Mapping ecosystem services provided by benthic habitats in the European North Atlantic Ocean

Ibon Galparsoro, Angel Borja and María C. Uyarra
AZTI-Tecnalia; Marine Research Division
igalparsoro@azti.es
INTRODUCTION

The mapping and assessment of the ecosystem services (ESs) provided by is a highly valuable source of information for understanding their current and potential benefits to society.

Accurate estimation of the values of services and their spatial distribution is not available for extensive areas.

Human pressures directly impact on ESs.

Interest in assessing the economic values associated.

Within Europe, Mapping and Assessment of Ecosystems and their Services (MAES) is one of the keystones of the EU Biodiversity Strategy to 2020.
OBJECTIVES

Qualitative assessment and mapping of the ESs provided by benthic habitats within the European North Atlantic Ocean; and

To determine their spatial distribution pattern
The Marine Strategy Framework Directive as spatial reference for the assessment

- 4,540,025 km$^2$,
- EEZ of 10 European Member States and part of Norway
MATERIALS AND METHODS

1. Cartographic information

Bathymetry

EMODnet
http://www.emodnet.eu/

Benthic habitats

EUSeaMap 1—Mapping European seabed habitats
http://www.emodnet-seabedhabitats.eu/

http://www.meshatlantic.eu

250 m res. DTM
250 m res. benthic habitat map

2. Benthic habitats services

Assessment of goods and services, vulnerability, and conservation status of European seabed biotopes: a stepping stone towards ecosystem-based marine spatial management

MATERIALS AND METHODS

<table>
<thead>
<tr>
<th>Provisioning</th>
<th>Food provision</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Raw materials (biological) (incl. biochemical, medicinal, and ornamental)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Regulating</th>
<th>Air quality and Climate regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Disturbance and natural hazard prevention</td>
</tr>
<tr>
<td></td>
<td>Photosynthesis, chemosynthesis, and primary production</td>
</tr>
<tr>
<td></td>
<td>Nutrient cycling</td>
</tr>
<tr>
<td></td>
<td>Reproduction and nursery</td>
</tr>
<tr>
<td></td>
<td>Maintenance of biodiversity</td>
</tr>
<tr>
<td></td>
<td>Water quality regulation and Bioremediation of waste</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cultural</th>
<th>Cognitive value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Leisure, recreation and cultural inspiration</td>
</tr>
<tr>
<td></td>
<td>Feelgood or warm glow</td>
</tr>
</tbody>
</table>

Categories:

“High” (3) When the provision is well documented and widely accepted;

“Low” (1) When a service is provided to a substantially lower magnitude and without being vital for human activity;

“Negligible/Irrelevant/Unknown” (0) In all other cases
RESULTS AND DISCUSSION

1.7 million km² covered by the integrated broad-scale habitat map

62 different benthic habitats and seabed seascape features
A gradient on the level of services provision, seawards and towards deeper areas ($p < 0.001$ for all services and in both cases - distance and depth)

E.g. areas providing high food provision services are located close to the coast ($16\pm35$ km) and in shallow areas ($47\pm50$ m)

The level of service provision significantly varies across sub-regions (Chi-Square test: $p$ always $< 0.001$), with the North Sea being the region generally providing services at the highest levels
“Food”, “biodiversity maintenance” and “nursery grounds” are the services most commonly provided by habitats (and to the highest level)

- 93% provides food provision services (of which 62% with high food provision values)
- 99% is providing biodiversity maintenance services (41% High, 58% Low)
- 53% reproduction and nursery services
RESULTS AND DISCUSSION

Regulating services

The area covered by habitats providing high values is much smaller.

The disturbance and natural hazard prevention service has the smallest spatial coverage.

Only benthic habitats, which may explain the relatively small area providing this service in the European North Atlantic Ocean.
RESULTS AND DISCUSSION

Cultural services

Area covered (both, at high and low levels) is very limited (around 11% of the total)

Likely to be a consequence of the dependence of these services on accessibility
RESULTS AND DISCUSSION

Aggregated ecosystem services (i.e. provisioning, regulating and cultural):

Significant differences in the spatial distribution (Friedman test $\chi^2 = 47,858; p < 0.001$)

Provisioning services are supplied at significantly higher levels than both regulating (Wilcoxon post-hoc test $z = -154, p < 0.001$) and cultural services (Wilcoxon post-hoc test $z = -171, p < 0.001$);

Regulating services are also provided at significantly higher levels than cultural services (Wilcoxon post-hoc test $z = -130, p < 0.001$)
RESULTS AND DISCUSSION

Only benthic habitats have been considered, which may explain the relatively small area providing services in the European North Atlantic Ocean.

The reliability of the results depend on, among others:

(i) the quality and reliability of benthic habitat maps used; and

(ii) the valuation based on scientific expert judgment, which could be biased towards the knowledge of the experts who published that research; meanwhile, social and economic aspects could be under-rated.

Weaknesses could be overcome by:

(i) enhancing the scientific knowledge of marine ecosystem functioning (i.e. finalising detailed benthic habitat maps of the complete study area); and

(ii) improving the assessment of services valuation, promoting the multidisciplinary discussions among environmental and social scientists and economists, to achieve consensus on benthic habitat services values.
A **pragmatic** way of getting a first snapshot of the distribution of ESs based on the available information

A promising **starting point** for further **research** and discussion on ESs contribution of benthic habitats

Spatially explicit assessment and valuation of ESs might be of crucial interest for future **management** measures adoption such as Marine Spatial Planning
Mapping ecosystem services provided by benthic habitats in the European North Atlantic Ocean

Ibon Galparsoro*, Angel Borja and María C. Uyarra

Marine Research Division, AZTI-Tecnalia, Pasaia, Spain


Thank you very much for your attention