the wind farm, the turbines need to be shut down, to facilitate oil spill response operations in the wind farm. This would lead to an economic loss for not producing electricity. Furthermore, the missing electricity has to be compensated for by production with land-based power plants. Figure 3-36 shows the location of existing and planned offshore wind farms.

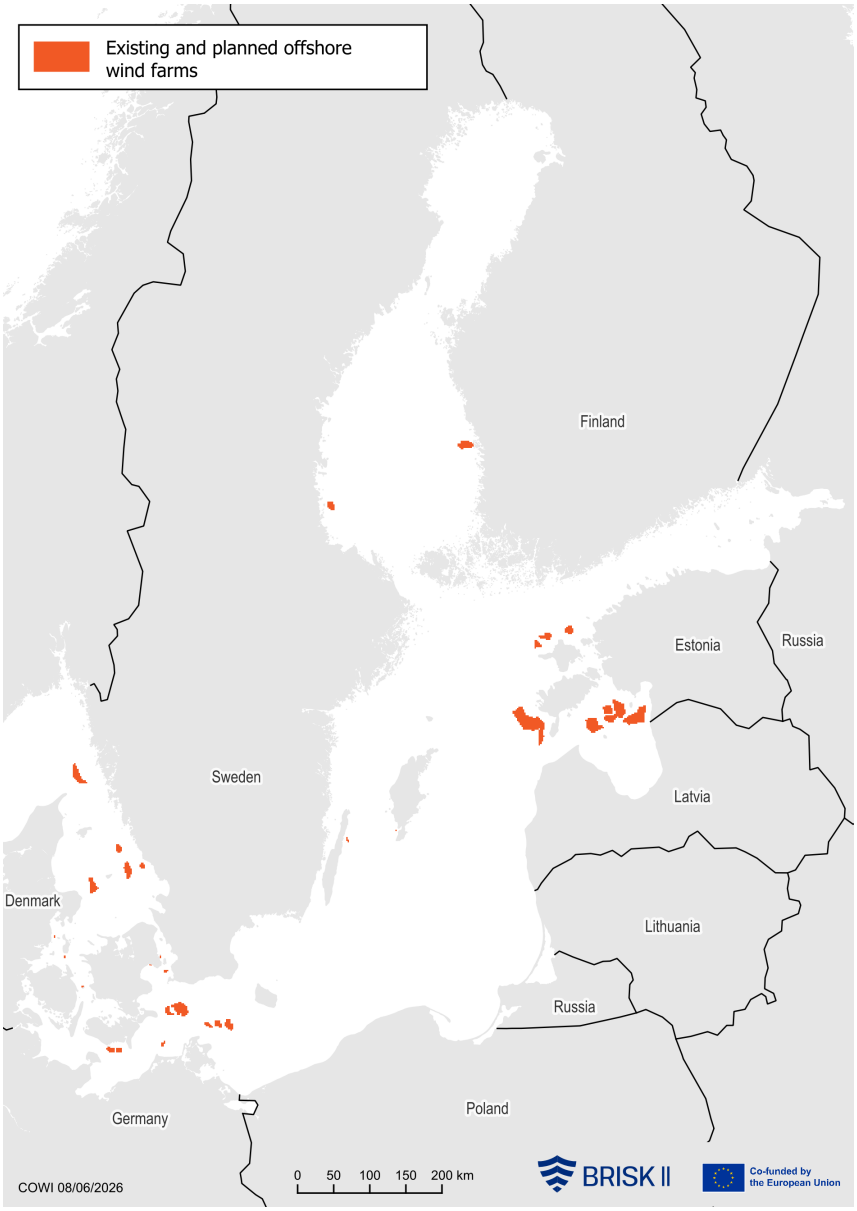


Figure 3-36 Location of the existing and planned offshore wind farms in the study area.

Vulnerability scoring of the offshore wind farms

- Scores for offshore wind farms: Winter: 2, Spring; 2, Summer: 2, Fall: 2

Water intakes of nuclear power plants

Oil contamination of nuclear power plants' water intake systems can result in significant economic impacts. If oil enters the water circulation systems that are essential for facility operations, it may damage equipment, disrupt processes, and compromise electric production. Even precautionary shutdowns of water intakes to prevent contamination can affect the operation of an entire facility and lead to substantial economic losses. Figure 3-37 shows the location of water intakes of nuclear power plants.

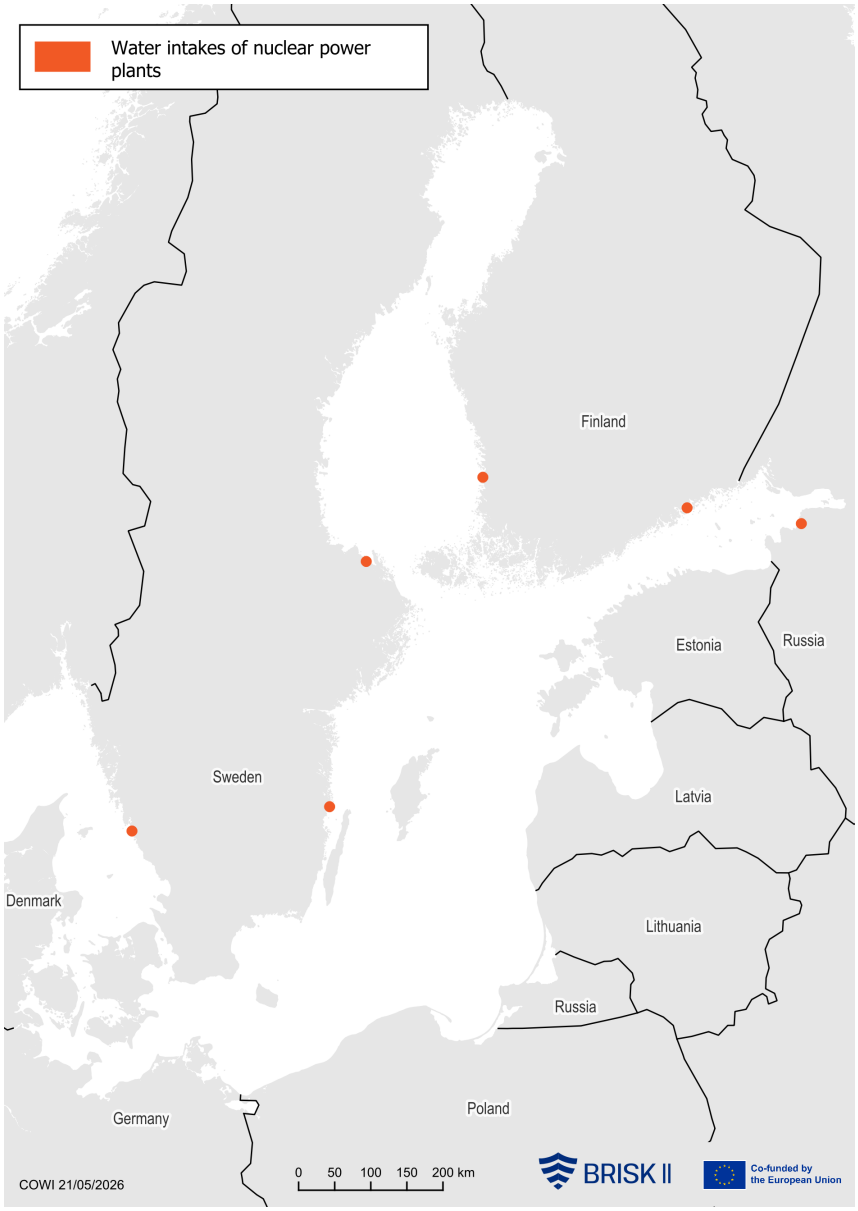


Figure 3-37 Location of the water intakes of nuclear power plants in the study area.

Vulnerability scoring of water intakes of nuclear power plants

- Scores for water intakes of nuclear power plants: Winter: 3, Spring; 3, Summer: 3, Fall: 3

Cod, herring and sprat extraction landings

An oil spill can have significant impacts on fisheries. Fishing equipment may become contaminated, but also catches may be affected, leading to tainting of fish through unpleasant oil tastes. In some cases, even uncontaminated fish may suffer reduced market value if they originate from an affected area. Fishing activities may be temporarily restricted or halted, and operations may remain suspended until equipment has been properly cleaned. Figures 3-38, 3-39, 3-40 show the cod, herring and sprat extraction landings.

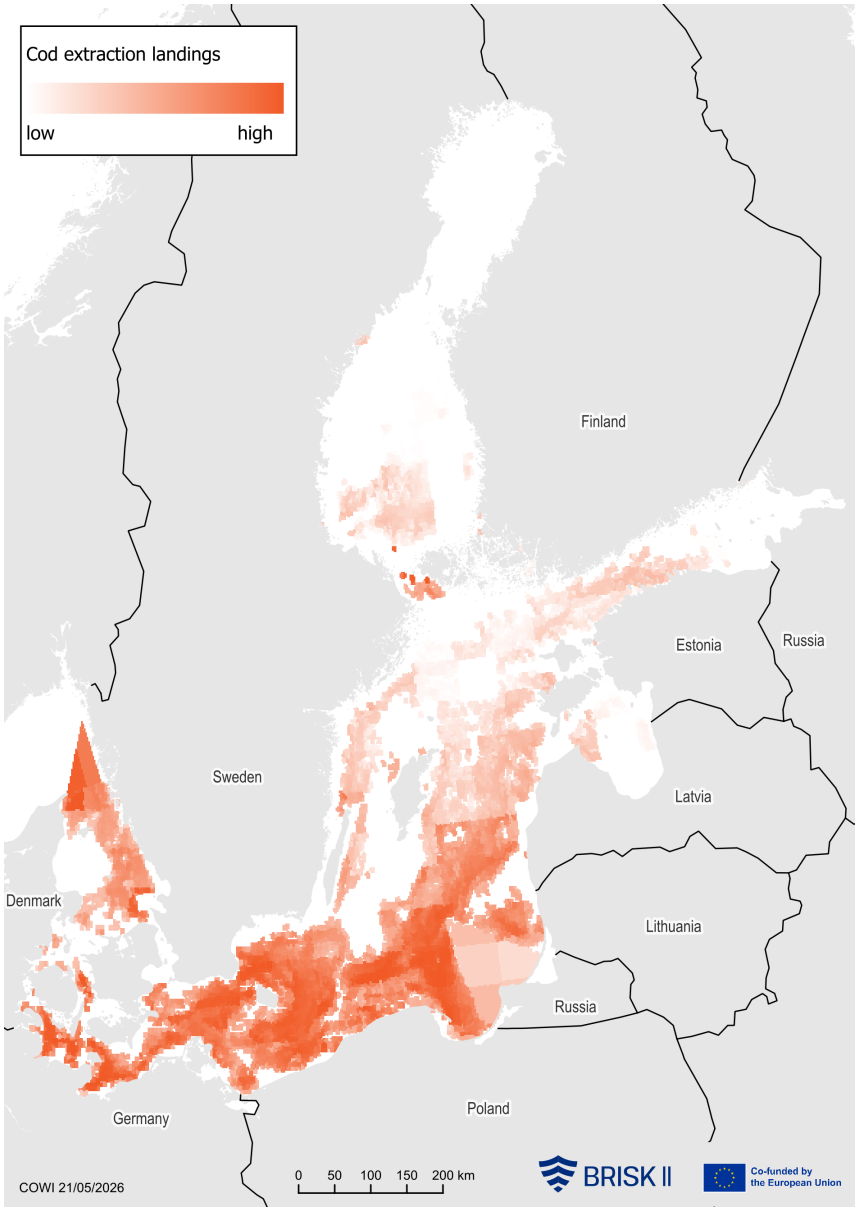


Figure 3-38 Location of cod extraction landings in the study area.

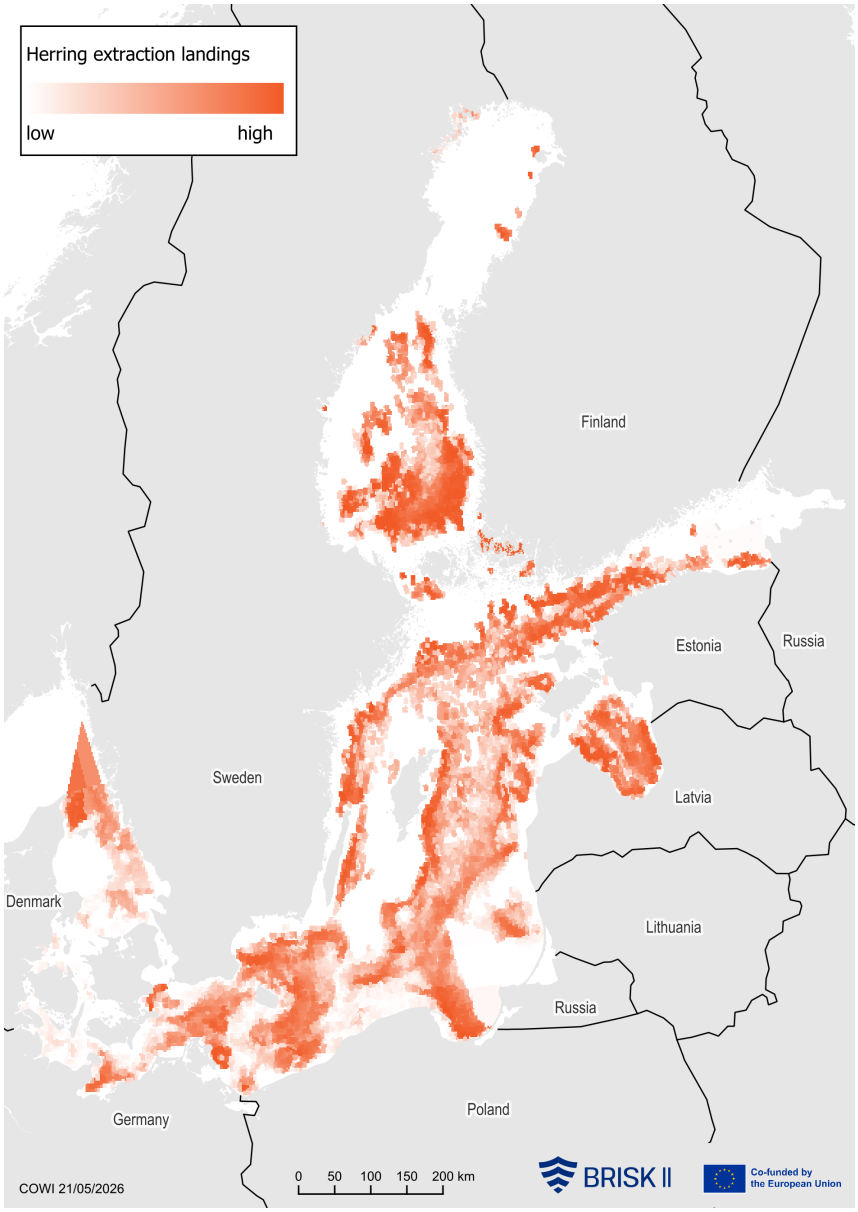


Figure 3-39 Location of herring extraction landings in the study area.

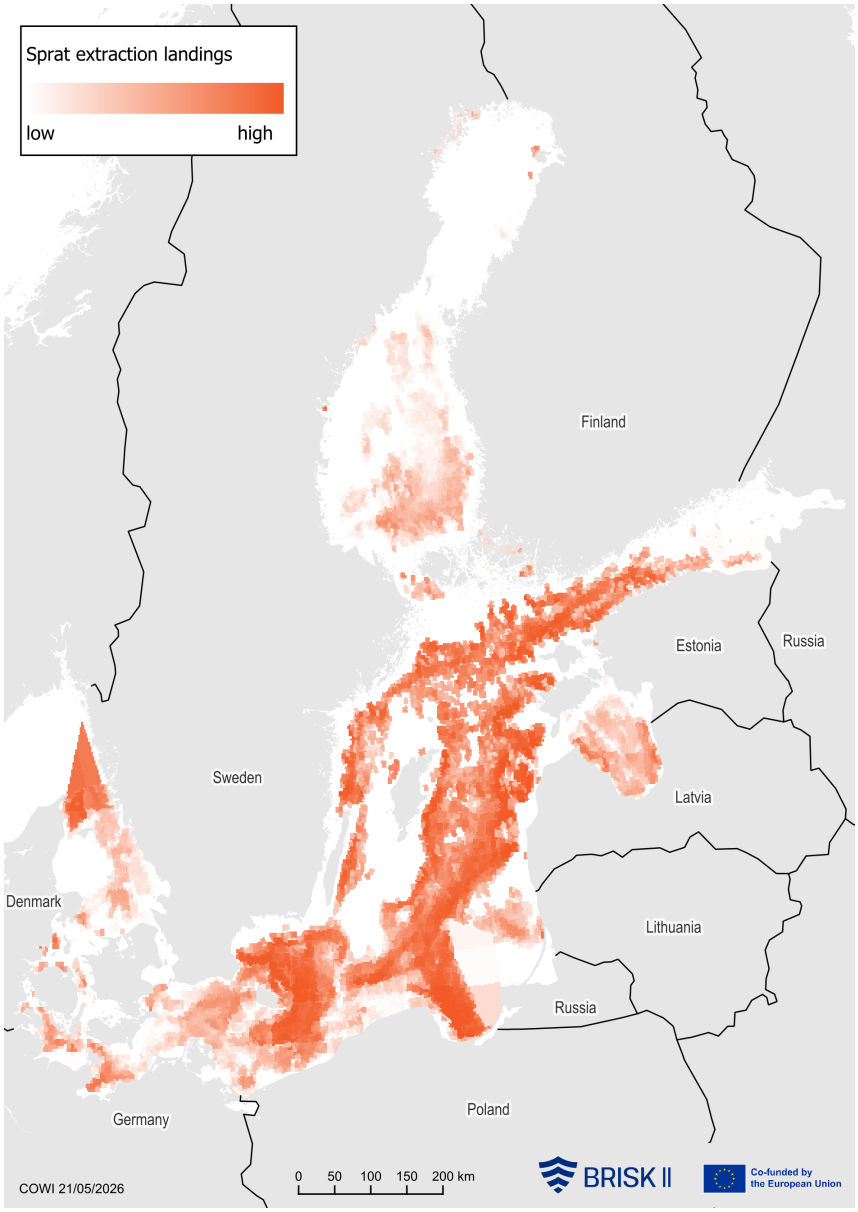


Figure 3-40 Location of sprat extraction landings in the study area.

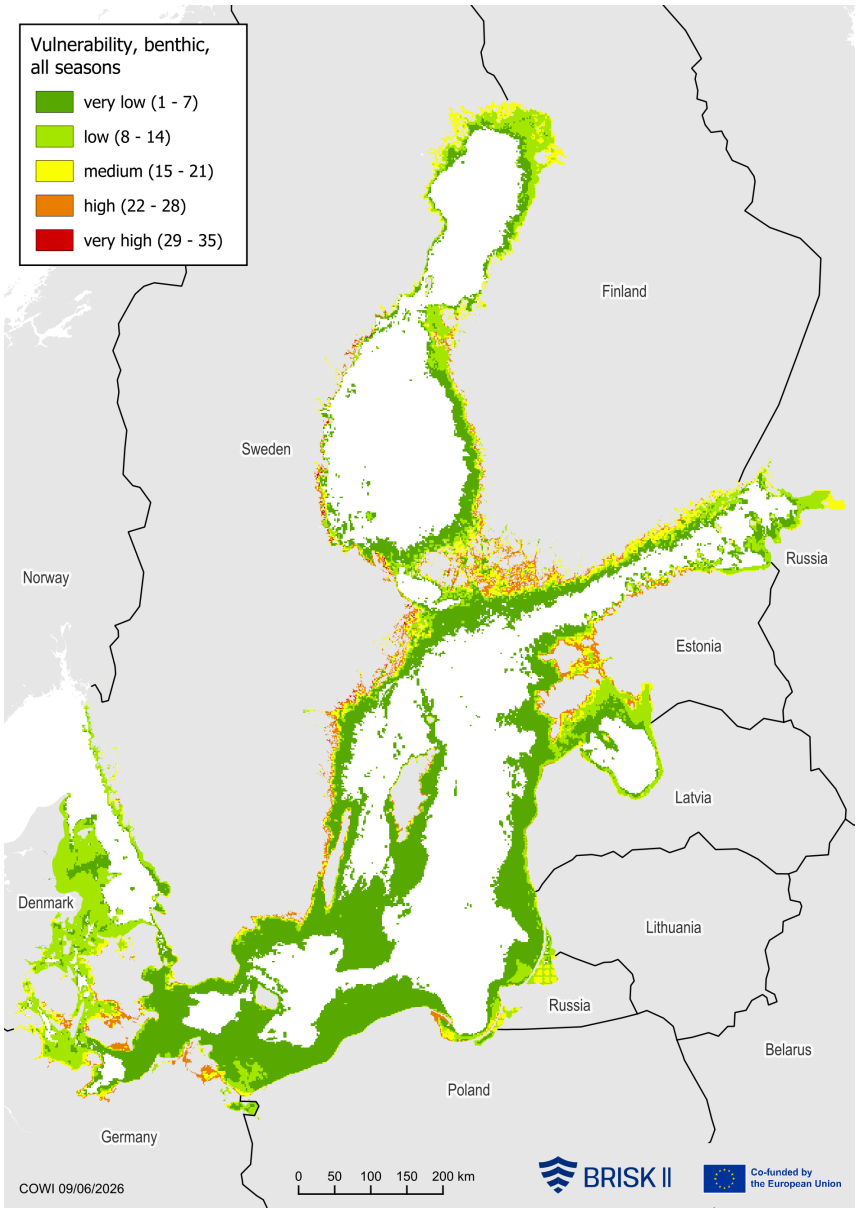
Vulnerability scoring of fish extraction landings

- Scores for cod, herring and sprat extraction landings: Winter: 3, Spring: 3, Summer: 3, Fall: 3

4 Vulnerability maps

4.1 Benthic species

Figure 4-1 illustrates the seasonal vulnerability of benthic species to oil or HNS spill. Since the scores assigned to benthic species indicators where the same in every season, there are no seasonal differences within this group. The areas with the highest vulnerability are located in the coastal areas.



The Figure 4-1 Seasonal vulnerability of benthic species to oil or HNS spill.

4.2 Other species

Figures 4-2, 4-3, 4-4, and 4-5 illustrate the seasonal vulnerability of other species (birds, fish and marine mammals) to oil or HNS spill. It is visible that spring is the most vulnerable season. Coastal areas are generally vulnerable, with some locations reaching high and very high vulnerability levels, especially in spring.

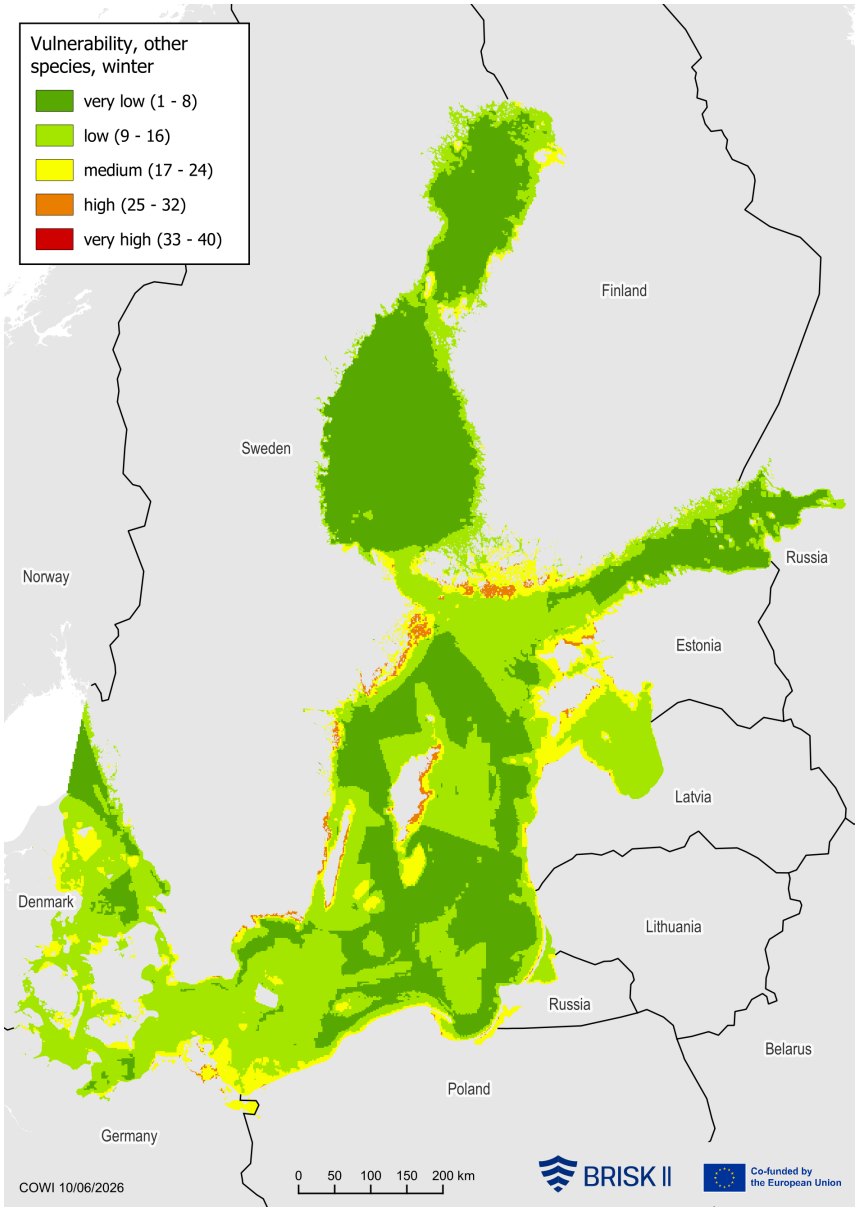


Figure 4-2 Vulnerability of other species to oil or HNS spill in winter.

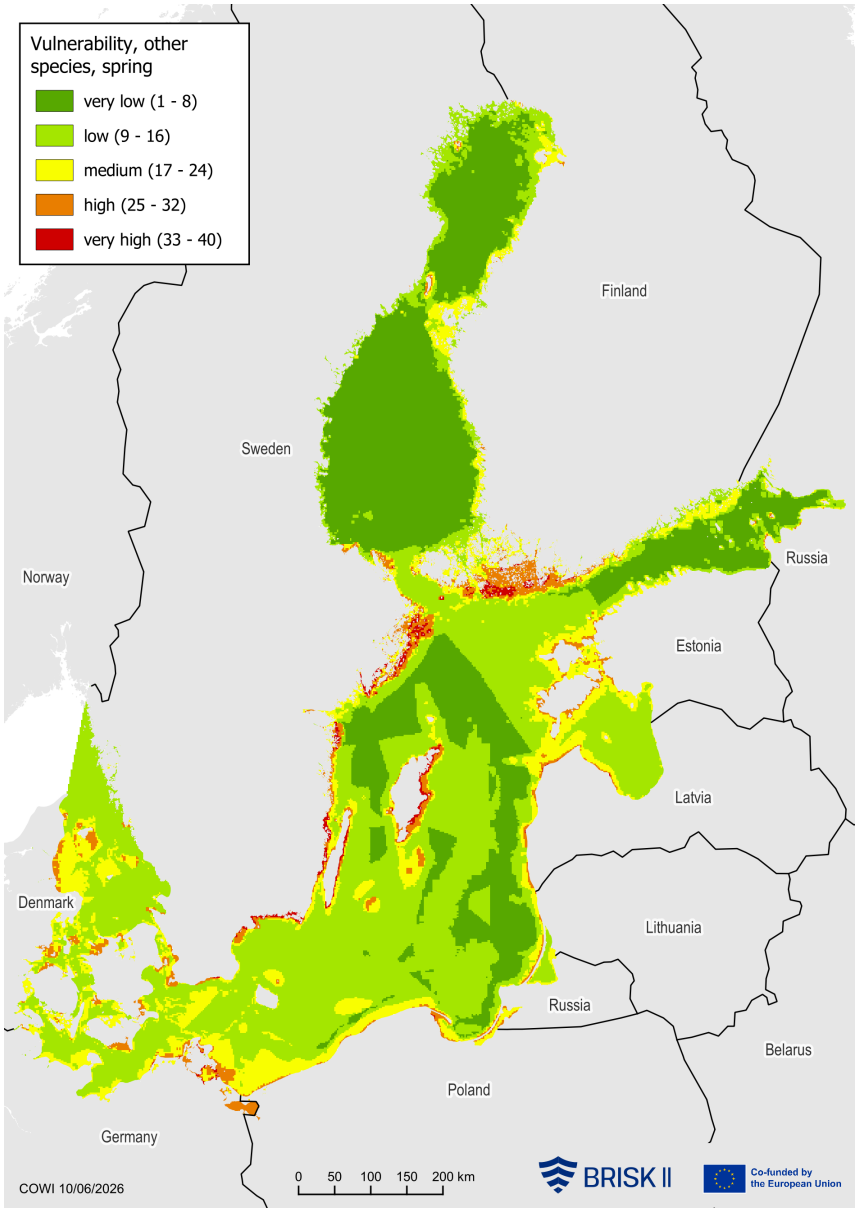


Figure 4-3 Vulnerability of other species to oil or HNS spill in spring.

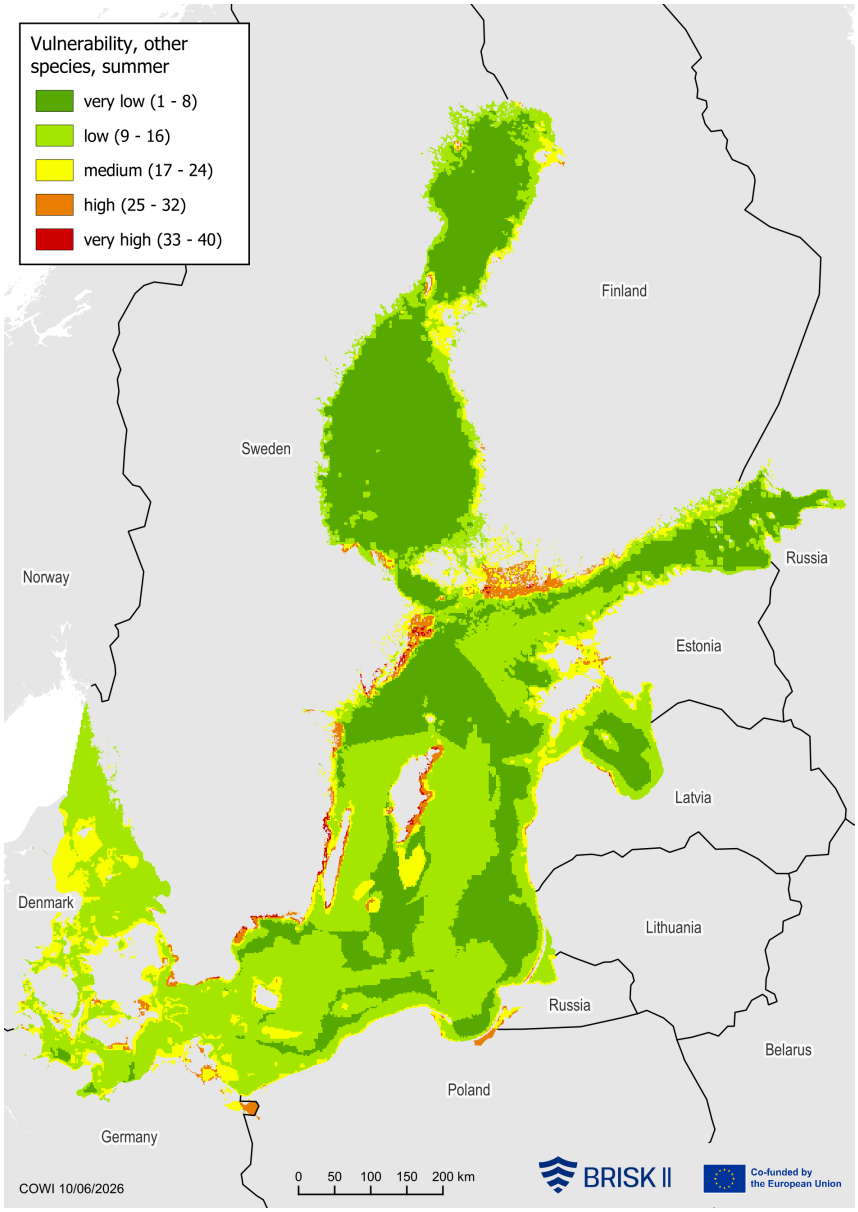


Figure 4-4 Vulnerability of other species to oil or HNS spill in summer.

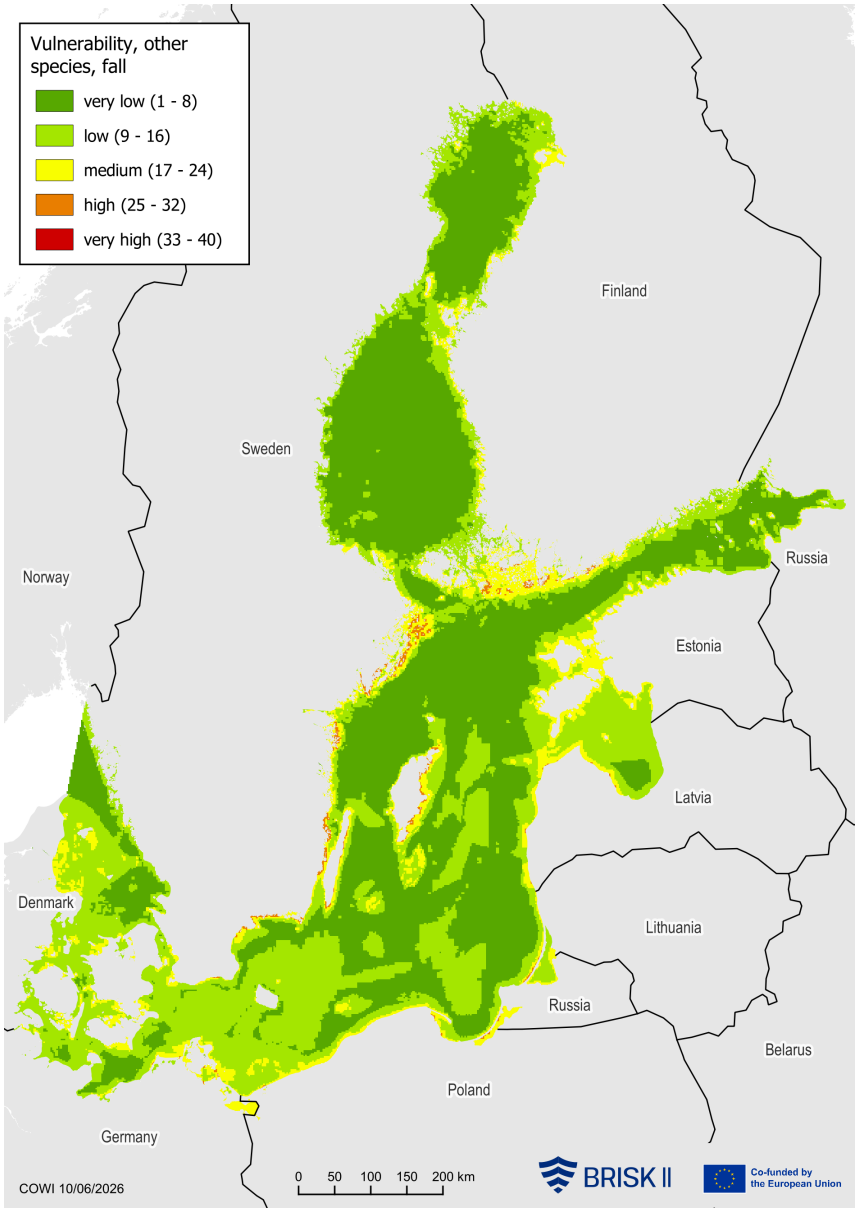


Figure 4-5 Vulnerability of other species to oil or HNS spill in fall.

4.3 Protected areas

Figure 4-6 illustrates the seasonal vulnerability of protected areas to oil or HNS spill. The highest vulnerability score (4) was assigned to each protected area indicator in every season. Therefore, there are no seasonal differences within this group, and the variation in vulnerability among areas reflects only the number of protected areas present at each site.

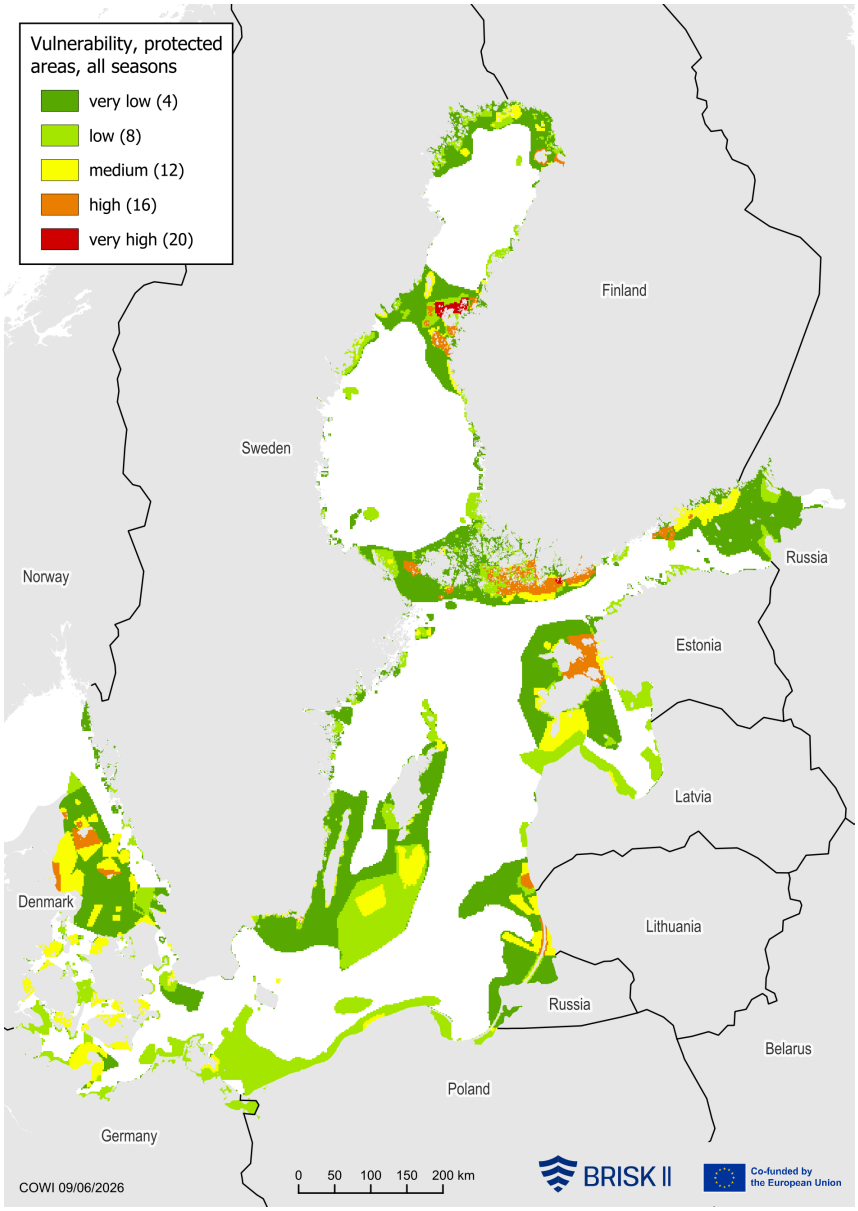


Figure 4-6 Seasonal vulnerability of protected areas to oil or HNS spill.

4.4 Socio-economy

Figures 4-7, 4-8, 4-9 and 4-10 illustrate the seasonal vulnerability of socio-economic indicators to oil or HNS spill. The seasonal differences are so small that they are hardly visible. The maps are dominantly green indicating very low or low vulnerability.

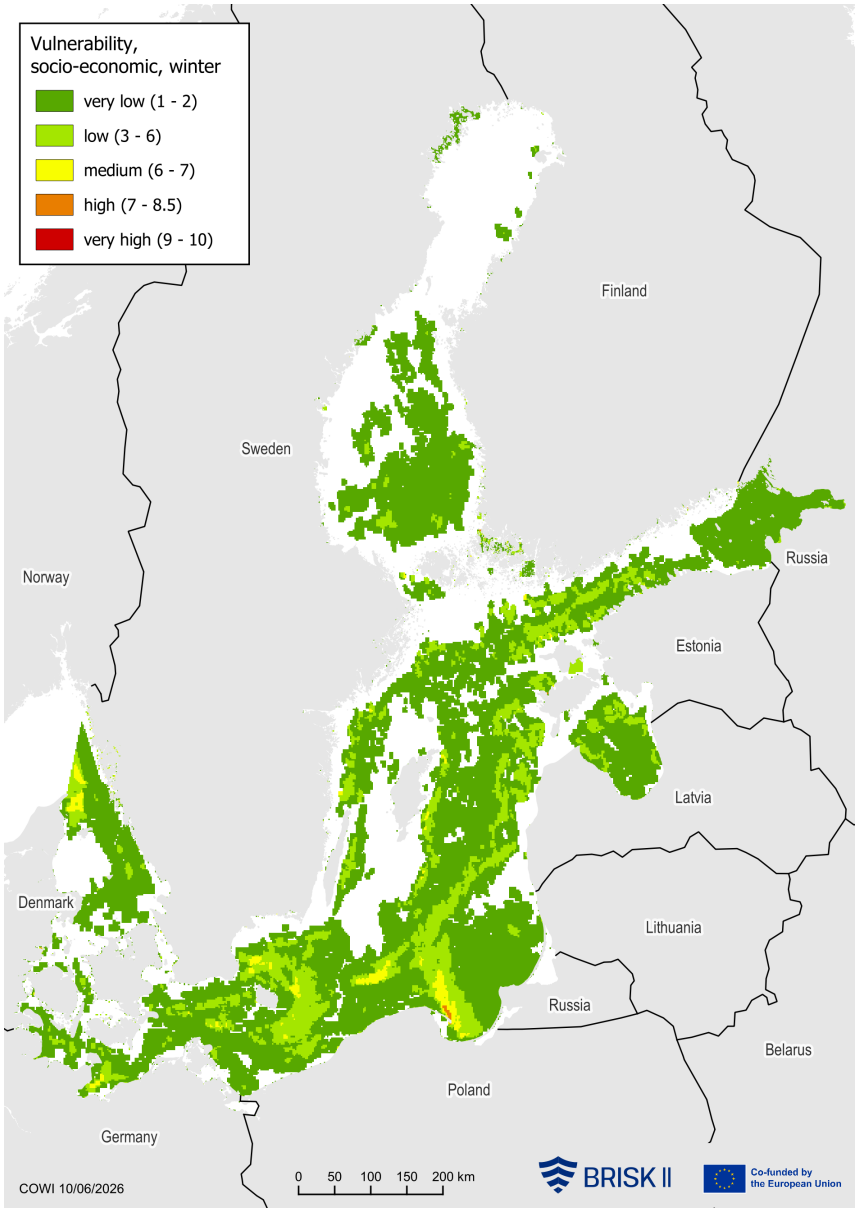


Figure 4-7 *Vulnerability of socio-economic indicators to oil or HNS spill in winter.*

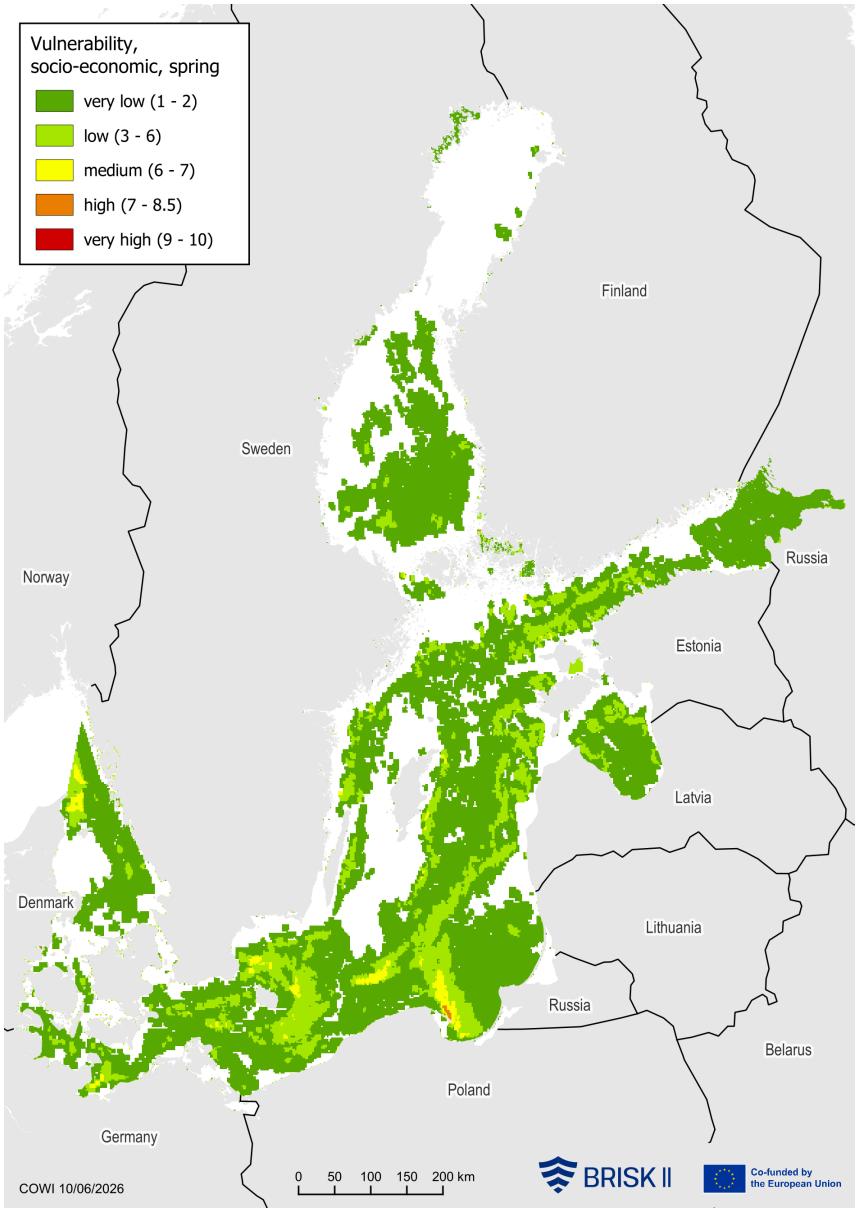


Figure 4-8 Vulnerability of socio-economic indicators to oil or HNS spill in spring.

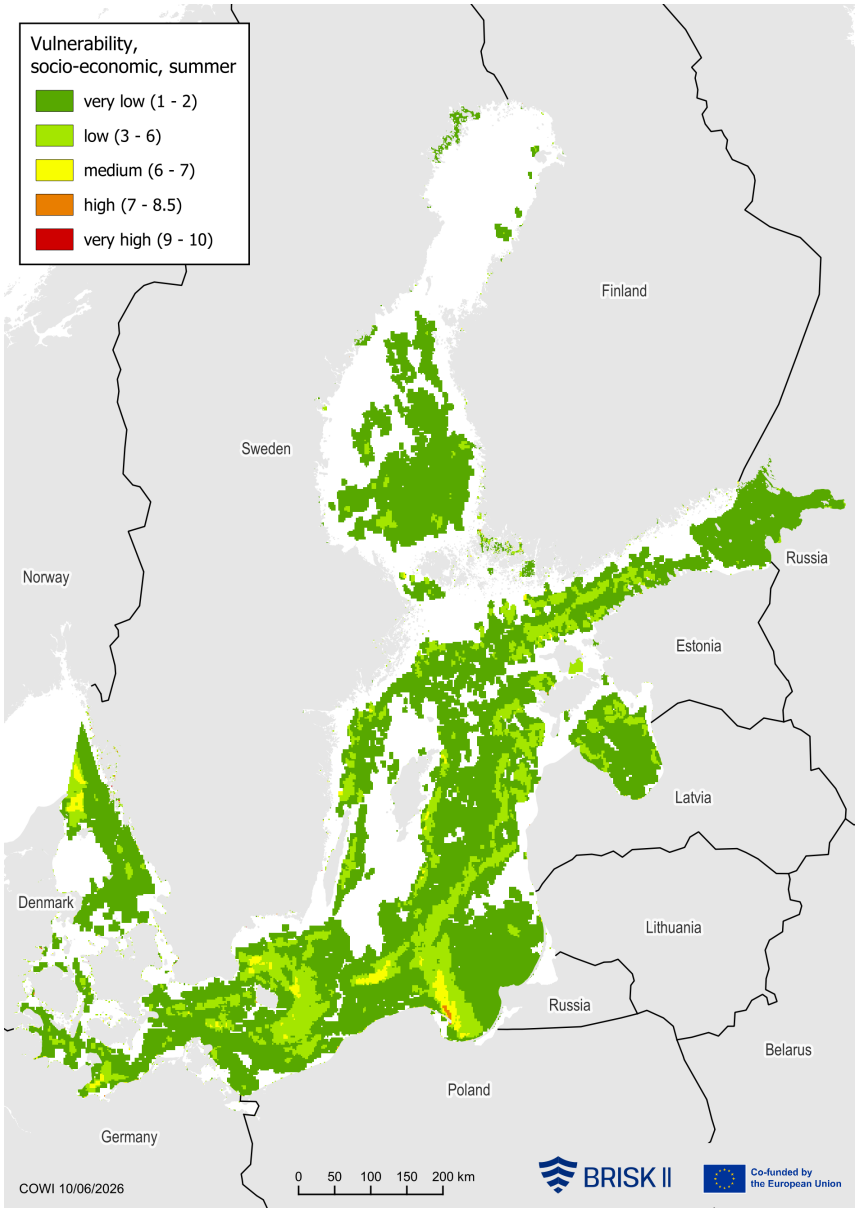


Figure 4-9 Vulnerability of socio-economic indicators to oil or HNS spill in summer.

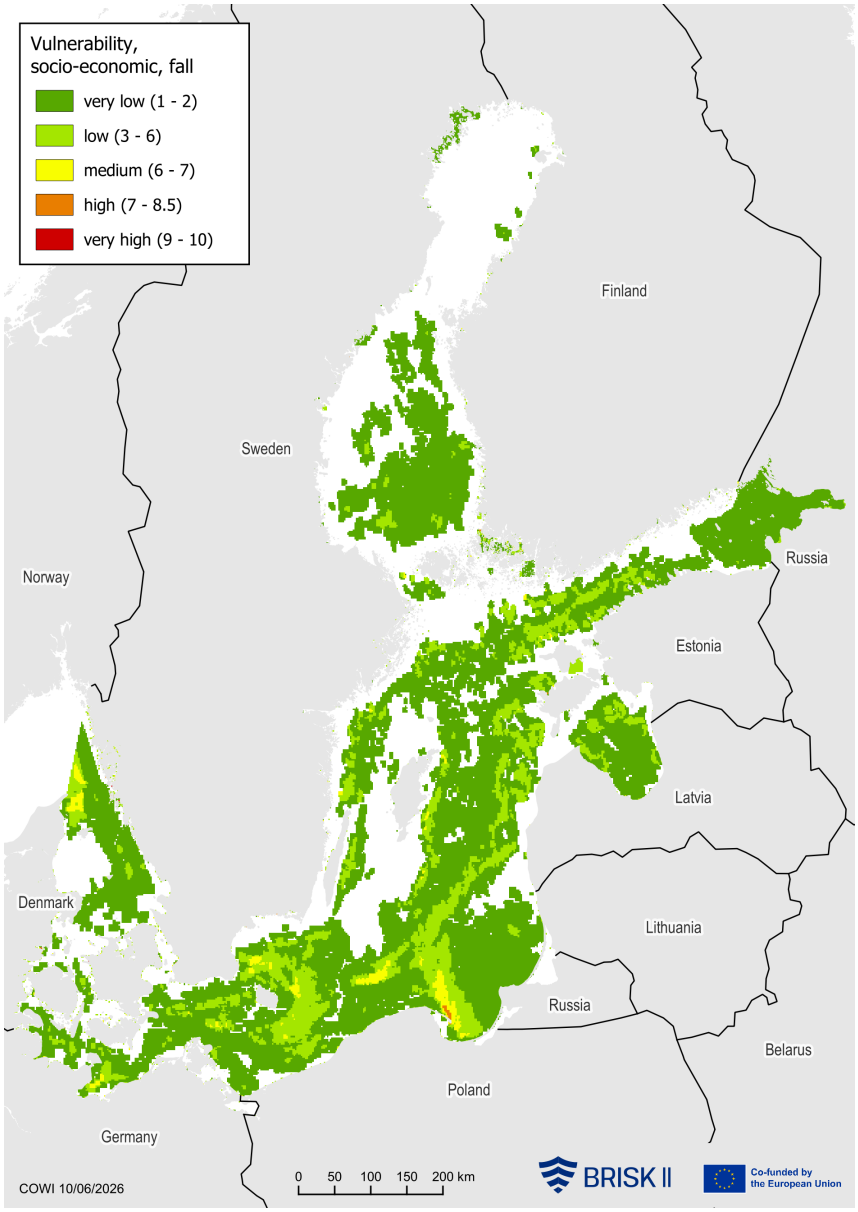


Figure 4-10 Vulnerability of socio-economic indicators to oil or HNS spill in fall.

4.5 Combined maps

The seasonal maps of the four groups (benthic species, other species, protected areas, socio-economy) were combined to make the total seasonal vulnerability maps. As stated earlier, it was decided to use equal weight for each of the four groups (See chapter 2.5). Figures 4-11, 4-12, 4-13 and 4-14 show the combined seasonal vulnerability to oil or HNS spill. The most vulnerable areas are located in coastal areas. Since multiple indicators, such as benthic species and protected areas, received the same vulnerability score in every season, seasonal differences are too small to be visible in total vulnerability maps.

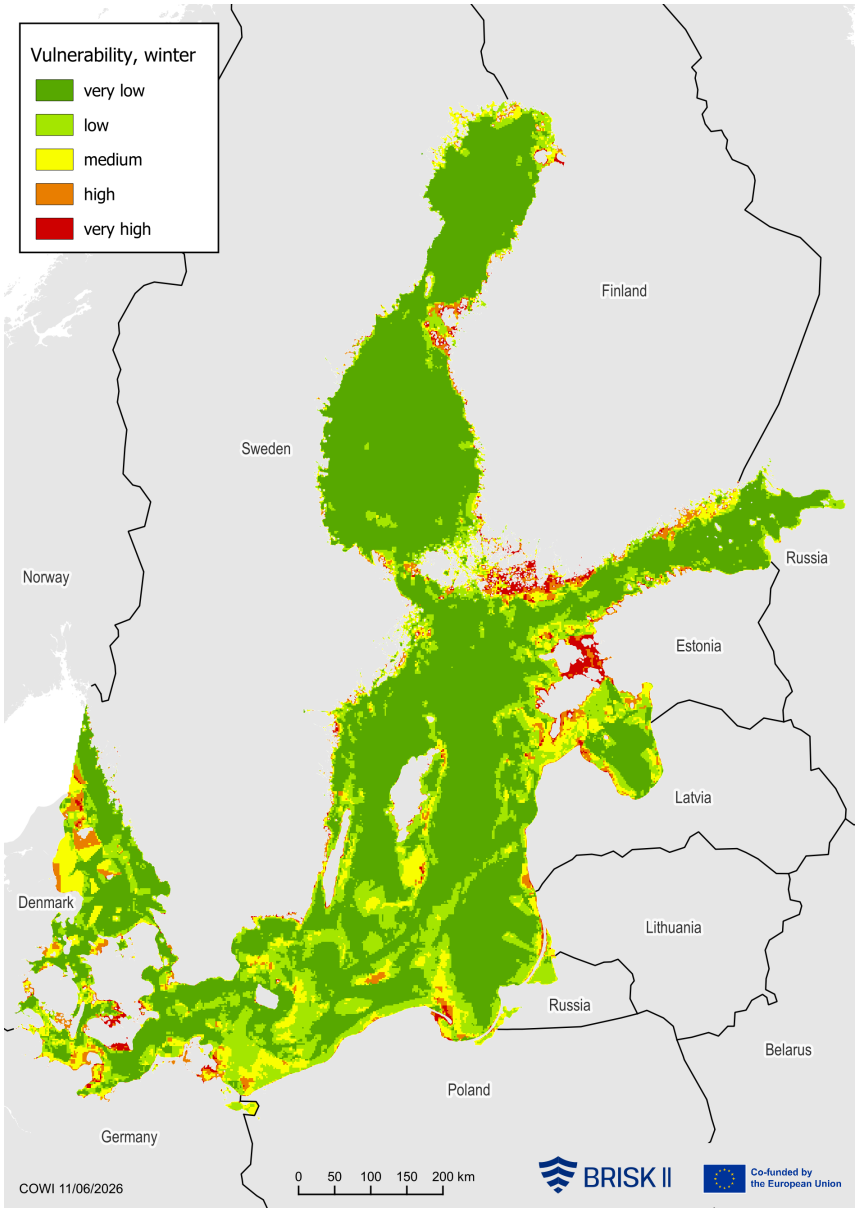


Figure 4-11 Combined vulnerability to oil or HNS spill in winter.

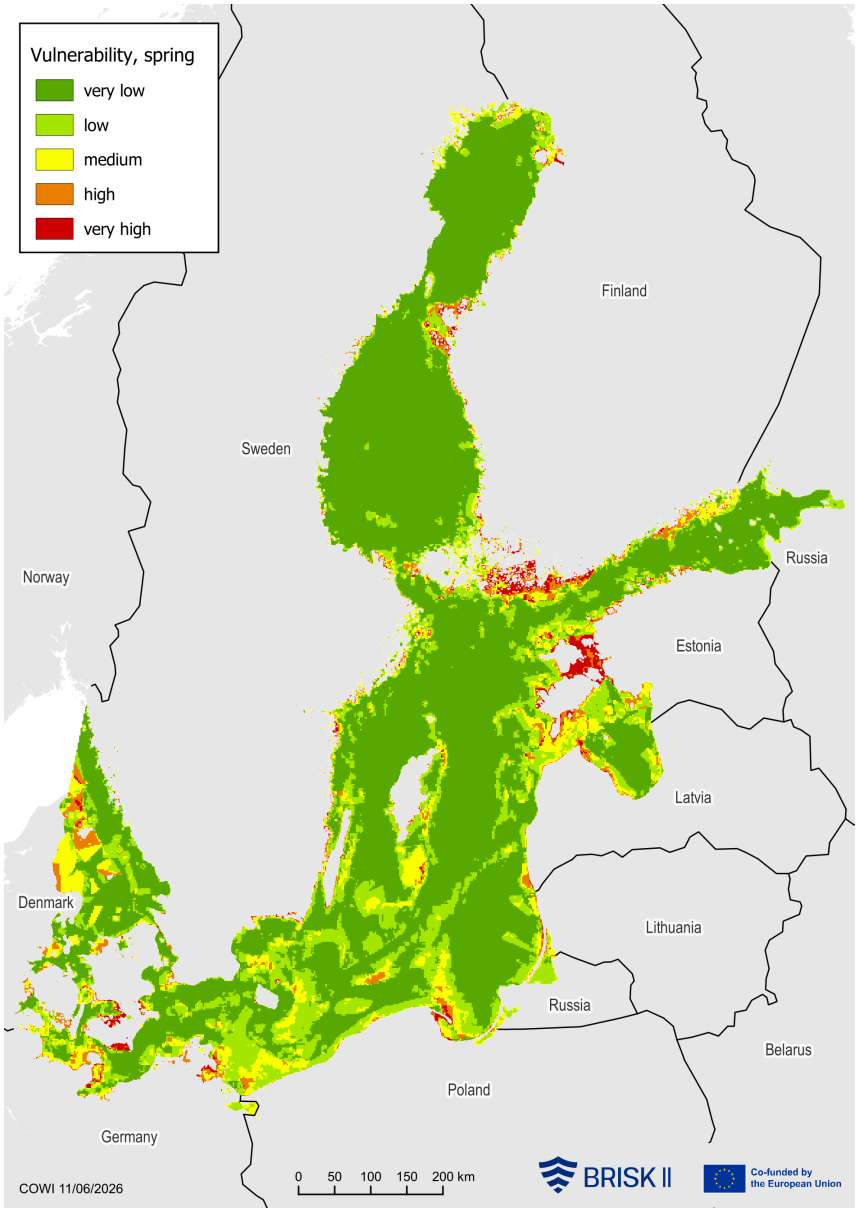


Figure 4-12 Combined vulnerability to oil or HNS spill in spring.

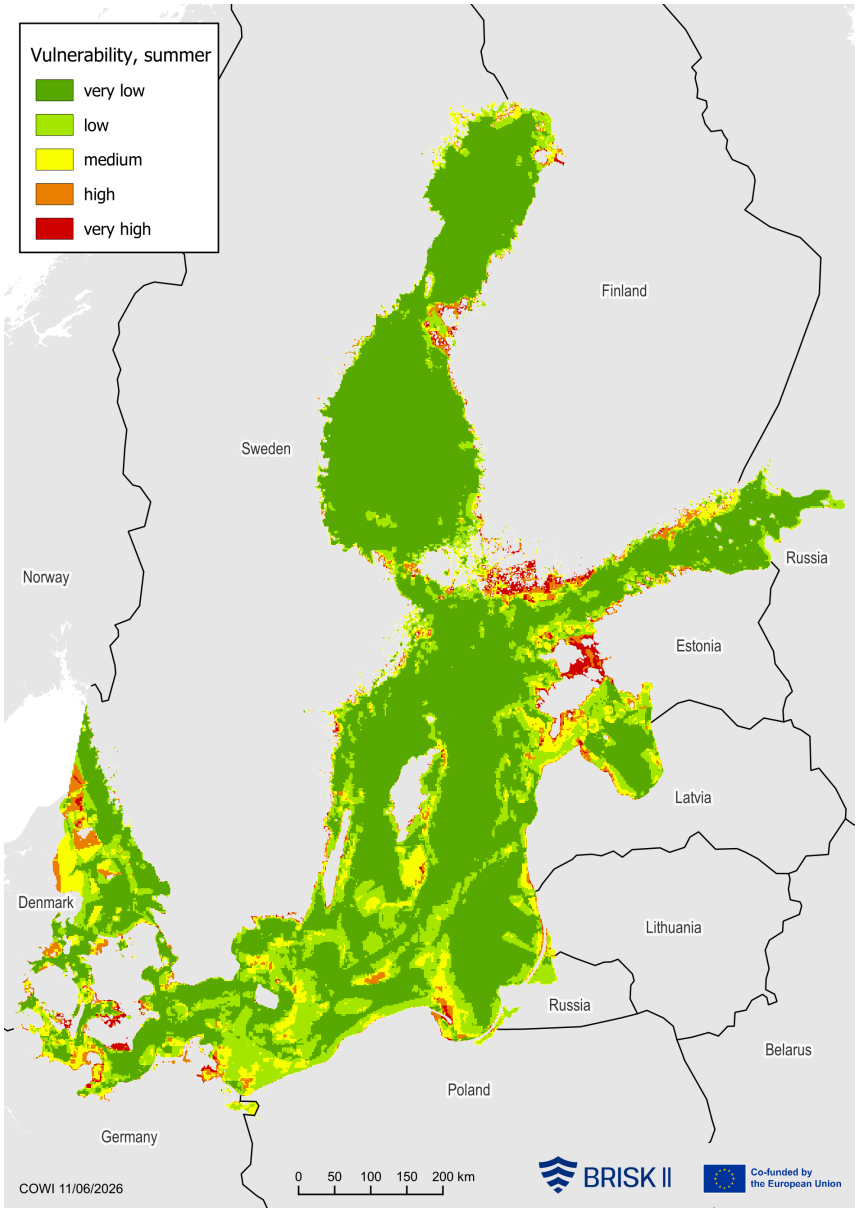


Figure 4-13 Combined vulnerability to oil or HNS spill in summer.

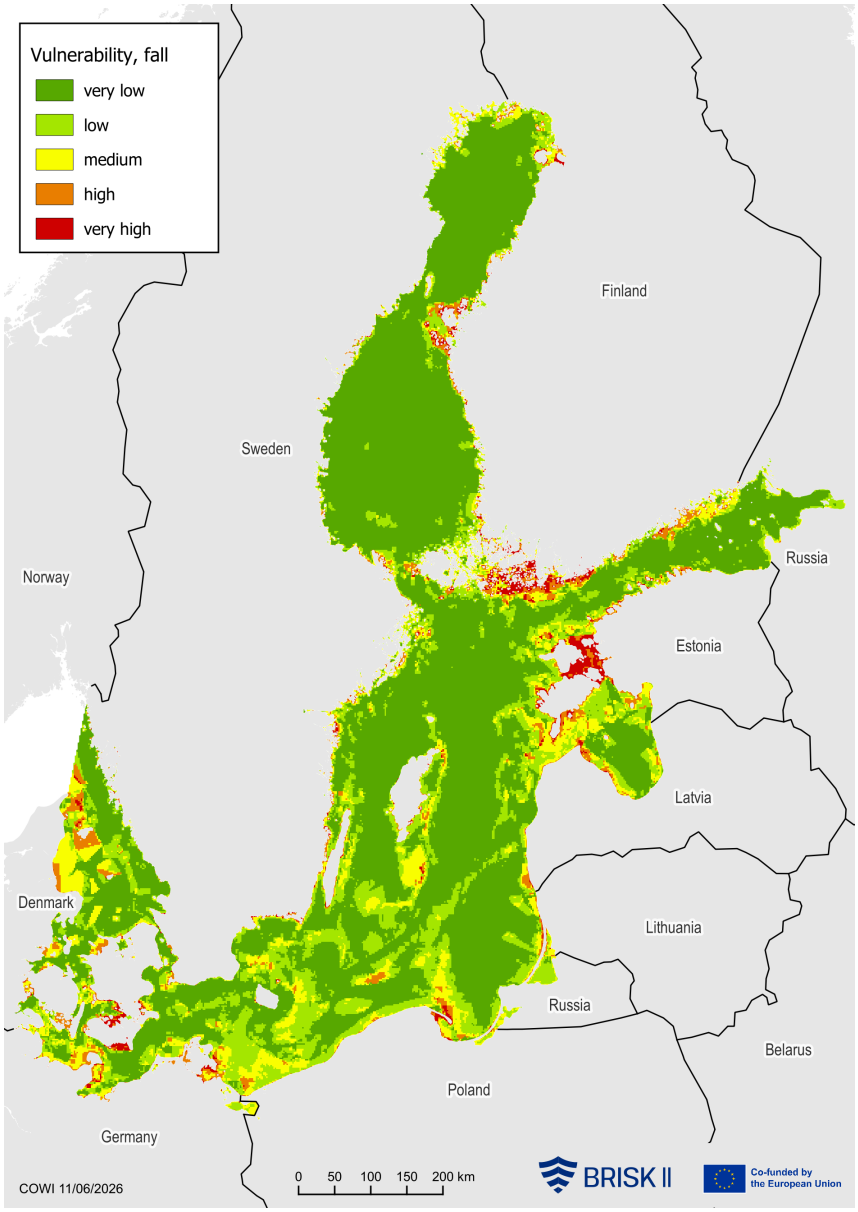


Figure 4-14 Combined vulnerability to oil or HNS spill in fall.

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Protect Baltic (2026) The SDM layers are published in HELCOM's GitHub: Baltic Sea SDMs

SEPA Swedish Environmental Protection Agency, Available online: http://naturvardsverket.se/en/ and Naturvårdsverkets Metadatakatalog för Geodata

SMHI Available online: Datavärdskap oceanografi och marinbiologi — SMHI; https://shark.smhi.se/hamta-data/

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