Condition of Benthic Habitat Communities: Subtidal Habitats of the Southern North Sea

MSFD Descriptors: 1 - Biological diversity, 6 - Seafloor integrity
MSFD Criteria: 1.6 - Habitat condition, 6.2 - Condition of benthic community

OSPAR COMMISSION

Key Message Benthic habitat community quality has been sub-regionally assessed in terms of species richness in the southern North Sea. Community quality is generally lower in coastal areas than offshore areas and this is partly due to higher fishing pressure in coastal areas

Background

Benthic (seafloor) habitats 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 compared to fish or marine mammals. The whole community is therefore exposed when a bottom pressure occurs. As a result, the condition (quality status) of benthic habitats is a reflection of the combined effect of all the pressures put upon it. The number of species corrected for their abundance, is often used to assess the impacts of different pressures (such as disturbance of the seafloor and extraction of species by fisheries, nutrient and organic enrichment, sedimentation and contaminants) on the benthic habitat and community condition.

Sub-regional-scale benthos assessments are a relatively new development. However, they build upon 15 years of international marine benthos experience within the framework of the European Union Water Framework Directive (WFD). The southern North Sea includes the waters of Belgium, Denmark, Germany, the Netherlands and the United Kingdom (**Figure 1**) and can be regarded as a coherent biogeographical zone of mainly subtidal soft sediments. Therefore the southern North Sea was selected for the first application of a common multi-metric index (MMI) for marine benthos. Several MMIs were tested and the single Margalef diversity index was selected because it is the most pressure sensitive.

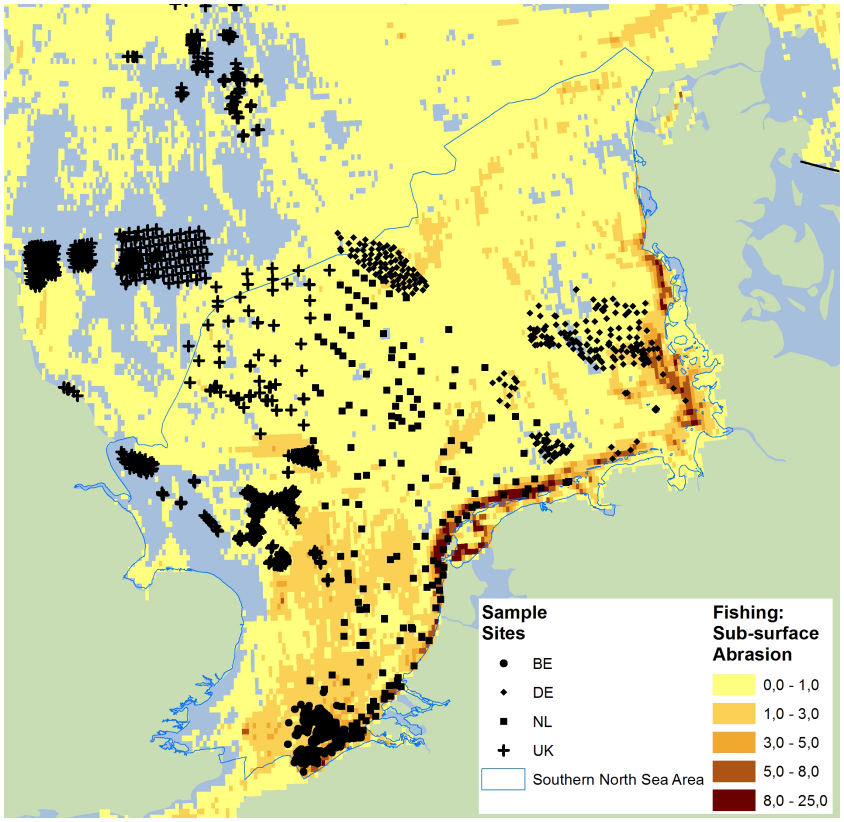

Figure 1: The southern North Sea encompasses the waters of the Belgium, Denmark, Germany, Netherlands, and United Kingdom
Black symbols indicate benthos monitoring samples (no benthos data from Denmark). Yellow/orange shading indicates bottom fishing abrasion in terms of swept area ratio

Results

The Margalef diversity index shows that in the shallow coastal areas of Belgium, Germany and the Netherlands a relatively lower benthic condition is generally observed compared to deeper offshore areas (**Figure 2**). The assessment result shows that, in spite of lower coastal reference values, the normalised Margalef diversity values (defined as sample index values divided by the reference value) in the Belgian, German and Dutch coastal areas are generally lower compared to the offshore areas (such as the German and Dutch Dogger Bank). The areas of the southern North Sea assessed (**Figure 2**) are based on the EUNIS 3 habitat classification system. Each habitat type has been assessed separately.

For the first time, the normalised Margalef diversity value (range 0–1) can be significantly related at a broad international scale to average fishing pressure in the assessment areas of the southern North Sea (**Figure 3**). In Figure 3, the curve shows an exponential decrease in the benthic habitat community condition in the fisheries activity range 0–2.3 subsurface sweeps / year, followed by a stabilisation of the community condition at higher fishing activities. This curve shows that at a fishing activity of >2.3 subsurface sweeps / year a resilient benthic community of lower quality has been induced, which remains at the same quality level under increasing fishing activity. Note that fishing activity has been averaged per assessment area-year to obtain an improved curve. The 90% confidence interval for each data point (assessment area-year) is shown. The relation is highly significant ($p < 0.0001$).

This fishing activity is generally relatively high in coastal areas (**Figure 1**) and relatively low in the Dogger Bank areas. The Dogger Bank extends from the eastern part of British waters to the northern Dutch and German waters. In summary, the normalised Margalef diversity index shows clear differences in benthic community quality between the assessment areas in the southern North Sea (**Figure 2**).

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Results cont...

The results of this assessment describe the impact of fisheries on benthic habitats. However, other human pressures in the coastal zone, such as nutrients and / or organic enrichment, dumping and sedimentation, coastal sand nourishment (at the shoreline), sand extraction and contaminants can also add to the coastal pressure mix on habitats, depending on the local conditions. Of these typically coastal pressures, only nutrients and / or organic enrichment may be present at a wider scale, while the other pressures generally act on a more local scale.

There is moderate confidence in the method for this assessment and high / moderate confidence for data availability.

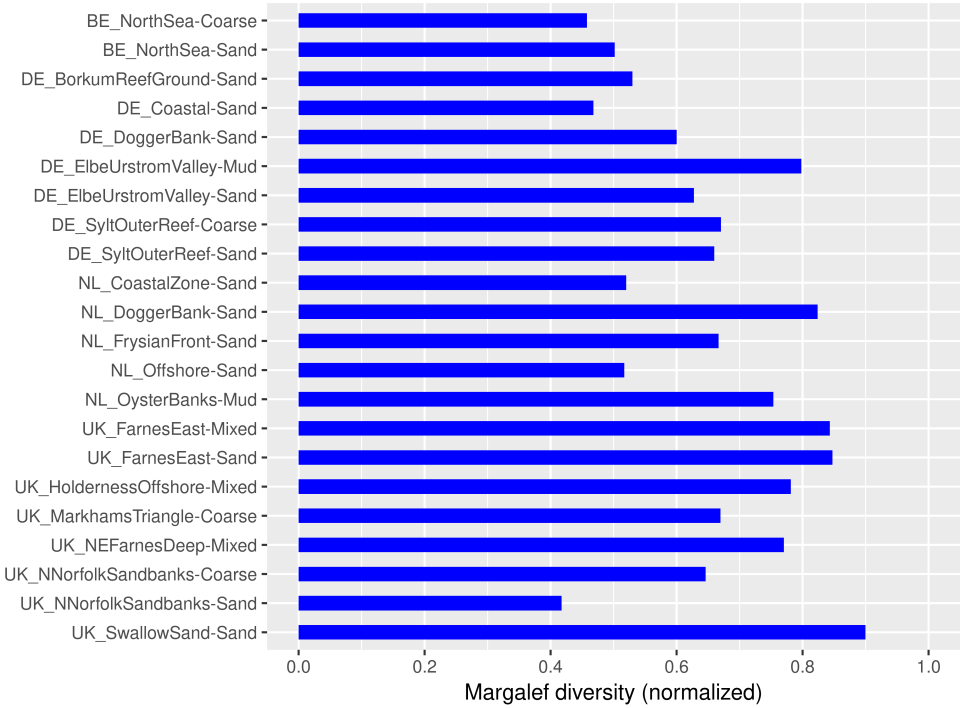

Figure 2: Assessment results for the southern North Sea assessment areas (habitat types) using the normalised Margalef diversity scores (range 0–1) averaged for the period 2010–2015 *Note that higher index scores indicate a higher benthic community quality*

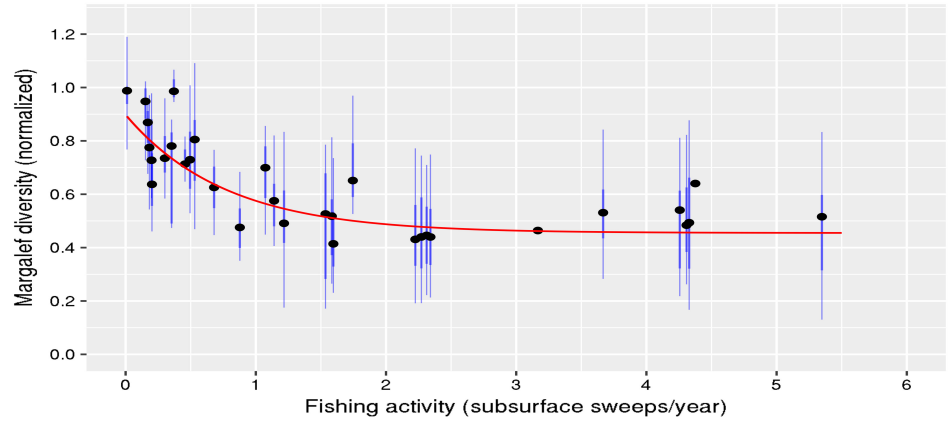

Figure 3: Relation between fishing activity (subsurface) and the normalised Margalef diversity value, as demonstrated for all benthos data from the Southern North Sea in the period 2009–2013 from assessment areas with sufficiently reliable reference values

Conclusion

This assessment has focused on the assessment of Condition of Benthic Habitat Communities - Subtidal Habitats of the Southern North Sea as one component of a more comprehensive indicator of the condition of benthic habitats defining communities (Condition of Benthic Habitat Communities).

The selected Margalef diversity index assessed the benthic community quality and shows clear differences between assessment areas. Coastal areas usually showed lower benthic quality (reduced Margalef diversity compared to reference values), partly due to relatively high fishing activity. Offshore areas, especially those with greater depth, had relatively higher or high Margalef diversity per sample compared to reference values.

This diversity index appears to be the most sensitive benthic index for indicating differences in impacts of fisheries pressures on benthic community condition in the areas assessed. This index was also the most sensitive benthic index to indicate anthropogenic nutrient and / or organic enrichment, sedimentation and heavy metal pressures in the areas assessed.

This is the first time that an international diversity index has been applied on such a broad geographic scale (across four countries). This method and the corresponding tailor-made software showed good results. This method could also be applicable to other OSPAR sub-regions in the next assessment cycle.

Knowledge Gaps

Margalef diversity reference values for assessment areas appeared to be well related to the important environmental variable depth. Depth is an important driver for a suite of habitat variables, including sediment composition. However, reference values may still be improved by explicitly incorporating sediment type within the model.

An assessment value for the Margalef diversity index score needs to be developed. It may also be useful to differentiate this assessment value for specific assessment areas. Further consideration of benthos data availability across the OSPAR Maritime Area is also needed for wider application of the indicator in the future.

This document was published as part of OSPAR's Intermediate Assessment 2017.

The full assessment can be found at www.ospar.org/assessments