

High-seas fish biodiversity is slipping through the governance net

States at the United Nations have begun negotiating a new treaty to strengthen the legal regime for marine biodiversity in areas beyond national jurisdiction. Failure to ensure the full scope of fish biodiversity is covered could result in thousands of species continuing to slip through the cracks of a fragmented global ocean governance framework.

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Over the past 70 years, commercial fisheries have expanded farther and deeper into the open ocean^{1–4}, impacting many forms of marine biodiversity that exist in areas beyond national jurisdictions (ABNJ; generally, the area beyond 200 nautical miles from shore)^{5,6}. The growth of other industries, such as shipping, has further expanded the presence of humans in the open ocean, while new activities, such as seabed mining, are on the horizon¹. These impacts are compounded by the effects of a changing climate, deoxygenation and ocean acidification^{7–9}.

In 2017, after more than a decade of informal discussions at the United Nations (UN) regarding gaps in the legal framework for the conservation and management of marine biodiversity beyond national jurisdiction (known as the BBNJ process), states agreed to convene an intergovernmental conference for the negotiation of a legally binding instrument under the UN Convention on the Law of the Sea (UNCLOS) (an ‘implementing agreement’)¹⁰.

The agreement to launch the negotiations was partly achieved by the consensus that any new instrument “should not undermine existing legal instruments and frameworks and relevant global, regional and sectoral bodies”¹⁰. This has generally been assumed to mean that the new instrument should complement and strengthen the existing framework and prevent the adoption of weaker or dissonant management measures. However, a small number of states wish to see commercial fisheries (including all forms of fish biodiversity, which they group as a commercial resource whether or not it is harvested) excluded from a new agreement and are concerned that any new provisions will inevitably undermine existing fisheries management bodies. However, there is a significant difference between the number of fish species subject to management and

the number of fish species in ABNJ that may be impacted by commercial fishing activities. As fish are a major component of marine biodiversity in ABNJ and have a major role in marine ecosystem functioning, it is important to understand what regional fisheries management organizations (RFMOs) are in fact responsible for monitoring and managing. Here, we contrast fish biodiversity estimates in ABNJ with a comprehensive database of existing fish population assessments to help delineate the current competencies of RFMOs and identify areas of improvement that could be addressed both through the new agreement as well as by strengthening the mandates and actions taken by such bodies.

We first describe the overarching legal framework for high-seas fisheries, then enumerate how many fish species are either targeted, affected or simply unstudied and potentially at risk of slipping through the cracks of the current management arrangements. The final section analyses how these gaps are relevant to ongoing negotiations at the UN for a new treaty and concludes with specific recommendations.

Governance of high-seas fish

The 1982 UNCLOS defines the scope of maritime rights, jurisdictions, duties and activities in the ocean. In the high seas, beyond 200 nautical miles from shore, UNCLOS recognizes the right of all states to engage in fishing. This right is subject to obligations, including a duty to cooperate in the adoption of management measures through the establishment of subregional or regional organizations (UNCLOS, Part VII, Articles 116 and 117).

The UN adopted a new implementing agreement under UNCLOS in 1995 for the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UN Fish Stocks Agreement (UNFSA))¹¹. The UNFSA provided an enhanced set of obligations for fisheries

and ecosystem conservation and a stronger framework for cooperation through establishing RFMOs as the principal mechanisms for fisheries management in ABNJ. The UNFSA obliges states, acting individually and cooperating through RFMOs, to “assess the impacts of fishing, other human activities and environmental factors on target stocks and species belonging to the same ecosystem or associated with or dependent upon the target stocks” and assess impacts on “non-target and associated or dependent species and their environment” (UNFSA, Part II, Articles 5 and 6). Further, they are required to: develop data collection and research programmes and plans to ensure the conservation of such species and protect habitats of special concern; protect biodiversity in the marine environment; and apply the precautionary approach widely, ensuring that caution is taken when information is uncertain, unreliable or inadequate (UNFSA, Part II, Articles 5 and 6). These obligations are substantial obligations, both in terms of assessing the impacts of fishing on non-target, associated or dependent species and even more so in regard to assessing the impacts of other human activities and environmental factors on these species. The implementation of these obligations could be significantly enhanced by mechanisms established under a new treaty. These obligations, however, have never been formalized through specific taxonomic lists across RFMOs.

High-seas fisheries have been shown to have both direct and indirect impacts (for example, through trophic linkages) on a wide range of species beyond those targeted⁵. Nevertheless, management and monitoring efforts remain focused largely on species of commercial importance without a systematic approach to assessing the status of or minimizing the catch of, or impacts on, BBNJ as a whole. Recent studies regarding tuna management, for example, have

shown that, although many of the elements necessary for ecosystem-based management are already present in the RFMO frameworks, they have been “implemented in an ad hoc way, without a long-term vision and a formalized plan”¹². Similar progress as well as significant shortcomings have been shown to exist within non-tuna RFMOs¹³. This raises a basic question: what species are being actively assessed and managed by RFMOs and who is responsible for monitoring the impacts of fishing on fish species and biodiversity not actively being assessed and managed by RFMOs?

Scope of management in ABNJ

While UNCLOS and the UNFSA provide both a framework and detailed obligations of states for the governance and management of fisheries in ABNJ, they do not describe the specific scope of BBNJ that fall under the mandate of RFMOs. To provide insight into the scope of unmanaged fish species, we describe known fish biodiversity in ABNJ and assess the degree to which their populations are being monitored. We calculated this by contrasting high-seas fish biodiversity estimates, from the Ocean Biogeographic Information System (OBIS; www.iobis.org), with the RAM Legacy Stock Assessment Database¹⁴, which reflects the number of (mostly target) harvested species that are being monitored and managed (Box 1)^{15,16}.

We also contrasted the list of high-seas fish biodiversity against the International Union for Conservation of Nature (IUCN) Red List, which provides another source of information about extinction status and abundance trends for some species. Of the 4,018 fish species in the high seas recorded in OBIS, 42.4% did not show up on the IUCN Red List based on the scientific name taken from the OBIS record (which is drawn from the World Registry of Marine Species). Of the 2,315 species with IUCN Red List records, the abundance trend of <1% was increasing, 17% were stable, 7% were decreasing and the remaining ~75% were either unknown or unavailable. Collectively, this means that 85.7% of the high-seas fish species do not have any information on population trends under the IUCN. Of the same group of species with IUCN Red List records, 1,903 were labelled as Least Concern of extinction, which we found surprising since 57.8% of high-seas fish under OBIS have less than 10 records in the historic series. The IUCN Red List portal suggests that “Least Concern or Data Deficient species may warrant reclassification” as more data become available (www.iucnredlist.org/assessment/process).

The call by the UNFSA for RFMOs to assess the impacts of fishing on species belonging to the same ecosystem is quite daunting given the taxonomic diversity of high-seas ecosystems. More ambitious taxonomic mandates of existing RFMOs are needed where such bodies have mandates that restrict their application to species potentially impacted by fisheries under their management. The new high-seas treaty can help ensure that complementary management or monitoring frameworks can be developed for those species that are not currently being assessed (that is, approximately ~95% of fish biodiversity in ABNJ). It is not economically feasible to conduct stock assessments for the almost 4,000 unmonitored species; however, other forms of abundance and status assessment are available. It is also important to note that this study is limited to high-seas fish biodiversity, whereas the direct and indirect impacts of human activities in ABNJ extend to other taxonomic groups, including sea birds and marine invertebrates.

Strengthening management

As UN members begin negotiating a landmark international treaty for high-seas biodiversity conservation, we stress the need to discuss and adopt an instrument that establishes or enhances mechanisms to assess impacts of fisheries non-target species. These should include fish species and need to complement mechanisms already established by RFMOs. If fisheries are exempted from a new high-seas treaty, fisheries impacts on non-fish biodiversity will also slip through the gaps of the new global ocean governance net. Moreover, coverage of high-seas fish biodiversity through the new agreement could complement and enhance the strengthening of existing mechanisms and requirements for ecosystem approaches across all sectors including fisheries. By providing common principles, obligations and standards for states, together with a more rigorous global review process to assess implementation and overall progress, the BBNJ treaty can help ensure that all organizations with management competency in ABNJ (including RFMOs) effectively and consistently apply an ecosystem approach and avoid or prevent adverse impacts on biodiversity as a whole. The new agreement could also call for global mechanisms to fill geographic (for example, the Arctic or the Southwest Atlantic) and taxonomic governance gaps where regional and sectoral bodies cannot be developed, or mandates cannot be extended. While the taxonomic mandates of existing RFMOs could be expanded, it is improbable and unrealistic

to expect that this expansion would functionally lead to monitoring efforts across all “species belonging to the same ecosystem or associated with or dependent upon the target stocks” (UNFSA, Part II, Article 5). Complementary approaches under the new treaty may include a call on regional seas organizations and global or regional observing systems to provide monitoring and assessment of cumulative impact on biodiversity (including fish biodiversity). Any new agreement could also provide a global framework for how the interests of states not engaged in resource extraction in ABNJ may be considered in sectoral management bodies.

In addition, to implement an ecosystem approach to the conservation of high-seas biodiversity across all sectors, the new treaty will need to contain strong provisions for (1) establishing and implementing cross-sectoral marine protected areas and applying other area-based management tools, and (2) requiring and guiding environmental impact assessments and strategic environmental assessments across all high-seas taxa and ecosystems¹³. However, if fish are not considered part of the biodiversity covered by a new treaty, no area-based management tools or environmental impact assessments will be designed and implemented for their conservation under the agreement. On the contrary, by including fish as part of the agreement whether explicitly or implicitly, the agreement would probably enhance the capacity of states and RFMOs to assess the impacts of fisheries, other human activities and the environment on non-target, associated or dependent species or species belonging to the same ecosystems. This would enhance implementation of the UNFSA, probably lead to better conservation of such species and, crucially for RFMOs, help identify impacts of other activities on fish populations, including cumulative impacts, and actions needed by other sectors to conserve fish biodiversity as well.

Mechanisms to enhance cooperation and data sharing among sectors and competent organizations will be critical to the successful implementation of an ecosystem approach through the new instrument. In particular, there is a strong role for existing entities such as OBIS and the Global Ocean Observing System (GOOS) to support the development of data standards and means of dissemination to operationalize data sharing and improve data streams used by fisheries managers and other sectors. Such a recommendation could be supported globally as part of the UN Decade for Ocean Science for Sustainable Development. Institutionalizing

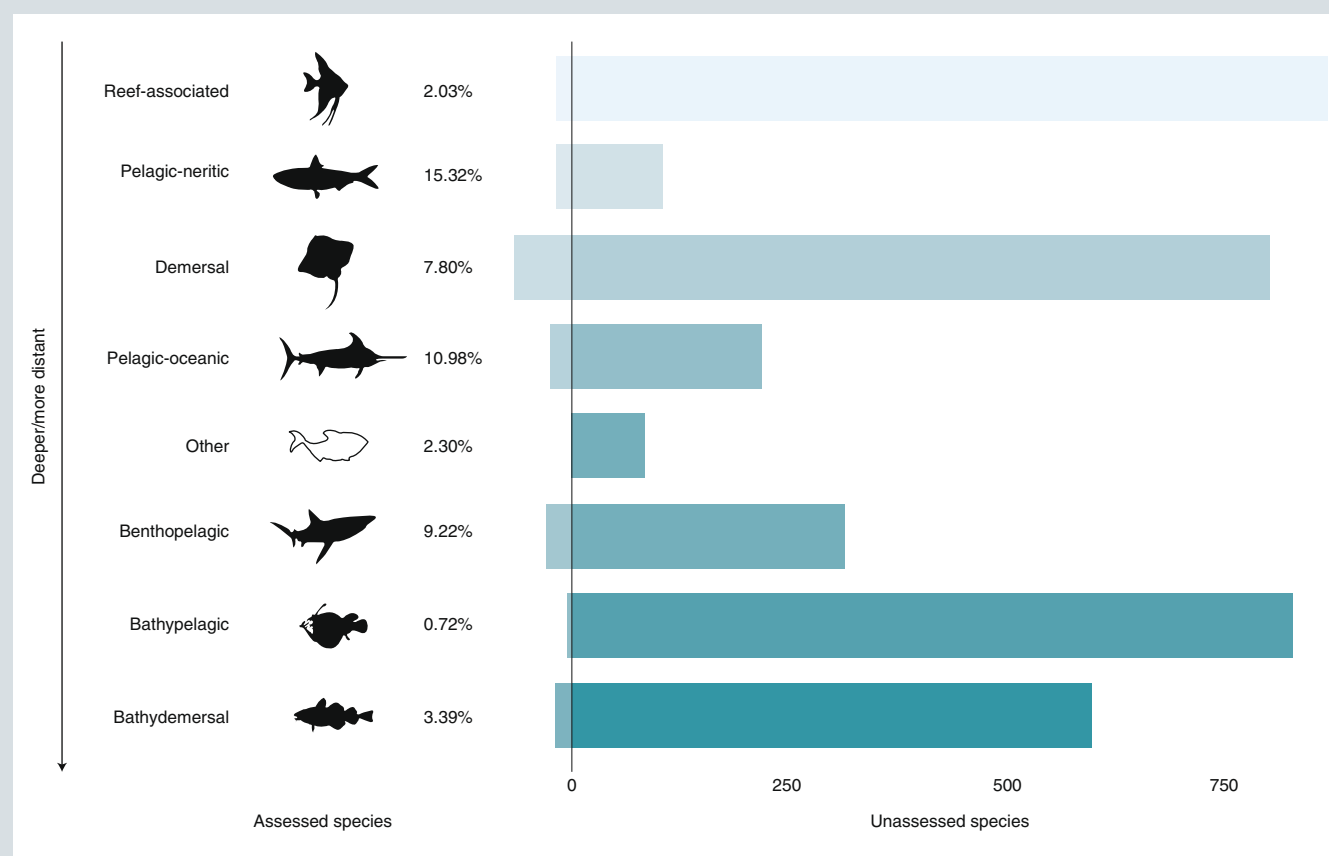
Box 1 | How much do we know about fish in ABNJ?

OBIS is a global open-access information clearinghouse for marine biodiversity observations. OBIS contains records of 4,018 species observed in ABNJ, comprising the known fish biodiversity in the high seas. It is also worth noting that most of these recorded species are grossly understudied, as only a quarter ($n = 1,098$) have more than 10 records and almost a third ($n = 1,224$) have only one record in OBIS. The abundance assessments available as part of the RAM Legacy Stock Assessment Database¹⁴ included 51 different methods of assessment, including stock assessments. Abundance or stock assessments, which are generally data intensive and require sophisticated modelling efforts, are primarily conducted for commercially valuable species. These constraints have resulted in only 193, or 4.8%, of the observed fish species in ABNJ

being assessed. Most high-seas fish species (~95%) are not known to be targeted¹⁷ or assessed by any RFMO or fishing state, yet may still be at risk from the impacts of fishing⁷. It is important to note that in most cases a stock is only one population of a species, thus our estimate of percent species assessed would be far smaller if we considered individual stocks as opposed to entire species. We note that this knowledge gap affects fish biodiversity across various habitat types in the high seas including the deep-water column.

Species with slow growth and late maturity, as well as species with large range migration patterns, are particularly vulnerable to mismanagement and ecological extinction¹⁸. One illustrative example is the status of migratory or possibly migratory chondrichthyan species.

A UN report found that out of the 1,093 species in the class Chondrichthyes, 153 are migratory or possibly migratory¹⁹. Of those migratory sharks and rays, 46% were classified as Vulnerable, Endangered or Critically Endangered under the IUCN Red List and a further 23% were Data Deficient¹⁹. We found that only 9 of the 153 (5.8%) migratory chondrichthyans had stock assessments or analogous assessment methods recorded in the RAM Legacy Stock Assessment Database, of which six are Vulnerable or Endangered according to the IUCN. None of the nine species have had catch limits established. The geographic and taxonomic limitations of existing abundance assessment repositories makes it difficult to ascertain the exact proportion of fish biodiversity in ABNJ that has been assessed.



Species assessment status. Representation of the number of stock assessments ($n = 193$; from the RAM Legacy Stock Assessment Database) for fish species in the high seas ($n = 4,018$; OBIS). High-seas fish species are separated by general habitat type (from [FishBase.org](https://www.fishbase.org)). The species comprising the group 'Other' ($n = 87$) were not assigned a habitat type on [FishBase.org](https://www.fishbase.org).

cross-sectoral support for coordinated monitoring programmes is the only possible means of moving towards more

holistic assessment and conservation of the remaining ~95% of fish biodiversity, as well as high-seas biodiversity as a whole.

As fisheries management can benefit from improved biodiversity data being fed into their data streams from groups

such as OBIS and GOOS, so too should RFMO members contribute to the data streams used to manage other sectors via global data clearinghouses; which may require reinforcing the coverage of fisheries observer programmes to enable the collection of biodiversity data across regions and fisheries. A new treaty could provide consistent obligations across sectors for member countries to transparently share detailed biodiversity data (for example, catch/bycatch documentation by RFMO member countries) to the global community at appropriate spatial, temporal and taxonomic resolutions.

RFMOs are in a unique position to both benefit from and contribute to the conservation and sustainable use of BBNJ under a new international legally binding instrument. They have a specific mandate to monitor and manage the impacts of fisheries on target species and associated species or species belonging to the same ecosystem, which should not be undermined, but rather their capacity to implement this mandate enhanced by a new treaty. However, the taxonomic vagueness of their mandate and current assessment efforts has created a governance vacuum for ~95% of fish biodiversity in ABNJ. Despite being fish species, they are not assessed by fisheries management organizations, nor are they being considered as part of the biodiversity to be monitored by a new

international treaty. To close the legal gaps under existing frameworks that allow thousands of fish species potentially impacted by fisheries and other activities to slip through the cracks of global ocean governance, fish biodiversity needs to be addressed in the new BBNJ treaty. □

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Competing interests

The authors declare no competing interests.

Additional information

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