



# **CIOOS Implementation Plan (2021-26)**

## **Foreword**

Knowledge and understanding of the ocean is dependent on access to accurate, readily available, and integrated ocean data. By addressing fragmented ocean data and previous lack of coordination within ocean observing, the Canadian Integrated Ocean Observing System (CIOOS) aims to connect the dots, and emerge as Canada's nucleus for ocean observing. Building on existing strengths of ocean expertise and regionally-based data collection, CIOOS' powerful online platform improves access and visibility to high quality ocean data and information. This information and knowledge can enable ocean prediction, mitigate risk to ecosystems and coastal populations, increase ocean safety, and contribute to evidence-based decision making for the ocean. CIOOS benefits all Canadians by promoting healthy ocean-human interactions and contributing to a sustainable blue economy. CIOOS fully supports inclusivity in the ocean domain and is working to facilitate ocean leadership, enhancing global recognition of ocean observing in Canada.

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## 1.0 Introduction

CIOOS was launched in 2018 following a decade of initiatives seeking nationally coordinated ocean observations.

The CIOOS Strategic Plan (2021-2026) outlines three phases to CIOOS becoming an internationally recognized and nationally utilized ocean observing system; Phase 1 concentrated on the creation of a proof of concept, Phase 2 focuses on developing into a fully operational and mature system and Phase 3 will target sustainability and continuous improvement. Phase 1, where CIOOS built infrastructure, defined metadata standards, prioritized EOVs and established relationships with partners, has recently been completed. Now in Phase 2, CIOOS is advancing its leading role in Canadian ocean observing and over the next five years (2021-2026) will focus its objectives across four thematic areas as outlined in the Strategic Plan, paying particular attention to the unique challenges and opportunities for the establishment and maintenance of an ocean observing system in Canada.

This Implementation Plan expands on the goals identified within the thematic areas. The plan includes detailed work packets which have been prioritized, assigned to the task team/committee responsible, and have a clear timeline for completion. The Implementation Plan is intended to act as a roadmap for CIOOS to achieve the top priority goals over the next five years (2021-2026).

It is likely that over the next five years, the disciplinary scope of CIOOS will broaden, requiring CIOOS to remain open and responsive to new and emerging needs, projects, and opportunities such as the United Nations Decade of Ocean Science for Sustainable Development. CIOOS' long term success will be determined by its ability to integrate information from diverse disciplines in order to leverage the numerous thematic data repositories that exist globally, stay flexible in its approach, and remain relevant to a multidisciplinary community of users. Therefore, the Implementation Plan will be revised every two years to ensure the goals of the Strategic Plan are met by 2026.

**Vision:** As Canada's nucleus for ocean observing, CIOOS makes connections for a sustainable ocean future.

**Mission:** To foster partnerships and grow a powerful online platform that generates information, knowledge and place-based solutions to advance our understanding of the ocean.

## **2.0 Funding Caveat**

The scope and timeline of the deliverables outlined in this implementation plan will be dependent on the level of resources obtained for CIOOS in 2022-26. A CIOOS community-wide priority setting exercise was completed in November 2021 to provide further guidance on the prioritization of goals as required by funding level. The results of this exercise can be found in Appendix 3.

## **3.0 Business Model**

In Phase 2, CIOOS aims to secure itself as an operational data repository for ocean observations. In doing so, CIOOS must demonstrate a stringent business model which aligns with its mission and vision and is sensitive to the context in which it operates, acknowledging that these may change over time (OECD, 2017). It is also important to clearly articulate the value proposition of CIOOS to various stakeholders, including current and potential funders.

Currently CIOOS follows a hybrid funding model. Rather than revenue being restricted to one funding source, this model allows for a combination of cash and in-kind contributions from multiple funding sources across multiple sectors, including government, research institutions, and philanthropic entities. The ability to forge connections at the national scale across multiple and diverse types of funding organizations and sources is immensely beneficial for ocean data management. In adopting a hybrid funding model, CIOOS must ensure that the funding criteria and matching requirements for each source are met. In some cases, the requirements or mandates of multiple funding sources can be divergent from one another or from the mission and vision of CIOOS, so the hybrid approach must be carefully balanced.

Structural funding, defined as central funding for infrastructure or an ongoing service in the form of a multi-year contract, is the preferred funding type for CIOOS (OECD, 2017). Compatible with open data principles, structural funding provides multi-year stability and can be flexible in terms of scale. The hybrid model of diverse and multiple funding sources, where each can provide structural funding, can prevent failure should one source withdraw or reduce its contribution. Multiple sources of structural funding also maintains compatibility with open data principles and allows the flexibility for experimentation with new products and services (OECD, 2017).

Ensuring the financial sustainability of CIOOS also requires consideration of economies of scale. CIOOS must aim to collaborate effectively with other national and international organizations on open data to increase the efficiency of ocean observing data repositories globally. All opportunities for cost optimization within the system should be explored, for example, leveraging partnerships, use cases and user testing, automating key processes, developing efficient tools, and considering a move to cloud

platforms—acknowledging that cost of data storage will continue to decrease (OECD, 2017). Cost optimization efforts can help ensure the effective management of digital assets in the long-term (OECD, 2017). Data repositories, like CIOOS, are unique infrastructure, in that their economic value will increase over time, assuming that the data within remains usable, accessible, and is being reused. Nonetheless, CIOOS' revenue source or sources must scale with demand, for example, as the number of datasets to be ingested and hosted increases, so too should funding for maintenance of the repository, data management, and stewardship.

CIOOS continues to explore and monitor all national and regional funding opportunities. This may increase overall funding and help make CIOOS a long-term, sustainable organization. The establishment of a National Advisory Committee will add financial and strategic expertise to advise on local and national funding opportunities. Furthermore, increasing recognition of CIOOS through a Communications and Engagement Campaign and sharing the Strategic Plan will demonstrate CIOOS' value as the nucleus for ocean observing in Canada and will help leverage new and arising funding opportunities.

## **4.0 Objectives/Development: Themes, Goals/Objectives & Work Packets**

### **4.1 Theme 1: Strengthening partnerships for improved ocean observations and service delivery**

*Goal 1.1. **Regional partnerships:*** Strengthen engagement with new and existing regional partners to increase and diversify data holdings, promote usability and provide products and services.

**1.1.1.** Implement ongoing user-testing, monitoring and evaluation to ensure that CIOOS meets the needs of its regional partner organizations e.g., data contributors, data users, funding contributors and collaborators.

**1.1.2.** Develop a Communications and Engagement action plan within CIOOS to foster a culture of engagement and promote effective and sustainable partnerships.

**1.1.3.** Identify priority areas of focus, user groups, and potential new partners at the regional and provincial level to engage with such as Indigenous governments and organizations.

**1.1.4.** Coordinate with other regional data management hubs to increase data flows into CIOOS.

*Goal 1.2. **National partnerships:*** Promote the work of CIOOS' community of partners at the national level to increase collaboration within CIOOS and across Canadian initiatives.

**1.2.1.** Develop a mechanism to encourage regional collaboration, sharing of knowledge and best practices to feed into the national work plan for developing partnerships across CIOOS.

**1.2.2.** Increase collaboration with other Canadian initiatives on ocean observation, data platforms, and organizations curating Traditional Ecological Knowledge.

**1.2.3.** Engage with additional Federal departments e.g. Environment and Climate Change Canada (ECCC), Natural Resources Canada (NRCan) and Defence Research and Development Canada (DRDC), to encourage contributions to CIOOS.

**1.2.4.** Implement social media, partner profiles and success stories at a regional level to highlight CIOOS national, as well as to cross-promote the Regional Associations.

**1.2.5.** Represent ocean domain digital infrastructure within the Digital Research Alliance of Canada.

*Goal 1.3. **International partnerships:*** Represent Canadian ocean observing on a world stage through increasing visibility and expanding international collaborations and partnerships.

**1.3.1.** Leverage international connections and representation from experts within CIOOS to increase global recognition and awareness as an ocean observing system.

**1.3.2.** Adhere to international standards and best practices on ocean data management.

**1.3.3.** Promote Indigenous co-management and governance of ocean data globally, encouraging partner organizations to consider and respect their Indigenous ocean data.

**1.3.4.** Actively participate in international working groups, the UN Ocean Decade for Sustainable Development, and become a fully recognized Regional Alliance of the Global Ocean Observing System (GOOS).

**1.3.5.** Present on CIOOS progress at national and international conferences and workshops.

*Goal 1.4. **Indigenous partnerships:*** Continue ongoing engagement and dialogue with Indigenous governments, organizations and communities to explore best practices for sharing and preserving Indigenous ocean knowledge and data in ways that support Indigenous data sovereignty.

**1.4.1.** Develop CIOOS' best practices for effectively and respectfully working with Indigenous knowledge and data, including Traditional Ecological Knowledge, following the CARE (Collective benefit, Authority to control, Responsibility and Ethics) Principles.

**1.4.2.** Support Indigenous data sovereignty by exploring partnerships that facilitate best practices for Indigenous data and inform how CIOOS can support the integration of Indigenous metadata.

**1.4.3.** Determine frameworks needed for integration, monitoring, and compliance related to specialized data usage constraints (e.g. Traditional Knowledge and Biocultural labels) that can be customized and applied to datasets.

## **4.2 Theme 2: Improve the discoverability, accessibility and interoperability of Canadian oceanographic data**

*Goal 2.1. Expand data sets available to increase discoverability and accessibility.*

**2.1.1.** Introduce additional GOOS and Canadian-specific essential ocean variables (EOVs) to CIOOS based on user needs, availability, and readiness.

**2.1.2.** Increase number of datasets and partner organizations from whom CIOOS gets data, outputs, and data products.

**2.1.3.** Contribute CIOOS data to international harvesters and registries for target data types (e.g. OBIS and GBIF for biological observations).

**2.1.4.** Ensure CIOOS is cloud compatible by investing in our data processing infrastructure and building ocean-to-desktop systems.

**2.1.5.** Examine the evolution of core standards for ocean data such as ISO, Climate and Forecast (CF) metadata conventions, and Attribute Convention for Data Discovery (ACDD).

*Goal 2.2. Increase real- and near real-time data sharing to improve forecasting capabilities.*



**2.2.1.** Develop consistent data and metadata quality control (QC) tools and procedures for use by data providers to implement automated QC of real- and near real-time datasets and make these datasets accessible via CIOOS.

**2.2.2.** Increase the number of real- and near real-time datasets available in CIOOS to the Global Telecommunication System (GTS) and other global systems used for forecasting.

*Goal 2.3. Develop standardized, reliable methodology for ocean data in Canada which is categorized and developed to improve interoperability.*

**2.3.1.** Work towards meeting external data certification standards by advancing consistency of data and data standards in accordance with FAIR, CARE, and TRUST principles.

**2.3.2.** Develop the metadata catalogue with improved filtering and sorting capabilities, and develop processes for cases where insufficient metadata is available for new datasets.

**2.3.3.** Develop a process for assigning and implementing persistent identifiers for the research objects (e.g. DOIs for data, ORCIDs for individuals, and RORs for organizations) to enable and support data citation.

**2.3.4.** Develop processes for long term archival of datasets in repositories such as the Federated Research Data Repository (FRDR) and develop new processes for data hosting.

**2.3.5.** Continuously improve data management processes and infrastructure to ensure CIOOS is a fully operational system with structural integrity as it matures.

**2.3.6.** Examine and implement data security from a wide range of standpoints, following established best practices.

*Goal 2.4. Leverage Regional Associations as national data assembly centres to maximize on regional expertise.*

**2.4.1.** Create CIOOS national data assembly centres for centralized and secure management of specialized data types based on user needs and data availability and readiness.

**2.4.2.** Implement and sustain a community of practice that brings together Canadian data experts to share expertise and to collaborate together on shared project priorities.

### **4.3 Theme 3: Converting ocean data into information and knowledge through the development and use of tools, products and applications**

*Goal 3.1. Catalogue, adopt, and adapt tools that enable efficient ingestion and processing of ocean data.*

**3.1.1.** Catalogue existing tools and applications, adopting and adapting to fit CIOOS needs where necessary.

**3.1.2.** Develop tools to streamline and further automate the deposit process for data providers.

**3.1.3.** Promote best practices on how to use data tools and applications to small data providers, partners, and end-users.

**3.1.4.** Provide lineage and data quality information in metadata records so that users can determine the records as fit-for-use.

**3.1.5.** Develop a Portage CIOOS template to be able to demonstrate a data preservation plan to data providers.

*Goal 3.2. Develop tools to increase the usability and accessibility of the CIOOS user interface.*

**3.2.1.** Provide a map-based user interface that allows users to easily find, filter, and access ocean data products and information.

**3.2.2.** Develop user group-specific website interfaces designed to improve the functionality for high-priority user groups.

**3.2.3.** Develop key performance indicators that allow CIOOS to understand and interpret usage of its datasets, products, and services.

*Goal 3.3. Develop tools, products, and applications that are purpose-made for specific end-user groups.*

**3.3.1.** Create an outreach plan to evaluate the needs of our various user groups to develop targeted data products from CIOOS data.

**3.3.2.** Conduct outreach and user-testing, work with targeted user groups to address their unique needs, and receive feedback, e.g. on restricted access to Indigenous data.

**3.3.3.** Produce national visualization tools or products that have the flexibility to meet the unique needs of each user group.

**3.3.4.** Develop tools for data consumers to create data products and applications, leading to the creation of information and knowledge.

*Goal 3.4. Showcase and share tools, products, and applications developed by end-users to create a valuable knowledge base within CIOOS that builds on itself.*

**3.4.1.** Record usage of CIOOS data, and research enabled by CIOOS data to further awareness, showcase the various uses, and inspire future uses of CIOOS data.

**3.4.2.** Create a visualization tool that showcases our impact, measured by downloads, posters, reports, publications, with the purpose of demonstrating CIOOS' value.

**3.4.3.** Provide a mechanism for sharing data products and tools created by external sources so that they can become their own resource within CIOOS, where applicable.

**3.4.4.** Create a library of technical tools for CIOOS data from contributions developed by external sources that can be reused or re-purposed by the CIOOS community and end-users.

**3.4.5.** Promote CIOOS products and applications on national and international scales to enhance recognition and relevance.

#### **4.4 Theme 4: Increase the ability to understand current states and predict future states of Canada's ocean spaces by supporting modelling efforts and sharing ocean model results**

*Goal 4.1. Catalogue models and model standards available regionally and nationally in Canada to increase overall use of model data and support reusability.*

**4.1.1.** Develop a rubric for model reusability and replicability by adopting existing global standards, while working to meet the "Predicted Ocean" goal of the United Nations Decade of Ocean Science.

**4.1.2.** Provide a framework for model intercomparisons, working with other modelling experts as needed.

**4.1.3.** Promote reusability of numerical models by making existing models and model inputs discoverable and accessible.

*Goal 4.2. Develop CIOOS model metadata standards* in order to more efficiently ingest model output data.

**4.2.1.** Establish CIOOS model metadata standards that are based on international standards in order to promote the overall use of model data.

**4.2.2.** Support regional and coastal modelling efforts by making nowcast and forecast results from global and regional models discoverable.

*Goal 4.3. Connect modellers with ocean observational data* to enable the development, assimilation, and validation of models.

**4.3.1.** Promote CIOOS as a method to link observational and modelling programs to improve model accuracy and sampling effectiveness.

**4.3.2.** Increase usage of observational data in modelling by supporting model validation and data assimilation workflows in ocean models.

**4.3.3.** Engage with UN Decade of Ocean Science programs (e.g. Coast Predict) to align our efforts with national and international modelling work.

**4.3.4.** Share existing models to allow for utilization of model output as a digital twin where there are observational data gaps.

*Goal 4.4. Enable CIOOS partners to develop data products* and applications to address model user requirements.

**4.4.1.** Enable use of operational models by creating informational data products and applications based on model data.

**4.4.2.** Create a library of products to visualize, process, and extract useful information from ocean models developed by the ocean science community.

**4.4.3.** Develop topical tools to enable place-based solutions for data-driven decision-making by municipal, regional, and national authorities.

## 5.0 Prioritization and Assignment of Responsibilities

Colour code				
Immediate and ongoing	Cycle 3, Year 1	Cycle 3, Year 2	Cycle 4	Beyond

Please note that some work packets may be ranked as important to complete, however they are prioritized lower because they rely on the completion of other work packets first.

### 5.1 Executive Committee (ExCom)

Work Packet	Collab with
<b>1.2.2.</b> Increase collaboration with other Canadian initiatives on ocean observation, data platforms, and organizations curating Traditional Ecological Knowledge	CC, RA, MD
<b>1.2.3.</b> Engage with additional Federal departments e.g. Environment and Climate Change Canada (ECCC), Natural Resources Canada (NRCan) and Defence Research and Development Canada (DRDC), to encourage contributions to CIOOS	CC
<b>1.2.5.</b> Represent ocean domain digital infrastructure within the Digital Research Alliance of Canada	TC, DMP
<b>1.3.1.</b> Leverage international connections and representation from experts within CIOOS to increase global recognition and awareness as an ocean observing system	SC, CC
<b>1.3.2.</b> Adhere to international standards and best practices on ocean data management	TC, SC
<b>1.3.4.</b> Actively participate in international working groups, the UN Ocean Decade for Sustainable Development, and become a fully recognized Regional Alliance of the Global Ocean Observing System (GOOS)	SC, TC
<b>2.4.2.</b> Implement and sustain a community of practice that brings together Canadian data experts to share expertise and to collaborate together on shared project priorities	SC, TC

### 5.2 Technical Committee (TC)

Work Packet	Collab with	TT/CD
<b>1.1.1.</b> Implement ongoing user-testing, monitoring and evaluation to ensure that CIOOS meets the needs of its regional partner organizations e.g. data contributors, data users, funding contributors and collaborators	CC, RA	UX

<b>1.1.4.</b> Coordinate with other regional data management hubs to increase data flows into CIOOS	RA	SA
<b>1.4.1.</b> Develop CIOOS' best practices for effectively and respectfully working with Indigenous knowledge and data, including Traditional Ecological Knowledge, following the CARE (Collective benefit, Authority to control, Responsibility and Ethics) Principles	CC, SC	MD, DMP
<b>1.4.3.</b> Determine frameworks needed for integration, monitoring, and compliance related to specialized data usage constraints (e.g. Traditional Knowledge and Biocultural labels) that can be customized and applied to datasets	SC	MD
<b>2.1.3.</b> Contribute CIOOS data to international harvesters and registries for target data types (e.g. OBIS and GBIF for biological observations)	NWP	SA, MD, BD
<b>2.1.4.</b> Ensure CIOOS is cloud compatible by investing in our data processing infrastructure and building ocean-to-desktop systems	NWP	DMP
<b>2.1.5.</b> Examine the evolution of core standards for ocean data such as ISO, Climate and Forecast (CF) metadata conventions, and Attribute Convention for Data Discovery (ACDD)		DMP, MD
<b>2.2.1.</b> Develop consistent data and metadata quality control (QC) tools and procedures for use by data providers to implement automated QC of real- and near real-time datasets and make these datasets accessible via CIOOS	SC	SA, MD
<b>2.2.2.</b> Increase the number of real- and near real-time datasets available in CIOOS to the Global Telecommunication System (GTS) and other global systems used for forecasting	NWP	SA, MD
<b>2.3.1.</b> Work towards meeting external data certification standards by advancing consistency of data and data standards in accordance with FAIR, CARE, and TRUST principles	SC	DMP, MD
<b>2.3.2.</b> Develop the metadata catalogue with improved filtering and sorting capabilities, and develop processes for cases where insufficient metadata is available for new datasets	SC, NWP	MD, SA
<b>2.3.3.</b> Develop a process for assigning and implementing persistent identifiers for the research objects (e.g. DOIs for data, ORCIDs for individuals, and RORs for organizations) to enable and support data citation	SC	MD
<b>2.3.4.</b> Develop processes for long term archival of datasets in repositories such as the Federated Research Data Repository (FRDR) and develop new processes for data hosting		DMP
<b>2.3.6.</b> Examine and implement data security from a wide range of standpoints, following established best practices		DMP
<b>2.3.5.</b> Continuously improve data management processes and infrastructure to ensure CIOOS is a fully operational system with structural integrity as it matures	RA, NWP	SA, CD

<b>3.1.1.</b> Catalogue existing tools and applications, adopting and adapting to fit CIOOS needs where necessary		SA, CD
<b>3.1.2.</b> Develop tools to streamline and further automate the deposit process for providers		SA, DMP
<b>3.1.4.</b> Provide lineage and data quality information in metadata records so that users can determine the records as fit-for-use	SC	MD
<b>3.1.5.</b> Develop a Portage CIOOS template to be able to demonstrate a data preservation plan to our data providers		DMP
<b>3.2.1.</b> Provide a map-based user interface that allows users to easily find, filter, and access ocean data products and information	SC, DSN, NWP	SA, UX
<b>3.2.2.</b> Develop user group-specific website interfaces designed to improve the functionality for high-priority user groups	SC, RA, CC	UX
<b>3.2.3.</b> Develop key performance indicators that allow CIOOS to understand and interpret usage of its datasets, products, and services	SC, ExCom	MD
<b>3.3.2.</b> Conduct outreach and user-testing, work with targeted user groups to address their unique needs, and receive feedback, e.g. on restricted access to Indigenous data	CC, RA	UX
<b>3.3.3.</b> Produce national visualization tools or products that have the flexibility to meet the unique needs of each user group	NWP	UX, CD
<b>3.3.4.</b> Develop tools for data consumers to create data products and applications, leading to the creation of information and knowledge		SA, CD
<b>3.4.1.</b> Record usage of CIOOS data, and research enabled by CIOOS data to further awareness, showcase the various uses, and inspire future uses of CIOOS data		SA, CD
<b>3.4.2.</b> Create a visualization tool that showcases our impact, measured by downloads, posters, reports, publications, with the purpose of demonstrating CIOOS' value	CC	SA, CD
<b>3.4.3.</b> Provide a mechanism for sharing data products and tools created by external sources so that they can become their own resource within CIOOS, where applicable	RA, CC	CD
<b>3.4.4.</b> Create a library of technical tools for CIOOS data from contributions developed by external sources that can be reused or re-purposed by the CIOOS community and end-users	RA, CC	DMP
<b>4.3.4.</b> Share existing models to allow for utilization of model output as a digital twin where there are observational data gaps	SC	Model
<b>4.2.1.</b> Establish CIOOS model metadata standards that are based on international standards in order to promote the overall use of model data	SC	Model, MD
<b>4.2.2.</b> Support regional and coastal modelling efforts by making nowcast and forecast results from global and regional models discoverable	SC	Model

<b>4.3.2.</b> Increase usage of observational data in modelling by supporting model validation and data assimilation workflows in ocean models	SC	Model
<b>4.4.1.</b> Enable use of operational models by creating informational data products and applications based on model data	SC, RA, NWP	Model, CD
<b>4.4.2.</b> Create a library of products to visualize, process, and extract useful information from ocean models developed by the ocean science community	NWP	Model
<b>4.4.3.</b> Develop topical tools to enable place-based solutions for data-driven decision-making by municipal, regional, and national authorities	RA, NWP	Model

### **5.3 Communications Committee (CC)**

<b>1.1.2.</b> Develop a Communications and Engagement action plan within CIOOS to foster a culture of engagement and promote effective and sustainable partnerships		
<b>1.1.3.</b> Identify priority areas of focus, user groups, and potential new partners at the regional and provincial level to engage with such as Indigenous governments and organizations	RA, SC	
<b>1.2.1.</b> Develop a mechanism to encourage regional collaboration, sharing of knowledge and best practices to feed into the national work plan for developing partnerships across CIOOS	SC	
<b>1.3.3.</b> Promote Indigenous co-management and governance of ocean data globally, encouraging partner organizations to consider and respect their Indigenous ocean data	RA, ExCom, SC, DMP	
<b>3.1.3.</b> Promote best practices on how to use data tools and applications to small data providers, partners, and end-users		
<b>3.2.2.</b> Develop user group-specific website interfaces designed to improve the functionality for high-priority user groups	UX	
<b>3.3.1.</b> Create an outreach plan to evaluate the needs of our various user groups to develop targeted data products from CIOOS data	UX	
<b>3.4.5.</b> Promote CIOOS products and applications on national and international scales to enhance recognition and relevance	ALL, NWP	
<b>4.3.1.</b> Promote CIOOS as a method to link observational and modelling programs to improve model accuracy and sampling effectiveness	TC (model)	
<b>4.3.3.</b> Engage with UN Decade of Ocean Science programs (e.g. Coast Predict) to align our efforts with national and international modelling work	ALL	



## 5.4 Science Committee (SC)

<b>1.3.1.</b> Leverage international connections and representation from experts within CIOOS to increase global recognition and awareness as an ocean observing system	ExCom, CC
<b>1.3.2.</b> Adhere to and expand CIOOS in accordance with international standards and best practices on ocean data management	ExCom, MD, DMP, CC
<b>1.3.3.</b> Promote Indigenous co-management and governance of ocean data globally, encouraging partner organizations to respect and consider their Indigenous ocean data	ExCom, CC, DMP, RAs
<b>1.3.5.</b> Present on CIOOS progress at national and international conferences and workshops	ExCom, TC
<b>2.1.1.</b> Introduce additional GOOS and Canadian-specific essential ocean variables (EOVs) to CIOOS based on user needs, availability, and readiness	TC (Data stewards), NWP
<b>4.1.1.</b> Develop a rubric for model reusability and replicability by adopting existing global standards, while working to meet the “Predicted Ocean” goal of the United Nations Decade of Ocean Science	TC (Model)
<b>4.1.2.</b> Provide a framework for model intercomparisons, working with other modelling experts as needed	TC (Model)
<b>4.1.3.</b> Promote reusability of numerical models by making existing models and model inputs discoverable and accessible	TC (Model)

## 5.5 Regional Associations (RAs)

<b>1.2.4.</b> Implement social media, partner profiles and success stories at a regional level to highlight CIOOS national, as well as to cross-promote the Regional Associations	CC
<b>1.1.3.</b> Identify priority areas of focus, priority users, and potential new partners at the regional level to engage with e.g. Indigenous governments and organizations, shortlist of other groups of priority focus for engagement	SC
<b>1.4.2.</b> Support Indigenous data sovereignty by exploring partnerships that facilitate best practices for Indigenous data and inform how CIOOS can support the integration of Indigenous metadata	CC, MD
<b>2.1.2.</b> Increase number of datasets and partner organizations from whom CIOOS gets data, outputs, and data products	SC, NWP
<b>2.4.1.</b> Create CIOOS national data assembly centres for centralized and secure management of specialized data types based on user needs and data availability and readiness	SC, TC

## **6.0 Maturing the System**

It is important that as CIOOS develops and tackles new challenges within ocean observing, that we continue to dedicate resources for maintaining and maturing the solution, ensuring we continue to cover all the needs of an operational system. A number of measures should be taken to continuously improve data management and systems infrastructure within CIOOS (further outlined in Appendix 4). Importantly, careful consideration of technical and semantic interoperability will ensure that these data can be used and understood no matter where they are stored or used (OECD, 2017).

In addition to the data management processes outlined in the work packets, CIOOS will ensure data integrity and authenticity, while working to improve workflow efficiency. A top priority will be to assess the completeness of data and of metadata, checking for data alteration or corruption, in addition to tracking data changes, data versioning and data provenance.

To become a mature system, CIOOS will need to define a process to handle data that is currently out of scope. CIOOS will also need to improve specification and implementation of workflows for data integration of physical, biological, model, real-time, and other data types, including data/metadata QC steps. Finally, CIOOS will need to continue to adopt software development and deployment best practices.

## **Appendices**

### **Appendix 1: CIOOS Strategic Plan 2021-2026**

EN <https://cioos.ca/wp-content/uploads/CIOOS-Strategic-Plan.pdf>

FR <https://cioos.ca/wp-content/uploads/SIOOC-Plan-strategique.pdf>

## Appendix 2: Key for Priorities/Responsibilities abbreviations

<b>CIOOS Group</b>	<b>Abbreviation</b>
Communications Committee	CC
Technical Committee	TC
Science Committee	SC
Executive Committee	ExCom
Regional Association	RA
Model Data TT	Model
Metadata TT	MD
Solution Architecture TT	SA
User Experience TT	UX
Data Management Plan TT	DMP
Biological Data TT	BD
Collaborative Development Team	CD

### Appendix 3: Data/figures from CIOOS-wide goal prioritization exercise

The CIOOS community had the opportunity to provide input to determine which of the CIOOS Goals outlined in the Strategic Plan should be a priority for the next two year cycle of CIOOS. The community was asked to give each goal a rating for each of the following questions:

- How important is it to achieve this goal?
- Is this currently within resources?
- Readiness? How simple would it be to move this forward?

#### Ranked order

Responses from the poll were averaged across all questions and sorted from high to low.

Key:

Theme 1	Theme 2	Theme 3	Theme 4
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<b>2.1</b>	Expand data sets available to increase discoverability and accessibility
<b>1.1</b>	<b>Regional partnerships:</b> Strengthen engagement with new and existing regional partners to increase and diversify data holdings, promote usability and provide products and services
<b>3.2</b>	Develop tools to increase the usability and accessibility of the CIOOS user interface
<b>1.2</b>	<b>National partnerships:</b> Promote the work of CIOOS' community of partners at the national level to increase collaboration within CIOOS and across Canadian initiatives
<b>2.3</b>	Develop standardized, reliable methodology for ocean data in Canada which is categorized and developed to improve interoperability
<b>1.4</b>	<b>Indigenous partnerships:</b> Continue ongoing engagement and dialogue with Indigenous governments, organizations and communities to explore best practices for sharing and preserving Indigenous ocean knowledge and data in ways that support Indigenous data sovereignty
<b>3.1</b>	Catalogue, adopt, and adapt tools that enable efficient ingestion and processing of ocean data
<b>2.4</b>	Leverage Regional Associations as national data assembly centres to maximize on regional expertise
<b>3.4</b>	Showcase and share tools, products, and applications developed by end-users to create a valuable knowledge base within CIOOS that builds on itself

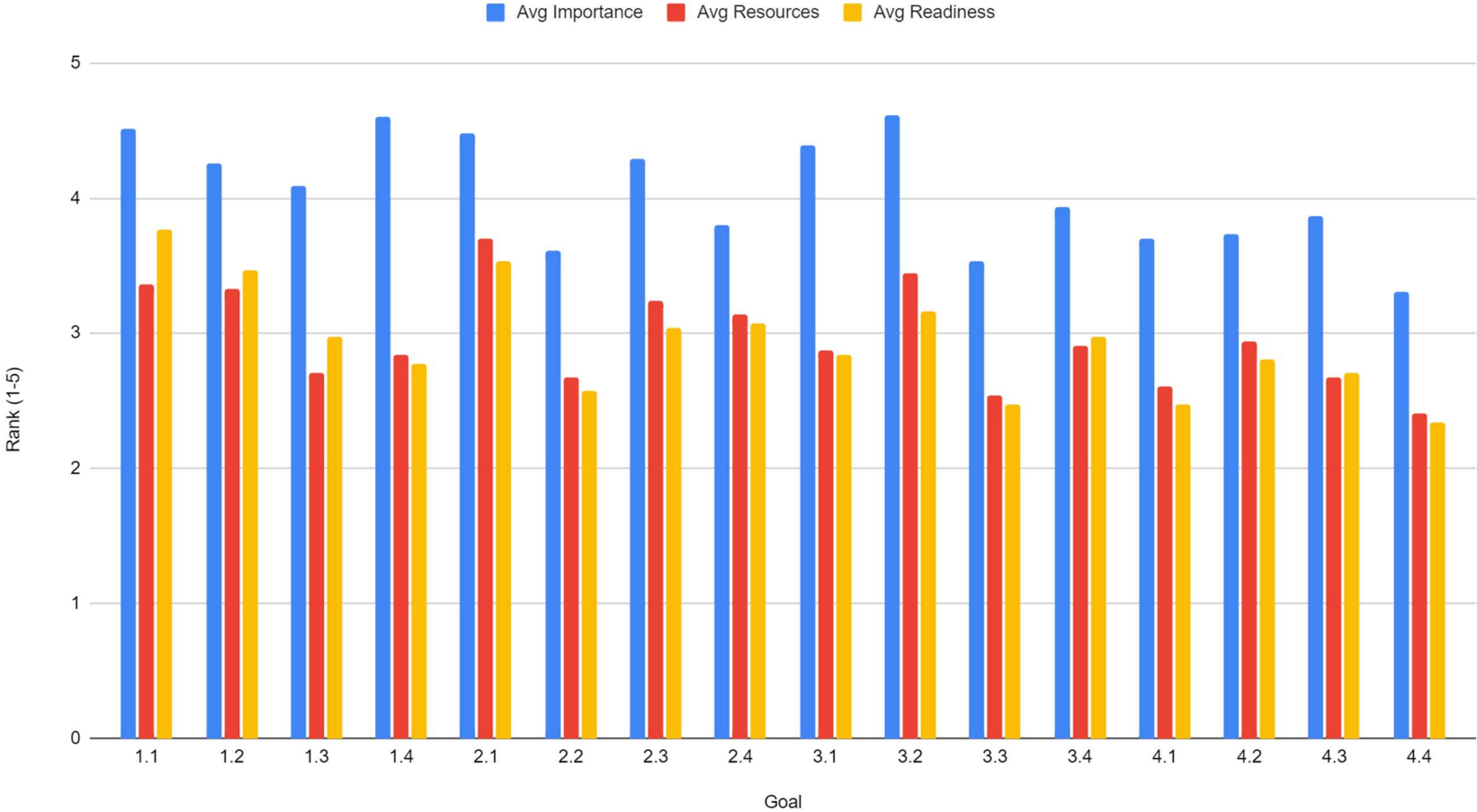
<b>1.3</b>	<b>International partnerships:</b> Represent Canadian ocean observing on a world stage through increasing visibility and expanding international collaborations and partnerships
<b>4.2</b>	Develop CIOOS model metadata standards in order to more efficiently ingest model output data
<b>4.3</b>	Connect modellers with ocean observational data to enable the development, assimilation, and validation of models
<b>2.2</b>	Increase real- and near real-time data sharing to improve forecasting capabilities
<b>4.1</b>	Catalogue models and model standards available regionally and nationally in Canada to increase overall use of model data and support reusability
<b>3.3</b>	Develop tools, products, and applications that are purpose-made for specific end-user groups
<b>4.4</b>	Enable CIOOS partners to develop data products and applications to address model user requirements

#### **Appendix 4: Data Management Plan Matrix**

The operational plan section was based on the matrix developed by the DMP team here:

[https://docs.google.com/spreadsheets/d/1GGfN1Hp4lXBsk7KZdraTqNbYcqkyY\\_Jup3imgKyQdzY/edit#gid=962153571](https://docs.google.com/spreadsheets/d/1GGfN1Hp4lXBsk7KZdraTqNbYcqkyY_Jup3imgKyQdzY/edit#gid=962153571)

### Avg Importance, Avg Resources and Avg Readiness





## References

OECD (2017), "Business models for sustainable research data repositories", *OECD Science, Technology and Industry Policy Papers*, No. 47, OECD Publishing, Paris, <https://doi.org/10.1787/302b12bb-en>