ONE OCEAN HUB | POLICY BRIEF

UK Research and Innovation

GCRF Global Challenges Research Fund

Issue Date: 01.08.22

The need for Strategic Environmental Assessments and Regional Environmental Assessment in ABNJ for ecologically meaningful management

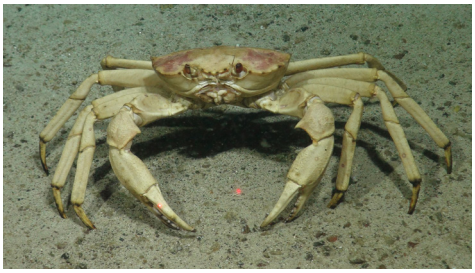
Kirsty McQuaid[1,2], Kerry Howell[1], Sian Rees[1], Holly Niner[1], Giulia La Bianca[1], Kristina Gjerde[3] and Elisa Morgera[4]

Abstract

The latest draft negotiating text for a new international instrument on marine biodiversity of areas beyond national jurisdiction (BBNJ Agreement) includes a provision on Strategic Environmental Assessment (SEA) that should be further strengthened to ensure that the BBNJ Agreement contributes to 1) advancing ocean science, 2) ensuring strategic decisions on cumulative impacts to the benefit of more effective implementation of all other elements of the BBNJ Agreement, and 3) contributing to climate change mitigation. To that end, it is necessary for SEAs to include explicitly Regional Environmental Assessments (REAs) to collect existing information on marine biodiversity at a regional scale, which is essential to enable environmental management at a scale that is ecologically-meaningful.

Equally, REAs provide an opportunity to identify and address fundamental knowledge gaps and support cooperation and pooling of resources, that is needed to provide a background for effective consideration of cumulative impacts in environmental impact assessments (EIAs), as well as planning of area-based management tools (ABMTs), exploration of marine genetic resources (MGRs) and informs capacity-building and technology transfer (CB&TT) efforts - all of which can contribute also to climate change mitigation. The process and outcomes of REAs can also benefit national ocean governance within national jurisdiction, due to ecological connectivity. This policy brief provides the views of marine scientists on the need for SEAs and REAs to ensure the effectiveness of a future BBNJ Agreement, as well as to bring about a step-change in ocean science, for which the new international bodies established under the BBNJ Agreement can contribute to harmonizing scientific practices, pooling resources, inter-link and compare data, and support scientific collaboration.

[1] University of Plymouth, UK
[2] South African National Biodiversity Institute, South Africa
[3] Middlebury Institute of International Studies at Monterey, US
[4] University of Strathclyde, UK



Introduction: Deep-sea ecosystem services & humankind's wellbeing

Marine ecosystems found deeper than 200m, called the deep sea, provide services that are essential to support human wellbeing (Thurber et al., 2014; La Bianca et al., submitted), from food resources like fish catch to cultural services such as inspiration for the arts

Photo: courtesy of the NERC funded Deep Links Project Plymouth University, Oxford University, BGS, JNCC

KEY MESSAGES

BBNJ negotiators should:

- include in SEAs consideration of impacts on and risks to ecosystem services and linked benefits, including services related to climate change mitigation, to facilitate strategic thinking on cumulative impacts and alternatives
- clarify that SEAs provide a baseline for EIAs and context to monitor effects of project- or sector-specific activities, to support adaptive management;
- clarify that SEAs provide information for all other decisions under the BBNJ Agreement (MGRs, ABMTs, CB&TT);
- require, as part of SEA, environmental assessment and baseline setting at a regional scale to gather new and comparable regional-level data on foundational biodiversity information needed to enable environmental management at a scale that is ecologically meaningful
- mandate the Scientific and Technical Body to: develop a uniform framework for regional research programme co-development to collect new data, support integration of multiple data sets and comparability of data; identify opportunities for, and lessons from, cooperation and pooling of resources and support periodic review of SEA reports, including with a view to benefitting also management of areas within national jurisdiction (due to ecological connectivity).

Photo: courtesy of the NERC funded Deep Links Project, Plymouth University, Oxford University, BGS, JNCC

or spiritual value. Ecosystem services are the product of complex interactions between multiple ecosystems, and the spatial extent of the deep sea (when compared to terrestrial, coastal and shelf systems) means that the potential contribution of deep-sea ecosystems to planetary health is vast. This is particularly the case for regulating ecosystem services that serve benefits to humankind through vital life support functions such as climate regulation (Hilmi et al., 2021; Levin, 2021; Box 1). Dissolved organic carbon is ~70% of the total organic carbon in the ocean, and most of this is found at depths ~1000 m where this carbon remains out of contact with the atmosphere for thousands of years (Hilmi et al., 2021). Researchers have found that although rates of carbon sequestration in deep sediments are much lower than in shallow water habitats such as seagrasses, saltmarshes and mangroves, these environments play a really important role in storing carbon because they cover such vast areas (Luisetti et al., 2019; Atwood et al., 2020). The literature shows that the deep ocean plays a crucial role in delivering climate change mitigation, facilitating the presence of other ecological processes and services, across large spatial and temporal scales. Ecosystem services from the deep sea, therefore, benefit not just specific groups of people, but global society, supporting a habitable climate that underpins many aspects of human health and wellbeing.

Deep-sea ecosystems also present novel and unique opportunities that are still being discovered. Through the exploration of new ecosystems, genetic resources, and unique ecological processes and functions, new opportunities for biodiscovery (e.g. novel drugs to combat antimicrobial resistance) and climate change mitigation are being discovered (e.g., DOSI, 2018). Whilst the evidence linking deep-sea living and nonliving components, the services they provide and the benefits derived therefrom lags behind the development of similar ecosystem service frameworks for terrestrial and coastal ecosystems, we know that these ecosystems are of major global importance.

The ability of deep-sea ecosystems to provide ecosystem services depends on the health and functionality of the constituent parts. To effectively govern human activities that impact upon deep-sea marine ecosystems, the BBNJ Agreement needs to consider and advance knowledge and understanding of these ecosystems. For some areas beyond national jurisdiction (ABNJ) scientists have a fairly good understanding of species taxonomy (what animals are present), with some limited knowledge on how these animals function, their life history traits (e.g. how long they live), how they interact with each other and their environment, and how different populations of animals are connected. However, in most areas of ABNJ, we have little to no knowledge on these most fundamental aspects of biodiversity. In the Clarion-Clipperton Fracture Zone (CCZ), arguably one of the most well studied areas of ABNJ in the central eastern Pacific, there remain large knowledge gaps limiting the ability for evidence-based decision-making regarding deep-sea mining activities (Amon et al., 2022). These include gaps in baseline knowledge on the aspects mentioned above, how these patterns vary both spatially and temporally and how this translates to ecosystem services. In other areas of interest for seabed mining in ABNJ there is no or next to no scientific knowledge to enable evidence-based

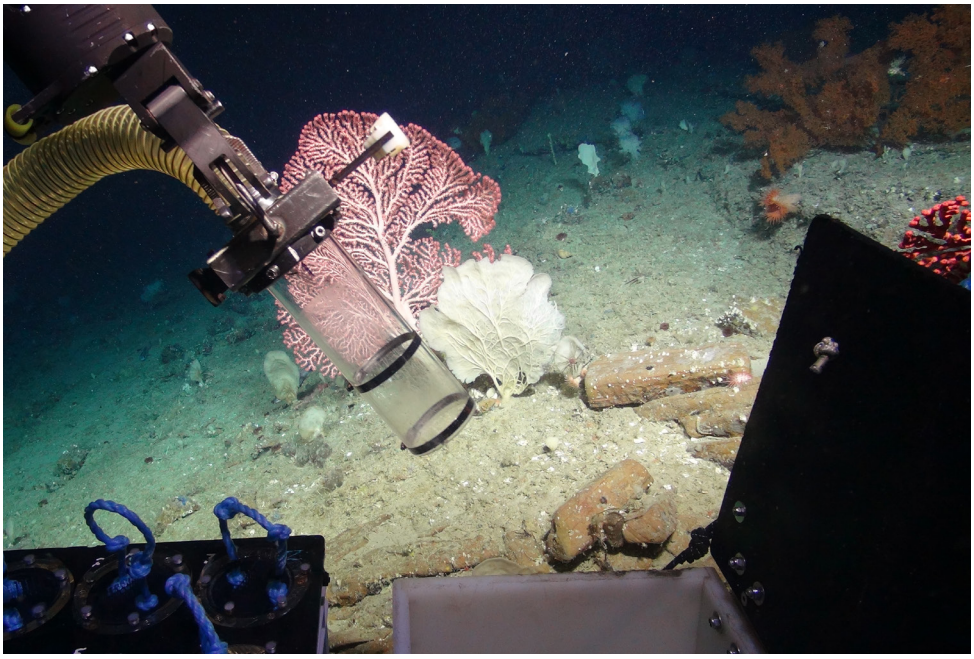


Photo: courtesy of the NERC funded Deep Links Project, Plymouth University, Oxford University, BGS, JNCC

management on topics ranging from the oceanographic setting (including currents, temperature, suspended material) to the most foundational biodiversity knowledge such as species taxonomy (or what animals are there) (Amon et al., 2022).

Recommendation: SEAs need to include current knowledge, and support the production of new knowledge, on deep-sea ecosystems and ecosystem services, including in relation to climate regulation and climate change mitigation, to facilitate strategic thinking on cumulative impacts and alternatives. This is essential both to provide a baseline for EIAs and context to monitor effects of project- or sector-specific activities, to support adaptive management; and to provide crucial information for all other decisions under the BBNJ Agreement (MGRs, ABMTs, CB&TT). To that end, SEAs need to include Regional Environmental Assessment processes. The next sections illustrate why REA is important for environmental management in ABNJ, what is needed to support its implementation, and how this might be achieved through the new BBNJ Agreement. All comments herein refer to the latest revised draft text of the BBNJ Agreement , prepared by the President of the Intergovernmental Conference in July 2022.

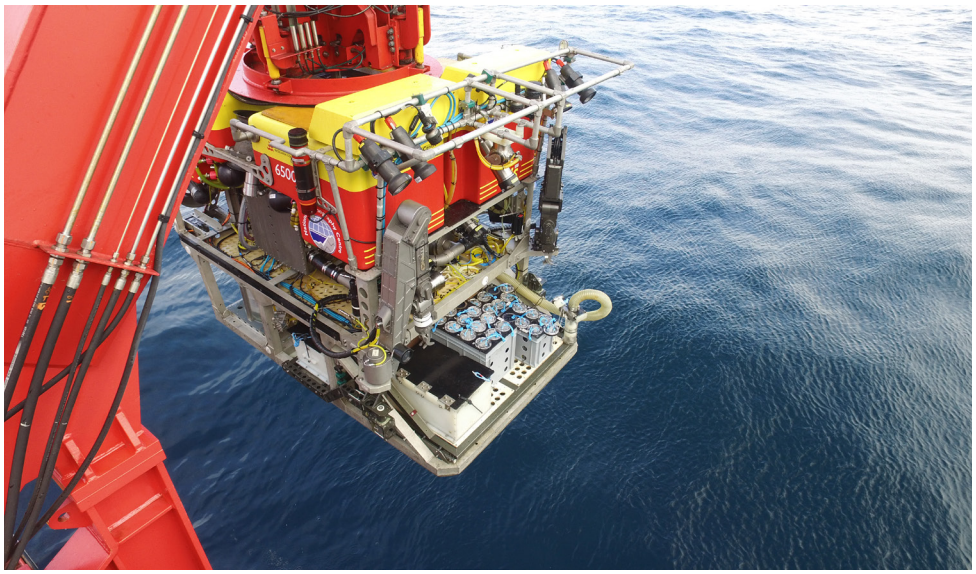


Photo: courtesy of the NERC funded Deep Links Project, Plymouth University, Oxford University, BGS, JNCC

Nesting EIAs into SEA and REA

The current negotiating draft is mainly focused on EIAs, which are concerned with assessing the potential impacts and mitigation measures of an individual project or activity. EIAs are also expected to address cumulative impacts, including climate change. However, it will be extremely challenging for EIAs to effectively address cumulative impacts given their narrow focus and reactive approach. Rather, there is a need for proactive, strategic and future-thinking assessments to better understand ecosystems and their services, as well as risks and cumulative impacts on them. Ecosystems in ABNJ are connected over large spatial scales, and are closely connected to coastal systems (Popova et al., 2019). This means that human impacts in one area of ABNJ may affect other areas further afield, including within national jurisdiction, and this could cause damage to both deep-sea biodiversity and linked ecosystem services. A shortcoming of current management identified through the Second World Ocean Assessment (UN, 2021) is that management is reactive (EIA-focused) rather than proactive.

As indicated in Hassanali and Mahon (2022), SEA that includes environmental assessment at a regional-level can provide a proactive, rather than reactive, vision and mechanism to support conservation of biodiversity in ABNJ to 1) advance ocean science, 2) ensure strategic decisions on cumulative impacts to enable more effective implementation of all other elements of the BBNJ Agreement, and 3) contribute to climate change mitigation. Their proposal starts with global scale mapping of marine habitats (for example Howell, 2010; Watling et al., 2013; McQuaid et al., submitted), followed by zoning into regions based on ecological function, importance and uniqueness. SEA (including environmental assessment) is then carried out for each region (prioritised based on vulnerability and potential for use), and is used to inform the development of marine spatial plans or other types of planning processes including for ecologically connected networks of marine protected areas and other types of ABMTs as well as EIAs. An ambitious BBNJ Agreement would therefore require:

- REAs to assess the ecological status and trends of a particular region,

BOX 1. CLIMATE REGULATION BY THE DEEP SEA

Climate regulation by the deep sea is linked to nutrient cycling and involves biogeochemical processes that transport organic materials from ocean surface to deeper layers. Carbon dioxide and methane in the atmosphere are dissolved in surface waters in the upper ocean and transported to depth through global ocean circulation patterns.

In addition, carbon from marine organisms in surface waters sinks and accumulates in the deep sea. Here, some of this carbon is sequestered or stored in sediments through burrowing and bioturbation by marine organisms on the seafloor (Miatta & Snelgrove, 2022). The deep ocean thus plays a major role in regulating climate and mitigating climate change by removing carbon dioxide from the atmosphere and storing it at depth.

together with potential cumulative impacts of existing or planned activities;

- on the basis of REAs, SEA to assess the potential environmental and socio-economic impacts of government policies, plans and programmes, and different classes or types of development projects or technologies
- and EIAs on planned projects and activities in the context of the outcomes of REAs and SEAs.

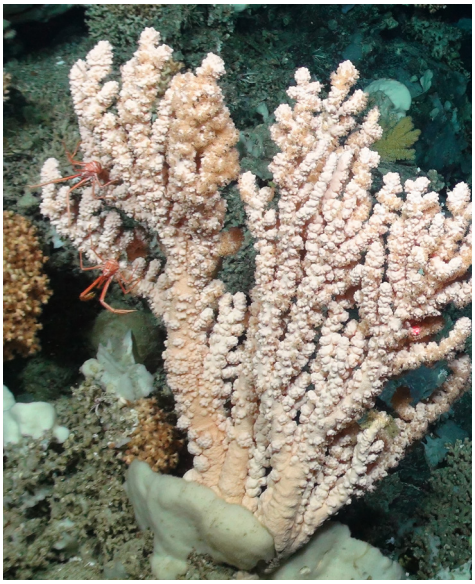
Instead, the current draft only provides for one provision on SEAs and it is unclear how it relates to EIAs and other parts of the BBNJ Agreement. In addition, there has been divergence on what should be included in SEA throughout the BBNJ negotiations, in terms of the scope, level of assessment, responsible parties, triggers, and role of a governing body in review and monitoring, amongst others (Gu, 2019).

Even within the current limited approach to SEAs, it is crucial to include REAs within SEAs. REA can provide baseline environmental information to support a proactive approach by collating existing information and providing a framework to support the generation of new knowledge. The target of assessment in REA is the environment and trends including effects of climate change and other cumulative impacts. REA includes measurements of all aspects of the environment, from biological to oceanographic, hydrographic and physical conditions, as well as ecosystem services. REA collates and synthesises environmental information and knowledge on a system of interest to provide a regional level environmental assessment of an area. REA also includes the identification of environmental knowledge gaps, and in some cases the design and implementation of research programmes to address these knowledge gaps.

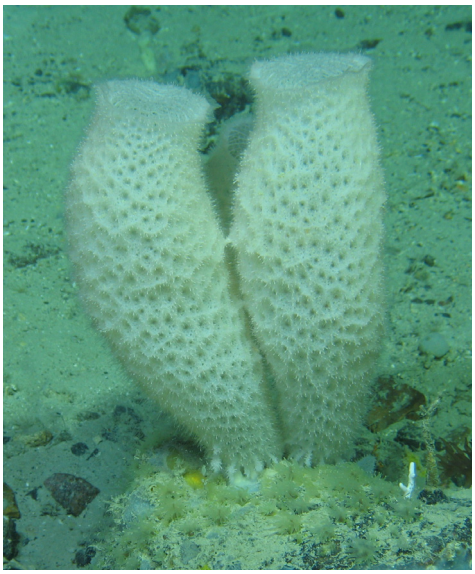
This would not be unprecedented. Within national waters, SEA inclusive of environmental assessment at a regional-scale has previously been recognised as a useful tool for managing multiple parties carrying out commercial activities in the marine environment in a number of countries, including the United States, Canada, Norway and Denmark (Doelle, 2009; Verheem & Tonk, 2000). REA has been undertaken by offshore industries in the United Kingdom, including oil and gas (Bett, 2001), renewable energy (Gill et al., 2005; Nedwell et al., 2007), and aggregate dredging sectors (Wallingford, 2010). In ABNJ, REA has been undertaken in the deep-sea mining sector through a process to develop a Regional Environmental Management Plan for the northern Mid-Atlantic Ridge (Weaver et al., 2019; ISA, 2022).

Envisioning a Gold Standard for REA

The scope of REA can vary based on the status of activities and the level of additional sampling undertaken. Ideally, for new activities that have not yet started, proactive REA should occur prior to the commencement of any commercial activities and/or awarding of contracts and should address identified knowledge gaps (Box 2). In this scenario, REA would consist of collating and synthesising existing environmental data and knowledge for a region (including links to ecosystem services), followed by a gap analysis to identify key areas where knowledge is missing (thematically or geographically). The next critical step would be to coordinate and implement a research programme co-developed with developing country parties to address those gaps, with this new knowledge then integrated into a revised REA. This approach could apply to new activities in ABNJ, for example areas of interest for deep-sea mining prior to the designation of contract areas, fishing in new grounds, or MGR activities.



Where activities have already commenced or contracts for future activities have been awarded, reactive REA is still valuable to provide context to future EIAs and to support regional-level marine spatial planning (MSP) and ABMT planning. This has occurred in the context of deep-sea mining, in both the CCZ and the northern Mid-Atlantic Ridge, where commercial activities have not yet commenced, but exploration contracts have been awarded and exploration activities have begun. In these cases, scientific information and data have been compiled and synthesised (Weaver et al., 2019; ISA, 2020) and in the CCZ this has contributed to MSP and ocean conservation through the designation of additional protected areas (ISA,



Photos: courtesy of the NERC funded Deep Links Project, Plymouth University, Oxford University, BGS, JNCC

2021). These REAs could be improved through inclusion of information from EIAs into the REA and additional, targeted research programmes to address identified knowledge gaps. Such approaches could also be applied to areas of ongoing fishing activity.

REA encourages a cooperative approach whereby collective data, knowledge and resources are pooled and capacities shared and developed. In ABNJ this could mean bringing together relevant sectoral and regional management bodies, government research organisations, NGOs and other stakeholders to contribute environmental data to a larger study of a specific region. This cross-sectoral cooperation, facilitated through REA, would allow the description of environmental patterns and ecological processes acting at regional scales, improved understanding of poorly known areas, identification of sensitive areas and assessment of potential cumulative impacts. REA can also promote pooling of resources and reduce duplication of efforts by facilitating the co-design and development of fair partnerships in implementing a region-wide research programme, including sampling, to address knowledge gaps identified through environmental assessment. This can contribute to the implementation of the capacity building and technology provisions of the BBNJ Agreement. Issues of equity and inclusive participation would need to be addressed when identifying relevant partners and stakeholders in this process. Better understanding of deep-sea ecosystem services and their benefits for particular countries and communities, as well as humankind as a whole, can support this exercise (Morgera, 2022).

In undertaking a regional assessment, consideration would need to be given to approaches that support learning across regions, and for repeating the assessment to measure change. These include standardising thresholds and targets, sampling design, data collection protocols, morphospecies catalogues and data storage. These are all outstanding issues that the deep-sea community is working to address through initiatives such as **Challenger 150** and the **Deep Ocean Observing Strategy** (UN Decade-endorsed global programmes, whose work covers some aspects of standardisation in data collection and storage), as well as the work of the International Seabed Authority (ISA) on taxonomic standardization, Large Marine Ecosystems on transboundary diagnostic assessments including socio-economic impacts, and the UN Regular Process (the ongoing intergovernmental process developing World Ocean Assessments, which is starting a process of regional assessments) . Implementation of the BBNJ Agreement could support harmonisation through the work of a Scientific and Technical Body (or other technical committee, see discussion below), with benefit to the global scientific community and ocean management. In addition to the synthesis and collection of data, REA requires periodic review and

BOX 2. OBJECTIVES OF REA

In its best form, REA should have as core objectives to:

- **assess the environmental status and trends of a specified region;**
- **assess potential for ecological links to ecosystem services;**
- **identify knowledge gaps;**
- **design and implement additional research programmes to fill knowledge gaps;**
- **assess potential cumulative impacts to biodiversity and ecosystem services of multiple activities in a region;**
- **provide regional context for project or activity-specific EIAs; and**
- **inform planning of ABMTs systems and ecologically coherent MPA networks**

Importantly, this should be undertaken in a framework of equitable participation and inclusion of all knowledge holders, noting that barriers to participation in deep-sea science include limited capacity to engage in policy processes (Sink et al., 2021).

Photo: courtesy of the NERC funded Deep Links Project, Plymouth University, Oxford University, BGS, JNCC

TEXTUAL SUGGESTIONS:

Article 1, para 16. Option B: "Strategic environmental assessment" means **the assessment of the ecological status and trends of a particular region and** the evaluation of the likely environmental effects, including health effects **and impacts on ecosystem services,** which comprises determining the scope of an environmental report and its preparation, carrying out public participation and consultations, and taking into account the environmental report and the results of the public participation and consultations in a plan or programme.

Article 41 ter: Strategic environmental assessments (additional paragraph to either option A or B)

When undertaking environmental impact assessments pursuant to this Part, and when **planning and reviewing area-based management tools pursuant to Part III, access to marine genetic resources pursuant to Part II, and capacity-building and technology transfer initiatives pursuant to Part V,** Parties shall take into account the results of relevant strategic environmental assessments carried out under paragraph 1, where available.

monitoring, as new data are made available and knowledge gaps are filled. REA outputs should inform assessment aspects of SEA and EIA, including assessment of the risks to biodiversity and linked ecosystem services posed by policies, plans and programmes. New data from REA should inform the implementation of other parts of the BBNJ Agreement on ABMTs, MGRs, and CB&TT. For example, proposals for ABMTs should take into account relevant REAs, and CB&TT programmes should develop capacity to enable participation by developing country parties in REA processes, including on MGR-based scientific and assessment tools.

Benefits of REAs to the ocean science community and the importance of FAIR data standards

To support REA, data from different areas and collectors need to be accessible and comparable; whereas at the moment different ocean science endeavours take different (and therefore not always comparable) approaches. In 2016, guiding principles for producing data that are essentially reusable were introduced (Wilkinson et al., 2016). These are referred to as FAIR data, and are defined based on four principles: **F**indability, **A**ccessibility, **I**nteroperability, and Reusability. This approach to data management ensures that data can be reused for multiple purposes, and that they are comparable between data sources. In their blueprint for an inclusive global deep-sea research programme, Howell et al. (2020) propose a way forward for standardising observations and methodologies for deep-sea sample collection that draws from and integrates multiple previous proposals. Implementation of this proposal, together with FAIR data principles for storage of digital products and physical specimens would lead to a transformative increase in ocean knowledge, by unlocking existing and new data sources for use in broad-scale analyses. This would be key for REA, which involves collating and synthesising data from multiple sources. It is also of particular importance in ABNJ, where deep-sea data are difficult and expensive to collect (Clark et al., 2016), and knowledge would benefit all humankind. FAIR data also supports the review and monitoring of REA reports and data.

The use of REA and FAIR data on BBNJ would also benefit national ocean governance in areas within national jurisdiction and support states in meeting international commitments under the Paris Agreement on climate change and the Convention on Biological Diversity. For example, were impacts in ABNJ to extend to within national waters, this could limit those ecosystems' ability to sequester carbon or could result in release of carbon from seafloor sediments (e.g., Sala et al., 2021). Previous studies suggest that protection of offshore shelf habitats that play an important role in climate regulation could save billions of US dollars through mitigation of damage to these systems (Luisetti et al., 2019).

The need for international institutional body to support REAs in ABNJ

REAs are complex and there are a number of ways they could be carried out through SEA in ABNJ under a new BBNJ Agreement. Importantly, all of these could serve as a platform to build common understanding and enhance capacity for science-based management within the present array of existing legal instruments, frameworks or bodies (a core concept of the BBNJ Agreement: see Art. 4(3)).

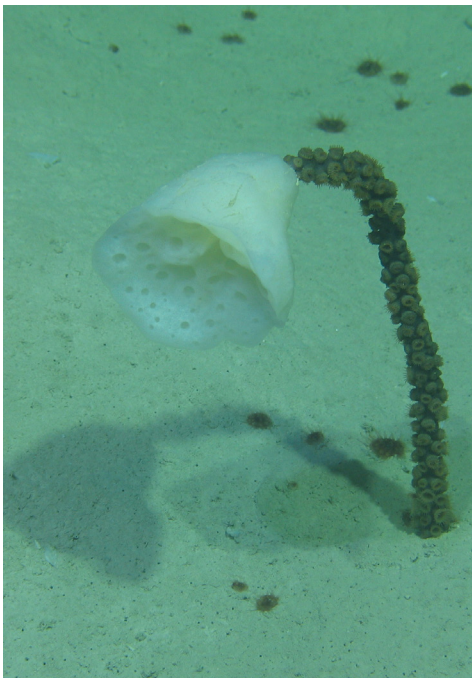


Photo: courtesy of the NERC funded Deep Links Project, Plymouth University, Oxford University, BGS, JNCC

TEXTUAL SUGGESTION:

Article 41 This Guidance to be developed by Scientific and Technical Body

1. The Scientific and Technical Body shall develop [standards and guidelines] [guidance] [guidelines] for consideration and adoption by the Conference of the Parties on:

- **FAIR data**
- **international scientific collaboration to address knowledge gaps identified through SEAs**
- **a uniform framework for regional sampling to support integration of multiple data sets and comparability of data;**
- **periodic review of data and reports from SEAs, including with a view to benefitting management of areas within national jurisdiction.**

An international body under the BBNJ Agreement is needed to support international scientific collaboration to address knowledge gaps identified through REAs and encourage further cooperative approaches whereby resources and expertise are pooled to advance ocean science. This has previously been demonstrated through programmes like ATLAS, iAtlantic, and JPI Oceans, a pan-European intergovernmental platform which addresses marine issues highlighted in national strategies and priorities of member states by funding and implementing research programmes. This could require that scientists from developing nations bordering an area of interest are included in research activities, contributing to goals of the United Nations Decade of Ocean Science for Sustainable Development for capacity building and equitable participation. Such an approach could be supported by initiatives such as the All-Atlantic Ocean Research Alliance and the UN-endorsed Challenger 150 programme.

An international body would ensure that the maximum benefit from data is obtained and that processes are streamlined. It could: develop a uniform framework for regional sampling to support integration of multiple data sets and comparability of data; identify opportunities for, and lessons from, cooperation and pooling of resources; and support periodic review of data and reports from SEAs, including with a view to benefitting management of areas within national jurisdiction (due to ecological connectivity).

These functions could be carried out by the Scientific and Technical Body (STB) already provided for in the draft text (Art. 39), in conjunction with the secretariat and the Conference of the Parties (COP), as is proposed for ABMTs (Art. 18(2)). The draft text already foresees that the STB will develop standards and/or guidelines for EIA and SEA.

However, REA is a significant undertaking, requiring technical expertise in the field of deep-sea environmental assessment and management, and would thus be better led by a group of specialists than a group with broader expertise and remit. So a more effective institutional approach could be through an expert group , whose specific purpose would be to focus on regional environmental assessment. This could build upon the idea already envisaged under the current draft of a "pool of experts" under the Scientific and Technical Body (Art. 30(4)). This could be supported by regional working groups (Gjerde et al., 2021). Careful consideration would need to be given to the make-up of such an expert group to ensure equitable participation by all relevant stakeholders.

This expert group could support the STB in:

- monitoring, reviewing and making recommendations on REA to the COP, by synthesizing information from REA and identifying knowledge gaps;
- facilitating cooperation and coordination with other relevant global, regional, subregional or sectoral bodies, allowing for consultation with and participation by these bodies in the REA process, such as is proposed for EIA (Art. 23(2)).
- developing a strategy to support inclusive and equitable participation from relevant stakeholders (see Hub Policy Brief BBNJ 2).

TEXTUAL SUGGESTION:

Article 30 Process for environmental impact assessments

[4. A group of experts shall be created under the Scientific and Technical Body, **with fair geographic representation.** Parties with capacity constraints may commission those experts to conduct and evaluate screenings and environmental impact assessments for [planned] [proposed] activities under their jurisdiction or control.

The expert group will also support the Scientific and Technical Body in reviewing SEAs and synthesizing regional environmental data and gap analysis, to provide context for EIAs and for cooperation with relevant global, regional, subregional and sectoral bodies.

Consideration would need to be given to financing and implementation of REA. Possible models include financial contributions into a central pot by member states, economically developed member states or corporations with an interest in operating in ABNJ. This central pot could then be administered by a Governing Body. Alternatively, proposals could be submitted to financial organisations to leverage funds, such as partial funding provided to support regional research in the Sargasso Sea[3]. Funds from an organisation or central pot could then be used either to finance REA by a technical body or to stimulate funding for marine scientific research by the international scientific community. The latter could occur under the auspices of the UN Decade for Ocean Science, as a global or regional scientific programme. The proposed expert group could thus also advise the STB on funding mechanisms, notably for regional research programmes.

Artwork : Margherita Brunori

Conclusion

The BBNJ negotiations provide a unique opportunity to develop proactive environmental management measures that could change the way we manage our ocean and support conservation and sustainable use of biodiversity in ABNJ, thereby contributing to **multiple dimensions of human wellbeing and to climate change mitigation** (SDGs 1-3, 6-7, 11.4, 13 and 14). In fact, such an approach would also support a **step-change in current ocean science** practices, by bolstering cooperation, integration and comparability, particularly to the benefit of developing countries, to support ecologically meaningful ocean management in ABNJ as well as within national jurisdiction. SEAs in ABNJ that is inclusive of REAs would put **ecosystems, their services and benefits to humankind at the centre of ocean research and management efforts**, to ensure that all Parties with an interest in BBNJ work together to ensure its sustainable future. It is essential that REAs in the context of the BBNJ Agreement are included at least as a subset of SEAs, and their implementation supported by a specific international body.

[3]The Sargasso Sea is an area of the High Seas of great biodiversity importance. Funds from the Global Environment Facility are being directed towards addressing key knowledge gaps in this area through the Sargasso Sea Project to support regional management in ABNJ. See: Freestone D. 2021. The Sargasso Sea Commission: An evolving new paradigm for High Seas ecosystem governance? Frontiers in Marine Science 8:668253. DOI: 10.3389/fmars.2021.668253.

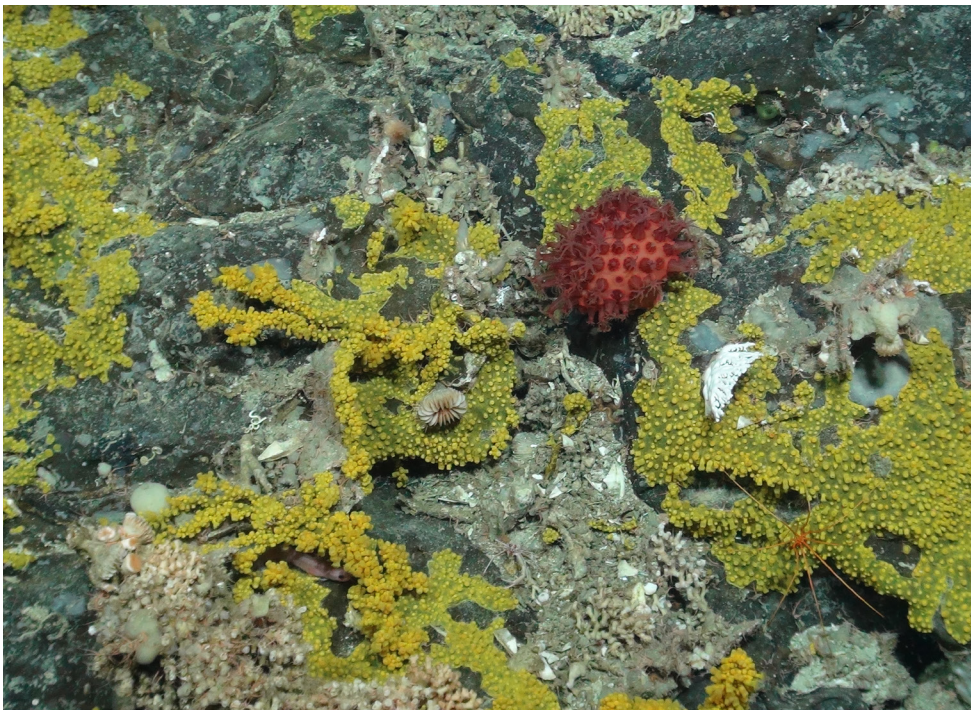


Photo: courtesy of the NERC funded Deep Links Project, Plymouth University, Oxford University, BGS, JNCC

References

Amon DJ, Gollner S, Morato T, Smith CR, Chen C, Christiansen S, Currie B, Drazen JC, Fukushima T, Gianni M, Gjerde KM, Gooday AJ, Guillen Grillo G, Haeckel M, Joyini T, Ju S-J, Levin LA, Metaxas A, Mianowicz K, Molodtsova TN, Narberhaus I, Orcutt BN, Swaddling A, Tuhumwire J, Palacio PU, Walker M, Weaver P, Xu X-W, Mulalap CY, Edwards PET & Pickens C. 2022. Assessment of scientific gaps related to the effective environmental management of deep-seabed mining. Marine Policy 138: 105006. DOI: 10.1016/j.marpol.2022.105006.

Atwood TB, Witt A, Mayorga J, Hammill E & Sala E. 2020. Global patterns in marine sediment carbon stocks. Frontiers in Marine Science 7:165. DOI: 10.3389/fmars.2020.00165.

Bett BJ. 2001. UK Atlantic Margin Environmental Survey: Introduction and overview of bathyal benthic ecology. Continental Shelf Research 21(8): 917-956. DOI: 10.1016/S0278-4343(00)00119-9.

Clark MR, Consalvey M & Rowden A. 2016. Biological Sampling in the Deep Sea. Hoboken, New Jersey: Wiley-Blackwell, pp. 498.

Doelle M. 2009. Role of strategic environmental assessments in energy governance: A case study of tidal energy in Nova Scotia's Bay of Fundy. Journal of Energy & Natural Resources Law 27(2): 112-144. DOI: 10.1080/02646811.2009.11435210.

DOSI. 2018. The Full Value of Marine Genetic Resources (MGR). Policy Brief. Available: https://www.dosi-project.org/wp-content/uploads/2018/05/027-DOSI-MGR-1.pdf.

Gill A, Gloyne-Philips I, Neal K & Kimber J. 2005. COWRIE 1.5 The potential effects of electromagnetic fields generated by sub-sea power cables associated with offshore wind farm developments on electrically and magnetically sensitive marine organisms - A review. Centre for Marine and Coastal Studies Ltd (CMACS) and Cranfield University.

Gjerde KM, Wright G & Durussel C. 2021. Strengthening high seas governance through enhanced environmental assessment processes: A case study of mesopelagic fisheries and options for a future BBNJ treaty. STRONG High Seas Project.

Gu K. 2019. Assessing the role of strategic environmental assessments in the conservation and sustainable use of marine biodiversity of areas beyond national jurisdiction. Blog for Norwegian Centre for the Law of the Sea.

Hassanali K & Mahon R. 2022. Encouraging proactive governance of marine biological diversity of areas beyond national jurisdiction through Strategic Environmental Assessment (SEA). Marine Policy 136: 104932. DOI: 10.1016/j.marpol.2021.104932.

Hilmi N, Chami R, Sutherland MD, Hall-Spencer JM, Lebleu L, Benitez MB & Levin LA. 2021. The role of blue carbon in climate change mitigation and carbon stock conservation. Frontiers in Climate 3. DOI: 10.3389/fclim.2021.710546.

Howell KL. 2010. A benthic classification system to aid in the implementation of marine protected area networks in the deep/high seas of the NE Atlantic. Biological Conservation 143: 1041-1056. DOI: 10.1016/j.biocon.2010.02.001.

Howell KL, Hilário A, Allcock AL, Bailey DM, Baker M, Clark MR, Colaço A, Copley J, Cordes EE, Danovaro R, Dissanayake A, Escobar E, Esquete P, Gallagher AJ, Gates AR, Gaudron SM, German CR, Gjerde KM, Higgs ND, Le Bris N, Levin LA, Manea E, McClain C, Menot L, Mestre NC, Metaxas A, Milligan RJ, Muthumbi AWN, Narayanaswamy BE, Ramalho SP, Ramirez-Llodra E, Robson LM, Rogers AD, Sellanes J, Sigwart JD, Sink K, Snelgrove PVR, Stefanoudis PV, Sumida PY, Taylor ML, Thurber AR, Vieira RP, Watanabe HK, Woodall LC & Xavier JR. 2020. A Blueprint for an inclusive, global deep-sea ocean decade field program. Frontiers in Marine Science 7. DOI: 10.3389/fmars.2020.584861.

International Seabed Authority (ISA). 2020. Deep CCZ Biodiversity Synthesis Workshop Report. Friday Harbor: International Seabed Authority, 206 pp.

International Seabed Authority (ISA). 2021. Review of the implementation of the Environmental Management Plan for the Clarion-Clipperton Zone. ISBA/26/C/43; ISA. 2021. Decision of the Council of the International Seabed Authority relating to the review of the environmental management plan for the Clarion-Clipperton Zone. ISBA/26/C/58.

International Seabed Authority (ISA). 2022. Stakeholder consultation on the draft regional environmental management plan for the Area of the northern Mid-Atlantic Ridge with a focus on polymetallic sulphide deposits. Available: https://isa.org.jm/news/draft-regional-environmental-management-plan-northern-mid-atlantic-ridge-open-consultation.

La Bianca G, Rees S, Attrill MJ, Lombard AT, McQuaid K, Niner H, van Rein H, Sink K & Howell KL. From theory to practice: Development of an ecosystem services framework for the deep sea. Submitted.

Levin LA. 2021. IPCC and the Deep Sea: A Case for Deeper Knowledge. Frontiers in Climate 3: 720755. DOI: 10.3389/fclim.2021.720755.

Luisetti T, Turner RK, Andrews JE, Jickells TD, Kröger S, Diesing M, Paltriguera L, Johnson MT, Parker ER, Bakker DCE & Weston K. 2020. Quantifying and valuing carbon flows and stores in coastal and shelf ecosystems in the UK. Ecosystem Services 35: 67-76. DOI: 10.1016/j.ecoser.2018.10.013.

McQuaid KA, Bridges AEH, Howell KL, Gandra TBR, de Souza V, Currie JCC, Hogg OT, Pearman TRR, Bell JB, AtkinsonLJ, Baum D, Bonetti J, Carranza A, Defeo O, Furey T, Gasalla MA, Golding N, Hampton SL, Horta S, Jones DOB, Lombard AT, Manca E, Marin Y, Martin S, Mortensen P, Passdore C, Piechaud N, Sink KJ & Yool A. Broad-scale benthic habitat classification of the South Atlantic. Submitted.

Miatta M & Snelgrove PVR. 2022. Sea pens as indicators of macrofaunal communities in deep-sea sediments: Evidence from the Laurentian Channel Marine Protected Area. Deep Sea Research Part I: Oceanographic Research Papers 182: 103702. DOI: 10.1016/j.dsr.2022.103702.

Morgera E. 2022. "The Relevance of the Human Right to Science for the Conservation and Sustainable Use of Marine Biodiversity of Areas Beyond National Jurisdiction: A New Legally Binding Instrument to Support Co-Production of Ocean Knowledge across Scales" in De Lucia et al (eds), International Law and Marine Areas beyond National Jurisdiction: Reflections on Justice, Space, Knowledge and Power (Brill) 242-274

Nedwell J, Parvin S, Edwards B, Workman R, Brooker A & Kynoch J. 2007. Measurement and interpretation of underwater noise during construction and operation of offshore windfarms in UK waters. Report commissioned by COWRIE Ltd.

Popova E, Vousden D, Sauer WHH, Mohammed EY, Allain V, Downey-Breedt N, Fletcher R, Gjerde KM, Halpin PN, Kelly S, Obura D, Pecl G, Roberts M, Raitsos DE, Rogers A, Samoilys M, Sumaila UR, Tracey S & Yool A. 2019. Ecological connectivity between the areas beyond national jurisdiction and coastal waters: Safeguarding interests of coastal communities in developing countries. Marine Policy 104: 90-102. DOI: 10.1016/j.marpol.2019.02.050.Sala

E, Mayorga J, Bradley D, Cabral RB, Atwood TB, Auber A, Cheung W, Costello C, Ferretti F, Friedlander AM, Gaines SD, Garilao C, Goodell W, Halpern BS, Hinson A, Kaschner K, Kesner-Reyes K, Leprieur F, McGowan J, Morgan LE, Mouillot D, Palacios-Abrantes J, Possingham HP, Rechberger KD, Worm B & Lubchenco J. 2021. Protecting the global ocean for biodiversity, food and climate. Nature 592: 397–402. DOI: 10.1038/s41586-021-03371-z.

Sink KJ, McQuaid K, Atkinson LJ, Palmer RM, Van der Heever G, Majiedt PA, Dunga LV, Currie JC, Adams R, Wahome M, Howell K & Patterson AW. 2021. Challenges and Solutions to Develop Capacity for Deep-sea Research and Management in South Africa. South African National Biodiversity Institute, 35pp.

Thurber AR, Sweetman AK, Narayanaswamy BE, Jones DOB, Ingels J & Hansman RL. 2014. Ecosystem function and services provided by the deep sea. Biogeosciences 11: 3941–3963. DOI: 10.5194/bg-11-3941-2014.

United Nations. 2021. The Second World Ocean Assessment (WOA II). United Nations, New York. Available: https://www.un.org/regularprocess/woa2launch.

Verheem RAA & Tonk JAMN. 2000. Strategic environmental assessment: One concept, multiple forms. Impact Assessment and Project Appraisal 18(3): 177-182. DOI: 10.3152/147154600781767411.

Wallingford H. 2010. South Coast Dredging Association: MAREA Summary Report; British Marine Aggregate Producers Association. 2019. Regional Assessment.

Watling L, Guinotte J, Clark MR. & Smith CR. 2013. A proposed biogeography of the deep ocean floor. Progress in Oceanography 111: 91-112. DOI: https://doi.org/10.1016/j.pocean.2012.11.003.

Weaver PPE, Boschen-Rose RE, Dale AC, Jones DOB, Billett DSM, Colaço A, Morato T, Dunn DC & Priede IG. 2019. Regional Environmental Assessment of the Northern Mid-Atlantic Ridge, 229 pp.

Wilkinson M, Dumontier M, Aalbersberg I, et al. 2016. The FAIR Guiding Principles for scientific data management and stewardship. Scientific Data 3: 160018. DOI: 10.1038/sdata.2016.18.

In conjunction with:

Food and Agriculture Organization of the United Nations

Funded by:

GCRF Global Challenges Research Fund

UK Research and Innovation