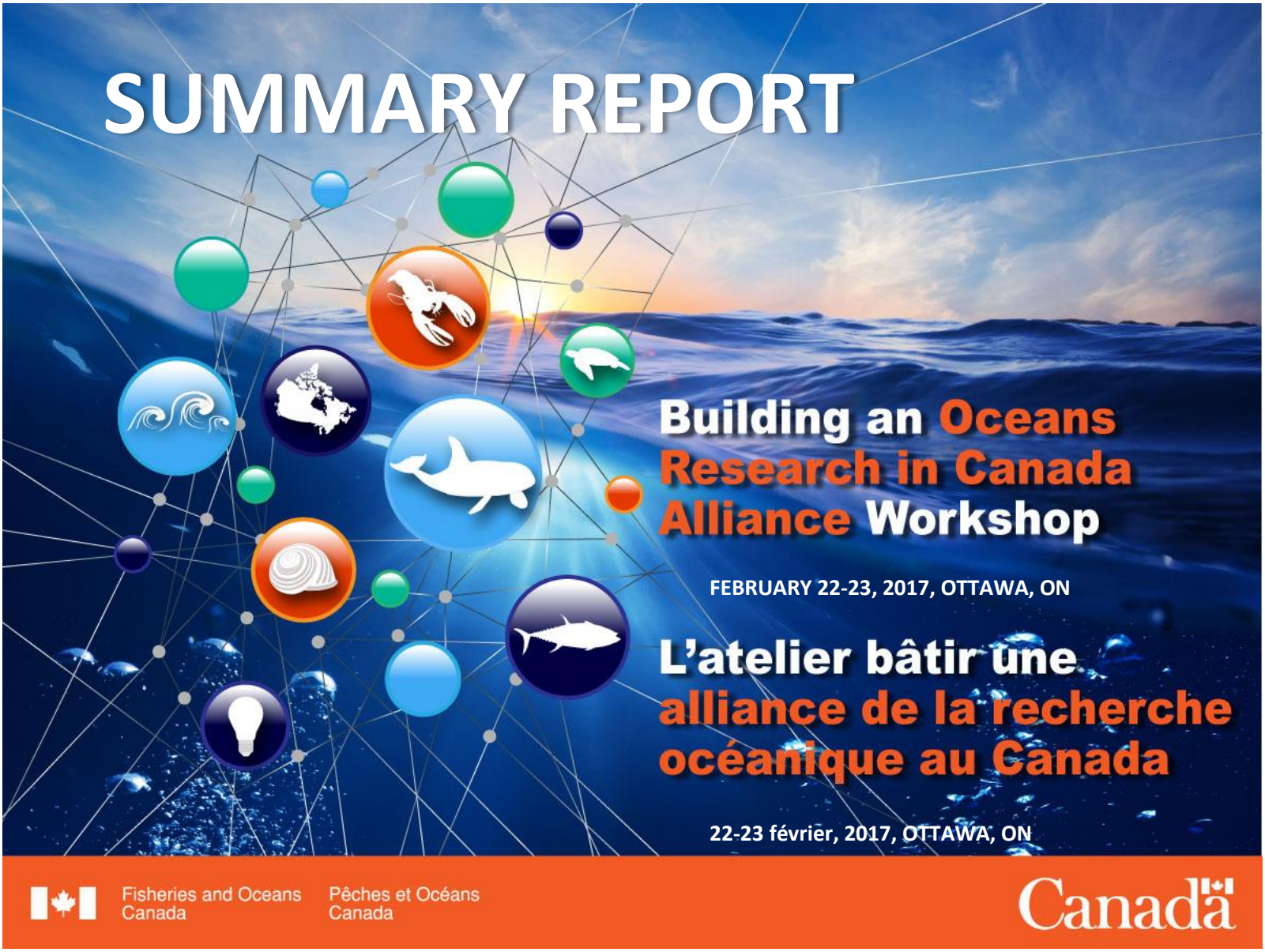
SUMMARY REPORT



PREPARED BY:

Fisheries and Oceans Canada | Pêches et Océans Canada

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Head Office: 300-205 Catherine Street, Ottawa, ON K2P 1C3 | Tel: 613-230-6424 Fax: 613-567-1504
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Executive Summary

In June of 2016, Fisheries and Oceans Canada (DFO) announced the intent to work with Canada's ocean science and technology community to establish an Oceans Research in Canada Alliance (ORCA or "the Alliance"). The decision to establish the ORCA was predicated on dialogue within the ocean science and technology (OST) community on the need for improved coordination of efforts as a result of the Council of Canadian Academies (CCA), *Ocean Science in Canada: Meeting the Challenge, Seizing the Opportunity,* released in 2013.

On February 22 and 23, 2017, DFO convened approximately ninety leaders from the OST community in Ottawa for a two-day Workshop (Appendix A). The objective of the Workshop, *Building an Oceans Research in Canada Alliance*, was to arrive at a suite of tangible initiatives that will help move the community towards coordination of research efforts, programming, and associated infrastructure so that new and on-going Canadian investments in ocean science technology are leveraged for maximum benefit both domestically and abroad.

On day one, experts presented evidence related to the current challenges as well as the opportunities associated with new investments in OST with a view to building a shared understanding of the current state of ocean science and technology in Canada. On day two, participants worked towards the following preliminary "Vision for an Oceans Research in Canada Alliance" and its desired outcomes:

- An entrenched forum for ocean science which serves as the foundation for advancing community interests.
- The government, academic, non-governmental, Indigenous, and private sector OST community is well networked and features a high degree of research mobility, with strong coordination in the sharing of research infrastructure and resources.
- Decision-makers and funders have established or affirmed a long-term political commitment to ocean research, monitoring and conservation programming.
- A cohesive and comprehensive approach to international engagement where Canada has affirmed its leadership role.
- Open science and open data to the advantage or all science players at both the national and international level.
- A more robust, comprehensive evidence base in support of decision-making on Canada's oceans.

Following the articulation of the draft vision, during break-out sessions participants identified concrete initiatives to advance OST coordination in Canada along five key themes. Some of the initiatives spanned more than one theme, but generally, the recommendations initiatives were:

1. **Aligning effort and funding around shared priorities**: To better align priorities and efficiently utilize available resources, participants recommended an inclusive community engagement initiative, a coordination office to communicate government research needs, a five-year funding plan for infrastructure and ocean research, and investments that align with Canadian priorities (i.e. Marine Protected Areas) and opportunities for international collaboration (e.g. the European Union Framework Programme for Research and Innovation).

2. **Infrastructure:** To advance the sharing and efficient use of infrastructure, participants recommended the creation of a national inventory of research expertise, activities, priorities, resources and assets, and the establishment of a working group and forum on multi-organizational infrastructure utilization, funding, and management. The need for a five-year infrastructure and funding plan was reiterated.

3. **Public policy, regulation and decision-making**: To improve the ability of government departments to internalize and harness results of ocean research from the broader community, participants recommended that a policy fellowships program be established, a knowledge mobilization group within government be established and an annual ORCA conference should be held. Creating a culture of communication was also highlighted as an enabling factor to address this issue.

4. **Commercialization of knowledge and technology**: In order to improve the commercialization of ocean knowledge and technology, participants recommended the establishment of a communication and coordination mechanism with small and medium sized enterprises, and the identification of national challenges to be addressed and new marine technologies to be developed and tested through science-engineering cooperation.

5. **International fora**: In order for the Canadian OST community to fully engage in international fora, participants recommended a more coordinated approach supported by a secretariat, and the targeting of specific conferences for Canadian leadership and participation.

A sixth cross-cutting thematic area arose as a result of discussions in which the following initiatives were recommended as foundational/enabling strategies to help to guide the establishment and work of the Alliance:

- Build an inclusive, flexible and resilient ORCA from existing successful models
- Establish and improve regular communication mechanisms and create a culture of communication
- Establish a secretariat to support ORCA
- Develop an ocean data and information strategy to enhance ocean literacy and evidence-based decision making in Canada

Introduction and Context

Purpose of the Workshop

In June of 2016, Fisheries and Oceans Canada (DFO) announced the intent to work with Canada's ocean science and technology community to establish an Oceans Research in Canada Alliance (ORCA). This Alliance of Canada's funders and performers of ocean science and technology (OST) is envisioned as a means of institutionalizing co-operation to improve the coordination of research efforts, programming, and associated infrastructure so that new and on-going Canadian investments in OST are leveraged for maximum benefit both domestically and abroad. On February 22 and 23, 2017, DFO convened approximately ninety leaders (Appendix B) from the Canada's ocean science and technology community in Ottawa, to discuss collectively how an ORCA could improve the overall coordination amongst the community through the identification of tangible forward looking initiatives.

Renewed Investment: Major Investments in Oceans Science and Technology

There is substantial growth in the collective capacity of Canada's OST community as a result of recent federal investments. This capacity presents opportunities for major Canadian scientific achievement to be realized through an integrated, coordinated approach to the management and conduct of OST, such as envisioned with the Alliance. An overview of recent investments in Canadian OST provided context. In 2016, the federal government made the largest investment in aquatic science within government in over a decade, allocating $197 million over five years to DFO. This revitalization created 135 new science positions and designated significant annual amounts for collaborative science with the OST community. This core science investment was augmented with further funds for science and technology within federal science departments supporting initiatives under Canada's $1.5 billion Oceans Protection Plan (OPP). The federal government has also made considerable new and renewed investments in the OST community beyond federal science-based departments and agencies. These investments include $94 million for the establishment of the Ocean Frontier Institute for science relating to the North Atlantic and the Canadian Arctic gateway and funds to Oceans Network Canada, the Oceans Tracking Network, the Canadian Healthy Oceans Network, Laval University's science program aboard CCG *Amundsen,* the academic Canada Research Chairs program among numerous others.

Ocean Science in Canada: Meeting the Challenge, Seizing the Opportunity

The Council of Canadian Academies (CCA) convened a panel of experts to identify ocean science research priorities and assess Canada's capacities and infrastructure gaps associated with those priorities. They published two reports in 2013: *40 Priority Research Questions for Ocean Science in Canada* and *Ocean Science in Canada: Meeting the Challenge, Seizing the Opportunity.* In addition to research priorities and major themes, the executive summary to the latter report identified three gaps in the coordination and alignment of the ocean science community in Canada that required action:

- "**The vision gap**: In contrast to other countries, or other disciplines in Canada, no comprehensive national strategy or vision currently exists for ocean science in Canada. This makes it difficult to prioritize needs and comprehensively plan investments for ocean science.
- **The coordination gap**: Addressing the increasingly complex issues of ocean science requires enhanced collaboration at the local, regional, national, and international levels, and across disciplines and sectors. Despite the many instances of successful collaboration in Canada, coordination in key areas, such as ocean observation, is lacking, and support for research networks has often been constrained by temporary

funding. More generally, there is no effective national-level mechanism to coordinate the allocation of resources and facilitate the sharing of infrastructure and knowledge among ocean scientists. This also hinders the sharing of resources and knowledge at the international level.
- **The information gap**: Limitations in access to, and availability and comparability of, information makes it difficult to assess several categories of ocean science capacity (e.g., the number of active researchers, comprehensive data on research spending, or inventories of large instruments relevant to ocean science)."

In discussing these gaps as well as the ongoing challenges and opportunities identified within these reports, the establishment of an Alliance was affirmed as the mechanism to advance efforts to address a number of these cross-cutting issues.

- Where Canada lacks a common national vision and up-to-date strategy for ocean science, ORCA could develop a national strategy for OST;
- Where Canada is facing a fragmented community, with no national coordination of resource allocation efforts, ORCA could play an interface and coordination role across Canada;
- Where there is an information gap to assess Canadian highly qualified personnel in ocean science and technology, ORCA could collate inventories of university-based networks to provide insights into the intellectual capital.

Vision for the Oceans Research in Canada Alliance (ORCA)

Since the release of the Council of Canadian Academies reports, a vision for a Canadian Alliance, what it would look like, how it would function, and its desired outcomes has been evolving under the leadership of the Canadian Consortium of Ocean Research Universities (CCORU). In addition to being instrumental in advocating for the Council of Canadian Academies reports, CCORU and its members have held an *Ocean Science Roundtable*, a number of workshops, and commissioned the report, *Investigating the Establishment of a Canadian Organization for the Coordination of Ocean Science Activities in Canada.* These efforts and others have informed the following draft vision, tabled at the Workshop as a departure point for further discussion by the community at large:

- An entrenched forum for ocean science which serves as the foundation for advancing community interests.
- The government, academic, non-governmental, Indigenous, and private sector OST community is well networked and features a high degree of research mobility, with strong coordination in the sharing of research infrastructure and resources.
- Decision-makers and funders have established or affirmed a long-term political commitment to ocean research, monitoring and conservation programming.
- A cohesive and comprehensive approach to international engagement where Canada has affirmed its leadership role.
- Open science and open data to the advantage or all science players at both the national and international level.
- A more robust, comprehensive evidence base in support of decision-making on Canada's oceans.

In keeping with the overarching vision, key functions, such as facilitating networking and connectivity, learning and alignment, and acting together with a focus on tangible results were seen as foundational in moving forward with the Alliance. Though DFO convened the Workshop, the Department views the Alliance as a collective enterprise with shared leadership and ownership of the path forward and associated outcomes.

Equally important in discussions shaping the vision for the Alliance is what it is not. The Alliance is not intended to be a lobby group, nor an advisory body to DFO. Additionally, the Alliance is not intended to be a funding mechanism, though it may seek to provide strategic guidance to the community on priorities and coordination of funding.

Recommended Initiatives: A Coordinated Ocean Science and Technology Community

On the second day, participants took part in targeted discussions to develop recommendations on how to build a more coordinated path forward for OST in Canada. Discussions were framed within the context of five key themes (Table 1). The objective of this exercise was to have the Canadian OST community identify tangible initiatives in each of the thematic areas that the Alliance could undertake to improve and advance the coordination of OST in Canada.

Table 1: Key themes and associated questions discussed by participants in targeted Workshop sessions

Theme	Question
1. Funding and Shared Priorities	What do we need to do as a community to align efforts, forward looking plans, and associated funding around common/shared priorities?
2. Infrastructure	What do we need to do to advance the sharing of infrastructure?
3. Public Policy, Regulation and Decision Making	What do we need to do to improve Government departments' ability to internalize/harness the results from ocean science performed outside of Government to inform public policy, regulation, and decision-making?
4. Commercialization of Knowledge and Technology	What do we need to do to strengthen the linkages in the ocean science innovation system that will result in improvements in the commercialization of knowledge and technology?
5. International Fora	What do we need to do to better engage as a Canadian ocean science community with shared purpose and objectives in International fora?

Two concurrent discussions were facilitated to address each question. Participants were asked to describe their preferred future for OST in Canada, as well as to identify key initiatives to realize the preferred future. The preferred future represents strengths, achievements, and impacts that participants hope to see by 2020 and beyond. Initiatives represent tangible actions that are proposed to achieve the preferred future. This summary integrates the input of the two groups that addressed each question. In some cases, responses to different questions yielded similar solutions, reflecting a growing consensus on what needs to be done to improve coordination of OST in Canada.

1. Aligning Efforts, Plans, and Funding Around Shared Priorities

Question

What do we need to do as a community to align efforts, forward looking plans, and associated funding around common/shared priorities?

Preferred Future

The OST community has rallied around a common, inclusive vision that is accepted by members and decision makers. Greater mutual understanding and alignment has facilitated the leveraging of assets. Funding mechanisms for research and infrastructure are more harmonized, and effectively support the sharing and use of infrastructure. Resources (e.g., information and facilities) and costs (e.g., maintenance) are shared. As ORCA facilitates communication and creates closer connections, funding agencies are putting more money into the sector, recognizing the value of increased collaboration. The coordination of research through ORCA, including national and international at-sea efforts, has increased Canada's credibility at international meetings. The public supports ORCA's forward-looking plans, as Canadians become more knowledgeable about the sustainability of our ocean.

Proposed initiatives

In order to achieve this aligned, inclusive, and efficient funding model, the following initiatives were proposed:

I. *Information gathering and gap analysis*

   As a precursor to the initiatives that follow, in order to align efforts, an initial exercise should be undertaken to ensure that the mandates of different groups have been shared and understood by community members and priorities have been aligned and gaps addressed.

II. *Establish a coordinating office to communicate government research needs to non-government researchers, and to identify (and help augment) funding programs for specific government research needs.*

   A coordinating office could maintain an inventory of programs and tools from all partners, recognizing each partner's unique contribution and reducing duplication. A process for incorporating science advice into policy could be initiated.

III. *Launch a community engagement initiative that includes Indigenous communities among key stakeholders*

   An ORCA strategic plan could include OST projects defined by key stakeholders, including Indigenous communities, and an engagement process with regular meetings and town halls to obtain their input at the beginning of research projects. By being more reflective of key stakeholder positions, needs, and interests, the Alliance could benefit from greater support on the part of community stakeholders.

IV. *Develop a five-year funding plan for ocean research and infrastructure*

   A scientific funding model inclusive of asset, community and training needs across ORCA members would ensure alignment between the infrastructure asset envelope and scientific project work, as well as more effective engagement and involvement of Indigenous and community stakeholders.

V. *Strengthen and sustain investments in strategically important areas for Canada, and align funding with calls for international collaborations*

Investment in strategically important areas for Canada, such as the Arctic, should be strengthened and sustained. This could be done through new or existing Networks. ORCA's role could be to provide proactive Canadian leadership; advising funding agencies of research priorities for ocean science. There is a need to identify areas where Canada is leading in research, and focus on these as priorities to make an even greater global impact. The European Union's Framework Programme for Research and Innovation "Horizon2020" is an example of international opportunity for collaboration that could help frame investment in the Canadian context.

VI. *Invest in marine environment hotspots and innovative approaches to the creation of Marine Protected Areas (MPAs).*

This could be a pilot project to demonstrate how ORCA can be a mechanism to connect conservation, economic and social outcomes. Ensuring healthy and productive oceans through the establishment of MPAs is an important priority for Canada, and the government is in the process of establishing more MPAs.

2. Infrastructure

Question

What do we need do to advance the sharing of infrastructure[1]?

Preferred Future

Canada has a long-term plan for world-class ocean infrastructure that is resilient, looking beyond short-term government and political priorities.

A better collaborative process for priority setting, issue identification, and research planning serves to identify infrastructure needs. With new ships on board, the community manages infrastructure in a collective manner. There are shared ocean resources and infrastructure, such as the Canadian High Arctic Research Station (CHARS) being opened by Polar Knowledge Canada in 2017. Stakeholders have a clear understanding of partners' inventories and capacity, and there are effective mechanisms to manage, share and store data. The sharing of infrastructure has triggered productive partnerships. Low cost, creative solutions to infrastructure maximize the value of existing capacity, while continuing to look for improved ways to build new capacity.

Proposed initiatives

In order to achieve this long-term, resilient plan for world-class ocean infrastructure, the following initiatives were proposed:

[1] Infrastructure in this context is understood to include land-based and ocean-based facilities (e.g., research vessels, laboratories, buildings, pilot plants), and data-sharing infrastructure (e.g., specialized equipment and communication networks).

I. Create an accessible national inventory of ocean science research expertise, activities, priorities, resources and assets, with web-based tools to encourage individuals to contribute research and infrastructure information

This inventory could create a common lexicon and tool to do a gap analysis that would enable better multi-organizational planning of science cruises. A searchable online database could be created to identify scientific facilities interested in multi-organizational collaboration, the capabilities and assets possessed by these facilities, and a contact name for further inquiry. As a "one-stop-shop", it would improve access to the diversity of resources of ORCA members, such as data and vessels, and reduce the duplication of research efforts.

Such an open repository of OST resources and products could develop a common understanding of the breadth of the Canadian marine environment, and lead to new collaboration and partnerships. It would require the establishment of transparent standards for access and costing, and a streamlined reservation process. Support and training components also need to be taken into account when involving communities and Indigenous stakeholders. It was suggested that the Canadian Foundation for Innovation (CFI) research navigator system could be extended to federal departments, and considered as a starting point.

II. Make infrastructure an explicit part of the mandate for ORCA, and establish a working group and forum for conversations on infrastructure sharing that would examine innovative mechanisms for multi-organizational infrastructure utilization, funding, and management

Establishing an entrenched forum for scientific collaboration and discussion on infrastructure must form an explicit part of the ORCA mandate. The close involvement of partners is important to address a resource allocation and optimization problem among diverse partners from both governmental and non-governmental entities, with different funding and governance models. ORCA could offer mechanisms for discussion of equipment priorities among a cooperation panel that would identify common infrastructure needs and then purchase equipment. A coordinated process and funding tools could be developed to lease/obtain vessels and vessel time for science missions. Both one-off (highly specific) and broadly based (systemic) solutions should be considered. A short-term result would be more ship time available to do more research.

With respect to joint ownership and/or joint management of infrastructure, a multi-organizational hub concept is being explored at the Bedford Institute of Oceanography (BIO) focused on intelligent marine systems with Natural Resources Canada (NRCAN) and Defence Research and Development Canada (DRDC) as partners.

III. Develop a five-year funding plan for infrastructure and ocean research

A scientific funding model inclusive of asset, community and training needs across ORCA members would ensure alignment between the infrastructure asset envelope and scientific project work, as well as more effective engagement and involvement of Indigenous and community stakeholders.

3. Public Policy, Regulation, and Decision Making

Question

What do we need to do to improve government departments' ability to internalize/harness the results from ocean science performed outside of government to inform public policy, regulation, and decision-making?

Preferred future

Government uses ocean science results generated outside of government as part of its evidence base, and departments have a strategy to internalize how external OST is used to inform policy. Relationships and networks contribute to effective collaborative work and integration between government and external agencies. The Canadian Ice Service (CIS) and the Canadian Space Agency (CSA) relationship is an example of this, where CSA acts as a conduit through which the entire space industry/knowledge domain is accessed. In the future, knowledge sharing mechanisms and efficiencies that already exist between government, industry and the academic sector will be leveraged fully, resulting in high levels of cooperation and trust. University academics also ensure that their research fits within DFO priority areas; that it is aligned with public policy considerations, and the requirements of users from both industry and government. Robust communication systems that include collaborative discussion on priorities, and standards for data access and management, are in place to facilitate community engagement, and the coordination of research needs.

Proposed initiatives

In order to improve the ability of government departments to internalize and harness results of ocean science from the broader community, the following initiatives were proposed:

I. *Set up a policy fellowships program*

   Adjunct opportunities for external researchers within DFO could be expanded, in order to align the research agendas of both federal and non-governmental organizations. Encouraging the movement of scientific personnel between government and academia would build personal relationships and networks across organizational lines, and encourage more alignment of scientific programming/research priorities.

II. *Hold annual ORCA conference where government priorities can be presented along with advances in research.*

   A formal annual event could become a complementary piece of the ORCA infrastructure to meet the objective of synchronizing internal and external science. Another way to describe this is as a coordinated, multi-organizational space where university scientists can work in closer collaboration with DFO scientists, and present results to the DFO community/users. On-demand science panels could assemble all disciplines to answer specific questions such as: “Is climate affecting fishing conditions on the east coast?”

III. *Establish a knowledge mobilization group within government*

   Drawing on the model already in place for social sciences in Canada, knowledge mobilization groups could be established within government to foster information exchange. The creation of an

access point for bringing scientific results to the attention of government that could act as a single window for the reception and direction of knowledge to where it is needed.

Creating a culture of communication was also highlighted as an enabling factor to address this question, and it is discussed further in section 6.

4. Commercialization of Knowledge and Technology

Question

What do we need to do to strengthen the linkages in the ocean science innovation system that will result in improvements in the commercialization of knowledge and technology?

Preferred future

Canada remains a world leader in collecting ocean data. Data are made public in real time; and people are trained to use ocean science data. Open data help to tackle the commercialization issue, by helping to nurture private enterprises that want to conduct research and generate commercial activity in the sector. New technologies deliver advances in science, and create global opportunities for Canadian ocean technology. Industry connects more quickly to researchers with the ability to create knowledge that can be commercialized.

Identified key players in the commercialization of knowledge and technology find creative ways to increase market potential. The engagement and involvement of communities and users of OST have brought resilience to the system. A more resilient ocean science innovation system has also brought new investments. Commercialization to larger markets cycles back to support research and technology in a positive feedback loop.

Enhanced communications and integrated networks that link government departments, provinces, Indigenous organizations, and small and medium enterprises (SMEs) across the country bring attention to national challenges, make better use of existing experts, and also create new career opportunities in OST.

Proposed initiatives

In order to improve the commercialization of knowledge and technology from ocean science, the following initiatives were proposed:

I. *Establish a communications and coordination mechanism between researchers requiring new marine technologies and SME technology developers, to focus on accelerating knowledge transfer and technological development*

A coordination office or knowledge mobilization group should be created to bring scientific results to the attention of government, acting as a single window for the reception, extensive review, and direction of knowledge to where it is needed. Another suggestion is to have a coordinated space where government researchers can work with external scientists to define research questions, organize data collection, manage open access to data, plan work ahead of time, and ensure that products of research are used. This would also respond to theme 1 and theme 3. Similarly, more tangible SME and user involvement through connector events at national hubs would result in more rapid adoption of new technologies by research communities. Making it easier for SMEs to connect with researchers doing work relevant to their business would result in more

commercialization of research, more rapid adoption of new technologies by researchers, better information for decision-making, more jobs and exports, and better environmental conditions.

II. *Identify national challenges in marine technology development*

Taking a long-term, national focus on technologies at the interface of science and engineering, as opposed to individual research initiatives, would allow sufficient time for productive science-engineering collaborations to go from idea to commercialization. Experts should be identified to work on trans-disciplinary projects to address complex issues. This would enhance the sustainable use of ocean resources, and improve marine safety. A focus on grand challenges that includes funding agencies, universities and government departments would develop Canadian leadership in both science and engineering.

III. *Identify new Canadian technologies that can be developed and tested through science-engineering cooperation*

Canada should play a leadership role to initiate, plan and fund international OST ventures. Canada should also be proactive in promoting Canadian technology overseas. For example, ORCA could promote the new Ocean Technology Alliance of Canada (OTAC), which supports companies that refine and perfect ocean technology. Canada is known as the go-to country for ocean sensor technology. OTAC and ORCA could work with SMEs across Canada to develop the technology, and then test it in different environments. The creation of international science programs and globally transferrable information would be valuable Canadian contributions to international science. Thinking ahead to 2020, one of the anticipated successes is for Canada to have created international grad student and post doc positions in projects that focus on OST. This also relates to theme 5.

An ocean data and information strategy was also raised as a crosscutting foundational strategy impacting commercialization, and this is described in section 6 below.

5. International Fora

Question

What do we need to do to better engage as a Canadian ocean science community with shared purpose and objectives in international fora?

Preferred Future

Canada is well represented by experts at key international fora, and speaks with one voice that represents the vision of the ocean community. Opportunities to participate in conferences and meetings are identified, prioritized, and coordinated. ORCA engages with other groups within Canada and with Global Affairs Canada to identify entry points into a few select meetings, and ensure optimal representation. Canadian ocean research priorities inform and shape international engagements (i.e. with networks like the International Council for the Exploration of the Sea (ICES) and the North Pacific Marine Science Organization (PICES)).

ORCA plays a leadership role to coordinate national participation in the international Our Ocean conferences. Knowledge gained by sending delegates to conferences internationally is disseminated in Canada. Keys to this success are properly funded research priorities and well established connections with

the SME community in Canada. Canadians continue to be sought after as global leaders and partners in international projects. ORCA works with leaders from both developed and developing nations to develop shared resources on big-ticket research initiatives.

Proposed initiatives

In order to enable the OST community to fully engage internationally, the following initiatives were proposed:

I. *Develop a coordinated approach to participation in international fora by prioritizing entry points, building an engagement calendar, engaging all relevant departments (including Global Affairs), and disseminating information to target audiences*

In consultation with the broader science community, and with the collaboration of science-based departments and agencies, create an International ORCA Secretariat that would help to identify how Canadian and international research and priorities are connected. This would be a starting point to build an engagement calendar to participate strategically in international fora. Specific milestones in the establishment of the Secretariat could include the development of a calendar of events, a website or social media communications, a marketing strategy to establish joint ventures, and proposals to obtain extra resources, as needed.

This initiative would give Canada a stronger global voice, with both developed and developing nations and boost Canada's ranking in terms of international impact. More consistent messaging and broader dissemination of OST information would reach the general public, who would care more about having a sustainable global ocean. Efficiencies gained from better coordination and information sharing between industry, government and university scientists, within Canada and internationally, would help Canada to capture a greater part of the global ocean economy. Success could be evaluated by increased numbers of co-publications, co-patents, and international collaborations.

ORCA could also play a leadership role in identifying new Canadian technologies which could be promoted internationally.

II. *Send delegates to international fora such as ICES, PICES and Our Ocean conference. Propose that Canada host Our Ocean conference in 2020 - after Malta, Indonesia, and Norway.*

To maximize impact on international positions related to ocean science management, Canada could sponsor an international ocean conference in Canada such as ICES, PICES or Our Ocean conference. This would bring in international expertise, improve engagement, and shine light on what Canadians can do to resolve the world's ocean challenges.

6. Foundational and Enabling Strategies

Guiding principles and fundamental elements necessary for the successful evolution of the Alliance emerged from the discussions. The importance of incorporating the following elements was reflected in initiatives cutting across all five main themes of the Workshop:

- Alignment
- Inclusivity
- Organization
- Open data

- Communication
- Resilience

To reflect these overarching principles, the following initiatives, identified by participants, are presented as foundational and enabling strategies that can help to guide the implementation of the ORCA:

I. Build an inclusive, flexible and resilient ORCA from existing models, starting with terms of reference

Existing models (e.g., Réseau Québec Maritime, Canadian Fisheries Research Network, Canada Networks Centres of Excellence, JPI Oceans, etc) should be studied to assess the factors that maximize returns, and create terms of reference for an inclusive ORCA model.

II. Establish and improve regular communication mechanisms and create a culture of communication

Establish regular communications between government departments, Indigenous ocean science organizations, universities and non-governmental organizations to foster the integration of knowledge and skills of all stakeholders to support decision-making. An improved culture of communication would support the coordination of "big picture" innovative opportunities instead of piece-meal projects.

III. Establish a Secretariat to support ORCA

Establish a secretariat to support ORCA in its collaboration, integration, networking, and data sharing efforts.

IV. Develop an ocean data and information strategy to enhance ocean literacy and evidence-based decision making in Canada

This initiative would bring together a broad user community to define user information needs, and strategies to meet those needs: from open data to modeling to analytics. Participants would include academia, government departments, coastal/Indigenous communities, SMEs and larger enterprises. Stronger user involvement would make science more relevant and resilient. An ocean data and information strategy, built on an open data concept, would support public policy, infrastructure, and commercialization.

The final plenary session at the Workshop included a discussion identifying the proposed initiatives that were "quick start items": items that are both essential to moving forward with an ORCA and important to begin as soon as possible. The group identified the establishment of an ORCA Secretariat (coordination, support and communication functions), the engagement of Indigenous stakeholders, the inventory and gap analysis of infrastructure, the development of an ocean data and information strategy, and the analysis of current Canadian engagement in international fora as "quick start items" for ORCA.

Conclusion

This Workshop resulted in greater cohesion and clarity around a shared community vision, a preferred future, as well as a number of highly tractable ideas and suggestions for initiatives in moving the community towards improved coordination. It is evident that the Canadian OST community is committed to moving forward together, in a more coordinated and strategic way. Building on this momentum, DFO committed to continuing

to facilitate OST dialogue with a view to bringing greater precision to the establishment of the Alliance and its work plan.

Appendix A – Workshop Agenda

Fisheries and Oceans Canada | Pêches et Océans Canada

Building an Oceans Research in Canada Alliance Workshop

February 22 & 23, 2017

The Ottawa Conference and Event Centre

200 Coventry Road

Ottawa, Ontario

February 22

12:00 – 1:00	**Registration**	*Atrium*
1:00 – 1:15	**Welcome to Algonquin Territory** • Algonquin representative, Verna McGregor	*Room 118 ABC*
1:15 – 1:35	**Introduction** • Trevor Swerdfager, Assistant Deputy Minister, Ecosystems and Oceans Science, Fisheries and Oceans Canada	*Room 118 ABC*
1:35 – 2:00	**Opening Remarks** • Catherine Blewett, Deputy Minister, Fisheries and Oceans Canada • Kelly Gillis, Associate Deputy Minister, Innovation, Science and Economic Development Canada	*Room 118 ABC*
2:00 – 2:40	**Renewed Investment: Examples of Recent Major Investments in Ocean Sciences** The Ocean Protection Plan (OPP) • Trevor Swerdfager, Assistant Deputy Minister, Ecosystems and Oceans Science, Fisheries and Oceans Canada The Ocean Frontier Institute (OFI) • Wendy Watson-Wright, Chief Executive Officer	*Room 118 ABC*
2:40 – 3:00	**Break**	*Room 118 ABC*

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Fisheries and Oceans Canada | Pêches et Océans Canada

Building an Oceans Research in Canada Alliance Workshop

February 22 & 23, 2017

The Ottawa Conference and Event Centre

200 Coventry Road

Ottawa, Ontario

3:00 - 3:30	**The Problématique: Ocean Science in Canada: Meeting the Challenge, Seizing the Opportunity** • Louis Fortier, Université Laval, Québec	*Room 118 ABC*
3:30 – 4:00	**Interactive Session** • Facilitated session providing an opportunity for participants to interact with speakers, ask questions of clarification, and engage with other participants at their tables	*Room 118 ABC*
4:30 – 6:30	**Reception: Meet and Greet**	*Room 106D*

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Fisheries and Oceans Canada | Pêches et Océans Canada

Building an Oceans Research in Canada Alliance Workshop

February 22 & 23, 2017

The Ottawa Conference and Event Centre

200 Coventry Road

Ottawa, Ontario

February 23

8:00 – 9:00	**Light Breakfast**	*Room 118 ABC*
9:00 – 9:15	**Welcome to Day 2**	*Room 118 ABC*
9:15 – 9:45	**The Vision: An Oceans Research in Canada Alliance (ORCA)** • Martha Crago, Chair, Canadian Consortium of Ocean Research Universities (CCORU) • Trevor Swerdfager, Assistant Deputy Minister, Ecosystem and Oceans Science, Fisheries and Oceans Canada	*Room 118 ABC*
9:45 – 10:15	**Interactive Session** • Facilitated session providing an opportunity for participants to ask questions and to develop a common understanding of the vision for ORCA and the expectations of the break-out sessions	*Room 118 ABC*
10:15 – 10:30	**Break**	*Room 118 ABC*
10:30 – 12:00	**Arriving at a Work Plan for the Oceans Research in Canada Alliance (ORCA)** **Break-out Sessions:** Identify tangible initiatives in each of the assigned questions that the Alliance could undertake to improve and advance the coordination of ocean science and technology in Canada **Question 1:** What do we do as a community to align efforts, forward looking plans, and associated **funding** around **common/shared priorities**?	*(Rooms 209, 210, 211, 212 and 214)*

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	Question 2: What can we do to advance the sharing of **infrastructure?** **Question 3:** How do Government departments improve their ability to internalize/harness the results from ocean science performed outside of Government to inform **public policy, regulation, and decisions-making?** **Question 4:** What needs to happen to strengthen the linkages in the ocean science innovation system that will result in improvements in the **commercialization of knowledge and technology?** **Question 5:** How do we better engage as a Canadian ocean science community with shared purpose and objectives in **International fora?**	
12:00 – 1:00	**Lunch**	*Room 118 ABC*
1:00 – 2:15	**Arriving at a Work Plan for the Oceans Research in Canada Alliance (ORCA)** **Continue Break-out Sessions**	(*Rooms 209, 210, 211, 212 and 214*)
2:15 - 2:30	**Break**	*Room 118 ABC*
2:30 – 3:45	**Plenary: Roll-up Discussion of ORCA Work Plan** • Presentation and discussion of tangible initiatives identified in the	*Room 118 ABC*

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	break-out sessions	
3:45 – 4:00	**Closing Remarks**	*Room 118 ABC*

Appendix B – Participants List

Building an Oceans Research in Canada Alliance Workshop

February 22-23, 2017, Ottawa

Last Name	First Name	Title and Affiliation
Blais	Marie-Josee	Assistant Deputy Minister, Science and Innovation sector, Ministry of Economy, Science and Innovation, Government of Quebec
Bonnell	Carey	Head, School of Fisheries, Marine Institute, Memorial University
Brown	Craig	Research Scientist, Nova Scotia Community College
Brunet	Gilbert	Director, Meteorological Research Division, Science and Technology Branch, Environment and Climate Change Canada
Burns	David	Vice-President of Research, University of New Brunswick
Burt	Helen	Vice-President Research , University of British Columbia
Carr	Jon	Executive Director, Research & Environment, Atlantic Salmon Federation
Castle	David	Vice-President Research, University of Victoria
Charbonneau	Sylvain	Associate Vice-President, Research, University of Ottawa
Courtemanche	David	Director, MERINOV
Courtenay	Simon	Scientific Director, Canadian Water Network; Science Director, Canadian Rivers Institute; Professor, University of Waterloo
Crago	Martha	Vice-President Research, Dalhousie University, Canadian Consortium of Ocean Research Universities
Critchley	Jacques	Senior Program Officer, Research Grants and Partnerships Division , Social Sciences and Humanities Research Council of Canada (SSHRC)
Cunsolo	Ashlee	Director, Labrador Institute of Memorial University
Day	Andrew	Vice-President, Vancouver Aquarium; Executive Director, Coastal Ocean Research Institute
de Lafontaine	Yves	Regional Director of Science, Quebec, Department of Fisheries and Oceans
Forest	Alexandre	Marine Research Manager, Amundsen Science
Fortier	Louis	Scientific Director, ArcticNet
Fortier	Martin	Executive Director of Sentinel North and Assistant to the Vice-Rector Research and Innovation, Université Laval
Frid	Alejandro	Science Coordinator, Central Coast Indigenous Resource Alliance
Giangioppi	Martine	Senior Arctic Marine Conservation Specialist, World Wildlife Fund Canada
Giguère	Noémie	Chief Executive Officer, Technopole Maritime du Québec
Graham	Mark	Canadian Museum of Nature
Hamelin	Bettina	Vice-President, Research Partnerships Directorate, Natural Science and Engineering Research Council (NSERC)
Hanlon	Jim	CEO, Institute for Ocean Research Enterprise
Harrison	Peter	Professor Emeritus, Queen's University
Hill	Paul	Departmental Chair, Oceanography, Dalhousie University
Hogan	Cathy	Executive Director, OceansAdvance
Iverson	Sara	Scientific Director, Ocean Tracking Network (OTN)
Jackson	David	Director, Canadian Ice Service
Jayas	Digvir S.	Vice-President, Research and International, University of Manitoba
Juniper	Kim	Chief Scientist, Ocean Networks Canada (ONC)
Lambert	Catherine	Executive Director, The Mi'gmaq Maliseet Aboriginal Fisheries Management Association

Koizumi		(MMAFMA)
Lebel	Daniel	Director General, Geological Survey of Canada, Natural Resources Canada
Leclair	Alain	Director, Science & Technology Research, Polar Knowledge Canada
Leslie	Megan	Vice President Oceans, World Wildlife Fund Canada
Leslie	Stefan	Executive Director, Marine Environmental Observation, Prediction and Response Network (MEOPAR)
Levesque	Guy	Vice-President, Programs and Performance, Canada Foundation for Innovation (CFI)
Locke	Stephen	Director - Atlantic, Geological Survey of Canada, Natural Resources Canada
MacDougall	Lesley	Science Advisor, Pacific, Department of Fisheries and Oceans
MacKinnon	Anne-Margaret	Manager, Aquatic Health Division, Gulf Region, Department of Fisheries and Oceans
Mate	David	Director, Science and Technology Operations, Polar Knowledge Canada
McCallum	Barry	Regional Director of Science, NL, Department of Fisheries and Oceans
McLean	Scott	Director, Innovation Centre, Ocean Networks Canada (ONC)
McPherson	Arran	Director General, Ecosystem Science, Department of Fisheries and Oceans
Moore	Wayne	Director General, Strategic and Regulatory Science Directorate, Department of Fisheries and Oceans
Moorman	David	Senior Advisor, Policy and Planning, Canada Foundation for Innovation (CFI)
Moran	Kate	President and Chief Executive Officer, Ocean Networks Canada (ONC)
Munro	Geoff	Chair, Ocean Frontier Institute, Excellence, Impact and Engagement Committee
Myers	Paul	Professor in the Department of Earth and Atmospheric Sciences, University of Alberta
Nightingale	John	President and CEO, Vancouver Aquarium
Pakhomov	Evgeny	Director, Institute of Oceans and Fisheries, Department of Earth, Ocean & Atmospheric Science, University of British Columbia
Pirenne	Benoit	Director of User Engagement, Ocean Networks Canada
Plourde	Ariane	Director, Institut des sciences de la mer de Rimouski (ISMER)
Point	Jordan	Executive Director, First Nations Fisheries Council of British Columbia
Rangeley	Robert	Director of Science, Oceana Canada
Rogers	Sean	Associate Professor, Biological Sciences, University of Calgary
Saunders	Mark	North Pacific Anadromous Fish Commission (NPAFC)
Schimnowski	Adrian	Chief Executive Officer/Operations Director, Arctic Research Foundation
Seube	Nicolas	Scientific Director, Interdisciplinary Center for the Development of Ocean Mapping (CIDCO) and Chair Canada Ocean Mapping Education and Research Network (COMREN)
Siron	Robert	Director Oceanography, Ouranos
Smith	James	Executive Director, Huntsman Marine Science Centre
Snelgrove	Paul	Network Director, Canadian Healthy Oceans Network (CHONe II) Interim Associate Science Director, Ocean Frontier Institute University Research Professor, Memorial University
Snider	James	Vice President Science, World Wildlife Fund Canada
Snook	Jamie	Executive Director, Torngat Wildlife, Plants and Fisheries Secretariat; Torngat Joint Fisheries Board
Stigant	Jessica	Strategic Partnerships Officer, Ocean Networks Canada
St-Onge	Guillaume	Director, Réseau Québec Maritime
Sumaila	Rashid	OceanCanada Partnership, Professor in Fisheries Economics Research Unit; Institute for the Oceans and Fisheries, University of British Columbia
Swerdfager	Trevor	ADM Ecosystems and Ocean Science, Department of Fisheries and Oceans
Taylor	Jeff	Associate Vice-President, Applied Research and Innovation, Nova Scotia Community College
Tessier	Christina	Director General, Canada Science and Technology Museum
Thomas	Mary Ellen	Senior Research Officer, Nunavut Research Institute (Iqaluit)

Thompson	Susan	Manager, Canadian Fisheries Research Network (CFRN)
Tremblay	Jean-Eric	Member, Québec-Océan
van der Molen	Henk	Director of Development, Students on Ice
Vezina	Alain	Regional Director of Science, Maritimes, Department of Fisheries and Oceans
Virc	Stephen	Director, Office of Partnership and Collaboration, Department of Fisheries and Oceans
Wallace	Douglas	Science Director, Marine Environmental Observation Prediction and Response (MEOPAR)
Wang	Feiyue	Canada Research Chair in Arctic Environmental Chemistry, University of Manitoba
Watson-Wright	Wendy	Chief Executive Officer, Ocean Frontier Institute; Dalhousie University
Whoriskey	Frederick	Executive Director, Ocean Tracking Network (OTN)
Wong	Mike	Chair Science Advisory Committee, Canada C3