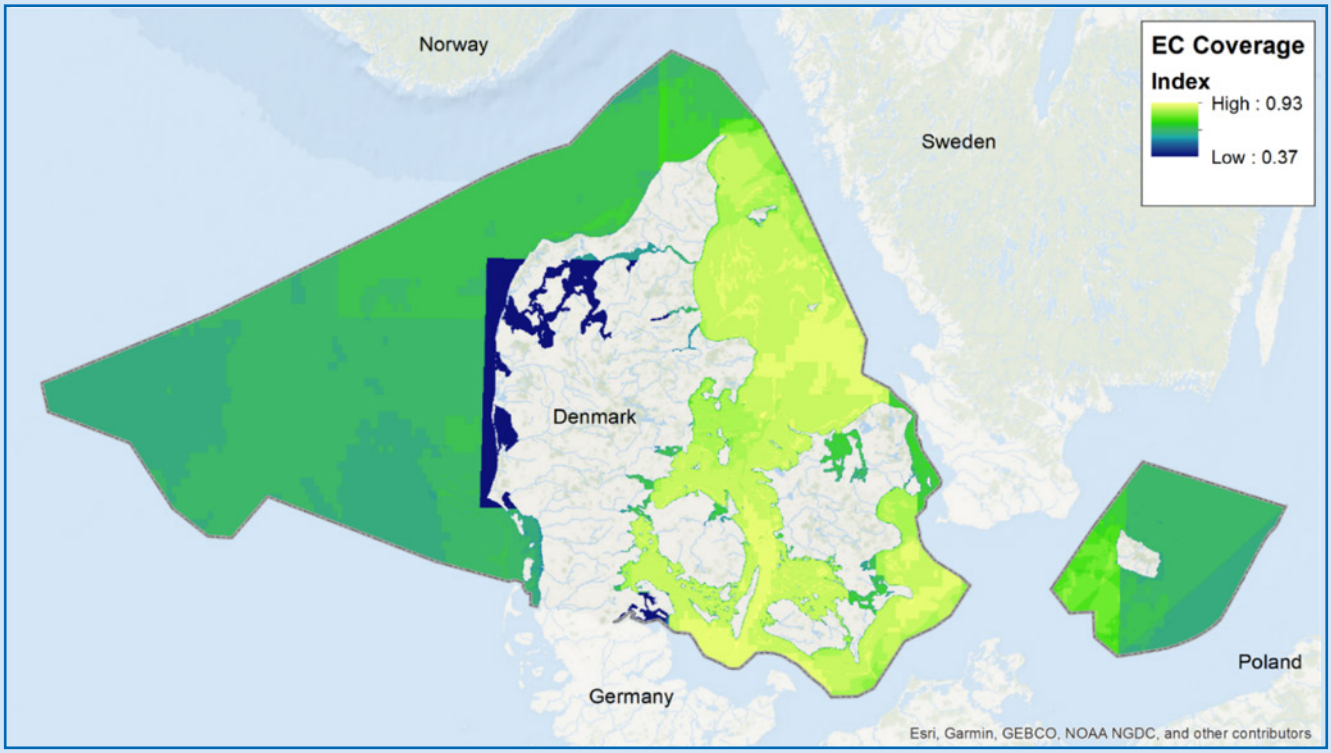
REPORT S.NO. 7525-2020

Supplementary material to ECOMAR: A data-driven framework for ecosystem-based Maritime Spatial Planning in Danish marine waters



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REPORT

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Title	Serial number	Date
Supplementary material to ECOMAR: A data-driven framework for ecosystem-based Maritime Spatial Planning in Danish marine waters	7525-2020	28 August 2020
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	Geographical area Denmark	Pages 216

Client(s)	Client's reference
THE VELUX FOUNDATIONS	Mikkel Klougart
	Printed NIVA
	Project number 180048

Summary

This report contains, as said in the title, the supplementary material to the synthesis report from the ECOMAR project (2018-2020). The supplementary material consists of three parts: 1) Annex A, being the data sets and layers dealing with human pressures and activities, 2) Annex B, being the data set related to ecosystem components and analogue data sets, and 3) Annex C, being additional data used for the mapping of potentially cumulative effects in Danish marine waters as well as maps of results mentioned, but not show in the synthesis report. For each data set, a specific reference to the data authoring organization as well as contact information for the Data Author.

Four keywords	Fire emneord
1. Maritime Spatial Planning	1. Havplanlægning
2. Pressures	2. Presfaktorer
3. Ecosystem components	3. Økosystemkomponenter
4. Data	4. Datagrundlag

This report is quality assured in accordance with NIVA's quality system and approved by:

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ISBN 978-82-577-7260-4
NIVA-report ISSN 1894-7948

Supplementary material to ECOMAR: A data-driven framework for ecosystem-based Maritime Spatial Planning in Danish marine waters

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Annex A: Pressures and human activities

This appendix contains the meta data for the pressure activities data layers used within ECOMAR.

The procedure (e.g. observations, interpolation of observations or models) for creating each spatial dataset is explained as well as the sources of the raw data. All datasets were scaled or fitted to the common ECOMAR grid by 500m*500m. Contact persons are also listed for each dataset. Maps showing i) the data layer ii) the uncertainty of the dataset and iii) the data coverage of the dataset are presented. The uncertainty variables used were variable and are explained for each data set. When a parametric uncertainty estimate was missing a categorical uncertainty (i.e. estimation) was applied using a scale of 0 = Observed data, 0.25 = Very good/validated model, 0.5 = Good model, 0.75 = Weak model/best guess/extrapolation and 1 = No data. From the uncertainty estimates the data coverage could be estimated by presence or absence, where grid cells containing any type of data (also true 0) was regarded as data being present with a data coverage and cells with no estimate of data as no data.

Note that some layers are only used in the zonation map:

- A1.3 Nutrient discharge (point source)
- A1.4 Riverine nutrient inputs

A1 Pollution - Nutrients

A1.1 Nitrogen winter concentrations (DIN)

Data name	Dissolved inorganic nitrogen (DIN), winter surface concentrations
Category of activity	Pollution
Data units, max and min values	Surface concentration of dissolved inorganic nitrogen [DIN µg L^{-1}]. Min: 36 µg L^{-1} Max: 4004 µg L^{-1}.
Category	Pressure
Date created	2019-06-28
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	Average 2013 - 2018
Units in raster data	µg N L^{-1}
Spatial extent and resolution	This dataset is derived from point measurements and interpolated to the 500 x 500 m ECOMAR grid. Top: 3906500 m, Left: 3905350 m, Bottom: 4733350 m, Right: 3474500 m
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035

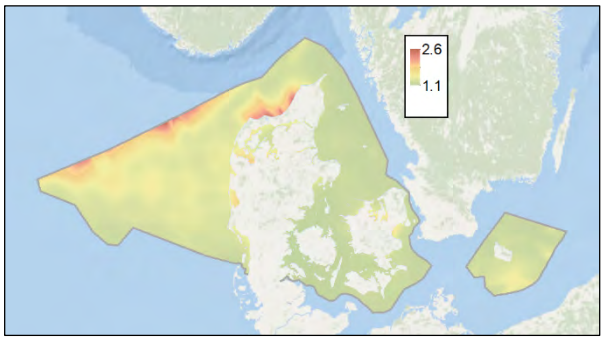
Summary:
This dataset shows average surface winter concentrations of dissolved inorganic nitrogen (DIN) for the period 2013-2018. The dataset was created by calculating average surface concentrations from in situ measurement points. The observation data was obtained from ICES' database and from the Danish national monitoring database, ODA.
Then a GIS tool was used to interpolate spatially between the measurement points. This interpolation was done using "barriers". This means that distance between points is calculated around coastlines rather than directly "as the crow flies". This means, for example, that we can avoid interpolating directly between a point on the west coast of Jutland and a point on the east coast.

Lineage:
Data were downloaded from the ICES Data Centre (http://ocean.ices.dk) and from ODA, the joint database of the Ministry of Environment and Food of Denmark and DCE - Danish Centre for Environment and Energy, Aarhus University, for surface water data (https://odaforalle.au.dk). Data were downloaded from both databases on 13-06-2019.
At each discrete (in time and space) measurement point, the concentration of dissolved inorganic nitrogen, DIN [µM] was calculated as the sum of concentrations of ammonium-N (NH_4-N), [µM], nitrate-N (NO_3-N), [µM] and nitrite-N (NO_2-N), [µM]. In most data from ODA, combined concentrations of nitrate-N and nitrite-N were given rather than separate concentrations of each.
In data from ICES, there were cases where the concentration of nitrite-N was missing, it was assumed that DIN concentration was equal to the sum of NH_4-N and NO_3-N, since the concentration of nitrite-N is generally an order of magnitude smaller than that of nitrate-N. If either ammonium-N or nitrate-N were missing, then no DIN concentration was calculated.
The surface DIN concentration was calculated as the average of all measurements at the same position

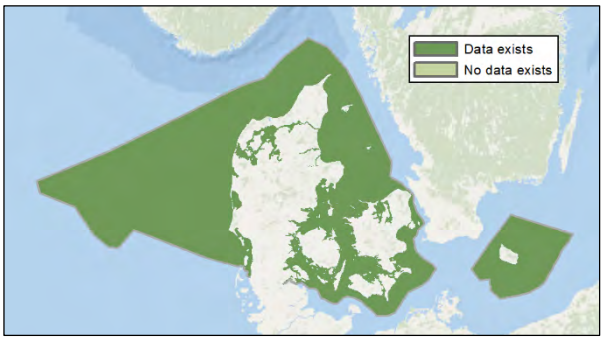
(latitude and longitude) and on the same day, where the sampling depth was less than 5 m. Latitude and longitude were rounded to 3 decimals. This is order of magnitude of 100 m in the final coordinate reference system (x 64m, y 111m at 55°N 12°E). The winter average was then calculated as the average of all observations occurring in December, January and February. Concentrations were converted from µM to µg N L^{-1} before being projected to the target coordinate reference system. Log-transformed concentrations were interpolated to a 500 m raster using the "Kernel Smoothing with barriers" function in ArcGis 10.3, using the following parameters: Kernel Type=Gaussian, Power=1, Ridge=100, Bandwidth=50000 m. Finally, the interpolated log-transformed data were transformed back to concentrations. The uncertainty was estimated as the standard error of the results Kernel smoothing.	
Considerations for use in ECOMAR: None	
Recommendations for data improvement: A potential improvement could be to use the results of a biogeochemical model to determine spatial variation in concentrations more accurately.	
Data authoring organization	NIVA Denmark
Data author contact	cjm@niva-dk.dk
Data source	ICES Ministry of Environment and Food of Denmark and DCE - Danish Centre for Environment and Energy, Aarhus University
Data source contact	ocean@ices.dk, miljoeportal@miljoeportal.dk
INSPIRE topic category	Environment, Oceans
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Eutrophication, pollution effect, environmental impact
Maintenance	No planned
Metadata date	2019-07-01
Metadata organization	NIVA Denmark
Metadata contact	cjm@niva-dk.dk

DIN winter concentration (µg L^{-1})

Estimated uncertainty



Data coverage



Estimated uncertainty: Standard error of the model.

Data coverage: Modelled area based on data collection within the Danish EEZ.

A1.2 Phosphorous winter concentration (DIP)

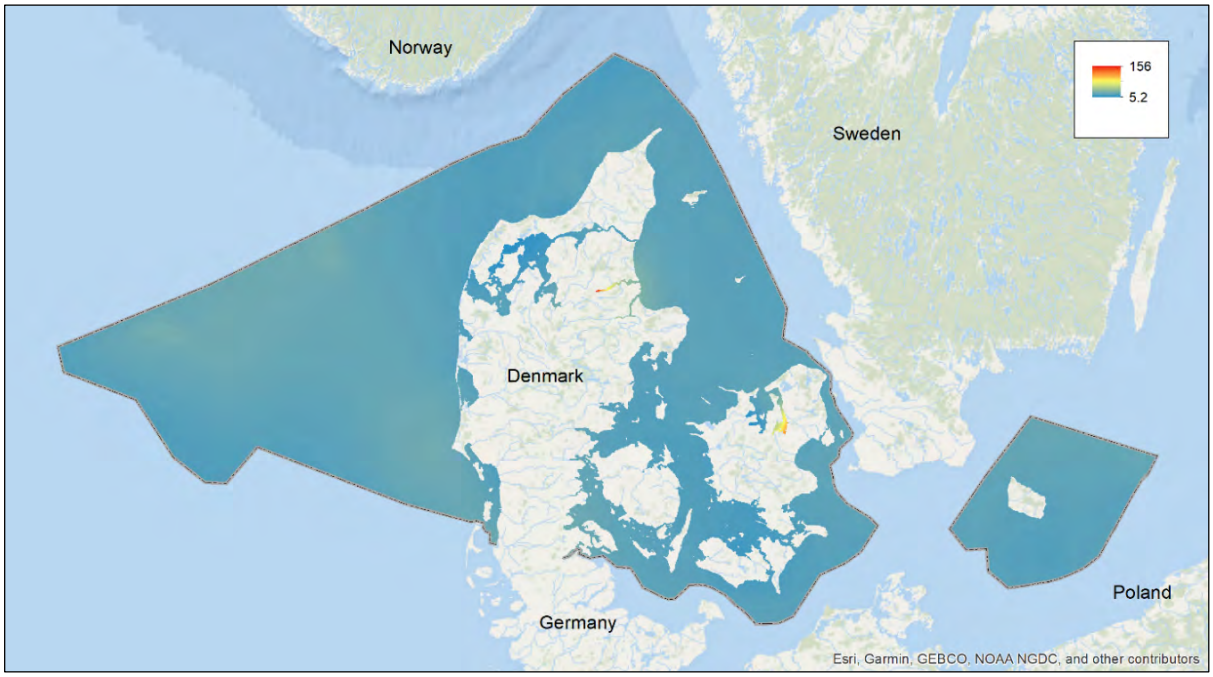
Data name	Dissolved inorganic phosphorous (DIP), winter surface concentrations
Category of activity	Pollution
Data units, max and min values	Surface concentration of dissolved inorganic phosphorous [DIP µg L^{-1}]. Min: 5.16 µg L^{-1} Max: 156 µg L^{-1}.
Category	Pressure
Date created	2019-06-28
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	Average 2013 - 2018
Units in raster data	µg P L^{-1}
Spatial extent and resolution	This dataset is derived from point measurements and interpolated to the 500 m ECOMAR grid. Top: 3906500 m, Left: 3905350 m, Bottom: 4733350 m, Right: 3474500 m
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035

Summary:
This dataset shows average surface winter concentrations of dissolved inorganic phosphorous (DIP) for the period 2013-2018. The dataset was created by calculating average surface concentrations at measurement points. The observation data was obtained from ICES' database and from the Danish national monitoring database, ODA.
Then a GIS tool was used to interpolate spatially between the measurement points. This interpolation was done using "barriers". This means that distance between points is calculated around coastlines rather than directly "as the crow flies". This means, for example, that we can avoid interpolating directly between a point on the west coast of Jutland and a point on the east coast.

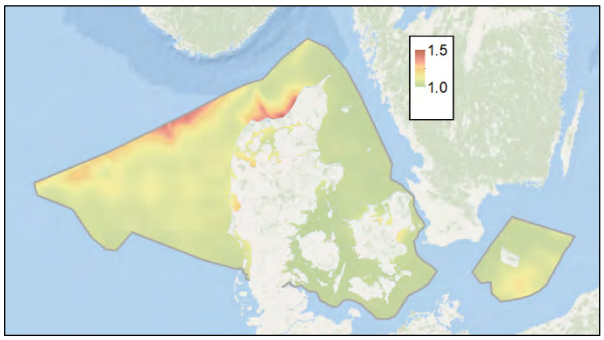
Lineage:
Data were downloaded from the ICES Data Centre (http://ocean.ices.dk) and from ODA, the joint database of the Ministry of Environment and Food of Denmark and DCE - Danish Centre for Environment and Energy, Aarhus University, for surface water data (https://odaforalle.au.dk). Data were downloaded from both databases on 13-06-2019.
The surface DIP concentration was calculated as the average of all measurements at the same position (latitude and longitude) and on the same day, where the sampling depth was less than 5 m. Latitude and longitude were rounded to three decimals. This is order of magnitude of 100 m in the final coordinate reference system (x 64m, y 111m at 55°N 12°E).
The winter average was then calculated as the average of all observations occurring in December, January and February. Concentrations were converted from µM to µg P L^{-1} before being projected to the target coordinate reference system. Log-transformed concentrations were interpolated to a 500 m raster using the "Kernel Smoothing with barriers" function in ArcGis 10.3, using the following parameters: Kernel Type=Gaussian, Power=1, Ridge=100, Bandwidth=50000 m. Finally, the interpolated log-transformed data were transformed back to concentrations.
The uncertainty was estimated as the standard error of the results Kernel smoothing.

Considerations for use in ECOMAR: None	
Recommendations for data improvement: A potential improvement could be to use the results of a biogeochemical model to determine spatial variation in concentrations more accurately.	
Data authoring organization	NIVA Denmark
Data author contact	cjm@niva-dk.dk
Data source	ICES Ministry of Environment and Food of Denmark and DCE - Danish Centre for Environment and Energy, Aarhus University
Data source contact	ocean@ices.dk, miljoeportal@miljoeportal.dk
INSPIRE topic category	Environment, Oceans
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Eutrophication, pollution effect, environmental impact
Maintenance	Unknown
Metadata date	2019-07-01
Metadata organization	NIVA Denmark
Metadata contact	cjm@niva-dk.dk

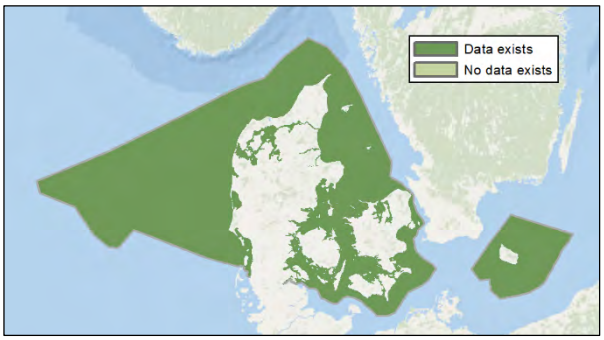
DIP winter concentration (µg L^{-1})



Estimated uncertainty



Data coverage

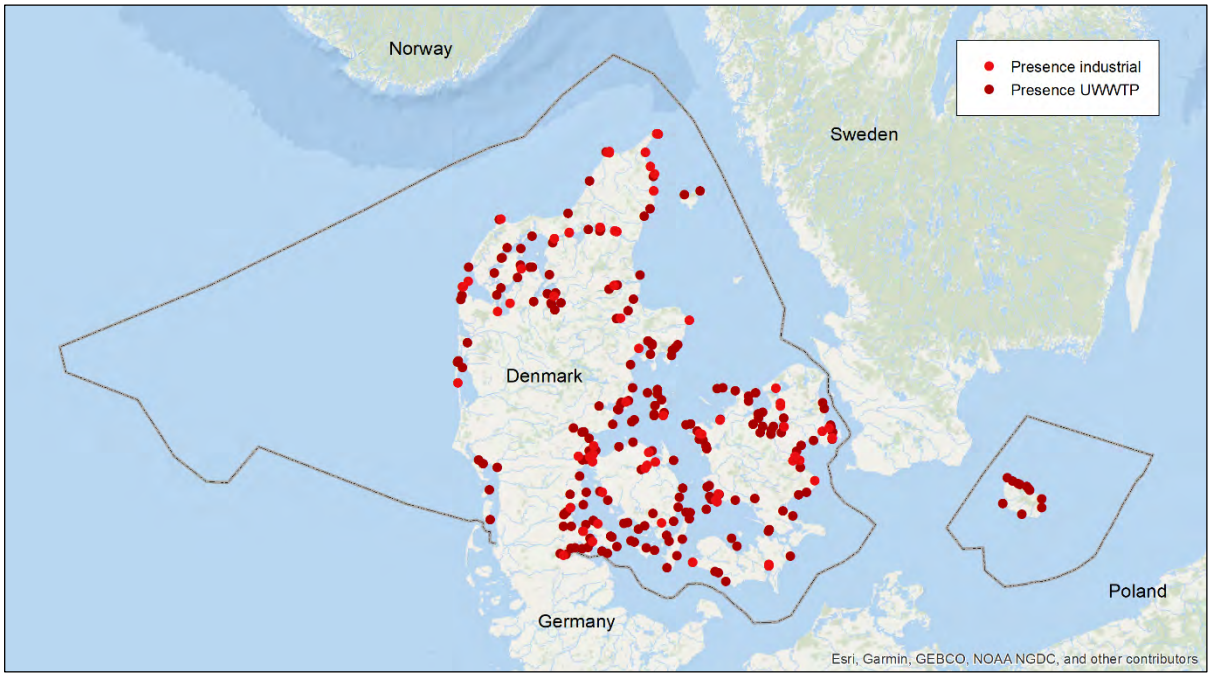


Estimated uncertainty: Standard error of the model.
Data coverage: Modelled area based on data collection within the Danish EEZ.

A1.3 Nutrient discharge (point source)

Data name	Nutrient discharge points
Category of activity	Pollution
Data units, max and min values	Point sources of nutrient inputs from land
Category	Pressure
Date created	2019-04
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	2018
Units in raster data	Presence/absence of locations
Spatial extent and resolution	1:100 000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The data layer shows the location of the industrial and the urban wastewater treatment plants (UWWTP) input points located close to the shore.	
Lineage: The original data was received from Danish Environmental Agency (Miljøstyrelsen).	
Considerations for use in ECOMAR: The dataset will be used for zonation analyses when it is important to know the exact locations of the point sources. This dataset will not be included in the analysis of cumulative human impacts.	
Recommendations for data improvement: None	
Data authoring organization	Danish Environmental Protection Agency
Data author contact	support@miljoeportal.dk
Data source	MiljøGIS https://mst.dk/service/miljoegis/
Data source contact	support@miljoeportal.dk
INSPIRE topic category	Oceans, Environment, Coast, Pollution
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Eutrophication, Pollution effect, Environmental impact
Maintenance	Not planned
Metadata date	2019-06-12
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

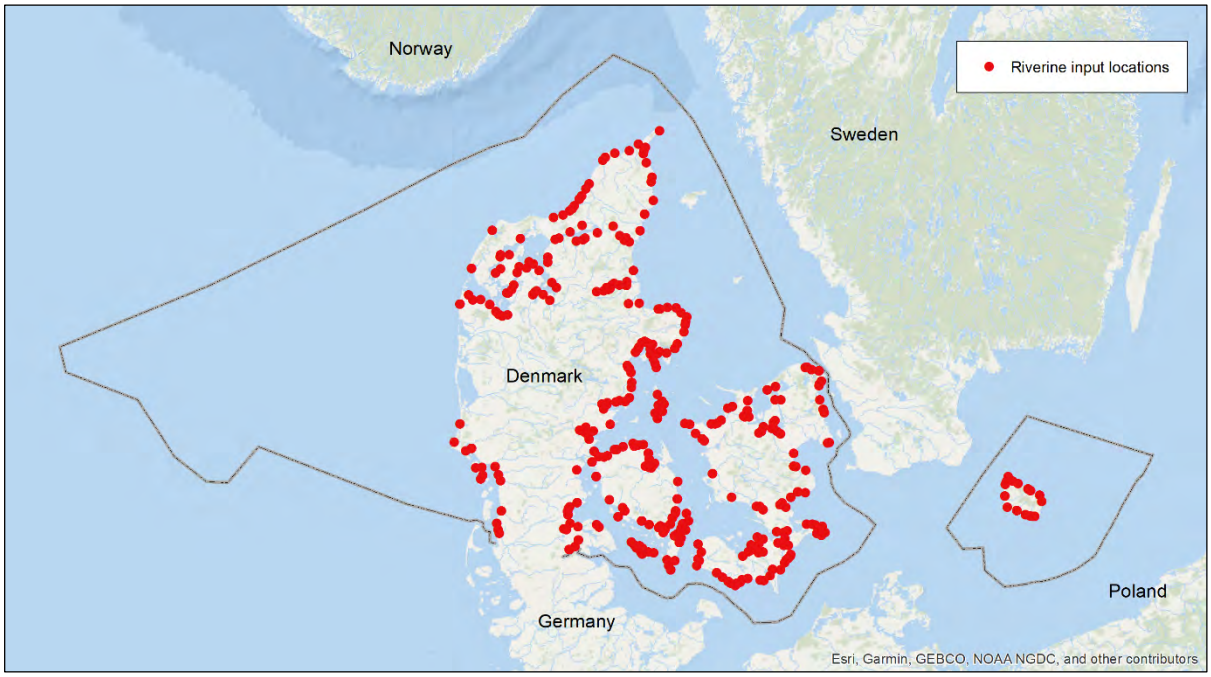
Presence of industrial and UWWTP point sources



A1.4 Riverine nutrient inputs (point source)

Data name	Riverine inputs
Category of activity	Pollution
Data units, max and min values	Point sources of nutrient inputs from land
Category	Pressure
Date created	2019-04
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	2018
Units in raster data	Presence or absence of monitoring points
Spatial extent and resolution	1:100 000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The data layer shows the NOVANA location of the monitoring station for measuring nutrient discharge from rivers representing diffuse land sources.	
Lineage: The original data was received from Danish Environmental Agency (Miljøstyrelsen).	
Considerations for use in ECOMAR: The dataset will be used for zonation analyses when it is important to know the exact locations of the point sources. This dataset will not be included in the analysis of cumulative human impacts.	
Recommendations for data improvement: None	
Data authoring organization	Danish Environmental Protection Agency
Data author contact	support@miljoeportal.dk
Data source	MiljøGIS https://mst.dk/service/miljoegis/
Data source contact	support@miljoeportal.dk
INSPIRE topic category	Oceans, Environment, Coast, Pollution
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Eutrophication, Pollution effect, Environmental impact
Maintenance	Not planned
Metadata date	2019-06-12
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

Presence of riverine input locations (ODA sampling stations)



A2 Pollution – Contaminants

A2.1 Contaminants

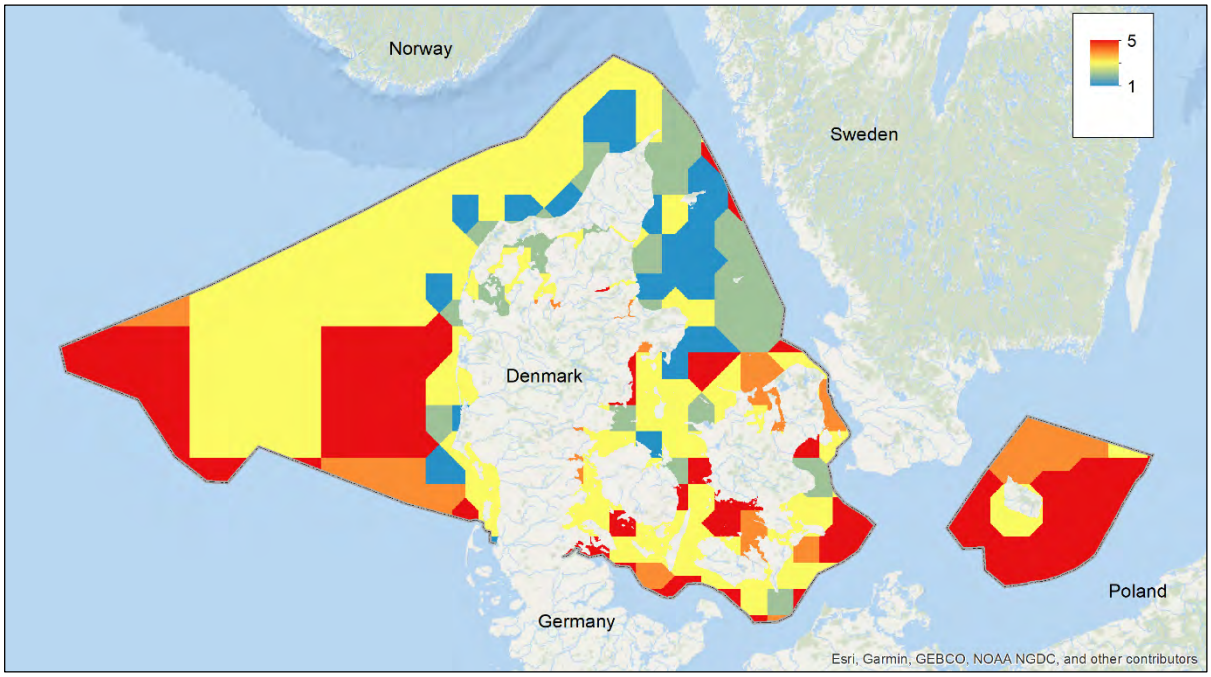
Data name	Contamination by hazardous substances
Category of activity	Pollution
Data units, max and min values	CHASE+ Status Assessment Class: dimensionless integer value from 1 to 5, corresponding to status 1: High, 2: Good, 3: Moderate, 4: Poor and 5: Bad
Category	Pressure
Date created	2018
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	2009-2016
Units in raster data	Dimensionless status class
Spatial extent and resolution	The original dataset covers Europe's seas with a grid resolution 20 km in coastal areas and 100 km in open seas. Top: 3906500 m, Left: 3905350 m, Bottom: 4733350 m, Right: 3474500 m
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035

Summary:
This data set is derived from a Europe-wide assessment of status with respect to contaminants, applying the CHASE+ assessment tool. The results of this assessment were published in May 2019 in EEA Report No 25/2018 "Contaminants in Europe's seas" doi:10.2800/511375.
https://www.eea.europa.eu/publications/contaminants-in-europes-seas
The original report presents the results of the CHASE+ status assessment made on a grid combining 100 km open sea grid cells and 20 km coastal grid cells. The original CHASE+ results have been "downscaled" to the 500 m ECOMAR grid.

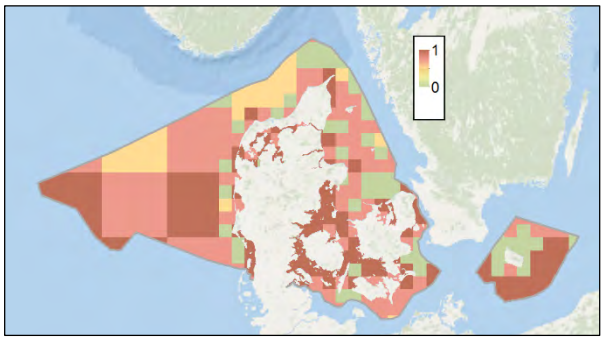
Lineage:
The CHASE+ assessment method is described in the above-mentioned EEA Report (No 25/2018). Briefly, within each grid cell, measured concentrations of different contaminants were compared with agreed threshold values to determine a Contamination ratio. The contamination ratio was aggregated within Biota, Sediment and Water matrices to give a Contamination Sum. The matrix having the "worst" (highest) Contamination Sum determines the overall status, which is classified as High, Good, Moderate, Poor or Bad, according the Contamination Sum.
Data in the original study for the North Sea / Baltic region were obtained from the DOME data portal of the International Council for the Exploration of the Sea (ICES), the European Environment Information and Observation Network (Eionet) and EMODnet Chemistry.
For ECOMAR, the CHASE+ classifications were to a numerical scale 1: High, 2: Good, 3: Moderate, 4: Poor and 5: Bad before downscaling from the EEA 100 km/20 km grid to the ECOMAR 500 m grid in ArcGIS. In the EEA assessment, grid cells having no observations were left empty. After downscaling, empty raster cells in the 500 m grid were filled using the ArcGIS raster "Expand" tool.
The CHASE assessment includes a classification of confidence in the assessment based on the availability of observations within each matrix. This is then converted into a numerical score.

Considerations for use in ECOMAR: None	
Recommendations for data improvement: None.	
Data authoring organization	NIVA Denmark
Data author contact	cjm@niva-dk.dk
Data source	Owner of the background data and models used for producing the data layer
Data source contact	Email address for the background data.
INSPIRE topic category	Oceans, Environment, Pollution
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Ocean dumping, chemical pollution, environmental impact
Maintenance	Unknown
Metadata date	2019-07-01
Metadata organization	NIVA Denmark
Metadata contact	cjm@niva-dk.dk

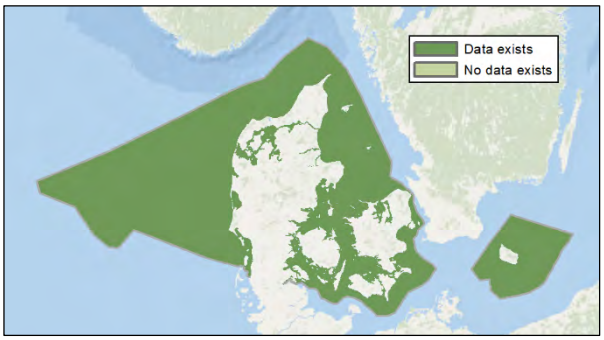
Assessment of chemical status (CHASE classes)



Estimated uncertainty



Data coverage



Estimated uncertainty: Score based on availability of measurements in water, sediment and biota.

Data coverage: Modelled area based on data collection within the Danish EEZ.

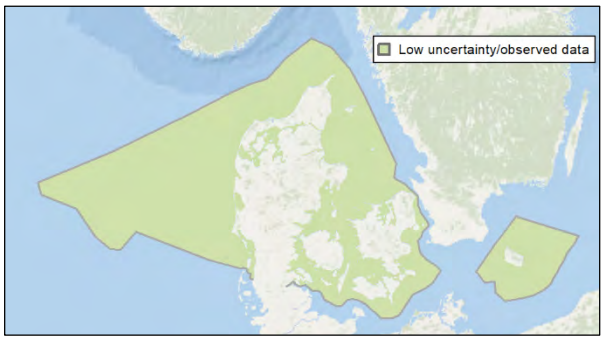
A2.2 Dumped chemical munitions

Data name	Dumped chemical munitions
Category of activity	Pollution
Data units, max and min values	Locations/presence-absence
Category	Pressure
Date created	2019-03-20
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	1945-1999
Units in raster data	Presence/absence
Spatial extent and resolution	1:100 000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.rio/3035
Summary: The data layer shows the presence of the known areas and dumpsites used for dumping of toxic munitions containing organic and inorganic toxins within the Danish EEZ. The dumping took place in coastal and offshore waters at the end of the second world war. Encounters with toxins are reported and marked as a location The original data is compiled for EMODnet as a shapefile with points and the areas are from HELCOM	
Lineage: The data was created using polygons of known dump sites areas and point locations for dumping sites and encounters. The encounters within the known areas and sites was not included. The datasets were combined into a single raster.	
Considerations for use in ECOMAR: The degree of accuracy of these dumping sites is very hard to estimate as there are yearly encounters every year	
Recommendations for data improvement: In general, a qualitative estimation of the toxins within the sediments would be beneficial. There are research studies that has studied this but it cannot at the moment be applied for the whole Danish EEZ.	
Data authoring organization	NIVA Denmark
Data author contact	Therese.Harvey@niva-dk.dk
Data source	EMODnet human activities http://www.emodnet-humanactivities.eu HELCOM Mapservice http://maps.helcom.fi/website/mapservice/
Data source contact	http://www.emodnet-humanactivities.eu helcom.data@helcom.fi
INSPIRE topic category	Oceans, Environment, Pollution
INSPIRE theme	Oceanographic geographical
GEMET keywords	Military activities, chemical pollution, environmental impact

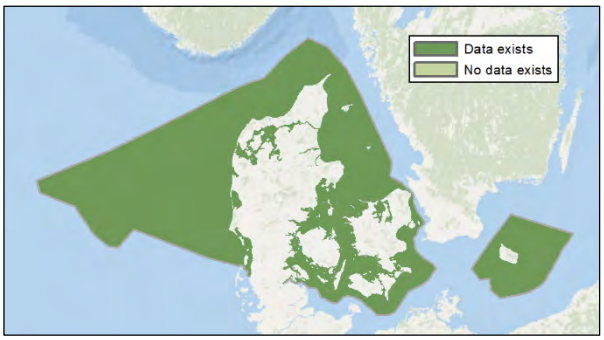
Maintenance	Unknown
Metadata date	2019-06-12
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

Presence of areas used for toxic munition dumping

Estimated uncertainty



Data coverage



Estimated uncertainty: Observed data within the Danish EEZ.
Data coverage: Data collection within the Danish EEZ.

A2.3 Oil spills

Data name	Oil spills
Category of activity	Pollution
Data units, max and min values	Occurrence of oil spills
Category	Pressure
Date created	2019-03-25
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	2011-2016
Units in raster data	Dimensionless
Spatial extent and resolution	1:100 000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035

Summary:
The data layer shows oil spills from ship accidents, accidents and illegal discharges. Data for the area of oil spills per grid cell is used for buffering the spatial effect.
The area of the detection of confirmed or observed as mineral oil was calculated using the Bonn Agreement Oil Appearance Code using the lower figure (BAOAC minimum) in m^3.

Lineage:
In HELCOM:
The pressure oil slicks and spills are a combination of the following datasets:
• Illegal oil discharges
• Polluting ship accidents

Illegal oil discharge data is based on airborne surveillance with remote sensing equipment in the Baltic Sea Area. The area of the detected spills in 2011–2016 was used to represent the pressure. For polluting ship accidents, the reported oil spill areas (m^2) in years 2011-2015 were used for the pressure.

The data layer shows the number of times an oil spill has been observed in each grid cell. The shape and extent of the original observed oil spills is not known. In each case the oil spill was approximated by a circle centered on the observed location of the oil spill and having the same area as reported. The number of oil spills occurring in each grid cell was then counted.

Data: HELCOM map service http://maps.helcom.fi/website/mapservice/index.html
Data from HELCOM 2011-2016.
Data from OSPAR 2016, includes both accidents and oil spills.
https://www.bonnagreement.org/publications

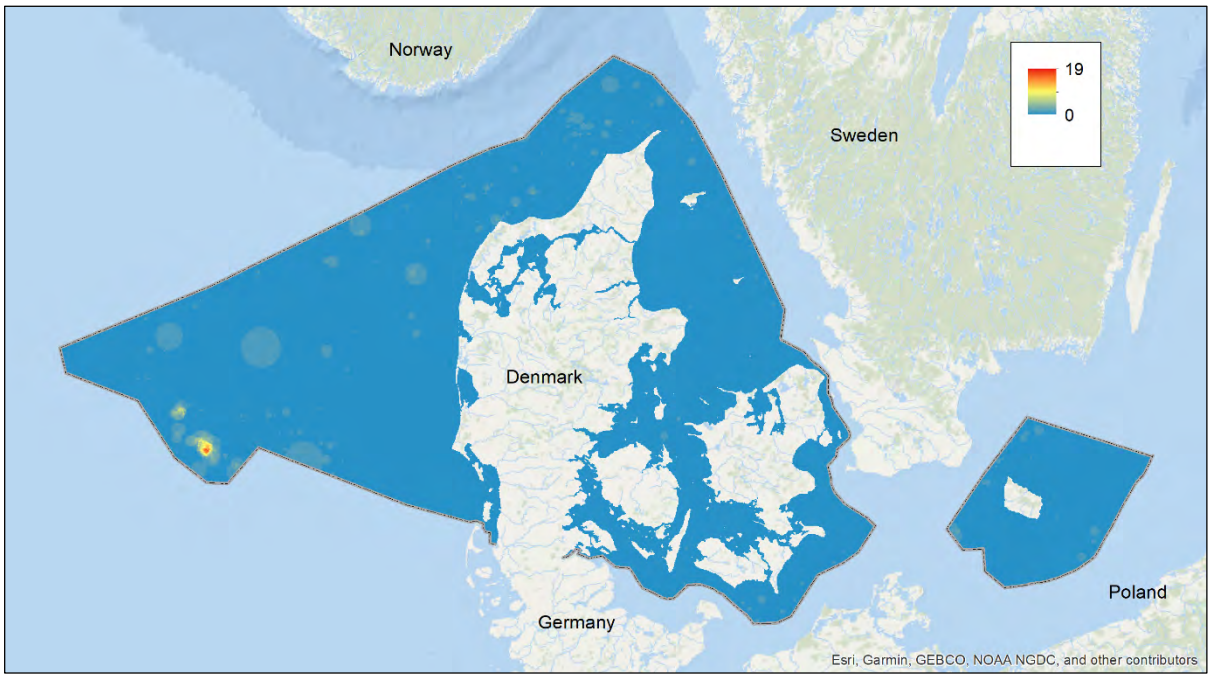
Considerations for use in ECOMAR: None

Recommendations for data improvement: None

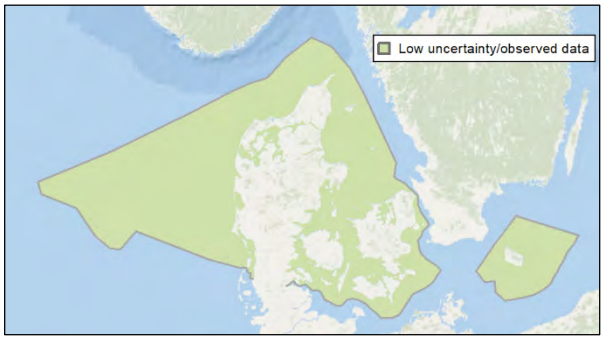
Data authoring organization	NIVA Denmark
Data author contact	Therese.Harvey@niva-dk.dk

Data source	OSPAR: North Sea data https://odims.ospar.org/odims_data_files/ HELCOM: Kattegat, Skagerrak and The Baltic Sea. http://maps.helcom.fi/website/mapservice/
Data source contact	OSPAR: Chris Moulton chris.moulton@ospar.org HELCOM: joni.kaitaranta@helcom.fi
INSPIRE topic category	Ocean, environment, pollution
INSPIRE theme	Energy
GEMET keywords	Pollution, oil
Maintenance	Not planned
Metadata date	2019-04-29
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

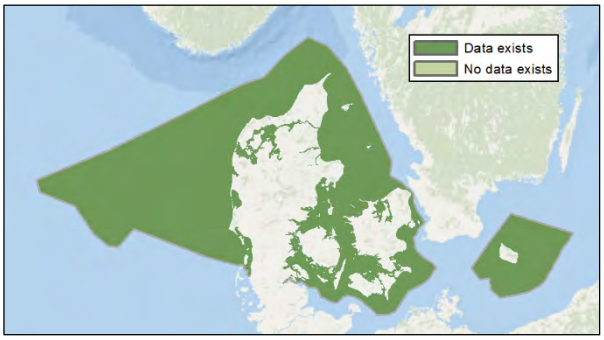
Number of oil spills per grid cell based on reporter locations and areas of the slicks



Estimated uncertainty



Data coverage



Estimated uncertainty: Observed data within the Danish EEZ.

Data coverage: Data collection within the Danish EEZ.

A3 Marine Litter

Data name	Plastic and other types of litter (weight)
Category of activity	Pollution
Data units, max and min values	1) Weight of total plastic litter per km^2 Min = 0.11 Kg- Max = 78.05 Kg 2) Weight of total non-plastic litter per km^2 Min = 0.02 Kg- Max = 438.19 kg
Category	Pressure
Date created	2019-04-01
Data type	Dataset
Status	Completed
Data format	Raster geoTIFF layer
Temporal period	2011- 2018
Units	Kg / km^2
Spatial extent and resolution	1:100 000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035

Summary:
The two datasets reflect the weight of plastic and other types of litter per km^2 in an ICES rectangle, it does not include microplastic. Examples of items found are: sanitary litter, metal, rubber, glass, natural litter and miscellaneous litter. Data is collected in IBTS and BITS surveys, where a number of stations are trawled in a standardized procedure, and where, in addition to fish caught, all litter caught in the trawl is collected and measured. The dataset used in ECOMAR is a merged and averaged data layer based on the normalized values from each group.

Lineage:
The data was collected from the following two surveys:

1. ICES International Bottom Trawl Survey (IBTS), where the purpose is to estimate abundance of commercial and non-commercial fish species by means of bottom trawling and to collect otoliths of commercial species to assess abundance by age, in particular for the recruiting year classes in the North Sea, Skagerrak and Kattegat. It is a trawl survey using GOV-trawl.
Two surveys are conducted each year:
   a. one in 1st quarter, which include 80 planned plankton hauls and 39 planned fish hauls for a total of 18 days at sea.
   b. second in 3rd quarter, which include 50 planned fish hauls for a total of 18 days at sea.

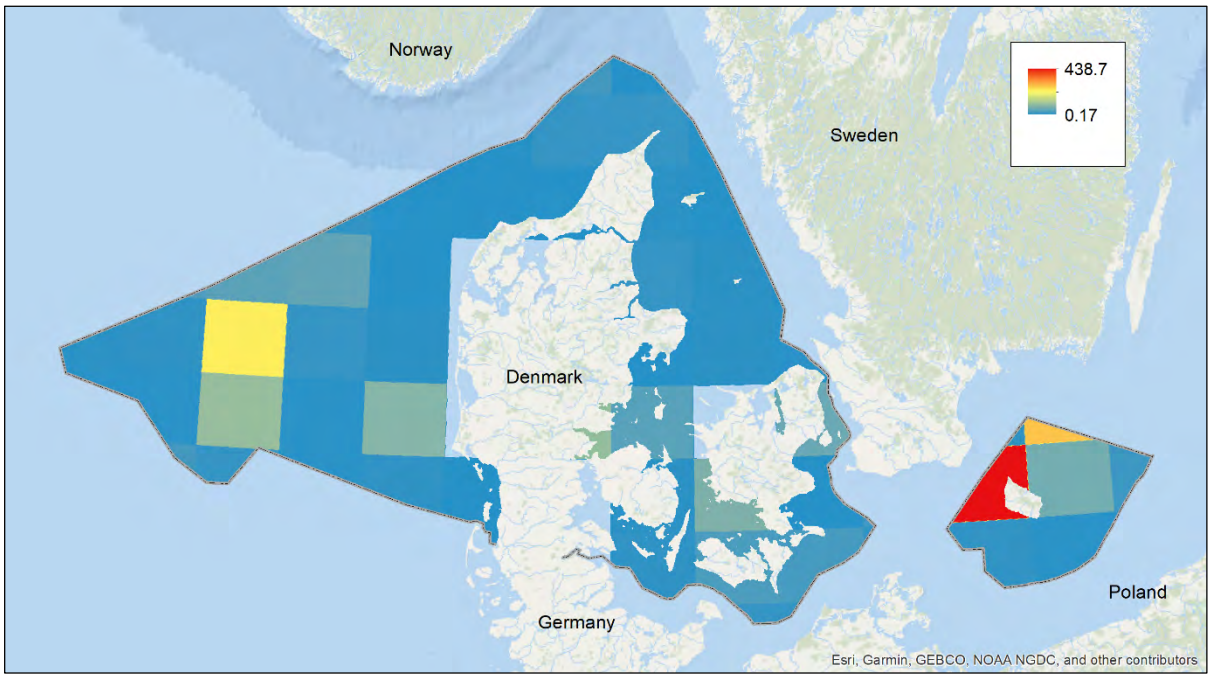
2. KASU I and II (BITS 1st & 4th quarter), where the purpose of the survey is to estimate abundance of commercial (mainly cod, flounder and plaice) and non-commercial fish species by means of bottom trawling and to collect otoliths of commercial species to assess abundance by age, in particular for the recruiting year classes in the Baltic Sea. It is a trawl survey using TV3-trawl with a 20 mm cod-end. KASU I and II both include 49 planned fish hauls for a total of 20 days at sea each. Both surveys are coordinated by the ICES International Bottom Trawl Survey Working Group.

Survey data was downloaded from DATRAS Litter Exchange Data (BITS and PT-IBTS). Using R, the litter data was merged with haul data. Swept area is calculated using the trawled distance x width of the gear used (GOV, TVL and TVS).

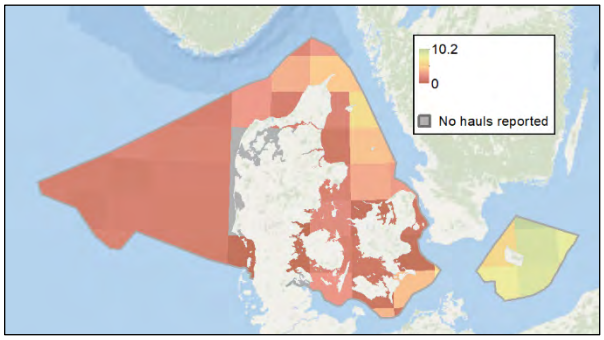
Missing data is calculated in the following fashion: - Where distance is missing, it is calculated using the distance between the start and end point of the haul. Some hauls were unrealistic long (>5 km). These were set to the median of trawl distances for the corresponding survey. - Where gear width was missing, it was calculated using the following relationship between depth and gear width: ○ GOV: 16.556659+0.040770 x Depth ○ TVL: 26.474953+0.024016 x Depth For TVS, too little data was available to make a feasible relationship, so missing data was set to 17 m. Litter is recorded as per item or per weight or both. Hauls where only weight was recorded was omitted from the data. In ECOMAR the weight data has been used. Data for each ICES rectangle was rasterized to a 500 m x 500 m grid (using the midpoint of the grid to establish affiliation) in Danish EEZ. Estimated uncertainty is given as total area swept per ices rectangle per year. Rectangles with is given a data coverage and rectangles without hauls is regarded as no data.
Considerations for use in ECOMAR: The survey based data on litter have been rescaled from ICES rectangles (varying from 3270 km^2 to 3628 km^2 within the Danish EEZ) to the 0.25 km^2 grid requested for the ECOMAR project.
Recommendations for data improvement: Combined estimate of weight/item/km^2

Data authoring organization	DTU Aqua
Data author contact	jsv@aqua.dtu.dk
Data source	International Council for the Exploration of the Sea (ICES).
Data source contact	accessions@ices.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Plastic, litter
GEMET keywords	Plastic, litter
Maintenance	Not planned
Metadata date	2019-04-03
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

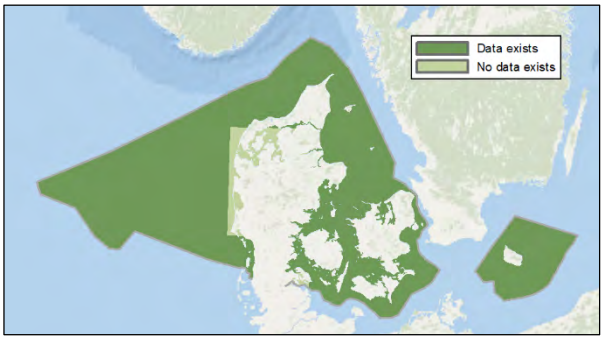
Normalized averaged marine litter (plastic and all other things) kg/km^2



Estimated uncertainty



Data coverage



Estimated uncertainty: Total area swept per ICES rectangle/year.

Data coverage: ICES rectangles with or without hauls.

A4 Selective extraction of species

A4.1 Commercial fishing effort by gear group

<table>
<tr><td>Data name</td><td>Fishing effort by gear group</td></tr>
<tr><td>Category of activity</td><td>Selective extraction of species</td></tr>
<tr><td>Data units, max and min values</td><td>Hours per year
<table>
<tr><th>Gear group</th><th>Minimum value</th><th>Maximum value</th></tr>
<tr><td>Pelagic trawl</td><td>0</td><td>3.53</td></tr>
<tr><td>Mobile bottom contacting gears, for industrial purposes (small mesh sizes)</td><td>0</td><td>3.96</td></tr>
<tr><td>Mobile bottom contacting gears, for human consumption (large mesh sizes)</td><td>0</td><td>18.69</td></tr>
<tr><td>Longlines</td><td>0</td><td>0.62</td></tr>
<tr><td>Set gillnets</td><td>0</td><td>2.04</td></tr>
</table></td></tr>
<tr><td>Category</td><td>Pressure</td></tr>
<tr><td>Date created</td><td>2019-03-29</td></tr>
<tr><td>Data type</td><td>Data series</td></tr>
<tr><td>Status</td><td>Completed</td></tr>
<tr><td>Data format</td><td>32-bit floating point Tagged Images File Format (.tif)</td></tr>
<tr><td>Temporal period</td><td>Average hours in the period 2015-2017</td></tr>
<tr><td>Units in raster data</td><td>Hours</td></tr>
<tr><td>Spatial extent and resolution</td><td>Danish EEZ
Original resolution of data: 0.05 degrees grid. Values have been distributed evenly out on 500 m raster</td></tr>
<tr><td>Coordinate reference system</td><td>European Terrestrial Reference System 1989 – Lambert Azimuthal Equal Area http://epsg.io/3035</td></tr>
<tr><td colspan="2">Summary:
The data series show international fishing effort in hours by the gear groups pelagic trawl, mobile bottom contacting gears for industrial purposes, mobile bottom contacting gears for human consumption, longlines and set gillnets as a yearly average based on the period 2015-2017. In the ECOMAR context, it is used as a pressure layer.
VMS is mandatory for vessels larger than 12 m, so for those vessels, all fishing activity is represented in the data layers. An indicator is given in the uncertainty layer as the percentage effort from the fishing logbooks (vessels larger than 10 m or larger than 8 m in the Baltic) that is covered in the VMS data.</td></tr>
<tr><td colspan="2">Lineage:
The data comes from an annual ICES VMS logbook data call that requests VMS based data on fishing effort and landings by c-square (0.05 degrees), year, month, gear and métier. Logbook based data on fishing effort and landings by ICES rectangle (0.5 degrees x 1 degree), year, month, gear, métier and an indication on if the effort is covered with VMS data. For this project, permission have been given from all countries fishing within the Danish EEZ (Denmark, Sweden, Norway, Germany, Poland, Lithuania, Latvia, Estonia, Finland, UK, The Netherlands, Belgium and France) to use data from the ICES data call within the Danish EEZ to use the data for the ECOMAR project.
VMS and logbook data within the Danish EEZ have been extracted by ICES. To classify the data into the requested gear groups (pelagic trawl, mobile bottom contacting gears for industrial purposes, mobile bottom contacting gears for human consumption, longlines and set gillnets) a list of métiers</td></tr>
</table>

for logbook and VMS data was extracted, and the métiers classified into the gear groups. Data were aggregated by year and gear group and included information on fishing effort and landings.
The VMS based data were split by gear group, and the fishing effort (hours) and landings (ton) by c-square (0.05 degrees) were distributed evenly out on the ECOMAR raster grid using the ratio between the 500*500 m^2 raster cells and the area of the c-square. A yearly average by raster cell was made for the period 2015-2017.
To give an indicator on uncertainty, the logbook-based data were split by gear group and the fishing effort (days at sea) and landings (ton) by ICES rectangle (0.05*1 degrees) are categorized as VMS_enabled, Yes or No. The percentage coverage with VMS was calculated from the days at sea and ton landings recorded in logbooks by ICES rectangles, and the percentage values distributed evenly out on the 500 m raster, and a yearly average by raster cell was made for the period 2015-2017. Thus, the uncertainty indicates the part of the fishery not represented by the VMS data.
The data coverage layer has been set to 0 (data exists) for the whole Danish EEZ, as data exists if there is a fishery.

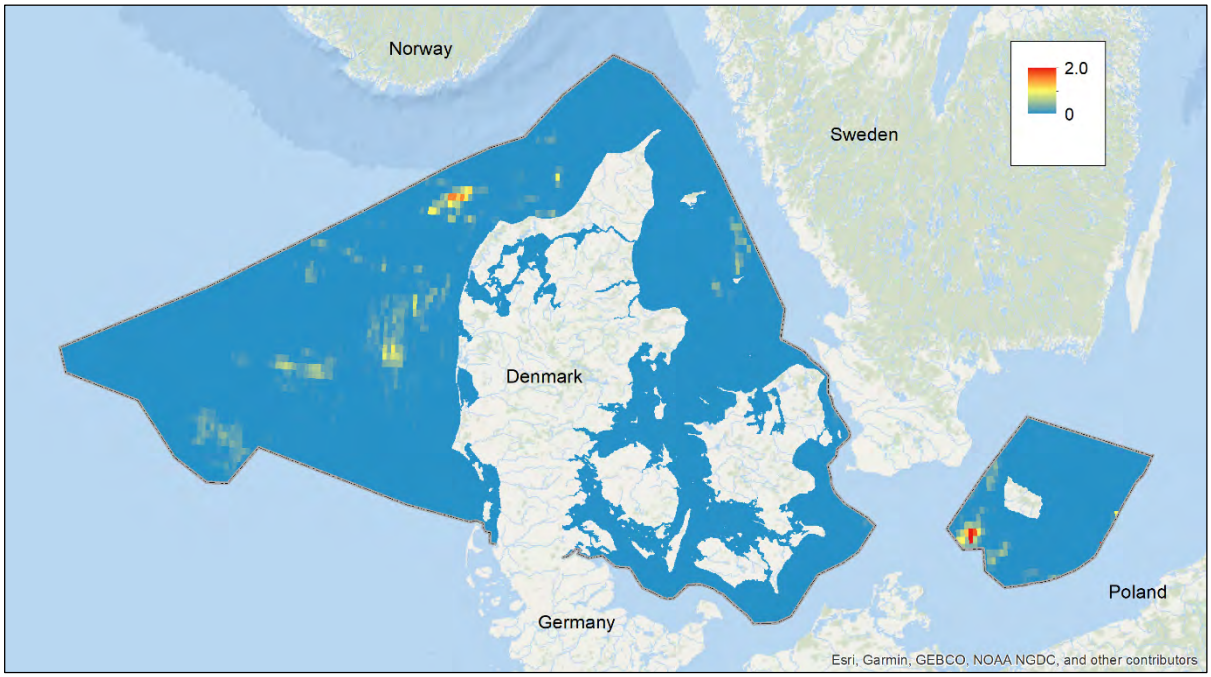
Considerations for use in ECOMAR:
The VMS based data on fishing hours have been rescaled from a 0.05 degrees grid (varying from 16 to 18 km^2 within the Danish EEZ) to the 0.25 km^2 grid requested for the ECOMAR project.
The logbook based data on VMS coverage (the uncertainty layer) have been rescaled from the ICES rectangles (0.5*1 degrees) to the 0.25 km^2 grid requested for the ECOMAR project.
Data from the smallest vessels that does not have logbooks (<10 m, <8 m in the Baltic) are not included.
The data submitted by Denmark for the ICES data call have been filtered to exclude values when there are less than three vessels within the aggregation level.

Recommendations for data improvement: None

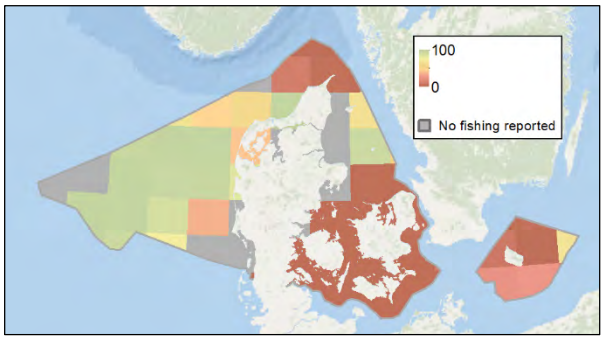
Data authoring organization	DTU Aqua
Data author contact	jsv@aqua.dtu.dk
Data source	International Council for the Exploration of the Sea (ICES).
Data source contact	accessions@ices.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Fishing
GEMET keywords	Fishing, open sea fishing
Maintenance	Not planned
Metadata date	2019-03-29
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

A4.1.1 Set gillnet

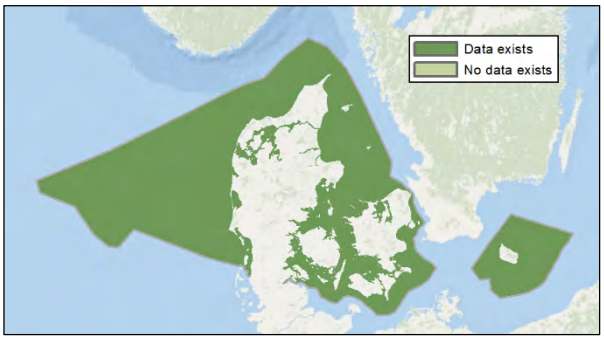
Set gillnet based on VMS data (fishing h/year)



Estimated uncertainty



Data coverage

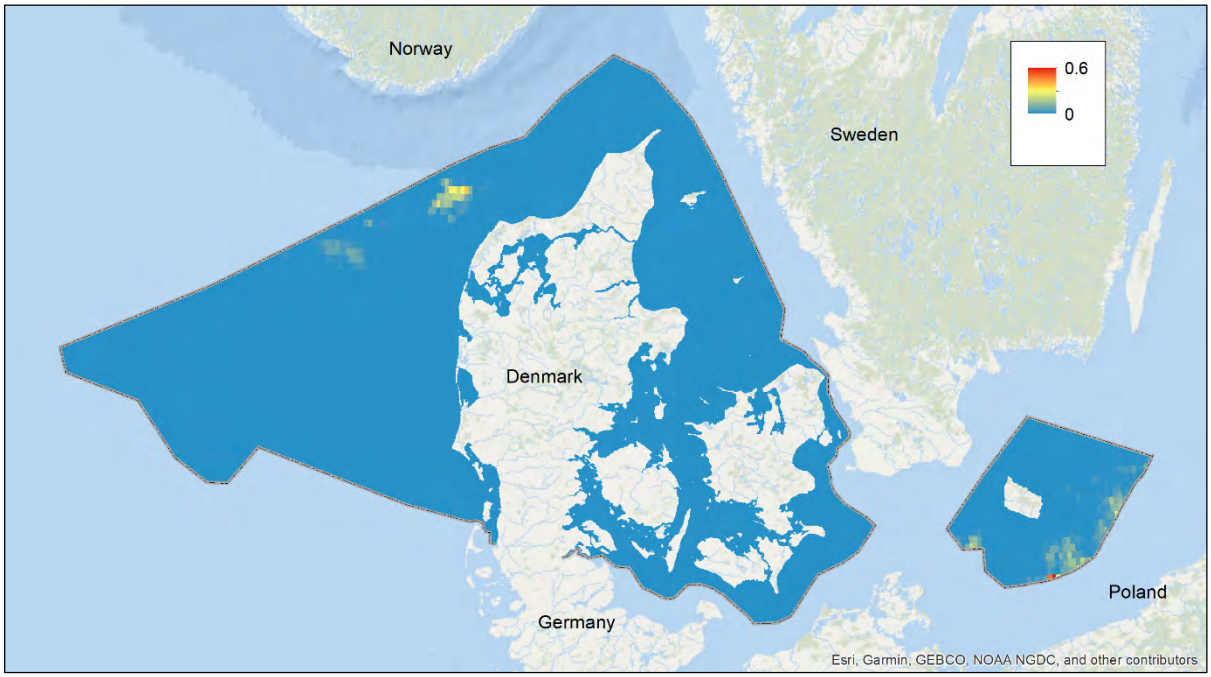


Estimated uncertainty: Percentage effort (days at sea) covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas where no fishing by the specific gear type is reported and has a higher uncertainty.

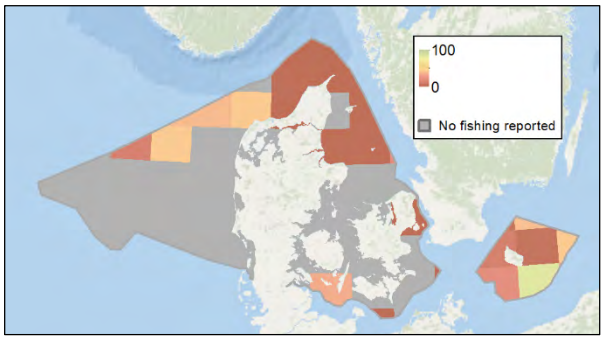
Data coverage: Data collection within the Danish EEZ.

A4.1.2 Longlines

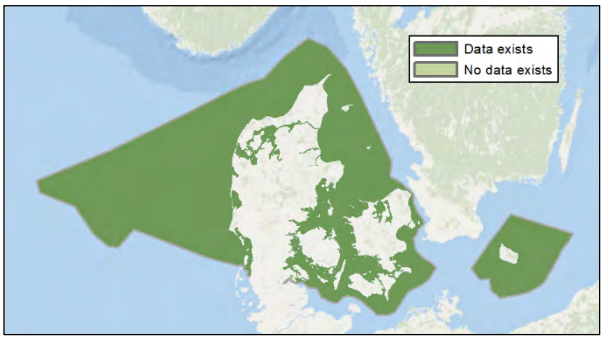
Longlines based on VMS data (fishing h/year)



Estimated uncertainty



Data coverage

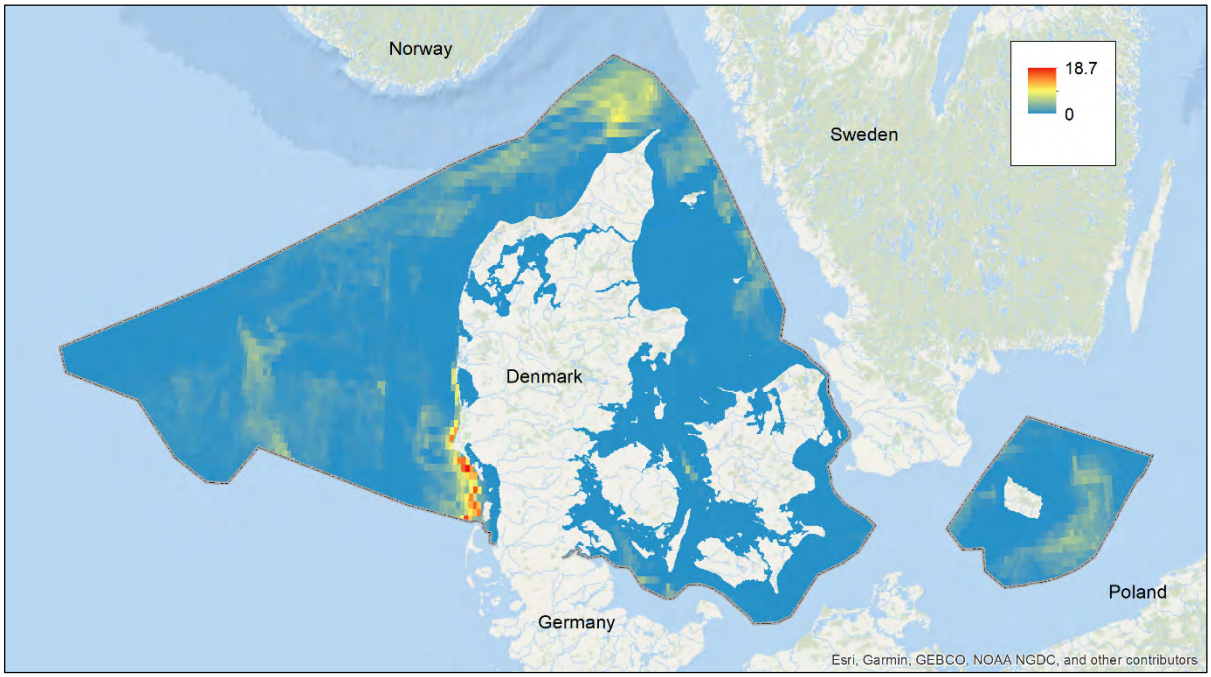


Estimated uncertainty: Percentage effort (days at sea) covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas where no fishing by the specific gear type is reported and has a higher uncertainty.

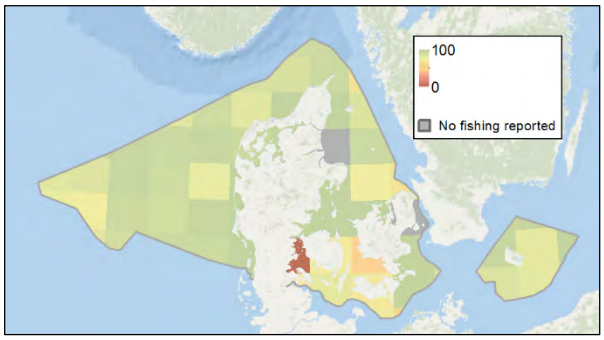
Data coverage: Data collection within the Danish EEZ.

A4.1.3 Mobile contacting gears (large mesh sizes)

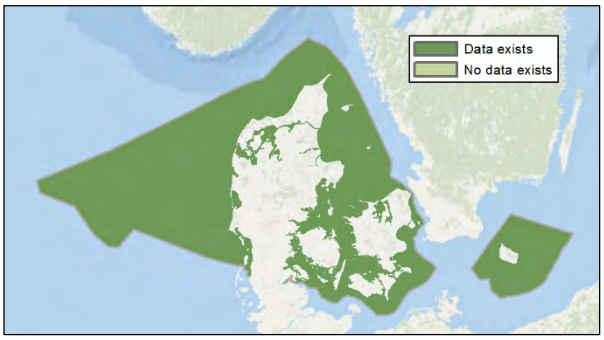
Mobile bottom contacting gears for human consumption based on VMS data (fishing h/year)



Estimated uncertainty



Data coverage

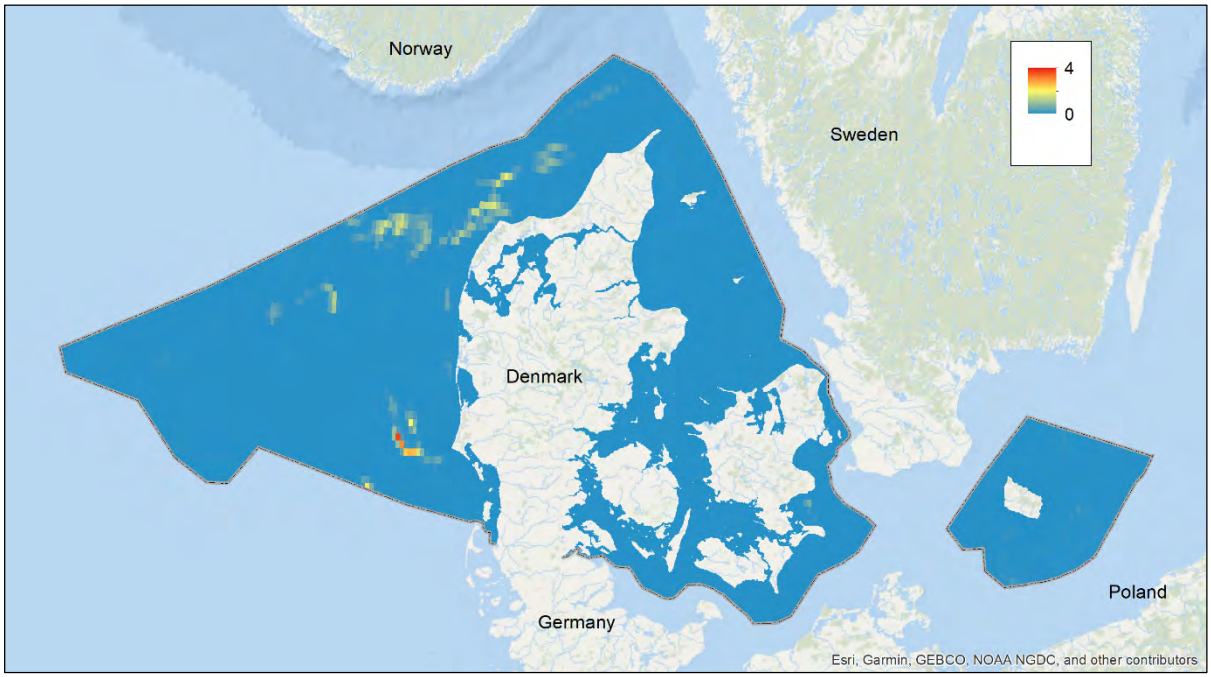


Estimated uncertainty: Percentage effort (days at sea) covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas where no fishing by the specific gear type is reported and has a higher uncertainty.

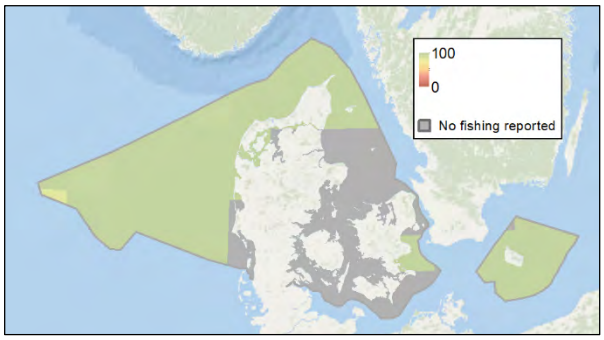
Data coverage: Data collection within the Danish EEZ.

A4.1.4 Mobile contacting gears (small mesh sizes)

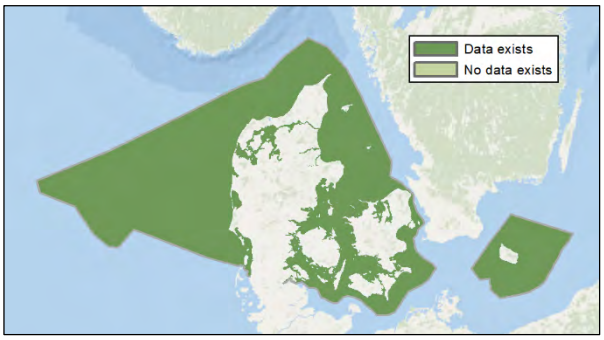
Mobile bottom contacting gears for industry purposes based on VMS data (fishing h/year)



Estimated uncertainty



Data coverage



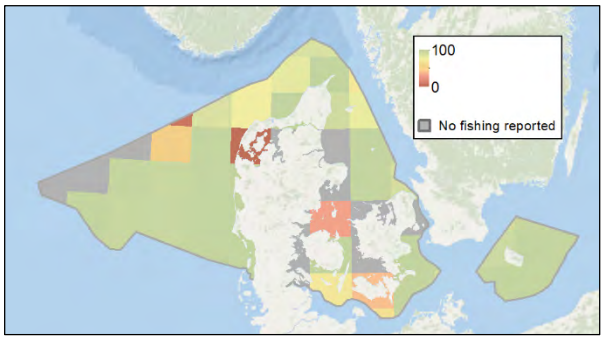
Estimated uncertainty: Percentage effort (days at sea) covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas where no fishing by the specific gear type is reported and has a higher uncertainty.

Data coverage: Data collection within the Danish EEZ.

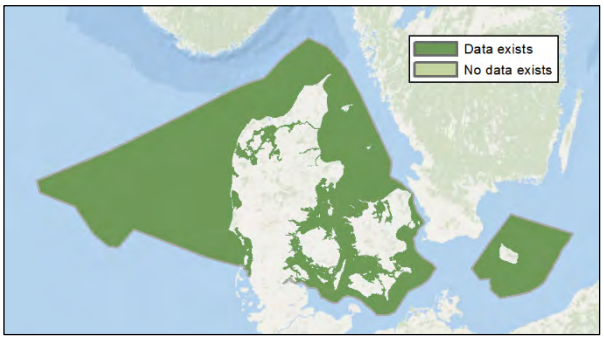
A4.1.5 Pelagic trawl

Pelagic gears based on VMS data (fishing h/year)

Estimated uncertainty



Data coverage



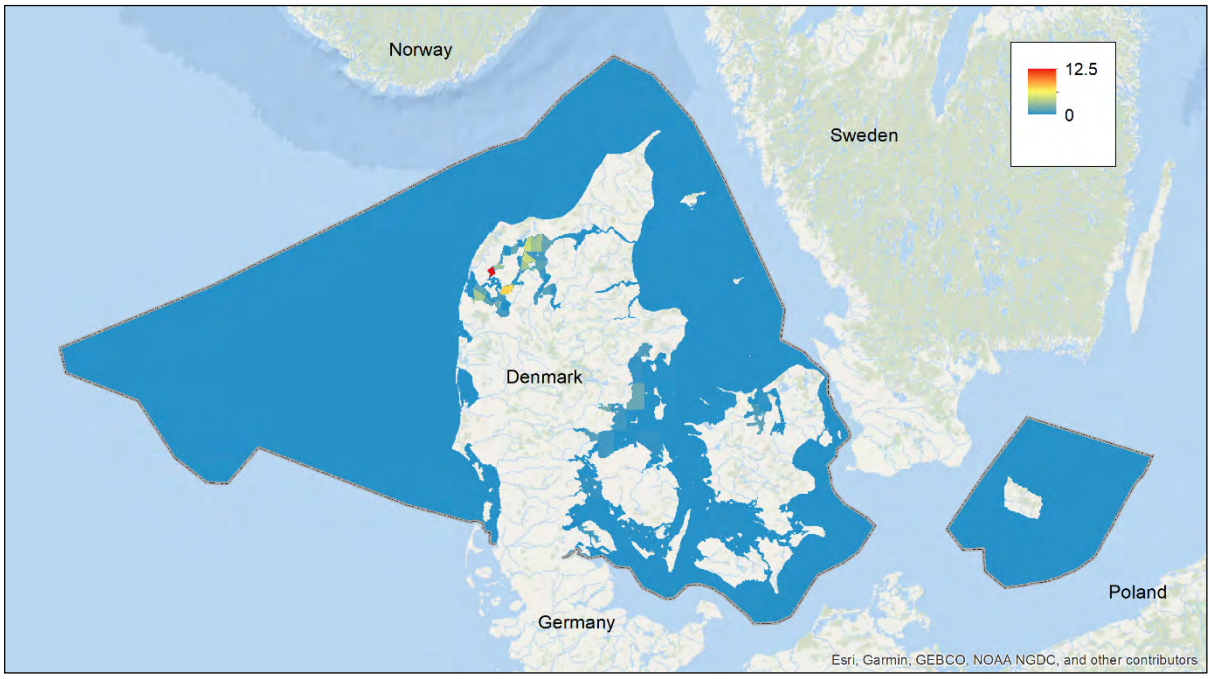
Estimated uncertainty: Percentage effort (days at sea) covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas where no fishing by the specific gear type is reported and has a higher uncertainty.

Data coverage: Data collection within the Danish EEZ.

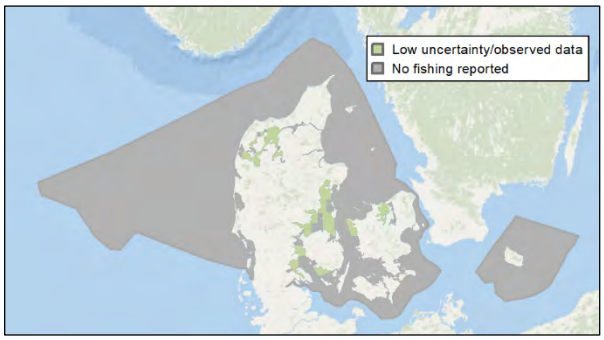
A4.1.6 Mussel dredging

Data name	Mussel dredging
Category of activity	Selective extraction of species
Data units, max and min values	Fishing days km^{-2} per year Min=0, Max=12.51
Category	Pressure
Date created	2019-03-28
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format (.tif)
Temporal period	2015-2017
Units	Fishing days km^{-2}
Spatial extent and resolution	Mussel production area
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The dataset shows the number of fishing days per km^2, per year per mussel production area during the period 2015-2017.	
Lineage: The number of fishing days per mussel production area has been extracted from the Danish DFAD database (combination of logbook and sales notes data) for the years 2015-2017. Days with more than 0 kg landings have been included. The data have been merged with a shapefile containing the polygons of mussel production areas and days divided with the area of the production area. The number of fishing days per mussel production area is used within ECOMAR. The fishing days per km^2 have been distributed evenly out on the 500*500 m grid used for the ECOMAR project.	
Considerations for use in ECOMAR: The data have been distributed evenly out on the mussel production area, but dredging is not taking place in the whole production area.	
Recommendations for data improvement: None	
Data authoring organization	DTU Aqua
Data author contact	jsv@aqua.dtu.dk
Data source	Danish Fisheries Agency
Data source contact	jsv@aqua.dtu.dk
INSPIRE topic category	Oceans, Biota, Environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Marine ecosystem, marine biota
Maintenance	Not planned
Metadata date	2019-03-28
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

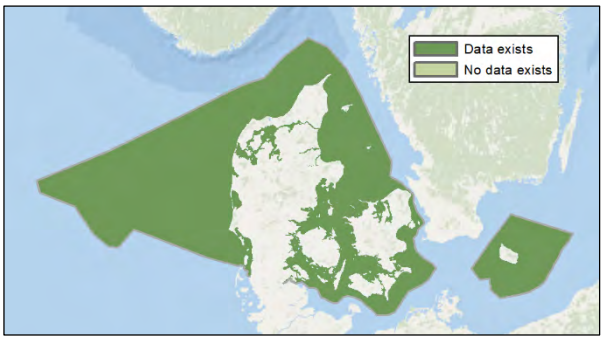
Mussel production area (fishing days/km^2 /year)



Estimated uncertainty



Data coverage



Estimated uncertainty: Observed data within mussel production areas, no observed data outside mussel production areas.

Data coverage: Data collection within the Danish EEZ.

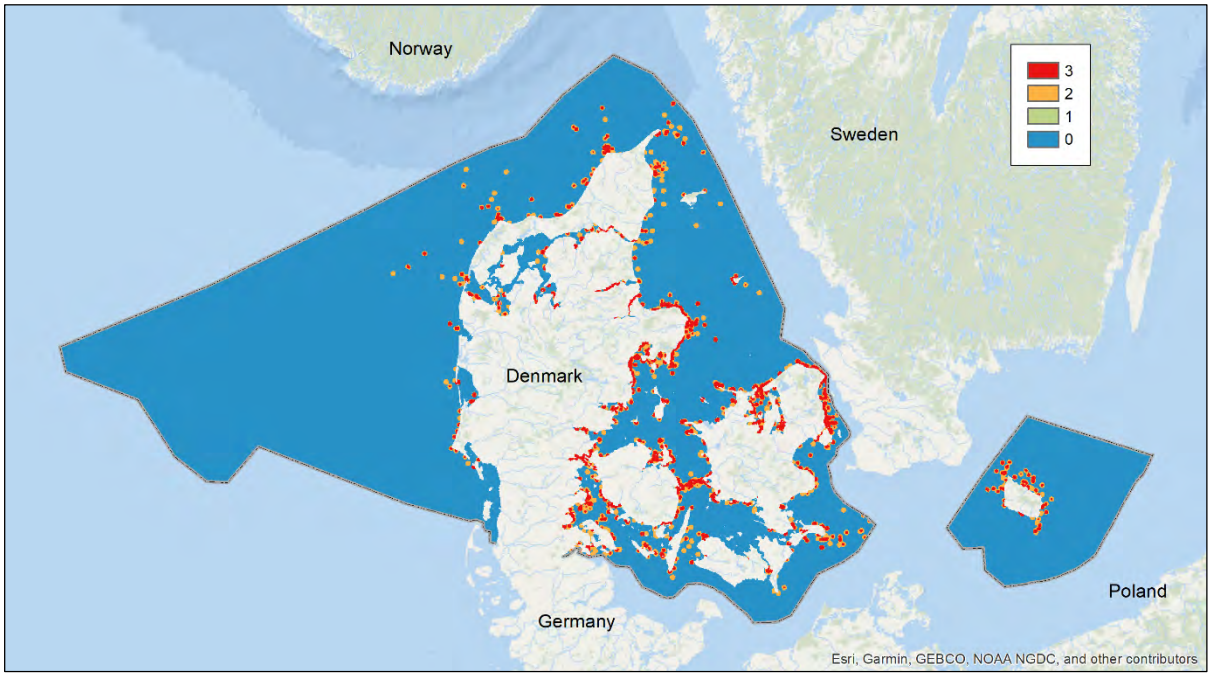
A4.2 Recreational fishing and hunting

A4.2.1 Recreational fishing

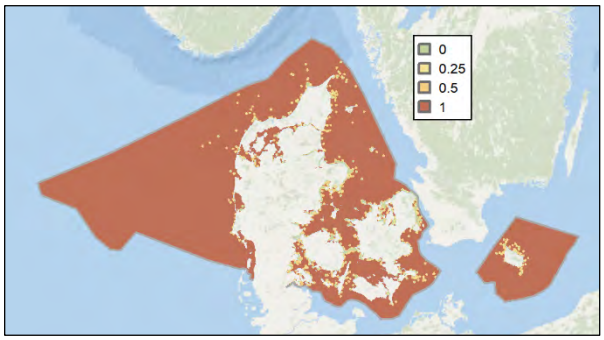
Data name	Recreational fishing
Category of activity	Selective extraction of species
Data units, max and min values	3 levels (1-3)
Category	Pressure
Date created	2019-05-13
Data type	Dataset
Status	Completed
Data format	Shp. File (point data)
Temporal period	2015-2016
Spatial extent and resolution	Top: 3906250 m, Left: 3901250 m, Right: 4733250 m, Bottom: 3474750 m
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The data shows a surface map over recreational fishing places in Danish waters according to the density of places and number of visits to each place. Multiple types of fishing are included, see the table. The map is a model output (kernel density surface) based on combined data from a crowdsourced survey, a representative panel survey, and finally, data from DTU aqua on tour boats in Øresund. Visit frequency (number of visits per year) is the unit of analysis for the two surveys. 1350 mapped places are included in the model from the crowdsourced survey (with Danish categories), and 230 mapped places from the panel survey.	
Lineage: A kernel density model output (500 m cell size, 2000 m search criteria) on the stated visit frequency to places mapped by users. Reclassified outputs (quantile distribution) summarized into a single data layer. Final 3 level classification (1=low, 2=medium, 3=high) by quantile distribution. See www.havfriluftsliv.dk and Kaae et al. (2018) for further information. Estimated uncertainty is categorical, based on the intensity classes, where the most intense class (#3) is assumed to have a lower uncertainty and given the value 0, class 2 is given the value of 0.25, class 1 a value of 0.5 and the class with no recorded data, class 0 is assumed to have a rather high uncertainty and is thus given a value of 1.	
Limitations for use in ECOMAR: A possible limitation of the data is the crowdsourced sampling which might be might be oversampled. However, the map output is validated by external data to some extent.	
Recommendations for data improvement: None	
Data authoring organization	University of Copenhagen, Department of Geosciences and Natural Resource Management (IGN), Section of Landscape Architecture and Planning, Rolighedsvej 23, 1958 Frederiksberg C
Data author contact	asol@ign.ku.dk
Data source	KU, IGN
Data source contact	asol@ign.ku.dk, bck@ign.ku.dk
INSPIRE topic category	Oceanographic geographical features

INSPIRE theme	Oceans, environment
GEMET keywords	Fishing, environmental impact
Maintenance	Not planned
Metadata date	2019-04-03
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

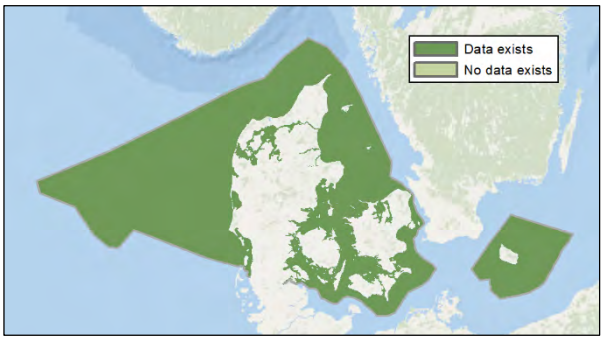
Intensity classes of recreational fishing



Estimated uncertainty



Data coverage



Estimated uncertainty: Estimated uncertainty is categorical and based on the intensity classes.

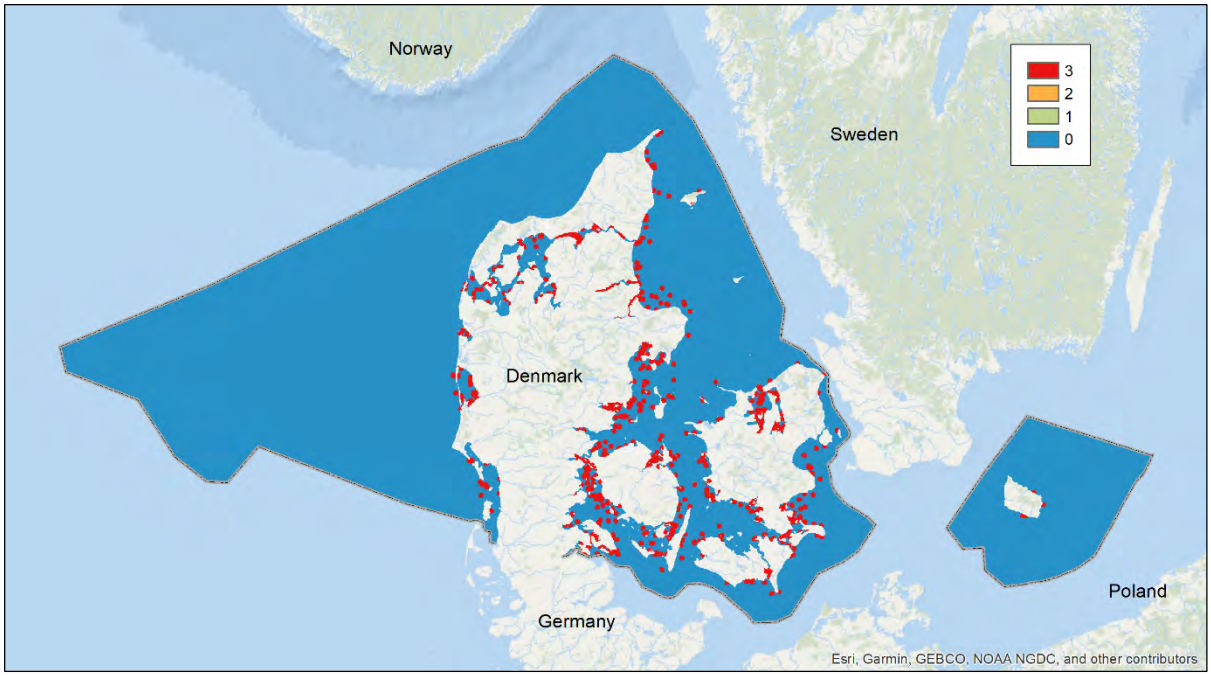
Data coverage: Data collection within the Danish EEZ.

A4.2.2 Bird hunting

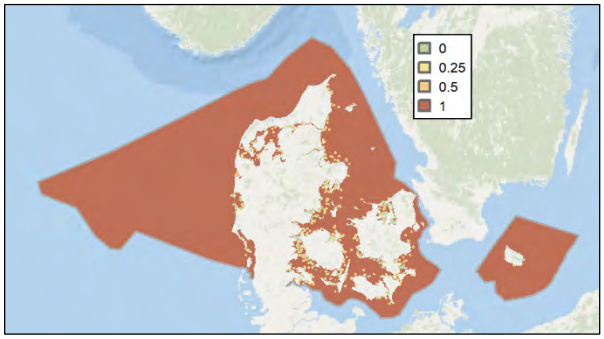
Data name	Marine hunting places, birds
Category of activity	Selective extraction of species
Data units, max and min values	Normalized data between 0-1
Category	Pressure
Date created	2019-04-29
Data type	Dataset
Status	Completed
Data format	Shape File (point data)
Temporal period	2015-2016
Spatial extent and resolution	Top: 3906250 m, Left: 3901250 m, Right: 4733250 m, Bottom: 3474750 m
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The data shows a surface map over recreational hunting places in Danish waters according to the density of places and number of visits to each place. The hunting is focused on water birds. The map is a model output (kernel density surface) based on data from a crowdsourced survey with dedicated marine recreation users. Visit frequency (number of visits per year) is the unit of analysis. A total of 875 mapped places are included in the model (mapped by 313 respondents). The map output is externally validated by hunting statistics summarized by municipalities (vildtudbyttestatistik, http://fauna.au.dk/jagt-og-vildtforvaltning/vildtudbytte/) and the 783 locations in Vingeundersøgelsen (http://fauna.au.dk/fileadmin/bioscience/Videnudveksling/Vingeundersoegelsen/Data_2016/Saeson_2016-2017.pdf).	
Lineage: A kernel density model output (500 m cell size, 2000 m search criteria) on the stated visit frequency to 875 places mapped by hunters (n=313). The final values are normalized on a scale from 0-1. See www.havfriluftsliv.dk and Kaae et al. (2018) for further information. Kaae, B. C., A.S. Olafsson and H. Draux (2018). Blåt friluftsliv i Danmark, IGN Report. February 2018, Department of Geosciences and Natural Resource Management, University of Copenhagen, 169 pp. Estimated uncertainty is categorical, based on the intensity classes, where the most intense class (#3) is assumed to have a lower uncertainty and given the value 0, class 2 is given the value of 0.25, class 1 a value of 0.5 and the class with no recorded data, class 0 is assumed to have a rather high uncertainty and is thus given a value of 1.	
Limitations for use in ECOMAR: A possible limitation of the data is the crowdsourced sampling which might be oversampled. However, the map output is validated by external data to some extent.	
Recommendations for data improvement: None	
Data authoring organization	University of Copenhagen, Department of Geosciences and Natural Resource Management (IGN), Section of Landscape Architecture and Planning, Rolighedsvej 23, 1958 Frederiksberg C
Data author contact	asol@ign.ku.dk

Data source	KU, IGN
Data source contact	asol@ign.ku.dk, bck@ign.ku.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Hunting, Environmental impact
Maintenance	Not planned
Metadata date	2019-04-03
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

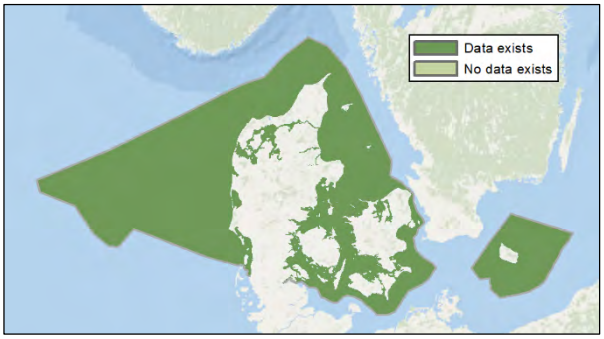
Intensity classes of the use of bird hunting sites



Estimated uncertainty



Data coverage



Estimated uncertainty: Estimated uncertainty is categorical and based on the intensity classes.

Data coverage: Data collection within the Danish EEZ.

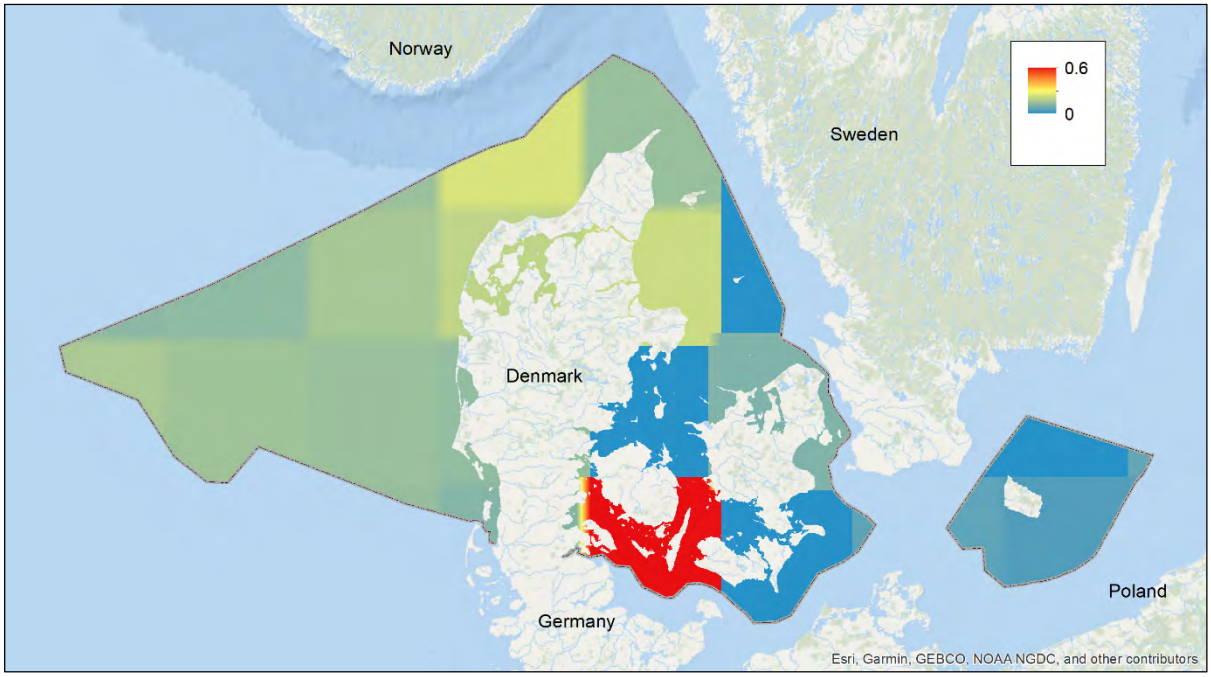
A5 Climate change

A5.1 Sea surface anomalies

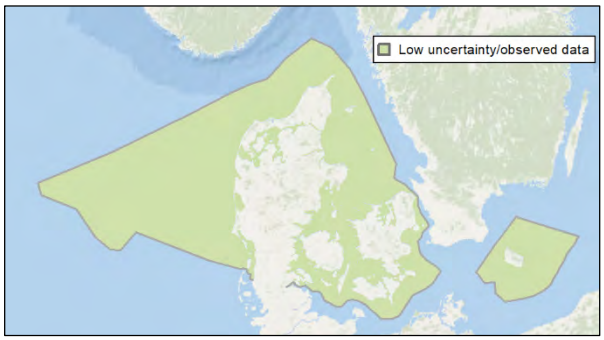
Data name	Sea surface temperature anomalies
Category of activity	Climate change
Data units, max and min values	Temperature anomaly
Category	Pressure
Date created	2019-03-25
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	1865-2015
Units in raster data	SST anomalies in °C
Spatial extent and resolution	1:100 000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: This data layer is based on time series of annual average sea surface temperature (°C), referenced to the average temperature, between 1993 and 2012, in the global ocean and in each of the European seas.	
Lineage: The data was produced by the European Environmental Agency and is based on the CMEMS 'High Resolution L4 Sea Surface Temperature-Reprocessed' product. The spatial resolution from the satellite images used is 0.05° x 0.05° (approx 5km x 5 km) grid cells and can therefore appear quite coarse on a national level. For details see; https://www.eea.europa.eu/data-and-maps/indicators/sea-surface-temperature-2/assessment	
Considerations for use in ECOMAR: None	
Recommendations for data improvement: Use of higher resolution data on a local scale instead of European data.	
Data authoring organization	NIVA Denmark
Data author contact	Therese.Harvey@niva-dk.dk
Data source	European Environmental Agency *Ref: Climate change, impacts and vulnerability in Europe 2016, An indicator-based report, No1 2017* Mediterranean Sea: High Resolution L4 Sea Surface Temperature Reprocessed provided by Copernicus Marine Environment Monitoring Service HadISST1: Global sea ice and Sea Surface Temperature analyses provided by Met Office Hadley Centre observations datasets
Data source contact	https://www.eea.europa.eu/contact-us
INSPIRE topic category	Oceans, Environment
INSPIRE theme	Oceanographic geographical features

GEMET keywords	Global temperature increase, climate change impact
Maintenance	Not planned
Metadata date	2019-04-29
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

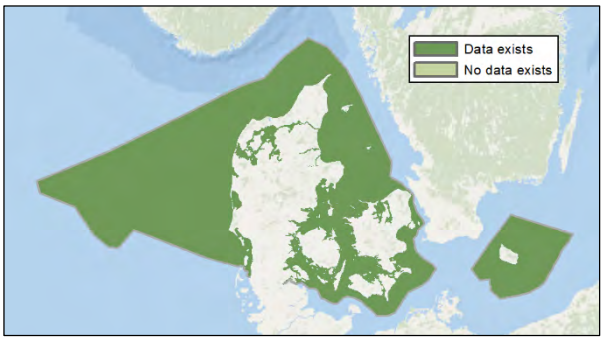
Sea surface temperature anomalies (°C)



Estimated uncertainty



Data coverage



Estimated uncertainty: Observed data within the Danish EEZ.

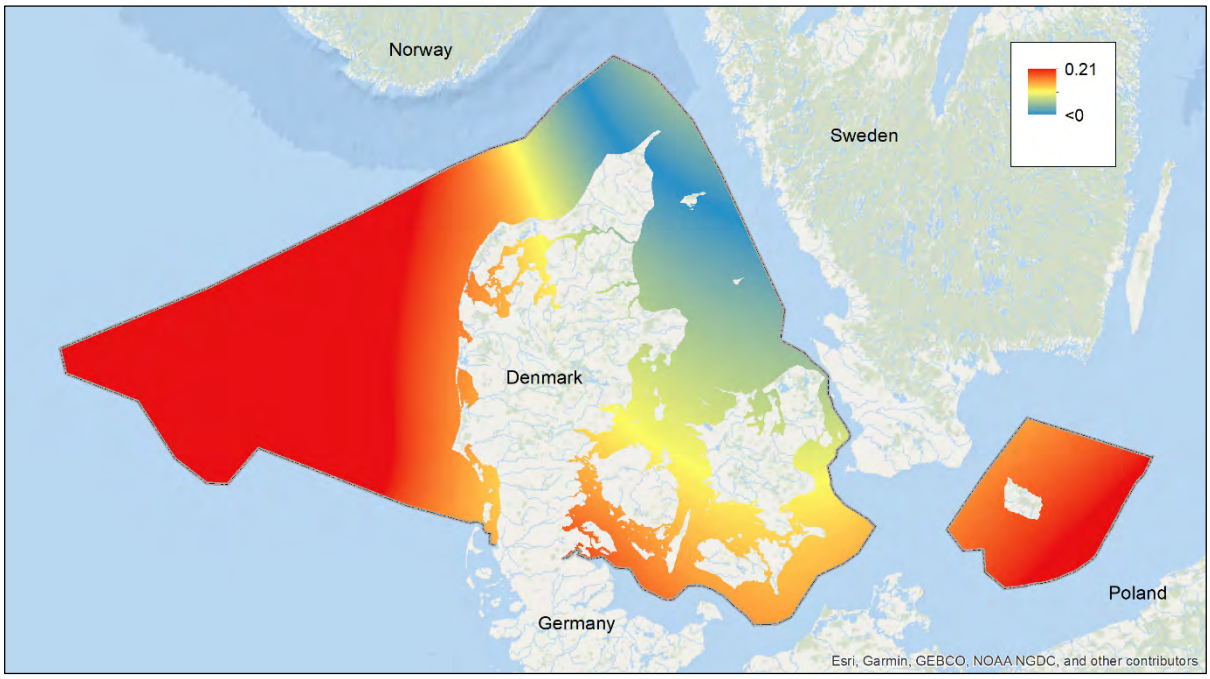
Data coverage: Data collection within the Danish EEZ.

A5.2 Sea level rise trend

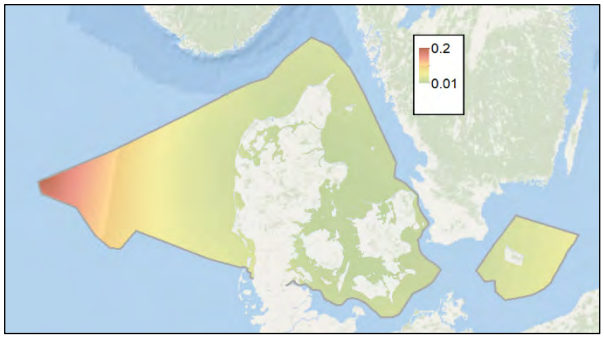
Data name	Sea level rise trend
Group/category of activity	Climate change
Data units, max and min values	Trend in sea level raise, relative to a reference
Category	Pressure
Date created	2019-06
Data type	Dataset
Status	Completed, to be extended to ECOMAR grid
Data format	32-bit floating point Tagged Images File Format
Temporal period	1889 – 2017
Units in raster data	Trend in cm / year
Spatial extent and resolution	1:100 000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The data layer of sea level trends is based on observation from Danish harbours. The trend and changes in Sea level raise is calculated by Danish Meteorological Institute, DMI. Then a GIS tool was used to interpolate spatially between the measurement points. This interpolation was done using "barriers". This means that distance between points is calculated around coastlines rather than directly "as the crow flies". This means, for example, that we can avoid interpolating directly between a point on the west coast of Jutland and a point on the east coast.	
Lineage: Trends in sea level from 14 positions were interpolated to a 500 m raster covering the Danish EEZ. The interpolation was done using the "Kernel Smoothing with barriers" function in ArcGis 10.3, with the following parameters: Kernel Type = Exponential, Power = 1, Ridge = 1, Bandwidth = 35,0000m. Standard error of the model output was calculated and is provided as the uncertainty estimate. This data layer is based on point data for sea level rise in harbours and interpolated. The interpolation assumed the same trend over offshore waters, which is not confirmed. For details on background data and calculations of trends (Hansen, 2018); Hansen, L. (2018). Sea Level data 1889-2017 from 14 stations in Denmark. Mean, maximum and minimum values calculated on monthly and yearly basis including plots of mean values, DMI Report No. 18-16.	
Considerations for use in ECOMAR: None	
Recommendations for data improvement: The map could be improved by including offshore data.	
Data authoring organization	NIVA Denmark
Data author contact	Therese.Harvey@niva-dk.dk
Data source	Danish Meteorological Institute, DMI (Hansen , 2018) Hansen, L. (2018). Sea Level data 1889-2017 from 14 stations in Denmark. Mean, maximum and minimum values calculated on monthly and yearly basis including plots of mean values, DMI Report No. 18-16.
Data source contact	www.dmi.dk
INSPIRE topic category	Oceans, Environment

INSPIRE theme	Oceanographic geographical features
GEMET keywords	Sea level rise, Climate change impact
Maintenance	Not planned
Metadata date	2019-04-29
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

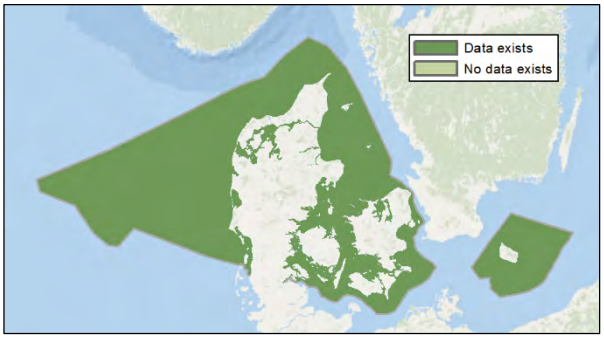
Sea level rise trend (cm year^{-1})



Estimated uncertainty



Data coverage



Estimated uncertainty: Standard error of the model.

Data coverage: Modelled area based on data collection within the Danish EEZ.

A6 Physical disturbance of the sea floor

A6.1 Swept area ratio (SAR) from bottom trawling

<table>
<tr><td>Data name</td><td>Swept area ratio, Mobile Bottom Contacting Gears (Abrasion from bottom trawl)</td></tr>
<tr><td>Category of activity</td><td>Physical disturbance</td></tr>
<tr><td>Data units, max and min values</td><td>SAR (swept area ratio)
<table>
<tr><th></th><th>Minimum value</th><th>Maximum value</th></tr>
<tr><td>Surface SAR</td><td>0</td><td>20.32</td></tr>
<tr><td>Subsurface SAR</td><td>0</td><td>4.65</td></tr>
</table></td></tr>
<tr><td>Category</td><td>Pressure</td></tr>
<tr><td>Date created</td><td>2019-03-29</td></tr>
<tr><td>Data type</td><td>Data series</td></tr>
<tr><td>Status</td><td>Completed</td></tr>
<tr><td>Data format</td><td>32-bit floating point Tagged Images File Format (.tif)</td></tr>
<tr><td>Temporal period</td><td>Average swept area ratio (surface and subsurface) in the period 2015-2017</td></tr>
<tr><td>Units in raster data</td><td>Ratio ~ number of times swept /year</td></tr>
<tr><td>Spatial extent and resolution</td><td>Danish EEZ
Original resolution of data: 0.05 degrees grid. Values have been distributed evenly out on 500 m raster</td></tr>
<tr><td>Coordinate reference system</td><td>European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035</td></tr>
<tr><td colspan="2">Summary:
The data series show international abrasion by mobile bottom contacting gears as surface and subsurface swept area ratios as a yearly average based on the period 2015-2017. In the ECOMAR context, it is used as a pressure layer. The swept area ratio is an indicator of the number of times a c-square is swept by mobile bottom contacting gears, assuming that the fishing haul tracks are not overlapping. VMS is mandatory for vessels larger than 12 m, so for those vessels, all fishing activity is represented in the data layers. An indicator is given in the uncertainty layer as the percentage effort from the fishing logbooks (vessels larger than 10 m /larger than 8 m in the Baltic) that is covered in the VMS data.</td></tr>
<tr><td colspan="2">Lineage:
The data comes from an annual ICES VMS logbook data call that requests VMS based data on fishing effort and landings by c-square (0.05 degrees), year, month, gear and métier. Logbook based data on fishing effort and landings by ICES rectangle (0.5 degrees*1 degree), year, month, gear, métier and an indication on if the effort is covered with VMS data. For this project, permission have been given from all countries fishing within the Danish EEZ (Denmark, Sweden, Norway, Germany, Poland, Lithuania, Latvia, Estonia, Finland, UK, The Netherlands, Belgium and France) to use data from the ICES data portal within the Danish EEZ to use the data for the ECOMAR project.
Swept Area Ratio (SAR) was computed using the algorithm described here https://github.com/ices-tools-dev/sfdSAR. The main steps in the data processing are:</td></tr>
</table>

1. Determine the gear width of the VMS record according to:
   a. Where average gear widths are supplied these are used.
   b. For VMS records with missing gear widths but that have supplied average vessel characteristics (i.e. average overall vessel length or average KW engine power): use the model described in (Eigaard et al., 2016) to provide an estimate of gear width
   c. For VMS records with missing gear widths and missing vessel characteristics use a fill-in value provided by ICES (2015)
2. Estimate swept area based on gear type, fishing hours (hours), fishing speed (speed) and gear width (width) for each record from ICES (2016):
   a. **Trawl** : $\text{hours} * \text{speed} * \text{width} * 1.82$
   b. **Danish seine** : $\frac{\text{hours}}{2.591234} * \frac{\text{width}^2}{4\pi}$
   c. **Scottish seine** : $\frac{\text{hours}}{1.9125} * \frac{1.5 * \text{width}^2}{4\pi}$
3. Accumulate across gears for each year to produce annual totals of SA by c-square and gear category, and finally average over years within gear category and c-square.
4. Calculate SAR values by scaling by the area of the c-squares.

The VMS based data by c-square (0.05 degrees) were distributed evenly out on the 500m*500m raster. A yearly average by raster cell was made for the period 2015-2017.

To give an indicator on uncertainty, the logbook-based data from mobile bottom contacting gears were selected and the fishing effort (days at sea) by ICES rectangle (0.05*1 degrees) categorized as VMS_enabled, Yes or No. The percentage coverage with VMS was calculated from the days at sea and ton landings recorded in logbooks by ICES rectangles, and the percentage values distributed evenly out on the 500 m raster, and a yearly average by raster cell was made for the period 2015-2017. Thus, the uncertainty indicates the part of the fishery not represented by the VMS data.

The confidence layer has been set to 0 (data exists) for the whole Danish EEZ, as data exists if there is a fishery.

Eigaard, O. R., Bastardie, F., Breen, M. et al (2016) Estimating seabed pressure from demersal trawls, seines, and dredges based on gear design and dimensions. ICES Journal of Marine Science, 73(Suppl. 1), 27-43. DOI: 10.1093/icesjms/fsv099

ICES 2015. Report of the Working Group on Spatial Fisheries Data (WGSFD), 8–12 June 2015, ICES Headquarters, Copenhagen, Denmark. ICES CM 2015/SSGEPI:18. 150pp

ICES 2016. Interim Report of the Working Group on Spatial Fisheries Data (WGSFD), 17–20 May 2016, Brest, France. ICES CM 2016/SSGEPI:18. 244 pp

Considerations for use in ECOMAR:

The VMS based data on fishing hours have been rescaled from a 0.05 degree grid (varying from 16 to 18 km^2 within the Danish EEZ) to the 0.25 km^2 grid requested for the ECOMAR project.

The logbook-based data on VMS coverage (the uncertainty layer) have been rescaled from the ICES rectangles (0.5*1 degrees) to the 0.25 km^2 grid requested for the ECOMAR project.

Data from the smallest vessels that does not have logbooks (<10 m, <8 m in the Baltic) are not included.

The data submitted by Denmark for the ICES data call have been filtered to exclude values when there are less than three vessels within the aggregation level.

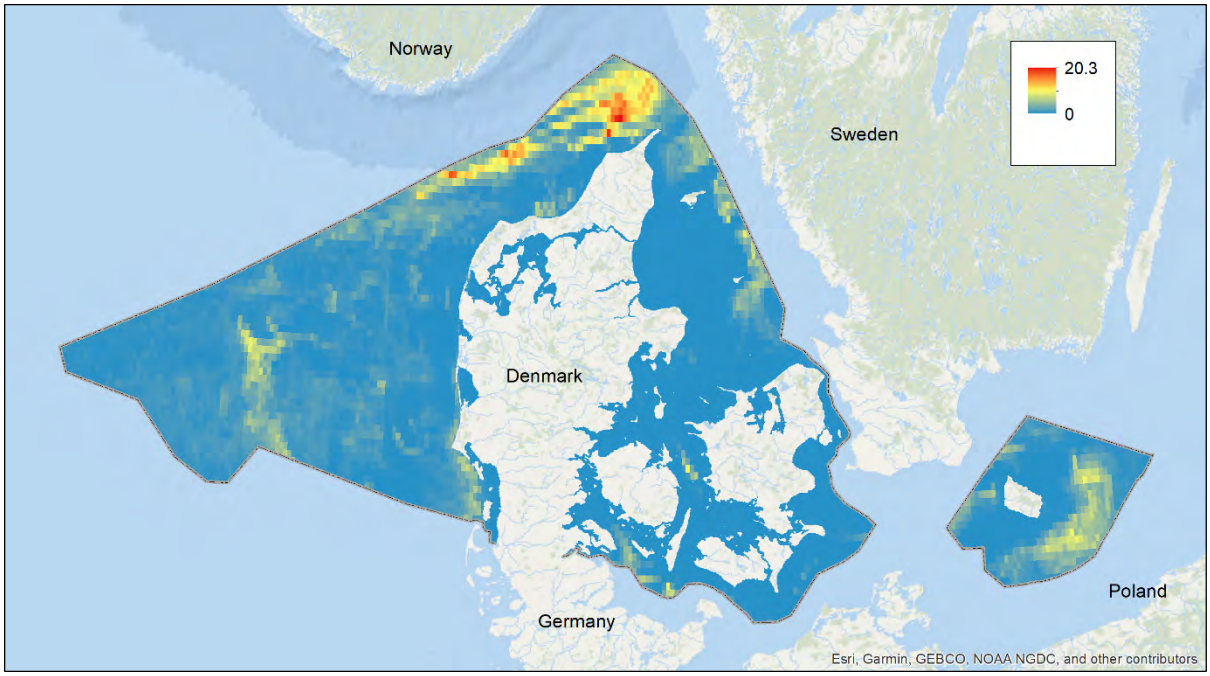
Recommendations for data improvement: None

Data authoring organization	DTU Aqua
Data author contact	jsv@aqua.dtu.dk
Data source	International Council for the Exploration of the Sea (ICES).
Data source contact	accessions@ices.dk
INSPIRE topic category	Oceans, environment

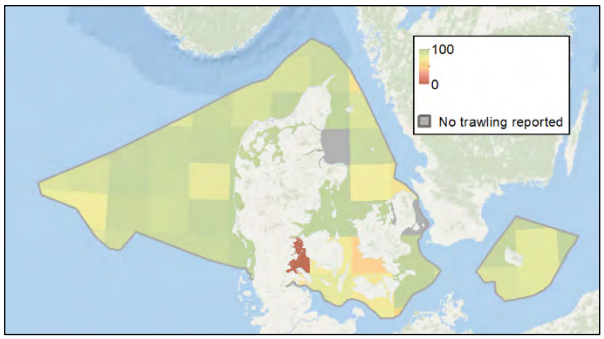
INSPIRE theme	Fishing
GEMET keywords	Fishing, open sea fishing
Maintenance	Not planned
Metadata date	2019-03-29
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

A6.1.1 Surface SAR

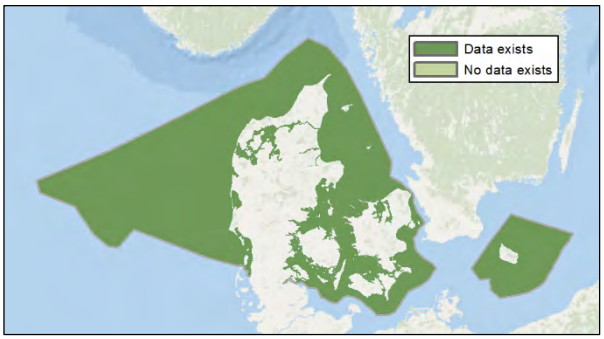
Surface swept area ratio from mobile bottom contacting gears (average SAR)



Estimated uncertainty



Data coverage

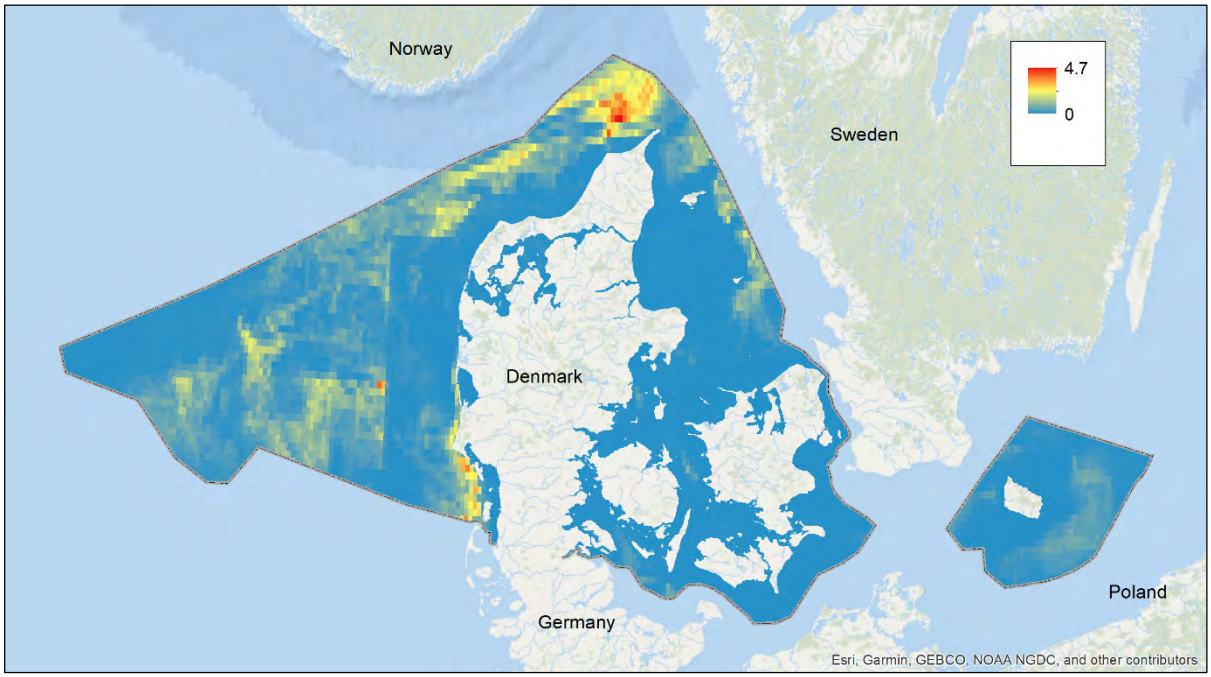


Estimated uncertainty: Percentage effort (days at sea) covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas where no bottom trawling is reported and has a high uncertainty.

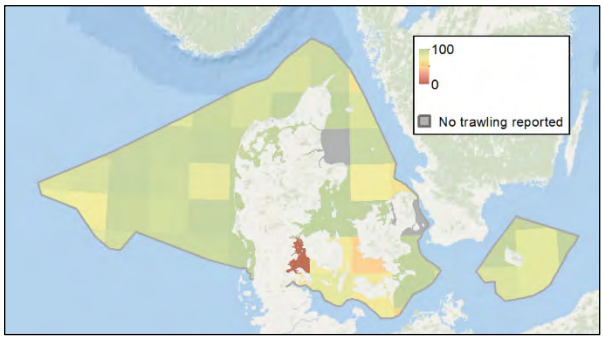
Data coverage: Data collection within the Danish EEZ.

A6.1.2 Sub-surface SAR

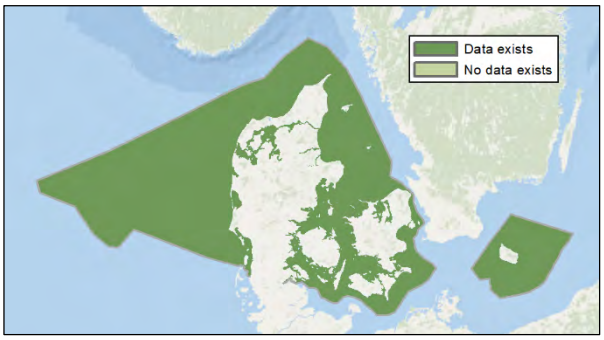
Sub-surface swept area ratio from mobile bottom contacting gears (average SAR)



Estimated uncertainty



Data coverage



Estimated uncertainty: Percentage effort (days at sea) covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas where no bottom trawling is reported and has a high uncertainty.

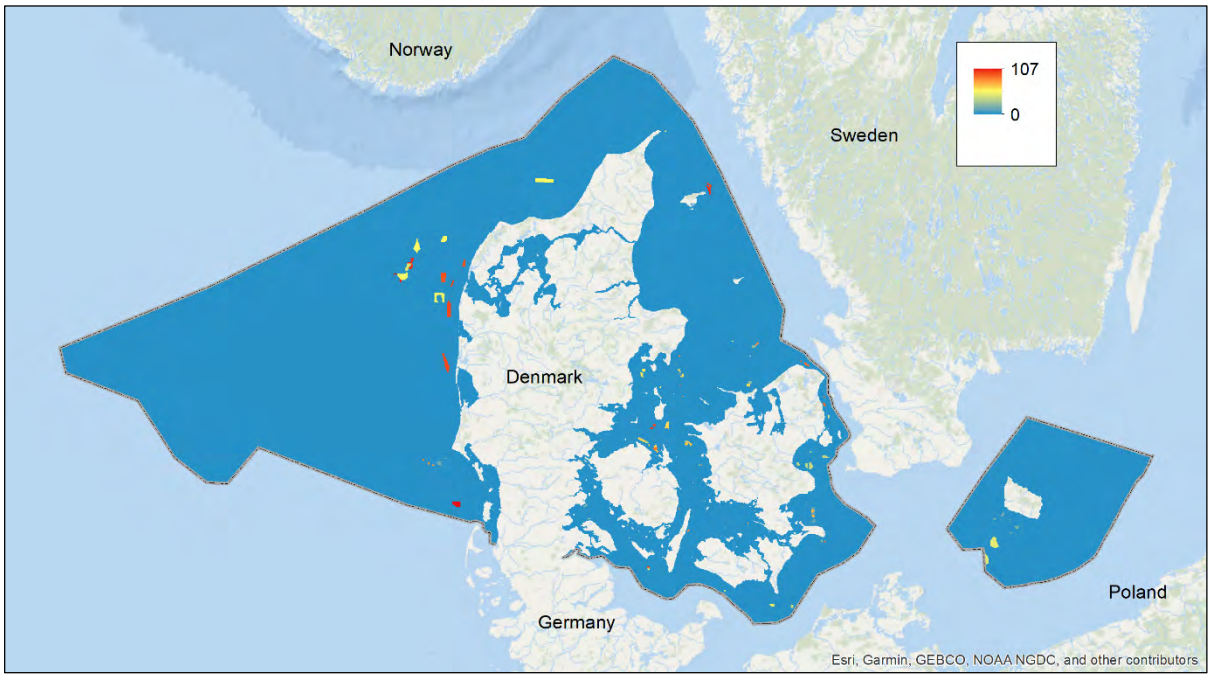
Data coverage: Data collection within the Danish EEZ.

A6.2 Extraction of material from the seafloor

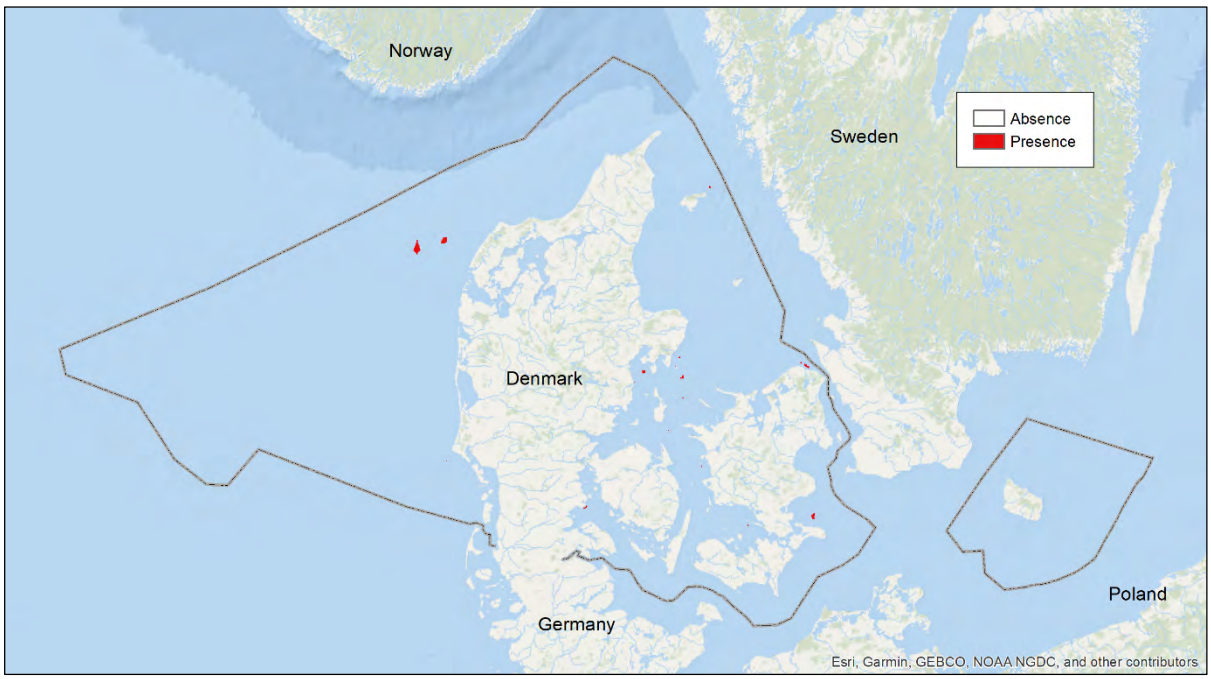
Data name	Production Sites
Group/category of activity	Physical disturbance
Data units, max and min values	Fields in production: m^3/year Inactive fields and potential: Presence/absence
Category	Pressure
Date created	Accumulated over the years (Original data) 2019-03-18 (uploaded)
Data type	Dataset
Status	Completed
Data format	8-bit IMAGINE image format
Temporal period	2014 - 2018
Units	Presence/absence
Spatial extent and resolution	The Danish EEZ marine area with an overall resolution of 1:10000.
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The dataset represents the aggregate production sites in the Danish waters that has the permission for extraction by the Ministry of Environment. The locations are subject to evaluation and can change if it is required.	
Lineage: The location polygons were downloaded from The Ministry of Environment and food/ Nature agency GIS portal, http://miljoegis.mim.dk/cbkort?profile=miljoegis-raastofferhavet/. It comprises information about the location of these production sites in the Danish EEZ, and the extraction volume average of five years 2014-2018 was extracted and calculated from (https://mst.dk/erhverv/raastoffer/statistik-om-raastoffer/). It comprises information about the extraction sites and the extraction volume per year. These areas represent: 1. Common areas where the companies holding a license are currently dredging. 2. Dredging areas within the reservation areas where dredging licenses can be issued upon request for coastal replenishment or development projects. No such in Øresund. 3. Auction areas where exclusive dredging licenses have been issued. No such in Øresund.	
Considerations for use in ECOMAR: The extraction site dataset was reclassified into 500 m grid.	
Recommendations for data improvement: None	
Data authoring organization	GEUS/ Jørgen O. Leth & Zyad Al-Hamdani
Data author contact	jol@geus.dk & azk@geus.dk
Data source	http://miljoegis.mim.dk/cbkort?profile=miljoegis-raastofferhavet
Data source contact	info@mst.dk; GIS-service@MST.dk
INSPIRE topic category	oceans, environment
INSPIRE theme	oceanographic geographical features
GEMET keywords	Turbidity, mining, environmental impact
Maintenance	If necessary

Metadata date	2018
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

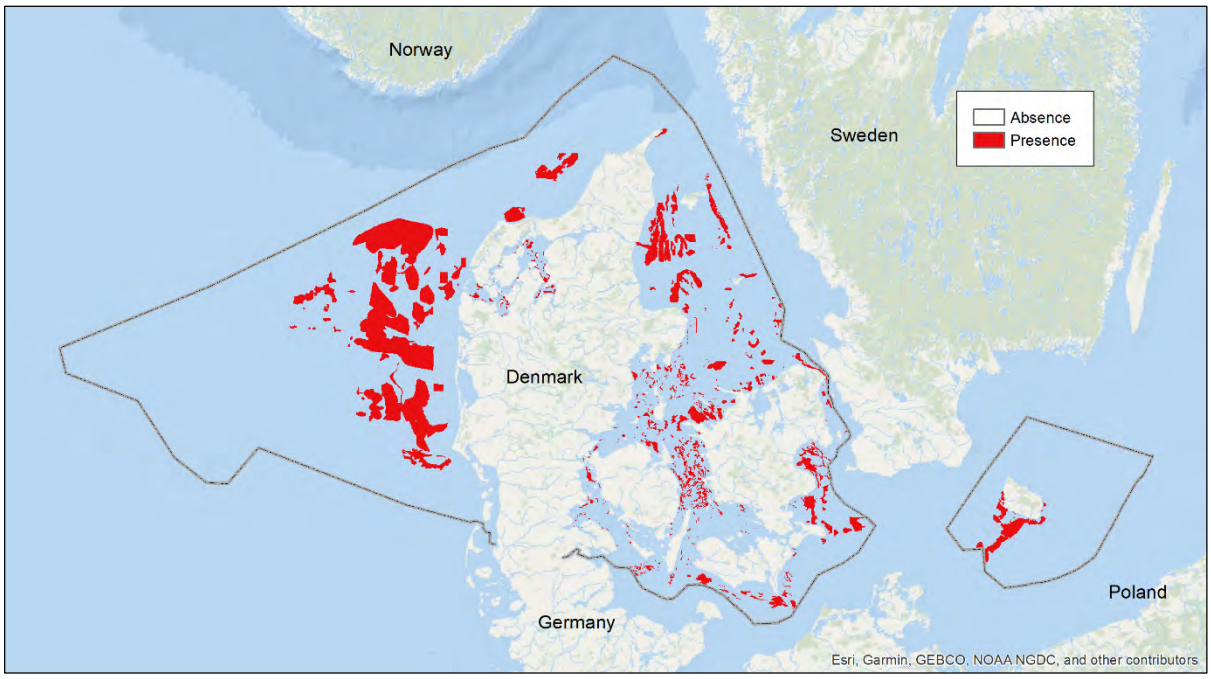
Average amount of material per extraction site used in production (m^3/year)



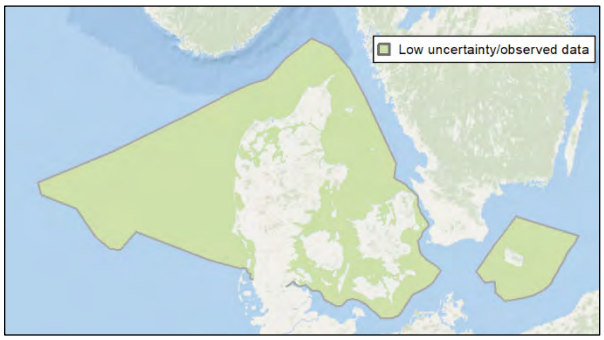
Presence of inactive extraction sites



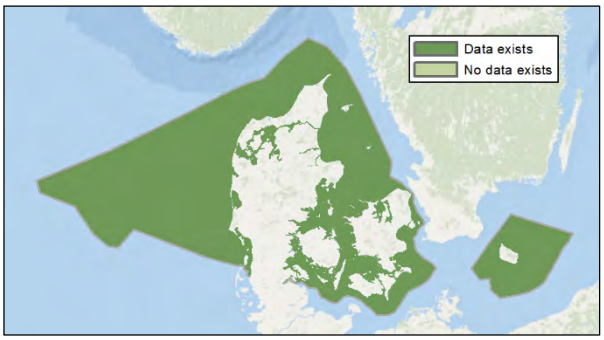
Presence of potential extraction sites



Estimated uncertainty



Data coverage



Estimated uncertainty: Observed data of the sites in production within the Danish EEZ.

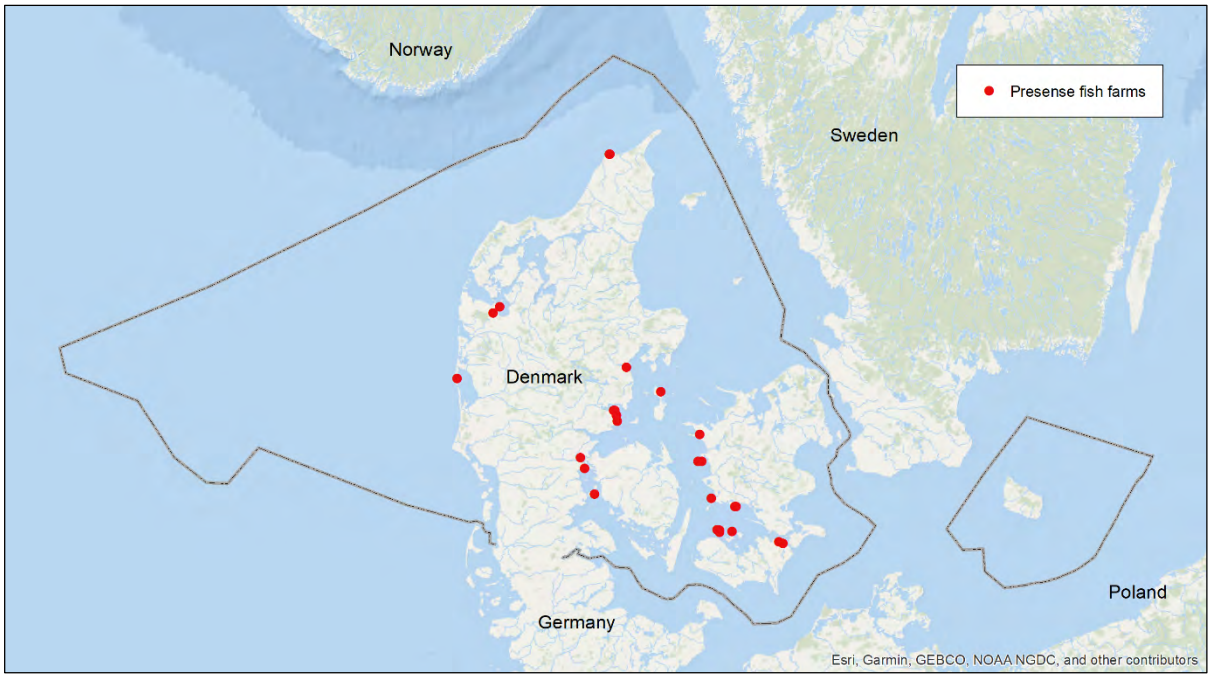
Data coverage: Data collection within the Danish EEZ.

A7 Aquaculture

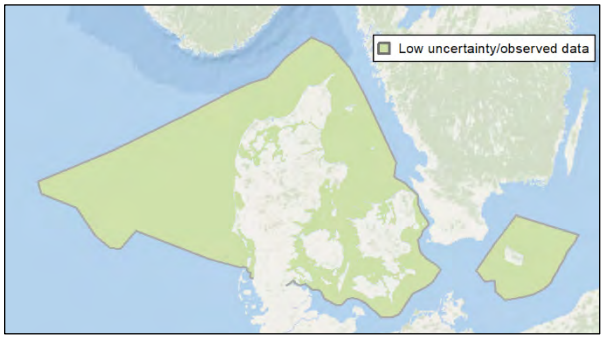
Data name	Aquaculture fish farms, Aquaculture shellfish farms
Group	Aquaculture
Data units, max and min values	Presence/absence
Category	Pressure
Date created	2019-03-29
Data type	Data series
Status	Completed
Data format	32-bit floating point Tagged Images File Format (.tif)
Temporal period	2018
Units in raster data	Presence/absence
Spatial extent and resolution	Danish EEZ Original resolution of data: 0.05 degrees grid. Values have been distributed evenly out on 500 m raster
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: This data layer shows the presence of aquacultures with saltwater fish and mussels and oysters	
Lineage: Data was downloaded from the Danish Food Ministry (Fødevarestyrelsen): https://chr.fvst.dk/chri/faces/frontpage?_adf.ctrl-state=ievo4ycqf_3 by selection 'MJF – Miljøforurening' in the 'Disease code' option bar. The dataset was sorted to only contain aquacultures categorized as 'Saltwater cages/enclosures/pens' and 'Mollusk farm open' for fish and mussel or oyster farms respectively. Aquacultures with freshwater fish and others were omitted.	
Considerations for use in ECOMAR: None	
Recommendations for data improvement: None	
Data authoring organization	The Danish Food Adminisration Agency (DVFA), Fødevarestyrelsen
Data author contact	jsv@aqua.dtu.dk
Data source	The Danish Food Administration Agency (DVFA), Fødevarestyrelsen
Data source contact	email@fvst.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Food
GEMET keywords	Food, fish farming, habitat loss, environmental impacts of aquaculture
Maintenance	Not planned
Metadata date	2019-03-29
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

A7.1 Fish farms

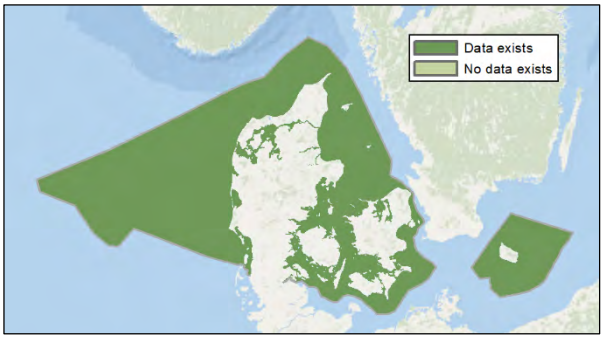
Presence of aquaculture farms for fish



Estimated uncertainty



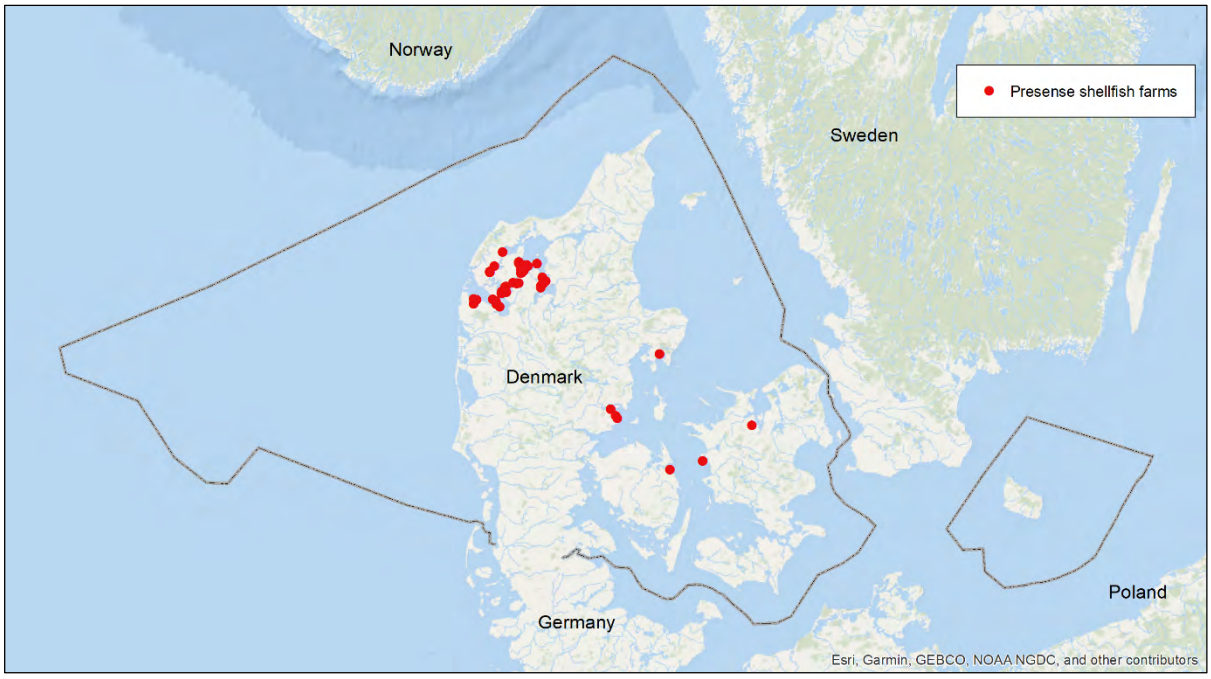
Data coverage



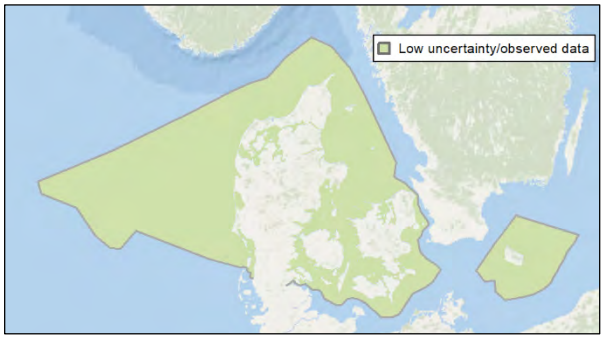
Estimated uncertainty: Observed data within the Danish EEZ.
Data coverage: Data collection within the Danish EEZ.

A7.2 Shellfish farms

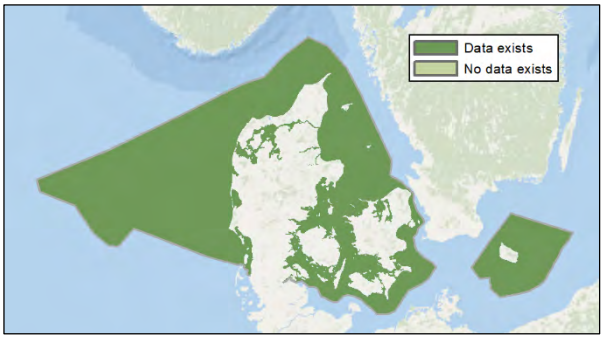
Presence of aquaculture farms for blue mussel and pacific oysters



Estimated uncertainty



Data coverage



Estimated uncertainty: Observed data within the Danish EEZ.
Data coverage: Data collection within the Danish EEZ.

A8 Industry, energy and infrastructure

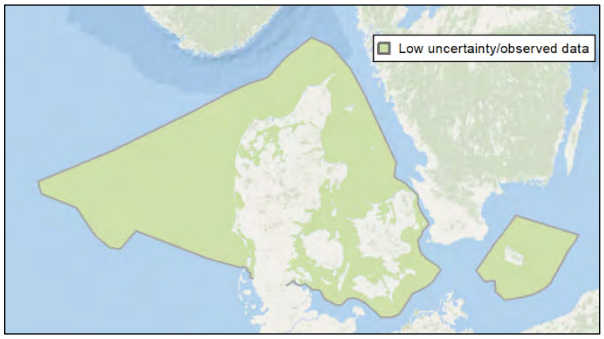
A8.1 Coastal habitat modification

Data name	Coastal habitat modification
Group/category of activity	Pressures
Data units, max and min values	Meters
Category	Physical disturbance
Date created	2019-03-20
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	1998-1999, updated to 2017
Units in raster data	Presence/absence
Spatial extent and resolution	1:100 000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The dataset contains data on coastal defense structures detected by aerial photos between 1998-1999 and is updated every quarterly (4 times in a year). Data accuracy is 1-20 m (both the construction itself or the area of construction is included). The coastal constructions are categorized as: 'new construction', 'breakwater', 'jetty (updated untill 1998)', 'structure', 'dike', 'mixed structure', 'groyne', 'slope protection', 'T groyne', 'outer groyne', 'stones', 'artificial reef (updated untill 1998)', 'emission (updated untill 1998)', 'sand nourishment' and 'bypass'. Data for coastal defense were downloaded from HELCOM Map service. http://metadata.helcom.fi/geonetwork/srv/eng/catalog.search#/metadata/2d47c5ea-4590-465f-a462-60ef59d3d7d3	
Lineage: Data was downloaded and rasterized to the ECOMAR grid.	
Considerations for use in ECOMAR: None	
Recommendations for data improvement: None, can be updated with the new data if available from the Danish Coastal Authority (Kystdirektoratet).	
Data authoring organization	HELCOM Mapservice http://maps.helcom.fi/website/mapservice/
Data author contact	joni.kaitaranta@helcom.fi
Data source	HELCOM Mapservice http://maps.helcom.fi/website/mapservice/
Data source contact	joni.kaitaranta@helcom.fi
INSPIRE topic category	Oceans, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Coastal development, habitat loss, environmental impact
Maintenance	Unknown
Metadata date	2019-06-12

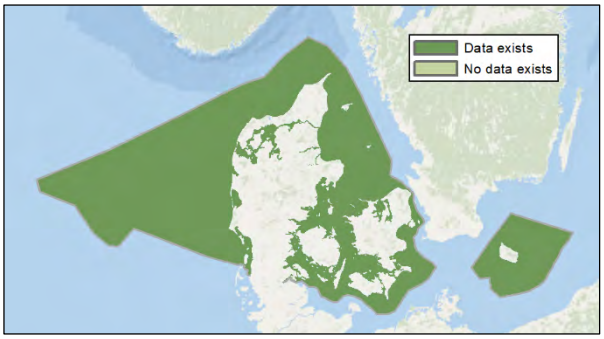
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

Length of coastal defense constructions (m/grid cell)

Estimated uncertainty



Data coverage



Estimated uncertainty: Observed data within the Danish EEZ.

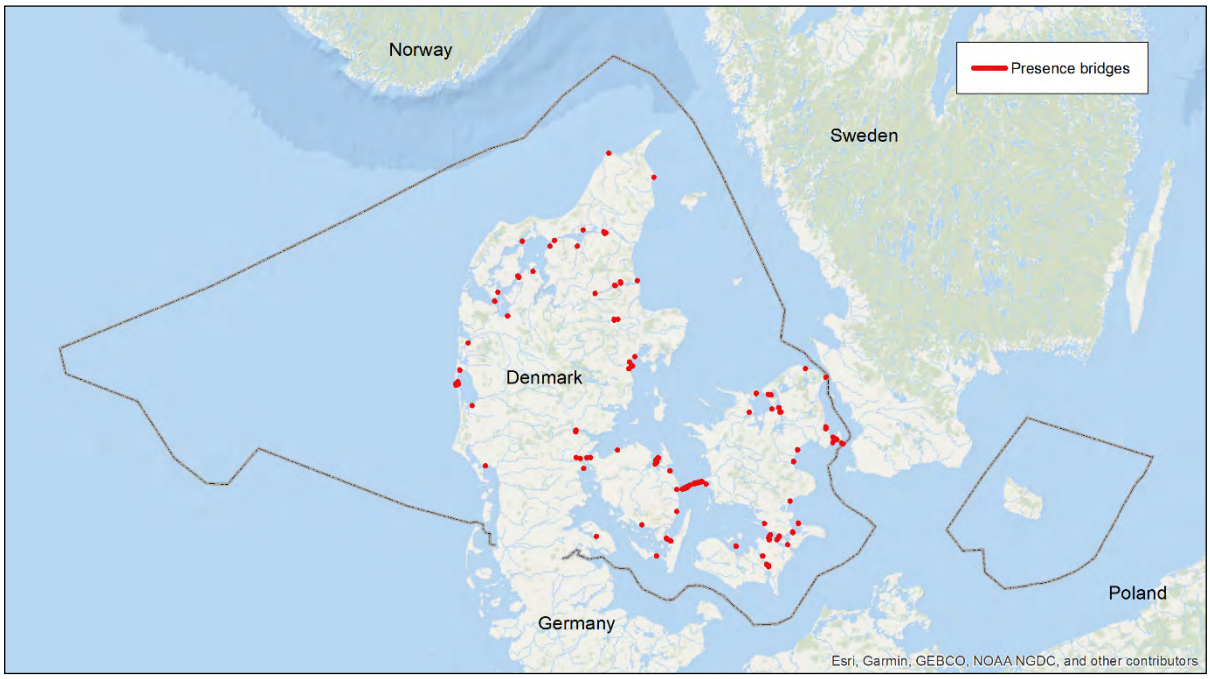
Data coverage: Data collection within the Danish EEZ.

A8.2 Bridges and coastal constructions

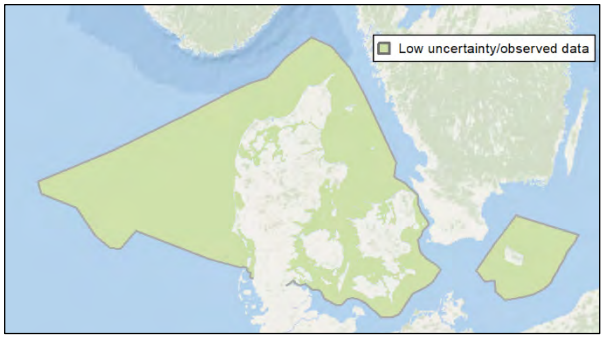
Data name	Bridges and coastal constructions
Group/category of activity	Pressures
Data units, max and min values	Presence of constructions
Category	Physical disturbance
Date created	2019-03-20
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	Current state in 2018 and 2015 for coastal constructions
Units in raster data	Presence / absence
Spatial extent and resolution	1:100 000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The dataset contains data on bridges and other constructions. The dataset is constructed from Open Street Map "roads" shapefiles downloaded through 'Geofabrik' (www.geofabrik.de/) by extracting all features where attribute bridges=1. It should be noted that the dataset contains major bridges and all other smaller constructions that have been classified as bridges in Open Street Map. Data for land claim (permanent or temporary establishments of the sea) were downloaded from HELCOM Map service. The two datasets were merged.	
Lineage: Data includes all road segments where attribute "bridge" has value "1". Bridges on land has been removed. This was done with the ECOMAR raster file so that the extracted data only covered the areas of interest. Original data is not quality assured and is based on a dataset that can be freely modified by all users.	
Considerations for use in ECOMAR: Original data for bridges is not quality assured and is based on a dataset that can be freely modified by all users.	
Recommendations for data improvement: None	
Data authoring organization	Open street map Foundation https://www.openstreetmap.org/#map=7/56.188/11.617 HELCOM Mapservice http://maps.helcom.fi/website/mapservice/
Data author contact	joni.kaitaranta@helcom.fi
Data source	Open street map Foundation https://www.openstreetmap.org/#map=7/56.188/11.617 HELCOM Mapservice http://maps.helcom.fi/website/mapservice/
Data source contact	joni.kaitaranta@helcom.fi Therese.Harvey@niva-dk.dk
INSPIRE topic category	Oceans, environment

INSPIRE theme	Oceanographic geographical features
GEMET keywords	Coastal development, habitat loss, environmental impact
Maintenance	Unknown
Metadata date	2019-06-12
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

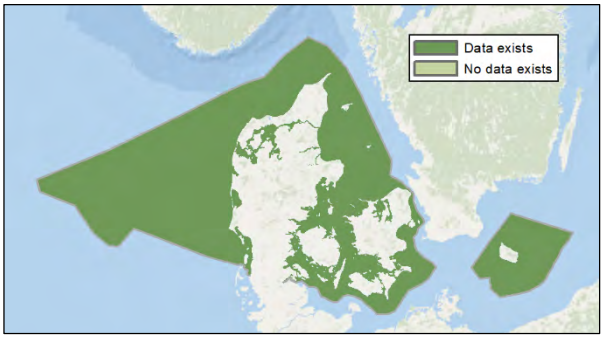
Presence of bridges and land claim



Estimated uncertainty



Data coverage

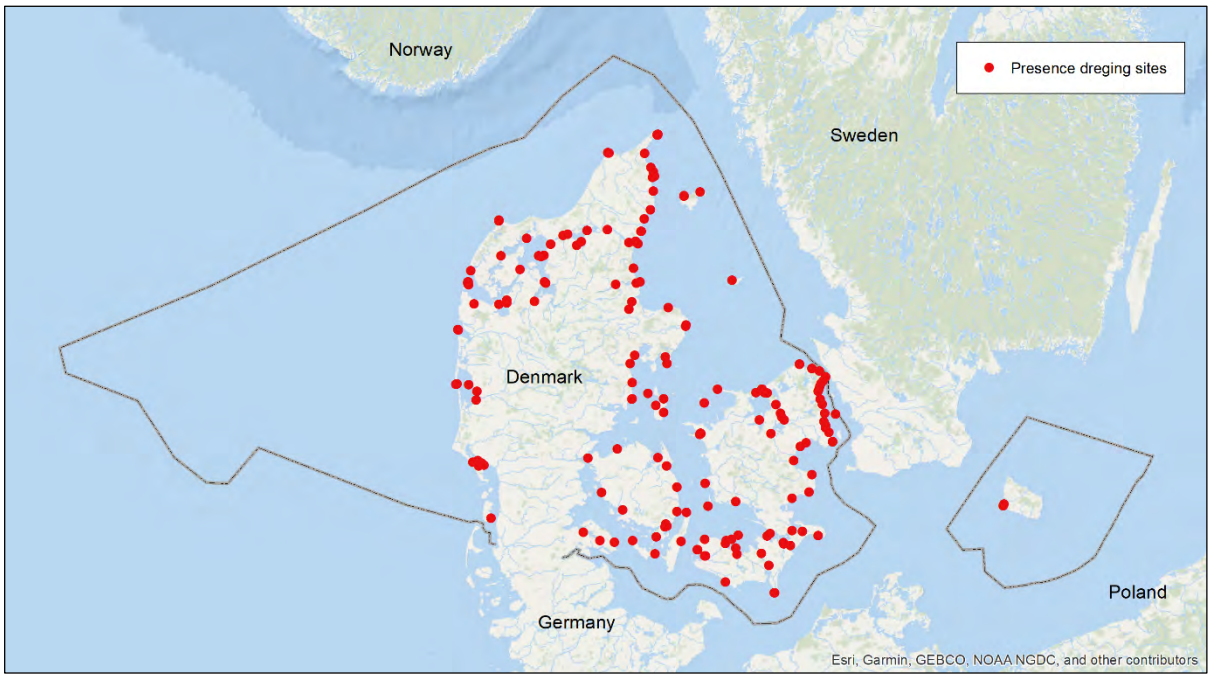


Estimated uncertainty: Observed data within the Danish EEZ.
Data coverage: Data collection within the Danish EEZ.

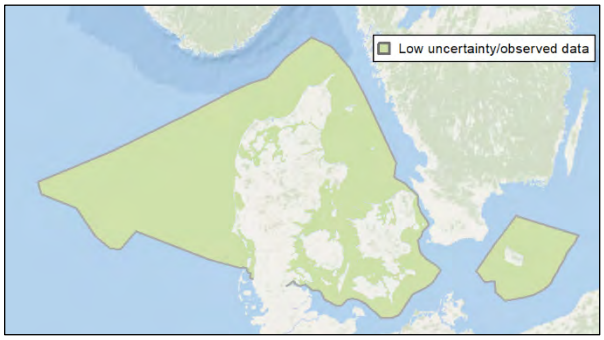
A8.3 Dredging

Data name	Dredging sites
Group/category of activity	Pressure
Data units, max and min values	Locations, presence/absence
Category	Habitat loss
Date created	2019-03-20
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	Current usage
Units in raster data	Presence / absence
Spatial extent and resolution	1:100 000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.rio/3035
Summary: The data layer shows the presence of sites which are regularly dredged. The original data is compiled for EMODnet as a shapefile with points.	
Lineage: The data was created using polygons of know dump sites areas and point locations for dumping sites and encounters. The encounters within the known areas and sites was not included. The datasets were combined into a single raster.	
Considerations for use in ECOMAR: None	
Recommendations for data improvement: None	
Data authoring organization	NIVA Denmark
Data author contact	Therese.Harvey@niva-dk.dk
Data source	EMODnet human activities http://www.emodnet-humanactivities.eu
Data source contact	http://www.emodnet-humanactivities.eu
INSPIRE topic category	Oceans, Environment
INSPIRE theme	Oceanographic geographical features GEMET keywords chemical pollution, military activities, environmental
GEMET keywords	Coastal development, habitat loss, environmental impact
Maintenance	Unknown
Metadata date	2019-06-12
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

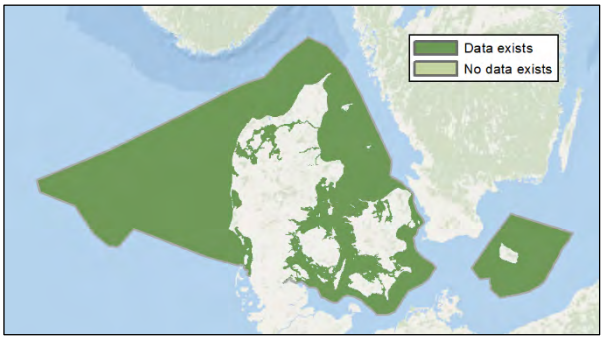
Presence of dredging sites



Estimated uncertainty



Data coverage



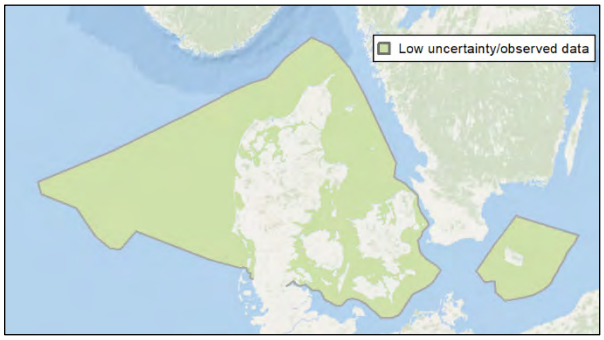
Estimated uncertainty: Observed data within the Danish EEZ.
Data coverage: Data collection within the Danish EEZ.

A8.4 Disposal sites for construction, garbage and dredged material

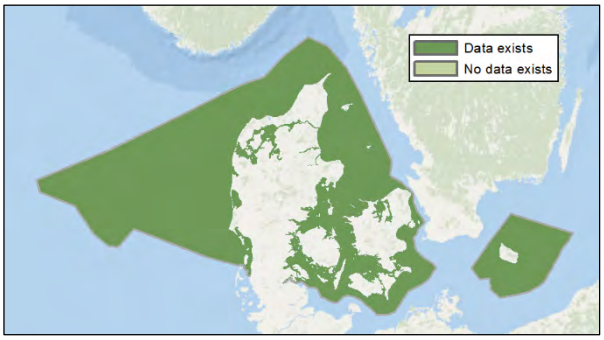
Data name	Dumping sites
Group/category of activity	Habitat loss
Data units, max and min values	Presence/absence
Category	Pressure layer
Date created	Accumulated over the years (Original data) 2019-03-18 (uploaded)
Data type	Dataset
Status	Completed
Data format	8-bit IMAGINE image format.
Temporal period	2018
Units	Presence / absence
Spatial extent and resolution	The Danish EEZ marine area with an overall resolution of 1:10000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The dataset represents the dumping sites in the Danish waters that has the permission for dumping by the Ministry of Environment. The locations are subject to evaluation and can change if it is required.	
Lineage: The data was downloaded from The Ministry of Environment and food/ Nature agency GIS porta, web site (http://miljoegis.mim.dk/cbkort?profile=miljoegis-raastofferhavet). It comprises information about the location of these dumpsites in the Danish EEZ.	
Considerations for use in ECOMAR: The dumpsites dataset was reclassified into 500 m grid.	
Recommendations for data improvement: None	
Data authoring organization	GEUS/ Zyad Al-Hamdani
Data author contact	azk@geus.dk
Data source	http://miljoegis.mim.dk/cbkort?profile=miljoegis-raastofferhavet
Data source contact	info@mst.dk; GIS-service@MST.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Coastal development, ocean dumping, habitat loss, environmental impact
Maintenance	Not planned
Metadata date	2019-04-03
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

Presence of dumping sites

Estimated uncertainty



Data coverage



Estimated uncertainty: Observed data within the Danish EEZ.
Data coverage: Data collection within the Danish EEZ.

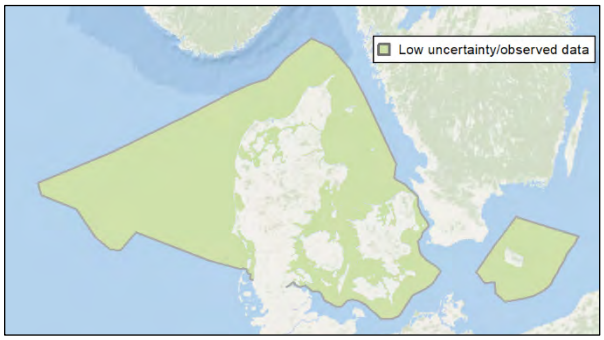
A8.5 Offshore oil and gas installations

Data name	Offshore oil and gas installations
Group/category of activity	Habitat loss
Data Units, min and max values	Number of Installations in operation, under constructions and closed down, 0-6
Category	Human activities & Pressures
Date created	2015-11-06 (original data layer), 2019-01-10 (date for download)
Data type	Data series
Status	Completed
Data format	Shape file in UTM 32 N (ED 50)
Temporal period	The data layer shows presence of oil and gas installations by 2015-11-06
Units in raster data	Number of gas/oil installations per grid cell
Spatial extent and resolution	Danish EEZ Original resolution of data: 0.05 degrees grid. Values have been distributed evenly out on 500 m raster
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The dataset represents the human activity of non-renewable energy and give rise to the pressures: Substratum loss and pollution by Chemical substances. The data set shows the locations of offshore oil and gas installations. The data layer includes presence and status of installations in operation (main part), under constructions and two closed down installations, which still remains in place.	
Lineage: The data was downloaded as point shapefiles from The Danish Energy Agency https://ens.dk/en/our-services/oil-and-gas-related-data/shape-files-maps The dataset was gridded to the 500 m x 500 m template raster format. The data layer is presented as the number of installations per grid cell, which was summarized in ArcGIS. Installations in operation, under construction and the two ones that are closed down were included. Different sizes of the installations and productions has not been considered. 0= Absence of offshore oil and gas installations 1-6= Number of offshore installations per grid cell	
Considerations for use in ECOMAR: No considerations	
Recommendations for data improvement: Not relevant for this data layer	
Data authoring organization	Danish Energy Agency
Data author contact	ens@ens.dk
Data source	Danish Energy Agency
Data source contact	ens@ens.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Energy
GEMET keywords	Drilling for oil, marine gas oil, oil exploration, oil extraction, offshore oil drilling, fossil fuel gas

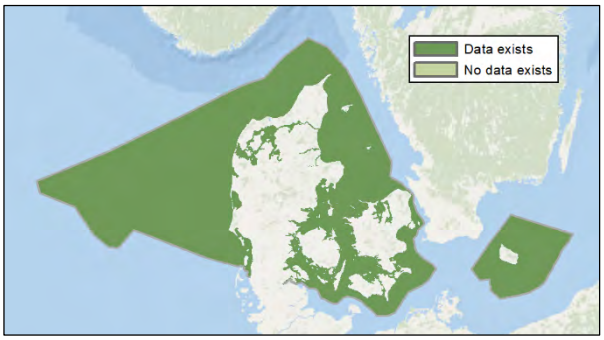
Maintenance	Not planned
Metadata date	2019-03-29
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

Presence of field delineations and oil and gas installations

Estimated uncertainty



Data coverage



Estimated uncertainty: Observed data within the Danish EEZ.

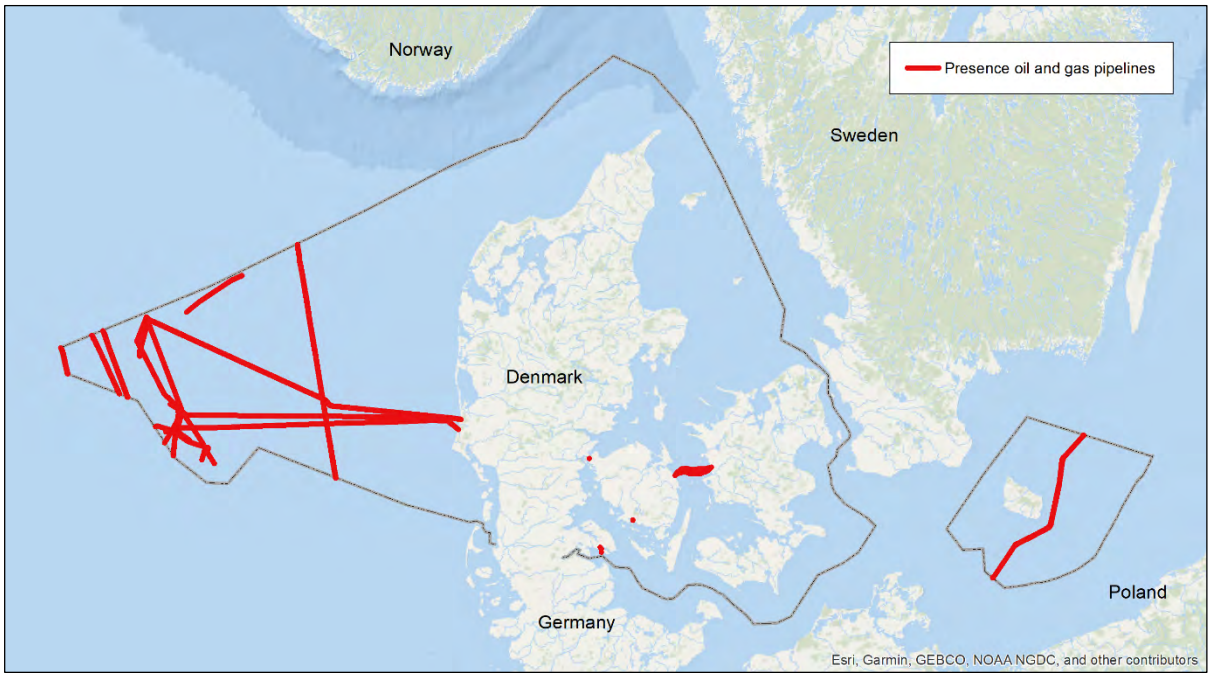
Data coverage: Data collection within the Danish EEZ.

A8.6 Oil and gas pipelines

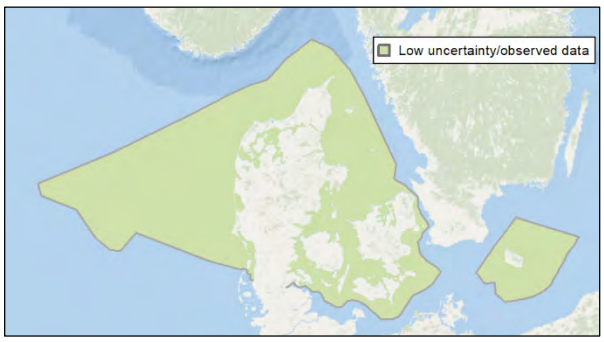
Data name	Oil and gas pipelines
Group/category of activity	Energy/ Habitat loss
Data units, max and min values	Number of pipelines within a grid cell
Category	Pressure
Date created	2019-03-20
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	2017-03-02
Units in raster data	Presence/absence
Spatial extent and resolution	1:100 000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The data layer shows the presence of the main offshore oil and gas pipelines within the Danish EEZ. The original data is compiled by Cogea srl. for EMODnet as a shapefile with polygons. The lines were rasterized, and the number of pipelines were counted within each grid cell.	
Lineage: The original data for EMODnet were retrieved from six different sources, but only two of them were included for the Danish EEZ. The individual data sources accounted for the validation and quality assurance and Cogea harmonized the data. The data generally comes from official national sources and are therefore considered to be very reliable. The polylines were snapped to the predefined ECOMAR grid of 500 m x 500 m. The processing was done in R with the packages “Sp and “Raster”.	
Considerations for use in ECOMAR: The degree of accuracy of the pipelines can be different between the countries. Hence, the number of pipelines per grid cell are an assumption of combined information of the positions of the individual pipelines and the predefined grid. There was no information available on the diameter size of the pipelines. Larger pipelines har in general a larger effect as they cover a larger extent of the sea bottom.	
Recommendations for data improvement: In general, a better positioning of the individual pipelines would increase the accuracy. Include information of the diameter size of the pipelines.	
Data authoring organization	Cogea Srl
Data author contact	lfalco@cogea.it ; apititto@cogea.it
Data source	EMODnet human activities http://www.emodnet-humanactivities.eu Title: EMODnet Human Activities: Offshore Pipelines Delivery of Background data: - Norway – Oljedirektoratet - HELCOM HOLAS II Dataset: Pipelines (2017)
Data source contact	http://www.emodnet-humanactivities.eu
INSPIRE topic category	Pipe, Transport Network, Transport Object
INSPIRE theme	Utility and governmental services

GEMET keywords	Groups: EFFECTS, IMPACTS, TRAFFIC, TRANSPORTATION Concepts: Energy
Maintenance	Unknown
Metadata date	2019-06-12
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

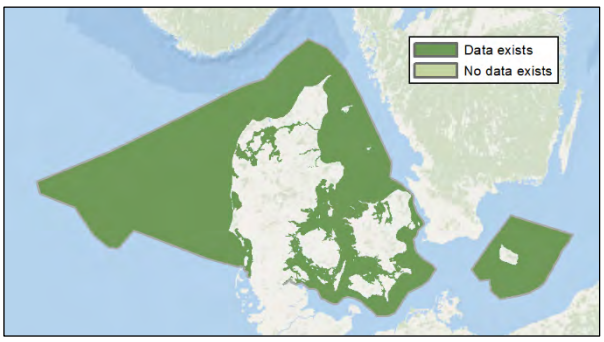
Presence of oil and gas pipelines



Estimated uncertainty



Data coverage



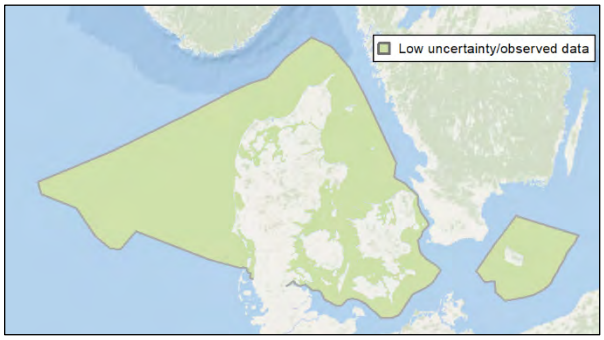
Estimated uncertainty: Observed data within the Danish EEZ.
Data coverage: Data collection within the Danish EEZ.

A8.7 Wind farms

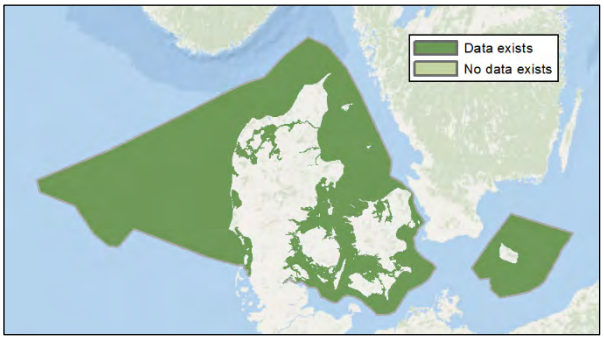
Data name	Wind farms
Group/category of activity	Pressures
Data units, max and min values	Number of wind power plants per grid cell
Category	Energy/ Habitat loss
Date created	2019-03-20
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	Current state in 2018
Units in raster data	Number of windmills within a grid cell or areas for wind farms (presence)
Spatial extent and resolution	1:100 000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The data layer shows the presence of offshore wind power plants.	
Lineage: Data was downloaded from the Danish Energy Agency (Energistyrelsen): https://ens.dk/service/statistik-data-noegletal-og-kort/download-gis-filer The input point shape file was rasterized to the ECOMAR grid and the number of wind power plants per grid cell were calculated.	
Considerations for use in ECOMAR: None	
Recommendations for data improvement: None	
Data authoring organization	Danish Energy Agency
Data author contact	ens@ens.dk
Data source	Danish Energy Agency
Data source contact	ens@ens.dk
INSPIRE topic category	Energy, oceans, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Wind power, environmental impact
Maintenance	Not planned
Metadata date	2019-06-12
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

Wind farms fields (2019) and number of offshore wind power plants per grid cell

Estimated uncertainty



Data coverage

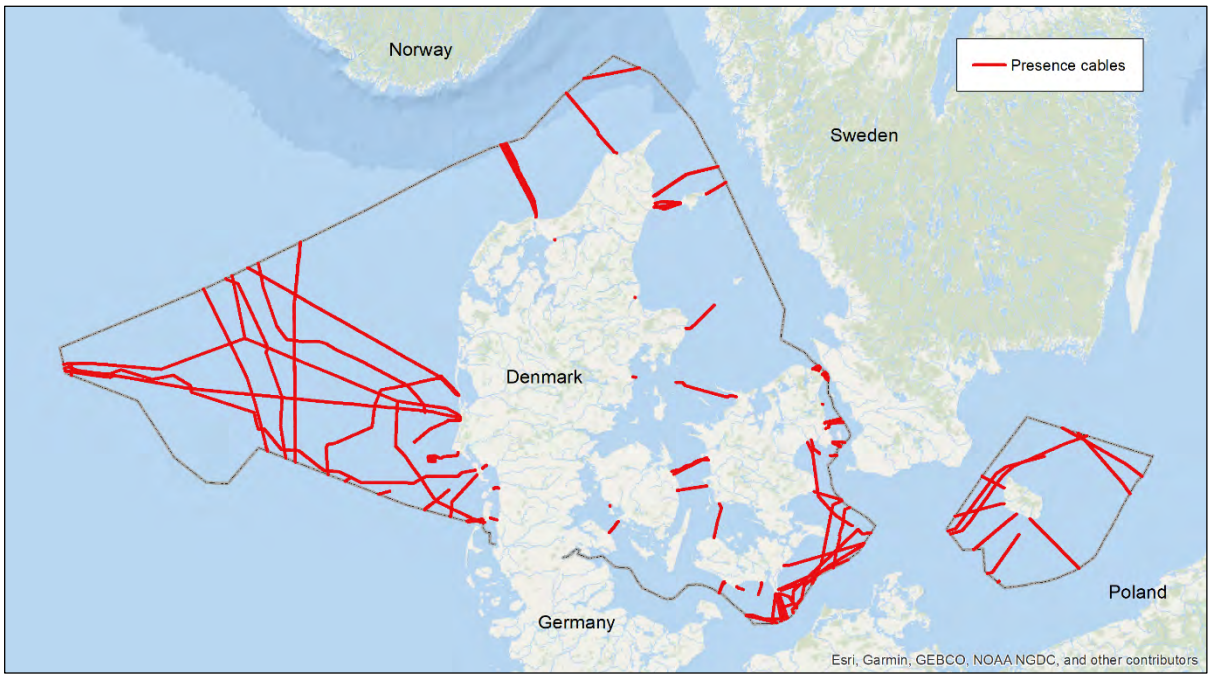


Estimated uncertainty: Observed data within the Danish EEZ.
Data coverage: Data collection within the Danish EEZ.

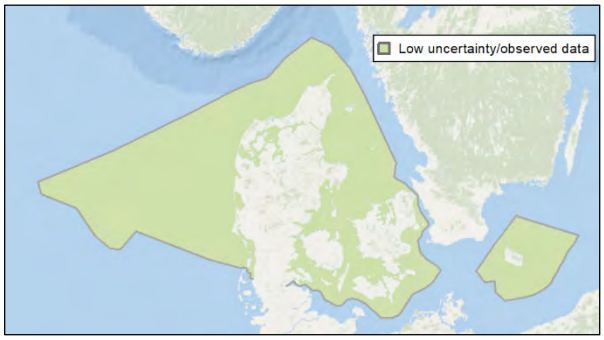
A8.8 Sea cables

Data name	Sea cables
Group/category of activity	Habitat loss
Data units, max and min values	Presence/absence
Category	Pressure
Date created	2019-03-29
Data type	Data series
Status	Completed
Data format	32-bit floating point Tagged Images File Format (.tif)
Temporal period	2018
Units in raster data	Presence/ absence
Spatial extent and resolution	Original resolution of data: 0.05 degrees grid. Values have been distributed evenly out on 500 m raster
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: This data layer shows the presence of sea cables	
Lineage: Data was downloaded from the EMODnet human activities and HELCOM map service	
Considerations for use in ECOMAR: None	
Recommendations for data improvement: None	
Data authoring organization	EMODnet human activities http://www.emodnet-humanactivities.eu HELCOM Mapservice http://maps.helcom.fi/website/mapservice/
Data author contact	http://www.emodnet-humanactivities.eu helcom.data@helcom.fi
Data source	EMODnet human activities http://www.emodnet-humanactivities.eu HELCOM Mapservice http://maps.helcom.fi/website/mapservice/
Data source contact	http://www.emodnet-humanactivities.eu helcom.data@helcom.fi
INSPIRE topic category	Oceans, environment
INSPIRE theme	Food
GEMET keywords	Food, fish farming
Maintenance	Not planned
Metadata date	2019-03-29
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

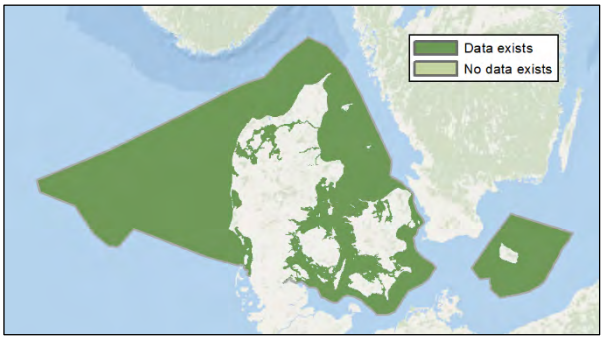
Presence of sea cables



Estimated uncertainty



Data coverage

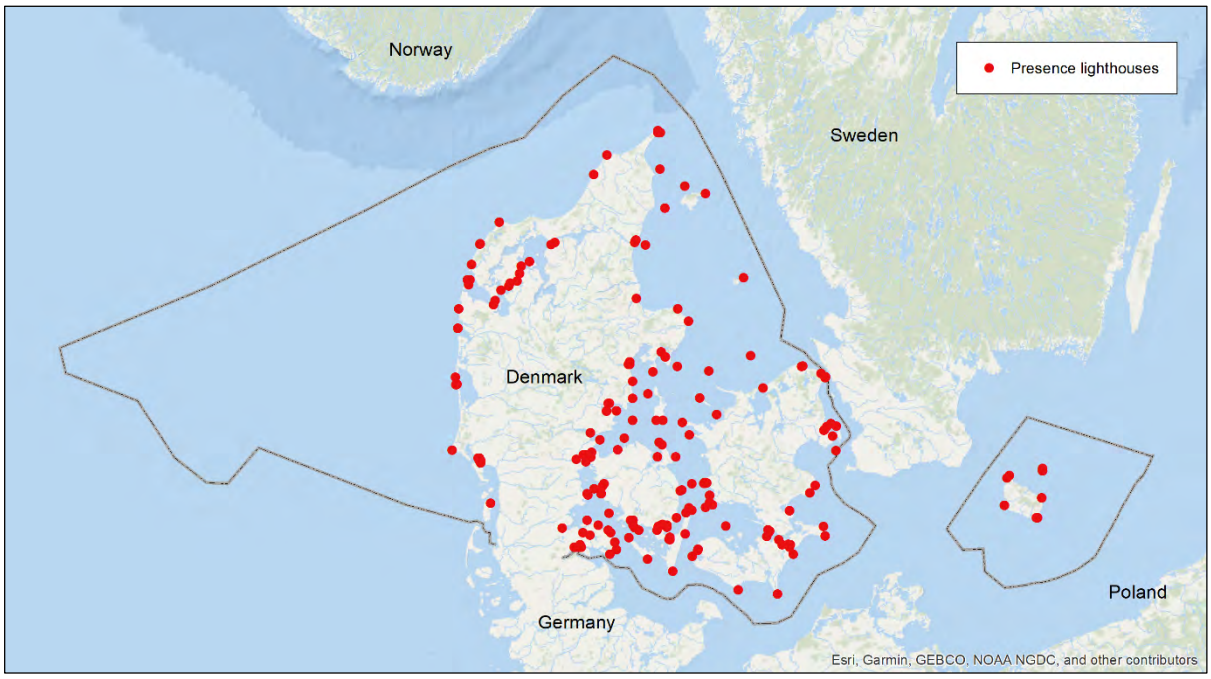


Estimated uncertainty: Observed data within the Danish EEZ.
Data coverage: Data collection within the Danish EEZ.

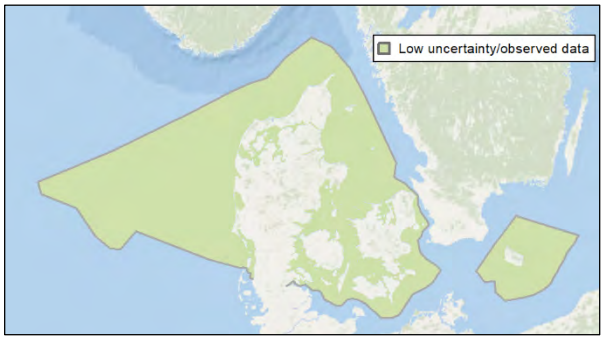
A8.9 Lighthouses

Data name	Lighthouses
Group/category of activity	Pressure
Data units, max and min values	Locations, presence/absence
Category	Infrastructure and Physical disturbance
Date created	2015-08-13
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	Current state
Units in raster data	Presence/absence
Spatial extent and resolution	1:100 000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.rio/3035
Summary: The data layer shows the presence of lighthouses in the Danish EEZ.	
Lineage: The data was created by downloading the shapefile for Europe of lighthouse locations. The data was rasterized to the ECOMAR grid.	
Considerations for use in ECOMAR: None	
Recommendations for data improvement: None	
Data authoring organization	AND-International
Data author contact	bruno.bordeau@and-international.com severine.renault@and-international.com
Data source	EMODnet human activities http://www.emodnet-humanactivities.eu
Data source contact	bruno.bordeau@and-international.com severine.renault@and-international.com
INSPIRE topic category	Oceans, Environment
INSPIRE theme	Buildings
GEMET keywords	Man-made object, Traffic Flow Direction, Waterway, building, tourism, transport
Maintenance	Unknown
Metadata date	2019-06-12
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

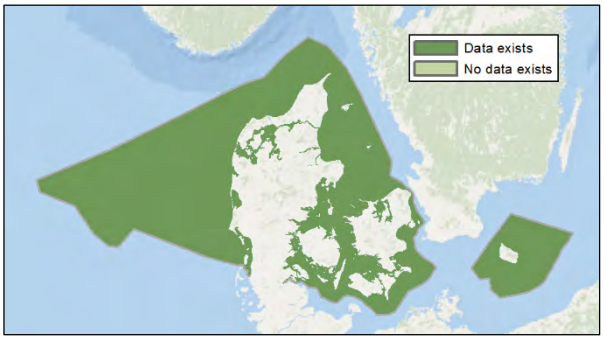
Presence of lighthouses



Estimated uncertainty



Data coverage



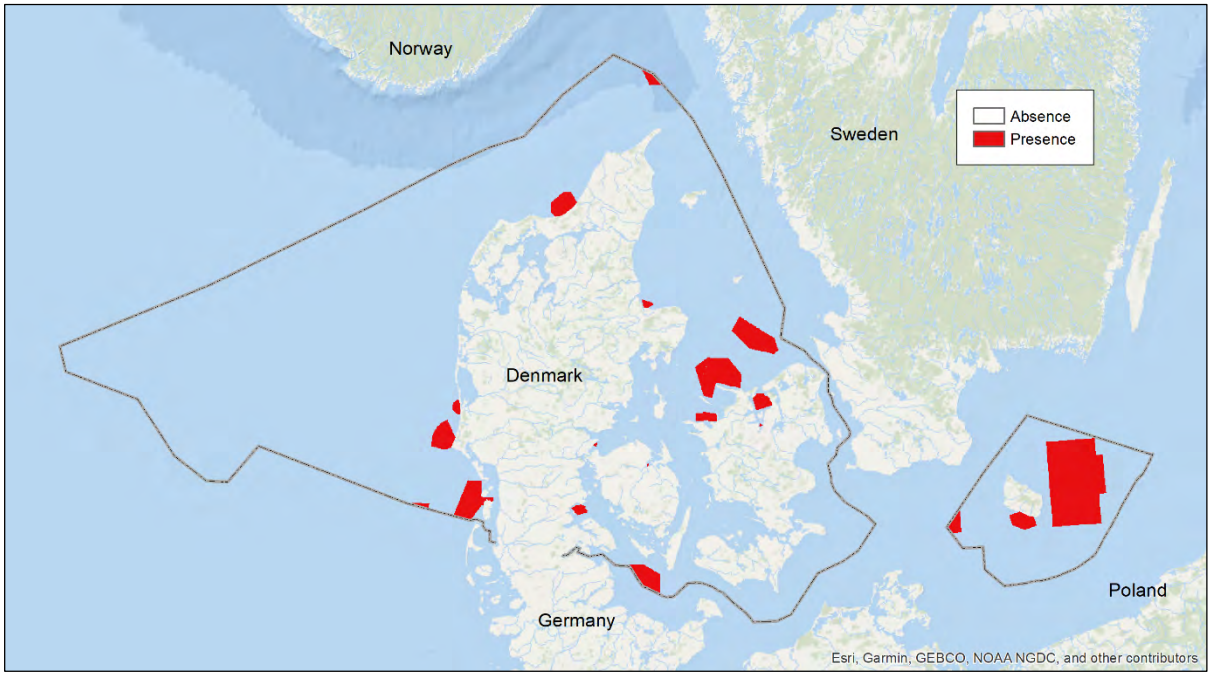
Estimated uncertainty: Observed data within the Danish EEZ.
Data coverage: Data collection within the Danish EEZ.

A8.10 Military areas

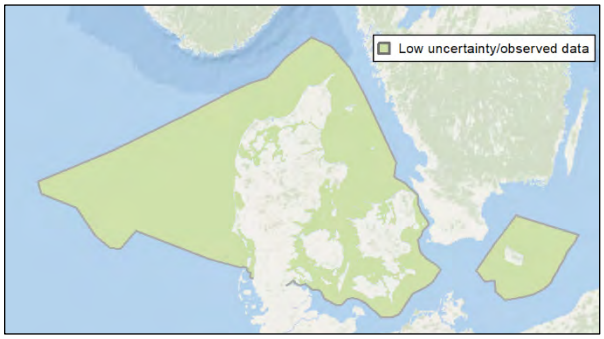
Data name	Military areas
Group/category of activity	Pressure
Data units, max and min values	Presence/absence
Category	Habitat loss, Military activities
Date created	2013
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	Not available
Units	Presence/absence
Spatial extent and resolution	100m x 100m original resolution, 1:100 000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The military areas represent areas at sea used for military training and includes all the activities that can take place, such as shooting, bombing and boating activities.	
Lineage: The data layer was conducted by image analysis and based on nautical charts in Mohn et al. (2015). The data was rasterized to the ECOMAR grid. Mohn, C., C. Göke, K. Timmermann, J.H. Andersen, K. Dahl, R. Dietz, L.I. Iversen, et al. 2015. "Symbiose - Ecologically Relevant Data for Marine Strategies." Technical Report from DCE – Danish Centre for Environment and Energy 62. Aarhus University, DCE – Danish Centre for Environment and Energy. http://dce2.au.dk/pub/TR62.pdf.	
Considerations for use in ECOMAR: None	
Recommendations for data improvement: None	
Data authoring organization	NIVA Denmark
Data author contact	Therese.Harvey@niva-dk.dk
Data source	Aarhus University Mohn, C., C. Göke, K. Timmermann, J. H. Andersen, K. Dahl, R. Dietz, L.I. Iversen, et al. (2015): "Symbiose- Ecologically Relevant Data for Marine Strategies." Technical Report from DCE – Danish Centre for Environment and Energy 62. Aarhus University, DCE – Danish Centre for Environment and Energy. http://dce2.au.dk/pub/TR62.pdf.
Data source contact	Therese.Harvey@niva-dk.dk
INSPIRE topic category	Ocean, Environment
INSPIRE theme	oceanographic geographical features
GEMET keywords	Military, defence, chemical pollution, military activities , environmental impact
Maintenance	Not planned
Metadata date	2019-03-28

Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

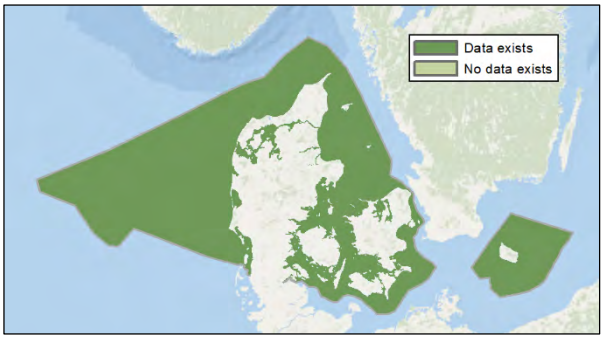
Presence of military areas



Estimated uncertainty



Data coverage



Estimated uncertainty: Observed data within the Danish EEZ.

Data coverage: Data collection within the Danish EEZ.

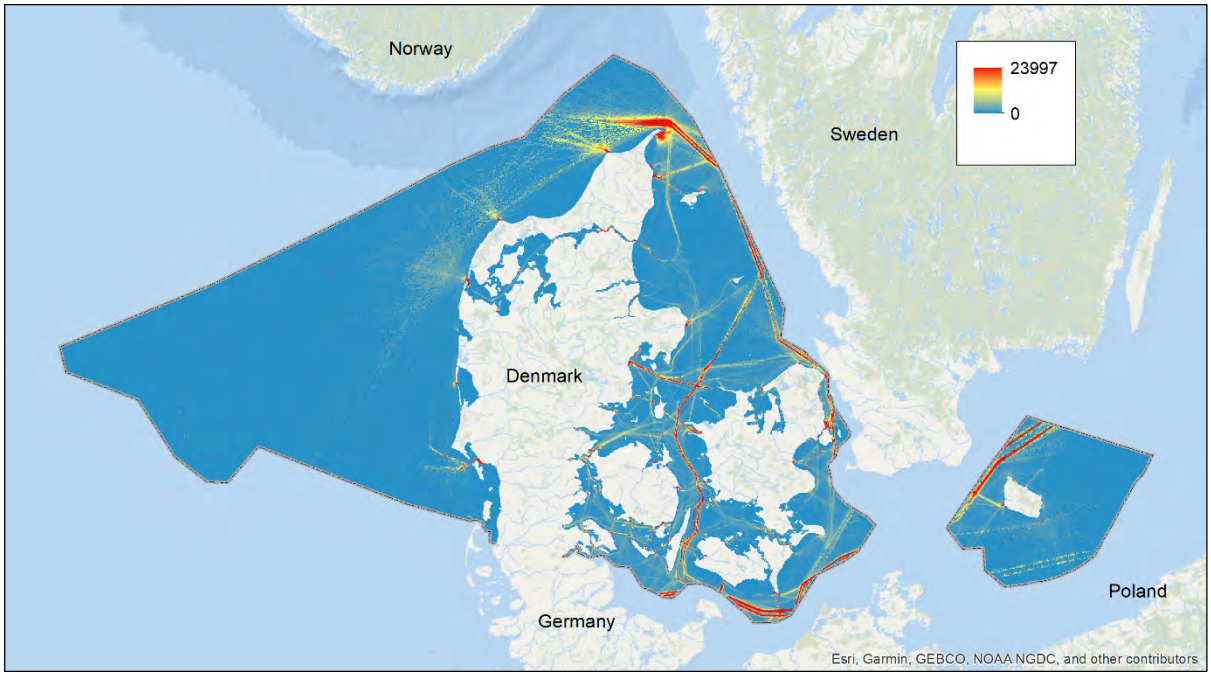
A9 Shipping and transportation

A9.1 Shipping

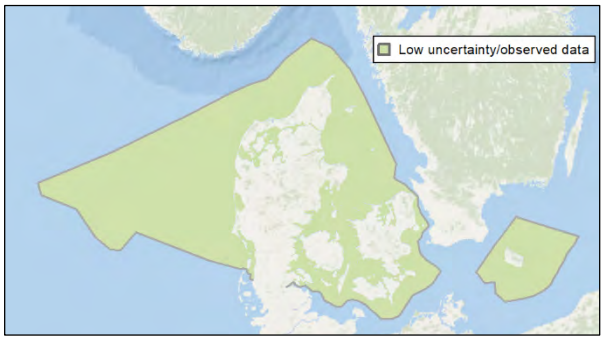
Data name	Vessel density
Group/category of activity	Shipping and transportation
Data units, max and min values	Vessel density, number of ships
Category	Pressures
Date created	2019-03-11
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	2017
Units in raster data	Presence/absence
Spatial extent and resolution	1:100 000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.rio/3035
Summary: The data layer shows the ship intensity of all types of vessels within the Danish EEZ for 2017.	
Lineage: The data was created by downloading the shapefile for European of vessel intensity sites from EMODnet. Ship movements were registered by the AIS positioning system. The data set presents vessel density in 2017. The following ship types are included in the yearly average: 0) Other, 1) Fishing, 2) Service, 3) Dredging or underwater operations, 4) Sailing, 5) Pleasure Craft, 6) High speed craft, 7) Tug and towing, 8) Passenger, 9) Cargo, 10) Tanker, 11) Military and Law Enforcement, 12) Unknown and All ship types. Human Activities web portal (www.emodnet-humanactivities.eu) The data was rasterized to the ECOMAR grid.	
Considerations for use in ECOMAR: Smaller boats and ships with a length shorter than 12 m are not obliged to be equipped with AIS. Therefore, not all ships are represented.	
Recommendations for data improvement: None	
Data authoring organization	Cogea Srl
Data author contact	lfalco@cogea.it apititto@cogea.it
Data source	EMODnet human activities http://www.emodnet-humanactivities.eu Cogea Srl
Data source contact	lfalco@cogea.it apititto@cogea.it
INSPIRE topic category	Oceans, Environment
INSPIRE theme	Infrastructure, traffic
GEMET keywords	Merchant shipping, environmental impact

Maintenance	Unknown
Metadata date	2019-06-12
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

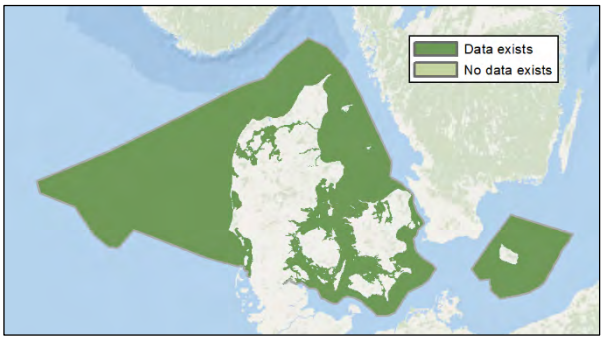
Shipping as vessel intensity (vessel density i.e. number of ships)



Estimated uncertainty



Data coverage



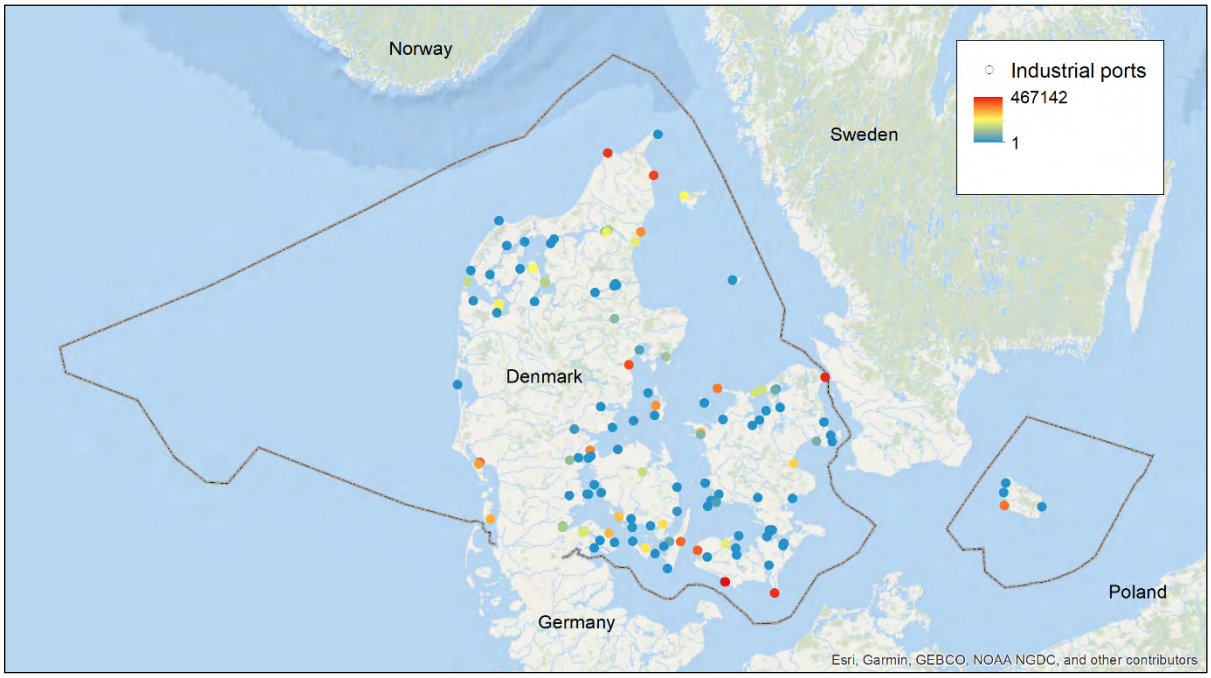
Estimated uncertainty: Observed data within the Danish EEZ.
Data coverage: Data collection within the Danish EEZ.

A9.2 Industrial ports

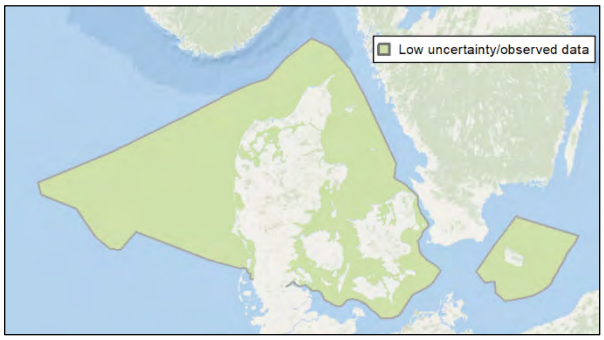
Data name	Industrial ports
Group/category of activity	Shipping and transportation
Data units, max and min values	Total yearly gross tonnage of ships
Category	Pressures
Date created	2019-03-11
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	2017
Units in raster data	Number of Industrial ports per gridcell
Spatial extent and resolution	1:100 000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.rio/3035
Summary: The data layer shoves the annual average of the maritime transport in and out from the main Danish ports and is a part of the EU main ports dataset from EMODnet. The layer represents gods traffic data in thousands of tonnes by type and direction. In ECOMAR the total average over 7 years (2012-2018) was used. The spatial data layer of the main European ports was created in 2014 by Eurofish and Cogea for the European Marine Observation and Data Network (EMODnet). The yearly reported data includes geodatabase includes goods, passengers and vessels traffic.	
Lineage: The data was created by downloading the shapefile for European of main ports sites and excel datasheets with the information of the yearly goods traffic. Average total thousands tonnage per harbour were calculated based on the yearly reports for 2012-2018. The data was rasterized to the ECOMAR grid. Human Activities web portal (www.emodnet-humanactivities.eu)	
Considerations for use in ECOMAR: None	
Recommendations for data improvement: None	
Data authoring organization	NIVA Denmark
Data author contact	Therese.Harvey@niva-dk.dk
Data source	EMODnet human activities http://www.emodnet-humanactivities.eu Cogea srl Eurofish International Organisation
Data source contact	lfalco@cogea.it apititto@cogea.it info@eurofish.dk
INSPIRE topic category	Oceans, Environment
INSPIRE theme	Infrastructure, Transport networks
GEMET keywords	Merchant shipping, environmental impact
Maintenance	Unknown

Metadata date	2019-06-12
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

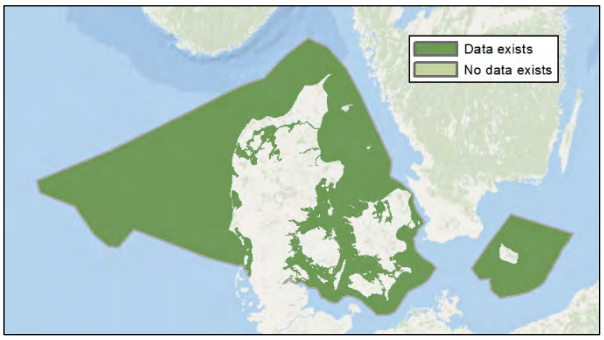
Industrial ports (average gross tonnage/year)



Estimated uncertainty



Data coverage

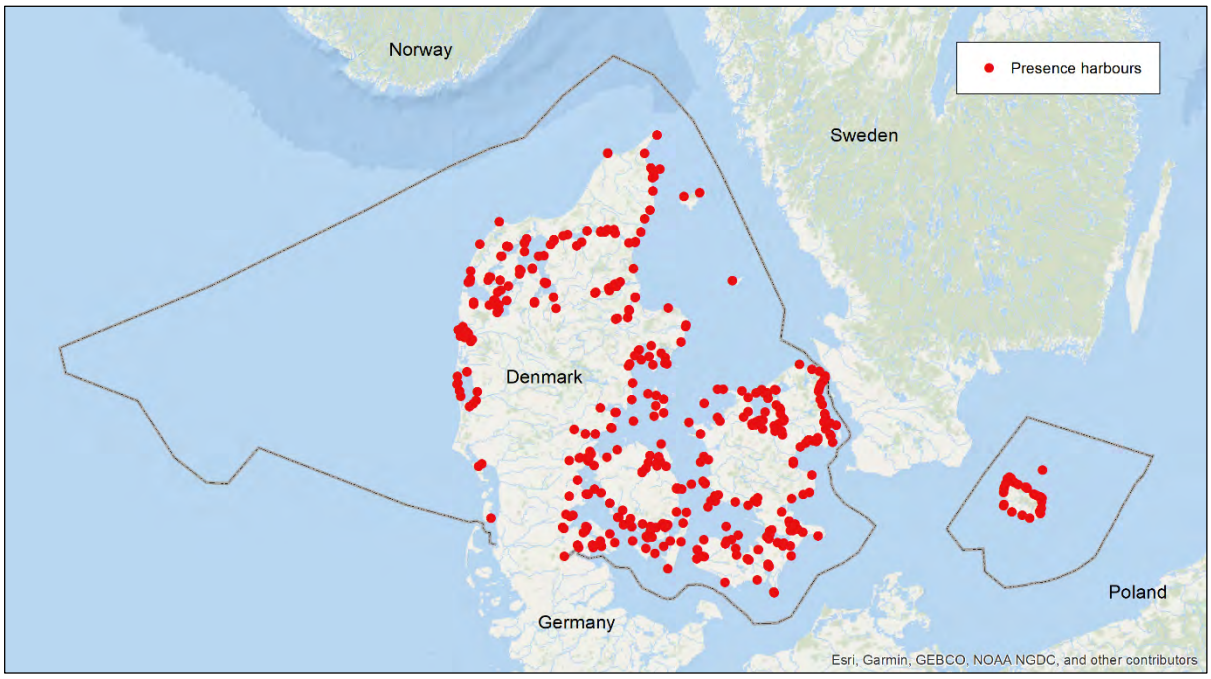


Estimated uncertainty: Observed data within the Danish EEZ.
Data coverage: Data collection within the Danish EEZ.

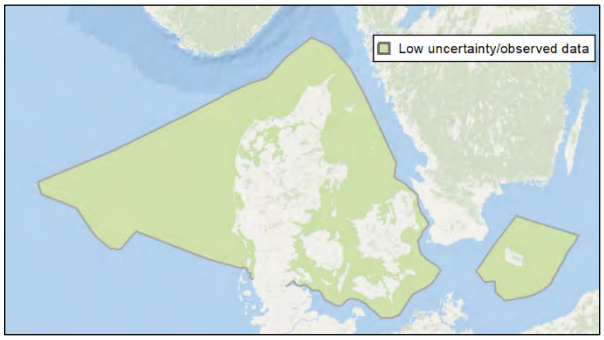
A9.3 Harbours

Data name	Harbours
Group	Shipping and transportation
Data Units	Presence/absence of locations
Category	Pressure
Date created	2019-04
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	2013
Units in raster data	Number of harbours per grid cell
Spatial extent and resolution	1:100 000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The data layer shows the location of the Danish harbours that are used for recreation and leisure boating.	
Lineage: The original data was downloaded from Danish Environmental Agency (Miljøstyrelsen). The data was part of the background data for the initial analysis for the EU Water Framework Directives 2015-2021. For ECOMAR the positions of harbours were rasterized to the ECOMAR grid and the number of harbours per grid cell was counted.	
Considerations for use in ECOMAR: None	
Recommendations for data improvement: None	
Data authoring organization	NIVA Denmark
Data author contact	Therese.Harvey@niva-dk.dk
Data source	MiljøGIS https://mst.dk/service/miljoegis/
Data source contact	support@miljoeportal.dk
INSPIRE topic category	Oceans, Environment
INSPIRE theme	Buildings, Infrastructure
GEMET keywords	Environmental impact, recreation
Maintenance	Not planned
Metadata date	2019-06-12
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

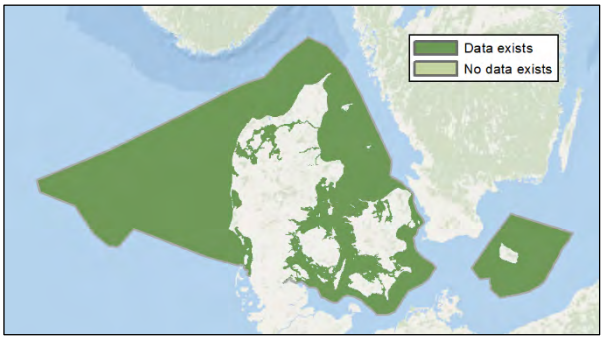
Presence of harbours



Estimated uncertainty



Data coverage



Estimated uncertainty: Observed data within the Danish EEZ.
Data coverage: Data collection within the Danish EEZ.

A10 Noise and energy

A10.1 Continuous noise (ship sound 125 Hz)

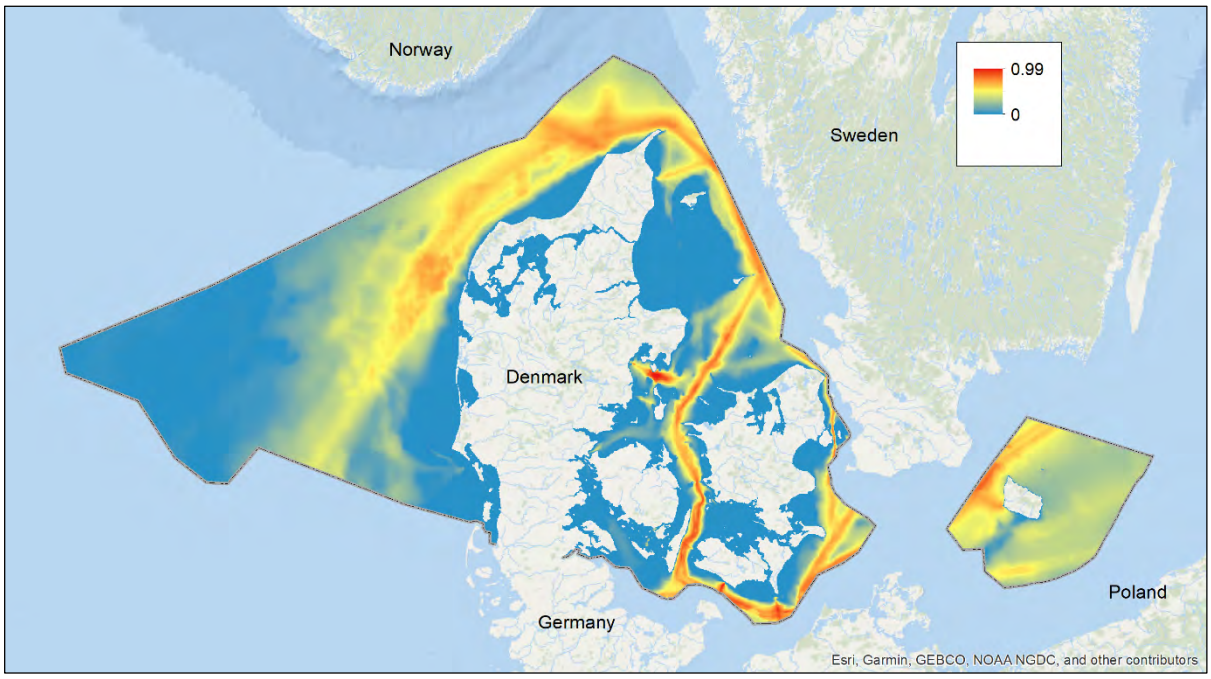
Data name	Continuous noise
Group/category of activity	Noise and energy
Data units, max and min values	Normalised index
Category	Pressure
Date created	2019-05-05
Data type	Dataset
Status	Completed
Data format	Free text used to define the format and if applicable the format version that the data is supplied in, e.g. "32-bit floating point Tagged Images File Format"
Temporal period	Average over July 2018
Units in raster data	Scaled indicator [0..1]
Spatial extent and resolution	Entire Danish EEZ. Resolution of original data approx. 200 m for main area, 50 m for Bornholm. Final layer 500 x 500 m.
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035

Summary:
The map represents an index of ship noise in Danish waters. Rather than expressing absolute sound levels, the index is intended to show how much the ship noise exceeds the natural ambient noise. An index of zero indicates an area dominated by natural ambient noise and an index of one an area completely dominated by ship noise. The ship noise has been modelled based on input in the form of AIS positions for all ships in Danish waters in 2018, whereas the natural ambient noise was derived from measurements made in 2014 during the monitoring project BIAS.
Known weaknesses in the data includes that only ships with AIS are includes, which leaves out most of the smaller pleasure boats and some fishing vessels.

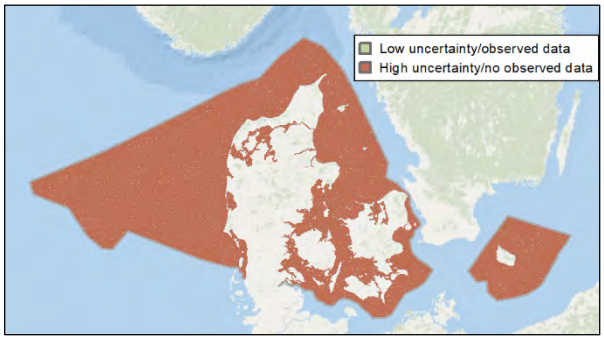
Lineage:
AIS-data for all ships in Danish waters were obtained from Søfartsstyrelsen. This data was used as input to model the underwater noise in the 125 Hz third-octave band in the Danish EEZ. Modelling was performed by the company Quiet Oceans and by means of their modelling framework Quonops. Modelling is based on snapshots, once every hour, which are combined to statistical maps of the noise month by month. The source characteristics of individual ships is modelled by the Randi3 model, which provides spectral noise level estimates based on the length and speed of the vessels. Propagation loss was modelled by a parabolic equation approach (RAM), with environmental input in the form of sediment acoustic properties, bathymetry, as well as dynamic data on hydrography and sea surface roughness obtained from EMODnet, HELCOM, Swedish Meterological and Hydrological Institute and other databases.
Natural ambient noise was estimated from long-time measurements obtained during the BIAS project. This data was correlated with wind and wave models and local Wenz-curves were generated, which could be used to estimate the wind-generated noise throughout the model area.
Monthly statistics were modelled and from these the upper 5% exceedance level (L_5) was extracted and levels in the 125 Hz third-octave band (MSFD criterion 11C2.2) was used as a proxy for ship noise. This level was normalized according to the method developed for the HOLAS II assessment. Monthly

L_5 values were averaged across all 12 months of 2018 and normalized on a 0 to 1 scale against a zero of 92 dB re. 1 µPa (considered representative of the average pre-industrial level on noise) and a maximum of 127 dB re. 1 µPa, considered representative of the noise level in most severely exposed waters, such as the shipping lanes through Storebælt and Femern Bælt. For technical reasons the waters around Bornholm were modelled separately and on a finer spatial scale than the rest of the Danish EEZ. This is not thought to affect the results. The modelled maps were transferred to the ECOMAR grid by extrapolation in GIS. Generally, the uncertainties in the modelling originate from uncertainties in the input data and are thus very difficult to assess. The model itself does not estimate variance or any other indicator of precision. Although error propagation would be possible in theory the processing demands alone would be prohibitive, even if reasonably good estimates on the errors on input data could be obtained, which they cannot.	
Considerations for use in ECOMAR: The data layer was created as a designated modelling for ECOMAR and it cannot be used outside the ECOMAR project without permission from Quiet Oceans and Aarhus University.	
Recommendations for data improvement: Derivation of higher-resolution data would require that data be obtained again from the original sources.	
Data authoring organization	Aarhus University, Department of Bioscience
Data author contact	Jakob Tougaard: jat@bios.au.dk
Data source	Quiet Oceans, Brest, France
Data source contact	info@quiet-oceans.com
INSPIRE topic category	Oceans, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Merchant shipping, noise pollution, environmental impact
Maintenance	Annually
Metadata date	2019-04-12
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

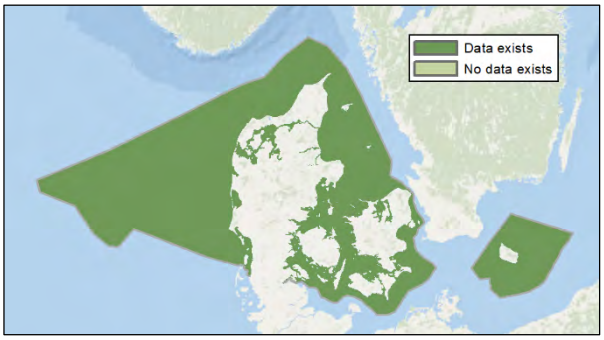
Continuous noise (normalized index)



Estimated uncertainty



Data coverage



Estimated uncertainty: Observed data at stations within the Danish EEZ.
Data coverage: Data collection/ model covers the Danish EEZ.

A10.2 Impulsive noise

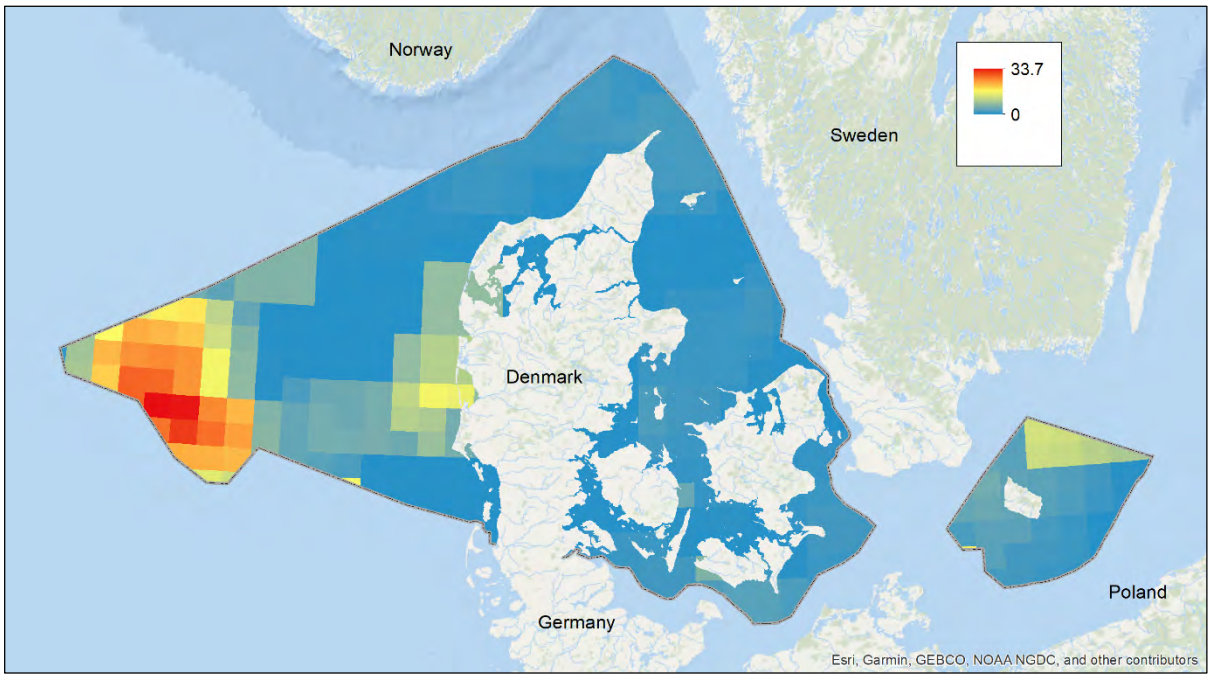
Data name	Impulsive noise
Group/category of activity	Noise and energy
Data units, max and min values	Unit is impulse-block days per year. Minimum is 0 (no impulsive noise in block). Maximum is 365 (impulsive noise every day in block)
Category	Pressure
Date created	2019-03-19
Data type	Dataset
Status	Completed
Data format	Floating point
Temporal period	Average over years 2015-2017
Units in raster data	Average impulse-block-days per year
Spatial extent and resolution	Entire Danish EEZ. Resolution ICES statistical sub-rectangles (1/6° latitude x 1/3° longitude).
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035

Summary:
The layer contains data extracted from the ICES impulsive noise register for the years 2016-2018. The noise register contains impulsive noise divided into five categories:
1) Seismic surveys with air guns
2) Pile driving (from sheet piles in harbours to large wind turbine foundations)
3) Explosions
4) Sonars with energy below 10 kHz (primarily military sonars) and acoustic alarms (seal scarers)
5) Generic impulsive sources (for example subbottom profiling equipment).
All entries are treated as equal and exported as impulse-block-days per ICES statistical subrectangle. One impulse-block-day means that an impulsive noise source (one of the five different types) was present in the statistical subrectangle during a 24-hour period and can thus consist of everything from a single explosion to a full day of seismic survey. There is no scaling with duration of the activities (within each 24-hour day) or intensity of the sound.
Major limitations of the dataset include the lack of scaling with duration and intensity, but also underreporting. For Danish waters, no explosions or military sonars have been reported in the period 2016-2018, although it is almost certain that such activities have occurred.

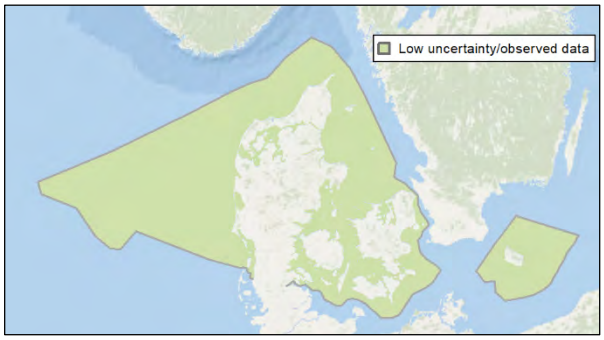
Lineage:
Original data were compiled by national permitting agencies and submitted to the ICES impulsive noise register, as part of the monitoring program for impulsive noise, as specified by the MSFD, and HELCOM and OSPAR monitoring programs. Data for this layer were extracted from the ICES database in the form of impulse-block-days for the years 2016-2018, on a spatial scale of ICES statistical subrectangles. Most of the activities were conducted within the Danish EEZ, but some activities were reported by other countries in shared rectangles.
Impulse-block-days were averaged over the three reporting years, imported into ArcGIS and transferred to the ECOMAR grid.
The layer contains only reported activities and underreporting is a known source of error. Significant underreporting is known for pile driving in connection to construction works at harbours and will affect the coastal waters. No explosions or use of military sonars have been reported. Such activities are known to have taken place in Danish EEZ in the years 2016-2018, but the extent is unknown and

the effect of this lack of reporting cannot be evaluated. Different activities are not scaled by magnitude. A single shot with a small airgun is thus weighted the same as a 3-hour pile driving operation, although the impact on the marine environment is likely to be very different. Both are reported as one impulse-block-day. This is an inherent limitation of the reporting system and cannot be overcome within the limitations of ECOMAR.	
Considerations for use in ECOMAR: Spatial resolution of original data is lower than ECOMAR grid, approx. 20 x 20 km.	
Recommendations for data improvement: Derivation of higher-resolution data would require that data is obtained again from the original sources.	
Data authoring organization	Aarhus University, Department of Bioscience
Data author contact	Jakob Tougaard: jat@bios.au.dk
Data source	ICES impulsive noise register
Data source contact	info@ices.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Environmental impact, noise pollution
Maintenance	Annually
Metadata date	2019-04-12
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

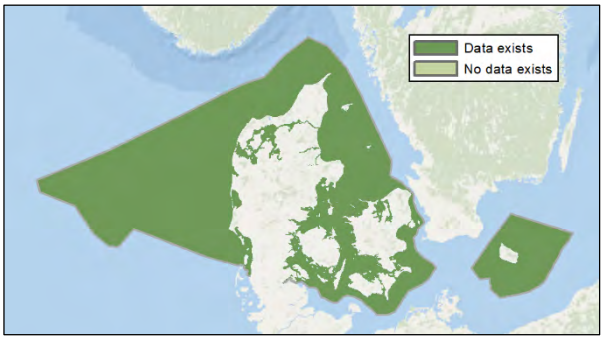
Impulsive noise (block days/year)



Estimated uncertainty



Data coverage

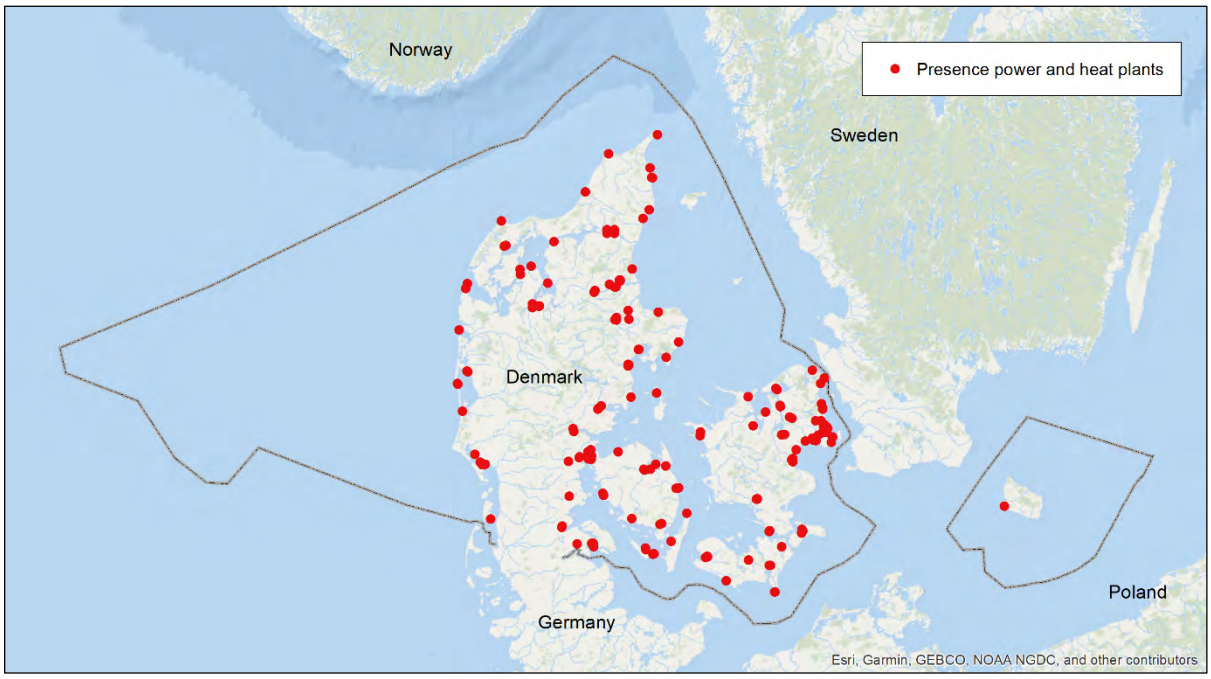


Estimated uncertainty: Observed data within the Danish EEZ.
Data coverage: Data collection within the Danish EEZ.

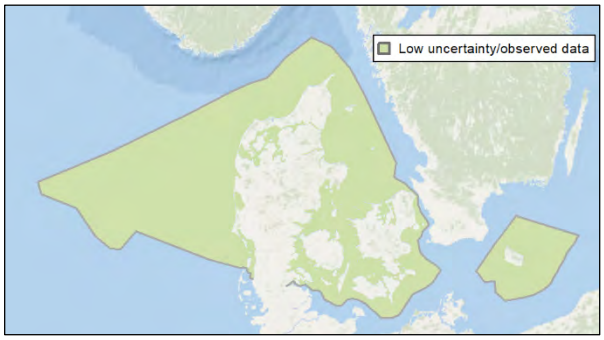
A10.3 Energy production

Data name	Power and heat plants
Group/category of activity	Noise and energy
Data units, max and min values	Presence/absence
Category	Pressure
Date created	2019-03-20
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	2018
Units in raster data	Presence/absence
Spatial extent and resolution	1:100 000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: Heat and power plants located close to the shoreline.	
Lineage: Data was downloaded from the Danish Energy Agency (Energistyrelsen): https://ens.dk/service/statistik-data-noegletal-og-kort/download-gis-filer	
Considerations for use in ECOMAR: None	
Recommendations for data improvement: None	
Data authoring organization	Danish Energy Agency
Data author contact	ens@ens.dk
Data source	Danish Energy Agency
Data source contact	ens@ens.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Heat power plants, environmental impact
Maintenance	Not planned
Metadata date	2019-06-12
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

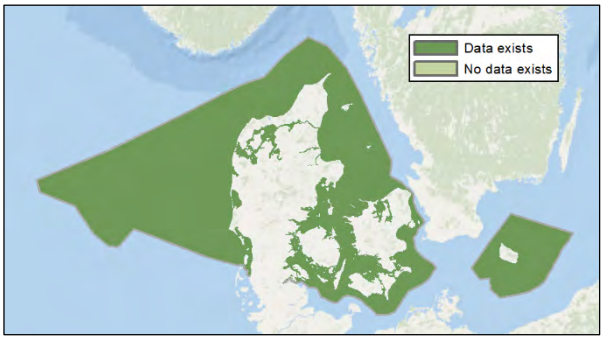
Presence of energy power and heat plants



Estimated uncertainty



Data coverage



Estimated uncertainty: Observed data within the Danish EEZ.
Data coverage: Data collection within the Danish EEZ.

A11 Non-indigenous species

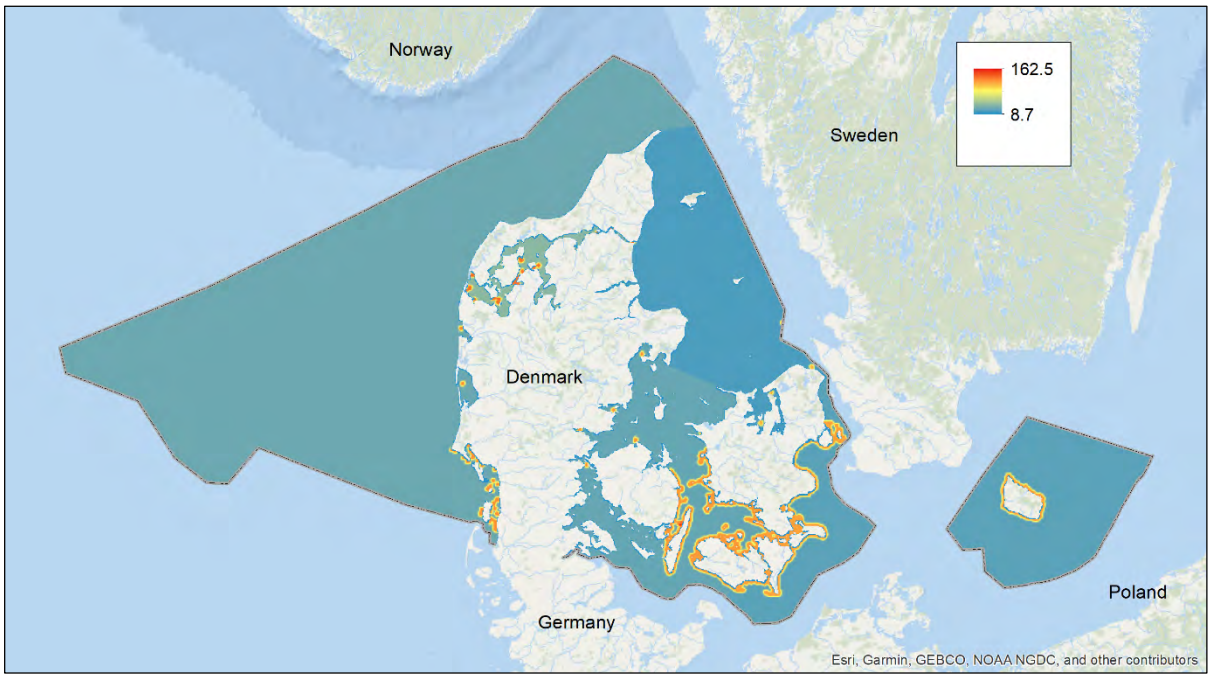
Data name	Non-indigenous species
Group	Non-indigenous species
Data units, max and min values	Normalized, relative unit – Min: 8.7, max: 162.5
Category	Pressure
Date created	2019-07-02
Data type	Dataset
Status	To be updated
Data format	32-bit floating point Tagged Images File Format
Temporal period	From Ralaha report: Pacific Oyster (*Crassostrea gigas*): 2017 Round Goby (*Neogobius melanostomus*): 2016 Phytoplankton, zooplankton, macroalgae, benthic invertebrates: 2006-2014 MONIS 2016-2017
Units in raster data	Index
Spatial extent and resolution	1:100 000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035

Summary:
The non-indigenous data set is based on a combination of data sources of different types.
The data layer is meant to represent a general index over the presence of non-indigenous species.

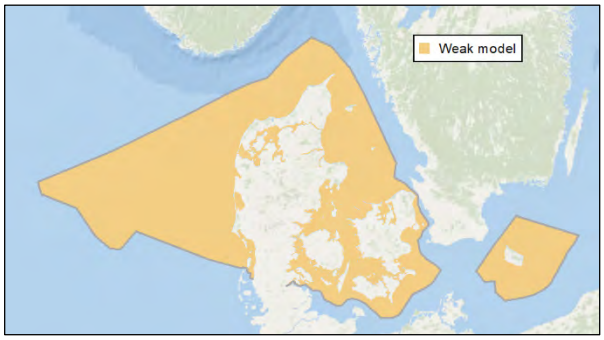
Lineage:
The data layer was conducted from different sources that was merged.
From www.fugleognatur.dk data for Pacific Oyster (*Crassostrea gigas*) is based on location coordinates where the pacific oyster has been found, and those were transferred to ArcGIS as points. For the present report the scientific name 'Crassostre gigas' is used, although the synonymization with 'Magallana gigas' have been suggested (Bayne et al., 2017). A buffer around each point of 2000 meters were used, as a proxy of the distribution. Values within the buffer zones were given the value "100". Round Goby (*Neogobius melanostomus*): a buffer of 2000 meter from the coast of Denmark in areas where the Round Goby was found was used as a proxy of the distribution. Values within the buffer zone were given the value "100".
Phytoplankton, zooplankton, macroalgae, benthic invertebrates: For each marine area, the similarity value of the four groups were summed, and the sum was given as value to each marine area (Staehr et al 2016) and in additional data on occurrence of Round goby from Carl et al. (2016) were added to the dataset. The areas with found species from Staehr et al (2016) was given half value in the final calculation. The three data layers were combined and the summed value of each grid cell, was used as an index value of non-indigenous species.
Bayne B.L., Ahrens M., Allen S.K., Anglès D'Auriac M., Backeljau T., Beninger P., Bohn R., Boudry P., Davis J., Green T., Guo X., Hedgecock D., Ibarra A., Kingsley-Smith P., Krause M., Langdon C., Lapègue S., Li C., Manahan D., Mann R., Perez-Paralle L., Powell E.N., Rawson P.D., Speiser D., Sanchez J.L., Shumway S. & Wang H. (2017): The proposed dropping of the genus Crassostrea for all Pacific cupped oysters and Its replacement by a new genus *Magallana*: A dissenting view. Journal of Shellfish Research. 6(3): 545-547., available online at https://doi.org/10.2983/035.036.0301
Carl H., Behrens J., & Rask Møller P.. 2016. 'Statusrapport_NIS_Fisk_2016.Pdf'. https://fiskeatlas.ku.dk/nyheder/Statusrapport_NIS_Fisk_2016.pdf.

Stæhr P., Jakobsen H., Jørgen L. Hansen S., Andersen P., Storr-Paulsen M., Christensen J., Lundsteen S., Göke C., and Carausu M-C.. 2016. 'Trends in Records and Contribution of Non-Indigenous Species (NIS) to Biotic Communities in Danish Marine Waters', 48.	
Considerations for use in ECOMAR: The accuracy of the data layer is very variable, depending on the data source. The data for areas in Staehr et al (2016) are extrapolated to the offshore areas, therefore the lower value.	
Recommendations for data improvement: A more accurate common data layer could be created if more data was available.	
Data authoring organization	NIVA Denmark
Data author contact	Therese.Harvey@niva-dk.dk
Data source	Pacific oyster (*Crassostrea gigas*): "Fugleognatur.dk," (2017, http://www.fugleognatur.dk/artintro.asp?ID=7480) Round Goby (*Neogobius melanostomus*): Carl et al. (2016) Phytoplankton, zooplankton, macroalgae, benthic invertebrates: Stæhr et al. (2016)
Data source contact	Therese.Harvey@niva-dk.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Non-indigenous species, environmental impact
Maintenance	Not planned
Metadata date	2019-04-12
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

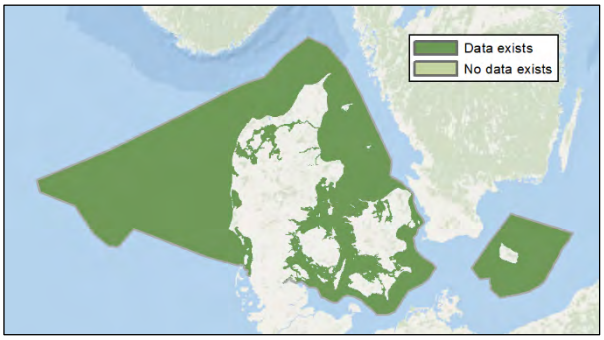
Relative presence index of NIS per grid cell



Estimated uncertainty



Data coverage



Estimated uncertainty: Index based on observed data with various accuracy within the Danish EEZ.

Data coverage: Data collection within the Danish EEZ.

A12 Recreational activities

A12.1 Recreational boating

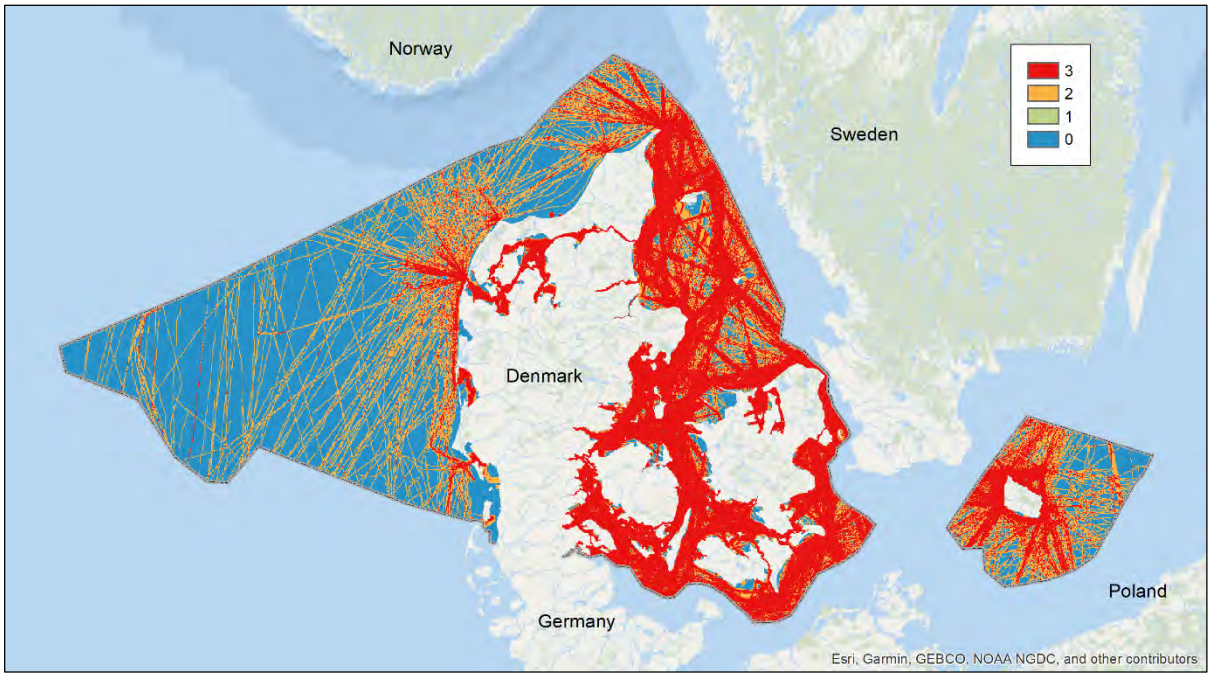
Data name	Recreational boating
Group	Recreational activities
Data units, max and min values	3 levels (1-3)
Category	Pressure
Date created	2019-04-12
Data type	Dataset
Status	Completed
Data format	Shape File (point data)
Temporal period	2015-2016
Spatial extent and resolution	Top: 3906250 m, Left: 3901250 m, Right: 4733250 m, Bottom: 3474750 m
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035

Summary:
The data shows a general surface map over boating in Danish waters according to three relative intensity levels. The map is a model output (kernel density surface) based on data from two national PPGIS surveys (one representative survey with the public and one crowdsourced survey with dedicated marine recreation users), and AIS tracking of pleasure crafts (data from the Maritime Authority). For survey data, mapped places of visits (points) and routes (polylines) are included. Visit frequency (number of visits per year) is the unit of analysis. The AIS tracking of pleasure crafts is not representative for recreational sailing in DK, since only very large sailing boats have AIS transponders, however, the aggregated yearly patterns correlate with the main used recreational sailing waters in DK. Furthermore, the AIS data allows for including of international sailing tourism.

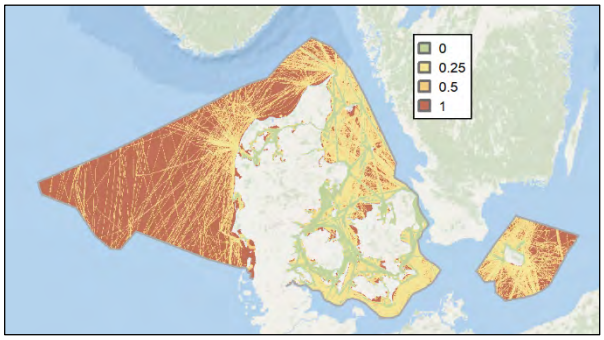
Lineage:
Aggregated Kernel Density Model outputs of five different datasets reclassified into tree relative levels of yearly use frequency (low, middle, high).
The five kernel density analyses criteria were all based on: cell size=500m, search distance=2000m, value= number of visit days per year (1-365) and a comparative number of registrations per cell for AIS data (1-835).
The data input derives from two different national surveys (data A and B) and AIS tracking of pleasure crafts (data C).
Data A: A national representative panel survey with the Danish population (n=4054) resulting in point mapping of used places for sailing (data A1, 271 places) and a polyline mapping of sailing routes (data A2, 373 routes). Each respondent estimated the number of visits per year to the mapped places and routes (yearly visit frequency). See www.havfriluftsliv.dk and Kaae et al 2018 for further information.
Data B: A national crowdsourced survey with marine recreation users (n=2437) resulting in point mapping of used places for sailing (data B1, 731 places), and a polyline mapping of sailing routes (data B2, 201 routes). Each respondent estimated the number of visits per year to the mapped places and routes (the yearly visit frequency). See www.havfriluftsliv.dk and Kaae et al 2018 for further information.
Data C: Aggregation of tracking data of pleasure boating from the AIS system (for the year 2016) to

500m resolution. Procedure: Generation of individual kernel density surfaces for each of the five datasets based on the same cell size, search criteria and value (visit frequency). Each kernel density surface was reclassified into three levels (1,2,3) according to quantile distribution (excluding '0' values, 0=No Data). The five resulting kernel density surfaces were then aggregated into a single map feature, which then was reclassified again into three relative levels (1,2,3) according to quantile distribution. Hence, the final map output highlights areas (level 3, high) supported by inter-subjectivity between the three data sources, i.e. areas that were mapped by multiple users in the surveys and/or cells with multiple AIS registrations. Estimated uncertainty is categorical, based on the intensity classes, where the most intense class (#3) is assumed to have a lower uncertainty and given the value 0, class 2 is given the value of 0.25, class 1 a value of 0.5 and the class with no recorded data, class 0 is assumed to have a rather high uncertainty and is thus given a value of 1.	
Limitations for use in ECOMAR: A possible limitation of the data is the aggregated nature of the data. Since all type of recreational activities are included, the dataset is not suited to detailed analyses of pressure relationships between different types of recreational activities (e.g. motorized vs non-motorized recreation) and different ecosystem components.	
Recommendations for data improvement: None	
Data authoring organization	University of Copenhagen, Department of Geosciences and Natural Resource Management (IGN), Section of Landscape Architecture and Planning, Rolighedsvej 23, 1958 Frederiksberg C
Data author contact	asol@ign.ku.dk
Data source	KU, IGN and Søfartsstyrelsen (AIS data)
Data source contact	asol@ign.ku.dk, bck@ign.ku.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Recreation, environmental impact
Maintenance	Not planned
Metadata date	2019-07-02
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

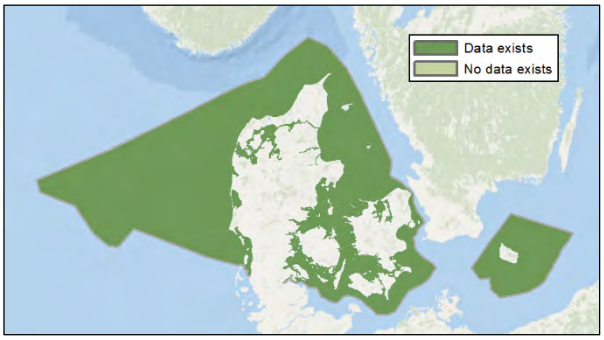
Intensity classes of recreational boating



Estimated uncertainty



Data coverage



Estimated uncertainty: Estimated uncertainty is categorical and based on the intensity classes.
Data coverage: Data collection within the Danish EEZ.

A12.2 Non-motorised water craft

Data name	Non-motorised watercraft activities (kayak, surfing)
Group	Recreational activities
Data units, max and min values	3 levels (1-3)
Category	Pressure
Date created	2019-05-13
Data type	Dataset
Status	Completed
Data format	Shape File (point data)
Temporal period	2015-2016
Spatial extent and resolution	Top: 3906250 m, Left: 3901250 m, Right: 4733250 m, Bottom: 3474750 m
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035

Summary:
The data shows a surface map over places and routes for small non-motorised water crafts which can operate on shallow waters. Mainly different types of kayak, rowing and surfing (see Kaae et al 2018 for details, www.havfriluftsliv.dk) are included. The map is based on the density of places and number of visits to each place. The map is a model output (kernel density surface) based on combined data from a crowdsourced survey and a representative panel survey. 201 routes and 2076 mapped places are included in the model from the crowdsourced survey, and 53 routes and 156 mapped places from the panel survey.

Lineage:
A kernel density model output (500m cell size, 2000m search criteria) on the stated visit frequency to places and routes mapped by users. Reclassified outputs (3 levels, quantile distribution) summarised into a single data layer, and then reclassified into a final 3 level feature (low; medium; high). See www.havfriluftsliv.dk and Kaae et al. (2018) for further information.
Estimated uncertainty is categorical, based on the intensity classes, where the most intense class (#3) is assumed to have a lower uncertainty and given the value 0, class 2 is given the value of 0.25, class 1 a value of 0.5 and the class with no recorded data, class 0 is assumed to have a rather high uncertainty and is thus given a value of 1.

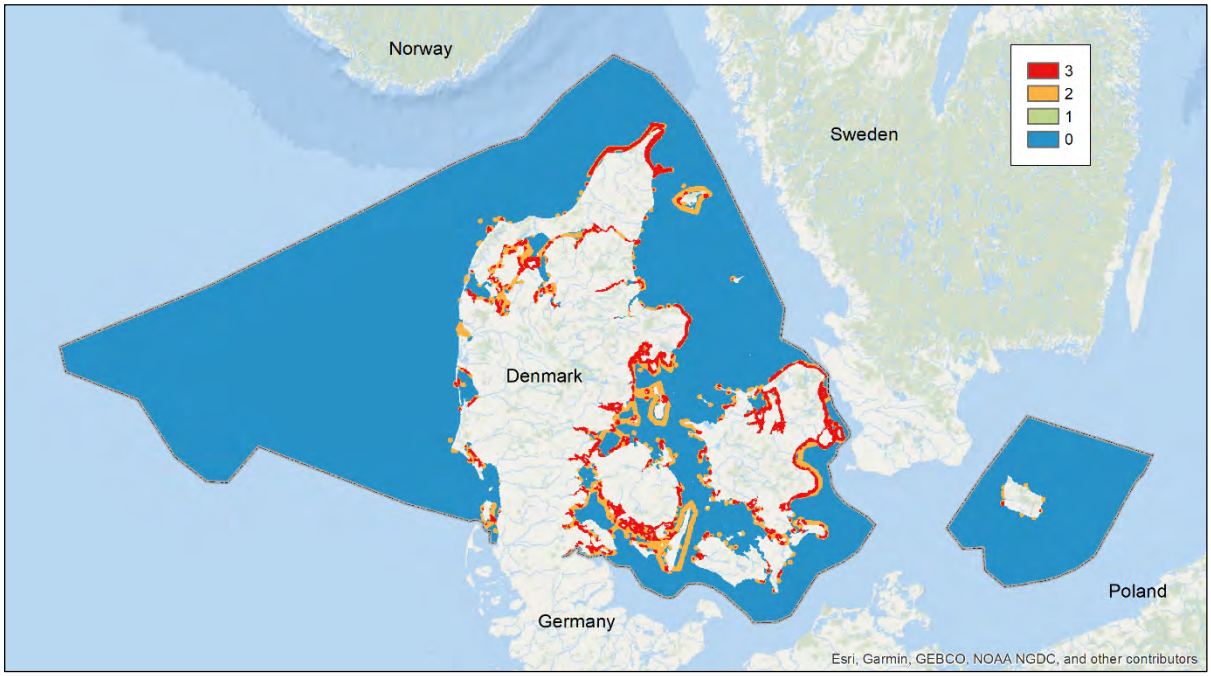
Limitations for use in ECOMAR:
A possible limitation of the data is the crowdsourced sampling which might be oversampled. However, the map output is validated by external data to some extent (e.g. data from kitemekka.dk, and data on kayak clubs in DK).

Recommendations for data improvement: None

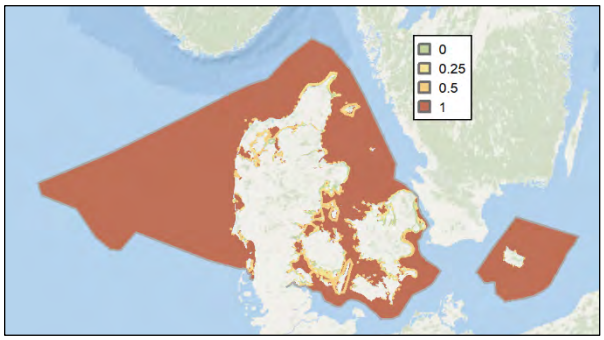
Data authoring organization	University of Copenhagen, Department of Geosciences and Natural Resource Management (IGN), Section of Landscape Architecture and Planning, Rolighedsvej 23, 1958 Frederiksberg C
Data author contact	asol@ign.ku.dk
Data source	KU, IGN
Data source contact	asol@ign.ku.dk, bck@ign.ku.dk
INSPIRE topic category	Oceans, environment

INSPIRE theme	Oceanographic geographical features
GEMET keywords	Kayaking, surfing, environmental impact
Maintenance	Not planned
Metadata date	2019-07-02
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

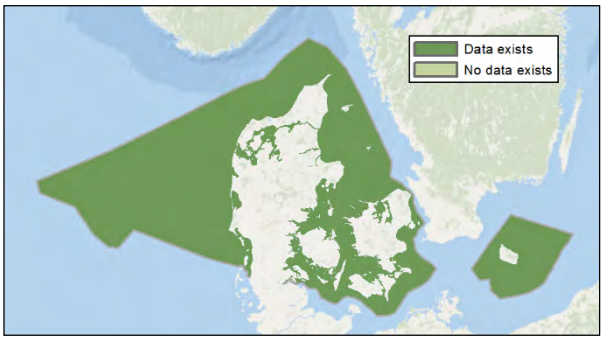
Intensity classes of non-motorized watercraft



Estimated uncertainty



Data coverage



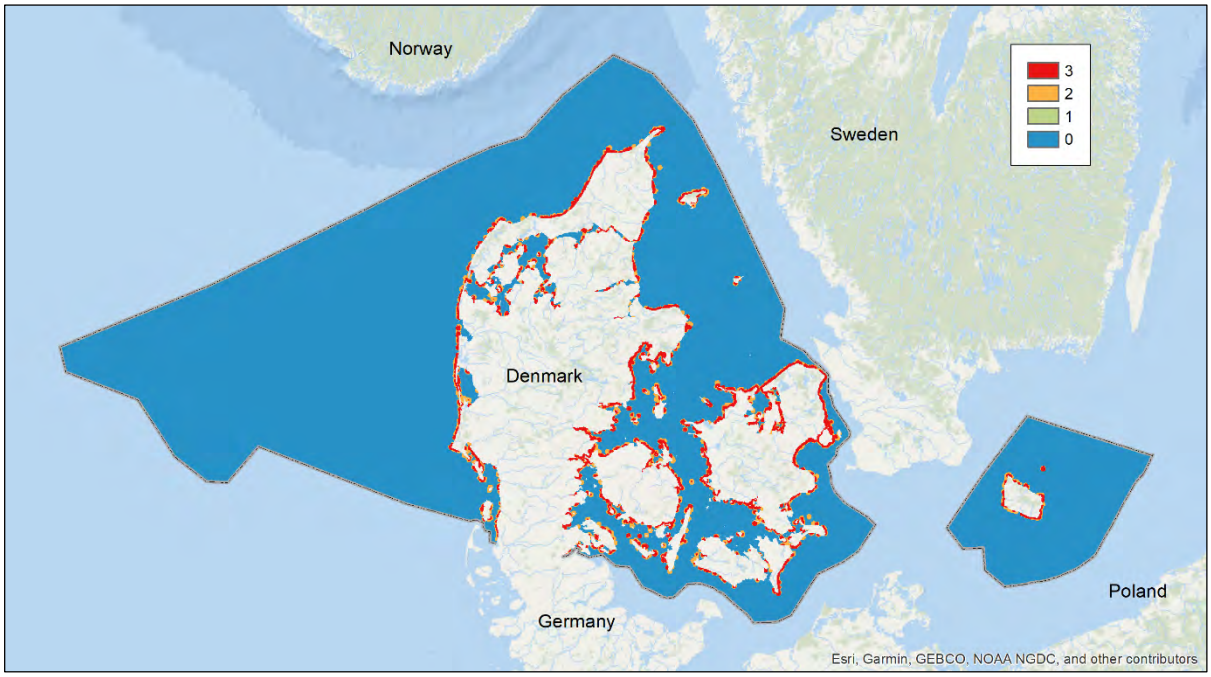
Estimated uncertainty: Estimated uncertainty is categorical and based on the intensity classes.
Data coverage: Data collection within the Danish EEZ.

A12.3 Coastal recreation sites

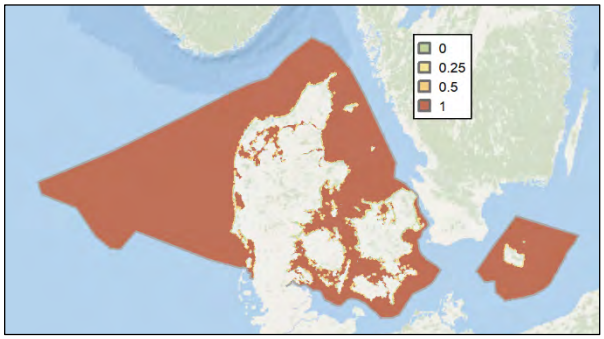
Data name	Coastal recreation sites
Group	Recreational activities
Data units, max and min values	Categorical data. Three levels (1 = low use, 2 = middle use, 3 = high use), and 0 = No Data. Max = 3 and min = 0.
Category	Pressure
Date created	2019-04-12
Data type	Dataset
Status	Completed
Data format	Shape file
Temporal period	2015-2016
Spatial extent and resolution	Top 3906250, Left 3901250, Right 4733250, Bottom 3474750
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The data shows a general surface map over the most visited part of the Danish coast according to three relative intensity levels. The map is a model output based on data from a representative national PPGIS survey. Mapped places of visits (points) and the stated yearly visit frequency to the place (number of visits per year) is the unit of analysis. In total, 4747 coastal activity places were mapped. Type and count of activity places: Walking, visiting (n=3437), swimming (n=984), observing nature (n=187), collecting (n=94), guided tours and interactive activities (n=45). The respondents are representative according to the population in the five region of DK, and gender and age distribution.	
Lineage: Kernel Density Model outputs of coastal activities reclassified into tree relative levels of yearly use frequency according to quantile distribution (low, middle, high). The kernel density analysis criteria: cell size=500 m, search distance=2000 m, value= number of visit days per year (1-365). In practice, the 2000 m search distance means that a 2 km offshore coastal zone is included. This distance is within visual contact from coast visits. Data input: A national representative panel survey with the Danish population (n=4054 persons) resulting in point mapping of visited places along the coast (4747 places) Each respondent estimated the number of visits per year to the mapped places and routes (yearly visit frequency). See www.havfriluftsliv.dk and Kaae et al. (2018) for further information.Procedure: Generation of a kernel density surfaces for the data. The kernel density surface was reclassified into three levels (1,2,3) according to quantile distribution (excluding '0' values, 0 = No Data). Estimated uncertainty is categorical, based on the intensity classes, where the most intense class (#3) is assumed to have a lower uncertainty and given the value 0, class 2 is given the value of 0.25, class 1 a value of 0.5 and the class with no recorded data, class 0 is assumed to have a rather high uncertainty and is thus given a value of 1.	
Limitations for use in ECOMAR: A possible limitation of the data is the aggregated nature of the data. Since all type of recreational activities are included, the dataset is not suited to detailed analyses of pressure relationships between different types of recreational activities (e.g. motorized vs non-motorized recreation) and different ecosystem components.	
Recommendations for data improvement: None	
Data authoring organization	University of Copenhagen, Department of Geosciences and Natural Resource Management (IGN), Section of Landscape Architecture and Planning

Data author contact	asol@ign.ku.dk
Data source	KU, IGN and Søfartsstyrelsen (AIS data)
Data source contact	asol@ign.ku.dk, bck@ign.ku.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Coast, coastal environment, local recreation, recreation, tourism
Maintenance	Not planned
Metadata date	2019-07-02
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

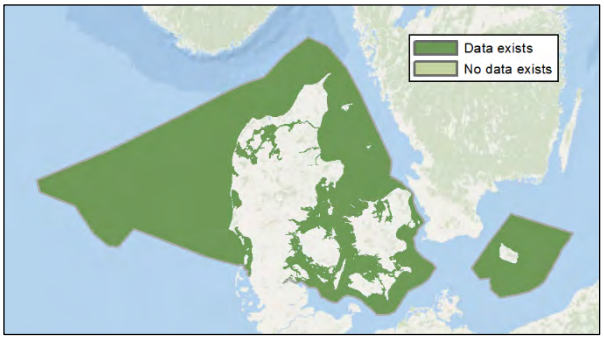
Intensity classes of coastal recreation sites



Estimated uncertainty



Data coverage



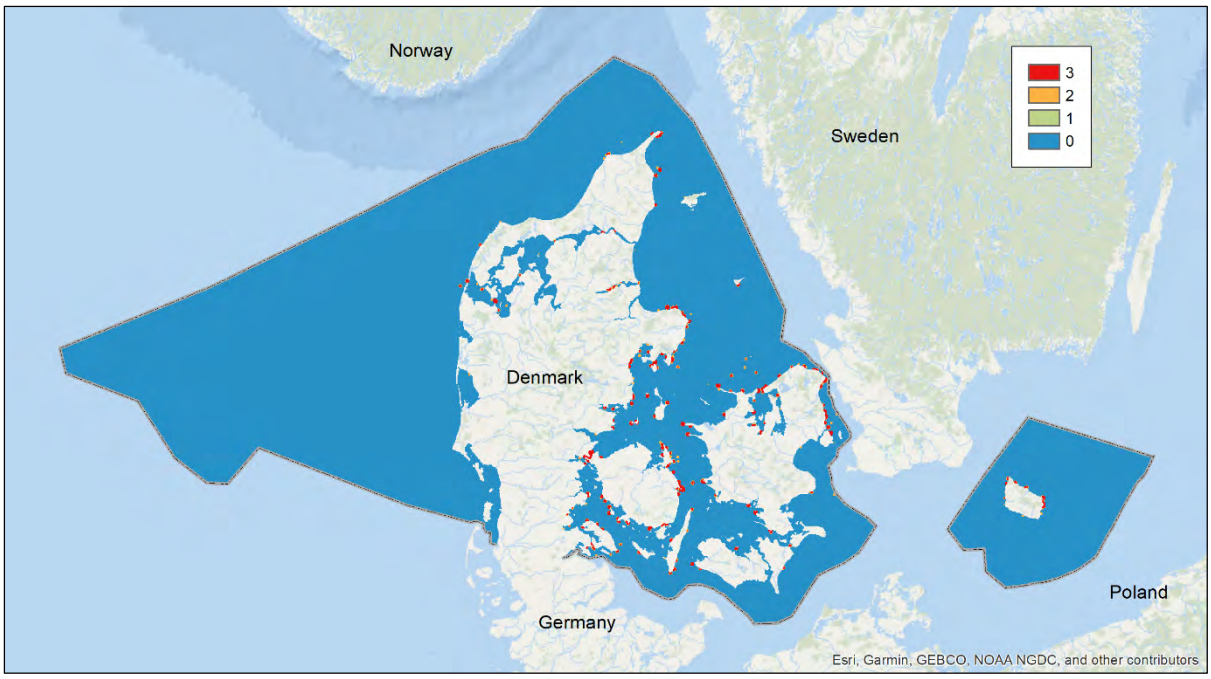
Estimated uncertainty: Estimated uncertainty is categorical and based on the intensity classes.
Data coverage: Data collection within the Danish EEZ.

A12.4 Scuba-diving recreational

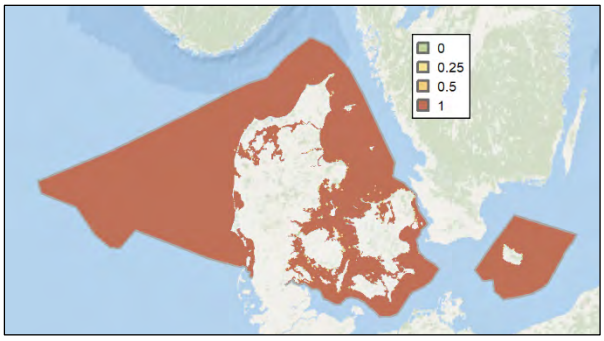
Data name	Recreational diving
Group	Recreational activities
Data units, max and min values	3 levels (1-3)
Category	Pressure
Date created	2019-05-13
Data type	Dataset
Status	Completed
Data format	Shape file
Temporal period	2015-2016
Spatial extent and resolution	Top: 3906250 m, Left: 3901250 m, Right: 4733250 m, Bottom: 3474750 m
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The data shows a surface map over diving places in Danish waters according to the density of places and number of visits to each place. Multiple types of diving are included, see www.havfriluftsliv.dk. The map is a model output (kernel density surface) based on a crowdsourced survey with divers. Visit frequency (number of visits per year) is the unit of analysis. 764 diving sites are included.	
Lineage: A kernel density model output (500m cell size, 2000m search criteria) on the stated visit frequency to places mapped by users. Final 3 level classification (1 = low, 2 = medium, 3 = high) by quantile distribution. See www.havfriluftsliv.dk and Kaae et al. (2018) for further information. Estimated uncertainty is categorical, based on the intensity classes, where the most intense class (#3) is assumed to have a lower uncertainty and given the value 0, class 2 is given the value of 0.25, class 1 a value of 0.5 and the class with no recorded data, class 0 is assumed to have a rather high uncertainty and is thus given a value of 1.	
Limitations for use in ECOMAR: A possible limitation of the data is the crowdsourced sampling which might be oversampled. However, the map output is validated by external data to some extent.	
Recommendations for data improvement: None	
Data authoring organization	University of Copenhagen, Department of Geosciences and Natural Resource Management (IGN), Section of Landscape Architecture and Planning
Data author contact	asol@ign.ku.dk
Data source	KU, IGN
Data Owner Contact	asol@ign.ku.dk, bck@ign.ku.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Recreation, environmental impact
Maintenance	Not planned

Metadata date	2019-07-02
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

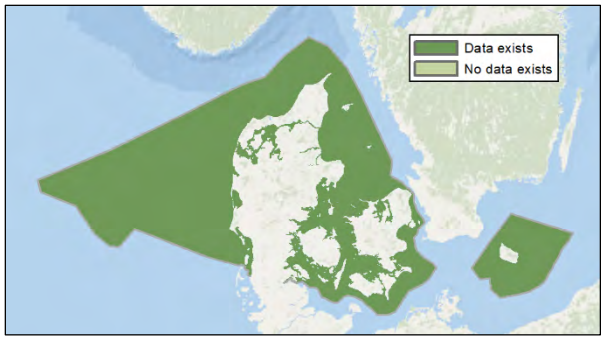
Intensity classes of recreational scuba diving



Estimated uncertainty



Data coverage



Estimated uncertainty: Estimated uncertainty is categorical and based on the intensity classes.
Data coverage: Data collection within the Danish EEZ.

Annex B: Ecosystem components

This appendix contains the meta data for the ecosystem components data layers used within ECOMAR.

The procedure (e.g. observations, interpolation of observations or models) for creating each spatial dataset is explained as well as the sources of the raw data. All datasets were scaled or fitted to the common ECOMAR grid by 500m*500m. Contact persons are also listed for each dataset. Maps showing i) the data layer ii) the uncertainty of the dataset and iii) the data coverage of the dataset are presented. The uncertainty variables used were variable and are explained for each data set. When a parametric uncertainty estimate was missing a categorical uncertainty (i.e. estimation) was applied using a scale of 0 = Observed data, 0.25 = Very good/validated model, 0.5 = Good model, 0.75 = Weak model/best guess/extrapolation and 1 = No data. From the uncertainty estimates the data coverage could be estimated by presence or absence, where grid cells containing any type of data (also true 0) was regarded as data being present with a data coverage and cells with no estimate of data as no data.

B1 Pelagic Habitats

B1.1 Productive surface waters - chlorophyll a

Data name	Chlorophyll a summer surface concentrations
Group	Pelagic habitats
Data Units	Surface concentration of chlorophyll a [µg Chl L^{-1}]. Min: 0.325 µg L^{-1} Max: 46.100 µg L^{-1}.
Category	Ecosystem component
Date created	2019-06-28
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	2013 - 2018
Units in raster data	µg L^{-1}
Spatial extent and resolution	This dataset is derived from point measurements and interpolated to the 500 m ECOMAR grid. Top: 3906500 m Left: 3905350 m Bottom: 4733350 m Right: 3474500 m
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035

Summary:
This dataset shows average summer concentrations of chlorophyll a for the period 2013-2018. The dataset was created by calculating average surface concentrations at measurement points. The observation data was obtained from ICES' database and from the Danish national monitoring database, ODA.
Then a GIS tool was used to interpolate spatially between the measurement points. This interpolation was done using "barriers". This means that distance between points is calculated around coastlines rather than directly "as the crow flies". This means, for example, that we can avoid interpolating directly between a point on the west coast of Jutland and a point on the east coast.

Lineage:
Data were downloaded from the ICES Data Centre (http://ocean.ices.dk) and from ODA, the joint database of the Ministry of Environment and Food of Denmark and DCE - Danish Centre for Environment and Energy, Aarhus University, for surface water data (https://odaforalle.au.dk). Data were downloaded from both databases on 13-06-2019.

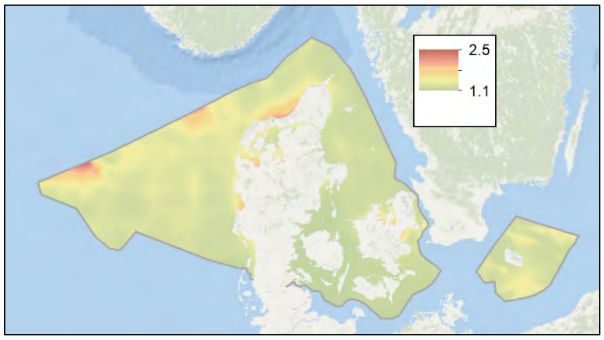
The surface chlorophyll a concentration was calculated as the average of all measurements at the same position (latitude and longitude) and on the same day, where the sampling depth was less than 5m. Latitude and longitude were rounded to three decimals. This is order of magnitude of 100 m in the final coordinate reference system (x 64 m, y 111 m at 55°N 12°E). The summer average was then calculated as the average of all observations occurring in June, July and August.

Observations were projected to the target coordinate reference system. Log-transformed concentrations were interpolated to a 500 m raster using the "Kernel Smoothing with barriers"

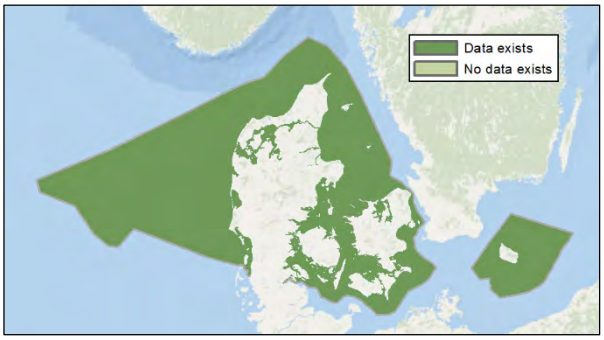
function in ArcGis 10.3, using the following parameters: Kernel Type = Gaussian, Power = 1, Ridge = 100, Bandwidth = 50000 m. Finally, the interpolated log-transformed data were transformed back to concentrations.	
Considerations for use in ECOMAR: None	
Recommendations for data improvement: A potential improvement could be to use the results of a biogeochemical model to determine spatial variation in concentrations more accurately.	
Data authoring organization	NIVA Denmark
Data author contact	cjm@niva-dk.dk
Data source	ICES , Ministry of Environment and Food of Denmark and DCE - Danish Centre for Environment and Energy, Aarhus University
Data source contact	ocean@ices.dk, miljoeportal@miljoeportal.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Biotic environment, benthic ecosystem, marine environment
Maintenance	Not planned
Metadata date	2019-07-01
Metadata organization	NIVA Denmark
Metadata contact	cjm@niva-dk.dk

Chlorophyll *a* average summer surface concentrations (µg L^{-1})

Estimated uncertainty



Data coverage



Estimated uncertainty: Standard error of the model.

Data coverage: Data collection and model expansion within the Danish EEZ.

B1.2 Oxygen depletion

Data name	Oxygen depletion (<4 mg L^{-1})
Group/category of activity	Ecosystem component
Data units, max and min values	Estimated proportion of the grid cell experiencing oxygen concentration <4 mg L^{-1} during August-October
Category	Ecosystem component
Date created	2019-03-27
Data type	Data series
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	2017-08-01 to 2017-10-31 and 2018-08-01 to 2018-10-31
Units	No unit. Relative presence of oxygen depletion.
Spatial extent and resolution	Danish Straits including estuaries; 500 m x 500 m
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035

Summary:
This data layer shows where oxygen concentrations below 4 mg L^{-1} are estimated to have occurred in 2017 and 2018 during the months August-October. It is based on the spatial extent of oxygen concentrations below this oxygen threshold estimated with a statistical interpolation method that is used in the Danish national marine status reporting.

Lineage:
Oxygen depletion maps describing areas with less than 4 mg L^{-1} are produced every year for the late summer and autumn months, based on observed oxygen profiles from monitoring cruises carried out by the Danish Environmental protection Agency (Miljøstyrelsen). The model used for estimating the spatial extent of oxygen depletion was developed in 2002 and has undergone minor revisions thereafter. The largest revision was in 2016 when an improved bathymetry was implemented. The details of the original model are described in HELCOM (2003; BSEP No 90, available at www.helcom.fi). The oxygen depletion maps are produced with a resolution of approximately 137 m in E-W and 237 m in N-S directions, i.e. a higher resolution than the present data layer, and monthly maps are published at http://bios.au.dk/raadgivning/vand/havmiljoe/iltsvind/arkiv/. The oxygen depletion maps do not cover the Danish EEZ entirely.

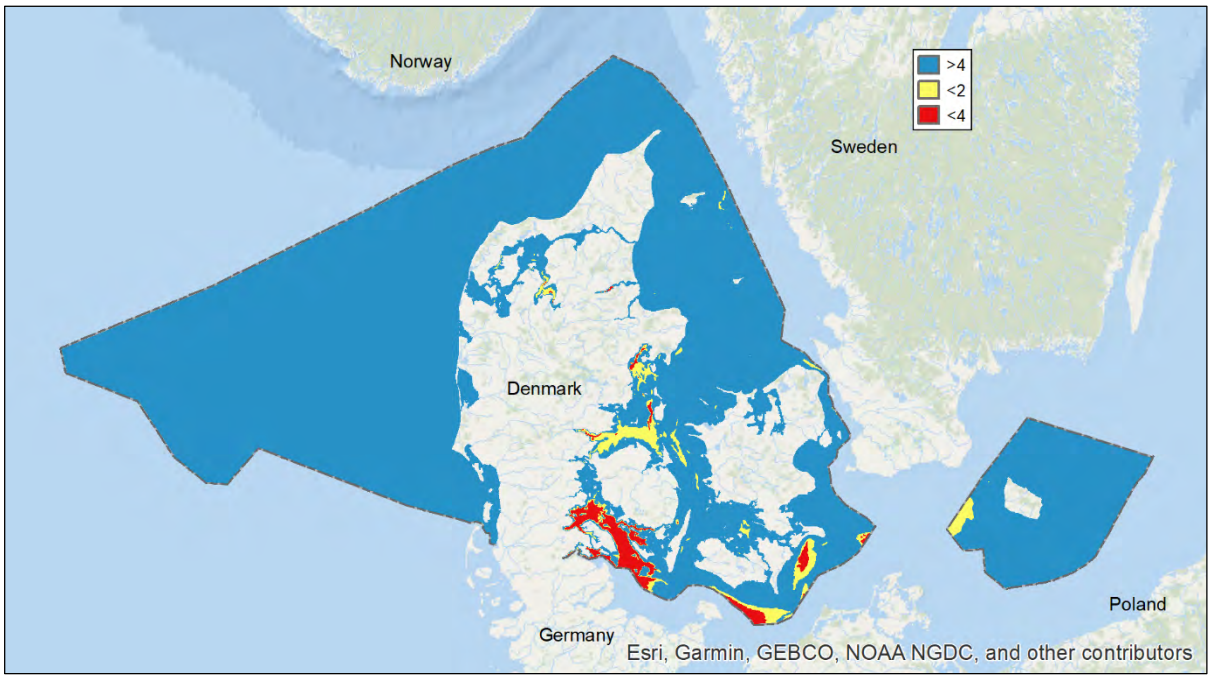
This data layer was constructed by investigating six monthly maps (August-October in 2017 and 2018) and for each grid point in the model assess if the given point was predicted to have experienced oxygen concentrations below 4 mg L^{-1} at any time during these two years. Since the resolution of the oxygen depletion maps is higher than the current data layer, there are multiple grid points in the oxygen depletion model for each grid cell in the current data layer. Consequently, for each grid cell in the current data layer, the proportion of grid points in the aggregated oxygen depletion map with oxygen concentrations below 4 mg L^{-1} was calculated as an estimate of the areal proportion of the grid cell likely to experience oxygen depletion.

The statistical model for estimating the areal extent of oxygen depletion has been employed for more than 15 years and is well tested against hydrodynamical models and observations. Therefore, it is considered to have a low uncertainty, but there are no quantitative estimates yet.

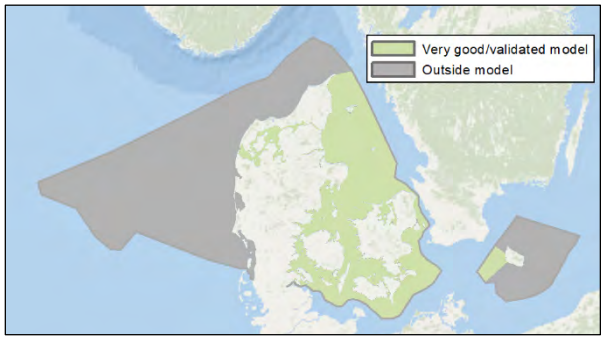
Considerations for use in ECOMAR:

The data layer can be used as a pressure layer affecting ecosystem components. In estuaries and coastal waters, the resolution of the data layer can be coarse, as the bathymetry may change drastically within 500 m, having a large impact on the precision of the data layer in such instances.	
Recommendations for data improvement: The data layer can be improved by considering more years, but at present it presents a contemporary state of two years that had neither exceptionally good or bad oxygen conditions.	
Data authoring organization	Aarhus University, DCE
Data author contact	jac@bios.au.dk
Data source	DCE
Data source contact	jac@bios.au.dk
INSPIRE topic category	Environment, Oceans
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Oxygen deficiency, eutrophication, climate change impact
Maintenance	Irregular
Metadata date	2019-03-27
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

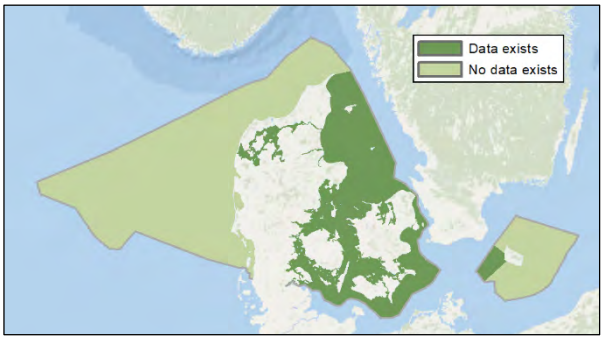
Oxygen depletion areas (estimated concentration <4 mg L^{-1} or <2 mg L^{-1})



Estimated uncertainty



Data coverage



Estimated uncertainty: Categorical; Very good/validated model and areas outside the model area (grey) has a high uncertainty.

Data coverage: Representing areas covered or not covered by the oxygen model.

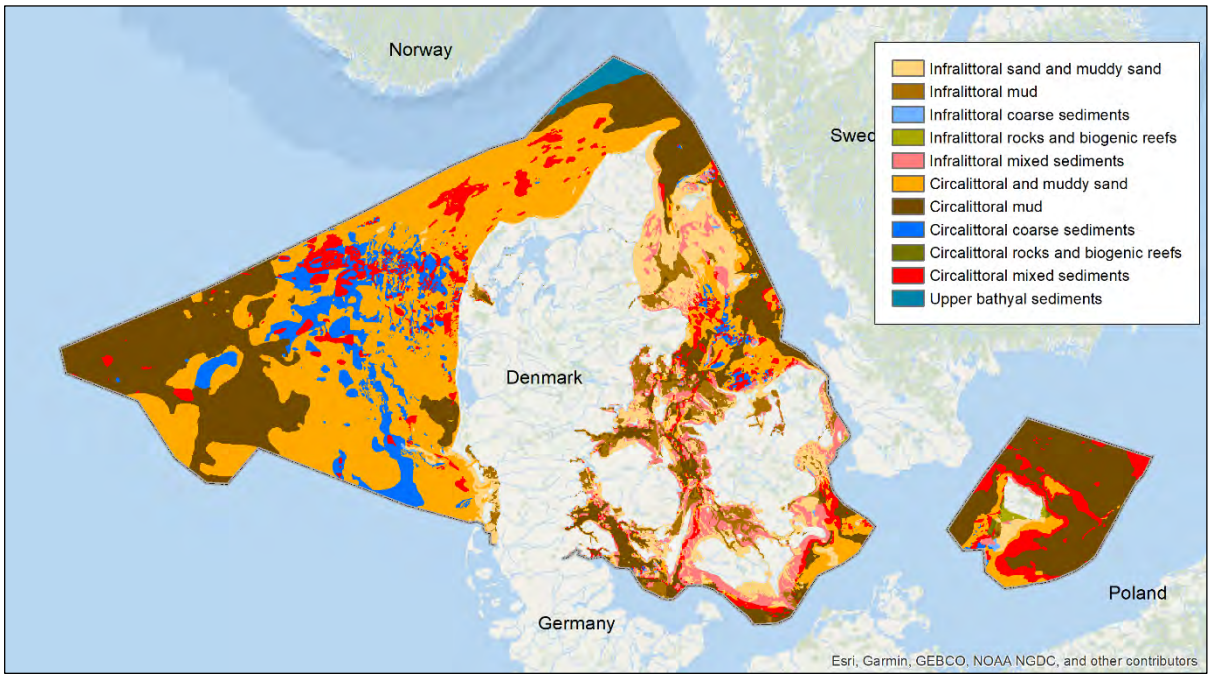
B2 Benthic habitats

B2.1 Broad scale benthic habitats

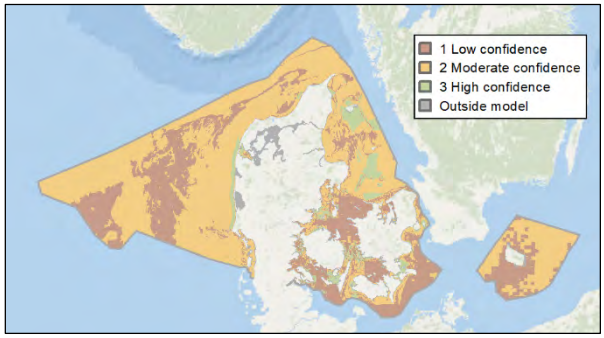
Data name	Broad scale habitats (EMODnet Seabed Habitats)
Group/category of activity	The category group used to classify this data type (see list)
Data units, max and min values	Presence/absence.
Category	Ecosystem component
Date created	2017-06-01 (Original data) 2019-03-18 (uploaded)
Data type	Dataset
Status	Completed
Data format	8-bit IMAGINE image format.
Temporal period	The data shows the habitat model produced with available data in 2017-06-01
Units	Presence and absence
Spatial extent and resolution	The Danish EEZ marine area with an overall resolution of 200000.
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The dataset represents the modelled benthic habitats for the Danish waters. It shows ecosystem layers classified according to EUNIS and MSFD habitat classification. Within ECOMAR the following classes are included; 1) Infralittoral sand and muddy sand 2) Infralittoral mud 3) Infralittoral coarse sediments 4) Infralittoral rocks and biogenic reefs 5) Infralittoral mixed sediments 6) Circalittoral sand and muddy sand (includes Offshore circalittoral sand and muddy sand) 7) Circalittoral mud (includes Offshore circalittoral mud) 8) Circalittoral coarse sediments (includes Offshore circalittoral coarse sediments) 9) Circalittoral rocks and biogenic reefs 10) Circalittoral mixed sediments (includes Offshore circalittoral mixed sediments) 11)Upper bathyal sediments. The data usage has some limitations expressed by the confidence layer produced with the data.	
Lineage: The dataset was originated from multiple environmental layers with different resolution and accuracy, these background datasets were classified according to thresholds that were inferred from measurements and expert judgement. The main environmental layers used to produce the habitat models are the bathymetry, the photic depth, the salinity, the current and wave energy and the seabed sediment. They came originally in different scales and ArcGIS was used to rescale them to the desired cell size. Fuzzy method was used to classify the data and combine them according to the predefined thresholds into the final habitat map.	
Considerations for use in ECOMAR: The habitat dataset was reclassified into 500 m grid.	
Recommendations for data improvement: None	
Data authoring organization	GEUS/ Zyad Al-Hamdani
Data author contact	azk@geus.dk
Data source	EMODnet Seabed Habitats/ Helen Lillis
Data source contact	Helen.Lillis@jncc.gov.uk
INSPIRE topic category	Oceans, biota, environment

INSPIRE theme	Oceanographic geographical features
GEMET keywords	Abiotic environment, benthic ecosystem, marine environment
Maintenance	Irregular
Metadata date	2019-04-16
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

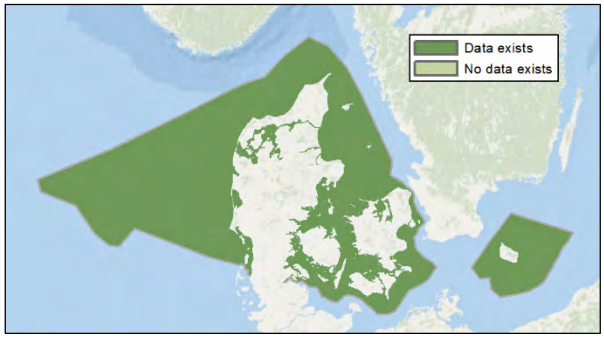
Presence of broad scale habitats



Estimated uncertainty



Data coverage



Estimated uncertainty: Categorical according to EUSeaMap and the grey areas outside the model has a high uncertainty.
Data coverage: Data collection and model expansion within the Danish EEZ.

B2.2 Eelgrass potential distribution, *Zostera marina*

Data name	Habitat model of eelgrass in Danish coastal waters
Group/category of activity	The category group used to classify this data type (see list)
Data units, max and min values	Ratio (0 to 1)
Category	Ecosystem component
Date created	2019-03-28
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	1994 – 2010
Units	Same as above
Spatial extent and resolution	Danish waters and 100 m x 100 m original resolution
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035

Summary:
The habitat model of eelgrass in Danish coastal waters combines information on six key eelgrass habitat requirements (light availability, water temperature, salinity, frequency of low oxygen concentration, wave exposure and sediment type) for which we were able to obtain national coverage. The modeled potential current distribution area of Danish eelgrass meadows was 2204 km^2 compared to historical estimates of around 7000 km^2, indicating a great potential for further distribution. While validating the modeled eelgrass distribution area in three areas (83-111 km2) that hold large eelgrass meadows, we found an agreement of 67 % with in situ monitoring data and 77 % for eelgrass areas as identified from summer orthophotos. The GIS model predicted higher coverage especially in shallow waters and near the depth limits. Areas of disagreement between GIS-modelled and observed coverage generally exhibited higher exposure level, mean summer temperature and salinity compared to areas of agreement. A sensitivity analysis showed that the modeled area distribution of eelgrass was highly sensitive to light conditions, with 18 % to 38 % increase in coverage following an increase in light availability of 20 %. Modelled coverage of eelgrass was also sensitive to wave exposure and temperature conditions while less sensitive to changes in oxygen and salinity conditions.

Lineage:
For original model see: Staehr et al. (2019). The data was aggregated from its original resolution as bilinear interpolation with the tool extract value to point in ArcGIS Desktop 10.6.1.
Staehr PA, Göke C, Krause-Jensen D, Timmermann K, Upadhyay S, Ørberg SB, & Holbach AM (2019): Habitat model of eelgrass in Danish coastal waters: development, validation and management perspectives. Frontiers in Marine Science.

Considerations for use in ECOMAR:

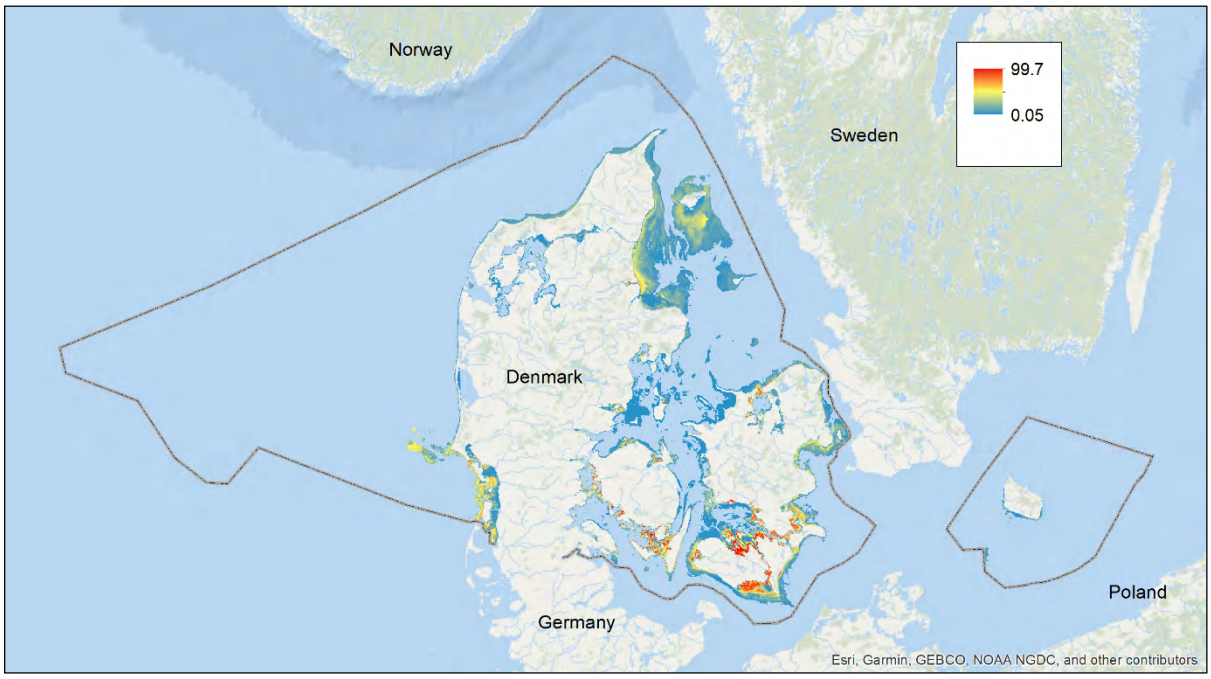
- Resolution: with 500 m resolution it is not possible to represent the variation of eelgrass
- The model is currently updated because newer input data is available

Recommendations for data improvement: Update of the original as suggested in Staehr et al. is under progress.

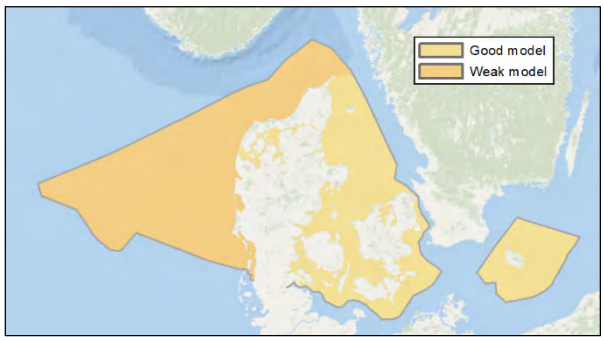
Data authoring organization	Aarhus University
Data author contact	Cordula Göke, cog@bios.au.dk
Data source	Aarhus University

Data source contact	Cordula Göke, cog@bios.au.dk
INSPIRE topic category	Oceans, biota, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Model, habitat, marine ecosystem
Maintenance	Irregular
Metadata date	2019-03-28
Metadata organization	Aarhus University
Metadata contact	Cordula Göke, cog@bios.au.dk

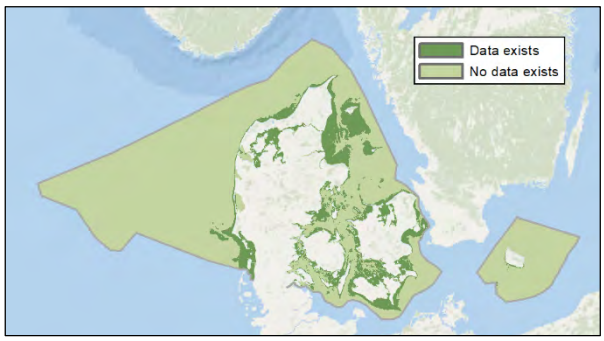
Eelgrass distribution probability (%)



Estimated uncertainty



Data coverage

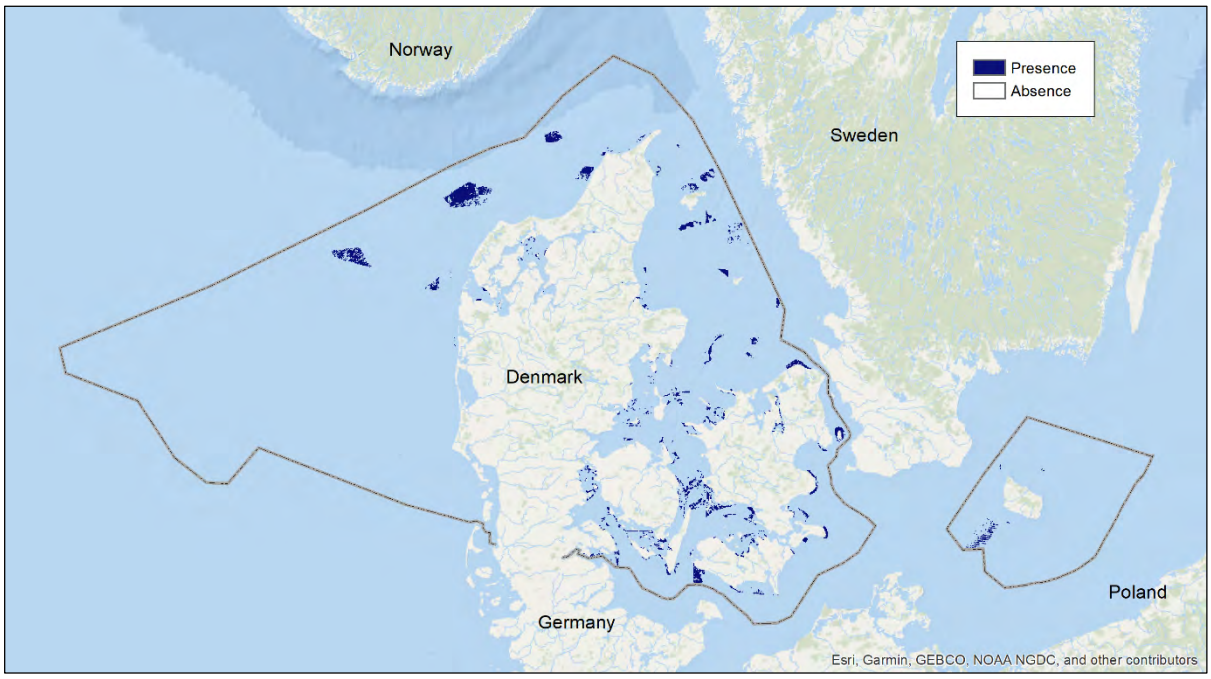


Estimated uncertainty: Categorical; Good model and weak model.
Data coverage: Representing areas areas with potential eelgrass distribution.

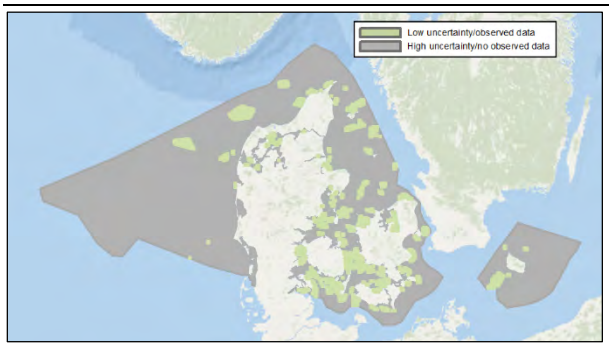
B2.3 Stone reefs within `Natura 2000´ areas

Data name	Stone reefs inside' Natura 2000' areas
Group/category of activity	Habitat loss
Data units, max and min values	Presence/absence
Category	Ecosystem layer
Date created	Acquired over years up till 2018
Data type	Dataset
Status	Completed
Data format	8-bit IMAGINE image format
Temporal period	1995 – 2018
Units	Presence and absence
Spatial extent and resolution	The Danish EEZ marine area with an overall resolution of 1:10000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The dataset represents the results of a mapping program conducted by GEUS and other institutes for mapping Habitat Directive habitats inside the 'Natura 2000' areas. The mapping endeavor was supported by the Ministry of Environment in Denmark.	
Lineage: The data acquisition was part of the Ministry of Environment in Denmark to map the 'Natura2000' habitats which will be used for MSP and delineating MPAs. Some of the 'Natura 2000' area have full coverage with a full acoustic measurements and ground truth data and some were partially covered with the survey lines. Within the`N2000´areas the high data coverage is high and the uncertainty low, but the areas outside 'Natura2000' does not necessarily has high uncertainty, reef could exist there, but the data coverage is low.	
Considerations for use in ECOMAR: The stone reef dataset was reclassified into 500 m grid.	
Recommendations for data improvement: None	
Data authoring organization	GEUS/ Zyad Al-Hamdani
Data author contact	azk@geus.dk
Data source	GEUS Marta Database. http://data.geus.dk/geusmap/
Data source contact	GEUS/Department of Marine geology/Zyad Al-Hamdani azk@geus.dk
INSPIRE topic category	Oceans, biota, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Marine biota, benthic ecosystems, marine ecosystem
Maintenance	When new data is obtained, which can be annually or If necessary.
Metadata date	2019-05-01
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

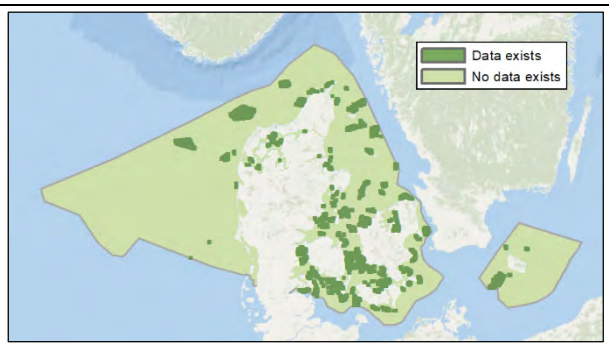
Presence of stone reefs within `Natura 2000´ areas



Estimated uncertainty



Data coverage



Estimated uncertainty: Categorical; Areas within N200areas observed data.
Data coverage: Representing areas that has been investigated.

B3 Sensitive fish species

Data name	Sensitive fish species
Group/category of activity	Ecosystem components
Data units, max and min values	Presence / Absence of rare species (2001-2017) Min = 0 (Absence) Max = 1 (Presence)
Category	Ecosystem components
Date created	2019-04-03
Data type	Dataset
Status	Completed
Data format	Raster geoTIFF layer with a resolution of 500 x 500 m in EPSG:3035 (ETRS89 / ETRS-LAEA)
Temporal period	Rare species data is based on BITS, IBTS and BTS survey in the period from 2001-2017
Units	Absence / Presence
Spatial extent and resolution	Northernmost latitude: 58.30° Westernmost longitude: 2.84° Easternmost longitude: 17.03° Southernmost latitude: 54.17° Resolution: 500 m x 500 m grid
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035

Summary:
This dataset reflects whether a sensitive fish species is caught in a BITS, IBTS or BTS surveys in the period from 2001 to 2018.

Lineage:
The data was collected from the following surveys:

ICES International Bottom Trawl Survey (IBTS), where the purpose is to estimate abundance of commercial and non-commercial fish species by means of bottom trawling and to collect otoliths of commercial species to assess abundance by age, in particular for the recruiting year classes in the North Sea, Skagerrak and Kattegat. It is a trawl survey using GOV-trawl.
Two surveys are conducted each year

- one in 1st quarter, which include 80 planned plankton hauls and 39 planned fish hauls for a total of 18 days at sea, and
- second in 3st quarter, which include 50 planned fish hauls for a total of 18 days at sea.

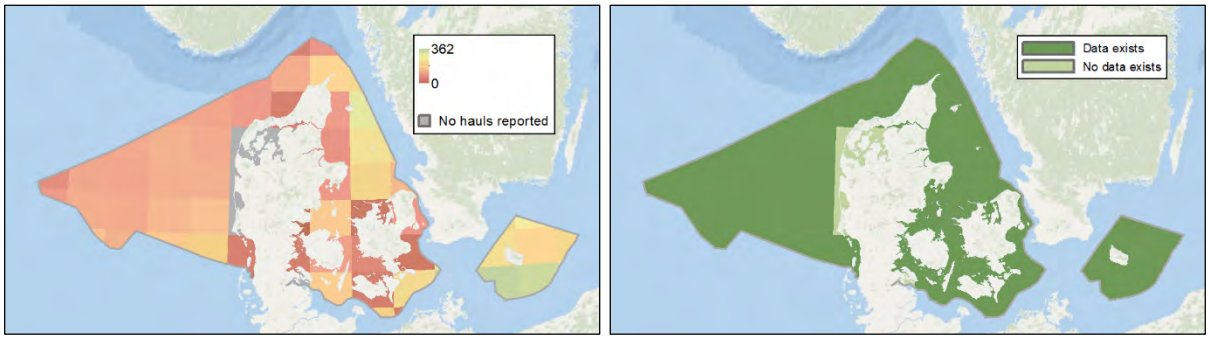
KASU I and II (BITS 1st & 4th quarter), where the purpose of the survey is to estimate abundance of commercial (mainly cod, flounder and plaice) and non-commercial fish species by means of bottom trawling and to collect otoliths of commercial species to assess abundance by age, in particular for the recruiting year classes in the Baltic Sea. It is a trawl survey using TV3-trawl with a 20 mm cod-end. KASU I and II both include 49 planned fish hauls for a total of 20 days at sea each.

Offshore Beam Trawl Surveys, where the purpose of the survey is to estimate the abundance of the dominant age groups of plaice and sole including pre-recruits. The surveys covered by WGBEAM

have all their own origins and were not set up as one survey. Due to that, no standardization has taken place in gears. The different countries all have their own sampling area and because the gears used vary, it is not possible to change sampling locations from one country to the other without any thorough scientific study beforehand Survey data was downloaded from DATRAS Exchange Data. The following species, which are all monitored under D1 biodiversity, were included: *Amblyraja radiata, Anarhichas lupus, Chimaera monstrosa, Dipturus* spp*., Galeorhinus galeus, Hippoglossus hippoglossus, Lophius piscatorius, Molva molva, Mustelus spp, Phycis blennoides, Raja clavata* and *Raja montagui*. Estimated uncertainty is given as total number of hauls per ICES rectangle per year. Rectangles with no hauls is given a confidence of 0, and rectangles with hauls is given 1. Maps of the distribution for each species is showed separately showing the presence/absence within each grid cell. The uncertainty and data coverage maps are presented in the beginning and are the same for all species
Considerations for use in ECOMAR: The survey-based data on sensitive fish species have been rescaled from ICES rectangles (varying from 3270 km^2 to 3628 km^2 within the Danish EEZ) to the 0.25 km^2 grid requested for the ECOMAR project.
Recommendations for data improvement: None

Data authoring organization	DTU Aqua
Data author contact	jsv@aqua.dtu.dk
Data source	International Council for the Exploration of the Sea (ICES)
Data source contact	accessions@ices.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Sensitive fish species
GEMET keywords	Sensitive fish species
Maintenance	Not planned
Metadata date	2019-04-03
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

Estimated uncertainty **Data coverage**



Estimated uncertainty: Total number of hauls per ICES rectangle per year. Grey areas are areas with no reported fishing and has a high uncertainty.

Data coverage: ICES rectangles with or without hauls.

B3.1 Cartilaginous fish species

B3.1.1 School shark, *Galeorhinus galeus*

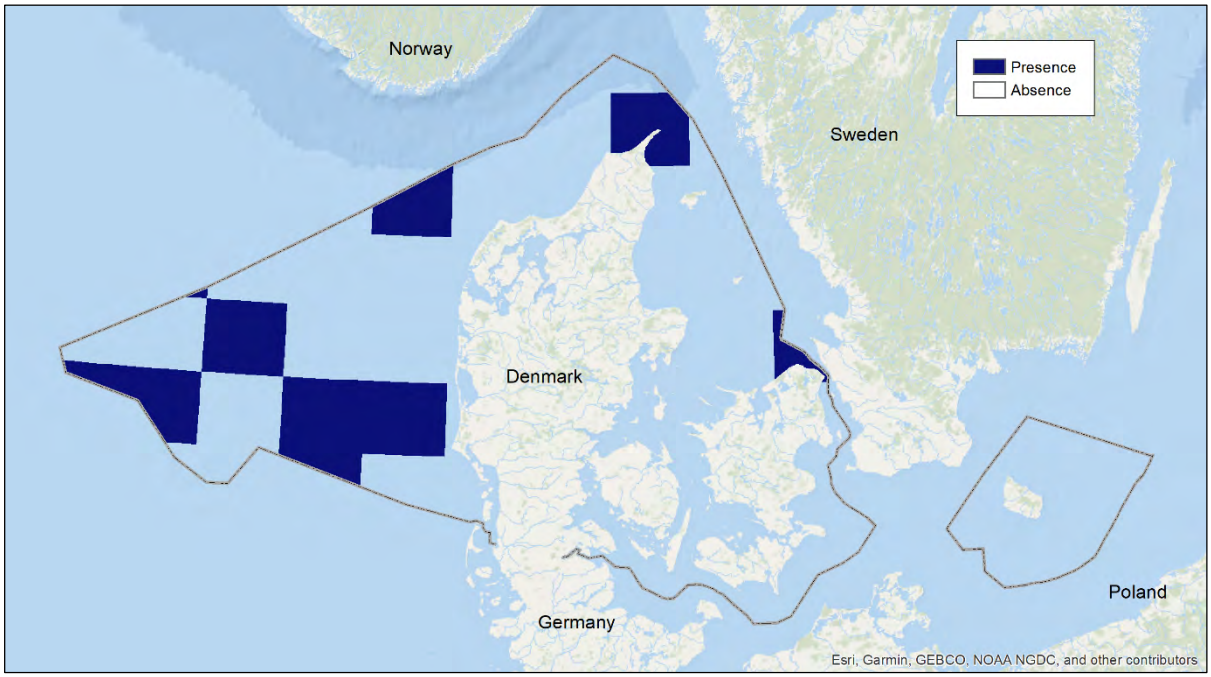
Presence School shark, *Galeorhinus galeus*

B3.1.2 Skates, *Dipturus* spp.

Presence Skates, *Dipturus spp.*

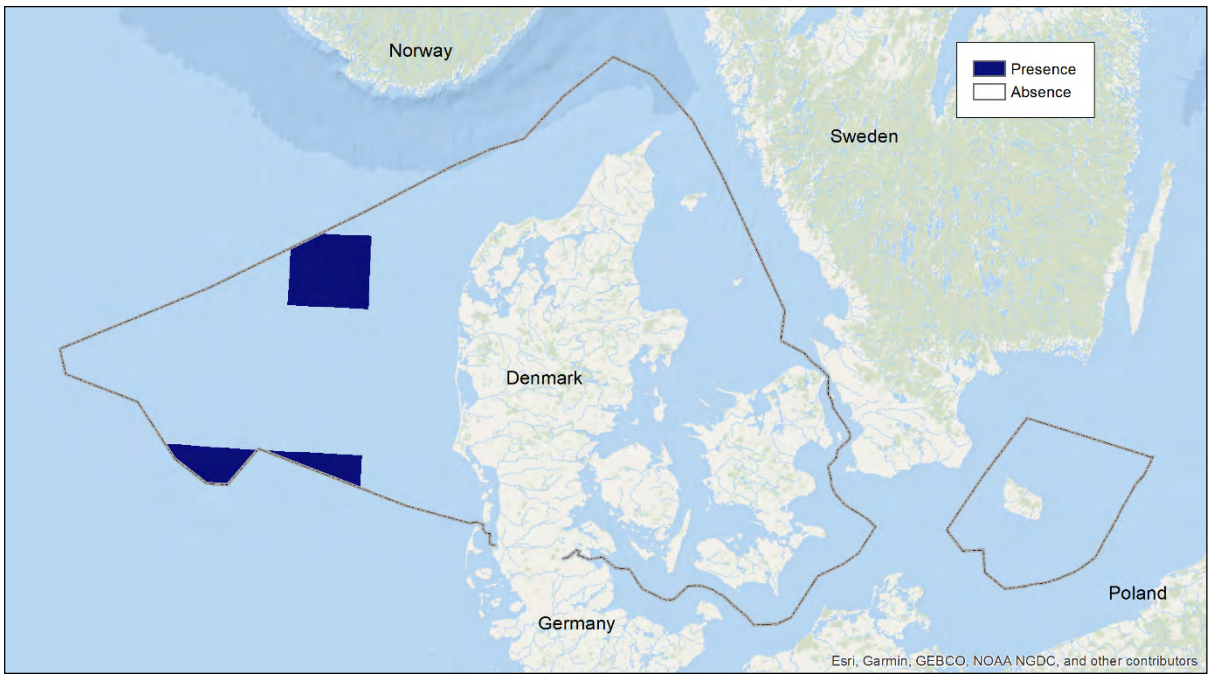
B3.1.3 Smooth-hound sharks, *Mustelus spp.*

Presence Smooth-hound sharks, *Mustelus spp.*



B3.1.4 Spotted ray, *Raja montagui*

Presence Spotted ray, *Raja montagui*

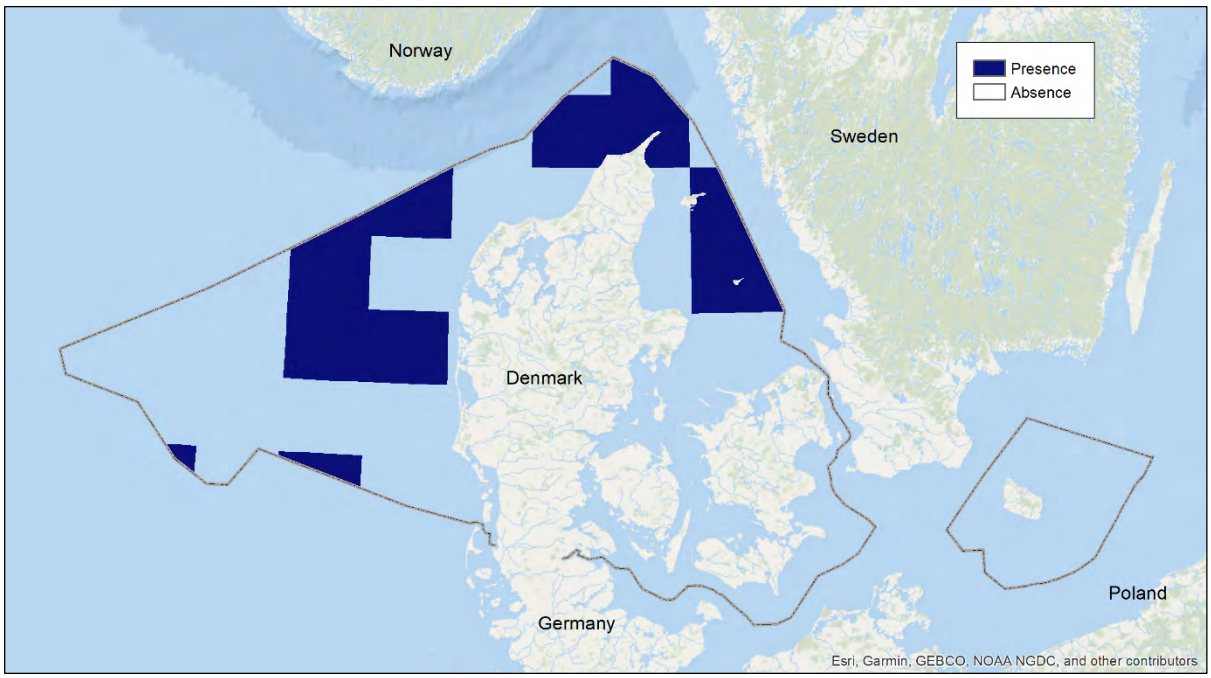


B3.1.5 Starry ray, *Amblyraja radiata*

Presence Starry ray, *Amblyraja radiata*

B3.1.6 Thornback ray, *Raja claviata*

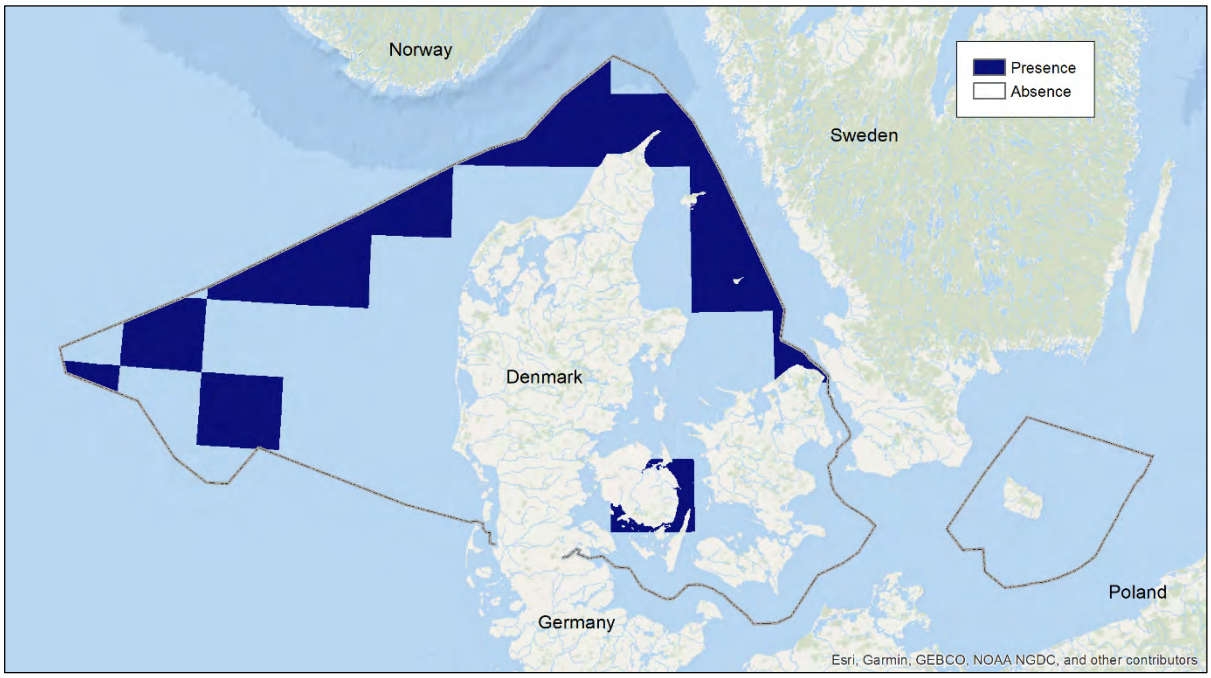
Presence Thornback ray, *Raja claviata*



B3.2 Bony fish species

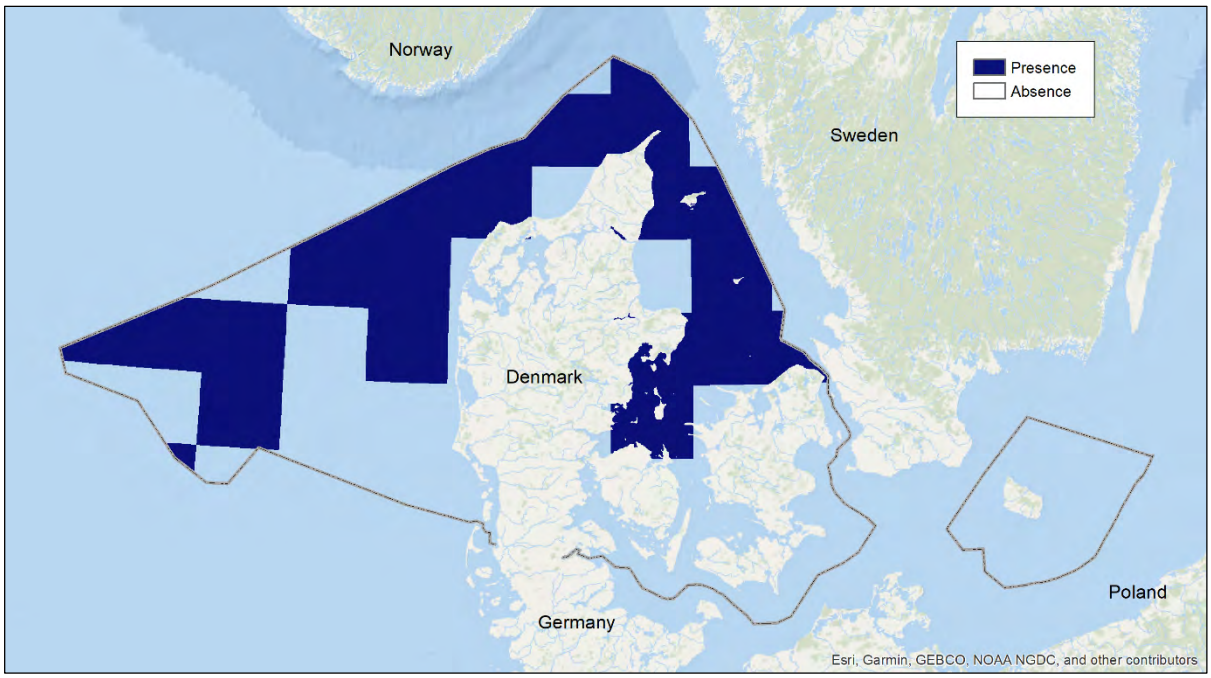
B3.2.1 Atlantic wolffish, *Anarchichas lupus*

Presence Atlantic wolffish, *Anarchichas lupus*



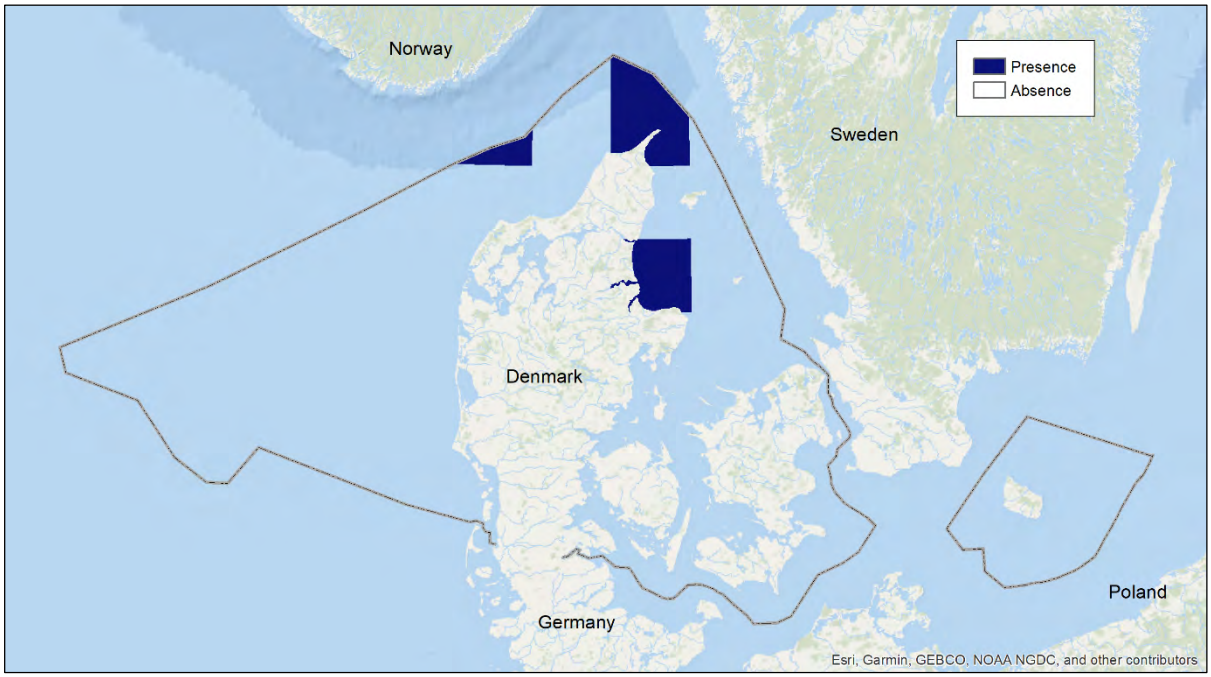
B3.2.2 Atlantic halibut, *Hippoglossus hippoglossus*

Presence Atlantic halibut, *Hippoglossus hippoglossus*



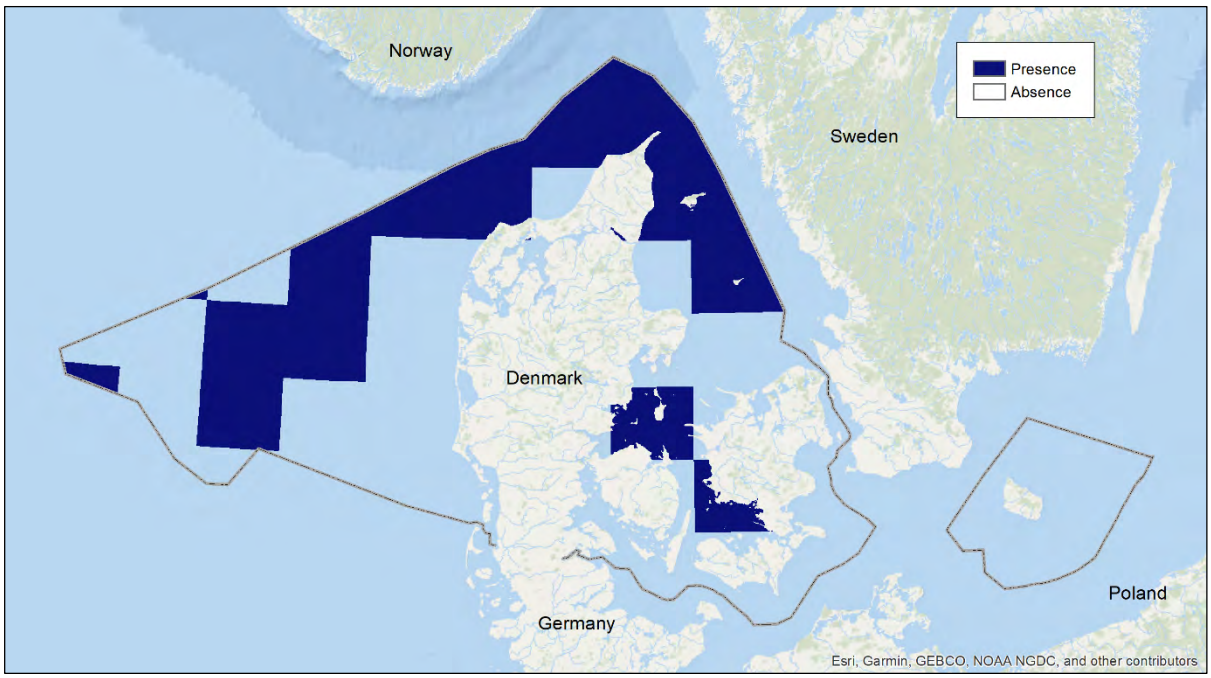
B3.2.3 Greater forkbeard, *Phycis blennoides*

Presence Greater forkbeard, *Phycis blennoides*



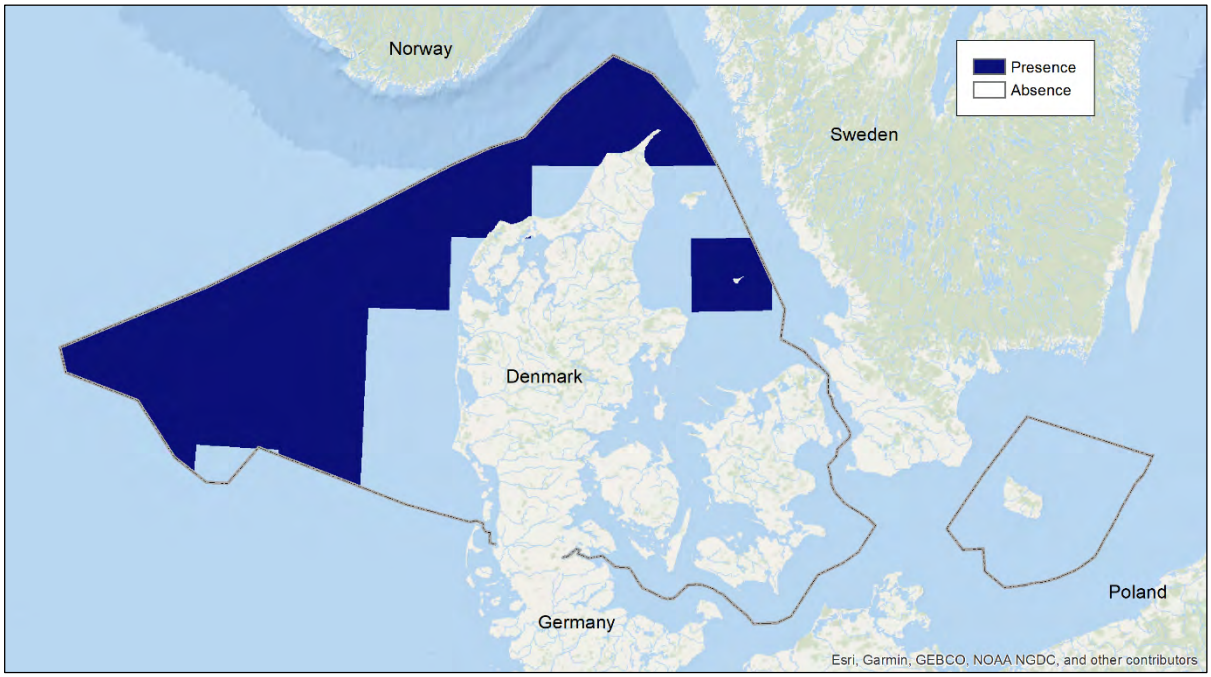
B3.2.4 Ling, *Molva molva*

Presence Ling, *Molva molva*



B3.2.5 Monkfish, *Lophius piscatorius*

Presence Monkfish, *Lophius piscatorius*



B3.2.6 Rabbit fish, *Chimaera monstrosa*

Presence Rabbit fish, *Chimaera monstrosa*

B4 Commercial fish species

Commercial MSFD fish species are estimated by two methods 1) Catch per unit effort (CPUE kg/Effort_GT) for the period 2015-2017, based on VMS fishing data and by 2) Abundance of commercial MSFD fish species estimated from scientific surveys. For species with data from both methods the CPUE and the survey data representing the adult part of the population were merged by averaging the normalised values to one layer in the model, but both underlying datasets are presented. The data layers for each fish species are described separately.

1) Catch per unit effort

<table>
<tr><td>Data name</td><td>Catch Per Unit Effort – commercial fish species</td></tr>
<tr><td>Group/category of activity</td><td>Ecosystem components – MSFD commercial fish species</td></tr>
<tr><td>Data units, max and min values</td><td>CPUE (kg/Effort_GT)
<table>
<tr><th>Species</th><th>Minimum value</th><th>Maximum value</th></tr>
<tr><td>Sprat (BRS)</td><td>3969.2</td><td>17789.6</td></tr>
<tr><td>Nephrops (DVH)</td><td>4.0</td><td>110.5</td></tr>
<tr><td>Pandalus (DVR)</td><td>105.2</td><td>460.1</td></tr>
<tr><td>Crangon (HRJ)</td><td>45.6</td><td>135.6</td></tr>
<tr><td>Hake (KLM)</td><td>3.2</td><td>184.1</td></tr>
<tr><td>Haddock (KUL)</td><td>3.6</td><td>68.3</td></tr>
<tr><td>Mackerel (MAK)</td><td>5.0</td><td>813.5</td></tr>
<tr><td>Saithe (MSJ)</td><td>5.3</td><td>133.2</td></tr>
<tr><td>Turbot (PGH)</td><td>2.3</td><td>32.5</td></tr>
<tr><td>Plaice (RSP)</td><td>6.0</td><td>365.9</td></tr>
<tr><td>Herring (SIL)</td><td>176.9</td><td>51913.5</td></tr>
<tr><td>Sandeel (TBS)</td><td>1671.3</td><td>12973.4</td></tr>
<tr><td>Sole (TNG)</td><td>5.1</td><td>79.8</td></tr>
<tr><td>Cod (TOR)</td><td>8.9</td><td>711.7</td></tr>
</table></td></tr>
<tr><td>Category</td><td>Ecosystem components</td></tr>
<tr><td>Date created</td><td>2019-03-28</td></tr>
<tr><td>Data type</td><td>Data series</td></tr>
<tr><td>Status</td><td>Completed</td></tr>
<tr><td>Data format</td><td>32-bit floating point Tagged Images File Format (.tif)</td></tr>
<tr><td>Temporal period</td><td>Average CPUE per species in the period 2015-2017</td></tr>
<tr><td>Units in raster data</td><td>CPUE GT (Catch per unit effort, standardized by vessel gross tonnage)</td></tr>
<tr><td>Spatial extent and resolution</td><td>Danish EEZ
Original resolution of data: 0.05 degrees grid. Values have been distributed out on 500 m raster</td></tr>
<tr><td>Coordinate reference system</td><td>European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035</td></tr>
<tr><td colspan="2">Summary:
The data series show the yearly average Catch Per Unit Effort (CPUE) per species for commercial MSFD species for the period 2015-2017. The catch is in kg and the effort is based on hours*vessel gross tonnage, standardized to a 500 gross tonnage vessel.
It is based on VMS data, which is only available for vessels larger than 12 m, so species caught by</td></tr>
</table>

smaller vessels cannot be presented using this method (e.g. eel, blue mussels and cockle).

Lineage:

The species distribution for MSFD commercial species is based on VMS/logbook data from the Danish commercial fishery. As VMS (the position of the vessel per hour) is only available for vessels larger than 12 m, the species distribution can only be shown based on these vessels, meaning that the distribution of the MSFD commercial species eel, blue mussels and cockle cannot be assessed using this method. The species that are mapped for the ECOMAR project using VMS/logbook data are: sprat, nephrops, pandalus, crangon, hake, haddock, mackerel, saithe, turbot, plaice, sandeel, sole and cod. Norway pout is on the list of MSFD commercial species, but the stock is not within the Danish EEZ.

For these species, the landings are found in the DTU Aqua DFAD database (a combination of logbook, sales notes and fleet register data). The landings per species is merged with VMS data by vessel id and date, and the VMS data are filtered to speeds where fishing activity is assumed. The landings (kg) of the species are distributed out on the VMS positions with fishing activity by vessel and fishing date. The landings (kg) and effort (hours) are summarized by year, c-square code (0.05 degrees resolution) and vessel and the gross tonnage (GT) effort standardized to a 500 GT vessel is calculated as:

Effort_GT=$\sqrt{\frac{GT}{500}} * Hours$

Data are summarized by year and c-square, and a yearly average is found of catch per unit effort_GT. To reduce extreme values in data, the values above the 90 quantile are reduced to the value of the 90 quantile, and the values below the 10 quantile are increased to the 10 quantile. Due to the data confidentiality agreement DTU Aqua has with the Danish Fisheries Agency, data are filtered to only include cells with three or more vessels. Doing this also has the positive effect that it reduces noise caused by coincidences/outliers in the data. The data on 0.05 degrees c-square resolution are distributed out on the 500 m grid used in the ECOMAR project.

To give a measure of the uncertainty of the data, landings of the species from logbooks per ICES rectangle (0.01 x 1 degrees) were categorized as with and without VMS, and the percent landings covered by VMS was calculated by ICES rectangle and year, and a yearly average for the time period 2015-2017 was found. The percentage values were distributed evenly out on the 500 m raster. The uncertainty indicates the part of the landings not represented by the VMS data.

Considerations for use in ECOMAR:

VMS data are only available for vessels larger than 12 m, and a speed filter is applied where fishing activity is assumed. In some cases, the vessel is sailing with the speeds where fishing activity is assumed, which can give some noise in the data. For this project, positions with time stamps close to departure/arrival to harbour has been filtered out to reduce this problem.

The data have been filtered to exclude values when there are less than 3 vessels within the aggregation level.

The VMS based data on fishing hours have been rescaled from a 0.05 degrees grid (varying from 16 to 18 km^2 within the Danish EEZ) to the 0.25 km^2 grid requested for the ECOMAR project.

Data from the smallest vessels that does not have logbooks (<10 m, <8 m in the Baltic) are not included in the uncertainty data.

The logbook-based data on VMS coverage (the uncertainty layer) have been rescaled from the ICES rectangles (0.5*1 degrees) to the 0.25 km^2 grid requested for the ECOMAR project.

Recommendations for data improvement: None

Data authoring organization	DTU Aqua
Data author contact	jsv@aqua.dtu.dk
Data source	Danish Fisheries Agency
Data source contact	jsv@aqua.dtu.dk

INSPIRE topic category	Oceans, biota, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Marine ecosystem, marine biota, fish, fishing, open sea fishing
Maintenance	Not planned
Metadata date	2019-03-28
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

2) Abundance of commercial fish species estimated from scientific surveys

<table>
<tr><td>Data name</td><td>Abundance of commercial fish species estimated from scientific surveys</td></tr>
<tr><td>Group/category of activity</td><td>Ecosystem components – MSFD commercial fish species</td></tr>
<tr><td>Data units, max and min values</td><td>Catch Per Unit Effort (CPUE, catch in numbers in a standardized trawl haul) or presence (probability of catching at least one individual in a standardized trawl haul).
<table>
<tr><th>Method and species</th><th>Minimum value</th><th>Maximum value</th></tr>
<tr><td>CPUE, Cod 35+ cm, quarter 4</td><td>0.0</td><td>211</td></tr>
<tr><td>CPUE, Sole 25+ cm, quarter 3</td><td>0.0</td><td>3.6</td></tr>
<tr><td>CPUE, Plaice 25+ cm, quarter 4</td><td>0.2</td><td>246</td></tr>
<tr><td>CPUE, Herring 20+ cm, quarter 4</td><td>2.1</td><td>1805</td></tr>
<tr><td>CPUE, Sprat 14+ cm</td><td>0.0</td><td>13901</td></tr>
<tr><td>Presence, Hake 25+ cm</td><td>0.0</td><td>0.8</td></tr>
<tr><td>Presence, Turbot 25+ cm</td><td>0.0</td><td>0.7</td></tr>
<tr><td>Presence, Norway pout 10+ cm</td><td>0.0</td><td>1</td></tr>
<tr><td>Presence Haddock 20+ cm</td><td>0.0</td><td>1</td></tr>
<tr><td>Presence, Saithe 25+ cm</td><td>0.0</td><td>1</td></tr>
</table></td></tr>
<tr><td>Category</td><td>Ecosystem components</td></tr>
<tr><td>Date created</td><td>2019-03-29</td></tr>
<tr><td>Data type</td><td>Data series</td></tr>
<tr><td>Status</td><td>Completed</td></tr>
<tr><td>Data format</td><td>32-bit floating point Tagged Images File Format (.tif)</td></tr>
<tr><td>Temporal period</td><td>CPUE per species in the period 2009-2018</td></tr>
<tr><td>Units in raster data</td><td>Relative abundance (number) or probability of presence</td></tr>
<tr><td>Spatial extent and resolution</td><td>Danish EEZ
Original resolution of data: 0.05 degrees grid. Values have been distributed out on 500 m raster. Water depth 10-250 m.</td></tr>
<tr><td>Coordinate reference system</td><td>European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035</td></tr>
<tr><td colspan="2">Summary:
Catch Per Unit Effort (CPUE kg/Effort_GT) or Presence derived from scientific trawl surveys for the period 2009-2018 are used as a proxy for abundance of commercial MSFD species. This data series show the CPUE (number caught per trawl haul, standardized with respect to haul duration, year,</td></tr>
</table>

time of the year and gear used) or Presence (probability of catching at least one individual in a standardized trawl haul).
Spatial abundance indices are derived from analysis of the data from the International scientific trawl surveys, IBTS, BITS, BTS available from ICES and data from the Danish Cod and the Sole surveys.

Lineage:

The species distribution for MSFD commercial species Spatial abundance indices are derived from analysis of data from the international scientific trawl surveys, IBTS, BITS, BTS available from ICES (http://ices.dk/marine-data/data-portals/Pages/DATRAS.aspx) and Danish data from the Cod and the Sole surveys from the period 2009-2018.
Survey spatial coverage, timing and gear used are different between surveys:

a) IBTS in the North Sea, Skagerrak and Kattegat in quarter 1 and 3, using mainly the GOV bottom trawl
b) BITS in Kattegat and the Baltic in quarter 1 and 4 using mainly bottom trawl gears TVL and TVS
c) BTS in the southern and central North Sea in quarter 3 using various types of beam trawls
d) The Cod survey covers Kattegat in Quarter 4 using various types of bottom trawls
e) The Sole survey covers Kattegat and partly Skagerrak in quarter 4 various types of bottom trawls.

In addition, data from a Danish BITS survey in quarter 3 covering Kattegat and the Western Baltic are available from one year only.
The spatial distributions of the species are estimated from GAM models for standardization of the effect of gear used, year and time of the year. The spatial component of the models allows a gradual change in species distribution over the year but assumes a constant distribution between years. The effects of water depth, gear used, and haul duration and year is also included in the GAM models where the effect is significant.
Specific GAM models were fitted for the individual species using trawl hauls inside and outside the Danish EEZ within the longitude range 1^{o} west to 19^{o} east and latitude range 53.5^{o} – to 58.5^{o}. For some species data from some surveys were excluded due to a very limited overlap between species distribution and survey coverage, e.g. the BTS survey (mainly covering the Southern and Central North Sea) was not used for Norway pout with a northerly distribution.
The presented data includes model predictions for the Danish EEZ on a 500 m grid as used in the ECOMAR project. Species distribution depends very much on the time of the year. The day of the year chosen for prediction of the individual species was based on the uncertainty of the predicted distributions. This means that mainly one day (day 325) within Q4 was chosen, as Q4 includes most survey observations.
The minimum depth fished varies between surveys, but depths less than 10 m and thereby most of the coastal areas are not or poorly covered by the surveys. Likewise, predictions are not made for depth less than 10 m.
For some of the less abundant species and for species with a limited distribution area the probability of presence (in a standardized trawl haul) is modelled instead of the abundance (numbers caught per standardized trawl haul).

Considerations for use in ECOMAR:

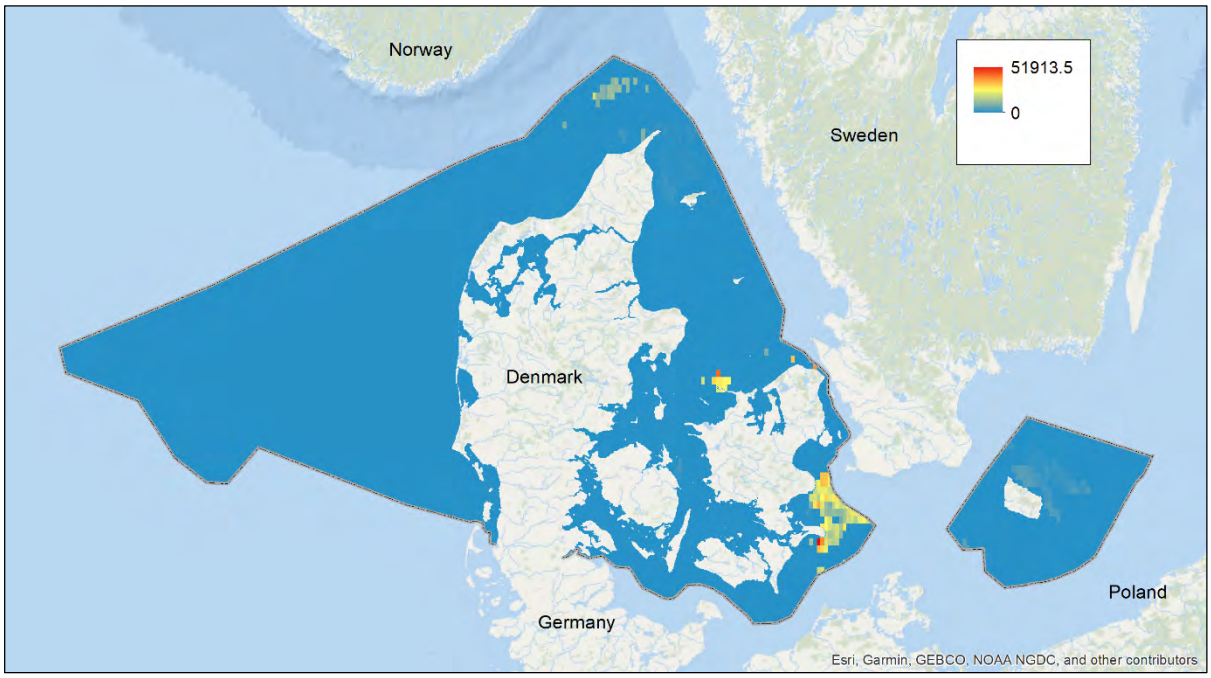
For management purposes fish species are divided into stocks (e.g. North Sea & Skagerrak cod, Kattegat cod, Western Baltic cod and Eastern Baltic cod) and scientific surveys are designed to cover a stock and not the full distribution area for the species. This means that for example a species like cod within the Danish EEZ are monitored by a number of surveys taking place at different time of the years, each covering only parts of the distribution area and using different gears. The available scientific survey data are therefore highly “unbalanced” which makes the standardization of gear effects and time of the year uncertain. Estimated abundance by fish stock would therefore be more accurate; however, this would provide estimates for each stock area which would be scaled

differently. The vertical opening of the gears used is in the range 1-5 m and they operate mainly on the bottom, such that the proportion of the water column fished will depend on the water depth. The abundance indices shown will therefore be more accurate for demersal species than for pelagic species. The survey design is directed towards resources on open sea rather than the shallow coastal waters. In addition, the used modelling approach takes spatial correlation into account, but it was not possible to exclude boundaries (land) in this correlation. Species abundance estimated for the inshore waters, with its presence of islands and narrow necks of land, may consequently be highly uncertain.	
Recommendations for data improvement: None	
Data authoring organization	DTU Aqua
Data author contact	mv@aqua.dtu.dk
Data source	National and international trawl surveys coordinated by The International Council for the Exploration of the Sea (ICES).
Data source contact	mv@aqua.dtu.dk
INSPIRE topic category	Oceans, biota, environment
INSPIRE theme	Species distribution
GEMET keywords	Marine ecosystem, marine biota, fish, fish stock, fishery resource
Maintenance	Not planned
Metadata date	2019-03-28
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

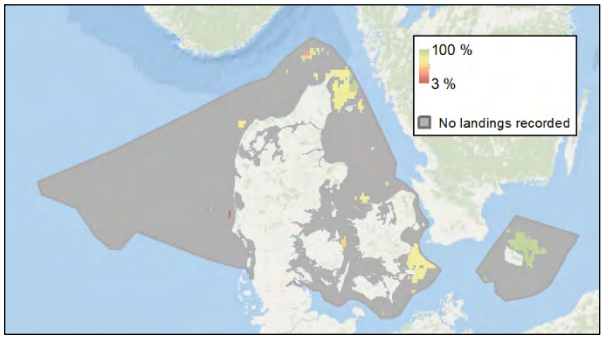
B4.1 Pelagic fish species

B4.1.1 Herring, *Clupea harengus*

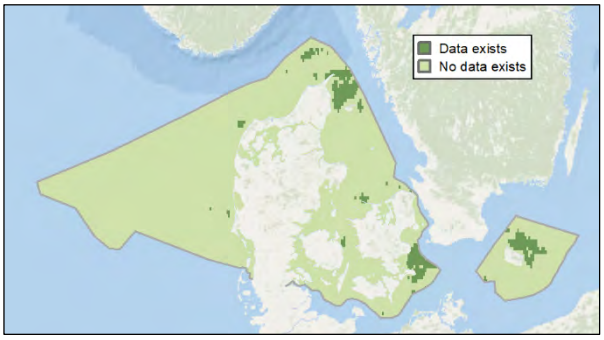
Herring (*Clupea harengus*) based on VMS data (CPUE kg/Effort_GT)



Estimated uncertainty

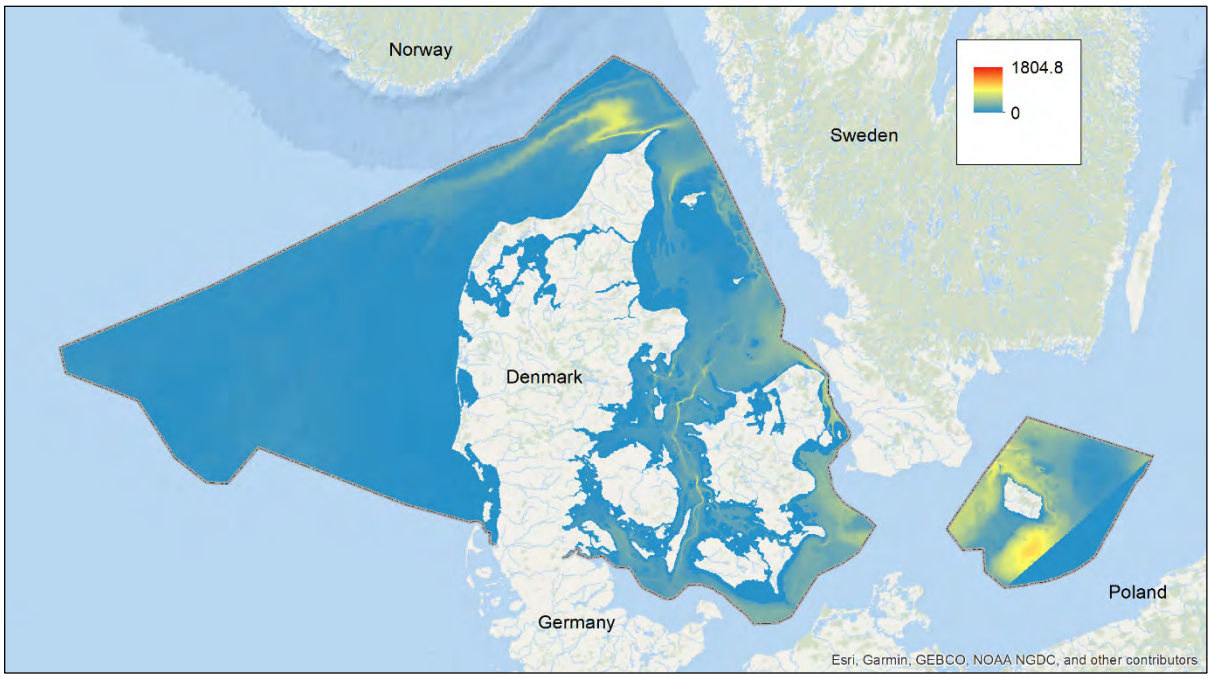


Data coverage

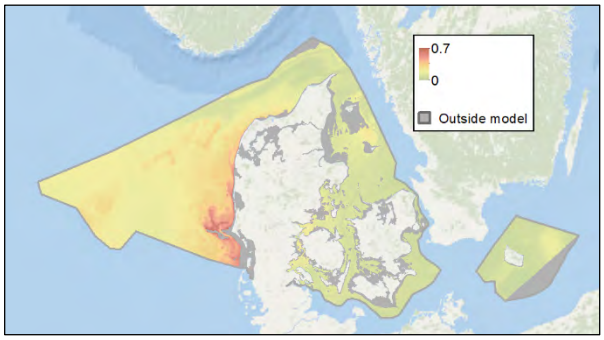


Estimated uncertainty: Percentage landings covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas with no reported landings and has a higher uncertainty.
Data coverage: Data collection within the Danish EEZ.

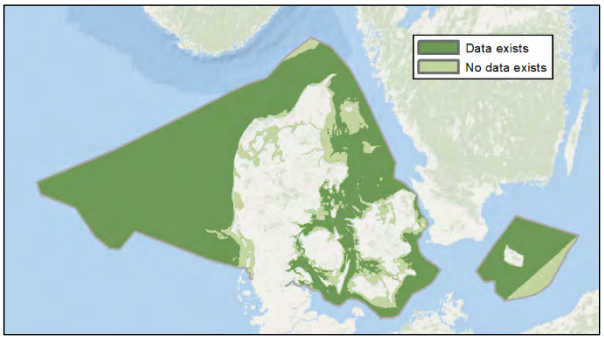
Herring abundance (*Clupea harengus*) 20+ cm based on standardized survey (CPUE n/year)



Estimated uncertainty



Data coverage

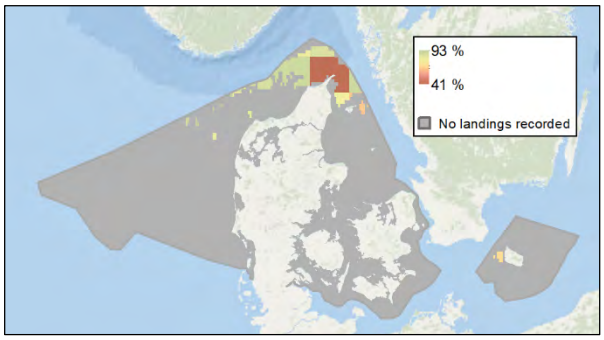


Estimated uncertainty: Coefficient of Variation of estimated value. Grey areas represent areas are not included in the model and has a higher uncertainty.
Data coverage: Data collection and model expansion within the Danish EEZ, Data exists = prediction exists, No data exists = No reliable prediction exists.

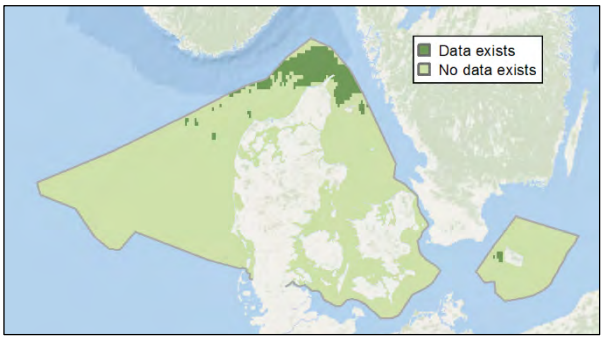
B4.1.2 Mackerel, *Scomber Scombrus*

Mackerel (*Scomber Scombrus)* based on VMS data (CPUE kg/Effort_GT)

Estimated uncertainty



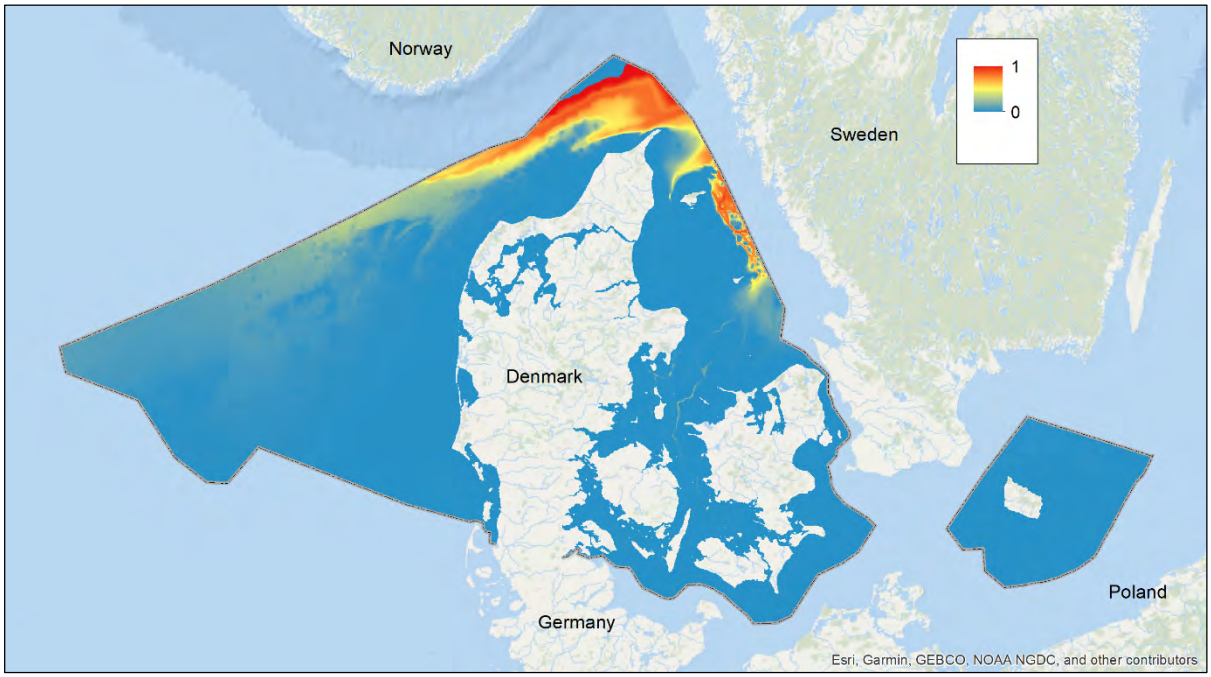
Data coverage



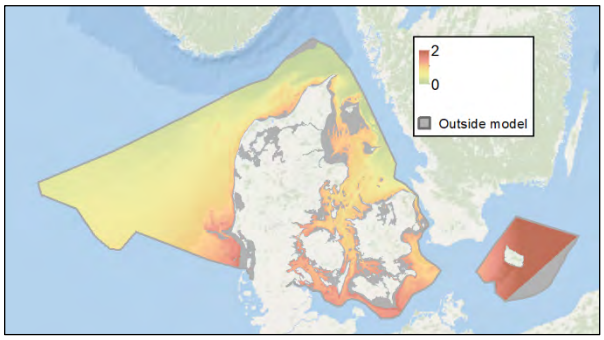
Estimated uncertainty: Percentage landings covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas with no reported landings and has a higher uncertainty.
Data coverage: Data collection within the Danish EEZ.

B4.1.3 Norway pout, *Trisopterus esmarki*

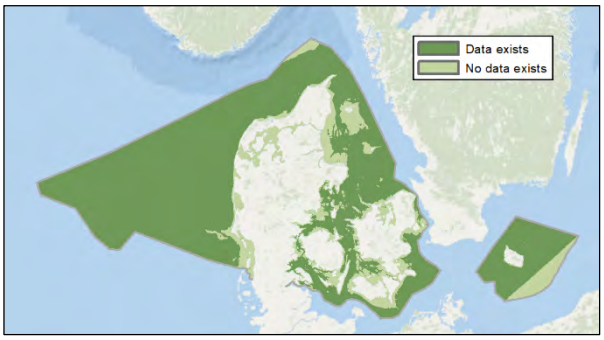
Norway pout abundance (*Trisopterus esmarki*)10+ cm, standardized survey (CPUE n/year)



Estimated uncertainty



Data coverage

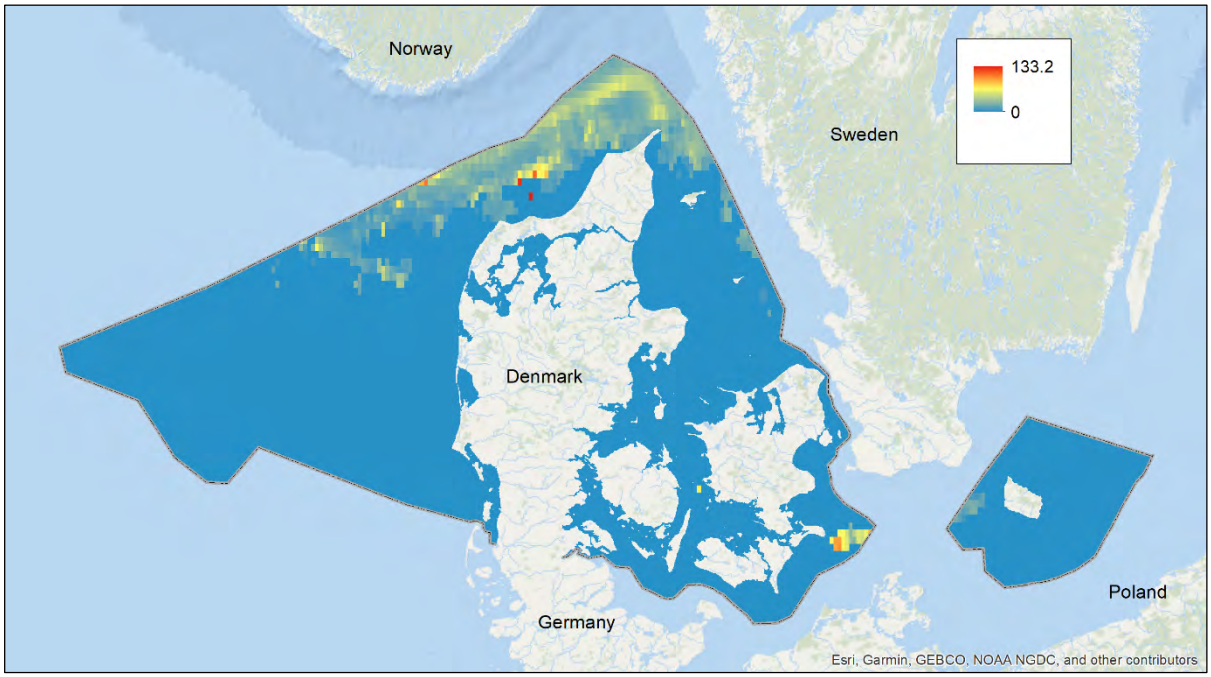


Estimated uncertainty: Coefficient of Variation of estimated value. Grey areas represent areas are not included in the model and has a higher uncertainty.

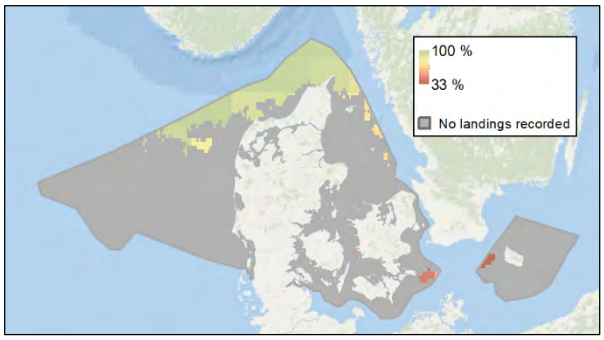
Data coverage: Data collection and model expansion within the Danish EEZ, Data exists = prediction exists, No data exists = No reliable prediction exists.

B4.1.4 Saithe, *Pollachius virens*

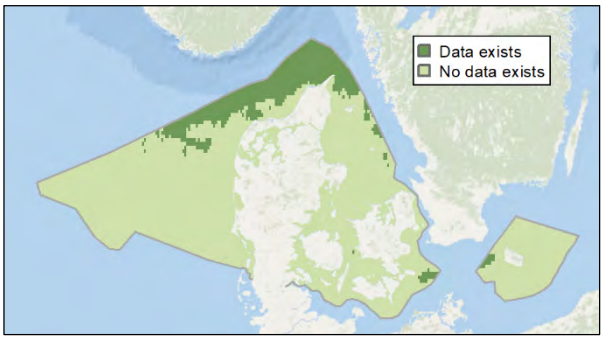
Saithe (*Pollachius virens*) based on VMS data (CPUE kg/Effort_GT)



Estimated uncertainty

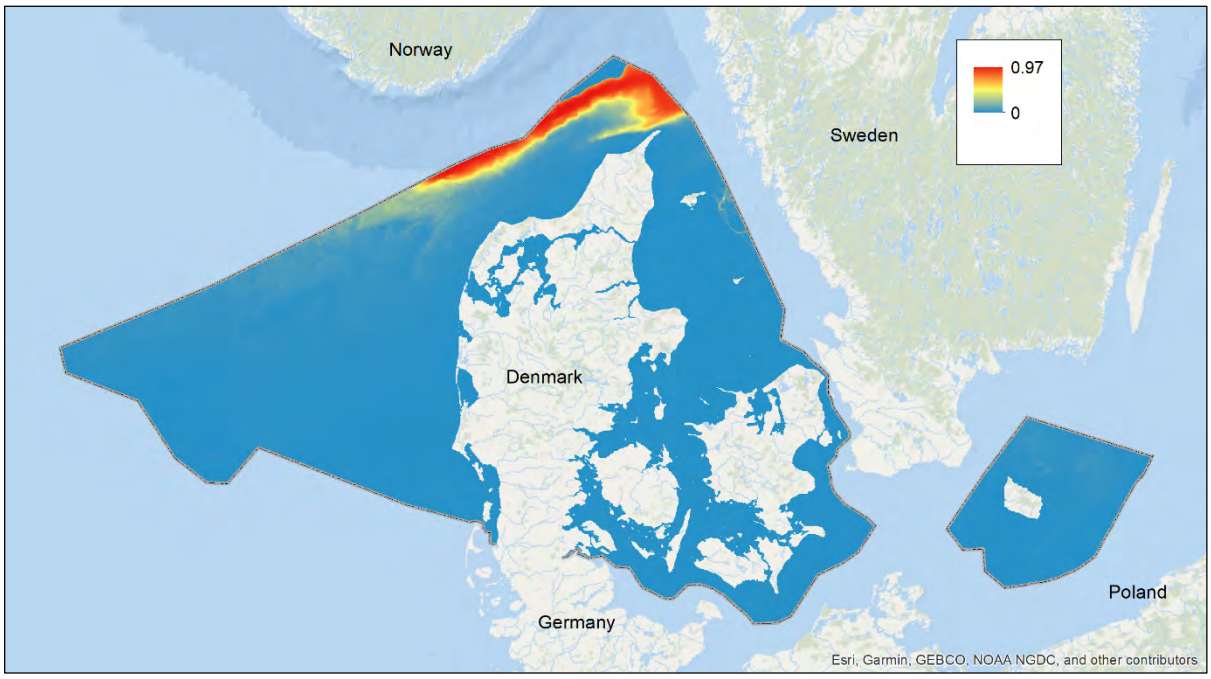


Data coverage

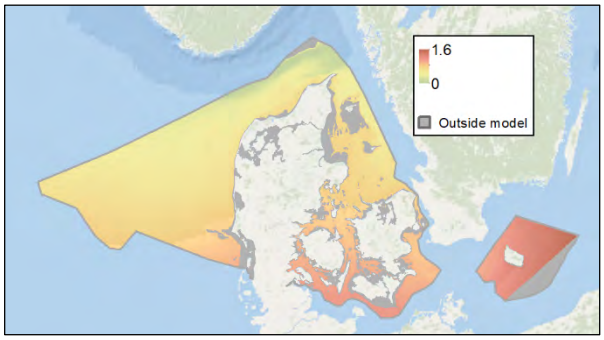


Estimated uncertainty: Percentage landings covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas with no reported landings and has a higher uncertainty.
Data coverage: Data collection within the Danish EEZ.

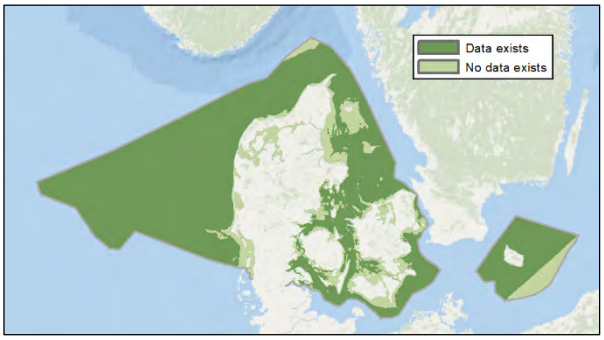
Saithe 25+ cm based on standardized survey (CPUE n/year)



Estimated uncertainty



Data coverage

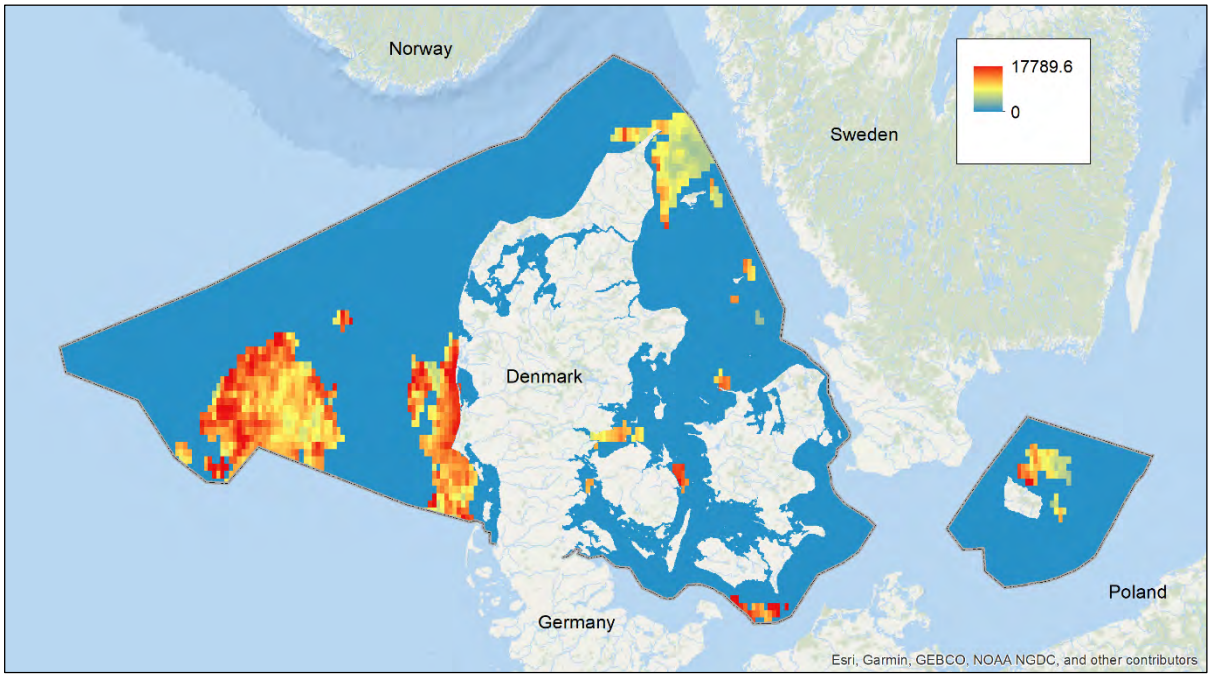


Estimated uncertainty: Coefficient of Variation of estimated value. Grey areas represent areas are not included in the model and has a higher uncertainty.

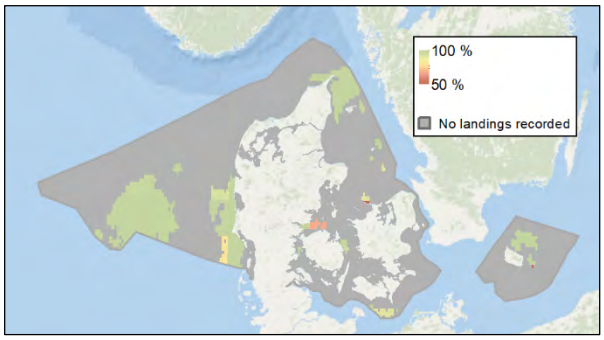
Data coverage: Data collection and model expansion within the Danish EEZ, Data exists = prediction exists, No data exists = No reliable prediction exists.

B4.1.5 Sprat, *Sprattus sprattus*

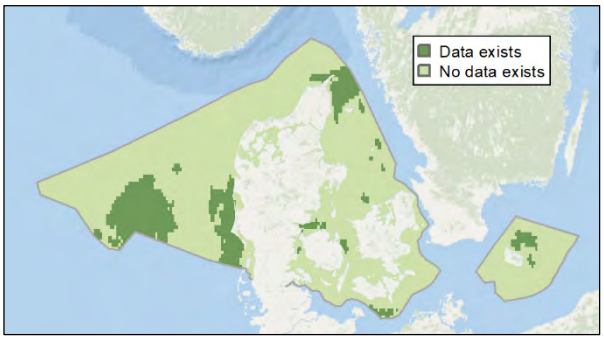
Sprat (*Sprattus sprattus*) based on VMS data (CPUE kg/Effort_GT)



Estimated uncertainty

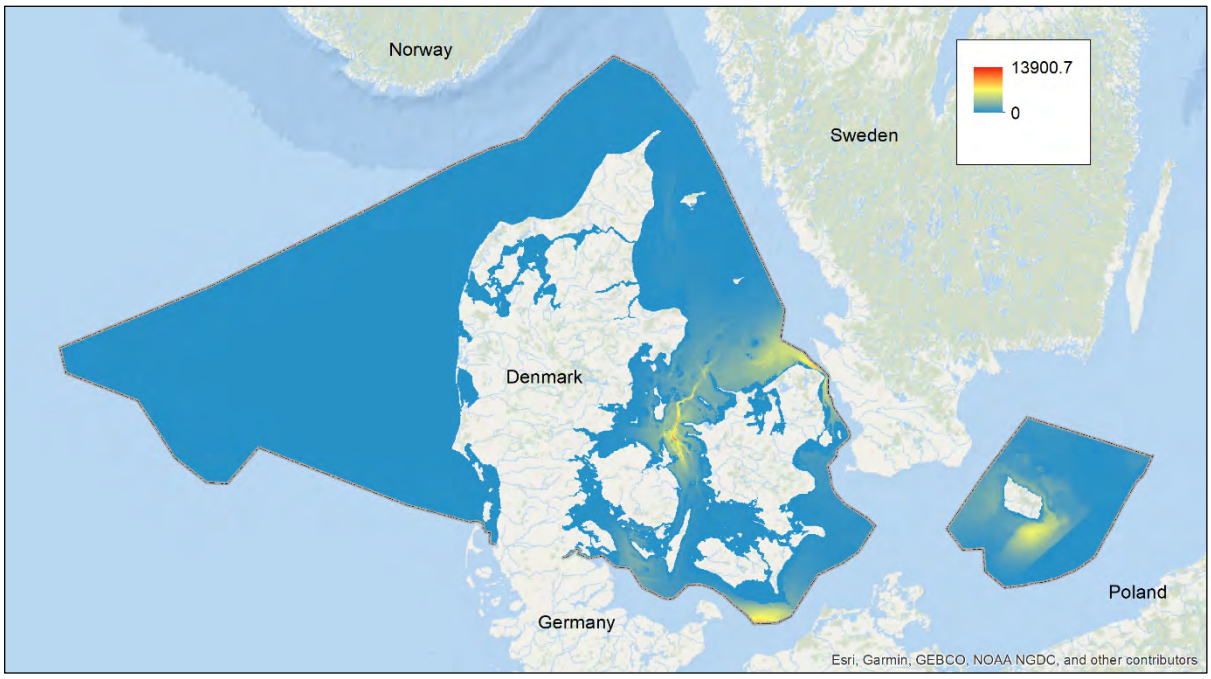


Data coverage

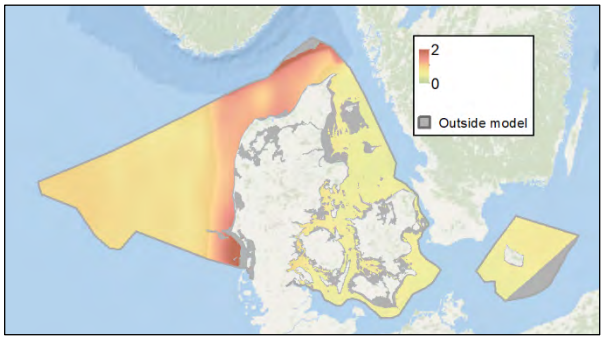


Estimated uncertainty: Percentage landings covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas with no reported landings and has a higher uncertainty.
Data coverage: Data collection within the Danish EEZ.

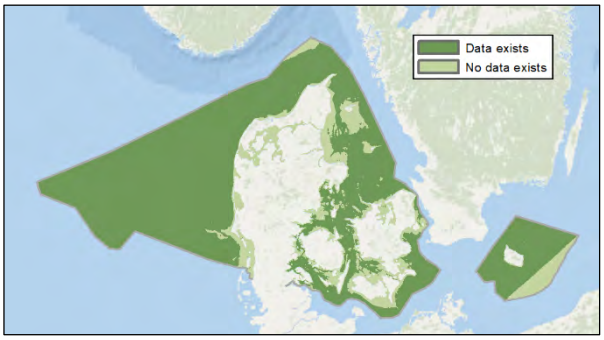
Sprat 14+cm based on standardized survey (CPUE n/year)



Estimated uncertainty



Data coverage



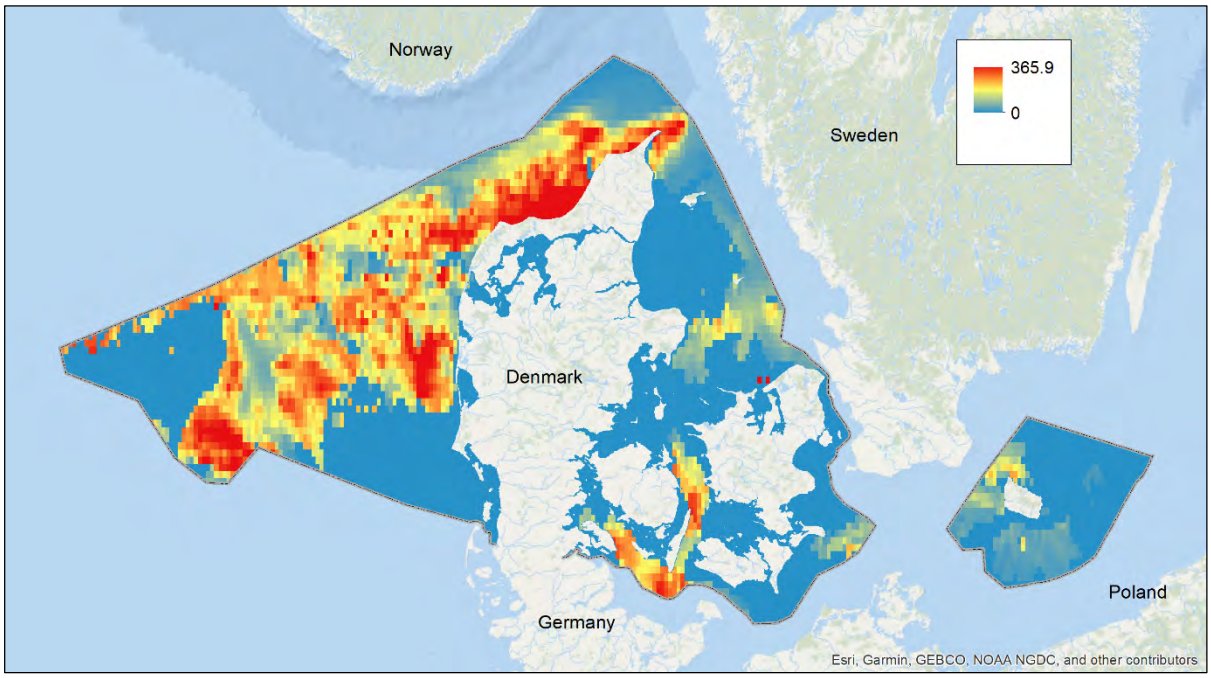
Estimated uncertainty: Coefficient of Variation of estimated value. Grey areas represent areas are not included in the model and has a higher uncertainty.

Data coverage: Data collection and model expansion within the Danish EEZ, Data exists = prediction exists, No data exists = No reliable prediction exists.

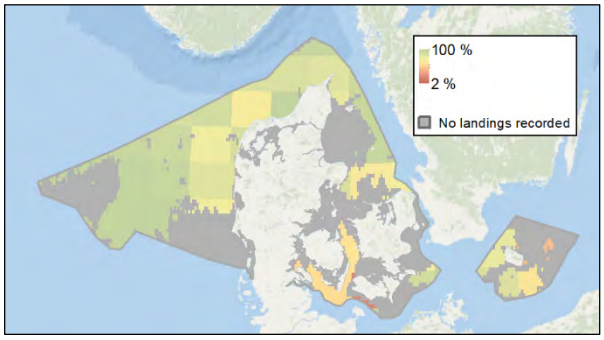
B4.2 Demersal/benthic fish species

B4.2.1 Plaice, *Pleuronectes platessa*

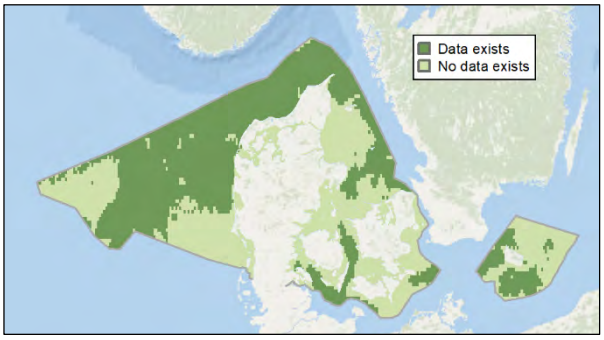
Plaice (*Pleuronectes platessa*) based on VMS data (CPUE kg/Effort_GT)



Estimated uncertainty

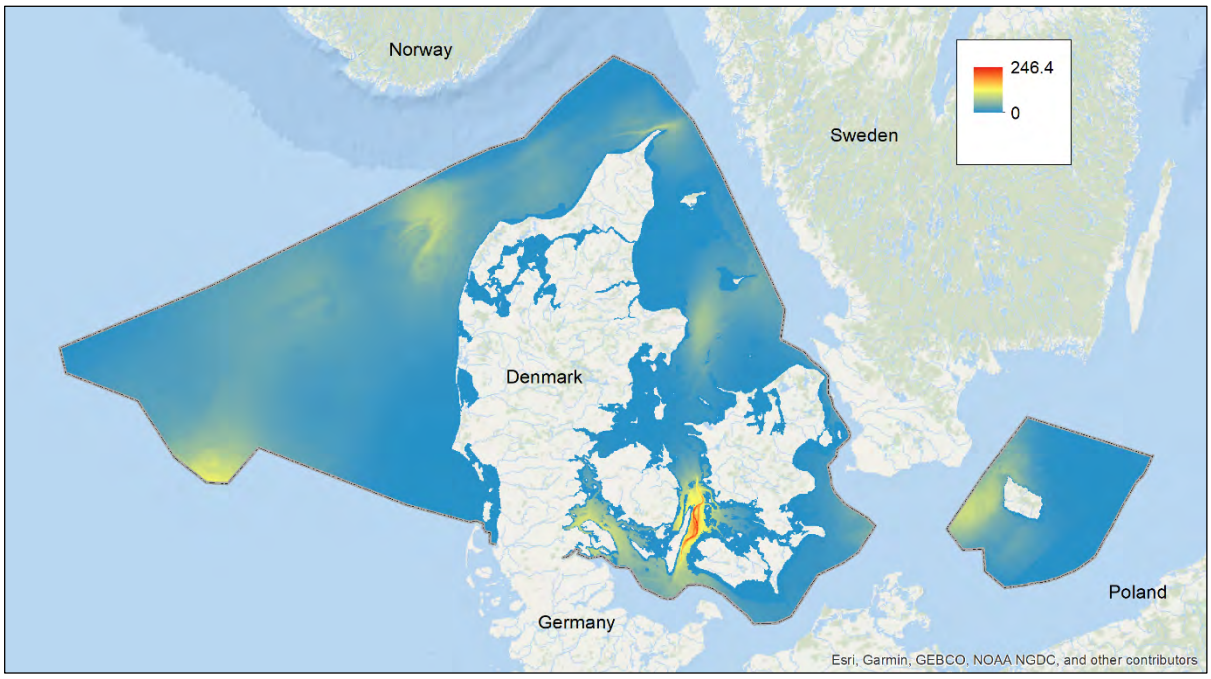


Data coverage

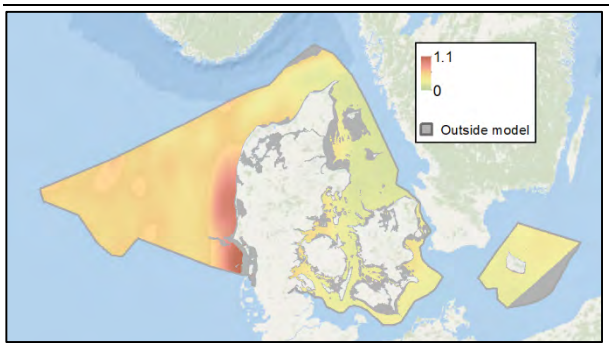


Estimated uncertainty: Percentage landings covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas with no reported landings and has a higher uncertainty.
Data coverage: Data collection within the Danish EEZ.

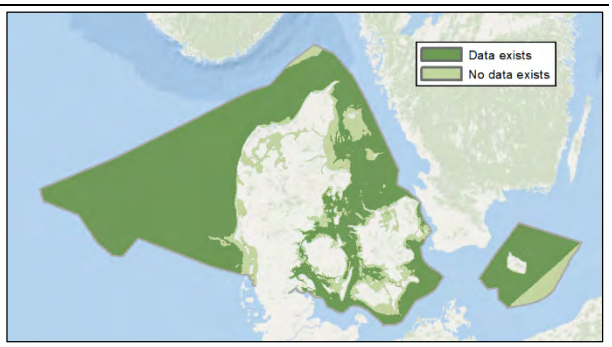
Plaice (*Pleuronectes platessa*) 25+ cm based on standardized survey (CPUE n/year)



Estimated uncertainty



Data coverage

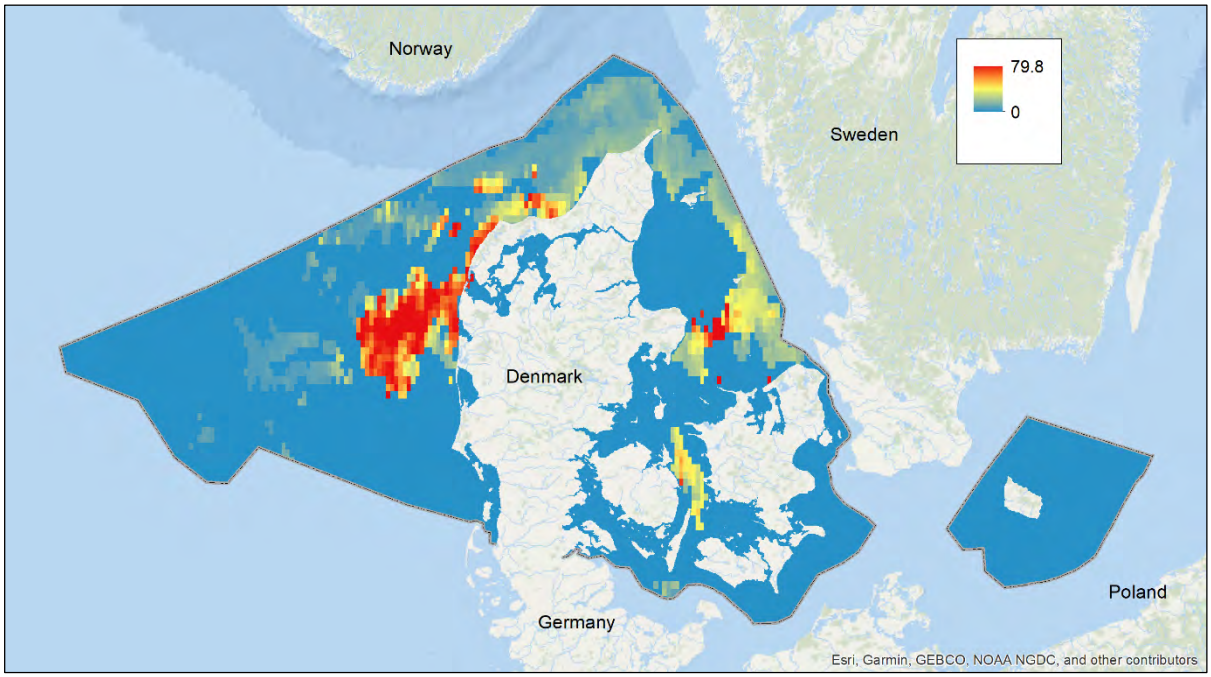


Estimated uncertainty: Coefficient of Variation of estimated value. Grey areas represent areas are not included in the model and has a higher uncertainty.

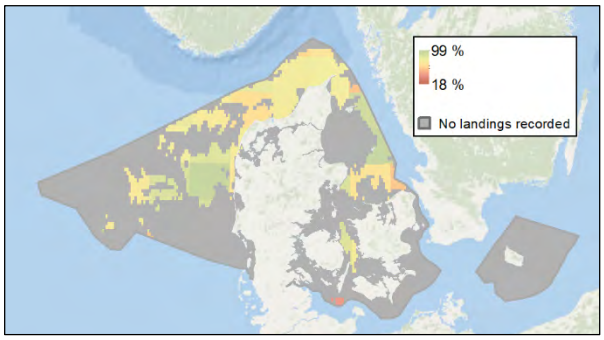
Data coverage: Data collection and model expansion within the Danish EEZ, Data exists = prediction exists, No data exists = No reliable prediction exists.

B4.2.2 Sole, *Solea solea*

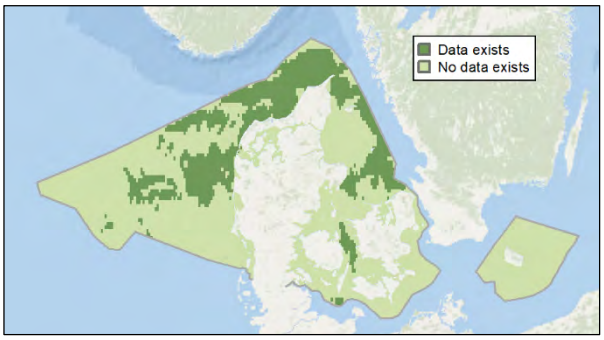
Sole (*Solea solea*) based on VMS data (CPUE kg/Effort_GT)



Estimated uncertainty

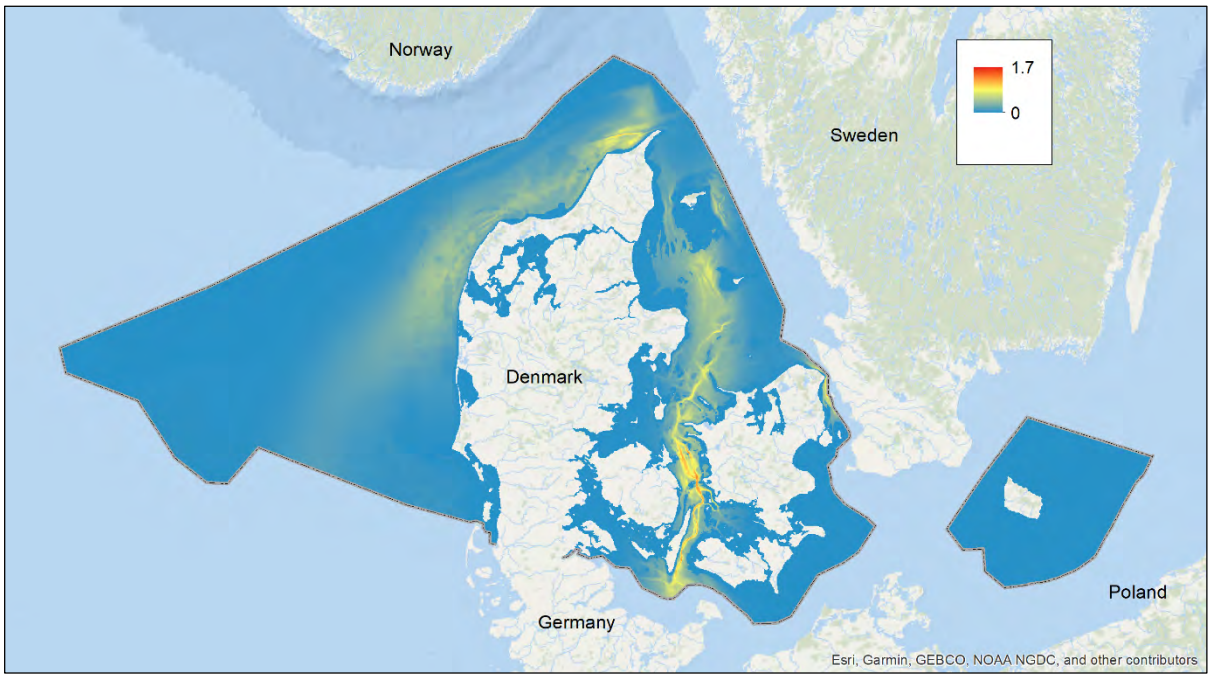


Data coverage

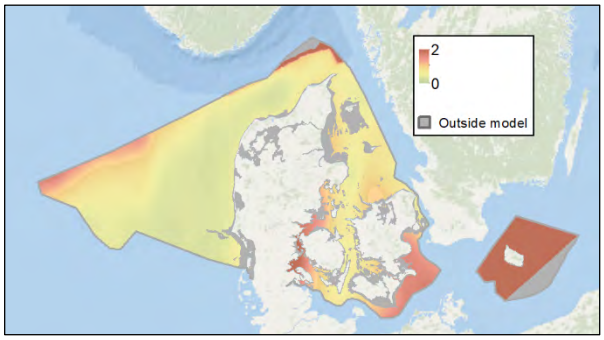


Estimated uncertainty: Percentage landings covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas with no reported landings and has a higher uncertainty.
Data coverage: Data collection within the Danish EEZ.

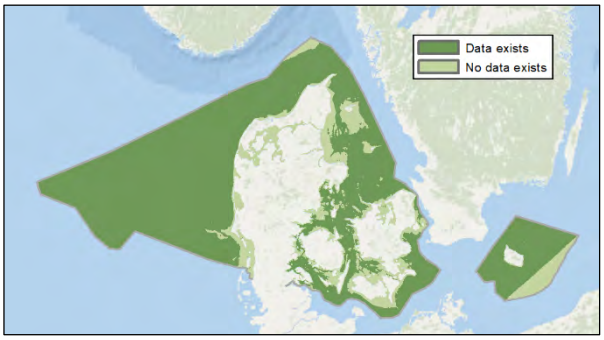
Sole (*Solea solea*) 25+ cm based on standardized survey (CPUE n/year)



Estimated uncertainty



Data coverage

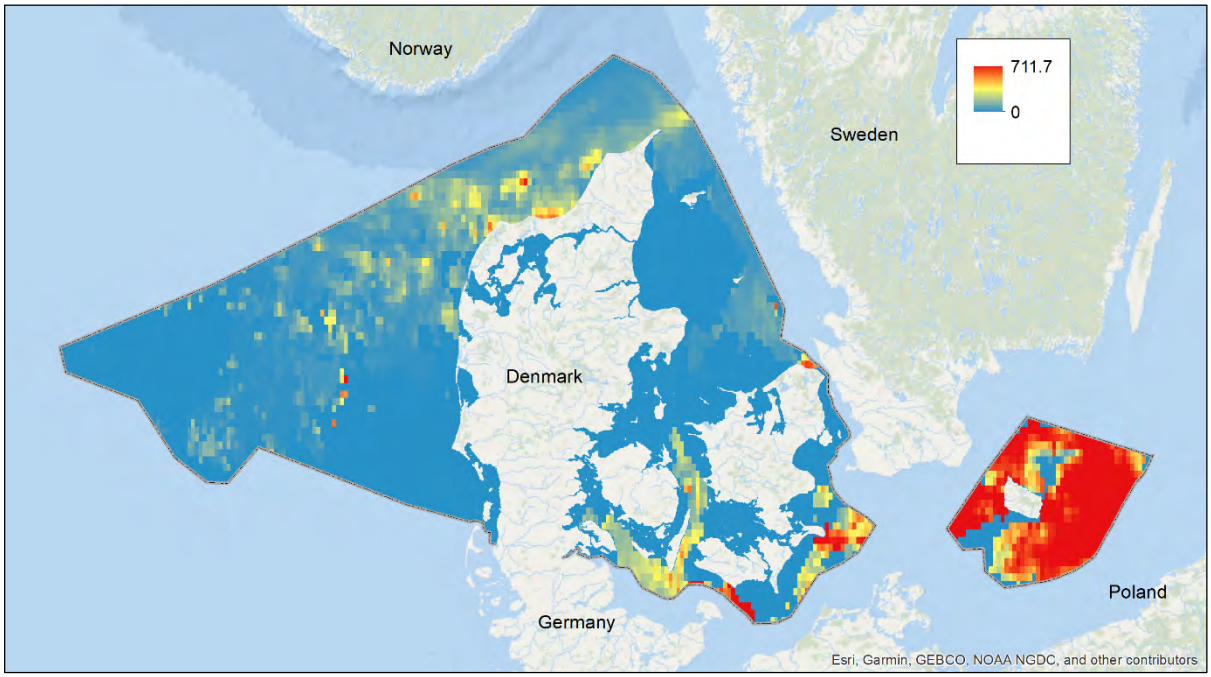


Estimated uncertainty: Coefficient of Variation of estimated value. Grey areas represent areas are not included in the model and has a higher uncertainty.

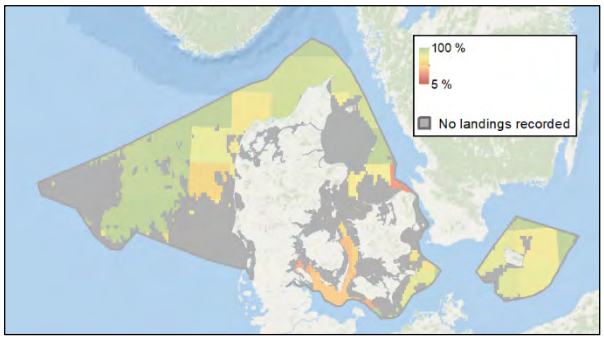
Data coverage: Data collection and model expansion within the Danish EEZ, Data exists = prediction exists, No data exists = No reliable prediction exists.

B4.2.3 Cod, *Gadus morhua*

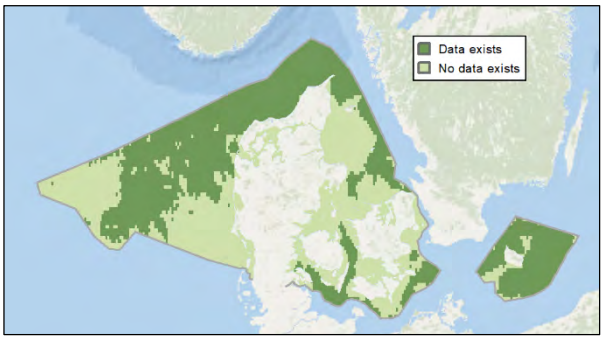
Cod (*Gadus morhua*) based on VMS data (CPUE kg/Effort_GT)



Estimated uncertainty



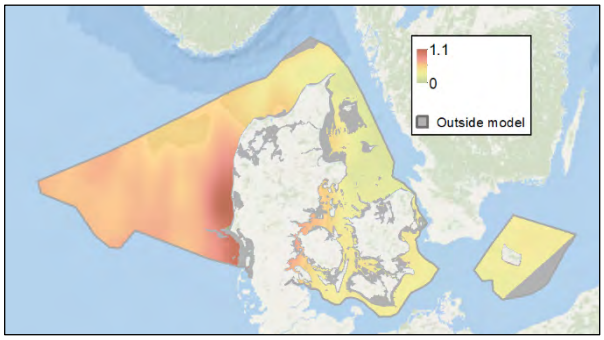
Data coverage



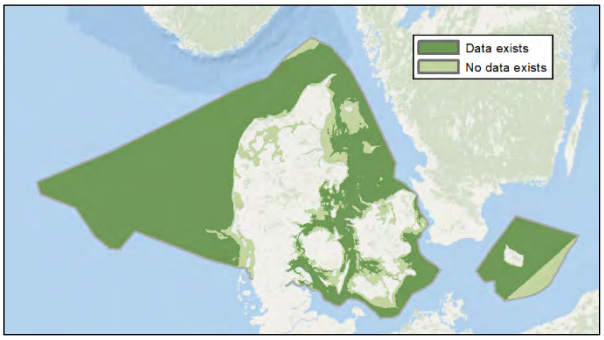
Estimated uncertainty: Percentage landings covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas with no reported landings and has a higher uncertainty.
Data coverage: Data collection within the Danish EEZ.

Cod (*Gadus morhua*) 35+ cm based on standardized survey (CPUE n/year)

Estimated uncertainty



Data coverage

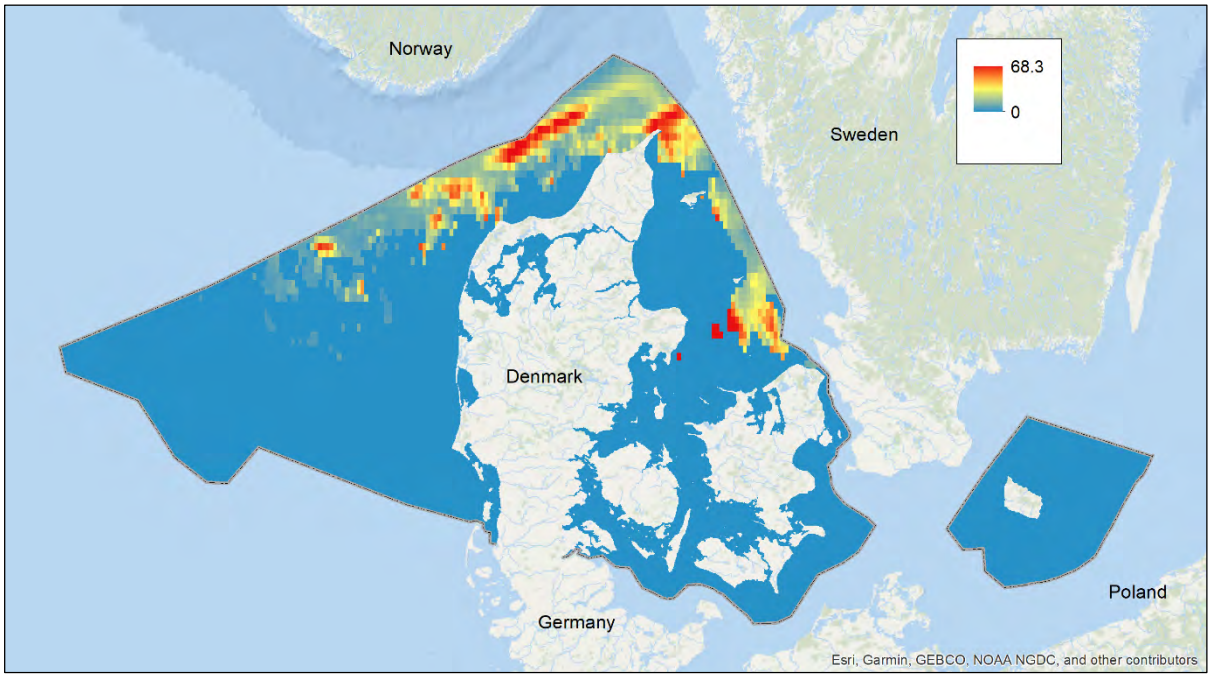


Estimated uncertainty: Coefficient of Variation of estimated value. Grey areas represent areas are not included in the model and has a higher uncertainty.

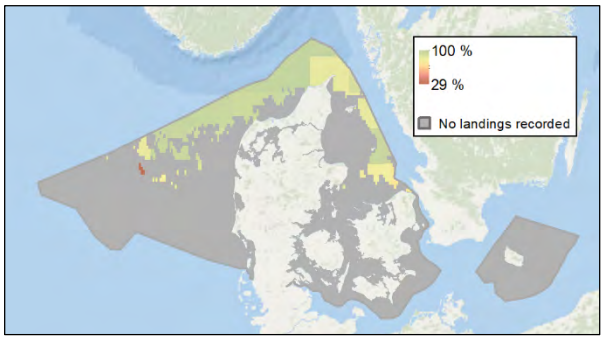
Data coverage: Data collection and model expansion within the Danish EEZ, Data exists = prediction exists, No data exists = No reliable prediction exists.

B4.2.4 Haddock, *Melanogrammus aeglefinus*

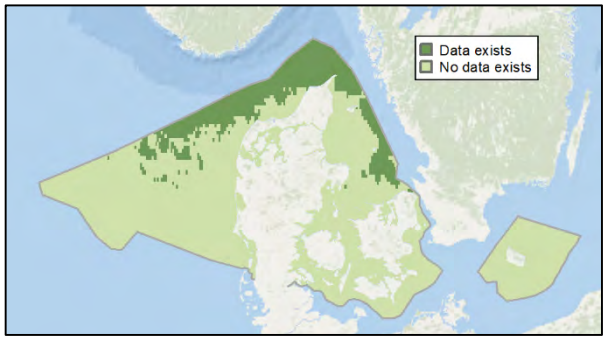
Haddock (*Melanogrammus aeglefinus*) based on VMS data (CPUE kg/Effort_GT)



Estimated uncertainty

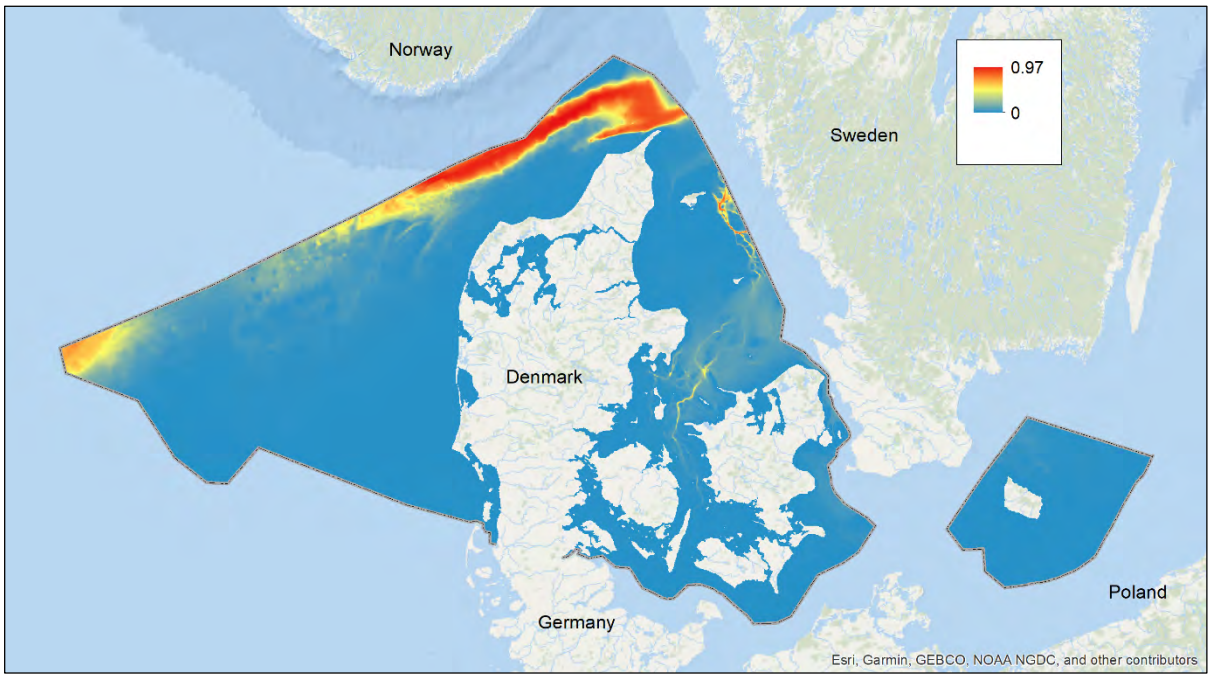


Data coverage

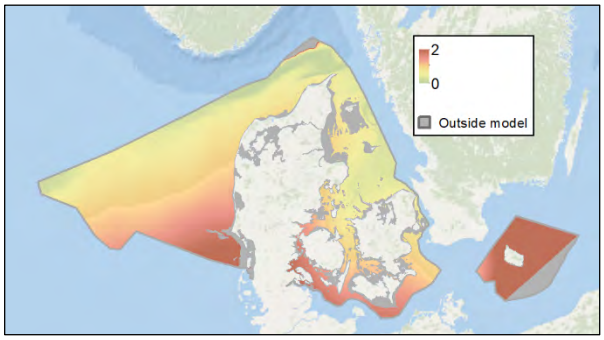


Estimated uncertainty: Percentage landings covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas with no reported landings and has a higher uncertainty.
Data coverage: Data collection within the Danish EEZ.

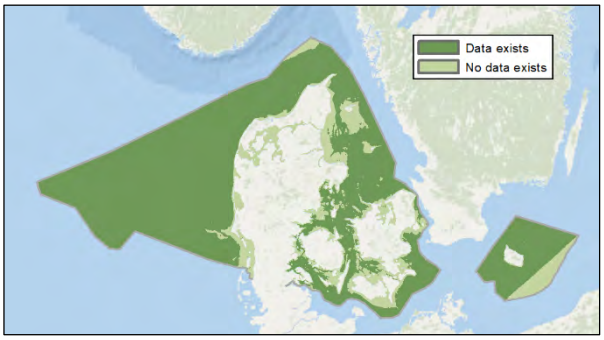
Haddock (*Melanogrammus aeglefinus)* 20+ cm, standardized survey (presence prob./year)



Estimated uncertainty



Data coverage

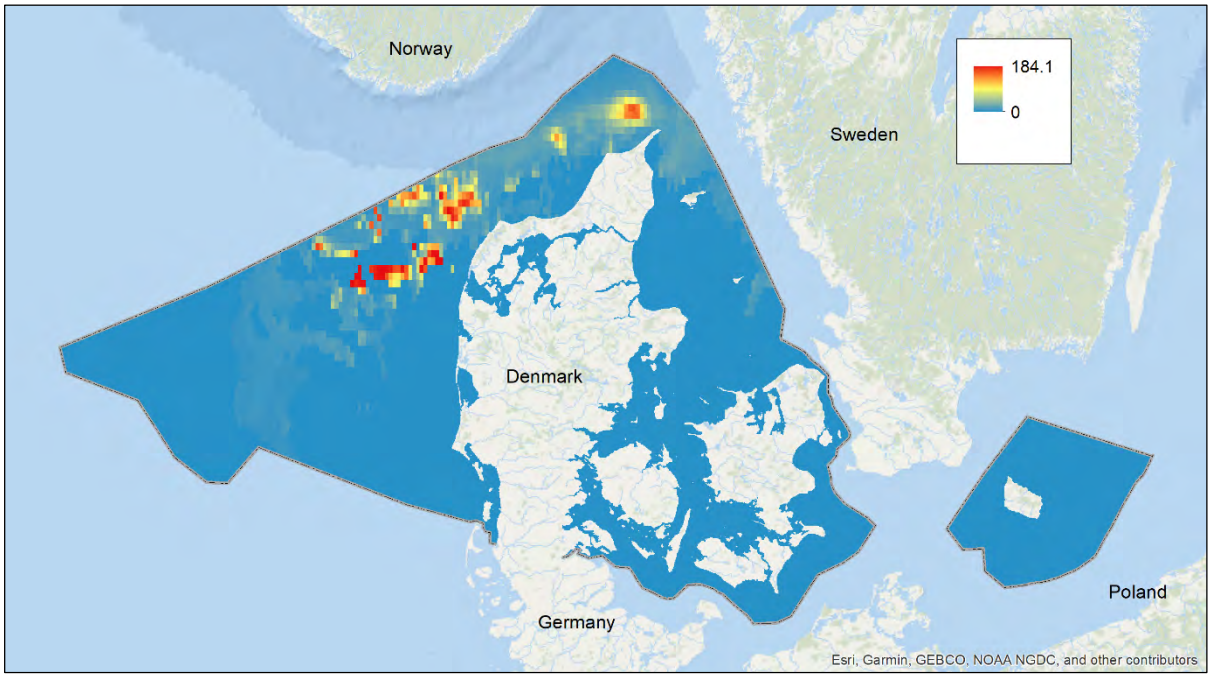


Estimated uncertainty: Coefficient of Variation of estimated value. Grey areas represent areas are not included in the model and has a higher uncertainty.

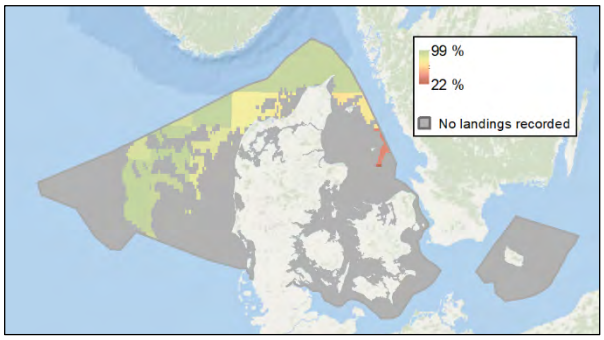
Data coverage: Data collection and model expansion within the Danish EEZ, Data exists = prediction exists, No data exists = No reliable prediction exists.

B4.2.5 Hake, *Merluccius merlucccius*

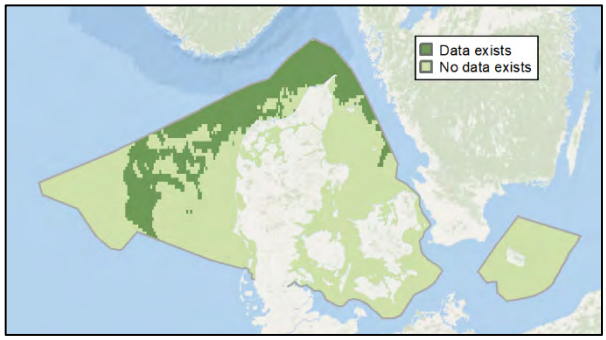
Hake (*Merluccius merlucccius*) based on VMS data (CPUE kg/Effort_GT)



Estimated uncertainty

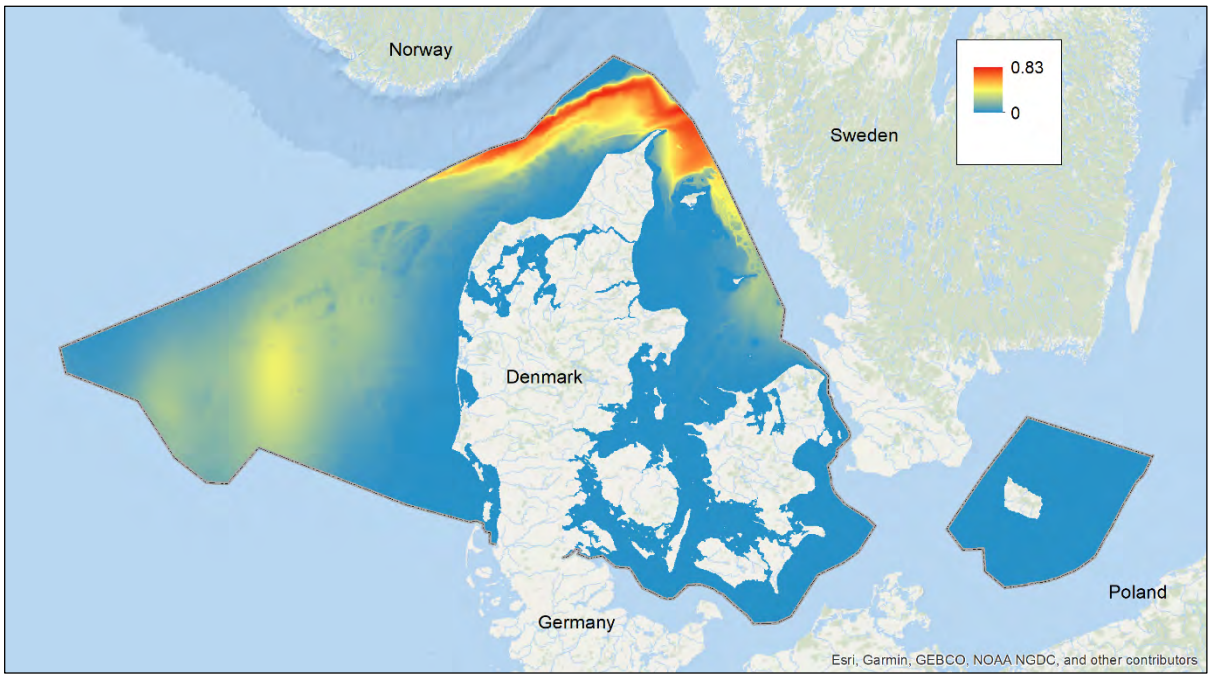


Data coverage

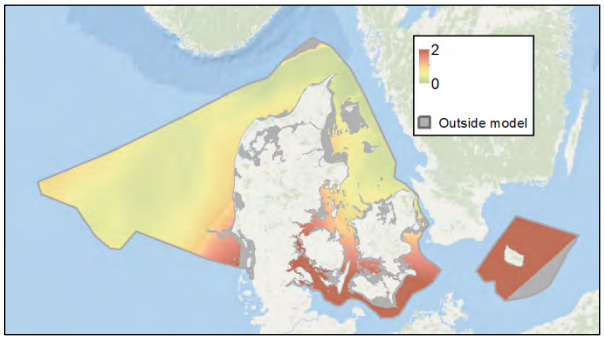


Estimated uncertainty: Percentage landings covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas with no reported landings and has a higher uncertainty.
Data coverage: Data collection within the Danish EEZ.

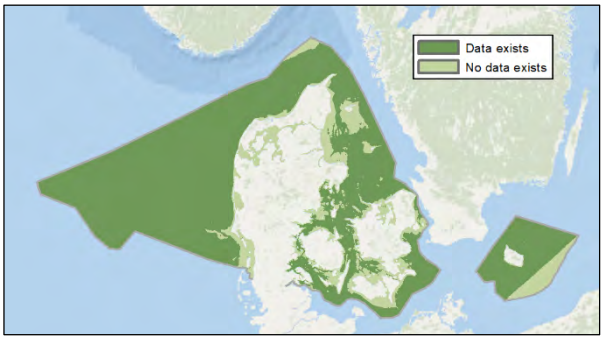
Hake 25+ cm based on standardized survey (presence probability/year)



Estimated uncertainty



Data coverage

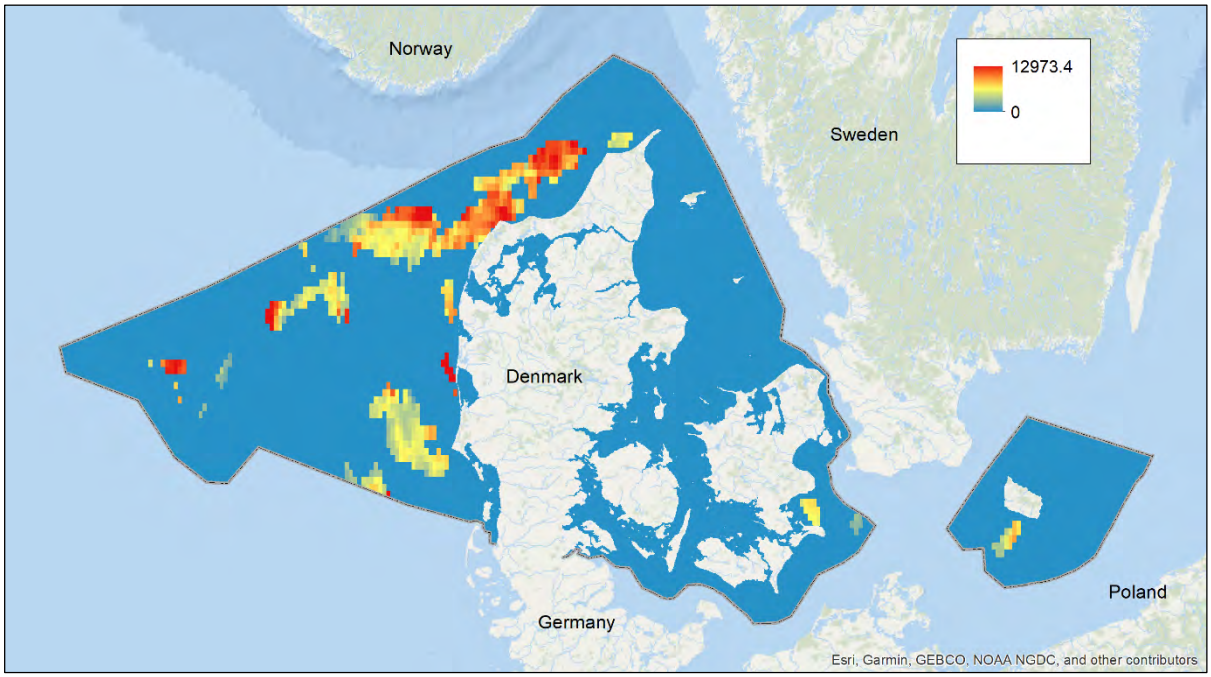


Estimated uncertainty: Coefficient of Variation of estimated value. Grey areas represent areas are not included in the model and has a higher uncertainty.

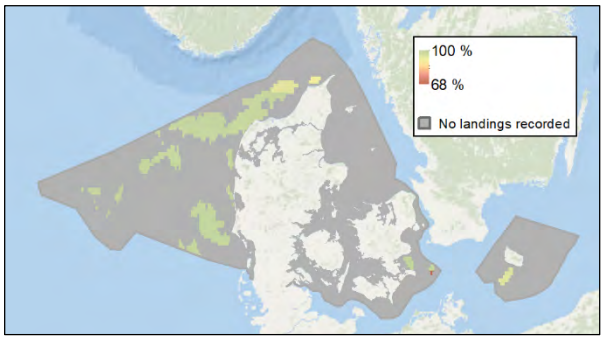
Data coverage: Data collection and model expansion within the Danish EEZ, Data exists = prediction exists, No data exists = No reliable prediction exists.

B4.2.6 Sandeel, *Ammodytes spp.*

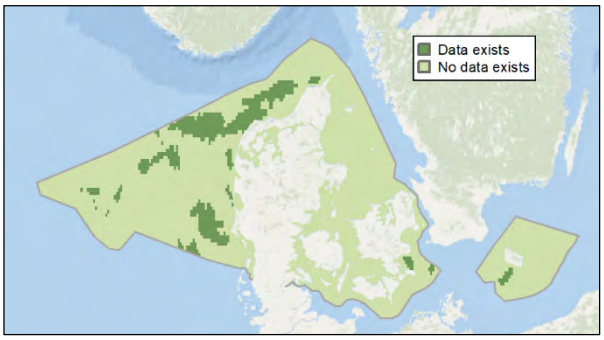
Sandeel (*Ammodytes spp.)* based on VMS data (CPUE kg/Effort_GT)



Estimated uncertainty



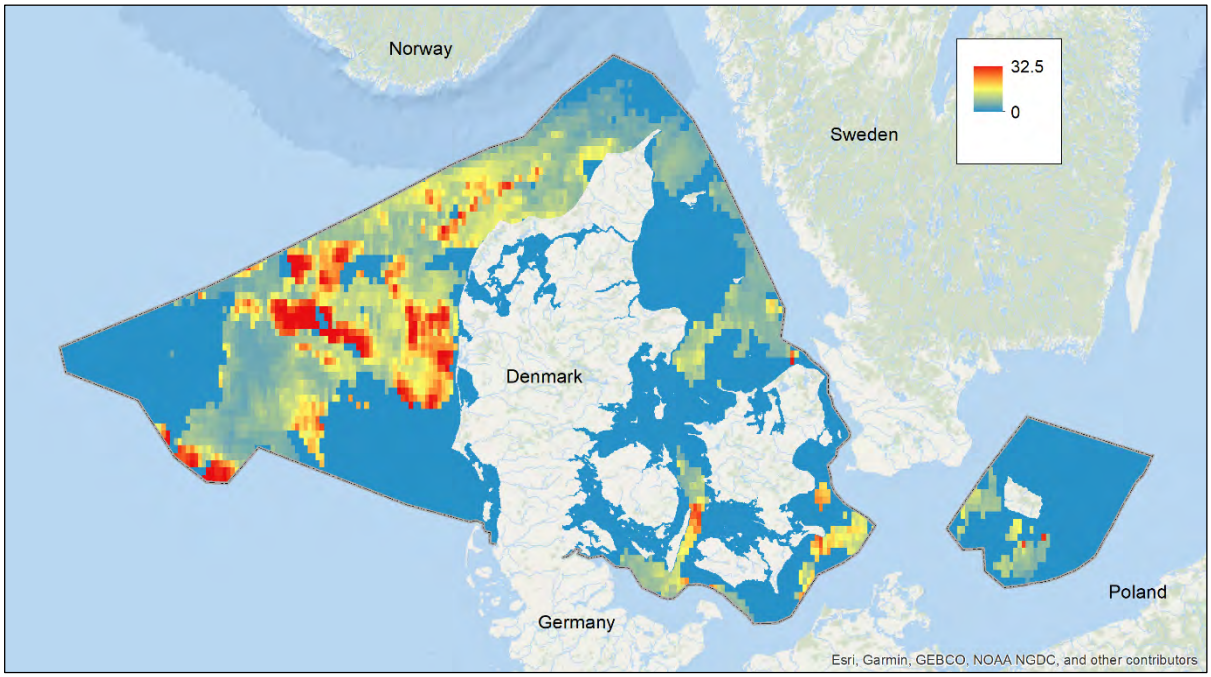
Data coverage



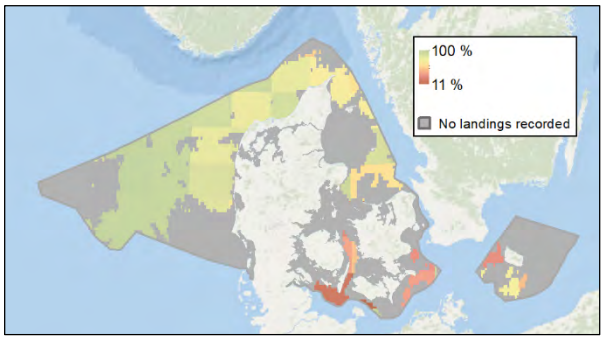
Estimated uncertainty: Percentage landings covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas with no reported landings and has a higher uncertainty.
Data coverage: Data collection within the Danish EEZ.

B4.2.7 Turbot, *Psetta maxima*

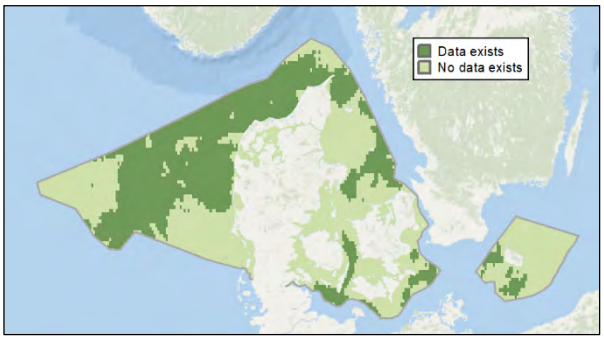
Turbot (*Psetta maxima*) based on VMS data (CPUE kg/Effort_GT)



Estimated uncertainty

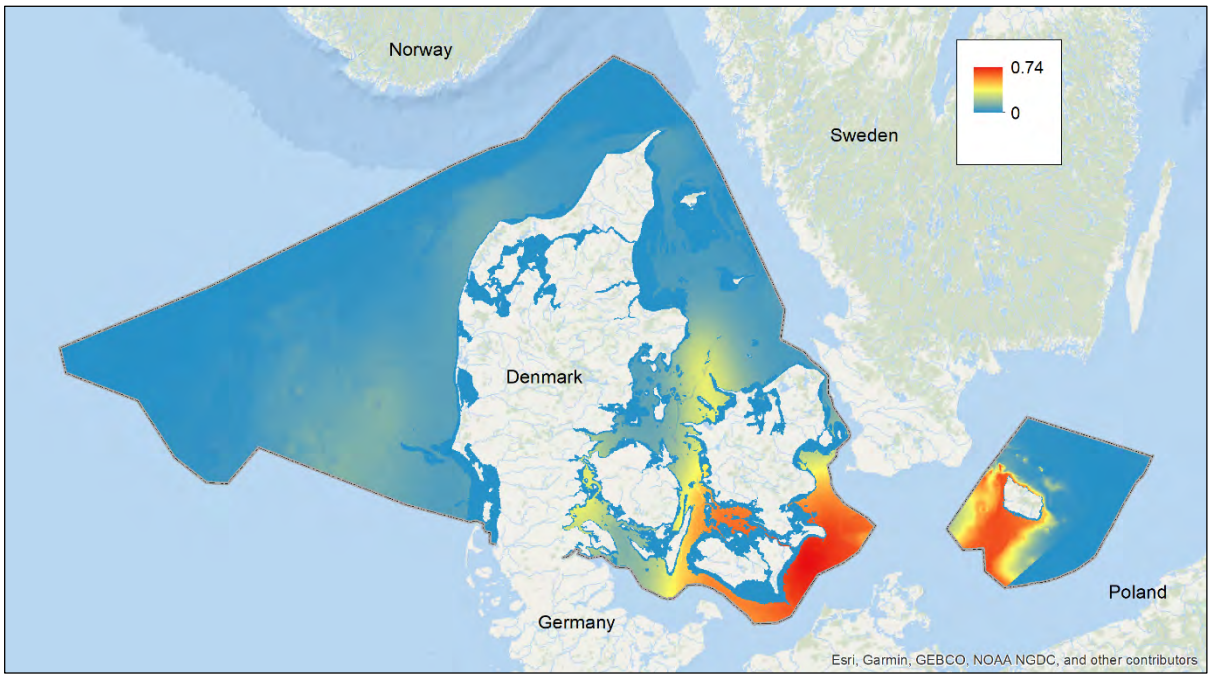


Data coverage

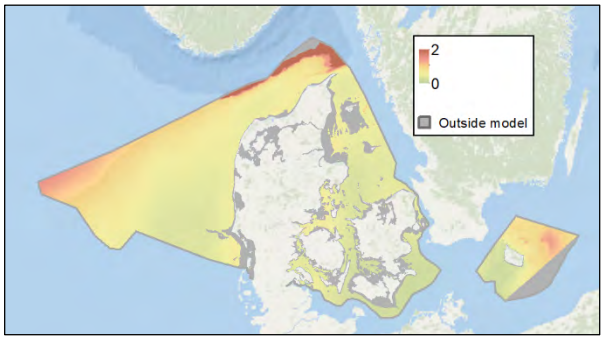


Estimated uncertainty: Percentage landings covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas with no reported landings and has a higher uncertainty.
Data coverage: Data collection within the Danish EEZ.

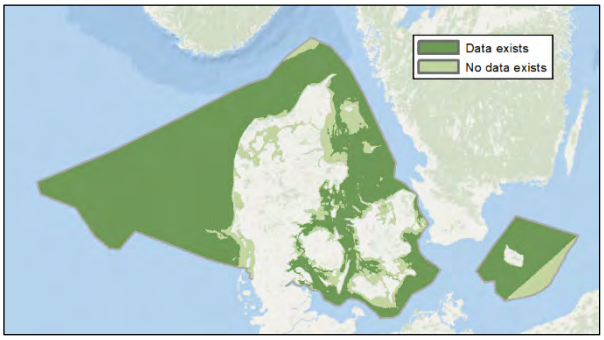
Turbot (*Psetta maxima*) 25+ cm cm based on standardized survey (presence probability/year)



Estimated uncertainty



Data coverage



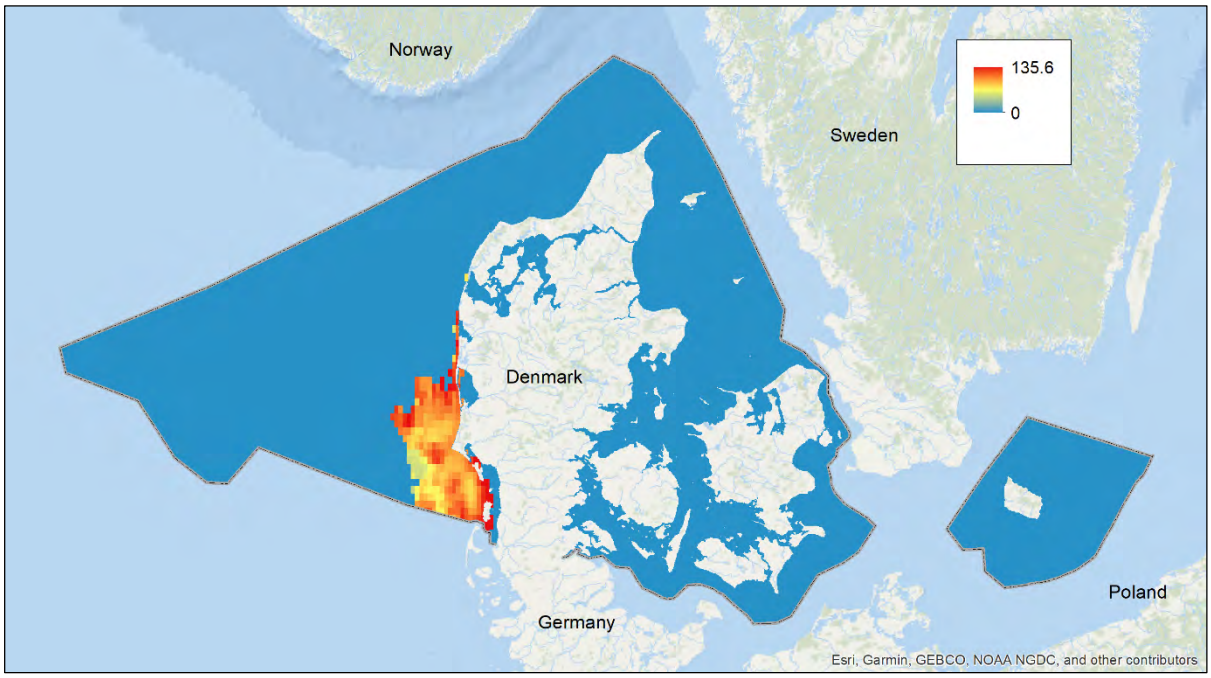
Estimated uncertainty: Coefficient of Variation of estimated value. Grey areas represent areas are not included in the model and has a higher uncertainty.

Data coverage: Data collection and model expansion within the Danish EEZ, Data exists = prediction exists, No data exists = No reliable prediction exists.

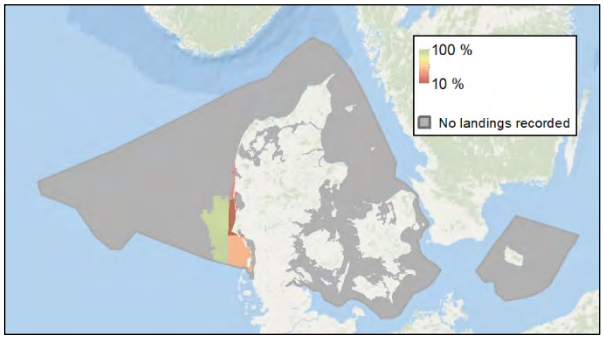
B4.3 Crustaceans living in benthic habitats

B4.3.1 Shrimp, *Crangon crangon*

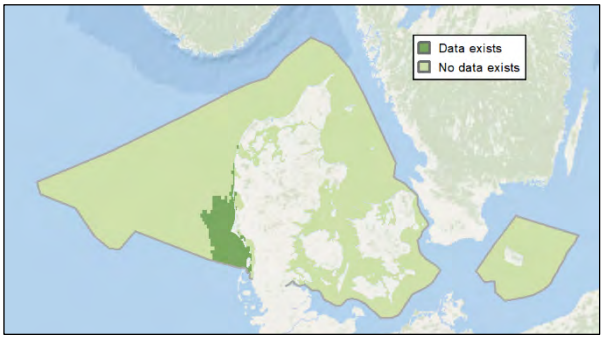
Shrimp (*Crangon crangon)* based on VMS data (CPUE kg/Effort_GT)



Estimated uncertainty



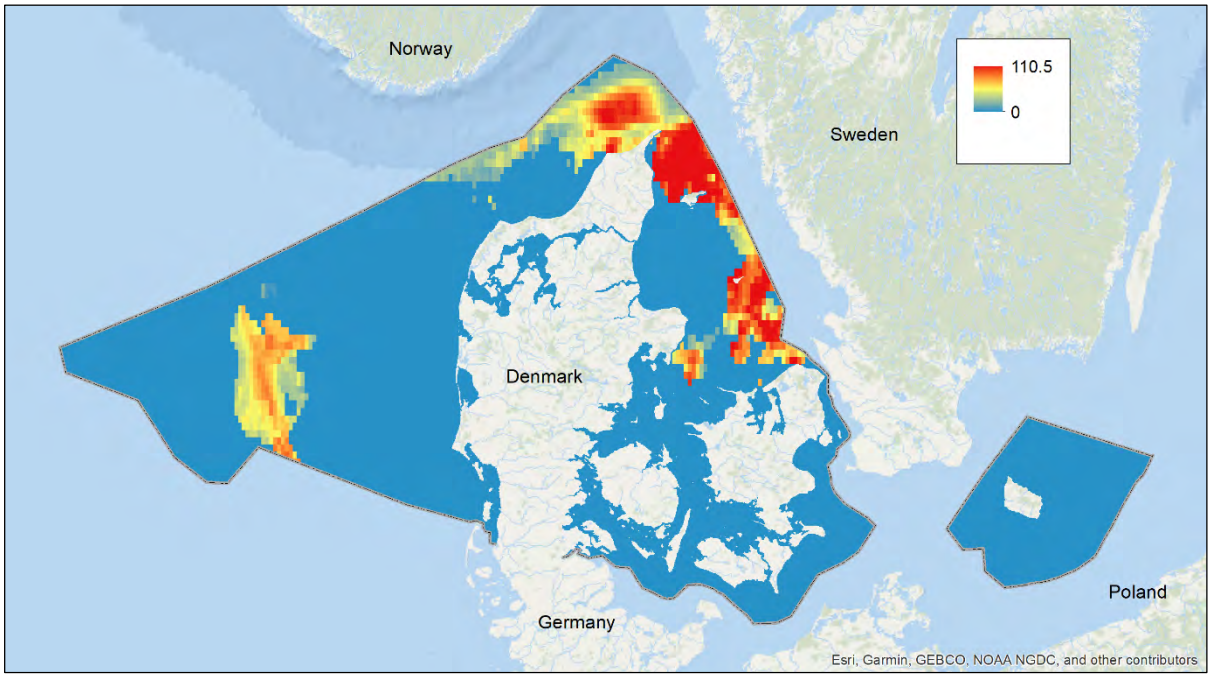
Data coverage



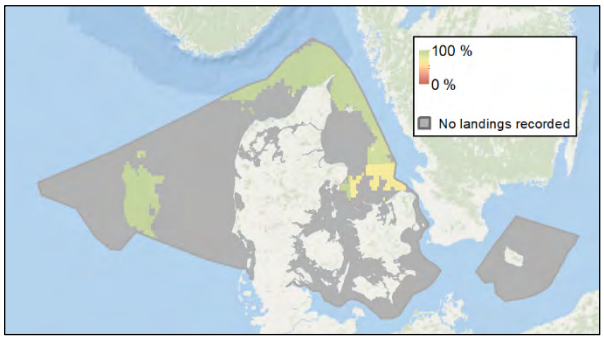
Estimated uncertainty: Percentage landings covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas with no reported landings and has a higher uncertainty.
Data coverage: Data collection within the Danish EEZ.

B4.3.2 Norwegian lobster, *Nephrops norvegicus*

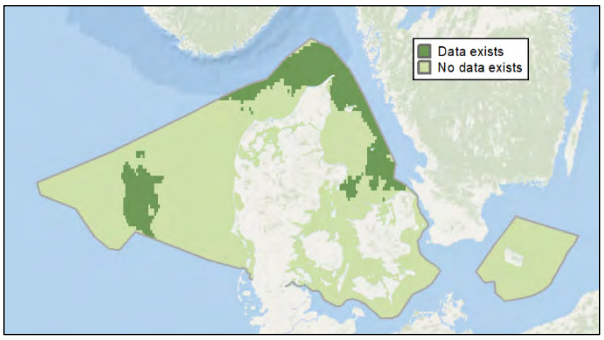
Norway lobster (*Nephrops norvegicus)* based on VMS data (CPUE kg/Effort_GT)



Estimated uncertainty



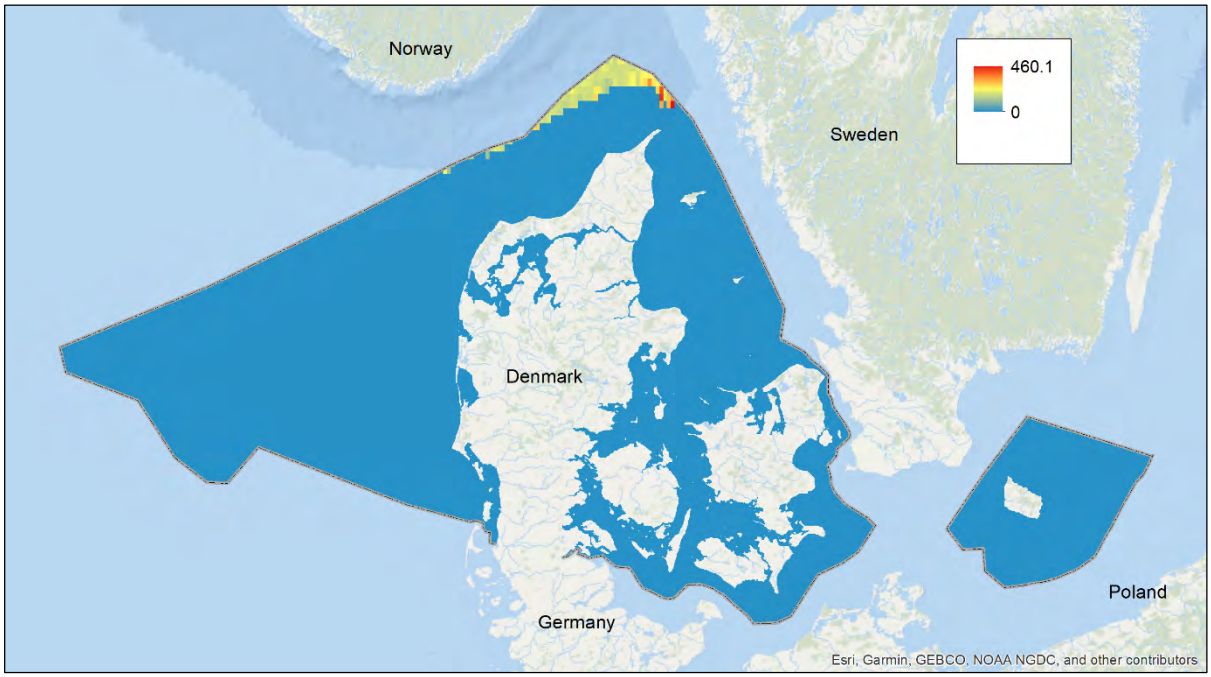
Data coverage



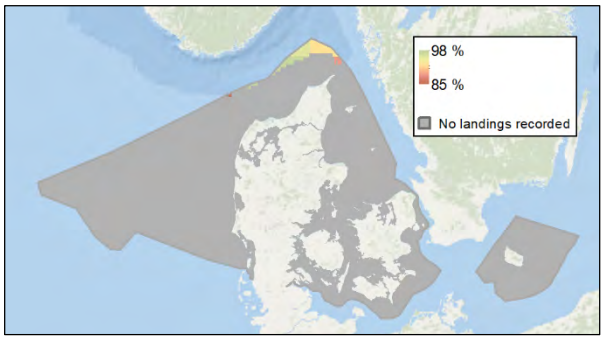
Estimated uncertainty: Percentage landings covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas with no reported landings and has a higher uncertainty.
Data coverage: Data collection within the Danish EEZ.

B4.3.3 Pandalus, *Pandalus borealis*

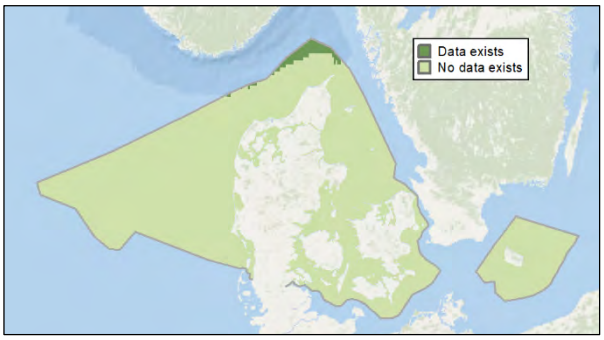
Prawn (*Pandalus* borealis) based on VMS data (CPUE kg/Effort_GT)



Estimated uncertainty



Data coverage



Estimated uncertainty: Percentage landings covered with VMS data, compared with logbook data, by ICES rectangle. Grey areas represent areas with no reported landings and has a higher uncertainty.
Data coverage: Data collection within the Danish EEZ.

B5 Sea birds

B5.1 Auks, *Alcidae* (Razorbill/Guillemot)

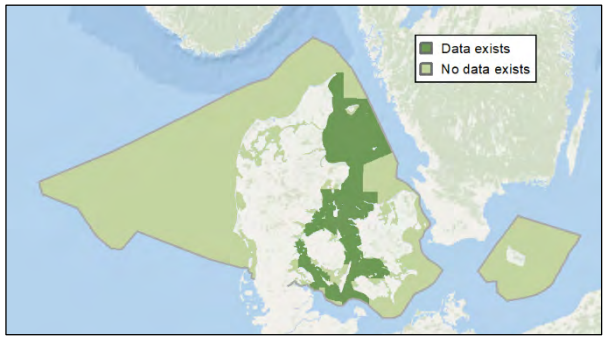
Data name	Alcid abundance
Group/category of activity	The category group used to classify this data type (see list)
Data units, max and min values	Abundances (n individuals) pr. gridcell.
Category	Sea birds
Date created	2019-03-27
Data type	Ecosystem component
Status	Completed
Data format	Dataset
Temporal period	2006 and 2008
Units in raster data	Metric, cell size 500 m x 500 m
Spatial extent and resolution	500*500m
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: This layer represents modelled abundance estimates of Alcids (Razorbill and Guillemot) in the inner Danish waters in July - August 2006 and January - February 2008.	
Lineage: The data was collected as part of the Danish monitoring program, NOVANA. Surveys were conducted from aerial surveys by the line transect sampling method.	
Considerations for use in ECOMAR: Abundance estimates have only been calculated to grid cells within the actual survey area of the monitoring.	
Recommendations for data improvement: Both spatial and temporal extension of data collection would be beneficial for a more precise description of the presence of these species in Danish waters.	
AU	Aarhus University, Department of Bioscience
Data author contact	ikp@bios.au.dk
Data source	Aarhus University, Department of Bioscience
Data source contact	Ib Krag Petersen: ikp@bios.au.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Sea birds
Maintenance	Not planned
Metadata date	2019-03
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

Auks (*Alcide*) summer abundance 2006 (n individuals/grid cell)

Estimated uncertainty

No information

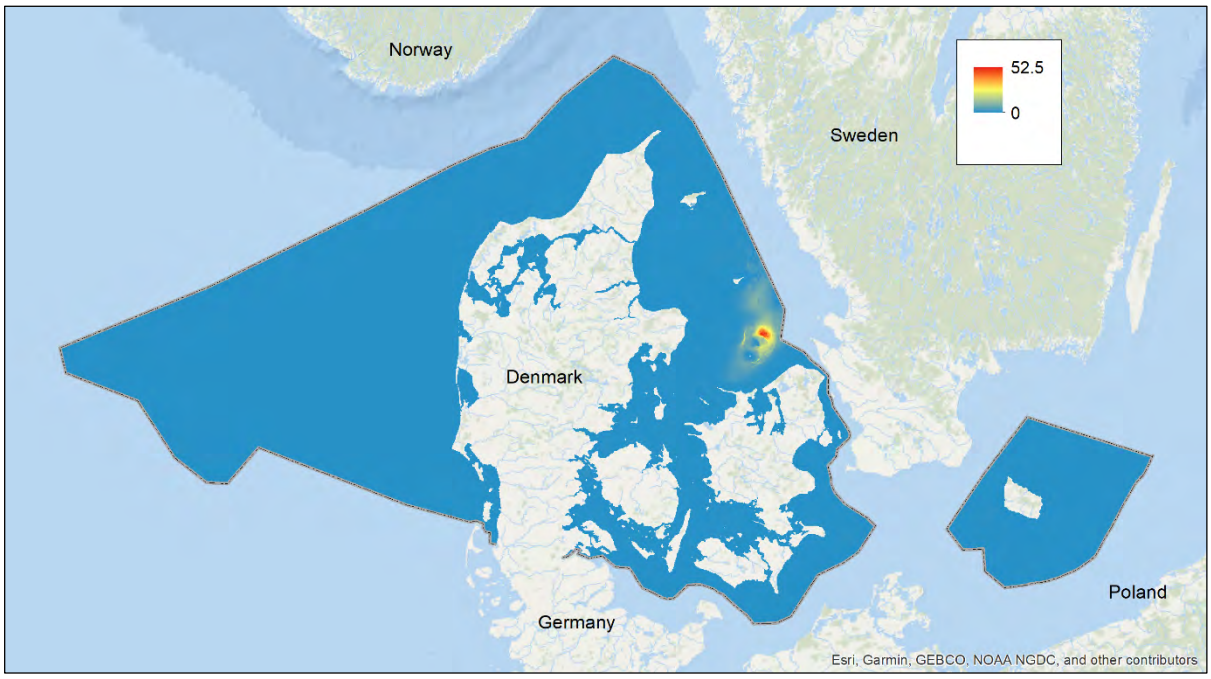
Data coverage



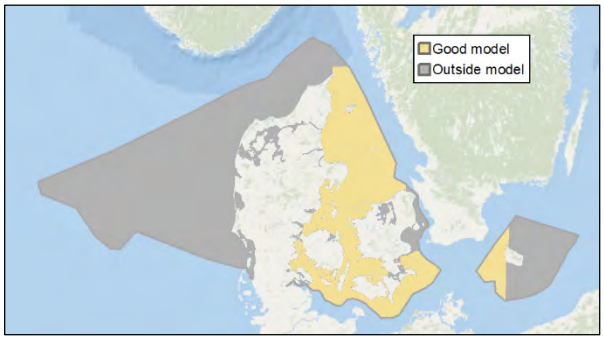
Estimated uncertainty: No information.

Data coverage: Representing areas covered or not covered by the model within the Danish EEZ.

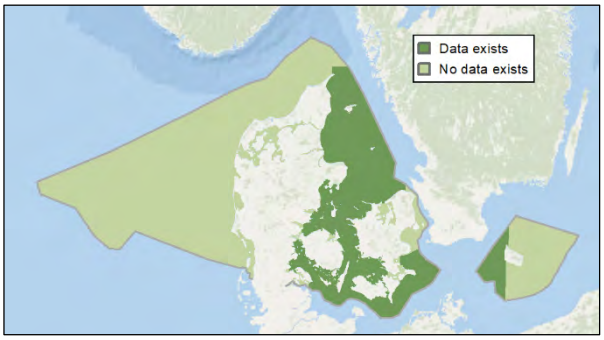
Auks (*Alcide*) winter abundance 2008 (n individuals/grid cell)



Estimated uncertainty



Data coverage



Estimated uncertainty: Represented by the model coefficient of determination in %, r^2 =64% within the area of the model.

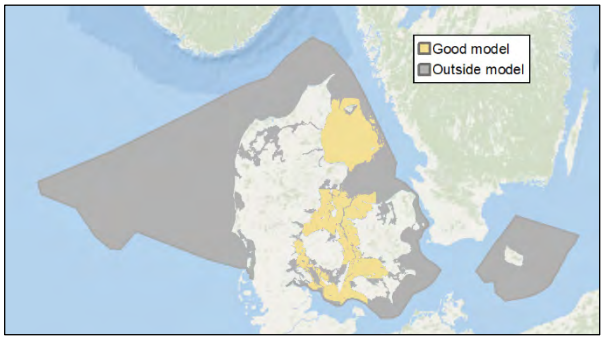
Data coverage: Representing areas covered or not covered by the model within the Danish EEZ.

B5.2 Common scoter, *Melanitta nigra*

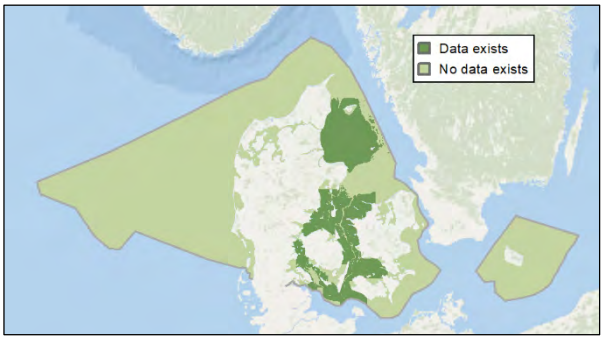
Data name	Common Scoter abundance
Group/category of activity	Sea birds
Data units, max and min values	Abundances (n individuals) pr. gridcell
Category	Ecosystem component
Date created	2019-03-27
Data type	Ecosystem component
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	2006 and 2008
Units in raster data	Metric, cell size 500 x 500 m
Spatial extent and resolution	Top 3907000, Left 3901000, Right 4733500, Bottom 3474000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: This layer represents modelled abundance estimates of Common Scoter in the inner Danish waters in July - August 2006 and January - February 2008.	
Lineage: The data was collected as part of the Danish monitoring program, NOVANA. Surveys were conducted from aerial surveys by the line transect sampling method.	
Considerations for use in ECOMAR: Abundance estimates have only been calculated to grid cells within the actual survey area of the monitoring.	
Recommendations for data improvement: Both spatial and temporal extension of data collection would be beneficial for a more precise description of the presence of these species in Danish waters.	
AU	Aarhus University, Department of Bioscience
Data author contact	ikp@bios.au.dk
Data source	Aarhus University, Department of Bioscience
Data source contact	Ib Krag Petersen: ikp@bios.au.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Sea birds
Maintenance	Not planned
Metadata date	2019-03
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

Scoter (*Melanitta nigra*) summer abundance 2006 (n individuals/grid cell)

Estimated uncertainty



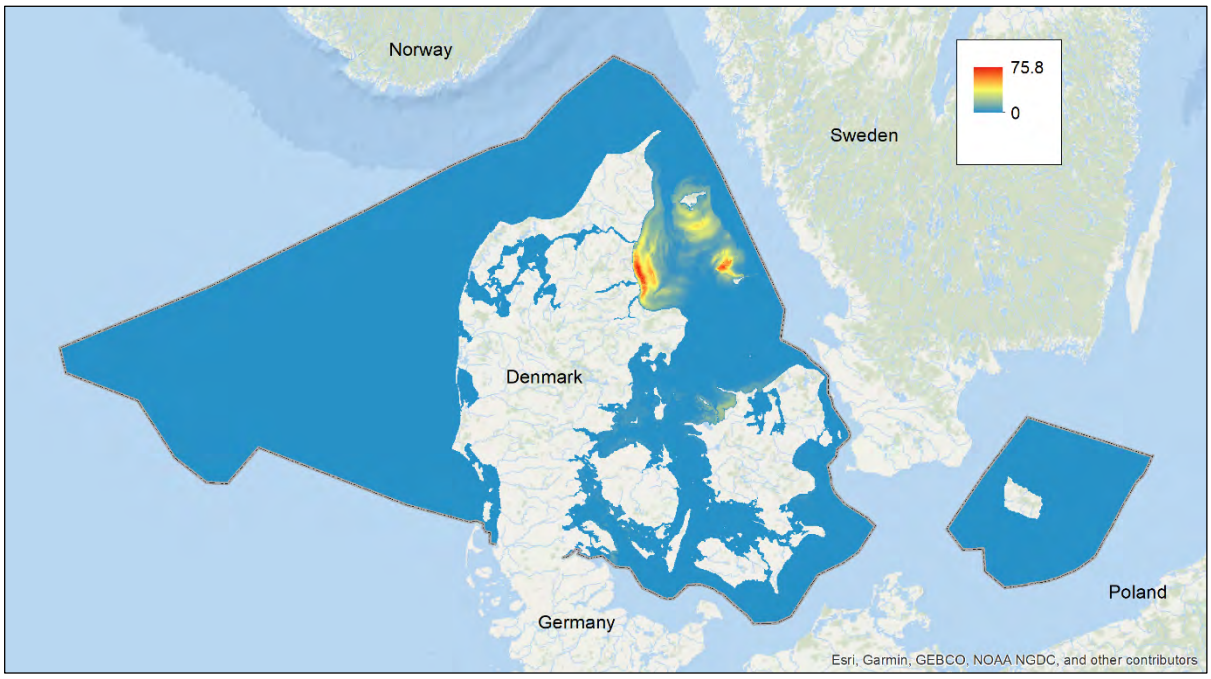
Data coverage



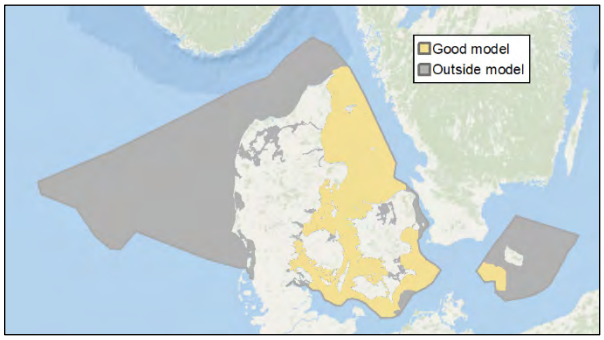
Estimated uncertainty: Represented by the model coefficient of determination in %, r^2 =64% within the area of the model.

Data coverage: Representing areas covered or not covered by the model within the Danish EEZ.

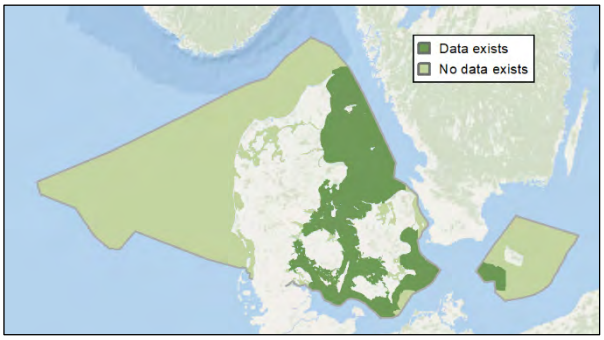
Scoter (*Melanitta nigra*) winter abundance 2008 (n individuals/grid cell)



Estimated uncertainty



Data coverage



Estimated uncertainty: Represented by the model coefficient of determination in %, r^2 =64% within the area of the model.

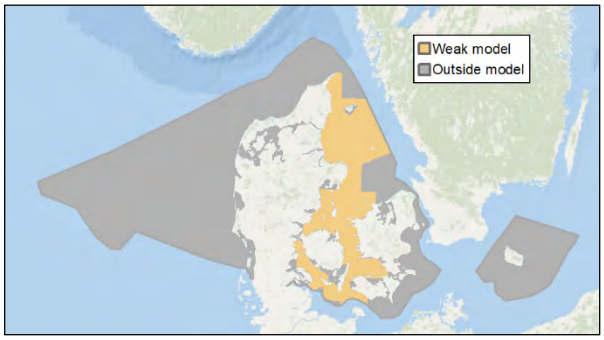
Data coverage: Representing areas covered or not covered by the model within the Danish EEZ.

B5.3 Eider, *Somateria mollissima*

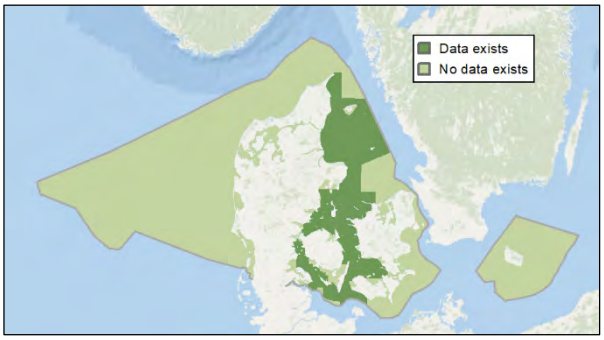
Data name	Common Eider
Group/category of activity	Sea birds
Data units, max and min values	Abundances (n individuals) pr. gridcell
Category	Ecosystem component
Date created	2019-03-27
Data type	Ecosystem component
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	2006 and 2008
Units in raster data	Metric, cell size 500 m x 500 m
Spatial extent and resolution	Top 3907000, Left 3901000, Right 4733500, Bottom 3474000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: This layer represents modelled abundance estimates of Common Eider in the Danish waters in July - August 2006 and January - February 2008	
Lineage: The data was collected as part of the Danish monitoring program, NOVANA. Surveys were conducted from aerial surveys by the line transect sampling method.	
Considerations for use in ECOMAR: Abundance estimates have only been calculated to grid cells within the actual survey area of the monitoring.	
Recommendations for data improvement: Both spatial and temporal extension of data collection would be beneficial for a more precise description of the presence of these species in Danish waters.	
AU	Aarhus University, Department of Bioscience
Data author contact	ikp@bios.au.dk
Data source	Aarhus University, Department of Bioscience
Data source contact	Ib Krag Petersen: ikp@bios.au.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Sea birds
Maintenance	Not planned
Metadata date	2019-03
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

Eider (*Somateria mollissima*) summer abundance 2006 (n individuals/grid cell)

Estimated uncertainty



Data coverage

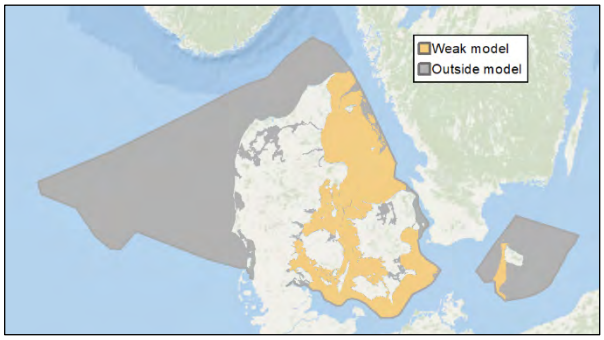


Estimated uncertainty: Represented by the model coefficient of determination in %, r^2 =64% within the area of the model.

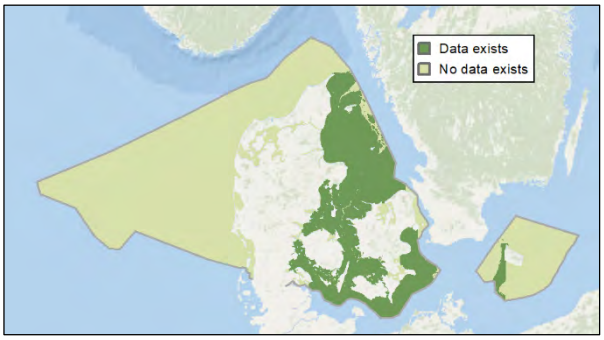
Data coverage: Representing areas covered or not covered by the model within the Danish EEZ.

Eider (*Somateria mollissima*) winter abundance 2008 (n individuals/grid cell)

Estimated uncertainty



Data coverage



Estimated uncertainty: Represented by the model coefficient of determination in %, r^2 =64% within the area of the model.

Data coverage: Representing areas covered or not covered by the model within the Danish EEZ.

B5.4 Fulmar, *Fulmar spp.*

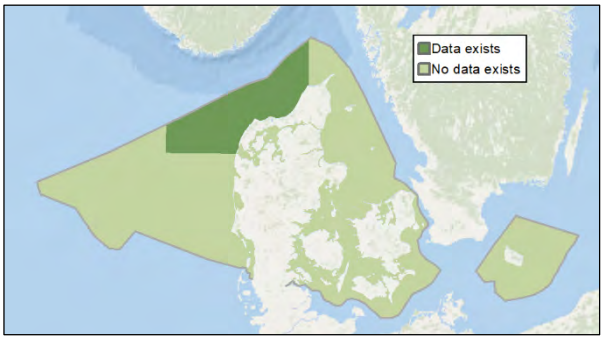
Data name	Fulmar
Group/category of activity	Sea birds
Data units, max and min values	Abundances (n individuals) pr. gridcell
Category	Ecosystem component
Date created	2019-03-27
Data type	Ecosystem component
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	January and February 2008
Units in raster data	Metric, cell size 500 m x 500 m
Spatial extent and resolution	Top 3907000, Left 3901000, Right 4733500, Bottom 3474000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: This layer represents modelled abundance estimates of Fulmar in the inner Danish waters in January and February 2008	
Lineage: The data was collected as part of the Danish monitoring program, NOVANA. Surveys were conducted from aerial surveys by the line transect sampling method.	
Considerations for use in ECOMAR: Abundance estimates have only been calculated to grid cells within the actual survey area of the monitoring.	
Recommendations for data improvement: Both spatial and temporal extension of data collection would be beneficial for a more precise description of the presence of these species in Danish waters.	
AU	Aarhus University, Department of Bioscience
Data author contact	ikp@bios.au.dk
Data source	Aarhus University, Department of Bioscience
Data source contact	Ib Krag Petersen: ikp@bios.au.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Sea birds
Maintenance	Not planned
Metadata date	2019-03
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

Fulmar winter abundance 2008 (n individuals/grid cell)

Estimated uncertainty

No information

Data coverage



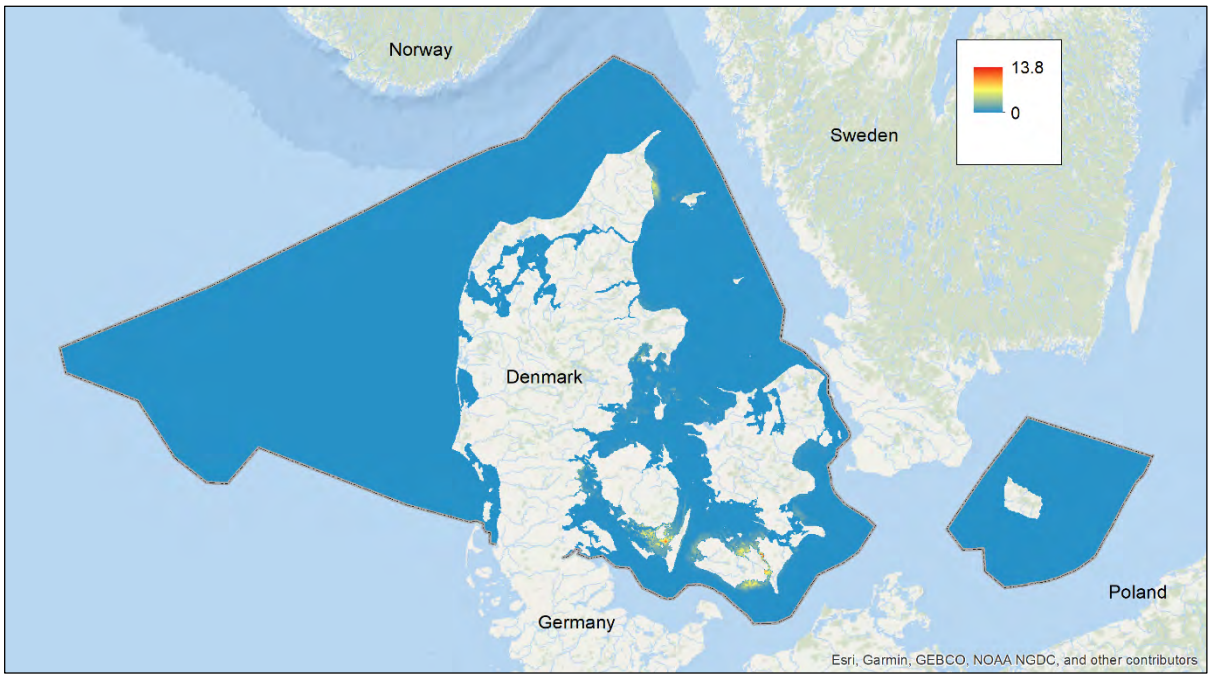
Estimated uncertainty: No information.

Data coverage: Representing areas covered or not covered by the model within the Danish EEZ.

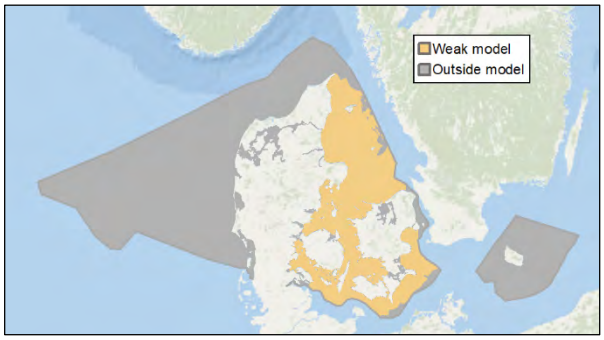
B5.5 Red-breasted Merganser, *Mergus serrator*

Data name	Red-breasted Merganser
Group/category of activity	Sea birds
Data units, max and min values	Abundances (n individuals) pr. gridcell
Category	Ecosystem component
Date created	2019-03-27
Data type	Ecosystem component
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	January and February 2008
Units in raster data	Metric, cell size 500 m x 500 m
Spatial extent and resolution	Top 3907000, Left 3901000, Right 4733500, Bottom 3474000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: This layer represents modelled abundance estimates of Red-breasted Merganser in the inner Danish waters in January and February 2008.	
Lineage: The data was collected as part of the Danish monitoring program, NOVANA. Surveys were conducted from aerial surveys by the line transect sampling method.	
Considerations for use in ECOMAR: Abundance estimates have only been calculated to grid cells within the actual survey area of the monitoring.	
Recommendations for data improvement: Both spatial and temporal extension of data collection would be beneficial for a more precise description of the presence of these species in Danish waters.	
AU	Aarhus University, Department of Bioscience
Data author contact	ikp@bios.au.dk
Data source	Aarhus University, Department of Bioscience
Data source contact	Ib Krag Petersen: ikp@bios.au.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Sea birds
Maintenance	Not planned
Metadata date	2019-03
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

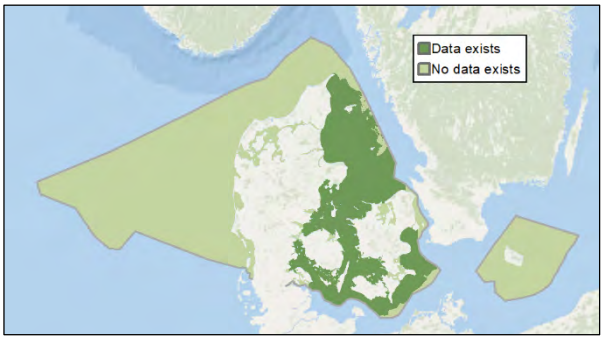
Red-breasted Merganser (*Mergus serrator*) winter abundance 2008 (n individuals/grid cell)



Estimated uncertainty



Data coverage



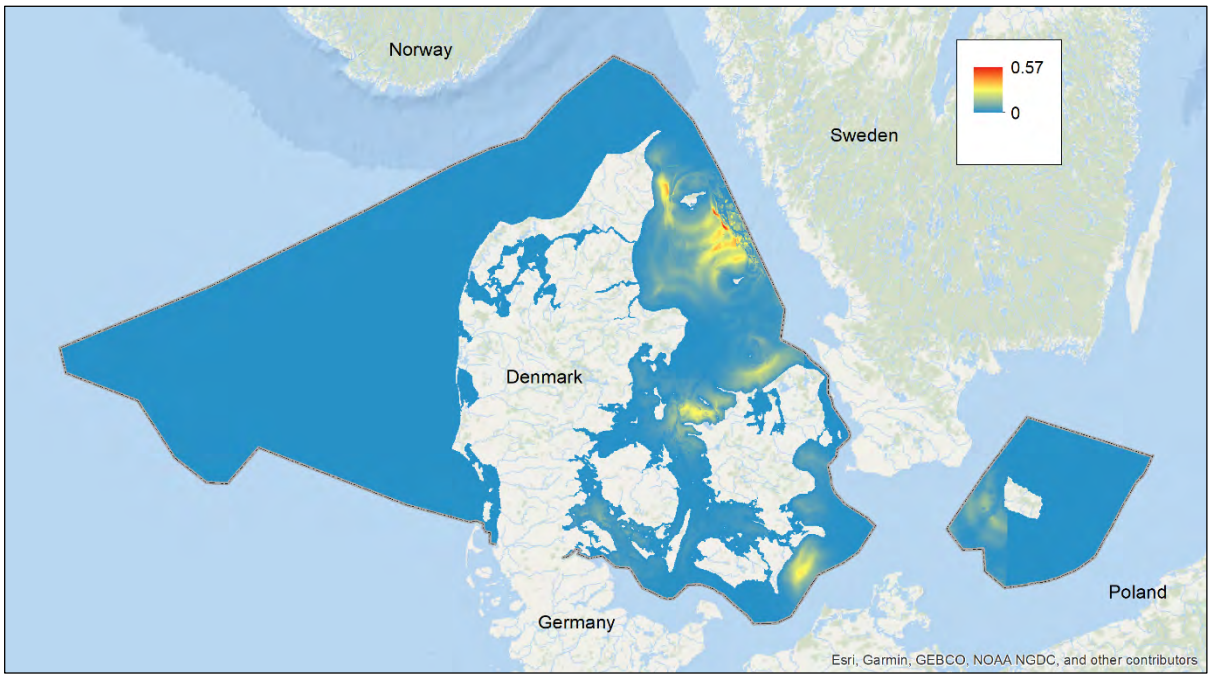
Estimated uncertainty: Represented by the model coefficient of determination in %, r^2 =64% within the area of the model.

Data coverage: Representing areas covered or not covered by the model within the Danish EEZ.

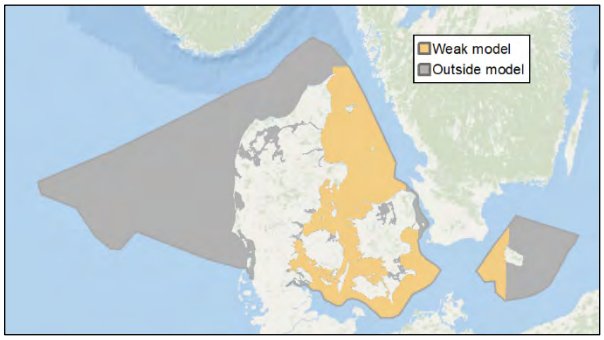
B5.6 Red-throated/Black-throated diver, *Gavia spp.*

Data name	Diver abundance
Group/category of activity	Sea birds
Data units, max and min values	Abundances (n individuals) pr. gridcell
Category	Ecosystem component
Date created	2019-03-27
Data type	Ecosystem component
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	January and February 2008
Units in raster data	Metric, cell size 500 m x 500 m
Spatial extent and resolution	Top 3907000, Left 3901000, Right 4733500, Bottom 3474000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: This layer represents modelled abundance estimates of Divers (Red-throated Diver and Black-throated Diver) in the inner Danish waters in January and February 2008.	
Lineage: The data was collected as part of the Danish monitoring program, NOVANA. Surveys were conducted from aerial surveys by the line transect sampling method.	
Considerations for use in ECOMAR: Abundance estimates have only been calculated to grid cells within the actual survey area of the monitoring.	
Recommendations for data improvement: Both spatial and temporal extension of data collection would be beneficial for a more precise description of the presence of these species in Danish waters.	
AU	Aarhus University, Department of Bioscience
Data author contact	ikp@bios.au.dk
Data source	Aarhus University, Department of Bioscience
Data source contact	Ib Krag Petersen: ikp@bios.au.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Sea birds
Maintenance	Not planned
Metadata date	2019-03
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

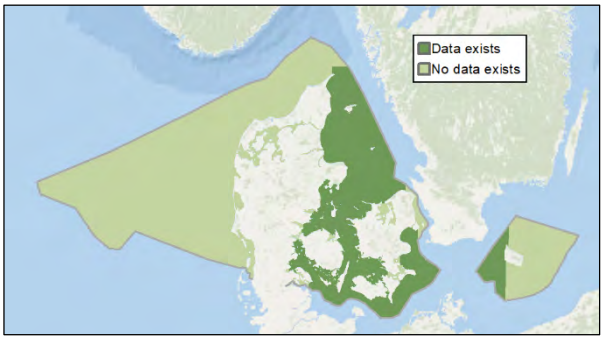
Red- /Black-throated diver (*Gavia spp*.) winter abundance 2008 (n individuals/grid cell)



Estimated uncertainty



Data coverage



Estimated uncertainty: Represented by the model coefficient of determination in %, r^2 =64% within the area of the model.

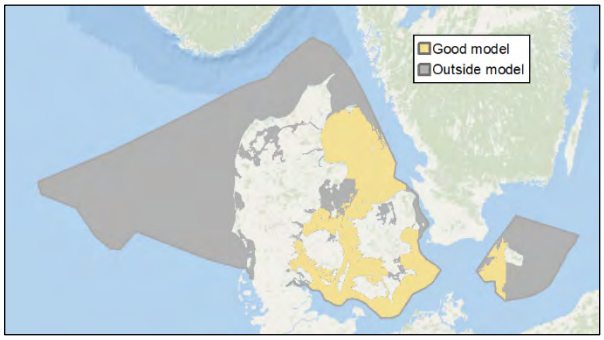
Data coverage: Representing areas covered or not covered by the model within the Danish EEZ.

B5.7 Long-tailed duck, *Clangula hyemalis*

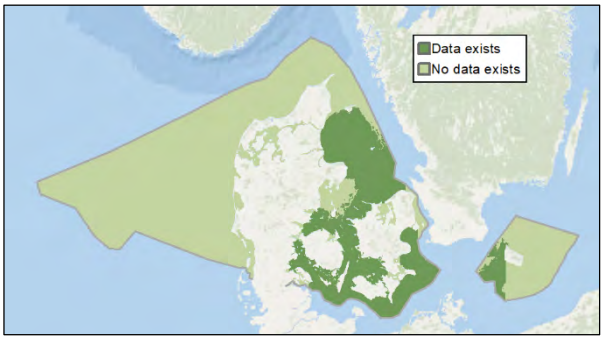
Data name	Long-tailed duck
Group/category of activity	Sea birds
Data units, max and min values	Abundances (n individuals) pr. gridcell
Category	Ecosystem component
Date created	2019-03-27
Data type	Ecosystem component
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	January and February 2008
Units in raster data	Metric, cell size 500 m x 500 m
Spatial extent and resolution	Top 3907000, Left 3901000, Right 4733500, Bottom 3474000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: This layer represents modelled abundance estimates of Long-tailed duck in the inner Danish waters in January and February 2008.	
Lineage: The data was collected as part of the Danish monitoring program, NOVANA. Surveys were conducted from aerial surveys by the line transect sampling method.	
Considerations for use in ECOMAR: Abundance estimates have only been calculated to grid cells within the actual survey area of the monitoring.	
Recommendations for data improvement: Both spatial and temporal extension of data collection would be beneficial for a more precise description of the presence of these species in Danish waters.	
AU	Aarhus University, Department of Bioscience
Data author contact	ikp@bios.au.dk
Data source	Aarhus University, Department of Bioscience
Data source contact	Ib Krag Petersen: ikp@bios.au.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Oceanographic geographical features
GEMET keywords	Sea birds
Maintenance	Not planned
Metadata date	2019-03
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

Long tailed duck (*Clangula hyemalis*) winter abundance 2008 (n individuals/grid cell)

Estimated uncertainty



Data coverage



Estimated uncertainty: Represented by the model coefficient of determination in %, r^2 =64% within the area of the model.

Data coverage: Representing areas covered or not covered by the model within the Danish EEZ.

B6 Marine mammals

B6.1 Grey Seal, *Halichoerus grypus*

Data name	Habitat use by grey seals
Group	Marine mammals
Data units, max and min values	Mean and standard error of probability of habitat use by grey seals, (1 -0)
Category	Ecosystem component
Date created	2019-04-28
Data type	Dataset
Status	Completed
Data format	Floating point
Temporal period	2009-2015
Units in raster data	Mean and standard error of probability of habitat use by grey seals.
Spatial extent and resolution	Inner Danish Waters and waters around Bornholm, original resolution: 1 km x 1 km
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035

Summary:
The two raster layers represent the mean and SE probability of grey seal habitat use throughout the study area. The underlying data to produce the map were locations acquired while the GPS transmitters were attached to 13 individual grey seals in 2009-2015. The GPS locations were mainly collected by seals moving in the southwestern part of the Baltic Sea, thus we assume that grey seals in the southwestern Baltic use habitat similarly throughout the predicted area. Importantly, few grey seals currently live in the Inner Danish Waters so the probability values shown in this area should be interpreted as potential habitat use/suitability, not probability of occurrence.

Lineage:

Seal GPS data:

This study used data collected through Fastloc GPS data loggers (Sea Mammal Research Unit, UK) from projects conducted by Aarhus University. Between 2009 and 2015, 13 grey seals (all juveniles) were captured at Rødsand (Denmark), Måkläppen, Sweden and Svenska Stenarna, Sweden fitted with tracking devices recording and transmitting position, hauling out and dive depth.

Seal count data: Total of 18 haul outs used/surveyed

These data represent average counts of seals on 18 haulouts in Denmark, Germany and Sweden based on 1-3 annual surveys in the period 2015-2017 during the grey seal moulting season in May-June.

Raster data:

1) Sediment layer (resolution original 200 m x 200 m) created by GEUS was used to calculate % cover of 5 sediment types (mud, sand, clay, hard bottom complex and bedrock) at a 1000 m x 1000m resolution across the study area.
2) Bathymetry layer (resolution original 1 km x 1km) from www.GEBCO.net was used to extract water depth (m) across the study area.
3) Distance (Euclidian) to coast (km) layer was calculated at a 1 km x 1 km resolution across the study area.

Distance (shortest route) to haul out site (km) layers were calculated for each known grey seal haul out site (see seal count data) at a 1 km x 1 km resolution across the study area.

Data analysis:

To quantify the probability of habitat use by grey seals, a resource selection function (RSF) was constructed. RSFs are based on used–available data and are typically solved using logistic regression. Here the GPS locations of seals were the used points (scored as 1) and randomly selected available locations (scored as 0) throughout the study area. We used Generalized additive mixed models to solve the RSF-based logistic regression with thin-plate regression splines for all predictor variables and grey seal ID and Year were fitted as random effects. Here used: availability was the response variable and nine environmental conditions were considered as explanatory variables (see raster layers description above). We removed % cover mud from the RSF as it showed no quantifiable effect on grey seal habitat use. Finally, a weighting structure for seal counts was included in the RSF so that haul outs with high seal abundance were given more weight than haul outs with lower seal abundance. Analyses were performed in R (Core Team, 2019). The RSF explained 54 % of the variation in the data.

Mapping:

Once the RSF was solved, the outcome was used to predict and map the probability of grey seal habitat use (both the model average and standard error) across the entire study area at 1000 m x 1000 m resolution. As such, the two maps show for each pixel the average and SE value of probability of grey seal habitat use as a function of the environmental variables included in the model.

Uncertainty and assumptions:

The GPS locations acquired came from seals moving in the southwestern part of the Baltic Sea. The probability of habitat use values in areas where the GPS-tagged seals were not observed (e.g. Kattegat) are therefore predictions with reduced certainty as the validity of the predictions is based on what the grey seals were doing in another region.

Considerations for use in ECOMAR:

This field describes possible considerations of the data specific to use in the ECOMAR application e.g. taking into account the desired resolution of the data (500 m grid)

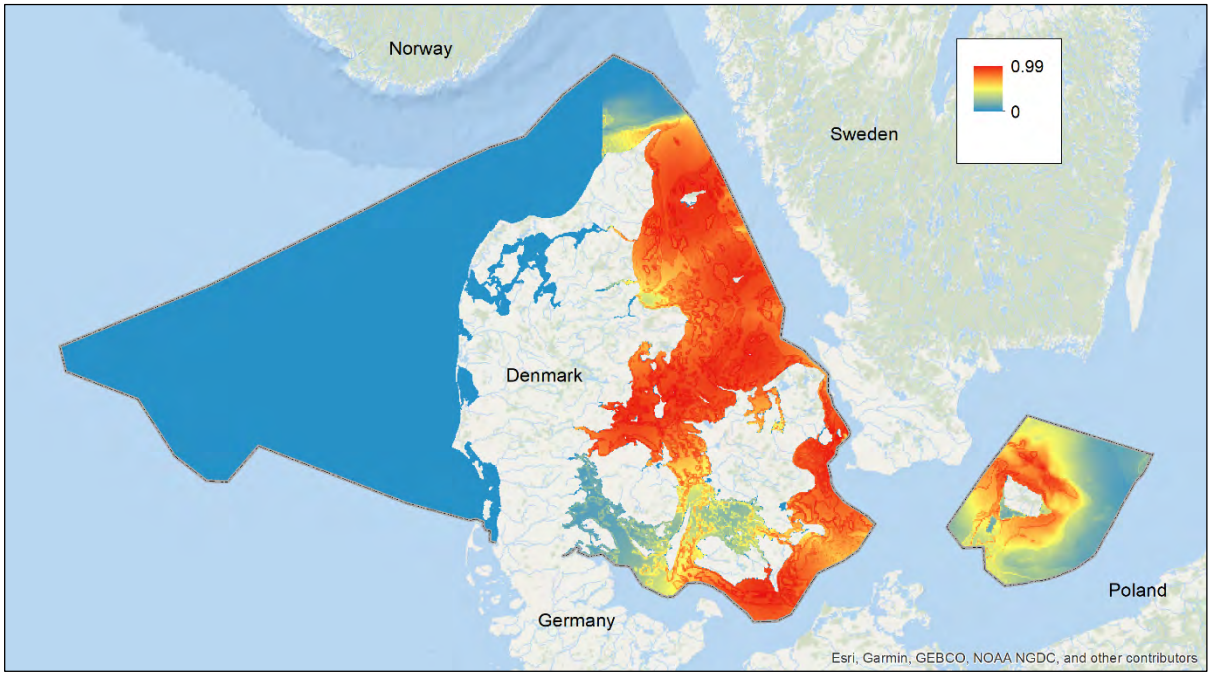
Recommendations for data improvement:

1) GPS tracking of more individual grey seals especially in areas not covered by the current GPS database (to reduce uncertainty in spatial extrapolation of results and increase map certainty).
2) Maps could be produced at finer temporal scales by constructing RSFs for each year and season to assess temporal variation in habitat use.
3) Dynamic environmental variables (sea surface salinity and temperature) can be included into the RSF modelling procedure if such data are available for the spatial and temporal extent of the GPS data and study area.
4) Anthropogenic disturbance (fishing activity, boat traffic) can be included into the modelling procedure if such data are available for the spatial and temporal extent of the GPS data and study area.

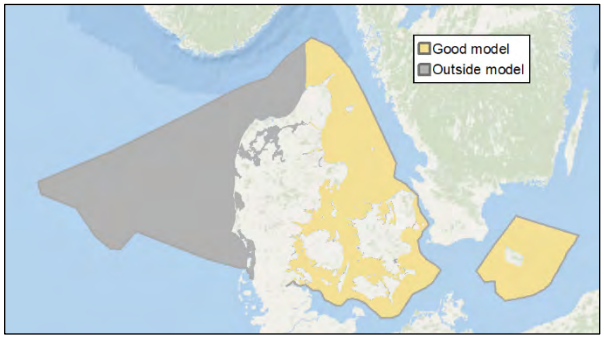
Data authoring organization	Aarhus University, Department of Bioscience
Data author contact	mailto:agj@bios.au.dk
Data source	Anders Galatius, Rune Dietz, Jonas Teilmann, Floris van Beest, Department of Bioscience, Aarhus University
Data source contact	mailto:agj@bios.au.dk
INSPIRE topic category	Biota

INSPIRE theme	Habitats and biotopes, oceanographic geographical features, population distribution – demography
GEMET keywords	Habitats and biotopes, oceanographic geographical features, population distribution – demography
Maintenance	Not planned
Metadata date	2019-04-28
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

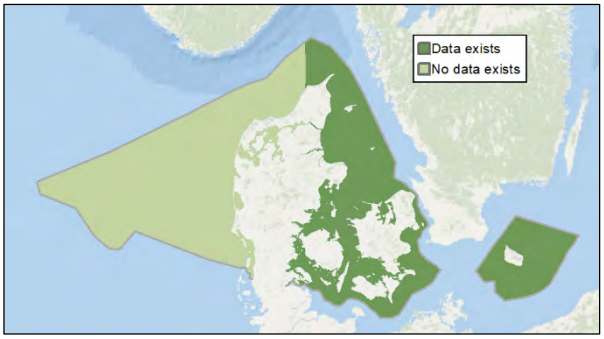
Grey Seal (*Halichoerus grypus*) distribution (habitat probability/grid cell)



Estimated uncertainty



Data coverage



Estimated uncertainty: Categorical; grid cells covered by the model is considered to be a good model (0.5), grid cells outside the model is no data (0).
Data coverage: Representing areas covered or not covered by the model within the Danish EEZ.

B6.2 Harbour Seal, *Phoca vitulina*

Data name	Habitat use by harbour seals
Group/category of activity	Ecosystem component
Data units, max and min values	Mean and standard error of probability of habitat use by harbour seals (1-0)
Category	Ecosystem component
Date created	2019-04-28
Data type	Dataset
Status	Completed
Data format	Floating point
Temporal period	2009-2013
Units in raster data	Mean and standard error of probability of habitat use by harbour seals.
Spatial extent and resolution	Inner Danish Waters and waters around Bornholm, original resolution: 1 km x 1 km
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035

Summary:
The two raster layers represent the mean and SE probability of harbour seal habitat use throughout the study area. The underlying data to produce the map were locations acquired while the GPS transmitters were attached to 14 individual harbour seals in 2009-2013. The GPS locations were mainly collected by seals moving in the southwestern part of the Baltic Sea. The probability of habitat use values in areas where the GPS-tagged seals were not observed are therefore predictions with reduced certainty as the validity of the predictions is based on what the harbour seals were doing in another region.

Lineage:

Seal GPS data:

This study used data collected through Fastloc GPS data loggers (Sea Mammal Research Unit, UK) from projects conducted by Aarhus University. Between 2009 and 2013, 14 harbour seals (all juveniles) were captured at Rødsand (Denmark) and Måkläppen, Sweden (2012) and Svenska Stenarna, Sweden (2012) fitted with tracking devices recording and transmitting position, hauling out and dive depth.

Seal count data: Total of 44 haul outs used/surveyed

These data represent average counts of seals on 45 haulouts in Denmark and Sweden based on 2-3 annual surveys in the period 2015-2017 during the harbour seal moulting season in August.

Raster data:

1) Sediment layer (resolution original 200 m x 200 m) created by GEUS was used to calculate percent cover of five sediment types (mud, sand, clay, hard bottom complex and bedrock) at a 1000 m x 1000 m resolution across the study area.
2) Bathymetry layer (resolution original 1 km x 1 km) from www.GEBCO.net was used to extract water depth (m) across the study area.
3) Distance (Euclidian) to coast (km) layer was calculated at a 1 km x 1 km resolution across the study area.
4) Distance (shortest route) to haul out site (km) layers were calculated for each known harbour seal haul out site (see seal count data) at a 1 km x 1 km resolution across the study area.

Data analysis:

To quantify the probability of habitat use by harbour seals, a resource selection function (RSF) was constructed. RSFs are based on used–available data and are typically solved using logistic regression. Here the GPS locations of seals were the used points (scored as 1) and randomly selected available locations (scored as 0) throughout the study area (ratio of used: available = 1:2). We used generalized additive mixed models to solve the RSF-based logistic regression with thin-plate regression splines for all predictor variables and harbour seal ID and Year were fitted as random effects. Here used: availability was the response variable and nine environmental conditions were considered as explanatory variables (see raster layers description above). We removed percent cover mud from the RSF as it showed no quantifiable effect on harbour seal habitat use. Finally, a weighting structure for seal counts was included in the RSF so that haul outs with high seal abundance were given more weight than haul outs with lower seal abundance. Analyses were performed in R (Core Team, 2019). The RSF explained 70 % of the variation in the data.

Mapping:

Once the RSF was solved, the outcome was used to predict and map the probability of harbour seal habitat use (both the model average and standard error) across the entire study area at 1000 m x 1000 m resolution. As such, the two maps show for each pixel the average and SE value of probability of harbour seal habitat use as a function of the environmental variables included in the model.

Uncertainty and assumptions:

The GPS locations acquired came from seals moving in the southwestern part of the Baltic Sea. The probability of habitat use values in areas where the GPS-tagged seals were not observed (e.g. Kattegat) are therefore predictions with reduced certainty as the validity of the predictions is based on what the harbour seals were doing in another region.

Considerations for use in ECOMAR:

This field describes possible considerations of the data specific to use in the ECOMAR application e.g. taking into account the desired resolution of the data (500 m grid)

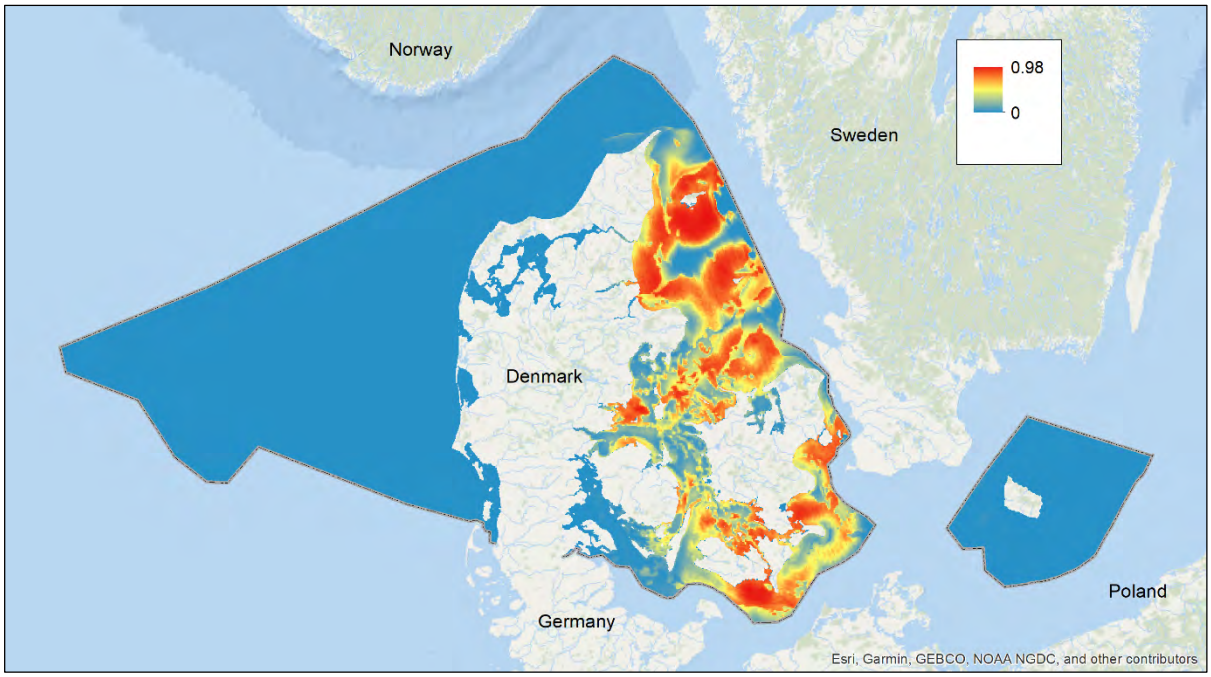
Recommendations for data improvement:

1) GPS tracking of more individual harbour seals especially in areas not covered by the current GPS database (to reduce uncertainty in spatial extrapolation of results and increase map certainty).
2) Maps could be produced at finer temporal scales by constructing RSFs for each year and season to assess temporal variation in habitat use.
3) Dynamic environmental variables (e.g. sea surface salinity and temperature) can be included into the RSF modelling procedure if such data are available for the spatial and temporal extent of the GPS data and study area.
4) Anthropogenic disturbance (e.g. fishing activity, boat traffic) can be included into the RSF modelling procedure if such data are available for the spatial and temporal extent of the GPS data and study area.

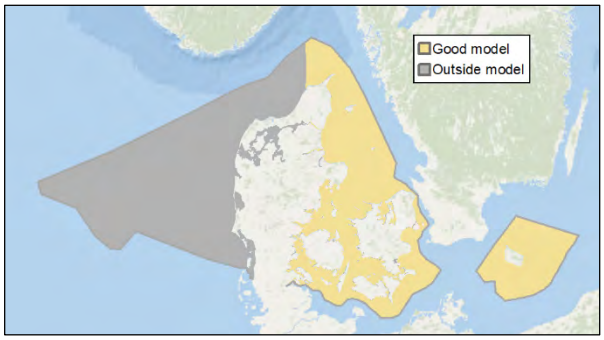
Data authoring organization	Aarhus University, Department of Bioscience
Data author contact	agj@bios.au.dk
Data source/delivery of Background data	Anders Galatius, Rune Dietz, Jonas Teilmann, Floris van Beest, Department of Bioscience, Aarhus University
Data source contact	agj@bios.au.dk
INSPIRE topic category	Biota
INSPIRE theme	Habitats and biotopes, oceanographic geographical features, population distribution – demography

GEMET keywords	Habitats and biotopes, oceanographic geographical features, population distribution – demography
Maintenance	Not planned
Metadata date	2019-04-28
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

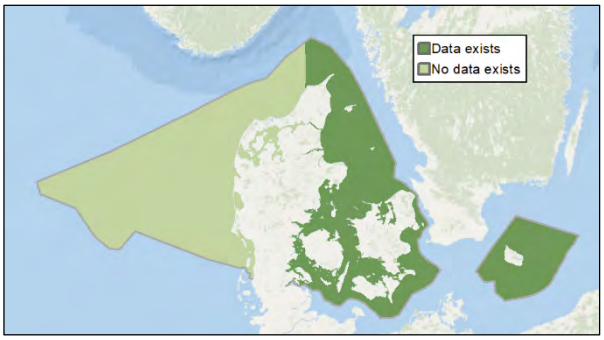
Harbour Seal (*Phoca vitulina*) distribution (habitat probability/grid cell)



Estimated uncertainty



Data coverage



Estimated uncertainty: Categorical; grid cells covered by the model is considered to be a good model (0.5), grid cells outside the model is no data (0).
Data coverage: Representing areas covered or not covered by the model within the Danish EEZ.

B6.3 Harbour Porpoise, *Phocoena phocoena*

Data name	Habitat model of Harbour porpoises
Group	Marine mammals
Data units, max and min values	Harbour porpoises per km^2 (0 – 3)
Category	Ecosystem component
Date created	2019-04-28
Data type	Dataset
Status	Completed
Data format	Floating point
Temporal period	1994 – 2016
Units	Porpoise density
Spatial extent and resolution	North Sea and Western Baltic, original resolution: 5 km × 5 km
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035

Summary:
The data is divided in to two seasonal habitat- based density models: 1) one for the North Sea and Skagerrak published by Gilles et al. (2016) and 2) a new model using the same method for the Western Baltic not covering the Danish waters around Bornholm. The models are based on an unprecedented set of aggregated aerial survey data of harbour porpoise (*Phocoena phocoena*) sightings collected in the UK (SCANS II and III, Dogger Bank), Belgium, the Netherlands, Germany, Sweden and Denmark. Here the summer model which includes most data from Danish waters are presented. Visual survey data were collected 2005–2016 by means of dedicated line- transect surveys, taking into account the proportion of missed sightings. Generalized additive models of porpoise density were fitted to the on- effort survey data of porpoises. Selected predictors included static and dynamic variables, such as depth, distance to shore and to sandeel (*Ammodytes* spp.) grounds, sea surface temperature (SST), proxies for fronts, and day length. Day length and the spatial distribution of daily SST proved to be good proxies for "season," allowing predictions in both space and time. By combining the large-scale international SCANS II and III survey with the more frequent, small- scale national surveys, it has been possible to provide seasonal maps representing harbour porpoise distribution.
The two maps overlap in Skagerrak. Here an average of the two maps for each grid point were calculated.
Gilles, A., S. Viquerat, E. A. Becker, K. A. Forney, S. C. V. Geelhoed, J. Haelters, J. Nabe-Nielsen, M. Scheidat, U. Siebert, S. Sveegaard, F. M. van Beest, R. van Bemmelen & G. Aarts (2016): Seasonal habitat- based density models for a marine top predator, the harbour porpoise, in a dynamic environment. Ecosphere 7(6):e01367. 10.1002/ecs2.1367

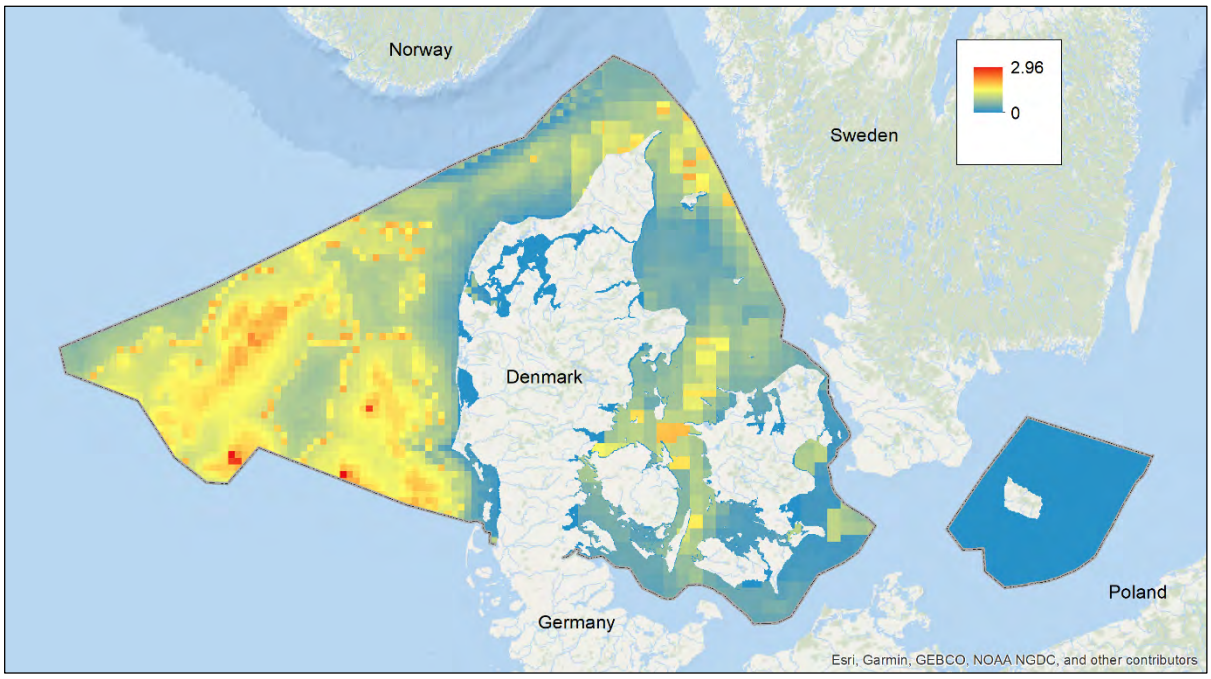
Lineage:
For original model see: Gilles, A., S. Viquerat, E. A. Becker, K. A. Forney, S. C. V. Geelhoed, J. Haelters, J. Nabe-Nielsen, M. Scheidat, U. Siebert, S. Sveegaard, F. M. van Beest, R. van Bemmelen, & G. Aarts (2016): Seasonal habitat- based density models for a marine top predator, the harbor porpoise, in a dynamic environment. Ecosphere 7(6):e01367. 10.1002/ecs2.1367

Considerations for use in ECOMAR:

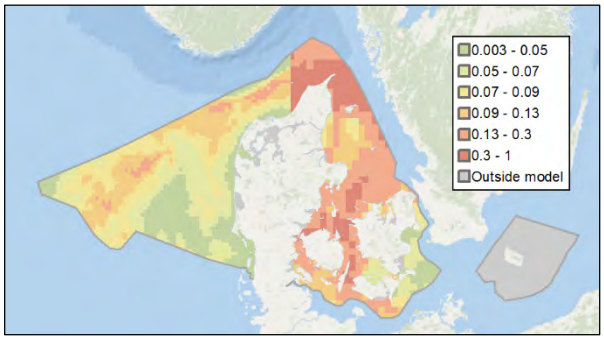
- There are some edge effects especially in the model for the Western Baltic that seems to lower the density at the edges. E.g. the northern Sound normally holds high densities of porpoises, which is not included here.

• Also, although the two models both give data in the same unit (individuals per km^2) the densities in the North Sea seem to be too high relative to the Western Baltic.	
Recommendations for data improvement: Should be updated once new survey data becomes available.	
Data authoring organization	Aarhus University
Data author contact	Signe Sveegaard, ssv@bios.au.dk
Data source	Aarhus University
Data source contact	Signe Sveegaard, ssv@bios.au.dk
INSPIRE topic category	Biota
INSPIRE theme	Habitats and biotopes, oceanographic geographical features, population distribution – demography
GEMET keywords	Habitats and biotopes, oceanographic geographical features, population distribution – demography
Maintenance	Irregular
Metadata date	2019-04-28
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

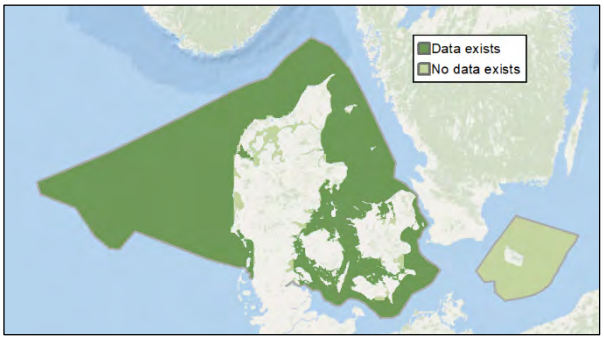
Harbour Porpoise (*Phocoena phocoena*) (density per km^2)



Estimated uncertainty



Data coverage



Estimated uncertainty: Standard deviation of the model (density per km^2).

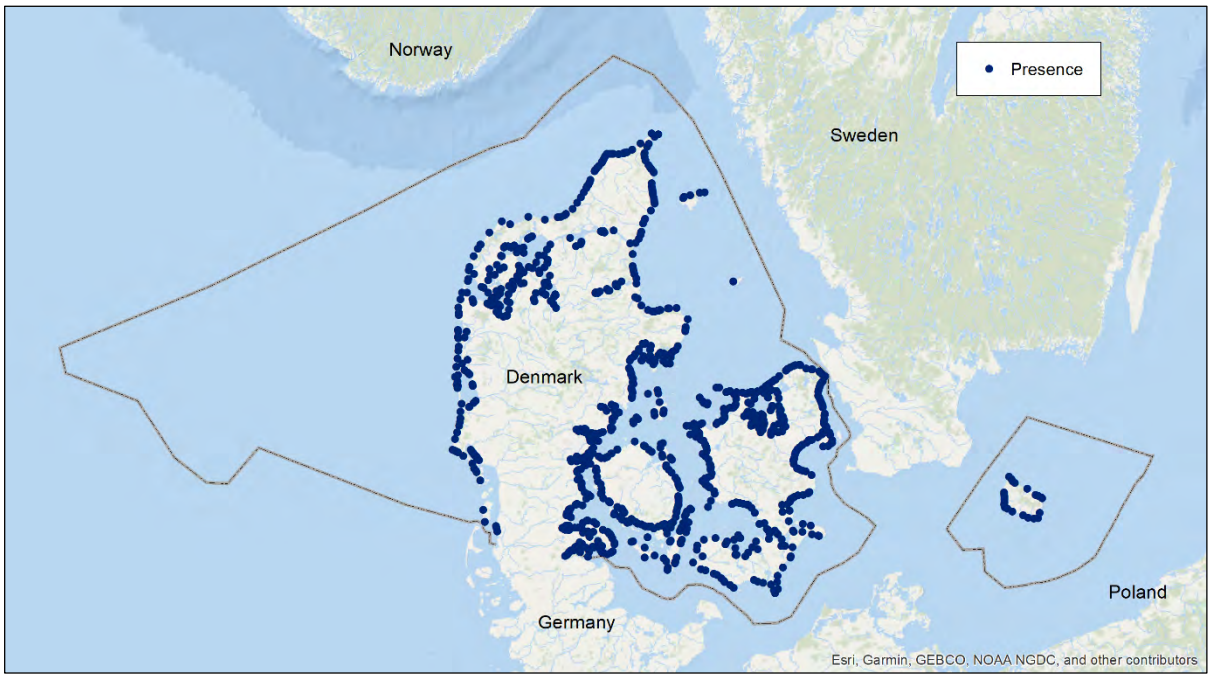
Data coverage: Representing areas covered or not covered by the model within the Danish EEZ.

B7 Recreational and archaeological interests

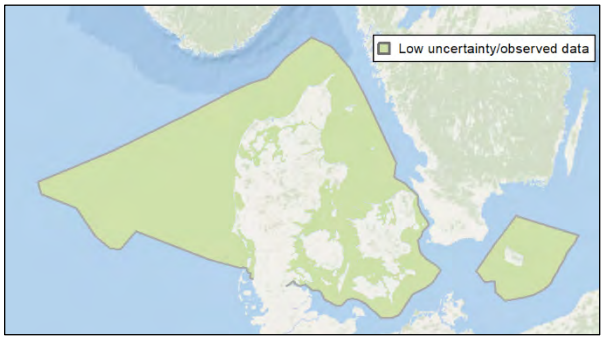
B7.1 Bathing sites

Data name	Bathing sites
Group/category of activity	Recreational interest
Data units, max and min values	Locations/presence -absence
Category	Ecosystem component
Date created	2015-07-01, revised 2018-10-22
Data type	Dataset
Status	Completed
Data format	32-bit floating point Tagged Images File Format
Temporal period	Current state until 2017
Units in raster data	Presence/absence
Spatial extent and resolution	1:100 000
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.rio/3035
Summary: The data layer shows the presence of bathing sites in the Danish EEZ.	
Lineage: The data was created by downloading the shapefile for European of bathing sites from EMODnet. The data set presents the latest information of official blue water flag bathing sites as reported by the coastal Member States and Montenegro for the 2017 bathing season, as well as some historical data since 1990. A total of 1097 official bathing site where included. The data was rasterized to the ECOMAR grid.	
Considerations for use in ECOMAR: The bathing sites included in ECOMAR are the official monitored bathing sites in Denmark, but many other unofficial sites are used for bathing and thus not included here. However, these other sites are covered to some extent by the data layer B7.2 Areas important for recreation and tourism.	
Recommendations for data improvement: None	
Data authoring organization	Cogea srl
Data author contact	lfalco@cogea.it / apititto@cogea.it
Data source	EMODnet human activities http://www.emodnet-humanactivities.eu and Cogea Srl
Data source contact	lfalco@cogea.it / apititto@cogea.it
INSPIRE topic category	Oceans, environment
INSPIRE theme	Environmental monitoring facilities
GEMET keywords	Bathing water, bathing seawater, recreational area, recreation
Maintenance	Unknown
Metadata date	2019-06-12
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

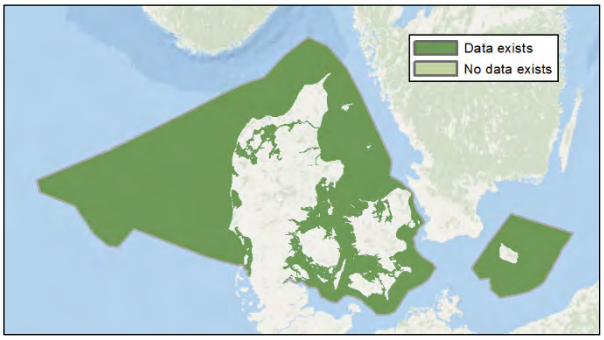
Presence of bathing sites



Estimated uncertainty



Data coverage



Estimated uncertainty: Categorical with observed data within EEZ.
Data coverage: Data collection within the Danish EEZ.

B7.2 Areas important for recreation and tourism

Data name	Recreational Use Intensity
Group	Recreational interest
Data units, max and min values	Categorical data. Three levels (1=low use, 2=middle use, 3=high use)
Category	Ecosystem component
Date created	2019-04-12
Data type	Dataset
Status	Completed
Data format	CSV. Table.
Temporal period	2015-2016.
Spatial extent and resolution	Top: 3906250 m Left: 3901250 m Right: 4733250 m Bottom: 3474750 m
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.rio/3035

Summary:

The data shows a general surface map over recreational use intensity in Danish waters according to three relative intensity levels. The map is a model output (kernel density surface) based on data from two national PPGIS surveys (one representative survey with the public and one crowdsourced survey with dedicated marine recreation users), and AIS tracking of pleasure crafts. Mapped places of visits (points) and routes (polylines) are included. Visit frequency (number of visits per year) is the unit of analysis.

More than 16000 mapped places and routes by 6500 people are included in the model. The respondents are representative according to the population in the five region of Denmark, and gender and age distribution. The AIS tracking of pleasure crafts is not representative for recreational sailing in Denmark, since only very large sailing boats have AIS transponders, however, the aggregated yearly patterns correlates with the main used recreational sailing waters in Denmark according to sailing organisations and statistics from overnight numbers in Danish recreational harbours.

Lineage:

Aggregated Kernel Density Model outputs of five different datasets reclassified into tree relative levels of yearly use frequency (low, middle, high). The five kernel density analyses criteria were all based on: cell size=500 m, search distance=2000 m, value= number of visit days per year (1-365) and a comparative number of registrations per cell for AIS data (1-835). The data input derives from two different national surveys (data A and B) and AIS tracking of pleasure crafts (data C).

Data A: A national representative panel survey with the Danish population (n=4054) resulting in point mapping of visited places (data A1, 6894 places, mainly coastal visits) and a polyline mapping of routes (data A2, 1428 routes, mainly coastal visits). Each respondent estimated the number of visits per year to the mapped places and routes (yearly visit frequency). See www.havfriluftsliv.dk and Kaae et al. (2018) for further information.

Data B: A national crowdsourced survey with marine recreation users (n=2437) resulting in point mapping of visited places (data B1, 7314 places, mainly kayak, diving, surfing, swimming, fishing places), and a polyline mapping (data B2, 577 routes, mainly kayak and sailing routes). Each respondent estimated the number of visits per year to the mapped places and routes (the yearly

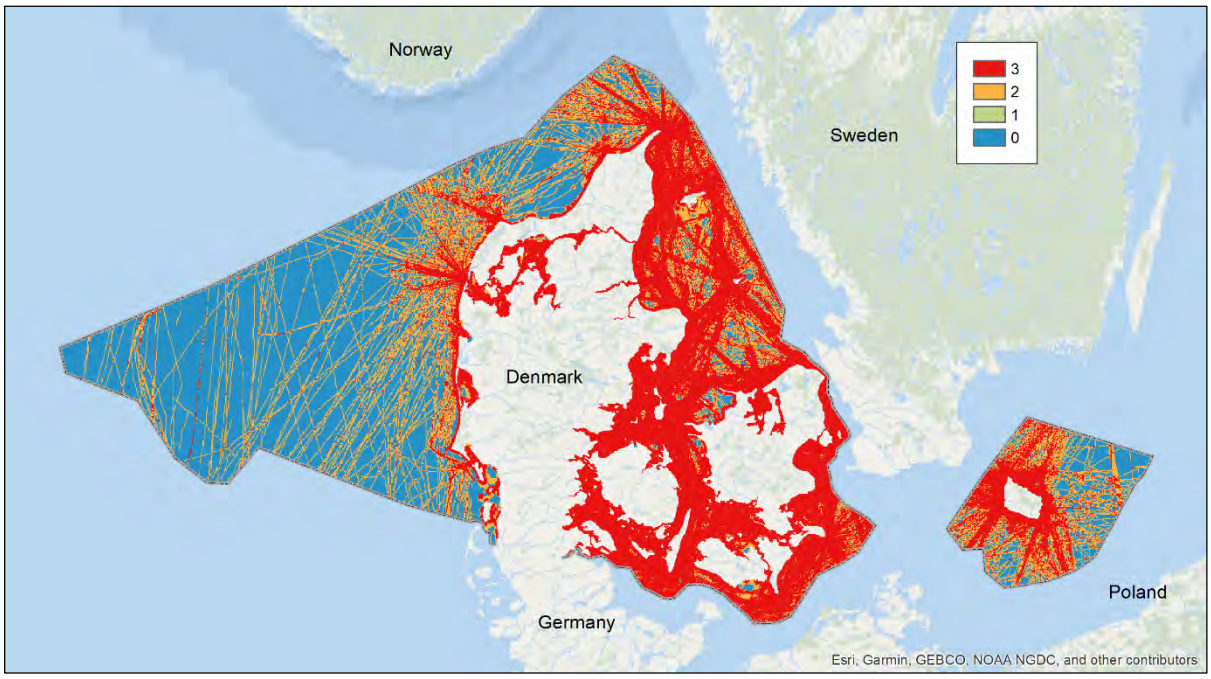
visit frequency). See www.havfriluftsliv.dk and the study by Kaae et al. (2018) for further information.
Data C: Aggregation of tracking data of pleasure boating from the AIS system (for the year 2016) to 500m resolution.
Procedure: Generation of individual kernel density surfaces for each of the five datasets based on the same cell size, search criteria and value (visit frequency). Each kernel density surface was reclassified into three levels (1,2,3) according to quantile distribution (excluding '0' values, 0 = No Data). The five resulting kernel density surfaces were then aggregated into a single map feature, which then was reclassified again into three relative levels (1,2,3) according to quantile distribution. Hence, the final map output highlights areas (level 3, high) supported by inter-subjectivity between the three data sources, i.e. areas that were mapped by multiple users in the surveys and/or cells with multiple AIS registrations.
Estimated uncertainty is categorical, based on the intensity classes, where the most intense class (#3) is assumed to have a lower uncertainty and given the value 0, class 2 is given the value of 0.25, class 1 a value of 0.5 and the class with no recorded data, class 0 is assumed to have a rather high uncertainty and is thus given a value of 1.
Kaae, B. C., A.S. Olafsson & H. Draux (2018): Blåt friluftsliv i Danmark, IGN Report. February 2018, Institute for Geovidenskab og Naturforvaltning, Københavns Universitet, 169 pp.

Limitations for use in ECOMAR:
A possible limitation of the data is the aggregated nature of the data. Since all type of recreational activities are included, the dataset is not suited to detailed analyses of pressure relationships between different types of recreational activities (e.g. motorized vs non-motorized recreation) and different ecosystem components.

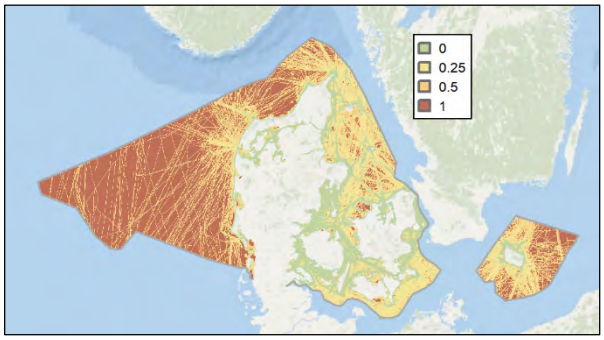
Recommendations for data improvement: None

Data authoring organization	University of Copenhagen, Department of Geosciences and Natural Resource Management (IGN), Section of Landscape Architecture and Planning
Data author contact	asol@ign.ku.dk
Data source	KU, IGN and Søfartsstyrelsen (AIS data)
Data source contact	asol@ign.ku.dk, bck@ign.ku.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Environmental monitoring facilities
GEMET keywords	Recreational area, mass recreation
Maintenance	Unknown
Metadata date	2019-06-12
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

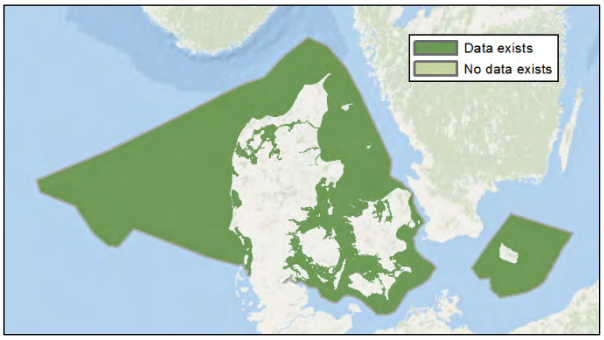
Intensity class of recreational use



Estimated uncertainty



Data coverage

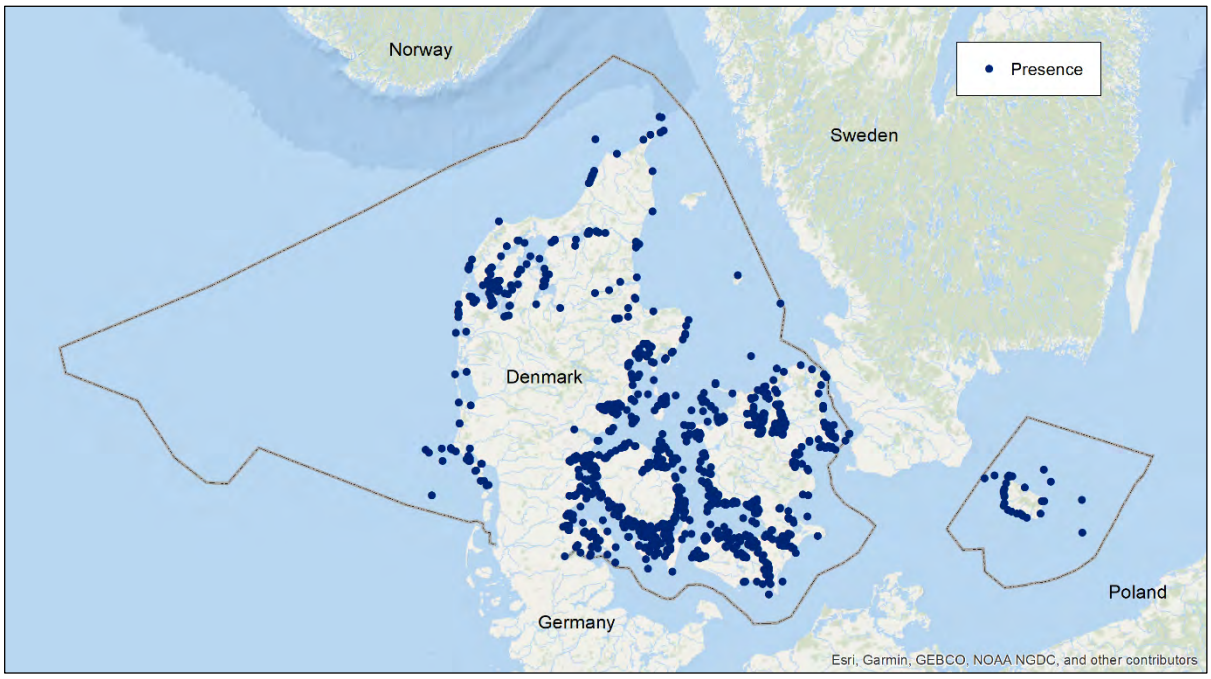


Estimated uncertainty: Estimated uncertainty is categorical and based on the intensity classes.
Data coverage: Data collection within the Danish EEZ.

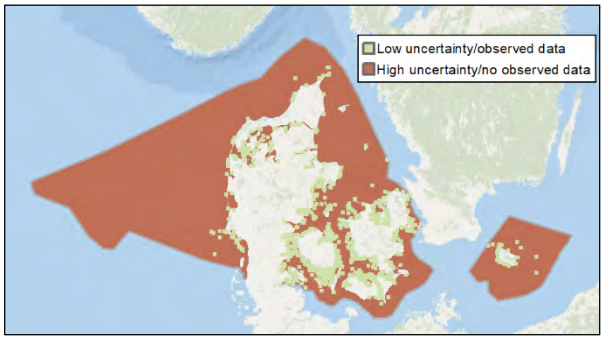
B7.3 Archaeological sites, findings, findings and wrecks

Data name	Archaeological findings, findings and wrecks
Group/category of activity	Cultural heritage
Data units, max and min values	Presence/absence
Category	Ecosystem component
Date created	Accumulated over the years (Original data) 2019-03-18
Data type	Dataset
Status	Completed
Data format	8-bit IMAGINE image format
Temporal period	Up to 2018
Units	Presence and absence
Spatial extent and resolution	The Danish EEZ marine area with an overall resolution of 1:10000.
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The dataset represents the archaeological shipwrecks in the Danish waters being documented by divers. The age is approximate as not all finds were carbon dated. It is the collection made by the Culture Agency in Denmark.	
Lineage: The data is downloaded from the Kulturstyrelsen web site (http://www.kulturarv.dk/fundogfortidsminder/Download/), It comprises information about the location, the type of the artifact, the name of the location and the archaeological date as well as the approximate age manifested in a range of years it can fall into. The dataset was filtered for age first so all finds and wrecks, the finds which are from the Old age, Middle age, Stone age, Viking age, and Bronze age were taken into consideration. Then the data was divided into Finds and wrecks.	
Considerations for use in ECOMAR: The archaeological dataset was reclassified into 500 m grid.	
Recommendations for data improvement: None	
Data authoring organization	GEUS/ Zyad Al-Hamdani
Data author contact	azk@geus.dk
Data source	The data shows the offshore archaeological finds and settlement sites updated annually by the Culture Agency (Kulturstyrelsen) in Denmark http://www.kulturarv.dk/fundogfortidsminder/Download/
Data source contact	ff@slks.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Environmental monitoring facilities
GEMET keywords	Cultural area, cultural heritage
Maintenance	Continuous
Metadata date	2019-03-22
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

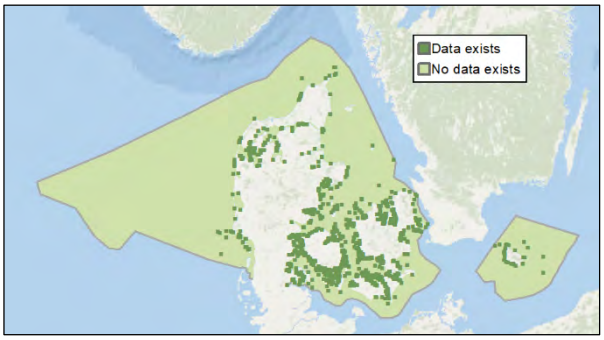
Presence of archeological sites and findings



Estimated uncertainty



Data coverage

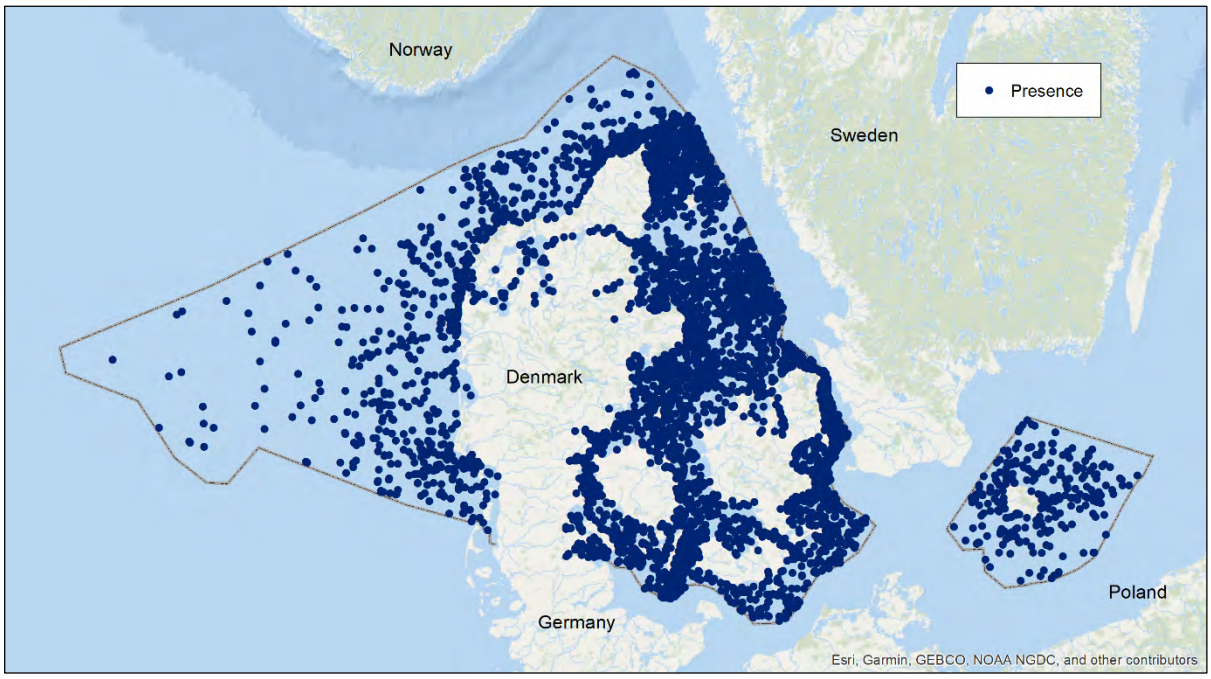


Estimated uncertainty: Data recorded for archeological sites and findings within the Danish EEZ
Data coverage: Data collection within the Danish EEZ, areas outside findings are not investigated.

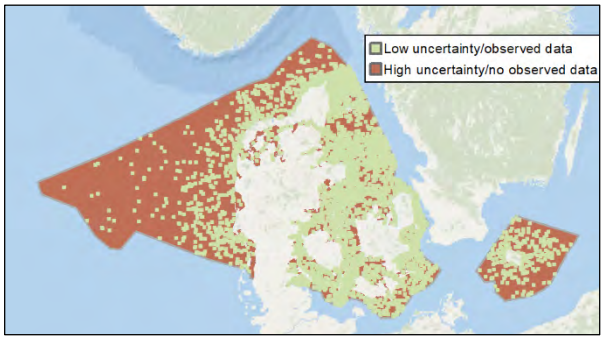
B7.4 Shipwrecks

Data name	Shipwreck sites-Historic and new age
Group/category of activity	Cultural heritage
Data units, max and min values	Presence/absence
Category	Ecosystem component
Date created	Accumulated over the years (Original data) 2019-03-18 (uploaded)
Data type	Dataset
Status	Completed
Data format	8-bit IMAGINE image format
Temporal period	Up to 2018
Units	Presence and absence
Spatial extent and resolution	The Danish EEZ marine area with an overall resolution of 1:10000
Spatial Representation	Dataset
Coordinate reference system	European Terrestrial Reference System 1989 - Lambert Azimuthal Equal Area http://epsg.io/3035
Summary: The dataset represents the archaeological shipwrecks in the Danish waters being documented by divers. The age is approximate as not all finds were carbon dated. It is the collection made by the Culture Agency in Denmark.	
Lineage: The data is downloaded from the Danish: 'Kulturstyrelsen' web site (http://www.kulturarv.dk/fundogfortidsminder/Download/), It comprises information about the location, the type of the artifact, the name of the location and the archaeological date as well as the approximate age manifested in a range of years it can fall into. The dataset was filtered for age first, so all finds and wrecks, the wrecks which are from the Historic, new age and After-Reformulation age were taken into consideration.	
Considerations for use in ECOMAR: The archaeological dataset was reclassified into 500 m grid.	
Recommendations for data improvement: None	
Data authoring organization	GEUS/ Zyad Al-Hamdani
Data author contact	azk@geus.dk
Data source/delivery of Background data	The data shows the offshore shipwreck sites updated annually by the Culture Agency ('Kulturstyrelsen') in Denmark
Data source contact	ff@slks.dk
INSPIRE topic category	Oceans, environment
INSPIRE theme	Environmental monitoring facilities
GEMET keywords	Cultural area, cultural heritage, recreational use
Maintenance	Continuous
Metadata date	2019-04-30
Metadata organization	NIVA Denmark
Metadata contact	Therese.Harvey@niva-dk.dk

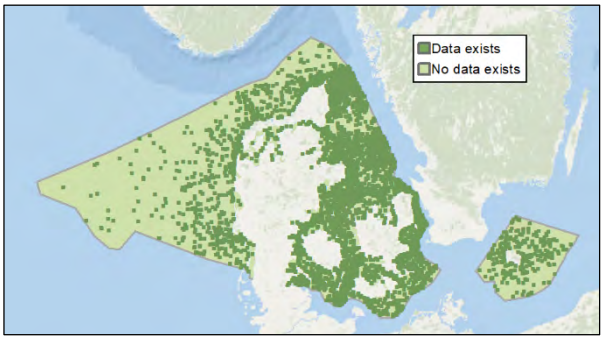
Presence of archeological sites and findings



Estimated uncertainty



Data coverage



Estimated uncertainty: Data recorded for shipwrecks within the Danish EEZ

Data coverage: Data collection within the Danish EEZ, areas outside findings are not investigated.

Annex C: Additional data and results

C1 Sensitivity scores

	Pelagic habitats		Benthic habitats													
	Productive surface waters	Oxygen depletion	Infralittoral coarse sediments	Infralittoal rocks and biogenic reefs	Infralittoral mixed sediments	Infralittoral mud	Infralittoral sand and muddy sand	Circalittoral coarse sediments	Cicalittoral rocks and biogenic reefs	Circalittoral mixed sediments	Circalittoral mud	Cicalittoral sand and muddy sand	Upper bathyal sediments	Stone reefs within Natura 2000	Eelgrass distribution
Pollution - Nutrients															
Nitrogen winter concentrations	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Phosphorous winter concentrations	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Pollution - Contaminants															
Dumped chemical munitions	1	0	1	1	1	1	1	2	2	2	2	2	2	1	1
Contaminants	1	0	1	2	2	2	2	1	2	2	2	2	2	1	1
Oil spills	2	1	2	2	2	2	2	1	1	1	1	1	1	2	2
Marine litter															
Marine litter	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Selective extraction of species- Commercial fishing effort by gear group															
Fishing: longlines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fishing: pelagic trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fishing: set gillnets	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fishing: mobile contracting gears (industrial purposes)	0	0	2	1	2	2	2	2	2	2	2	2	2	2	2
Fishing: mobile contracting gears (human consumption, large mesh sizes)	0	0	2	1	2	2	2	1	2	2	2	2	2	2	2
Selective extraction of species - Recreational fishing and hunting															
Fishing: recreational	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Mussel dredging	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2
Bird hunting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Climate change															
Sea surface anomalities	2	2	2	2	2	2	2	1	1	1	1	1	1	2	2
Sea level rise trend	0	0	1	1	1	1	1	1	1	1	1	1	0	1	2
Physical disturbance to the seafloor															
Surface SAR (swept area ratio)	1	0	2	2	2	2	2	2	2	2	2	2	2	2	2
Sub-surface SAR (swept area ratio)	1	0	2	2	2	2	2	2	2	2	2	2	2	2	2
Extraction of material from the seafloor	1	0	2	2	2	2	2	2	2	2	2	2	2	2	2
Aquacultures															
Aquacultures: fishfarms	2	2	2	2	2	2	2	1	1	1	1	2	1	1	2
Aquacultures: shellfish farms	2	1	2	2	2	2	2	1	1	2	2	2	1	2	2
Industry, energy and infrastructure															
Sea cables	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Offshore oil and gas installations	0	0	1	1	1	2	2	2	2	2	2	2	2	2	1
Oil and gas pipelines	0	0	1	1	1	1	1	1	1	1	1	2	1	2	2
Disposal sites for construction, garbage and dredges material	0	1	2	2	2	2	2	2	2	2	2	2	2	2	2
Dredging	1	0	2	2	2	2	2	2	2	2	2	2	2	2	2
Offshore wind turbines	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Bridges and costal constructions	0	0	1	1	1	1	1	1	1	1	1	2	1	2	2
Coastal habitat modification	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Lighthouses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Military areas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shipping and transportation															
Shipping	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Industrial ports	1	0	2	2	2	2	2	1	1	1	1	1	1	1	2
Harbours	0	0	1	2	1	1	1	1	1	1	1	1	0	1	2
Noise and energy															
Continious noise (ship sound 125 Hz)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Impulsive noise	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Energy production	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
Non-indiginous species															
Non-indiginous species	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Recreation and tourism															
Coastal activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Non-motorised water craft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Boating recreational	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Scuba-diving recreational	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Sensitive fish species											
	Starry Ray	Thornback Ray	Spotted ray	Atlantic catfish	Rabbit fish	Skates	School Shark	Smooth-hound sharks	Atlantic Halibut	Monkfish	Ling	Greater forkbeard
Pollution - Nutrients												
Nitrogen winter concentrations	0	0	0	0	0	0	0	0	0	1	1	1
Phosphorous winter concentrations	0	0	0	0	0	0	0	0	0	1	1	1
Pollution - Contaminants												
Dumped chemical munitions	1	1	1	1	1	1	1	1	1	1	1	1
Contaminants	2	2	2	2	2	2	2	2	2	2	2	2
Oil spills	2	2	2	2	2	2	2	2	2	2	2	2
Marine litter												
Marine litter	1	1	1	1	1	1	1	1	1	1	1	1
Selective extraction of species- Commercial fishing effort by gear group												
Fishing: longlines	1	1	1	1	1	1	1	1	1	1	1	1
Fishing: pelagic trawl	1	1	1	1	1	1	1	1	1	1	1	1
Fishing: set gillnets	1	1	1	1	1	1	1	1	1	1	1	1
Fishing: mobile contracting gears (industrial purposes)	2	2	2	1	1	2	1	1	1	1	1	1
Fishing: mobile contracting gears (human consumption, large mesh sizes)	2	2	2	2	2	2	1	1	2	2	2	2
Selective extraction of species - Recreational fishing and hunting												
Fishing: recreational	1	0	0	1	1	1	1	0	1	1	1	1
Mussel dredging	0	0	0	0	0	0	0	0	0	0	0	0
Bird hunting	0	0	0	0	0	0	0	0	0	0	0	0
Climate change												
Sea surface anomalities	1	1	1	1	1	1	1	1	1	1	1	1
Sea level rise trend	0	0	0	0	0	0	0	0	0	0	0	0
Physical disturbance to the seafloor												
Surface SAR (swept area ratio)	1	1	1	1	1	1	1	1	1	1	1	1
Sub-surface SAR (swept area ratio)	1	1	1	1	1	1	1	1	1	1	1	1
Extraction of material from the seafloor	1	0	0	0	0	1	0	0	0	0	0	0
Aquacultures												
Aquacultures: fishfarms	0	0	0	0	0	0	0	0	0	0	0	0
Aquacultures: shellfish farms	0	0	0	0	0	0	0	0	0	0	0	0
Industry, energy and infrastructure												
Sea cables	0	0	0	0	0	0	0	0	0	0	0	0
Offshore oil and gas installations	0	0	0	0	0	0	0	0	0	0	0	0
Oil and gas pipelines	0	0	0	0	0	0	0	0	0	0	0	0
Disposal sites for construction, garbage and dredges material	0	0	0	0	1	1	1	0	0	1	1	1
Dredging	1	1	1	0	1	1	1	1	1	1	1	1
Offshore wind turbines	0	0	0	0	0	0	0	0	0	0	0	0
Bridges and costal constructions	0	0	0	0	0	0	0	0	0	0	0	0
Coastal habitat modification	0	0	0	0	0	0	0	0	0	0	0	0
Lighthouses	0	0	0	0	0	0	0	0	0	0	0	0
Military areas	0	0	0	0	0	0	0	0	0	0	0	0
Shipping and transportation												
Shipping	0	0	0	0	0	0	0	0	0	0	0	0
Industrial ports	0	0	0	0	0	0	0	0	0	0	0	0
Harbours	0	0	0	0	0	0	0	0	0	0	0	0
Noise and energy												
Continious noise (ship sound 125 Hz)	0	0	0	0	0	0	0	0	0	0	0	0
Impulsive noise	1	1	1	1	1	1	1	1	1	1	1	1
Energy production	0	0	0	0	0	0	0	0	0	0	0	0
Non-indiginous species												
Non-indiginous species	0	0	0	0	0	0	0	0	0	0	0	0
Recreation and tourism												
Coastal activities	0	0	0	0	0	0	0	0	0	0	0	0
Non-motorised water craft	0	0	0	0	0	0	0	0	0	0	0	0
Boating recreational	0	0	0	0	0	0	0	0	0	0	0	0
Scuba-diving recreational	0	0	0	0	0	0	0	0	0	0	0	0

	Commercial fish species														
	Mackerel	Herring	Sprat	Saithe	Norway pout	Sandeel	Cod	Sole	Plaice	Hake	Turbot	Haddock	Nephrops	Pandalus	Crangon
Pollution - Nutrients															
Nitrogen winter concentrations	0	1	1	1	1	1	1	1	1	0	1	0	1	1	1
Phosphorous winter concentrations	0	1	1	1	1	1	1	1	1	0	1	0	1	1	1
Pollution - Contaminants															
Dumped chemical munitions	1	1	1	1	1	2	1	2	2	1	2	1	1	1	1
Contaminants	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Oil spills	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Marine litter															
Marine litter	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Selective extraction of species- Commercial fishing effort by gear group															
Fishing: longlines	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
Fishing: pelagic trawl	2	2	2	2	2	1	1	1	1	1	1	1	0	0	0
Fishing: set gillnets	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
Fishing: mobile contracting gears (industrial purposes)	1	1	1	1	1	2	1	1	1	1	1	1	2	1	2
Fishing: mobile contracting gears (human consumption, large mesh sizes)	1	1	1	1	1	1	2	2	2	2	2	2	2	1	1
Selective extraction of species - Recreational fishing and hunting															
Fishing: recreational	1	1	1	1	1	0	1	1	1	1	1	1	0	0	0
Mussel dredging	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bird hunting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Climate change															
Sea surface anomalities	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sea level rise trend	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Physical disturbance to the seafloor															
Surface SAR (swept area ratio)	0	1	0	1	0	2	1	2	2	2	2	1	2	2	2
Sub-surface SAR (swept area ratio)	0	1	0	1	0	2	1	2	2	1	2	1	2	2	2
Extraction of material from the seafloor	0	0	0	0	0	2	0	1	1	1	1	0	2	2	2
Aquacultures															
Aquacultures: fishfarms	0	0	0	0	0	0	0	1	1	0	1	0	1	0	1
Aquacultures: shellfish farms	0	0	0	0	0	0	0	1	1	0	0	0	1	0	1
Industry, energy and infrastructure															
Sea cables	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Offshore oil and gas installations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oil and gas pipelines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Disposal sites for construction, garbage and dredges material	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dredging	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2
Offshore wind turbines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges and costal constructions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coastal habitat modification	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lighthouses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Military areas	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Shipping and transportation															
Shipping	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Industrial ports	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harbours	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Noise and energy															
Continious noise (ship sound 125 Hz)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Impulsive noise	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0
Energy production	1	1	1	1	1	0	0	0	0	0	0	0	1	1	1
Non-indiginous species															
Non-indiginous species	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Recreation and tourism															
Coastal activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-motorised water craft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Boating recreational	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Scuba-diving recreational	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Sea birds							Marine mammals			Recreational and archeological interests			
	Auks	Red-throated/Black-throated Diver	Common scoter	Eider	Red-breasted Merganser	Fulmar	Long-tailed duck	Grey seal	Harbour seal	Harbour Porpoise	Bathing sites	Areas important for recreation and tourism	Archaelogical sites	Ship wrecks
Pollution - Nutrients														
Nitrogen winter concentrations	0	0	0	0	0	0	0	1	1	1	2	2	1	1
Phosphorous winter concentrations	0	0	0	0	0	0	0	1	1	1	2	1	1	1
Pollution - Contaminants														
Dumped chemical munitions	1	1	1	1	1	1	1	1	1	1	2	2	1	1
Contaminants	2	1	1	1	1	1	1	2	2	2	2	2	0	0
Oil spills	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Marine litter														
Marine litter	2	2	2	2	2	2	2	1	1	1	2	2	1	1
Selective extraction of species- Commercial fishing effort by gear group														
Fishing: longlines	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Fishing: pelagic trawl	1	0	0	0	0	1	0	1	1	1	0	0	0	0
Fishing: set gillnets	1	1	1	1	1	1	1	1	1	2	0	0	0	0
Fishing: mobile contracting gears (industrial purposes)	0	0	0	0	0	0	0	1	1	1	0	0	2	2
Fishing: mobile contracting gears (human consumption, large mesh sizes)	0	0	0	0	0	0	0	1	1	1	0	0	2	2
Selective extraction of species - Recreational fishing and hunting														
Fishing: recreational	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Mussel dredging	0	0	0	0	0	0	0	0	0	0	1	1	2	2
Bird hunting	1	1	1	1	1	1	1	0	0	0	2	1	0	0
Climate change														
Sea surface anomalities	0	0	0	0	0	0	0	1	1	1	1	1	0	0
Sea level rise trend	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Physical disturbance to the seafloor														
Surface SAR (swept area ratio)	0	0	0	0	0	0	0	0	0	0	1	1	2	2
Sub-surface SAR (swept area ratio)	0	0	0	0	0	0	0	0	0	0	1	1	2	2
Extraction of material from the seafloor	0	0	1	1	1	0	1	1	1	1	1	1	2	2
Aquacultures														
Aquacultures: fishfarms	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Aquacultures: shellfish farms	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Industry, energy and infrastructure														
Sea cables	0	0	0	0	0	0	0	0	0	0	1	1	2	2
Offshore oil and gas installations	0	0	0	0	0	0	0	0	0	0	1	1	2	2
Oil and gas pipelines	0	0	0	0	0	0	0	0	0	0	1	2	2	2
Disposal sites for construction, garbage and dredges material	0	0	0	0	0	0	0	0	0	0	2	2	2	2
Dredging	0	0	0	0	0	0	0	0	0	1	2	2	2	2
Offshore wind turbines	1	1	1	1	1	1	1	1	1	1	1	1	2	2
Bridges and costal constructions	0	0	0	0	0	0	0	0	0	0	1	1	2	2
Coastal habitat modification	0	0	0	0	0	0	0	0	0	0	1	1	2	2
Lighthouses	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Military areas	1	1	1	1	1	1	1	1	1	1	2	2	1	1
Shipping and transportation														
Shipping	1	1	1	1	1	1	1	1	1	1	1	2	1	1
Industrial ports	1	1	1	1	1	1	1	1	1	1	2	2	2	2
Harbours	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Noise and energy														
Continious noise (ship sound 125 Hz)	1	1	1	1	1	1	1	2	2	2	0	1	0	0
Impulsive noise	1	1	1	1	1	1	1	2	2	2	0	1	0	0
Energy production	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Non-indiginous species														
Non-indiginous species	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Recreation and tourism														
Coastal activities	1	1	1	1	1	1	1	1	1	1	1	1	0	0
Non-motorised water craft	1	1	1	1	1	1	1	1	1	1	1	1	0	0
Boating recreational	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Scuba-diving recreational	0	0	0	0	0	0	0	0	0	0	0	0	1	1

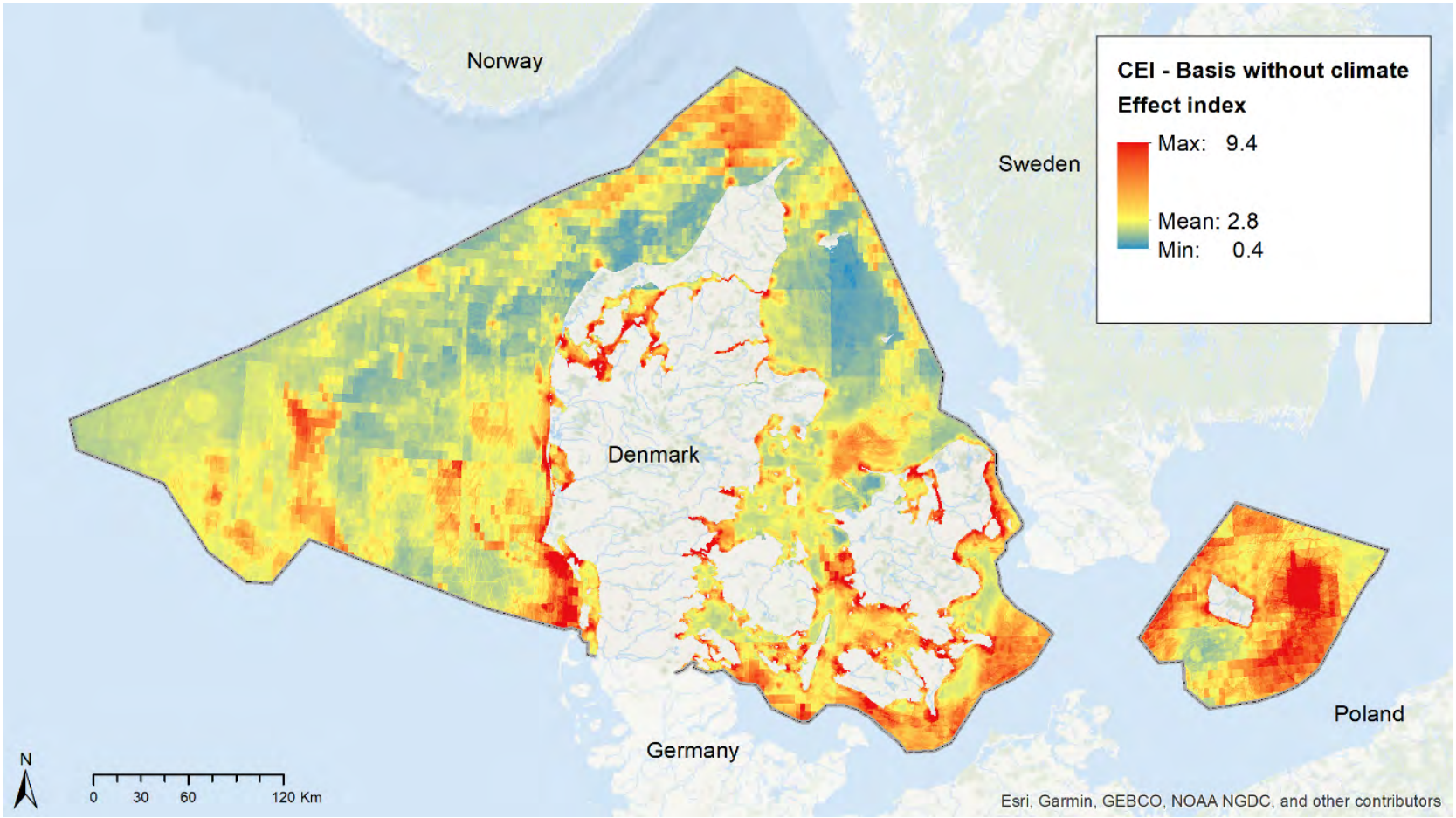
C2 Effect distances

Table showing the median, mean, maximum and minimum values (in km) for the estimated effect distances used within the CEI model. The standard deviation (km) is presented and the number of replies as well (n).

Pressure	Median	Mean	Max	Min	Stdev	n
Dumped chemical munitions	5	11.6	50	0	18.1	19
Aquacultures: fish and shellfish farms	5	10	50	0	7	20
Sea cables	0	0.10	1	0	0.37	20
Offshore oil and gas installations	1	3.5	25	0	5.77	20
Oil and gas pipelines	0	0.2	1	0	0.47	20
Heat and power plants	1	3.1	10	0	3.67	14
Disposal sites for construction and dredged material	5	8.9	50	0	12.9	20
Dredging in harbours and shipping lanes	5	6.4	50	0	12.7	14
Excavation sites in production	1	5.1	50	0	10.9	20
Offshore wind turbines	1	4.3	50	0	10.0	20
Bridges and costal constructions	1	3.2	25	0	7.5	20
Coastal habitat modification (coastal protection and piers)	1	3	25	0	6.8	14
Lighthouses	0	5.4	50	0	13.2	14
Military areas	7.5	13.4	50	0	15.3	20
Marine ports: industrial	5	10.1	50	0	14.0	14
Marine ports and marinas: recreational	3	5.6	50	0	10.9	20
Mussel dredging	1	1.2	10	0	2.6	18

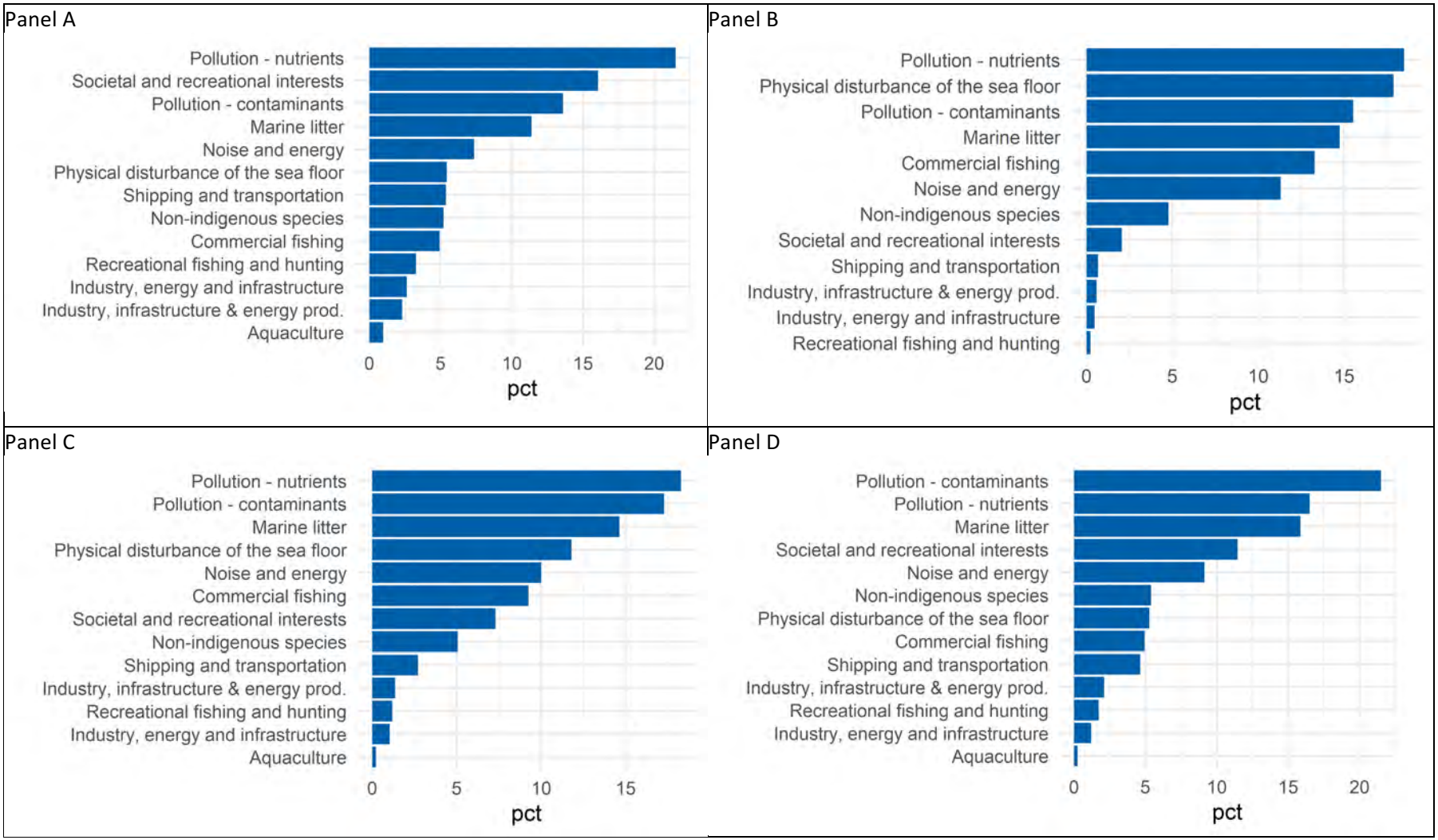
C3 Results without climate

C3.1 CEI spatial results without climate



Map of intensities and spatial variations in the estimated combined effects of human pressures and activities without climate change. The colour scale shows the stretch for 2.5 standard deviations from the mean, where red indicates a higher effect impact and blue lower. Not that the values are unit less and that the magnitude is defined by the models data inputs, which here is normalised data between 0-1. The index is calculated using EcoImpactMapper by Stock (2016).

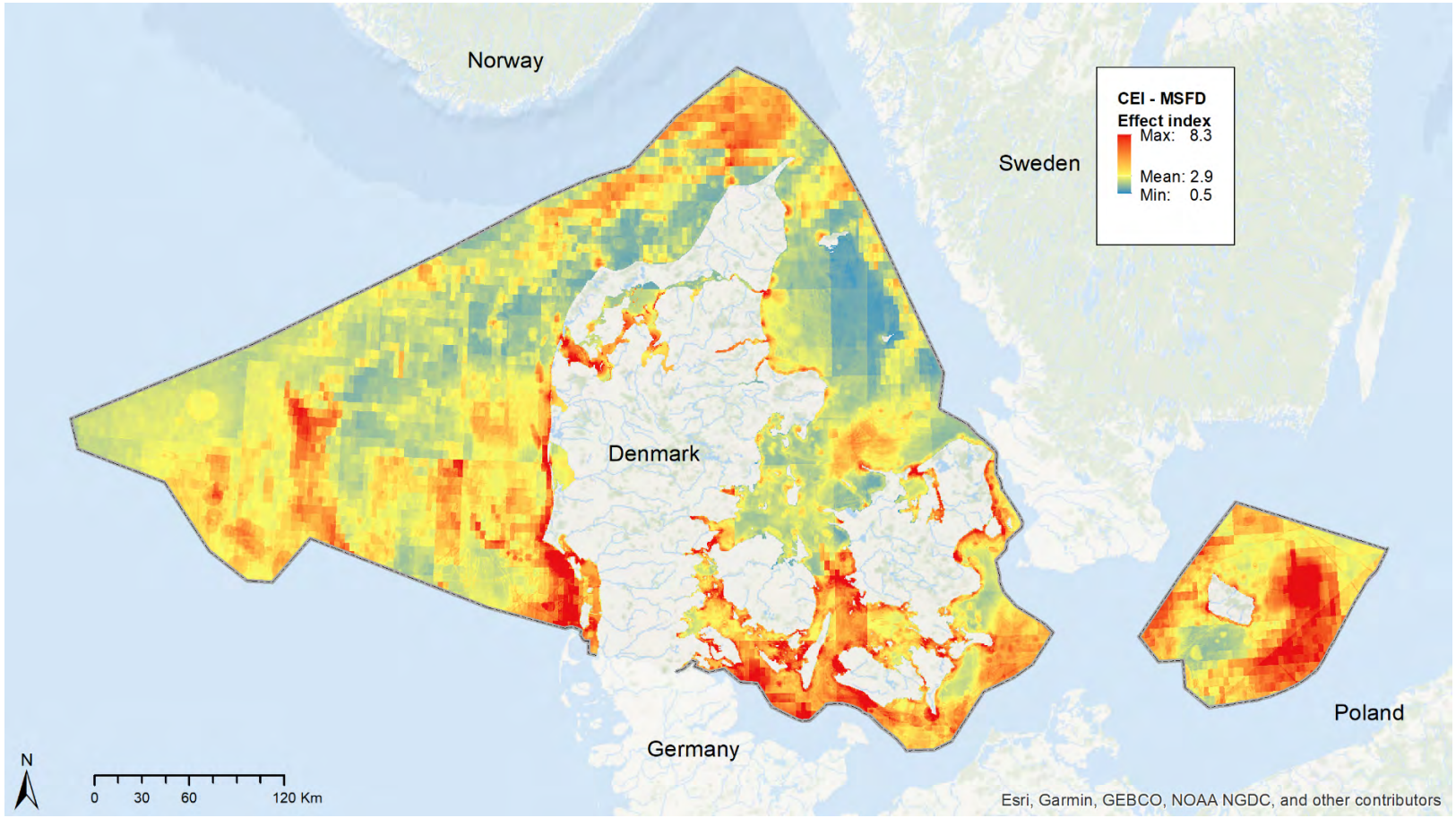
C3.2 Ranking of pressures without climate



Ranking of pressures without the pressure group 'climate change' in the Danish EEZ (panel A). Results for sub-divisions, i.e. the Danish parts of the North Sea and Skagerrak, the Kattegat and the western Baltic Sea, are shown in panels B, C and D, respectively.

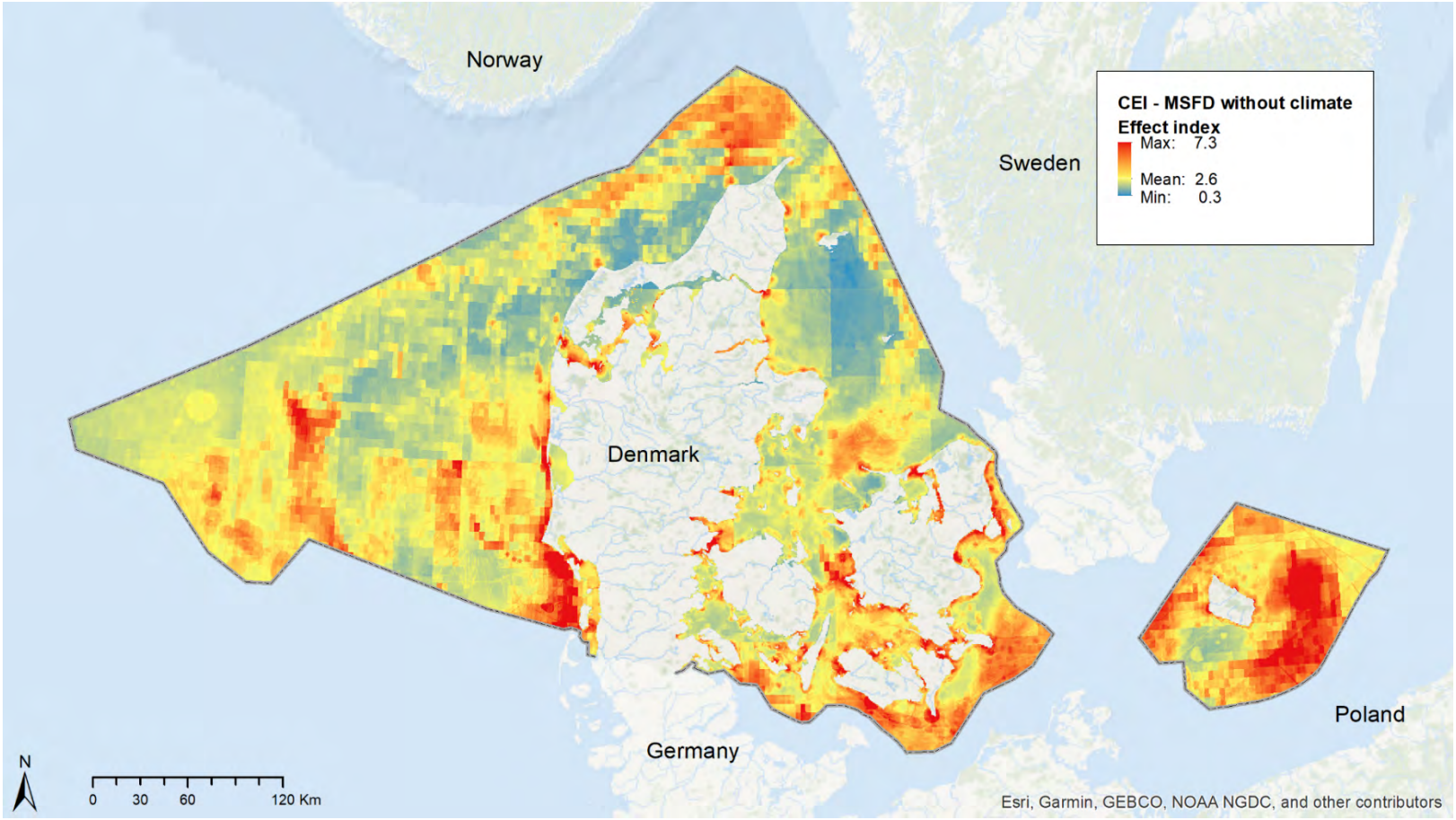
C4 MSFD analyses CEI maps

C4.1 CEI spatial MSFD results with climate



Map of intensities and spatial variations in the estimated combined effects of human pressures and activities with climate change for the MSFD relevant Ecosystem components. The colour scale shows the stretch for 2.5 standard deviations from the mean, where red indicates a higher effect impact and blue lower. Not that the values are unit less and that the magnitude is defined by the model's data inputs, which here is normalised data between 0-1. The index is calculated using EcoImpactMapper by Stock (201x).

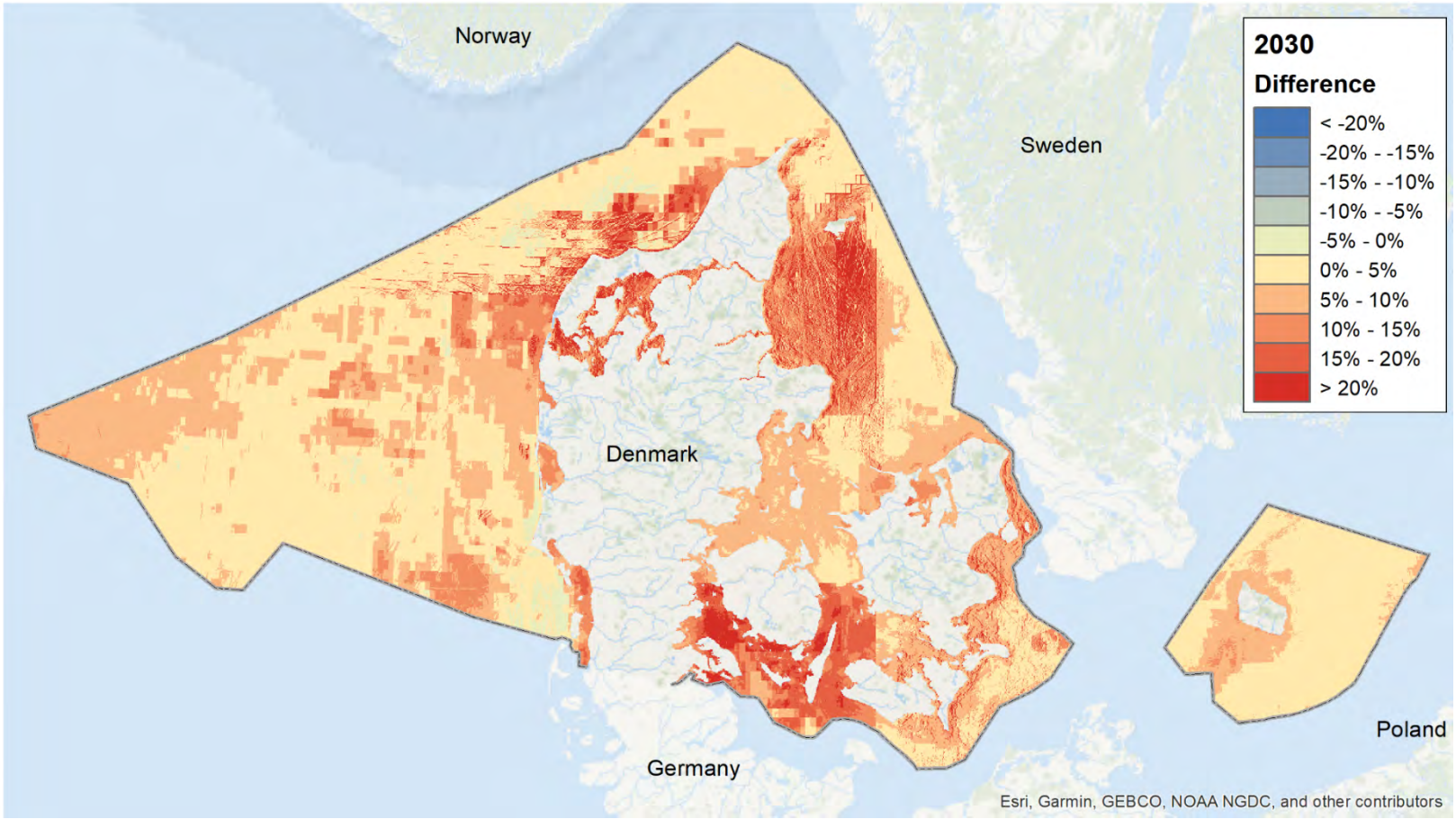
C4.2 CEI spatial MSFD results without climate



Map of intensities and spatial variations in the estimated combined effects of human pressures and activities with climate change for the MSFD relevant ecosystem components. The colour scale shows the stretch for 2.5 standard deviations from the mean, where red indicates a higher effect impact and blue lower. Not that the values are unit less and that the magnitude is defined by the model's data inputs, which here is normalised data between 0-1. The index is calculated using EcoImpactMapper by Stock (201x).

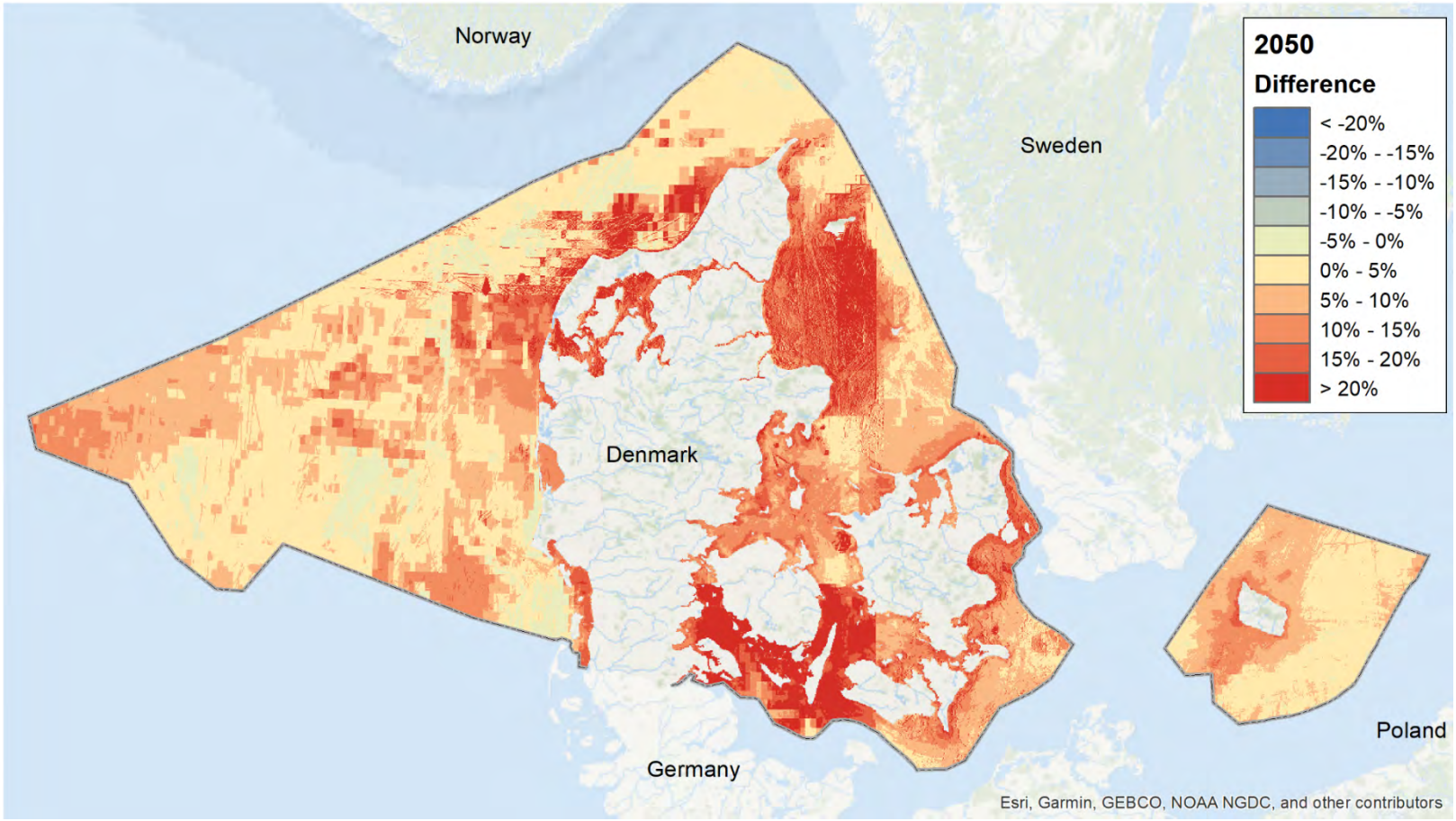
C5 Spatial differences between baseline and scenarios

C5.1 Baseline and 2030



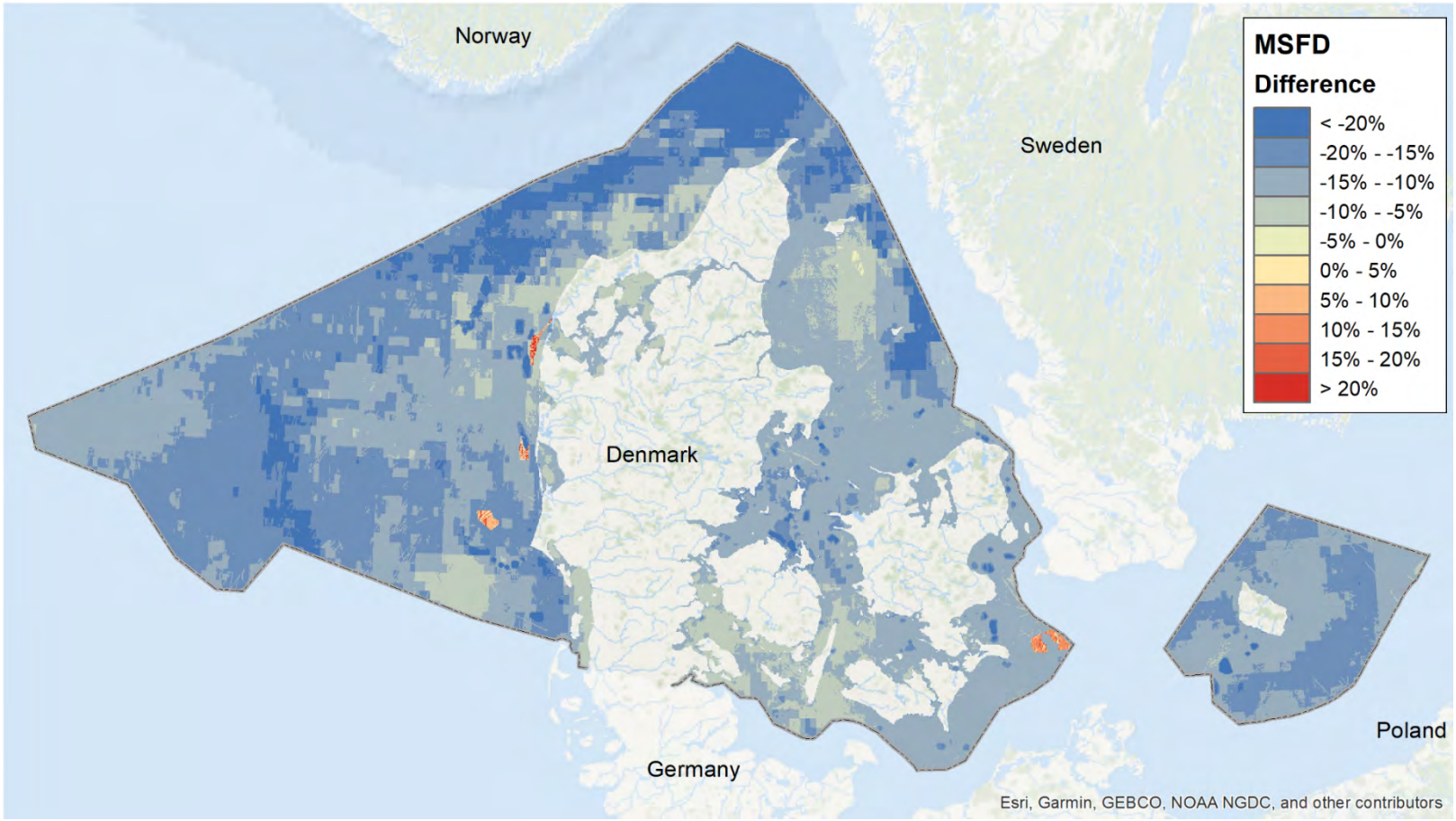
The map shows the percentage difference between the baseline impacts and when the changes in scenario 2030 are applied. No decrease in impact can be seen within the Danish EEZ, only increases. The largest impacts are found in all coastal areas, Smålandshavet (south east), south of Bornholm, Wadden Sea (south western North Sea), eastern North Sea, within Limfjorden, Aalborg bay (east of Jylland, western Kattegat) and offshore areas in western North Sea.

C5.2 Baseline and 2050



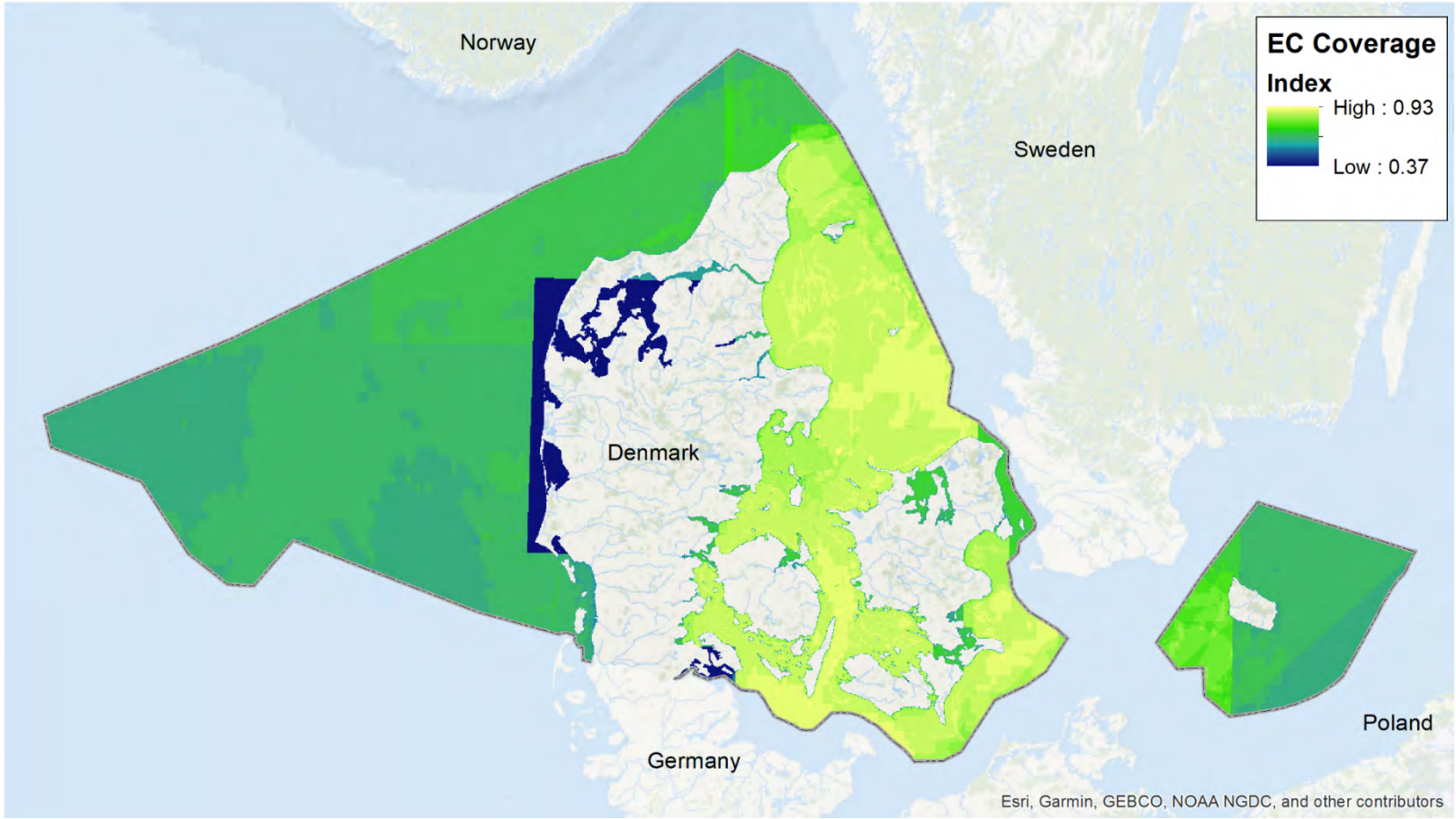
The map shows the percentage difference between the baseline impacts and when the changes in scenario 2050 are applied. No decrease in impact can be seen within the Danish EEZ, even more increases are seen compared to the 2030 scenario as more areas are above the 20% increase level. The largest impacts are found in the same places as 2030; all coastal areas, Smålandshavet (south east), south of Bornholm, Wadden Sea (south western North Sea), eastern North Sea, within Limfjorden, Aalborg bay (east of Jylland, western Kattegat) and offshore areas in western North Sea.

C5.3 Baseline and MSFD GEnS



The map shows the percentage difference between the baseline impacts and when the changes in scenario MSFD GEnS are applied. Dark red areas indicate increased impacts larger than 20 % and dark blue areas a decrease in impact larger than 20 % whereas yellow areas show 0 to 5% change in impact. For the MSFD GEnS scenario where the environment is prioritized, a decrease in impact from human pressures and activities can be seen within the whole Danish EEZ, and many areas also show a decrease above 20%, especially in the fishing grounds. The only areas showing an increased impact are the areas of new wind farms, which will have a local increase in human impact but a general decrease on climate change.

C6 Data coverage map



Map showing the data coverage index for Denmark based on the data coverage of the ecosystem components. The index is calculated in each grid cell as the fraction of ecosystem component layers having information on presence/intensity/concentration. A known absence of an ecosystem component is counted as information in the same way as a known presence. This is not the same as the ecosystem component index (see ECOMAR Report Figure 7) which is an index of the number of ecosystem components present.

C7 Descriptions of pressure and activity layers

Table describing the pressure and activities included in ECOMAR. Description of all pressure and activities layers used in the analysis (n = 45).
All pressures are either current threats, long-term ongoing threats[#] (climate change) or near-future threats* (2015 to 2030). Adopted from HELCOM 2017, Doubleday et al. 2017 and JNCC 2018 Cormier and Kannen "ICES training course on marine spatial planning process" 2019.

Pressure/Activity		Description	Threat
A1: Pollution - Nutrients			
A1.1	Nitrogen winter concentrations (DIN)	• Winter average concentrations in sea surface waters • Includes inputs from point and diffuse sources of N; waterborne (riverine) and direct discharges from coast, atmospheric deposition (nitrogen), discharges from aquaculture, discharges in sewage from passenger ships, loading from coastal waste water treatment plants	• Eutrophication effects such as; • Decrease light availability • Algae blooms • Higher chl-a concentrations • Oxygen depletion
A1.2	Phosphorus winter concentrations (DIP)	• Winter average concentrations in sea surface waters • Includes inputs from point and diffuse sources of P; waterborne (riverine) and direct discharges from coast, atmospheric deposition (nitrogen), discharges from aquaculture, discharges in sewage from passenger ships, loading from coastal waste water treatment plants.	• Eutrophication effects such as; • Decrease light availability • Algae blooms • Higher chl-a concentrations • Oxygen depletion
A1.3	Nutrient discharge (point source) *Will only be used in specific areas for scenario analyses with the background nutrient levels excluded*	• Mainly nitrogen and phosphorous annual averages • Point-source pollution from wastewater treatment plants, steel manufacture, fish processors, power plants, aquaculture (finfish) hatcheries • Also includes occasional outlets of untreated waste water caused by accidental outlets and overflow • Does not include impacts from sea cage aquaculture	• Eutrophication effects such as; • Decrease light availability • Algae blooms • Higher chl-*a* concentrations • Oxygen depletion • Input of heat
A1.4	Riverine nutrient inputs *Will only be used in specific areas for scenario analyses with the background nutrient levels excluded*	• Mainly nitrogen and phosphorous annual averages • Agricultural runoff via riverine discharge	• Eutrophication effects such as; • Decrease light availability • Algae blooms • Higher chl-*a* concentrations • Oxygen depletion

A2: Pollution - Contaminants			
A2.1	Contaminants	• Integrated chemical assessment an assessment tool (CHASE) • Includes point sources and diffuse pollution from industry, stormwater, metal manufacture, power stations and other diffuse sources	• Input of hazardous substances (synthetic substances, non-synthetic substances, heavy metals) • Reproduction disturbances e.g. imposex or weak eggshells, mis-growth or mutations of juveniles, lower survival of off-spring • Hormonal disruption • Increased mortality due to toxic shock or poisoning • Growth disturbances • Reduced photosynthesis/production • Disruption of natural behaviour • Changes in species distributions or trophic levels
A2.2	Dumped chemical munitions	• Indicate areas formerly chosen and designated for dumping munitions at sea • Recorded encounters with munitions	• Input of hazardous substances (synthetic substances, non-synthetic substances, heavy metals) • Change of seabed substrate or morphology (~ physical loss) • Disturbance or damage to seabed
A2.3	Oil spills	• Average of volume m3 buffered over the area of the oils pill for 2011-2016 • Detected illegal oil discharges, polluting ship and drilling accidents and reported oil spills, calculated according to the Bonn agreement	• Input of hazardous substances (Hydrocarbon & PAH contamination) • Change of seabed substrate or morphology (~ physical loss) • Disturbance or damage to seabed • Smothering
A3: Marine litter			
A3	Marine litter	• Marine litter detected by ICES surveys (IBTS, BITS, BTS) data • Includes plastics, metals, rubber, timber, glass, rope, fishing gear, aquaculture gear and illegal dumping sanitary litter and miscellaneous litter • Does not include microplastic	• Change of seabed substrate or morphology (~ physical loss) • Disturbance or damage to seabed • Smothering • Entangling • Input of hazardous substances (synthetic substances, non-synthetic substances, heavy metals) • Degradation from coarse litter to microplastic

A4: Selective extraction of species			
A4.1: Commercial fishing effort by gear group			
A4.1.1	Fishing: Set gillnets	• Average fishing effort in h • Commercial fishing with static nets that are left for a period before being recovered	• Extraction of species intended • Extraction of species un-intended (by-catch) • Demersal fish and other species
A4.1.2	Fishing: Longlines	• Average fishing effort in h • Commercial fishing, not interaction with the seabed	• Extraction of species intended • Extraction of species un-intended (by-catch) • Pelagic and demersal fish and other species
A4.1.3	Fishing: Mobile bottom contacting gears, for human consumption (large mesh sizes)	• Average fishing effort in h • Bottom trawl that interacts with the seafloor • Does not include physical disturbance of the seafloor by abrasion (estimated by surface swept area ratio, SAR)	• Extraction of species intended • Extraction of species un-intended (by-catch) • Prawns, Scrimp, Norwegian lobster, demersal fish and other species
A4.1.4	Fishing: Mobile bottom contacting gears, for industrial purposes (small mesh sizes)	• Average fishing effort in h • Bottom trawl that interacts with the seafloor • Does not include physical disturbance of the seafloor by abrasion (estimated by estimated by surface swept area ratio, SAR)	• Extraction of species intended • Extraction of species un-intended (by-catch) • Fish (primarily Sandeel) and other other demersal species
A4.1.5	Fishing: Pelagic trawl	• Average fishing effort in h • Commercial fishing for pelagic species, not interaction with the seabed	• Extraction of species intended • Extraction of species un-intended (by-catch) • Pelagic fish and other species
A4.1.6	Mussel dredging	• Commercial dredging for mussel • Fishing days/km^2	• Extraction of species intended • Extraction of species un-intended (by-catch) • Change of seabed substrate or morphology (~ physical loss) • Disturbance or damage to seabed
A4.2: Recreational fishing and hunting			
A4.2.1	Fishing: Recreational	• Fishing by hand-held gear and long-lines on charter fishing boats • Fishing by private recreational fishing	• Extraction of species intended • Extraction of species un-intended (by-catch) • Pelagic and demersal fish species
A4.2.2	Bird hunting	• Number of visits at reported recreational hunting places	• Extraction of species • Noise impulsive

A5: Climate change			
A5.1	Sea surface anomalies [#]	• Observed anomalies in sea surface temperature over 11 years, and expressed as anomalies with reference to the average temperature in the period 1993-2012	• Changes in productivity • Changes in hydrology (stratification, currents) • Changes in oxygen levels • Increased algae blooms • Physiological changes in species function • Species composition • Decline in biodiversity
A5.2	Sea level rise trend[#]	• Modelled trend in mean sea level rise between 1993-2015	• Extreme sea level events • Changes in hydrological conditions • Changes in habitat distribution
A6: Physical disturbance to the seafloor			
A6.1: Swept area ratio (SAR) from bottom trawling			
A6.1.1	Surface SAR (swept area ratio)	• <2 cm penetration depth of the surface • Abrasion from mobile bottom contacting gears (Trawls, Danish seine and Scottish seine) • Yearly average of surface swept area SAR based on gear type, fishing hours, speed and gear width	• Change of seabed substrate or morphology (~ physical loss) • Disturbance or damage to seabed • Changes in siltation (sediment re-suspension)
A6.1.2	Subsurface SAR (swept area ratio)	• ≥2 cm penetration depth of the surface • Abrasion from mobile bottom contacting gears (Trawls, Danish seine and Scottish seine) • Yearly average of surface swept area SAR based on gear type, fishing hours, speed and gear width	• Change of seabed substrate or morphology (~ physical loss) • Disturbance or damage to seabed • Changes in siltation (sediment re-suspension)
A6.2: Extraction of material from the seafloor			
A6.2	Extraction of material from the seafloor	• Sand and gravel excavation • Average amount of extracted material	• Change of seabed substrate or morphology (~ physical loss) • Disturbance or damage to seabed • Changes in siltation (sediment re-suspension) • Changes to hydrological conditions e.g. alteration of currents/tides • Input of light (disturbance of navigation, disturbance of natural behaviour)

A7: Aquacultures			
A7.1	Fish farms	• Saltwater cages/enclosures/pens • Salmonids, Sole and flounder and Turbot • Blue mussel, European flat oyster & Pacific oyster • Does not include impacts from hatcheries or introduced pathogens • Does not include impacts from diffuse nutrient inputs (included in other layers) • Does not include underwater noise from seal scarcer	• Physical loss: Change of seabed substrate or morphology • Disturbance or damage to seabed • Changes to hydrological conditions e.g. alteration of currents/tides • Smothering
A7.2	Shellfish farms	• Saltwater cages/enclosures/pens • Salmonids, Sole and flounder and Turbot • Blue mussel, European flat oyster & Pacific oyster • Does not include impacts from hatcheries or introduced pathogens • Does not include impacts from diffuse nutrient inputs (included in other layers) • Does not include underwater noise from seal scarcer	• Physical loss: Change of seabed substrate or morphology • Disturbance or damage to seabed • Changes to hydrological conditions e.g. alteration of currents/tides • Smothering
A8: Industry, energy and infrastructure			
A8.1	Coastal habitat modification	• Such as land reclamation, shoreline hardening, piers, banks, sea walls, jetties, slope protections • Does not include threats associated with increased coastal activities or sediment runoff	• Changes to hydrological conditions e.g. alteration of currents/tides • Input of light (disturbance of navigation, disturbance of natural behaviour)
A8.2	Bridges and coastal constructions	• Presence of bridges and coastal constructions for transportation	• Change of seabed substrate or morphology (~ physical loss) • Disturbance or damage to seabed • Changes in siltation (sediment re-suspension) • Changes to hydrological conditions e.g. alteration of currents/tides • Input of light (disturbance of navigation, disturbance of natural behaviour)

A8.3	Dredging	• Dredging sites	• Changes to hydrological conditions e.g. alteration of currents/tides • Change of seabed substrate or morphology (~ physical loss) • Disturbance or damage to seabed • Changes in siltation (sediment re-suspension) • Changes to hydrological conditions e.g. alteration of currents/tides • Input of light (disturbance of navigation, disturbance of natural behaviour)
A8.4	Disposal sites for construction, garbage and dredged material	• Marine areas used for dumping	• Smothering • Change of seabed substrate or morphology (~ physical loss) • Disturbance or damage to seabed • Changes in siltation (sediment re-suspension) • Input of light (disturbance of navigation, disturbance of natural behaviour)
A8.5	Offshore oil and gas installations	• Presence of oil and gas installations •	• Change of seabed substrate or morphology (~ physical loss) • Disturbance or damage to seabed • Changes to hydrological conditions e.g. alteration of currents/tides • Ambient underwater noise • Physical interactions and collisions • Input of light (disturbance of navigation, disturbance of natural behaviour)
A8.6	Oil and gas pipelines	• Presence of oil and gas pipelines • Does not include oil spills	• Change of seabed substrate or morphology (~ physical loss) • Disturbance or damage to seabed • Changes to hydrological conditions e.g. alteration of currents/tides • Ambient underwater noise

A8.7	Wind farms	• Presence of offshore wind turbines •	• Change of seabed substrate or morphology (~ physical loss) • Disturbance or damage to seabed • Ambient underwater noise • Physical interactions and collisions • Input of light (disturbance of navigation, disturbance of natural behaviour) • Changes to hydrological conditions e.g. alteration of currents/tides
A8.8	Sea cables	• Cables on the seafloor (electrical, telecommunication, others)	• Change of seabed substrate or morphology (~ physical loss) • Disturbance or damage to seabed • Electromagnetic fields • Ambient underwater noise
A8.9	Lighthouses	Directs light sources from lighthouses	• Input of light (disturbance of navigation, disturbance of natural behaviour)
A8.10	Military areas	• Areas of military practice (no reported intensity data of the activities taking place) • Assumptions of explosions • Assumptions of sonars with energy below 10 kHz • Military practices	• Change of seabed substrate or morphology (~ physical loss) • Disturbance or damage to seabed • Impulsive underwater noise • Disturbance of natural behaviour • Disturbance of breeding activities • Disturbance of navigation by species using sonar • Input of light (disturbance of navigation, disturbance of natural behaviour)

A9: Shipping and transportation			
A9.1	Shipping	• Average yearly shipping intensity (h/m^2) within the Danish EEZ • Include vessels for fishing, service, tankers, dredging, pleasure crafts, military and law, passenger, sailing, high-speed crafts, thug and towing, cargo and others • Does not include threats related to invasive species, • Does not include threats related to noise • Does not include threats related to or oil spills	• Changes in siltation (sediment re-suspension) • Anchor damage • Waste discharge • Coastal erosion • Input of hazardous substances (synthetic substances, non-synthetic substances, radionuclides) • Changes to hydrological conditions e.g. alteration of currents/tides • Input of light (disturbance of navigation, disturbance of natural behaviour) • Input of litter
A9.2	Industrial ports	• Yearly Gross tonnage of vessels/harbour • Large industrial ports have high activity levels • Does not include nutrient inputs • Does not include non-indigenous species	• Change of seabed substrate or morphology (~ physical loss) • Disturbance or damage to seabed • Changes in siltation (sediment re-suspension) • Coastal erosion • Input of light (disturbance of navigation, disturbance of natural behaviour) • Changes to hydrological conditions e.g. alteration of currents/tides
A9.3	Harbours	• Number of ports within a grid cell	• Include alteration of currents/tides, sedimentation and coastal erosion • Input of light (disturbance of navigation, disturbance of natural behaviour)
A10: Noise and energy			
A10.1	Continuous noise (ship sound 125 Hz)	• Model intensity of continuous noise from larger vessels equipped with AIS • Spectral noise level estimates based on the length and speed of the vessels • Combined with a model of wind and wave generated natural ambient noise	• Disturbance of natural behaviour • Disturbance of breeding activities • Disturbance of navigation by species
A10.2	Impulsive noise	• Impact areas of offshore constructions sites include; – seismic surveys with air guns,	• Disturbance of natural behaviour • Disturbance of breeding activities • Disturbance of navigation by species using sonar

		– pile driving for construction of harbours to large wind turbine foundations – sonars with energy below 10 kHz (primarily military sonars) and acoustic alarms (seal scarers) – generic impulsive sources (for example sub bottom profiling equipment) • Does not include military explosions and sonars	
A10.3	Energy production	• Point-source from heating producing plants	• Input of heat • Input of hazardous substances (synthetic substances, non-synthetic substances)
A11: Non-indigenous species			
A11	Non-indigenous species	• Number of invasive species found within Danish EEZ • Key species of benthic filter-feeders (Pacific oyster) • Key species of encrusting, fouling (ascidians, hydroids and macroalgae) • Key species of predators, parasites (crabs, goby fish and shell-boring worms)	• Species composition • Change of seabed morphology • Competition • Trophic effects
A12: Recreational activities			
A12.1	Boating recreational	• From recreational activities and ecotourism • Does not include threats related to invasive species or fishing	• Disturbance of natural behaviour • Disturbance of breeding activities • Sediment re-suspension • Anchor damage • Waste discharge and antifoulants • Input of ambient noise Input of marine litter and degradation from coarse litter to microplastic
A12.2	Non-motorised water craft	• Kayaking, wind and kite surfing, dinghi	• Disturbance of natural behaviour • Disturbance of breeding activities Input of marine litter and degradation from coarse litter to microplastic

A12.3	Coastal recreation sites	• Such as walking, sunbathing, swimming, snorkelling	• Coastal erosion • Change of seabed substrate or morphology (~ physical loss) • Disturbance or damage to seabed • Changes in siltation (sediment re-suspension) • Input of marine litter and degradation from coarse litter to microplastic
A12.4	Scuba-diving recreational	• Areas used for scuba diving	• Disturbance of natural behaviour • Disturbance of breeding activities • Sediment re-suspension • Input of marine litter and degradation from coarse litter to microplastic

C8 Description of ecosystem and societal component layers

Table describing the ecosystem and societal components layers included in ECOMAR. Description of all ecosystem and societal components used in the analysis (n = 56). Adopted from HELCOM 2017, Doubleday et al. 2017 and JNCC 2018.

Ecosystem component		Description
B1: Pelagic habitats		
For estimating the sensitivity, consider the characteristic elements (biological communities) of the pelagic habitats, which are particularly sensitive for the given pressure		
B1.1	Productive surface waters - chlorophyll a	• Chl-*a* concentration used as a proxy for plankton communities • This habitat type is specifically meant to estimate sensitivity of plankton (phyto- and zooplankton) • Basis of the marine food chain
B1.2	Oxygen depletion	• Areas of oxygen depletion • Include oxygen levels of <4 mg/l • This habitat type is specifically meant to estimate sensitivity of benthic habitats/species to oxygen depletion
B2: Broad scale benthic habitats		
For estimating the sensitivity, consider the characteristic elements (biological communities and structures) of the broad habitat, which are particularly sensitive for the given pressure • **Littoral** -within the light penetration depth • **Circalittoral** -below the light penetration depth		
B2.1	Infralittoral sand and muddy sand	• Support invertebrate and vertebrates that lives borrowed down in the sediment, polychaetas, bivalves, amphipods also blue mussels • Often seasonal changes with more stable conditions during summer time • Muddier sands support bivalve shells (e.g. cockles) and spire shell snails • Seaweeds are scarce, but the green sea lettuce is also found on some muddy sand shores
B2.1	Infralittoral mud	• Mudflats typically formed, exposed at low tides • High biodiversity of e.g. polychaetes, bivalves and oligochaetes dominated communities, e.g. *Hediste diversicolor, Macoma baltica* and *Hydrobia ulvae and* of associated species • Very stable sheltered sediments • Often found in estuaries, sheltered inlets, straits or embayment
B2.1	Infralittoral coarse sediments	• Small rocks, pebbles, and gravel, sometimes mixed with coarse sand • Relatively low biodiversity but special adapted species are living here • Habitat of constant move

B2.1	Infralittoral rocks and biogenic reefs	• Sabellaria reefs (tubes of the honeycomb worm) and those created by mussels, Haploops community • High biodiversity of associated species • The reefs exist in a wide range of habitats from exposed open coasts to estuaries, marine inlets and deeper offshore habitats and may be found in a variety of sediment types and salinity regimes
B2.1	Infralittoral mixed sediments	• Ranging from muds with gravel and sand components to mixed sediments with pebbles, gravels, sands and mud in more even proportions • Very diverse animal and plant communities where e.g. barnacles may be abundant on hard surfaces whereas brown and green seaweeds are found on larger rocks • The community within the sand and mud or between the pebbles may include many polychaetes e.g. ragworms, mud shrimps and sandhoppers, bivalve shells (e.g. cockles) and spire shell snails • Vulnerable as the recovery time of the habitat is long or non-existent • High biodiversity
B2.1	Circalittoral sand and muddy sand (includes Offshore circalittoral sand and muddy sand)	• Often disturbed by waves and ties situated in open coasts, offshore or in estuaries and marine inlets • Infauna of deposit feeding worms and bivalves, sea pens • Supports flat fish and sand eels that camouflaged on the surface of the sand • Heart urchins, razor shells and sea cucumbers
B2.1	Circalittoral mud (includes Offshore circalittoral mud)	• Too deep to be exposed to the tides and are mainly found in extremely sheltered areas with very weak tidal currents • High numbers of worms, cockles and other bivalve shells, urchins and sea cucumbers live in muddy seabeds and sea pens, burrowing anemones and brittlestars (*Amphiura spp.)* • Dominated by echinoderm and polychaetes (worms) and oligochaetes (worms) in estuaries • Norway lobster not included here- assessed separately
B2.1	Circalittoral coarse sediments (includes Offshore circalittoral coarse sediments)	• Small rocks, pebbles, and gravel, sometimes mixed with coarse sand in constant move • These areas are disturbed by waves and tides, which prevent finer sands and mud from settling • Infauna buried in the sediment • Robust fauna including venerid bivalve • Small varieties of calcareous algae may also live on fine gravels

B2.1	Circalittoral rocks and biogenic reefs	• The communities develop in a range of habitats from exposed open coasts to estuaries, marine inlets and deeper offshore habitats and may be found in a variety of sediment types and salinity regimes • Important-provide a stable habitat for other marine life in an otherwise featureless seabeds • High biodiversity of associated species • Polychaete reefs (Sabellaria reefs, tubes of the honeycomb worm) and those created by mussels (both blue and horse mussels), Haploops community • Dead mussel shells are bound up with sand and mud
B2.1	Circalittoral mixed sediments (includes Offshore circalittoral mixed sediments)	• Unsorted, heterogenous pebbles, gravels, sands and mud, and they may also include rocks and a few large boulders • May support a wide range of infauna and epibiota including infauna polychaetes, bivalves (e.g. Horse mussel), echinoderms, anemones and burrowing anemones, hydroids and bryozoa • High biodiversity and species abundances
B2.1	Upper bathyal sediments	• Various kinds of deep-sea bed, including bedrock, limestone pavements, boulders, gravel, sand and mud • Unique biological seabeds include 'bioherms', which are mounds or reefs of rock formed from the remains of marine organisms, and embedded within mineral rock • Unique large colonies of sponges can also be found in the deep-sea
B2.2	Eelgrass distribution, *Zostera marina*	• For estimating the sensitivity, consider the characteristic elements (biological communities and structures) of the broad habitat, which are particularly sensitive for the given pressure • Eelgrass communities stabilises the sediments and provides a shelter against wave exposure • High biodiversity of associated species • Nursery for juveniles • Carbon sink (binds dissolved carbon in the sediments) • Increase water clarity by reducing re-suspension
B2.3	Stone reefs within Natura2000	• Survey data of detected stone reefs within N2000 areas. Typical species include communities of barnacles and mussel communities, robust seaweeds (e.g. *Ceramium, Ulva, Cladophora*) and fucoid communities (*Fucus vesiculosus, F. Serratus, Ascophyllum nodosum)* • Ranging from exposed to sheltered habitats • High biodiversity of associated species
B3: Sensitive fish species		
B3.1: Cartilaginous fish species		
B3.1.1	School Shark, *Galeorhinus galeus* (Gråhaj)	• Max 200 m long • Habitat: relatively shallow water and down to 200 m depth • Eats fish, squids, crustaceans and echinoderms

B3.1.2	Skates, *Dipturus spp*	• Max 285 cm long • Habitat: different types of seabed and sediments at depths between 100-600 m • Eats all types of benthic animals and fish
B3.1.3	Smooth-hound sharks, *Mustelus spp* (Glathajer)	• Max 165 cm long • Habitat: lives close to bottom at 20-150 m depth • Eats crustaceans, mollusks and fish
B3.1.4	Spotted Ray, *Raja montagui* (Storplettet rokke)	• Max 80 cm long • Habitat: different types of seabed and sediments at depths between 20-120 m • Eats scrimps and crabs
B3.1.5	Starry ray, *Amblyraja radiata* (Tærbe)	• Max 90 cm long • Habitat: different types of seabed and sediments • Eats crabs, scrimps and smaller fish
B3.1.6	Thornback Ray, *Raja clavate* (Sømrokke)	• Max 120 cm long • habitat: sedimentary seabed such as mud, sand or gravel at depths between 20-300 m • Eats crabs, scrimps and smaller fish
B3.2: Bony fish species		
B3.2.1	Atlantic wolf fish, *Anarhichas lupus* (Havkat)	• Max 125 cm long • Habitat: hard and rocky seabed at depths between 20-50 m • Eats benthic animals like crabs, mussels and sea urchins
B3.2.2	Atlantic Halibut, *Hippoglossus hippoglossus* (Helleflynder)	• Max 200 cm long • Habitat: hard and soft bottom benthic habitats between 50-2000 m. Is partly pelagic. • Eats fish, scrimps, crabs and benthic habitats
B3.2.3	Greater forkbeard, *Phycis blennoides* (Skælbrosme)	• 40-45 cm long, max 110 cm • Habitat: near-bottom waters at 100-450 m
B3.2.4	Ling, *Molva molva* (Lange)	• Max 200 cm • Habitat: hard bottom habitats at 100-400 m
B3.2.5	Monkfish, *Lophius piscatorius* (Alm. havtaske)	• Max 200 cm long (often 50 cm) • Habitat: all types of benthic habitat from a few meters to 1000 m depth • Eats mainly fish
B3.2.6	Rabbit fish, *Chimaera monstrosa* (Havmus)	• Max 150 cm • Habitat: benthic habitats between 40-500 m • Eats crustaceans, molluscs and sea urchins

B4: Commercial fish species		
B4.1 Pelagic fish species		
B4.1.1	Herring, *Clupea harengus* (Sild)	• Max 40 cm long • Habitat: Pelagic down to about 200 m depth • Eats zooplankton especially copepods, krill and wing screws but also fish larvae
B4.1.2	Mackerel, *Scomber scombrus* (Makrel)	• Max 60 cm long • Habitat: pelagic shoal fish in upper water layers • Eats smaller fish
B4.1.3	Norway pout *Trisopterus esmarki* (Sperling)	• Max. ca 25 cm long • Habitat: pelagic shoal fish at 80-300 m depth, sometime close to the bottom • Eats zooplankton and smaller fish
B4.1.4	Saithe, *Pollachius virens* (Sej)	• Max 130 cm • Habitat: Pelagic shoal fish offshore and close to the shore down to 130 m depth • Eats zooplankton, krill, fish fry, herring, sprat and others
B4.1.5	Sprat, *Sprattus sprattus* (Brisling)	• Max 16 cm long • Habitat: Pelagic shoal fish in fjords and coastal waters down to 5-50 m during summer and 150m during winter. Demersal day-time, off-bottom in night-time • Eats zooplankton, especially copepods
B4.2: Demersal/Benthic fish species		
B4.2.1	Plaice, *Pleuronectes platessa* (Rødspætte)	• Max 90 cm, often not more than 50 cm long • Habitat: sandy or mixed bottom from near coast to about 200 m depth, grown plaice live mostly on 10-50 m depth while the young fish is found on more shallow water, mostly active during night time • Eats benthic animals, mostly thin shelled mussels, but also worms and crustaceans
B4.2.2	Sole, *Solea solea* (Tunge)	• Max 60 cm • Habitat: soft, sandy and muddy bottom in shallow water until about 150 m depth • Eats worms, small crustaceans and thin shelled mussels at the bottom, are active during night time
B4.2.3	Cod, *Gadus morhua* (Torsk)	• Max 110 cm long • Habitat: benthic waters from near coast until 5-600 m depth, sometimes pelagic • Eats all kinds of crustaceans, worms and molluscs
B4.2.4	Haddock, *Melanogrammus aeglefinus* (Kuller)	• Max 100 cm long • Habitat: near bottom at 10-20 m depth • Eats mostly benthic animals

B4.2.5	Hake, *Merluccius merluccius* (Kulmule)	• Max 135 cm long • Habitat: Demersal day-time, off-bottom in night-time at 70-400 m depth • Eats squids and smaller fish
B4.2.6	Sandeel (TBS), *Ammodytes spp.* (Tobis)	• Max ca. 25-35 cm long • Habitat: sand bottom in relatively shallow water • Eats zooplankton
B4.2.7	Turbot, *Psetta maxima* (Pighvarre)	• Max 100 cm long, often not more than 50 cm for males and 70 cm for females • Habitat: sandy, rocky or mixed bottom at 20-70 m depth • Eats mostly benthic fish, but also larger crustaceans and mussels
B4.3: Crayfish living in benthic habitats		
B4.3.1	Shrimp (HRJ), *Crangon crangon* (Hestereje/Sandreje)	• Max 8 cm long • Habitat: Shallow coastal waters (0 to 20 m) although there are records of up to 130 m depth. Sand or muddy sand • Eats all types of benthic animals
B4.3.2	Norwegian lobster (DVH), *Nephrops norvegicus* (Jomfruhummer)	• Max 24 cm • Habitat: Muddy bottoms in which it digs its burrows at 40-250 meters depth
B4.3.3	Pandalus (DVR) (*Pandalus borealis* (Dybhavsreje/Grønlandsreje)	• Max 16-17 cm long • Habitat: Bottom clay and mud at 50-500 m. Pelagic during night time • Eats smaller crustaceans and worms
B5: Sea birds		
B5.1	Auks, Alcidae (Razorbill/Guillemot) (Alkefugle)	• Winter abundance on rocky shores, cliffs and islands, some species are mainly pelagic/offshore • Razorbill dives usually down to 5-7 m depth but up to 10-15 m depth • Guillemot dives usually down to 1-8 m depth but commonly up to more than 20 m depth down to the bottom • Eats mostly fish and crustaceans
B5.2	Common scoter, *Melanitta nigra* (Sortand)	• Summer abundance-breeds on coastal islands or along ponds and lagoons near the ocean • Winter abundance - in coastal waters, especially over rocky bottoms • Dives for prey on or near bottom • Eats primarily aquatic invertebrates and molluscs (mussels), a little vegetation but also crustaceans

B5.3	Eider, *Somateria mollissima* (Ederfugl)	• Summer abundance- breeds on coastal islands or along ponds and lagoons near the ocean • Winter abundance- offshore near marine shoals • Dives down to the sea bottom • Eats primarily blue mussels but also crustaceans, other molluscs, aquatic invertebrates and sea urchins
B5.4	Fulmar, *Fulmarus*, *Fulmarus glacialis*, northern fulmar *Fulmarus glacialoides,* southern fulmar (Mallemuk)	• Winter abundance • Strong flyer that lives in offshore areas and forage by seizing its prey on the surface down to max 4 m depth • Eats shrimps, fish, jellyfish, squids and refuse from trawling boats
B5.5	Red-breasted Merganser, *Mergus serrator* (Toppet Skallesluger)	• Winter abundance in coastal shallow areas • Dives shallow • Eats mainly small fish, but also crustaceans
B5.6	Red-throated/Black-throated Diver (Rødstrubet/sortstrubet lom)	• Winter abundance at sea in coastal areas • Dives down to 2-9 m depth • Eats fish (e.g. sprat) but sometimes feeds on molluscs, crustaceans and aquatic invertebrates
B5.7	Long-tailed Duck, *Clangula hyemalis* (Havlit)	• Winter abundance in open ocean • Usually stays close to the surface but are able to dive down to 60 m depth • Eats molluscs, crustaceans and small fish, vegetation
B6: Marine mammals		
B6.1	Grey Seal, *Halichoerus grypus*	• Breed in colonies on and around the coast • Lives for 25 (males) or 35 (female) years • Dives to about 70 m depth, max 300 m • During the winter months grey seals can be seen hauled out on rocks, islands, and shoals not far from shore, occasionally coming ashore to rest • Feeds on a variety of fish, mostly benthic or demersal, e.g. Sandeel, Cod, flatfishs, herring and skates
B6.2	Harbour Seal, *Phoca vitulina*	• Solitary species, but may gather at haulouts and during breeding season • Lives for 20-25 (males) or 30-35 (female) years • Stays at familiar protected resting spots or haulout sites, generally rocky areas (although ice, sand, and mud may also be used), near a foraging area • During the winter months grey seals can be seen hauled out on rocks, islands, and shoals not far from shore, occasionally coming ashore to rest • Feeds on fish e.g. salmon, herring, mackerel, cod, whiting and flatfish, as well as shrimp, crabs and molluscs

B6.3	Harbour Porpoise, *Phocoena phocoena*	• Solitary species (sometimes forage in small packs), that lives in coastal areas or river estuaries • Average age about 15 years • Dives down to the bottom to max 200 m depth • Uses echolocation in dark murky waters for hunting • Feeds on fish – herring and sprat but also squid and crustaceans
B7: Recreational and archaeological interests		
B7.1	Bathing sites	• Danish beaches reordered and monitored as Blue flag bathing sites within EU • Used by humans for recreation and tourism
B7.2	Areas important for recreation and tourism	• Recreational use intensity, merged all activities e.g. Mapped places of visits (points) and routes (polylines) • Visit frequency (number of visits per year)
B7.3	Archaeological sites	• Archaeological sites are places with findings or settlements dated to Stone age, Bronze age and Viking age • The sites consist of e.g. settlements, former constructions for shipping as well as other types of findings • At all depth but many in shallow waters, near coastal areas and in estuaries or bays
B7.4	Shipwrecks	• Sites of recorded shipwrecks from recent times • Including a few archaeological ones from the Stone age, from historical times (1500-1900) and recent time. • Used for recreation

NIVA Denmark is the name, water is our game

NIVA Denmark Water Research is a regional office of the Norwegian Institute for Water Research (NIVA) established in 2014 to resolve environmental issues concerning the freshwater and marine systems that relate to Denmark.

NIVA Denmark has primary focus on research-based implementation of a number of EU's directives *inter alia* the Water Framework Directive, the Marine Strategy Framework Directive, and the Maritime Spatial Planning Directive together with international conventions (HELCOM, OSPAR, BDC). We occasionally provide consultancy to authorities and small and medium-sized companies.

NIVA Denmark is a place for practice, observation, testing and synthesis. Key research and test areas include eutrophication, hazardous substances, biodiversity, and ecosystem health as well as the implications of multiple human activities in marine waters and in streams, rivers and lakes. We develop indicators, monitoring methods and tools to assess the state of an ecosystem in order to carry out analyses and contribute to evidence based and sustainable solutions to the challenges we and the environment face.

NIVA Denmark, as a regional office to NIVA, has thus the backing of more than 200 dedicated researchers and experts.

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