Mapping Habitats on the OSPAR List of Threatened and/or Declining Species and Habitats

Data submited in 2020 and 2022 to OSPAR by the Netherlands

Author(s): Oscar G. Bos, Jan Tjalling van der Wal

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Summary

In 2008 OSPAR published a list of endangered and / or declining species and habitats in the north-eastern part of the Atlantic (OSPAR 2008). The distribution of the habitats is mapped in the EMODNet Seabed Habitat map viewer (https://www.emodnet-seabedhabitats.eu/access-data/launch-map-viewer/?zoom=3&center=-39.477,61.172&layerIds=800,801&baseLayerId=-3&activeFilters).

OSPAR Contracting Parties are asked regularly to submit national data on these OSPAR Threatened and/or Declining habitats (TD habitats) to update the EMODNet Seabed Habitat map viewer. This work is coordinated by the Joint Nature Conservation Committee (JNCC).

OSPAR TD habitats present in the Netherlands are (1) intertidal mudflats, (2) intertidal *Mytilus edulis* beds, (3) *Ostrea edulis* beds, (4) *Sabellaria spinulosa* reefs, (5) Sea pen and burrowing megafauna, and (6) Zostera beds, seagrass beds. For the Netherlands data on these habitats data were collected by Wageningen Marine Research, as commissioned by of the Dutch Ministry of Agriculture, Nature and Food Quality (LNV). This report describes the data submitted in 2020 and 2022 to OSPAR/JNCC and provides background information on how they were compiled and collected.

1 Introduction

In 2008 OSPAR published a list of endangered and / or declining species and habitats in the north-eastern part of the Atlantic (OSPAR 2008). The list is used by the OSPAR Committee as a guideline for setting priorities for measures for conservation and protection of marine biodiversity according to Annex V of the OSPAR Convention.

One of the joint actions to be taken by OSPAR Contracting Parties is the improvement of the OSPAR habitat mapping database (see action 2, https: //www.ospar.org/work-areas/bdc/species-habitats/implementation-of-species-and-habitat-recommendations). This work is coordinated by the UK by the Joint Nature Conservation Committee (JNCC) (https://jncc.gov.uk/our-work/marine-habitat-data-product-ospar-threatened-andor-declining-habitats/). Contracting Parties are asked regularly to submit data on OSPAR Threatened and / or Declining habitats (TD habitats) to update the EMODNet Seabed Habitat map viewer (https://www.emodnet-seabedhabitats.eu/access-data/launch-map-viewer/?zoom=3&center=-39.477,61.172&layerIds=800,801&baseLayerId=-3&activeFilters).

For the Netherlands the TD habitats data are collected and sent to JNCC by Wageningen Marine Research, as commissioned by of the Dutch Ministry of Agriculture, Nature and Food Quality (LNV).

This report shows the submitted TD habitats data for the year 2020 and 2022, and provides background information on how they were collected.

2 Materials and Methods

2.1 Selection of TD habitats

OSPAR threatened and / or declining habitats (TD habitats) are listed in OSPAR (2008). The definitions of the habitats are given in background documents (Table 1). The occurrence of TD habitats in the Netherlands have been presented in earlier reports (Bos et al., 2012; Bos & Tamis, 2020). TD habitats present in the Netherlands are: (1) intertidal mudflats (OSPAR, 2009), (2) intertidal *Mytilus edulis* beds (OSPAR, 2015), (3) *Ostrea edulis* beds (OSPAR, 2009), (4) *Sabellaria spinulosa* reefs (OSPAR, 2013), (5) Burrowing megafauna (OSPAR, 2010) and (6) *Zostera* beds (both *Zostera marina* and *Zostera noltii*).

Furthermore, we have searched for the habitats 'kelp forest' and 'haploops' habitats in our databases. For kelp no records were found. For haploops only 4 records were found, but the amphipod species *Haploops tubicola* had too low densities (14-29 ind/m^2) to be considered a reef (and were situated in the German part of the Dogger Bank.

Table 1. Overview of OSPAR TD habitat definitions.

TD habitat	Subtypes	Definition
Intertidal mudflats	Marine intertidal mudflats Estuarine intertidal mudflats	"Intertidal mud typically forms extensive mudflats in calm coastal environments (particularly estuaries and other sheltered areas), although dry compacted mud can form steep and even vertical faces, particularly at the top of the shore adjacent to salt marshes. The upper limit of intertidal mudflats is often marked by saltmarsh, and the lower limit by Chart Datum. Sediments consist mainly of fine particles, mostly in the silt and clay fraction (particle size less than 0.063 mm in diameter), though sandy mud may contain up to 80% sand (mostly very fine and fine sand), often with a high organic content. Little oxygen penetrates these cohesive sediments, and an anoxic layer is often present within millimetres of the sediment surface. Intertidal mudflats support communities characterised by polychaetes, bivalves and oligochaetes. This priority habitat has been divided into two sub-types, based on the predominant salinity regime." (OSPAR, 2009)
Intertidal *Mytilus edulis* beds on mixed and sandy sediments		"Sediment shores characterised by beds of the mussel *Mytilus edulis* occur principally on mid and lower shore mixed substrata (mainly cobbles and pebbles on muddy sediments) but also on sands and muds. In high densities (at least 30% cover) the mussels bind the substratum and provide a habitat for many infaunal and epibiotic species. This habitat is also found in lower shore tide-swept areas, such as in the tidal narrows of sealochs. A fauna of dense juvenile mussels may be found in sheltered firths, attached to algae on shores of pebbles, gravel, sand, mud and shell debris with a strandline of fucoids. (OSPAR Agreement 2008-7: Descriptions of habitats on the OSPAR List of threatened and/or declining species and habitats)" (OSPAR, 2015)
Ostrea edulis beds		"Beds of the oyster *Ostrea edulis* occurring at densities of 5 or more per m^2 on shallow mostly sheltered sediments (typically 0 – 10 m depth, but occasionally down to 30 m). There may be considerable quantities of dead oyster shell making up a substantial portion of the substratum. The clumps of dead shells and oysters can support large numbers of the ascidians *Ascidiella aspersa* and *A. scabra*. Several conspicuously large polychaetes, such as *Chaetopterus variopedatus* and terebellids, may be present as well as additional suspension-feeding polychaetes such as *Myxicola infundibulum*, *Sabella pavonina* and *Lanice conchilega*. A turf of seaweeds such as *Plocamium cartilagineum*, *Nitophyllum punctatum* and *Spyridia filamentosa* may also be present (Connor et al, 2004)."(OSPAR, 2009)
Sabellaria spinulosa reefs		"*S. spinulosa* is a small, tube-building polychaete worm found in the subtidal and lower intertidal/ sublittoral fringe. In most parts of its geographic range it does not form reefs but is solitary or found in small groups, encrusting pebbles, shell, kelp holdfasts and bedrock. When conditions are favourable, dense aggregations may be found, forming reefs up to about 60 cm high and extending over several hectares; these are often raised above the surrounding seabed. Reefs may persist in an area for many years although individual clumps may regularly form and disintegrate (Jackson & Hiscock, 2008; Jones et al., 2000)."(OSPAR, 2013)
Seapen and Burrowing megafauna communities		"Plains of fine mud, at water depths ranging from 15–200 m or more, which are heavily bioturbated by burrowing megafauna; burrows and mounds may form a prominent feature of the sediment surface with conspicuous populations of sea-pens, typically *Virgularia mirabilis* and *Pennatula phosphorea*. The burrowing crustaceans present may include *Nephrops norvegicus*, *Calocaris macandreae* or *Callianassa subterranea*. In the deeper fjordic lochs which are protected by an entrance sill, the

		tall sea-pen *Funiculina quadrangularis* may also be present. The burrowing activity of megafauna creates a complex habitat, providing deep oxygen penetration. This habitat occurs extensively in sheltered basins of fjords, sea lochs, voes and in deeper offshore waters such as the North Sea and Irish Sea basins and the Bay of Biscay. (OSPAR other agreement 2008-7)" (OSPAR, 2010)
Zostera beds, Seagrass beds	*Zostera marina*	"*Zostera marina* forms dense beds, with trailing leaves up to 1m long (up to 2 m in Western Europe (Brittany France) (Hily et.al. 2003), in sheltered bays and lagoons from the lower shore to about 5 m depth, occasionally down to 10 m (in Sweden and Norway) if water is very clear, typically on sand and sandy mud (occasionally with an admixture of gravel). Where their geographical range overlaps, such as the Solent in the UK, *Z. marina* passes upshore to *Z. noltii* "(OSPAR, 2009).
	Zostera noltii	*Z. noltii* forms dense beds, with leaves up to 20 cm long, typically in the intertidal region (although it can occur in the very shallow subtidal), on mud/sand mixtures of varying consistency. To qualify as a *Zostera* 'bed', plant densities should provide at least 5% cover (although when *Zostera* densities are this low, expert judgement should be sought to define the bed). More typically, however, *Zostera* plant densities provide greater than 30% cover." (OSPAR, 2009)

2.2 Data submission guidance

The Joint Nature Conservation Committee (JNCC) in the UK is responsible for processing the data of the OSPAR Contracting Parties. JNCC has developed a guidance document (OSPAR Habitat Data Submission Guidance, version 1.6) which contains instructions how to submit data to JNCC. In addition, JNCC organized two webinars in April 2020 and in July 2022 with the national coordinators to explain the submission process. The national coordinators were provided with a package containing templates and example excel files and shapefiles.

The datasets submitted by The Netherlands consist of polygons (shapefiles) or point data (excel files). In addition, per dataset an excel sheet is provided with metadata, describing the datasets including sampling techniques used and reference to literature for background information, according to the instructions in the guidance document.

The OSPAR data are combined by JNCC and accessible via the EMODnet Seabed Habitats map viewer (https://www.emodnet-seabedhabitats.eu/access-data/launch-map-viewer/?zoom=3&center=-39.477,61.172&layerIds=800,801&baseLayerId=-3&activeFilters) (Figure 1).

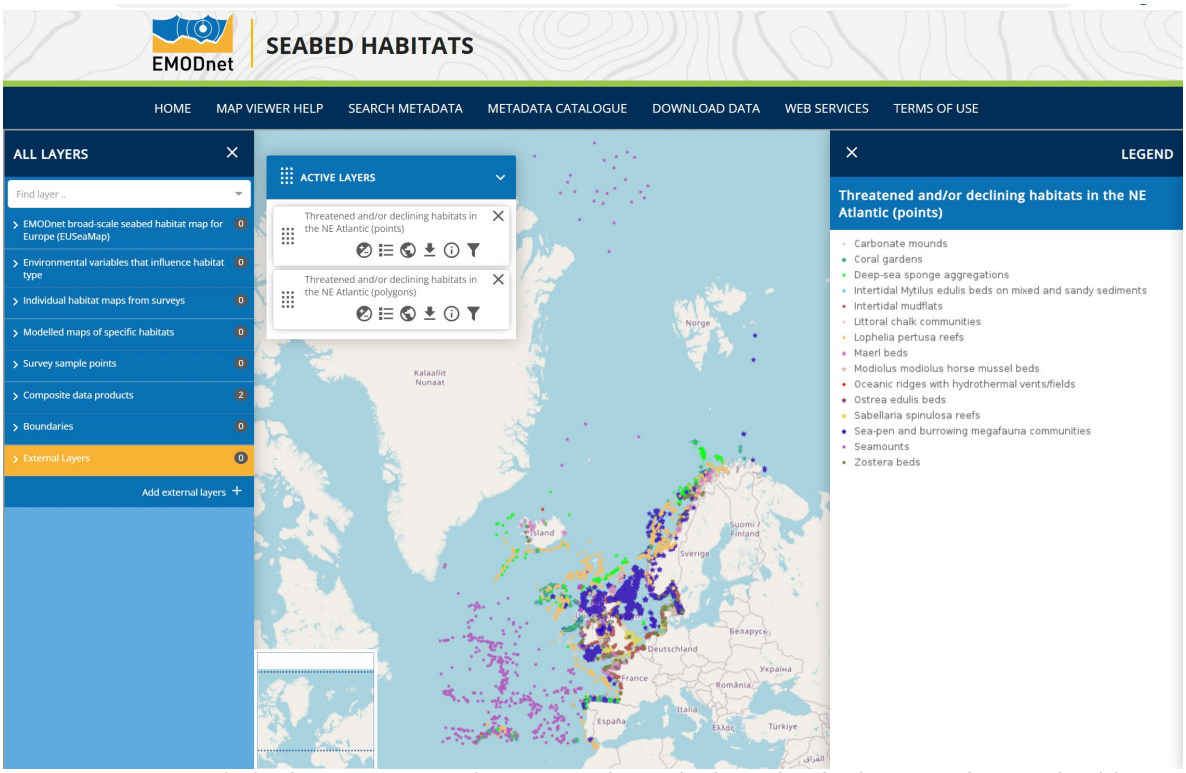

Figure 1. EMODnet Seabed Habitats map viewer showing point data and polygon data for the OSPAR threatened and / or declining habitats (accessed Nov 2022) (https://www.emodnet-seabedhabitats.eu/access-data/launch-map-viewer/?zoom=3&center=-39.477,61.172&layerIds=800,801&baseLayerId=-3&activeFilters).

2.3 Data preparation

Table 2 provides a summary of data used to compile maps for each TD habitat. More information is given in the paragraphs below.

Table 2. Overview of data sources for OSPAR TD habitats in the Netherlands.

TD habitat	Area in NL	Data source / compilation method	Classification of presence of the habitat for the OSPAR map (certain/uncertain)
1. Intertidal mudflats			
	Wadden Sea	Data compiled by Baptist et al. (2016). Selection: intertidal categories ('laag-litoraal' (low-littoral), 'midden-litoraal' (mid-littoral) and 'hoog-litoraal' (high-littoral))	Certain
	Wadden Sea – Eems Dollard	Data compiled by Baptist et al. (2016). Selection: 'Estuarine intertidal mudflat'	Certain
	Delta area and Eastern and Western Scheldt	For the Delta area (Voordelta, Eastern Scheldt, Western Scheldt) Ecotope maps of Rijkswaterstaat were used. In the dataset, each ecotope polygon is assigned to a certain Habitat Directive habitat type (1140B, 1160, 1310, 1320). To obtain the tidal part of the habitat, polygons were combined with a bathymetry map (TNO-NITG). The following HD habitat types included intertidal mudflats:	
		• H1140B - Mudflats and sandflats not covered by seawater at low tide	Certain
		• H1160 – Large shallow inlets and bays	Certain
		• H1310A – Salicornia and other annuals (living only one season) colonizing mud and sand	Uncertain
		• H1320 – Spartina swards	Uncertain
2. Intertidal *Mytilus edulis* beds on mixed and sandy sediments			
		Data are collected in the field annually and described in a report (Van den Ende et al. 2020, Troost et al. 2021). Three habitat types are distinguished:	
		• Mixed mussel/oyster beds (*Mytilus edulis* and *Crassostrea gigas*: 'mussel/oyster')	Certain
		• *Mytilus edulis* mussel beds ('mussel')	Certain
		• *Crassostrea gigas* oyster beds ('oyster').	Uncertain
3. *Ostrea edulis* beds			
		Currently there is only one natural European flat oyster reef known in the Dutch North Sea. This is described in Christianen et al. (2018).	Certain
4. *Sabellaria spinulosa* reefs			
		Currently there is only one *Sabellaria spinulosa* reef known in the Dutch North Sea. This is described in Van der Reijden et al. (2019)	Certain
5. Seapen and Burrowing megafauna communities			
		Data were obtained from the national North Sea benthos N2000/MSDF monitoring with a boxcorer. Data were aggregated in 2500mx2500m grid cells, since sampling does not occur at exactly the same spot. The burrowing megafauna was considered to be present in a grid cell if any of the selected taxa was present in 2 or more years from the available 4 years. All grid cells fulfilling the >10% silt content and presence of selected taxa for 2 or more years, were considered 'uncertain'.	Uncertain
6. *Zostera* beds, Seagrass beds			
	Zostera marina *Zostera noltii*	Zostera is monitored every three years. Zostera polygons (both species) were directly taken from the Rijkswaterstaat geoportal https://geoservices.rijkswaterstaat.nl/arcgis2/rest/services/GDR/zeegras/MapServer. Data are described in Schutter et al.(2021), Zwarts et al. (2018) and Tolman & Pranger (2016).	Certain

2.3.1 Intertidal mudflats

Figure 2. Intertidal mudflats in the Wadden Sea (photo: Oscar Bos, Wageningen Marine Research).

Intertidal mudflats (Figure 2) are present in the Wadden Sea in the northwestern part of the Netherlands, and in the region of Zeeland (Delta area and the Eastern – and Western Scheldt) in the southwest.

Wadden Sea

For identification of the intertidal mudflat habitat in the Wadden Sea, ecotope data from the Wageningen Marine Research Open Data portal (https://opengeodata.wmr.wur.nl/geoserver/) was used. This data set by Baptist et al. (2016) is based on the Dutch Ecotope System for Coastal Waters (ZES.1) described in Bouma et al. (2005). From this data set the intertidal habitats were identified by selecting the categories ('laag-litoraal' (low-littoral), 'midden-litoraal' (mid-littoral) and 'hoog-litoraal' (high-littoral)) and for the Eems-Dollard area by 'Estuarine intertidal mudflat'. The rest of the intertidal Wadden Sea area was considered 'Marine intertidal mudflats'. All of these habitats were classified as 'certain'.

Delta area and Eastern and Western Scheldt

Data on the location of intertidal mudflats was derived from ecotope maps for the Delta area (Voordelta (ecotope map 2015), Eastern Scheldt (NL Oosterschelde) (2016) and Western Scheldt (NL: Westerschelde) (2018) through the Dutch National Georegister (http://www.nationaalgeoregister.nl/geonetwork/srv/dut/catalog.search#/metadata/291d329a-a421-41f4-b219-a904756e7aa5). In the ecotope maps also information on Habitat Directive habitat types is included. Nearly all of the ecotopes in the Western Scheldt were classified as H1130 (Estuary) and the majority in the Eastern Scheldt as H1160 (Large Bays), and in parts of the Voordelta as H1140B. These polygons were combined with a 2010 bathymetry map (available through https://www.defensie.nl/onderwerpen/hydrografie/) to distinguish between subtidal and intertidal. Polygons were classified as intertidal based on the water depth, indicative of being intertidal (littoral) or not. For water depth no exact limits were used, a.o. because the depth at which intertidal/littoral habitat occurs changes within the estuary. Also a visual interpretation was used to decide whether a given polygon partially overlapping intertidal area, should or should not be included. Spidery polygons (= creeks = predominantly wet/water covered) were excluded. The presence of intertidal mudflats was considered 'certain' for the ecotope polygons classified as HD habitat types 'H1140B - Mudflats and sandflats not covered by seawater at low tide' or 'H1160 – Large shallow inlets and bays'.

The presence of intertidal mudflats was considered 'Uncertain' for habitat types 'H1310A – *Salicornia* and other annuals (living only one season) colonizing mud and sand' and 'H1320 – *Spartina* swards'.

2.3.2 Intertidal Mytilus edulis beds

Figure 3. Intertidal mussel beds in the Wadden Sea (photo: Oscar Bos, Wageningen Marine Research).

In the Netherlands, three types of intertidal shellfish beds are present: mixed mussel/oyster beds (*M. edulis* and *Maggalana gigas* (syn. *Crassostrea gigas*): 'mossel/oester'), *M. edulis* beds ('mossel') and oyster beds (*Maggalana gigas*: 'oyster'). Data of commercial shellfish species are collected and reported annually by Wageningen Marine Research (WMR) for the ministry of LNV (Van den Ende et al. 2020, Troost et al. 2021).

Researchers estimate the size and contours of littoral mussel and oyster beds by walking around the beds at low tide, using a handheld GPS. Since it is impossible to visit all areas each year, as many areas as possible within the available time frame are visited.

Wadden Sea

In the Wadden Sea, prior to the GPS survey by foot, an inspection flight is carried out, to visually check where the major changes in mussel or oyster beds have occurred. When selecting areas to visit, these areas are then given priority.

Eastern and Western Scheldt

In the Eastern and Western Scheldt areal pictures are used for the same purpose (Van den Ende et al., 2020). If a new mussel bed is found, its age is determined by inspecting the size and appearance of the mussels. If and age is determined of more than one year, datasets of previous years (up to two years) are altered accordingly. The final area estimation can therefor only be given after two years, (Van den Ende et al., 2020). Next, data of the measured beds are combined with data of beds that were seen in inspection flights or areal pictures but only measured in previous years to estimate the total surface area.

For 2020, we used the shapefiles of the quality assured mussel bed data of 2016 (Eastern Scheldt, Western Scheldt) and 2017 (Wadden Sea) (C. van Zweeden, WMR, pers. com). In the attribute table of the shapefile, mussel/oyster and mussel beds are classified as 'certain', while oyster beds are classified as 'uncertain'. In 2022, these data were updated with the 2020 spring data (Eastern Scheldt, Western Scheldt, Wadden Sea) (Troost et al. 2021).

2.3.3 *Ostrea edulis* beds

Figure 4. Flat oyster reef in the Voordelta (photo: Oscar Bos, Wageningen Marine Research).

In the Dutch North Sea only one natural European flat oyster reef is present (Figure 4). This reef was found in the Voordelta, near the Brouwersdam in October 2015 and covers about 40 ha (Christianen et al., 2018). It is believed that this reef is formed from spat of a flat oyster reef located in the nearby Lake Grevelingen, where they still occur naturally.

Oyster densities were on average 6.8 individuals/m^2. The method used to monitor oyster density was 'diver survey' and 'diver video'. To determine the extent of the oyster reef, scuba divers determined the outer edges by checking for oyster densities > 5 ind/m^2 (see definition in Table 1), marking the edge with small buoys of which the GPS position was determined by others in a boat (for details, see Christianen et al., 2018). Since 2015 no other natural flat oyster reefs have been found in the Dutch North Sea. Data about the Voordelta reef were classified as 'certain'.

In the rest of the Delta area (Eastern Scheldt (NL Oosterschelde), Western Scheldt (NL Westerschelde)) the flat oyster also occurs on aquaculture plots and perhaps also in beds, but data on the distribution of natural flat oyster beds in these areas are lacking. Therefore it was decided to leave them out. We also left out data of single oyster findings and of current oyster restoration projects in the North Sea, as reported by Bos et al. (2019, 2022). They are left out, because these observations do not match the definition of oyster beds (Table 1).

2.3.4 *Sabellaria spinulosa* reefs

Figure 5. Ross worm (Sabellaria spinulosa) reefs on the Brown Ridge (photo: OCEANA).

Three small *Sabellaria spinulosa* reefs were discovered in 2017 during the OCEANA project 'Protecting the North Sea 2017: Biodiversity Hotspots and recovering fish stocks'. OCEANA investigated the benthic habitat of the Dutch Brown Bank area by means of sediment grabs, video attached to a remote operated vehicle ROV and acoustics (multi-beam) surveys. These reefs are the only *Sabellaria* reefs described for the Netherlands so far with a minimum extent of 1016 m^2. The area comprises a large-scale sandbank and adjacent troughs within which the reefs were found. Results are described in Van der Reijden et al. (2019) and Garcia et al. (2020) (Figure 5). Positions of the reefs reported here were obtained directly from OCEANA. Data were classified as 'certain' because the reefs were clearly visible on ROV video footage (see https://eu.oceana.org/en/file/90367).

Since solitary or small patches of *Sabellaria spinulosa* do not count as the habitat type, such findings were left out (for data see Bos et al. 2019, 2023 in prep.).

2.3.5 Seapen and burrowing megafauna communities

Figure 6. Burrowing megafauna (Callianassa subterranea) (photo: Oscar Bos, Wageningen Marine Research).

This habitat is present in the muddy areas in the middle of the Dutch North Sea. However, the definition of this habitat type is not very precise (Table 1): "*Plains of fine mud, at water depths ranging from 15–200 m or more, which are heavily bioturbated by burrowing megafauna*...". Therefore we developed calculation rules to identify this habitat.

Data were taken from the 3-yearly North Sea MWTL benthos monitoring programme (https://waterinfo-extra.rws.nl/monitoring/biologie/bodemdieren) using boxcores, available from the Dutch Marine Information and Data Centre (https://www.informatiehuismarien.nl/open-data/). The dataset can be downloaded from "Regular Monitoring RWS > Biology > Benthos Noordzee". Available years were: 2009, 2010, 2012, 2015 (Not yet available: 2018, 2021). Data are described in Leewis et al (2015). More reports (https://waterinfo-extra.rws.nl/monitoring/biologie/bodemdieren/bodemdieren-noordzee/). For the monitoring, a Reineck boxcorer (0.078 m^2) is used.

Based on the definition of the habitat (Table 1), and due to the absence of seapens, we used the presence of burrowing shrimp (Figure 6) and lobsters to identify suitable habitat for burrowing megafauna communities. The relevant taxa present in the data set are listed in Table 3.

Table 3. Taxa selected from the MWTL Benthos dataset to be part of Seapen and Burrowing megafauna communities.

Taxa	Present in dataset?
Callianassa (genus)	present
Callianassa subterranea	present
Nephrops norvegicus	present
Upogebia (genus)	present
Upogebia deltaura	present
Upogebia stellata	present
Pennulata phosphorea	not present

To determine the presence of the habitat type, and exclude single observations of burrowing crustaceans, we assumed that one characteristic of the habitat type would be that it would occur over longer time periods, and that therefore the burrowing crustaceans needed to be present in more than one year in a certain area. Since sampling does not occur at exactly the same spot, we chose to aggregate the data for which a grid of 2500 x 2500 m was constructed. The burrowing megafauna was considered to be present in a grid cell if any of the selected taxa was present in 2 or more years from the available 4 years.

Another characteristic of the habitat type is the presence of plains of fine mud. To select grid cells with fine mud, a map of silt percentage (raster data) was taken from TNO-NITG, compiled in 2008 for the MESH project and grid cells containing > 10% silt were selected. All grid cells fulfilling the >10% silt content and presence of selected taxa for 2 or more years, were considered 'uncertain', since it is not clear if the approach taken here can guaranty that the habitat is really present.

2.3.6 *Zostera* beds, Seagrass beds

In the Netherlands, two species of seagrass occur: *Zostera noltii* and *Z. marina*. Seagrass is present in the Wadden Sea and Delta area and is 3-yearly monitored through an intertidal survey commissioned by Rijkswaterstaat. Data were provided for 2017, 2019 and 2020. % Coverage is estimated in 20x20 m cells in the field (Schutter et al. 2021; Zwarts et al., 2018; Tolman & Pranger, 2016). *Zostera* polygons were directly taken from the Rijkswaterstaat geoportal
https://geoservices.rijkswaterstaat.nl/arcgis2/rest/services/GDR/zeegras/MapServer
In the Wadden Sea the survey was conducted by Schutter et al.(2021), Zwarts et al. (2018) and in the Delta area by Tolman & Pranger (2016). All data were classified as 'certain'.

2.4 Submitted datasets

After data preparation, metadata were described per dataset and per survey in excel sheets, including used survey techniques and references to data reports, following the Guidance document. The Dutch OSPAR TD habitats datasets and surveys were coded according to the coding suggestions in the guidance document (Table 4).

Table 4. Overview of OSPAR TD habitat datasets submitted to JNCC by The Netherlands in 2020 and 2022.

OSPAR TD habitat	Dataset	Surveys within dataset
Intertidal mudflats	OSPARHab2020NL1v1	NL_WZecotopesWMR
		NL_VDhabitatsRWS
		NL_OShabitatsRWS
		NL_WShabitatsRWS
Intertidal *Mytilus edulis* beds	OSPARHab2020NL2v1	NL_WMR_VJ_2016_OS
		NL_WMR_VJ_2016_WS
		NL_WMR_VJ_2017_WZ
	OSPARHab2022NL2v1	NL_WMR_OS_VJ20_WGS84
		NL_WMR_WS_VJ20_WGS84
		NL_WMR_WZ_VJ20_VJ20_WGS84
Ostrea edulis beds	OSPARHab2020NL3v1	NL_NL3Surv1
Sabellaria spinulosa reefs	OSPARHab2020NL4v1	NL_OceanaNLSurv2
Sea pen and burrowing megafauna	OSPARHab2020NL5v1	NL_MWTLrefdApril2020
Zostera beds, seagrass beds	OSPARHab2020NL6v1	NL_2017Waddenzee
		NL_2019Delta_ZW_Nederland
	OSPARHab2022NL6v1	NL_2020Waddenzee
		NL_2020Delta_ZW_Nederland

3 Results

3.1 Intertidal mudflats

The habitat ' Intertidal mudflats' occurs in the Wadden Sea (Figure 7, upper panel) and in the Delta area (Voordelta, Western Scheldt and Eastern Scheldt, Figure 7, lower panel).

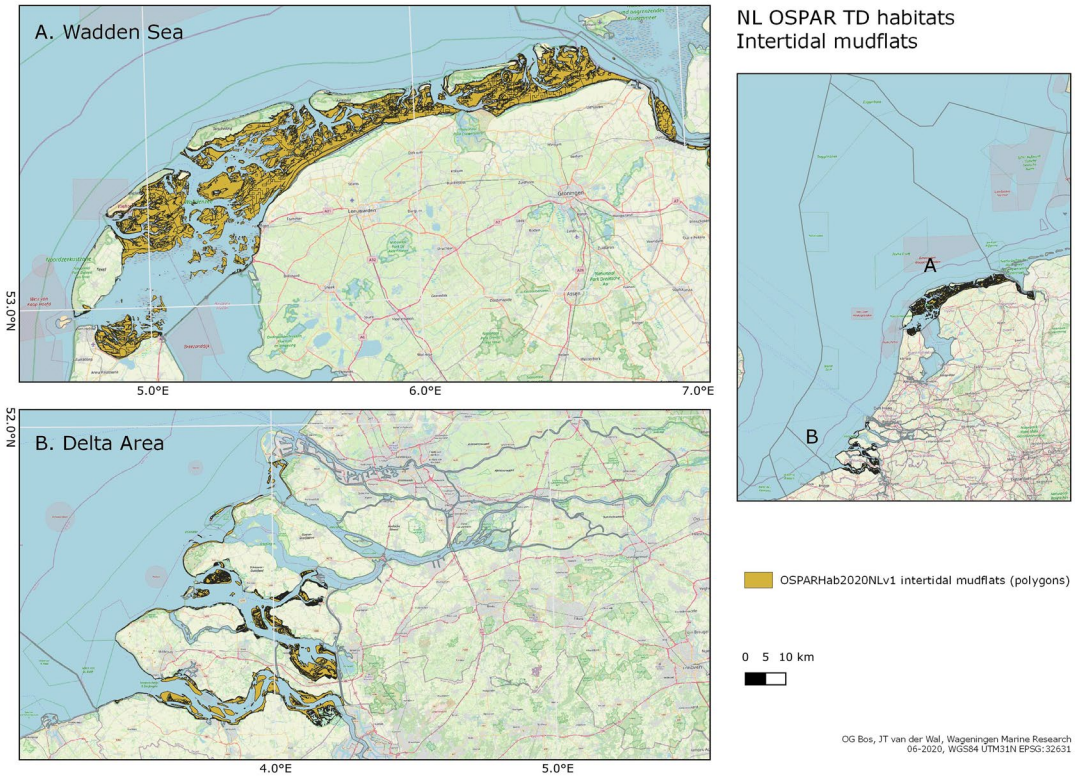

Figure 7. Distribution of OSPAR TD habitat 'Intertidal mudflats' in 2012 in the Wadden Sea and 2015-2018 in the Delta area in the Netherlands for the 2020 OSPAR database.

3.2 Intertidal *Mytilus edulis* beds

Intertidal mussel beds occur in the Wadden Sea (Figure 8, upper panel) and Delta area (mainly Eastern Scheldt (NL: Oosterschelde), less so in the Western Scheldt (NL: Westerschelde) (Figure 8, lower panel).

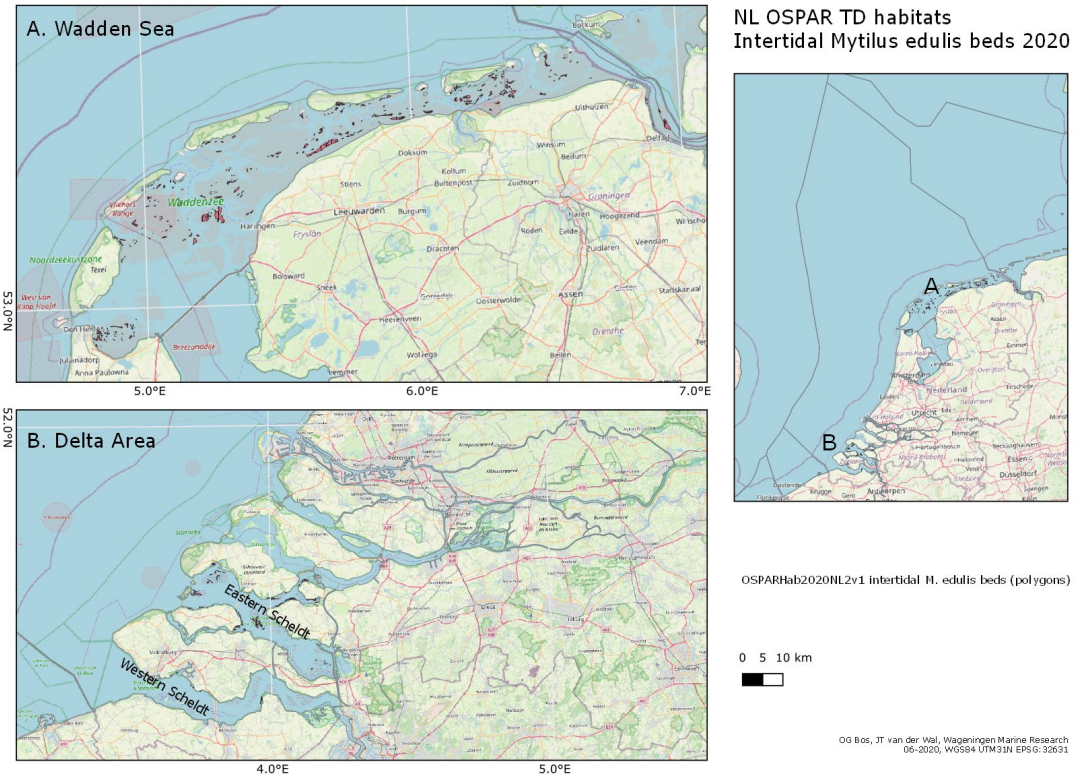

Figure 8. Distribution of OSPAR TD habitat 'Intertidal Mytilus edulis beds' in 2017 in the Netherlands (Van den Ende et al. 2020) for the 2020 OSPAR database. Mussel beds are indicated with the small red polygons.

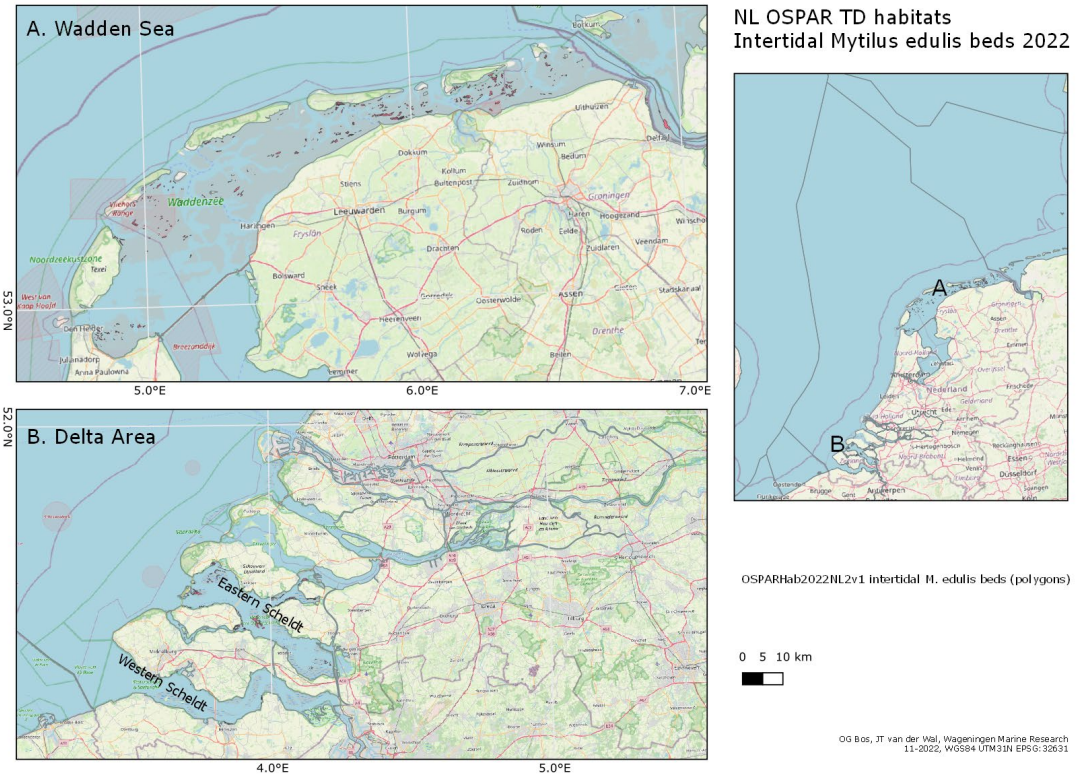

Figure 9. Distribution of OSPAR TD habitat 'Intertidal Mytilus edulis beds' in 2020 in the Netherlands (Troost et al. 2021) for the 2022 OSPAR database. Mussel beds are indicated with the small red polygons.

3.3 *Ostrea edulis* beds

In the Dutch North Sea only one natural flat oyster reef is present, covering about 40 h (Figure 10).

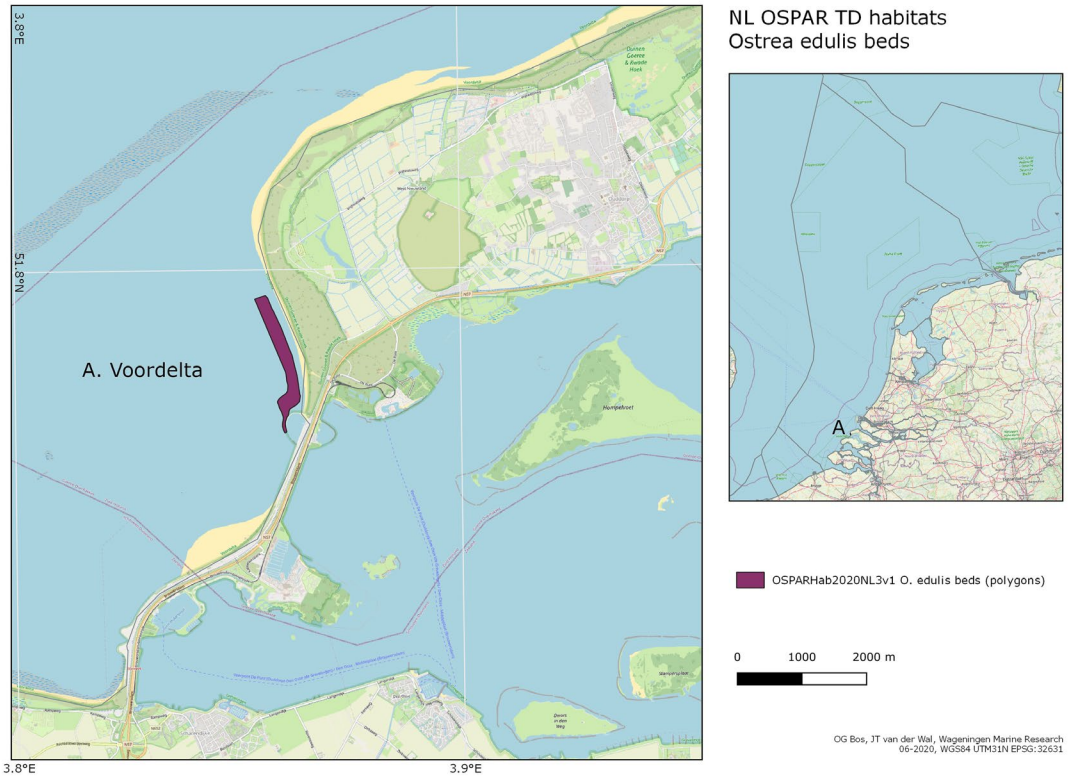

Figure 10. Distribution of OSPAR TD habitat 'Ostrea edulis' since 2015 in the Netherlands (Christianen et al., 2018) for the 2020 OSPAR database.

3.4 *Sabellaria spinulosa* reefs

Only three small reefs of *Sabellaria spinulosa* are known for the Dutch North Sea (Van der Reijden et al. 2018), for which point data are given. Data of small clumps of Sabellaria near or on e.g. shipwrecks or platforms have been summarized in Bos et al. (2019, 2023 in prep.) and are not shown here.

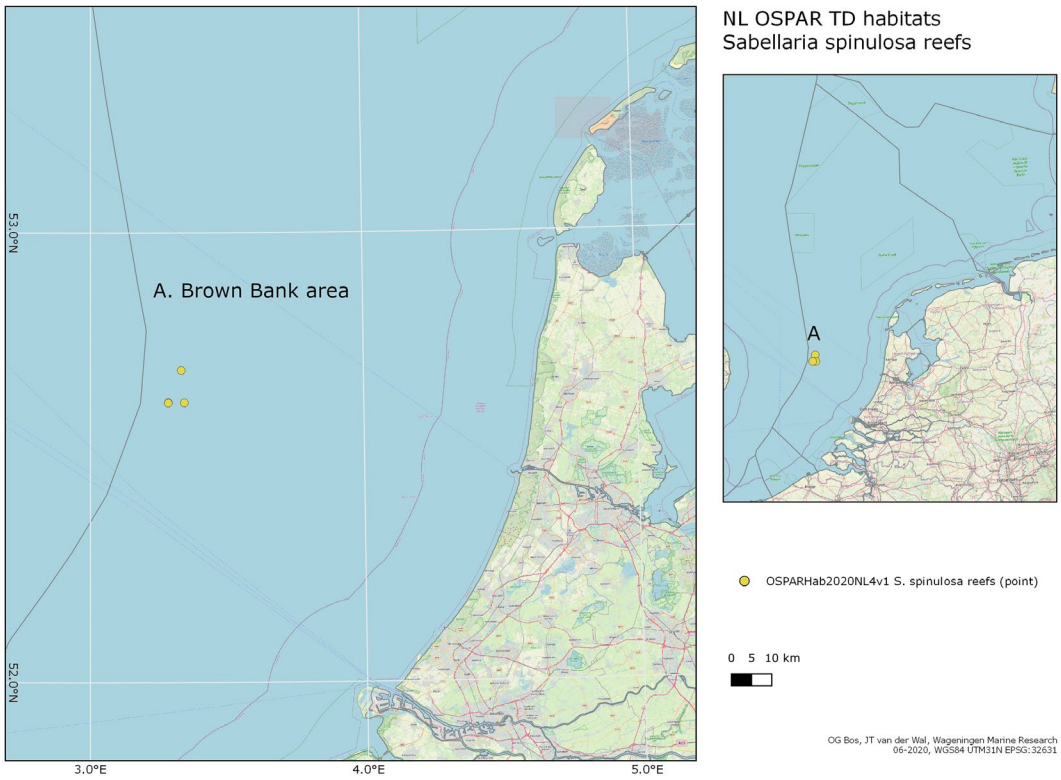

Figure 11. Distribution of OSPAR TD habitat 'Sabellaria spinulosa *reefs' as found in 2017 in the Netherlands (Van der Reijden et al. 2018) and submitted for the 2020 OSPAR database.*

3.5 Sea pen and burrowing megafauna communities

In the Netherlands, sea pens are absent. Based on the presence of different burrowing shrimp species, burrowing megafauna communities occur in the deeper middle part of the Dutch North Sea (Figure 12).

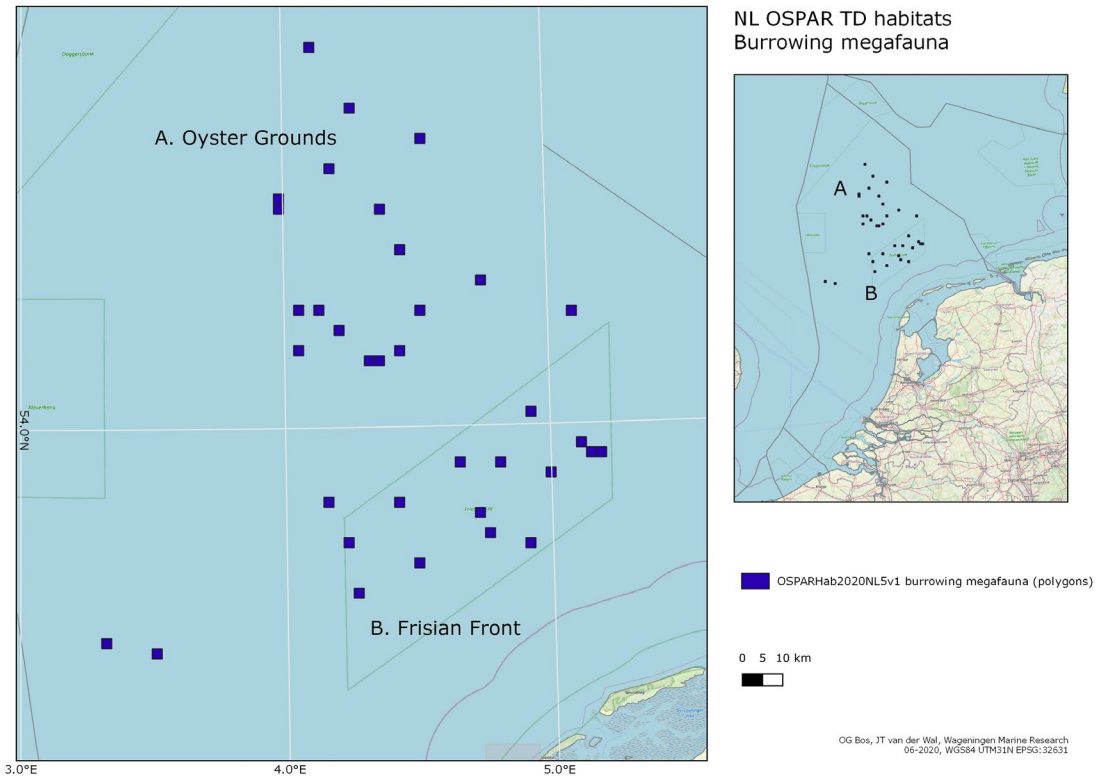

Figure 12. Distribution of OSPAR TD habitat 'Burrowing megafauna' in 2009-2015 in the Netherlands for the 2020 and 2022 OSPAR database.

3.6 Zostera beds, Seagrass beds

Zostera beds occur in the western Wadden Sea (Figure 13, upper left panel), eastern Wadden Sea (Figure 6, middle left panel) and Delta area (mainly Eastern Scheldt, NL: Oosterschelde) (Figure 13, lower panel).

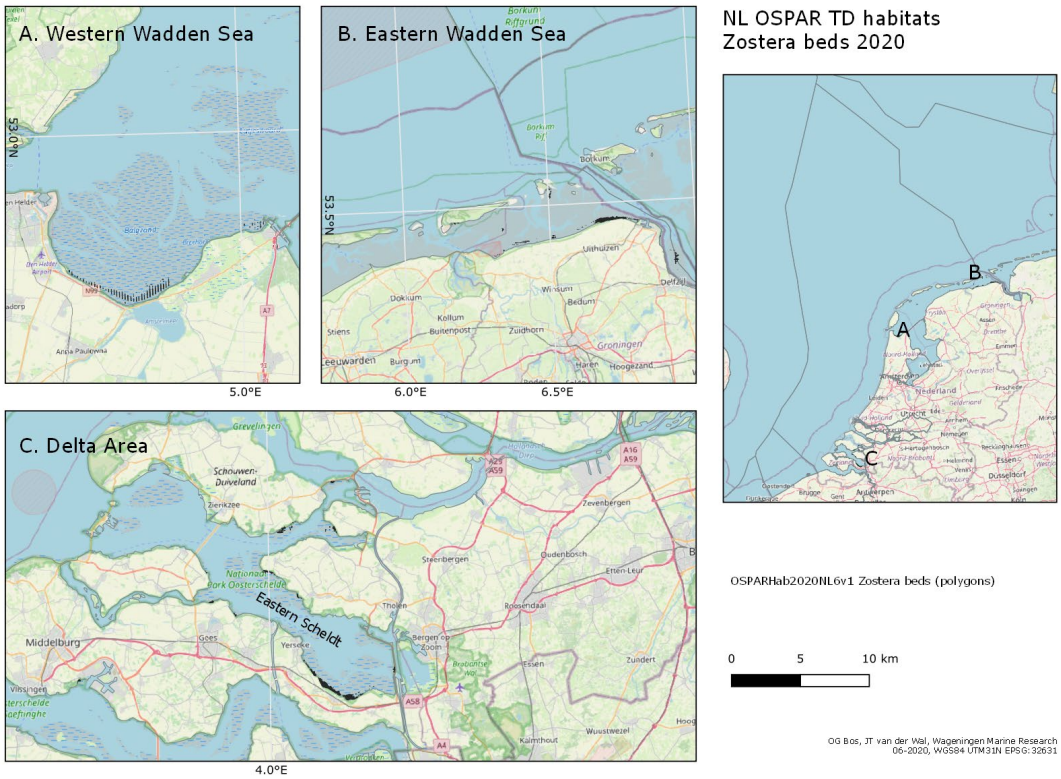

Figure 13. Distribution of OSPAR TD habitat 'Zostera beds, Seagrass beds' in 2017 (Wadden Sea) and 2019 (Delta area) in the Netherlands for the 2020 OSPAR database (Zwarts et al., 2018; Tolman & Pranger, 2016). Zostera beds are indicated with the black polygons and dots. In the Delta Area seagrass mainly occurs in the Eastern Scheldt .

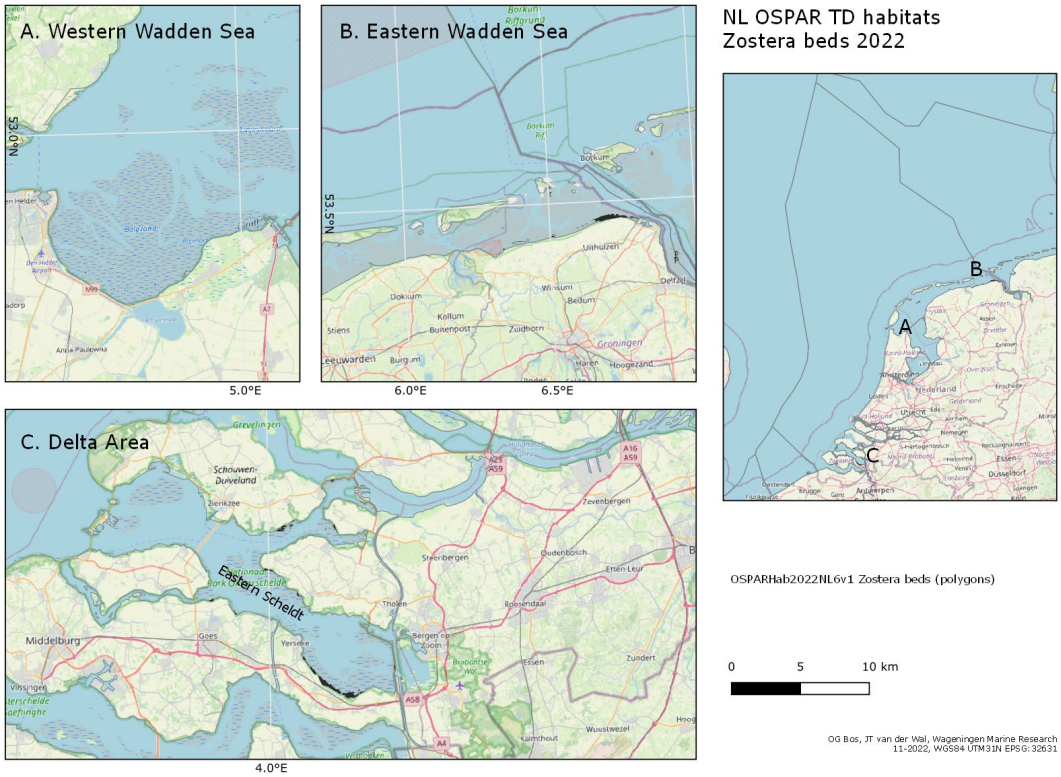

Figure 14. Distribution of OSPAR TD habitat 'Zostera beds, Seagrass beds' in 2020 (Wadden Sea) and 2019/20 (Delta area) in the Netherlands for the 2022 OSPAR database (Schutter et al. 2021). Zostera beds are indicated with the black polygons and dots. In the Delta Area seagrass mainly occurs in the Eastern Scheldt.

4 Conclusions and recommendations

Datasets were collected for 6 OSPAR threatened and / or declining habitats: intertidal mudflats, intertidal *Mytilus edulis* beds, *Ostrea edulis* beds, *Sabellaria spinulosa* reefs, Sea pens and burrowing megafauna and *Zostera* beds. For most these habitat types, collecting data was quite straightforward, since nowadays data are either stored on national geoportals or in accessible databases.

The intertidal mudflats habitat was composed by expert judgement and using different sources (bathymetric data and ecotope maps with information on Habitat Directive habitat types). Fine scale inspection of the resulting habitat area revealed that that some beaches are included that should be excluded. Since this concerns only a small part of the map, we decided to leave the dataset as it is.

For the habitat type ('Sea pen and burrowing megafauna') the definition of the habitat type is not very explicit. Multiple ways to derive to this habitat type exist. Here we used our own set of rules to define the presence of the habitat on the basis of benthos and sediment data. We recommend that OSPAR provides more guidance on how to practically determine absence/presence of this habitat to be able to identify this habitat between the countries in a more uniform way.

Finally, we recommend that specific monitoring for Sabellaria reefs will be set-up, since this is the only OSPAR TD habitat of which the distribution in the Dutch North Sea is still largely unknown.

5 Quality Assurance

Wageningen Marine Research utilises an ISO 9001:2015 certified quality management system. The organisation has been certified since 27 February 2001. The certification was issued by DNV.

If the quality cannot be guaranteed, appropriate measures are taken.

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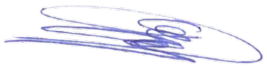
Justification

Report
Project Number: 431810274 (2020) and 4318100274 (2022)

The scientific quality of this report has been peer reviewed by a colleague scientist and a member of the Management Team of Wageningen Marine Research

Approved: Sander Glorius
researcher

Signature: 

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Date: 30-11-2022

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