

Northwest Atlantic



Fisheries Organization

Serial No. N193

NAFO SCS Doc. 80/IX/28

ANNUAL MEETING OF SCIENTIFIC COUNCIL - SEPTEMBER 1980

Canadian Research Report, 1979

by

E. J. Sandeman
Department of Fisheries and Oceans
Research and Resource Services
St. John's, Newfoundland, Canada

J. S. Scott
Department of Fisheries and Oceans
Marine Fish Division, Biological Station
St. Andrews, New Brunswick, Canada

and

J. Boulva
Department of Fisheries and Oceans
Fisheries Research Branch
Quebec City, Quebec, Canada

This report was compiled from information provided by various agencies of the Department of Fisheries and Oceans: the Research and Resource Services, St. John's, Newfoundland; the Biological Station, St. Andrews, New Brunswick; the Marine Fish Division, the Marine Ecology Laboratory, and the Atlantic Oceanographic Laboratory, Dartmouth, Nova Scotia; the Arctic Biological Station, Ste. Anne de Bellevue, Quebec; the Fisheries Research Branch, Quebec City, Quebec; the Invertebrate and Plants Divisions, Halifax, Nova Scotia. Information was also supplied by the Atlantic Geosciences Centre of the Department of Energy, Mines and Resources, Dartmouth, Nova Scotia; the Quebec Ministry of Industry and Commerce, and the Quebec Salmon Council. Nominal fish catches for 1979 were derived from data summaries of NAFO and the Statistics Divisions of the Maritimes, Newfoundland and Quebec Regions of the Department of Fisheries and Oceans.

The sections of this report dealing with Subareas 0, 1, 2 and 3 were prepared by E. J. Sandeman, the Subarea 4 section was prepared by J. S. Scott and J. Boulva, and the sections dealing with Subarea 5 and Seals were prepared by J. S. Scott.

SUBAREAS 0 AND 1

A. STATUS OF THE FISHERIES

1. Catches

- a) Shrimp. Canadian landings of shrimp from these subareas in 1979 totaled 1712 t.
- b) Other species. No species of fish or invertebrates were landed from these subareas in 1979.

B. SPECIAL RESEARCH STUDIES

The M.V. "Zagreb", a 46-m stern trawler, was chartered by the Department of Fisheries and Oceans to conduct research in Subareas 0 and 1 during the period August 15-September 17, 1979.

1. Biological Studies

- a) Salmon. A total of 16 sets of drift nets at various positions off the coast of West Greenland from the vicinity of Disko Island to latitude 61°22' were made between August 15 and September 4, 1979. In addition a single set was made in the Labrador Sea which yielded a total of four salmon.

A total of 344 adult Atlantic salmon were caught. The estimated proportion from scale character analysis of North American salmon in research vessel catches in the West Greenland area was 46.6%; of these, 5.1% were identified as being of hatchery origin. Concurrently, 1655 salmon were sampled in the fish plants to compare to the research vessel sampling. The estimated proportion from scale character analysis of North American salmon in commercial catches in the West Greenland area was 50.0%; of these, 3.8% were identified as being of hatchery origin.

b) Shrimp and groundfish. A total of 36 survey sets (mostly 30 min duration) were made using a Sputnik 1600 shrimp trawl in the Davis Strait area as well as a further 15 sets at a single position to examine diurnal variability in catches.

Shrimp catches were quite variable with the highest catch of 627 kg being taken at a depth of 358 m. Small redfish were taken in most sets with catches ranging from a few kilograms to 350 kg and one large catch of 2722 kg in 260-265 m depth (mean weight 45 g). The largest catch of Greenland halibut was 56 kg and the largest American plaice catch was 228 kg.

Biological observers placed on three vessels licensed to fish the Canadian allocation of shrimp in Davis Strait have collected additional data from this area during 1979.

Canadian scientists participated in a cruise of the French research vessel "La Thalassa". The main objective of this cruise was to obtain an abundance estimate of the shrimp stocks in the Davis Strait area. The structure of the shrimp population was also examined with special emphasis on several biological parameters.

2. Gear and Selectivity Studies, Including Studies of Fishing Operations

a) Salmon. A technique has been developed utilizing the catch in two sizes of mesh; when both have been fished concurrently with equal effort, to reconstruct the population of Atlantic salmon exposed to the gear at West Greenland. Salmon escaping the gear were then identified by comparing the actual catch to this population. The escapement mortality losses (those fish that die from injuries sustained during their exposure to the net) were estimated at 10%.

SUBAREA 2

A. STATUS OF THE FISHERIES

1. Cod

Canadian landings were almost 16,100 t, up substantially from 11,400 t landed in 1978. This difference was mainly attributable to an increase in the Div. 2J offshore landings of 4,100 t. There was also an increase in the Div. 2J inshore landings of just over 600 t. Canadian landings in Div. 2G and 2H were small, amounting to only 100 t. The offshore fishery in Subarea 2 amounted to 55% of the total catch as compared to 41% in 1978 and only 12% in 1977. This increase in offshore landings reflects the continuing expansion of the Canadian offshore fleet into more northern areas.

2. Redfish

Canadian landings were almost 16,200 t, up from 10,200 t in 1978 and only 2,700 t in 1977. Landings were almost entirely from Div. 2J, with only 5 t landed from Div. 2H. This significant increase in landings again reflects the continuing increase in Canadian offshore fishing effort in northern areas.

3. Other groundfish

Canadian landings of the combined flatfish species were just over 3,400 t as compared to 1,300 t in 1978. Greenland halibut landings accounted for most of this increase, with 3,200 t landed as compared to just under 1,270 t in 1978. Landings of other groundfish species were about 475 t in 1979.

4. Capelin

Landings of capelin remained at a low level.

5. Herring

Landings remained at a low level (< 1000 t) in 1979.

6. Atlantic salmon

The salmon landings (commercial and recreational) in ICNAF Subarea 2 during 1979 were about 300 t; a decrease of 25% from 1978. The decline was particularly evident in the abundance of the 2-sea-winter salmon and is partially attributed to a poor sea survival of the 1977 year-class of smolt.

7. Arctic char

Landings of Arctic char in ICNAF Subarea 2 during 1979 were 213 t; a decrease of 14% from 1978. The decline was partially due to the imposition of quotas in five bays.

8. Shrimp

The Subarea 2 shrimp fishery was subject to a total quota restriction of 6200 t in 1979; 4000 t of this was in the Cartwright and Hopedale channels and the catch in these areas was taken and the area closed to further fishing by September 24. Total landings in 1979 were 3289 t.

9. Seals

As in recent years, the 1979 seal quotas were taken in NAFO Subareas 2 and 3: 114,508 harp seals and 15,125 hooded seals.

B. SPECIAL RESEARCH STUDIES

1. Environmental Studies

a) Oceanography

(i) Stations on the Seal Island Section were occupied on two occasions in August and in November 1979 (Table 1). During the latter cruise nutrient measurements were made in addition to the usual measurements of salinity and temperature. The data are available through MEDS.

(ii) Current and hydrographic studies were carried out on the continental slope in Div. 2J.

(iii) Sediment dynamics, paleo-oceanography and geochemistry studies were carried out off Hamilton Inlet in Div. 2J and investigations of the surficial morphology and surficial geology of the Saglek Bank area (Div. 2G).

b) Plankton studies

Though not strictly in the NAFO area, investigations were undertaken in Ungava Bay, adjacent to Div. 2G, on physiology and photosynthesis in cold water phytoplankton populations.

2. Biological Studies

a) Cod. Catches by both inshore and offshore sectors were composed mainly of cod of ages 5-7 years. The 1973 year-class was predominant. In the gillnet fishery, cod of ages 6-8 years were most abundant although cod up to about 11 years were well represented.

Various biological observations were made during three survey cruises to this area. In addition about 5,500 cod were tagged in the spring of 1979 in Div. 2J and 3K.

b) Redfish. Data on the abundance and distribution of redfish were collected during a research cruise to the area in the fall of the year. Samples of the incidence of infection by Sphyrion lumpi were collected throughout the area. Research and commercial length frequencies and otolith collections were made and analyzed for use in assessments. Studies are in progress dealing with stock discrimination.

c) Flatfish. All flatfish stocks in Subarea 2 overlap Subarea 3, thus assessments are dealt with under the latter Subarea. Data on distribution and abundance of flatfish in Div. 2G, 2H, and 2J were collected during autumn research vessel cruises.

d) Grenadier. Studies continued in the areas of ageing and determination of an anal fin length to total length ratio. A research cruise to Subarea 2 and Div. 3K in the fall of 1979 involved the measurement of approximately 8000 specimens of which only 30 were deemed to have complete tails.

An extensive otolith collection was made and stomach samples were collected. Information was obtained concerning the distribution of grenadier and their stratification by size with depth.

e) Capelin. Both acoustic and analytical assessments of the Subarea 2+Div. 3K capelin stock revealed that this stock has experienced a decline from 1977 to 1979 due to poor recruitment. An acoustic survey was conducted in October 1979.

f) Atlantic salmon. Atlantic salmon caught in the commercial fisheries were sampled for size, age and sex ratio.

g) Arctic char. Catch and effort statistics were obtained from the commercial Arctic char fishery in northern Labrador. A sampling program for the Labrador fishery continues to provide quantitative information on mortality and exploitation rates derived from size and age composition of char in various fishing areas. During a research vessel trip to northern Labrador in August 1979, a total of 176 char were tagged and 536 were sampled for size, age and sex composition.

h) Shrimp. A research vessel survey in July 1979 attempted a biomass survey using a Sputnik 1600 shrimp trawl in the major areas where commercial concentrations occur. A total of 186 sets were made with greatest catch 2288 kg being obtained in the Hopedale Channel. Catches in the Cartwright Channel ranged to 438 kg and were still lower in the Hawke Channel.

An observer program on commercial vessels allowed the collection of much useful data from this source.

i) Seals. Research on harp seals in 1979 included age determination of 1700 1+ animals sampled from December 1978 to May 1979, analysis of 335 female reproductive tracts, a mark-recapture experiment in which 2884 pups were tagged resulting in an estimated production of 203,000 and detailed CPUE analyses. Hooded seal samples included 1200 male jaws and 445 female jaws and reproductive tracts collected from the commercial harvest.

3. Gear and Selectivity Studies

a) Grenadier. During the fall 1979 research cruise on grenadier, attempts were made to conduct mesh selection studies using the alternate tow method. Because of mesh clogging and the stratification of the species by length with depth the efforts were largely unsuccessful.

SUBAREA 3

A. STATUS OF THE FISHERIES

1. Cod

Total Canadian landings were almost 167,000 t, 32% above 1978 landings. Inshore landings increased from 100,200 t to 108,200 t, while offshore landings increased more dramatically from 26,300 t to 58,700 t. Offshore landings were down in Div. 3M and Subdiv. 3Ps, however, these decreases were far outweighed by increases in all other Divisions. The most dramatic increases in offshore landings were in Div. 3K and 3L (19,500 t and 7,000 t increase respectively). These increases reflect an increase in the Canadian offshore fishing effort in more northern areas. Inshore landings were down by 9% in Div. 3K, however, they increased in all other Divisions.

2. Redfish

Canadian landings totaled 37,500 t, slightly below the 1978 level of 38,900 t. There were significant increases in Div. 3L, 3M, 3N and 3O landings (total increase of 8,200 t). However, these increases were offset by decreases in Div. 3K, Subdiv. 3Ps and 3Pn landings of 3,400, 5,800 and 350 t respectively.

3. Flatfish

These were the principal species taken by the Canadian offshore fishery in Subarea 3. Total Canadian landings of the combined flatfish species were about 103,900 t, up 3% from 100,500 t landed in 1978. Almost 53,700 t of American plaice were landed, showing a 3% decrease from 55,600 t landed in 1978. This difference was mainly attributable to a decrease in Div. 3L and 3O landings of 1,350 and 1,650 t respectively. Canadian yellowtail landings were 18,800 t, up 17% from 16,100 t in 1978. This was a direct result of an increased Canadian quota for yellowtail in Div. 3LNO. Witch landings

were about 4,000 t, showing a decrease from 4,400 and 12,200 in 1978 and 1977 respectively. Thus, there is a continuing trend towards declining witch catches in Subarea 3. Greenland halibut landings amounted to 26,800 t, up 13% from 23,700 t landed in 1978. This was largely attributable to a 3,050 t increase in Div. 3K and 3L inshore landings. Inshore landings amounted to 88% of the total Greenland halibut landings in 1979.

4. Other groundfish

Canadian landings of other groundfish were about 4,800 t in 1979. This was mainly composed of wolffish (2,000 t), hake (1,300 t) and pollock (1,100 t).

5. Capelin

Approximately 13,000 t were landed in 1979, an increase of approximately 3200 t over the 1978 level.

6. Herring

Herring landings from eastern Newfoundland (Div. 3KL) were 28,400 t, a 17% increase above the 1978 catch level. Herring landings along southern Newfoundland (Div. 3P) increased 52% over 1978 to 3800 t in 1979.

7. Mackerel

Mackerel landings by Newfoundland were 14,500 t, slightly above the 1978 catch level. The fishery occurred primarily in Div. 3K and 3L.

8. Squid

Total catch for squid in 1979 was 81,800 t, an increase of 85% above the catch in 1978 (44,300 t). Offshore catch for 1979 (2400 t) represented only 3% of the Subarea 3 total. This is down from 5000 t (11%) in 1978. The success of the 1979 fishery was due to several factors, including increase in inshore effort, increased processing facilities and extended wharfage processing by foreign trawlers. Real squid abundance was high and landings were less severely restricted than they had been in 1978.

9. Atlantic salmon

Total salmon landings (commercial and recreational) for 1979 were about 623 t, slightly lower than the 1978 landings. There was a noticeable decline in the proportion of 2-sea-winter salmon. This was partially attributed to a poor survival of the 1977 year-class of smolt.

B. SPECIAL RESEARCH STUDIES

1. Environmental Studies

a) Oceanography. Extensive oceanographic work was done in Subarea 3 in 1979. Most standard sections were visited and some on several occasions (Table 1). The data are available through MEDS.

An experimental bottom temperature-pressure recorder in the Avalon Channel required three stations to supplement normal Station 27 occupation. These four stations were occupied on five occasions from September 1979.

Temperature profiles were made on every research trawling station.

A transect for nutrients was run on the Seal Island line in September 1979.

As part of the Flemish Cap experiment current and other oceanographic studies have been continued on Flemish Cap and the grid and sections were occupied in February, March, April, May and June.

Table 1. Oceanographic sections occupied in 1979.

<u>Section</u>	<u>Date</u>	<u>Ship</u>	<u>Stations</u>	<u>Notes</u>
Seal Island	4-5/8/79	Arctica	9	nutrients
	23/11/79	Gadus 29	8	
White Bay	6-7/8/79	Arctica	15	
Bonavista Triangle	31/7-1/8/79	Arctica	12	
Flemish Cap (47°N)	16-19/3/79	Gadus 19	17	
	21-22/4/79	Gadus 20	15	
	3/5/79	Gadus 20	27	
	9-10/5/79	Gadus 20	10	
	27-30/7/79	Arctica	23	
Flemish Cap (NW-SE)	29/4/79	Gadus 20	12	
USSR 7-A	30/4/79	Gadus 20	8	
	8-11/8/79	Arctica	15	
S.W. Grand Banks	10-11/8/79	Arctica	11	
St. John's USCG-3	12-13/8/79	Arctica	11	
USCG 2B	10-11/5/79	Gadus 20	10	
USCG 3A	12/5/79	Gadus 20	12	
4325 N	13/5/79	Gadus 20	24	"New Look '79"

Paleo-ecological and paleo-oceanographical studies were carried out west of Orphan Knoll (Div. 3K).

Bedrock sampling and seismic/sidescan surveys took place in Placentia Bay (Subdiv. 3Ps).

b) Plankton studies. The Flemish Cap project was begun intensively in 1979 with some 10 occupations in total, three of which were plankton collections on the standard grid by NAFC using BONGO gear, March, April, and May.

Southern Grand Banks plankton was collected in June and July 1979, as it was in 1978. Ammodytes was the dominant in June; other species being represented as eggs. In July, cod, redfish and yellowtail and Ammodytes were the dominants.

2. Biological Studies

a) Cod. In Div. 3K and 3L the catch in both the inshore and offshore sectors was comprised mainly of cod of ages 4-7 years. In Div. 3N and 3O most of the catch was comprised of cod aged 4-6 years while in Subdiv. 3Ps cod of ages 4-7 years predominated. Various biological observations were made during some 10 research vessel cruises in Subarea 3.

b) Redfish. Random stratified surveys were carried out throughout Subarea 3 in order to collect information on distribution and abundance of the species. Research and commercial frequencies and ageing data were collected for assessment purposes.

As in Subarea 2, studies are underway in the area of stock discrimination.

c) Flatfish. As in previous years the emphasis has been on the improvement of the data base for the various flatfish stocks aimed at more precise stock assessments and a better understanding of the biology of the flatfish species.

d) American plaice. For the Subarea 2+3K, 3LNO and 3M stocks the recommended TACs remained at the 1979 level of 6,000, 47,000 and 2,000 t respectively. For the Subdiv. 3Ps stock the recommended TAC was increased from 4,000 to 5,000 t.

e) Yellowtail. The recommended TAC for 1980 was the same as for 1979 at 18,000 t.

f) Witch. Assessments of witch stocks in Div. 2J-3KL and Subdiv. 3Ps indicated that the recommended TAC should remain at the 1979 levels of 17,000 and 3,000 t respectively. A general production and cohort analysis of the Div. 3NO stock indicated that the 1979 TAC of 7,000 t might be too high, however, because of anomalies in the data which could not be explained it was recommended that the TAC remain at the 1979 level. Studies to determine precise stock boundaries of witch are continuing and results should be available in 1980.

g) Greenland halibut. An assessment of Greenland halibut in Subarea 2 and Div. 3KL indicated an increase in the catch per unit effort of the offshore component. There is evidence that the biomass of this stock is increasing probably because of recent good recruitment from the 1970-73 and possibly 1974 year-classes. Because of this it was recommended that the TAC for 1980 be increased from 30,000 to 35,000 t.

Stock delineation studies were initiated in 1979 to elucidate the stock composition of Subareas 0-3 Greenland halibut. In addition to meristic-morphometric, parasite and biochemical studies, approximately 3,000 Greenland halibut were tagged in Div. 3K in 1979 and this program will be expanded to include tagging in Statistical Area 0 and hopefully Subarea 2.

h) Capelin. An acoustic survey in Div. 3LNO provided biomass estimates of approximately 200,000 t of capelin in Div. 3L and 3000 t in Div. 3NO. A survey for pre-recruit capelin in Div. 3KL was conducted in September.

Studies on stock discrimination and general biology of capelin were continued.

i) Atlantic salmon. Three research cruises were carried out to determine migration routes of salmon and for stock identification. In total 340 salmon were tagged and released, another 233 were sampled for size, age, and sex. Commercial sampling occurred at Burgeo and at St. Anthony. Blood samples were also collected from salmon in the St. Anthony area. These samples when analyzed for plasma vitellogenin will provide information on the percentage of maturing salmon caught in the commercial fisheries.

j) Squid. In early March a survey was conducted toward studying the distribution of larval and juvenile squid in the Gulf Stream. From a pre-recruit survey in June on the Grand Bank, a predictive index of inshore abundance was determined. Inshore catch, effort and CPUE were collected throughout the season. Samples were taken from the commercial catch at regular intervals to study changes in size, sex composition and maturity. Environmental data were collected and their effect on CPUE was assessed. The tagging program was intensified in 1979 and studies continued on validating the ageing of squid from statoliths.

k) Whales. Aerial surveys for whales were conducted in the inshore zone of eastern Newfoundland from June to August, and several large concentrations of whales were identified and assessed. Three short-duration cruises in inshore waters were carried out, and a total of 85 whales (chiefly humpback and fin whales) was tagged with Discovery marks bearing visible streamers. A whale sighting program for government and commercial vessels in the Newfoundland area was initiated, and a great many whale sightings were reported to us during 1979. It is hoped that this system will be expanded and systematized during 1980. Several stranded and net-entangled whales were examined during 1979, including two minke, one beluga, one humpback, one narwhal, one fin whale, and one sperm whale. A herd of 135 pilot whales stranded on the south coast of Newfoundland, and biological data were collected from almost all animals.

Memorial University of Newfoundland undertook a government-sponsored study of the whale net-entanglement problem in Newfoundland inshore waters.

l) Sampling of foreign and Canadian offshore catches. A total of 2,286 samples representing 537,802 lengths and 32,965 ages were taken from the catches of foreign and Canadian offshore fisheries as follows: cod 1132 samples for 290,448 lengths and 14,668 otoliths, redfish 171 samples for 31,905 lengths and 5,731 lengths and 1,810 otoliths, haddock 2 samples for 254 lengths and 42 otoliths, yellowtail flounder 14 samples for 1709 lengths and 138 otoliths, witch 119 samples for 18,527 lengths and 1897 otoliths, turbot 113 samples for 22,622 lengths and 2,895 otoliths, roundnose grenadier 87 samples for 18,230 lengths and 907 otoliths, silver hake 35 samples for 5,491 lengths and 471 otoliths, argentine 1 sample for 214 lengths and 35 otoliths, pollock 3 samples for 585 lengths and 101 otoliths, squid 5,616 lengths, capelin 13,201 lengths and 3,492 otoliths, shrimp 411 samples for 110,265 lengths, white hake 33 samples for 6,247 lengths and 431 otoliths, other species 3,026 lengths and 347 otoliths. About 11,974 sets were observed and 2,870 were recorded from the fishing log over 4,900 observed days fished. This represents a 45% coverage of the various fisheries (excluding Canada).

3. Gear and Selectivity Studies

A mesh experiment with American plaice was carried out in cooperation with a Canadian fishing company utilizing codends with mesh sizes 130, 140 and 156 mm. Preliminary results indicate a fairly marked reduction in the amount of discarded small plaice, however, there was a significant reduction also in the marketable fish retained. An alternate tow experiment with a chartered otter trawler (Tonnage Class 5) in October 1979 gave similar results. Preliminary analysis of the data indicates that while there would be considerable reduction in catch per unit effort in the initial year of changing to a larger mesh size, there would be a rapid recovery in subsequent years.

In the summer of 1979 a selection experiment was conducted using cod traps of minimum mesh size of 3, 3½, 4 and 5 inches respectively. The large number of observations are presently being analyzed.

SUBAREA 4

A. STATUS OF THE FISHERIES

1. Groundfish General

Total nominal annual catches (Maritimes and Quebec) increased by 31.5% from the 1978 level to 263,000 metric tons (MT). Increases were shown by all categories except for haddock which showed a slight decrease. Quotas were in effect on all major stocks and limited landings of cod and haddock in particular.

Under development charter arrangements, Japan was the only country making landings - 25,239 MT of squid only.

2. Cod

Landings (Maritimes and Quebec) continued to increase, by 54% over the 1978 figure, to almost 136,000 MT, and constituted 52% of the total groundfish catch. Increases were shown in all Divisions, but particularly in the southern Gulf of St. Lawrence where landings increased 2½ times over those of 1978, to almost 41,000 MT.

Newfoundland landings totalled 42,800 MT, about 8% higher than in 1978. Most of the change was attributable to increased offshore landings in Div. 4T, 4W and Subdiv. 4Vs, with a significant decrease in Subdiv. 4Vn landings from 3,400 MT in 1978 to only 1,300 MT in 1979.

3. Haddock

Landings, almost wholly from the Scotian Shelf (Div. 4V, 4W, 4X), decreased by 7% from the 1978 level to just below 28,000 MT, constituting 10% of total groundfish landings. A decrease was shown in all areas. Newfoundland catches were also down, to 500 MT from 1,300 in 1978.

4. Flatfish

Total nominal landings (Maritimes and Quebec) of combined flatfish species (except Atlantic halibut) increased by 35% to almost 33,000 MT, constituting 12.5% of total groundfish landings. Increases were shown in all Divisions except Div. 4W for which landings fell by almost half. Almost the whole of the increase was due to improved catches in the Gulf of St. Lawrence (Div. 4R, 4S, 4T) and Sydney Bight (Subdiv. 4Vn). Increased landings were shown by all species with American plaice increasing by 25% to 17,000 MT and constituting 52% of the flatfish landings. Greenland halibut landings increased three times to almost 6,000 MT, mostly from southern Gulf of St. Lawrence (Div. 4T).

Newfoundland landings totalled about 9,800 MT, 19% above 1978 landings. There was a slight decrease in American plaice and witch landings, but this was more than compensated for by an increase in Greenland halibut landings, mostly from the northern Gulf of St. Lawrence (Div. 4R) offshore fishery.

5. Redfish

Redfish landings (Maritimes and Quebec) recovered slightly from the decline in recent years, increasing by 12% over the 1978 level to almost 18,000 MT. The increase was almost wholly from the Gulf of St. Lawrence (Div. 4R, 4S, 4T) as catches showed little change in other areas.

Newfoundland catches fell by 26% from the 1978 level, to about 4,000 MT. The decrease was almost wholly due to reduced landings from the northeastern part of the Scotian Shelf (Subdiv. 4Vs). The landings reflect quota restrictions on the 4R, 4S, 4T redfish fishery.

6. Pollock

Pollock landings (Maritimes and Quebec) continued to rise, increasing by 20% over the 1978 catch, to more than 26,000 MT, 10% of the total groundfish landings. As usual, almost the whole catch was from the Scotian Shelf (Subdiv. 4Vs and Div. 4W, 4X), with 67% coming from the Browns Bank area (Div. 4X) alone. There was a slight decrease in catches from Div. 4W but this was more than compensated for by increased catches from the northeast part of the Scotian Shelf (Subdiv. 4Vs). Landings from the Gulf of St. Lawrence (Div. 4R, 4S, 4T) were negligible.

7. Other groundfish

Landings by Maritimes and Quebec increased by 9% from the 1978 figure to almost 22,000 MT, and Newfoundland catches were about 1,000 MT, almost double the 1978 figure. Catches on the Scotian Shelf (Subdiv. 4Vs, Div. 4W, 4X) were down about 10%, but increased landings from the Gulf of St. Lawrence (Subdiv. 4Vn, Div. 4R, 4S, 4T) more than compensated for the decrease.

Common hake catches increased by 10% to almost 11,000 MT, constituting 50% of the "other groundfish", compensating for a 19% decrease in cusk catches, to about 4,000 MT. As usual, the major contributor to common hake catches was the southern Gulf of St. Lawrence (Div. 4T) where catches increased by 79% from 1978, to almost 8,000 MT, 72% of the total "other groundfish" in that Division. Silver hake landings decreased from 163 MT in 1978 to 88 MT in 1979.

8. Sea scallops (*Placopecten magellanicus*)

Landings totalled 11,571 MT round weight, an increase of 58% over 1978 landings (7,301 MT). This was due to improved landings from Div. 4X, Browns Bank (2,379 MT, up 976% from 221 MT in 1978) and a newly discovered scallop bed near German Bank. Landings remained fairly constant in the Bay of Fundy (Div. 4X), but decreased by 12% in the Northumberland Strait (Div. 4T) from 2,298 MT in 1978 to 2,028 MT in 1979.

9. Herring

Total nominal catches (Maritimes and Quebec) from Subarea 4 were 131,872 MT, a decrease of 32% from the 1978 level. Landings from Div. 4X were down 38% at about 73,000 MT, constituting 56% of the total catch. Landings from the central part of the Scotian Shelf (Div. 4W) were down 77% at just over 5,000 MT, while an increase in Subdiv. 4Vs catches compensated for a decrease in northern Cape Breton (Subdiv. 4Vn) catches from about 6,700 MT in 1978 to about 1,000 MT in 1979.

Newfoundland landings, almost wholly from the northeast Gulf of St. Lawrence (Div. 4R), totalled 19,570 MT, an increase of 12% to about the 1977 level.

10. Mackerel

Improved catches in the southern Gulf of St. Lawrence (Div. 4T) were mainly responsible for a rise in the total catch from 10,925 MT in 1978 to 14,913 MT in 1979, an increase of 36% to about the 1977 level.

11. Tuna

Total Canadian landings of bluefin tuna in 1979 amounted to 245 MT, a decrease of 426 MT from the previous year.

The commercial (trap) catch of bluefin in the St. Margaret's Bay area (Div. 4X) yielded 31 MT, a decrease of 190 MT from 1978. Individual weights ranged from 298-609 kg, with a seasonal mean weight of 424.3 kg.

The sport (rod-and-reel) fishery in the Gulf of St. Lawrence (Div. 4T) yielded 214 MT, an increase of 5 MT from 1978. The Prince Edward Island area yielded 129 MT, with individual weights ranging from 252.6-544.3 kg and a seasonal mean of 405.8 kg. In the Bay of Chaleur area, 30 MT were taken with a seasonal mean of 397.8 kg. The remaining 55 MT were taken in the Georges Bay area where the seasonal mean weight was 493.1 kg and a record 678.6 kg bluefin tuna was landed.

12. Swordfish

This fishery which has remained closed since 1971, was officially reopened in July 1979. The Canadian swordfish catch in 1979 was estimated to total about 2600 MT for Subareas 3+4.

13. Atlantic salmon

Total landings, including both commercial and sports fisheries, but excluding those from the

Newfoundland fishery in the eastern Gulf of St. Lawrence (Div. 4R), were 216 MT, a decrease of 27% from the 1978 landings and continuing the decrease from previous years. The decrease was shown both in the Maritimes and Quebec regions. The commercial catch (105 MT) was 50% of that in 1978, with the greatest decrease in the Maritimes region, but the angling catch (111 MT) was only slightly lower than that in 1978, a reversal of the changes shown in the previous two years.

The Newfoundland coastal set-net fishery in Div. 4R yielded 108 MT, a decrease of 11% from the 1978 level.

The ban on commercial fishing in New Brunswick and the Gaspé has continued.

14. Squid

The squid fishery on the Scotian Shelf yielded reduced catches in 1979, falling by 23% from the 1978 level to about 5,000 MT. This was due to absence of landings from the northeast Scotian Shelf (Subdiv. 4Vs), which increased landings from the central and southwest Scotian Shelf (Div. 4W, 4X) did not compensate for.

Under development charter arrangements, Japan landed 25,239 MT of which about 50% was from the central Scotian Shelf (Div. 4W) and 37% from the northeast Scotian Shelf (Subdiv. 4Vs).

B. SPECIAL RESEARCH STUDIES (MARITIMES REGION)

1. Environmental studies

(a) Hydrography. Lagrangian measurements of surface currents by means of satellite-tracked drogues, drift cards and bottles were made in April-December off southwest Nova Scotia (Div. 4X). Preliminary results indicate intermittent offshore excursions of shelf water related to passage of Gulf Stream eddies.

Seasonal variations in water column variables (nutrients, organic matter, heavy metal chemistry and plant pigments) were studied in the Bay of Fundy (Div. 4X), as well as biological and chemical analysis of synoptic water and mud samples.

The first stage of an oceanographic model of St. George's Bay (Div. 4T) was completed and predicted reasonably well known features, including a clockwise gyre and an outflow of deep water.

In St. George's Bay (Div. 4T), distribution of particulate material in relation to oceanographic structure was studied and preliminary investigations were made to assess the importance of Langmuir cells to the nutrition of fish larvae.

Measurements of particle size distribution, both at the surface and at depth were made on the Scotian Shelf (Div. 4V, 4W, 4X, 5Z) during the period February-November. Particle concentration decreased with depth and showed a cline from northeast to southwest.

Analysis of monthly surface and bottom temperature distributions in the southern Gulf of St. Lawrence (Div. 4T) for the period 1965-75 was completed.

(b) Plankton studies. The Scotian Shelf Ichthyoplankton Program (SSIP) continued for its third year. Eight survey cruises were carried out (Jan, Apr, May, Aug (2), Sep, Oct, Nov) including two (Aug and Sep) by the Russian vessel "Viandra". Sorting and identification of material is being done. Cruise protocols have been finalized.

Studies of plankton primary production were carried out in different areas of the Bay of Fundy (Div. 4X) as well as measurements of microbial number, biomass and activity.

Annual larval herring surveys in the Bay of Fundy (Div. 4X) have continued, including seasonal surveys in summer, fall and late winter. A herring larval survey was carried out in the northern Northumberland Strait (Div. 4T) to study larval origin and dispersal.

(c) Benthic studies. Studies of benthic organisms, benthic and epibenthic algal production and production of benthic animals were included in examination of the mudflat ecosystem in the Bay of Fundy (Div. 4X).

2. Biological studies

(a) General. The annual groundfish research survey program continued with three seasonal cruises (March, July and October-November) on the Scotian Shelf-Bay of Fundy (Div. 4V, 4W, 4X) and one cruise (September) in the southern Gulf of St. Lawrence (Div. 4T) and a survey of haddock stocks in Div. 4W, 4X (March).

Monitoring and biological sampling of commercial catches and the foreign vessel program continued.

Monitoring of incidence of codworm and of the fungus Ichthyophonus hoferi in yellowtail flounder continued.

(b) Cod. Tagging experiments were resumed with 9,710 released from the vicinity of Halifax Harbour (Div. 4W) and 4,300 in the Banquereau area (Subdiv. 4Vs). Returns from the Halifax area were about 20% and showed movement in both directions along the coast and offshore to the Div. 4VW banks.

The effects of stock biomass on growth rates of southern Gulf of St. Lawrence (Div. 4T) and Scotian Shelf (Div. 4V, 4W, 4X) cod were studied.

Analysis of cod stomach contents to determine the pattern and extent of cod feeding on capelin was initiated in the southern Gulf of St. Lawrence (Div. 4T).

Experiments to determine the effects of food ration on the reproductive cycle show a definite relationship between ration/growth rate and fecundity.

Monitoring of the commercial fishery in Div. 4RS continued, with collection of samples for length-age and other biological characters. A research vessel survey in January provided data on abundance of cod and other groundfish species as well as biological data. An assessment of the cod stock in Subdiv. 3Pn and Div. 4R, 4S indicated a catch of 75,000 metric tons should be sustainable over the next few years.

(c) Haddock. A good series of data on the spawning populations of haddock in the Emerald (Div. 4W), Browns (Div. 4X) and Georges Bank (Div. 5Z) areas was obtained in a groundfish survey cruise in March.

(d) Pollock. Monitoring of intestinal parasites of both fry (harbour pollock) and adult (offshore) pollock continued.

A total of 6,030 juvenile pollock was tagged at various locations on the Nova Scotia Atlantic coast (Div. 4W, 4X) and in the Bay of Fundy (Div. 4X). Young-of-the-year pollock were exceptionally abundant throughout the summer. An additional 5,638 pollock were tagged offshore in Div. 4W, 4X.

(e) Herring. A total of 28,554 herring were tagged and released in various areas. Returns from previous years' tagging experiments confirm wide dispersal of herring from tagging sites on the Maritimes Atlantic coast.

A study of the Gaspé (Div. 4T) herring showed a mixture of local and offshore populations. Seasonal variation in feeding, catches, and catch-per-effort were analyzed.

A detailed study of herring spawning beds, aerial survey of fixed gears and experimental hatching of eggs and larval rearing were carried out in relation to the southern Gulf of St. Lawrence (Div. 4T) stocks.

(f) Redfish. Monitoring of the commercial fishery for redfish in the Gulf of St. Lawrence (Div. 4RST) continued in 1979 with collection of samples for length, age and other biological characters. A research vessel survey in September provided data on abundance, while a chartered vessel survey in August provided estimates of recruitment to the stock. Indications are that the year-classes in the early 1970's were better than those of the 1960's, but were not recruited to the fisheries in 1979. The TAC for 1980 was recommended at 16,000 MT, the same as 1979. The bycatch of redfish in the shrimp fishery was monitored.

(g) Silver hake. Age and growth studies of silver hake from the central and southwestern Scotian Shelf (Div. 4W, 4X) continued.

(h) American plaice. A total of 5,494 American plaice were tagged as part of a programme of tagging of various groundfishes.

(i) Bluefin tuna. Biological sampling in the southern Gulf of St. Lawrence (Div. 4T) and St. Margaret's Bay, Nova Scotia (Div. 4X) was continued. The failure of the St. Margaret's Bay impoundment fishery reduced the experimental and field program.

Three tagged tuna were recaptured in 1979, two in Chaleur Bay (Div. 4T) after release from the same area in 1975 and 1977, the third in the Caribbean south of Puerto Rico after release off Nova Scotia in 1977.

(j) Swordfish. Analysis of logbooks indicates increase in mean size and catch per unit effort compared to preclosure of the fishery levels in 1971.

One swordfish, tagged off Nova Scotia, was recaptured, after 11 years at large, in the swordfish longline fishery off Florida. This is the first of 23 returns to be recaptured a significant distance from the release area and indicates a complex stock structure involving the traditional New England fisheries and the relatively new fisheries off the southern United States.

(k) Mackerel. A model was developed to estimate spawning stock abundance from egg catches. Egg counts were made on gonads and a gonad weight-fecundity relationship derived. Analysis of mackerel stomach contents was continued.

3. Gear and selectivity studies

Initial sea trials were carried out on a prototype trawl instrument set and calibration data obtained for a 145-ft Engel trawl, Atlantic Western IIA survey trawls and shrimp survey trawls.

Acoustic development work continued on measurement and variation in target strength. Target strengths of various sized groups of capelin were measured for application in capelin surveys. A method was developed for measuring herring quantities at very high densities, e.g. in herring weirs. This may be applied to other densely-schooling species.

Sea trials with the Bottom Referencing Underwater Towed Instrument Vehicle (BRUTIV) were successful.

C. SPECIAL RESEARCH STUDIES (QUEBEC REGION)

1. Environmental studies

(a) Hydrography. Temperatures, salinities and light penetration were monitored monthly at standard depths from March to December over a grid of 29 stations in the St. Lawrence Estuary as part of a comprehensive study of the mechanisms controlling productivity in this area. Temperatures were measured daily at the Magdalen Islands during April to June in relation to the date of arrival of herring. A program on the dynamics of trace metals in the St. Lawrence Estuary was continued.

(b) Plankton studies. Phytoplankton production in the St. Lawrence Estuary (Div. 4T) was assessed on a monthly basis from March to December. Measurements under ice were initiated during a 15 day cruise in March and should provide an idea of plankton activity in late winter.

An ichthyoplankton survey of nearshore (0-6 miles from shore) areas was completed in the Estuary. Preliminary results indicate extremely high concentrations of newhatched larvae of coastal spawning fishes, but few species remain resident in this area throughout the larval period. A study of interactions of larval herring, capelin and smelt in the St. Lawrence Estuary was initiated, to determine relative importance of biotic and abiotic factors in determining survival through the larval period.

(c) Benthic studies. A comprehensive research project on the dynamics and production of benthos in the inshore areas of the St. Lawrence Estuary has been initiated. Analysis of benthic data from the Magdalen Islands is in progress, in relation to the impact of construction of a harbour to ship salt from a new salt mine.

(e) Other environmental studies. A study to assess the Blue Mussel as a pollution indicator in the lower estuary and gulf of St. Lawrence has been completed.

2. Biological studies

(a) Herring. A study of herring population separation using meristic characters indicated that herring fished on the mid (Port Cartier) and lower (La Tabatière) North Shore of the Gulf consists of separate populations, which in turn are distinct from populations of the west coast of Newfoundland.

A study of population characteristics and migrations of the St. Lawrence Estuary population was completed; spawning biomass of this population was estimated from a small scale intensive ichthyoplankton survey directed toward yolk-sac larvae. Sampling for biological characteristics in the Gaspé peninsula indicated continued dominance of 1974 year-class fish with 1976 fish showing up well in some areas. Feeding studies (in comparison with mackerel) were initiated. Meristics studies suggested little variation between year-classes.

(b) Capelin. Sampling of commercial catches indicated the highly variable sex ratio characteristic of capelin caught near shore, and also indicated that ovary weights were adequate for the foreign roe market.

(c) Smelt. Sampling on spawning grounds and in commercial and sports fisheries was initiated, to examine separation and structure of Quebec sea-run populations.

(d) Lobster. Monitoring of tag recoveries was continued in collaboration with the Province of Quebec, to study local movements of lobsters in and out of relatively enclosed bays at the Magdalen Islands; the role of these bays was studied in relation to increased growth rate and to the constitution of a lobster reserve for seeding of coastal areas.

(e) Crabs. Research on snowcrab, directed toward local and seasonal variations in size, condition of shell, maturity and sex ratio in the western Gulf of St. Lawrence, has provided recommendations for solution of the soft-shell crab problem. Studies on abundance and distribution of snow and spider crab in the same area were initiated.

(f) Seals. A major tagging program was conducted in the Gulf of St. Lawrence with 2680 harp seals being marked. Sampling in the St. Lawrence Estuary near the Saguenay provided 250 animals. Data were integrated with Newfoundland information to provide assessment of pup production and population size in 1979.

3. Fishing operations studies

(a) Herring. Questionnaire studies on inshore fishery characteristics and effort were completed for the Gaspé peninsula and the Magdalen Islands. An experiment on aerial photography for evaluation of anchored gillnet effort intensity and distribution demonstrated the feasibility of this technique.

SUBAREAS 5 AND 6

A. STATUS OF THE FISHERIES

1. Groundfish general

Total nominal landings from Div. 5Y, 5Z decreased from the 1977 level by 41% to 13,655 MT, about the same total as for 1976. Landings were largely from Georges Bank (Subdiv. 5Ze). Decreases were registered for all species except witch flounder, with the bulk of the losses sustained by cod, haddock and pollock. Quotas were in effect on all major stocks and limited landings.

2. Cod

Catches decreased by 20% to 6,498 MT, almost all from Georges Bank area (Subdiv. 5Ze).

3. Haddock

Catches decreased by 50% from the 1978 level to just over 5,000 MT, almost all from Georges Bank area (Subdiv. 5Ze).

4. Pollock

Following increasing catches in recent years, 1979 showed a reversal of the trend with a decrease of 36% from the 1978 level to about 3,000 MT. Georges Bank (Subdiv. 5Ze) yielded 81% of the total.

5. Other groundfish

Catches of flatfish, mainly American plaice, witch, yellowtail flounder and winter flounder fell drastically by 66% to just over 100 MT.

6. Sea Scallop (*Placopecten magellanicus*)

Landings totalled 76,422 MT whole weight, a decrease of 24% from 1978 landings. This reflected depletion of the above-average recruitment in 1972. Pending settlement of the Canada-USA boundary question, it has not been possible to implement effective management schemes to protect declining stocks.

7. Herring

No herring catches were reported from Subarea 5, compared with 582 MT in 1978.

8. Swordfish

Approximately 400 MT of swordfish were caught in the re-opened Canadian swordfish fishery.

9. Bluefin tuna

There was no Canadian fishery for bluefin tuna off the middle-Atlantic coast in 1979.

SEALS (SUBAREAS 2, 3 AND 4)

A. STATUS OF THE FISHERIES

The TAC for harp seals remained at 170,000 as for 1978, plus 10,000 for Greenland, Labrador and the Canadian Arctic. Canada took 140,253, slightly lower than in 1978, of which 44,529 were taken by landmen, the remainder by ships. The "Front" yielded 67.2% of the total.

The TAC for hooded seals remained at 15,000, of which Canada's share was 6,000, Norway's 6,000 and the balance available to either country after the main hunt. Canada's total catch was 6,819, an increase of 62.8% over the 1978 level, all being taken at the "Front".

B. SPECIAL RESEARCH STUDIES

Harp Seals

In a mark-recapture experiment to determine harp seal pup production on the "Front", 2,884 pups were tagged, of which 420 were double-tagged to estimate tag loss. Estimated production, including a survey estimate of 25% recoveries not being reported, was 203,000 with confidence intervals of 174,000-239,000.

A large-scale tagging experiment was carried out near the Magdalen Is., Gulf of St. Lawrence (Div. 4T) for second successive year.

Age was determined in a sample of 1,664 harp seals from all components of the harvest on the "Front" from December 1978 to May 1979, including 562 moulting seals from Labrador in April. A catch-at-age table and population age structure were constructed.

Analysis of reproductive tracts from 335 harp seals shows mean age at sexual maturity has declined from 6.2 years in the early 1950's to 4.3 years in 1979, while fertility rate has shown a corresponding increase from 0.85-0.94 in the same period.

Studies of age composition, reproductive rate and feeding intensity were continued for the Gulf of St. Lawrence (4R, 4S, 4T) fishery.

Approximately 200 stomachs were collected for analysis of harp seal diet.

Using the survival index method and most recent data, pup production for mid-year 1973 is estimated as 342,000 with 95% confidence limits of 267,000 and 625,800.

Cohort analyses for the period 1960-79 give estimates of age 1+ population size in 1979 as 1.23 million for a mean (best) estimate of 1979 pup production (352,000) and 1.38 million for a lower confidence limit (304,000).

Under a number of assumptions, and using the population age structure from cohort analysis that produces 352,000 pups in 1979, the age 1+ population increases at an instantaneous rate of 0.02 per year, giving projected pup production increase to 397,500 in 1985. If pup production in 1979 is about 304,000, the instantaneous rate is reduced to 0.01 per year, giving projected pup production increase to 339,400 in 1985.

With mean whelping age of 5.3 years and fertility rate of 0.94, the equilibrium sustainable yields were calculated to be 237,000 animals (80% pups) and 205,000 animals (80% pups) for 1979 pup productions of 352,000 and 304,000, respectively. These estimates assume a stable age distribution and population in equilibrium, but are low with present evidence which indicates increasing population. The replacement yield based on best estimate of pup production is estimated at 205,400.

Hooded Seals

Small-scale tagging as opportunity permitted was continued in the Gulf of St. Lawrence (Div. 4R, 4S, 4T).

Age samples from 480 females and 1,200 males and reproductive tracts from 432 females were collected from the "Front" for studies of ageing and changes in mean age at maturity and fertility.

Grey Seals

3,600 grey seals were tagged on Sable Island (Div. 4W) and 400 in the Gulf of St. Lawrence (Div. 4T). Returns do not correspond to earlier results, possibly due to effects of the Kurdistan oil spill.

Harbour Seals

387 harbour seals were tagged on Sable Island (Div. 4W), approximately 98% of the pup production for 1979.

Northwest Atlantic



Fisheries Organization

Serial No. N193

NAFO SCS Doc. 80/IX/28
(Addendum)

ANNUAL MEETING OF SCIENTIFIC COUNCIL - SEPTEMBER 1980

Canadian Research Report, 1979

Under Section C (page 12) in NAFO SCS Doc. 80/IX/28, Special Research Studies (Quebec Region) included only the projects carried out by the Department of Fisheries and Oceans of the Government of Canada. Research programs undertaken in 1979 by the Direction générale des pêches maritimes, Ministère de l'Agriculture, des Pêcheries et de l'Alimentation of the Province of Quebec are presented below to complete the Canadian Research Report for 1979.

1. Environmental studies

- a) Hydrography. As in earlier years, temperature profiles (XBT) were taken from mid-May to mid-June in Divisions 4R and 4S.
- b) Plankton studies. Ichthyoplankton sampling (approximately 20 oblique bongo sampler tows) was conducted in Divisions 4R and 4S (mid-May to mid-June).

2. Biological studies

- a) Groundfish. A groundfish survey was conducted in Divisions 4R and 4S between mid-May and mid-June, continuing the series begun in 1946.

In the Div. 4RS/3Pn cod stock, the 1977 year-class was very abundant in samples from the survey cruise. The 1974 year-class of redfish, which has appeared quite promising in 1976, had essentially disappeared as indicated from survey cruise data. A study of Greenland halibut biology was carried out, based on data from 1976-1979 survey cruises; despite the significant increase in landings, the minimum biomass estimate in 1979 was about the same as in 1978.

- b) Pelagic fish. Sampling of herring catches was carried out at the Magdalen Islands, in the Gaspé peninsula, and along the lower north shore of the Gulf.
- c) Crustacea. Natural mortality estimates were made for several stocks of shrimp in the Gulf of St. Lawrence, values varying from 0.5 to 0.8. Analysis of tag recapture data from lobster tagged in 1978 at the Magdalen Islands was continued; the data do not confirm the hypothesis of a northerly migration pattern.
- d) Molluscs. Studies of scallops off the Magdalen Islands indicate generally low abundance. Samples of scallops from along the lower north shore of the Gulf indicate slow growth in that region. Studies were carried out to investigate the causes of high mortality of cultured mussels at age 2 years.

In addition, two corrections should be made to the 1979 Research Report, as follows:

- (a) under "Lobster" in Subarea 4 (page 13, paragraph 1), it should be noted that Quebec scientists carried out a tagging study for lobster movements offshore at the Magdalen Islands, independent of the study there by Department of Fisheries and Oceans scientists;
- (b) under "Shrimp and groundfish" in Subareas 0 and 1 (page 2, paragraph 5), it should be noted that some scientists from the Province of Quebec participated in the "Thalassa" cruise.