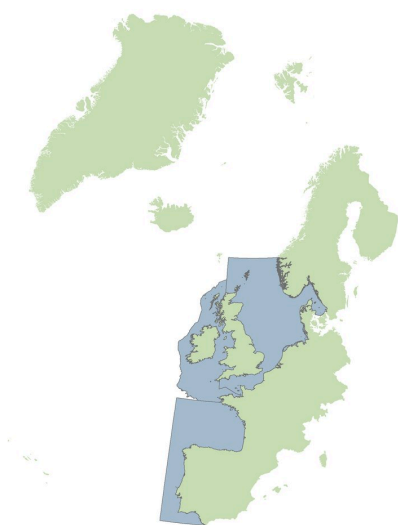


Status Assessment 2023 - Intertidal Mudflats

Compared to the last report from 2009, the **status** of mudflats is still poor in the OSPAR area. While the geographical distribution and extent of the habitat are generally good and stable (in Regions II, III and IV, no data for I), the condition of intertidal mudflats is poor due to multiple anthropogenic pressures including **climate change**, nutrient enrichment, invasive species and hydrological changes (e.g., construction).



(/en/ospar-assessments/quality-status-reports/qsr-2023/)

								Previous OSPAR status assessment	Status (overall assessment)		⊕ Table Legend
		Distribution		Extent		Condition					⊕ Method of Assessment
Region	I	?		?		?		•	?		
	II	↔	1,3	↔	1,3	↔	3,5	•	Poor	3,5	
	III	↔	1,3,5	↔	1,2,3,5	↓	3	•	Poor	3	
	IV	↔	3	?		↔	3,5	•	Poor	3,5	
	V	NA		NA		NA		NA	NA		

		*Habitat damage & loss		*Hydrographical changes		*Hazardous substances		*Oil pollution		*Climate changes		Introduction of non-indigenous species and translocations			Removal of target and non-target species		Nutrient and organic enrichment		Threat or impact	
Region	I	?		?		?		?		?		?			?		?		?	
	II	?	1,2,3,5	?	2,5	? 2,5		?2,5		?		↑	2,5		?	3,5	?	2,5	?	
	III	?	3,5	?	1,2,5	?	2	?1,2		?1		?1,5			?1,2		?1,2		?	
	IV	↔	2	↔	2	↓	2	↔	2	?			↔	↑	1	↔	2	↔	2	?
	V	?		?		?		?		?		?			?		NA		NA	

Confidence

Medium: The confidence in this assessment is medium. A lot of information has been taken from the EU Habitats Directive (HD) Article 17 assessments (2019) (**Figure 1** and **Figure 2**), which cover broader habitats (1140 and 1130) than the OSPAR-habitat (**Figure 3**). The OSPAR area is broader however. Relevant EU Member States are: SE, DK, DE, NL, UK (still in 2018), IE, FR, ES, PT. Non-EU members are IS and NO.

Figure 1 also shows that different countries report differently for the same HD assessment, since colours are largely specific to countries (IE orange, UK red, NL orange, DE green, etc) for unknown reasons. In general, however, the habitat is well visible, presumably leading to a good confidence in conclusions on extent and distribution (in contrast to e.g., deep sea habitats), but not always well monitored in terms of condition and threats (less certain conclusions). Finally, not all Contracting Parties were able to deliver input; the reasons for this are unknown.

1. Relation between EU Habitat Directive habitat types 1140, 1130 and OSPAR mudflats:

The conclusions on this habitat type are largely based on the HD 1140 and 1130 Article 17 reporting, and further detailed based on information delivered by Contracting Parties. Assessments on HD scale may imply some room for error, because HD conclusions may be valid for a broader habitat type than the OSPAR mudflats (**Figure 3**). Therefore, an attempt has been made to correct the general conclusions with Contracting Party-specific input of specialists.

1. Conclusions:

For the EU HD Art 17 assessments themselves, the integration of assessment criteria is based on the One Out All Out principle (if one criterion scores bad, and the others good, the final result is scored bad, in contrast to e.g., averaging all scores to obtain a final score) (Borja *et al.* 2013, 2014, Barnard & Strong 2014, Probst & Lynam 2016), although it can be over-ridden or modified with expert judgement weighted for area/importance/value of separate contributions (Barnard & Strong 2014).

The Article 17 reports treat pressures and threats status separately, but without trend indication. The following 'translation' rules were applied:

- If pressure is assessed identical for status and threat:

trend = no change

- If pressure is assessed higher for status than for threat (or not at all for threat): trend = decline
- If pressure is assessed lower (or not at all) for status than for threat: trend = increase

Background Information

Year added to OSPAR List: 2003 (OSPAR 2009). Case report (OSPAR, 2008) providing the justification for species inclusion in the list: (https://www.ospar.org/site/assets/files/44271/intertidal_mudflats.pdf (https://www.ospar.org/site/assets/files/44271/intertidal_mudflats.pdf))

Key criteria that led to the listing in 2003:

- **Decline:** Reduction in the area of intertidal mudflats has occurred in many parts of the OSPAR area mainly due to land claim, infrastructure development and spread of the cordgrass *Spartina anglica*.
- **Sensitivity:** Mudflats are naturally resilient and can recover well from isolated physical and chemical disturbances, except from oil pollution. However, once the habitat disappears the process is irreversible.
- **Ecological significance:** Intertidal mudflats provide feeding and resting areas for waterfowl and nursery- and feeding areas for fish. Other functions mentioned are protection against coastal erosion, its role in nutrient chemistry and sequestration of contaminants.
- **Key pressures affecting intertidal mudflats are (QSR 2010):** Climate changes; Hydrographical changes; Hazardous substances; Oil pollution; Habitat damage; and Habitat loss.
- **Knowledge gaps:** In QSR 2010 it was recommended to further harmonise data collection on these habitats since it was not possible to determine the exact extent (including loss) and condition of this habitat.
- This habitat largely overlaps with the EU Habitat Directive habitat type 1140 (mudflats and sandflats not covered by seawater at low tide) (only the mudflats part) and partly with 1130 (estuaries).



Figure 1. Status of habitat type 1140 'mudflats and sandflats not covered by seawater at low tide', HD Article 17 summary report by EEA. Green: FV (Favourable): A habitat is in a situation where it is prospering and with good prospects to do so in the future as well; Orange: U1 (Unfavourable-Inadequate): A habitat is in a situation where a change in management or policy is required to return the habitat to favourable status but there is no danger of disappearance in the foreseeable future; Red: U2 (Unfavourable-Bad): A habitat is in serious danger of disappearing (at least regionally); Grey: XX (Unknown): The information available for the habitat type is scarce and does not allow a proper assessment of its conservation status (Map source: <https://maps.eea.europa.eu/>)

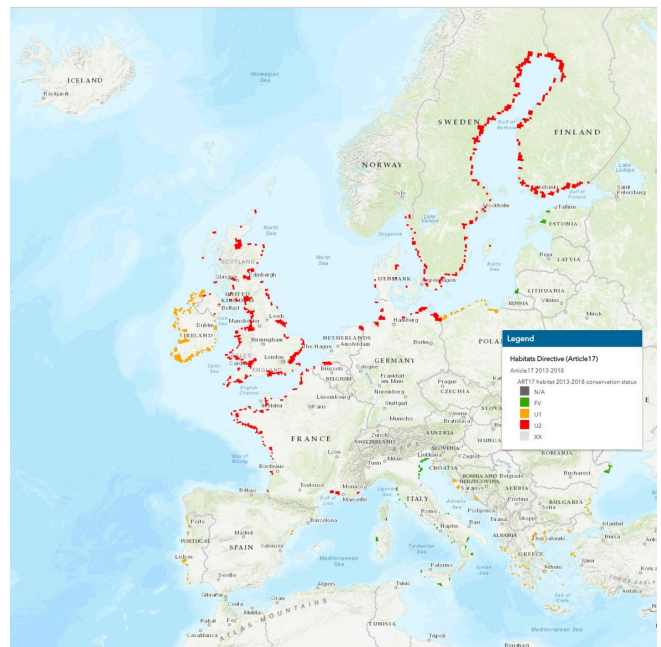


Figure 2. Status of habitat type 1130 'estuaries', HD Article 17 summary report by EEA: <https://maps.eea.europa.eu/>). For explanation of colours, see Figure 1

Geographical Range and Distribution

In the HD Article 17 reporting on 1140 and 1130, over the period 2013-2018 the range of the habitat was considered favourable and stable (BE, DE, DK, ES, FR, IE, NL, PT, SE, UK). According to the Article 17 Habitats Directive Assessment Reports on 1140 the overall range status is favourable. (<https://nature-art17.eionet.europa.eu/article17/habitat/summary/> (<https://nature-art17.eionet.europa.eu/article17/habitat/summary/>))

Data specifically delivered for this assessment by individual Contracting Parties indicate that the extent shows (local) declines in FR and UK Wales.

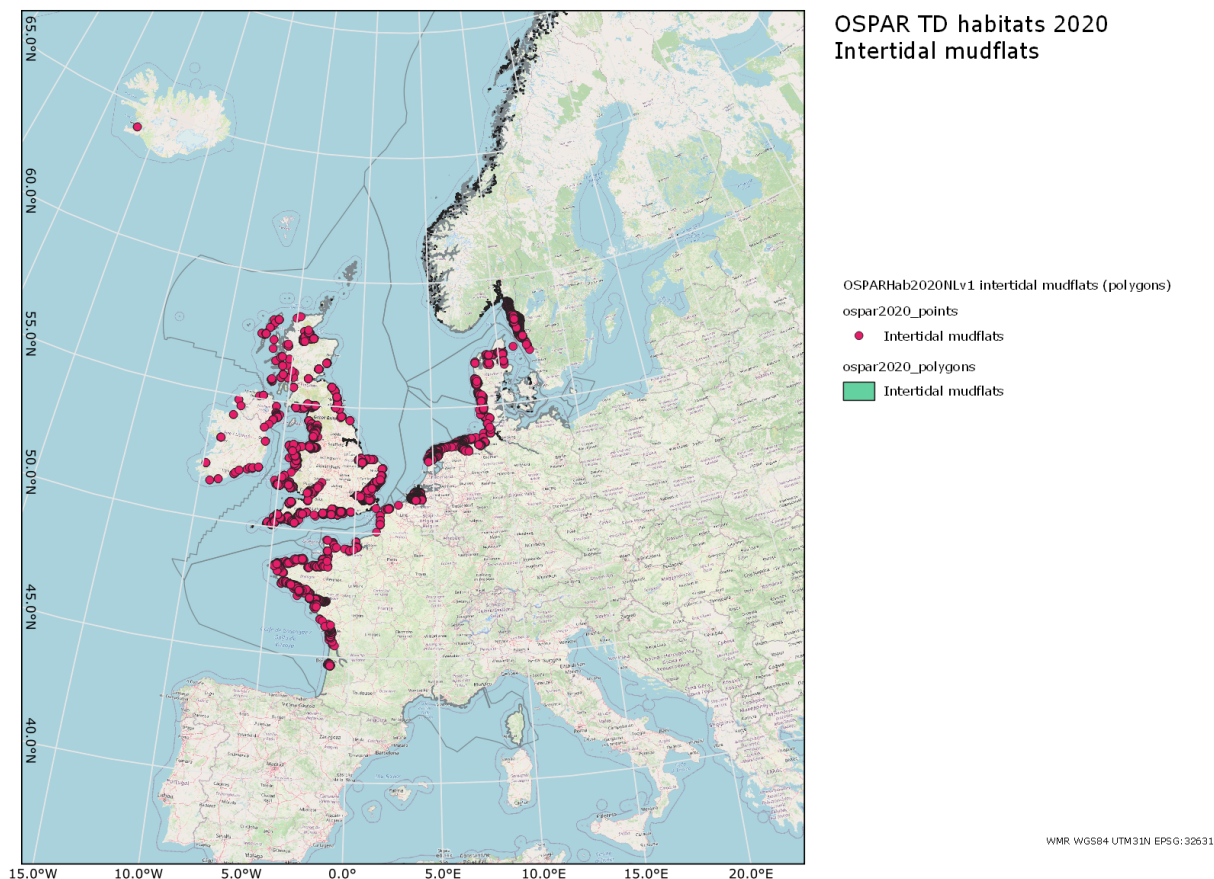


Figure 3: Data from the OSPAR data portal 2020 on distribution of intertidal mudflats. (Source: <https://emodnet.ec.europa.eu/en/ospar-threatened-and-or-declining-habitats-spatial-dataset>)

Method of assessment: 1,2,5

Extent

This habitat is present in a vast number of estuaries, bays and inlets in the OSPAR maritime area, each with their own specific environmental and management conditions (OSPAR Commission 2009). In the last status assessment (QSR 2010), it was reported that the full extent of this habitat and its loss in extent over time is not fully documented for most Contracting Parties. Since then, the known surface area has increased due to improved mapping. However, the habitat extent is probably still larger than reported so far (Figure 3).

Over the period 2013-2018 the area of the habitat was considered favourable and stable in BE, DK, FR, DE, IE, NL and SE (Article 17 Habitats Directive Assessment Reports). For PO, ES and the UK, the extent was assessed as unknown. According to the Article 17 Habitats Directive Assessment Reports, the area status is still unknown (49% favourable; 51% unknown).

In more detail and additional to the HD assessment, OSPAR Contracting Parties (UK Wales, France) report a decrease in extent.

Method of assessment: 1, 2, 3, 4, 5.

Condition

The HD Article 17 reporting 2013-2018 for habitats 1140 and 1130 shows:

1. unfavourable and decreasing condition in IE and UK,
2. unfavourable and unknown trend in NL and ES
3. stable but unfavourable condition for both habitat types in DK, FR, PT, SE
4. Stable and favourable in DE (apart from 1130)

Method of assessment: : 3 (Region II, III and IV)

Threats and Impacts

Intertidal mudflats are easily impacted because of their location between land and sea. Main threats according to background document (OSPAR, 2009) and based on input of Contracting Parties are:

- Coastal developments such as urban and transport infrastructure and for industry, causing: physical removal of the habitat; food web effects; toxic effects (effluent discharges on industrialised and urbanised estuaries and coastlines may contain contaminants); organic enrichment effects (e.g., increased coverage by opportunistic green macroalgae resulting in the formation of green tide mats causing anoxic conditions below the mats). For example, in Sweden the nutrient load is still at a very high level but due to improved sewage treatment, the Water Framework Directive and other directives the actual annual input of N and P, e. g., by river runoff, has decreased.
- Oil spills from e.g., ship accidents, which may cause pollution (accumulation) and anoxia resulting in the death of infauna.
- Fishing and bait digging (e.g., suction dredging for shellfish or juvenile flatfish, or by-catch from shrimp fisheries) causing impact on community structure and substratum.
- Climate change, causing sea level rise and increased storm frequency, affecting the sedimentation patterns of mudflats and estuaries, coastal squeeze (e.g., in UK), and changes in exposure time. Climate change also leads to temperature increase resulting in changing ecological interactions between species.
- Invasive species (such as Pacific oyster *Magallana gigas* (syn. *Crassostrea gigas*)* in the Wadden Sea: NL, DE, DK or *Ensis leii*, *Mya arenaria*, *Austrominius modestus*, *Streblospio benedictii*, *Neomysis americana* in FR).
- Human disturbance (e.g., tourism).

**Magallana gigas* is currently considered as a species that provides opportunities to intertidal mussels *Mytilus edulis* to recover by providing shelter (Folmer *et al.*, 2017).

Measures that address key pressures from human activities or conserve the species/habitat

There are no agreed protocols for intertidal habitat restoration (OSPAR Commission 2009). Artificial mudflats and other compensatory measures are considered not to be a viable compensation since the functional characteristic of artificial mudflats would be rapidly lost without regular maintenance.

Managed Realignment (MR) is a measure to conserve intertidal mudflats and is applied in the UK. MR is the technique of re-locating the land/sea border inland by lowering, removing or breaching the previous defences and constructing new or maintaining previous secondary defences (Dale *et al.*, 2017). Many coastal managers advocate MR as a preferred management strategy (Dale *et al.*, 2017).

Another example of compensation and also mitigation however is the Mud Motor method (NL), where mud (removed for deepening shipping lanes) is deposited upstream of the area to be restored. This can be successful in promoting natural mudflats and saltmarsh development (Baptist *et al.*, 2019).

Instances of protection of intertidal mudflats in Marine Protected Areas in the different Regions are Region I: 2; Region II: 21; Region III: 23; Region IV: 11 (Hennicke *et al.*, 2022). It is concluded that there is MPA replication in all OSPAR Regions where the feature is considered to be under threat/subject to decline (Hennicke *et al.*, 2022).

Collective Actions from the OSPAR recommendation for intertidal mudflats (<https://www.ospar.org/documents?d=35391> (<https://www.ospar.org/documents?d=35391>)) are:

- Improving the OSPAR mapping database
- Sharing knowledge on intertidal mudflats with stakeholders and other competent international authorities
- Identifying whether further measures to maintain or improve water quality (contaminants and nutrients) are necessary to safeguard relevant habitats and implement if required

Conclusion (including management considerations)

- Compared to the QSR 2010 report, the status of mudflats is still poor in the OSPAR area. While the geographical distribution and extent of the habitat are generally good and stable (in Regions II, III and IV, no data for Region I), with some exceptions, the condition of intertidal mudflats is poor due to human pressures including climate change, nutrient enrichment, invasive species and hydrological changes (e.g., construction).
- The conclusions on this habitat type are largely based on the HD 1140 and 1130 Article 17 reporting, and filled in with more details for these assessments, based on information delivered by Contracting Parties. Assessments on HD scale may imply some room for error, because HD conclusions may be valid for a broader habitat type than the OSPAR mudflats. Therefore, an attempt has been made to correct the general pictures with Contracting Party-specific input of specialists. In general, the habitat is well visible, leading to a good confidence in conclusions on extent and distribution (in contrast to e.g., deep sea habitats), but not always well monitored in terms of condition and threats (less certain conclusions). However, due to its coastal connection, its easily impacted and evidence

of e.g., 'coastal squeeze', pollution, etc. is well visible and should be managed better where possible. The poor condition justifies keeping the habitat on the OSPAR List.

- In the context of the HD Directive, relevant management measures will be implemented for 1140 and 1130 and improvement will be monitored.
- A re-assessment is advised to be done in the long-term (6-10 y), since HD management measures will need time to result in improvement.

Knowledge Gaps

- sufficiency of data: for a number of areas, data on extent, distribution and threats are lacking. Based on the comparison of HD and OSPAR habitats (although they are not exactly the same) (**Figure 4**), it is expected that the OSPAR habitat is more widely spread than reported to JNCC now.

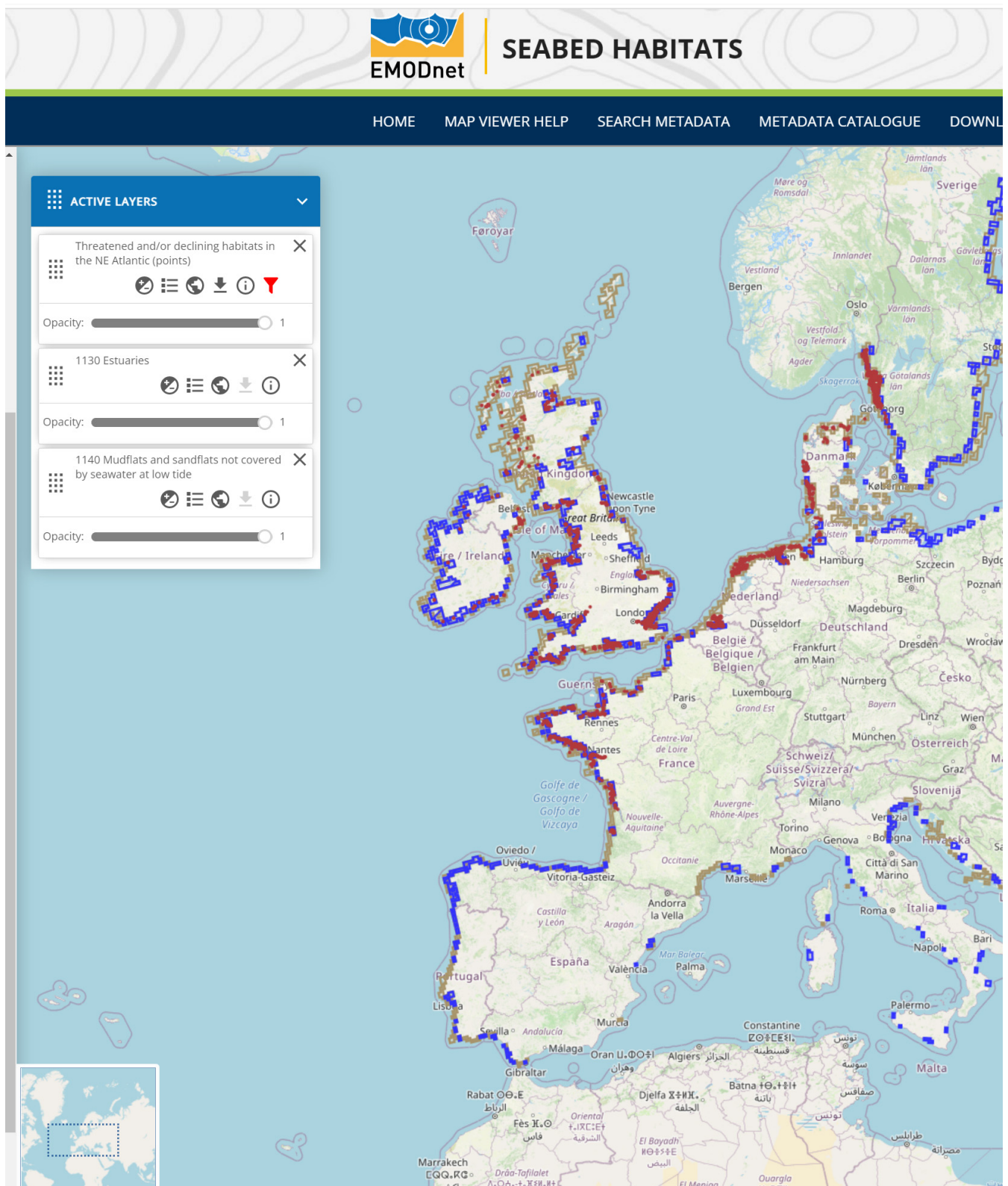


Figure 4: Comparison of reported distributions of H1140 (orange), H1130 (purple) and OSPAR mudflats (red) (EMODNET, 2022)

Method used

Main source of information:

1. OSPAR data assessment only
2. Assessment derived from third party assessment
3. Assessment derived from a mix of OSPAR data assessment and assessments from third parties

Assessment is based upon:

- a) complete survey or a statistically robust estimate (e.g. a dedicated mapping or survey or a robust predictive model with representative sample of occurrence data, calibration and satisfactory evaluation of its predictive performance using good data on environmental conditions across entire species range);
- b) based mainly on extrapolation from a limited amount of data (e.g. other predictive models or extrapolation using less complete sample of occurrence and environmental data);
- c) based mainly on expert opinion with very limited data;
- d) insufficient or no data available.

Assessment carried out by Wageningen Marine Research (Bos, Tamis)

Main source of information:

- Key documents (Background document, Case Report, Recommendations) (OSPAR Commission 2008, 2009, 2016);
- OSPAR status report (QSR, 2010);
- EU Habitat Directive Article 17 reports H1140, H1130 (EU 2019);
- A literature review and;
- A questionnaire send to experts from all relevant contracting parties.
- HD related online databases and mapservers (EEA, EUNIS)

(EEA 2018)

References

Sheet reference:

BDC2023/Intertidal mudflats



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