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Status Assessment 2022 - Oceanic Ridges with hydrothermal vents

Oceanic ridges with hydrothermal vents are assessed as being in good status, but low confidence is placed overall on the assessment. Any trends in status associated with climate change and ocean acidification are unknown, and future plans to explore and exploit vents for deep-seabed minerals are of concern. In order to improve or maintain the good status, conservation measures for deep-sea hydrothermal vents are necessary to protect these important but rare, sensitive, island-like ecosystems with unique biotic and abiotic features.

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

Assessment of status		**Distribution**	**Extent**	**Condition**	**Previous OSPAR status assessment**	**Status (overall assessment)**
Region	**I**	⟷[3,5]	⟷[5]	⟷[2,5]	∘	Good
	II					NA
	III					NA
	IV					NA
	V	⟷[3,5]	⟷[5]	↑[2,5]	•	Good

Assessment of threats		Fishing, particularly demersal trawling and long lining (long lining not assessed here)	Climate change	Threat or impact
Region	I	↓[1,5]	?[3,5]	↓[1,5]
	II			NA
	III			NA
	IV			NA
	V	⟷[1,5]	?[3,5]	⟷[1,5]

⊞ Table Legend

⊞ Method of Assessment

Confidence

Overall: Low confidence is placed overall on the assessment.

Distribution: High confidence that the distribution has not changed.

Extent: Low confidence, due to data paucity.

Condition: Low confidence of the overall condition across the regions, as time series data are only available for one vent field in Wider Atlantic (Region V) and can't be extrapolated. Since >50% of vents in Region V are protected from anthropogenic impacts, we conclude that the condition and overall status has improved in Region V. However, effects of climate change and ocean acidification on these habitats are unknown.

Fishing Pressure: Low confidence in the scale of fishing pressure currently acting on the habitat. Available fishing data sets are not comprehensive and analyses rely on a series of assumptions. Assessment of fishing pressure using Global Fishing Watch data focussed only on demersal trawling. There was no assessment of impacts from long lining at the regional level. Information from Iceland for Arctic Waters (Region I) indicates long lining takes place on shallower vents.

Background Information

Year added to OSPAR List: 2007
https://www.ospar.org/site/assets/files/44271/oceanic_ridges_hydrothermal_vents.pdf
(https://www.ospar.org/site/assets/files/44271/oceanic_ridges_hydrothermal_vents.pdf)

- The key criteria for their inclusion were:
  - Their regional importance, based on the evidence of a very localized regional distribution at spreading centers, but impact of vents beyond the localized distribution
  - The potential decline due to the small geographic area that the habitat covers and the fragility of the structures.

  - Their rarity based on the unique microbial and animal communities associated with hydrothermal vents (most endemic).
  - Their sensitivity based on the specialized adaptations which allow organisms to exploit vent habitats, resulting in specialized faunas, which are rarely found in other environments.
  - The main threats to hydrothermal vent systems and their associated biological communities are from scientific research (including collecting), seabed mining, tourism and bioprospecting (InterRidge, 2000). In 2006, InterRidge published a "code of conduct" for responsible research at vents, which is followed voluntarily by scientists.
- Major threats were considered to be fishing and habitat damage, listed in Table 10.3 of QSR 2010. More specifically these threats stem from physical disturbance or damage to seabed, and extraction of, or mortality/injury to species by fishing.
- In 2010, Oceanic ridges were assessed as being under threat or declining https://qsr2010.ospar.org/en/ch10_02.html (https://qsr2010.ospar.org/en/ch10_02.html) for Region V but not referring to Region I.

Geographical Range and Distribution

The geographic range and distribution of Oceanic ridges with hydrothermal vents remains unchanged.

Oceanic ridges with hydrothermal vents, occur along the Mid-Atlantic Ridge in Regions I and V. Active vents are small in size, but impact the surrounding areas. The distance between the vent fields ranges from several to hundreds of kilometers.

Whilst the distribution of active vent fields has remained constant, several new vent fields have been discovered since the last assessment. In addition, multiple vent fields that are currently listed in the InterRidge database as inferred (no visual confirmation, but plume anomaly detected), or (shallow) vents that are known but nowhere formally registered, may be added to the list of confirmed active vent fields in the near future. Further, based on animals' genetic connectivity data, the finding of additional vent fields is expected.

At the time of the first assessment in 2010 there was no information and knowledge on inactive vents in the OSPAR Regions, so these were not included in the first assessment. New information on inactive vents in the OSPAR Regions have not been assessed in 2021, as no OSPAR background document is in place.

Method of assessment: 3b

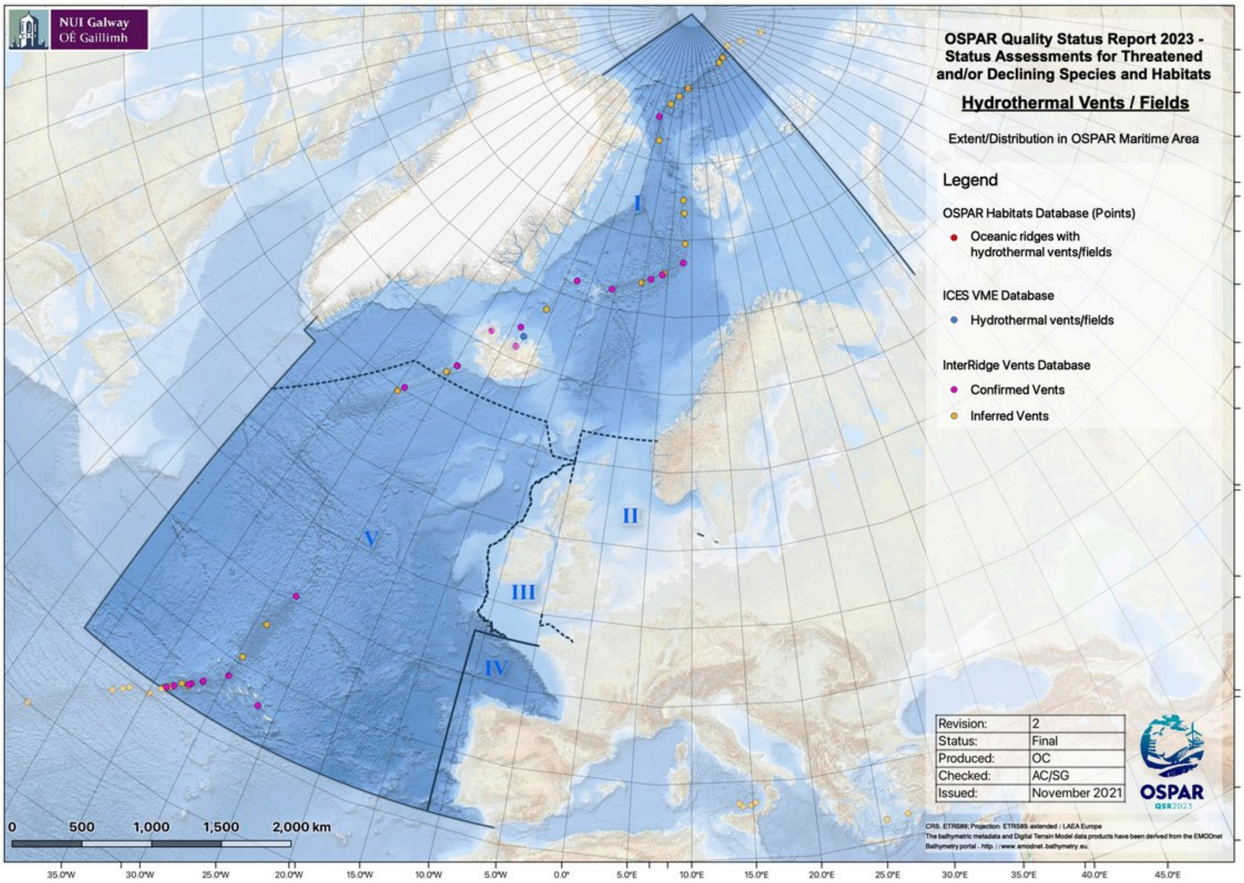

Figure 1: Distribution of known Oceanic ridges with hydrothermal vent fields in the OSPAR Maritime Area, and occurrence of inferred vent fields that might be indicative of hydrothermal vent presence

Extent

Overall, it is expected that populations remain stable, as long as they are not affected by anthropogenic impact (i.e. fishing, direct and indirect impact by potential future deep-seabed mining, change of currents due to climate change and associated change in larval dispersal).

Deep-sea hydrothermal vent fields are globally rare and extremely small in area but are typically rich in extraordinary life based on chemosynthesis rather than photosynthesis. Population densities at active hydrothermal vents are considered high compared to densities in non-vent surrounding areas. Species are often vent endemic/obligate (restricted to the active vent habitat). In general, deeper vent fields have more endemic species compared to shallower vent fields. Underlying reasons for this trend are not known.

With the exception of one vent field (Lucky Strike, Region V), time series data on population densities are not available in Region I and V. Currently, no conclusion on trends can be drawn.

Method of assessment: 1d

Condition

Overall the condition is expected to remain stable but without time series analyses, the response to any environmental changes linked to climate change, fisheries or other impacts, cannot be assessed.

The definition of active vent habitat represents a range of habitats, each with varied characterizing species. Therefore, abundance and density are likely species-specific, without thresholds of "good" habitat condition. Due to data paucity, direct condition assessments are challenging. However, in absence of robust data, conditions could be inferred from absence/presence of pressure-causing activities.

The assessment of the condition (e.g., density, biomass, body-size distribution) of ocean ridges with hydrothermal vents across the Regions I, V is quite challenging, especially because no time series (with a few exceptions) exist on the identified hydrothermal vent fields.

The Lucky Strike hydrothermal vent field inside the OSPAR and Azorean marine park protected areas have a deep-sea observatory installed, and some temporal studies were performed showing that the populations are quite stable, and that the changes observed are due to fluid dynamics. However, studies on the temporal variability of benthic invertebrates at hydrothermally active habitats have to date focused on the megafauna, with little known about the temporal variability of the macrofauna or meiofauna.

The few well studied vent fields in Regions I and V, i.e. vent fields visited on an annual basis, are unimpacted by human activities (except for very minor disturbance by scientific research). Based on expert knowledge and on the analyses of pressures that indicated low risk of impact, it is inferred that vents are in good overall condition. Very little is known about the resilience of vent communities to stress and disturbance in the OSPAR Maritime Area. Recent small-scale disturbance experiments conducted in the Lucky Strike vent field, demonstrated that recovery patterns in response to even small-scale disturbances on the northern Mid-Atlantic Ridge, are slow, very complex and not yet understood. Direct comparisons of resilience of vent communities in different oceanic settings (e.g. Mid-Atlantic Ridge and East Pacific Rise) should not be made, as the natural rate of disturbance as well as communities differ significantly.

In Region I, the upper bathyal oceanic ridges with hydrothermal vents are potentially impacted by longline fishing that could break the fragile chimneys.

A proportion of oceanic ridges with hydrothermal vents is located within Marine Protected Areas and/or NEAFC closures in the OSPAR Maritime Area, but the proportion protected varies from 0% in Region I to 54,5% in Region V (**Figure 2** and **Figure 3**). These figures do not account for other protective actions taken beyond the scope of the OSPAR measures.

Repeat monitoring of known oceanic ridges with hydrothermal vents is essential for future assessment of the condition of this habitat. At present in Region V an uncabled observing system at Lucky Strike hydrothermal vent field (EMSO-Azores) was first deployed in 2010. In Region I, the University of Bergen will deploy a permanent observatory (EMSO-Mohn) in 2022 at one of the deep vent fields. It will have several modules to measure abiotic and biotic parameters continuously at least until 2025

Method of assessment: 3c

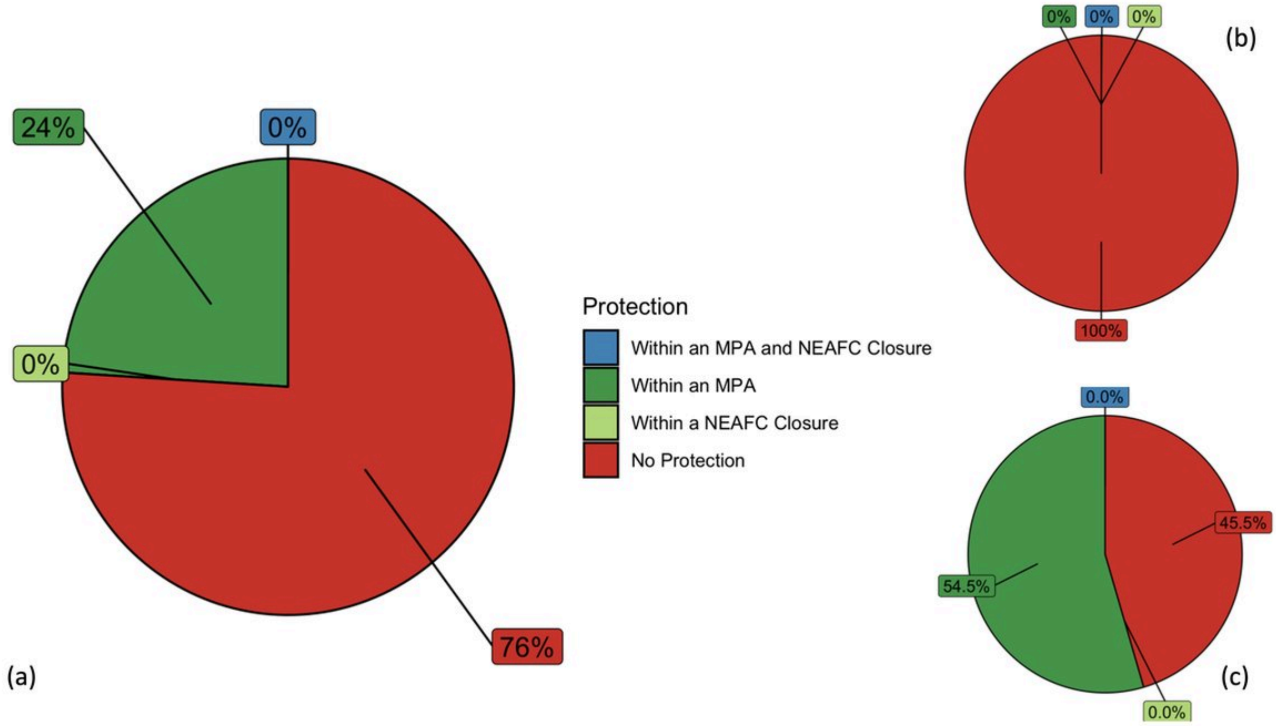

Figure 2: Proportion of Oceanic ridge with hydrothermal vents within an OSPAR Marine Protected Area and/or NEAFC Closure a) OSPAR Region ; b) OSPAR Region I; c) OSPAR Region V

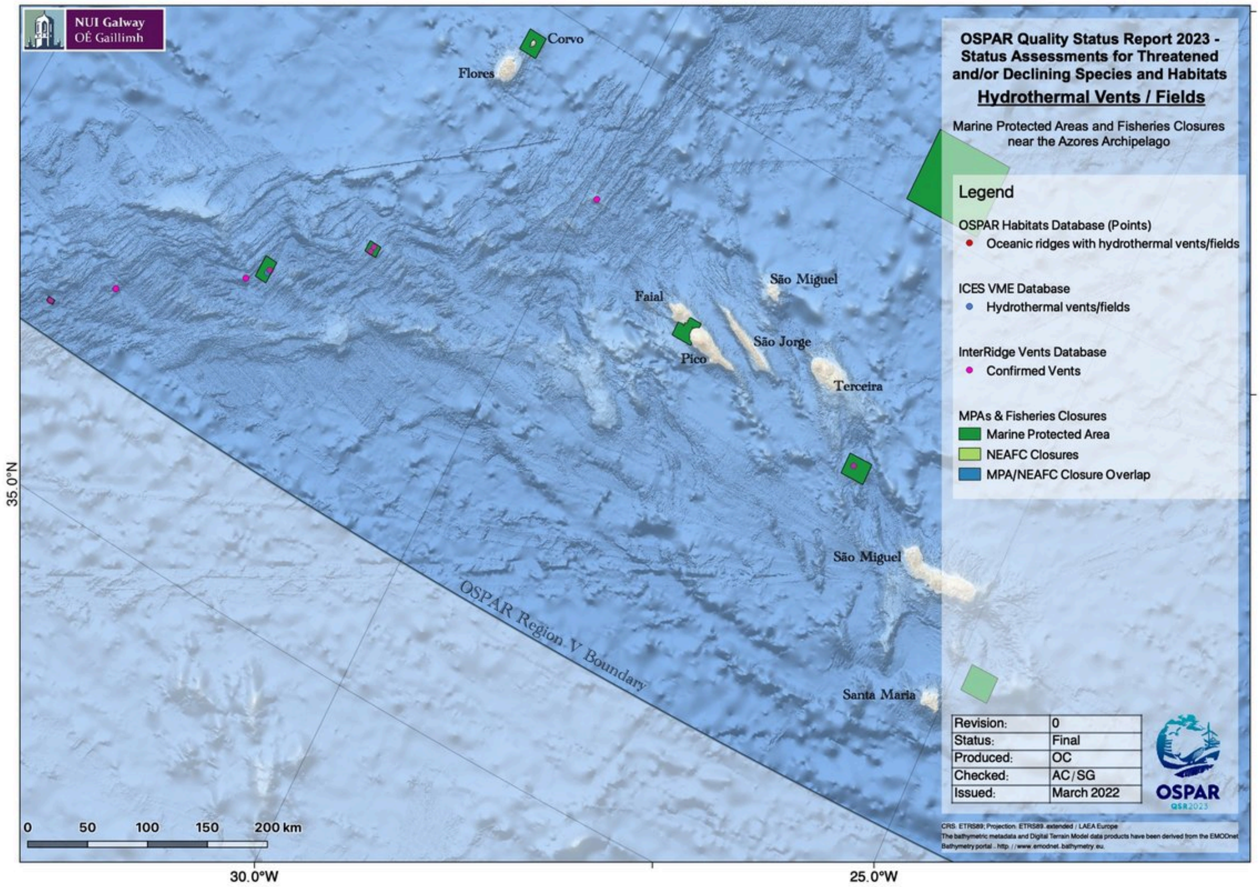

Figure 3: Location of MPAs in relation to hydrothermal vents in the Azores

Threats and Impacts

Key threats to oceanic ridges with hydrothermal vents in the QSR 2010 were fishing, particularly demersal trawling and long lining, and habitat damage (QSR 2010). Climate change, ocean acidification, marine litter, deep-seabed mining, were not identified in 2010, but pose additional threats.

Fishing

Not all the identified hydrothermal vents are at fishable depths, and some of the identified areas are under protection.

Analysis of the overlap of global fishing watch data on bottom trawling with oceanic ridges with hydrothermal vent habitat records suggests there has been little change in the overall impact of fishing on the habitat since 2016, when Regulation EU 2016/2336 was adopted.

Assessment of fishing pressure using Global Fishing Watch data focussed only on demersal trawling. There was no assessment of impacts from long lining at the regional level.

Pressure from fishing on this habitat appears to remain steady in Region V or slightly improving due to conservation measures in Region I.

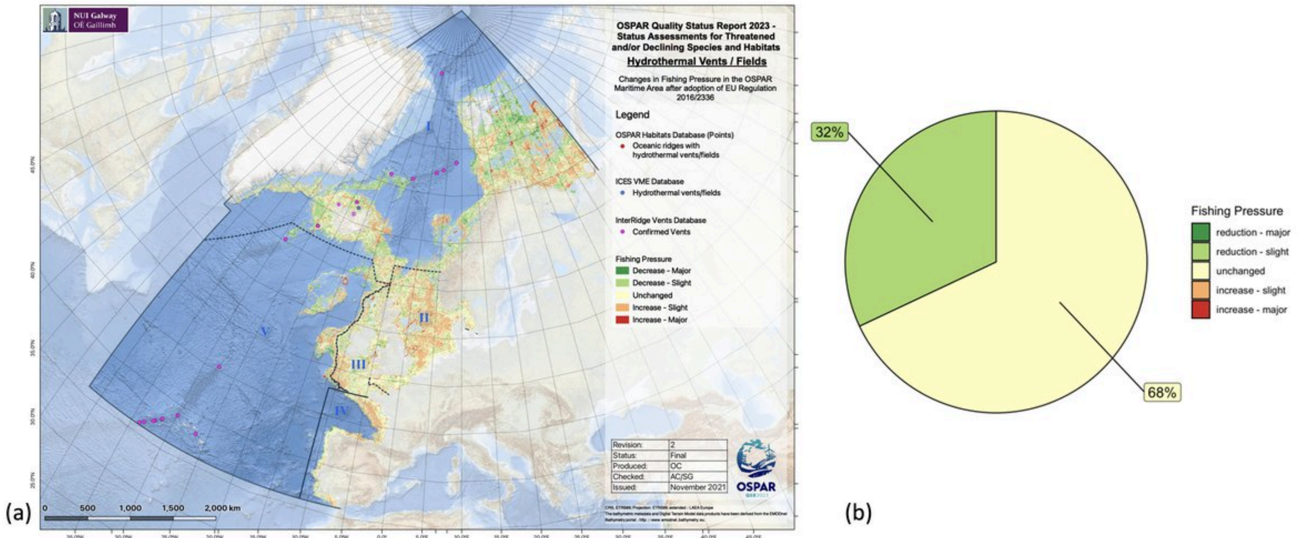

Figure 4: a) Relative change in fishing pressure across OSPAR Region after introduction of EU regulation 2016/2336 and b) change in fishing pressure in those cells known to contain oceanic ridges with hydrothermal vents

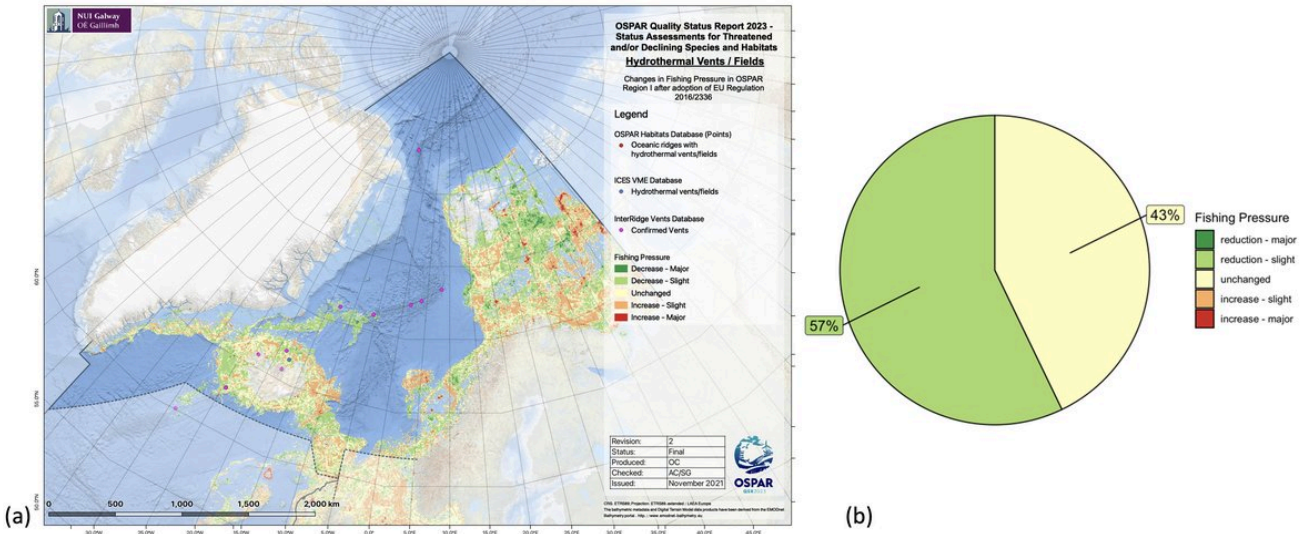

Figure 5: a) Relative change in fishing pressure across OSPAR Region I after introduction of EU regulation 2016/2336 and b) change in fishing pressure in those cells known to contain oceanic ridges with hydrothermal vents

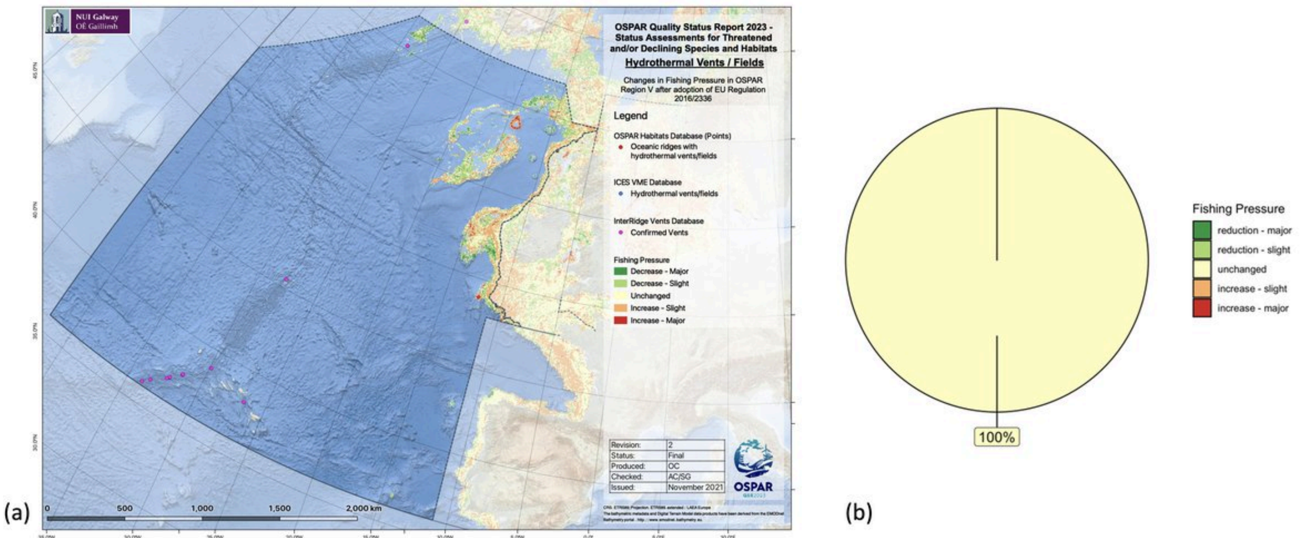

Figure 6: a) Relative change in fishing pressure across OSPAR Region V after introduction of EU regulation 2016/2336 and b) change in fishing pressure in those cells known to contain oceanic ridges with hydrothermal vents

Climate change

Although all OSPAR Regions are affected by climate stressors, ocean acidification, temperature increase, changes in POC flux, and in dissolved oxygen, the contemporary and immediate future impacts on oceanic ridges with hydrothermal vents are difficult to quantify. Scientific literature showed that contemporary climate velocities (1955 to 2005) were faster in the deep sea than at the surface. The same authors reported that projected climate velocities in the near future (2050 to 2100) will be faster at all depth layers with the exception of the surface. The different regions of the North Atlantic are predicted to experience impact differently. Whilst adult vent organisms are adapted to oscillations and variable low pH, high temperature and low oxygen of the vent fluids, it is not known if species are adapted to permanent change of environmental variables. To what degree and if vent larvae that disperse via ocean currents are adapted to changes in pH, temperature and oxygen of the ocean, is unknown. Changes induced by climate stressors, such as for example changes in circulation due to the slowdown of the Atlantic Meridional Overtunig Circulation (AMOC), can impact connectivity at regional scales and even may increase the risk of species extinction, especially due to the fragmented nature of these environments, and the planktonic nature of many vent species.

Potential future key-pressures include Deep-seabed mining and Litter. Currently there is no commercial deep-seabed mining within the OSPAR Maritime Area but, under the Seabed Minerals Act, the Norwegian government has initiated an opening process for offshore mineral activity, including an impact study (EIHA (WP) 21/01/02-Add.5Rev1). The opening process may lead to licenses being issued for mineral exploration as of mid-2023.

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

(i) OSPAR measures:

Since 2010, 34 MPAs encompassing deep-sea areas have been designated. These encompass important deep-sea habitat topographic elements such as mid-ocean ridge and fracture zones (Charlie-Gibbs North and South, and Mid Atlantic Ridge North of the Azores High Seas MPAs), and four hydrothermal vent fields (Menez Gwen, Lucky Strike , D. João de Castro, and the water column above Rainbow hydrothermal vent field) in Region V. None of the vent fields in Region I currently has OSPAR measures.

Despite the existing MPAs and NEAFC closure areas, 76% of active hydrothermal vents remain unprotected, with considerable variability across Region I and V. The proportion of records under protection (by one or both measures) varies between 0% in Region I and 54% in Region V. However, these values do not account for other protective actions taken beyond the scope of the OSPAR/NEAFC measures.

(ii) Actions taken beyond the scope of the OSPAR measures

In 2006, the United Nations General Assembly called upon States to take action through Regional Fisheries Management Organisations (RFMOs) to, inter alia, protect vulnerable marine ecosystems (VMEs) from destructive fishing practices and prevent significant adverse impacts (SAIs) (UNGA Resolution 61/105). VMEs and SAIs are further defined in FAO (2009) and VMEs include the OSPAR habitats deep-sea sponge aggregations, coral gardens, cold-water coral reefs, seamounts and hydrothermal vents/fields.

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 by-catch from bottom-contacting gears.

Within EU waters, Regulation (EU) 2016/2336 restricts bottom fishing >400 m to the 2009 to 2011 fishing footprint, prohibits bottom fishing >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. Council regulation no. 1568/2005 established a ban on the use of bottom-contacting gears (gillnet, entangling and trammel nets, bottom trawl or similar towed nets) at depths below 200 m in certain areas of the Atlantic Ocean including the Azores archipelago (Region V).

In Portugal, since 2016, the Marine Park of the Azores which is currently constituted by 17 MPAs, covers an area of approximately 246 000 km^2 (Decreto Legislativo Regional n.º 28/2011/A, modified by the Decreto Legislativo Regional n.º 13/2016/A and Portaria Portaria n.º 68/2019)

In Norway, none of the hydrothermal vent fields are protected by law. In Norwegian waters, Regulation 2011/755 restricts fishing with bottom gear on vulnerable benthic habitats in areas deeper than 1 000 m in the Norwegian Economic zone, including the Fisheries Protection Zone near Svalbard, and the Fisheries Zone around Jan Mayen.

In Iceland, the Strýtan and Arnarnesstrýturnar hydrothermal vent sites are protected from fishing activities cf. regulation no. 249/2001. All bottom trawling is prohibited on the Steinahóll vent field and within the fjord Eyjafjörður but bottom trawling for shrimp is allowed at the Grímsey and Kolbeinsey vent locations with data on fishing activities indicating regular trawling on or close to the Grímsey vent field. At present there is ongoing policy work on protecting Steinahóll from all bottom-fishing activities and preparations are being made to request for increased protection for the Grímsey and Kolbeinsey vent sites.

Conclusion (including management considerations)

The overall condition of oceanic ridges with hydrothermal vents is considered to be stable or improving with regard to fishing impact across all OSPAR Regions. Impacts from climate change are difficult to assess but presumed to become detrimental in the future, alongside with other emerging pressures such as potential future deep-seabed mining.

Oceanic ridges with hydrothermal vent fields continue to meet the Texel-Faial criteria, and new research further emphasises their regional and global importance.

High scientific knowledge on fundamental ecological processes at active vents gives high confidence that active vents are of high regional importance, are rare and sensitive.

Vent fields host small, island-like ecosystems with unique biotic and abiotic features. Given the very small and discrete areas they inhabit, vent-endemic species are globally rare. All active hydrothermal vents support primary production by microorganisms, serve as discrete feeding areas, and are essential for the growth, survival, reproduction, and persistence of vent endemic species. All active vent fields are fragile ecosystems that are geographically isolated and discrete, hosting populations of benthic invertebrate species that rely on dispersal through pelagic larval stages for maintenance of populations and genetic connectivity. Habitat degradation and fragmentation due to anthropogenic disturbance may result in local loss of biodiversity and ecosystem services. Connectivity among metapopulations of species is characterized by source-sink dynamics, making these systems sensitive to reduction or loss of source populations, with ecological consequences on the structure and function of metacommunities.

Various area-based management tools (OSPAR MPAs) and other effective conservation measures (NEAFC closures) have been developed, but these are only located in Region V, whereas all of the habitat that occurs within Region I is unprotected by OSPAR/NEAFC measures. Increased protection in Region I is desirable. In Region V, the new MPA's from the Azores Marine Park give an additional protection to this habitat in water under portuguese jurisdiction. However the only deep-sea hydrothermal vent field situated at the MidAtlantic Ridge north of the Azores remains unprotected.

Status reassessments should be performed on a mid-term cycle (six years) to allow for substantial new data to be collected and changes in condition to be noticeable. The discovery of new vent fields is expected and the potential start of mineral exploration in Region I is planned for 2023.

Coastal active vent fields have been excluded from this assessment, as those are typically a secondary manifestation of volcanism, and fauna is typically a subset of fauna present in the vent-surroundings. Oceanic ridges with hydrothermal vents were proposed as a A6 Eunis habitat, which means deep-sea hydrothermal vents. However, coastal vents are very little studied. Contracting Parties may wish to consider assessing the habitat against the Texel-Faial criteria with a view to nominating it for inclusion on the OSPAR list of threatening and declining habitats.

Inactive vents were not considered in this assessment, as they fall outside the scope of definition of the 2010 background document. However, inactive vents are geographically located very close to active vents, within the same vent field, and will face similar threats as active vents. Contracting Parties may wish to consider assessing the habitat against the Texel-Faial criteria with a view to nominating it for inclusion on the OSPAR list of threatening and declining habitats.

The chemosynthetic environment "cold seeps" are not assessed against Texel-Faial criteria. This habitat occurs in several margins at the OSPAR Maritime Area and is an important and localized habitat, with endemic fauna, and in some cases under threat of climate change or of future gas hydrate exploration. Contracting Parties may wish to consider assessing the habitat against the Texel-Faial criteria with a view to nominating it for inclusion on the OSPAR list of threatening and declining habitats.

Knowledge Gaps

Given the remote location and high costs to access hydrothermal vent fields (requiring usage of remotely operated vehicles or small submersibles), most data is point data - from a few locations at one time point. Multiple sampling operations at multiple times (monitoring) would be needed to address knowledge gaps of biodiversity, connectivity, life histories (including for example reproduction and growth rates), function and resilience of communities to disturbance and change (e.g. fishing, climate change, potential future deep-seabed mining). Only for few vent fields ia such data (partly) available or currently researched. There is a trend of deeper vent fields having more endemic species compared to shallower vent fields. Underlying reasons for this trend is not known. A comparison between the OSPAR active vent fields is currently not possible.

Method used

Assessed as part of a group of deep-sea habitat assessments led by Ireland, chaired by Louise Allcock (National University of Ireland Galway, Ireland). Oceanic ridges and hydrothermal vent habitat assessment by Ana Colaço (Universidade dos Açores, Portugal; habitat lead), Sabine Gollner (Royal Netherlands Institute for Sea Research, Netherlands), Hrönn Egilsdóttir (Marine and Freshwater Research Institute, Iceland), Pedro Ribeiro (University of Bergen, Norway), with further contributions from the participants of the OSPAR deep-sea habitat assessment workshop, held online 6 to 8 September 2021. GIS analyses by Oisín Callery (NUI Galway, Ireland) and Anthony Grehan (NUI Galway, Ireland). Marjolaine Matabos (IFREMER) commented on the completed draft.

⊞ References

Sheet reference:

BDC2022/Oceanic_Ridges_with_hydrothermal_vents