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SECTION I. Newfoundland Region, by L. W. Coady

SECTION II. Scotia-Fundy Region, by J. S. Scott

SECTION III. Gulf Region, by J. S. Loch

SECTION IV. Quebec Region, by L. Cleary

Section I. Newfoundland Region

by

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SUBAREAS 0 AND 1

A. Status of the Fisheries

1. Shrimp. Canadian landings of shrimp from Subarea 0 in 1985 totalled 3,073 t up from 2,279 t in 1984.
2. Other species. No other species of fish or invertebrates were landed by Canada from these Subareas in 1985.

B. Special Research Studies

1. Environmental Studies

- a) Atlantic salmon. A multiple linear regression was used to assess the impact of environment on salmon abundance at West Greenland. Of the variables tested, the northward extent of the 4°C water isotherm in January and in August explained 71% of the variation in abundance. It suggests that poor catches in 1983 and 1984 were environment related, probably due to the cold 1982-83 and 1983-84 winters.
- b) Atlantic Oceanographic Laboratory (BIO). Researchers set four current meter moorings and recovered five moorings set in previous years as a continuation of a program to improve our knowledge of the circulation patterns in Baffin Bay. In addition, a number of CTD stations were occupied and six surface drifters tracked throughout Baffin Bay. Analysis of historical data sets and numerical/theoretical modelling of Baffin Bay circulation continued.

Additional studies by AOL:

- measurements of the "age" of the bottom water in Baffin Bay (Subarea 1 also);
- geochronology and radioactivity in sediments of Baffin Island fjords and sedimentation processes;
- regeneration of nutrients in Baffin Bay (also Subarea 1);
- distribution of sea-ice melt water in Baffin Bay.

- c) Newfoundland Institute for Cold Ocean Science (Memorial University). Investigations were made of the buoyant plume from a submarine spring in Cambridge Fjord, Baffin Bay in September. Visual and photographic observations, and water property and discharge velocity measurements at the vent were made using the submersible PISCES IV, deployed from the PANDORA II. Biota at the vent were spectacular.

## 2. Biological Studies

- a) Atlantic salmon. A total of 4,703 salmon was sampled at the fish plant in Holstenborg; 1,469 from Sukkertoppen, 5,247 from Godthaab and 1,885 from Frederikshaab in centimeter length groups; including detailed measurements of fork length, gutted weight, and of these 3,300 were scale-sampled. This project provides an annual assessment of the proportion of North American and European fish caught at West Greenland. Also, 35 salmon were detected with micro tags and 40 with Carlin tags. Carlin tags were from Canada, USA, Scotland, and Norway.

Examinations were made of the potential of blood protein analysis for providing known origin salmon for yearly verification of scale character analysis. Starch gels previously processed were examined but continent of origin could not be interpreted. Further studies will be attempted in 1986.

- b) Canadian observers participated in several trips fishing shrimp in Davis Strait (0+1) during 1985. All trips were on foreign vessels chartered to fish the Canadian allocation except for twelve days fished in 1A&1B. A total of 389 fishing days and 2,110 sets was observed, with a total of some 156,517 shrimp measured.

## SUBAREA 2

### A. Status of the Fisheries

1. Cod. Canadian landings were 11,100 t, down from 23,400 t in 1984 and 48,800 t in 1983. Landings were almost entirely from Div. 2J, with only 240 t from Div. 2G and 2H. Landings from the Inshore sector amounted to 9,500 t or 85% of the total Canadian landings from this Subarea, a decrease 13,600 t landed Inshore in 1984. Offshore landings were only 1,600 t, compared to 9,800 t in 1984. This decrease is explained by a reduction in offshore fishing effort in this Subarea during 1985.
2. Redfish. Canadian landings were 940 t, compared to 180 t landed in 1984. These landings were primarily from Div. 2J, with 130 t landed from Div. 2H.
3. Greenland halibut. Canadian landings were 5,400 t compared to about 6,700 t landed both in 1983 and 1984. About 4,100 t were landed from Div. 2J, with the remainder being landed from Div. 2H. The Inshore sector accounted for about 37% of the landings in this Subarea.
4. Other groundfish. Canadian landings of other groundfish species amounted to only 100 t in 1985.
5. Capelin. Landings of capelin remained at a low level.
6. Herring. Landings of herring remained at a low level.
7. Atlantic salmon. Commercial landings of Atlantic salmon in Subarea 2 during 1985 were 211 t, compared to 229 t in 1984. The recreational harvest totalled 4.5 t.
8. Arctic charr. Landings of Arctic charr in Subarea 2 during 1985 were 141 t, a decrease of 5% from 1984. Factors contributing to the decreased catches included reduced effort (possibly due to ice conditions) and overall decreased abundance of charr in the region.
9. Shrimp. The Subarea 2 shrimp fishery was subject to a total quota restriction of 4,920 t in 1985, 2,800 t of which were in the Hopedale Channel. Total landings in 1985 were approximately 1,400 t.

### B. Special Research Studies

#### 1. Environmental Studies

- a) Hydrographic studies. The Seal Island section in 2J was occupied in July. Temperature profiles were taken at each fishing station occupied during 1985.

- b) Atlantic Oceanographic Laboratory (BIO). The long-term current meter mooring program on Hamilton Bank was expanded (8th year). Additional moorings and bottom pressure gauges were set to determine whether such bottom pressure measurements can provide a better estimate of the transport of the Labrador Current.

An additional line of bottom pressure gauges was placed across Nain Bank for the same purpose. Satellite tracked ice beacons were placed on the ice offshore of Nain and used to track the drift of ice down the Labrador Shelf.

Hydrographic measurements were carried out on Hamilton Bank and the continental slope.

Additional studies:

- trace metal geochemistry;
  - paleoclimatology of Lake Melville;
  - background levels of petroleum residues in the waters and surficial bottom sediments.
- c) Marine Ecology Laboratory (BIO). In September a major interdisciplinary cruise was undertaken to the Labrador Shelf. Earlier studies within MEL suggested mixing in Hudson Strait and Ungava Bay produces nutrient enriched surface waters during the summer which are carried by the mean circulation onto the Labrador Shelf. It was hypothesized that this nutrient flux results in increased primary production and as a food chain develops it is advected southward by the Labrador Current. This would result in an increase in the relative importance of larger size particles to the south along the Labrador Shelf. The cruise was an attempt to test this hypothesis by measuring biomass as a function of size (particle size spectra) both along and across the Shelf. Bacteria and phytoplankton size particles were measured using a Coulter Counter; zooplankton were collected in vertical net hauls and a large mesh Tucker trawl and size fractionated and fish abundances were determined using acoustical methods (ECOLOG). Such data, together with information on the temperature, salinity, currents, nutrients and chlorophyll, were collected on ten transects over the Labrador Shelf from Hamilton Bank in the south to Cape Chidley in the north. At selected sites benthic samples were taken for benthic particle size spectra determinations. This voyage represented the first ever cruise dedicated to measuring spectra over such a wide range of particle sizes.
- d) Newfoundland Institute for Cold Ocean Science (Memorial University). The physical oceanographic data sets collected on the Labrador Shelf as part of the Offshore Labrador Biological Studies (OLABS) program which terminated in 1982 are being analysed. Models are being developed dealing primarily with shelf wave response.

## 2. Biological Studies

- a) Cod. Biological sampling of the commercial fishery included observations from both the inshore and offshore sectors. From research vessels, distribution and abundance studies were carried out and detailed biological sampling was conducted.
- b) Redfish. A research cruise to Div. 2J in the fall collected data on the distribution and abundance of redfish. Samples of length frequencies and otoliths were taken both from research and commercial catches in order to monitor the age distribution of commercial catches and the population as a whole.
- c) Flatfish. Data on distribution and abundance of American plaice, Greenland halibut, and witch were collected during a regular fall survey of Div. 2J. This is part of a regular survey program that began in 1977.
- d) Capelin. An acoustic survey in Div. 2J3K in October 1985 located capelin mainly in Div. 2J.
- e) Atlantic salmon. A total of 3,025 Atlantic salmon caught in the commercial fisheries was sampled for size and age distribution.
- f) Arctic charr. In excess of 2,700 samples were obtained for age determination of Arctic charr in commercial landings from thirteen northern Labrador fishing areas. Approximately 22,000 fish were sampled for length distribution from the same areas. Tagging studies were continued to clarify the extent of seasonal and annual movements and to determine the degree of annual commercial exploitation. Stomach samples were obtained from seven areas for evaluation of food and feeding habits. Information on the sex distribution and maturation of commercially caught charr was obtained from twelve subareas.

A counting fence research facility which was established on Ikarut River, Hebron Fiord in 1981 was operated again in 1985. Characteristics of upstream migrating charr and the dynamics of the population are being examined.

- g) Shrimp. A research vessel survey which was conducted in August, 1985 completed a biomass survey using a Sputnik 1600 shrimp trawl in the major areas where commercial concentrations occur. A total of 182 sets was made with the greatest catch (1,600 kg) being obtained in the Cartwright Channel. Catches in the Hopedale Channel ranged to 854 kg. Information from this survey was used to estimate shrimp abundance which, in turn, was used to update CAFSAC advice on total allowable catches for 1985. Given the year to year variability in abundance, CAFSAC has considered that the above approach to advising catch levels is appropriate for the Labrador stocks.

### SUBAREA 3

#### A. Status of the Fisheries

1. Cod. Canadian landings were 244,000 t, up from 228,000 t in 1984 and 222,000 t in 1983. Landings from the offshore sector were 145,000 t, up from 111,000 t in 1984, while inshore landings showed a decrease from 116,000 t in 1984 to 99,000 t. Landings from Div. 3K and 3L accounted for about 70% of all cod landings in the Subarea.
2. Redfish. Canadian landings were 26,700 t, compared to 23,100 t landed in 1984 and 20,500 t landed in 1983. Div. 3K landings accounted for 77% of the total landings, with 20,500 t landed compared to 17,200 t in 1984.
3. Flatfish. Canadian landings of the combined flatfish species were 72,400 t compared to 67,100 t landed in 1984. American plaice landings were 44,300 t up from 37,600 t in 1984. Yellowtail landings were 13,400 t compared to 12,600 t landed in 1984. Landings of Greenland halibut showed a decrease from around 12,300 t in 1983 and 1984 to 8,300 t. Witch landings amounted to 4,600 t, up from 3,500 t in 1984. Around 1,650 t of Atlantic halibut were landed in this Subarea in 1985. Landings from the inshore sector amounted to only 17% of total flatfish landings. About 95% of all Greenland halibut landings were landed inshore.
4. Other groundfish. Canadian landings were 11,900 t, comprised mainly of haddock (5,900 t), white hake (3,000 t), pollock (1,400 t) and wolffish (1,500 t). Haddock landings increased from 450 t in 1983 and 2,500 t in 1984. These haddock landings were primarily from Div. 30 (3,000 t) and Subdiv. 3Ps (2,200 t).
5. Capelin. Approximately 24,000 t of capelin were landed inshore in Div. 3L and 7,000 tons in Div. 3K in 1985. Landings in other Divisions in Subarea 3 were low. The inshore catches were taken during the inshore spawning migration. Female capelin are preferred to satisfy the Japanese roe market.
6. Herring. Herring landings from Newfoundland were approximately 2,700 t, 2,500 t from Div. 3KL and 200 t from Div. 3P. The commercial fishery, restricted to gillnets only, did not catch the quota primarily due to reduced effort and poor market conditions.
7. Mackerel. Mackerel landings in Subarea 3 were about 15,000 t, compared to 5,200 t landed in 1984.
8. Squid. Total catch of squid in 1985 was 380 t (preliminary data), similar to the 1984 catch. Early season catch rates on the southern Grand Bank indicated a very low inshore resource level for the summer/autumn fishery. The low catch was due to a natural absence of squid from commercial fishing areas.
9. Atlantic salmon. Landings were 559 t in the commercial fishery and 42 t in the recreational fishery. Abundance of large salmon was lower than previous years.
10. Scallops. Only sporadic effort was directed to the offshore scallop fishery on St. Pierre Bank. Landings of scallops dropped to 53 t meats from 413 t in 1984. Catch-per-unit-effort showed further declines of approximately 13% from 1984 levels.

#### B. Special Research Studies

##### 1. Environmental Studies

- a) Hydrographic studies. Most of the standard sections in Subarea 3 were occupied. In addition, data were collected south of the Grand Banks during squid surveys. As always, a temperature profile was made for every fishing station occupied for biomass estimates. In Trinity Bay, three CTD transects were occupied six times, covering all seasons.

The inshore thermograph network was maintained, with about 40 instruments in the field. The time series of Station 27 (4 km east of Cape Spear) was continued.

- b) Atlantic Oceanographic Laboratory (BIO) activities:

Coastal temperature monitoring program throughout the year, at about 30 sites.

Drifting buoys (10) launched on Grand Banks along 47°N. Drogues for upper 15 m re near surface circulation and exchange between Banks and Labrador Current.

Array of 9 moorings with Petro-Canada, Mobil, Husky-Bow Valley and ESSO Resources in Flemish Pass and outer Grand Bank. Purpose - study of Labrador Current variability and stability characteristics.

Modelling of mean barotropic circulation of Grand Banks circulation through numerical modelling techniques.

Background levels of petroleum residues in the Grand Banks/Hibernia areas.

A considerable number of hydrographic and velocity measurements were taken in the vicinity of Hibernia, both in conjunction with iceberg motion studies and also with internal wave studies.

c) The oil industry continued ongoing oceanographic observations on the Grand Banks in support of offshore exploratory drilling operations.

d) Plankton studies. No plankton data were collected on the Flemish Cap in 1985.

Trinity Bay was sampled five times, with both fine and coarse mesh nets, in a survey to study recruitment in herring and capelin.

Replicate plankton samples were collected on 30 dates May-August in Conception Bay to study spawning times and feeding of ichthyoplankton.

Plankton samples for squid larvae were taken south of the Grand Bank in February-March.

d) Other environmental studies. Tissue samples were taken at various locations within Subarea 3 for use in multi-variate monitoring of the biological effects of offshore hydrocarbon exploration and development. Field studies were conducted at the site of an 1982 spill of No. 2 fuel oil (inshore site).

The Grand Bank Modelling Exercise (organized by the Marine Ecology Laboratory, Halifax) continued in 1985. General aims are to produce a process-based dynamic ecological model of the Grand Bank to aid in assessing the environmental effects of proposed hydrocarbon development. A report on the modelling work was published in May and significant changes were made to the model during the year. An on-line bibliographic data base for the Grand Banks, encompassing over 100 references, was established. Project will wind down in 1986.

## 2. Biological Studies

a) Cod. Sampling of the landings from the commercial fishery both inshore and offshore was continued in 1985. Using research vessels, surveys were carried out in all NAFO Divisions to determine the distribution and abundance of cod. Biological sampling was extensive during these surveys and several thousand cod were tagged, mainly in Div. 3L and 2J.

Acoustic tracking of cod on their inshore migration provided observations on their diurnal behaviour in relation to feeding and temperature.

b) Redfish. Several research cruises throughout Subarea 3 (except Div. 3NO) were conducted yielding information on abundance and distribution. The collection and subsequent ageing of otoliths from both research and commercial catches, and the application of these to respective length frequencies yielded information about commercial catch at age as well as population structure.

c) Flatfish. Distribution and abundance of flatfish were studied during fall random stratified surveys during the fall in 3K, and spring in 3NO and 3Ps. Four seasonal surveys were conducted in 3L. Information from these surveys additionally provided data on year-class strengths of pre-recruited flatfish. These surveys are a major source of information for continued biological studies on the various flatfish species.

d) Seasonal surveys in Div. 3L (groundfish) were carried out in January-February, April-May and October-November.

e) Capelin. There was a delay in the inshore migration of capelin in 1985 (as in 1984) apparently due to unusually low temperatures which retarded maturation rates as well as delayed the time when beach spawning normally occurs. Acoustic surveys in April and June detected juvenile capelin in Div. 3L. The June survey also detected a good spawning biomass in Div. 3NO. The inshore capelin fishery was monitored by a comprehensive logbook survey. An aerial survey was conducted during

the inshore spawning migration. Capelin were tagged during the inshore phase of their life cycle to describe migration patterns. Analyses of yearclass variations in capelin abundance have shown meteorological and hydrographic factors to be the main regulators of year class strength.

The submersible PISCES with support ship PANDORA were used during 18-23 July in an attempt to locate capelin spawning beds on the S. E. Shoal, Grand Banks. Four dives totalling 10h were made. Anomalously low bottom water temperatures were evident throughout the region which delayed capelin spawning in the region by nearly one month. Ichthyoplankton sampling conducted during September aboard CSS DAWSON revealed the presence of large numbers of newly hatched capelin larvae. Attempts to retrieve a current meter mooring deployed on the Shoal in June by the GADUS ATLANTICA were unsuccessful.

- f) Herring. Surveys to determine distribution and abundance of herring larvae were conducted in Trinity Bay in June, August, September and October. The goal of the project is to determine at which stage in the early life history recruitment of a particular year-class can be reliably predicted. Sonar surveys for herring were conducted in bays of southeastern Newfoundland during March and northeastern Newfoundland in October-November.
- g) Scallops. Two surveys were undertaken to assess the state of sea and Iceland scallop stocks on St. Pierre Bank (Subdiv. 3Ps).
- h) Shrimp. A research vessel survey was conducted in Div. 3K during August, 1985. Highest catches (up to 225 kg) were obtained in depths of 350-400 m in the St. Anthony Channel. Catches throughout this area were quite variable as observed in the previous year. Additional sets were made outside the St. Anthony Channel to determine if other concentrations of shrimp occur in Div. 3K. Most of these were unproductive for shrimp.
- i) Squid. In February-March a survey was conducted by the Nfld. Region to study the distribution of larval and juvenile squid in the Gulf Stream system between 55°W and 60°W longitude. A predictive index of squid abundance for the commercial fishery was also developed. From a pre-recruit survey in June on the Grand Bank a predictive index of inshore abundance was determined. At Holyrood some commercial samples were acquired during August-September, catch and effort data were collected using squid traps, ageing studies were continued using chemical time-markers in conjunction with mark-recapture methods, and water temperature was monitored.
- j) Crabs. Studies on biological aspects of a shallow-water spring breeding migration of snow crabs were continued. Occurrence of a major recruitment failure in the southern zone of the fishery was documented and studies investigating the effect of water temperature on yearly recruitment were initiated.
- k) Atlantic salmon. Long-term research studies have been initiated to develop a model which could be used to estimate salmon production capacities of streams, optimal egg deposition and stock and recruitment relationships. A survey of about 130 commercial salmon fishermen was conducted to assess local sales and by-catch. A total of 930 Atlantic salmon caught in the commercial fisheries was sampled for size and age distribution.
- l) Multispecies. Investigations of multispecies relationships are progressing using stability studies of computer models of marine trophic webs. Work is focusing on role of early life history stages in ecosystem dynamics and of specific linkages for higher stages.
- m) Benthos. A research cruise along the 47° line was conducted in April, sampling meio- and macro-benthos with a variety of gear, and obtaining estimates on meiobenthos productivity.
- n) Newfoundland Institute for Cold Ocean Science (Memorial University). Biological and oceanographic data collected in Fortune Bay and on the Southeast Shoal, Grand Bank are being analysed. A three year study on seabird-capelin interactions at Witless Bay, near St. John's is completed and reports are in preparation.

#### SUBAREA 4

#### A. Special Research Studies

##### 1. Biological Studies

- a) Redfish. An acoustic cruise for redfish was conducted in Div. 4Rs during July. The data collected will yield information concerning stock biomass as well as diel movements and spatial distribution of redfish.

SUBAREAS 2 AND 3

A. Special Research Studies

1. Environmental Studies

- a) Hydrographic and related studies. The Bedford Institute (AOL) prepared monthly State-of-the-Oceans reports (from July, 1984) on research activities throughout the NAFO Area. Ships of opportunity XBT programs have also been expanded.
- b) Marine Ecology Laboratory (BIO). Using principally time series of oceanographic and meteorological data, such as those taken at fixed sites and the daily to weekly repetitive coverage of surface conditions by satellite and ships of opportunity, an overview was provided of 1984 conditions in the NAFO region. Although comparisons made to 1983 conditions and to longer term reference periods indicate that 1984 was a near average year in many respects, a number of significant anomalies and trend changes were noted. These include lower surface salinities and deep layer temperatures in the Inshore Labrador Current, and indications that the 'warm in the north' epoch seen in the sea surface temperature pattern since about 1978 may be nearing an end.

Based primarily on the oceanographic analysis charts produced by the National Weather Service in the United States, monthly analyses of environmental conditions from the Grand Banks to the Gulf of Maine were undertaken. These charts contain information on sea surface temperatures, warm-core eddies, the frontal boundary between the Shelf and Slope waters and the location of the Gulf Stream. Additional information on ice conditions were obtained from ice charts produced by AES in Downsview and occasionally satellite-tracked buoys provided current drift data. The monthly reports were presented in the BIO Briefing Sheets.

Environmental effects on fisheries in the NAFO area were investigated by examining the recent performance of previously published relationships between environmental indices and landings of various commercial fish and shellfish species in the Gulf of St. Lawrence, the Gulf of Maine and the Labrador Shelf.

An investigation was initiated on the variability of sea surface temperatures (SST) for selected areas of the Northwest Atlantic (north of 30°N and west of 40°W) using data collected in the 1940-80 period, principally by merchant ships, and archived at the National Climatic Centre, Asheville, North Carolina. Analyses of SSTs include space-time plots of annual anomalies, correlations among monthly anomalies, and computation of empirical orthogonal functions by season. SST anomalies show persistence from season to season, particularly from winter to summer and are coherent over a large geographical area. The role of freshwater discharge, wind effects and offshore forcing in producing the observed variability is currently being examined.

2. Biological Studies

- a) Assessments. Assessments of some 25 groundfish stocks presently under catch quota regulations were conducted and in some cases refined and advice on TACs for the 1985 fishing season was provided either through CAFSAC on NAFO. Further assessments were conducted of 17 pelagic-shellfish-marine mammal stocks, the marine phase of mixed Atlantic salmon stocks originating from Nfld., Labrador, Quebec and Maritime rivers, four Arctic charr stocks and other commercial and potentially commercial species.
- b) Research vessel cruises. Sixty-four research vessel cruises were undertaken in 1985 utilizing DFO-owned vessels (WILFRED TEMPLEMAN, MARINUS, SHAMOOK, ALFRED NEEDLER, E. E. PRINCE), the GADUS ATLANTICA (on long-term charter) and seven other vessels on short-term charters.
- c) Commercial sampling. Sampling of foreign and Canadian offshore catches by the Canadian Observer Program continued in 1985. A total of 1,223 samples representing some 299,036 length measurements and approximately 7,654 otolith pairs were collected from the catches of foreign and Canadian offshore fisheries in Subareas 2+3 (includes a small amount from S.A. 4 fisheries). A total of 2,893 days and 10,747 sets was observed. Approximate coverage in 1985 was 9% for Canadian and 59% of foreign. High levels of coverage were also maintained on RSP and other types of charter trips. In addition, analysis of production on factor and wetfish trawlers was completed as was a 4 year study of discarding practices for the domestic offshore fleet and an examination of fisheries in the vicinity of Hibernia (in conjunction with NORDCO).
- d) Seals. Our harp seal program is now being realigned with increased emphasis on monitoring and quantifying its role in the marine ecosystem and how changes in its abundance affect other species, particularly those of commercial interest. Approximately 400 harp seal stomachs were collected from the inshore fishery in 1985. Harp seal tagging data and their returns were updated in 1985 and converted to machine readable form. A comprehensive research proposal was prepared on

harp (and hooded) seal surveys. This included survey design (fixed-wing aircraft and/or helicopter), ground-truthing techniques, photographic methods (UV camera or UV filter), survey areas (Front and Gulf of St. Lawrence), duration and costs.

Analysis of the 1984 hooded seal aerial survey data were completed and the results presented to a NAFO Special Meeting. Analysis of the 1984 aerial surveys of hooded seals of the Front (Div. 2J3K) and Davis Strait provides the first sample of pup production estimates which are corrected for the flux of pups in whelping patches. A primary publication is in preparation. An aerial photographic survey of hooded seal pups was conducted at the Front in March, 1985. Results were presented to the CAFSAC Marine Mammals Meeting in November, 1985. During the survey, 702 hooded seal pups were tagged. Data on the maturation rates of hooded seals at the Front and in Davis Strait were presented to the ICES Ad Hoc Working Group on Harp and Hooded Seals of the Greenland Sea in Copenhagen, September, 1985.

## Section II. Scotia-Fundy Region

by

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### Subarea 4: Divisions 4V-W-X

#### A. STATUS OF THE FISHERIES

##### 1. Groundfish General

Total nominal catches increased by 4.5% to 184,894 MT. The increase was due to improved catches of redfish and pollock which more than compensated for decreased catches in almost all other major species.

##### 2. Cod

Total landings decreased by 1.6% to 87,370 MT, 47.25% of total groundfish catches in the area. The decrease was almost entirely due to a 10% decrease in landings from Div. 4X which overcame a 2.5% increase in Div. 4Vs.

##### 3. Haddock

Nominal landings decreased by 4.5% to 25,703 MT. Decreases of 22.2% and 27.4% from Divs. 4X and 4W, respectively, were partly met by a 133.3% increase in landings from Div. 4Vs, indicating a recent shift in the Scotian Shelf haddock fishery towards the east.

##### 4. Flatfish

Flatfish catches fell by 25%, mainly due to reduced landings of plaice and yellowtail. American plaice constituted 41% of the total.

##### 5. Redfish

Catches rose by 35% to about 10,340 MT with the increase spread over the whole of the Scotian Shelf.

##### 6. Pollock

Pollock catches increased by 33.8%. This was mainly due to a 41.5% increase in Div. 4X, which produced 68.6% of total landings from the Shelf. Catches fell in Div. 4W but almost doubled to over 9000 MT in Div. 4Vs.



7. Other Groundfish

Total landings from the area were down 2.2% from the 1984 level at 9543 MT with the decrease spread over several species. Of the principal species, white hake and wolffish showed increases of 14.5% and 8.6%, respectively, and cusk a decrease of 32.6%.

8. Scallop (*Placopecten magellanicus*)

Landings totalled 8436 MT round weight, a 22% decrease from 1984.

9. Herring

Total nominal catches were 143,363 MT. This is some 50% greater than the reported catches in 1984, mainly because of estimated underreporting of catches last year from Div. 4X. Catches from Div. 4X constituted 91% of the total. Catches in all three Divs. 4V-W-X were about the same as in 1984.

10. Mackerel

Nominal landings increased by 7% over 1984 to 6265 MT, almost all from Div. 4X.

11. Tuna

No information available.

12. Swordfish

Seventeen longline vessels reported landings totalling 390.9 MT, 3.4% above the 1984 landings but only about half the 1983 level. The average weight of fish was about the same as in 1984 at 103.2 lb.

13. Atlantic Salmon

Total nominal landings for Subarea 4, but excluding Quebec landings in Division 4S-T, were 129.3 MT, down 1.5% from 1984. Angling catches were up 21% at 66.6 MT, but this includes grilse only catches (large fish cannot be retained) other than from the west coast of Newfoundland (Div. 4R). Commercial catches were down by about 50%, largely due to the ban on commercial fisheries in New Brunswick and Nova Scotia (Divs. 4V-W-X-T), although commercial landings on the west coast of Newfoundland (Div. 4R) also fell, by 17.3%, to 75.8 MT. Angling returns in Div. 4R fell by 29.4% to 15.4 MT.

Subarea 4: Divisions 4V-W-X

B. SPECIAL RESEARCH STUDIES

1. Environmental Studies

(a) Hydrography. Monthly analyses were made of environmental conditions from the Grand Banks to the Gulf of Maine (Subareas 3, 4, 5), including sea surface temperatures, warm core eddies, the frontal boundary between Shelf and Slope waters and location of the Gulf Stream.

An investigation was initiated of variability of sea surface temperatures in the northwest Atlantic, using data for the 1940-80 period.

Maps were prepared of 1984 water temperature and salinity anomalies for use in 1985 stock assessments:

A study of residual current patterns in the Scotian Shelf-Bay of Fundy area (Divs. 4Vs-W-X).

(b) Plankton Studies. BIONESS sampling, combined with observation from a multiple frequency acoustic system, was carried out in June and September in the region of the Shelf break to determine the biomass and exact vertical position of various components of the zooplankton and micronekton, in relation to each other and to the other biological and physical features of the water column.

The extent of diurnal vertical migration of larval lobsters occurring on Browns Bank (Div. 4X) was studied.

Concurrent inshore and offshore sampling was carried out to study changes in distribution of early life history stages of commercial fishes.

Distributions of eggs and larvae of flatfishes were plotted for identification of spawning grounds and seasons.

Spatial and temporal distributions and variability of plankton on the Scotian Shelf were described. The distribution and abundance of haddock eggs and larvae were used to identify haddock spawning units. The MININESS sampler was used for a study of vertical migration/distribution of gadoid larvae and juveniles.

The first larval scallop survey of the Bay of Fundy, southwest Nova Scotia (Div. 4X) and Georges Bank (Div. 5Ze) was completed in October.

(c) Benthic Studies. Samples from epibenthic sled tows were correlated with analysis of fish stomach contents for examination of differences in size composition of the benthos and possible association of the characteristic with that of fish food and of the fish themselves.

Submersibles were used in association with moored experimental equipment for measurement of sedimentation and resuspension of particulate matter across the sediment-water interface.

## 2. Biological Studies

(a) General. The annual groundfish research survey program continued with the regular summer (July) survey, but the objective of general seasonal surveys in March and October was changed to specific surveys for cod and haddock. The annual Canada/U.S.S.R. silver hake survey (Subareas 4 and 5) was completed in November. The special 5-year series of ichthyoplankton surveys in relation to the 4X haddock ecology project was completed. Two annual herring larval surveys (March-October) were carried out in the Bay of Fundy (Div. 4X). Two squid cruises were carried out (Subareas 4, 5, 6), one in the Cape Hatteras-Straits of Florida area and the other in the Gulf Stream area between 69° and 58°W, for examination of distribution of different life stages and related environmental factors. An annual midwater trawl juvenile gadoid survey was carried out in June.

Monitoring and biological sampling of commercial catches both at sea (International Observer Program) and landing places continued.

A study of fish production and commercial potential of fish resources along the edge of the continental shelf and adjacent oceanic waters was initiated. This includes description of interrelationships between on-shelf and off-shelf ecological systems and examination of exotic forms as indicators of environmental variability and trends.

Age verification of groundfish by oxytetracycline tagging was initiated as well as examination of otolith microstructure for measurement of growth rate and importance of early life history parameters to the recruitment process.

Studies were continued on the mechanisms and factors producing observed groundfish distribution patterns and on utilization of inshore habitat by juveniles of important commercial species.

(b) Cod. Electrophoretic analysis of cod tissue for stock differentiation was carried out. A study of condition factor in larvae continued, including the effect of reaction to simulated predators. Age-related temporal and seasonal changes in distribution were analyzed for identification of short- and long-term trends.

Tagging studies continued for examination of movements in different fish stocks and elucidation of relationships between different stocks. A total of 9325 cod was tagged and released.

(c) Haddock. The 5th (final) year of the Fish Ecology Project (FEP) (Div. 4X) was completed. Special research studies included all phases of the life history, behavior, growth, feeding and relationships of water circulation of egg and larval retention and distribution.

The 5th annual inshore survey of Sable Island (Div. 4W) was completed.

A field study was made of vertical distribution of juveniles (midwater phase) in two contrasting hydrographic sites in relation to the thermal structure of the water column and distribution of zooplankton.

Proximate chemical analysis of field samples of tissues for determination of body growth and composition continued. Live animal experiments were carried out on digestibility and digestion rate and on determination of feeding and metabolic parameters.

A total of 15,646 fish was tagged and released.

(d) Pollock. Verification of maturity stages was carried out at both gross and microscopical levels.

An examination was made of distributional characteristics of pollock aggregates including age-specificity and of the impact of traditional assessment procedures for a schooling fish.

Analysis of crystallization in otoliths was completed.

(e) Herring. Catch patterns were used to define movements of herring along the New Brunswick coast, Bay of Fundy (Div. 4X). Spawning stocks were sampled for determination of morphometric and meristic characters for stock differentiation. Tests were carried out to identify a tag suitable for juvenile herring.

An acoustic survey was carried out in the Chedabucto Bay area (Div. 4W) to estimate size, composition and abundance of overwintering concentrations for use in stock assessment.

(f) Redfish. Age validation studies were made by (a) radionucleotide assay and (b) refining assays for  $Pb^{210}$  and  $Rn^{222}$ .

(g) Silver hake. A study was initiated on the use of morphometric parameters for stock discrimination.

Results of stomach content analysis of silver hake were used to examine predator-prey relationships. Results for the period 1980-85 do not support the hypothesis that silver hake predation may have contributed to the decline in haddock stocks.

(h) Hakes. A comparative parasitological study of the five hake species of the Scotian Shelf was completed.

(i) Squid (*Illex illecebrosus*). The study of oceanic factors associated with distribution and abundance continued. The Tucker trawl has been introduced as an additional sampling gear.

(j) Spiny dogfish. Electrophoretic analysis of samples from the Scotian Shelf was carried out to investigate stock structure. A study of feeding and fecundity was initiated.

(k) Miscellaneous tagging. The following were tagged and released: 67 yellowtail flounder; 585 witch flounder (see also cod, haddock).

### 3. Gear and Selectivity Studies

Development of acoustic methodology for estimation of pelagic and groundfish abundance. Determination of spatial distribution of herring using underwater towed vehicle. Development of ECOLOG dual beam acoustic system for fish counting has reached stage of production of prototype for commercial development.

#### Subareas 5 and 6

##### A. STATUS OF THE FISHERIES

###### 1. Groundfish General

Total nominal landings increased by 27.6% from the 1984 level of 21,210 MT, about 82% of which was from Georges Bank (Div. 5Ze). Landings of all major species except pollock improved, particularly cod and haddock which together constituted 76% of the landings.

###### 2. Cod

Landings increased by 34% to 11,885 MT of which 88% was from Georges Bank (Div. 5Ze). This restored the landings to somewhere near the 1983 level.

###### 3. Haddock

Landings increased by 58% from the 1984 level to 4275 MT, still well below the 1983 level but reversing the downward trend since 1980.

###### 4. Pollock

Nominal landings decreased by 45% to 1764, almost equally divided between Georges Bank (Div. 5Ze) and the Gulf of Maine (Div. 5Y).

###### 5. Other Groundfish

These constituted only 15% of the total groundfish landings, flatfish being the main contributor, with landings almost three times that of 1984 at 438 MT.

###### 6. Scallop (*Placopecten magellanicus*)

Landings totalled 31,957 MT round weight, almost twice the 1984 landings.

###### 7. Herring

No herring were landed from Subarea 5.

#### SEALS

##### A. STATUS OF THE FISHERIES

Statistics not yet available.

##### B. SPECIAL RESEARCH STUDIES

###### Harp Seals

From fisheries in the estuary of the St. Lawrence River, studies

continued on age composition and reproductive rate of the Gulf of St. Lawrence population.

#### Grey Seals

A total of 5747 pups was tagged on Sable Island in January-February and 499 in May. A study of post-weaning pup growth was completed, involving 2100 pups weighed. In a tag loss study, 3643 grey seals were tagged, of which less than 1% loss was recorded in the 1st year. Collect information on movements and activity patterns of grey seals using radio-tracking. Study movements and patterns of tenure of branded male grey seals.

#### Harbour Seals

All newborn seals on Sable Island were tagged in May-June. Estimated minimum pup production was 526 animals, with pre-weaning mortality at 27. A project on juvenile growth was initiated and seal-worm samples collected. A study on breeding colony composition and development was conducted.

### Section III. Gulf Region

by

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#### Subarea 4: Divisions 4R-S-T

#### A. Status of the Fisheries

1. **Southern Gulf Cod (4TVn):** The Total Allowable Catch was 67,000 tonnes, including 7,000 tonnes for France. Preliminary data indicate that the domestic fleet took 90% of their allowance and France took 100% for total landings of 61,000 tonnes. Catch rates in the 4Vn winter fishery were slightly lower than the exceptionally high catch rates experienced in 1984. Catch rates for the Maritimes portion of the domestic fleet were similar to 1984. Quebec vessels had improved catch rates over 1984 with the otter trawls doubling their catches of 1984. Forty percent of the landings were composed of 5 year old fish. This year class had been noted as very strong in the 1981 to 1985 research surveys.

2. **Gulf Redfish (4RST):** The Total Allowable Catch was 50,600 tonnes, but the reported catch was only 55% of this. The standardized catch rate for Gulf redfish declined 21% from 1.20 t/h in 1984 to 0.95 t/h in 1985. Gulf-based processors expressed serious concern about the decline in their catch per sea day and about the financial viability of their operations. From 75-80% of the supply for processors on P.E.I. and on the Magdalen Islands is redfish. Gulf fishermen fish for redfish throughout the year. Less pessimism was expressed by non-Gulf processors, who fish primarily in the fall when redfish catch rates are optimum.

The decline in commercial catch rates in 1985 cannot be explained by natural mortality and fisheries exploitation. The observed decline in catch rates in 1985 was greater than fisheries projections predicted for the decline in the abundance of redfish of the early 1970's year classes. Data collected by research vessel surveys in 1984 and 1985 indicate that warmer bottom water temperatures during 1985 influenced the distribution of redfish. This could have affected the availability of redfish for commercial fishing vessels.

3. **Southern Gulf American Plaice (4T):** The Total Allowable Catch was 10,000 tonnes, whereas landings were slightly over 90% of this amount. The allocation for vessels less than 20m fishing mobile gears was reached in October which led to the unprecedented closure of this fishery. The plaice fishery has been primarily a by-catch fishery in the past, however

in 1985 almost 50% of the landings were the result of a directed fishery on the species. This was the result in part of the improved price paid for this species.

4. Southern Gulf White Hake (4T): The Total Allowable Catch for 1985 was 12,000 tonnes. The reported landings were slightly more than 40% of this. Low landings appear to be due to poor availability inshore and an overall decline in the numbers of larger fish. The existing TAC has no analytical basis and was set as an upper precautionary limit. Using data from new surveys and intensified catch sampling, a first analytical assessment was prepared in 1985. Two inshore surveys were carried out in 1985 and will be repeated to 1986.

5. Southern Gulf Herring (4T): The Total Allowable Catch was 32,500 tonnes in 1985. The reported landings were 31,000 tonnes. True total catches may have been nearer to 40,000 tonnes. Catch rates in the spring fishery were similar to 1984, but the highest in 12 years in the fall fishery. High incidental catches of herring in the research vessel survey and greater egg densities from spawning bed surveys corroborate the greater stock abundance of fall spawners.

6. Atlantic Bluefin Tuna (SA 3-6): The Total Allowable Catch for 1985 was 573 tonnes. This TAC is set by ICCAT and is part of an overall western Atlantic quota of 2,660 tonnes. The reported nominal landings for Canada was 313 fish (142 tonnes). The Canadian rod and reel and tended line catch rate series are used for calibrating the older fish 16+ years in the stock assessment. The mean age of fish in the Canadian landings has been increasing over time. The oldest fish aged to date are in the range of 35+ years.

7. Gulf Lobster (4RT): Lobster landings from the majority of areas in the Gulf of St. Lawrence fishery have remained stable or increased over the last five years. The fishing effort does not appear to have increased over the same period. These two factors indicate that the near future of the lobster fishery should be generally good. However, some specific areas have experienced a gradual decline or plateauing of landings. Research has been conducted in these areas to further monitor the stocks. In response to questions raised on the effects of a carapace minimum size increase, researchers have presented scenarios of the possible short and long term effects of a size change to industry and management. Research is continuing to assess the long term impact of a minimum size increase.

8. Southern Gulf Snow Crab (4T): The total allowable catch for the midshore fleet in southwestern Gulf of St. Lawrence was increased from its 1984 level of 26,000 tonnes to 28,000 tonnes in 1985 thereby extending the season and alleviating employment problems in the processing industry. Total official landings were estimated at 25,751 tonnes and the mean catch per unit effort (CPUE) was 57.3 kg/trap haul (the lowest since 1980).

The total landings for the western Cape Breton (Areas 1 and 7) fisheries (1,235 tonnes and 537 tonnes, respectively) were comparable to 1984 levels. Mean CPUE estimates for these fisheries (34.8 kg/trap haul for Area 1 and 31.4 kg/trap haul for Area 7) are lower than those observed in 1984 (50.5 kg/trap haul and 35.8 kg/trap haul respectively) thereby continuing a downward trend in CPUE initiated in 1983.

Exploratory snow crab fisheries were initiated off northern Prince Edward Island (P.E.I.) and northwest Newfoundland in 1985. In P.E.I. sixteen experimental permits were issued and a season running from April 15 to October 10 was established. Despite a mid-season closure incurred by a high incidence of white crabs in the catch, a total estimated catch of 802 tonnes was realized. The mean CPUE was 52.8 kg/trap haul. In northwest Newfoundland 4 experimental permits were issued with the season running from April 20 to December 31. Total landings for the fishery were estimated at 275 tonnes and preliminary data indicate a mean CPUE of 13.9 kg/trap haul for the Japanese conicals used in this fishery.

Apparent decreases in Cape Breton's Area 1 and Area 7 snow crab stocks coupled with the establishment of new snow crab fisheries and zones have initiated concern about the integrity of and interaction between the Gulf's snow crab populations.

9. Southern Gulf Scallop (4T): Estimated total landings for 1985 were 198 metric tonnes of meats as compared to estimated landings of 252 metric tonnes in 1984. A decrease in landings occurred in District 8 (southeastern New Brunswick and western Prince Edward Island) from 140 tonnes in 1984 (revised data) to 122 tonnes in 1985 and specially in District 7B1 (Nova Scotia/Cape Breton/eastern Prince Edward Island), from 72 tonnes in 1984 (revised data) to 33 tonnes in 1985. In District 7C (northeastern New Brunswick and Baie des Chaleurs) an increase of landings occurred from 40 tonnes in 1984 (revised data) to 43 tonnes in 1985. A decrease in fishing effort which is related to a diminution of the resource in some areas.

B. Special Research Studies

1. Environmental studies

a) Hydrographic studies - Temperature profiles were collected at 80 stations in the southern Gulf Div. 4T area and 175 stations in the northern Gulf Divs. 4RST during 1985.

2. Biological studies

a) Cod: Catch sampling both at sea and at the landing ports were conducted for an assessment of the 4TVn cod stock. A four week research survey in Division 4T was conducted during September. Inshore surveys in 4T were conducted during the summer months to gather information on abundance in these areas. In addition to information on abundance and age composition of the stock, cod stomachs were examined in all surveys for future multi-species work.

b) Redfish - Data from research vessel surveys and the commercial fisheries were used in an assessment of the status of the redfish stock in Divs. 4RST. A new biochemical technique was developed to separate the Deepwater redfish (Sebastes mentalla) from the Golden Redfish (S. norvegicus). A shipboard Data System (SDS) for electronic data acquisition on research vessel surveys was implemented and tested. Three electronic fish measuring boards, 2 laptop computers and 2 IBM compatible microcomputers were used to collect and edit data at sea. The hardware and software of the SDS eliminates the need for recording on paper, facilitating rapid analysis for the provision of more timely biological advice on the status of fish stocks. The electronic fish measuring board perfected in 1985 was also shown to be an efficient device for stand-alone operation by port samplers and observers on commercial vessels.

Age validation studies continued during 1985. A paper was presented at the International Symposium on Age and Growth of Fish in Des Moines, Iowa. A detailed analysis of catch rates by province and tonnage class of vessels directing for Gulf redfish was completed. A review of biological advice pertaining to this stock was also conducted for the Canadian Atlantic Fisheries Advisory Council. The redfish scientist met with the fishing industry and attended fisheries conferences in Canada and the United States.

c) American Plaice A stock update on plaice and other flounder was made using research vessel and commercial fisheries data.

d) White Hake An analytical assessment was carried out on this species for 1986. Extensive feeding studies have been conducted with analysis scheduled for 1986. A morphometric and meristic study of stock structure in NAFO Division 4T is in progress. Inshore surveys targetted to hake as well as other species are being conducted.

e) Herring An analytical assessment, including virtual population analysis of both spring and fall spawning groups, was made utilizing commercial fisheries data. A spawning bed survey, of Fisherman's Bank off Prince Edward Island, was initiated; previous surveys were made in Miramichi Bay, New Brunswick. Diver surveys of spawning beds are used to map the size of the beds, estimate population size and exploitation rate, and observe time of hatching. Analysis of changes in herring maturity and fecundity demonstrated density dependent growth which indicates that fecundity acts as a compensating mechanism for declining stock biomass.

Analysis of meristics and morphometric data showed the separation of spring and autumn spawning groups; there was also circumstantial evidence to support homing on the spawning grounds. A parasitological study continued on the usefulness of parasites to differentiate spring and fall spawners, and for identifying stock components of the 4Vn fishery. An acoustics survey of herring distribution and abundance was made in autumn 1986.

f) **Atlantic Bluefin Tuna** An analytical assessment was carried out at the annual ICCAT meetings. Sampling of individual fish at local fishing ports is the only source of biological data for tuna in Canadian waters and the fishermen logs are coded and analysed for commercial catch and effort data.

g) **Lobster** Research was directed to provide scientific advice to fisheries managers on the impact of potential changes in legal size, and geographic limits of fishing districts. Projects included an aerial survey of buoys and calibration study of said survey in the southern Gulf of St. Lawrence to determine fishing effort; lobster tagging off northern New Brunswick and in Northumberland Strait; lobster sea sampling throughout the southern Gulf and western Newfoundland; ultrasonic telemetry tracking of the short term movements of lobsters and lobster escape behavior in response to traps with lobster escape mechanisms.

h) **Snow Crab** Research included sampling in northeast New Brunswick, P.E.I. and Cape Breton to establish seasonal changes in size frequencies; sexual maturity, molt stage, and sex ratios of crabs caught commercially; logbook collection and analysis from commercial vessels, and molting cycle studies and staging using pleopods. Special projects on tagging, sonic tracking of molting snow crabs, aquarium and SCUBA observation of behavior, and growth and allometry studies were undertaken.

i) **Scallop** Research was directed to monitoring and providing a stock assessment of the sea scallop resource in the southern Gulf of St. Lawrence and the Icelandic scallop in the northeastern Gulf of St. Lawrence. Projects included research vessel surveys using sampling drags to estimate densities, and to determine catch rates and size frequencies. Other related studies included; age and growth, maturation, selectivity and efficiency of a scallop drag and a preliminary allometric study for discrimination of sub-populations.

#### Section IV. Quebec Region

Submitted by

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This report summarizes the research of several laboratories in Quebec, which are identified as follows:

ABS - Arctic Biological Station in Ste-Anne de Belevue (DFO)  
CREP - Fisheries Research Branch, Rimouski laboratory (DFO)  
QUE - Fisheries Research Branch, Quebec laboratory (DFO)  
MAPAQ - Direction de la Recherche Scientifique et Technique,  
Quebec Provincial Government.  
QUE-MAPAQ - Joint projects for QUE and MAPAQ



BIOLOGICAL STUDIES:

Cod

QUE - Catch sampling and compilation of commercial fishery data were carried out and summarized for an assessment of the status of the 3Pn-4RS stock. A biomass survey was conducted in January 1986. A research project on inshore migrations was continued. Stomach samples were collected to study the impact of cod predation on other species.

QUE-MAPAQ - Tagging studies to determine relationships between 2J 3K1 cod and 3Pn-4Rs cod were continued. Commercial catch and effort data from the Quebec fleet were analyzed to complete the stock assessment.

ABS - Greenland cod samples were collected in James Bay for parasite analyses. Sampling and biological analysis of Atlantic cod taken at Killiniq were carried out by the Makivik Corporation.

MAPAQ - Migratory studies on the cod (Gadus morhua) populations of the Lower North Shore of the Gulf of St. Lawrence (4Sv and 4Sw) have been conducted since 1983 to better understand their migratory patterns and to estimate the proportion of mixing with cod from the 4Rs-3Pn and 2J and 3K stocks. Twelve thousand cod have been tagged at different localities on the Lower North Shore from 1983 to 1985 in the months of June and July, and numerous blood samples have been taken to evaluate trypanosome infections. Preliminary results from the recaptures (around 1400) show that the majority of the cod tagged over winter in the Cabot Strait area (4R and 3Pn) and subsequently move northwards and inshore along the Lower North Shore of the Gulf of St. Lawrence near the tagging sites in June. There seems to be some migration through the strait of Belle-Isle, however at this stage this seems to be minimal. Results of trypanosome infections have not yet been analysed in detail.

Greenland Halibut

QUE-MAPAQ - Catch sampling, research survey results and compilation of commercial fishery data were used to make an assessment of stock status of 4RST Greenland halibut. Histological analyses of gonads were made to determine the spawning period in the Gulf of St. Lawrence.

ABS - Sampling and biological analyses of Greenland halibut taken at Killiniq were carried out by the Makivik Corporation.

Atlantic Halibut

MAPAQ - An exploratory fishing cruise on Atlantic halibut (Hippoglossus

hippoglossus) was undertaken in 1985 (May and June) off the southern, eastern and north eastern coast of Anticosti Island in the Gulf of St. Lawrence (4S). The efficacy of standard and circle hooks has been compared by using longlines on which the two types of hooks alternated.

#### Sandlance

QUE - A bibliography on sandlance was completed.

#### Herring

QUE - Catch sampling and compilation of commercial fishery data were carried out and summarized for an assessment of the status of 4R herring. Commercial gillnet fishermen of this area were contacted to maintain logbooks to obtain an index of stock size. A written questionnaire was mailed to all 4R herring gillnet fishermen to collect fishing effort information. The gillnet fishery characteristics in the Southern Gulf (4T) were summarized in a report. Using herring samples from the Southern Gulf, a comparative study of microscopic and macroscopic determination of maturity stages was continued. Biological and statistical information were also collected for 4S herring. A tagging programme was begun to study the migration patterns and degree of mixing of these stocks with the 4R stocks.

CREP - The growth of larvae and juveniles in the St. Lawrence estuary was studied in relation to environmental factors. Otoliths of the larvae were collected for a study of daily growth. Herring samples were taken for morphometric, meristic and electrophoretic analyses as well as population age structure and fecundity studies. A project on schooling behaviour during the spawning period was initiated. A biological update of the St. Lawrence estuary stock was compiled.

#### Mackerel

QUE - Catch sampling and compilation of commercial fishery data were carried out and summarized for an assessment of the status of Northwest Atlantic mackerel. An egg and larval survey was conducted in order to estimate spawning stock size. A fecundity study was continued. Data on the factors affecting migration patterns were analysed. Sampling for stock differentiation was continued and the validity of genetic markers previously identified is now being tested. Larval counts and measurements were performed in certain littoral zones.

#### Anadromous and catadromous fish

QUE - The state of knowledge on salmon post-smolts was reviewed and the analysis of data from 1981 to 1984 was continued. Post-smolts having spent 8 to 16 weeks at sea were sampled and tagged to study migration factors. The survey on elvers and young eels on the North Shore has continued and for the fourth consecutive

year the arrival date of elvers has been determined. The research program on eel mass mortalities in the St. Lawrence estuary was continued and the study of daily growth of elvers otoliths was completed.

ABS - The results of an Arctic charr range expansion study was presented to the Inuit communities. A study on life history of Arctic charr in the Koroc River was made. Factors determining the successful overwintering of charr are being studied. Sampling and biological analyses of Arctic charr taken at Killiniq were carried out by the Makivik Corporation.

#### Snow crab

QUE - Catch sampling and compilation of commercial fishery data were used to make an assessment of stock status. Results from a magnetic tagging program conducted in the Estuary will also be used to assess stock size. A special project was carried out to improve tagging techniques. A photographic method used to assess stock size was also tested. An analytical model for snow crab assessment was developed. Following a histological study started in 1984, the existence of a terminal moult in male snow crab was shown. The abundance of crabs in terminal moult in an exploited population was then studied.

QUE-MAPAQ - Statistical and biological data collected in 1983 were analyzed to follow the population trends in the Estuary and the Northern Gulf of St. Lawrence.

MAPAQ - A snow crab (*Chionoecetes opilio*) exploratory survey was conducted on the Lower North Shore of the Gulf of St. Lawrence (4Sw). Two different sectors were surveyed. The first sector visited was located between St-Paul's River and St-Augustine. Very good catches per unit of effort (CPUE) were obtained with an average of 29 kg per rectangular trap. Recently molted crabs represented 22% of the individuals caught. The mean size of the crabs captured increased with depth and the best commercial CPUE were obtained at depths ranging between 80 and 120 meters. The second sector surveyed was located offshore of Mecatina Bank on the slope leading towards the Esquiman Channel. This sector seems to present no potential for supporting a commercial fishery; only 304 male crabs were captured in 84 pot hauls.

A new sampling gear, merging some characteristics of a scallop drag and a beam trawl, has been tested on snow crab grounds in the Southern Gulf of St. Lawrence (4Tn). The gear is expected to be used to sample pre-recruits.

#### Shrimp

QUE - Catch sampling, compilation of commercial fishery data and the results of a stratified survey were used to make an assessment of stock status. Commercial

catch and effort data were also analyzed to determine the exploitation pattern of the fleet. Cod stomachs were collected on shrimp vessels to study the influence of that predator on shrimp. The study of inter-moult growth was continued to complete data collected in 1982. Analyses were performed to genetically discriminate the different stocks.

QUE-MAPAQ - A research cruise was conducted to study the vertical migration of shrimp.

ABS - Extensive collections of shrimp were obtained from Killiniq for determination of fecundity and developmental stages and for determination of biochemical composition and energy content of whole animals and selected tissues. Live shrimp are being maintained in a close circulation seawater system for studies on moulting and sexual development and on the development of larvae.

#### Lobster

QUE - Juvenile lobster abundances were determined for different habitat around the Magdalen Islands. A survey of the commercial fishery was started and fishermen were asked to fill research logbooks. Some hydrographic data collected at the Magdalen Islands tend to confirm some hypotheses on recruitment and population mix. Samples were taken from 8 different regions in Quebec to collect morphometric data and study stock discrimination. The contaminant level in the hepatopancreas for these samples was also determined. A study on the co-existence of crab and lobster as well as feeding habits was initiated. An egg production model was developed.

QUE-MAPAQ - Magnetic tagging was done in the Magdalen Islands to study the effect of dredging on the lobster density. A comparative study was conducted to evaluate the performance of shyrion tags and magnetic tags.

CREP - A project on larval feeding and energetic needs was completed. Data on larval distribution were analyzed.

MAPAQ - In the scope of an environmental study concerning the effects of dredging activities on the lobster population in the Grande-Entrée lagoon (Magdalen Islands, 4Tf), population estimates were made by the mark and recapture method.

The spatial distribution of trap catches and samples from a beam trawl, taken in four control zones, were used to study the impact of dredging activities on lobster distribution and density.

#### Scallop

QUE - Commercial catch and sample data and the results of a research cruise were

used to assess stock size. A photographic method for assessing stock size was tested. Hydrographic data from the Magdalen Islands were studied and related to recruitment parameters. Spat collectors were monitored to determine the fixation rate. Experiments on growth and feeding behaviour were conducted in cooperation with the Scotia-Fundy region. The project on identification of the factors initiating spawning in the Chaleur Bay area was continued. Exploratory fishing was conducted along the Quebec North Shore in response to the growing demand for new fishing grounds.

ABS - Sampling and biological analyses of Iceland scallop taken at Killiniq were carried out by the Makivik Corporation.

MAPAQ - An Iceland scallop (Chlamys islandica) survey was conducted in the northeastern Gulf of St. Lawrence (4Sw) to collect biological data in the Blanc-Sablon area and to explore the areas west of Blanc-Sablon, mainly the Mecatina Bank area. Three concentrations were observed near Great Mecatina Island yielding 12 to 16 kg per ten minute tow, and another bed near Mutton Bay yielded 90 kg per tow. These four concentrations were very small in surface area. However, averaging approximately 0.25 sq. nautical miles each. Results from this survey are presently being analysed in detail.

#### Mussels

QUE - Growth and feeding behaviour were studied in relation to food abundance.

QUE-MAPAQ - The density and the position of mussels on collectors was shown not to affect growth at densities presently used. Several projects were initiated in order to optimize the strategies of mussel farming.

#### Buccins

CREP - A three year project on the availability and population dynamics of buccin was initiated. Sampling was done to determine the distribution and abundance of the stocks. The reproductive cycle was studied and individuals were tagged and kept in tanks for growth studies.

#### Early life stages

QUE - A literature review of recent studies on ecology and sampling techniques for larval shrimps, herring, cod and turbot was completed. A survey was conducted to locate the major concentrations of shrimp in the Gulf of St. Lawrence.

ABS - A study of the nearshore distribution of larval fish and their vulnerability and sensitivity to crude oil is being carried out in Frobisher Bay.

CREP - Herring larvae collected in the St. Lawrence estuary were kept in tanks to study the influence of temperature, light and food availability on growth. An analytical model on the influence of feeding behavior on risk to predation was initiated. The influence of temperature on the digestion and respiration rate of mackerel and herring larvae was studied. A project on larval lobster feeding and energetic needs was completed. Data on the vertical and horizontal distribution of lobster larvae were analyzed.

#### Marine mammals

##### ABS:

##### Ringed seals

The second year of a three-year study on the population of ringed seals inhabiting the fast ice of Barrow Strait in the Northwest territories was completed. This study is attempting to relate numbers, reproductive status and condition of ringed seals to the quality and extent of sea ice. Ring seals specimens were collected from Inuit hunters. A study of the economics of seal hunting and the importance of renewable resources was initiated.

##### Harp seals

From catches in the St. Lawrence estuary, studies were continued on age composition and reproductive rate of the Gulf population.

##### Grey seals

A tagging program in the Gulf of St. Lawrence was carried out during Jan-Feb 1985. Returns will provide an estimate of production in the Gulf.

##### Whales

Historical studies of North Atlantic and Arctic whales were continued on the estimation of original population abundance and assessment of current status of several species, especially the bowhead and white whale. A field study of diurnal activities, feeding behavior, pod and population structure, and individual identification of fin and minke whales was carried out in the Gulf of St. Lawrence.

A historical study on Lancaster Sound belugas has been completed. A fifth year of study on the behavior and vocalizations of belugas was completed at

Cunningham Inlet, Summerset Island, N.W.T. Biological collections were made from belugas killed by Inuit hunters in eastern Hudson Bay and behavioral observations and counts were made of belugas frequenting the Nastapoka River estuary. The second year of a three-year project on the biology, population dynamics and energetics of Northern Québec belugas was completed. Aerial surveys of belugas were conducted in James Bay, eastern Hudson Bay and Ungava Bay. Analyses of data were completed and population estimates are now available. Epidermal samples from belugas were collected in the spring and autumn for a study of the moult that appears to occur in this species. Collection of vocalization of belugas in Northern Québec and the St. Lawrence River were made on an opportunistic basis for a study of dialects. A photographic aerial count of the St. Lawrence estuary beluga population was carried out.

CREP - Results from boat and aerial counts of beluga were analyzed. The program aimed at identifying the cause of death of stranded marine mammals was continued. Toxicological and pathological analyses were conducted on carcasses of stranded belugas.

#### Marine plants

MAPAQ - Various harvesting regimes were used on the intertidal brown algae Ascophyllum nodosum (L.) in order to determine appropriate management regulations permitting an optimum yield for this resource. The effects of harvesting frequency (from 1 to 5 yr) and degree of cutting (manual harvest method) on instantaneous and long-term biomass recovery were investigated.