Policy brief on how ecosystem valuations influence MSP

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UNDERSTANDING DEEP ATLANTIC ECOSYSTEMS

POLICY BRIEF

Influence of valuations of ecosystem goods and services on Atlantic marine spatial planning

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Executive Summary

- The identification of services, in particular their values and conflict areas, is important for marine/maritime spatial planning (MSP).
- Monetary valuation for improving decision making is promoted by global and EU policies.
- Ecosystem valuation should be an integral part of marine management decision models and can encourage investment and Blue Growth.
- Valuation could have additional specific uses in deep-sea contexts where governance structures are weak or incomplete.
- Changes in well-being for different stakeholder groups, as expressed by economic valuation, can feed into MSP.
- The EU ATLAS project has undertaken a spatial assessment of the relative values of 12 ecosystem services in selected case study areas.

Introduction

Marine ecosystems provide many benefits to people, including familiar market-traded resources such as fish and seafood, as well as access to marine transport and mineral resources, and more novel marketed services such as marine wind and tidal power. Marine ecosystems also support human life and activity in ways not captured in markets, in particular through regulation of the earth's climate and global biogeochemical cycles.

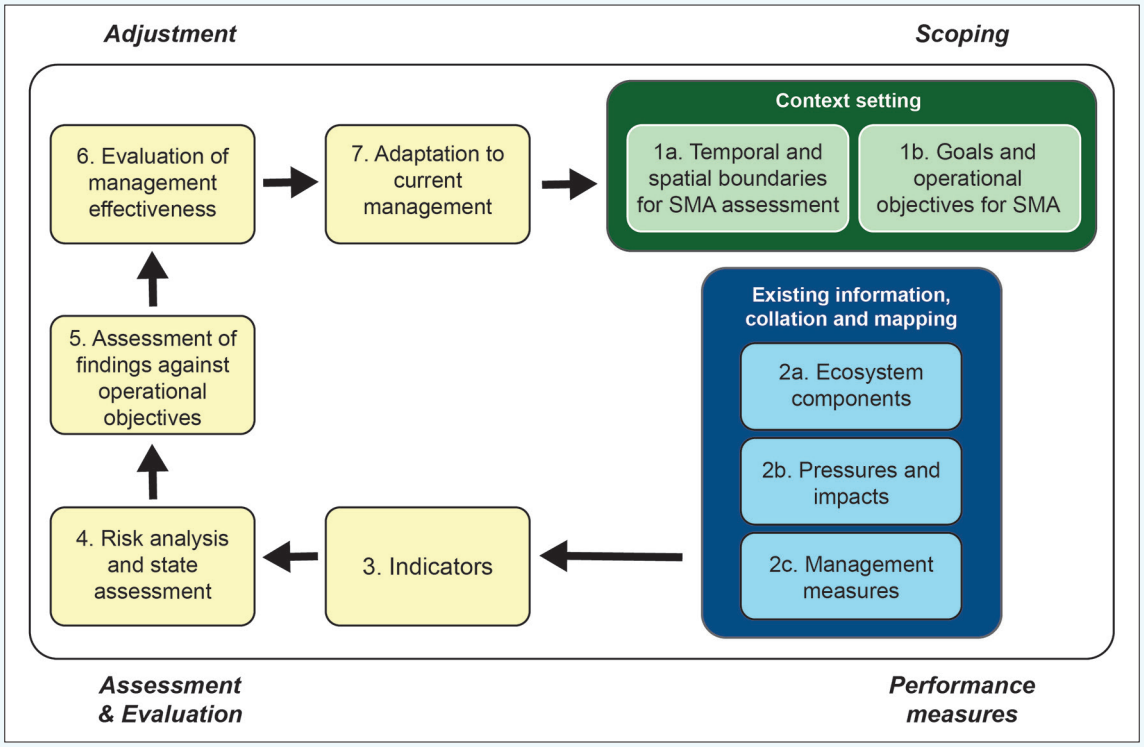
At the same time, the capacity of marine ecosystems to provide and sustain all these benefits is impacted by the direct pressures of marine exploitation and the indirect pressures of global change. These impacts often extend over large areas and across jurisdictional boundaries, as well as over long timescales. With multiple - often competing - benefits, and complex, long-term and wide-scale pressures and impacts, a coordinated approach to understanding and managing marine systems is crucial. These challenges for governance and management of marine systems can be partially met through a combination of spatially explicit planning processes and valuation of marine ecosystem goods and services.

Marine Spatial Planning

Marine (or maritime) spatial planning (MSP) is a process that implements ecosystem-based management (EBM) principles and focuses on the spatially explicit nature of many ocean activities and resources[1]. EBM differs from traditional approaches focused on single sectors, activities or species, by taking account of interactions, synergies and cumulative effects. MSP needs to take account of the services provided and potentially provided from different areas, the activities involved in accessing them, and the resulting cumulative effects on marine ecosystems. It should aim to ensure that the collective pressure of activities remains compatible with a healthy and sustainable marine environment[2]. MSP can be thought of as a "*public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives*" [3]. This involves considering a wide range of different systems, features, activities and services with complex interactions, and reaching difficult decisions about priorities where there are trade-offs or competing objectives, such as protecting biodiverse deep-sea habitats while at the same time safeguarding marine commercial interests and human livelihoods.

However, there are challenges to implementing MSP: governance structures are often complex, conflicting and incomplete, and our understanding of ecosystem functions and processes, how they sustain benefits and how they are impacted by human activities, is often limited. Assessing ecological processes and resources in terms of the ecosystem goods and services they provide helps to translate highly complex systems into a series of measurements, which can be more readily understood by a wide range of stakeholders. However, quantitative assessments of cumulative impacts and multiple stressors on ecosystems and services remain the exception rather than the norm[4]. One tool that can help in seeking appropriate balances is the monetary valuation of non-marketed ecosystem goods and services. The ubiquitous nature of trade-off and conflicting objectives means that identification of services, their values and conflict areas is important for policy making, and for MSP in particular, with new opportunities to balance uses and protection of marine ecosystems in support of the implementation of ecosystem-based management, in line with evolving policies. This brief focuses on the role of monetary valuation in supporting MSP.

This brief also highlights the **ATLAS** objective of assessing the feasibility and benefits of applying MSP rather than sectoral approaches in support of new Blue Growth in the Atlantic at both basin and regional/local scales. To this end, **ATLAS** is testing a generic MSP framework developed by the FP7 MESMA project to assess spatially managed areas (SMAs) in 12 **ATLAS** case studies.



Framework step	Think about possible roles for valuation evidence
Step 1 Definition of spatial and temporal boundaries, context, goals and objectives.	Some goals/objectives could be established in economic terms. Desires/needs of stakeholders, to consider here and throughout, could be assessed in monetary metrics, including estimation of public non-use values for natural systems and biodiversity.
Step 2 Collation and mapping of existing natural, economic and social information relevant to the objectives	Socio-economic components must be mapped and the (cumulative) impacts of these assessed. Values of activities/ service could form one map layer. Tools such as InVEST, ARIES , MARXAN can facilitate this.
Step 3 Definition of indicators and related thresholds.	Values can be used as service indicators. Values as thresholds may be appropriate for subsistence uses or benefit sharing.
Step 4 Assessments of indicator states and risk analysis of management scenarios.	Economic assessment/comparison of scenarios, using CBA, MCA or portfolio analysis methods, including the tools identified above.
Step 5 Evaluating findings against the operational objectives.	In value terms where appropriate including assessment of trade-offs and sustainability. Possible role for ecosystem accounting.
Step 6 Assessing effectiveness of proposed management measures.	Effectiveness can be assessed in terms of realisation of potential values, and should include estimates of costs, opportunity costs, and cost-effectiveness.
Step 7 Collation of outputs and resulting management recommendations.	Including financing needs and potentially guidance on management instruments. Identification of valuation/data gaps and proposals to address them.

Box 1: Steps in the MESMA Framework and possible associated uses of valuation evidence

Policy context

Several international and national initiatives promote greater use of monetary valuation for improving decision making. Notably, these include the CBD Aichi Biodiversity targets[5], in particular:

- ***Aichi Target 2:*** *By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.*
- ***Aichi Target 19:*** *By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.*

At the European level, the EU Biodiversity Strategy[6] (Target 2, Action 5) called for the mapping and assessment of ecosystems and their services by all Member States (MS). This also included the assessment of the economic value of such services where possible by 2020. A common system of typologies of ecosystems and services for mapping and inclusion in natural capital accounting was developed to be applied by the EU and MS in order to ensure consistent approaches[7]. At the same time, MS are developing their National Marine Spatial Plans as required under the EU Maritime Spatial Planning Directive[8]. The availability of information on ecosystem service delivery at different spatial scales is essential for this, to ensure that marine economic activities are conducted in a way that sustains the long-term capacity of the oceans to deliver ecosystem services. Recent changes to the Marine Strategy Framework Directive[9] (MSFD) have made MS reporting requirements more explicit regarding information on the human pressures on marine ecosystem and taking into account recent scientific progress[10]. The amendments have also introduced a risk-based approach to the reporting requirements for the MSFD through the use of threshold values based on the precautionary principle, helping MS to assess areas at risk that may need further action in achieving Good Environmental Status. The MSFD also requires the availability of ecosystem services valuation for the assessment of the environmental status and to define the measures that make sustainable human activities at sea[11].

As part of this process, the ecosystem services provided by benthic habitats in the European North Atlantic Ocean have been assessed and mapped in the context of the Mapping and Assessment of Ecosystems and their Service (MAES)[12] programme, the European Biodiversity Strategy and the implementation of the MSFD[13]. However, the mapping of marine ecosystems services and associated benefits still lags behind the terrestrial counterparts, and this is even more so for deep-water ecosystem services. Most of the recommended indicators[14] for ecosystem services delivered by marine ecosystems fall under 'marine inlets and transitional waters' followed by 'coastal waters', with few listed for 'open ocean' or 'shelf waters'. The EEA has reported[15] that for marine ecosystems, the information base "*is poor and fragmented, so that assessment at the European level remains challenging*", while within Member States' reporting there was "*some lack of clarity in the ecosystem typology, in particular with regards to marine ecosystems*". These issues need to be resolved before better integration of ecosystem service valuation in policy can be achieved.

With growing anthropogenic pressures in the marine environment, better knowledge of the values provided through habitat-based sea-floor ecosystem services could help to justify further policy action, development of Marine Protected Areas, conservation, and resource use[16]. This information could also help design responses to global change that will inevitably impact on marine ecosystems and biodiversity, and the services they provide[17].

Valuation of marine services

Ecosystem service valuation can highlight the 'hidden' ecosystem benefits and costs and improve understanding of the economic trade-offs from different marine plans or scenarios, including trade-offs among different kinds of ecosystem services as well as between those services and commercial economic activities that impact on condition of marine ecosystems[18]. Use of market values to account for goods and services actually traded in markets (for example fish, energy, minerals) is relatively uncontroversial – disagreements are mostly about rules and interventions (subsidies, taxes, redistribution etc.) rather than the use of markets and prices *per se*. But the estimation and uses of economic values for services such as biodiversity protection or climate regulation can be contentious. Valuation is not essential: there are alternative ways of carrying out appraisal, for example, using multi-criteria approaches or collective decision methods. However, valuation may have a number of advantages, including making the processes easier, more defensible, more transparent, and/or

more (cost-) effective. In particular, arguments for recognising the importance of remote marine ecosystem services might be more convincing - for some decision makers or contexts - when they are expressed in monetary values that can be compared with the values of marketed marine products.

For the deep seas, the TEEB Oceans study[19] set two key questions to consider in this regard:

- What economic information do we need to weigh the trade-offs between the industrial exploitation of the deep sea and the emerging economic value of living resources there?
- Can a better economic understanding of the value of deep-sea ecosystems help in the design of industrial best practices, deep-sea marine protected areas, and international governance of the deep sea?

Valuation could have additional specific uses in deep-sea contexts where governance structures are weak or incomplete. Areas where expanding the knowledge base on economic values and ecosystem services relating to ABNJ (areas beyond national jurisdiction) and BBNJ (biodiversity beyond national jurisdiction) could inform policy include, for example, new agreements to implement EBM and MSP, effective implementation of tools such as MPAs, EIA, SEA, benefit sharing mechanisms for from marine genetic resources beyond national jurisdiction, and providing incentives for transfer of technology and innovative financial mechanisms for capacity development and implementation[20].

There is increasing acceptance that, despite the serious challenges of valuing deep-sea ecosystem services, valuation evidence could indeed help improve decision making. The need to enhance and facilitate integration in decision making is widely recognised and a focus of recent effort - for example the Ecosystem Services Partnership (ESP) Regional Europe conference in 2018 on the theme "*Ecosystem services in a changing world: moving from theory to practice*" [21] - although, illustrating the challenge, the conference was mainly attended by the research community. Nevertheless momentum is gathering. The European Parliament Intergroup Seas, Rivers, Islands and Coastal Areas (Searica Intergroup) together with the European Marine Board organised a conference[22] to discuss requirements to assess the long-term sustainability of Blue Growth, support ecosystem-based policy development and marine management decisions, and raise awareness of the importance of the marine environment to society and in the economy. The European Commission Blue Economy Report 2019[23] includes a chapter on ecosystem services and natural capital, noting increasing evidence on the value of ecosystem services. The few cost-benefit studies available conclude that the overall welfare benefits of marine protected areas are positive, but with a narrower focus on the market impacts in Blue Economy sectors, the situation is less clear. This illustrates the importance of being able to account for the non-market improvements in societal welfare, because the market impacts alone may not be enough to offset the costs of action.

Recently, the European Marine Board Future Science Brief[24] showcased current thinking in ecosystem service valuation for the marine environment and reported that, although ecosystem valuation has advanced significantly over the past decade, results are rarely used to support marine management and policy. They conclude that making ecosystem valuation an integral part of marine management decision models would both improve decision making and enhance the evidence base.They make a number of specific recommendations to improve the situation, including the need to "*Include ecosystem valuation in marine management decision models*", "*Develop the Natural Capital Approach and Natural Capital Accounting*", and "*Create open databases that contain the data, meta-data, applied methodology and results of marine ecosystem valuation studies (monetary as well as non-monetary).*"

Enhancing the valuation evidence base and integrating values in MSP is also seen as a way to encourage investment and Blue Growth. For example, the Mid-Atlantic Regional Ocean Assessment (ROA)[25] reports on-going research to investigate the suitability of modelling tools based on ecosystem services valuation, including Marine InVest[26], exploring the potential for marine-focused market mechanisms for ecosystem services such as water filtration provided by oyster beds, and wave attenuation and carbon sequestration services of tidal marshes. In Europe, the ALICE project[27] has the main goal of promoting sustainable investments in Blue-Green Infrastructure Networks (BGINs) through identification of the benefits of ecosystem services delivered at the terrestrial-aquatic and land-sea interface in the Atlantic region.

Requirements for valuation in MSP

The application of valuation in a MSP framework can take place in many ways: see Box 1 for possible entry points in the MESMA framework. At the most basic level, the following steps are necessary:[28]

- Select a suitable typology of ecosystem services to which activities can be linked.
- Identify and define relevant marine/maritime activities and sectors.
- Assess how the environmental pressures arising from the activities impact on the ecosystem services.

Economic valuation then seeks to assess changes in well-being for different stakeholder groups. Ideally, this is done through monetary indicators. To value deep-sea ecosystems and their goods and services, we need knowledge about the biodiversity, structure and functioning of the systems, and the factors influencing these - including the threats and pressures impacting on the systems, and how the systems and services respond over time[29]. Partly due to gaps in this knowledge base, little information of an economic nature is available, particularly for the deep sea[30]. Hence, in many cases, changes may have to be described quantitatively (physical units), semi-quantitatively (with scores), or qualitatively (text). Assessment may also go beyond simple cost benefit analysis (CBA) by including wider issues such as employment opportunities and distributional effects. Such information as does exist is mostly tied to the provisioning services of the ocean such as fisheries and fish habitat, with little information on regulating and cultural services or future potential services from Blue Growth. Provisioning services such as fisheries are quantifiable, but regulating or cultural services are not well known to the public.

Supporting services are commonly omitted from valuations and appraisals in order to avoid double counting. However this is only appropriate if the boundaries of the assessment encompass all the final services. In the case of the deep sea, it will often be the case that the spatial boundaries do not in fact do this, because the final services supported arise elsewhere. MSP should recognise and value supporting services in this situation.

A further complication is that services may not be spatially fixed (e.g. fish stocks) creating a challenge for spatial valuation in MSP. This can be partly addressed through setting appropriate scales and boundaries, and cooperation across governance scales to make robust assessments of trade-offs[31]. Global change will also impact on ecosystems, services and values in ways that may be both complex and uncertain[32].

This makes total valuation a demanding exercise, and most marine-related valuation studies focus on coastal environments. However, there have been some studies carried out on the deep sea and in **ATLAS** case study countries including Ireland, UK and Azores, for example for cold-water corals[33].

The few studies that have been carried out demonstrate that people are willing to pay for protection of deep-sea ecosystems, despite their remoteness and lack of familiarity. A recent example[34] used a combination of the contingent valuation and value transfer to estimate the value of non-market benefits associated with the achievement of Good Environmental Status as specified in the MSFD for Atlantic Member States. The study estimated that the overall value of achieving GES for five Atlantic member states varied between €2.37 billion and €3.64 billion.

There have also been a number of interesting qualitative assessments of deep-sea ecosystem services that can feed into MSP. One study[35] created a seafloor habitat ecosystem service scoring system drawing on a standardised system of classifying ecosystems through EUNIS[36] codes and a compilation of the goods, services, sensitivity, and conservation status of 56 European seabed areas. A later development[37] expanded this to 62 seafloor habitats, qualitatively evaluating the ecosystem services. **ATLAS** has drawn on these methods in the analysis of service values for the case studies.

ATLAS analysis

The relative lack of data available for deep-sea benthic ecosystems relative to terrestrial or even nearshore benthic ecosystems constrains the possible assessment of ecosystem services. **ATLAS** therefore uses a mixed methods approach, with a qualitative approach to map the expected or potential ecosystem service delivery levels initially for 12 ecosystem service types[38], and a quantitative approach for estimating the ecosystem service of food provision through generated

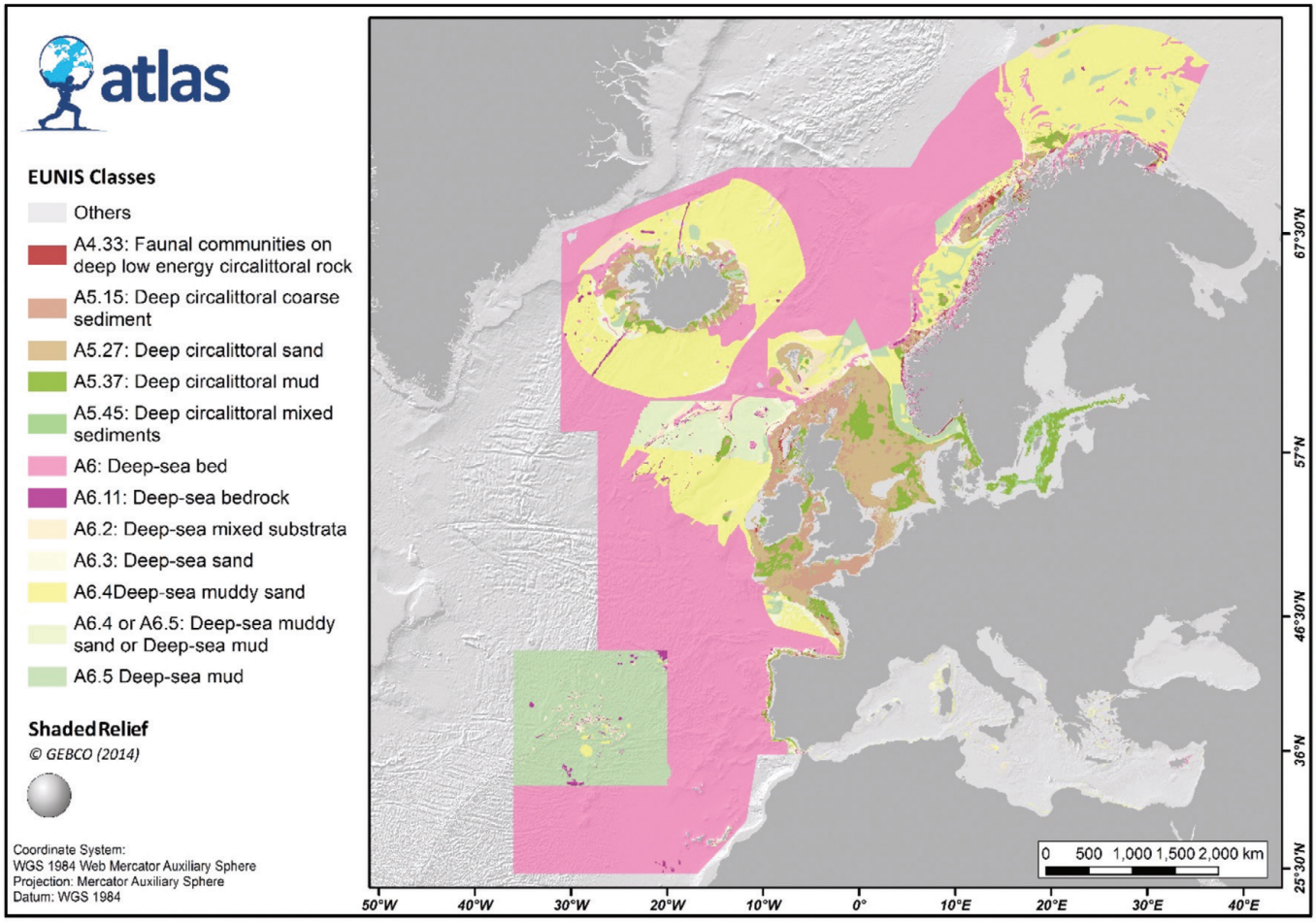


Figure 1: EU-SEA Map 2016 with EUNIS Codes for seafloor habitats relevant to the ATLAS case study areas.

estimates of landings volume and value for case studies. This has been enhanced by use of a Delphi survey[39] to assess expert views on the relationships between human activities and ecosystem services, and through choice experiments as discussed below.

For mapping seafloor habitats in case studies, **ATLAS** used data from EMODnet (European Marine Observation and Data Network[40] and EUSeaMap (Mapping European seabed habitats)[41]. Figure 1 shows the extent of EU-SeaMap seafloor habitat mapping for the main deep-sea benthic EUNIS habitats found in the case study sites.

Application of these methods leads to a spatial assessment of the relative values of 12 ecosystem services across the case study areas in **ATLAS** (see map at the back of this brief), as illustrated in the following examples (Figure 2). For fisheries, full monetary evaluation is possible (Figure 3). This remains however a static analysis; a fuller appreciation of the situation can be achieved via analysis of the risks posed to vulnerable marine ecosystems and fish habitats through fishing pressure (Figure 4). These are examples of analyses provided in full detail in **ATLAS** project reporting[42].

The way forward

To help fill the gaps in valuation evidence, **ATLAS** is collecting empirical evidence on non-market deep-sea ecosystem services values for four case study areas: the Azores, LoVe Observatory, Mingulay (in the eastern Atlantic) and Flemish Cap (in the western Atlantic). These areas have been selected to cover the broadest range of both ecosystem types (seamounts, cold-water corals, sponge grounds) and jurisdictional regimes (national, European, ABNJ). National surveys for Mingulay

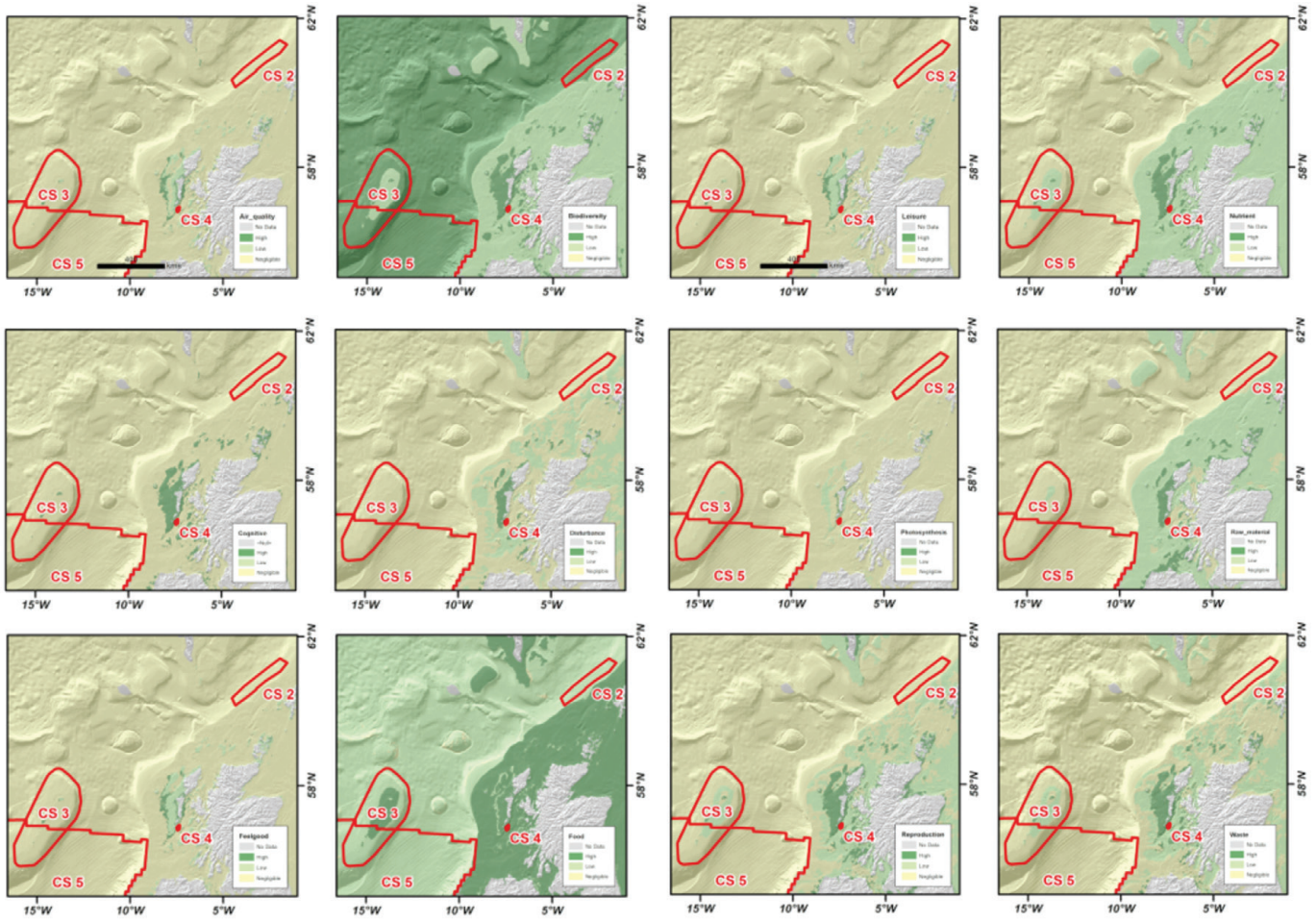


Figure 2: Ecosystem service scores for Mingulay Reef, UK

in Scotland and LoVe in Norway have been completed and published[43] while national surveys for the Azores and ABNJ for Flemish Cap (for Norway, Scotland and Canada) are in the final phase of data collection.

Results from Mingulay and LoVe suggest that the public in Scotland and in Norway show general eco-centric attitudes towards the marine environment, with broad recognition of the importance of ecosystem services, the current ecological crisis and the need for sustainable management, but only low to modest knowledge relating to deep-sea environments. The valuation experiment assessed trade-offs for improvement in a number of deep-sea environment attributes (environmental health and quality, increase in size of MPAs and new marine-related job creation). Results indicate that the public in both countries is willing to pay to support conservation of the unfamiliar deep-sea ecosystem, highlighting preferences for reducing specific marine pressures including marine litter and impacts on the health of fish stocks, followed by increasing MPA coverage generally, with least value ascribed to the creation of jobs. For example, for improving fish stocks to '>80% fish stocks healthy', the weighted average value for the Scottish public is €75 and for Norwegians is €179, while a change in deep-sea marine litter densities from 'poor' to 'good', the Scottish public weighted average is €100 while for Norwegians it is €200.

Results such as these highlight that deep-sea ecosystems are seen as important by the general public, and provide support for further collective action required by the EU in moving beyond the 2020 MSFD objective of achieving Good Envieonmental Status (in this case, in terms of Descriptors 3 and 10 - commercial fish and litter) for Europe's seas.

Although at present the evidence base is incomplete, limiting the extent to which deep marine ecosystem services can be valued in monetary terms, methods and frameworks are available that can be put in place to support decision making with the best available information, including quantitative or qualitative spatial assessments of ecosystem services. Use of these frameworks will, in addition to directly supporting current decision processes, create additional demand for improved valuation evidence in the future. As the evidence base expands, there will be more opportunities to use economic valuation evidence to support deep marine and ABNJ management, monitoring and decision processes, and MSP in general.

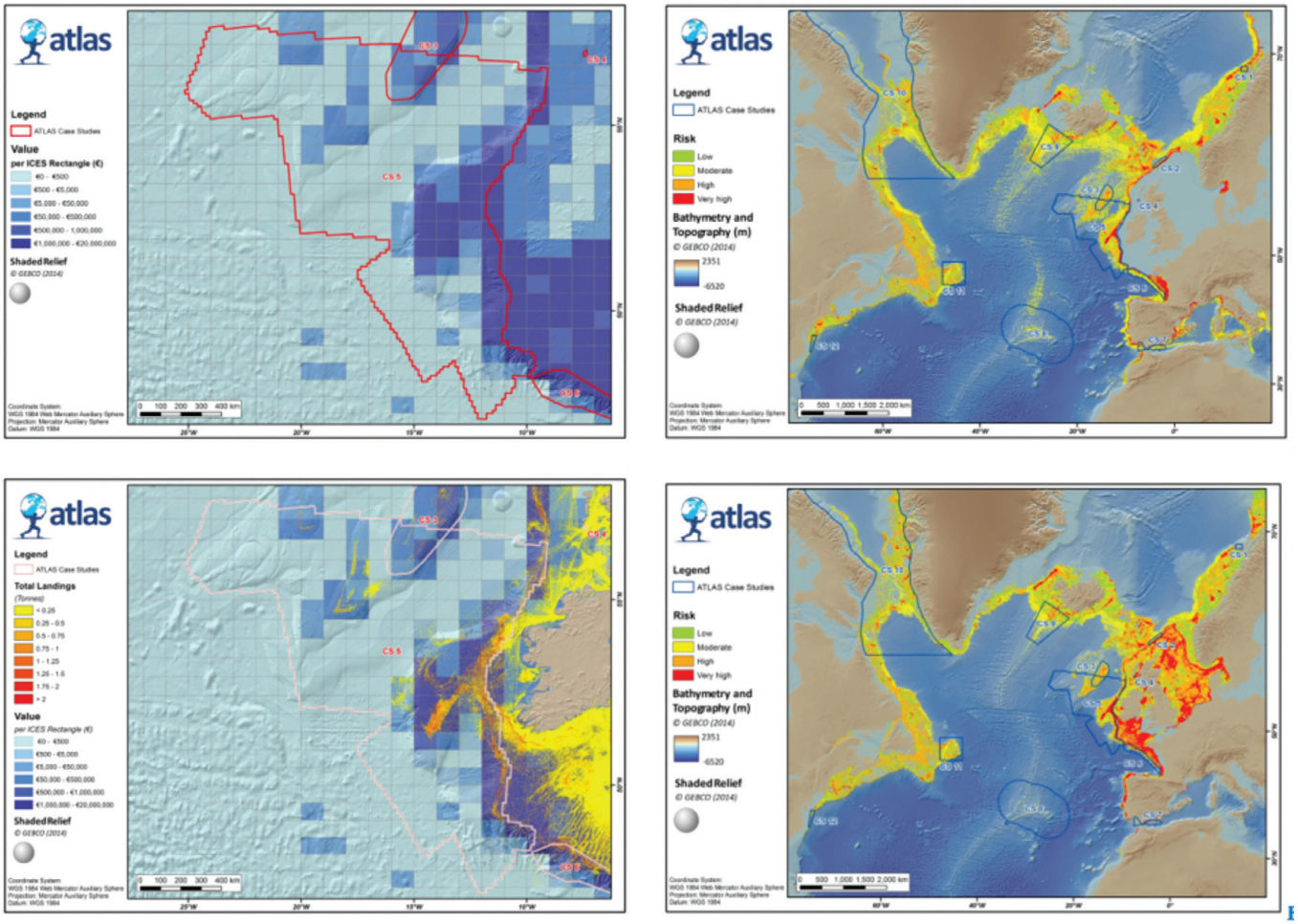


Figure 4 (left panels): Value per ICES rectangle and deep-sea demersal species landings in the Porcupine area offshore Ireland. Figure 5 (right panels): Assessment of risk posed to VME and fish habitat from pressures due to fishing activity across the North Atlantic basin.

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Further notes

The EU **ATLAS** project – A Trans-Atlantic Assessment and deep-water ecosystem-based spatial management plan for Europe – focuses on providing essential new knowledge of deep North Atlantic ecosystems through data gathering and synthesis, to inform and facilitate stakeholder dialogue on marine policy and regulation and to advance the European Commission's Blue Growth Strategy. One of the specific aims of **ATLAS** is to review the current and likely future status of ABMTs in North Atlantic ABNJ, informed by predicted shifts in ecosystem dynamics and to provide the knowledge needed to guide international conservation processes.

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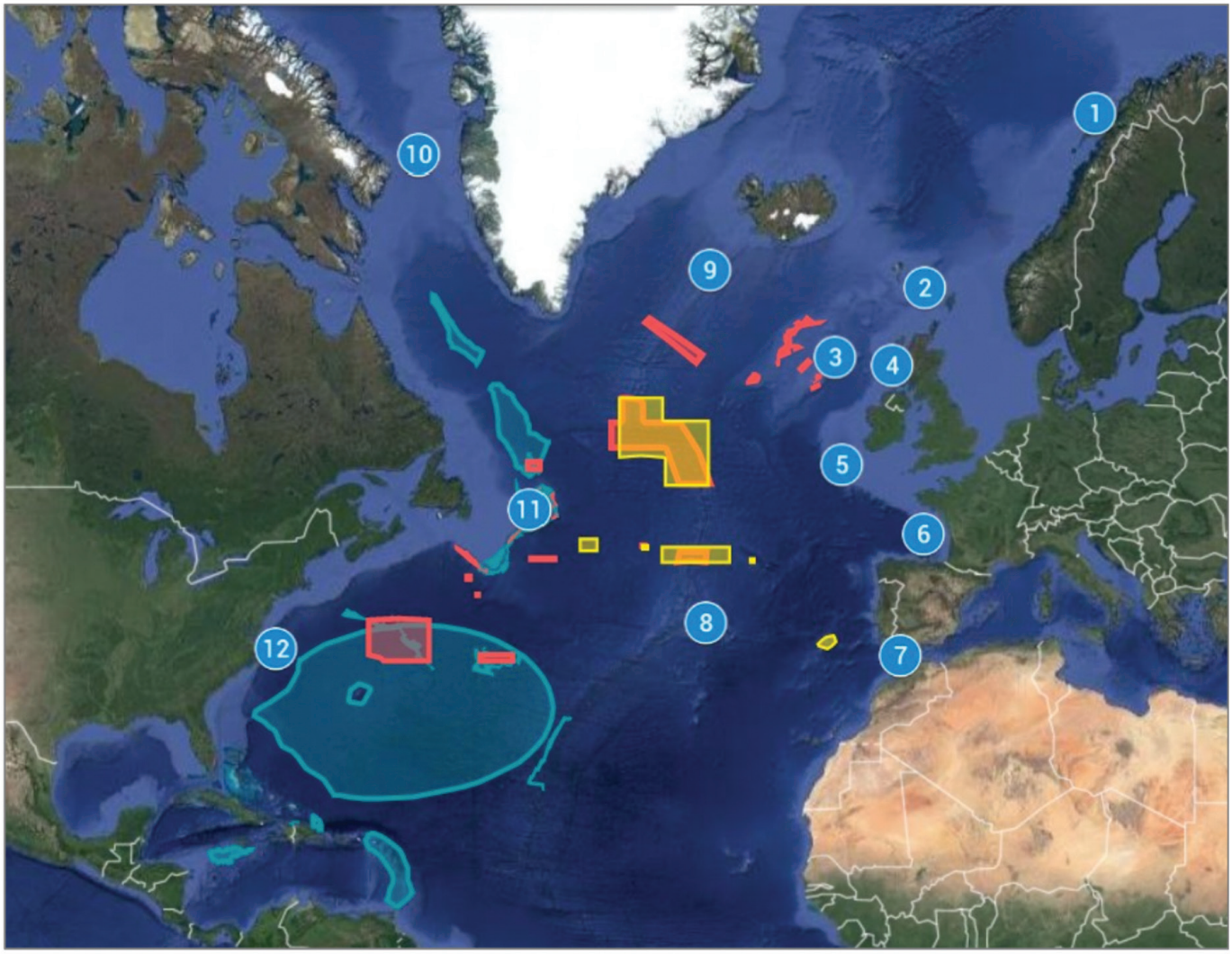
[43] Ankamah-Yeboah et al (2019) "Willingness to Pay for Conservation in the North Atlantic Deep-Sea Ecosystems" ATLAS Deliverable 5.4

ATLAS Case Study locations (numbered items) overlaid with Ecologically or Biologically Significant Areas (light blue areas); Vulnerable Marine Ecosystems (red boxes) and OSPAR Marine Protected Areas in Areas Beyond National Jurisdiction (yellow boxes).



Case study key:

1. LoVe observatory
2. Faroe Shetland Channel, UK
3. Rockall Bank, northern NE Atlantic
4. Mingulay Reef, UK
5. Porcupine Seabight, SW of Ireland
6. Bay of Biscay
7. Gulf of Cádiz/ Strait of Gibraltar/ Alborán Sea
8. Azores
9. Reykjanes Ridge
10. Davis Strait, Eastern Arctic
11. Flemish Cap
12. Mid-Atlantic canyons

For more information please visit
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