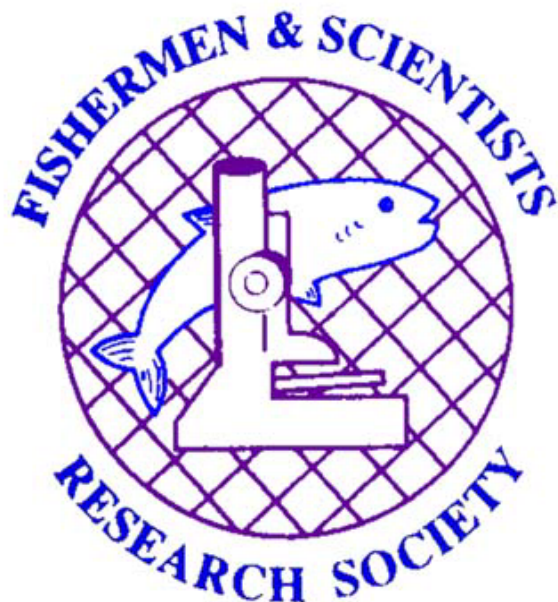


**DFO/FSRS  
INSHORE ECOSYSTEM  
RESEARCH ON THE  
SCOTIAN SHELF**



**2005 – 2006 Year End Report  
October 2005 to March 2006  
JPA F5261-050048**



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# Inshore Ecosystem Research on the Scotian Shelf FSRS 2005/2006 Year End Project Report

## Introduction

Both nationally and regionally, the Department of Fisheries and Oceans (DFO) is undertaking an ecosystem approach to oceans management, including the Eastern Scotian Shelf Integrated Management (ESSIM) initiative, and the development of methods for the identification of Ecologically and Biologically Significant Areas (EBSAs). Recently the geographic scope of Integrated Management planning under the Oceans Action Plan has been extended to include inshore waters of the Scotian Shelf.

Inshore areas are critical nursery and feeding areas for many marine species but we have insufficient scientific data to meaningfully contribute to either Integrated Management of the inshore or definitions of EBSAs. The DFO/FSRS Inshore Ecosystem Research on the Scotian Shelf project, funded under Phase 1 of the Oceans Action Plan, aims to fill this data gap to the extent possible. We propose to bring together existing data and knowledge from a range of sources, including a local ecological knowledge survey of commercial fishermen, and to collect new data, on the use of the inshore by marine and diadromous fish, marine mammals, invertebrates, and marine plants and their habitat associations. These data are essential for the successful implementation of Integrated Management.

The Inshore Ecosystem Research Project is a joint project between the Fishermen and Scientists Research Society (FSRS) and DFO, which we hope will grow to include other researchers and members of the fishing industry. This project relies heavily upon the participation of inshore fishermen for both the local ecological knowledge survey and the collection of new data. FSRS fishermen members have been involved in the design of the project and will be critical to the successful completion of the project. Through the FSRS field personnel, the community presence of the FSRS will be maintained.

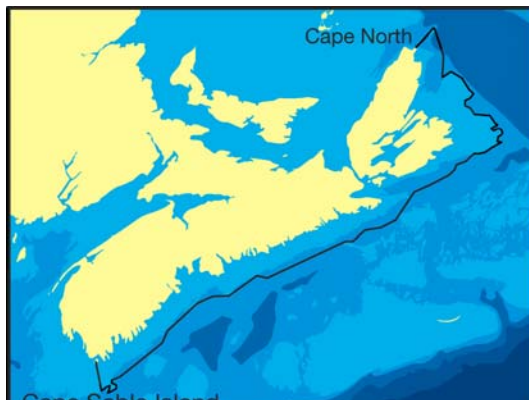


Figure 1. Map of Nova Scotia, Canada, showing the 50 fathom line (100m) and the 12 mile offshore line.

The geographical scope of the proposed project is the inshore area of the Scotian Shelf (Figure 1), from Cape North to Cape Sable Island. For the purposes of this project, the inshore is defined as the current inshore limit of the DFO Research Vessel Trawl Survey, less than 50 fathoms depth or less than 12 miles offshore. We note however that these limits neither reflect the functional role of this ocean area in the structuring and population dynamics of diadromous or marine species, nor the distribution of species, habitats and ecological processes. Therefore, we consider

these limits as a guide only, and during the course of the project we will explore the more ecologically and biologically relevant boundaries.

This project will begin with baseline research on the distribution and relative abundance of marine and diadromous fish, marine mammals, invertebrates and marine plants by surveying existing scientific literature and data; conducting a local ecological knowledge survey; and by conducting at-sea catch analysis during commercial fishing activities. The second year of the project will also involve fisheries-independent research to describe the distribution of species along the Atlantic coast of Nova Scotia out to 50 fathoms. This will provide a degree of ground-truthing for the baseline information and provide more detailed data to identify geographic gradients, habitat and species associations, and candidate EBSAs. By April 2007, we will have completed a draft Ecosystem Overview and Assessment Report (EOAR) for the Inshore of the Scotian Shelf, which will contribute to the development of a strategic research plan in support of Phase 2 of the Oceans Action Plan.

### **Overall Deliverables**

- Draft EOAR for the inshore area of the Scotian Shelf.
- Provisional descriptions of potential EBSAs in the inshore area.
- Provision of data, identification of data gaps and plan of research, including methodology, for future EBSA research in the inshore area.

### **Project 1. EOAR Report Development**

#### **Purpose**

The Project Officer will produce the draft Ecosystem Overview and Assessment Report for the projects in this JPA and will participate in the other projects outlined in this JPA, organize the Science Data Gathering and Overview Workshop in January 2006, and function as liaison with the DFO/FSRS Ecosystem Working Group. A proceedings document from the workshop will be produced, which will form the first contribution towards the draft Ecosystem Overview and Assessment Report.

#### **Results**

The Project Officer, Nell den Heyer, has been hired to oversee various aspects of this project and the other projects associated with this JPA.

The *Workshop on Inshore Ecosystems and Significant Areas of the Scotian Shelf* was hosted by the Department of Fisheries and Oceans (DFO) and the Fishermen and Scientists Research Society at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia on January 16 – 19, 2006. Participants included government, university, industry and NGO-supported researchers. The objectives of the workshop were: (i) to explore our knowledge of the biodiversity, structure and function of the inshore Scotian Shelf, (ii) to explore

the criteria and metrics for the identification of ecologically and biologically significant areas (EBSAs), and iii) to identify EBSAs based on scientific expert opinion. Participants identified 36 possible EBSAs in the inshore, and 27 in the offshore. The proceedings are an important first step in the development of the first Ecosystem Overview and Assessment Report (EOAR) for the inshore of the Scotian Shelf and the identification of EBSAs in both the inshore and offshore. The proceedings and copies of many of the presentations are available on the Centre for Marine Biodiversity website:  
<http://www.marinebiodiversity.ca/en/other-activities1.html>.

## **Project 2. Catch and Data Analysis of Commercial and Non-Commercial Species to Develop Broad Baseline Knowledge of Inshore Ecosystem Use**

### **Purpose**

The purpose of this project is to synthesize existing data on marine plants, invertebrates and marine and diadromous fish and their fisheries to compile a picture of their spatial and seasonal distribution in the inshore area. At-sea analysis of catch will be performed to determine the range of species that is seen by the commercial sector and their current distribution and relative abundance. A Local Ecological Knowledge survey will be developed and captains and crew will be interviewed to obtain their knowledge of current and historical fish/invertebrate/marine plant distribution and spawning/feeding areas in the inshore. Data obtained will be used for the draft EOAR, to identify preliminary EBSA's, to enable Phase II OAP research and to identify areas for EBSA directed research.

### **Results**

#### **(i) Archival work**

##### *Section 52 Licences*

A review of the Section 52 licences between 1999 and 2005 identified the recent and ongoing research initiatives in the inshore area of the Scotian Shelf. On average, 55 licences were given for research in the study area each year. Licence holders were associated with various government departments, universities, NGOs, the Nova Scotia Museum of Natural History, and the tourism, fishing and aquaculture industries. Several of the Section 52 licence holders attended the Workshop on Inshore Ecosystems and Significant Areas on the Scotian Shelf.

##### *Literature Search*

The workshop on Inshore Ecosystems and Significant Areas highlighted the diversity of research that has taken place in the inshore and the need to compile this information. The research and knowledge of 4 of the 10 Significant Habitats: Atlantic Coastal Initiatives (SHACI) units in our study area, has recently been described in some detail. The literature search will be structured in accordance with the outline of the EOAR, and will build on the SHACI Reports.

**(ii) Aerial photographs and remote sensing**

Megan Veinot (FSRS Fisheries Technician) worked with Glyn Sharp and Bob Semple to recover data from old files and photographs. She converted data on bottom type and macrophyte cover from inter-tidal transects done in 1993 in Mahone Bay to an S-plus compatible database, and provided summary statistics. She also cleaned the macrophyte biomass data from St. Margarets Bay, Lunenburg, Mahone Bay and LaHave. Map Info was used to create polygons of the Marine Plant Harvesting areas in St. Margaret's Bay, Prospect and Sambro from hard copies drawn by Bob Semple. Aerial photographs in those areas were hot-linked to the map. Eventually this and other data will be made public. Megan also estimated the area of seaweed beds per sector from aerial photos using Image-J, a freeware product that allows you to estimate the area of an object.

**(iii) Existing research survey and observer catch data for diadromous fishes**

The observer data has been extracted from the database by Jim Simon (DFO technician), see (iv) below, and the data will be examined to determine the catch of diadromous fishes.

**(iv) Catch statistics from inshore fishers**

Jim Simon (DFO Technician), extracted catch information from a number of DFO databases to better our understanding of all of the species caught in the inshore and offshore areas. Where possible, depth, bottom temperature, number of hooks and other set information was also extracted. To determine whether an observation was inshore or offshore, SHACI units, expanded out to the 50fm depth contour, were combined into a single polygon. The positional data was then applied to the polygon to identify each set as inshore or offshore.

The 4Vn and 4VsW Sentinel surveys as well as the ITQ industry survey were examined in detail. Other industry surveys had too few sets in the inshore area to make comparisons worthwhile. The 4Vn Sentinel survey has been conducted since 1994. The total number of sets examined was 2966. The 4VsW Sentinel survey began in 1995 and covered the entire area until 2004. In 2005, the survey was restricted to 4W. Total number of observations is 2158. The ITQ industry survey began in 1996 and covers 4X. The total number of sets is 1842. Generally species identification on surveys is better than on most observer trips.

The observer program has been conducted on the Scotian Shelf since 1977. Initially coverage was primarily of foreign vessels near the edge of the shelf. Coverage was expanded quickly to the offshore component of Canadian vessels, but there was little coverage in the inshore area. For example in 1990 only 44 out of 9000 observations were from the inshore area. As the offshore fleet has been reduced coverage in the inshore area was increased but is still a relatively small part of the coverage. Since 2000 approximately 10-15% of the observer coverage in 4VWX has been in the inshore area. Species identification problems within the database have been noted in the past and care must be taken in understanding the information.

The largest database examined was the commercial landings. Positional information has been available since 1990, although 1990 is incomplete. Many

inshore fleet sectors, for example the lobster fleet, have little latitudinal or longitudinal information, but they do have NAFO area. The 1990 to 2002 information was extracted from the ZIF database. This information is summarized into subtrips which have a latitude and longitude, but no individual set locations. Since 2002 the commercial landings are in the MARFIS data system. Information is on a set by set basis. This is a huge database, for example in 2003 over 270,000 individual catch records were extracted. These were summarized into 45,000 sets and then identified as within the SHACI polygon. Of these sets approximately 8800 were within the inshore area. Non-commercial species are not included in this data and species like dogfish, skate and sculpins are not covered under the Fisheries Act.

**(v) At-sea analysis of catch**

Catch statistics in DFO databases only provide data on the catch that are taken from the sea and recorded. At-sea analysis of the commercial catch is being undertaken to determine the distribution and relative abundance of the whole spectrum of species caught by commercial fishing gear. FSRS fisheries technicians are going out on commercial vessels, primarily lobster and longline vessels. The technicians also plan to collect at-sea analysis of catch for other fisheries including the eel fishery, mackerel trap fishery and all other inshore fisheries. At-sea sampling will take place year round to capture seasonal changes, although the interpretation of this data will have to take into consideration the seasonality of most fisheries. 42 samples have been completed to date, primarily from lobster fishing vessels.

To capture and record the data from the inshore, we are using the DFO Industry Survey Database (ISDB) to ensure that the Inshore Ecosystem Project data will be compatible with other types of data collected by the DFO and FSRS. This entails using the ISDB datasheets that are currently used by fishery observers. At sea, fishery observers record all the fish being landed on the ISDB data sheets but they do not record other marine invertebrate species and marine plants, etc. Carl MacDonald (FSRS) in discussion with the IEP working group and Shelley Bond modified the datasheets to capture all the data we wish to record from the inshore area and prepared a manual for the technicians. The paper datasheets then follow the same fate as the fishery observer sheets and are entered into a flat file by a third party. The flat file is then edited and uploaded into a DFO oracle database for analysis. The Ecosystem Research From Lobster Traps operations manual (Appendix 1) was developed from the ISDB manual. For the longline fishery, the 4VsW sentinel manual provides the instructional detail required to record the inshore ecosystem data. Due to the time required to develop manuals, recording data from other fisheries and capturing it on ISDB sheets will be done on an ad hoc basis.

At-sea catch analysis began in the fall of 2005 for the inshore ecosystem project. The first trip where ecosystem data were recorded was from a longline vessel. Recording the data went very well on board the inshore longliner. For the next trips, at-sea analysis of catch was recorded from lobster vessels. There were many problems trying to record ecosystem data from lobster traps. The major problem faced was that each lobster trap generates a separate catch sheet. The technicians became quickly swamped with sheets of paper. The solution was for

the technicians to develop a multitasking data sheet (Appendix 2). This sheet allows a technician to record data from a number of lobster traps on one sheet of waterproof paper. Once on dry land, the technician can transfer the data to the proper ISDB datasheets. This method of recording data from the lobster fishery appears to be working well.

The next step is to have the data collected thus far entered and uploaded into the DFO oracle database. Then, we need the technicians to collect more at sea catch data from as many inshore fisheries as possible. In final, the collections of at-sea catch data are a work in progress, which requires focus and constant effort.

**(vi) LEK survey of fishermen**

The Local Ecological Knowledge Survey of commercial fishermen will map local knowledge of the distribution, seasonal changes in abundance, and life history and habitat associations of fish, invertebrates, birds, mammals and macrophytes based on fishing histories and practices in the inshore ecosystem. Fishermen will also be asked to identify ecologically and biologically significant areas. These maps will compliment fisheries independent research, at-sea catch analysis along the coast of Nova Scotia and the identification of ecologically and biologically significant areas by scientific experts (Proceedings of the DFO-FSRS Workshop on Inshore Ecosystems and Significant Areas of the Scotian Shelf).

A rigorous two-tiered approach to this survey has been adopted. The first tier of this survey, which is underway, is a telephone survey that asks inshore commercial fishermen to identify the local experts in their community. The telephone survey has four parts and takes approximately 20 minutes to complete. The districts in which transects are planned for the Fisheries Independent survey have been chosen as the focal areas for the local knowledge survey. Twenty per cent of inshore fisheries (e.g. lobster, herring, mackerel, clam, marine plants) licence holders in each statistical district were randomly selected for the tier 1 telephone survey. FSRS Community Technicians are expected to complete these surveys by the end of October.

The second tier will be a semi-structured face-to-face interview with the peer-identified experts from Tier 1. This semi-structured interview is being developed and FSRS Community Technicians will complete the face-to-face interviews of peer-identified experts between September and November. The local knowledge maps will be digitized and this information will be included in the EOAR.

**(vii) Monitoring eelgrass and kelp from boats**

Questions about eel grass distribution and other macrophytes will be incorporated into the LEK mapping survey with local experts.

**Project 3. Determine the Location of Inshore Grey Seal Pupping Areas**

**Purpose**

The purpose of this project is to identify inshore grey seal pupping areas in order to map the pupping grounds and gather information for EOAR and EBSAs. The data will support the DFO grey seal population survey to be conducted in 2007.

**Results**

Fishermen's local knowledge of grey seal pupping areas is being gathered through an interview process. All FSRS fishermen members were asked to participate. 216 interviews were completed (72 face-to-face and 144 by telephone), 14 people refused to participate in the interview or were unable to be contacted. The results will be used to help DFO design an effective study to reliably estimate pup production in the Maritimes Regions. Jim McMillan (DFO) is analysing the data. The collected information will be summarized and reported through the FSRS newsletter and other avenues if requested or appropriate.

**Project 4. FSRS Oceanographic Monitoring, Database Development and Analysis**

**Purpose**

The purpose of this project is to create a process to incorporate the FSRS data into the DFO's Coastal Time Series (CTS) database. It will result in a description of oceanographic conditions of the inshore for the oceanographic components of the EOAR and definition of EBSAs.

**Results**

Current FSRS data protocols have been modified to make the FSRS data more easily incorporated into the DFO CTS database and therefore, more readily accessible and useable by DFO and the FSRS. A program was generated to translate the FSRS data time series over the last six years into the CTS database.

The FSRS Lobster Recruitment Database and the Positional Information text file have been modified to:

- Convert positional data from degrees minutes to decimal degrees.
- Convert the depth data from fathoms into meters.
- Add minilog number to the database for use in the excel file.
- Send the data to Roger Pettipas in a single workbook as opposed to individual workbooks; send data in files per LFA in text format.
- Send *ascii* files in LFA labelled folders.
- Add LFA to the data file sent to Roger Pettipas.
- Include time of haul in the data file sent to Roger Pettipas.
- Initialize minilogs in GMT (was not done for Spring 2006 gauges)

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- All blank spaces in the temperature and minilog number column will be - 99.
- All date and time formats will be in general format when sent in the text file.

All these changes were made either to the database or the file sent to Roger Pettipas, Technician (Oceanographic Data, DFO). The file was sent as a text file as well. Some of the *ascii* files sent were in a different format but could not be changed since the problem only occurred when opened with an editing software. Victor Soukhovtsev (Evans Computer Application) and Roger Pettipas were consulted about any positional errors found or any other errors that needed to be corrected. All FSRS lobster recruitment temperature *ascii* files have been sent to Roger Pettipas as well as the corresponding positional text files.

A two part procedure for the processing of the FSRS temperature data has been developed.

- Part 1 The new scripts were designed to process the FSRS temperature data. Draft ODF files were generated as input for the next part.
- Part 2 The existing ODS MatLab scripts were modified as necessary to generate the final ODF files. The draft instructions for the procedure is prepared.

The data from LFA33 and LFA34 from 2003 to 2005 are processed (about 180 minilog files). The final ODF files are generated (about 294 ODF files) for the testing and maintaining by the OSD datashop staff. The edition of the scripts used in Part 1 is following. The FSRS data from other LFAs was processed in January 2006.

Incorporation of FSRS data sets into the CTS database and a demonstration that they can be accessed was completed in January and the website for the CTS was sent out. Doug Gregory, Head, Data Management, DFO, gave a demonstration of the CTS database at the April 7, 2006 Ecosystem Working Group meeting. The web site address for the CTS database is:

[http://www.mar.dfo-mpo.gc.ca/science/ocean/database/data\\_query.html](http://www.mar.dfo-mpo.gc.ca/science/ocean/database/data_query.html).

## Project 5. Fishery Independent Surveys of Areas of Interest to Ground-Truth and Supplement Fishery Information

### **Purpose**

A depth and region (Cape Breton, Eastern Shore, Southern Shore) stratified transect survey has been designed to:

- Determine the broad spectrum of species that inhabit the inshore (assessment of biodiversity).
- Determine associations between species, life-histories, and habitat types.
- Identify spawning, feeding, and nursery areas, seasonal refugia, or migration pathways for commercial and non-commercial species.

- Verify or “ground-truth” results from fisheries landings and at-sea catch analyses.
- Contribute to the assessment of Ecologically and Biologically Significant Areas (EBSAs) in the inshore, based on the EBSA criteria: uniqueness, aggregation, life-history consequences, naturalness and resilience.

A variety of fishing gears and sampling equipment will be used to capture demersal fish and invertebrates, sample water for nutrients, measure temperature, salinity and chlorophyll “a”, and bottom type. Fish and invertebrates will be sampled with a beach seine, multi-paneled experimental gill nets and traps. Sampling will take place in the summer (beginning late June to September). Research will be conducted in ten sites. Nine transects will be sampled once, and one transect will be sampled four times. Site selection criteria includes size of embayment (km<sup>2</sup>), prior research, proximity to three FSRS community technicians, potential for partnerships, and interest of local fishermen. Areas being considered include: Port LaTour, Port Mouton, LaHave River Area, St. Margaret's Bay, Chezzetcook, Ship Harbour, Sheet Harbour, Country Harbour, Gabarus Bay, Mira Bay, and St.Peter/Isle Madame. A charter vessel will be contracted for 2-3 days for each transect out to 12 nautical miles, and in the very nearshore sampling will be supported by a DFO Boston Whaler.

## **Results**

Much of the sampling gear for the survey has been identified. There will be some gear testing in May and June and the survey will start the first week of July.

## **Collaborations**

### *Birds*

An outcome of the Workshop on Inshore Ecosystems and Significant Areas in January was the identification of the potential for collaboration between Canadian Wildlife Service and the FSRS. The FSRS has put a proposal into the Science Horizons Internship to support an FSRS intern. The intern will develop educational material for fishermen and seek to involve fishermen in monitoring sea birds. Also, the CWS is developing a protocol for FSRS Community Technicians to survey seabirds during the fisheries independent sampling and is helping to develop questions on distribution and abundance of birds for the Local Ecological Knowledge Survey.

### *Invasive Species*

A recent Letter of Intent (LOI) was funded (Invasive Species funding, lead is Benedikte Vercaemer) to monitor tunicates from the nearshore transect stations in the Fisheries Independent Research. This was proposed as a collaborative project whereby we will deploy settling devices during the fisheries independent sampling and coordinate retrieval, and will benefit from an extra body in the field for some of the summer. Further, educational materials to elicit participation of fishermen in the identification and reporting of invasive tunicates will be developed. The information on invasive tunicates will be incorporated into the EOAR.

