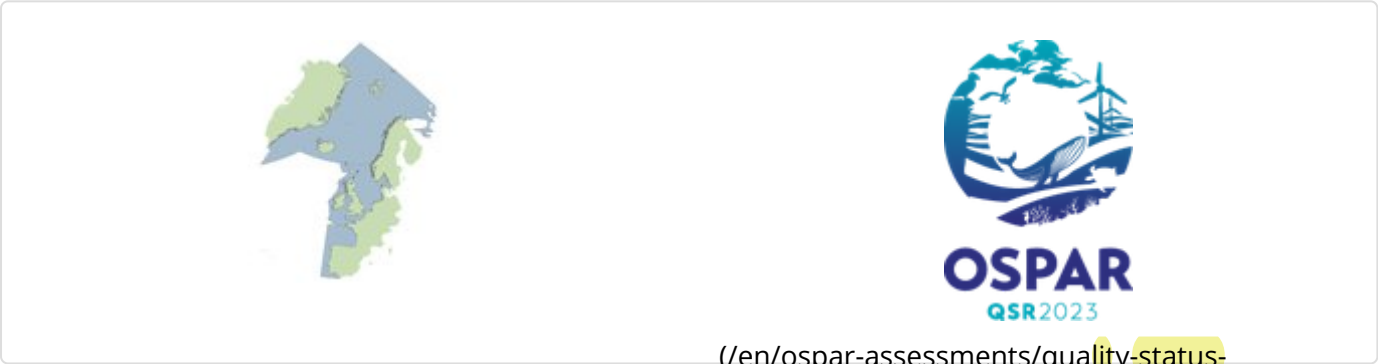


# Status Assessment 2022 - Sea-pen and Burrowing Megafauna Communities

Sea-pen and burrowing megafauna communities continue to be threatened and / or declining across Greater North Sea (Region II) and Celtic Seas (Region III). In Bay of Biscay and Iberian Coast (Region IV) communities are also likely threatened and / or declining. The current status is unknown in Arctic Waters (Region I). The most widespread direct pressure continues to be from towed, bottom contacting fishing gear.



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

Assessment of status		Distribution	Extent	Condition	Previous OSPAR status assessment	Status (overall assessment)
Region	I	↔2,5	↔2,5	?	○	Unknown
	II	↔2,5	↔2,5	↔2,5	●	Poor
	III	↔2,5	↔2,5	↔2,5	●	Poor
	IV	↔2,5	↔2,5	?2,5	○	Unknown
	V					NA

Assessment of threats		Bottom Trawling Fisheries	Climate change	Aquaculture Organic pollution	Land based & marine industrial/commercial pollution	Infrastructure Development	Threat or impact
Region	I	↑ <sup>23</sup>	↑ <sup>4</sup>	↑ <sup>2</sup>	↔ <sup>2</sup>	↔ <sup>2</sup>	Unknown
	II	↑ <sup>23</sup>	↑ <sup>4</sup>	↑ <sup>2</sup>	↔ <sup>2</sup>	↔ <sup>2</sup>	Poor
	III	↓ <sup>23</sup>	↑ <sup>4</sup>	↑ <sup>2</sup>	↔ <sup>2</sup>	↔ <sup>2</sup>	Poor
	IV	↑ <sup>23</sup>	↑ <sup>4</sup>	↑ <sup>2</sup>	↔ <sup>2</sup>	↔ <sup>2</sup>	Unknown
	V						NA

⊕ Table Legend

⊕ Method of Assessment

## Confidence

High for Region II and Region III.

Low for Region I and Region IV due to lower volume of data for analysis.

## Background Information

**Year added to OSPAR list:** 2003

The original evaluation of Sea-pen and burrowing megafauna communities habitat against the Texel-Faial criteria indicated a lack of detailed mapping of habitat distribution and therefore no quantifiable information can be presented on changes in extent over time. Expert judgement played a part in nominating this habitat as certain fishing operations are known to impact and therefore threaten the habitat. It is highly likely that this habitat has been adversely affected by extensive fisheries activities.

- **Decline:** The habitat is not fully mapped and so a decline in extent is unknown. However, the decline is related more to quality than extent and as demersal fisheries continue to be widespread and intensive in inshore and shallow waters the habitat is likely continuing to undergo a loss in benthic trophic structure and diversity shifts (Le Loc'h, 2004, Hiddink *et al.*, 2006) including loss of more sensitive but characterising species of the biotope such as the sea-pen *F. quadrangularis*. A recent study of *F. quadrangularis* distribution across the United Kingdom continental shelf found that it is more likely to occur on areas where surface abrasion from fishing activity had not occurred and be missing from muddy depressions of heavily disturbed areas such as the Fladen grounds, despite modelling indicating site suitability for them (Downie *et al.*, 2021). *F. quadrangularis* appears to occupy a different niche

in the North Sea from the Celtic seas due to modification by fishery impact (Downie *et al.*, 2021) suggesting declines in species extent. However, the presence of sea-pens - even on heavily fished sites - does suggest a more complex relationship (Aristegui *et al.*, 2021)

- **Sensitivity:** Towed fishing gear as used in *Nephrops* and *Pandalus* fisheries exert significant pressures on this habitat and can lead to irreversible shifts in the benthic trophic structure of the habitat (Le Loc'h, 2004, Hiddink *et al.*, 2006). This can be through the removal of target and (considerable) non target species including sea pens and through resuspension of sediment (Linders *et al.*, 2017) which can result in oxygen depletion in areas with limited water exchange (Bradshaw *et al.*, 2021), reducing the functioning capacity of burrowing megafauna. Being erect and sessile, sea-pens are vulnerable to bottom towed fishing gears, particularly the species *F. quadrangularis* due to its inability to retract into the sediment. The brittle stalk adds to its vulnerability to damage by fishing gears (Hughes, 1998).

The habitat is also sensitive to organic enrichment and contaminants from finfish aquaculture although these impacts are at a more localised level and vary depending on organic deposition and the hydrology at the site. Burrowing megafauna were common on a site surveyed in Scotland where sediment organic content was lower than 4%, but absent when organic content exceeded 6% (Hughes, 1998).

**Last Status assessment:** OSPAR (2010) -

[https://qsr2010.ospar.org/media/assessments/Species/P00481\\_Seapen\\_and\\_burrowing\\_megafauna.pdf](https://qsr2010.ospar.org/media/assessments/Species/P00481_Seapen_and_burrowing_megafauna.pdf)  
([https://qsr2010.ospar.org/media/assessments/Species/P00481\\_Seapen\\_and\\_burrowing\\_megafauna.pdf](https://qsr2010.ospar.org/media/assessments/Species/P00481_Seapen_and_burrowing_megafauna.pdf))

## Geographical Range and Distribution

The known geographic range is shown in **Figure 1**. Sea-pen and burrowing megafauna have been found as far north as the south east of Svalbard and as far south as the Gulf of Cadiz. These soft mud habitats occur extensively throughout more sheltered bays and fjords and may be present in relatively shallow depths of up to 15 m - likely due to the sheltered sites away from wave action. This habitat also occurs in deeper offshore waters in the North Sea and Atlantic with high densities of *Nephrops norvegicus* present.

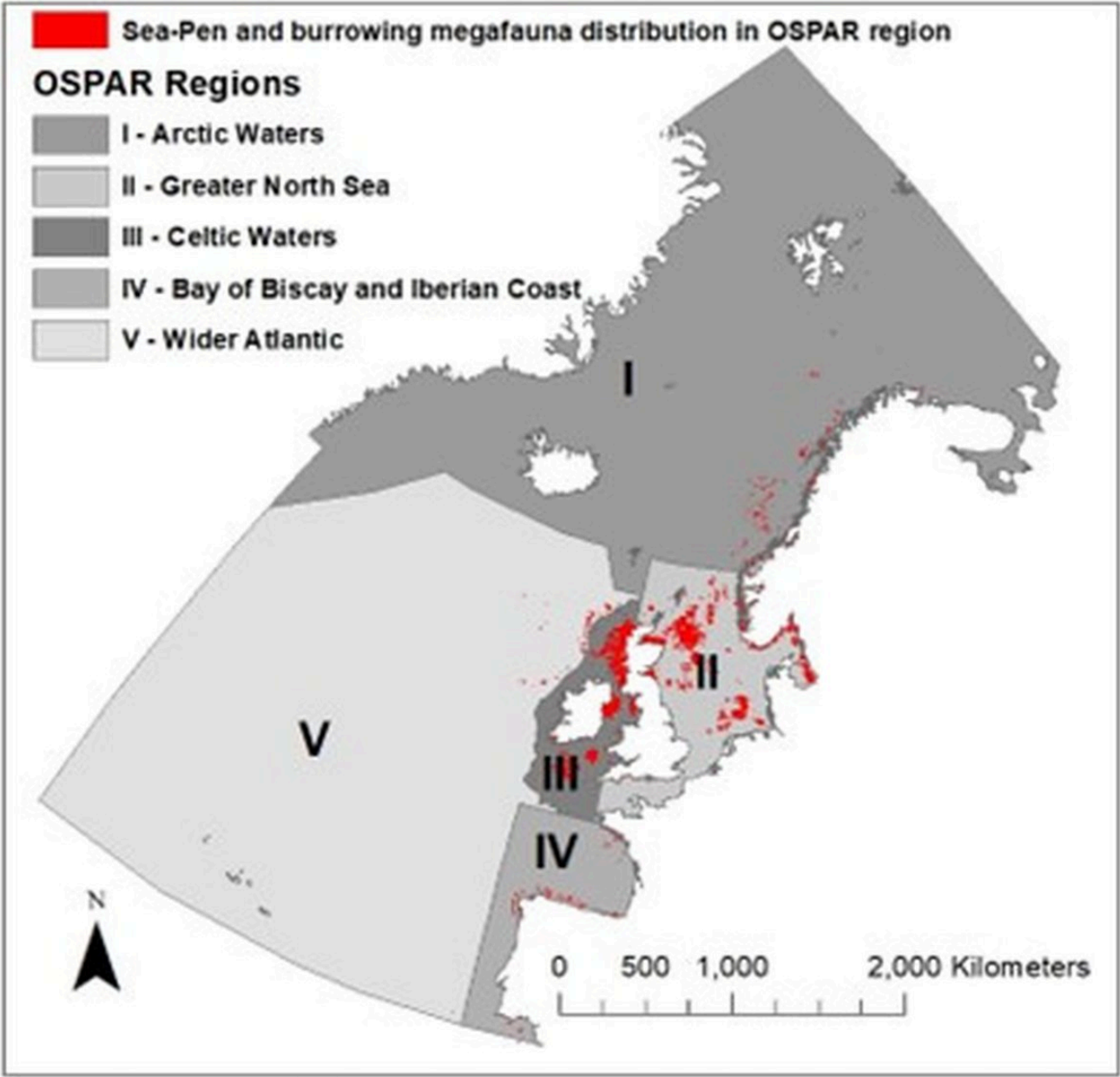


Figure 1: Distribution of 10km squares containing Sea-pens and burrowing megafauna communities habitat from OSPAR Threatened and/or Declining habitats database (2020). The habitat is known to occur in the Porcupine bank and in waters near the Aran islands, Ireland but are not included in this diagram. The presented distribution in the German part of the North Sea is nationally under technical review.

Extent

Table 3 Number of 10 x 10 km squares containing Sea-pen and burrowing megafauna communities recorded in each Member State and OSPAR Region. The OSPAR T&D database (2020) was intersected with 10 km grid for presence or absence of known habitat. Please note that sea-pen and burrowing megafauna communities are not fully mapped in any of the five Regions.

Contracting Party	Arctic waters (Region I)	Greater North Sea (Region II)	Celtic Seas (Region III)	Bay of Biscay and Iberian Coast (Region IV)

<b>Contracting Party</b>	<b>Arctic waters (Region I)</b>	<b>Greater North Sea (Region II)</b>	<b>Celtic Seas (Region III)</b>	<b>Bay of Biscay and Iberian Coast (Region IV)</b>
Denmark	N/A	13	N/A	N/A
France	N/A	0	0	14
Iceland	0	N/A	N/A	N/A
Ireland	N/A	N/A	119	N/A
Norway	141	194	N/A	N/A
Portugal	N/A	N/A	N/A	4
Spain	N/A	N/A	N/A	64
Sweden	N/A	68	N/A	N/A
UK	N/A	480	703	N/A
Netherlands	N/A	47	N/A	N/A
Germany	N/A	119*	N/A	N/A
High Seas	N/A	N/A	N/A	N/A
Total	141	921	822	82
Source	OSPAR T& D database	OSPAR T& D database	OSPAR T& D database	OSPAR T& D database

\*The presented distribution in the German part of the North Sea is nationally under technical review.

The total extent of sea-pen and burrowing megafauna communities in OSPAR waters is unknown but new data submissions continue to be added.

EU Habitats Directive Article 17 assessment standards were followed to calculate Extent using 10 x 10 km grids and weighted to each Contracting Party.

Method of assessment: 2b

## Condition

The sea-pen and burrowing megafauna habitat is considered to be in a declining or modified but stable condition over much of its extent, primarily due to the use of towed, bottom-contacting fishing gears throughout the habitat's extent and distribution. Bottom-contacting fishing effort has declined from an overall peak in 2003 in the Celtic and Greater North Sea. ICES 2021 fisheries overviews indicate a decline in otter trawl effort in the Celtic seas since 2015 but an increase in the Greater North Sea since 2015. The footprint from bottom towed fishing gears has not declined,

with OSPAR Fisheries feeder report (2021) (/en/ospar-assessments/quality-status-reports/qsr-2023/other-assessments/fisheries/) highlighting that 86% of assessed areas in these regions were physically disturbed, with 58% being classed as 'highly disturbed'. Consistent fishing pressure occurred over 74% of assessed OSPAR areas and was considered very likely to affect the ability of habitats to recover. One study of *Nephrops norvegicus* indicated the age at which females first reach sexual maturity has declined significantly over two decades in the Western Irish Sea, suggesting despite a reduction in fishing pressure (and therefore disturbance) (Sigwart *et al.*, 2020) the habitat is not yet at a disturbance level at which it can be sustained.

In Arctic Waters (Region I) and Bay of Biscay and Iberian Coasts (Region IV) the condition is assessed as unknown due to limited data availability.

## Threats and Impacts

Bottom-contacting fishing gears continues to be the main threat (2015 to 2021) in the Greater North Sea (Region II) and Celtic Seas (Region III). Bottom-contacting fisheries physically disturb the seabed and result in a reduction of sediment complexity, removal of some species and damage to more fragile benthic species, leading to a shift in benthic communities. It is a major disturbance factor of the continental shelf communities of OSPAR Region II, III and IV. Whilst also occurring in Region I, the scale of disturbance is unknown. Considerable overlap occurs between the mapped distribution of the sea-pen and burrowing megafauna habitat and areas with highest seabed disturbance (Scotland's Marine Assessment 2020; EMODnet Human Activities).

The damage fishing gears cause is largely determined by penetration depth of the gear, frequency of trawl passes (Eigaard *et al.*, 2016, Hiddink *et al.*, 2017) and the susceptibility of the benthic organisms to the fishing gear. Epibenthic species often present on burrowed mud habitats such as sea-pens and fireworks anemone *Pachycerianthus multiplicatus* are particularly vulnerable (Dinesen *et al.*, 2020; Dinmore *et al.*, 2003). Studies found the seapen *F. quadrangularis* at about eight times higher density on protected sites compared to trawled sites, highlighting larger species greater sensitivity to physical disturbance and smaller species such as *Virgularia spp.* and burrowing fauna including crustaceans such as *Nephrops norvegicus* are less sensitive (Sköld *et al.*, 2021; Dinmore *et al.*, 2003). The result is a shift to short-lived species (Rijnsdorp *et al.*, 2018) and a reduction in habitat complexity.

Aquaculture is projected to expand in all OSPAR Regions (OSPAR Aquaculture feeder report, 2021) with a 37% increase in output forecast in Scottish waters by 2030 from 2016 output (Scotland's Marine Assessment 2020). However, its footprint is localised and may not constitute a threat for habitat on a regional basis. Threat from finfish aquaculture to benthic environments include organic enrichment and chemical contamination from therapeutants, antifoulants, feed additives, disinfectants and net washings. Organic enrichment from cage aquaculture results in oxygen depletion on the seabed as the material breaks down (Hughes, 1998). Increases in ammonia entering the marine environment from the expanding aquaculture sector have been reported in Norway (OSPAR aquaculture feeder report, 2021) whilst medicines to treat pests and diseases and contaminants in feed such as pesticides, mycotoxins and heavy metals accumulate in the surrounding sediment (OSPAR aquaculture feeder report, 2020). Levels of contaminants in fish feeds and farmed fish are monitored but regulatory limits have been set for fish feed based on fish health and food safety rather than the environmental impacts it could cause in sediments surrounding the sites (Grefsrud *et al.*, 2018). Benthic surveys around Scottish finfish aquaculture sites found lice treatment compounds are more widely distributed in the sediments than had previously been observed (Bloodsworth *et al.*, 2019).



Habitat loss or alteration due to development of infrastructure and pollution from land-based and marine industrial or commercial sources may present a threat in some areas.

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

Actions towards the recommendations are summarised below using data submitted by the United Kingdom, Sweden, Norway, Denmark, Germany and Ireland.

- 3.1a. National legislation in the United Kingdom and Germany now exists for the conservation of sea-pen and burrowing megafauna communities.
- Under The Common Fisheries Policy and Animals (Amendment etc.) (EU Exit) Regulations 2019 S.I. 2019, No. 1312 (amending S.I. 2019, No. 753) there is a prohibition on the use of bottom-set gillnets, entangling nets, and trammel nets at depths greater than 200 m. These protective measures are also applied in the North-East Atlantic Fisheries Commission (NEAFC) technical measures regulatory area (beyond European Union waters) through the same Statutory Instrument.
- Incentives have been introduced in Norway and Sweden to switch from trawl to creel fishery for *Nephrops*.
- 3.1b. A trawl boundary in Sweden protects inshore benthic habitats from abrasion, which includes areas of this habitat. In offshore areas such as Bratten in the Skagerrak, large Natura2000 sites with zones closed to bottom trawling provide protection for rich sea-pen communities.
- Denmark has also designated OSPAR MPAs in Kattegat with the aim to protect the soft seafloor including these habitats. A Joint proposal with Sweden and Denmark has been adopted by the EU Commission banning bottom trawling in the sites to protect among others the sea-pen communities.
- 3.1c & d. Work is ongoing to establish the use of *Nephrops* under water TV (UWTV) surveys as a tool for monitoring sea-pen and burrowing megafauna communities (Benson *et al.*, 2021). *Nephrops* UWTV surveys have been successfully used to quantitatively monitor the habitat in Sweden. A predictive modelling approach has been performed by Gutow *et al* (2020), linking the presence of burrowing megafauna species (*Callinassa* spp., *Upogebia* spp.) with environmental predictors including water depth and sediment characteristics (mud content), but also with the structure of associated infauna communities with the aim to get an initial proxy for the distribution of the habitat.
- 3.1e. The introduction of Vessel monitoring Systems (VMS) to the <12 m fleet in the United Kingdom will better establish pressures. Proposed introduction in Welsh fleet in 2022. A proposed increase in the ping rate of VMS for >12 m in the United Kingdom fleet will improve access to fishing distribution, frequency and intensity data.
- 3.1f. New records of the habitat continue to be submitted to OSPAR. Data submitted to the joint ICES/NAFO Working Group on Deep-water Ecology (ICES WGDEC, 2020) are collated to provide new information on the distribution of Vulnerable Marine Ecosystems (VMEs) including sea-pen fields for use in annual ICES advisory processes and the development of new methods and techniques to increase knowledge of deep-sea ecosystems, and suggest novel management tools to ensure human activities do not adversely affect them.
- 3.1g & h. 20 MPAs are designated in the United Kingdom that include sea-pen and burrowing megafauna habitat as a conservation priority. Further fisheries measures to reduce the habitat degradation caused by bottom towed gears will be introduced in the near future. Norway has a number of designated MPAs (with varying management measures) that include

sea pen and burrowing megafauna habitats. Particularly valuable and vulnerable areas have also been identified on the basis of multiple criteria including the presence of sea pen and burrowing megafauna habitats ("Særlig Verdifulle og Sårbare Områder" SVOs). However, no management actions are applied in SVOs. In Strangford Lough, Northern Ireland, an area of this habitat will be designated as a new MCZ feature pending consultation. In Germany, there are currently no management actions for the OSPAR-biotope. A related nationally protected biotope type "muddy substrate with burrowing megafauna" is a conservation target of the "Sylt Outer Reef - Eastern German Bight" nature conservation area.

- In Wales, the Scallop Order 2010 prohibits scallop dredging within Special Areas of Conservation giving protection to examples of this habitat within Pembrokeshire Marine SAC and Pen Llŷn a'r Sarnau SAC.

## Conclusion (including management considerations)

There is currently little monitoring carried out on this habitat compared to its extent and so conclusions that are made are done on the basis of secondary information and/or expert judgement. The current assessment is in general agreement with the last QSR 2010 status assessment in that the most widespread direct pressure continues to be from towed, bottom contacting fishing. ICES fisheries overviews indicate increases in effort from bottom trawling since 2015 in Regions I, II and IV but decreasing effort in Region III. In summary, the habitat continues to be impacted by fishing over much of its range and distribution. Questions remain about the extent to which there are ongoing declines in the habitat or whether much of the fished areas are in a stable yet permanently modified condition. Management approaches to minimise the impacts of the fishery on benthic habitats are ongoing and include use of less intrusive gears such as the development of 'flying trawl doors, laser trawls and other alternative fishing gears to reduce gear disturbance on the seabed. Incentives and gear restrictions are in place in several countries including Norway and Sweden to encourage the use of creels in the *Nephrops* fishery as an alternative, less abrasive gear (Hornborg *et al.*, 2017), with trawling for *Nephrops* in Norway now only allowed in Skagerrak.

Aquaculture presents a negative pressure on the habitat and continued expansion in areas that overlap with the habitat will result in increased localised damage. OSPAR Recommendations from 2010/11 on furthering the protection and restoration of Sea-pens and burrowing megafauna communities have yet to be fully implemented by all Contracting Parties. Further management measures are still required to prevent the ongoing loss and damage of sea-pen and burrowing megafauna communities by human activities.

MPAs have been set up throughout the OSPAR regions, with this habitat represented. Scotland's Wester Ross MPA has extensive areas of sea-pen and burrowing megafauna habitat which are protected from bottom-contacting fishing, but full implementation of fisheries management measures is not yet in place to protect the features in all MPAs, although this work is progressing. For areas out with MPAs, Vessel Monitoring Systems (VMS) are used to model fisheries disturbance and several nations within the OSPAR Maritime Area have started introducing VMS for vessels 12 m and under, including the United Kingdom and Norway. Ping rates in the United Kingdom are once every two hours which is considered insufficient for nature conservation purposes in nearshore waters. Ping rates in Norway are at once per hour and provide greater accuracy on localised fishing pressure.



For the conservation of deep-sea habitats, sea pens qualify as indicator species for Vulnerable Marine ecosystems (VME) under the criterion of Structural complexity (Kenchington *et al.*, 2014; FAO 2009). In this regard, consideration could be given to the future inclusion of this listed habitat for the Wider Atlantic (Region V), given abundant scientific evidence of its occurrence in Atlantic waters greater than 200 m depth (e.g. Porcupine Bank region).

## Knowledge Gaps

Data for the assessment of Region I, II, III and IV is insufficient.

Pressure thresholds in relation to varying intensity of fishing pressure and condition of habitat.

Shared understanding of the habitat definition.

## Method used

Assessment carried out by NatureScot based upon:

- Literature review
- Data submitted by contracting parties
- Third party assessments with close-geographic match
- Workshop with representatives and experts nominated by Contracting Parties.

## References

## Sheet reference:

BDC2022/Sea-pen and Burrowing Megafauna Communities



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