Fisheries and Oceans Canada | Pêches et Océans Canada

Science that Matters to Canadians

Canada

"This is a moment in the history of fisheries science and oceanography when we can recognize the start of a new era in which we can study whole ecosystems. We have today a new generation of scientists who are achieving data collections and interpretations that would have been unbelievable 50 years ago."

Dr. Timothy R. Parsons, Honorary Scientist, Institute of Ocean Sciences, Fisheries and Oceans Canada, Professor Emeritus, University of British Columbia, Japan Prize for Science and Technology, 2001, Parsons Medal for Ocean Sciences, 2004, Order of Canada, 2006.

Photo Credit: DFO

Cover Photo: Researchers stand on ice located off the eastern side of Southampton Island that contains wind-deposited sediment eroded from the western shore of Hudson Bay. They collected snow, sediment, water, zooplankton, and air samples to learn about contaminant dynamics. Monitoring missions in the Hudson Bay Complex began in 2003 and are continuing.

Contact Information
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Published by:
Fisheries and Oceans Canada
Ottawa, Ontario, K1A 0E6
DFO/2006-1142

Cat. No. Fs23-525/2007 paper ISBN 978-0-662-69964-4 paper
Cat. No.Fs23-525/2007E-PDF ISBN 978-0-662-46477-8
Cat. No. Fs23-525/2007F-PDF ISBN 978-0-662-09789-1

Printed on recycled paper.

The electronic version of this report is available at:
www.dfo-mpo.gc.ca/science

Message from the Assistant Deputy Minister

Science is the foundation of the strategic outcomes of Fisheries and Oceans Canada (DFO) — Safe and Accessible Waterways, Sustainable Fisheries and Aquaculture, and Healthy and Productive Aquatic Ecosystems.

Modern science is increasingly complex and therefore must be increasingly collaborative. With 15 research institutes and laboratories across Canada, the Science Sector of DFO is at the cutting edge of science. It is an active member of key regional, national and international networks and organizations that enable us to expand our capabilities and increase knowledge through partnering and collaboration.

DFO Science aims to produce a vibrant aquatic science program based on excellence that supports and informs departmental and government needs and best serves Canadians. To learn more about DFO Science than can be presented in this brief overview, I invite you to visit us online at www.dfo-mpo.gc.ca/science/

Dr. Wendy Watson-Wright
Assistant Deputy Minister, Science Sector
Fisheries and Oceans Canada

The Structure of DFO Science Sector

DFO is a science-based department, and the Science program supports policy and program delivery for operations in Canada and international commitments.


Photo: DFO

A Science Management Board sets strategic priorities, and a Science Advisory Council of mostly external experts provides input on science and technology. The Assistant Deputy Minister of Science works closely with Directors General for Science Renewal, Integrated Business Management, Ecosystem Science and for Ocean Sciences - Canadian Hydrographic Service and the Executive Director of Strategic Science Outreach. The National Science Directors Committee, which directs operations, consists of these managers and six Regional Directors of Science.

In the six operational regions — Newfoundland and Labrador, Maritimes, Gulf, Quebec, Central and Arctic, and Pacific — DFO Science operates 15 science institutes, laboratories and experimental centres. In addition, centres of expertise (COEs) — mostly virtual — focus on key issue areas where it is more effective to partner both internally and externally to achieve results on particular scientific challenges.

Science at Work

The department's strategic outcomes, federal policies, programs, decisions and regulations are supported by DFO Science core functions including scientific research, monitoring, advice, products and services, and data management.


Photo: DFO

Safe and Accessible Waterways Strategic Outcome

With respect to safe and accessible waterways, the Canadian Hydrographic Service (CHS) provides navigational products and services, and undertakes oceanographic research and monitoring of ocean tides and currents. Hydrographic data are used to support territorial claims and establish international limits and borders, a benefit to Canadian sovereignty.

Sustainable Fisheries and Aquaculture Strategic Outcome

DFO Science supports sustainable fisheries and aquaculture with research-based advice and recommendations on the status of fishery resources, monitoring and information management plus products and services concerning Canada's waters.

In support of the *Species at Risk* Act, DFO Science evaluates and provides advice on the status of aquatic species at risk, advises on permits and agreements, and assists in the identification of critical habitat and the formulation of recovery plans.

To prevent the introduction and spread of invasive species, the Science program engages in research and the development and application of new methodologies for detection and control. Risks are assessed and existing populations are monitored for rapid response to new introductions.

DFO Science works to monitor, detect and report on aquatic animal diseases in wild and cultured aquatic animals to prevent serious disease outbreaks and to ensure that the department fulfills its responsibilities to the public and the fish and seafood trades under the *Health of Animals Act* and the *Fisheries Act*.

Improved nutrition, health, production and increasing knowledge of the interactions between aquaculture and the environment are among the roles Science plays in aquaculture science. This knowledge informs decisions and policy making and assists the industry in adopting practices that improve sustainability.

The advancement of genomics and the application of biotechnology research tools in aquatic science improve the department's ability to protect endangered species, manage opening and closing of fisheries, avoid over-exploitation of resources, prosecute poachers, improve aquaculture practices, control disease outbreaks, remediate contaminated sites, and develop the knowledge necessary to support regulation and risk assessments of aquatic organisms with novel traits.

Healthy and Productive Aquatic Ecosystems Strategic Outcome

Fish habitat can be affected by oil and gas exploration, development and production, forestry, mining, hydroelectric power generation and agriculture. DFO Science provides advice on potential impacts of contaminants and toxic substances to marine and freshwater fish habitat, mitigation measures and risks, and regulations in support of the fish habitat management authorities identified in the *Fisheries Act*, the *Policy for the Management of Fish Habitat, Species at Risk Act, Oceans Act, Navigable Waters Protection Act* and the *Canadian Environmental Assessment Act*.

Integrated management of aquatic ecosystems is made challenging by the multiple and sometimes conflicting uses of our oceans. The Science program provides advice, information and data management services to support integrated ocean management programs such as the delineation of Marine Protected Areas (MPAs) through ocean mapping, preparation of ecosystem overview and status reports on Large Ocean Management Areas (LOMAs), and frameworks of ecological and biologically significant ocean areas.

With three interconnected oceans, Canada, together with the international community, has a vested interest in understanding the role of oceans in global climate and the impacts of climate change on aquatic ecosystems. The DFO Science ocean climate program examines the interaction among the oceans, ice and atmosphere to enable prediction of ocean responses to climatic change, and assesses the potential impacts on marine environments, ecosystems, fish and marine mammal populations.

To learn more, visit the complete A–Z index of DFO Science activities online at www.dfo-mpo.gc.ca/science/A-Z/a-z_e.htm.

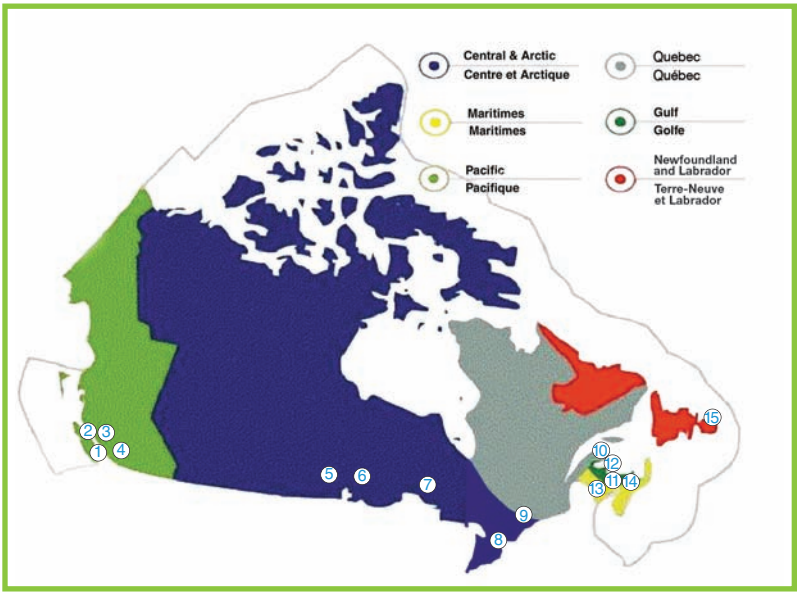

Photo: DFO

Priorities for an Ecosystem-Based Approach to Science

Short, medium- and long-term activities based on the following priorities are moving DFO Science to an ecosystem-based approach to science:

1. Setting clear ecosystem objectives for monitoring and protection;
2. Developing ecosystem indicators and reporting systems;
3. Developing risk-based frameworks;
4. Generating integrated ecosystem information for fisheries and aquaculture management;
5. Identifying habitats of special importance and sensitivity;
6. Understanding impacts on aquatic biodiversity (species at risk and aquatic invasive species);
7. Understanding pathways of effects driving changes; and
8. Understanding climate variability and impacts on resources.

Science Across Canada



Map of Canada showing locations of Science Institutes, as follows:

1 Institute of Ocean Sciences (Sidney)
2 Pacific Biological Station (Nanaimo)
3 Centre for Aquaculture and Environmental Research (Vancouver)
4 Cultus Lake Salmon Research Laboratory (Cultus Lake)
5 Freshwater Institute (Winnipeg)
6 Experimental Lakes Area (N. Ontario)
7 Sea Lamprey Control Centre (Sault Ste. Marie)
8 Bayfield Institute (Burlington)
9 Canadian Hydrographic Service (Ottawa)
10 Maurice Lamontagne Institute (Mont-Joli)
11 Gulf Fisheries Centre (Moncton)
12 Charlottetown Aquatic Animal Pathogen Biocontainment Laboratory
13 St. Andrews Biological Station (St. Andrews)
14 Bedford Institute of Oceanography (Dartmouth)
15 Northwest Atlantic Fisheries Centre (St. John's)

Science at Work with Coast Guard Vessels


Photo: DFO

DFO also depends on the vessels of the Canadian Coast Guard (CCG) for the successful delivery of its Science program. CCG is the marine arm of DFO — managing and operating a fleet of ships in support of DFO's Navigational Aids, Icebreaking, Search and Rescue, Environmental Response, Science, and Fisheries Conservation and Protection programs.

The Science program off the Atlantic and Pacific coasts and on the Great Lakes and inland waters includes fisheries and biodiversity and habitat research, stock assessment, oceanographic research and hydrographic surveys conducted by researchers from DFO, other government departments and universities. In addition to research trawlers, oceanographic and hydrographic survey vessels and smaller research vessels, Canadian Coast Guard icebreakers, such as the flagship *CCGS Louis S. St-Laurent*, support Canadian and Canadian-led international marine research projects in the Arctic. These tasks are carried out in addition to CCG's regular annual Arctic deployment in support of commercial shipping and northern re-supply. During the open water season, the icebreaker *Amundsen* is operated by the CCG in support of the ArcticNet science mission led by Université Laval; in the winter it reverts to its icebreaking duties in the estuary and the Gulf of St. Lawrence.

DFO Science Operates These Leading Data Services

The Canadian Hydrographic Service *(CHS) provides clients with up-to-date, timely and accurate hydrographic products and services necessary for safe and efficient navigation of navigable waters of Canada, and is a partner in ocean technology development and applications nationally and internationally. To learn more, visit www.charts.gc.ca.*

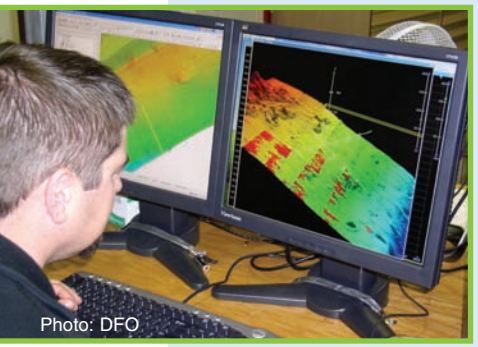


Photo: DFO

The Integrated Science Data Management *(ISDM) branch of DFO manages and archives marine environmental data, and disseminates scientific data, data products and services. ISDM is a member of the International Oceanographic Data and Information Exchange (www.iode.org), which facilitates the international exchange of oceanographic data and information. Learn more at: www.meds-sdmm.dfo-mpo.gc.ca.*

Centres of Expertise

DFO Science centres of expertise (COEs) focus on areas where it is more effective to partner both internally and externally with academia, other departments and other governments to achieve results. Some of these use regionally based infrastructure and others are virtual, focusing experts from many locations on specific projects.

The Centre for Offshore Oil and Gas Environmental Research (COOGER) is a virtual centre of expertise that coordinates research efforts into the environmental and oceanographic impacts of offshore petroleum exploration, production and transportation. COOGER focuses on sharing expertise and resources in an international setting. Learn more at www.dfo-mpo.gc.ca/science/cooger-crepge.

The National Centre for Arctic Aquatic Research Excellence (N-CAARE) has a mandate to increase knowledge of Arctic marine and freshwater ecosystems. N-CAARE works with recommendations from federal departments, northern co-management groups, universities and industry to play a key role in developing national and international partnerships to further research in priority areas. The Winnipeg-based secretariat coordinates science opportunities aboard Canadian Coast Guard vessels, as well as the infrastructure necessary for the implementation of Northern aquatic research.


Photo: ArcticNet

ArcticNet and International Polar Year

DFO researchers contribute to ArcticNet, a Network of Centres of Excellence of Canada. ArcticNet contributes to the development and dissemination of knowledge needed to formulate adaptation strategies and national policies to help Canadians face the impacts and opportunities of climate change and globalization in the Arctic. The DFO research vessel, CCGS Amundsen*, is vital to this multidisciplinary effort. Researchers from 27 Canadian universities and five federal departments collaborate with researchers from 11 other countries in ArcticNet. Learn more at www.arcticnet-ulaval.ca.*

DFO Science is also an important contributor to International Polar Year (IPY) 2007-2008. The two-year IPY science research program aims to advance knowledge of geophysical, climate and biological processes and our understanding of cultural, social, economic and health dimensions in polar regions. To learn more, visit the federal IPY website at www.ipy-api.gc.ca.

Photo: DFO

The Centre of Expertise on Marine Mammals (CEMAM) links marine mammal experts across Canada with a secretariat located at the Maurice Lamontagne Institute in Mont-Joli, Quebec. Researchers work on a wide range of projects to obtain information on the dynamics, ecology and health of marine mammals. Learn more at www.osl.gc.ca.

The Centre for Environmental Research on Pesticides (CERP) is located at the Freshwater Institute in Winnipeg. CERP carries out effects-based research related to the potential impacts of pesticides on fish and fish habitat in marine and freshwater ecosystems. Research is conducted in collaboration with other federal departments and the results are presented to the agency responsible for regulating the use of pesticides in Canada, the Pest Management Regulatory Agency (PMRA).

The Centre of Expertise for Aquatic Risk Assessment (CEARA), based in Burlington, Ontario, focuses on the principal pathways that transport aquatic invasive species to freshwater and marine ecosystems in Canada; characterizes the factors that influence establishment success of these species; and constructs risk assessment models that will direct future management policies.

CEARA links to the Canadian Aquatic Invasive Species Network (CAISN), which is funded by the Natural Sciences and Engineering Research Council of Canada, DFO, Transport Canada and other agencies.

The Centre for Ocean Model Development and Application (COMDA) is coordinating DFO's development of computer models for providing improved and increased information on ocean and marine ecosystem variability off Canada. COMDA's activities include collaboration with Environment Canada, other agencies and academic researchers in the development of a national forecasting capability for ocean temperature, currents and salinity in conjunction with atmospheric weather and sea ice.

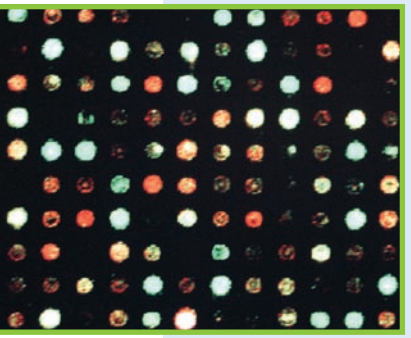

Photo: DFO

The Centre of Expertise on Hydropower Impacts on Fish and Fish Habitat (CHIF) Through partnerships with the Canadian hydroelectric industry and in collaboration with academia, CHIF sets national priorities and coordinates research activities of the department on the impacts of hydropower on fish and fish habitat. Cumulative impacts on the ecosystems in freshwater as well as in the coastal and marine environments are considered. Learn more at www.chif.gc.ca.

The Centre for Aquatic Animal Health Research and Diagnostics (CAAHRD) is a virtual network of experts with a secretariat in Moncton, New Brunswick that provides the regulatory research necessary to support the National Aquatic Animal Health Program (NAAHP).

Laboratories of Expertise in Aquatic Chemical Analysis (LEACA) at both the Institute of Ocean Sciences in Sidney, British Columbia, and the Maurice Lamontagne Institute in Mont-Joli, Quebec, undertake routine analytical services and support research.

The Centre for Integrated Aquaculture Science (CIAS) is led by St. Andrews Biological Station (SABS) in New Brunswick, and will operate virtually as required, to link research resources for evolving needs across Canada.



Barcode of Life

DFO Science contributes to large-scale DNA barcoding via the Canadian Barcode of Life Network. The national network of scientists is working to develop and apply DNA technologies for species identification. Initial work focuses on barcoding species of economic, social or environmental importance.

To learn about DFO Science and biotechnology and genomics research, visit www.dfo-mpo.gc.ca/science/aquaculture/biotech/biotech_e.html.

Attracting Top Talent

DFO Science Sector is recruiting and developing highly skilled personnel for a workforce focused on scientific excellence within a scientific culture. This is a new era of multidisciplinary ecosystem science that allows researchers the intellectual freedom to collaborate with partners in Canada and abroad. The culture fosters continuous learning and mentoring; concentrates on strengthening scientific and management capacity; and is conscious that addressing employment equity gaps creates a fair workplace. Learn about the work of scientists at Fisheries and Oceans Canada at www.dfo-mpo.gc.ca/science/career-carriere/career_e.htm.

Research published by DFO is subject to a rigorous peer review process. To learn more about the Canadian Science Advisory Secretariat, visit www.dfo-mpo.gc.ca/csas/Csas/Home-Accueil_e.htm.