Draft for the entire ORAP to Review

(Decisional item during the 4-5 Sept. 2024 Meeting)

From the Ocean Data Subgroup

DRAFT REPORT:

Developing a National Ocean Data Strategy (NODS) that improves data management, grows partnerships, and advances access and usability

EXECUTIVE SUMMARY:

The ocean is a critical resource to the United States and its effective management provides unique opportunities for generating solutions to the diverse problems facing society. These solutions require an ocean data strategy across a diverse range of scientific research, information, management, socioeconomic, and cultural areas. This strategy must use a framework for implementing findable, accessible, interoperable, and reusable (FAIR) data that adheres to collective and just benefits, authority to control, responsibility, and ethics (CARE) data principles. As such, the Ocean Research Advisory Panel (ORAP) recommends the development of a strategy that encompasses both federal and non-federal data (social, physical and biological), acknowledges the value of Indigenous Knowledge as a critical type and source of data, recognizes the need for strategic integration of data into policy and management decisions, and provides a clear pathway for equitable and just data presentation that responds to the particular needs of our most vulnerable communities.

Recommendations and actions to improve data and information access for advancing national ocean and coastal science, management, and policy goals is not a new concept for the federal government. The U.S. Commission on Ocean Policy was established by Congress through the Oceans Act of 2000. This Commission recommended a comprehensive ocean policy and the creation of a National Ocean Council currently operating as the White House Ocean Policy Committee. It also made key recommendations on the advancement of ocean and coastal data. While progress has been made related to ocean and coastal data, significant federal effort is still needed to reimagine dated systems and support a holistic strategy for the federal government that also allows for Tribal Nations, state, local, territorial and regional governments, Indigenous peoples, community partners, private, philanthropic, and others

(herein defined as **ocean communities**) to effectively collaborate and coordinate activities to advance our understanding and appreciation of the nation's ocean and coasts.

The existing Federal Data Strategy was not designed to address the current and exponential expansion of ocean data and information beyond the federal sphere. There is no consensus across the ocean community regarding data standards, quality control, management, and best practices for sharing, acquisition, and use. A **National Ocean Data Strategy (NODS)** is therefore needed to make Federal sources of ocean data more accessible and interoperable while also taking advantage of the increasing opportunities for ocean data use, sharing, and acquisition. The NODS should foster scientific advances and be accessible to ocean communities. In particular, a successful implementation of NODS requires new and adjusted policies and innovations that (1) measurably **improve Federal ocean data management** by assessing and establishing best practices and standards, (2) actively **incentivize and grow ocean data partnerships** that are inclusive of the diverse ocean community and recognize Tribal data sovereignty, and (3) **rapidly maximize ocean data public access and usability**. The effective implementation of the NODS requires a Presidential commitment to provide resources to action with the Office of Management and Budget (OMB). A strong outreach strategy will be necessary to secure Congressional support. The NODS must be developed collaboratively in partnership with the ocean community and interface with existing national and international efforts such as the National Strategy for a Sustainable Ocean Economy, and the UN Ocean Decade Data and Information Strategy.

Previous work of the Ocean Policy Committee should be referenced, built upon, and used as guidance for the NODS. These might include the White House Summit on Partnerships in Ocean Science and Technology hosted by the Ocean Policy Committee (2019), the report commissioned by NOAA and BOEM on Regional Data Platform needs (2018), the report on a National Strategy on Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone (2020), the White House's commitment to elevating Indigenous Knowledge in federal policy decisions (2021) and the White House OSTP updated policy guidance (2022) to ensure the results of taxpayer-supported research are immediately available to the American public among others. While useful, these reports and policies only tackle a subset of the problem, are often siloed within a given federal agency, and are released as policy statements that are not fully integrated into agency practice either due to resource limitations or competing priorities. The NODS should build upon this important work to create a holistic and actionable strategy to solve 21st century challenges.

RECOMMENDATIONS

ORAP recommends the development of a **National Ocean Data Strategy** with an **Implementation Plan** linked to agency budget priorities and existing efforts that includes the following goals and objectives:

1. **Goal: Measurably improve Federal ocean data management.** Incorporating FAIR and CARE principles, the Federal government should assess and establish best practices for managing current and new federal data and federally funded data.
   - 1.1. Review and assess ocean data programs across and within federal agencies with the goal of reducing programmatic redundancies, optimizing resource sharing and delineating program-specific roles and objectives.
   - 1.2. Define policies and support work plans to reconfigure or clarify federal processes for ocean data management**.** Federal policies and practices should be developed or modified to systematically improve intra- and interagency cooperation and compatibility of data preservation, sharing, management, and resources. This should include developing policies for ensuring timely and open data access and long-term support of all federally managed and funded data.
   - 1.3. Create and adopt ocean data management standards, in conjunction with the ocean community, based on international, national, and related data information systems that include specific information on how data is managed, curated, validated, and quality controlled. This includes generation of an implementation strategy to apply these standards across existing and new data collection and management programs.
   - 1.4. Review the disparate commercial ocean data acquisition programs within and across federal agencies with the goal of identifying gaps and developing standard policies and practices.
   - 1.5. Actively pursue and ensure collection, organization, and integration of social science data into a cohesive ocean data management system.
   - 1.6. Support immediate federal investment in data infrastructure to support storage, retrieval, and analytical requirements used in data-intensive decision making tools, such as artificial intelligence and computational predictive models.

2. **Goal: Actively incentivize and grow partnerships.** Data sharing among federal and ocean community partners must be facilitated and fostered while recognizing the sovereignty of Indigenous Peoples, Tribal Nations, and Territorial governments and the needs of vulnerable coastal communities.

2.1. Identify pathways to ensure more ocean community data are available to more users. Tools to be used should include creative funding mechanisms that streamline the grant application process and rewards innovation**.**

2.2. Convene a White House Summit on NODS inviting the ocean community to explore future areas of collaboration (modeled after the 2019 White House Summit on Ocean S&T Partnerships).

2.3. Ensure social science data collection is done in partnership with the ocean community. Social science data may include, but are not limited to, demographic and economic information, oral histories, economic and political context (current and over time), cultural and historical heritage data, the importance of ecosystem services, and climate change.

2.4. Identify gaps and barriers to the integration of data, including data from marginalized and underrepresented communities, and develop strategies and partnerships to address missing data and information. This must involve recognition of Indigenous and other local communities' ways of knowing and relating to our environment that might mediate and enhance processes of data collection and interpretation.

2.5. Evaluate, adjust, and implement funding and partnership mechanisms designed to build capacity across the ocean community to ensure long term engagement with the NODS.

2.6. Establish policies that respect and systematize Tribal data sovereignty and public engagement requirements across federal agencies.

3. Goal: Rapidly advance and maximize public access and usability of ocean data. Data accessibility and dissemination should be creatively designed to ensure just and equitable decision-making within the ocean community.

3.1. Evaluate and implement innovations and derivative products that rapidly advance the usability of data for the ocean community. This could include a data "storefront" that allows access to multiple data sources and provides easy-to-use derived products (summaries, graphs, analytic results, etc.).

3.2. Develop and support innovative approaches, such as artificial intelligence and data analytics to rapidly in-fill missing data and data types in conjunction with data providers and ocean communities.

3.3. Evaluate current federal policies that require those outside of government to pay to share and store data federally.

3.4. Engage non-traditional ocean agencies, such as the Department of Treasury, to explore tax incentives and other policies that support industry sharing data with

the federal government, especially if industry (e.g., offshore wind developers; case study two) are required to cover the upfront cost of data storage.

CLOSING REMARKS

A NODS developed in partnership across ocean communities positions the United States to maximize the many opportunities and mitigate the emerging challenges associated with the economic, environmental, and national security dimensions of our oceans, coasts, and Great Lakes. Consistent long term investment needs should be highlighted in annual Presidential Budgets and supported by agency leadership. The OMB should direct agencies to evaluate and prioritize improving data infrastructure within current budget priorities and agency missions. The ORAP stands ready to provide additional detail on the above recommendations as well as assist on initial steps for NODS development.

CASE STUDIES

Case studies are included as examples of implementation pathways for the goals and recommendations outlined above. Each case study references specific goals. Please note that these are only examples, and serve as discussion points for the suite of potential implementation pathways that OPC might consider around the NODS.

CASE STUDY 1: Coordinated data collection and distribution

The USGS 3D Elevation Program (3DEP) initiative is accelerating the rate of three-dimensional (3D) elevation data collection in response to a call for action to address a wide range of nationally urgent needs, such as flood risk management, agriculture and precision farming, infrastructure and construction management, natural resource management and conservation, and geologic resource assessment and hazard mitigation. The coordinated data collection case study links directly to the Recommendations in Goals 1 and 2 as well as 3.1, 3.2, and 3.3. This case study is presented as an example of federal leadership in bringing many partners together to meet demands of many users.

ACHIEVEMENTS: The need and demand for high resolution 3D mapping becomes more urgent every year. In addition, the geographical demands continue to grow with expanding population, development and our understanding (and attempts to plan accordingly) of potential for flooding and other natural disaster impacts. It can even help in some of the most demanding cases requiring both extensive and specific geographic data visualizations such as that needed for rescue missions. These data are also now routinely required, applied and relied upon for general construction and development planning. This need and routine design

application applies for private industry, utilities, and federal, state and local development projects. What once was a challenge for consistency and scale, is today achievable and expected, and most important of all, available.

The USGS three-dimensional Elevation Program (3DEP) initiative was established in 2012. Specifically, the program relies on a large number of contributors of high-quality light detection and ranging (lidar) data for the conterminous United States, Hawaii, and the U.S. territories and includes interferometric synthetic aperture radar data for Alaska. The goal of 3DEP is to complete acquisition of nationwide lidar (Ifsar in AK) to provide the first-ever national baseline of consistent high-resolution topographic elevation data. Organizing and defining the program required that needs and challenges were identified, and included an interactive method to easily and rapidly provide accessible data. Contributors and end users needed to include multiple Federal, State, and regional governments, and Tribal partners as well as industry, who used the knowledge gained to target innovations and improvements to sensors and processing software. Specifications were created for collecting 3D elevation data, with data management and delivery systems continuously under review and modernization.

As reported by USGS a national baseline of this data is expected to be complete this fiscal year. This multi-year effort which leveraged non-federal investments was resourced to meet over 600 requirements for enhanced (3D) elevation data from 34 federal agencies, all 50 states, a sample of private sector companies and tribal and local governments. USGS estimates $690 million annually in new benefits directly to the private sector and indirectly to citizens through improved service. See https://www.usgs.gov/3d-elevation-program, https://www.usgs.gov/3d-elevation-program/what-3dep

CHALLENGES: The national 3DEP baseline will become increasingly more useful and valuable as it is compared with new 3DEP data collections to monitor where human and natural landscapes have changed. The challenge will be to maintain leadership and resources to support the introduction of new technologies and respond to changes in the natural landscape (e.g., from major flooding and new requirements.

APPLICABILITY TO OCEAN DATA CHALLENGES: Many of the technologies, data collection requirements/techniques, processing, analysis and distribution/access discussed in this example are directly related to the requirements and needs of ocean studies, mapping and distribution and access. One government agency cannot fulfill the Goals listed above. The continuously expanding number and diversity of the collaborative organizations collecting 3DEP data provides an excellent model for similar organizations and efforts looking to take on the challenges involving data datasets from multiple sources and an ever-expanding list of diverse users and applications.

CASE STUDY 2: Offshore wind data sharing and repositories

Offshore wind offers a direct example of the current challenge with our current ocean data infrastructure, including industry partnerships, rapidly emerging technologies, large volumes of data, and multiple levels of partnerships (offshore wind developers, states, federal agencies, universities, and community organizations). The offshore wind case study links directly to the Recommendations in Goal 1 as well as 2.1, 2.5, 3.1, and 3.6.

PROBLEM STATEMENT: The current federal ocean data infrastructure has not been strategically structured to accommodate the increasing volume of data and information from offshore wind development, research, and monitoring. Given the scale of proposed U.S. offshore wind development, the federal government must provide greater guidance to offshore wind developers, states, universities, and other regional organizations on the type and quality of data that should be collected and made public as well as provide the appropriate data management and repository structures to ensure data sharing long-term.

CHALLENGES: Existing and new ocean uses are changing and range from commercial fishing and shipping to offshore aquaculture and wind to marine carbon dioxide removal. Ocean data collection that informs management and regulatory requirements to ensure protection of biodiversity are also accelerating. New and emerging technologies have made ocean data acquisition faster and cheaper than ever before. Ocean data management systems, however, have not kept pace, and data collected during offshore wind development is already demonstrating the limitations of existing data infrastructure and repositories. The federal ocean data landscape needs to be reimagined and significantly improved to best serve the Nation's interests.

Numerous challenges beset the current system. Over time, multiple data repositories have been developed for federal agencies, and, in some instances, specific agency line offices. These repositories were not necessarily designed to house large volumes of data from outside of government or for sharing across agencies as many were developed over a decade ago when ocean uses and technological solutions were markedly different. Specific to offshore wind, industry is in some cases required to provide additional information within a federal agency permitting process, but many of those requirements cannot be executed due to the inadequacy of federal data infrastructure. Challenges include data standards that are inconsistent and unclear, especially to those outside of federal agencies; a lack of clear roles and responsibilities across the federal government on data acquisition and storage; and slow processing time to make data publicly available for decision making.

In addition to the challenge of the technical capacity of the ocean wind data landscape, there is a need to acquire and access information for current and future management challenges. For example, there are more than 29 active offshore wind leases in various stages of development on the Atlantic Coast, all of which either voluntarily collect, or are required by the federal government to collect, massive amounts of data. Wind developers, whose permits have been approved for construction are required to share data with the federal government, yet currently are unable to do so given the large amounts of data collected. As a result, these same non-federal partners are often required to store data. Adaptive management for offshore wind will be hindered by this inability to easily access the data and information necessary to make informed and potentially modified decisions over time.

OPPORTUNITIES: The multi-sector partnership and work within the Regional Wildlife Science Collaborative for Offshore Wind (RWSC) offer a framework to systematically address data challenges by data type and many of the recommendations outlined in the Goals for a NODS. RWSC includes federal agencies, Atlantic coast states, offshore wind companies, and environmental nonprofits. The collective released an Integrated Science Plan for Offshore Wind, Wildlife, and Habitat in U.S. Atlantic Waters (Science Plan, January 2024) that described the data needed to address priority offshore wind and wildlife research questions. In the Science Plan, subcommittees with experts on marine mammals, birds and bats, sea turtles, protected fish species, and habitat, have all identified data repositories for storing research and monitoring results across the partnership. The expert subcommittees recommended over 30 existing method- or data-specific cloud-based data repositories and data access points where data should be stored to ensure timely use for offshore wind planning, decision making, and adaptive management as well as future use and reuse by the research community. These raw or minimally processed wildlife, habitat, and oceanography data are critical inputs to the models and maps that support marine spatial planning processes, permitting processes, adaptive management, environmental assessments and monitoring, and university research related to offshore wind and many other ocean uses or resource assessments.

Experts within the RWSC Data Governance Subcommittee have also been working with the taxa- and habitat-focused RWSC Subcommittees to evaluate the capacity and functionality of the 30+ long-term storage options for each type of data as described in the Science Plan. It is clear from this work that some foundational data management infrastructure exists, often customized by each data community, and should be leveraged. But the assessment also found that most data repositories need significant additional resources and capacity to accommodate the volume of data being collected with respect to offshore wind.

The findings of RWSC to date, related to data repositories for offshore wind research, science, and monitoring, include the following:

- None of the repositories listed in the RWSC Science Plan met all the minimum criteria related to long-term data storage and access.
- A lack of publicly available, standardized metadata is a barrier to connecting data sources to a future data catalog.
- Many repositories require payment to the federal government to store data.
- Some repositories require data published to be linked to a journal article.
- Some are not data repositories (e.g. tissue banks) and need to be addressed differently; it is still important to track metadata about what is deposited there.
- Some are not repositories but data access points (e.g. ERDDAPs) or data aggregators (e.g. IOOSes) and need to be addressed differently; these might serve data but won't publish/archive data.
- Few repositories appear to assign DOIs to submitted datasets
- Repositories in the same system have different data and metadata standards (e.g. OBIS and OBIS-SEAMAP).
- Some repositories may be difficult to automatically/programmatically connect to a metadata catalog.

The limitations of the current data repositories outlined above demonstrate the range of challenges to be addressed in the NODS. As discussed in the Goals for an NODS, the federal government should work to review the disparate ocean data programs within agencies and address the coordination of the patchwork of distributively managed data systems and repositories. Discussions with offshore wind developers, Tribes, states, universities, technology providers, and others collecting data and information would greatly inform data sharing and future needs given the large volumes of data now available through offshore wind development.

CASE STUDY 3: Indigenous Knowledge and data sovereignty

Incorporation of Indigenous knowledge and science, ancestral technologies, and issues of data sovereignty are a direct example of the current challenges of ensuring FAIR and CARE principles in incentivising public-private partnerships that also includes accessibility and dissemination across multiple levels of ocean data users. The Indigenous case study links directly to the Recommendations in Goals 1 and 2 as well as 3.1 and 3.3.

PROBLEM STATEMENT: The White House has made a commitment to elevating Indigenous Knowledge in federal policy decisions (2021). Federal agencies (e.g., NOAA and others) have yet

to determine clear mechanisms to honor and protect Indigenous data sovereignty within the context of their data management systems. This has allowed for the continued appropriation of Indigenous Knowledge, has hindered data sharing among the multiple federal and non-federal partners, and hindered incentivization of collaboratively-developed research between Tribal/Indigenous partners and federally-funded research programs.

CHALLENGES: Beyond the dearth of mechanisms to honor and protect Indigenous data sovereignty, the different ways of knowing, valuing, and relating to ocean and coastal environments poses a challenge for the inclusion of Indigenous Knowledge and the establishment of data sovereignty agreements. As shown below, the need to define certain terms is, itself, a challenge to ensuring ethical and just data management, partnerships, and usability. Fully collaborating with Indigenous Knowledge holders, and securing successful Tribal and other Indigenous partnerships will not be achieved unless these challenges are overcome.

TERMINOLOGY: A series of definitions is provided to ensure understanding of and consensus on use of terms in order to clarify and support effective implementation of pathways.

“Indigenous Knowledge” (IK) is a term of art that refers to the knowledge systems accumulated in Place, and managed by Indigenous Peoples for millenia. Notably, IK systems have ontological and epistemological foundations that are often different from university-based knowledge systems. This term has generally replaced terms like “traditional ecological knowledge” (TEK) and others, which have been critiqued for arbitrarily elevating certain aspects of IK while ignoring others that Indigenous Peoples feel are interwoven and inseparable.

“Indigenous science” refers to the processes of building knowledge by Indigenous Peoples through their engagement in the scientific process. Indigenous Knowledge is built in part by Indigenous science; but, at a systems level, is larger-scale than Indigenous science. Indigenous science is foundational to ancestral technologies, such as large-scale Indigenous aquaculture systems (e.g., Winter et al. 2020), that could provide solutions to the many problems we face today globally in terms of conservation and sustainability.

“Data sovereignty” relates to the “intellectual property” (IP) of Indigenous Peoples and/or Tribal Nations that belongs to them and them alone in the realm of Indigenous science. This covers both “knew data” that has been cumulatively built by and passed down through successive generations, as well as “new data” that is generated through Indigenous science as practiced in the contemporary period. Data sovereignty should be covered under formal agreements in the context of research that is co-developed with Indigenous Peoples, which is particularly relevant in the context of federally-funded research that is always vulnerable to

Freedom of Information Act (FOIA) requests. While this remains a gray area, there are emerging tools to deal with these and related issues. One example of this is the Traditional Knowledge (TK) labels that can be applied to databases that are managed by both governmental and university systems.

OPPORTUNITIES: A relevant case study of how NOAA is attempting to engage in the issues described above and others is the Imila-alpa Commitments (2024). The Imila-alpa Commitments document is a product of the second Cross-Pacific Indigenous exchange facilitated by NOAA's Office of National Marine Sanctuaries (ONMS) in April 2024. The 15 commitments cover areas that ranged from NOAA's engagement with Indigenous Peoples in regard to general engagement with Indigenous Peoples and Indigenous Knowledge, co-management (a.k.a., co-stewardship) and decision-making, and research. As pertains to the ORAP's Ocean Data Report, Commitment 11 (below) is of particular interest.

> "**Commitment 11:** Work to support Indigenous data sovereignty and intellectual property rights. The commitment includes, but is not limited to:
>
> - Working to implement free, prior, and informed consent, ensuring Indigenous Peoples' awareness and consent of any sharing of information that they have provided, to the extent possible under U.S. regulations and policies;
> - Working to address challenges associated with the Freedom of Information Act (e.g., protecting sensitive information);
> - Establishing policies to support Indigenous data sovereignty and utilization of data agreements (e.g., develop data agreement templates);
> - Working with Indigenous governments and organizations to access data that is generated within the National Marine Sanctuary System and ensure that data is in usable formats; and
> - Raising awareness and capacity to support Indigenous intellectual property rights."

While written within the context of NOAA's ONMS, this work should be used as a microcosm of the federal government's overall engagement with Indigenous Peoples, Tribal communities, and Indigenous Knowledge. The OPC should use the foundation of the Imila-alpa Commitments, and ensure there is intentional, continued, respectful, and open dialogue about the challenges and opportunities for integration of ways of knowing. OPC should also be aware of emerging tools (e.g., "TK labels", described above) that are intended to protect Indigenous intellectual property with federally-managed databases.

THE END
