Using new technology to listen for whales in Placentia Bay, Newfoundland and Labrador

Left: Monitoring whale and dolphin activity in Placentia Bay. Right: Autonomous underwater acoustic recording system. Credits: Fisheries and Oceans Canada.

Located on the southeast coast of the island of Newfoundland, Placentia Bay is an ecologically and economically significant marine area. The bay is home to eelgrass, coral, and sponge habitats that support commercial fish species and seabirds, and provide food for species at risk, including the leatherback sea turtle, North Atlantic right whale, and Northwest Atlantic blue whale. Economically, Placentia Bay supports a thriving marine economy that includes petroleum **transshipment**, ferry and other commercial transportation, commercial fishing, aquaculture, and tourism.[1,2] In addition to its close proximity to international shipping routes south of the island, the bay is also adjacent to an active offshore petroleum exploration and development industry where multiple seismic surveys have been conducted in the last five years.[3] The growth of this marine economy is accompanied by an increase in human-generated underwater ocean noise (hereafter "ocean noise") with its potential impacts on marine species.

> **Transshipment** is the process of transferring oil between different modes of transportation.

The intersection of ecology and economics in Placentia Bay makes it a valuable testing ground for innovative technology used for monitoring, modelling, and managing the impacts of ocean noise on marine species.

There is a long history and ongoing underwater acoustic data collection on the south coast:

Since 2003: Fisheries and Oceans Canada (DFO) began systematic and opportunistic visual reporting of cetaceans and sea turtles.

Since 2009: Marine mammal experts from DFO started collecting underwater acoustic data using autonomous acoustic recorders (underwater microphones), focusing on identifying and describing natural and human-generated noise sources, and marine-mammal presence based on their vocalization patterns.

Since 2016: DFO, with funding from the Oceans Protection Plan (OPP), has expanded programs for collecting long-term acoustic data and conducting seasonal boat-based visual marine habitat surveys.

OPP funding has enabled DFO to expand its underwater sound research and monitoring capacities and applications to acoustic projects in Placentia Bay. The autonomous underwater acoustic recorders in Placentia Bay have detected vocalizations from various whale species, including North Atlantic right, blue, fin, humpback, sei, minke, sperm, and killer whales. Complemented by oceanographic and habitat baseline data, these data and surveys are used to study and monitor ocean noise and its potential impact on marine mammals.
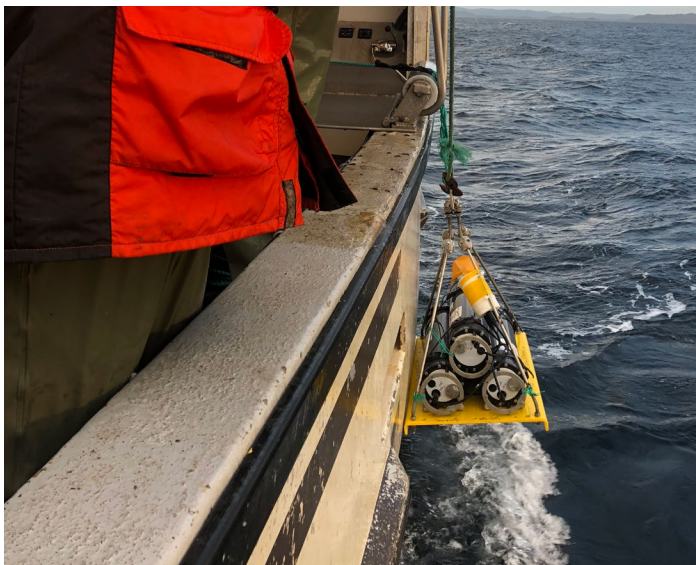
Deployment of JASCO Bottom Mooring System. Credit: Fisheries and Oceans Canada.

In addition to monitoring and field research on ocean noise, OPP also funded a multi-year project between DFO and Memorial University of Newfoundland (MUN) to develop soundscape and marine mammal risk modelling in Placentia Bay. The modelling helps researchers better understand how ocean noise contributes to the acoustic environment and how this might change over time and space. This comprehensive project helps to identify and predict the risks and impacts of ocean noise on marine mammals.

Projects undertaken by DFO in collaboration with MUN, and Marine Institute have also provided valuable data on marine-mammal acoustics, vocalizations, and habitat utilization in the bay.

Placentia Bay was identified as one of six assessment areas under Transport Canada's Cumulative Effects of Marine Shipping (CEMS) initiative, which was launched in 2017 and funded through the OPP.[4] Ongoing work for this project in Placentia Bay includes engagement with coastal communities and a range of different stakeholders to identify regional priority **valued components** and marine shipping stressors.[5,6] Vessel-generated underwater noise is included in the scope of assessment. The results of the ongoing CEMS assessment will be used to develop recommendations for regional mitigation measures and management strategies.

Despite the complex nature of ocean noise research and management, the acoustic research and monitoring innovation projects of Placentia Bay demonstrate strong collaboration and coordination of efforts to develop effective ocean-management measures:

## LISTENING FOR WHALES IN CHALLENGING CONTEXTS

In busy marine areas such as Placentia Bay, it is often difficult for large commercial vessel operators to visually detect marine mammals, such as whales, and surface-moored detectors can be a hazard to navigation. Memorial University, in collaboration with eSONAR Inc., is developing an innovative subsurface acoustic monitoring system to acoustically detect whales even if they cannot be seen.[7] This project was created through DFO's Whale Detection and Avoidance Initiative in collaboration with MUN's Autonomous Ocean Systems Laboratory, and previously funded through the OPP.

When this subsurface acoustic system detects target marine species, it is designed to wait until it is safe (e.g., when there is no vessel traffic to avoid being struck) to 'pop-up' a communication antenna to the water's surface to alert mariners of the presence of the targeted species. This warning would allow vessel operators to slow down and exercise increased vigilance for marine mammals in the vicinity. By initiating operational responses, this near real-time notification system could have two immediate benefits:

- reduce the potential for vessels collision with whales, and

- minimize vessel noise and its potential impacts to whales.[7]

The system is uniquely designed to stay under the water's surface to avoid hazards such as vessels and storms and to listen for whales at quieter depths where there is less surface noise from wind, waves and rain. As it moves to and from the surface, the system can also measure water temperature, salinity, and other environmental factors that are essential to understanding and modelling underwater sound in the marine environmentand modeling underwater sound in the marine environment.

Valued components are specific parts of the human, biotic, or physical environment that are considered important because of their cultural, social, aesthetic, economic or scientific value, such as water quality or beluga whales.[6]
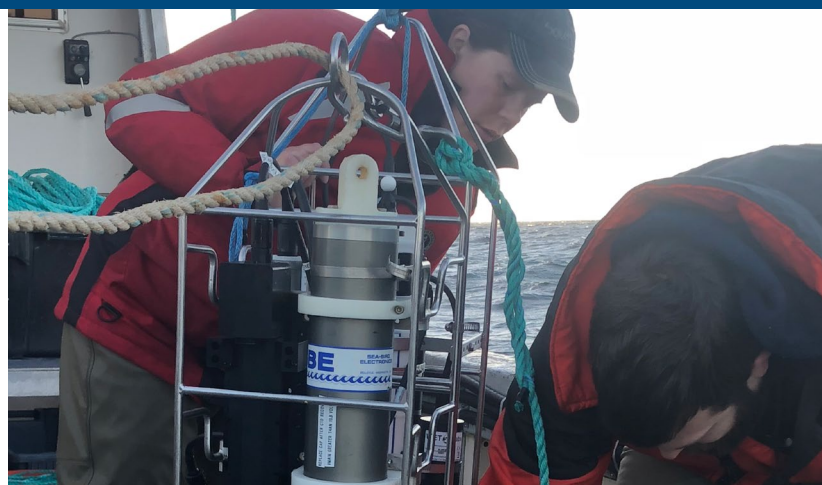
Left: Tools used by Marine Mammal Observers. Credit: Fisheries and Oceans Canada. Right: Deployment of oceanographic instruments to measure conductivity, temperature, and depth of the marine environment. Credit: Fisheries and Oceans Canada.

- The acoustic and marine-mammal monitoring work in Placentia Bay has helped build state-of-the-art technology to reduce the impacts of marine shipping by providing vessel operators with information on the predicted presence of marine mammals.

- The 'pop-up' acoustic monitoring system will be further tested in other locations, including in deep and ice-covered waters, which will provide new information on ocean noise and species present in these areas that are not currently being monitored.

- Long-term marine-mammal acoustic monitoring and habitat-utilization surveys will contribute to the development of soundscape and habitat-utilization models; these models will support risk assessments of noise disturbance to marine mammals and determine if mitigation or management measures would reduce these risks.

- The integration of DFO's marine mammal acoustic and visual monitoring with soundscape analysis will be an invaluable tool to assess the potential impacts of ocean noise.

The integration of science and technology, with input from the industry, local and Indigenous communities, other governmental partners and stakeholders, will inform decisions on ocean noise management and mitigation for marine mammal protection within Placentia Bay.

These efforts will help manage ocean noise generated by commercial activities in Placentia Bay so that the development of the marine economy does not compromise the rich biodiversity of the area and the health of its marine species.

References

1. Fisheries and Oceans Canada. (2017). *Integrated Management Planning*. https://www.dfo-mpo.gc.ca/oceans/publications/imnfld-tnlgi/index-eng.html

2. Government of Newfoundland and Labrador. (2021). *The Economy*. https://www.gov.nl.ca/budget/2021/wp-content/uploads/sites/5/Economy-2021.pdf

3. Canada-Newfoundland and Labrador Offshore Petroleum Board. (2016). *Southern Newfoundland Region Seismic Data Coverage 1980 – 2016*. https://www.cnlopb.ca/wp-content/uploads/geoinfo/snsdc.pdf

4. Transport Canada. (2019). *Assessing the cumulative effects of marine shipping.* https://tc.canada.ca/en/campaigns/protecting-our-coasts-oceans-protection-plan/better-protected-coastal-ecosystems/assessing-cumulative-effects-marine-shipping

5. Fisheries and Oceans Canada. (2020). Science Advice for Pathways Of Effects for Marine Shipping In Canada: Biological and Ecological Effects. *Canadian Science Advisory Secretariat, 2020/30*. https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/4090278x.pdf

6. Transport Canada. (2018). *Review of cumulative effects management concepts and international frameworks.* https://tc.canada.ca/en/corporate-services/review-cumulative-effects-management-concepts-international-frameworks

7. Fisheries and Oceans Canada. (2021). *Government of Canada continues to invest in research to inform protection measures for vulnerable whale populations.* https://www.newswire.ca/news-releases/government-of-canada-continues-to-invest-in-research-to-inform-protection-measures-for-vulnerable-whale-populations-869540978.html

Government of Canada / Gouvernement du Canada