

Coastal and Ocean Data Management Best Practices Final Report



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Introduction

Strong data management practices are essential to drawing accurate and powerful conclusions for coastal and ocean research. COINAtlantic has observed a range of capabilities when it comes to data management practices within environmental non-governmental organizations (ENGOS). Despite data management plans becoming more commonplace, many ENGOS are not given sufficient guidance and training on creating a proper data management strategy. External efforts to assist ENGOS are limited to consultations, scholarly resources, and the development of data tools and programs, often which are aimed at professional data managers. As such, COINAtlantic is engaging in a project aimed at empowering ENGOS to help increase and improve organizational data management capacity for projects in marine and coastal environments. This project seeks to not only understand the needs of the ENGO community, but also develop training materials to concretely build data management capacity. This project was conducted in collaboration with representatives from the Marine Environmental Quality Program from Fisheries and Oceans Canada, and the Clean Foundation.

Community Survey

An online survey was circulated during the preliminary research stage of the project to ensure the project accurately responds to the needs of the ENGO community. The survey results gathered insight on existing knowledge of data management practices and capacity, identified areas of least proficiency and needs going forward, and assessed the level of interest in training material that COINAtlantic can develop. The survey was circulated on behalf of COINAtlantic by the contracted market research firm, Narrative Research. Survey participants included maritime-based ENGOS, and Department of Fisheries and Oceans (DFO) employees working with data related to marine environmental quality.

Survey Results

A total of 27 participated in the survey.

Participants had varying knowledge of data management best practices. The survey found 30% of participants (n = 8) identified as “extremely familiar” with data management best practices. Only 14% of participants (n = 4) identified as “not at all familiar” with data management best practices. The remaining 56% of participants (n = 15) identified between this range with moderate

familiarity. Notably, participants familiar with data management were often more interested in further education on the subject than participants lacking in familiarity.

Approximately 93% of participants (n = 25) stated that their respective organizations conduct projects in collaboration with academia. Approximately 67% of participants (n = 18) share their raw data externally; most often with their network, online data sources, and various levels of government. Not surprisingly, sharing final data is more common than sharing raw data. Approximately 93% of participants (n = 25) share their final project data externally; most often in data reports, and on their organization website. Of note, organizations that are more familiar with data management best practices, and those who are interested in further education, are more likely to report sharing raw data externally with any sources.

Daily data management activities across survey participants show 96% of organizations are involved in reporting, 89% in field work, 81% in data analysis, 78% in making equipment, 70% in data collection, and 18% other tasks. Other tasks, including data sharing and storage, were only mentioned by those who were interested in learning more on the topic and those who expected their data management needs to increase in the future.

Survey participants identified a wide variety of coastal and ocean data types their respective organizations were involved with. Most commonly, water quality and sampling was mentioned by 33% of participants, and species data by 30% of participants. Other coastal and ocean data included fisheries by 19% of participants, coastal research, and ornithological data both by 15%, environmental data by 11%, and habitats, mapping data, and ghost gear all by 7%.

Approximately 30% of participants (n = 8) confirmed their organizations to have a data management policy, and 22% of organizations (n = 6) are in the process of establishing a policy. Of the remaining 41% of organizations (n = 11) that do not have a data management policy in place, 45% of participants pointed to not collecting enough data to benefit from a data management plan, 36% pointed to not having the knowledge to begin development, and 36% pointed to being unsure of the time commitment.

Survey results did not pinpoint a single area of least proficiency among participants. Instead, proficiency levels are dispersed. Among the variety of deficiencies mentioned, 63% of participants attributed their areas of poor proficiency to lack of time, and 50% mentioned lack of knowledge.

Most commonly, 33% of participants indicated that data management helps their organization achieve their strategic objectives by providing their organization with access to quality data.

Meanwhile, 30% attributed data management as an essential component of their research projects. Less commonly, 15% of participants mentioned data management allowing for easier sharing of information, and 7% referenced both promoting their organization's visibility, and helping them to organize and plan. Only 15% of participants mentioned that data management is not helpful for their organization in reaching its strategic objectives and goals.

For the most part, participants are interested in learning more about data management best practices. While 8% of participants (n = 2) express a low level of interest, the majority express some level of interest. Approximately, 59% of participants (n = 16) are "extremely interested" in learning more. The remaining 33% of participants (n = 9) identified between this range with moderate interest. Interest was highest among those who foresee increased data management needs in the future and those whose organizations were already familiar with data management best practices. Participants who were uninterested in learning more indicated their low level of interest is due to time constraints, or not dealing with data regularly.

Participants identify a range of data management resources that their organization would benefit from having. Coastal issues and management, best practices, and technical support were all commonly-mentioned by 11% of participants (n = 3) as data management resources that would benefit their organizations but do not have access to. A smaller 7% of participants also mentioned making data shareable, analytical programs, wildlife and species management, training resources, data storage, and working with databases respectively.

It is highly positive to note that all participants expressed some interest in using a free data management best practices guide. While 67% of participants (n = 18) expressed being moderately likely to use a guide, 34% of participants (n = 9) were highly likely to use a guide. Likelihood in this regard is highest among those who are familiar with data management best practices, those interested in learning more, and those who expect increased data management needs in the future.

Similar to a free data management guide, survey results show a high level of likelihood with regards to participating in a free data management webinar. Approximately 18% of participants (n = 5) identified as having a moderate likelihood of participating. Approximately 29% of participants (n = 8) expressed an extremely high likelihood of participating. The remaining 52% of participants (n = 14) identified between this range with a high likelihood. Once again, likelihood is greater among those whose organization is familiar with data management best practices, and those who are interested in learning more.

Data publishing and data quality management were mentioned by 85% and 78% of participants respectively as areas of interest for education and training. Areas of interest for professional development more commonly include data management plans suggested by 63%, data analysis by 59%, metadata standards by 56%, and data standards by 52%. Areas of interest less commonly include data validation, and data sharing both suggested by 48% of participants; and data preservation, data processing, and data acquisition all suggested by 41% of participants. Perhaps not surprisingly, those who are interested in learning more about data management best practices are more likely to express interest across each of these areas.

Looking to the future, 76% of participants (n = 21) expected their data management needs to increase within the next decade. Participants most commonly mentioned an increase in collecting more data in the future, conducting more research, and a need for improved structure and organization of data. The remaining 22% of participants (n = 6) expected their data management needs to stay the same. No participants expected their needs to decrease.

In closing, a final optional question provided participants with the opportunity to share potential opportunities for improving their organization's data management practices. Of the 13 responses, training resources were most commonly mentioned by 31% of participants (n = 4). Other strategies, including daily improvements, using best practices, funding, and data back-up were evenly suggested by 8% of participants (n = 1).

Survey results suggest that a best practices guide would be valuable in dealing with data management within ENGOs. The majority of participants stated they would be likely to use a data management best practice guide, and further there is existing interest in attending a webinar on the topic. Those whose organization is unfamiliar with data management best practices and those who are uninterested in learning more about data management best practices were most likely to mention that data management does not help their organization.

Narrative Research formatted the survey and ran it through their software and servers. They also gave advice to COINAtlantic through the process of finalizing the list of questions. Their report on the survey results is available on the [COINAtlantic website](#).

Interviews

One-on-one follow-up interviews were conducted with select participants to provide an in-depth explanation on survey responses. Interview participants were selected based on their responses to collect a range of perspectives. Of the seven survey participants contacted, three were available

for an interview. Interviews were semi-structured in nature to guide discussion while allowing for free flowing conversation. Questions were predetermined and tailored to gather a better understanding of the participant organizations’ data management capacity and needs for training materials. Interviews were conducted using the video conference platform, Zoom.

The table provides an overview of the interview questions and responses.

Topic: Data Management Plans	What we heard
*If the participant’s organization does not have a data management plan	
How familiar is your organization with data management plans?	Participants indicated that their respective organizations do not work with any formal data management plan. Any recording of data management practices is at the discretion of the researcher and is not consistent across the organization.
Do you know the typical components of a data management plan?	Participants were unfamiliar with the specific components of a data management plan. Current management practices include typical aspects of data management plans (eg. data storage and sharing); however best practices are unknown.
What barriers prevent your organization from creating a data management plan?	The largest barrier identified by participants was a lack of organizational capacity to begin the process of creating a data management plan. Organizations are restricted by time, skill, resources, and often experience frequent staff turnover.
Are you planning on creating a data management plan in the future?	Participants confirmed that their organization would benefit from a data management plan; however they would need guidance in creating one.
*If the participant’s organization has a data management plan	
What challenges did your organization experience creating a data management plan?	Organizations can experience challenges if there is not a clear understanding of the proposed data management activities. Participants noted that there were limited resources for assistance when creating a data management plan.

How long did the data management plan take to create? Were there any unexpected delays?	As a live document, a data management plan should be continually updated throughout the research project. Participants stated setting up a data management plan requires 48 hours of work. It is important to consider all aspects of the data lifecycle to avoid delays.
What resources did you use when creating the data management plan?	Participants used examples of similar research projects and associated data management plans from other stakeholders to predict their own data management practices.
What resources would help improve the process in the future?	Participants showed a desire for a data information network to provide resources and directories.

Topic: Training Material	What we heard
What type of training and format would best suit your organization?	Participants requested practical training on data management plans, including; how to create a plan and how to maintain it overtime. This information would be best presented through a combination of tailored training sessions and complementary documents. There is also a desire for templates and examples of data management plans as an additional resource.
What is the preferred level of difficulty for a resource?	It is expected that users of a data management resource will already have a base level of knowledge. As such, participants believe that a mid-level resource would be appropriate.
Would your organization benefit from recurring training materials?	Participants showed interest in recurring training materials, stating that their organizations experience frequent staff turnover and believe it would be beneficial to stay updated on new data management best practices.

Webinar Series

COINAtlantic hosted a series of information/training webinars aimed at explaining open data sharing platforms and data management plans. The Webinar Series was based on the progression of topics covered in this Best Practices Guide and the results of the pre-survey. Training sessions included an interactive component to walk attendees through concrete steps to implement and/or

augment data management practices within the participants' own organization. COINAtlantic collaborated with subject matter experts to ensure that the appropriate material is covered in each virtual training session. Webinars were conducted using the video conference platform, Zoom.

Webinar 1: CIOOSAtlantic - Data Discovery and Contribution

As Canada's nucleus for ocean observing, the [Canadian Integrated Ocean Observing System](#) (CIOOS) makes connections for a sustainable ocean future by fostering partnerships and growing a powerful online platform. Through the nation-wide open-access Data Catalogue, [CIOOS Atlantic](#) generates information, knowledge, and place-based solutions to advance our understanding of the ocean. CIOOS Atlantic uses Essential Ocean Variables aligned with the [Global Ocean Observing System \(GOOS\)](#) to help improve the monitoring of key ocean processes. You can contribute your data to CIOOS Atlantic by contacting info@cioosatantic.ca or submitting a form to the [Metadata Entry Tool](#). [Presenters from CIOOS Atlantic](#) included: Jeff Cullis, Technical Director, and Shen Molloy and Alexi Baccardax Westcott, Engagement Specialists. 55 people registered for the webinar, 34 People attended the webinar, and 12 people have watched the recording as of the end of May 2022.

[Watch the recording.](#)

Webinar 2: OBIS - From Nature to Numbers

The [Ocean Biodiversity Information System](#) (OBIS) is a global open-access data and information clearing-house on marine biodiversity for science, conservation, and sustainable development. OBIS works to build and maintain a global alliance that collaborates with scientific communities to facilitate free and open access to ocean biological data. The growing network currently houses over 4000 data sets, and 79,000,000 records, with contributions from 56 countries. You can contribute to OBIS through [OBIS Canada](#). The webinar explained about the process to submit data to OBIS, and many details about OBIS in general were presented by Ward Appeltans, and Pieter Provoost from the [OBIS Secretariat](#). The webinar also provided an explanation of OBIS Canada from the the DFO representative for OBIS Canada, Maria Cornthwaite. 21 people registered for the webinar, 18 People attended the webinar, and 42 people have watched the recording as of the end of May 2022.

[Watch the recording.](#)

Webinar 3: Digital Research Alliance of Canada - Research Data Management from Plan to Preservation

The [Digital Research Alliance of Canada](#) (the Alliance) is a national non-for-profit with the objective of advancing Canada's position as a global leader in research data. Research data management, or RDM, is increasingly recognized as an important part of the research enterprise in all disciplines. With the introduction of the Tri-Agency Research Data Management Policy, and the broad recognition of principles such as FAIR, it's crucial for researchers to understand and adopt good RDM practices. The webinar gave an overview of the essentials of RDM, with tips, resources, and tools provided and explained. Topics included: what is research data management, and why is it important; what is a data management plan, and how can it help you; and, what are some simple but effective steps you can take to manage data now so you are prepared to share or preserve your data later. 24 people registered for the webinar, 16 People attended the webinar, and 16 people have watched the recording as of the end of May 2022.

[Watch the recording.](#)

Best Practices Guide

COINAtlantic created a [Data Management Best Practices Guide for ENGOs](#) by consolidating information assembled from COINAtlantic's Coastal and Ocean Data Management Best Practices Webinar Series, and existing data management tools. Following consultation from the ENGO community, the Guide is a collection of key resources, tailored to address knowledge gaps and support the development and implementation of ocean conservation and management activities. The Guide provides information on the important connections between data management and marine environmental quality. Three resources are presented that can assist ENGOs in the creation of an effective plan for managing research data; data management plans, data management principles, and a resource index.

2-Page Reference Guide

COINAtlantic created a [2-page Reference Guide](#) infographic to complement the Best Practices Guide. The Reference Guide summarizes data management plans and principles for the user and is designed to act as a "quick reminder" for data management best practices that can be easily integrated into workflows to augment data management capacity. It also includes information and links to the Webinar Series. The Reference Guide was distributed to all survey and webinar

participants, as well as on COINAtlantic’s blog and newsletter. The Reference Guide was created using the graphic design platform, Canva.

Final Survey

COINAtlantic developed a post survey to assess the effectiveness of the Best Practices Guide, Webinar Series, and 2-Page Reference Guide. The survey also assessed the desire for future data management best practices for marine environmental quality. Project collaborators from the Clean Foundation and the contracted market research firm, Narrative Research, provided feedback before the survey was distributed. The survey was circulated to all webinar participants, those who had responded to the first survey, and through COINAtlantic’s blog and newsletter. The survey only resulted in four responses which does not allow for an analysis. Two respondents who did participate in one or more webinars indicated that the content was useful. Similar comments were also left in the chat at the end of the webinars, indicating that the webinar content was appreciated.

Recommendations

After completing all activities associated with this project, and consultation with the ENGO community, COINAtlantic has developed four recommendations.

1. **Implement a standard data management plan within the organization.** It is recommended that organizations mandate data management plans to be created and used for all current and future research projects. There are many ENGOs actively involved in coastal and ocean research in Atlantic Canada, all of which require the collection of data. Data use and reuse is optimized when data is appropriately managed using recognized standards and best practices. Implementing a data management strategy ensures that the data can be used to support evidence-based decision making related to Canada’s Oceans.
2. **Support long-term engagement for ENGO data management practices.** Given the current needs of the ENGO community, ongoing engagement and resources are recommended to ensure organizations have established data management best practices. This could include personalized seminars and annual webinars. Adhering to data management best practices is imperative for scientific work supporting ocean conservation and marine environmental quality.
3. **Encourage open data sharing.** Making data discoverable by publishing in data portals is an essential part of data management best practices. ENGOs are encouraged to share data with data repositories to contribute to a holistic view of Canada’s marine environments. Sharing data synergizes research activities happening across the Maritimes region with other initiatives that may also value access to important data and information.

- 4. Follow the FAIR and CARE Principles of data management.** A key component to data management is the comprehensive description of the data and contextual information so that future researchers can discover, use, and interpret the data after time has passed. This is achieved by adhering to the [FAIR Guiding Principles](#) for scientific data management and stewardship, and the [CARE Principles](#) for Indigenous data governance. The FAIR principles provide guidance for ensuring data is Findable, Accessible, Interoperable, and Re-usable. The CARE principles provide guidance for the Collective benefit, Authority to control, Responsibility, and Ethics of the data.

Conclusion

Integrated management of our coastal and marine resources and the advancement of marine spatial planning requires the capacity for all sectors to look at oceans in similar ways. Standardizing data management practices maximizes the ability to make transboundary comparisons. It is important that funding agencies recommend, suggest or even require various levels of data management for their funded projects, following recommendations listed above. An example of an emerging requirement for data management from Federal Canadian Funding agencies is the [Tri-Agency Research Data Management Policy](#) for: the Canadian Institutes of Health Research, the Natural Sciences and Engineering Research Council of Canada, and the Social Sciences and Humanities Research Council of Canada. The policy is being implemented incrementally and will require institutional plans, data management plans, and deposit of all digital research data into a digital repository. Through the initial project survey and follow up interviews we have heard that organizations have various levels of capacity to implement data management. Continued support for increasing capacity is needed. If a requirement for data management is required for funding, it should be noted that the extra cost of time for a data management plan to be written and implemented should be supported in the funding structure.