Key Activities to Support Research

Surveys

The Biological Station coordinates and leads the DFO Maritimes Region's annual **multi-species bottom trawl surveys** of the Scotian Shelf, Bay of Fundy, Gulf of Maine and Georges Bank. Since 1970, these surveys on DFO research vessels, have gathered information on the abundance and distribution of commercially important groundfish species and, more recently, have included Species at Risk and other non-commercial species. We have developed an integrated computer system of at-sea data collection known as the Groundfish Surveys Entry System (GSE) that has resulted in reliable and accurate data reporting within a week of completing a survey.

Hydroacoustic surveys undertaken in collaboration with industry have played a key role in the assessment of the southwest Nova Scotia and Bay of Fundy herring since 1998. In a project developed by our staff, herring fishing captains can record the depth, density and location of herring with the simple push of a button. The information, collected by a number of automated recording systems on fishing vessels, permits a quantitative assessment of herring distribution and abundance during the spawning and fishing seasons.

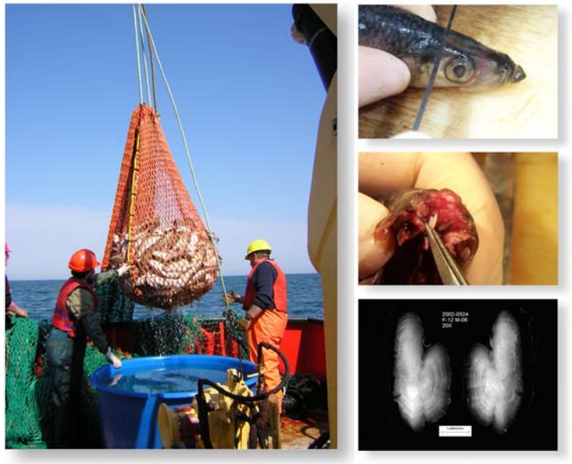
Scuba diving is used for **annual invertebrate surveys** of lobster spawning and lobster settlement grounds, as well as for the evaluation of sea urchin population size structure and densities. These surveys are often done in collaboration with the commercial fishing industry.

Lobster survey (left) and tagging yellowtail flounder (right)

Aging and Chemical Analyses

Accurate **age determination** of fishery and research samples provides the basis for evaluation of stock status using age-based models. The otoliths, or ear bones, are removed from the fish, and scientific staff examine them microscopically to determine growth patterns, spawning events and the age of the fish. Quality control is of utmost importance, and is aided by age-reader comparison readings, including international collaborations. The Section has established an otolith image library for training, workshop and testing purposes.

In addition, **chemical analysis** of the composition of bluefin tuna otoliths is being used to better understand their population structure in the Atlantic Ocean.



Catch in bottom trawl survey (left), herring otoliths (right) showing the location in the fish, extraction, and otoliths of a 9-year old herring

Tagging – A Collaborative Effort

Important **tagging research** on cod and yellowtail flounder migrations is being conducted jointly by Section staff and the Canadian fishing industry, as well as with scientists from the United States. Recent pollock mark-and-recapture tagging studies provide insight into stock structure, validation of the interpretation of fish ages and information on fish movements throughout the Gulf of Maine and Georges Bank area.

Herring exhibit a diverse level of stock complexity with distinct "spawning components" or groups which return to the same spawning areas at the same time year after year. We are currently involved in two tagging research projects in collaboration with industry and government organizations to better understand this stock complexity.

International collaboration helps to better understand bluefin tuna and swordfish migration patterns, and population size and structure in the Atlantic Ocean. Currently, we are using sophisticated high-tech electronic tags that record the swimming depth, water temperature, and location of swordfish, and relay information to a satellite for subsequent analyses.

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ST. ANDREWS BIOLOGICAL STATION

Dedicated to Excellence in Aquatic Science since 1908

POPULATION ECOLOGY RESEARCH

The Population Ecology Section staff conduct **research** and **stock evaluations** to provide scientific advice for fisheries management and the Species at Risk program. This includes research on a broad range of marine finfish and invertebrate resources, including Atlantic herring, haddock, cod, pollock, yellowtail flounder, swordfish, bluefin tuna, mackerel, lobster, Jonah crab, rock crab, and sea urchin. Scientific information is gathered from field surveys, tagging programs, aging studies, commercial catch data, and field and laboratory studies. Results are reported in peer-reviewed documents.

Our primary focus is the Gulf of Maine and the Bay of Fundy, which include several **transboundary** stocks that are assessed collaboratively with scientists from the United States. We have the national mandate for Atlantic tunas and swordfish, highly migratory fish stocks that are managed by an **international** fisheries commission. Research is conducted to improve the evaluation and management of **Species at Risk**, as referred to in the Species at Risk Act.

Station scientists are leading in the development of **methodology and technology for stock assessment**, including the transition to an **ecosystem approach to management**. Our work continues to draw international recognition and interest.

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DFO research vessel, CCGS Alfred Needler docking at SABS (top), commercial landing of a bluefin tuna (centre), and a North Atlantic right whale tail (bottom)

Canada

Ecosystem Approach to Management

The Population Ecology Section provides the science to support an **ecosystem approach to management** of human activities, in particular fisheries, consistent with the three pillars of conservation: to maintain productivity, to conserve biodiversity and to protect habitat. Science advice on suitable harvest levels is of paramount importance to maintain productivity of exploited populations and to permit those species to fill their traditional role in the ecosystem. Research on ways to manage discards and limit incidental mortality reduces waste and conserves biodiversity. Science aimed at classifying habitat sensitivity and measuring the disturbance caused by fishing can be used to devise ways to protect habitat. SABS has developed innovative methods to make an ecosystem approach to management operational.

Managed Fisheries

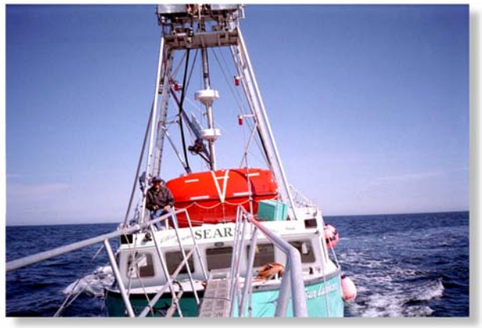
Science advice produced by SABS guides management of groundfish and herring on Georges Bank, the Scotian Shelf and the Bay of Fundy; bluefin tuna and swordfish in the Canadian Atlantic Zone; and lobster, crab and sea urchin in the Bay of Fundy. All are active and valuable fisheries. Our researchers provide and analyse scientific data used in the management of these resources, resulting in peer-reviewed documents.

Georges Bank, southwest Scotian Shelf and Bay of Fundy **groundfish** are economically important for the region. Cod, haddock and yellowtail flounder on Georges Bank are considered transboundary resources and are subject to directed fisheries in both Canadian and United States waters. Staff participate in the Transboundary Resource Assessment Committee (TRAC) and the Transboundary Management Guidance Committee (TMGC) where these Georges Bank stocks are assessed and managed cooperatively. The Scotian Shelf and Bay of Fundy groundfish stocks, including cod and pollock, are assessed in the DFO Maritimes Regional Advisory Process (RAP), where our staff play an important leadership role.

Since **tunas and swordfish** are highly migratory fish that range over the entire Atlantic Ocean, they are managed internationally by the International Commission for the Conservation of Atlantic Tunas (ICCAT). Canada is one of more than 40 Contracting Parties of ICCAT. Although Canada's catches are relatively low in the Atlantic-wide scheme of things, DFO plays a key role in the scientific and management committees, consistent with Canada's strategy to strengthen **International Fisheries Governance**.

The **herring** fishery is a vital industry for the southwest Nova Scotia, Bay of Fundy and coastal areas from Cape Breton to Grand Manan. Our researchers provide scientific advice on herring stock status and biology through RAP, to assist management and increase knowledge of the various herring fisheries. Decisions regarding the appropriate distribution and rates of fishing during the season are based on the latest available information including acoustic surveys and biological sampling so as to allocate fishing effort appropriately.

Invertebrate species are of great economic importance in the Bay of Fundy. Lobster, Jonah crab, rock crab and sea urchin fisheries are monitored and studied by our staff. Lobster research includes studies on the early life cycle, habitat and migration patterns. Jonah crab, rock crab and sea urchin are newer fisheries to the region and Section staff monitor their populations with the help of the commercial fishing industry.



Commercial swordfish harpoon vessel (top), herring weir fishing operation (centre), and crab fishing (bottom)

Species at Risk

In preparation for the implementation of Canada's Species at Risk Act (SARA) in June of 2003, DFO initiated Species at Risk programs across Canada. At the SABS, the Species at Risk group has three focal areas: research in support of the recovery of **listed species**, evaluation of potential **candidate species**, and research on strategic Species at Risk issues.

Research is conducted on the **North Atlantic right whale**, which is a **listed species** under SARA, in cooperation with both members of the local fishing industry and members of an international community of scientists. The North Atlantic right whale, one of the most endangered cetacean species in the world, frequents the Bay of Fundy in the summer months and is subject to ship strikes, entanglement in fishing gear and whale-watching activity. Collaborative research monitors the numbers, behaviour and health of the whale population as it frequents the area. An updated Recovery Strategy for this species has been prepared.

Information is collected and analyzed to evaluate species that are of potential conservation concern **(candidate species)**, but are not listed under the Species at Risk Act. These species may be considered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and may or may not be listed under SARA at some point in the future. On-going research on species biology, ecology and interactions with human activities assists in the development of mitigation strategies to reduce the threats to these species. Species that have been evaluated include **cusk** and **harbour porpoise**, and new species may be evaluated each year.

The Species at Risk program also addresses strategic research issues. An example is the investigation of how populations are spread out within their known ranges and the effect this distribution may have on population abundance through time.

North Atlantic right whale breaching (top), cusk (centre) and harbour porpoise (bottom, courtesy of Grand Manan Whale and Seabird Research Station)