OSPAR COMMISSION

Condition of Benthic Habitat Communities – The Common Conceptual Approach

Common Indicator Assessment

OSPAR

QUALITY STATUS REPORT 2023

2023

Condition of Benthic Habitat Communities – The Common Conceptual Approach

OSPAR Convention

The Convention for the Protection of the Marine Environment of the North-East Atlantic (the "OSPAR Convention") was opened for signature at the Ministerial Meeting of the former Oslo and Paris Commissions in Paris on 22 September 1992. The Convention entered into force on 25 March 1998. The Contracting Parties are Belgium, Denmark, the European Union, Finland, France, Germany, Iceland, Ireland, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Convention OSPAR

La Convention pour la protection du milieu marin de l´Atlantique du Nord-Est, dite Convention OSPAR, a été ouverte à la signature à la réunion ministérielle des anciennes Commissions d´Oslo et de Paris, à Paris le 22 septembre 1992. La Convention est entrée en vigueur le 25 mars 1998. Les Parties contractantes sont l´Allemagne, la Belgique, le Danemark, l´Espagne, la Finlande, la France, l´Irlande, l´Islande, le Luxembourg, la Norvège, les Pays-Bas, le Portugal, le Royaume- Uni de Grande Bretagne et d´Irlande du Nord, la Suède, la Suisse et l´Union européenne

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Citation

Guérin, L., Lizińska A., Schmitt P. and Wijnhoven, S. 2023. *Condition of Benthic Habitat Communities – The Common Conceptual Approach*. In: OSPAR, 2023: The 2023 Quality Status Report for the North-East Atlantic. OSPAR Commission, London.. Available at: https://oap.ospar.org/en/ospar-assessments/quality-status-reports/qsr-2023/indicator-assessments/condition-benthic-habitat/

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Key Message

Assessing the condition of benthic habitat communities against all pressure types is a challenge. Current results are based on the "Margalef species diversity index" and "Assessment of some coastal habitats in relation to nutrient and/or organic enrichment". Only a few habitats and pressure types are included in these assessments, further development is needed.

Background

Benthic habitats (**Figure 1**) are essential for marine life, because marine species rely directly or indirectly on the seafloor to feed, hide, rest or reproduce. Benthic habitats are characterised by animal and plant communities with no or slow mobility when compared to fish or marine mammals. The whole benthic community is therefore exposed when a pressure occurs. As a result, the condition (quality status) of benthic habitats reflects the combined effects of all the pressures to which they are subject.

The concept for a common approach for evaluating the condition of benthic habitats and their communities is presented. The application of this common approach has been endorsed by OSPAR for the Greater North Sea, Celtic Seas, and Bay of Biscay and Iberian Coast through the adoption of a Common Indicator. It has been recognised that to assess the impact of each human pressure on the condition of each benthic habitat type, along a pressure-impact gradient, requires specific assessment methodology and scales (**Table 1**). The aim is to inform management of human activities with as full an understanding as possible of the relative effects of different pressures on benthic habitats and their communities. For example, which habitats are affected, where, by how much and for how long.

OSPAR-wide assessments of benthic habitats are at a relatively recent stage of development and this concept will be further elaborated prior to the next OSPAR Quality Status Report and subsequent assessments.

Figure 1: Horse mussel beds (Modiolus modiolus) © Scottish Natural Heritage

Table 1: Relationships between habitat and pressure types, and how / if the relationships are currently assessed or considered. ***Relationships based on the revised EU Marine Strategy Framework Directive (MSFD) – Commission Decision (2017/848/EU), and OSPAR / MSFD pressure categories.***

	Broad Pressure Type							
Broad Habitat Type	Physical damage	Removal of species	Hydrological changes	Eutrophication (nutrients or organic matter)	Non indigenous species	Contaminants	Litter	Energy, including under water noise
Littoral rock and biogenic reef				A				
Littoral sediment				A				
Infralittoral rock and biogenic reef				A				
Infralittoral sediment	P			A				
circalittoral rock and biogenic reef				A				
circalittoral sediment	P			A				
Offshore circalittoral rock and biogenic reef								
Offshore circalittoral sediment	P							
Upper bathyal rock and biogenic reef								
Upper bathyal sediment								
Lower bathyal rock and biogenic reef								
Lower bathyal sediment								
Abyssal								

Key:

A	Assessed and reported under the European Union Water Framework Directive (WFD)
	Considered under the European Union Marine Strategy Framework Directive (MSFD)
P	Partially assessed in the OSPAR Quality Status Report 2023
	Main risk (potentially widespread across the OSPAR Maritime Area)
	Relationship identified but not currently assessed

Assessment Method

Use of this common approach to evaluate the quality of benthic habitat communities, according to each pressure type along a pressure-impact gradient, has been endorsed for the Greater North Sea, Celtic Seas, and Bay of Biscay and Iberian Coast. Preliminary testing demonstrated that it is conceptually applicable to all habitat types but has only been applied to selected habitat types for the Intermediate Assessment (IA) 2017. Further testing is required to conclude on the relevance and performance of each metric and statistical index, depending on the habitat and pressure types assessed (**Table 1**).

The colours in the table matrix identify where a particular pressure versus habitat relationship is considered within European Union Directives. The ambition of this indicator is both to draw on existing assessments and to complement this material with new data and knowledge in order to provide better understanding of the overall condition of the benthic habitat community.

Biological and environmental data are quantitatively sampled (such as by grabs, cores, quadrat) at community scale (for example, at least at EUNIS Level 5 for sublittoral sand or infralittoral rocks). The EUNIS habitat classification is a system to classify types of habitat at several nested levels. The higher the level, the more detail and sub-types of habitat are included.

Table 1 identifies the main pressures, with the potential for widespread impacts, for each habitat type at EUNIS (European Nature Information System) Level 2 in the OSPAR Maritime Area. The broad pressure and habitat types (EUNIS Level 2) presented in **Table 1** are summarised, however, to assess the condition of habitats versus pressures in the marine environment, relationships should be considered at a finer scale.

Monitoring, assessment and reporting should be completed per pressure and habitat type. The cumulative effect of co-occurring pressures (different types of pressure at the same place and in the same time range) is not currently assessed.

This indicator aims to assess and quantify the relationship between state and pressure. The indicator requires the following types of data, at relevant and compatible spatial and temporal scales: biological data (community species abundance), environmental data (substrate and water characteristics), and pressure data (type, intensity, frequency).

Monitoring and assessment scale should be adapted depending on each habitat and pressure type, from the site scale (100 m) to regional assessment scale (100 km).

The technical principle underpinning this assessment is to detect and quantify the impact of a pressure by a deviation (of values of the computed statistical index) compared to (simultaneously assessed) reference stations (defined as under least-damage condition), per habitat type.

Diversity indices and species richness indices as well as sensitivity / tolerance species classification systems have long been used to assess the qualitative state of benthic habitat communities. The development of Benthic Indices (BI), which combine the aforementioned indices and classifications, was made mandatory by the Water Framework Directive (WFD). Species composition and relative abundance of the benthic habitat community are basic common metrics. Multi-metric BI classically contain diversity indices, species richness indices and / or proportions of sensitive, tolerant and opportunistic species. Species sensitivity is a proxy used to quantify disturbance for some pressures on a benthic habitat community: either as a direct or indirect effect of nutrient and / or organic enrichment, oxygen depletion, sand extraction or hydrological changes. This requires a good knowledge (for the communities and species assessed) of natural spatial and temporal scales of variation and sensitivity to a specific pressure gradient.

In order to undertake an assessment to meet OSPAR and European Union Marine Strategy Framework Directive (MSFD) requirements, there are many gaps in knowledge of benthic habitats that require research, for example benthic habitat community and sensitivity classification for several habitats' types and the characteristics of pressure types (for example, physical, contaminants and biological pressures).

Multi-dimensional deviation in community structure from a reference condition, aims to link pressure (for management issues) and pressure-impact calibration of indices (level of disturbance / resilience). This is set up with various pressure types at the community level, by combining biological and pressure data. Analysis of sensitivity is then elaborated at community level rather than species level. This is an important distinction and a point of attention for further development by experts and implementation for management issues (i.e., specific parameters / metrics to be monitored).

The collection of biological, environmental and (semi-) quantitative pressure data along a pressure gradient is a key step to calculate this metric and to validate the pressure-impact evaluation for an effective multi-metric index.

This common approach has the potential to assess a wide range of environmental aspects and provide more information by looking at them together, than could be gained from assessing each aspect individually.

Further framework development for this indicator (methods, monitoring, data flows) is needed to address all potential MSFD / OSPAR purposes. This indicator should include a necessary flexibility (both for metrics and indices) to consider the wide range of applications to different habitat types, to target offshore habitats and to assess sensitivity / tolerance to various pressure types.

Further sub-assessments (for example on contaminants and sediment extraction or dumping) are being developed outside the OSPAR works and are likely to be incorporated into future OSPAR assessments. Future assessments would then be combined as components of an 'umbrella' assessment to provide an overall view of the condition of benthic habitats in the North-East Atlantic.

The sub-assessment sheets will follow specific assessment methodology depending on the habitat and pressure types (for now 'Condition of benthic habitat communities: assessment of some coastal habitats in relation to nutrient and/or organic enrichment' and 'Condition of Benthic Habitat Communities: Margalef diversity in region II (Greater North Sea)'). For the purposes of the QSR 2023, this assessment sheet sets out the proposed method for assessment of the indicator overall.

This indicator needs to be developed in close coordination with other benthic indicators, to ensure complementarity and avoid redundancies, that is, 'typical species composition', 'physical disturbance of benthic habitats' and other indicators that are still under development (such as 'area of habitat loss' and 'size-frequency distribution of bivalve or other sensitive / indicator species').

Guidelines for generic monitoring and assessment methods are described in the CEMP Guideline; including detailed technical specifications. These documents are regularly updated, according to the work conducted for the development, testing and implementation of this indicator. An applied research programme: The ecosystem approach to (sub) regional habitat assessments EcApRHA and NEA PANACEA projects were co-financed by the European Union and coordinated through OSPAR to address gaps in biodiversity indicator development. It has enabled the further development of several benthic indicators. In addition, these projects have also enabled links between indicators (methods, scales, monitoring and data requirements), including investigation of an integrated method for an overall assessment of benthic habitats, to be developed (Elliott *et al.*, 2017a, 2017b, 2018).

Results

Currently, only two conditions versus pressure interactions have sufficiently developed methodologies and data availability to undertake assessments in line with the common conceptual approach. These are 'Condition of benthic habitat communities: assessment of some coastal habitats in relation to nutrient and/or organic enrichment' and 'Condition of Benthic Habitat Communities: Margalef diversity in OSPAR Region II (Greater North Sea)'.

In the future, to have a better understanding of pressures on the seabed, the assessment of benthic habitats will include results from a range of assessments of specific pressures. Each set of results will differ depending on which pressure type (and thus, specific associated assessment scale) is considered. The cumulative effect of co-occurring pressures (different types of pressure at the same place and in the same time range) is not currently assessed. Further development will take place over the next assessment cycle (depending on progress in developing methods to integrate assessments and other indicators) to provide an overall understanding of the condition of benthic habitats in the North-East Atlantic. Progress on developing cumulative effects assessment is also addressed under the benthic habitat thematic assessment.

Conclusion

Assessing the condition of benthic habitats against all pressure types within the OSPAR Maritime Area is a huge challenge for science and management. In only a few years, experts involved in Regional Seas Conventions have developed common approaches to assess the effects of each pressure type.

Currently two habitat pressure interactions have been assessed in line with the common conceptual approach, however work to develop assessment of other habitat and pressure types is promising. Further work is needed to address knowledge gaps, monitoring and data flow needs to ensure sufficient and adequate data for an effective region wide assessment. The added value of a common approach to assessing the condition of benthic habitat communities will be realised through its application in combination with other benthic indicators. This will provide fuller understanding of the extent of the effects of pressures on benthic habitats: i.e., which habitat is affected, where, by how much and for how long has it been impacted.

More extensive data and the development of methods for assessments of additional pressure-habitat interactions should, in the future, provide clearer signals and identify clearer trends to inform management needs.

Knowledge Gaps

More benthic monitoring (**Figure 2**) and further methodological development is required to provide relevant data, adapt, operationalise and implement coherently this common conceptual approach for all pressure and habitat types. Although promising, this indicator requires more development and testing to be fully operational for all OSPAR and MSFD purposes for the next assessment. An action plan (Padegimas *et al.,* 2017) to address some of these knowledge gaps has been adopted as a result of the OSPAR EcApRHA project, completed through NEA PANACEA project deliverables, to be included in the updated OSPAR Science Agenda.

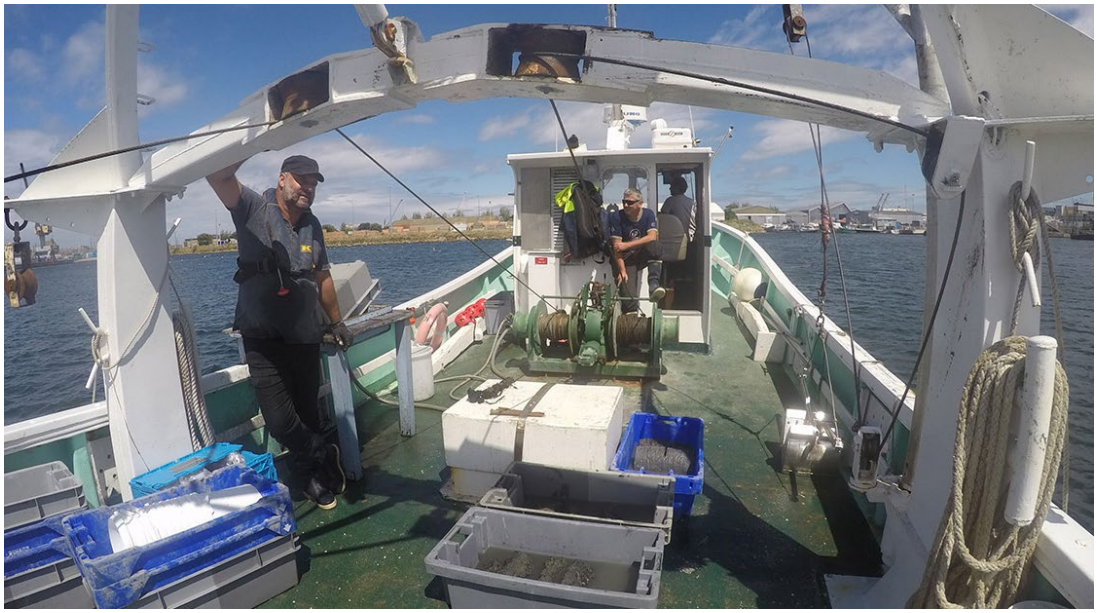

Figure 2: Coastal survey and sampling equipment for benthic habitat monitoring

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EcApRHA deliverable WP5.6, ISBN: 978-1-911458-30-2.
http://dx.doi.org/10.13140/RG.2.2.27994.82889

Assessment Metadata

Field	Data Type	
Assessment type	List	Indicator Assessment
SDG Indicator	List	14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution 14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans 14.a Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries
Thematic Activity	List	Biological Diversity and Ecosystems – Benthic Habitats
Relevant OSPAR Documentation	Text	OSPAR Agreement 2018-06 CEMP Guideline - Condition of benthic habitat communities (BH2) – common approach
Date of publication	Date	2023-06-30
Conditions applying to access and use	URL	https://oap.ospar.org/en/data-policy/
Data Snapshot	URL	No Data - Conceptual Approach
Data Results	Zip File	No data – conceptual approach

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Our vision is a clean, healthy and biologically diverse North-East Atlantic Ocean, which is productive, used sustainably and resilient to climate change and ocean acidification.

Publication Number: 945/2023