NOAA FISHERIES

Fisheries Modernization Strategy

From Data to Decisions

2023-2026 Implementation Plan

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Executive Summary

The National Oceanic and Atmospheric Administration (NOAA) is committed to *building a climate-ready nation*[1] through well-informed decisions based on transparent and reliable data collected across our core mission areas. To further *realize the potential of our ocean ecosystems using innovation to increase our understanding of a changing world*[2], the National Marine Fisheries Service (Fisheries) has identified transformational data modernization efforts to expand our scientific capabilities and empower conservation initiatives while advancing equity and environmental justice. *Data underpins every aspect of our mission*[3] and — as we work together to confront the growing effects of climate change — Fisheries is dedicated to clearly defining our data streams to meet mission goals faster and more effectively.

With the funding provided from the *Inflation Reduction Act (IRA)*[4], Fisheries has an unprecedented opportunity to further execute comprehensive modernization efforts that facilitate our mission. This strategy, in conjunction with ongoing efforts, aims to enhance our culture, processes, data management, and recruitment to evolve Fisheries' approach to data and information management. To succeed, we must increase our data expertise, implement technical solutions, and enable enterprise collaboration in alignment with NOAA's organizational efforts. The following 'Lines of Effort'(LOE) are foundational to accelerating actionable data-driven science that enables informed management decisions under the accelerated timelines of the ever-evolving climate crisis:

LOE 1: Strengthen and Enact Clear Data Standards and Accountability Metrics
LOE 2: Scope and Implement Cloud-based Solutions
LOE 3: Fully Enable Open Science
LOE 4: Refine and Formalize the Operating Model for Modernization

Bottomline: How we create, process, and use data continues to become more critical. Fisheries is ready to accelerate the pace of our response to rapidly changing oceans, including shifts in the distribution and abundance of marine species that are impacting the many people, businesses, and communities that depend on them. The implementation efforts in this plan ensure Fisheries is equipped to maximize our ability to rapidly deliver mission-critical information while supporting the data requirements of today and tomorrow.

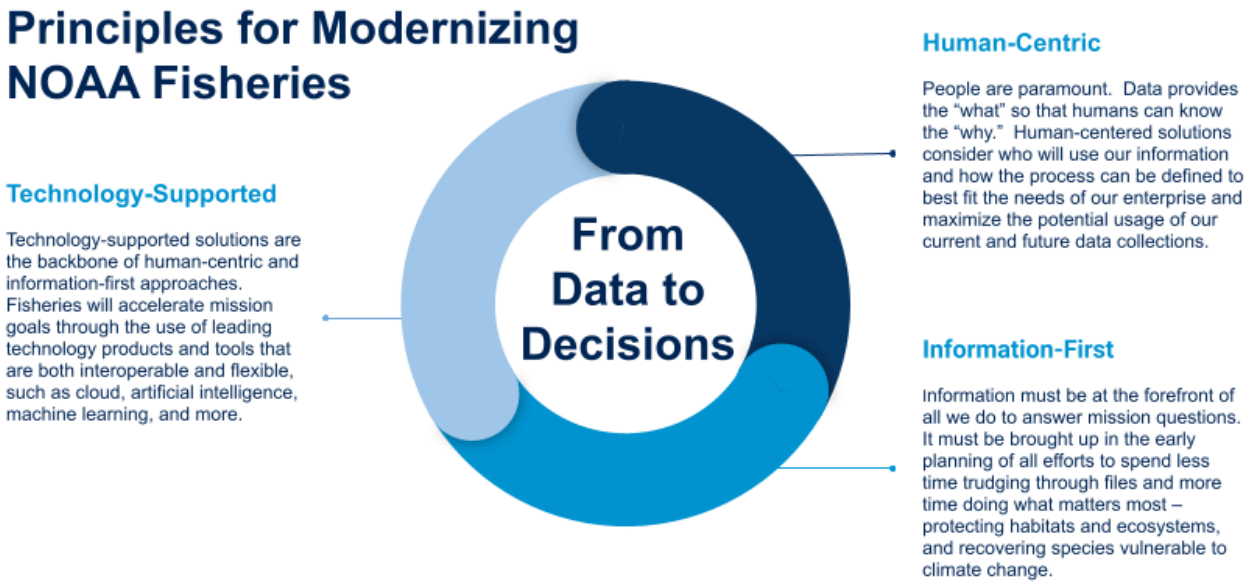
[1] Building a Climate Ready Nation: NOAA FY 22-26 Strategic Plan
[2] NOAA Fisheries 2022-2025 Strategic Plan
[3] NOAA Data Strategic Action Plan
[4] Inflation Reduction Act

Introduction

People and data are Fisheries' greatest assets in achieving our mission. This plan builds upon the work laid out across NOAA and Fisheries strategies to accomplish our shared mission goals. Our focus is to re-envision Fisheries' data capabilities and approaches in the short term to influence large-scale change with collaborative, human-centered solutions in the long term.

By pursuing our Fisheries Data Vision[5] (*noted below*), we will standardize our approach and improve our efficacy to spend more time on the work that matters most – managing public resources, protecting habitats and ecosystems, and recovering species vulnerable to climate change.

Fisheries Data Vision: Information, science, and technology exist together to serve our mission. Fisheries commits to creating a culture that confidently embraces a people-first approach to data service and delivery by keeping information at the forefront of all that we do to optimize scientific integrity for mission success and the public trust.



Information, science, and technology work together to fulfill our mission as we set forth to build a climate-ready nation based on sound, transparent, and reliable data. Through these principles, we will achieve our vision and culturally change Fisheries' approach to holistic modernization by delivering diverse, collaborative, and responsive Fisheries services – therefore expediting the time between science and decisions. As a result, Fisheries will be well-equipped to fulfill the needs of our people while also ensuring our information is Findable, Accessible, Interoperable, and Reusable (FAIR).

[5] Fisheries Data Vision one-pager

Problem Statement

The Need for Modernization at Fisheries

Culture-perspective: To date, NOAA Fisheries' data landscape has been characterized as having limited accessibility, siloed data, and technical solutions that impede our ability to provide open and accessible data effectively. Without forward-looking opportunities to pursue interoperable solutions that have the potential to fulfill the evolving demands of the mission, offices and centers have learned to work independently to adopt solutions that fit their requirements to sustain minimum operations. The work has become highly resource intensive and burdensome, and limits cross-functional collaborations that could ultimately reduce silos and unnecessary risk as well as increase the public's trust in our data and information.

Process-perspective: As part of our collection process, Fisheries has established various diverse systems for capturing fishery, survey, and environmental data over the years. These data and information systems are a combination of new and legacy systems comprising web applications, desktop applications, mobile applications, databases, and field-tested hacks. Due to the impacts across organizational and/or regulatory changes, staff turnover and handoffs, time, and other factors, many of these legacy systems have reached end-of-life, are duplicative, and require interoperability with other Fisheries systems. This hinders our ability to become a climate-ready nation; informed decisions cannot be more responsive to changing climate if throttled by data bottlenecks.

Strategic Approach

Defining the Path Ahead for Fisheries Data and Information

With an information-first approach, Fisheries is implementing human-centered solutions and enterprise-wide standards that are supported by leading technologies. The LOEs defined in this plan allow us to align data management practices with overall strategy to develop and deploy fully enabled cloud solutions while promoting a data-driven culture through the adoption of open science initiatives.

In utilizing the IRA investment, Fisheries is prioritizing the transformation of Fisheries Dependent Data (FDD) in partnership with Coastal States and Fisheries Commissions. Because of the complexity of FDD, the modernization efforts in this plan provide extensive detail on how Fisheries can accelerate our vision and build the foundational groundwork to be leveraged in the future phases of our enterprise applications.

While this approach is focused on FDD, it will significantly reduce the burden — both human and financial — of managing data, streamlining workflows, and maintaining the uniqueness and autonomy of each of our Fisheries-wide offices and centers. Additionally, the creation of a 'Federated Fisheries Data System' will enable a responsive community through integrated, prepped,

and standardized regional data systems that efficiently integrates, accesses, and merges already cleaned/conformed data in real-time. This solution will be developed through FY26 and achieve the following objectives:

Implementation Plan Governance

The Fisheries Office of the Chief Information Office (OCIO) and Office of Science and Technology (OST) are the co-sponsors of the Fisheries Modernization implementation and will each provide a subcomponent lead responsible for coordinating and aligning strategic efforts laid out in this plan. An LOE Lead will coordinate and track progress on implementation plan execution by ensuring regular briefings based on reporting from task leads up. The Lead Integrators must approve any changes to this plan. Roles and responsibilities at the execution level of this plan are as follows:

Subcomponent Lead: Responsible for overall oversight of the implementation plan:

- Change control for the implementation plan, i.e., significant or critical changes to lines of effort, objectives, and tasks listed in the plan
- Chair or high-level participation in associated governance forums
- Reporting oversight and ensuring required LOEs report progress at prescribed frequency, usually monthly
- Validation and updating plan at prescribed intervals (one year, depending on need)
- Development/Administration of relevant dashboards

LOE Lead: Responsible for coordinating objectives' performance and overseeing reporting requirements:

- Maintain awareness of LOE progress
- Coordinate information flow between Objective leads and Lead Integrators

- Reporting to Lead Integrators and relevant dashboards
- Coordination with Change Control (Governance) for Implementation Plan changes
- Oversight for Monthly Reporting

Objective Lead: Responsible for management/oversight of Tasks/Projects within the objective, ensuring reporting requirements are addressed, and coordinating with the LOE Lead for proper information flow:

- Maintaining awareness of Objective Tasks/Project progress
- Manage tasks/projects (as appropriate)
- Coordinating information flow to the LOE Lead
- Reporting to tracking Dashboards (Objective Lead owns delegation of reporting duties to task leads as necessary)

Task/Project Lead: Responsible for managing tasks identified below the objective level, maintaining necessary coordination with Objective Leads, and providing reporting to Lead Integrators level dashboards:

- Provide direct reporting to the tracking Dashboard (dependent on Objective Lead)
- Coordinating information flow to the Objective Lead
- Execute tasks and projects

SME Objective Advisor: Responsible for providing Subject Matter Expert (SME) expertise:

- Interface between LOE Lead and Objective Lead
- Solve problems that may arise outside the scope of IRA
- Provide Subject Matter Expert (SME) support
- Review quality of deliverables

Structure

PHASE I: NEAR-TERM (PRESENT- 2024)

DEFINE THE EXISTING ENVIRONMENT

This is the current phase of the modernization effort, set to end mid to late 2024. This phase aims to set the data vision, baseline the current environment, and increase the visibility across FDD systems most critically impacted by this overall effort. Key points:

➔ Begin to develop and validate product-agnostic solution requirements for any technical solutions.

➔ Take inventory of FDD and data systems. These inventories will ultimately drive the implementation of standards and the development of requirements for a cloud solution, as outlined in LOE 2.

➔ Assess today's human capital across Fisheries to determine the required skill sets for administering the landscape of tomorrow.

➔ Define financial requirements for all LOEs. Cost continues to be a critical factor in our efforts as we enhance how we handle, process, and use data.

PHASE II: MID-TERM (2025-2026)

ADDRESS GAPS - ESTABLISH STANDARDS AND REQUIREMENTS

In this phase, we address known people and technology gaps, further refine requirements and standards, and launch communications and training tools. The goal is to shift our culture across Fisheries, enhance and empower our workforce, and provide adaptable technology solutions to enable the effective dissemination of data and information. Key points:

➔ Enable effective data standardization and dissemination for long-term success.

➔ Develop and disseminate communication tools geared toward supporting a deeper understanding of data management for our workforce and promoting the Openscapes Value statement.

➔ Identify and provide training tools and curriculums for existing staff. These training programs will be based on the human capital gaps assessment completed in Phase I.

➔ Utilize the Fisheries Data Governance Committee (DGC) as a strategic body to implement and track new or updated governance policies across our Fisheries regions.

PHASE III: FAR-TERM (2026 AND BEYOND)

IMPLEMENT STANDARDS AND SOLUTIONS

This phase will focus on preparation for implementing the future data environment as Fisheries creates data standards and technological tools required to achieve the data vision. Key points:

➔ Realize an increase in the availability of interoperable software across the enterprise by leveraging the Openscapes program/framework.

➔ Achieve measurable changes to existing and emerging workforce, allowing Fisheries to focus on embedding IT and data expertise across the organization and filling the positions that empower the future workforce.

➔ Build on the Phase I cost assessment, develop an enterprise Sustainability Cost Model detailing the financial requirements for maintaining and administering the enterprise Fisheries federated cloud solution.

Priority Tasks

Standardized data and technical capabilities that manage, disseminate, and make data interoperable and artificial intelligence (AI) ready are the most critical aspects to the success of this plan. All LOEs are geared toward enabling the alignment of data management practices with overall strategy, as well as the development, deployment, and management of cloud solutions that provide

Fisheries with scalable cloud platforms to support flexible workflows and large-scale data sets (as detailed in LOE 2). These efforts move Fisheries closer towards our goal in ensuring our data are FAIR .

Our ultimate goal is to reduce time to science for mission success as we become a climate-ready nation.

Line of Effort 1: Strengthen and Enact Clear Data Standards and Accountability Metrics

Responsible Office or Group: OST
Timeline: Mid Term, FY25
Our ability to strengthen and enact clear data standards and accountability metrics is a dependency for the success of all LOEs. LOE 1 establishes a clear governance framework, develops and implements standards and policies for Fisheries, and enables training opportunities, culture change, and governance framework activities established by LOE 3: *Fully Enable Open Science*.

Objective 1.1: Utilize the Fisheries Data Governance Framework
Utilize the regionally-centric Fisheries Data Governance Framework to provide an agile and responsive structure that manages growing data and information management needs, as well as new and emerging requirements. Critical tasks to achieve this objective are:

- *1.1.1 Utilize the Fisheries Data Governance Framework* (FY23-26)
  Charge the Fisheries Data Governance Committee (Fisheries DGC) to serve as the advisory body that recommends Fisheries-level data standards and best practices.
- 1.1.2 *Establish Data Standards and Best Practices* (FY23-26)
  The Fisheries DGC will establish, review, and approve data standards and best practices through the Fisheries DGC and Data Governance Framework.
- *1.1.3 Inventory Fisheries Data Assets* (FY23-25)
  Ensure that all Fisheries data assets are inventoried and fully documented within the Fisheries metadata catalog, InPort.

Objective 1.2: Enable Interoperability and Sharing
Enable interoperability and sharing across our data and information systems. Critical tasks to achieve this objective are:

- *1.2.1 Develop and Implement Interoperability and Sharing Standards.* (FY24-26)
  Implement and track enterprise level data and systems interoperability and sharing standards.

- *1.2.2. Training* (FY24-26)
  Establish training requirements to ensure systems personnel are prepared and capable of maintaining interoperability standards across the fisheries enterprise.

Line of Effort 2: Scope and Implement Cloud-based Solutions

Responsible Office or Group: OCIO & OST
Timeline: Far Term (FY26)
For Fisheries, cloud solutions are critical in our modernization journey as we work to become more collaborative while supporting computing at a massive scale. This area ensures our data are interoperable, reduces the overall time to science, and provides reliable citizen services. Cloud-based solutions will be driven by our mission requirements with the default solution being a brokered commercial, multi-cloud, multi-tenant enterprise service supporting flexible workflows and large-scale data sets. Other expected benefits of cloud solutions, and this LOE, are as follows:

- Promote usability and transparency when provisioning cloud technologies.
- Minimize users' energy, time, and cost consumption due to lack of dynamic scalability.
- Increase the reliability and availability of computing resources and services.
- Address the challenges of data access while preserving privacy.
- Forward Fisheries' mission with on-demand self-serve services, broad network access on multiple devices, resource pooling, rapid elasticity to to quickly scale up and down as required, and measured service to control and optimize resource usage.

To realize these benefits, this LOE focuses on developing a strategy to address the incoming demands of science requirements to support efficient data collection, analysis, and dissemination of data, with a focus on FDD. Additionally, this effort seeks to pivot regional costs by reducing the use of on-premise data storage, analysis, and product development.

Objective 2.1: Establish the Fisheries Cloud Program.
The Fisheries Cloud Program is a strategic initiative within our organization to drive the adoption of cloud technologies – where and when appropriate – to support our mission. Critical tasks to achieve this objective are:

- *2.1.1 Establish the Cloud Program Office (CPO) within the Fisheries OCIO. (FY24)*
  Guide, facilitate, and accelerate the transition from primarily on-premises data center environments to cloud-enabled solutions–where and when appropriate–across Fisheries. The CPO will oversee the execution of *objectives 2.1.2–2.1.5.*
- *2.1.2 Define and implement Fisheries cloud governance. (FY24)*
  Define and implement a governance structure for cloud initiatives representative of a diverse set of Fisheries stakeholders, including the creation of policies and procedures that promote and hold the Fisheries enterprise accountable for cloud adoption.
- *2.1.3 Define and implement a cloud operations and service delivery model. (FY24-26)*
  Define and implement a framework for managing cloud operations and service delivery, including a formal operational structure that optimizes cloud resources, addresses service delivery mechanisms for various stakeholder groups, addresses cost modeling and resource limitations, and ensures efficient and secure management of data.

- *2.1.4 Re-skill, re-tool, and otherwise prepare the Fisheries workforce for cloud adoption. (FY24-26)*
  These efforts collectively aim to strengthen cloud adoption by addressing the various training needs across roles and ensure dedicated support staff are present within each FMC. These efforts also account for a cloud-enabled workforce of the future.
- *2.1.5 Facilitate a strategic and iterative cloud migration Fisheries-wide. (FY24-26)*
  Facilitate a strategic and iterative approach to cloud migration (cloud rationalization) by providing streamlined access to cloud services dependent on needs and technical capabilities. This will be performed through a centralized menu and ensure alignment with broader modernization strategies, particularly focused on legacy data and the decomposition/modernization of information systems across the agency.

Objective 2.2 Develop and Implement an Enterprise Modernization Plan for FDD Systems.
The initial focus in the near term will be to conduct an inventory and assessment of legacy data and information systems. A self-assessment tool will be developed and distributed to Fisheries regions and science centers to assess FDD systems' organizational and technical maturity across Fisheries. After this self-assessment, the Fisheries Information System (FIS) Program will host a workshop on legacy FDD and information systems modernization. It should include discussions on transition planning to ensure thoughtful progression through the project lifecycle to avoid accumulating future technical debt. The primary outcome would be developing recommendations for Fisheries leadership to move modernization efforts forward aggressively. These near term activities will be crucial for completing the critical tasks required to achieve success toward this objective, which include:

- *2.2.1 Establish an Enterprise Modernization Framework* (FY23-24)
  Fisheries will develop a strategy to promote successful modernization efforts while avoiding the accumulation of future technical debt. This will incorporate the efforts of objective 2.1 to establish the Fisheries Cloud Program.
- *2.2.2 Prioritize Data Modernization Initiatives (FY24-26)*
  This task will identify and fund high-priority, cross-regional data modernization projects through peer-reviewed proposal requests (RFPs).

Line of Effort 3: Fully Enable Open Science

Responsible Office or Group: OST
Timeline: Mid Term (FY23-26)
LOE 3 modernizes how the Fisheries' scientific and regulatory communities work and collaborate around data, modeling, analysis and decisions. There are four pillars of this LOE centered around the adoption of Open Science and Open Data norms at the staff and project level: 1) direct and cultivate culture change; 2) identify and develop human capital requirements; 3) provide technical support to staff and offices for migration to Open Science; and 4) support targeted research for climate-ready population and ecosystem models. The latter will use an Open Science model,

working openly and collaboratively to develop solutions for select projects that incorporate new climate and fisheries data streams into models and analyses.

Objective 3.1 Leverage Openscapes[6] to Develop Best Practices and Direct Culture Change. The Fisheries Openscapes Framework will directly build Fisheries' capacity for modern data-intensive science, including coding and reproducibility, responsible data practices, modern Open Science workflows, and tools that incorporate continuous improvement and transform team collaboration into project management. The Openscapes framework develops and trains the local Open Science mentor who will then support local change and empower local efforts for change. Critical tasks to achieve this objective are:

- *3.1.1 Identify the mentor group* (FY23)
  Identify and maintain the cadre of mentors and local leadership to engage in Open Science mentorship training. The mentor group is locally based in each FMC and understands the challenges and barriers of local staff when adopting improved data management, using cloud platforms developed by other LOEs, and transitioning to Open Science workflows.
- *3.1.2 Mentor group development and facilitation* (FY23-26)
  Openscapes will run coaching and development for the mentor group focusing on training in the coaching and facilitation skills needed for their role as local Open Science coordinators for local teams and staff. Openscapes acts as the facilitator to help the mentor team agree on what they can achieve during each sprint/effort cycle. They help the mentor team make progress on their Open Science goals by helping the team evaluate tasks and progress and help the team identify obstacles to progress.
- *3.1.3 Open Science and Open Data Communications* (FY23-26)
  Develop and execute a communications plan geared toward communicating the goals and progress of Open Science and Open Data, as well as share the value of the Openscapes framework. The framework creates the team and staff culture to allow for continuous improvement and allows for open discussion of problems to collaboratively work towards pragmatic solutions and actively reduce silos.
- *3.1.4 Team-based trainings in Open Science* (FY24-26)
  Run Openscapes Champions Open Science mentorship program for FMC teams and staff. These multi-week sessions support staff in reimagining data analysis & stewardship as a collaborative effort, learning modern Open Science and Open Data skills that are of immediate value to them, and cultivating collaborative and inclusive communities involved in data, modeling, and analysis for our science and decisions.
- *3.1.5 Communicate Fisheries Modernization best practices and feedback* (FY23-26)
  Ensure that best practices and activities in the other LOEs are communicated to teams and staff. Work with the mentor team to provide staff feedback from projects representing the full diversity of work carried out by science centers and regional offices.

[6] https://www.openscapes.org/tags/noaa-fisheries/

Objective 3.2 Leverage Openscapes to Develop Human Capital Requirements.
Fisheries will adopt Open Science workflows, Open Data standards, and incorporate new climate and fisheries data streams. To accomplish this, staff must learn new technical skills related to coding, programmatic data access, development platforms, and new team and project-management skills. Openscapes will coordinate a training program to improve staff skills in modern data-science, which is heavily dependent on 'R' or 'Python' and other version-control platforms—skills that many staff are not currently versed in from their academic training. In addition, active peer communities (user groups) are critical for supporting peer-learning and sharing training opportunities. Note that training in the Open Science team and project management is addressed in *Objective 3.1*. Critical tasks to achieve this objective are:

- *3.2.1 Human Capital Assessment* (FY23-25)
  Execute a human capital analysis (survey) to identify specific skill gaps that must be addressed to allow staff to adopt Open Science and Open Data workflows and pipelines. Revisit assessment yearly to evaluate progress and identify new skills gaps as needs evolve.
- *3.2.2 Manage Training Program for Data-Science* (FY24-26)
  Identify and set up a platform for online data-science or programming courses, identify high-priority courses, and select a cohort of participants. Coordinate peer mentoring, Question & Answer sessions, and monitor student progress.
- *3.2.3 Identify Specific Integrated Development Environment (IDE) and Data-Access Training Needs* (FY23-26)
  Identify training or tutorial needs for our Integrated Development Platforms (GitHub, Posit Connect, cloud computing, and others as they emerge) and programmatic access to databases. Coordinate, identify, and communicate solutions accordingly.
- *3.2.4 Support Fisheries Open Science Communities* (FY23-26)
  Support the maintenance and development of active R, C++, Python, Julia, Stan, and other needed user groups. Vibrant peer communities are critical for staff morale, peer help, and esprit de corps for those engaged in Open Science and Open Data efforts.
- *3.2.5 Support Diversity, Equity, Inclusion, and Accessibility (DEIA)* (FY23-26)
  Participate in the Openscapes Pathways to Open Science for Marine Science and other ocean-themed data-science events with academic and other partners in support of data-science and DEIA.

Objective 3.3: Support Integrated Development and Delivery Platforms for Science and Decision-Making.
A full-time data science position will support Fisheries staff and teams who need help with their Open Science and Open Data workflows. Additionally, the position will support the GitHub Governance Team and Posit Connect Forum, which include representatives from each center and regional office that use these platforms. Critical tasks to achieve this objective are:

- *3.3.1 GitHub and Posit Connect Governance* (FY23-26)
  Support Governance (Standard Operating Procedures and Terms of Reference) for GitHub Enterprise Cloud, GitHub Public, and Posit Connect. Ensure active participation of the local science and decision-making representatives is reflected in the governance of these resources.
- *3.3.2 Communication and Outreach* (FY23-26)
  Ensure that staff can access information. Identify emerging technologies and synergistic community efforts for Open Science Integrated Development Environments (IDE) and other delivery platforms.
- *3.3.3 Technical support for our GitHub and Posit Connect Platforms* (FY23-26)
  Support staff onboarding and training for these tools. Provide technical support to teams for their workflow modernization and Open Source development using these platforms. Support maintenance of these shared Fisheries resources and software.
- *3.3.4 Advise on cloud-computing requirements and needs for staff* (FY23-26)
  Assist in identifying needed staff onboarding, communication, and training related to new and emerging cloud-computing initiatives and required resource specifications. Evaluate equity of access to cloud resources across science centers and regional offices. Advise on the governance structure for the new and emerging cloud-computing platforms.

Objective 3.4: Develop Climate-Ready Population and Ecosystem Models.
Improved data streams and the demands of climate-ready model performance requires associated improvements in the models used to assimilate and analyze fishery and survey data. Improvements are needed in both fish population and ecosystem models to maximize the information obtained from NOAA data. The models need to be spatially explicit to analyze shifting population distributions and impacts of localized features, including offshore wind developments. They also need to assimilate information from climate models to analyze shifting life history rates. These models are vital to maximizing the utility of the Climate, Ecosystems, and Fisheries Initiative (CEFI) and the Fisheries Integrated Toolbox (FIT). Temporary positions (contractors/postdocs/CI and CESU partners) will support research and improvement to models related to:

- *3.4.1 Fish Population Models* (FY24-26)
  Fisheries Steering Committee Groups will prioritize, guide, and track projects using Open Science approaches. Prioritization by the Steering Committee Groups will target the model components needed for the Fisheries Integrated Modeling System (FIMS), CEFI, and climate-linked spatial models to improve workflows and overall integration of data.
- *3.4.2 Ecosystem Models* (FY24-26)
  Support 3-5 temporary positions (contractors/postdocs/CI and CESU partners) to work on advancing marine ecosystem models under the direction of cross-regional and national teams. Themes for model development will consider connectivity across regions, predictability of the production, location, and dynamics for a wide range of taxonomic groups, good practice guides to assure consistent approaches, incorporation of climate change changes in key ecosystem, community, and population processes, Management Strategy Evaluations (MSE) model development, enhanced connection to fish population models, and aggregate or systems-level evaluation of responses to change.

Line of Effort 4: Refine and Formalize the Operating Model for Modernization

Responsible Office or Group: OCIO & OST
Timeline: Mid-Term (FY25-26)
Dependencies on other LOEs or Objectives: This LOE builds upon and weaves together the efforts of the above LOEs to bring to fruition the Fisheries OCIO and OST coming together to modernize Fisheries. LOE 4 is the launch pad for how a modernized NOAA Fisheries will function, from elevating the value and stature of our data to decisions to fully defining a business model that supports the workforce of tomorrow.

Objective 4.1: Elevate The Stature Of Data To Be Commensurate With Research Publications
This objective will elevate the status of data on par with scientific publications to ensure fisheries data and information are FAIR and all users can confidently find, access, and use our data. Critical tasks include:

- *4.1.1 Establish a new executive Flash Team* (FY24)
  Establish an executive-level body focused on ensuring strategic alignment with Fisheries priorities.
- *4.1.2 Determine the criteria to increase data's value (FY25)*
  Determine criteria to increase the stature of data commensurate with research publications (i.e., digital object identifiers, peer review, etc.).

Objective 4.2: Define A Business Operating Model For Modernization
This objective will scope and define the business case for a modernized NOAA Fisheries data and information landscape. The business operating model will: 1) outline how we capture and offer value through products, services, value proposition, customers, key partners, and more, as well as outline how we will deliver on that value. This is critical in ensuring sustainable, long-term growth in modernization efforts beyond IRA. Tasks to achieve this objective are:

- *4.2.1 Scoping and Requirements.* (FY25)
  Develop the scope and requirements of the business operating model.
- *4.2.2 Cost Model.* (FY26)
  Develop a cost model with a communications plan to determine payment processes and the responsibilities for technology solutions, systems' egress, and a data-literate workforce within NOAA Fisheries.

Objective 4.3: Develop Requirements for Data Management and IT Expertise.
This objective seeks to assess the current human capital profile across Fisheries, develop the requirements to manage the future data landscape and enable Fisheries to obtain and integrate the skill sets required to manage Fisheries' data effectively. Ultimately, Fisheries will achieve an environment where proper expertise is available across all regions to seamlessly manage Fisheries' data according to practical standards while reducing silos.

Fisheries will build on the operating model for modernization through the *Recruit, Reskill, Retain, Rethink Campaign*, to be formalized with the below efforts. Tasks critical to the success of this objective include:

- *4.3.1 Human Capital Assessment.* (FY24-26)
  Execute a human capital analysis to identify skill gaps that must be addressed to continue long-term data modernization efforts across Fisheries. To maximize our potential and accelerate science, we will look for new opportunities to enhance our capabilities and create an IT workforce of the future that provides diverse, collaborative, and responsive Fisheries service.
- *4.3.2 Position Descriptions.* (FY23-26)
  Create position descriptions and staffing plans to establish a Modern Data Workforce across each Fisheries region. Through leadership engagement, Fisheries will ensure that data and growth mindset are recognized as critical assets that are fundamental to achieving Fisheries' mission priorities, and are effectively resourced, governed, managed and shared. This is how a modernized NOAA Fisheries will function, from elevating the value and stature of our data to decisions to a fully defined business model that supports and retains the workforce of tomorrow.
- *4.3.3 Training.* (FY24-26)
  Identify and provide training and tools for existing staff based on the Human Capital Assessment. Ensure that the Fisheries IT workforce is reskilled in innovative technology solutions.

Objective 4.4: Define the Customer Relationship Model (CRM).
This objective will define the framework for how Fisheries will manage the onboarding of new services, interact with NOAA partners, and establish communications frameworks that disseminate up-to-date information on what services and tools are available to support regional missions. Critical tasks to achieve this objective include:

- *4.4.1 Customer Relationship.* (FY24-25)
  Develop a customer relationship management model with a communications plan for implementation in conjunction with data standards implementation. Foster a decision-driven data and technology culture that encourages data literacy and IT skills development that promotes curiosity, experimentation, collaboration, and continuous learning. This is how we will Rethink how we work across Fisheries.

Conclusion

This Fisheries Data Modernization Implementation Plan provides the strategic framework to guide how Fisheries can operate in both the data environment of today and the future. The implementation efforts in this plan will ensure that Fisheries maximizes our ability to rapidly deliver mission-critical information as we continue to support the transition to a climate-ready nation amid a constantly changing technological landscape.

As a science-based organization, Fisheries inherently relies on sound data solutions to inform management decisions and therefore our modernization efforts vastly coalesce across other areas that support a Climate Ready Fisheries. Fisheries must stand ready to engage its mission in a way that promotes agile approaches to solving current and emerging climate challenges while balancing the regulatory and economic needs of the communities we support.

Together, we will succeed.

Glossary

Term	Definition
Data	Recorded information, regardless of form or the media on which the data are recorded.[7]
Fisheries Dependent Data (FDD)	FDD are collected directly from commercial and non-commercial fisheries and may include fishing efforts, total amount of fish removed from the ocean (from landings and discards), species, and biological information.
Fisheries Federated Cloud	A federated cloud means constructing a seamless multi-provider infrastructure/cloud environment that can interact with people, different devices, several application interfaces, and other entities. It is synonymous with cloud federation, i.e., getting two or more cloud providers to interact or collaborate.
Federated Fisheries Data System	A federated fisheries data system refers to a technique to autonomously combine multiple data sources/systems to efficiently integrate, access, and merge already cleaned/conformed data in real-time to advance organizational goals.
Information	Any communication or representation of knowledge such as facts, data, or opinions in any medium or form, including textual, numerical, graphic, cartographic, narrative, electronic, or audiovisual forms.[8]
Open Data	Publicly available data is structured to enable the data to be fully discoverable and usable by end users. In general, open data will be public, accessible, described, reusable, complete, timely, and managed post-release.[9]
Technical Debt	A term used to describe the implied cost to future upkeep of a system or program as a fast solution rather than a solution that may take longer to implement but be more effective.

[7] As defined by the Evidence Act
[8] As defined in OMB Circular A-130
[9] See *OMB M-13-13* *Section I* for additional details.

References

Building a Climate Ready Nation: NOAA FY 22-26 Strategic Plan[1]
NOAA Fisheries 2022-2025 Strategic Plan [2]
NOAA Data Strategic Action Plan [3]
Inflation Reduction Act [4]
Fisheries Data Vision [5]
https://www.niem.gov/ [6]
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A Proposal for a Comprehensive Data DOI solution for NOAA Hosted Data [8]
Evidence Act [9]
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