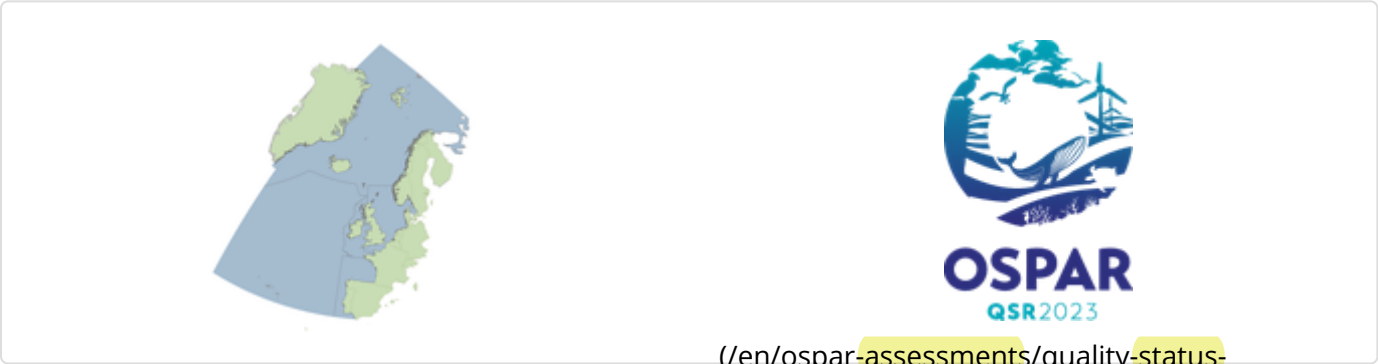


Status Assessment 2022 - Lophelia pertusa reefs

Lophelia pertusa reefs are assessed as being in poor overall status in Arctic Waters (Region I), Greater North Sea (Region II), Celtic Seas (Region III), Bay of Biscay and Iberian Coast (Region IV) and Wider Atlantic (Region V) due to their high vulnerability to fishing impacts, continued fishing pressure overlapping their distributions, and slow recovery due to their biology. Knowledge of where *Lophelia* reefs occur has increased facilitating their management.



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

Assessment of status		Distribution	Extent (for habitats)	Condition (for habitats)	Previous OSPAR status assessment	Status (overall assessment)
Region	I	↔1,2,5	↔1,5	↔1,5	●	Poor
	II	↔1,2,5	↔1,5	↔1,5	●	Poor
	III	↔1,2,5	↔1,5	↔1,5	●	Poor
	IV	↔1,2,5	↔1,5	↔1,5	●	Poor
	V	↔1,2,5	↔1,5	↔1,5	●	Poor

Assessment of threats		Habitat loss/degradation through physical damage from demersal fisheries	Habitat loss or alteration through community shifts and/or ocean acidification due to climate change	Threat or impact
Region	I	↔ 1,2,5	?3,5	
	II	↔ 1,2,5	?3,5	
	III	↔ 1,2,5	?3,5	
	IV	↔ 1,2,5	?3,5	
	V	↔ 1,2,5	?3,5	

⊕ Table Legend

⊕ Method of Assessment

Confidence

Overall: Low to Medium confidence is placed overall on the assessment.

Distribution: High confidence that the distribution has not changed.

Condition: Low to medium confidence that the overall condition across the Regions is still declining. There is good evidence for declining condition, but it is limited to particular sites that have been studied, and broader evidence of decline is drawn from proxies such as overlap of fishing pressure with the habitat. Of cause for concern is the presence of fishing activity within Marine Protected Areas and Special Areas of Conservation.

Fishing Pressure: Medium confidence in the scale of fishing pressure currently acting on the habitat based on analysis of Global Fishing Watch data notwithstanding the various assumptions made during the analysis. However, it should be noted that while sufficient to highlight risk, the link between pressure and actual impact has not been well established.

Background Information

Year added to OSPAR List: 2003 <https://www.ospar.org/documents?v=7182>
(<https://www.ospar.org/documents?v=7182>)

- The original evaluation of *Lophelia pertusa* reefs against the Texel-Faial criteria referred to global importance, decline and sensitivity criteria, with information also provided on threat.
- The key criteria for their inclusion were:
 - global and regional importance because of the high proportion of the known occurrences of these reefs in the North-East Atlantic;
 - decline principally due to the impact of deep-water fishing;

- sensitivity based on fragility and slow growth rates, and the likely long duration required for reef regeneration if any, following damage;
- evidence of reefs impacted by deep-sea trawling.

Last status assessment: 2009. OSPAR (2009) updated the evaluation of *L. pertusa* reefs against the Texel-Faial criteria to globally important, 'very sensitive' to the effects of demersal trawling and 'sensitive' to the localised effects of oil and gas exploitation, ecologically 'very important', experiencing 'significant' decline and 'currently' under threat. <https://www.ospar.org/documents?v=7182> (<https://www.ospar.org/documents?v=7182>)

Geographical Range and Distribution

Lophelia reefs are found in all OSPAR Regions. They typically occur below 200 m down to 1 200 m water depth but shallow occurrences in as little as 40 m have been recorded in Norwegian fjords. While the entire distribution and extent of *L. pertusa* reef habitat in the OSPAR area is not yet known, offshore exploration programmes, both national and as part of large EU projects such as CoralFISH and ATLAS, have since 2010 continued to increase the knowledge of the distribution of coral reefs in the OSPAR Maritime Area. For example, Arctic Waters (Region I) – Iceland, Faroes, Norway (Buhl-Mortensen *et al.*, 2015); Bay of Biscay and Iberian Coast (Region IV) – Bay of Biscay (van den Beld *et al.*, 2017), La Gavierra Canyon, Cantabrian Sea (Sanchez *et al.*, 2014); and Wider Atlantic (Region V) – Galicia Bank (Somoza *et al.*, 2014), Rockall Bank and Porcupine margin (SeaRover 2017/2019, Picton *et al.*, 2021) (**Figure 1**). Within the EU CoralFISH project, Davies *et al.* (2017) identified 81 coral biotopes in OSPAR and Mediterranean waters including a number of *Lophelia* biotopes (living and dead reefs, dense framework, loosely-packed framework, rubble and isolated colonies).

The recorded range in the OSPAR Maritime Area has not expanded northward since the last assessment, however due to habitat mapping in the Barents Sea undertaken as part of the Norwegian Mareano programme many new records have been added. Elsewhere, the number of known occurrences of the habitat has increased due to on-going targeted research assessing VMEs.

It is likely however that new *Lophelia* reefs will continue to be discovered as unexplored seafloor is investigated.

Method of assessment: 3a

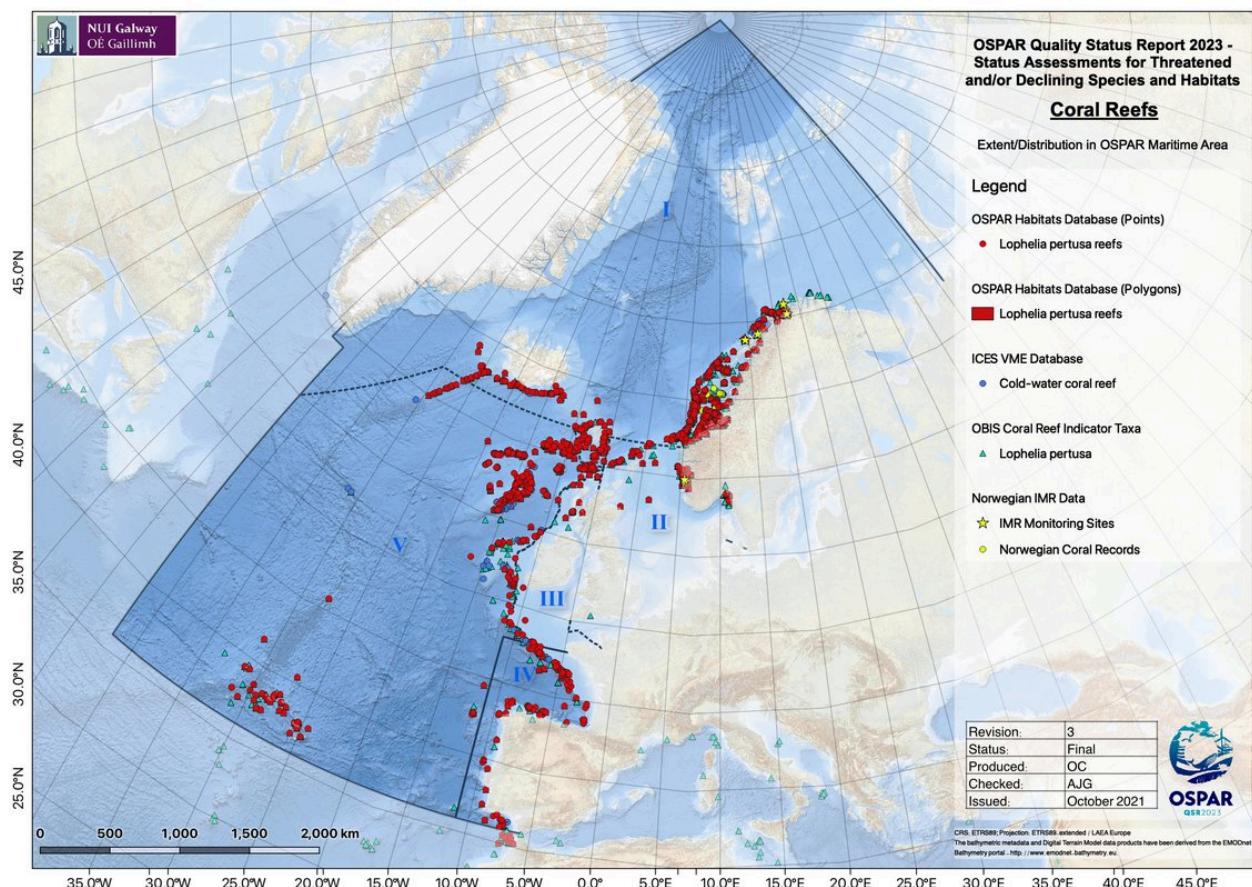


Figure 1: Distribution of known *Lophelia pertusa* reef in the OSPAR area.

Extent

Notwithstanding the introduction of successful management measures to reduce the impact of fishing in Norway, the extent of the habitat in OSPAR Region I is likely to still be decreasing because of fishing pressure (**Figure 2**). Buhl-Mortensen *et al.* (2019) carried out a risk assessment of the potential impact of fishing in Arctic and Sub-Arctic Waters and demonstrated that regionally, several VMEs are predicted to have experienced intermediate to high levels of fishing effort in > 50% of their optimal habitat including *Lophelia* reefs off Iceland. However, there is no direct evidence of impact and therefore it is not possible to state with confidence that the extent has decreased substantially.

Future prospects for habitat extent are that unprotected reefs, especially small patch reefs, are expected to continue to decline in extent due to the ongoing impacts of demersal fishing although the rate of decline may be slowing due to improved fisheries management (e.g. the 2016 EC Deep-Sea Access Regime; NEAFC VME protection measures and national initiatives such as in Norway) and over the next ten years should move from declining towards stability as pressure on reef habitats is relieved. There are indications that removing fishing pressure (e.g. in protected areas) can lead to recovery of ecosystem function in the short term and structural reef in the longer term (decades) (Buhl-Mortensen 2017; Beazley *et al.*, 2021).

Method of assessment: 2a

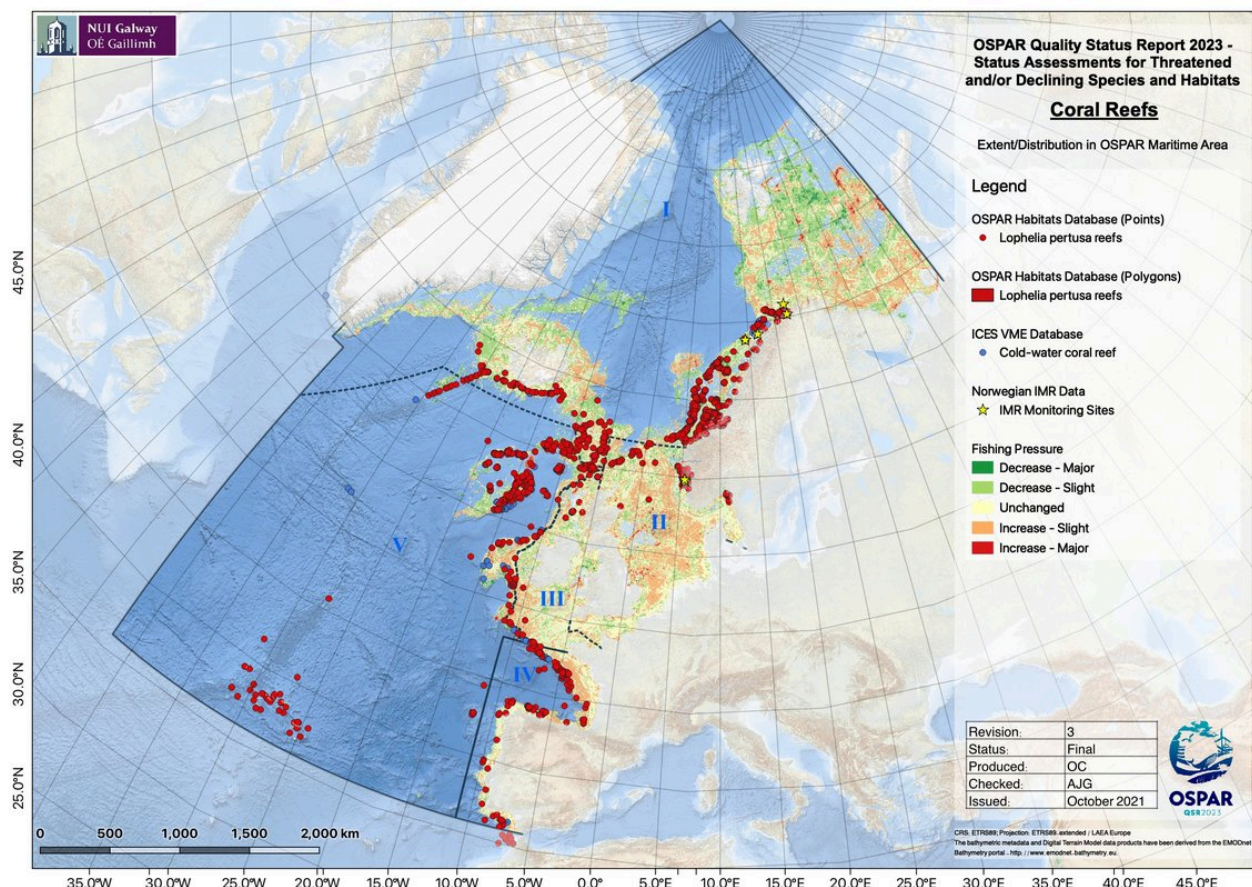


Figure 2: Distribution of coral reefs in the OSPAR region with fishing pressure.

Condition

Within OSPAR Region I and Greater North Sea (Region II), selected *Lophelia pertusa* reefs have been revisited regularly since 2012 as a part of an IMR (Norway) monitoring program of coral reefs. This monitoring uses a combination of functional indicators (e.g. respiration, nutrient cycling and energy stores of collected coral fragments) alongside structural indicators observed along randomly placed ROV video transects crossing the reefs (e.g. species composition, cover of live versus dead framework, siltation and tissue necrosis of corals and sponges) to assess the overall health status of the reefs. Over the nine year period, from the north (i.e. Stjærnsund, Korallen, Steinavær and Hola) to the south (i.e. Nakken and Straumsneset) along the western Norwegian coast, no changes in the health parameters assessed were detected. Instead, in all monitored coral reefs (that are all located within fisheries closure areas) reefs appear to be in a stable state and healthy.

Conservation Status (2013 to 2018) of Marine Atlantic Reef habitats (Habitats Directive, Article 17) by EU Member State were last recorded as “Unfavourable-Inadequate (Ireland) and “Unfavourable-Bad” (UK) (see <https://nature-art17.eionet.europa.eu/article17/> (<https://nature-art17.eionet.europa.eu/article17/>)). A deep-water habitat assessment performed in the ATLAS project (Kazanidis *et al.*, 2020) indicated that the Rockall in Region V and Mingualy in Celtic Seas (Region III) are not in good status. Some evidence of damage to reefs was also observed during the SeaRover surveys 2017 to 2019 (Picton *et al.*, 2021).

No change has been noted in Region IV but both Sanchez *et al.* (2016) and van den Beld *et al.* (2017), draw attention to possible evidence of historical fishing damage. France is embarking on a five year (2021-2026) monitoring programme: Characterisation and Ecology of Cold-water Reefs

(ChEReef) which will include the installation of a coral reef observatory and *in situ* growth and recruitment rate assessments (Menot *et al.*, 2021).

Threats and Impacts

The 2009 assessment noted that fishing was the only threat that has led to a documented decline in *L. pertusa* reefs while threats from deep-sea mining, and locally from oil and gas, activities existed. The report highlighted concerns that global increases in anthropogenic CO₂ and shifting ocean currents could alter the ecology of the OSPAR Maritime Area and threaten *L. pertusa* reefs. A more recent overview of threats to *Lophelia* reefs can be found in Ragnarsson *et al.* (2017).

Analysis of Global Fishing Watch data from 2012 to present indicates that fishing pressure has remained relatively unchanged over that period (**Figure 3**).

While potential threats from oil and gas activities have decreased (with the possible exception of decommissioning leading to the removal of coral-supporting oil and gas infrastructure in the North Sea), the threat from climate change is increasing. It has been shown that meridional overturning circulation has the potential to increase acidification in the deep Atlantic Ocean with rapid shoaling of the aragonite saturation horizon particularly in the subpolar North Atlantic possible within the next three decades (Perez *et al.*, 2018). Acidification can impact the integrity of coral reefs and cause ecosystem-scale habitat loss (Hennige *et al.*, 2020). Some recent studies, however, suggest that *Lophelia* may contain sufficient genetic variability to adapt to future ocean acidification (Kurman *et al.*, 2017) at least in some regions (Georgian *et al.*, 2016).

Morato *et al.* (2020) used habitat suitability modelling to compare present-day (1951 to 2000) and projected *Lophelia* distributions under future (2081 to 2100; RCP8.5 or business-as-usual scenario) environmental conditions. The models predict a decrease of c. 80% in suitable habitat for *Lophelia pertusa* by 2100. The authors stress the importance of identifying and preserving species climate refugia when planning conservation measures to improve resilience against climate change.

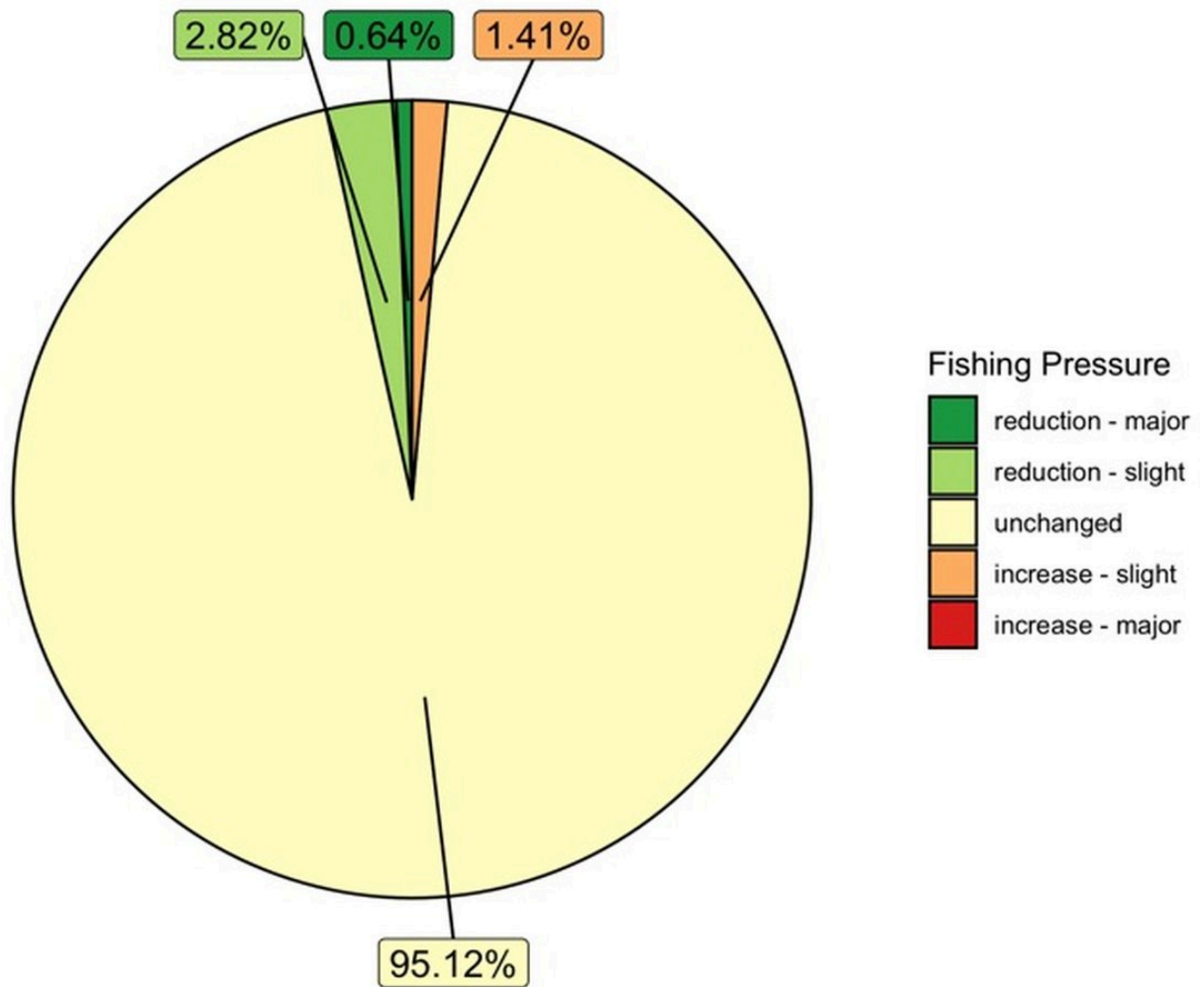


Figure 3: Overlap of Fishing Pressure and Coral Reefs based on Global Fishing Watch Data Aggregated to a Resolution of 25km² (2012 to present)

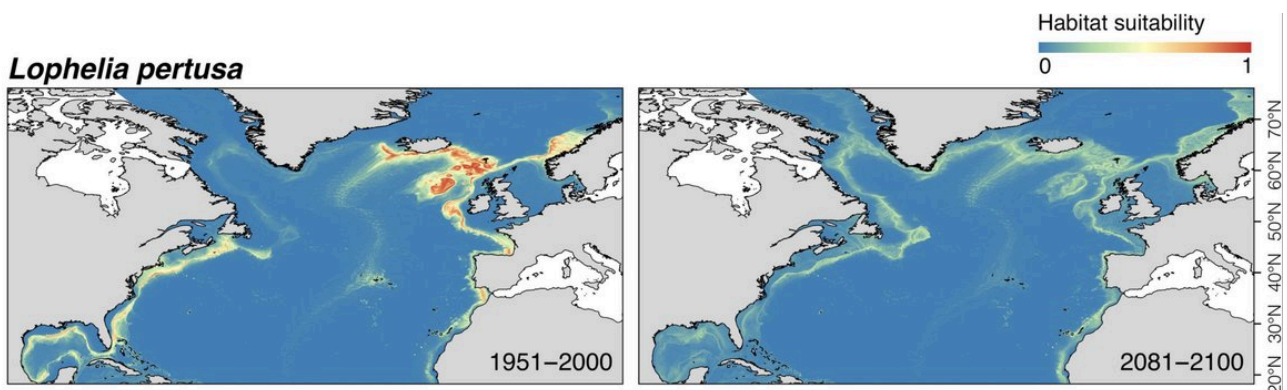


Figure 4: The predicted distribution of *Lophelia pertusa* under present day and under future environmental conditions (Morato et al., 2020).

Fishing pressure is likely to stabilize over the next 6 to 12 years as fisheries regulations implement a move to ecosystem based management. Ensuring that all anthropogenic pressures are removed from marine protected areas established for the conservation of *Lophelia* reefs is crucial to

promote resilience and allow the species the space to adapt to climate change over the coming decades.

Marine protected areas and fisheries closures using a variety of legislative tools afford partial protection for *Lophelia* reefs (**Figure 5**) in the OSPAR Maritime Area. In total over 70% of *Lophelia* occurrences lie outside protected areas. There is however considerable regional variation with 50% of *Lophelia* occurrences protected in Region V and only 13% protected in Region I.

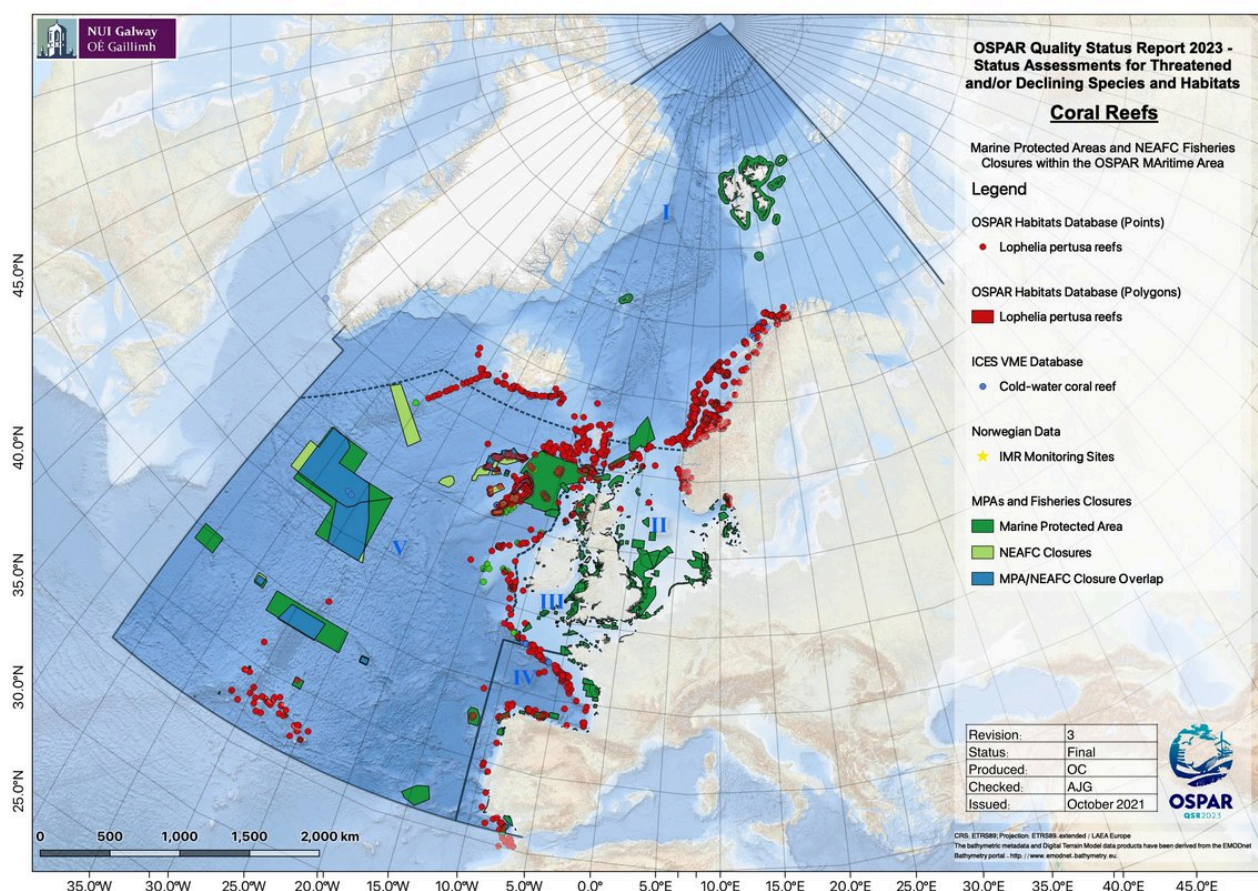


Figure 5: OSPAR marine protected areas and NEAFC fisheries closures in the OSPAR region

Of concern is evidence that bottom contact gear has been used in protected areas (**Figure 7**).

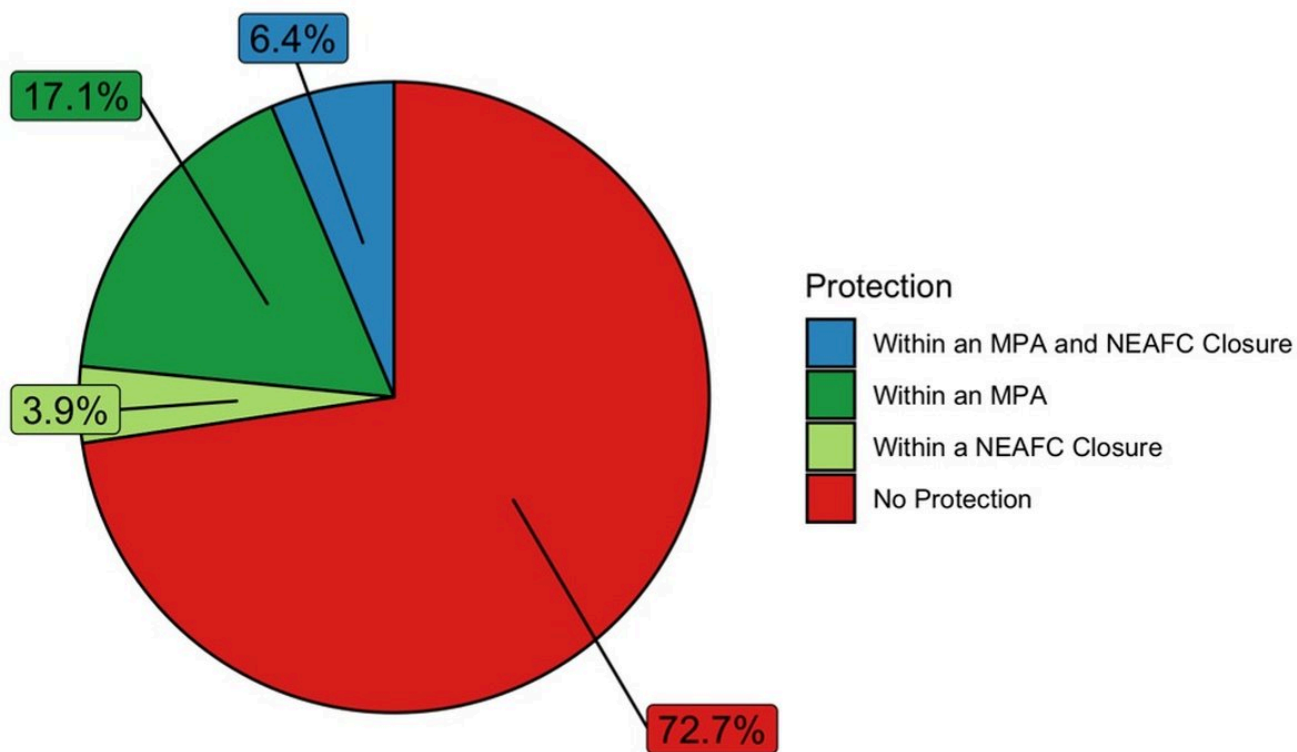


Figure 6: Distribution of *Lophelia* reef records with respect to MPAs and Fisheries Closures within the OSPAR Area.

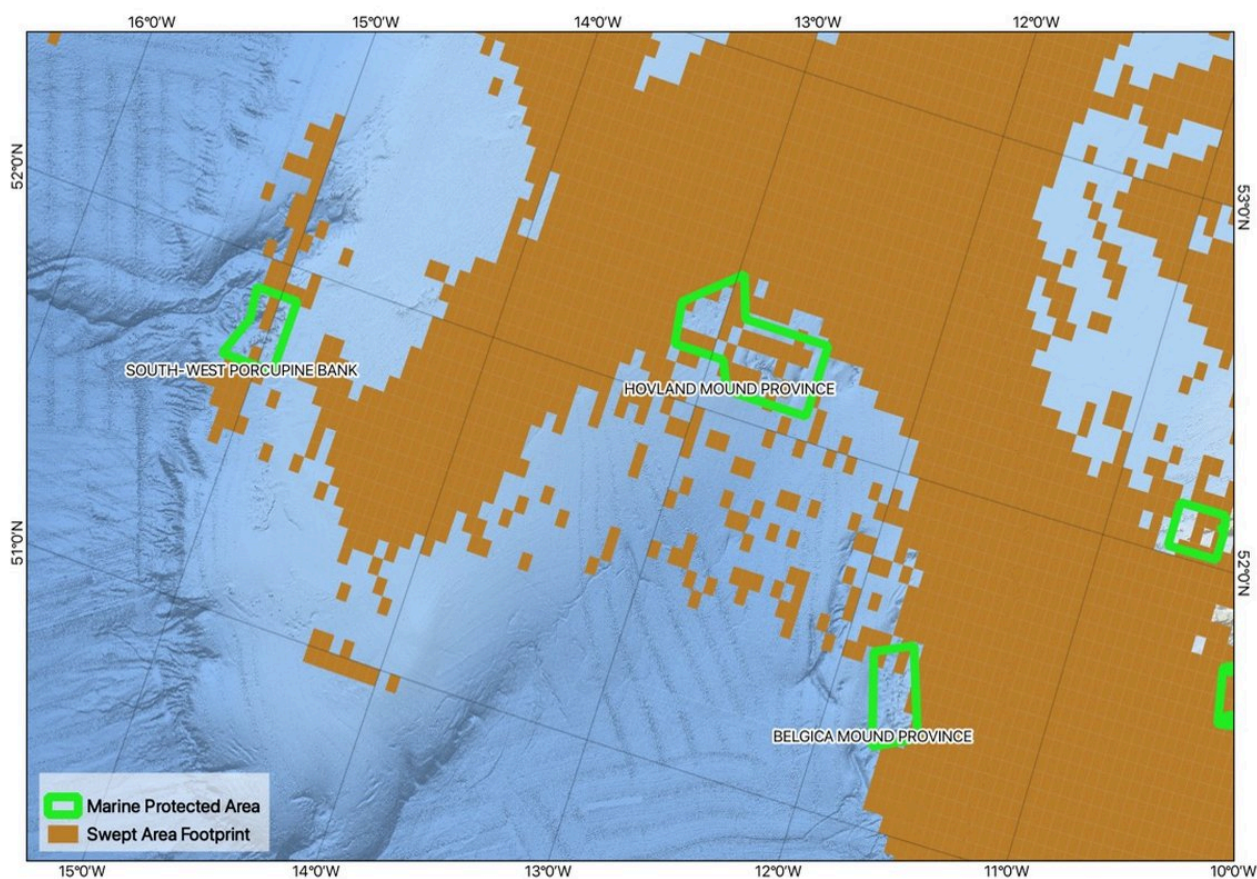


Figure 7: Example of bottom contacting fishing activity within the Hovland Mound Province SAC, Ireland in 2016. Map based on spatial data layers of swept area ratio produced by ICES in response to a 2017 request by OSPAR.

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

OSPAR measures:

3.1 a Iceland and Norway have closed all areas where *Lophelia* reefs are known to exist to bottom fishing; The United Kingdom, France, Ireland and Sweden have introduced legislation that allows protection of *Lophelia* reefs. Sweden has also implemented a total ban of fishing in areas with both dead and live coral reefs from October 2021.

3.1 b Iceland, Ireland, Norway, Spain, Sweden and the United Kingdom consider management measures to protect *Lophelia* reefs are effective. Iceland and Ireland may consider further measures to address key threats or pressures. Norway has reviewed existing closures implemented in 1999 and added additional protected areas in 2016.

3.1 c Iceland, Ireland, Norway, Spain, Sweden and the United Kingdom have implemented programmes mapping the distribution of *Lophelia* reefs.

3.1 d In Iceland, fisheries observers record coral by-catch, and companies attempt to record coral by-catch information from their vessels; Ireland is broadening its knowledge through research; Sweden is involving fisherman in a LIFE project; the United Kingdom is integrating data from fisheries surveys. In the EU, fisheries vessels are obliged to report VME bycatch between 400 and 800 m depth.

3.1 e Iceland, Ireland, Norway, Sweden and the United Kingdom make all VMS data available to regulators.

3.1 f France, Iceland, Ireland, Norway, Spain, Sweden and the United Kingdom all regularly report new data on the distribution, quality and extent of *Lophelia* reef habitat to the OSPAR habitat mapping database.

3.1 g France, Ireland, Norway, Spain, Sweden and the United Kingdom have all designated MPAs for *Lophelia* reefs. Designating of sites in Iceland is in progress.

3.1 h Only Sweden has a specific (adaptive) management plan for MPAs designated for *Lophelia* reefs. Management of activities likely to impact the reefs is routinely carried out amongst the other contracting parties.

3.1 i Iceland, Ireland, Spain, Sweden and the United Kingdom report various steps to address significant adverse impacts on *Lophelia* reefs arising from human activities in their waters, for example through fisheries legislation, including the Common Fisheries Policy, through MSFD, and through the Habitats Directive and internationally through support and advice for NEAFC (via ICES WGDEC). LIFE programme, LIFE *Lophelia*, is ongoing 2019 to 2025 with method development for restoration of *Lophelia* reefs (www.life-lopheelia.se (<http://www.life-lopheelia.se>)).

Actions taken beyond the scope of the OSPAR measures:

Within the North-East Atlantic Fisheries Commission (NEAFC) Regulatory Area, measures to protect VMEs include the implementation of bottom fishing closure areas and the use of "move-on" rules for fishing vessels, related to encounters of specific quantities of VME indicators within bycatch from bottom-contacting gears (NEAFC Recommendation 19 2014).

Within EU waters, Regulation (EU) 2016/2336 restricts bottom fishing below 400 m to the 2009-2011 fishing footprint, prohibits bottom fishing below 400 m where VMEs are known or likely to occur (through designation of VME closures) and places a complete ban on bottom trawling deeper than 800 m. Within UK waters, regulation (EU) 2016/2336 is transposed into the Common Fisheries Policy and Aquaculture (Amendment etc.) (EU Exit) Regulations 2019, with the same fishing restrictions and prohibitions in place. In Norwegian waters, Regulation 2011/755 restricts fishing with bottom gear on vulnerable benthic habitats in areas deeper than 1000 m in the Norwegian Economic Zone, including the Fisheries Protection Zone near Svalbard, and the Fisheries Zone around Jan Mayen.

Regulation (EU) 2019/1241 Annex II provides closed areas for the protection of sensitive habitats. It prohibits deployment of bottom trawls, bottom set gillnets, entangling nets and trammel nets within specified areas around El Cachucho, Madeira and the Canary Islands, and the Azores. It further prohibits deployment of bottom set longlines within El Cachucho. It specifies five areas closed to bottom trawls, bottom set gillnets, entangling nets, trammel nets and bottom set longlines in the Porcupine Seabight and Porcupine Bank, and prohibits bottom trawling around the Darwin Mounds.

Conclusion (including management considerations)

While the full distribution of *Lophelia pertusa* reef habitat in the OSPAR Maritime Area is not yet known, offshore exploration programmes, both national and EU funded, have contributed to improved knowledge of their locations. Evidence of local damage from trawling, fishing activity in MPAs and assessment of potential impact due to the overlap of fishing pressure with reef habitat suggest that reef extent is still under threat particularly reefs that are currently unprotected. Over the longer term, *Lophelia* reefs are projected to come under increasing stress from environmental changes linked to climate impacts.

Evaluation of *L. pertusa* reefs against the Texel-Faial criteria suggests that consideration should be given to including 'sensitive' to expected climate change induced environmental changes along with the criteria listed in the 2010 OSPAR assessment. Also it is recommended that the title of the habitat on the OSPAR List be amended to 'Stony Coral' reef to reflect the inclusion of other corals, such as *Madrepora oculata* (cf. Arnaud-Haond *et al.*, 2017) and *Solenosmilia variabilis*, which are within the scope of this habitat type and would take account of the recent reclassification of *Lophelia pertusa* as *Desmophyllum pertusum* (Addamo *et al.*, 2016).

The confidence for this assessment is low to medium given the caveats associated with calculating fishing pressure using Global Fishing Watch data. Modelling of the predicted response of reefs to changing environmental conditions associated with one IPCC scenario provides only one possible trajectory for the likely response of reefs. It does highlight, however, the importance of establishing an OSPAR wide monitoring network to provide an early indication of biological changes taking place at reef locations.

During the next reporting cycle, re-assessment of the impact of fishing should take place in six years to determine whether evolving fisheries regulations and expansion of MPA networks to meet UN CBD 2030 targets have reduced the fishing threat with due consideration of Annex 5 Article 4. A longer term ten year assessment should be planned to address potential changes in reef function and structure linked to climate change.

Knowledge Gaps

Accurate distribution maps of *Lophelia* reefs in the OSPAR Maritime Area are required to better assess threats from human activities especially bottom trawling. The OSPAR threatened and/or declining habitats database should therefore be the most up to date and comprehensive source of occurrence records for the region and it is imperative that Contracting Parties continue to update the database regularly and if possible in response to an annual data call.

More stringent monitoring of vessel compliance with fisheries regulations particularly in MPAs is required.

Consideration should be given to an assessment of OSPAR MPA network coherence using recently developed seascape genetics approaches combined with particle tracking (as a proxy for larval dispersion) (e.g. Ross *et al.*, 2017) in high resolution ocean models used in conjunction with multi-objective network optimization techniques (Fox *et al.*, 2019) or marine spatial planning decision support tools (e.g. Combes *et al.*, 2020).

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.

References

Sheet reference:

BDC2022/*Lophelia pertusa** reefs

* Based on molecular evidence, Addamo *et al.* (2012 and 2016) proposed that *Lophelia* be synonymized with *Desmophyllum* and the species become known as *Desmophyllum pertusum*. The basic difference between the two taxa is that *Desmophyllum* is solitary and *Lophelia* is colonial.

Stephen Cairns (Chair of the Department of Invertebrate Zoology at the Smithsonian's National Museum of Natural History) urges caution before accepting this change until more studies are published on the matter. The debate is ongoing and is mentioned here for noting.



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