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SUBJECT: RFI - Public Comment on the National Ocean Biodiversity Strategy

To whom it may concern,

As the coordinators of a global coalition of ocean experts, the Steering Committee of the Deep-Ocean Stewardship Initiative (DOSI) thanks the National Science Foundation and the National Science and Technology Council Subcommittee on Ocean Science and Technology for this opportunity to comment on key aspects of a US National Ocean Biodiversity Strategy. We would like to provide input from a deep-ocean perspective on all topics: “Coordination and Priority Setting”, “Science, Technology and Information”, and “Capacity Building and Community Engagement”.

Coordination and Priority Setting

Question 1: What are the most pressing topics and considerations for the National Ocean Biodiversity Strategy to address?

Over 75% of the US EEZ is water 200 m or deeper. This deeper water contains diverse habitats (including seamounts, canyons, seeps, vents, trenches, basins, fjords, slopes, plains, ridges, escarpments, banks and knolls) that support distinct species, which together represent high biodiversity. This biodiversity, from microbial life to deep-diving whales, supports ecosystem processes necessary for ocean and planetary systems to function. Deep-ocean biodiversity is connected to the US’s shallow seas, coasts and land, and is integral to ecosystem services that all US citizens depend upon, including the livelihoods, culture and wellbeing of local communities, as well as ocean-dependent industries.

While the deep ocean and its biodiversity are understood better now than ever before, the difficulty of accessing and studying them means that there is still much to learn. Gaining a better understanding of the deep ocean, including its habitats, ecosystems, and biodiversity is of critical importance for the National Ocean Biodiversity Strategy, especially to inform the many decisions about their use, exploitation and conservation. Increased research can be undertaken to characterise biodiversity and map deep-ocean habitats within the US EEZ, facilitated in part by technological advancements and resource mobilisation. Additionally, unlocking existing biodiversity data is critical to enable future research to build on existing knowledge.

Minimising human impacts and avoiding serious harm are essential in any marine environment, but especially in the deep ocean. Deep-ocean habitats and ecosystems are highly vulnerable to impact, often showing little recovery from impact after decades and centuries. Impacted habitats and ecosystems have reduced biodiversity. With our current knowledge, habitat and biodiversity restoration in the deep ocean is impractical and prohibitively expensive. Further, the deep ocean is not as well understood or monitored as shallower or terrestrial ecosystems, so evidence-based decision-making and forecasting can be challenging. The National Biodiversity Strategy can therefore also seek to foster and support activities by all stakeholders that reduce the potential for impact and halt the loss of biodiversity.

Finally, effective biodiversity conservation planning for the ocean, and especially the deep ocean, will require (a) incorporation of climate change considerations (adaptation, mitigation and carbon conservation), and (b) strategies that address uncertainty and lack of information. Concerted research efforts are required to address how best to incorporate these issues to create fit-for-purpose policies, practices and protections.

Question 2: What actions can federal agencies take to facilitate the harmonization of ocean biodiversity investments and policy to ensure benefits across all sectors?

To facilitate the harmonisation of ocean biodiversity investments and policy to ensure benefits across all sectors, federal agencies can:

1. Require all ocean-based US businesses to assess potential impacts to biodiversity, avoid significant adverse impacts to the environment, report on actions taken to avoid such impacts, and monitor the environment to ensure the effectiveness of such actions, in a similar way to the European Union. This would make biodiversity leadership the norm.
2. Create a US marine biodiversity data clearinghouse for metadata accessible to academia, industry, government, foundations and civil society.
3. Promote the US ratification of the BBNJ Agreement. Organisms in the US EEZ do not recognise political boundaries; fish, marine mammals, reptiles, and other species live, migrate, feed and breed both in waters within and beyond national jurisdiction. By protecting their habitats, prey, feeding and breeding grounds, the BBNJ Agreement can be critical to protect US ocean biodiversity.
4. Consider creating a US International Ocean Biodiversity Strategy to stimulate US leadership and partnerships in implementing the many aspects of the BBNJ Agreement that would benefit from advanced knowledge of deep-ocean biodiversity and broad stakeholder engagement.

Science, Technology and Information

Question 1: What are the priority needs and most promising approaches in science and technology to provide useful information on ocean biodiversity (species, genetic lineages, habitats, ecosystems) and the ecosystem processes and services they support?

Priority needs to provide useful information on ocean biodiversity and the ecosystem processes and services they support include the following:

1. Biodiversity characterisation in the deep ocean is critical. To the extent possible, identify habitats and species endemic to specific locations in the US EEZ. It is important that ecological aspects of these deep-ocean species and communities, including their trophic relationships, life histories, and how they vary over space and time, are elucidated.
2. Mapping of the bathymetry and hydrography of 100% of the US EEZ seafloor to establish the presence and distribution of habitats and biodiversity is an essential step in biodiversity assessment and preservation. Such data can be used to create habitat maps, which can be used to prioritise sites for focussed exploration and identify potential locations for marine protection.
3. Improving the understanding of microbial biodiversity and its linkages to plant and animal biodiversity, can reveal previously unknown ecosystem functions and services.

4. A large amount of published and unpublished US biodiversity data already exists (e.g., within research laboratories, unpublished dissertations, archives and publications). Unlocking these datasets and making them available via FAIR and CARE principles, potentially through a large-scale effort and a US Ocean Biodiversity Information System (OBIS) node, is critical to enable future research to build on existing knowledge.
5. Advancing knowledge of ecosystem functions and services associated with different deep-ocean habitats is necessary, particularly with respect to carbon transport, transformation and sequestration, nutrient regeneration, fisheries support, and genetic resources.
6. Identifying ecological connections (e.g., reproductive, trophic, energetic) among species and habitats within the deep sea, and with those in shallow water and ocean surface ecosystems can support holistic approaches to management and conservation.
7. Evaluating individual and cumulative impacts (e.g., ocean warming, acidification and deoxygenation) of existing human activities (e.g., bottom trawling, waste disposal, pollution) and nascent activities (e.g., offshore wind, seabed mining, marine carbon dioxide removal) on deep-ocean ecosystems and the services they provide will help plan for the future health of the planet.
8. Effective biodiversity conservation planning for the ocean, and especially the deep ocean will require (a) incorporation of climate change considerations (i.e., adaptation, mitigation and carbon conservation), and (b) strategies that address uncertainty and lack of information. Concerted research efforts are required to address how best to incorporate these issues to create fit-for purpose policies, practices, and protections.

Technological advancements are needed to enable characterisation and monitoring of biodiversity in deep and remote waters of the US EEZ, and ultimately close existing knowledge gaps. Unparalleled opportunities already available or becoming available include multibeam mapping, eDNA sampling and high-resolution imagery, as well as access to accelerating computational power for advanced analytical tools, such as multispecies distribution modelling, ecological trait analyses and ecosystem modelling. Further approaches may involve enhancing existing platforms and sensors, as well as the development of new *in situ* or autonomous instrumentation. Low-cost technology, citizen science, and wider data accessibility can broaden the equitability and utility of national biodiversity data.

Question 2: How can we best align the efforts of knowledge holders with the needs of knowledge users?

A deliberate approach to knowledge sharing and co-production for all knowledge and value systems should be developed. The approach should be built bottom-up by Indigenous Peoples and Local Communities, who possess critical knowledge such as traditional ecological knowledge, to help understand the biodiversity crisis in the context of the past and identify solutions or mitigation approaches for the future.

Using such a deliberate approach, knowledge holders must collaborate with communities, so that multiple solutions may be shared to address complex problems. Further, rights holders and stakeholders, including communities most affected by loss of ocean biodiversity, must be included in any decision-making process. This will promote applying diverse solutions (e.g., cooperative marine spatial planning, co-management, monitoring activities), and legitimising the entire process. Precedent can be taken from Ocean Exploration Trust and Schmidt Ocean Institute, which work alongside native Hawaiians and other Pacific Islander groups towards a more equitable science community (see Nautilus Live and In Kupe's Wake).

Question 3: How can ocean biodiversity data be made more usable and available? Which existing mechanisms or repositories could be leveraged?

The following are examples of existing mechanisms or repositories of biodiversity that can be leveraged:

1. OBIS is a global open-access data and information clearing-house on marine biodiversity for science, conservation and sustainable development. An effort could be targeted towards hosting a US-specific Biodiversity node; alternatively, a subgroup ID for the US EEZ could be created with the OBIS deep node.
2. The National Science Foundation, Biological and Chemical Oceanography Data Management Office (BCO-DMO) hosts many biodiversity datasets which could be transferred to OBIS.
3. For data to become usable and accessible, targeted effort should be placed on capacity development, both human and digital. Human training is needed for species identification and data quality control. Tools such as AI could be developed, perfected and subsequently employed to quantify biodiversity from 1000s of hours of video collected in the US EEZ (by NOAA, WHOI, MBARI and other institutions).
4. The Argo float program has been providing open access environmental information on Essential Ocean Variables on a long-term basis. This technology is evolving to incorporate sensors that can be more applicable to biodiversity studies, such as microscopic cameras that capture zooplankton, and hydrophones to monitor cetaceans. This database could be leveraged to improve the web interface to be more user-friendly and develop database integration with others such as OBIS.

Capacity Building and Community Engagement

Question 1: How could public and private partnerships be developed or enhanced to explore and characterize ocean life, which existing partnerships could be leveraged, and how might opportunities for participation by diverse parties in such partnerships be maximized?

The continued and enhanced application of successful programmes that explore and characterise ocean life is key. This includes those of NOAA Office of Ocean Exploration and Research, Ocean Exploration Trust, and Schmidt Ocean Institute, which replicate good practices of engagement with local communities and experts during research planning and execution, as recently done in Hawaii and other areas of the Pacific. The Declaration for the Enhancement of Marine Scientific Knowledge, Research Capacity and Transfer of Marine Technology to Small Island Developing States, launched by the Alliance of Small Island States in 2022, could also be useful guidance on equitable and effective partnerships. Also critical is the promotion of platforms for collaboration between research vessels and stakeholders interested in conducting marine research aboard these vessels, facilitating the access to resources and research platforms. One example that could be expanded into other stakeholders is the usage of the Marine Facilities Planning web platform of UNOLS.

Question 2: What are the key needs for training and education to improve broad knowledge and stewardship of ocean life?

Improving knowledge and stewardship of ocean life will require effective training on the deep ocean and its benefits. While often ignored or treated as either empty or frightening, the deep ocean contains a wide variety of organisms that collectively influence the climate, support key fisheries, and enable medical advances (see What Does the Deep Ocean Do for You). Many deep-ocean ecosystems exist in US waters and the national EEZ. On a global scale, most of the ocean is deep ocean. The health of the deep ocean is closely linked to human prosperity. Future training and education on the ocean should therefore highlight the importance of effective deep-ocean stewardship.

A key mechanism to support training and education with regard to the deep ocean, is the promotion of telepresence in schools, universities and communities. These can be important opportunities to join, participate and engage in research expeditions through real-time interactions. Investing in infrastructure for these interactions to be immersive could be beneficial to engage more stakeholders and develop capabilities, especially in young persons.

Question 3: How could the public be engaged in developing and implementing improved understanding and stewardship of ocean life?

Citizen science programmes should be more effectively utilised for the public to improve stewardship of marine life. With adequate training, citizen scientists can improve quality of data, identify taxa, and determine seafloor composition (e.g., the now completed Seafloor Explorer project from Zooniverse). Although it is more difficult to implement in deep-ocean exploration, citizen science is needed in deep-ocean research to support policymakers and improve conservation measures. One challenge is teaching audiences to identify deep-ocean species. To that end, new tools are emerging, including “FathomVerse” by Monterey Bay Aquarium Research Institute. This game teaches players how to distinguish and identify broad taxonomic groups in the deep sea, such as corals, bony fishes, and benthic worms. As participants identify organisms, they also teach AI software to do the same. This platform can attract diverse participants, while leveraging methods to describe and classify marine organisms. Additional tools that streamline the public’s ability to improve knowledge of deep marine life will be essential in the future. Citizen science may thus be useful for public engagement and long-term monitoring of ocean biodiversity. This could be especially helpful when researchers only have the funding/resources to conduct studies for short durations.

Yours faithfully,

The DOSI Steering Committee: Maria Baker, Lisa Levin, Diva Amon, Elva Escobar, Kristina Gjerde, Maila Guilhon, and Harriet Harden-Davies; the DOSI Conservation of Biodiversity Task Force leads: Anna Metaxas and Sergio Cambronero, DOSI Conservation of Biodiversity Task Force member Jayce Marino, and DOSI Director of Communications Brandon Gertz.