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Section I. Subareas 1, 2 and 3

by

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Research in Subareas 1, 2 and 3 was carried out by a number of laboratories of the Department of Environment: Biological Station, St. John's, Nfld.; Biological Station, St. Andrews, N.B.; Arctic Biological Station, Ste. Anne de Bellevue, Que.; Marine Ecology Laboratory, and Atlantic Oceanographic Laboratory, Dartmouth, N.S.

Subarea 1

A. Status of the Fisheries

There was no Canadian commercial fishery in this Subarea.

B. Special Research Studies

I. Environmental Studies

Surface particulate petroleum surveys were carried out on an opportunity basis.

II. Biological Studies

1. Atlantic salmon, *Salmo salar* L. During August-September 1972 Canada participated with research vessels from Denmark, France, and the

United Kingdom in an International Salmon Tagging Experiment at West Greenland. The object of the experiment was to obtain estimates of: the return rate of salmon from Greenland to home waters; the exploitation rate and fishing mortality rate at West Greenland; the distribution and relative density of salmon inside and outside the Greenland fishing area; and the migration of salmon into and out of the Greenland area. Of the 2500 Atlantic salmon tagged and released by research vessels and observers on commercial vessels during the experiment, 219 of these were tagged by staff from the *A.T. Cameron*, from a total catch of 464 fish. Monofilament gillnets of 130 mm (5 inch) and 150 mm (6 inch) mesh were used. The smaller-meshed nets produced the best catches overall, but the relative efficiencies of the two mesh sizes varied with area fished, possibly because of differences in the relative proportions of large and small salmon present.

To obtain an estimate of primary tagging mortality 31 tagged salmon were kept on the *A.T. Cameron* in tanks supplied with continuously running seawater for periods up to 55 hours. Only 2 of the fish died and the condition of the others improved over the period they were held.

A more detailed account of the Canadian participation in the International Tagging Experiment is contained in Res. Doc. 73/47.

Subarea 2

A. Status of the Fisheries

I. Cod, *Gadus morhua* L.

The Labrador coastal fishery again yielded very low cod catches totalling only 1200 tons. In 1971 the catch totalled 3300 tons.

II. Atlantic salmon

The coastal fishery, mainly by gillnet, landed 454 tons of salmon, but in 1971 the total landing was 565 tons.

III. Herring, *Clupea harengus* L.

The catch was small, 1270 tons, from the southern part of the Labrador coast.

B. Special Research Studies

I. Environmental Studies

1. Hydrographic Studies. The section off Seal Islands (Div. 2J) was occupied by the *Cape Freels*, August 1-2, 1972. Refer to Res. Doc. 73/50.

Offshore navigational and resource charting was carried out off the entrance to Hamilton Inlet (Div. 2J), and coastal navigational charting between Hopedale and Nain (Div. 2H).

Surface particulate petroleum surveys were carried out on an opportunity basis.

II. Biological Studies

1. Cod. Monitoring of the coastal cod fishery was continued in July and August with 4190 fish sampled for length and 644 for age. Cod were extremely scarce and samples could not be obtained in many of the usual sampling areas, either from commercial fishermen or through jigging from the research boat. In southern Labrador (Div. 2J) in July water temperatures were cold in all sampling areas, ranging from -1.3 to -1.6°C at depths of 50 m or more; in the north (Div. 2G and 2H) in August bottom temperatures ranged generally from -0.8 to -1.1°C. Temperatures suitable for cod were confined to a relatively shallow surface layer.

The combination of low abundance of the stock in the inshore area, and the unfavourable temperature conditions resulted in the complete absence of a cod fishery in most of the Labrador coastal area.

2. Atlantic salmon. During a cruise of the *A.T. Cameron* in the Labrador Sea in April, adverse weather hampered operations but drift netting and longlining were carried out, during which 38 Atlantic salmon were caught ranging from 70 to 75 cm fork length. Of these 13 were tagged and released; the remainder were utilized for morphometric and meristic measurements, and biochemical analysis in stock identification studies.

Subarea 3

A. Status of the Fisheries

I. Cod

Total cod landings in Newfoundland from this Subarea were about

92,000 tons, nearly 20% less than in 1971. The decrease is attributed to low catches in the coastal fisheries during the peak summer season, particularly in the codtrap fishery.

II. Haddock, *Melanogrammus aeglefinus* L.

The landings of haddock are no longer significant in volume; the 1972 total from Subarea 3, principally from Division 3Ps, was less than 700 tons, about half the 1971 level of 1241 tons.

III. Redfish, *Sebastes* sp.

Landings from the Subarea totalled 5300 tons caught principally in Division 3Ps, and were about 12% below the 1971 level. This is attributed to a diversion of effort to the fishery for redfish in the Gulf of St. Lawrence.

IV. American plaice, *Hippoglossoides platessoides* (Fabricius); Witch flounder, *Glyptocephalus cynoglossus* (L.); Yellowtail flounder, *Limanda ferruginea* (Storer); and Greenland halibut, *Reinhardtius hippoglossoides* (Walbaum).

Flounders are the principal species group landed by the otter-trawl fishery from Subarea 3, and an important component of the landings from the coastal fisheries by smaller boats. Plaice landings in 1972 were more than 20% below the 1971 landing of 5996 tons. The decrease occurred principally in Division 3L. The yellowtail flounder has increased its geographical distribution on the eastern part of the Grand Bank (Div. 3L and 3N) and landings have increased. The 1972 total of about 24,000 tons were 20% higher than the 1971 total. The 10,000 landing of witch flounder was slightly higher than the 1971 landing. The Greenland halibut are largely taken in the coastal and near-coastal gillnet fishery by smaller boats. Principally, landings are from Divisions 3K and 3L and totalled 9000 tons in 1972, about 500 tons less than in 1971.

V. Herring, *Clupea harengus* L.

Herring landings in Newfoundland from the Subarea in 1972 totalled about 50,000 tons, principally from the seiner fishery in the southwestern

coastal areas of Newfoundland. This was a large decrease from the 1971 landings of 118,000 tons. Poor fishing weather seriously affected the catch levels but poor recruitment contributed substantially to the large decline in the landings.

VI. Mackerel, *Scomber scombrus* L.

Mackerel appear in abundance sporadically in Newfoundland waters: In 1972, the coastal fisheries, particularly in Divisions 3K and 3L, with smaller amounts in 3Pn and 3Ps, landed over 1500 tons. The 1971 landing was 1300 tons.

VII. Atlantic salmon

The marine landings of Atlantic salmon were 783 tons from Subarea 3 in 1972. This was a decrease of over 100 tons from the 1971 landings. Much of the decrease resulted from interference with the fishery by ice conditions on the northeast coast of Newfoundland.

B. Special Research Studies

I. Environmental Studies

1. Hydrographic Studies. Five standard sections across the Labrador Current, from southern Labrador to the Grand Bank are monitored annually. They were occupied by the Fisheries Protection vessel *Cape Freels* in July-August 1972. The year-round monitoring of a hydrographic station off Cape Spear near St. John's was continued throughout 1972. For results of these observations please see Res. Doc. 73/ .

A physical oceanographic survey employing current meters, X-bathythermographs, and standard oceanographic stations was carried out from April to June.

2. Other Environmental Studies. Offshore navigational and resource charting was continued along the northern portion of the Grand Bank. Charting was conducted in various coastal areas.

Nutrient surveys were conducted in May during the oceanographic cruise.

Surface particulate petroleum surveys were conducted on an opportunity basis.

II. Biological Studies

1. Cod. Monitoring of the commercial coastal and offshore fisheries was continued in principal Newfoundland landing ports, and data gathered for stock inventory and assessment. The 1964 year-class continued to be a strong contributor to the cod catch, particularly by gillnets in deep coastal areas. The shallower catches by trap and handline were dominantly of the 1968 year-class.

The studies were supplemented by cruises of research ships, one in March to St. Pierre Bank (Div. 3Ps) and another in May to the Grand Bank (Div. 3L and 3N). During these cruises the distribution and abundance of cod, flounders and other groundfish were studied by otter-trawl catches using the stratified random method of fishing station selection. The results provide background data for a re-examination of the stock assessment of cod in Division 3Ps and more recent data toward completion of an assessment of the cod stock in Divisions 3N and 3O. Data for the cod stock from Divisions 3N and 3O indicate that, during 1959-66, cod were fully recruited at age 6, were 50% recruited at 4.4 years, but very few fish of age 3 were caught in the commercial fishery. During 1967-68 cod were fully recruited at age 5, were 50% recruited at 3.8 years, with an average of 15% being recruited at age 3. This indicates a distinct shift in fishing pattern toward the younger ages in this stock during 1967-68. (See Res. Doc. 73/4.)

2. Haddock. Research vessel cruises to the Grand Bank (Div. 3N and 3O) indicate no sign of recovery of the haddock stock. Recent year-classes have been very poor and are not expected to contribute significantly to the stock on St. Pierre Bank (Div. 3Ps), in 1972 the 1970 year-class dominated in the catches, and 1968 was still significant. But the 1968-70 year-classes are poorer than the relatively abundant 1966 year-class which did not support a large fishery on St. Pierre Bank.

3. Yellowtail flounder. Catches in Divisions 3L and 3N continued to be high due to the expansion of the stock in numbers and in geographic area, and an increased rate of fishing. There was strong recruitment of 5- and 6-year-old fish to the exploited stock in 1971 and the catch was

composed almost entirely of fish aged 5 to 9 years. The catch per unit of fishing intensity (hours fished/square nautical mile) indicates a continued expansion of the stock. Age frequencies from research and commercial catches indicate a progression of strong year-classes in the stock. The species has spread over most of the shallow parts of the Grand Bank, and it is probable that the habitat could sustain a fairly large stock, although water temperatures are considerably lower than off New England, the southerly part of the yellowtail range.

During a cruise to the Grand Bank area by the *A.T. Cameron* in October, 1000 yellowtail flounder were tagged near the Southeast Shoal (Div. 3N) to study stock relationships and migratory patterns.

4. Herring. The program of sampling for stock inventory and assessment purposes was continued in the Newfoundland coastal areas throughout 1972.

Biological characteristics of herring in Fortune Bay, Newfoundland (Div. 3Ps) indicate that these fish form a relatively discrete spring-spawning stock greatly different from the spring-spawning component to the west along the southwest coast of Newfoundland (Div. 3Ps and 3Pn). Returns of tags within Fortune Bay from a tagging experiment in the bay have supported this.

Studies on the usefulness of the larval nematode *Anisakis* in herring as indicators of herring stock heterogeneity have revealed substantial differences between infestation levels in herring of the north Scotia Shelf (Div. 4Vs, 4W) and those of the southwest Newfoundland-southern Gulf of St. Lawrence stock complex (Div. 3Ps, 3Pn, 4T).

In eastern Newfoundland a tagging program was directed to the studying of relationships between local stocks. In May and June 27,500 herring were tagged in various bays. Concurrent with the tagging program extensive sampling of local populations was continued, with particular emphasis on stock identification.

5. Mackerel. The recent large increase in mackerel abundance in Newfoundland and southern Labrador coastal areas is the result of a strong 1967 year-class. A tagging program to determine migratory patterns of mackerel was initiated with 1450 mackerel being tagged in northeastern

Newfoundland coastal waters (Div. 3K) during August 1972. An indication of a long distance migration is a recapture by a Polish trawler on the southern part of Georges Bank (Div. 5Z) in December 1972.

6. Atlantic salmon. The program of sampling salmon from commercial marine catches to provide data for stock separation and assessment was continued in 1972. An estimate of one- and two-sea winter salmon in the catches was obtained to determine the effects of the West Greenland fisheries. Estimated percentages of grilse in Labrador catches in 1969 and 1970 were 16 and 21 respectively. Comparable percentages for Newfoundland were 35 and 47.

Analyses of scale patterns of Atlantic salmon from various North Atlantic areas suggest that there are five possible characters for discrimination between fish of European and North American origin taken in the West Greenland fishery. These are: width of second river zone, number of circuli in second river zone, width of first sea zone, number of circuli in the first sea zone, and the river age of the fish.

Electrophoretic analyses of serum proteins in Atlantic salmon have shown that European and North American populations differ in transferrin phenotypes; one transferrin is common to both but others are restricted to either European or North American populations. Methods are now being devised to estimate the proportion of North American salmon in the fishery off West Greenland by biochemical genetics techniques. Preliminary results indicate close agreement in identification by scale characteristics and biochemical methods.

7. Pink salmon, *Oncorhynchus gorbuscha* (Walbaum). From 1116 natural spawning adult fish (progeny of previous transplant from British Columbia) returns in 1971 were low, 468 to the home river, North Harbour River, St. Mary's Bay, Newfoundland; other rivers reported returns of 154 fish.

From 1400 spawning adults in 1970 there were only 58 returns to the river, and 59 from other rivers and the commercial fishery in 1972. A probable reason for the low 1972 return was predation on the fry by cod and haddock which were present in unusually large numbers in the estuary of North Harbour River during the fry run in the spring of 1971.

Section II. Subareas 4 and 5

by

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Canadian researches in Subareas 4 and 5 on oceanography and fish stocks were carried out by the Fisheries Research Board of Canada from the following institutions: St. Andrews Biological Station, Marine Ecology Laboratory (Dartmouth), St. John's Biological Station, Arctic Biological Station (Ste. Anne de Bellevue). The Bedford Institute of Oceanography and Quebec Ministry of Industry and Commerce also contributed. Data for preliminary surveys of 1972 landings were obtained from the Fisheries Service of the Canadian Department of the Environment. This report was prepared from submissions by many scientists engaged in research into problems of ICNAF interest. Harp and hooded seals for Subareas 2, 3 and 4 combined are dealt with in Section III.

Subarea 4

A. Status of the Fisheries

1. Groundfish General

Total landings (Maritimes and Quebec) in Subarea 4 decreased by about 7% from 1971 level, continuing the general trend in recent years. The shortfall was spread over the major fisheries and would have been greater but for exceptionally high pollock landings. Estimated landings by Newfoundland from Subarea 4, mainly cod and redfish, decreased by about 12% from 1971.

2. Cod

Cod landings from Maritimes and Quebec were down 6% from 1971 although they formed a slightly higher proportion of total groundfish (37%) than in 1971 (35%). Landings from Gulf of St. Lawrence and Cape Breton (Div. 4R, 4S, 4T, 4Vn) fell by 11% from 1971 level, continuing the downward

trend since 1971. Those from the remainder of Subarea 4 (Div. 4Vs, 4W, 4X) were slightly higher than in 1971 but not enough to suggest any improvement in the stock.

Newfoundland landings from Subarea 4 decreased by 15% from 1971, mostly due to reduced catches from Div. 4R.

3. Haddock

Total haddock landings were down 41% from 1971 level, forming only 6% of total groundfish landings. Landings from Div. 4X, 80% of the total haddock catches, fell by 25%, and 4W landings fell by 75%. These decreases reflect the poor state of the stock as well as imposition of quota allocations and closed seasons. In minor fisheries, the Gulf of St. Lawrence (Div. 4R, 4S, 4T) landings remained about the same as in 1971, but in Cape Breton (Div. 4Vn) catches decreased by more than 50%, continuing the reversed trend which appeared in 1971.

4. Flatfish

Total landings (American plaice, witch, yellowtail, and winter flounders) showed a slight (3%) increase from 1971, wholly from Gulf of St. Lawrence and Cape Breton areas (Div. 4R, 4S, 4T, 4Vn) which counteracted a slight decrease from the remainder of Subarea 4. Atlantic halibut landings fell by about 25% from 1971.

5. Redfish

Total redfish landings (Maritimes and Quebec) decreased by 4% from 1971 level, following the 30% increase from 1970 to 1971. The fall was mainly due to a 30% decrease in catches from the Scotian Shelf (Div. 4X, 4W, 4Vs) plus a 35% fall from Cape Breton area (Div. 4Vn) which counteracted an 8% increase from the Gulf of St. Lawrence (Div. 4R, 4S, 4T).

Newfoundland landings from the Gulf of St. Lawrence, 50% of which were from the new midwater trawling effort in redfish, fell by 10% from 1971 level.

6. Pollock

Pollock landings increased by 50% over 1971 catches. This may reflect a diversion of effort from the restricted haddock fisheries, mainly in Div. 4X.

7. Other Groundfish

Landings decreased by 30% from 1971.

8. Scallops

Sea scallop, *Placopecten magellanicus*. Total landings fell by about 10% from 1971 level to 7,818 metric tons whole weight.

Icelandic scallop, *Chlamys islandicus*. A new inshore fishery in the northern Gulf of St. Lawrence landed 1,957 metric tons.

9. Herring

Herring landings (Maritimes and Quebec) from Subarea 4 (excluding Div. 4R) totalled about 190,000 metric tons, a decrease of 28% (about 78,000 tons) from 1971. The loss was mainly due to a 75% (100,000 tons) reduction in landings from the southern Gulf of St. Lawrence (Div. 4T) and a 44% (20,000 tons) decrease from Div. 4W from 1971. In contrast, landings from the southwest and northeast Scotian Shelf (4X, 4V) increased by about 25% (24,000 tons) and 100% (6,000 tons), respectively.

Newfoundland landings from Subarea 4, all from eastern Gulf of St. Lawrence (Div. 4R), decreased by 58% to about 10,000 tons, with no landings from the southern Gulf and Cape Breton (4T, 4Vn).

10. Swordfish

There were no swordfish landings in Subarea 4.

11. Mackerel

There was a general decrease of 7% to about 12,000 metric tons in mackerel landings from Subarea 4 (excluding Div. 4R) from 1971 level. This reflected reduced landings over most of the Scotian Shelf and Gulf of St. Lawrence (Div. 4X, 4W, 4T) although insignificant increases were made in Div. 4W and 4V.

12. Tuna

Tuna landings, mainly yellowfin and skipjack from the eastern Pacific, increased by about 25% from 1971 to 5,000 metric tons. Commercial landings

of bluefin were down 75% from 1971 level at 238 metric tons, the lowest since 1966. The sport fishery yielded 261 metric tons, 50% greater than the previous record set in 1968.

13. Sharks

There were no shark landings reported in 1972.

14. Atlantic Salmon

Total catch for Subarea 4, exclusive of Div. 4R which is reported with Subareas 2 and 3, fell by 12% from 1971 level to 306 metric tons.

A ban on commercial salmon fishing in New Brunswick and the Gaspé Peninsula contributed to a 50% fall in commercial catches in Subarea 4 to 140 metric tons.

Despite minor restrictions on angling, the angling catch increased by more than 90% to 166 metric tons.

B. Special Research Studies

1. Environmental Studies

(a) Hydrography. Three physical oceanographic surveys were made in the western Gulf of St. Lawrence in spring, summer and autumn. A physical oceanographic section was completed along 63° Longitude from 43°N to 37° 40'N. Coastal inlet studies continued in Nova Scotia (Div. 4W).

(b) Plankton. Feasibility studies of large-scale phytoplankton biomass measurement using chlorophyll fluorescence, of euphausiid abundance using acoustic methods, and comparisons of airborne and shipborne survey techniques were made in the Gulf of St. Lawrence (Div. 4R-S-T). Monitoring of distribution of fish eggs and larvae in southwest Gulf of St. Lawrence (Div. 4T) continued.

(c) Other environmental studies. Sampling for petroleum hydrocarbons and other oceanic pollutants in sea-area Halifax-Bermuda continued. Chemical oceanographic studies in the Gulf of St. Lawrence (Div. 4R-S-T) included distribution of dissolved and particulate trace elements and organic carbon, particulate hydrocarbon residues, nutrients, physico-chemical

properties and sediment composition.

Laboratory studies indicate that Atlantic salmon migration may be blocked by oxygen concentrations below 50% saturation level. Low concentrations occur in estuaries of some salmon rivers in summer.

2. Biological Studies

(a) Groundfish general. The third annual groundfish survey (Div. 4X to 4T) was carried out in June-July 1973. Abundance estimates of major species continue to show encouraging agreement with estimates from commercial data and comparable surveys by USA and USSR.

Two inventory cruises (January-February and November) investigated distribution and abundance of groundfishes in northeast Gulf of St. Lawrence (Div. 4R-4S). Principal year-classes of cod caught were 1964-1966. The only other significant catches were of redfish with bimodal length distribution at about 20 and 32 cm.

(b) Cod. Current estimates of fishing mortality for the 4T-Vn migrating stock indicate that F values are lower than in the early 1960's when there was no evidence of overfishing. A moderate increase to F = 0.40-0.45 may provide a sustainable increase in future annual production to 60-65,000 tons. The 4Vn inshore stock appears to have been stable over the past 10 years with annual landings of 5,000-6,000 tons, indicating F = 0.35 gives about maximum yield per recruit.

The offshore stock in Div. 4Vs-4W gives maximum yield per recruit at about F = 0.49, the level in 1960-69, while the inshore Div. 4W stock with F presumed to be about 0.66, as for 1954-57, is probably overexploited. The Div. 4X offshore stock abundance declined from 1965 with 1971 landings about half the 1969 level. The 1965-69 level of F = 0.70 was about double that giving maximum yield per recruit, indicating a need for protection of the stock.

(c) Haddock. Predicted catches in Div. 4V-4W of 6,500 tons from an estimated stock of 19,000 tons should reduce F to about 0.50 from about 0.9-1.2 in 1971, but continuing poor recruitment is expected to result in further decrease in abundance with no improvement foreseeable before 1975.

Recruitment predictions for the 4X stock indicate no improvement before 1976, with continuing decline in stock abundance in spite of a reduced quota of 9,000 tons in 1972 and closed-season-area regulations.

(d) Sand launce, *Ammodytes dubius*. The Nova Scotian (Div. 4X-4W-4Vs) offshore stock consists of local concentrations in sandy areas on top of offshore banks. Fish sizes and growth rates decrease from south to north with a particular distinction between 4X-4W and 4Vs groups. They feed largely on copepods in mid water, which, with their burrowing habit, possibly in association with tidal currents, partly explains difficulty in catching them with bottom trawls. Larval abundance and occasional large catches support estimates of biomass which match those for some commercially important fish species.

(e) Flatfish parasites. Assessment of intestinal parasites as population indicators continued. Incidence and intensity of infestation of particular parasites in American plaice is related to host size and feeding habits, and to area.

(f) Species assemblages of groundfish. Preliminary analysis of frequencies of co-occurrence of species in Div. 4X-4W indicate that demersal fishes fell into three basic assemblages: (1) "Sable Island" characterized by yellowtail flounder and longhorn sculpin; (2) "Roseway Basin" characterized by pollock, barndoor skate, thorny skate, and witch flounder; (3) "Deep Plains" (>75 fm) characterized by white hake, argentine, and cusk.

(g) Herring. There was no tagging in 1972 but 225 tags were recovered from the 1970 program, bringing total returns to 141 (0.40%) from Magdalen Island taggings, and 1,141 (5.6%) from Gaspé taggings (Div. 4T).

Lengths of 32,890 herring were taken for assessment purposes. For biological and stock identification studies, various biological data were collected from more than 20,000 fish, and meristic data from more than 6,800.

Preliminary analysis of results of a winter larval survey cruise supports the hypothesis that larvae from southwest Nova Scotia may be retained and overwinter in the upper reaches of the Bay of Fundy.

(h) Swordfish. A study of the distribution and amounts of total and methyl mercury in swordfish flesh and organs was completed. Results of this and of studies of food and feeding habits were published.

(i) Tuna. The total 1972 (sport fishing) catch of bluefin was 857 tons, about equally divided between southern Gulf of St. Lawrence (Div. 4T) and western Newfoundland (Div. 4R). Mean weights in the areas were 323.7 and 284.4 kg, respectively. In the Newfoundland area about 75% of the 363 fish caught were released alive; about 50% of these were tagged.

(j) Atlantic salmon. Totals of 13,400 wild smolts, 212,000 hatchery-reared smolts, 1,470 grilse and 2,244 older salmon were tagged and liberated in studies involving stock evaluation, exploitation in fisheries and migratory behaviour.

Tag returns (258) from 11,722 wild smolts of one river, liberated in 1970, continue to show high exploitation in distant fisheries. Many salmon of this river mature as grilse, but 20% of the total adult stock were caught in Greenland and 16% in distant Canadian fisheries. Among the 2-sea-winter component, 56% were recorded from Greenland, 7% in distant Canadian fisheries, 0% in home commercial fisheries which were banned, 13% in sport fisheries and 24% were recorded as escapement. The escapement represents a substantial increase of this component of the stock compared to recent years. About 6% of tag returns from stock of a Labrador river came from West Greenland, 85% were used in home fisheries and 9% contributed to spawning.

Runs of grilse and larger salmon into New Brunswick and Quebec rivers increased noticeably as a result of the ban on commercial fishing. This contributed to improved angling success and greater spawning escapement. In one study stream the improved escapement resulted in an increase from under one-fifth of normal requirement to about two-thirds of the normal requirement for optimum output of smolts.

In recent years angling catches have taken 25 to 40% of salmon and grilse ascending one study river, whereas in the decade of the 1950's the catch was only about 10-20%.

3. Gear and Selectivity Studies

A procedure has been developed to calculate, from various parameters,

normal and tangential hydrodynamic forces on plane screens at various angles to the stream. This will be applied to textile netting used in fishing gear.

A trawl-door instrument package underwent further development and field trials. Measurements at sea were made of the behaviour of an Engel high-lift trawl with oval and with rectangular doors, and with and without headline kite, of a modified Yankee #41 otter trawl, and of a Canadian west coast groundfish trawl.

A stadium-type hydraulic flume was constructed for study of behaviour of aquatic animals and underwater instruments under laboratory stream conditions.

A low-cost tracking hydroplane was developed for use with sonic tags to study migration behaviour of individual fish.

Subarea 5

A. Status of the Fisheries

1. Cod

Landings decreased by 13% from 1971, bringing catches back to about the 1970 level, less than 50% of 1969 landings.

2. Haddock

Landings fell to only 30% of 1971 level, about 3% of the 1966 figure.

3. Sea scallop, *Placopecten magellanicus*

Landings totalled 34,627 metric tons. The 5% increase over 1971 landings matched an increase in fishing effort, mainly on the northern and eastern edges of Georges Bank and in the Fundian Channel.

4. Herring

Canadian herring landings from Subarea 5 fell by 65% from 1971 level to little more than 11,000 tons. Total catch was from Jeffrey's Ledge (Div. 5Y) where catches were down 29% from 1971.

5. Swordfish

No swordfish were landed from Subarea 5.

6. Tuna

The purse-seine fishery for small bluefin off the New York and New Jersey coasts of the United States took only 202 metric tons, the smallest catches since 1966.

B. Special Research Studies

1. Biological Studies

(a) Sea scallop. Studies on efficiency and selectivity of the offshore dredge were continued in 1972, and an underwater camera survey was repeated over the limited area of 1970 recruitment on the northern edge of Georges Bank.

The recent and fairly general commercial practice of landing small scallops led to a recommendation at the 1972 annual ICNAF meeting, prohibiting the landing of scallops less than 95 mm in shell diameter and meats averaging less than 11.3 grams or 40 units per pound or more. As a first step towards this goal, Canada plans to prohibit the landing of meats averaging 60 units per pound or more.

(b) Swordfish. Studies of the early life history of swordfish were continued with research vessel surveys of the Caribbean and adjacent regions. Swordfish larvae have been found to have a discontinuous distribution during January-March, suggesting localized spawning areas in the northwest Caribbean, Windward Passage, Virgin Islands, Guinea current south of Trinidad, and the Florida current.

(c) Tuna. Landings of small bluefin from the purse seine fishery off the mid-Atlantic coast of the United States were examined for size (length) composition. There were three modes in the distribution of sizes which presumably represent different year classes and illustrate the degree of year-class variability that occurs in this population of bluefin.

Tagging efforts were continued. In 1971 a large scale tagging experiment was initiated in cooperation with the Woods Hole Oceanographic Institution. It was designed to test the relative merits of two types of tags by double tagging small bluefin from the purse seine fishery. Unsuccessful attempts were made to complete this project in 1972 and only one fish with Canadian tags was released.

Section III. Harp and Hooded Seals

A. Status of the Fisheries

The following table gives the Canadian Atlantic seal catch in Subareas 2, 3 and 4 for the years 1971 and 1972:

		Harp Seals			Hood Seals			
Year	Area	Young	Older	Total	Young	Older	Total	Grand Total
1971	Gulf	70,131	5,577	75,708	13	1	14	75,722
	Front	53,051	6,456	59,507	219	191	410	59,917
	Total	123,182	12,033	135,215	232	192	424	135,639

		Harp Seals			Hood Seals			
Year	Area	Young	Older	Total	Young	Older	Total	Grand Total
1972	Gulf	3,469	165	3,634	-	-	-	3,634
	Front	61,050	10,182	71,232	267	155	422	71,654
	Total	64,519	10,347	74,866	267	155	422	75,288

In 1972, the quota of harp seals for ships was reduced to 120,000, from the 1971 level of 200,000. The share for Canadian ships was 60,000, and the Gulf of St. Lawrence was closed to sealing from ships. The allowance for Canadian landsmen in all areas from Labrador southward was 30,000. Largely owing to heavy ice conditions, neither ships nor landsmen reached their limit of harp seals, Canadian ships taking some 52,000 and landsmen the balance.

B. Special Research Studies

1. Harp Seals

From aerial photographic survey, carried out in March 1972, the number of whelping adults was estimated at some 100,000 on the Front (Subareas 2 and 3), and 125,000 in the Gulf of St. Lawrence (Subarea 4). A correction factor of .80 (8 adults for every 10 pups), from comparison of results of aerial photography and capture/recapture tagging carried out in the Gulf

in 1966, gives 1972 estimates of 150,000 in Subareas 2 and 3, and 125,000 in Subarea 4 with a catch of 115,000 young harp seals from all agencies. Regardless of the absolute figures obtained by this method, the very large percentage of young harp seals whelped in the Gulf is unusual and is probably attributable to the very severe ice condition in spring, 1972. Since the catch by landsmen in the Gulf was negligible, initial survival of the 1972 year-class of harp seals must have exceeded 50% of total production.

From comparison of the catch of young and the strength of the corresponding age class at one year of age in samples from St. Anthony, Newfoundland, over the years 1967 to 1972, production is estimated at 300,000 young harp seals for the median year, 1968-69. Dividing the sample into two overlapping four-year time periods suggesting a decline to perhaps 250,000 by 1970.

In the Gulf of St. Lawrence, some 500 young harp seals were heat-branded, and 550 adult harp seals were branded using a new, explosive branding device. The program is to be continued by branding adults on the Front ice. Results are expected to give direct evidence on the degree of mixing harp seal substocks whelping in Gulf and Front areas.

2. Hood Seals

Seventy adult and young hood seals were explosive-branded in the Gulf of St. Lawrence in a continuing program. Results will indicate whether mixing occurs between hood seal stocks in Newfoundland and East Greenland areas.