

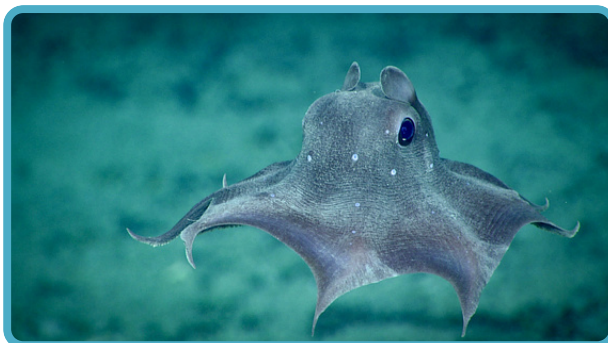
The deep ocean presents unique social and governance challenges that need to be addressed

Key messages

- While the deep ocean is remote, it is essential to people, communities and societies for its role in climate regulation and the carbon cycle, remineralisation, resource exploitation and benefit-sharing, and spiritual linkages.
- Features of the deep ocean give rise to unique social and governance concerns, most of which are poorly understood and represented.
- Challenges associated with deep-ocean governance need to be further considered and aligned across climate, biodiversity and associated policy frameworks.

The deep ocean, defined as the water column and seabed beneath 200 m of the surface, is **connected to people, communities and societies** in fundamental and intricate ways. This includes through its regulation of Earth system processes such as the **climate**, and through **resource extraction, distribution of benefits, research practices and governance regimes**, which all impact economies and human wellbeing. In addition, many Indigenous peoples have tight **spiritual connections** to the deep ocean in regions ranging from the Arctic to tropical Oceania.

Because of the deep ocean's particular characteristics – vastness, remoteness, connectedness, extreme latency, and three-dimensionality – activities in and impacts on the deep ocean give rise to **unique social and governance challenges**. At present, these challenges are not adequately reflected in policy frameworks for climate change mitigation and adaptation, biodiversity protection, or resource extraction.



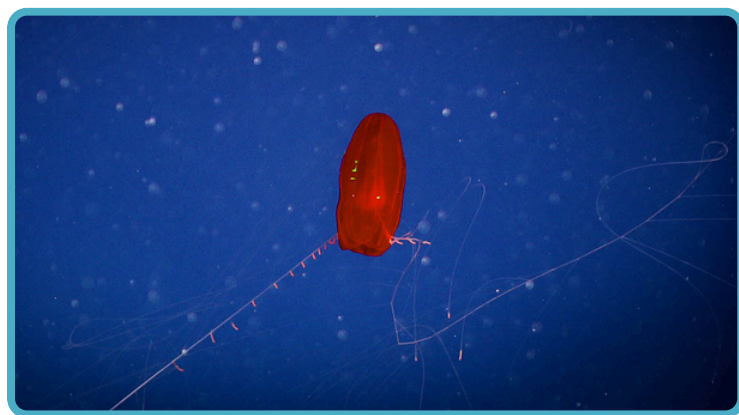
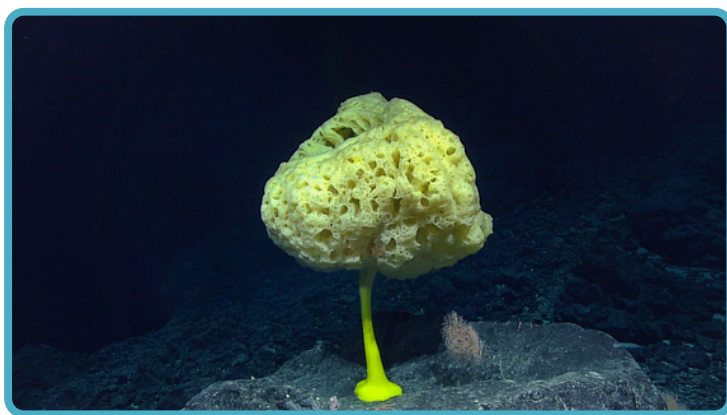
Left: Dumbo octopus (NOAA Office of Ocean Exploration and Research, 2019 Southeastern U.S. Deep-sea Exploration). Right: Brisingid sea stars (ROV SuBastian, Schmidt Ocean Institute).

Key social and governance challenges associated with the deep ocean

1. Deep-sea scientific **data are limited, often uncertain** and **sometimes simply lacking**. As a result, policy-makers are required to make decisions about the deep ocean under high uncertainty, making the **precautionary principle** fundamentally important in deep-ocean management. Its application involves mediating diverse risk preferences and interests, which implicates a range of ethical, social, cultural and cognitive dimensions. Many deep-sea scientific findings are disqualified from the influential IPCC summary reports because they do not reach the required certainty criteria. Such challenges should be treated through a different strategy than simply exclusion.

2. **Deep-sea literacy among the general public is low**, which results in deep-sea issues often either lacking public support or being treated with indifference. The low saliency and lack of understanding of deep-sea activities, often perceived as disconnected from human wellbeing, can make dumping of waste or environmentally harmful resource extraction appear as justifiable or of little concern. Reforming deep-sea narratives to better reflect planetary and societal connections can play a crucial role in reshaping how people perceive their relationship with the deep ocean.

3. Public discourse and media **underappreciate and underrepresent human impacts on the deep ocean** and their social and ecological consequences because they tend to be **incremental, out of sight, and delayed and displaced across time and space**, making them difficult to capture in fora that prioritise sudden and spectacular events. Consequences that are ultimately dispersed and experienced by future generations generate challenges in tracking, monitoring and accountability, as well as a lowering of incentives for refraining from causing harm in the first place.



Left: Yellow glass sponge (NOAA Office of Ocean Exploration and Research, *Deep-Sea Symphony: Exploring the Musicians Seamounts*). Right: Ctenophore (NOAA Office of Ocean Exploration and Research, *Deep Connections* 2019).

4. **Inequity in exploration, research and exploitation** occurs because the deep ocean is **expensive and challenging to access**. A substantial proportion of the world's EEZs belong to low- and middle-income small island states, with very limited deep-sea exploration capacity. Most deep-sea expeditions are led by scientists from a small number of institutions in high-income countries, even when expeditions target deep-sea areas within the jurisdiction of low-income states. A small number of countries and their EEZs dominate deep-sea observations to date, leading to geographic bias in knowledge of the deep ocean.

5. **Small-scale resource users are disadvantaged and developed economies are favoured** by the dependence on high levels of technological and financial **capacity to access deep-ocean resources**. States and private corporations are effectively racing to access minerals, oil, gas, and promising genetic resources. This **unbalanced race for resources** risks not only geopolitical tensions and monopolisation, but also irreversible environmental damage to fragile marine ecosystems. Environmental economists may help in developing tools for valuing the ecological and cultural components of the deep ocean.

6. Most ocean governance regimes, including the UN Convention on the Law of the Sea, display a **horizontal bias to ocean zones** and **fail to reflect the three-dimensionality** of the ocean space. The deeper parts of the ocean are fundamentally different from the shallower parts in their physical, chemical and ecological domains, which have implications for their use and governance. Flexible 3D-marine protected areas can help to counter this horizontal bias.

7. Deep-sea governance requires consideration of human **intergenerational equity** because most deep-sea processes operate on **much longer time-scales** than in shallow water. The slow growth, great longevity, late maturation and low reproduction rates of deep-sea organisms render them particularly vulnerable to disturbance, and most are unable to adapt or recover from disturbance within human-centric timeframes. Restoration of deep-ocean ecosystems is rarely feasible.

8. **Two-thirds of the deep ocean is found within a global commons**, which means that responsibilities associated with **access and distribution of benefits** require special attention. The basis of benefit-sharing has ethical, historical, colonial and economic dimensions that are complex and contested. New and emerging activities affecting deep-sea ecosystems, such as marine carbon dioxide removal, are wholly undefined in terms of rights-of-access and benefit-sharing. All involve complex geopolitical considerations that cannot be easily separated from the shared ecological consequences of exploitation, creating governance challenges between the distribution of deep-ocean benefits and burdens.

9. **Equity and justice challenges** emerge from the present situation of **state-based deep-ocean governance**, which overlooks rights-bearing groups and individuals. Human rights in connection with the deep ocean are only now emerging and remain ill-defined, but **rights to a clean and healthy environment should extend to the deep ocean**. Intergovernmental regulations have largely omitted or marginalised Indigenous voices, and have ignored their spiritual and cultural connections to the deep ocean. The **UN Declaration on the Rights of Indigenous People** needs further incorporation into deep-sea science and governance.



Left: Siphonophore (NOAA Office of Ocean Exploration and Research, Hohonu Moana 2016). Right: Bamboo coral and feather star (Ivan Hurzeler and DEEP SEARCH 2019 - BOEM, USGS, NOAA, ROV Jason, Woods Hole Oceanographic Institution).

Policy action

The social and governance concerns listed above need to be addressed through **multilateral and cross-sectoral efforts** including co-design and co-regulation across international agreements and bodies, such as the Convention on Biological Diversity (**CBD**), the UN Framework Convention on Climate Change (**UNFCCC**), the UN Convention on the Law of the Sea (**UNCLOS**), the International Seabed Authority (**ISA**), the Agreement on the Conservation and Sustainable Use of Marine Biodiversity Beyond National Jurisdiction (**BBNJ**), the Food and Agriculture Organisation (**FAO**), the International Maritime Organization (**IMO**), the London Convention/Protocol (**LC/LP**) and the UN Educational, Scientific and Cultural Organization (**UNESCO**).

Recognising social and governance concerns unique to the deep ocean and aligning efforts to address them across institutions is crucial for regulating resource exploitation and biodiversity protection in the deep ocean. Processes that engage and give voice to diverse stakeholders, such as the **Ocean and Climate Change Dialogue**, can be important tools, but are so far limited in reach. More fora are needed for discussion of cross-cutting topics such as the deep ocean, including ones that traditionally have been more focused on terrestrial ecosystems, such as the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

There is a need for increased **support for deep-sea science** and development of **equitable deep-sea research capacity**. Relevant agreements, treaties and bodies, such as the BBNJ Agreement, the Kunming-Montreal Global Biodiversity Framework, the ISA and the IPCC, should develop inclusive processes for determining and pursuing deep-ocean research priorities, and sharing knowledge.

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About DOSI

The Deep-Ocean Stewardship Initiative is a global network of experts that integrate science, technology, policy, law and economics to advise on ecosystem-based management of resource use in the deep ocean and strategies to maintain the integrity of deep-ocean ecosystems within and beyond national jurisdiction.

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Further reading

Amon et al. (2022) [Assessment of scientific gaps related to the effective environmental management of deep-seabed mining](#).

Bell et al. (2023) [Exposing inequities in deep-sea exploration and research: results of the 2022 Global Deep-Sea Capacity Assessment](#).

Bell et al. (2025) [How little we've seen: a visual coverage estimate of the deep seafloor](#).

Craik (2025) [Equitable marine carbon dioxide removal: the legal basis for interstate benefit-sharing](#).

Harden-Davies et al. (2024) [First to finish, what comes next? Putting capacity building and the transfer of marine technology under the BBNJ Agreement into practice](#).

Jacquemont et al. (2024) [3D ocean assessments reveal that fisheries reach deep but marine protection remains shallow](#).

Lidström et al. (2024) [Laying waste to the deep: parallel narratives of marine carbon dioxide removal and deep-seabed mining](#).

Levin (2021) [IPCC and the deep sea: a case for deeper knowledge](#).

Morgera et al. (2023) [Addressing the ocean-climate nexus in the BBNJ Agreement: Strategic Environmental Assessments, human rights and equity in ocean science](#).

Pillar et al. (2024) [Future directions for deep ocean climate science and evidence-based decision making](#).

Polejack et al. (2025) [Hope for an accessible ocean: blue justice and ocean science diplomacy central to the outcome of the UN Decade of Ocean Science](#).

Ranganathan (2024) [The seabed and the South: from stock stories to new histories of international lawmaking](#).