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EVALUATION OF THE NRC'S OCEAN, COASTAL AND RIVER ENGINEERING RESEARCH CENTRE

Office of Audit and Evaluation

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ABBREVIATIONS AND ACRONYMS

- **ANCP:** Arctic and Northern Challenge Program
- **CASRAS:** Canadian Arctic Shipping Risk Assessment Centre
- **CCA:** Climate Change Adaptation
- **CWB**: Coastal wave basin (OCRE facility, Ottawa, Ontario)
- **CWTT:** Clear water towing tank (OCRE facility, St. John's, Newfoundland and Labrador)
- **DND:** Department of National Defence
- **EDI:** Equality, Diversity and Inclusion
- **FTE:** Full-time equivalent
- **FWCI:** Field-weighted citation index
- **GBA Plus:** Gender-based Analysis Plus
- **HME:** Harsh marine environments
- **HQP:** Highly qualified personnel
- **ISED:** Industry, Science and Economic Development Canada (formerly Industry Canada)
- **IMO:** International Maritime Organization
- **KPIs:** Key performance indicators
- **MASS:** Marine autonomous surface shipping
- **MOU:** Memorandum of understanding
- **MUNL:** Memorial University of Newfoundland and Labrador (St. John's, Canada)
- **NRC:** National Research Council Canada
- **OAE:** Office of Audit and Evaluation
- **OCRE:** Ocean, Costal and River Engineering Research Centre
- **OEB:** Offshore engineering basin (OCRE facility, St. John's, Newfoundland and Labrador)
- **OGD:** Other government departments (Canadian federal)
- **OSC:** Ocean Supercluster Program
- **PRC:** Peer review committee (Convened for evaluation)
- **PSES:** Public Service Employee Survey
- **RCAB:** Research Centre Advisory Board
- **R&D:** Research and development
- **SME:** Small- to medium-sized enterprise
- **TC:** Transport Canada
- **UNDRIP:** United Nations Declaration on the Rights of Indigenous Peoples
- **U of O:** University of Ottawa (Ottawa, Canada)

INTRODUCTION • OCEAN, COASTAL AND RIVER ENGINEEERING RESEARCH CENTRE

The evaluation of the National Research Council (NRC)'s Ocean, Coastal and River Engineering Research Centre (OCRE) covered the period of 2015-16 to 2020-21. It assessed the research centre's impact, scientific excellence, relevance, engagement, and capabilities. It used a mixed-methods approach including data and document reviews, external and internal interviews and an expert peer review committee.

INTRODUCTION

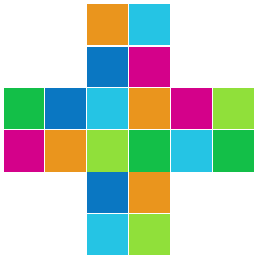
The evaluation of the NRC's Ocean, Coastal and River Engineering Research Centre (OCRE) covered the period of 2015-16 to 2020-21. It was carried out in accordance with the NRC's approved evaluation plan and the Treasury Board Secretariat's Policy on Results (2016). The research centre was last evaluated in 2015-2016.

This report begins by providing a profile of OCRE. It then presents the evaluation findings on the impact, scientific excellence, relevance, engagement, and capabilities of the research centre. Following the evaluation findings are 4 recommendations for improvements.

In this report, you will see the following symbols:

This symbol indicates information that is useful to know to help understand the findings.

This symbol indicates a quote that helps illustrate or support the main findings.



This symbol indicates information that supports equity, diversity and inclusion, and Gender-based Analysis Plus (GBA Plus) (i.e., factors that illustrate how diverse groups may experience policies, programs and initiatives).

Source(s): These are the methods from which the findings are drawn. The sources are listed at the bottom of each page.

EVALUATION APPROACH

Approach

This evaluation used a mixed-methods approach, incorporating qualitative and quantitative lines of evidence, including a peer review committee (PRC) of nationally and internationally recognized experts. The peer review was conducted virtually and took a focused approach, addressing the 3 evaluation questions on achieved or expected results, engagement and scientific excellence. Other lines of evidence included data and document reviews, and interviews with internal and external sources. A gender-based and diversity lens was also applied throughout the evaluation.

Concurrent or recent studies

Note that other studies or reviews were conducted around the same time as the evaluation. Findings and direction from these initiatives' final reports are included throughout this evaluation. These studies, in order of completion, include:

- Ocean Program Expert Panel, including external peer review, (2019-20)
- Positioning OCRE for Growth: Branding Exercise, Consultant, (2020-21)
- Project to Examine Business Model Options, Consultant (2020-21)
- NRC Facilities Review, informed by external peer review (2019-20 to 2020-21)
- Market and Impact Study: Climate Change Adaptation Services, Consultant (2020-21 to 2021-22)

Evaluation questions

1. To what extent has the research centre achieved or contributed to its expected results, including government policy solutions, business innovation, and environmental and social impacts?
2. To what extent is the research centre a leader in scientific excellence?
3. Is the research centre focused in the right areas?
4. Has the research centre engaged the most appropriate clients and collaborators in the most effective ways?
5. To what extent does the research centre have the resources (capacities, competencies, and facilities) to achieve its objectives and sustain its operations moving forward?

   a) To what extent are key performance indicators and targets appropriate given research centre objectives and resources?

Interested in the NRC's evaluation methodology? For more detailed information on the methods used by the NRC's Office of Audit and Evaluation (OAE), including limitations and mitigations, and PRC member biographies, refer to Appendix A.

PROFILE • OCEAN, COASTAL AND RIVER ENGINEEERING RESEARCH CENTRE

The Ocean, Coastal and River Engineering Research Centre is a research, development, test and evaluation centre of excellence in safety and performance of marine systems and infrastructure in harsh environments. With a staff of approximately 100, it works with industry, academia, and other government departments to develop next-generation marine transportation, improve the resilience of Canadian coastal infrastructure and waterways from the impacts of climate change, and develop sustainable technologies in harsh marine environments for the benefit of Canada’s economy and environment.

OCRE OVERVIEW

Vision: Enable safe and resilient ocean and freshwater infrastructure and environments for Canada.

Mission: Working with industry, academia, and governments to expand scientific knowledge through research leading to the development of sustainable technologies deployed in hash marine environments (HME) for the benefit of Canada's economy and environment.

OCRE was established in November 2012 through the merger of the NRC's Canadian Hydraulics Centre in Ottawa, Ontario, and its Institute for Ocean Technology in St. John's, Newfoundland and Labrador.

OCRE aims to be recognized as a global research leader for novel engineering solutions in HME characterized by ice, waves, cold and wind. **Broadly speaking, OCRE works towards 3 strategic goals.** It hosts 1 research program, the Ocean Program, which complements Industry, Science and Economic Development Canada's (ISED) Ocean Supercluster (OSC) Program. OCRE formerly hosted the Arctic Program. That program has been replaced by the Arctic and Northern Challenge Program (ANCP), which is hosted outside of OCRE due to its broader thematic focus.

OCRE's strategic goals

Strategic goals	Strategic actions
1. OCRE is recognized as a leader in the development of next generation marine transportation in Canada	• Develop technologies to facilitate autonomous shipping in Canada's harsh environment and ice-covered waters • Participate in and drive future regulatory frameworks • Reduce ship emissions and improve efficiencies by applying artificial intelligence (AI) to the interpretation of vessel operational data • Mitigate effects of ship underwater radiated noise using numerical prediction models
2. OCRE-developed models and designs help ensure Canadian coastal infrastructure and waterways are more resilient to the impacts of climate change	• Characterize and develop a better understanding of harsh environments • Develop resilient, intelligent and connected, coastal infrastructure • Physically (tanks) and digitally represent coastal processes and infrastructure to adapt and optimize design for climate change resilience
3. Digital models representing harsh marine environments are developed to improve operational safety and efficiency for marine based assets and technologies	• Develop extensive expertise in AI for modelling and predicting ice and harsh environments • Build comprehensive databases of environmental parameters (tank, field, numerical) • Develop required hardware infrastructure and partnerships to enable large-scale numerical and AI projects and programs

See **OCRE's logic model** in Appendix B for how these goals are achieved.

Source(s): 2019-2024 OCRE Strategic Plan and Management Toolkit

FACILITIES AND LOCATIONS

Facilities in Ottawa, ON, and St. John's, NL

OCRE's facilities are located in Ottawa, Ontario and St. John's, Newfoundland and Labrador. The St. John's facility is located adjacent to the campus of Memorial University of Newfoundland and Labrador (MUNL). Most of the Marine Transport directorate staff work in St. John's, while most Climate Resilience directorate staff are located in Ottawa.

St. John's, Newfoundland and Labrador

- Clear Water Towing Tank (CWTT)*
- Large Ice Tank (90m)
- Offshore Engineering Basin (OEB)*
- Cavitation Tunnel **

Shared Facilities

- Karluk Collaboration Space (MUNL / NRC)

Ottawa, Ontario

- Coastal Wave Basin**
- Flumes (Large wave, steel wave, and high-discharge)**
- Large Area Basin
- Multidirectional Wave Basin
- Small Ice Tank (21m)**

Facilities needing investment or new directions

* Per the NRC Facilities Review, these facilities are of high strategic value to the NRC. They need significant investments in order to support new opportunities identified by the research centre.

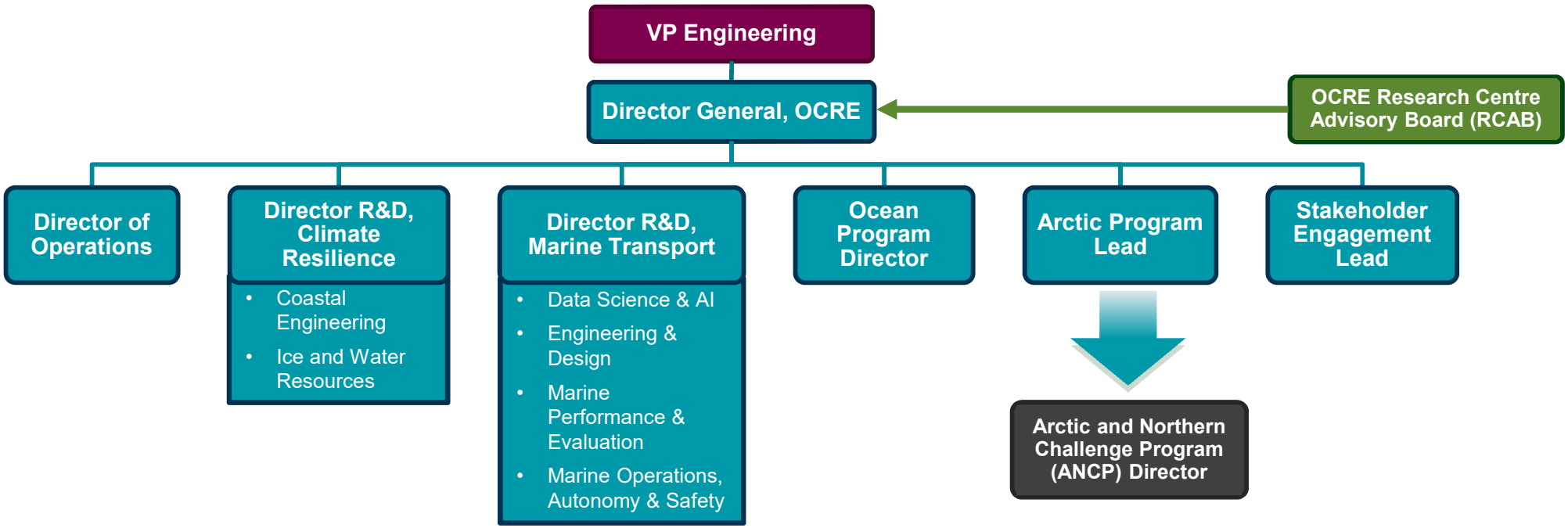
** These facilities generate less demand or are underutilized relative to international comparators. OCRE needs to make plans for co-investment, divestment, or re-orientation towards new research directions.

The **NRC Facilities Review** was conducted over the latter half of the evaluation period. Internal perspectives were complemented by external peer reviews to assess the value of the NRC's facilities and provide recommendations for renewal and investment planning.

Source(s): Data and document reviews, external and internal interviews

OCRE MANAGEMENT

Figure 1. OCRE's organizational structure



Note that in 2021-22 the **Arctic Program** will end. The **ANCP** will be administered external to OCRE, although the research centre will support relevant projects.

OCRE obtains strategic guidance from its **Research Centre Advisory Board (RCAB)**, which comprises 8 members from government, academia, research, and industry. RCAB members provide independent and neutral advice to OCRE's Director General.

Source(s): Data and document reviews

HUMAN RESOURCES AND DEMOGRAPHICS

OCRE added management, research and student capacity, 2015-16 to 2020-21

5 Management
(+2)

53 Research Officers
(+5)

32 Technical Officers
(no change)

7 Administration
(no change)

23 Students and Research Associates
(+12)

- As of April 1, 2021, OCRE employed 97 full-time equivalents (FTEs) and hosted an additional 22 co-op students and research associates. This was an increase, particularly for students, compared to the time of the last evaluation in 2015-16 (see Appendix C for annual figures).
- OCRE is near its overall target for representation of women, and in fact exceeded sub-targets for management, administrative, and senior clerical roles. The research centre has room to improve among its research and technical officers.

OCRE near target for representation of women, but lagging other targets

Employment Equity Group	2016-17		2020-21	
	Target	Actual	Target	Actual
Women	21%	18%	23%	21% (+3%)
Aboriginal people	1%	*	2%	*
Persons with disabilities	4%	*	8%	*
Visible minorities	22%	10%	25%	12% (+2%)

Note: 2016-17 was used as a baseline as earlier data were not available. Targets are based on labour market availability, which derives from the Census (2011, 2016) and Canadian Survey on Disability (2012, 2017).

*Figures representing 5 staff or less are redacted due to self-identification confidentiality rules. HR branch confirms Aboriginal people and persons with disabilities were under-represented among OCRE staff.

Source(s): Data review, document review, facilities review, and external and internal interviews

FINANCIAL RESOURCES

Revenues and expenses

- Throughout the evaluation period, OCRE had expenditures totaling $126.5 million and generated $45.2 million in revenues. OCRE earned an average of $7.5 million per year, while expenses averaged at $21.1 million per year.
- The majority (68%) of OCRE's earned revenues were generated through technical service projects while the remainder are attributable to strategic research and development (R&D) projects.
- The majority (59%) of OCRE's expenditures were for human resources, including direct labour costs for OCRE programs and projects, and indirect salary expenses for non-salary work.
- Minor capital investments accounted for 4% of expenditures and consisted of specific investments under $350k, including repairs or upgrades to existing equipment or relatively small new purchases. Other costs (37%) included ongoing facility expenses and operating costs.
- OCRE facilities also received $8.9 million in major capital investment as part of the NRC's Investment Plan. These investments are separate from research centre budgets and exceed $350k.

What is strategic R&D vs technical services? Strategic R&D consists of collaborative research projects undertaken with partners to de-risk R&D and accelerate commercial development timelines. Technical services consist of projects that assist clients in solving immediate technical problems (e.g., testing and certifications, prototyping, demonstrations, scale-up).

Figure 2. Human resources up while minor capital and other costs down

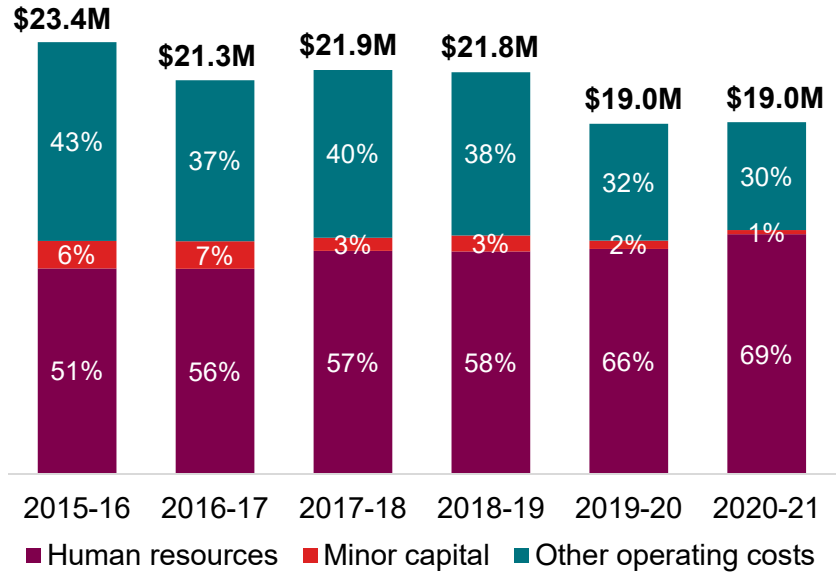
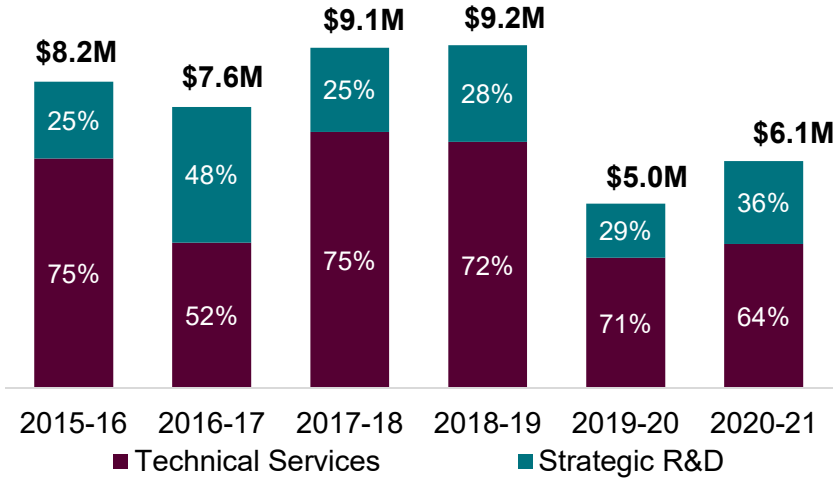


Figure 3. Most revenues earned from technical services



Source(s): Data review

CLIENTS AND COLLABORATORS

OCRE's clients and collaborators included other government departments, industry, academia and others.

Other government departments (OGDs) including 13 federal clients, most notably National Defence, Natural Resources Canada, Transport Canada, and Fisheries and Oceans Canada

- 158 projects: 66% technical services, 34% strategic R&D
- $24 million in revenues

Industry including 52 Canadian businesses and 18 foreign businesses

- 81 projects (Canadian): 81% technical services, 19% strategic R&D
- 27 projects (foreign): 89% technical services, 11% strategic R&D
- $18.4 million in total revenues (62% Canadian industry, 38% foreign industry)

Academia and others including 17 universities, provincial or territorial agencies, or foreign government or international bodies

- 46 projects total: 66% technical services, 32% strategic R&D, and 2% grants and contributions
- $2.9 million in revenues

OCRE completed or implemented over 300 projects with 100 unique clients and collaborators between 2015-16 and 2020-21. OGDs accounted for the largest proportion of OCRE's revenues in recent years. In addition to projects with clients, OCRE undertook an additional 165 internal projects including unique research, capacity development, and work in support of committees.

Source(s): Data and document reviews

IMPACT • OCEAN, COASTAL AND RIVER ENGINEEERING RESEARCH CENTRE

As a unique centre for excellence within Canada, OCRE enhanced the R&D capacity of its clients and collaborators across government, industry and academia. In turn, the research centre contributed to improved marine safety and performance through a range of government policy solutions and business innovation, often with direct or indirect environmental and social impacts. Though OCRE has had some difficulty tracking its impacts, there are many examples of OCRE achievements. The research centre has collaborated with OGDs to advance regulatory frameworks and to improve the safety and efficiency of OGDs' marine operations. Its Canadian and foreign industry clients have improved the operational safety and performance of their operations through OCRE research, in turn growing their businesses and in some cases creating new jobs. OCRE's research has been used to increase the resiliency and sustainability of coastal communities and marine assets in both Canada and abroad.

GOVERNMENT POLICY SOLUTIONS

OCRE has collaborated with OGDs to develop and advance regulatory frameworks and to improve the safety and efficiency of OGDs' marine operations. It is supporting government policies and regulations both nationally and internationally.

Supporting safety at sea and resilient coasts

- OCRE contributed to the development and advancement of **codes, standards and regulations**, most notably through the International Maritime Organization (IMO) and International Organization for Standardization (ISO) internationally and with Transport Canada (TC) nationally. It also participates in the Climate Resilient Built Environment Initiative led by Infrastructure Canada.
- Through its applied research strength, OCRE provided the technical input into new guidelines and standards for marine safety in harsh marine environments (HME), naval architecture, and flood risk management.
- OCRE is expected to continue to support IMO, ISO, and TC **responses to emerging technology** and trends (e.g., marine autonomous surface shipping [MASS] in ice, coastal resiliency, and underwater noise).
- OCRE could better track the outcomes of its participation in national and international bodies to more qualitatively report on its policy influence. This would go beyond existing key performance indicators (KPIs) that mainly quantify participation. OCRE has begun doing this, including new KPIs in its 2021-22 Management Toolkit.

Supporting naval shipbuilding

- OCRE contributed to Canada's National Shipbuilding Strategy and ship building mandates of the Canadian Navy and Coast Guard. It supported the **design of new ships** through numerical modelling, field data collection, and provision of expert analysis and guidance.
- More broadly, federal clients reported that their projects with OCRE resulted in safety and efficiency benefits, particularly **safer decision-making** by their fleets, through ice forecasting and risk-assessment models, efficiencies in ship design, and improved automation.

Supporting Canada and its allies

- OCRE supports Canada's role within the North Atlantic Treaty Organization (NATO) by participating in its Applied Vehicle Technology Panels, specifically through its **expertise on ice modelling and navigation**.
- In addition to its work with Canadian OGDs, OCRE is also recognized as a centre of excellence by American federal agencies such as the National Oceanic and Atmospheric Administration, the US Coast Guard, and the US Army Corps of Engineers.

"OCRE's research and technical advice supports our efforts to be compliant with the Polar Code, specifically the requirements related to voyage planning."

—OGD Client

Source(s): Data review, document review, facilities review, external and internal interviews, and peer review committee

BUSINESS INNOVATION

Canadian and foreign industry clients have improved the operational safety and performance of their operations through OCRE research, in turn growing their businesses and creating new jobs.

Improved performance

- OCRE worked with Canadian and foreign businesses to:
  - improve **operational safety and performance**, including testing marine-based assets and technologies under extreme conditions (e.g., ships, life boats, offshore platforms, and flood barriers),
  - use forecast models to support **safer decision-making**, and
  - develop **new safety guidelines**.

Tracking impact

- Although the evaluation identified some evidence of business innovation, going forward OCRE intends to more systematically track its impact in this area.
- Per their 2021-22 Management Toolkit, the research centre intends to monitor new KPIs such as health and safety indicators, reported efficiencies, and client success stories.

Competitive advantage

- Most industry clients reported that their work with OCRE directly contributed to their **competitiveness**, for instance having the trusted advice, models and test results that demonstrate their value to their own customers.
- Most industry clients reported **job creation**, either directly from their work with OCRE (e.g., to meet demand for new or improved products) or indirectly (e.g., among other factors that improved their reputation).
- The peer review committee (PRC) identified areas of potential for industry and technology transfer (e.g., OCRE's Canadian Arctic Shipping Risk Assessment Centre [CASRAS] data for navigation). The PRC observed some success in this area but thought the technology transfer process could be better coordinated at a program level.

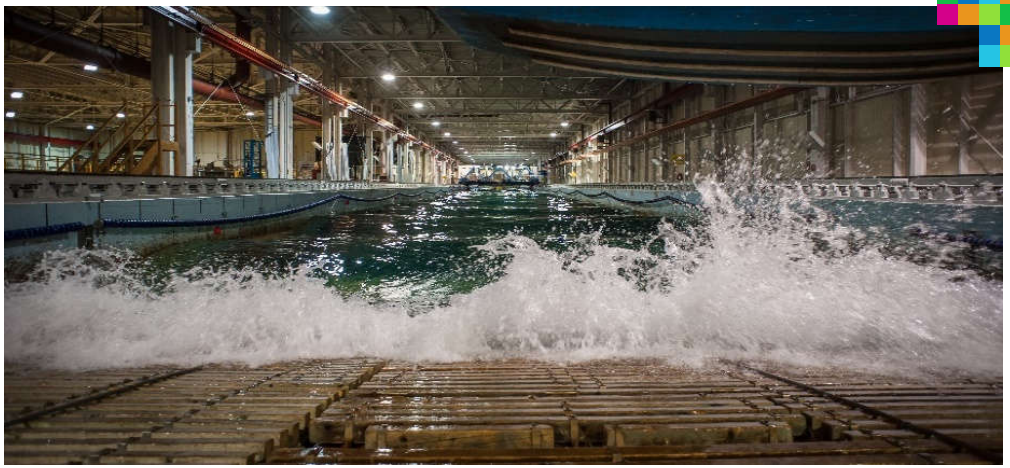
Source(s): Data review, document review, facilities review, external and internal interviews, and peer review committee

ENVIRONMENTAL AND SOCIAL IMPACTS

OCRE's research has been used to increase the resiliency and sustainability of coastal communities and marine assets in both Canada and internationally. Environmental and social impacts tend to be linked, and are often an intended outcome of research to improve marine safety and performance.

Mitigating environmental risks

- Clients and collaborators noted that OCRE's work will, or may, contribute to the **mitigation of environmental risks** (e.g., decreased emissions, reduced likelihood of spills).
- A continued and growing focus of OCRE is to predict the expected **impacts of climate change,** including future ice and wave conditions, storm surges, and water levels.
- The PRC commended OCRE for its understanding of the **importance of rightsholders** as well as stakeholders. OCRE will work to deliver digital information systems to support informed climate change adaptation (CCA) planning by coastal, Northern, and Indigenous communities.
- OCRE is expected to further focus its efforts towards climate change solutions, in relation to its capabilities, after receiving the CCA study's final report in 2021-22.



Enhancing the resiliency of coastal communities

- Clients and collaborators, including industry, academia and government (federal and provincial/territorial) identified contributions to the resiliency of coastal communities, infrastructure and waterways due to their work with OCRE. Some indicated that this work would **support Indigenous communities** in the North and other coastal areas in particular.
- The benefits tended to be related to coastal resiliency to flooding, as well as navigating harsh marine environments for rescue or resupply, and marine infrastructure safety (e.g., canals, ice bridges).
- OCRE will continue to contribute to benefits for vulnerable communities and populations as, even with the transfer of the ANCP outside of the research centre, it continues HME, coastal and waterways engineering research.

Source(s): Data review, document review, facilities review, external and internal interviews, and peer review committee

SCIENTIFIC EXCELLENCE • OCEAN, COASTAL AND RIVER ENGINEEERING RESEARCH CENTRE

OCRE is an international leader in engineering solutions for harsh marine environments and an emerging leader in coastal and waterways engineering. The research centre has begun to focus more on next generation marine technology, though it is too early to assess its leadership in this field. OCRE is very engaged in international and national committees and working groups that set international marine policy and it is an active participant in the conference circuit. Most of its publications are conference papers, which reach a large audience within OCRE’s sector. There is evidence that OCRE has contributed to its clients' technology and product development / enhanced their understanding of their products and operations. OCRE could better track its achievements.

DEMONSTRATED LEADERSHIP

Overall, OCRE has demonstrated leadership through its participation in international committees and associations, contributions to maritime codes and guidelines, attendance at and hosting of conferences, development of new tools, and training of highly qualified personnel (HQP).

Over the evaluation period, OCRE participated in approximately 150 **conferences, industry events and trade shows** with a majority of staff attending at least 1 event each (see the Engagement section for examples).

As of 2020-21, senior staff were involved in at least 26 **international committees, panels and working groups** plus an additional 65 national committees and working groups, engaging a mix of academic, government, and industry stakeholders (more detail can be found in Appendix D).

OCRE **trained students** at both of its locations, hiring 69 students and research associates over the evaluation period, and supporting another 12 in 2020-21 through Ocean Program-funded collaborations.

“OCRE is a demonstrated or emerging leader in all 3 of its research areas. It engages well with its traditional stakeholders, partners, and rightsholders.”

—PRC

Source(s): Data review, external and internal interviews, and peer review committee

ENGINEERING SOLUTIONS IN HARSH MARINE ENVIRONMENTS

OCRE has demonstrated international leadership for engineering solutions in harsh marine environments.

The PRC and interviewees identified its work in HME as the research centre's strongest area. For example, OCRE

- **advanced regulations** in HME (supporting TC as a representative at the IMO for the Polar Code),
- developed **tools for Arctic navigation** (e.g., CASRAS), and
- trained many **Canadian HQP**; for example, OCRE-developed technologies and models, such as CASRAS, which have been used by MUNL's Marine Institute – Centre for Marine Simulation for their training courses and certifications.

"In harsh marine environments, OCRE is a leader. In the North Atlantic, it is as harsh as it gets, which does give it some credibility above others. OCRE is always presenting at Arctic conferences on a wide variety of topics."

— Canadian industry client

Arctic Technology Conference's Distinguished Achievement Award (Organizations) for the NRC, with particular attention paid to the Arctic Program

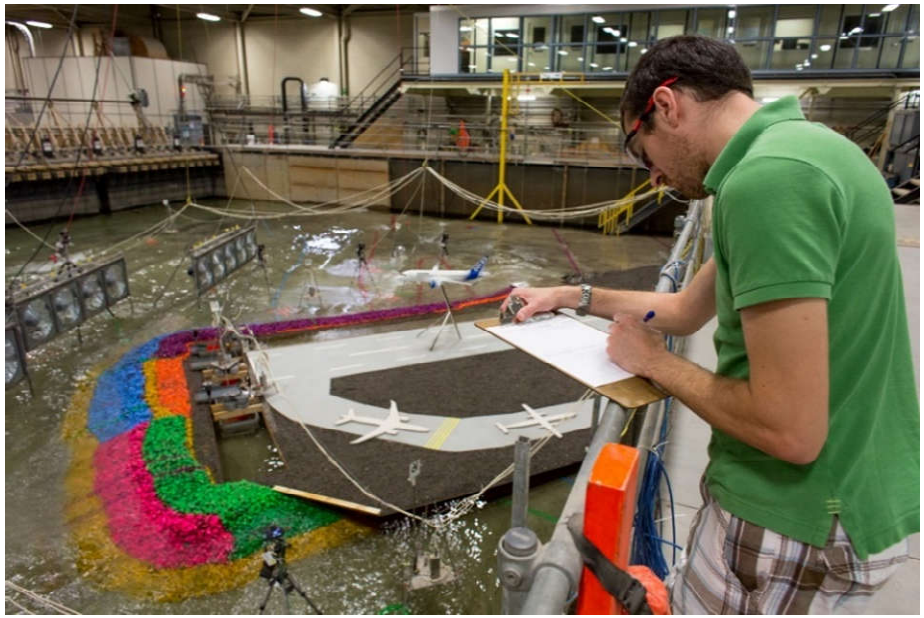
Society of Naval Architects and Marine Engineers Captain Joseph H. Linnard Prize for OCRE research on full-scale/model-scale comparisons of icebreaker performance

Source(s): Data review, document review, facilities review, external and internal interviews, and peer review committee

COASTAL AND WATERWAYS ENGINEERING

OCRE is a strong performer in coastal and waterways engineering. It has a solid international reputation comparable to leaders in the field, and is emerging as a leader in its own right.

- OCRE's coastal and waterways engineering work for industry is **comparable to leaders worldwide**. OCRE management and lead researchers participate in relevant committees and working groups (e.g., marine and tidal energy resources, port engineering, nature-based solutions for sustaining coasts and waterways).
- Stakeholders perceive OCRE as occupying a relatively **unique position** as a provider of climate change adaptation research services. However, as noted previously, OCRE's position is **undermined by a low level of awareness**.
- The PRC and external interviewees described OCRE as an **emerging leader** in coastal and waterways engineering. They identified strategies to advance its position and to establish the research centre as a leader. These strategies would **build on OCRE's experience convening experts**:
  - Leading the development of regulatory and emergency management policy (e.g., flooding) with players at all levels of government.
  - Collaborating more with academia (e.g., deeper relationship with the University of Ottawa [U of O] akin to MUNL, and engaging others).



"[OCRE has] a tendency of bringing people together. They host a lot of conferences. I think that puts OCRE in a leadership position."

— Provincial client

"I don't think OCRE is 'the' leader in the field, but they have a very solid reputation. Definitely in their consulting work OCRE has an equal reputation to Deltares."

— Academic collaborator

Source(s): Data review, document review, facilities review, external and internal interviews, and peer review committee

NEXT GENERATION TECHNOLOGY FOR MARINE TRANSPORTATION

OCRE has increased its work with next generation marine technologies, with a research focus on their deployment in ice and other harsh marine environments, but it is too early to have established leadership in this field.

- OCRE is **advancing its position** in next generation technology for marine transportation, such as in MASS.
- It is collaborating with industry, OGDs and academia on new and emerging technology, particularly **how new technology functions within HME**.
- While OCRE is working with TC on how to fit new technology into existing regulatory frameworks, it is **less engaged** internationally relative to the HME and coastal/waterways engineering research sectors.
- OCRE is not currently a leader in next generation technology but provides a **strong support network** to industry and government. As noted by the PRC, OCRE's digital capacity, though in need of growth, is excellent in quality.

"For MASS (marine autonomous surface shipping), they are in the learning mode. I would say OCRE has the dynamic ability to rally people to start and continue the MASS conversation in Canada."

— OGD client

"I wouldn't say OCRE is a leader but more a strong support network."

— Canadian industry client

Source(s): Data review, document review, facilities review, external and internal interviews, and peer review committee

PUBLICATIONS

As the NRC renewed its emphasis on research excellence during the evaluation period, OCRE's publication rate in conference proceedings and journals remained steady. OCRE could publish more journal articles and policy papers to establish itself as a thought leader.

Reaching industry, academic and policy audiences

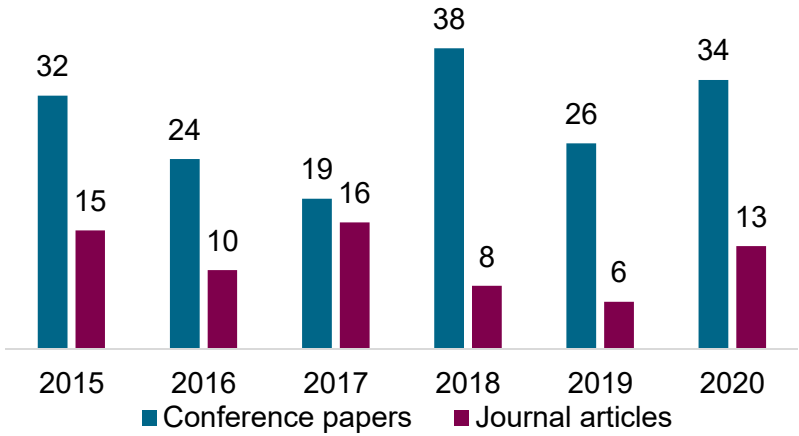
- OCRE has generated and shared its knowledge and findings mainly through conferences. Over the evaluation period, OCRE produced **240 publications**, mostly conference papers (72%) compared to journal articles (28%).
- Academic and industry clients and collaborators felt OCRE should publish more often, and generally saw both **conference and journal publications as equally important** to being a thought leader in scientific excellence.
- The PRC recommended OCRE publish position papers on **matters of concern** (e.g., rising seas, melting of coastal permafrost).This would be of interest to the general public, policymakers, and non-government organizations.

Difficulty tracking output

- OCRE has had **some difficulty tracking its publications** because the NRC's official reporting is based on peer-reviewed publications, as indexed in the Scopus citation database, and due to inconsistent data entry by OCRE staff. This mainly affected the number of conference papers counted as these publications were not always peer-reviewed or available beyond events themselves.
- As a result of conversations and challenges encountered during the evaluation project, OCRE **improved its internal processes** for publication tracking.

Source(s): Data review, and external and internal interviews

Figure 4. OCRE publishes primarily via conferences



Note: NRC tracks publications by calendar year, unlike other indicators which are tracked by fiscal year.

How many of OCRE's publications were peer-reviewed? Two-thirds (66%) of publications from 2015-2020 were indexed in Scopus and confirmed to have been peer-reviewed. This includes nearly all journal articles (91%), but only 58% of conference papers. These data are subject to change as publications are not always indexed immediately upon publication (e.g., 5 out of 6 articles unconfirmed as peer-reviewed were from 2020).

SETTING EXPECTATIONS FOR SCIENTIFIC INFLUENCE

Impact targets and metrics for OCRE did not adequately assess the research centre's scientific influence. OCRE has begun setting new targets which are more appropriate given the nature of its research activities.

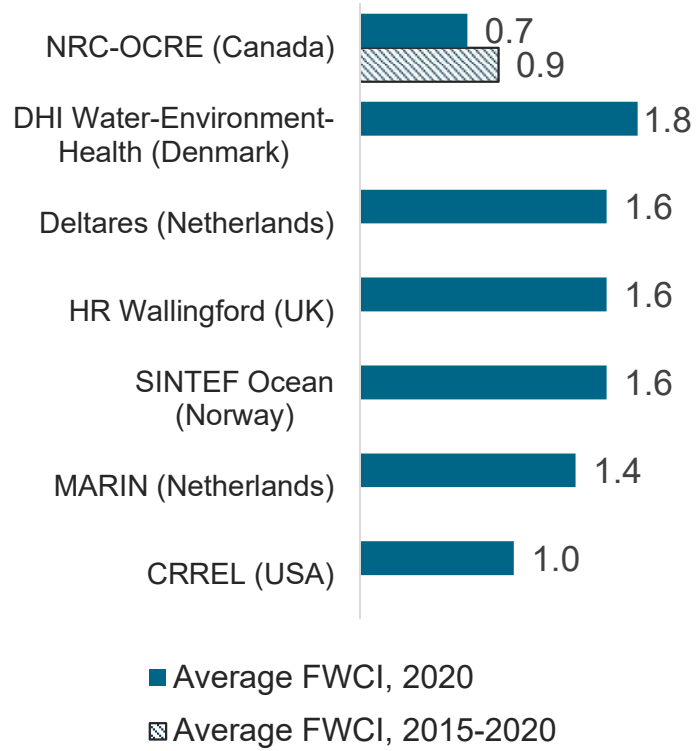
A full picture of scientific influence is hard to assess with current metrics

- The impact of OCRE's peer-reviewed publications was **below average relative to international comparator organizations**, averaging a field-weighted citation index (FWCI) of 0.94 over the evaluation period. This score does not account for non-reviewed publications excluded from Scopus.
- OCRE staff explained that their focus on revenue-generating testing and evaluation projects produced **content more suitable for conference papers**, which were less citeable than journal articles. Staff attributed the recent drop in FWCI to having entered new research areas where OCRE needs to build credibility.
- The PRC found it difficult to assess the quality of OCRE's scientific impact and recommended **more attention to strategies for quality assessment and metrics**.

Revisiting goals to reflect capacity

- Concurrent to the evaluation, OCRE worked with the NRC's Performance Measurement and Accountability Reporting group to revise its FWCI targets to reflect its current capacity (2021-22 target reduced from 1.2 to 0.75).
- Moving forward, the NRC is no longer setting research centre-specific publication targets, though OCRE plans to maintain its own **internal publication targets** as performance goals.
- Unique targets will also be set for the technical reports that OCRE produces for its clients and collaborators, as these reports are highly impactful on their recipients.

Figure 5. OCRE publications less cited relative to international comparators



Source(s): Data and document review, and peer review committee

RELEVANCE • OCEAN, COASTAL AND RIVER ENGINEEERING RESEARCH CENTRE

OCRE has focused its capabilities on strategic research and technical services that respond to the priorities of the marine sector. Its facilities are national assets that help Canada maintain and develop strategic capabilities needed by government, industry, and academia. As it reduces its work in the oil and gas sector, OCRE is well-positioned to reorient its facilities towards climate change adaptation research. OCRE has implemented new programs and initiatives that will keep it engaged with new developments in its sector, provide support to Canadian innovators in industry and academia, and advance the new standard for Indigenous engagement.

RESPONDING TO BOTH GOVERNMENT AND INDUSTRY DEMANDS

OCRE is aligned with the strategic objectives of the federal government and the NRC, such as sustainable growth, national defence, and marine safety. It is well-positioned to respond to both government and industry demands, including increasing demand for climate change adaptation and mitigation research.

National assets and strategic capabilities

- OCRE's current and future research objectives are **aligned with federal objectives** (e.g., climate change adaptation and mitigation, sustainable growth). Its federal clients consider its facilities and expertise national assets and strategic capabilities that complement the activities of OGDs (e.g., forecasting ice conditions, national defence, shipbuilding for Navy and Coast Guard, and developing regulations, guidelines, and codes).
- As of 2019, OCRE was **contributing to central elements of mandate letters for approximately half of all federal departments**. It also supported provincial, territorial, municipal and regional agencies, by providing data and reports to inform local policy (e.g., waterways and infrastructure management, community planning).
- There is potential for OCRE to more formally define its role as a knowledge leader in relation to OGDs. The PRC recognized OCRE as well-positioned to promote government policy, and that it is working with OGDs in this regard, but felt its role was not always clear.

Continued and emerging demand

- There is continued and emerging demand from industry for OCRE services and facilities. Over the evaluation period, demand decreased from some of its traditional clients, corresponding to the downturn in the oil and gas sector. There is however increasing **demand for climate change adaptation (CCA) and modelling** to which OCRE could respond (e.g., coastal resiliency, flood mitigation, ice navigation).
- While the use of digital modelling is increasing, there remains a **need for OCRE's physical testing capabilities**.

Some difficulty balancing NRC's 3 strategic goals

- OCRE has at times prioritized business innovation and government policy solutions over advancement of scientific knowledge, in order to generate revenue.
- Recent implementation of some new NRC initiatives has **begun to increase OCRE activity in advancing scientific knowledge** (i.e., Karluk Collaboration Centre with MUNL, grants and contributions through the Ocean Program to academia and small-to-medium enterprises [SMEs]).

Source(s): Document review, external and internal interviews, facilities reviews, and peer review committee

THE NRC'S OCEAN PROGRAM

OCRE's new Ocean Program builds on the research centre's strengths and existing relationships, creating new opportunities to boost innovation in parallel to the Ocean Supercluster Program.

Grants and contributions to scholars and SMEs support national priorities

- In 2020-21, an **NRC grants and contributions budget was approved for collaborations with Canadian industry and academia in the Ocean sector**. OCRE signed its first agreements with NRC Ocean Program clients in late 2020-21 in areas such as those outlined below. It is too early to assess outcomes.

Coastal erosion and flood risk management, and hydrokinetic power projects with U of O

Micro plastics and climate change modelling projects with McGill University

Emissions profiling of fishing and tour boats with Glas Ocean Electric, a Canadian SME

Underwater autonomous vehicle, AI bridge simulation, and marine acoustic projects with MUNL

Expert consultation guided program development and alignment with OSC

- The Ocean Program, originally the NRC's Ocean Supercluster Support Program, was first designed to directly support the OSC. OCRE had **difficulty aligning its program with the OSC**. OCRE faced challenges in aligning its capabilities with the OSC's broader research focus and orientation towards higher technology readiness levels.
- An expert panel convened in 2019-20 guided OCRE on how to better align and calibrate its program objectives and activities. The program was renamed the NRC's Ocean Program in order to distinguish that it was aligned with the Ocean sector but that it was not a direct support program to the OSC.

Federal Supercluster Program

- Industry, Science, and Economic Development Canada launched 5 Supercluster programs in 2017-18, including the Ocean Supercluster Program (OSC). The Superclusters are industry-led and federally-supported **fund matching programs to boost innovation** for academia, SMEs, and not-for-profit organizations in a particular sector.

Source(s): Document review, and external and internal interviews

THE NRC'S ARCTIC AND NORTHERN CHALLENGE PROGRAM

OCRE will contribute to the NRC's new Arctic and Northern Challenge Program (ANCP), in conjunction with other research centres. Its previous engagement in this region (through its former Arctic Program) makes it well suited to support ANCP-funded projects and other projects in the North.

Supporting NRC's efforts among Arctic and Northern communities

- The ANCP was designed with a **regional rather than specific research focus**, ultimately identifying 4 thematic areas through direct consultations with Arctic and Northern communities and stakeholders. The 4 selected themes – housing, health, food, and water – respond to regional needs, and go beyond OCRE's research areas and capabilities.
- As such, though the ANCP was developed under OCRE's purview, it was ultimately transferred out of the research centre in 2021-22 due to its broader scope. OCRE will play an **ad hoc role** supporting ANCP clients and projects, when appropriate (e.g., projects related to HME, marine transport, or coasts).

Shared priorities with Indigenous peoples

- As OCRE continues other Arctic strategic research and technical service projects that fall outside of the ANCP, it will need to do more to meet **the new standard set by the *United Nations Declaration on the Rights of Indigenous Peoples*** (UNDRIP) Act in 2021-22.
- The UNDRIP Act builds on the existing duty to consult, specifying the need for **meaningful participation** of and free, informed and prior consent from Indigenous peoples in decisions that affect them, their communities, and territories.
- Towards this, the Government of Canada has identified **shared priorities with Indigenous peoples** in the marine sector, such as marine safety, ocean and climate change science, and fleet and shore-based asset maintenance where this standard may be advanced.

Source(s): Document review, external and internal interviews, and facilities reviews

Why is considering diverse populations important?

- One of the Government of Canada's priorities is to consider Gender-based Analysis Plus (GBA Plus) in all of its activities. GBA Plus assesses how diverse people (e.g., gender, race, ethnicity, religion, age, physical differences) may experience policies, programs, and initiatives.
- Meaningful participation of Indigenous peoples is discussed further in the Engagement Section of this report.

ENGAGEMENT • OCEAN, COASTAL AND RIVER ENGINEEERING RESEARCH CENTRE

OCRE works with a suitable mix of clients and collaborators from government, industry and academia. It is well-known within the specific sectors and regions where it has operated but has the potential to collaborate both more broadly throughout the marine sector, and more deeply with existing clients. In recent years OCRE has dedicated significant effort to develop and implement engagement strategies to meet new demands and opportunities. However, it has had difficulty balancing competing priorities to attain revenue targets while also renewing its emphasis on scientific excellence. The research centre is developing or exploring deeper partnerships with key players in government, industry and academia in order to realize its full potential, rather than rely on fee-for-service contracts. This effort was inhibited somewhat by the limitations related to the COVID-19 pandemic.

A STRONG REPUTATION IN THE MARINE SECTOR

OCRE is well-known within the specific sectors and regions where it has operated. It is very engaged in international bodies where it contributes to scientific research and marine safety, while also advancing Canada's position internationally and building awareness of its own capabilities.

Strong reputation among those who know OCRE

- OCRE's clients and collaborators recognize its:
  - participation in **committees, panels and working groups** (see Appendix D for a list of selected bodies),
  - participation in **international conferences**, and
  - reputation, built on its **unique facilities** in Canada, and **a good track record** in delivering value.
- OCRE benefits from its professional networks and sector connections to maintain a steady mix of work (and repeat business) with OGDs, industry, and academia. Among external and internal interviews, there is agreement that OCRE is well-known within the specific sectors or regions where it operates.

Significant participation in international bodies

- OCRE is very engaged in international and national committees, panels and working groups. As of 2020-21, OCRE staff participated in 26 international bodies.
- The PRC recognized OCRE's contributions to Canadian positions within international bodies as a strength and **recommended further engagement with international organizations**, specifically suggesting a stand-alone active presence in the UN Decade of Ocean Science for Sustainable Development.
- OCRE staff also participate in 65 Canadian bodies, including those organized by OGDs (49%), the NRC itself (29%), industry (20%), and academia (12%). (Total exceeds 100% as some are co-organized).
- The CCA study recommended OCRE strengthen its involvement in Infrastructure Canada's Infrastructure and Buildings Working Group, to raise its profile and identify new opportunities.

Source(s): Data review, document review, external and internal interviews, and peer review committee

CONFERENCE ENGAGEMENT

By sustaining and growing its presence at conferences, industry events and trade shows, OCRE could raise awareness within the wider global community, of the expertise and facilities that it offers the marine sector.

Between 2015-16 and 2020-21, OCRE staff presented at or attended at least 148 conferences

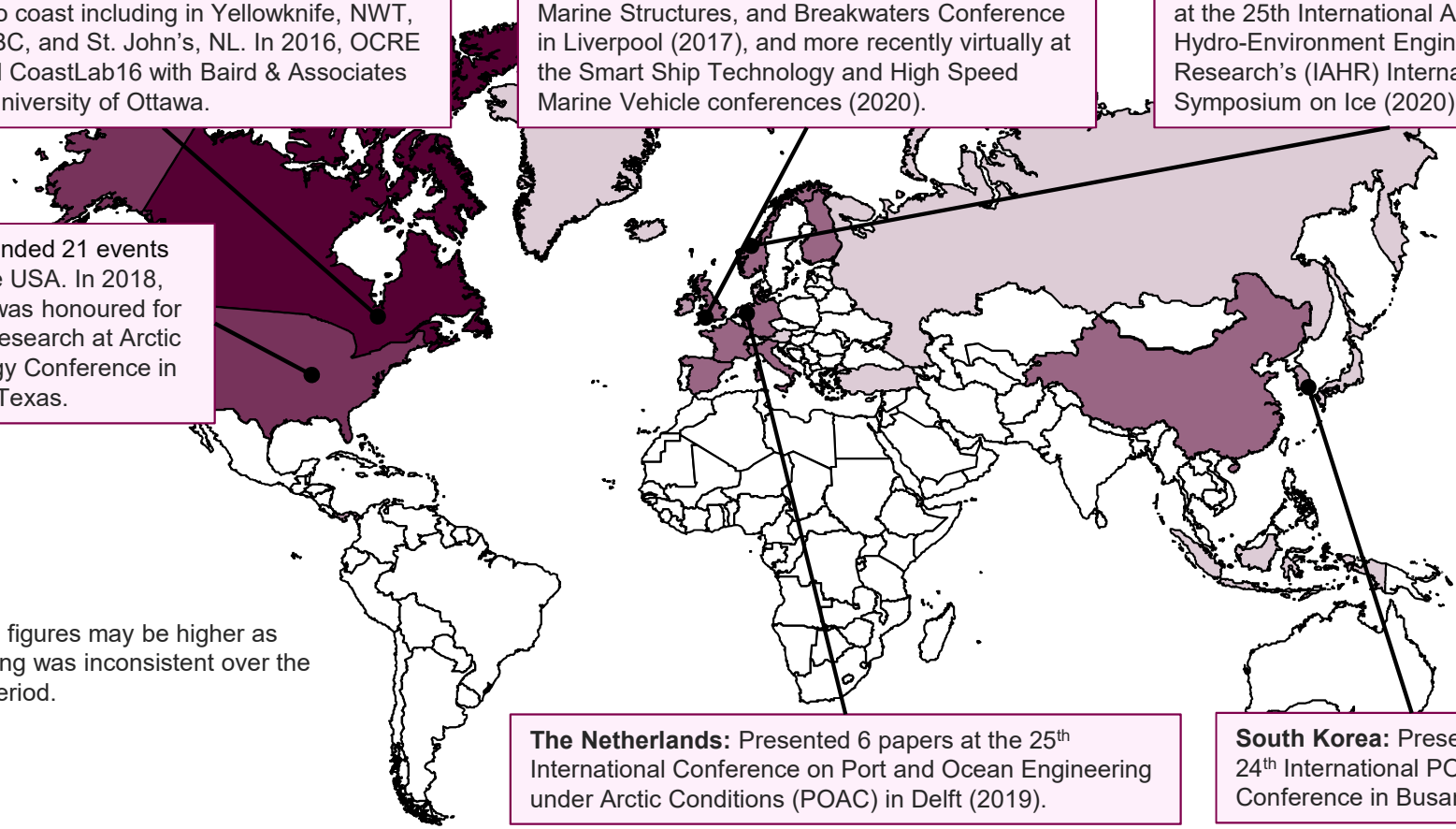
Below are recent or prominent conferences.

Canada: Attended at least 74 events from coast to coast to coast including in Yellowknife, NWT, Victoria, BC, and St. John's, NL. In 2016, OCRE co-hosted CoastLab16 with Baird & Associates and the University of Ottawa.

United Kingdom: Presented at the Coasts, Marine Structures, and Breakwaters Conference in Liverpool (2017), and more recently virtually at the Smart Ship Technology and High Speed Marine Vehicle conferences (2020).

Norway: Virtually presented 8 papers at the 25th International Association for Hydro-Environment Engineering and Research's (IAHR) International Symposium on Ice (2020).

USA: Attended 21 events across the USA. In 2018, the NRC was honoured for its Arctic research at Arctic Technology Conference in Houston, Texas.



Note: Actual figures may be higher as record-keeping was inconsistent over the evaluation period.

The Netherlands: Presented 6 papers at the 25th International Conference on Port and Ocean Engineering under Arctic Conditions (POAC) in Delft (2019).

South Korea: Presented at the 24th International POAC Conference in Busan (2017).

Source(s): Data review, document review, external and internal interviews, and peer review committee

ENGAGEMENT CHALLENGES AND OPPORTUNITIES

OCRE has potential to collaborate more broadly throughout relevant sectors, and more deeply with existing clients. Over the evaluation period, OCRE's engagement and communications strategy consisted of an informal mix of activities and initiatives. This lack of robust planning has left OCRE vulnerable to external factors. Recently OCRE has dedicated significant effort to address this gap.

OCRE vulnerable without engagement strategy

- OCRE lacked robust engagement planning and new business development. Its reliance on existing relationships for major contracts has left it more **sensitive to economic cycles**.
- This sensitivity to external trends, as well as **changing priorities** of the Government of Canada and the NRC (e.g., greater focus on advancement of science), led to a significant drop in revenues over the past 2 years.
- The research centre has recently taken significant **action to identify its strengths and opportunities**, and develop new engagement strategies (e.g., branding and market studies, hiring of an engagement lead, exploring possible consortia). Though program-level engagement plans were developed previously, an RC engagement plan remains in development.

"OCRE seems to be a 'hidden gem' which should be better known both nationally and internationally."

— PRC

Room to grow domestically and internationally

- There is room to grow OCRE's brand and engage more broadly (e.g., provincial, territorial, and municipal governments, Western Canada, private defence sector, broader academia). OCRE is not well known beyond its base or specialist peers (e.g., ice or coastal modellers).
- For instance, climate change adaptation was identified as a market opportunity for OCRE. The CCA Study found that **the most significant barrier to OCRE's growth was widespread unawareness of its capabilities and relevant experience** among key stakeholders in the CCA market.
- The PRC recommended that, within Canada, OCRE can do more with both OGDs and with Indigenous rightsholders. They found that OGD engagement relied on **"who you know"** and more strategic planning is necessary. As for Indigenous engagement, the PRC considered OCRE to be early on the learning curve in rightsholder engagement and needs to develop a formal process that adheres to the **new standard set out by the UNDRIP.**
- Beyond Canada, OCRE should continue to sustain and grow its presence at international events and participation in international bodies. The PRC recommended that OCRE explore with Global Affairs Canada how it **could enhance its contributions to Canada's global polices and reputation.**

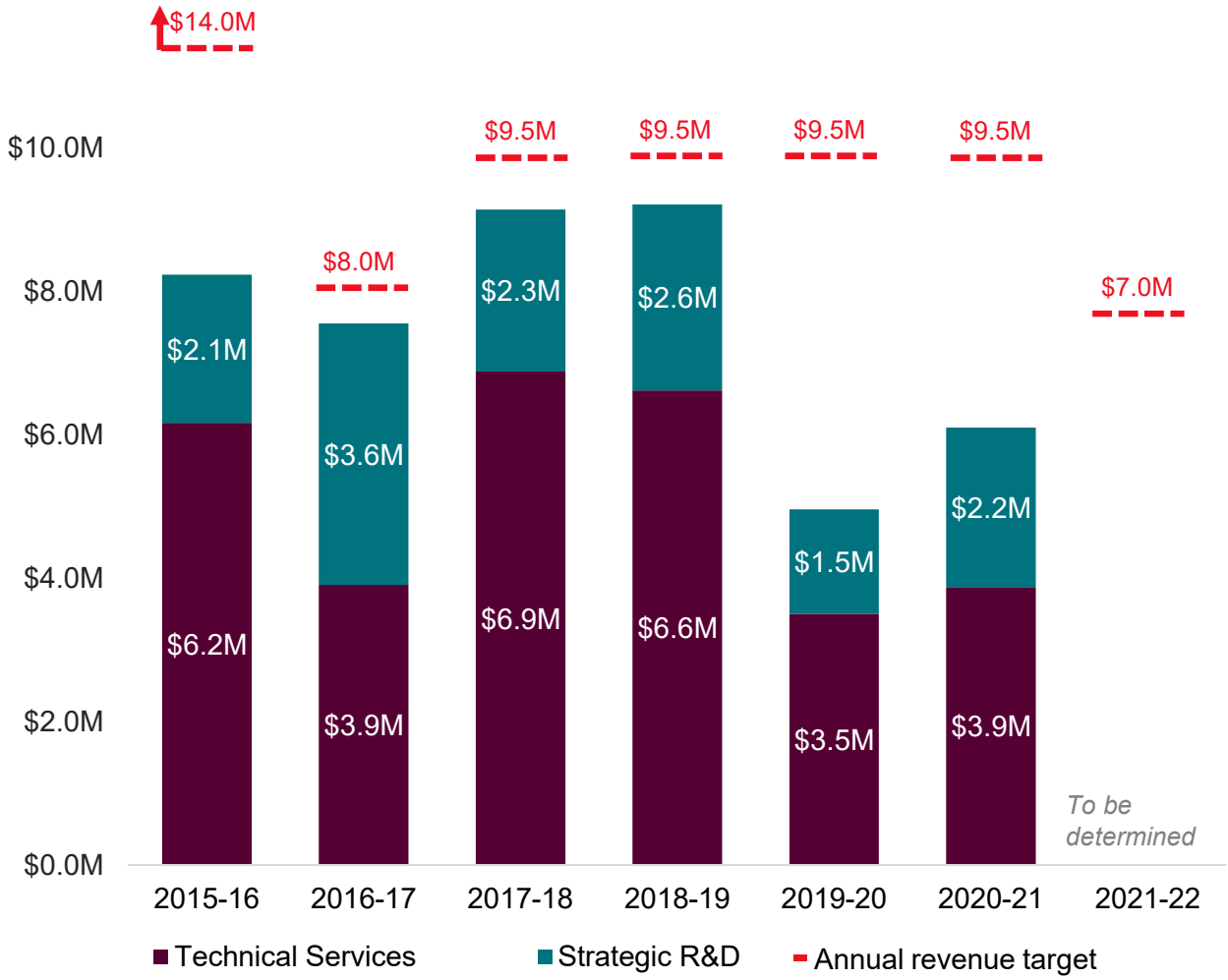
Source(s): Data review, document review, external and internal interviews, and peer review committee

REVENUE TARGETS AND ACHIEVEMENTS

In 2020-21, OCRE scaled down its revenue targets to reflect its renewed emphasis on strategic research and innovation, and economic conditions in its sector.

- OCRE's **revenue targets were set during a commercially strong period in the mid 2010's**, supported by the oil and gas sector boom and when the NRC prioritized cost-recovery and growth.
- OCRE was able to achieve near-target revenues for a time, but then fell short of them in 2019-20 (pre-pandemic). OCRE attributed the earned revenue target gap to a number of factors:
  - → a shift in focus from revenue generation to strategic research and business innovation
  - → unanticipated challenges in the oil & gas and shipbuilding sectors
  - → the re-allocation of resources to develop new programs
- **Targets were revised in light of internal and external factors** for 2021-22, when the annual target was reduced to $7M.

Figure 6. Revenues down as OCRE renewed emphasis on research excellence, 2015-16 to 2020-21



Source(s): Data review, document review, and external and internal interviews

PANDEMIC IMPACTS ON ENGAGEMENT

COVID-19 has affected OCRE, particularly in regards to engagement. Planned consultations and in-person collaborations were delayed. However, the research centre was able to advance strategically selected projects that aligned with its research priorities.

Pandemic impacts impeded engagement plans

- Towards the end of the evaluation period, **engagement activity and strategy development were inhibited by the Coronavirus pandemic and subsequent lockdowns**.
- Regular engagement initiatives such as site tours were **cancelled** and promotional activities for the Ocean Program were **scaled down** from in-person promotion at conferences to virtual engagement.
- Consultations with Indigenous communities in the North were **delayed**, which subsequently delayed the development and launch of the ANCP.

Projects strategically chosen to align with goals

- While projects requiring significant in-person collaboration were inhibited, OCRE **strategically selected** and fulfilled client service contracts in 2020-21.
- These projects were briefer in duration and did not fit within broader collaborative agreements, but still **aligned with OCRE's broader goals and those of its clients**.

Source(s): Data review, document review, and external and internal interviews

BUILDING AND RENEWING PARTNERSHIPS

To realize its full potential, OCRE is developing deeper partnerships with key players in government, industry and academia. At the same time, the research centre is working to balance these partnerships with strategically selected fee-for-service contracts. Going forward, OCRE will also have to expand its processes to meet the new standard for Indigenous engagement in Canada.

Partnerships and strategic engagements

- OCRE has begun **building and exploring deeper value partnerships with government and industry**, including both existing and new clients. It has signed MOUs with major national and international players to identify collaborative opportunities earlier in those organizations' decision-making processes to better coordinate, collaborate and leverage one another's capacities.
- Further advancing this approach was a central recommendation of the 2020-21 Business Model Options project conducted for OCRE.
- OCRE plans to **continue to strategically seek short-term contracts**, and balance them with more medium- and long-term engagements. Its intention is that deeper and on-going partnerships will support OCRE's stability by decreasing its vulnerability to economic cycles.

Re-engaging academia

- OCRE **re-engaged significantly with academia** during the evaluation period, following a period of reduced engagement. For example, OCRE renewed its historical relationship with MUNL launching the Karluk Collaboration Centre to support collaboration and resource-sharing.
- There are **opportunities for OCRE to replicate engagement efforts** with other Canadian universities.

Unique approaches for diverse populations

- As noted by the PRC, **stakeholders, partners, and Indigenous rightsholders are quite different** in terms of approach, and OCRE's differentiation among the 3 has not always been clear.
- The 2021 UNDRIP Act set a new standard for Indigenous engagement**. Engagement with northern Indigenous and coastal communities to date had been adequate**, as confirmed by the PRC, but processes must be expanded to adhere to the principles respecting the Government of Canada's relationship with Indigenous peoples.

Source(s): Data review, document review, external and internal interviews, and peer review committee

CAPABILITIES • OCEAN, COASTAL AND RIVER ENGINEEERING RESEARCH CENTRE

OCRE has had sufficient capacity, competencies, and facilities to meet client needs to date. The research centre's ensemble of facilities is unique in Canada and some facilities stand out internationally. That said, OCRE may not have the appropriate capabilities needed to meet the emerging needs of Canada and developments in the marine sector. OCRE must decide which of its facilities are critical to achieving its objectives, and develop co-investment partnerships to sustain them. The research centre's current complement of staff with expertise in data science and numerical modelling is of high calibre but limited in size. Capacity and morale have been strained by competing priorities and challenging performance targets, though OCRE has developed or identified strategies to address these issues. Going forward, deeper collaboration and coordination with federal, industry and academic partners may help to address resource gaps and sustain operations.

FACILITIES

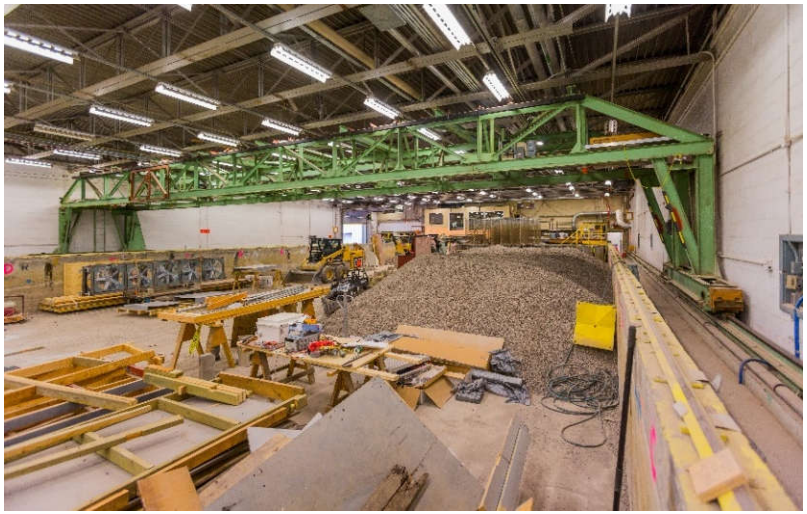
OCRE's ensemble of facilities is unique in Canada and some facilities stand out internationally. Overall demand remains strong and OCRE is directing their use more towards climate change adaptation.

Unique ensemble of facilities in Canada

- OCRE's **combination of facilities differentiates it from other marine research centres**. Though individual facilities have comparators (e.g., a similarly large ice tank in Finland), there is no comparable ensemble in North America or Europe. The NRC Facilities Review found synergistic relationships between the facilities co-housed both in Ottawa and St. John's.
- The PRC identified some individual facilities as both unique to Canada and otherwise unavailable to civilian users in the Western world, including the offshore engineering basin (OEB) and large ice tank in St. John's, and the large wave current flume in Ottawa.

Physical facilities respond to new demands

- Though the use of digital modelling is increasing within the marine sector, there remains demand for OCRE's physical facilities from OGDs, industry and academia. OCRE has begun to coordinate its facility plans with external collaborators in academia and industry to encourage complementarity rather than direct competition.
- In response to new demands, OCRE has begun to reorient its facilities towards **more climate change adaptation projects**. Facilities used primarily for energy sector or other industry projects (e.g., offshore infrastructure) may be reconfigured for climate change solutions (e.g., nature-based solutions for coastal resiliency).



Pictured: The coastal wave basin (CWB, above) and multidirectional wave basin (MWB, below) in Ottawa may be reconfigured for different research priorities, such as climate change adaptation.

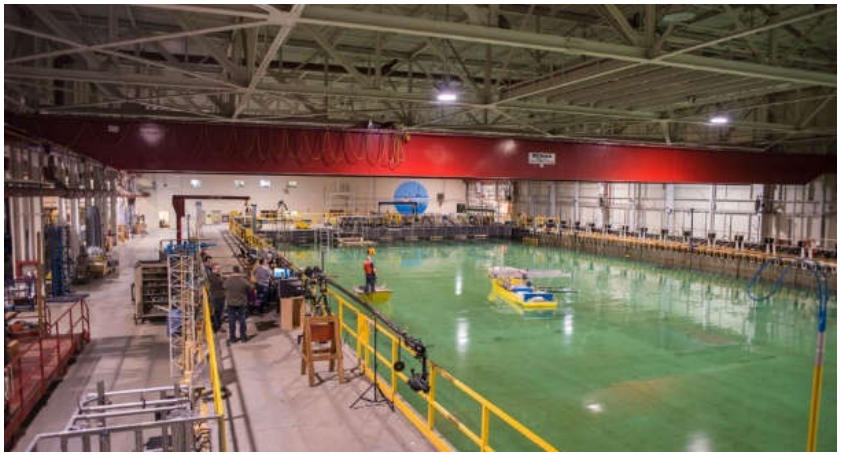
Source(s): Data review, document review, facilities review, external and internal interviews, and peer review committee

FACILITIES

OCRE must decide which of its facilities are critical to achieving its objectives, and develop co-investment partnerships to support new opportunities. In other cases, some facilities may be reoriented to new research directions or potentially divested from OCRE's portfolio.

New directions identified, significant investments needed

- OCRE has identified $45M in investments for its clear water towing tank (CWTT) and OEB in St. John's to support new opportunities aligned with its and the NRC's strategic plans. This amount was validated by external facilities reviewers as reasonable based on identified needs.
- As it is very unlikely that the NRC would have the ability to fund this through its annual investment planning envelope, the NRC Facilities Review suggested other solutions, such as seeking co-investment or leveraging federal initiatives.
- Additionally, **some facilities generate less demand** than international comparators and OCRE may need to make plans for co-investment or divestment. In some instances, facilities are being reoriented towards CCA projects (e.g., CWB in Ottawa). The cavitation tunnel in St. John's, which had been inactive for several years, is now central to a collaborative study of underwater noise with MUNL and TC. For other facilities, such as the small ice tank in Ottawa, future opportunities for use are less clear.
- The PRC affirmed that the facilities appear to be **well-managed** but will need **significant investment to remain state-of-the-art**. The PRC was confident that the NRC and OCRE's facilities investment plan will address related risks.



Pictured, above: The OEB in St. John's is a unique facility in Canada and in relatively high demand; it would benefit from significant new investments to exploit new opportunities. Below, the CWB in Ottawa has seen less demand but is being reoriented towards climate change adaptation projects

Source(s): Data review, document review, facilities review, external and internal interviews, and peer review committee

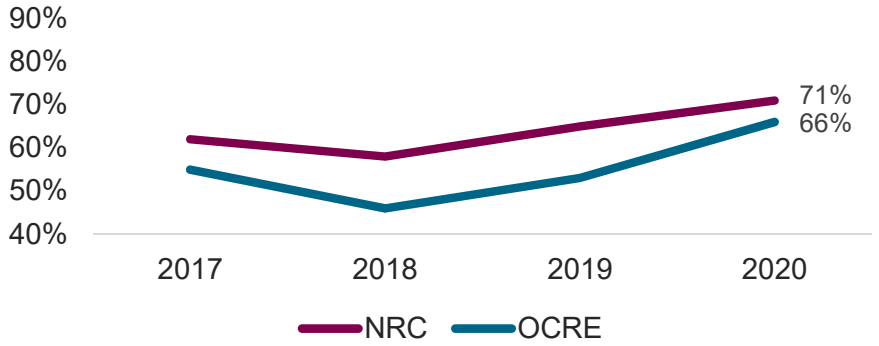
EXPERTISE AND CAPACITY TO DELIVER ON PROJECTS

OCRE has had sufficient competencies and facilities to meet client needs to date. However, the research centre's current complement of staff with expertise in data science and numerical modelling may not be sufficient to respond to emerging areas and new opportunities.

Capable resources, growing to meet new demand

- OCRE's **clients were highly satisfied** with the services and products they received. Clients interviewed for this evaluation characterized OCRE as capable, collaborative, flexible and responsive.
- OCRE's leadership expressed concern regarding the research centre's capacity to respond to new directions or new technologies. Specifically, OCRE had few staff with the data science and numerical modelling capacities needed to respond to emerging areas and new opportunities related to the Ocean Program.
- This 'digital capacity' gap has been addressed in part by accessing support from other research centres, and by expanding its own in-house capacities. This has included retraining, though some OCRE staff expressed **concern that not all staff are aligned with OCRE's new directions** and that retraining may be unsuitable given their existing skillsets (e.g., retraining civil engineers and naval architects for AI and other data science work). That said, OCRE staff have increasingly felt they have opportunities for professional development.

Figure 7. OCRE staff increasingly agree they have opportunities for development



Source(s): Public Service Employee Survey (PSES), average of agreement score for questions related to performance measurement, job fit and development (e.g., "I get the training I need to do my job").

HR strategy validated

- The PRC was confident in OCRE's HR strategy. They felt OCRE was **steadily building its capacity** in needed areas, managing resources well, and providing opportunities for advancement and succession.
- Moreover, while the PRC concurred OCRE **needs to grow its digital capacity**, they recognized that investment in recent years had ensured digital modelling capabilities were in the same class as physical modelling.
- The PRC recommended more early and mid-career staff be enrolled in **professional accreditation** schemes to support their career development (e.g., Chartered Marine Technologist or Chartered Marine Scientist).

Source(s): Data review, document review, facilities review, external and internal interviews, and peer review committee

STUDENT HIRING AND ACADEMIC COLLABORATION

OCRE has significantly increased its involvement of academia in its activities. This has included hiring and working with more students, and formally collaborating and sharing resources with MUNL. Through these activities, OCRE builds its own capacity as well as mentors and grows the next generation of the Canadian marine sector.

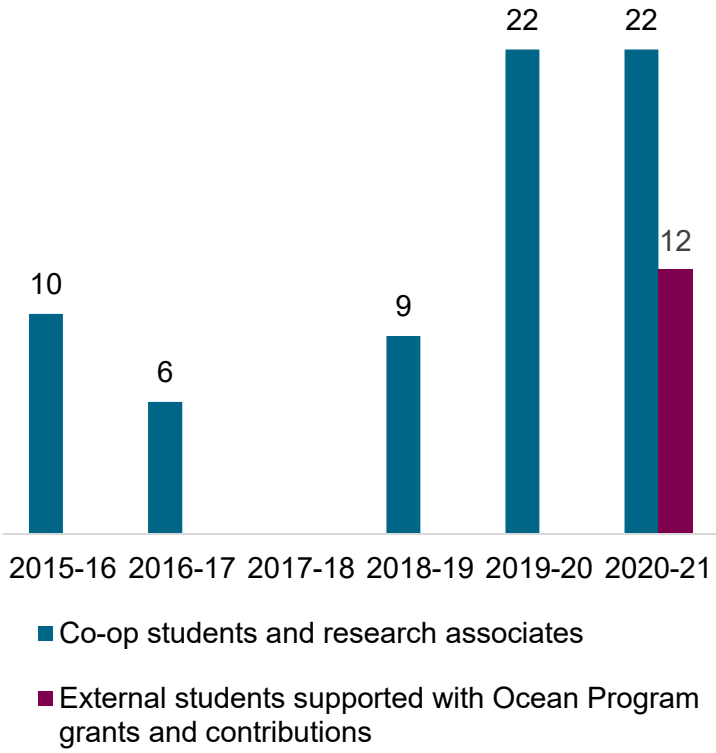
More students brought aboard, mentored

- As part of its re-engagement with academia, and in order to increase its capacity, OCRE **more than doubled its annual student hiring** over the evaluation period. It hired more co-op students to work at OCRE locations and, with the launch of the Ocean Program, provided grants and contributions to universities who in turn hired more students to work with OCRE on its NRC-funded projects.
- By engaging more students, **OCRE not only builds its own capacity but that of Canada**. OCRE has played an important role in growing the relatively small pool of Canadians trained in research, development, test and evaluation for the marine sector. In addition, a combination of staff with many years of experience and low turnover has enabled OCRE to build extensive specialist knowledge of benefit to students through mentoring.

Formal collaboration with academia

- The research centre is also seeking to leverage external support through the Karluk Collaboration Centre. The collaborative centre model may also be desirable with other institutions, as it could **mitigate resource and facility needs**, such as the need for new students, co-investment opportunities, and access to third-party funds.

Figure 8. More opportunities in the marine sector for students and researchers, 2015-16 to 2020-21



Source(s): Data review, document review, facilities review, external and internal interviews, and peer review committee

STAFF ENGAGEMENT, SUPPORT AND EQUITY

OCRE has taken effective steps to engage and support staff, but could do more to match other research centres, and to increase employment equity.

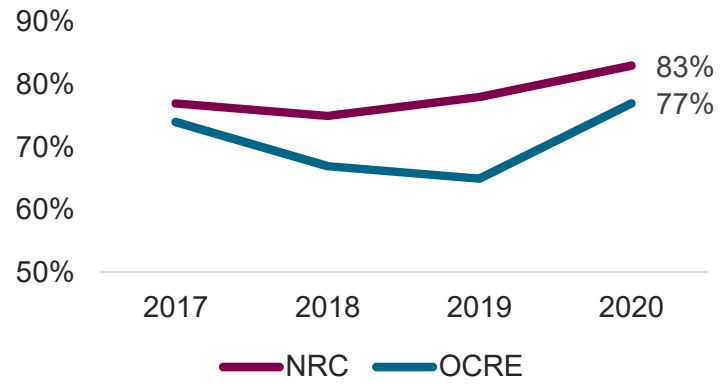
Consultations, new initiatives supported staff

- OCRE **staff reported feeling under-supported in light of competing priorities** throughout the evaluation period, though there is evidence of improvement over the last year as the research centre responded to staff needs.
- In response to this, OCRE management conducted staff consultations in 2019-20 to identify solutions. In 2020-21 OCRE developed and began implementing **strategies to support career and leadership development**, and identify and develop high potential personnel. OCRE also hired a dedicated stakeholder engagement lead to support business development.

Near target for women, lagging other targets

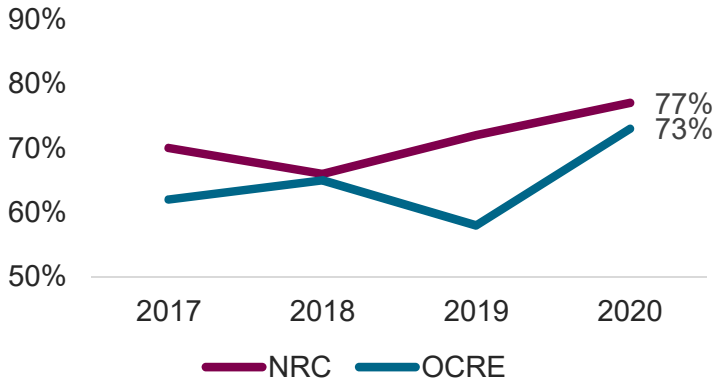
- Overall, OCRE neared its target for representation of women (23% target, 21% actual in 2020-21). In fact, it exceeded sub-targets for management, administrative and senior clerical roles. OCRE has room to improve among its research and technical officers.
- Compared to targets, OCRE lagged for other Employment Equity groups, such as members of visible minorities (25% target, 12% actual).

Figure 9. OCRE staff increasingly feel engaged



Source(s): PSES; average of agreement score for questions related to engagement (e.g., "I feel valued at work," "I am proud of the work I do")

Figure 10. OCRE staff increasingly feel supported



Source(s): PSES; average of agreement score for questions related to support (e.g., "I am encouraged to be innovative or take initiative in my work," "I have support at work to provide a high level of service")

Source(s): Data review, document review, facilities review, and external and internal interviews

CHALLENGES SUSTAINING CAPABILITIES

OCRE's capabilities were stretched by competing priorities and performance targets. Targets were reduced for 2021-22 to better reflect OCRE's capacity. However further cost reductions are required to support the NRC's reinvestment in its facilities. OCRE has identified strategies to sustain its operations and meet its revised targets.

OCRE required to respond to competing priorities and cost reduction

- Over the evaluation period, OCRE did not have access to additional funding to increase capacity to meet revenue and publication targets or capitalize on new demands.
- As established in the previous section, revenue targets were not revised when OCRE was also expected to achieve **ambitious targets** for publishing (discussed further in Scientific Excellence section).
- Targets were revised for 2021-22 to better reflect OCRE's capacity. However, OCRE, like other research centres, will be challenged by an **NRC-wide 10% budget reduction over 3 years**, beginning in 2021-22.
- The purpose of the NRC-wide reduction is to reallocate resources to real property and major capital. This will support renewing and updating major facilities (such as the CWTT or OEB). Additional strategies to offset resource shortages may be necessary.

Sustainability strategies

- OCRE has commissioned or participated in **studies on its capabilities** to identify strategies to improve its performance and ensure its sustainability.
- Common recommendations and themes included deeper partnerships, potentially including co-investment models, and strengthening OCRE's digital capacity.
- Deeper collaboration and coordination with federal, industry and academic partners may help to **address resource gaps and sustain operations**. This could include co-investment models or coordinated decision-making.

See a summary of **recommendations from third-party studies** in Appendix E including actions to strengthen, sustain, and better exploit its capabilities.

Source(s): Data review, document review, facilities review, and external and internal interviews

RECOMMENDATIONS • OCEAN, COASTAL AND RIVER ENGINEEERING RESEARCH CENTRE

RECOMMENDATIONS AND SUPPORTING RATIONALE

Capabilities

- Over the past 2 years, OCRE received direction and options from 3 external reviews (business model options project, CCA market and impact study, and PRC), as well as the NRC facilities review.
- Key facilities require significant investment. Other lower-demand facilities need to be reoriented or divested. As well, OCRE has struggled to achieve performance targets with existing capabilities.
- The marine sector is shifting towards more digital modelling though there remains a need for OCRE's ensemble of facilities. OCRE needs to balance investments in both its physical facilities and developing its digital capacity.

Recommendation 1

OCRE should develop and implement a resources strategy with specific timelines and milestones, along with clear accountabilities for decisions for:

a. Significant NRC investment or co-investment needed for facilities of high strategic merit

b. Reorientation or divestment of facilities with lower demand or strategic merit

Recommendation 2

OCRE should develop and implement a digital strategy to ensure a deliberate approach to this critical capacity.

Engagement

- OCRE's engagement and communications strategy consists of an informal mix of activities and initiatives. These activities have proven effective or demonstrate potential (e.g., conference participation, Collaboration Centre, MOUs), but are not formalized within an overall engagement strategy.
- The 2021 UNDRIP Act raised the standard for Indigenous engagement. OCRE is early on the curve in Indigenous rightsholder engagement.
- OCRE's expertise, capacity and potential were not widely known, particularly among the wider international community outside of specialist peers. Rather, it has relied heavily on repeat clients.

Recommendation 3

OCRE should formalize its approach to engagement and communications. A new engagement and communications strategy should include:

a. Separate sections for partners, stakeholder and Indigenous rightsholders

b. A section on international engagement to heighten OCRE's reputation

c. Planned publishing and social media activities

RECOMMENDATIONS AND SUPPORTING RATIONALE

Performance Measurement

- Publications, conference attendance, and committee participation were inconsistently tracked, though this was greatly improved upon by OCRE in order to meet the needs of the evaluation and peer review committee. This issue is not exclusive to OCRE but has been an ongoing challenge across the NRC.
- Robust and regular performance measurement would enable OCRE to affirm its successes and improve its ability to benchmark performance in light of budget and capacity. Per the PRC, this may be incorporated into communications materials to demonstrate OCRE's value to potential new partners, sector stakeholders, and Indigenous rightsholders.
- Accurate benchmarking may also be necessary to secure co-investments.

Recommendation 4

OCRE should address gaps in performance measurement and undertake regular performance monitoring in alignment with its strategic plan, including appropriate KPIs, related to:

a. Publications and conference attendance
b. Participation in committees and impact on policy and codes
c. Business innovation / industry indicators

MANAGEMENT RESPONSE AND ACTION PLAN

Recommendation 1
OCRE should develop and implement a resources strategy with specific timelines and milestones, along with clear accountabilities for decisions for: a. Significant NRC investment or co-investment needed for facilities of high strategic merit b. Reorientation or divestment of facilities with lower demand or strategic merit **Risk-level:** moderate

Management Response	Proposed Person(s) Responsible	Measure of Achievements	Expected Date of Completion
Response: Accepted **Action**: Informed by the NRC Facility Review, Real Property and Planning Services Space Cataloguing & Functionality Assessment Initiative, OCRE strategic plan, Market and Impact Study on Climate Change Adaptation Services, and other strategic documents, OCRE will prepare and carry out a facilities investment roadmap, with specific timelines and milestones, along with clear accountabilities for decisions for investment, co-investment, reorientation or divestment of its facilities.	Adrienne Fowlie Larocque, Director of Operations, OCRE	• Facilities investment roadmap developed • Facilities investment roadmap implemented	October 2022 March 2023

MANAGEMENT RESPONSE AND ACTION PLAN

Recommendation 2			
OCRE should develop and implement a digital strategy to ensure a deliberate approach to this critical capacity. **Risk-level:** moderate			
Management Response	**Proposed Person(s) Responsible**	**Measure of Achievements**	**Expected Date of Completion**
Response: Accepted **Action**: In consultation with the NRC Chief Digital Research Officer, and informed by other corporate initiatives such as the Mercury Program, OCRE will develop a digital strategy.	Martin Richard, Director of Research, OCRE	• Digital strategy developed • Digital strategy implemented	March 2023 September 2023

MANAGEMENT RESPONSE AND ACTION PLAN

Recommendation 3
OCRE should formalize its approach to engagement and communications. A new engagement and communications strategy should include: a. Separate sections for partners, stakeholders and Indigenous rightsholders b. A section on international engagement to heighten OCRE's reputation c. Planned publishing and social media activities **Risk-level:** moderate

Management Response	Proposed Person(s) Responsible	Measure of Achievements	Expected Date of Completion
Response: Accepted **Action**: In consultation with NRC's Communications Branch, NRC's National Program and Business Services, NRC's International Relations Office, the NRC Indigenous Engagement Network, and others as necessary, OCRE will develop a new engagement and communications strategy.	Thomas Puestow, Lead for Stakeholder Engagement, OCRE	• Engagement and communications strategy developed • Engagement and communications strategy implemented	June 2022 September 2022

MANAGEMENT RESPONSE AND ACTION PLAN

Recommendation 4
OCRE should address gaps in performance measurement and undertake regular performance monitoring in alignment with its strategic plan, including appropriate KPIs, related to a. Publications and conference attendance b. Participation in committees and impact on policy and codes c. Business innovation / industry indicators **Risk-level:** low

Management Response	Proposed Person(s) Responsible	Measure of Achievements	Expected Date of Completion
Response: Accepted **Action**: OCRE will continue to implement the OCRE Management Toolkit, which identified OCRE-specific KPIs, and will continue to develop its internal web-based tracking system to monitor those performance indicators and report at frequencies suitable to that indicator.	Adrienne Fowlie Larocque, Director of Operations, OCRE	• Implement performance measurement and reporting as outlined in the Management Toolkit • Establish baseline performance levels for each OCRE KPI • Internal web-based tracking system in place and tracking performance indicators	June 2022 September 2022

APPENDICES • OCEAN, COASTAL AND RIVER ENGINEEERING RESEARCH CENTRE

APPENDIX A – METHODOLOGY

Document review

Internal and external documents were reviewed to provide context and to complement other lines of evidence in assessing relevance and performance. Internal documents included operational and strategic plans, advisory board terms of reference and presentations, facilities reviews and project prioritization documents. External documents included the final reports from a branding exercise, a business model study, and a market and impact study focused on climate change adaptation, as well as documentation on international comparators and documents related to government priorities.

Data review

The research centre's administrative and performance data for 2015-16 to 2020-21 were reviewed to provide information on program inputs (i.e., resources), outputs and client engagement. This included key performance indicators, financial data, human resource data, project data and client data.

External and interviews

Internal interviews were conducted with a total of 14 individuals to collect information such as personal experiences, opinions and expert knowledge related to the research centre's relevance, engagement, resources, scientific excellence and achievement of expected results.

External interviews and focus groups were conducted with stakeholders to collect qualitative evidence with regards to the research centre's relevance, engagement, facilities, scientific excellence and achievement of expected results.

A total of 36 external interviews were completed, including academics (n=5), industry clients and partners (n=13), other federal government departments or agencies (n=10) and provincial, territorial, or regional agencies (n=3). Additionally, a focus group was conducted with the members of the OCRE Research Centre Advisory Board (n=5).

Information gathered through the interviews provided contextual information and was used in conjunction with the other lines of evidence.

APPENDIX A – METHODOLOGY

Peer review committee

A peer review committee was convened to assess the research centre's relevance, engagement and scientific excellence. The committee was composed of 6 members with expertise in next generation marine technology, coastal infrastructure and waterways resiliency, and modelling harsh marine environments.

Members included national and international representatives from academia, research organizations and industry. To ensure objectivity and avoid conflicts of interest, peer review committee members signed a confidentiality and conflict of interest agreement.

Peer review members examined key research centre documents, the preliminary evaluation findings and facilities reviews prior to participating in 4 virtual review sessions. Virtual sessions included presentations and poster sessions delivered by the research centre, and discussions with the OCRE's Director General and senior management.

Based on the documents reviewed and the virtual sessions, the peer review committee produced a report that responded to each of the areas under assessment. This report was used as a line of evidence in the overall evaluation findings.

Dr. Wendy-Watson Wright (Committee Chair)

Founder and CEO, 7 Mile Bay Vice Chair, UN Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP)

Dr. Janet King

Chairperson of NSERC Perrmafrost Net
Chairperson of OCRE Research Centre Advisory Board (RCAB)
President of Development Agency (CanNor) (Retired)

Bryn Wood

Director of Research, Education and Culture, NunatuKavut Community Council

Dr. Alain Pietroniro

Professor and Schulich Chair in Sustainable Water System in a Changing Climate, University of Calgary

Stephen Hall

Former CEO Society for Underwater Technology
Fellow of Institute of Marine Engineering, Science and Technology (IMarEST)
Marine Policy, Technology and Science Consultant

Liesl Hotaling

President, Education Director of Eidos Education
Vice President for Communications of Marine Technology Society (MTS)

APPENDIX A – METHODOLOGY

Limitations and mitigation strategies

Although the evaluation encountered some challenges, methodological limitations were mitigated, where possible, through the use of multiple lines of evidence and the triangulation of data. This approach was taken in order to establish the reliability and validity of the findings and to ensure that conclusions and recommendations were based on objective and documented evidence. Details on limitations and their associated mitigation strategies are described below.

Corporate data gaps

Participation in neither marine sector events (e.g., conferences, trade shows) nor national or international bodies (e.g., committees, panels, or working groups) were routinely tracked by OCRE.

The publication list maintained by the NRC's Library and Information Management Services (LIMS) was missing many conference papers published by OCRE.

Mitigation

OAE and OCRE worked together to address these data gaps, in turn both satisfying the data needs of the evaluation and providing baselines and best practices for OCRE going forward.

OCRE management aggregated a committee list by reaching out to its managers and lead researchers, first in winter 2021 then again in summer 2021 to capture any recent additions.

OAE and OCRE worked with NRC-Finance branch to identify expenses filed for event travel or fees. Additional events were found in the publication list (e.g., conference papers) that may not have had costs associated with them. This process provided at least a minimum number of events over the evaluation period.

OAE worked with LIMS and OCRE management to review and update the publication list, and addressed inconsistencies in data entry and tracking.

Contradiction or duplication of other studies

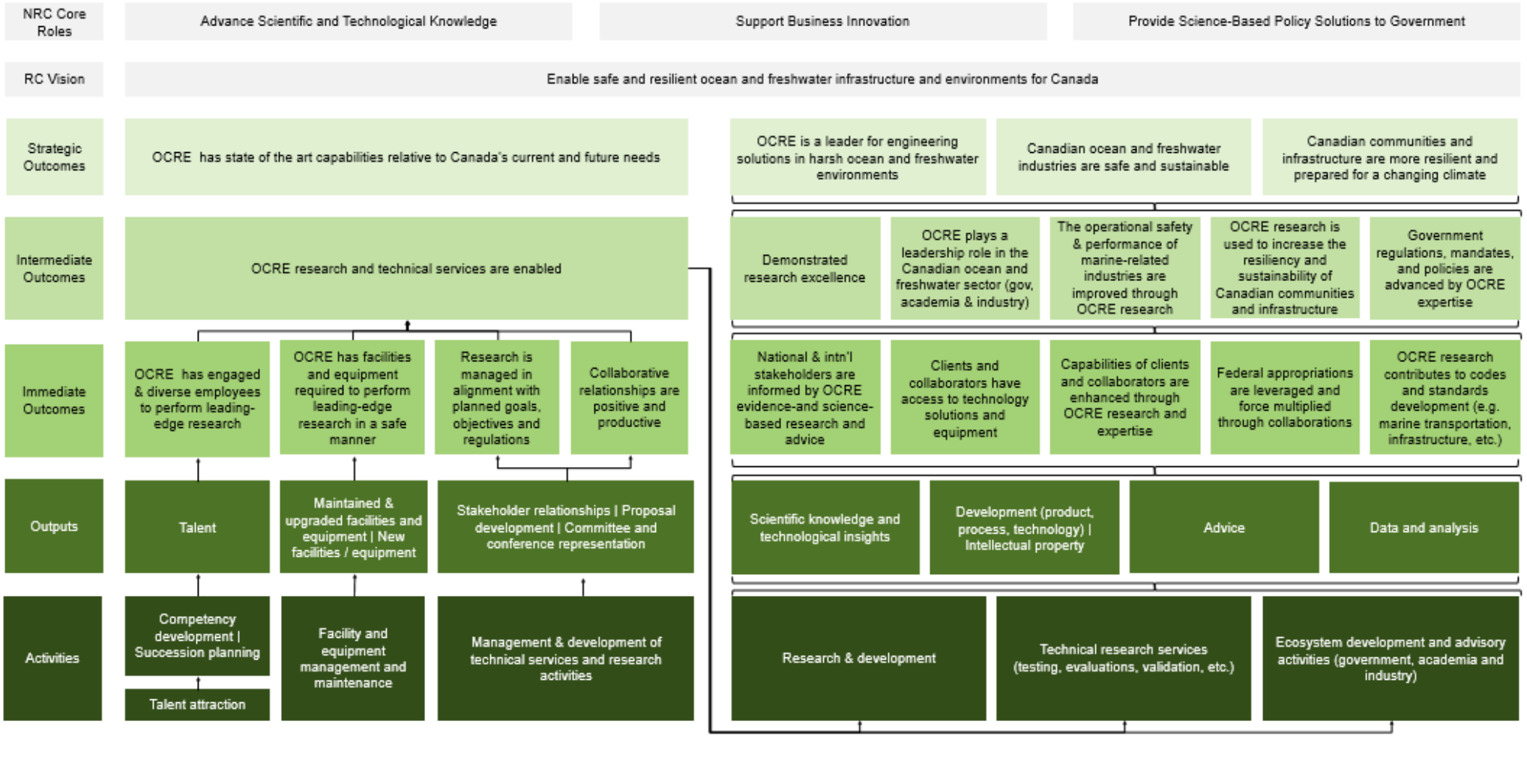
OCRE participated in or solicited several reviews, either recently before or concurrent to the evaluation. From a management perspective, it was necessary to minimize burden on both OCRE staff and external stakeholders who were to be engaged by OAE. Methodologically, it was necessary to minimize contradictions between the evaluation and the studies. This was necessary to provide NRC senior management and OCRE with a clear final report and recommendations based on the best available information.

Mitigation

Previous studies (e.g., NRC Facilities Review, branding exercise) were treated authoritatively and OAE minimized its primary data collection in some areas (e.g., facility performance, awareness), instead deferring to these products as they thoroughly consulted both internal and external sources.

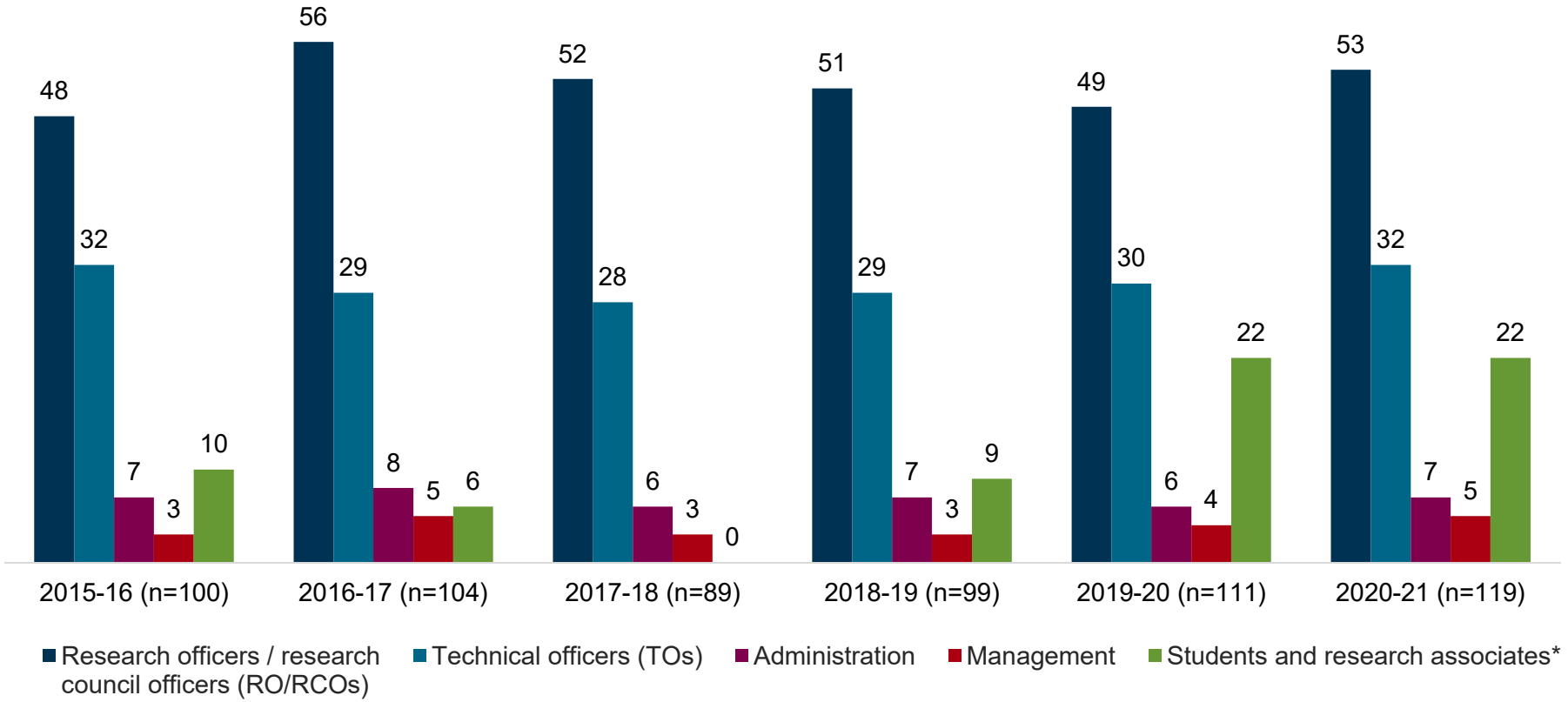
OAE coordinated its fieldwork with a concurrent study (i.e., CCA study) to avoid interviewing staff during the same month. External interviewee sampling was conducted jointly to minimize duplications.

APPENDIX B – OCRE LOGIC MODEL



APPENDIX C – NUMBER OF OCRE STAFF BY ROLE

More students in recent years, capacity otherwise stable, 2015-16 to 2020-21

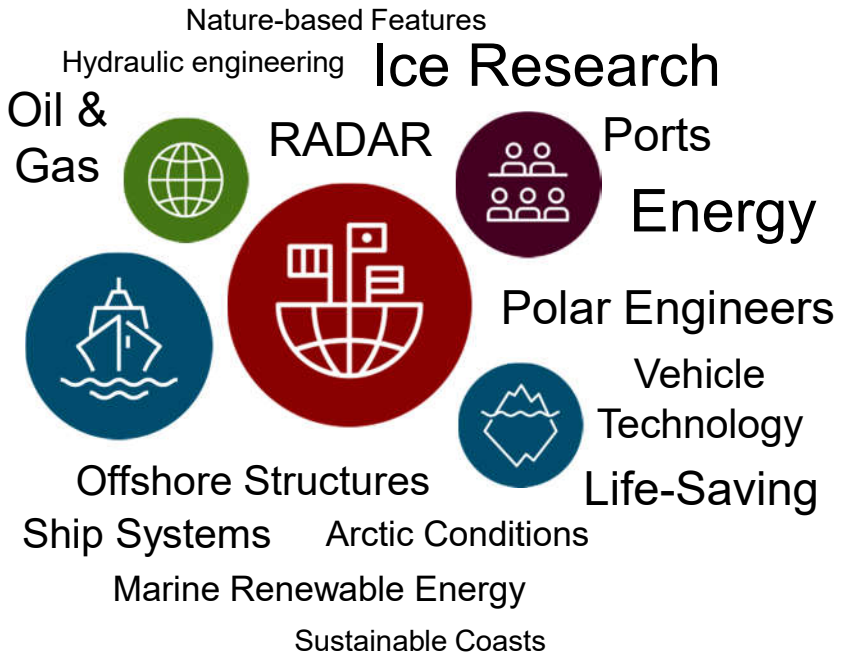


*This includes students directly hired by OCRE. It does not include students hired by academic collaborators who used grants and contributions from the OCRE Ocean Program or other NRC grants and contributions to hire students. In 2020-21, NRC funding supported the external hiring of an additional 11 students who worked with OCRE.

Source(s): Data review, document review, facilities review, and external and internal interviews

APPENDIX D – PARTICIPATION IN INTERNATIONAL BODIES (SELECTED EXAMPLES)

- Cooperative Research Ships Organization
- Ice Research and Engineering
- International Arctic Technology Conference (OTC)
- International Association of Hydraulic Engineering and Research (IAHR) Division II: Hydro-Environment
- International Electrotechnical Commission (IEC); 3 committees for river energy resource assessment, for tidal energy resource assessment, and standards for the marine renewable energy sector
- International Ice Charting Working Group (IICWG)
- International Maritime Organization, Ship Systems and Equipment (SSE) Correspondence Group on Life-Saving Appliances (advises Transport Canada, the member representative for Canada)
- International Organization for Standardization (ISO); 2 committees for petroleum and natural gas industries – Arctic offshore structures, and for Arctic Operations
- International Ship and Offshore Structures Congress (ISSC)
- International Society of Offshore Polar Engineers (ISOPE)
- International Towing Tank Conference (ITTC)
- International Working Group on Guidelines on the Use of Natural and Nature-Based Features for Sustainable Coastal and Fluvial Systems
- NATO Applied Vehicle Technology Panel, including subpanels on ice detection and sensing, ice load monitoring, ships in ice, and operational guidance
- Port and Ocean Engineering under Arctic Conditions (POAC)
- Synthetic Aperture RADAR Applications
- Technical Advisory Group for Ice Roads Establishment and Design Manual (sponsored by the US Federal Highway Administration)



Source(s): Document review

APPENDIX E – RECOMMENDATIONS FROM THIRD-PARTY STUDIES

OCRE has commissioned or participated in studies on its capabilities in order to identify strategies to improve its performance and ensure its sustainability. The text boxes below summarize their recommendations in regards to OCRE's capabilities.

2020-21 Project to Examine Business Model Options

- Secure **ongoing commitments** from major clients to create value partnerships featuring **systematic program and capability planning**
- Advance Collaboration Centre with MUNL to market collective capabilities of a **co-dependent platform**
- Explore possibility of a **co-investment model** with OGDs
- **Grow internal research capabilities**, specifically data science and AI

2020-21 NRC Facilities Review (informed by external peer reviewers)

- Support the VP in determining a **strategy for each OCRE f**acility
- Investigate opportunities for **co-investment by external partners** or other solutions for the CWTT and OEB
- Give serious **consideration to divesting facilities** of low strategic merit (e.g., small ice tank in Ottawa, cavitation tunnel in St. John's)

2021-22 Market and Impact Study: Climate Change Adaptation

- **Increase project-management resources** to deliver climate change adaptation-related projects
- **Maximize use of facilities** (availability and operation)
- Strengthen existing **data analysis and modelling capabilities**

2021-22 Peer Review Committee for the Evaluation

- Develop a **digital strategy** to ensure a deliberate approach to a critical competence, capacity and impact.
- This strategy should also articulate a plan for **Open Data** to increase uptake of OCRE's information products and technology transfer

Source(s): Document review