

# INTERNATIONAL COMMISSION

FOR THE

## NORTHWEST ATLANTIC FISHERIES



REDBOOK 1973, PART II

RESEARCH REPORTS  
BY  
MEMBER COUNTRIES

Dartmouth • Canada  
September, 1973

PREFACE

REDBOOK 1973 is issued in three parts: PART I contains the 1973 Proceedings of the Standing Committee on Research and Statistics (STACRES); PART II (this volume) contains Research Reports by Member Countries for the year 1972; and PART III contains Selected Papers from the 1973 Annual Meeting.

This volume (PART II) contains the revised and edited versions of the Research Reports presented as 1973 Annual Meeting Summary Documents as follows: Canada (Summ.Doc. 73/14), Denmark (73/19), France (73/13), Fed. Rep. Germany (73/20), Japan (73/31), Norway (73/12), Poland (73/27), Portugal (73/24), Spain (73/29), USSR (73/22), UK (73/15) and USA (73/26).

The preparation and printing of this volume was carried out in the Secretariat largely through the efforts of Mrs E. R. Cornford who did the typing and Mr R. Myers who did the multi-graphing.

20 September 1973

V. M. Hodder  
Assistant Executive Secretary

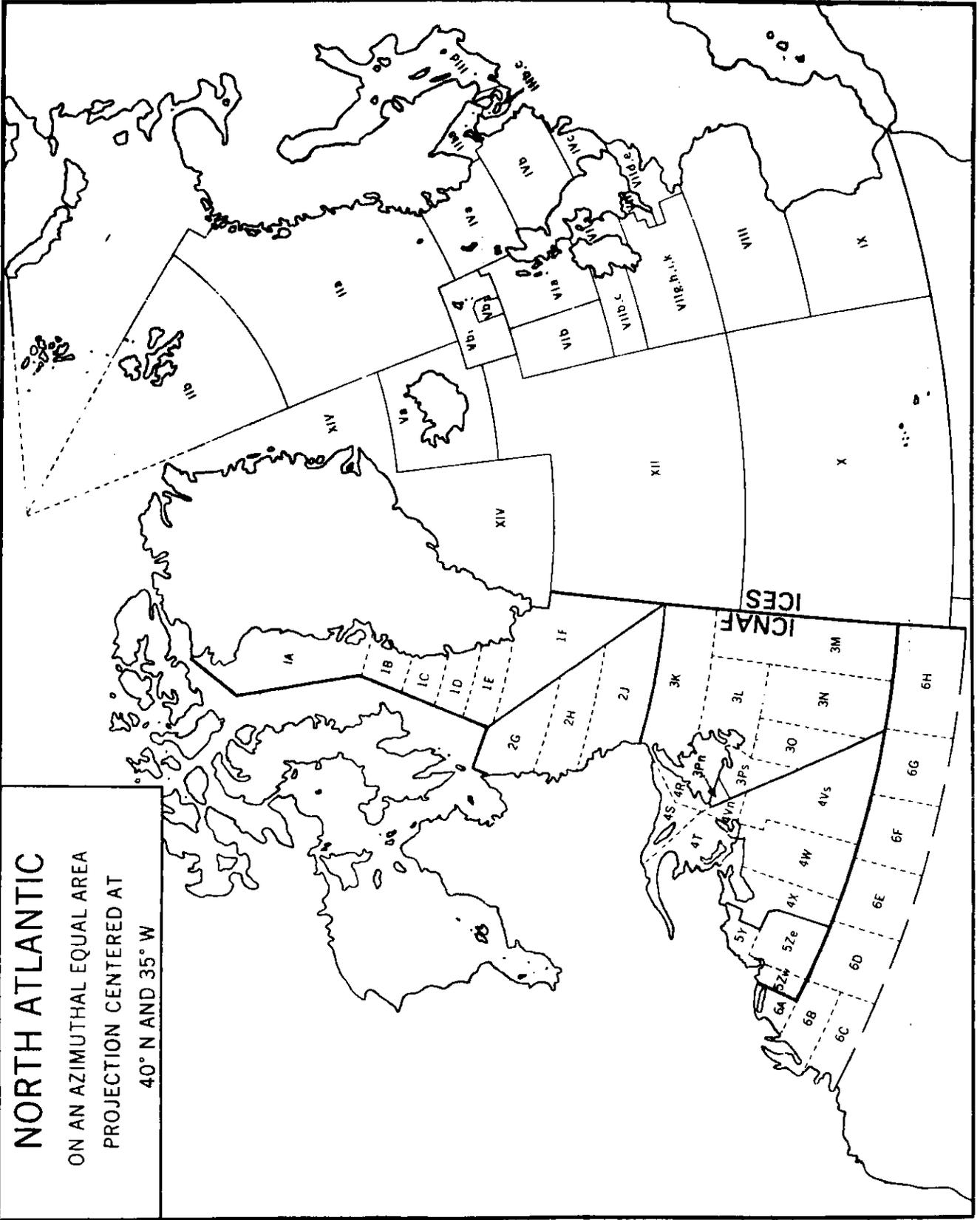
REDBOOK 1973, PART II

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# NORTH ATLANTIC

ON AN AZIMUTHAL EQUAL AREA  
PROJECTION CENTERED AT  
40° N AND 35° W



CANADIAN RESEARCH REPORT, 1972

Section I. Subareas 1, 2 and 3

by

A. M. Fleming

Research in Subareas 1, 2 and 3 was carried out by a number of laboratories of the Department of the Environment: Biological Station, St. John's, Newfoundland; Biological Station, St. Andrews, N.B.; Arctic Biological Station, Ste. Anne de Bellevue, Quebec; Marine Ecology Laboratory and Atlantic Oceanographic Laboratory, Dartmouth, N.S. Harp and hood seals in Subareas 2 and 3 are dealt with in Section III.

Subarea 1

A. STATUS OF THE FISHERIES

There was no Canadian commercial fishery in this subarea.

B. SPECIAL RESEARCH STUDIES

1. Environmental Studies

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

2. Biological Studies

a) Atlantic salmon. 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 approximately 2,500 Atlantic salmon tagged and released by research vessels and observers on commercial vessels during the experiment, 219 were tagged by staff on 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

1. Cod

The Labrador coastal fishery again yielded very low cod catches totalling only 1,728 tons. In 1971 the catch totalled 3,320 tons.

2. Atlantic salmon

The coastal fishery, mainly by gillnet, landed 467 tons of salmon, but in 1971 the total landing was 565 tons.

3. Herring

The small catch of 1,273 tons was taken from the southern part of the Labrador coast.

## B. SPECIAL RESEARCH STUDIES

### 1. Environmental Studies

a) Hydrography. The section off Seal Islands (Div. 2J) was occupied by the *Cape Freels*, 1-2 August 1972 (see 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.

### 2. Biological Studies

a) Cod. Monitoring of the coastal cod fishery was continued in July and August with 4,190 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) the July water temperatures were low 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) the August bottom temperature 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.

b) 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

#### 1. Cod

Total cod landings in Newfoundland from this subarea were 95,830 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.

#### 2. Haddock

The landings of haddock are no longer significant in volume; the 1972 total from Subarea 3, principally from Subdiv. 3Ps, was 825 tons; the 1971 landing was 1,299 tons.

#### 3. Redfish

Landings from the subarea totalled 6,867 tons, caught principally in Subdiv. 3Ps, and were 6% above the 1971 level.

#### 4. American plaice, Witch, Yellowtail and Greenland halibut

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. American plaice landings in 1972 were 49,125 tons, 15% below the 1971 landing of 57,888 tons. The decrease occurred in Div. 3L. The yellowtail 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 27,176 tons was over 10% higher than the 1971 total. The witch landing of 11,540 tons was 10% above the 1971 landing. The Greenland halibut are largely taken in the coastal and near-coastal gillnet fishery by small boats. Landings were principally from Div. 3K and 3L and totalled 9,130 tons in 1972, about 325 tons less than in 1971.

#### 5. Herring

Herring landings in Newfoundland from the subarea in 1972 totalled 51,304 tons, principally from the seiner fishery in the southwestern coastal areas of Newfoundland. This was a large decrease from the 1971 landings of 117,802 tons. Poor fishing weather seriously affected the catch levels, but poor recruitment

contributed substantially to the large decline in the landings.

6. Mackerel

Mackerel appear in abundance sporadically in Newfoundland waters. In 1972 the coastal fisheries, particularly in Div. 3K and 3L with smaller amounts in Subdiv. 3Pn and 3Ps, landed 1,554 tons. The 1971 landing was 1,299 tons.

7. Atlantic salmon

The marine landings of Atlantic salmon were 792 tons from Subarea 3 in 1972; the 1971 landing was 891 tons. Much of the decrease resulted from interference with the fishery by ice conditions on the northeast coast of Newfoundland.

B. SPECIAL RESEARCH STUDIES

1. Environmental Studies

a) Hydrography. 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 Free's* 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. 73/50.

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

b) 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.

2. Biological Studies

a) 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 (Subdiv. 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 Subdiv. 3Ps and more recent data toward completion of an assessment of the cod stock in Div. 3N and 3O. Data for the cod stock from Div. 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.)

b) 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 (Subdiv. 3Ps), where in 1972 the 1970 year-class dominated in the catches and 1968 year-class 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.

c) Yellowtail. Catches in Div. 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, 1,000 yellowtail were tagged near the Southeast Shoal (Div. 3N) to study stock relationships and migratory patterns.

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

Biological characteristics of herring in Fortune Bay, Newfoundland, (Subdiv. 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 (Subdiv. 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 (Subdiv. 4Vs and Div. 4W) and those of the southwest Newfoundland-southern Gulf of St. Lawrence stock complex (Subdiv. 3Ps, 3Pn and Div. 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.

e) 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 1,450 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.

f) 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.

g) Pink salmon (*Oncorhynchus gorbuscha* (Walbaum)). From 1,116 natural spawning adult fish (progeny of previous transplant from British Columbia) returns in 1971 were low: 468 fish to the home river, North Harbour River, St. Mary's Bay, Newfoundland, and other rivers reported returns of 154 fish.

From 1,400 spawning adults in 1970 there were only 58 returns to the river, and 59 reported 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

J. S. Scott

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 hood 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 10% 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 10% from 1971.

2. Cod

Cod landings from Maritimes and Quebec were down 1% from 1971, although they formed a slightly higher proportion of total groundfish (39%) than in 1971 (35%). Landings from Gulf of St. Lawrence and Cape Breton (Div. 4R, 4S, 4T and Subdiv. 4Vn) fell by 4% from 1971 level, continuing the downward trend since 1971. Those from the remainder of Subarea 4 (Subdiv. 4Vs, Div. 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 11% 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 23% and Div. 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 (Subdiv. 4Vn) catches decreased by more than 18%, continuing the reversed trend which appeared in 1971.

4. Flatfish

Total landings (American plaice, witch, yellowtail, and winter flounder) showed a slight (8%) decrease from 1971, mainly from Gulf of St. Lawrence and Cape Breton areas (Div. 4R, 4S, 4T and Subdiv. 4Vn) which counteracted a slight decrease from the remainder of Subarea 4. Atlantic halibut landings fell by about 20% from 1971.

5. Redfish

Total redfish landings (Maritimes and Quebec) decreased by 6% 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 and Subdiv. 4Vs) plus a 31% fall from Cape Breton area (Subdiv. 4Vn) which counteracted a 4% 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, rose by 12% from 1971 level.

6. Pollock

Pollock landings increased by 65% 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 26% from 1971.

8. Scallops

Total landings of sea scallops (*Placopecten magellanicus*) fell by about 10% from 1971 level to 8,028 tons whole weight.

A new inshore fishery for Icelandic scallop (*Chlamys islandicus*) in the northern Gulf of St. Lawrence landed 2,132 tons.

9. Herring

Herring landings (Maritimes and Quebec) from Subarea 4 (excluding Div. 4R) totalled about 220,000 tons, a decrease of 18% (about 48,000 tons) from 1971. There was a 60% (80,000 tons) reduction in landings from the southern Gulf of St. Lawrence (Div. 4T) and a 66% (35,000 tons) decrease from Div. 4W from 1971. In contrast, landings from the southwest and northeast Scotian Shelf (Div. 4X, 4V) increased by about 100% (67,000 tons) and 55% (4,000 tons), respectively.

Newfoundland landings from Subarea 4, all from eastern Gulf of St. Lawrence (Div. 4R), increased by 15% to about 12,000 tons, with no landings from the southern Gulf and Cape Breton (Div. 4T, Subdiv. 4Vn).

10. Swordfish

There were no swordfish landings in Subarea 4.

11. Mackerel

There was a general increase of 11% to about 14,500 tons in mackerel landings from Subarea 4 (excluding Div. 4R) from 1971 level. This was due to increased landings from the Gulf of St. Lawrence (Div. 4T) and northern part of the Scotian Shelf (Subdiv. 4Vn) which counteracted small reductions from the rest of Subarea 4.

12. Tuna

Tuna landings, mainly yellowfin and skipjack from the eastern Pacific, increased by about 25% from 1971 to 5,000 tons. Commercial landings of bluefin were down 75% from 1971 level at 238 tons, the lowest since 1966. The sport fishery yielded 261 tons, 50% greater than the previous record set in 1968.

13. Sharks

There were no shark landings reported in 1972.

14. Atlantic salmon

Total commercial catch for Subarea 4, exclusive of Div. 4R which is reported with Subareas 2 and 3, fell by 50% from the 1971 level to 143 tons. A ban on commercial salmon fishing in New Brunswick and the Gaspé Peninsula contributed to the decrease.

Despite minor restrictions on angling, the angling catch increased by more than 90% to 166 tons in 1972.

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 Div. 4T - Subdiv. 4Vn 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 Subdiv. 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 Subdiv. 4Vs - Div. 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 Div. 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 lance. The Nova Scotian (Div. 4X-4W-Subdiv. 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 Div. 4X-4W and Subdiv. 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: (i) "Sable Island" characterized by yellowtail flounder and longhorn sculpin; (ii) "Roseway Basin" characterized by pollock, barn-door skate, thorny skate, and witch flounder; (iii) "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 16% 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

Landings totalled 34,536 tons. The 6% 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 11,691 tons. The 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 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 co-operation 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 Hood 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:

Year	Area	Harp Seals			Hood Seals			Grand Total
		Young	Older	Total	Young	Older	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
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 landmen in all areas from Labrador southward was 30,000. Largely owing to heavy ice conditions, neither ships nor landmen reached their limit of harp seals, Canadian ships taking some 52,000 seals and landmen 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 0.80 (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 landmen 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.

DANISH RESEARCH REPORT, 1972

Section I. Subarea 1

by

Svend Aage Horsted

A. STATUS OF THE FISHERIES

1. General Trends

The nominal catches taken by Denmark (Greenland) in 1972 are given in Table 1 (provisional data).

Table 1. Denmark (Greenland) nominal catches in Subarea 1, 1972.

Species	Nominal catch (metric tons)	Increase or decrease from 1971 (%)
Cod	23,778 <sup>1</sup>	+ 19
Redfish	247	- 24
Wolfish	3,323	+ 27
Greenland halibut	3,021 <sup>2</sup>	+ 161
Halibut	14	+ 250
Capelin	1,916	- 22
Atlantic salmon	1,306	- 10
Arctic char	97	- 22
Lumpsucker roe (not converted to round, fresh fish)	124	- 49
Industrial fish	160	- 11
Other fish	0	0
Prawns ( <i>Pandalus borealis</i> )	7,502	- 16
Total (excl. lumpsucker roe)	41,364	+ 12

<sup>1</sup> Some few hundred tons caught by trawlers of SE Greenland are included together with 264 tons caught by small boats off Angmagssalik, East Greenland.

<sup>2</sup> Approximately 500 tons caught outside the ICNAF Area (W of Div. 1D) are included.

Besides the catches of Denmark (G) in Subarea 1, Denmark (Faroes) and Denmark (Mainland) also reported nominal catches as follows:

Species	Den(F)	Den(M)
Cod	9,949	-
Salmon	144	401
Prawns	755	114
Greenland halibut	442	20
Other species	82	-
Total	11,372	535

The three most important species (in terms of income) for the Greenland fishermen in 1972 were salmon (36%), cod (33%) and prawns (23%). While prawns were more important than cod in 1970 and 1971 (prawns 33%, cod about 25%), cod has in 1972 again superseded prawns while salmon has maintained the head position since

1969. However, this relative importance is measured only by the direct payment to fishermen, whereas employment and earnings by the land based production has not been taken into account.

Landings (in terms of weight) of the three major species showed a 19% increase for cod compared to 1971 while landings of prawns declined by 16% and those of salmon by 10%. A considerable increase (161%) occurred in the fishery for Greenland halibut. Further details on the major fisheries follow.

## 2. Cod

a) The fisheries. Nominal catch was 19% above that of 1971 but is still considered to be at a very low level. The progress must be seen in the light of further increase in trawlers' effort (4 trawlers at the end of 1972, 3 at the end of 1971). The trawlers took 37% of the catch by Denmark (G) in 1972 (30% in 1971).

The fishery by small boats, mainly in inshore and coastal waters and mainly by pound net, increased by 7% from 1971 to 1972 but is at a level which is only about 40% of the 1962 level. The increase in 1972 is due mainly to good pound net catches at Holsteinsborg (Div. 1B) and Sukkertoppen (Div. 1C), presumably based on the 1968 year-class. In nearly all other districts of West Greenland the small boat fishery continued to decline.

In some periods, especially in the last half of the year, the trawlers have had difficulties in finding concentrations of cod worthwhile fishing. In some such periods the trawlers have instead fished for Greenland halibut in the western part of the Davis Strait.

By the end of March 1973, catches are 14% less than catches by the same time in 1972. The trawlers account for 98% of this catch since the small boat fishery is usually at a very low level in winter time.

b) Forecast for 1973-74. The fleet of Greenland trawlers will be increased by 3 stern trawlers (501-900 tonnage class) in 1973/74, but further increase of the fleet is not planned at present.

Apart from the 1968 year-class the West Greenland cod stock has produced only very small year-classes since 1964 and will, therefore, be at very low level in the mid 1970's. If the trawlers are fishing at West Greenland only, their increased number may bring some increase in the total catch from Subarea 1. If in periods when cod fishing off West Greenland is poor the trawlers choose to operate in other areas (e.g. off SE Greenland) and/or fish for other species (e.g. Greenland halibut), their total catch may well increase further. Their possibilities for such other fisheries are, however, very limited due to the fact that they are not factory trawlers but trawlers used to supply fishing industries at West Greenland with iced fish.

The small boat fishery in coastal and inshore waters can hardly expect any improvement, except that in 1973 the 1968 year-class may lead to good pound net catches in Div. 1B-1C especially.

The international fishing activity at West Greenland is very dependent on the prospects there in relation to prospects in other areas. However, the West Greenland cod stock is now at a very low level which by itself indicates that the total international catch in 1973/74 will be very low, probably comparable to the low 1971/72 level. The main part of the catches is still expected to be taken by trawlers in the first half of the year, especially when the 1968 year-class starts maturation (mainly in 1974) and is expected to form spawning concentrations on the western slopes of the SW Greenland banks.

## 3. Atlantic salmon

The total international catch of salmon off West Greenland decreased from approximately 2,700 tons in 1971 to little more than 2,000 tons in 1972. Regulations to limit catch were in force in 1972, but great variations in catch rate with very poor catches in the last half of the season for the offshore fishery led to a greater overall decline than dictated by the regulations. The coastal fishery seems to have been more stable than the offshore fishery.

The reason for these variations in the fishery are not known, but a detailed analysis of environmental factors, especially water temperature, will be made, since some observations indicate abrupt changes in surface temperature may have caused the fluctuations in the fishery.

For further details of the 1972 salmon fishery see Report of the ICES/ICNAF Joint Working Party on North Atlantic Salmon, Copenhagen, 19-23 March 1973 (ICNAF Summ.Doc. 73/7).

No forecast for the 1973-74 fisheries at Greenland based on stock analysis can be given, but, as permissible catches by the offshore fishery are declining through 1973-76, it seems likely that the catches will be determined by the regulations more than by fluctuations in stocks and catchability.

#### 4. Other fish

The most pronounced change has taken place in the fishery for Greenland halibut of which more than 3,000 tons were caught. Part of the catch was taken as by-catch in trawl fisheries for cod and for prawns, but a direct inshore fishery by long-lines also took place. However, the progress in 1972 was due mainly to a trawl fishery directed towards Greenland halibut. This fishery took place at periods when trawlers have had difficulties in finding concentrations of cod, and the fishery has taken place at the western part of the Davis Strait.

#### 5. Deep sea prawn

The steady increase, which the fishery on *Pandalus* has shown for about ten years, ended in 1972 when catches dropped by 16% from the 1971 level. The decline seems to have been connected with a decrease in effort in the most important area (Disko Bay), but also ice and weather conditions are reported to have been less favourable than in 1971.

### B. SPECIAL RESEARCH STUDIES

#### 1. Environmental Studies

a) Hydrography. A detailed description of the hydrographic conditions in Subarea 1 in 1972 is given by Hermann, Lenz and Blacker in Res.Doc. 73/53. Their paper can be considered part of the Danish as well as the German Research Report for 1972. The following observations on water temperatures are noteworthy: (i) very cold conditions were found on the Fylla Bank section (Div. 1D) in the upper 100 m in April, June and July indicating that the 1972 year-class of cod will probably be poor; (ii) surface temperatures in the West and South Greenland area are now back at the level of the mean value for the years 1876-1915, and the climatic jump back to cold conditions has been just as sudden as the rise in temperatures in the twenties.

b) Plankton. Oblique hauls with 2 m stramin net (225 m wire) were taken at some of the standard hydrographic sections in the Davis Strait in April-July. The Danish Research Report, 1971 indicated that plankton catches (displacement volume) had been relatively poor in the last three years (1969-1971). The volume of plankton on the Fylla Bank section (Div. 1D) in July 1972 was even less, in average only 74 ml against 209 ml in 1971, which was the lowest in the 1961-1971 period.

c) Ice situation. Following a recommendation of STACRES at the 1972 Annual Meeting (*Redbook* 1972, Part I. p. 9 and 76) that national research reports should contain a section on ice conditions, particularly the concentration and extent of ice cover in the various subareas, a special section on the ice situation in Subarea 1 in 1972 is presented by Hans Valeur in Section II of this Research Report.

#### 2. Biological Studies

a) Cod: Eggs and larvae. In the spawning season (April-June) plankton samples were taken only on the Fylla Bank section (Div. 1D). Very few cod eggs were found but the material itself does not permit any judgement of the magnitude and distribution of spawning cod.

Observations on cod larvae in the plankton were made in June and July. The Fylla Bank section (Div. 1D) was surveyed in June as well as July, but no cod larvae at all were observed. The section off Sukkertoppen (Div. 1C) and off Holsteinsborg (Div. 1B) were surveyed only in July. The number of cod larvae found is given in Fig. 1. Cod larvae seem just as scarce as in 1971 but have a tendency to a more northerly distribution than in 1971. The number of larvae together with the hydrographic informations indicate that the 1972 cod year-class at West Greenland is poor.

Occurrence of pre-recruit cod (age-groups I, II, and III) has been studied only to a very limited extent in 1972, and no new information has been gained to change previous estimates that the 1969-71 year-classes are poor.

Age and size distribution of cod in landings. The most important material has been collected from the trawlers' landings. In 1971 there was a pronounced difference in age composition between landings from areas north of Godthaab (Div. 1D) and landings south of Godthaab. The 1965 and 1966 year-classes were predominating to the north (Div. 1B-1C) while the 1963 and 1964 year-classes were predominating in Div. 1E-1F. In Div. 1D the four year-classes were more evenly mixed.

Samples from 1972 (Fig. 2) indicate that, as in 1971, the 1963 and 1964 year-classes are nearly absent in Div. 1B and 1C. However, the 1965 and 1966 year-classes seem to be more evenly distributed along the coast than in 1971. The 1967 year-class, which in 1971 was rather pronounced in samples from coastal waters, now consist of individuals which are retained by trawls, and the year-class is rather well represented (relatively!) in most samples.

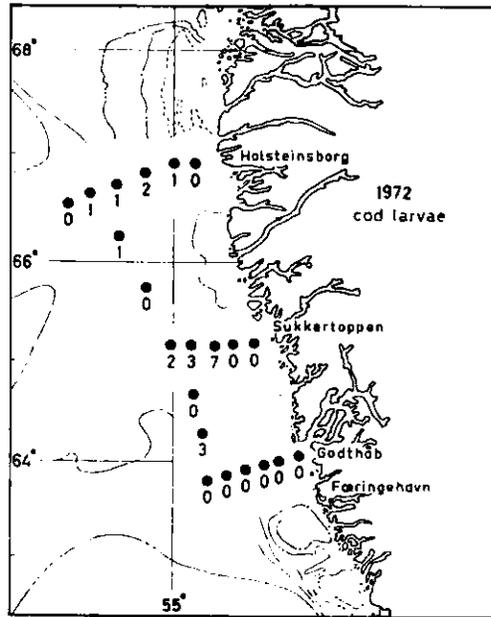


Fig. 1. Cod larvae (number per 30 min) taken by 2 m stramin net in the upper water layers (maximum depth about 50 m). July 1973.

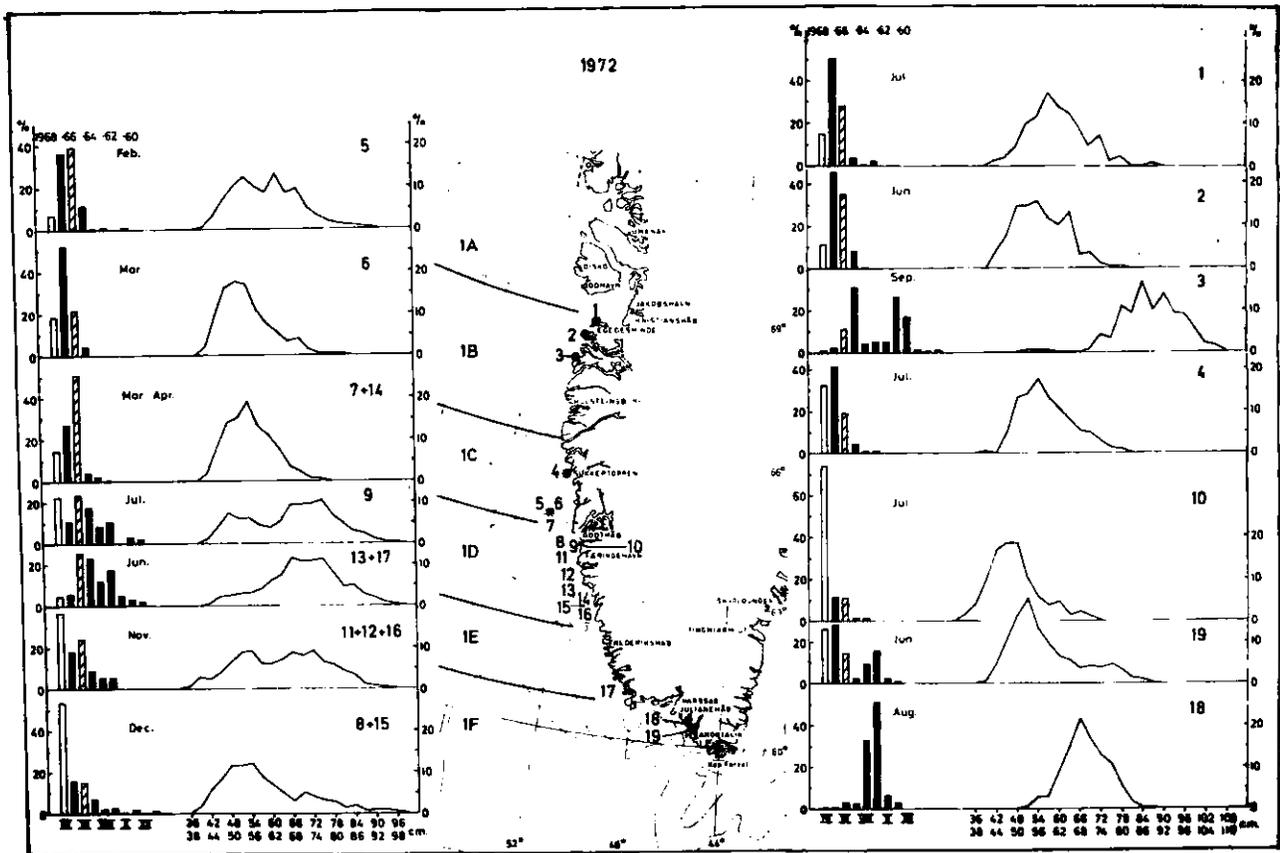


Fig. 2. Age and length composition of cod from commercial landings. All samples on the left hand side are from offshore waters by otter trawlers while those on the right hand side are from inshore waters and by pound net except for sample No. 3 where gear is unknown but could be long-line. Samples numbered by more than one figure, e.g. 7+14 are not combined of two or more individual samples but the figures indicate, that the landing (of which a single sample was taken) was obtained by fishing more than one locality on the same trip.

The 1968 year-class gradually recruited to the fishery in 1972 and by the end of the year this year-class seemed to be the most abundant in trawlers' catches (samples 11+12+16). It also seemed to have predominated in inshore pound net catches in all divisions, but most individuals at this time of the year (May-August) seem to have been discarded and are, therefore, not represented in the samples taken from landings (a local Greenland regulation forbids landing of cod less than 42 cm total length). Without doubt the 1968 year-class will be the predominating one in 1973 and 1974, but, as the following year-classes are regarded as poor, the stock as a whole will be at a very low level in the next four years at least.

The difference in growth rate between cod from northern and from southern divisions of Subarea 1, reported in 1971, was also evident in the 1972 samples. For cod in the southern divisions (Div. 1E-1F) there seems to have been a decline in growth rate in the last few years.

Tagging experiments. A total of 930 cod were tagged in 1972. Of these 605 were small cod (less than 50 cm total length) caught and released mainly in inshore waters of Div. 1D.

b) Atlantic salmon. A major part of the Danish research activity in 1972 was devoted to participation in the ICES/ICNAF International Salmon Tagging Experiment at West Greenland. Denmark participated with the R/V *Adolf Jensen* from 2 August to 15 October and with observers on 6 commercial vessels (3 Danish, 3 Faroese) throughout most of the season. Also the research cutter *Tormaq* in shorter periods took part in the experiment. For further details see Report of the ICES/ICNAF Joint Working Party on North Atlantic Salmon, Copenhagen, 19-23 March 1973 (ICNAF Summ.Doc. 73/7).

A two-year survey of Greenland fresh water systems aimed at elucidating the possibilities of planting salmon in Greenland rivers has been completed. A total of 78 major rivers and river systems between Kap Farvel and Holsteinsborg have been investigated. Unfortunately it seems clear that the possibilities of introducing salmon in rivers other than the only one in which salmon are already found are extremely limited. Lack of suitable spawning areas and very limited time with sufficiently high water temperatures are the main hindrances.

c) Other fish. Lengths, weights and otoliths have been collected from American plaice and Greenland halibut and 261 American plaice were tagged.

d) Crustaceans. Continuous research catches of deep-sea prawn (*Pandalus borealis*) were taken on various grounds especially in Div. 1C and 1D, and trap fishing experiments for the crab *Chionoectes opilio* have been conducted in inshore waters of Div. 1D. These experiments will be continued and extended in 1973.

e) Seals. Sampling of material for age determination of hood, harp and ringed seals was continued in 1972 to the same extent as in 1971. The northern districts, Umanak and Upernavik, were visited in June and July. Sampling of the three species mentioned above is now organized in the most important districts. The material collected in 1971 and 1972 is reported by F. Kapel in Res.Doc. 73/54.

### 3. Gear and Selectivity Studies

Material for studies of mesh size selectivity in salmon drift nets was collected during the International Salmon Tagging Experiment. Experimental fishing with various types of traps for crabs (*Chionoectes opilio*) was conducted and a special type of trap has now been selected for further experimental fishing.

Section II. Ice Conditions off the Greenland Westcoast South of 70°N in 1972

by

Hans Valeur

General

The occurrences of polar ice (storis) were much more sparse than during the preceeding three severe ice seasons. However, the local formation of coastal ice was favoured by cold calm weather, particularly in southern Greenland, where the thickness of the fast ice in Tunugdliarfig Fjord reached the very unusual thickness of 120 cm in March, and at Egedesminde in Disko Bugt, where three ships were ice-bound from about 15 December 1971 till 26 April 1972. Tunugdliarfig began to freeze up again in November 1972 and the ice reached 60 cm thickness at the end of December.

Polar ice

The polar ice passed Cape Farewell at the end of January 1972. During February and the first half of March moderate quantities were present in Julianehaab Bugt. During the latter half of March the polar ice was absent, but it reappeared at the beginning of April and culminated around 25 April when it reached a position off Ravns Storø, about 62°35'N. At that time the width of the belt was 50-80 nautical miles but with scattered concentrations. Shortly after the ice belt receded, but there were minor advances in between. After 15 June only scattered patches were present, and from 20 August all area to the west of Cape Farewell were ice free (except for bergs). The polar ice did not reappear in the area until around new year.

West ice

In January the west ice (Baffin Bay ice) was lying close to the Greenland west coast, a little north of Sondre Strømfjord. This position was nearly unchanged during the next two months. From 17 April the ice did not reach the coast south of 68°N any more, and between this latitude and Egedesminde several shore polynyas occurred in increasing amount. From 2 May the coast was ice free at Egedesminde and from 18 May at Vajgat, apart from a tongue which on 24 May reached the coast off Holsteinsborg but disappeared a few days later. At the beginning of December the west ice edge was situated about 30 miles to the west of Disko, increasing to about 60 miles west of Holsteinsborg, these distances becoming zero towards the end of the year.

FRENCH RESEARCH REPORT, 1972

Section I. French Metropolitan Fishery

by

R. H. Letaconnoux

A. STATUS OF THE FISHERIES

In 1972 cod fishing was rather poor and French trawlers took only 44,700 tons in the Northwest Atlantic compared with 50,200 tons in 1971 (Table 1). These catches are less than one-third of the 170,000 ton catch by France (M) vessels in 1968.

Table 1. France (M) fishery statistics (metric tons), 1971 and 1972.

ICNAF Divisions	Cod		Other species		Total	
	1971	1972	1971	1972	1971	1972
1B	-	494	-	8	-	502
1C	2,603	3,662	2	8	2,605	3,670
1D	1,007	1,076	2	8	1,009	1,084
1E	498	191	-	-	498	191
1F	-	92	-	-	-	92
Total	4,108	5,515	4	24	4,112	5,539
2G	14	86	-	-	14	86
2J	5,895	4,774	6	166	5,901	4,940
Total	5,909	4,860	6	166	5,915	5,026
3K	500	3,760	1	52	501	3,812
3L	2,984	5,481	22	328	3,006	5,809
3M	9,006	2,693	56	73	9,062	2,766
3NO	20	-	-	-	20	-
3P	2,730	2,687	26	34	2,756	2,721
Total	15,240	14,621	105	487	15,345	15,108
4RST	24,365	11,124	111	84	24,476	11,208
4V	618	8,289	-	111	618	8,400
4W	-	269	-	-	-	269
Total	24,983	19,682	111	195	25,094	19,877
5Z	-	-	-	506	-	506
6	-	-	-	296	-	296
Grand Total	50,240	44,678	226	1,674	50,466	46,352

In Subarea 1 (West Greenland) only 5,500 tons were taken mostly in April and May in Div. 1C and 1D with small catches in the autumn between 1B and 1F.

In Subarea 2 (off Labrador) 4,900 tons of cod were taken mostly in Div. 2J during January to April with some fishing there from September to December.

In Subarea 3 (off Northeast Newfoundland, Flemish Cap and St. Pierre Bank) 14,600 tons of cod were taken, over 60% of which were caught in Div. 3K and 3L. About 2,700 tons were taken in Div. 3M (9,000 tons in 1971) and about the same quantity in Div. 3P. While fishing took place during most months of the year, maximum activity occurred from February to April.

In Subarea 4 (Gulf of St. Lawrence and Scotian Shelf) 20,000 tons of cod were taken (25,000 in 1971), mostly from February to April in Div. 4R and from January to March in Div. 4V.

In Subarea 5 and Stat. Area 6 about 800 tons were taken, consisting of 500 tons of herring in Div. 5Z in November, and 302 tons of shellfish (295 tons of squid and 7 tons of lobster) during an exploratory trip in October to December in Stat. Area 6.

Section II. St. Pierre and Miquelon Fishery

by

J. Morice

A. STATUS OF THE FISHERIES

In 1972 a total of 4,842 tons of various fish species were taken by St. Pierre and Miquelon trawlers and dories in Subareas 3 and 4 (Table 2), compared to 5,528 tons in 1971 and 6,784 tons in 1970. These catches are less than half the peak total landings of 13,575 tons in 1961 (of which 4,653 tons were haddock). The continued decrease in landings may be due to the growing scarcity of cod and haddock in Subdiv. 3Ps where small trawlers of St. Pierre do most of their fishing.

Table 2. France (St. Pierre and Miquelon) fishery statistics, 1972.

ICNAF Divisions	Catches (tons)									
	Cod	Haddock	Redfish	A. plaice	Witch	Yellowtail	Skates	Mackerel	Others	Total
3L	20	-	-	100	9	-	23	-	11	163
3N	12	-	2	192	346	3	56	-	84	695
3O	2	-	2	30	3	14	19	-	3	73
3Pn	3	-	2	2	2	1	-	-	1	11
3Ps	1,436	52	558	383	183	69	184	25	130	3,020
<b>Total</b>	<b>1,473</b>	<b>52</b>	<b>564</b>	<b>707</b>	<b>543</b>	<b>87</b>	<b>282</b>	<b>25</b>	<b>229</b>	<b>3,962</b>
4R	3	1	2	-	-	5	-	-	-	11
4T	6	-	2	4	2	3	2	-	3	22
4Vn	62	3	49	27	13	21	8	-	7	190
4Vs	226	2	58	93	10	89	7	-	14	499
<b>Total</b>	<b>297</b>	<b>6</b>	<b>111</b>	<b>124</b>	<b>25</b>	<b>118</b>	<b>17</b>	<b>-</b>	<b>24</b>	<b>722</b>
NK	22	-	-	95	13	-	-	-	28	158
<b>Grand Total</b>	<b>1,792</b>	<b>58</b>	<b>675</b>	<b>926</b>	<b>581</b>	<b>205</b>	<b>299</b>	<b>25</b>	<b>281</b>	<b>4,842</b>

Cod were fished by trawlers mostly in Subdiv. 3Ps (St. Pierre and Burgeo Banks) in winter and spring (December to May) and in Div. 4V in winter (February and March); catches were 446 and 297 tons in Subareas 2 and 3 respectively by trawlers and small motorized dories using mostly handlines took 990 tons largely during June to September in Subdiv. 3Ps around the islands of St. Pierre and Miquelon.

Haddock were caught only on the slopes of St. Pierre Bank in winter, the catch being only 52 tons (similar to 1971) in contrast to 1,158 tons in 1970.

Redfish (564 tons) were taken on St. Pierre and Burgeo Bank slopes in May and July-September, and only 107 tons were taken in Subarea 4 (mostly in Div. 4V) for a total of 675 tons, in contrast to 1,747 tons in 1971 and, 1,627 tons in 1970 and 2,631 tons in 1969.

A total of 543 tons of American plaice were taken in Subarea 3, 383 tons from Subdiv. 3Ps spread over most of the year, 100 tons from Div. 3L in April-June and 222 tons from Div. 3NO in May, June, September and October. In Subarea 4 practically the whole catch (124 tons) came from Div. 4V in March. The total for the year was 926 tons compared with 1,166 tons in 1971.

The inshore dory fishery in Subdiv. 3Ps (Table 3) accounted for 990 tons of cod, compared with 1,651 tons in 1971 and 1,306 tons in 1970. As noted under "Special Research Studies", cod are becoming gradually scarcer in the coastal waters and this probably accounts for the reduction in catch in 1972. Experimental fishing with a long-line type vessel using either longline gear or gillnets was tried during May to October 1972, but the results were disappointing and the trial will be continued in 1973.

Table 3. Results of traditional dory fishing at St. Pierre and Miquelon in 1972.

Month	Catches (tons)				Total
	Cod	A. plaice	Skates	Mackerel	
May	37.0	-	-	-	37.0
June	331.5	0.2	0.3	-	332.0
July	246.0	6.8	0.7	-	253.5
August	214.5	3.5	0.5	25.0	243.5
September	134.0	0.4	-	-	134.4
October	24.5	0.1	0.5	-	25.1
November	2.5	-	-	-	2.5
Total	990.0	11.0	2.0	25.0	1,028.0

#### B. SPECIAL RESEARCH STUDIES

The R/V *Cryos* operated from the St. Pierre Research Center during most of the year carrying out observations in Subareas 3 and 4. From 20 August to 29 September the *Cryos* participated in the International Salmon Tagging Experiment at West Greenland. During June and July the *Cryos* carried out hydrographic work and exploratory fishing for cod, capelin, redfish and shrimps in the Strait of Belle Isle area of the Gulf of St. Lawrence in accordance with a cooperative program by France and the Canadian province of Quebec.

##### 1. Environmental Studies

a) Strait of Belle Isle area. A detailed hydrographic survey in June was devoted to the definition of temperature sections in the area. Perpendicular to the main axis of the Strait of Belle Isle, from Pointe Amour (Que.) to Flowers Cove (Nfld.) on the one hand and from Ile Ste. Marie (Que.) to Lake Mountain (Nfld.) on the other, seven hydrographic sections were established with 64 stations occupied during 17-20 June. At each station a BTS (temperature, salinity and depth recorder) and a bathythermograph were used. The hydrographic data are being processed by the research branch of the Quebec Department of Fisheries.

b) West Greenland. At each gillnet fishing station during the West Greenland Salmon Tagging Experiment a chain of reversing bottles were sent to standard depths at 0, 10, 20, 30, 50, and 60 m. In addition to the temperature observations, seawater samples were collected for the National Museum of Natural History in Paris, France to be used to study the ectocrin substances, the pterins and the flavins in the water. Samples of seawater were also collected and frozen for later study at the Oceanographical Institute Laboratories of Monaco.

Measurements of the clarity of the seawater were made at each station using a Secchi disc wherever the atmospheric conditions permitted (12 stations). Vertical plankton hauls from 100 m to surface and horizontal tows at the surface were also made. The data collected will be studied at the Institut des Pêches Maritimes.

##### 2. Biological Studies

Groundfish surveys were carried out in the St. Pierre and Burgeo Bank area and on the northern part of the Scotian Shelf in February and May 1972. Pelagic surveys were carried out in March, April and November-December primarily to study herring in Div. 3P, 4R, 4T, 4V and 4W. During 37 days at sea, 82 hauls were made with 64 hydrographic stations and 19 plankton hauls. Also a cooperative survey (a cooperative program by France and the Canadian province of Quebec) was carried out in June and July in the northern part of the Gulf of St. Lawrence. During August and September the research vessel *Cryos* participated in the tagging of salmon at West Greenland.

a) The Institute's first winter cruise in February 1972 followed summer (July) and autumn (November) cruises in 1971 whose main objectives were to study the biology and distribution of the principal commercial species (cod, haddock, flounders and redfish) according to season and environmental conditions. The trawl hauls were made at stations in accordance to the bathymetric strata recommended by ICNAF to enable valid comparisons of data in different seasons. After each haul the catches of individual species were weighed, and 37 trawl hauls of one-half-hour duration each yielded a total of 17,882 kg of various species, of which 7,304 kg were of commercial value, including 2,154 kg of cod (*Gadus morhua*), 2,379 kg of redfish (*Sebastes marinus mentella*), 695 kg of hake (*Urophycis* sp.), 792 kg of witch (*Glyptocephalus cynoglossus*), 371 kg of American plaice (*Hippoglossoides platessoides*) and 570 kg of skates (*Raja* sp.). Catches of species

having no commercial value in St. Pierre included 7,834 kg of dogfish (*Squalus acanthias*), 872 kg of *Argentina silus*, 1,579 kg of *Cyclopterus lumpus* and 193 kg of *Hemitripterus americanus*.

On the plateaux of the banks, where temperatures were low (-1.0 to +0.2°C), the small catches consisted mostly of *Cyclopterus lumpus*, *Cottidae*, *Hemitripterus americanus* and *Myoxocephalus octodecemspinosus*. Yields on the slopes of the banks, where temperatures were higher (2.37°C at 140 m to 7.17°C at 275 m), were greater than those on the plateaux but in general much smaller than those of the November 1971 survey. The best one-half-hour catches were 306 kg of cod on northeast slope of Burgeo Bank in 140 m, 587 kg of redfish on southwest slope of St. Pierre Bank in 365 m, 431 kg of witch and 170 kg of American plaice on the south slope of the bank. It must be noted that haddock were almost completely absent in the catches (148 kg for the entire survey), although February and March are usually the best fishing months for this species on the western slope of St. Pierre Bank.

Samples were taken of all commercial species caught, either the whole catch or random samples of large catches. Cod, redfish and American plaice were measured, sexed and otoliths taken for age determinations. Additional materials for study were stomachs from redfish and plaice and over 1,000 observations on maturity stages of plaice.

Cod sampled in Subdiv. 3Ps ranged in size from 13 to 116 cm for males with peaks at 25 and 53 cm, and from 16 to 130 cm for females with peaks at 25 and 49 cm (Fig. 1). The mean weights of males and females were 1.41 and 1.45 kg respectively.

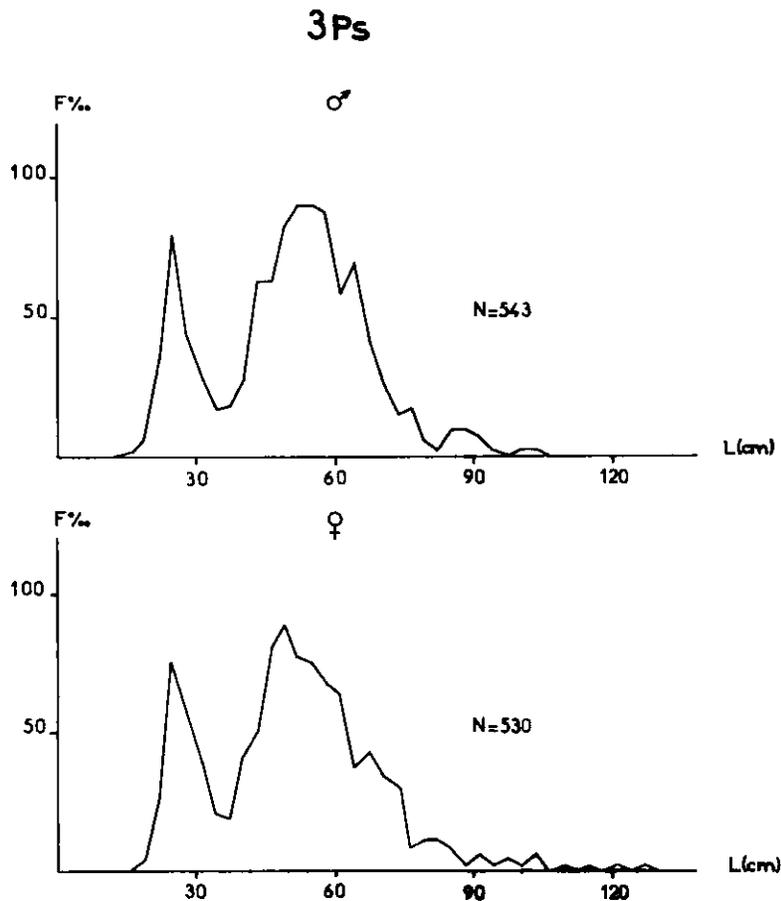


Fig. 1. Length composition of cod in Subdiv. 3Ps from research vessel surveys, February 1972.

Redfish in the samples ranged from 8 to 47 cm for males with modes at 16, 20.5 and 32 cm and from 10 to 46 cm for females with modes at 16, 20 and 34 cm (Fig. 2). The mean weights of males and females were 0.24 and 0.39 kg respectively.

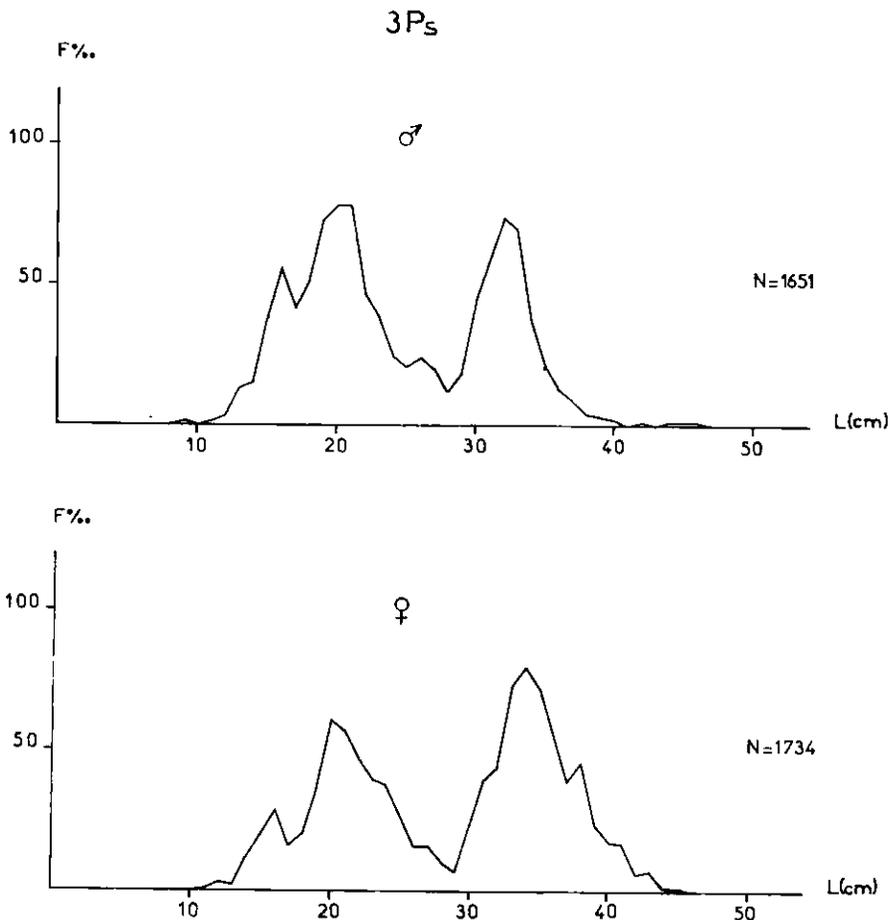


Fig. 2. Length composition of redfish in Subdiv. 3Ps from research vessel surveys, February 1972.

b) The second groundfish cruise in May was undertaken in three parts: (i) 2-12 May on the south, southeast and northeast slopes of St. Pierre Bank; (ii) 16-20 May on the northern part of St. Pierre Bank and off Cape North on Cape Breton Island; and (iii) 21-27 May in Subdiv. 4Vn and 4Vs.

During the first part of the cruise, the yields were rather unspectacular except for *Raja radiata* (up to 1,208 kg per one-half hour) and American plaice (up to 260 kg per one-half hour). Cod catches were very small, the largest ones being 144 and 139 kg per one-half hour. The overall result for 33 hauls were 3,107 kg of skates, 1,666 kg of cod, 1,424 kg of American plaice, 875 kg of witch and 575 kg of redfish. Biological materials (lengths, sex, stomachs and otoliths) were collected mainly for cod and American plaice.

During the second part of the cruise, which included 20 trawl hauls and 20 stations for hydrography and plankton, the yields were also relatively small over the area surveyed. The best yields per one-half-hour haul on St. Pierre Bank were: 576 kg of cod on the northeast part in 124 m at 4.24°C, 1,120 kg of redfish on northwest slope in 210 m at 7.88°C, 251 kg of plaice on northern part in 90 m at 2.07°C, 233 kg of haddock on northwest slope in 150 m at 6.57°C. The best yields per one-half-hour haul off Cape North were: 700 kg of red hake and 170 kg of witch in 250 m at 4.55°C.

During the third part of the cruise, 14 tows were made in Subdiv. 4Vn, where the operations were not very productive except for a catch of 1,031 kg of cod off Cape Smokey (Cape Breton Island). In Subdiv. 4Vs, 7 further tows were notably more productive and catches included 625 kg of herring in 55 minutes on the

east slope of Sable Island, 2,388 kg of silver hake in a tow of 75 minutes duration to the southeast of Sable Island Bank, and 160 kg of squid (*Illex illecebrosus*) in a 30-minute tow to the southeast of Sable Island. *Pandalus borealis* were present in catches in the deeps of Subdiv. 4Vn banks, Artimon Bank deeps, and the so-called "greysole deeps".

Fig. 3 and 4 show the length compositions by sex of American plaice sampled in Subdiv. 3Ps and 4Vn during the May survey. The size distributions are polymodal. In Subdiv. 3Ps males ranged from 10 to 56 cm with an average weight of 0.39 kg for 1,616 specimens, and females ranged from 9 to 74 cm with an average weight of 0.45 kg for 1,658 fish sampled. In Subdiv. 4Vn males ranged from 11 to 53 cm and females from 11 to 64 cm.

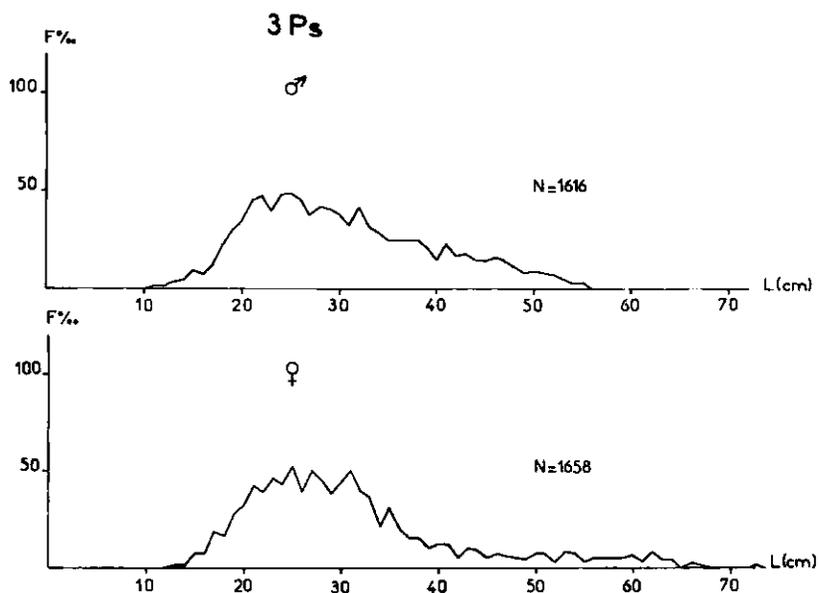


Fig. 3. Length composition of American plaice in Subdiv. 3Ps from research vessel surveys, May 1972.

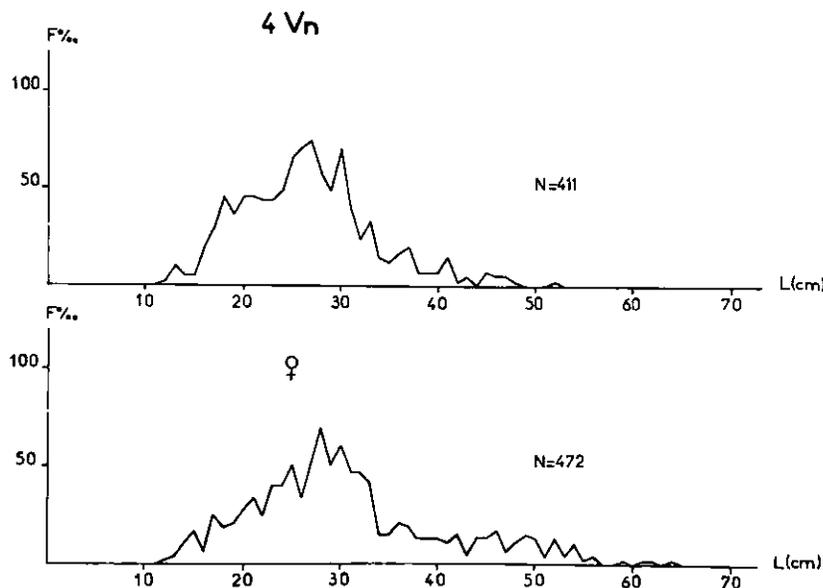


Fig. 4. Length composition of American plaice in Subdiv. 4Vn from research vessel surveys, May 1972.

Silver hake samples in May are compared with those taken during cruises in other months in Fig. 5 and 6 for Subdiv. 4Vs and Div. 4W separately. The length compositions are very similar in each of the areas with those in Subdiv. 4Vs slightly larger on the average than those in Div. 4W. The best yields were taken in areas where the temperature was 6 to 8°C.

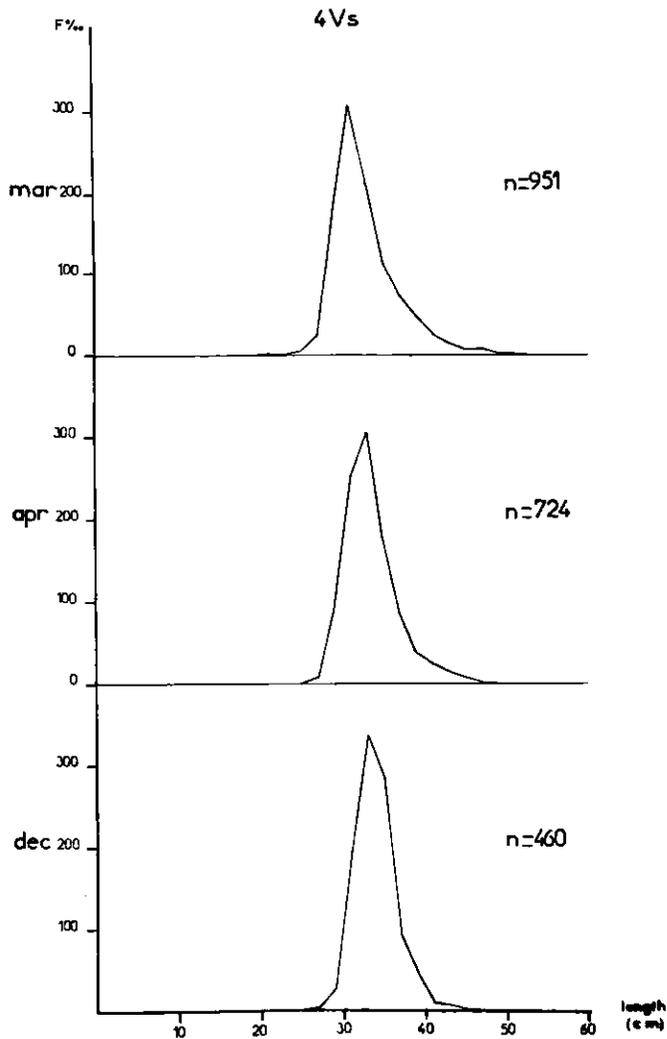


Fig. 5. Length composition of silver hake in Subdiv. 4Vs from research vessel surveys, March, April and December 1972.

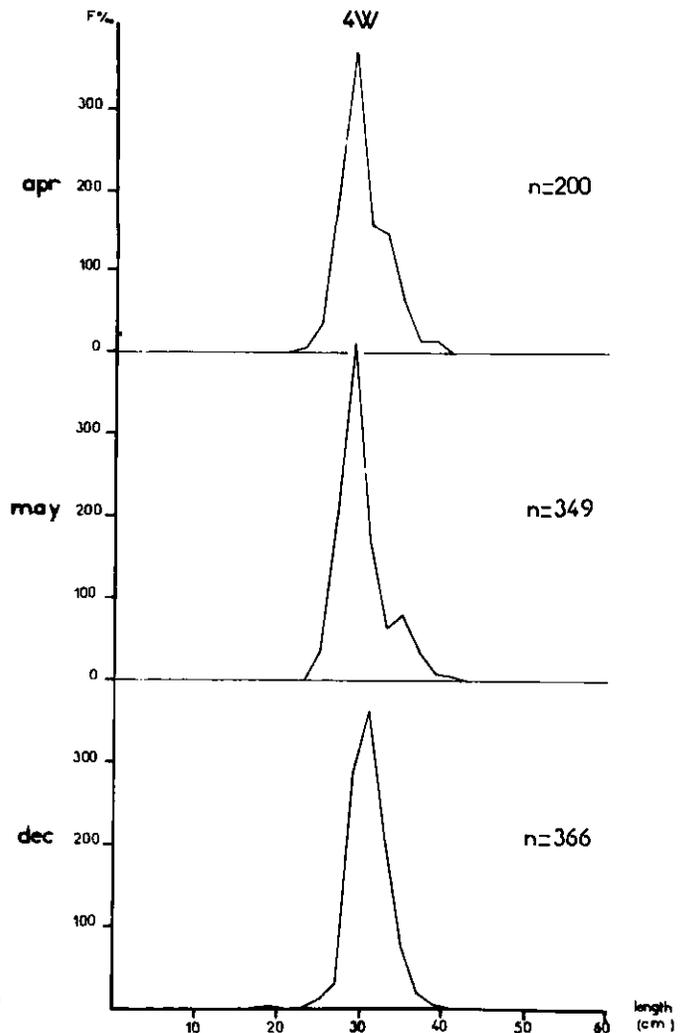


Fig. 6. Length composition of silver hake in Div. 4W from research vessey surveys, April, May and December 1972.

Fig. 7, 8 and 9 give the size compositions of witch sampled in May in Subdiv. 3Ps, 4Vn and 4Vs respectively. Distributions are polymodal, with the length range of 12-59 cm in Subdiv. 3Ps and 17-58 cm in Subdiv. 4Vn being greater than the range of 27-46 cm for witch in Subdiv. 4Vs.

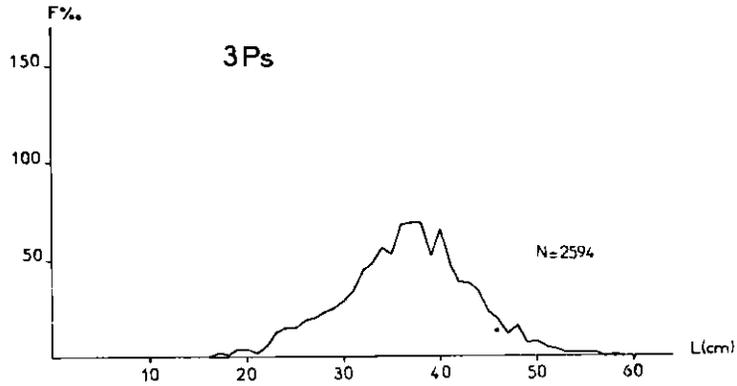


Fig. 7. Length composition of witch flounder in Subdiv. 3Ps from research vessel surveys, May 1972.

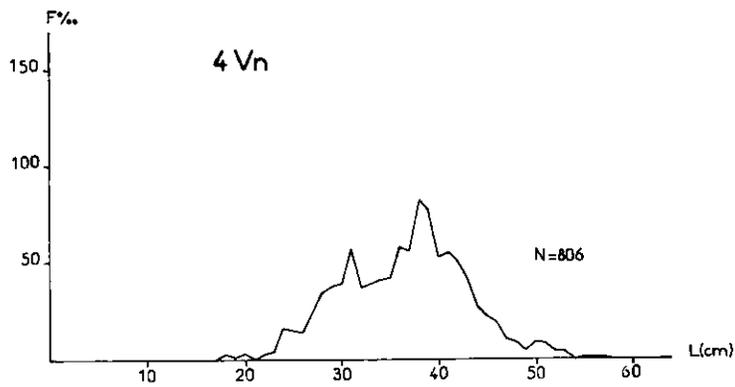


Fig. 8. Length composition of witch flounder in Subdiv. 4Vn from research vessel surveys, May 1972.

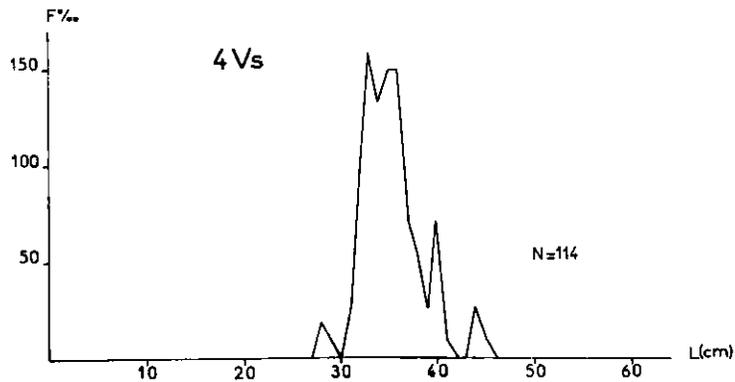


Fig. 9. Length composition of witch flounder in Subdiv. 4Vs from research vessel surveys, May 1972.

Fig. 10 and 11 give the size compositions of yellowtail sampled in May in Subdiv. 3Ps and 4Vs. Samples of catches with Lofoten and 35/42 trawls in Subdiv. 3Ps are compared in Fig. 10 with size ranges of 17-53 cm and 15-54 cm respectively. The size range (26-43 cm) was considerably narrower in Subdiv. 4Vs with a distinct mode at 34 cm.

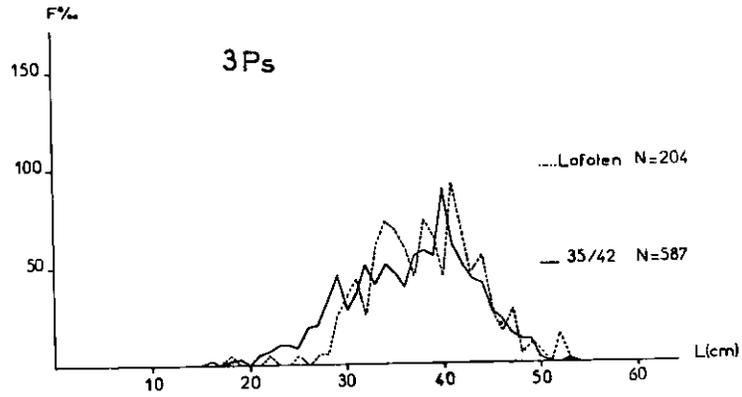


Fig. 10. Length composition of yellowtail flounder in Subdiv. 3Ps from research vessel surveys, May 1972.

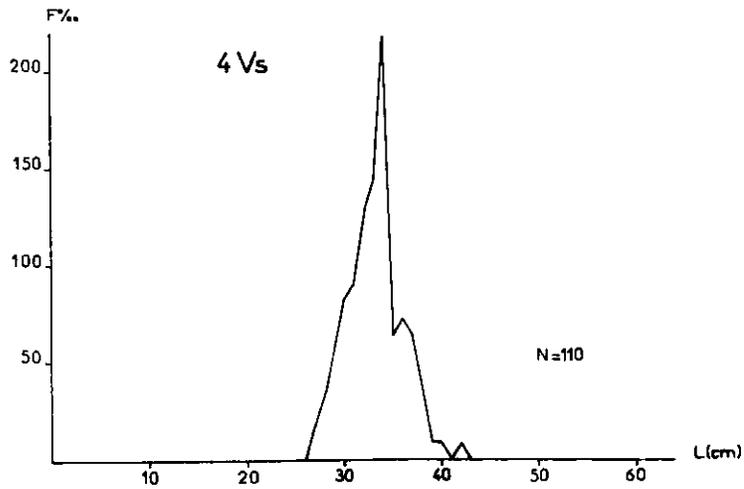


Fig. 11. Length composition of yellowtail flounder in Subdiv. 4Vs from research vessel surveys, May 1972.

Fig. 12 gives the length composition for cod sampled in Subdiv. 4Vn in May. Males ranged in size from 13 to 118 cm with peaks at 40 and 55 cm, and females were 19 to 124 cm long with a peak at 40 cm. Average weights were 1.05 and 1.25 kg for males and females respectively.

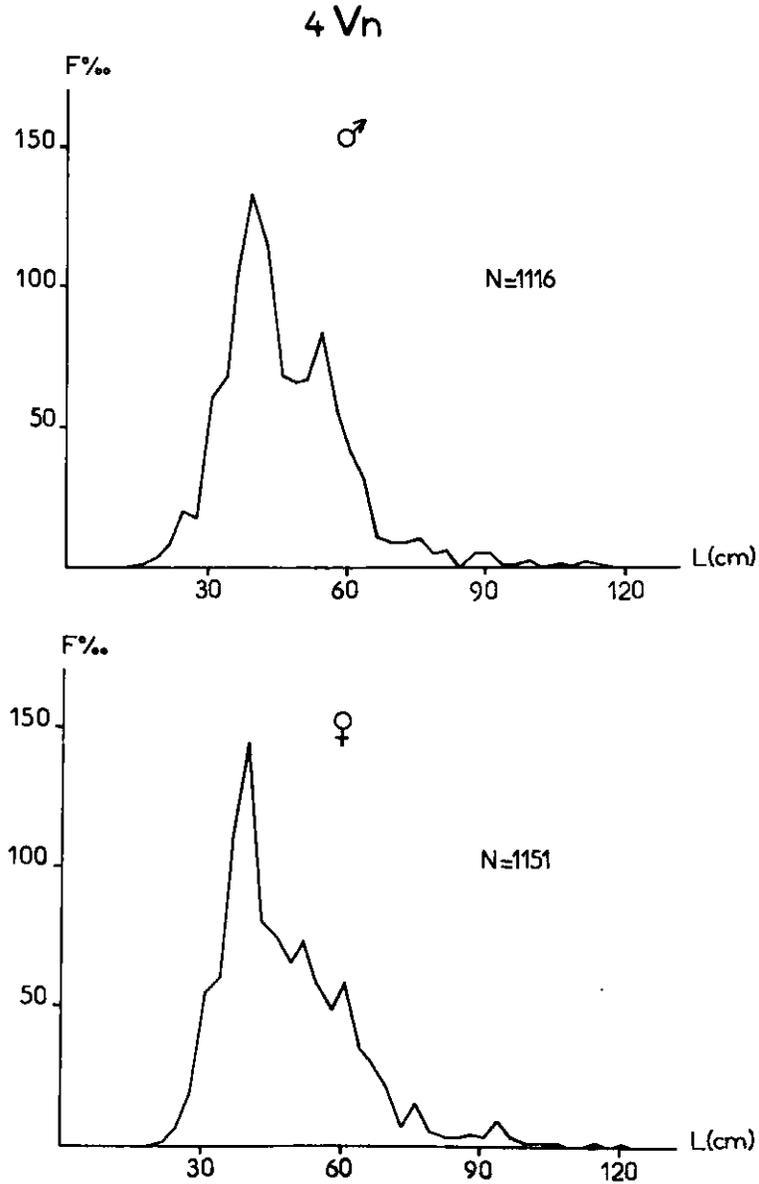


Fig. 12. Length composition of cod in Subdiv. 4Vn from research vessel surveys, May 1972.

Redfish were sampled in Subdiv. 3Ps, 4Vn and 4Vs during the May survey. Fig. 13-16 give the size composition of samples taken with Lofoten and 35/42 trawls. The length ranges were 16-48 cm and 17-45 cm with a major peak at 20 cm in each case. In Subdiv. 4Vn the length composition (12-55 cm with major modes at 18 and 35 cm) of samples with 35/42 trawl from Scatarie Bank and northeast of Sydney were quite different from those from Misaine Bank (10-40 cm with major modes at 15 and 27 cm). In Subdiv. 4Vs redfish were 14-51 cm with a major mode at 36 cm and a smaller one at 20 cm.

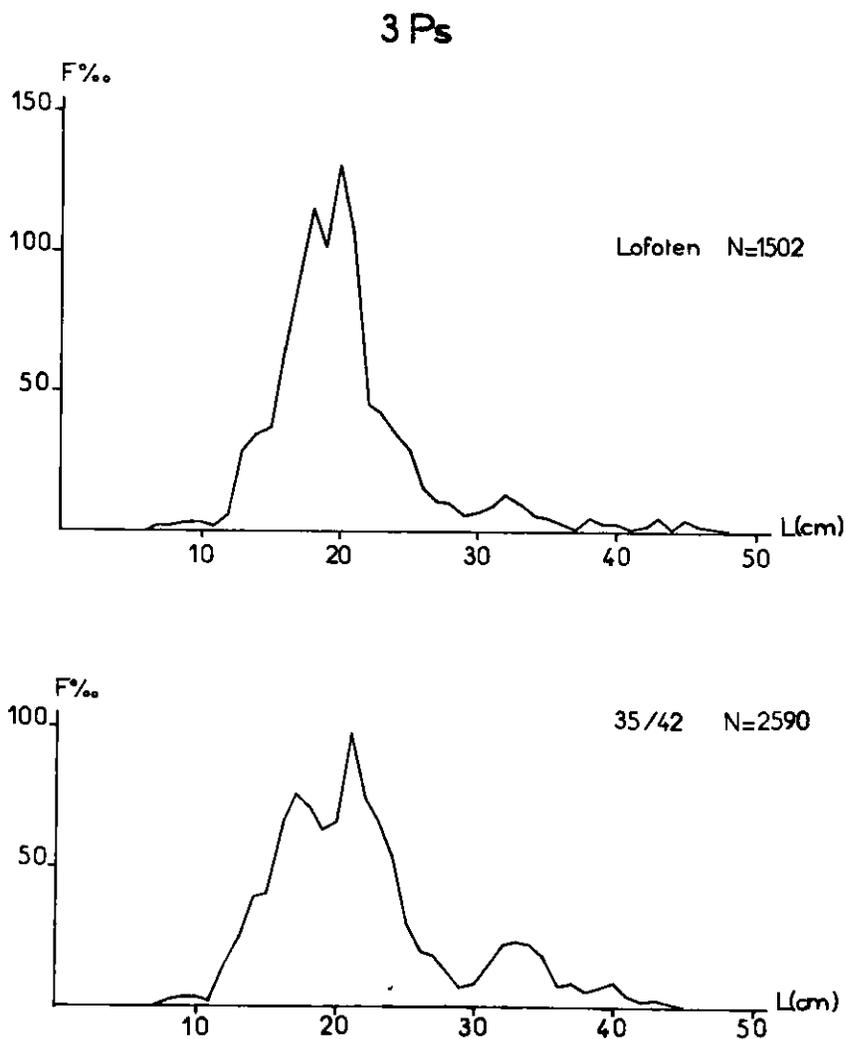


Fig. 13. Length composition of redfish in Subdiv. 3Ps from research vessel surveys, May 1972.

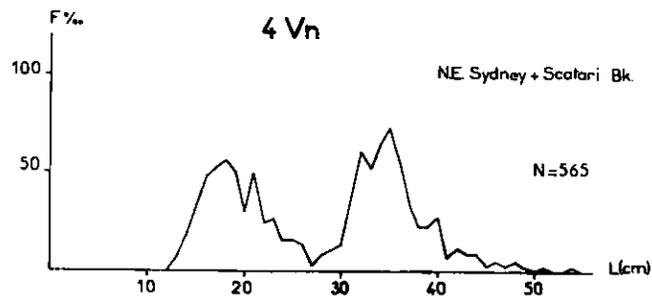


Fig. 14. Length composition of redfish in Subdiv. 4Vn from research vessel surveys, May 1972.

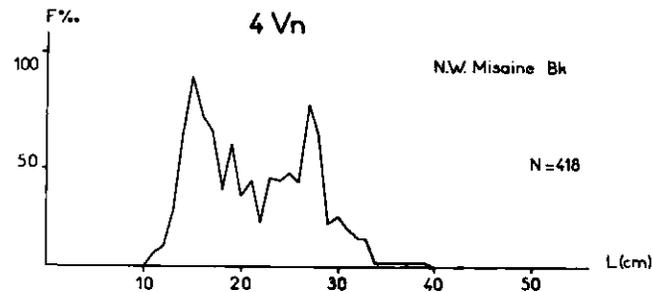


Fig. 15. Length composition of redfish in Subdiv. 4Vn from research vessel surveys, May 1972.

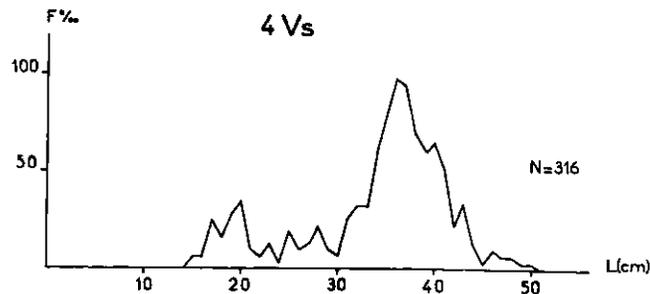


Fig. 16. Length composition of redfish in Subdiv. 4Vs from research vessel surveys, May 1972.

c) During 9 days in March 1972, 19 tows with a 35/42 semi-pelagic trawl were made on the northern part of Scotian Shelf. The Cabot Strait and Sydney Bight were blocked with ice from the end of December 1971, and at the time of the survey in March the outer boundary of the ice extended from "greysole deeps" (southeast of Scatarie Bank) along a line to Burgeo Bank off south Newfoundland. Although herring were generally scarce, a good catch was made on the southern slope of Banquereau. Some good yields of skate and cod were obtained, particularly to the north of Artimon Bank and in "greysole deeps". Silver hake and American plaice were detected in quantity south of Banquereau.

d) During 13 days in April 34 hauls were made in the Cabot Strait area (Subdiv. 3Pn, 4Vn and Div. 4R, 4T) and on the south slope of Banquereau. Excellent catches of herring were obtained near St. Paul Island and on Banquereau, and in all 16 tons of herring were caught. The best catch of 5,800 kg was made southwest of St. Paul Island in 30 m during a 35-minute tow, and the average yield on the south slope of Banquereau was 1,343 kg/hour. Catches were also obtained and samples taken off Isle aux Morts (Subdiv. 3Pn),

off Cape St. George (Div. 4R) and off Cape Lawrence (Div. 4T). Locations of herring catches sampled are shown in Fig. 17.

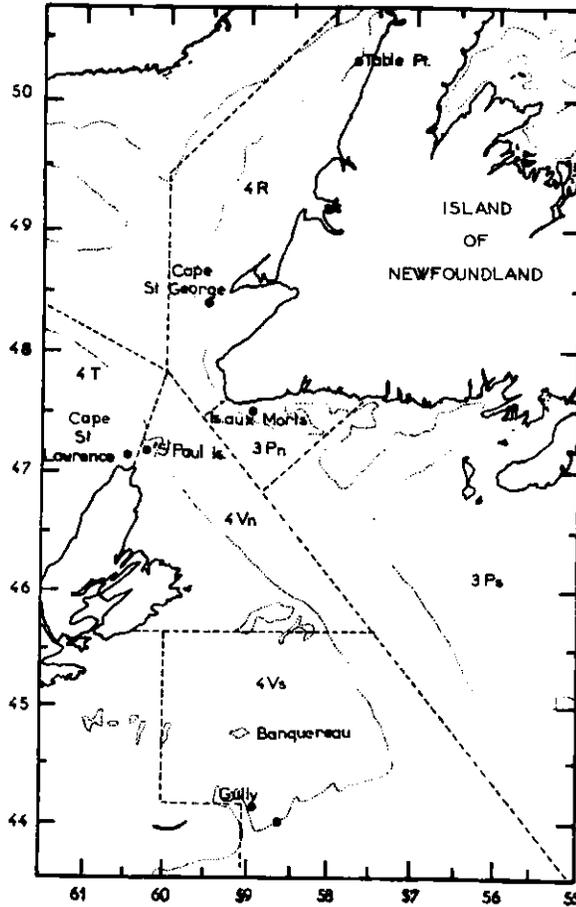


Fig. 17. Map showing positions of stations in herring explorations, March-May 1972.

Fig. 18 gives the length composition of the samples of herring from the various areas in April 1972 together with samples taken in May and July 1972 on other cruises. The Isle aux Morts and Cape St. George samples are bimodal with similar length ranges (23-41 cm) and modes at 27 cm and 34-35 cm. Likewise the Cape St. Lawrence and St. Paul Island samples have similar length ranges (23-38 cm) with peaks at 29 and 33 cm. The Banquereau sample in April and the east gully of Sable Island sample in May are also quite similar (23-41 cm) with a mode at 36 cm for each.

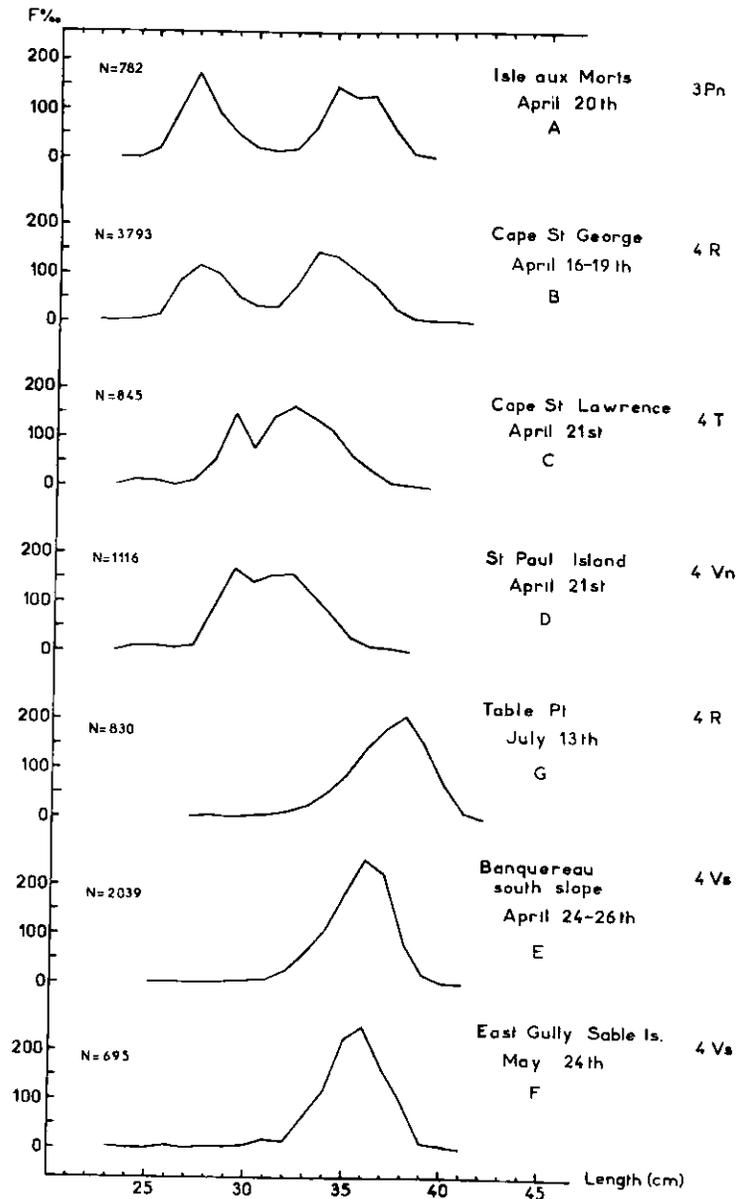


Fig. 18. Length composition of herring from research vessel catches, April-July 1972.

e) The late autumn cruise (November-December) lasted 15 days during which 29 tows were made in the Div. 3P and 4V area, and very limited catches of herring were obtained. Under the influence of very bad weather and unfavourable hydrographic conditions, the herring moved towards the interior of the deep bays of Cape Breton Island and southwest Newfoundland, where only Canadian purse-seiners could operate. However, some very limited samples of herring, silver hake, cod and white hake were frozen on board for later examination at the laboratory.

f) The northern Gulf of St. Lawrence survey took place from 15 June to 16 July when R/V *Cryos* covered 3,000 nautical miles and occupied 137 stations, of which 76 were for hydrography and 61 for fishing.

During 22-24 June exploratory fishing for deep-sea prawns (*Pandalus borealis*) was carried out in

the Esquiman Channel using a flat trawl 33, 10/37, 80, and 19 tows were made from off Corner Brook, Nfld. to Port au Choix, Nfld., 16 of which yielded commercial quantities of *Pandalis* where the bottom water temperature was above 4.5°C. Other fish taken were mainly redfish, Greenland halibut and witch.

Prospecting for capelin (*Mallotus villosus*) was carried out along the Labrador region of Quebec from off Flat Island to Port Saint-Servan. Capelin were present everywhere in 100-175 m in very cold water (-1.5 to -1.7°C), but the catches consisted mostly of very small fish, many of which passed through the meshes of the codend.

In early July bottom or near-bottom fishing was carried out with a semi-pelagic 35/42 trawl or with a 31, 20/17, 70 Lofoten trawl. The plateau and slope of Mecatina Bank as well as the Equiman Channel were explored during 6-14 July. At two stations in deep water on the Quebec side of the Channel catches were poor, but at 9 stations on the Newfoundland side between Port au Choix and Table Point herring, cod, redfish and Greenland halibut were present in the catches. Yields of redfish to the southeast of Mecatina Bank were as high as 4,750 kg/hour, 5,400 kg/hour and 3,270 kg/45-minute hauls. On the Newfoundland side of the Channel catches of 5,900 kg/2 hours and 3,300 kg/hour were obtained; in each case there were traces of herring. On 13 July to the west of Table Point catches of 567 kg of herring and 433 kg of herring mixed with 2,700 kg of cod were obtained in one-half-hour hauls. A 2-hour haul in the area yielded 2,000 kg of herring, 3,125 kg of cod and 325 kg of redfish.

In summary, the exploratory fishing for redfish was positive, but cod and herring occurred irregularly.

g) During 20 August-29 September the *Cryos* took part in tagging Atlantic salmon (*Salmo salar*) in West Greenland waters, the objective being to gather information on the proportion of fish which migrated from West Greenland to home waters in North America and Europe. Out of a total catch of 235 fish, 128 were tagged during 17 fishing operations, representing 55% tagging success relative to the catch. The data obtained during the survey will be analysed by the Joint ICES/ICNAF Salmon Working Party.

h) Fat and stomach contents of herring. The fat content of herring sampled during 1972 in various areas of the Gulf of St. Lawrence, southwest Newfoundland and the northern Scotian Shelf is given in Table 4. The change in % fat for herring of the Banquereau area between March and late May represent the transition from the non-feeding overwintering period to intensive feeding in the spring. All April samples had a generally low fat content (<7%) but those in July had a high value (>16%).

Table 4. Fat content of herring samples from various areas in 1972.

Spawning type	Area	Date	Number examined	Maturity stage	Percent fat
Autumn	Cape St. George	16-19 April	14	VIII	2.30
	Isle aux Morts	20 April	5	VIII	0.84
	St. Paul Island	21 April	15	VIII	3.96
	Table Point	13 July	5	III, IV	18.87
	Cape Dauphin	late November	2	VIII	5.45
	Banquereau south slope	5 March	4	VIII	4.30
	East Gully Sable I.	24 April	10	VIII, VIII-III	3.96
	Banquereau south slope	26 April	6	VIII	2.83
	East Gully Sable I.	24 May	8	VIII	9.77
	Spring	Cape St. George	16-19 April	11	IV, V
Isle aux Morts		20 April	1	IV	5.57
St. Paul Island		21 April	5	IV, V	6.02
Table Point		13 July	1	VIII	16.31

The stomach contents of herring collected in 1972 have been studied and an inventory of organisms used as food is being drawn up. The observations show that *Calanus finmarchicus* is very important as food for herring during most of the year (April-December), particularly in April the species formed 80-100% of the food organisms present. The presence of Euphausiids and Amphipods was more variable but they also constituted a significant portion of the stomach contents at certain periods.



GERMAN (FRG) RESEARCH REPORT, 1972

Section I. Subarea I and East Greenland

by

A. Meyer and W. Lenz

A. STATUS OF THE FISHERIES

1. General Trends

Table 1 gives the nominal catch off West and East Greenland, taken by the Federal Republic of Germany fleet from 1962 to 1972. The total output decreased by 42% to 50,500 tons. This is the lowest catch since 1955 and only 25% of the maximum catch in 1963. Also the catch per fishing day has never been as small as in 1972, although most fishing was carried out only during the months with the highest fish concentrations. Discards in 1972 were minimal (Table 2).

Table 1. Subarea I and East Greenland: FRG nominal catches including industrial fish (tons), 1962-1972.

	Year	Days fishing	COD			REDFISH			TOTAL		
			Catch	Catch per day fish.	% ind.	Catch	Catch per day fish.	% ind.	Catch	Catch per day fish.	% ind.
Subarea I	1962	6,584	133,404	20.3	5.1	57,902	8.8	5.2	200,932	30.5	7.7
	1963	7,175	152,934	21.3	4.2	44,355	6.2	4.7	202,923	28.3	8.6
	1964	5,639	107,982	19.1	7.7	22,956	4.1	10.0	137,794	24.4	10.9
	1965	5,882	107,127	18.2	13.3	18,476	3.1	10.3	131,445	22.3	14.7
	1966	4,696	82,928	17.7	12.8	14,911	3.2	6.1	102,029	21.7	13.1
	1967	6,305	137,773	21.9	9.1	13,600	2.2	3.0	155,606	24.7	9.4
	1968	5,819	132,498	22.8	5.3	11,858	2.0	1.8	146,432	25.2	5.3
	1969	3,234	67,431	20.9	4.0	6,964	2.2	5.2	75,293	23.3	4.3
	1970	1,722	38,551	22.4	4.0	4,501	2.6	9.1	44,283	25.7	5.9
	1971	1,545	37,950	24.6	1.9	3,335	2.2	2.0	42,482	27.5	2.4
	1972	1,312	16,963	12.9	0.3	2,650	2.0	1.9	20,732	15.8	1.8
E.Greenland	1962	1,660	14,317	8.6	0.5	25,032	15.1	1.2	40,999	24.7	1.2
	1963	2,182	13,677	6.3	0.5	31,368	14.4	1.4	47,700	21.9	2.2
	1964	3,287	29,400	8.9	0.2	38,154	11.6	2.3	71,364	21.7	2.5
	1965	2,734	11,746	4.3	0.6	33,491	12.2	4.5	47,877	17.5	4.4
	1966	1,827	7,231	4.0	0.7	23,222	12.7	6.3	32,006	17.5	6.0
	1967	2,157	13,025	6.0	0.1	22,879	10.6	4.7	37,803	17.5	4.4
	1968	1,361	9,825	7.2	0.2	15,432	11.3	2.0	26,417	19.4	2.0
	1969	2,164	14,292	6.6	0.9	24,587	11.4	4.6	40,505	18.7	4.2
	1970	1,532	14,388	9.4	0.9	15,672	10.2	4.5	31,104	20.3	3.3
	1971	1,737	28,735	16.5	0.6	14,037	8.1	2.9	44,062	25.4	2.4
	1972	1,732	21,664	12.5	0.4	7,153	4.1	1.6	29,742	17.2	0.9
Total	1962	8,244	147,721	17.9	4.6	82,934	10.1	4.0	241,931	29.3	6.6
	1963	9,357	166,611	17.8	3.9	75,723	8.1	3.3	250,623	26.8	7.4
	1964	8,926	137,382	15.4	6.1	61,110	6.8	5.2	209,158	23.4	8.0
	1965	8,616	118,873	13.8	12.1	51,967	6.0	6.5	179,322	20.8	11.9
	1966	6,523	90,159	13.8	11.8	38,133	5.8	6.2	134,035	20.5	11.4
	1967	8,462	150,798	17.8	8.4	36,479	4.3	4.1	193,409	22.9	8.4
	1968	7,180	142,323	19.8	4.9	27,290	3.8	1.9	172,849	24.1	4.8
	1969	5,398	81,723	15.1	3.5	31,551	5.8	4.8	115,798	21.5	4.3
	1970	3,254	52,939	16.3	3.2	20,173	6.2	5.5	75,387	23.2	4.9
	1971	3,282	66,685	20.3	1.3	17,372	5.3	2.8	86,544	26.4	2.4
	1972	3,044	38,627	12.7	0.4	9,803	3.2	1.7	50,474	16.6	1.3

Table 2. Discarded fish (tons) in Subarea 1, 1972.

Division	Cod	Redfish	Species (NK)	Total
1C	16	1	1	18
1D	2	-	0	2
1E	-	-	1	1
1F	-	1	0	1
Total	18	2	2	22

2. West Greenland (Subarea 1)

The decrease in catch was most pronounced in the catches of cod in Subarea 1, where in 1972 only 17,000 tons were caught which is only 11% of the FRG catch in 1963. The reason for this drastic decline, in particular the 50% decrease in catch per fishing day, is due to poor stock size especially of the West Greenland stock and the hindrance to the fishery by severe ice conditions for the fourth consecutive year. The catches of redfish also decreased further; only 2,650 tons were caught, which is less than 5% of the 1962 catch.

3. East Greenland

Although the catches off East Greenland decreased by 38% to 30,000 tons the FRG fleet caught 9,000 tons more fish off East Greenland than off West Greenland. Due to the still rather good stock size of mature cod the third highest catch was achieved in the FRG fishery for cod off East Greenland since its start in 1955. On the other side the redfish catch of 7,000 tons was by far the smallest since 1955. This surprising decrease in redfish landings is however more or less the consequence of less market demand.

4. Forecast for 1973

a) Subarea 1. Due to the reduced size of the cod stock of West Greenland origin and the gradual decrease in strength of the East Greenlandic spawning stock, which feed in Subarea 1, the catches will again be rather small and thus the West Greenland fishing grounds will lose much of their attraction for the FRG fleet. However, after 4 heavy ice-years, the ice situation in 1973 seems to be again normal (see Fig. 1). Thus, as in 1968, successful pelagic fishing on postspawners in May-June - non-practicable in 1969 to 1972 because of ice - could be possible. During the second part of the year a fishery on the northern banks based on the 1968 year-class could develop. The FRG cod landings in 1973 from Subarea 1 will also very much depend on the possibilities for paying cod (and saithe) catches in other areas such as Subarea 2 and 3, Iceland, the Norwegian Coast, and the Bear Island-Spitsbergen-Barents Sea area.

b) East Greenland. The consequence of the gradual decrease in size of the stock of mature cod due to fishing, emigration to Iceland, and poor recruitment (year-classes 1965 to 1967) will lead to a further reduction of the FRG cod catches. The catches of redfish could in 1973 surpass the cod catches, especially as consequence of the "fishery war" off Iceland.

B. SPECIAL RESEARCH STUDIES

1. Environmental Studies

Hydrographic measurements have been carried out by the R/V *Anton Dohrn* (ex. *Walther Herwig*) off West Greenland between Great Halibut Bank and Cape Farewell in December (1-10) 1972. The results are included in a special report about the hydrographic conditions by Frede Herman (see Res.Doc. 73/53).

Figure 1 represents informations on the appearance of ice on the fishing banks off East and West Greenland, as they are included in the daily weather reports from the FRG commercial fishing fleet. The data extends from 1971 to 1972 (up to 13 April) to comprise the two winter times 1971/72 and 1972/73. While the winter 1971/72 was a heavy ice winter as in the three years before, the winter just ending seems to be normal. In 1972/73 ice was reported from West Greenland on one day only.

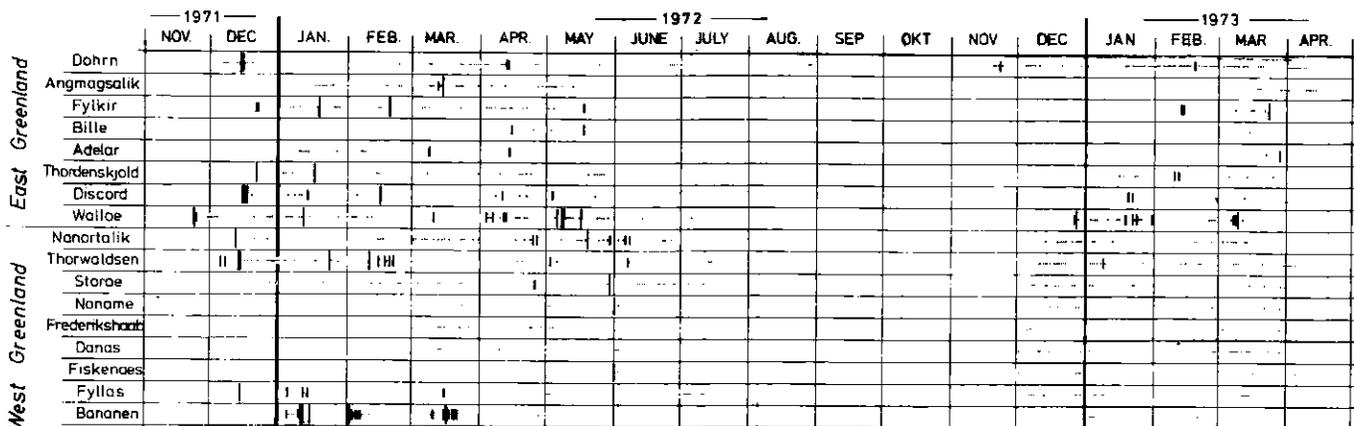


Fig. 1. Appearance of ice on the fishing banks off Greenland as reported by the FRG commercial fishing fleet. Dots indicate that a weather report was transmitted, the small and the long dashes stand for "ice" and "much ice" respectively within such a report.

## 2. Biological Studies

In 1972, 26,449 length measurements and 8,497 age determinations of cod were made in the Greenland area. They showed that 74% of the shoals of pre-spawners in February in Div. 1C and 1D consisted of the 1966 year-class (57%) and the 1965 year-class (17%). These 2 year-classes and the 3% of the 12 year old cod born in 1960 are real West Greenlandic year-classes. All the other older year-classes 1964, 1963, 1962, and 1961 are mostly of East Greenlandic origin and are dominating in the catches in the 2 southern divisions and off East Greenland. The 4 year-classes 1964 to 1961 made up only 12.6% in the shoals of West Greenlandic pre-spawners in February. However, in May after spawning the percentage of these East Greenlandic cod increased to 28% in the southern part of Div. 1C (Banana Bank) and in Div. 1D, demonstrating the northward drift of East Greenlandic post-spawners in this area. As a consequence of this immigration, the percentage of the 1966 and 1965 year-classes decreased to 47%.

In Div. 1E from the end of April to the beginning of June both stocks were more or less mixed; however, the East Greenlandic year-classes 1964 to 1961 dominated with 50% against 36% of the West Greenlandic cod born in 1966, 1965, and 1960.

Off South Greenland (Div. 1F) in February and March, when the spawners pass this area on their way to East Greenland, 90% of the catch consisted of the 1964 to 1961 cod year-classes with a clear dominance of the rich 1963 year-class with 43 to 48% and the moderate 1964 year-class with 21 to 30%. In May after spawning the 1964 year-class prevailed in this area.

Growth studies showed again (see also Res.Doc. 73/38 by A. Meyer) that the West Greenland cod grow faster than the East Greenland cod which grow up in the southern Div. 1E and 1F, an area which is much more under the influence of the cold waters of the east Greenland current than the northern Div. 1A to 1D. The 6 to 7 year old cod of West Greenland origin caught in Div. 1C and 1E in February to May - before the beginning of the new feeding season - had reached a mean length of 66.9 cm and 75.6 cm respectively. The 8 (1964 year-class) and 9 (1963 year-class) year old East Greenland cod caught in Div. 1F in February and March had a mean length of only 70.6 and 76.0 cm respectively. That, in the May catches in Div. 1C and 1D, the cod of the 1964 and 1963 year-classes (see above) were real East Greenlandic immigrants could also be proved by their small mean length of 70.9 and 74.9 cm, which is very close to the mean lengths found in Div. 1F.

In the beginning of December 1972 R/V *Anton Dohrn* (ex. *Walther Herwig*) worked in Div. 1C to 1F. The otolith studies showed that on Banana Bank, Fyllas Bank and Nanortalik Bank the 1968 year-class dominated with 53 to 76%. This means that the 1968 year-class is more or less equally represented in both Greenlandic stocks. These 4 year old cod had reached at the end of their fifth feeding period a mean length of 52.1 cm in Div. 1C, 1D and 1E and of 45.4 cm in Div. 1F. At the moment nothing can be said about the question, whether this 1968 year-class is a rich one or is only so strongly dominating, because the stock is so weak. Considering that the catches of the research ship have never been so poor as in December 1972, as were also the catches of the English R/V *Cirolana* (working together with *Anton Dohrn*), it would seem that no quick recovery of the Greenland stocks can be expected. On Little Halibut Bank, where the average catch was only 0.22 tons per hour, the 1966 year-class dominated followed by the 1968, 1965, and 1966 year-classes. On

Danas Bank the only substantial cod haul was 2.5 tons per hour. Here the catch was composed mainly of the 1966 (45%), 1968 (18%), and 1965 (15%) year-classes. Off Cape Farewell a 0.8 tons per hour catch (within the fishery limit with the kind permission of the Danish Government) almost exclusively consisted of the 1963 and 1964 year-classes (84%). Very few young fish were found in this area.

In the commercial catches of migrating and spawning cod off East Greenland during the first 5 months of the year, the good East Greenland year-classes of 1961 and 1964 dominated (90%). As in 1971, the rich 1963 year-class (with 49% in the southern part and with 55% in the northern part of East Greenland) was by far the most important year-class. In the southern part the 1964 year-class followed with 22%, while in the Angmagssalik-Dohrn Bank area the 1962 year-class took the second place. The rich and important year-class of 1961 in the meantime is reduced to 7-8% in the catches.

Section II. Subareas 2-5 (excluding herring)

by

J. Messtorff and W. Lenz

Subarea 2

A. STATUS OF THE FISHERIES

1. General Trends

The sharp decline of the FRG catches off Labrador since the peak catches of 1969 continued drastically also in 1972 to 53% of the 1971 total catch and to 15% of the 1969 catch. The 1972 nominal catches of groundfish as well as preliminary catch-per-unit effort data are given in Table 3. The catch-per-day fished was somewhat higher than in 1971, but the total effort (days fished) was 47% less. This reduction in effort again was primarily due to further increased severe ice conditions off Labrador in the spring of 1972. On account of these adverse conditions the fishing activity was restricted to a very short season. About 70% of the total catch was already taken during January, only 9% in February and the remainder in March. No fishing took place in Div. 2G, very few catches were reported from Div. 2H, and 99% from Div. 2J. Cod amounted to 93% of the total catch in Subarea 2. The redfish by-catch remained unimportant and amounted to only 5% of the total catch in Subarea 2.

Table 3. German (FRG) nominal catches (tons) in Subareas 2-5 (excluding herring fishery) in 1972 (including industrial fish = converted to fish meal on board).

Div.	Days fished	COD			REDFISH			OTHER FISH			TOTAL		
		Catch	Catch per day	% ind.	Catch	Catch per day	% ind.	Catch	Catch per day	% ind.	Catch	Catch per day	% ind.
2H	6	114	19.0	0.9	11	1.8	-	13	2.2	-	138	23.0	0.7
2J	342	9,681	28.3	3.9	562	1.6	67.3	129	0.4	40.3	10,372	30.3	7.8
Total	348	9,795	28.1	3.8	573	1.6	66.0	142	0.4	36.6	10,510	30.2	7.7
3K	514	19,147	37.3	2.2	450	0.9	45.4	195	0.4	44.1	19,792	38.5	3.6
3L	11	17	1.5	-	19	1.7	-	5	0.5	100.0	41	3.7	12.2
3M	47	605	12.9	4.0	240	5.1	6.7	27	0.6	+	872	18.5	4.6
3Pn	2	-	-	-	30	15.0	13.3	+	+	-	30	15.0	13.3
Total	574	19,769	34.4	2.3	739	1.3	30.4	227	0.4	40.1	20,735	36.1	3.7
4X	1	2	2.0	-	-	-	-	9 <sup>1</sup>	9.0	-	11	11.0	-
5Y	3	+	+	-	-	-	-	55	18.3	-	55	18.3	-
5Ze	6	-	-	-	-	-	-	49	8.2	-	49	8.2	-
Total	9	+	+	-	-	-	-	104 <sup>2</sup>	11.6	-	104	11.6	-

<sup>1</sup> Haddock 1, pollock 8.

<sup>2</sup> Pollock 104.

The quantities of discarded fish were very small (much less than in 1971) as shown in Table 4.

Table 4. Discarded fish (tons) in Subareas 2-5 (excluding herring fishery) in 1972 (1971 in brackets).

Subarea/Div.	Cod	Redfish	Other Fish	Total
2G	- (2)	- (-)	- (-)	- (2)
2H	- (4)	- (-)	- (2)	- (6)
2J	5 (57)	- (7)	3 (35)	8 (99)
<b>Total</b>	<b>5 (63)</b>	<b>- (7)</b>	<b>3 (37)</b>	<b>8 (107)</b>
3K	82 (27)	- (5)	8 (7)	90 (39)
4 + 5	No discards reported			

2. Forecast for 1973

Fishing operations of German (FRG) trawlers in Div. 2J, 3K and 3L during the first quarter of 1973 were again restricted by very severe ice conditions. After preliminary estimates the total German (FRG) catch of cod may, however, exceed the 1972 catch somewhat to a level around 80% of the national quota allocation set for 1973.

B. SPECIAL RESEARCH STUDIES

1. Environmental Studies

Hydrographical observations were carried out by R/V *Anton Dohrn* between 18 and 29 November 1972 consisting of three sections (Fig. 2) across the shelf off Labrador: Middle Labrador (Div. 2H); Hamilton Bank (Div. 2J); Ritu Bank (Div. 3K, the stations are not positioned exactly on a straight line, but this section represents a strip of 50 nautical miles in width). The measurements were done by BT and hydro cast.

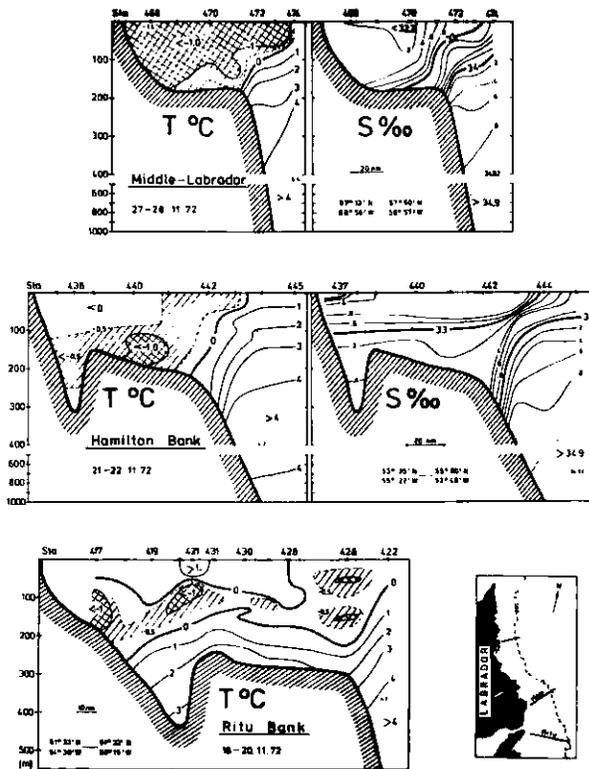


Fig. 2. Hydrographic sections off Labrador in November 1972.

North of 58°N no hydrographic observations could be carried out because of drift ice. The appearance of ice is very unusual so far south in the autumn, which indicates strong wind stress and/or strong surface current; the section off Middle Labrador shows that the mass of Arctic Water (-1.75°C, 33.2‰ in the origin) was very great. Water with negative temperature covered the whole shelf area down to the bottom (even much cooler than -1°C). This water was found on Ritu Bank in some tongues in depths between 50 and 200 m. Above the outer part of Hamilton and Ritu Banks the layer of temperature minimum ascended to the surface according to upwelling processes.

In the German (FRG) Research Report for 1971 a slight decrease in water temperature off Labrador compared to previous years was noted. In 1972 temperatures decreased still further; the water in the shallower part of the Labrador Current was cooler by nearly one degree in November 1972 than in November 1971, while in greater depths the values of temperature and salinity remained the same in the West Greenland branch of this current.

The trend of decreasing water temperatures has lasted for four years. The first appearance of drift ice is shown for the years 1969 to 1973 (Fig. 3) as reported in the daily messages of the German (FRG) fishing fleet. Since 1970 ice appeared about 10 days earlier each year, while the time of drifting between Hamilton and Ritu Bank remained about the same (22±6) days, which would stand for an average drift speed of 9 nautical miles per day.

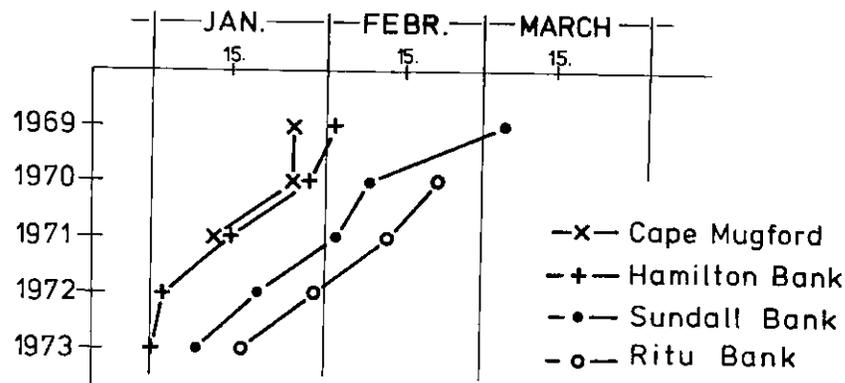


Fig. 3. First appearance of drift ice in different fishing areas off Labrador from 1969-1973 as reported by the German (FRG) fishing fleet.

## 2. Biological Studies

R/V *Anton Dohrn* (ex. *Walther Herwig*) carried out a groundfish survey in the subarea during the second half of November 1972. Due to limited working time the survey area had to be restricted mainly to Div. 2J (and the northern part of Div. 3K). Even then the coverage as well as the number of random trawling stations per sampling stratum was probably not sufficient in order to obtain significant abundance indices. A standard bottom trawl with small-meshed liner inside the codend was used throughout the survey. Towing time and speed were 30 minutes at 4 knots. If not sampled for length frequency distribution, each species caught (>30 in number) was at least recorded by number and weight.

In Div. 2J 20 hauls ranging from 150-600 m were carried out. All cod (2,818 kg = 3,489 fish, mean weight 0.8 kg) obtained in 16 hauls to 310 m were measured and 620 otoliths taken. No cod occurred in 4 hauls in deeper water between 450 and 600 m where redfish dominated with 59% of the total catch.

Four hauls in Div. 2J gave a total catch of 586 kg, 32% of which were cod. One haul in 500 m consisted mainly of roundnose grenadier (356 kg = 83%).

The proportion of older and larger cod seemed to have further decreased. With a mean length as low as 41.6 cm, only 11% of cod measured more than 60 cm and 1% over 80 cm. The scarcity of cod of age 8 and older is also well reflected by the percentage age composition as given below. The recently recruited 1966-68 year-classes made up 72% of the catch.

Year-class	1970	1969	1968	1967	1966	1965	1964	1963	1962	1961	1960	
Age	2	3	4	5	6	7	8	9	10	11	12	12+
%	1	10	18	33	21	10	5	1	1	+	+	+
Av. length	27.2	31.9	37.7	40.1	43.3	49.1	54.3	58.8	68.3	(68.1)	(87.5)	(88.5)

### Subarea 3

#### A. STATUS OF THE FISHERIES

##### 1. General Trends

Catches of German (FRG) trawlers increased considerably by 47% in Div. 3K against 1971, due to diversion of effort from Subarea 2, thus fully compensating for the loss caused by the worst ice conditions in Subarea 2. About 94% of the total catch from Div. 3K was taken in February after the Labrador fishery had to be abandoned. The nominal catches in Subarea 3 as well as preliminary catch-per-unit effort data are given in Table 3. In spite of the increased fishing effort the catch-per-day fished also increased quite remarkably. This could be an indication of a possibly higher abundance of cod in the area because of good recruitment by the stronger 1966-68 year-classes. About 95% of the total Subarea 3 catch consisted of cod. The redfish by-catch remained at the same low level as in previous years. Only very small catches were taken in Div. 3L, 3M and Subdiv. 3Pn. Discards are given in Table 4.

##### 2. Forecast for 1973 (see under Subarea 2)

#### B. SPECIAL RESEARCH STUDIES

##### 1. Environmental Studies

Hydrographic sections across the Laurentian channel from Div. 3P to 4V were carried out in March and November 1972 by R/V *Walther Herwig*. Results are given in Res.Doc. 73/83 by W. Lenz.

##### 2. Biological Studies

A groundfish survey was conducted by R/V *Anton Dohrn* (ex. *Walther Herwig*) during the second half of November 1972 in the northern part of Div. 3K and in Subarea 2 (see remarks under Subarea 2).

In Div. 3K 18 hauls ranging from 175-600 m were carried out. All fish species caught were recorded at least by number and weight. Length frequencies and ageing material were collected from priority species, especially cod. Fifteen hauls in depths between 175 and 350 m contained cod but they were most abundant in catches between 250 and 300 m. All cod (1,729 fish = 1,714 kg, mean weight 1.0 kg) were measured and partly sampled for otoliths (798). Cod accounted for 38% of the total catch by weight. Three hauls made in 450-600 m contained no cod; 60% were roundnose grenadier and 26% redfish (total catch 1,560 kg).

The percentage age composition of cod for the combined survey catches in Div. 3K as shown below is very similar to that found in Div. 2J of Subarea 2, and in fact also the length frequency distributions proved to be almost the same. Mean length of cod in Div. 3K was 44.5 cm, and larger fish of over 60 cm amounted to only 9% of the total number caught. About 76% of the cod were 4-7 years old (1968-65 year-classes).

Year-class	1970	1969	1968	1967	1966	1965	1964	1963	1962	1961	1960	
Age	2	3	4	5	6	7	8	9	10	11	12	12+
%	2	8	14	28	20	14	9	3	2	+	+	+
Mean length	25.3	31.2	37.9	40.7	45.0	52.0	56.6	61.8	70.6	(74.8)	(82.5)	(85.5)

### Subarea 4

#### A. STATUS OF THE FISHERIES

1. There was no significant fishery carried out by German (FRG) trawlers (see Table 3).

B. SPECIAL RESEARCH STUDIES

1. Environmental Studies

See under Subarea 3 above.

Subarea 5

A. STATUS OF THE FISHERIES

1. Besides the herring fishery (German (FRG) Research Report, Section III), only few pollock catches were obtained (Table 3).

B. SPECIAL RESEARCH STUDIES

1. Environmental Studies

Hydrographic observations were carried out by R/V *Anton Dohrn* (ex. *Walther Herwig*) in connection with the ICNAF larval herring survey during the first half of November 1972 (see Res.Doc. 73/19).

2. Biological Studies

R/V *Anton Dohrn* (ex. *Walther Herwig*) took part in the international ICNAF larval herring survey in the Gulf of Maine and Georges Bank area (see Res.Doc. 73/19).

In February and March 1973 R/V *Anton Dohrn* conducted a young herring survey in Subarea 5 and Stat. Area 6 (see Res.Doc. 73/84).

Section III. Subareas 3, 4, 5 and 6 (herring only)

by

K. Schubert

A. STATUS OF THE FISHERIES

1. General Trends

Thirteen stern freezer trawlers were fishing with pelagic nets from the middle of July to December 1972. The total catch in Subarea 3 (Subdiv. 3Ps) was 110 tons of herring in October. In Subarea 4 the total catch amounted to 510 tons of herring in August and October. The main fishing area of the German fleet was Subarea 5 and the catch was 30,635 tons of herring. Of this total 27,633 tons came from Subdiv. 5Ze from July to December, 2,931 tons from Div. 5Y in the same time and 71 tons from Subdiv 5Zw in October and November. In Stat. Area 6 there was only a squid fishery in November and December.

In Subarea 5 the catch decreased from 56,860 tons of herring in 1971 to 30,635 tons in 1972. This decrease was due to the effort which decreased from 1,250 fishing days to 944 fishing days. The catch-per-day decreased from 45.5 to 32.5 tons of herring.

The spawning on the northern part of Georges Bank was not so strong this year. The German fleet caught spawning herring in this area only some days in the second and third week of September. The main fishing area in 1972 was on the western side of the bank, east of Nantucket Shoal-Cape Cod between 41°-42°N, 68°30'-69°30'W. Spawning herring were caught here on definite places in September and October. Some spawning was observed in Div. 5Y in October too. One remarkable characteristic of the hydrographical situation on Georges Bank was the lower temperatures in 1972. Presumably, this hydrographical situation may have an influence on the spawning behaviour, but the lower stock density could be an explanation too.

Monthly catch, total catch, effort (fishing days), catch-per-unit effort (tons) and discarded fish (tons) are given in Table 5.

Figure 4 shows the catch-per-day in baskets (50 kg) on an average of about 5 days of 13 German freezer trawlers in 791 fishing days in Subdiv. 5Ze from the last week in July to the beginning of November 1972; as compared with the figures for 1971 and 1970, the stock density has strongly decreased in 1972.

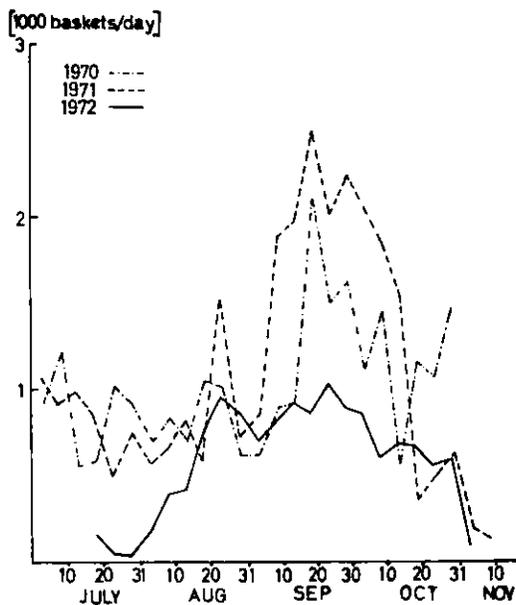


Fig. 4. Herring. Catch-per-day (baskets) on an average of about 5 days in Subdiv. 5Ze.

Table 5. Nominal catch (tons), effort (days fished), catch-per-unit effort (tons) and discards (tons) of German (FRG) freezer trawlers in Subareas 3, 4 and 5 and Stat. Area 6 in 1972.

A. Fishery for herring																
Div.	Month	Nominal catch (tons)			Effort DF	Catch per day (tons)			Discards (tons)							
		Her	Shad	Pol O F Total		Her	Shad	Mac Pol O F Total	Mac	Shad	O F Total					
3Ps	Oct	110	-	-	7	117	6	18.3	-	-	-	1.2	19.5	-	-	-
4V	Aug	3	-	-	-	3	2	1.5	-	-	-	-	1.5	-	-	-
	Oct	508	-	-	-	508	7	72.6	-	-	-	-	72.6	-	-	-
4W	Oct	79	-	-	10	89	3	26.3	-	-	-	3.4	29.7	-	-	-
SA 4	Total	590	-	-	10	600	12	49.2	-	-	-	0.8	50.0	-	-	-
5Y	Jul	319	40	-	18	377	24	13.3	-	1.7	-	0.7	15.7	3	4	-
	Aug	1,204	5	73	20	1,302	51	23.6	0.1	1.4	-	0.4	25.5	2	6	8
	Sep	60	-	-	-	60	3	20.0	-	-	-	-	20.0	-	-	-
	Oct	808	-	-	5	813	22	36.7	-	-	-	0.3	37.0	-	-	-
	Nov	452	25	52	130	749	28	16.1	0.9	1.9	4.6	3.2	26.7	-	-	-
	Dec	88	2	211	15	316	9	9.8	-	0.2	23.4	1.7	35.1	-	-	-
	Total	2,931	30	167	341	3,617	137	21.4	0.2	1.2	2.5	1.1	26.4	5	10	15
5Ze	Jul	320	-	-	1	321	25	12.8	-	-	-	-	12.8	24	9	-
	Aug	5,912	5	39	29	5,985	152	38.9	+	0.3	-	0.2	39.4	-	-	-
	Sep	13,004	13	93	94	13,204	318	40.9	+	0.3	-	0.3	41.5	-	-	10
	Oct	8,293	5	114	5	8,533	273	30.4	+	0.4	+	0.5	31.3	-	-	-
	Nov	95	7	88	20	227	19	5.0	0.4	4.6	1.1	0.8	11.9	-	-	-
	Dec	9	-	50	-	59	4	2.3	-	12.5	-	-	14.8	-	-	-
	Total	27,633	30	384	25	28,329	791	34.9	+	0.5	+	0.4	35.8	24	9	10
5Zw	Oct	47	-	-	-	47	2	23.5	-	-	-	-	23.5	-	-	-
	Nov	24	60	197	7	288	14	1.7	4.3	14.1	-	0.5	20.6	-	-	-
	Total	71	60	197	7	335	16	4.4	3.8	12.3	-	0.4	20.9	-	-	-
SA 5	Total	30,635	120	748	366	412	944	32.5	0.1	0.8	0.4	0.4	34.2	29	19	10

B. Fishery for squid

Div.	Month	Nominal catch (tons)			Effort DF	Catch per day (tons)			Discards (tons)				
		Mac	O	F		Mac	O	F	Mac	O	F		
5Zw	Dec	14	7	63	84	7	2.0	1.0	9.0	12.0	-	-	-
6A	Nov	1	-	10	11	2	0.5	-	5.0	5.5	-	-	-
	Dec	1	18	303	322	40	+	0.5	7.6	8.1	-	-	-
6B	Dec	12	8	86	106	12	1.0	0.7	7.1	8.8	-	-	-
SA 6	Total	14	26	399	439	54	0.3	0.5	7.3	8.1	-	-	-

Average gross registered tonnage of German (FRG) trawlers fishing for herring and squids were as follows: Subareas 3-5 (herring), 2261 GRT (1398-2684); Subareas 5-6 (squids), 1576 GRT (1572-1580).

B. SPECIAL RESEARCH STUDIES

1. Biological Studies

On board a trawler herring investigations were made in Div. 4X, Subdiv. 5Ze and Div. 5Y from August to October; in addition, one sample from a research vessel cruise in March from Subdiv. 3Ps was investigated. From 79 samples, 33,622 herring were measured in these divisions as follows: 127 in Subdiv. 3Ps, 328 in Div. 4X, 429 in Div. 5Y, and 32,738 in Subdiv. 5Ze. The average length in Subdiv. 3Ps was 34.7 cm in March; in Div. 4X, 24.27 cm in October; in Div. 5Y, 32.3 cm in October; and in Subdiv. 5Ze, the average length was 32.19 cm in August and decreased to 30.59 cm in October. Compared to 1971, the average length was greater in Subdiv. 5Ze (Table 6).

Table 6. Length composition (%.) of herring sampled in 1972.

Length (cm)	3Ps	4X	5Y(s)	5Ze		
	Mar	Oct	Oct	Aug	Sep	Oct
18	-	-	-	-	-	+
19	-	-	-	-	-	1
20	-	3	-	-	+	3
21	-	24	-	-	1	6
22	-	122	-	-	4	11
23	-	244	-	-	5	14
24	-	287	-	-	2	14
25	-	293	-	-	2	7
26	-	27	-	2	13	11
27	-	-	7	10	41	45
28	-	-	33	30	62	85
29	16	-	107	70	116	139
30	16	-	119	131	170	197
31	8	-	168	191	190	185
32	24	-	205	220	176	141
33	173	-	159	205	117	86
34	330	-	135	97	69	39
35	260	-	56	40	27	14
36	149	-	9	4	5	2
37	24	-	2	-	+	+
38	-	-	-	-	+	+
Total %.	1000	1000	1000	1000	1000	1000
No. of Samples <sup>1</sup>	1	1	1	5	37	34
No. Measured	127	328	429	1823	14972	15943
Mean Length (cm)	34.74	24.27	32.25	32.19	31.34	30.59
Mean Weight (kg)	0.289	0.100	0.245	0.288	0.253	0.216

<sup>1</sup> All samples are from commercial catches except the Subdiv. 3Ps sample which is from research vessel catch.

Maturity stages 8 (60.6%) and 7 (35.7%) were dominant in Subdiv. 3Ps in March. Some herring were still in spawning condition (2.4%), and some had maturity stages 4 (1.6%). In Div. 4X in October, juvenile herring from maturity stage 2 were observed (100%), whereas in Div. 5Y in October, only spawning herring (stage 6, 100%) were in the catches. Stage 5 formed the bulk (75.6%) of the catches in Subdiv. 5Ze in August with some stage 4 (23.2%); in addition, some herring of stages 2 and 3 were observed. In September the maturity was advanced. Stage 5 (63.1%) was still predominant. Some spawning herring (stage 6, 17.4%) and further spent fishes (stages 7 and 8) were in the catches. Stage 4 (13.0%) had still some importance. Finally in October, spawning herring (stage 6) were predominant (79.4%) in the catches but some juvenile herring in stage 1 (18.8%) were observed (Table 7).

Table 7. Maturity stage composition (%.) of herring sampled in Subareas 3, 4 and 5 in 1972.

Stages of maturity	3Ps	4X	5Y(s)	5Ze		
	Mar	Oct	Oct	Aug	Sep	Oct
1	-	-	-	-	-	188
2	-	1000	-	4	4	12
3	-	-	-	8	4	-
4	16	-	-	232	130	-
5	-	-	-	756	631	2
6	24	-	1000	-	174	794
7	354	-	-	-	46	4
8	606	-	-	-	11	-
Total	1000	1000	1000	1000	1000	1000
No. Sampled	127	100	98	95	686	492

The age compositions are shown in Table 8. In Subdiv. 3Ps in March herring over 8 years old (88.8%) were dominant but some herring from the 1964, 1965, 1966 and 1968 year-classes were present. In Div. 4X in October only 2-year-olds (1970 year-class) were in the catches. In Div. 5Y in the same month the 1967 year-class (22.7%) were dominant, some importance had the year-classes 1966 (16.5%), 1968 (15.5%), 1964 (13.4%) and the age-groups >9 (11.3%). No herring from the 1970 year-class was found. In Subdiv. 5Ze in August, the 6-year-old herring (27.4%) were predominant; moreover, the year-classes 1967 (16.9%), 1968 (16.5%), and 1965 (15.6%) had some importance. In September the 4-year-old herring (1968 year-class) was dominant (27.0%). In October the change to younger herring continued. The bulk of the catches now consisted of 4-year-old (1968 year-class) herring (35.5%). The portion of the 1966, 1967 and 1965 year-classes decreased, whereas the 3-year-old (1969 year-class) herring (11.2%) increased. For the first time 2-year-old herring (1970 year-class) appeared in this month in the catches (13.2%).

Table 8. Age composition (%.) of herring sampled in Subareas 3, 4 and 5 in 1972.

Year-class	Age	3Ps	4X	5Y(s)	5Ze		
		Mar	Oct	Oct	Aug	Sep	Oct
1971	1	-	-	-	-	-	-
70	2	-	1000	-	-	-	132
69	3	-	-	72	25	64	112
68	4	16	-	155	165	270	355
67	5	-	-	227	169	174	138
66	6	8	-	165	274	208	138
65	7	32	-	82	156	102	55
64	8	56	-	134	89	54	20
63	9	888	-	52	46	43	12
<63	>9		-	113	76	85	38
Total		1000	1000	1000	1000	1000	1000
No. aged		126	100	97	237	1118	757

Table 9 gives the mean length-at-age and mean  $L_1$  for herring sampled in 1972.

Table 10 shows the average number of vertebrae and gillrakers. Only the catch in March in Subdiv. 3Ps contained spawning herring, all other samples being autumn spawners. It seems from these data that the autumn spawners in the different months and divisions belong to different stocks.

Table 9. Mean length-at-age (cm) and L<sub>1</sub> (cm) for herring sampled in Subareas 3, 4 and 5 in 1972.

Year-class	Age	Mean length (cm)						L <sub>1</sub> (cm)					
		3Ps	4X	5Y(s)	5Ze			4X	5Y(s)	5Ze			
		Mar	Oct	Oct	Aug	Sep	Oct	Oct	Oct	Aug	Sep	Oct	
1971	1	-	-	-	-	-	-	-	-	-	-	-	-
70	2	-	23.51 1.363 100	-	-	-	22.38 2.389 100	16.32 1.763 11	-	-	-	-	15.58 1.174 12
69	3	-	-	27.79 0.571 7	28.33 0.566 6	27.68 1.389 72	27.75 1.259 85	-	13.50 -	-	15.90 0.800 5	16.58 4.083 12	
68	4	30.00 0.500 2	-	30.17 1.095 15	29.88 0.979 39	29.95 1.072 302	29.91 1.040 269	-	-	13.00 3.667 4	13.81 6.578 29	14.35 5.276 48	
67	5	-	-	30.91 0.443 22	31.58 0.737 40	31.20 0.964 195	31.13 0.935 104	-	16.10 7.800 5	15.25 14.916 4	14.39 4.766 19	13.43 6.071 14	
66	6	32.50 -	-	31.81 0.495 16	32.53 0.811 65	32.13 0.882 232	31.90 0.961 104	-	13.00 12.500 2	12.58 3.743 13	11.82 2.476 25	12.61 4.766 19	
65	7	31.75 2.916 4	-	32.50 0.285 8	33.01 0.645 37	32.95 1.063 114	33.00 0.695 42	-	11.00 4.500 2	13.50 8.000 2	14.02 6.624 23	14.00 5.166 10	
64	8	33.26 1.809 7	-	33.35 0.307 13	33.50 0.700 21	33.48 0.864 60	33.50 0.571 15	-	12.83 4.333 3	13.50 2.000 2	13.83 4.750 9	15.50 -	
63	9	35.06 1.077 112	-	34.10 0.800 5	34.23 0.218 11	34.06 0.761 48	34.06 0.777 9	-	-	13.83 1.390 3	12.36 6.476 7	12.10 1.300 5	
<63	>9	-	-	34.77 1.018 11	34.67 0.735 18	34.68 0.871 95	34.67 0.790 29	-	13.50 -	12.50 1.000 3	12.79 6.989 14	11.50 3.142 8	
Total	$\bar{x}$ $s^2$ n	34.76 2.002 126	23.51 1.363 100	31.78 3.994 97	32.23 3.003 237	31.55 4.239 1118	29.59 11.697 757	16.32 1.763 11	13.86 7.939 14	13.21 4.679 31	13.45 6.050 131	14.03 6.031 129	

Table 10. Average number of vertebrae and gillrakers in herring sampled in Subareas 3, 4 and 5 in 1972.

Year-class	Age	Vertebrae						Gillrakers						
		3Ps	4X	5Y(s)	5Ze		3Ps	4X	5Y(s)	5Ze				
		Mar	Oct	Oct	Aug	Sep	Oct	Mar	Oct	Oct	Aug	Sep	Oct	
1971	1	-	-	-	-	-	-	-	-	-	-	-	-	-
70	2	-	56.55 0.372 99	-	-	-	56.33 0.325 98	-	48.57 1.964 100	-	-	-	-	49.02 2.181 100
69	3	-	-	56.43 0.285 7	57.00 -	56.41 0.386 44	56.46 0.366 54	-	-	48.86 1.809 7	49.00 -	48.68 2.222 47	48.48 1.990 54	
68	4	56.50 0.500 2	-	56.43 0.571 14	56.21 0.335 14	56.41 0.358 191	56.54 0.512 161	49.00 -	-	49.00 1.714 15	49.21 2.950 14	49.10 2.381 195	49.20 2.722 164	
67	5	-	-	56.23 0.374 22	56.44 0.261 18	56.40 0.333 110	56.36 0.288 73	-	-	50.18 2.727 22	49.72 3.388 18	49.12 2.824 111	49.51 2.691 74	
66	6	56.00 -	-	56.50 0.533 16	56.32 0.228 19	56.37 0.370 133	56.40 0.345 60	48.00 -	-	50.44 1.729 16	50.00 1.888 19	49.80 2.323 136	50.15 2.807 60	
65	7	56.00 -	-	56.75 0.500 8	56.50 0.266 16	56.32 0.281 68	56.73 0.398 22	48.25 4.250 4	-	48.88 3.553 8	50.06 5.262 16	49.46 2.193 69	49.43 3.347 23	
64	8	56.86 0.809 7	-	56.77 0.192 13	56.38 0.256 13	56.57 0.297 44	56.33 0.500 9	50.14 2.809 7	-	50.08 3.077 13	49.71 4.066 14	49.93 2.669 44	49.89 2.611 9	
63	9	56.68 0.530 110	-	56.40 0.300 5	56.33 0.334 3	56.61 0.430 23	56.33 1.390 3	49.29 2.314 112	-	48.80 2.700 5	50.67 0.333 3	49.26 4.110 23	50.00 3.000 3	
<63	>9	-	-	56.36 0.454 11	56.18 0.363 11	56.38 0.379 58	56.70 0.233 10	-	-	49.09 2.291 11	50.09 4.491 11	49.28 2.274 60	50.10 3.655 10	
Total	$\bar{x}$ $s^2$ n	56.66 0.534 124	56.55 0.372 99	56.46 0.419 96	56.36 0.274 95	56.41 0.351 671	56.45 0.403 490	49.29 2.381 126	48.57 1.964 100	49.63 2.652 97	49.82 3.347 96	49.32 2.573 685	49.29 2.751 497	



JAPANESE RESEARCH REPORT, 1972

by

Ikuo Ikeda

Japanese trawlers fished in Subareas 3, 4 and 5 and in Stat. Area 6 during 1972, taking a total of 34,900 tons. This is 6,700 tons lower than in 1971, but the 1972 figure is preliminary. Principal species caught were squids (18,702 tons), butterfish (3,675 tons), herring (3,298 tons) and redfish (3,031 tons).

Subarea 3

A. STATUS OF THE FISHERIES

The catch by Japanese trawlers in Subarea 3 decreased from 8,169 tons in 1971 to 1,567 tons in 1972. Fishing grounds were mainly in Div. 3L and 3P for redfish and Div. 3P for herring.

Table 1. Japanese catch in Subarea 3, 1968-72.

	1968	1969	1970	1971	1972 <sup>1</sup>
Hours fished	1,043	410	1,861	3,088	
Total catch (tons)	1,672	810	3,511	8,169	1,567
Cod	574	83	49	9	-
Haddock	6	1	6	-	-
Redfish	774	533	2,586	7,634	743
Flatfishes	38	21	4	2	1
Herring	-	-	-	-	611
Argentines	145	106	793	445	157
Other species	135	66	73	79	55

<sup>1</sup> Preliminary

B. SPECIAL RESEARCH STUDIES

1. Biological Studies

Length measurements for redfish were made on board commercial trawlers in Div. 3P.

Subarea 4

A. STATUS OF THE FISHERIES

In this subarea the total catch was about 1,000 tons less than in 1971. Significant changes in species composition of the catch from 1971 to 1972 were increases in the catches of redfish and herring and a decrease in the catch of argentine. Fishing grounds were basically the same as in the previous year, argentine in Div. 4X and redfish on the eastern slope of Div. 4V.

Table 2. Japanese catch in Subarea 4, 1968-72.

	1968	1969	1970	1971	1972 <sup>1</sup>
Hours fished	1,075	896	2,176	1,991	
Total catch (tons)	2,012	1,936	4,779	5,507	4,512
Cod	21	39	154	6	22
Haddock	18	20	13	1	23
Redfish	524	251	967	1,164	2,273
Silver hake	76	213	128	8	63
White hake	-	-	17	30	24
Flatfishes	28	21	9	1	24
Herring	9	14	100	768	1,526
Argentine	1,086	1,256	2,940	3,160	456
Squids	...	...	...	57	10
Other species	250	122	451	312	91

<sup>1</sup> Preliminary

#### B. SPECIAL RESEARCH STUDIES

##### 1. Biological Studies

Length measurements for redfish, silver hake, yellowtail flounder, herring and argentine were made on board commercial trawlers.

#### Subarea 5

##### A. STATUS OF THE FISHERIES

The catch of Japanese trawlers in Subarea 5 decreased from 15,340 tons in 1971 to 12,538 tons in 1972. Catches of squids and butterfish increased, while catches of argentine and herring decreased. The fleets operated mainly in Subdiv. 5Ze.

Table 3. Japanese catch in Subarea 5, 1968-72.

	1968	1969	1970	1971	1972 <sup>1</sup>
Hours fished	540	8,216	9,310	9,220	
Total catch (tons)	724	8,789	10,722	15,340	12,538
Cod	2	45	15	20	96
Haddock	3	9	1	10	-
Redfish	-	61	19	4	15
Silver hake	52	229	73	103	115
Red hake	-	-	1	7	186
White hake	-	-	158	109	156
Flatfishes	2	79	138	9	6
Herring	1	527	1,222	2,434	1,159
Mackerel	1	197	463	272	209
Butterfish	328	1,291	1,724	973	1,396
Argentine	-	976	368	5,398	97
Squids	113	3,902	5,086	4,661	7,862
Other species	222	1,473	1,454	1,340	1,241

<sup>1</sup> Preliminary

B. SPECIAL RESEARCH STUDIES

1. Biological Studies

Length measurements were carried out on cod, silver hake, herring, mackerel, argentine, butterfish and common American squid.

a) Common American squid. Stock assessment for Subarea 5 combined with Stat. Area 6 was made on the basis of daily catch records by Japanese trawlers throughout four seasons from 1968-69 to 1971-72. The results of this analysis is presented in Res.Doc. 73/62.

b) Butterfish. Otoliths of the fish caught in Subarea 5 and Stat. Area 6 were prepared for age determination.

Statistical Area 6

A. STATUS OF THE FISHERIES

The Japanese catch in this area increased from 12,550 tons in 1971 to 16,300 tons in 1972. Among the main species caught by Japanese trawlers, there was a substantial increase in squid and a decrease in butterfish.

Table 4. Japanese catch in Stat. Area 6, 1968-72.

	1968	1969	1970	1971	1972 <sup>1</sup>
Hours fished	4,056	8,623	16,112	12,917	
Total catch (tons)	6,536	8,133	18,933	12,551	16,277
Silver hake	30	44	255	41	90
Red hake	-	-	2	7	203
White hake	-	-	58	105	328
Mackerel	311	326	1,036	753	895
Butterfish	3,198	2,010	6,897	4,795	2,265
Squids	1,619	3,805	8,275	5,941	10,829
Other species	1,378	1,948	2,410	909	1,667

<sup>1</sup> Preliminary

B. SPECIAL RESEARCH STUDIES

See special research studies for Subarea 5.



NORWEGIAN RESEARCH REPORT, 1972

by

Ø. Ulltang

Subareas 1-3

A. STATUS OF THE FISHERIES

From 1971 to 1972 there was a marked increase in the fishing effort by Norwegian vessels in Subarea 1 and a corresponding increase in catch. In Subareas 2 and 3 the activity decreased from 1971 to 1972. These changes are illustrated in Table 1.

Table 1. Total catch and effort for 1971 and 1972<sup>1</sup>.

Subarea	Days fished, trawlers		Catch trawlers (metric tons)		Total catch (metric tons)	
	1971	1972	1971	1972	1971	1972
1	206	767	2338	21488	7893	33001
2	259	49	5556	1111	5556	2345
3	71	24	2187	362	21178	6142
Total	536	840	10081	22961	34627	41488

<sup>1</sup> Preliminary.

In Subarea 1 an expanding fishery for deep-sea prawn gave catches of 984 tons in 1972. Except for this development, the species composition of the total catch did not change significantly from 1971 to 1972 (Table 2).

Table 2. Catch (metric tons) by species and subareas, 1972 (provisional data).

Subarea	Cod	Redfish	Halibut	Greenland halibut	Deep-sea prawn	Salmon
1	32086	46	13	14	984	158
2	1105	4	112	1387	-	-
3	6141	1	-	-	-	-
Total	39332	51	125	1401	984	158

B. SPECIAL RESEARCH STUDIES

1. Biological Studies

a) No length or age sampling of commercial catches was carried out.

b) Capelin. Capelin investigations were carried out on a survey with R/V *Johan Hjort* in Newfoundland waters 17 May to 19 June 1972. The research vessel was accompanied by 3 purse seiners. A more detailed report on the results is given in a research document by O. Dragesund and T. Monstad (ICNAF Res.Doc. 73/33, Serial No. 2967). The aim of the survey was to gain more knowledge about the distribution and migration of the capelin, the structure and size of the resource and the catchability, particularly of the mature stock prior to and during the spawning season.

Capelin were distributed over large areas on the Grand Banks from the ice edge to the tail of the bank. The highest concentrations were found in the northern part and the Southeast Shoal. The 1969 year-class dominated the mature part of the stock, followed by the 1968 year-class. The behaviour of capelin off Newfoundland during the spawning migration apparently is different from that observed for the Barents Sea capelin. No dense shoals were observed during the spawning migration on the Grand Banks towards the Southeast Shoal. The mature capelin gradually approached the spawning grounds in rather small shoals. In May no suitable shoals for purse-seining were found. However, from the first week of June onwards, purse-seining might be a possibility, as concentrations become denser at the Southeast Shoal. Spawning started in the middle of June.

On the basis of echo-integrator readings, the total abundance of capelin in the area covered was estimated to be about 800,000 tons. The recorded abundance may be only a small part of the total resource off Newfoundland and Labrador. In order to obtain more information on the resource, research has to be carried out further north along the coast throughout the summer and early autumn.

### Harp and Hood Seals

#### A. STATUS OF THE FISHERIES

Status of the fisheries is reviewed in the Report of a Mid-Term Meeting of Panel A, Charlottenlund, Denmark, 9 November 1972 (Summ.Doc. 73/4, Serial No. 2906).

#### B. SPECIAL RESEARCH STUDIES

##### 1. Biological Studies

In 1972 harp and hood seals were studied on the Front off Newfoundland-Labrador on board a commercial sealer during the sealing season from 12 March to 24 April. Ice-edges and the distribution of seals were plotted and 26 hood seal pups and 61 harp seal pups were tagged. One young harp seal was recaptured in Disko Bay, West Greenland, in late September. This is the third young harp seal tagged by Norway off Newfoundland which has been recaptured in West Greenland in the autumn of the year it was tagged. A hood seal tagged at Newfoundland in 1971 was recaptured in southern West Greenland in April 1972 and a hood seal tagged at Newfoundland in 1970 was recaptured in the Angmagssalik Fiord in East Greenland in late July 1972. This is the first recovery near the moulting area in the Denmark Strait of a hood seal from Newfoundland.

Dated and sexed material for age analysis was collected from 747 hood seals. Additional age material was collected from 255 hoods and 149 harps by sealers. Material for studies of reproductive performance was collected from 156 hood seals. A total of 148 harp seal pups were weighed and measured.

POLISH RESEARCH REPORT, 1972

by

E. Stanek

Total Polish catches in the ICNAF Area (Subareas 1 to 5) increased slightly from 173,404 tons in 1971 to 174,182 tons in 1972. This was due to increased mackerel catches in Subarea 5 and cod catches in Subarea 3 and to a lesser extent to flatfish catches, but these increases were nearly offset by a considerable decrease in the herring catch in Subarea 5 and redfish in Subarea 3 (Table 1).

Table 1. Polish catches (tons) in the Northwest Atlantic, 1971 and 1972.

Species	1971				1972			
	SA 1-5	SA 6	Total	%	SA 1-5	SA 6	Total	%
Cod	29,365	101	29,466	10.9	42,159	97	42,256	15.8
Redfish	8,444	3	8,447	3.1	3,182	4	3,186	1.2
Flatfish	11,978	-	11,978	4.4	14,528	2	14,530	5.4
Other gro'fish	420	177	597	0.2	703	235	938	0.4
Herring	69,086	19,242	88,328	32.9	41,252	8,368	49,620	18.6
Mackerel	43,684	68,612	112,296	41.7	61,731	80,513	142,244	53.3
Other pelagics	26	27	53	+	21	1	22	+
Other fish	10,401	8,016	18,417	6.8	5,564	3,318	8,882	3.3
Shellfish, etc.	-	-	-	-	5,042	386	5,428	2.0
Total	173,404	96,178	269,582	100.0	174,182	92,924	267,106	100.0

In Stat. Area 6 the 1972 total catch of 92,924 tons was slightly less than the 1971 catch of 96,178 tons. More than 80% of the Stat. Area 6 catches consisted of mackerel (Table 1).

In the Northwest Atlantic as a whole (Subareas 1-5 and Stat. Area 6) the Polish total catch of 267,106 tons in 1972 was only slightly less than the 1971 catch of 269,582 tons. Increases were recorded for cod and mackerel, while the herring catch decreased significantly.

In 1972, 31 factory trawlers, 8 large freezer trawlers (3100 GT), 13 smaller freezer trawlers (1900 GT), 14 side motor trawlers and 35 side steam trawlers operated in the Northwest Atlantic fishery. Factory trawlers operated mainly in Subareas 2 and 3 and the freezer trawlers in Subarea 5 and Stat. Area 6. Side trawlers operated together with motherships as in previous years.

Subarea 1

A. STATUS OF THE FISHERIES

The Polish fleet does not usually operate in Subarea 1. However, in 1972 one factory trawler operated mainly in Div. 1C for 24 days in the autumn. The catches are shown in Table 2.

Table 2. Polish catches (tons) in Subarea 1 in 1972.

Div.	Greenland halibut	Grenadier	Total
1C	140	118	258
1D	7	17	24
1E	-	-	-
Total	147	135	282

B. SPECIAL RESEARCH STUDIES

No investigations were carried out in this subarea during 1972.

Subarea 2

A. STATUS OF THE FISHERIES

Twenty-four factory trawlers operated in this subarea, mainly in Div. 2J but with some fishing in Div. 2H. In Div. 2J the catches were taken mostly in January, and in Div. 2H mostly in January and August. Early in February the trawlers had to withdraw from these divisions, due to the appearance of drift ice, and they shifted to Div. 3K. After the ice moved in April, trawlers operated in Div. 2J again for a short period. During May to July Polish trawlers did not fish in Subarea 2, but fishing started again in August. Cod was the most important species taken. The composition of the catches is shown in Table 3.

Table 3. Polish catches (tons) in Subarea 2 in 1972.

Div.	Cod	Redfish	Flatfish <sup>1</sup>	Other species	Total
2H	2,792	65	1,319	61	4,237
2J	16,422	483	2,737	76	19,718
Total	19,214	648	4,056	137	23,955

<sup>1</sup> Mainly Greenland halibut.

The best fishing yields were obtained in January, February and April. In Div. 2H the yield reached 36.4 tons per day in January. In Div. 2J the yields were 37.3 tons per day in January, 27.6 tons in February, 11.7 tons in March, 27.0 tons in April and 17.3 tons in December. During other months the yields were lower. In general, however, the fishing yields in 1972 were slightly higher than those in 1971.

B. SPECIAL RESEARCH STUDIES

1. Cod

Investigations were carried out on factory trawlers. In January and February, 12,526 cod were measured in Div. 2J and 1,250 otoliths were taken for age determination. The lengths of cod ranged from 24 to 89 cm and their ages from 3 to 19 years. The mean length was 46.5 cm and mean age 5.9 years. Cod in the length range of 36-56 cm were most frequent in the catches (78.5%) and the ages were 5-7 years (1967, 1966 and 1965 year-classes) with a predominance of 5 year old fish (39.0%). However, cod of the 1968 year-class were relatively numerous.

2. Redfish

In Div. 2J 1,300 redfish (*mentella*-type) were measured in March and 200 otoliths read for age. The length range was 20-52 cm and the age range was 5-33 years. The most numerous redfish in the catches were 35-48 cm in length and 15-28 years old. The mean length was 41.3 cm and mean age was 20.5 years.

Subarea 3

A. STATUS OF THE FISHERIES

In the period January to April and June to October 26 factory trawlers operated in this subarea, with the best catches in January, February and June. Fishing was carried out mostly in Div. 3K. Catches were considerably less in Div. 3L, M, N and O where fishing occurred mainly in March, April and August.

Cod was the most important species taken followed by considerably smaller catches of flatfish and redfish (Table 4).

The mean yields-per-day in Div. 3K were 35.0 tons in January, 19.5 in March, 18.2 in May, 33.0 in June, 19.5 in July, 20.5 in August, 14.9 in September and 11.5 in October. The fishing yields in 1972 were

in general higher than in 1971, especially those in January and June.

Table 4. Polish catches (tons) in Subarea 3 in 1972.

Div.	Cod	Redfish	Greenland halibut	Other flatfish	Other species	Total
3K	21,809	1,488	3,481	3,989	20	30,787
3L	897	94	182	1,617	1	2,791
3M	35	960	-	8	-	1,003
3N	19	-	1	1,054	-	1,074
3O	10	26	-	2	-	38
3Ps	-	-	-	-	-	-
Total	22,770	2,568	3,664	6,670	21	35,693

## B. SPECIAL RESEARCH STUDIES

### 1. Environmental Studies

a) Hydrography. Observations were carried out in Div. 3K and 3L during 2-21 September 1972. They included measurements of temperature, salinity, oxygen and phosphate-phosphorus content. The surface water temperature ranged from 5 to 14°C. At a salinity of 31.5‰, the water temperature was higher in the south and usually 5°C lower in the north (51°30'N). The lowest salinity (<31.0‰) was noted on the border line of Div. 3K and 3L. The oxygen content in the surface layer was 7 ml/l, at 20-50 m was 12 ml/l, and in the bottom layer was 7.0-9.5 ml/l. The highest concentration of phosphate-phosphorus (2.5-3.0 µg atom P/L) was observed in the northern part of Div. 3L.

### 2. Biological Studies

a) Cod. In Div. 3K 13,197 fish were measured and 1,359 otoliths read for age. The lengths ranged from 27 to 89 cm and ages from 4 to 20 years. The main component in the catches were cod in the 33-62 cm length range (85%) and in the 5-7 age range. The 1965, 1966 and 1967 year-classes were the dominant ones with the last two (6- and 5-year-old fish) being the most numerous. The mean length of cod in the samples was 50.2 cm and the mean age 6.7 years. The number of cod caught per hour in February 1972 averaged 2,152 fish, whereas in the same month in 1971 and 1970 corresponding catches were 226 and 1,264 fish per hour. The catch (in numbers) of the most important year-classes in 1972 were 446, 608 and 657 fish per hour of the 1965, 1966 and 1967 year-classes respectively.

In Div. 3L only 1,746 fish were measured and 200 otoliths read for age. The length ranged from 21 to 83 cm and age from 2 to 16 years. The most numerous cod were in the 33-44 cm length range and 4-5 age range (1968 and 1967 year-classes respectively). The mean length of cod in the samples was 40.8 cm and the mean age was 4.8 years.

In the 7-21 September period young cod were fished in Div. 3K in order to estimate their abundance. However, no conclusions could be drawn from this survey, as young cod were very scarce in the catches. This period would seem to be too late in the season for evaluating the abundance of young cod on the fishing grounds.

b) Redfish. In Div. 3K 6,040 redfish (*mentella*-type) were measured in February and March and 850 otoliths read for age. Lengths ranged from 20 to 56 cm and ages from 6 to 35 years. The mean length of redfish was 38.2 cm and the mean age 17.6 years.

c) Greenland halibut. In Div. 3K 971 fish were measured in March. The length range was 37-91 cm with fish of 37-57 cm being the most numerous. The mean length was 49.4 cm.

d) Witch. In Div. 3K 2,446 witch were measured in March and April and 200 otoliths read. The length ranges were 21-67 cm with fish of 43-48 cm being the most numerous. The mean length was 46.6 cm.

e) American plaice. In Div. 3K 670 fish were measured in April and 170 otoliths read for age. The length range was 20-56 cm and the age range was 4-18 years. The most numerous component in the catches were fish of 30-38 cm and 6-9 years old. The mean length was 33.3 cm.

In Div. 3L 1,500 fish were measured and 100 otoliths read for age. The length range was 20-65 cm and the age range was 6-20 years. However, fish of 38-53 cm and 13-15 years were the most numerous. The

mean length was 41.2 cm.

f) Shrimp. Shrimp occurring in the catches in Div. 3K during 7-21 September 1972 were measured. Carapace lengths of 6,442 shrimp were measured, the range being 7-30 mm.

#### Subarea 4

##### A. STATUS OF THE FISHERIES

In this subarea the fishery was carried on by only 8 vessels (4 factory trawlers, 2 smaller freezing trawlers and 2 side steam trawlers). In Subdiv. 4Vn and 4Vs the catches consisted of mostly redfish, whereas in Div. 4W some mackerel were taken. The catches are shown in Table 5.

Table 5. Polish catches in Subarea 4 in 1972.

Vessel type	Div.	Redfish	Herring	Mackerel	Other species	Total
Factory trawlers	4Vn	20	-	-	4	24
	4Vs	45	-	-	-	45
Freezer trawlers (1900 GT)	4W	-	-	243	60	303
Steam side trawlers	4W	-	28	2	-	30
<b>Total</b>		<b>65</b>	<b>28</b>	<b>245</b>	<b>64</b>	<b>402</b>

Fishing for redfish in Subdiv. 4Vs took place mainly in March and October. The yields were as follows: 1,733 kg/hr in March, 1,250 kg/hr in October and 359 kg/hr in November. In Div. 4W mackerel was fished almost exclusively in January.

##### B. SPECIAL RESEARCH STUDIES

###### 1. Environmental Studies

a) Hydrography. Observations were carried out in Div. 4X during 21-24 September 1972. They included measurements of temperature, salinity, oxygen and phosphate-phosphorus content. The data showed a lack of hydrographic contrasts throughout the subarea. The temperature of the water layers from the surface to the bottom were generally below 10°C. The salinity of the surface water ranged from 32.5‰ in the western part to 32.0‰ and below on Browns Bank. In the bottom layer the salinity values were usually lower than 33‰. The oxygen content in the surface water of the coastal region was 7 ml/l and towards the open ocean oxygen values were higher. The phosphate-phosphorus values were 1.00-1.25µg atom P/L. Only in the eastern part were the values slightly higher.

b) Plankton. Within the ICNAF program of coordinated researches, observations on the distribution of herring larvae were carried out in Div. 4X. The samples were taken by the 61 cm Bongo net. The larvae had a mean length of 26 mm. It would appear that the spawning of herring in this area started during the summer.

The plankton biomass was estimated at 107 cm<sup>3</sup>/m<sup>3</sup>. The main components of the zooplankton were *Copepoda*, *Euphausiidae*, *Amphipoda* and *Chaetognatha*.

###### 2. Biological Studies

No other biological studies were carried out in this subarea.

#### Subarea 5

##### A. STATUS OF THE FISHERIES

The catches by Polish vessels in this subarea in 1972 are shown in Table 6.

Table 6. Polish catches (tons) in Subarea 5 in 1972.

Vessel type	Div.	Cod	Herring	Mackerel	Other species	Total
Factory trawlers	5Ze	4	11,703	14,621	269	26,597
	5Zw	-	437	8,192	167	8,796
	5Y	-	48	129	-	177
Freezer trawlers (3100 GT)	5Ze	51	10,079	8,846	4,708	23,684
	5Zw	-	360	6,984	793	8,137
Freezer trawlers (1900 GT)	5Ze	8	13,805	18,244	3,635	35,692
Side motor trawlers	5Ze	51	481	875	584	1,991
Side steam trawlers	5Ze	45	3,732	2,112	612	6,501
	5Zw	15	527	1,474	197	2,213
	5Y	-	52	9	1	62
Total		174	41,224	61,486	10,966	113,850

Fishing operations on herring and mackerel were carried out in this subarea during all months except February. The best fishing for herring was during August to December, particularly in September and October, while mackerel were fished with best results in November and December. The yields per unit fishing effort of particular types of vessels are shown in Table 7. The data indicate that factory and freezer trawlers using pelagic trawls had better fishing results in comparison to the catches by side trawlers which used bottom trawls.

Table 7. Yield per unit effort of Polish vessels by month in Subarea 5 in 1972.

Month	Yield per hour (kg)				
	Factory trawlers	Freezer trawlers (3100 GT)	Freezer trawlers (1900 GT)	Motor side trawlers	Steam side trawlers
January	8,796	-	8,461	-	693
February	-	-	-	-	-
March	3,887	-	4,334	-	-
April	3,486	-	2,354	-	-
May	-	-	2,214	-	992
June	-	4,640	2,107	2,428	1,282
July	-	2,443	1,374	3,500	1,421
August	-	3,016	1,466	1,053	1,105
September	1,951	4,326	2,647	1,189	947
October	2,165	4,540	3,102	1,195	1,039
November	3,401	6,329	3,055	1,387	998
December	5,859	7,290	4,414	1,154	-
Mean	3,723	3,972	2,931	1,781	1,071

## B. SPECIAL RESEARCH STUDIES

### 1. Environmental Studies

a) Hydrography. Observations were carried out during 2-28 October 1972 in the region of Georges Bank, near Nantucket and in the Gulf of Maine. The investigations included measurements of temperature, salinity, oxygen and phosphate-phosphorus content. Res.Doc. 73/21 by A. Furtok presents the results of these studies in some detail.

In the Georges Bank area the surface water temperature was 14 to 15°C; only in the eastern part were 12 to 13°C temperatures observed. At greater depths (200-500 m) the range of temperatures was 6-9°C. The salinity, both in surface and bottom layers was about 32.5‰. The oxygen content was 6.5 ml/l, and phosphate-phosphorus varied from 0 to 2µg atom P/L.

In the Nantucket area the surface temperature varied between 15 and 22 °C and the bottom layer at 280 m on the slope area was 8°C. The salinity was 32.0‰, near the coast increasing to 35.5‰ toward the open ocean. Oxygen content in the coastal zone was 6.5-7.5 ml/l, while at greater depths and near the bottom it was 4.0-6.5 ml/l. The phosphate-phosphorus content ranged from 1.0 to 1.5µg atom P/L.

In the Gulf of Maine the surface temperature ranged between 10 and 14°C. At 100-150 m temperatures were 5 to 6°C, while in deeper water 1.5 to 2°C temperatures were recorded. Salinity ranged from 33.0 to 34.5‰ in the bottom layer. The oxygen content at the surface was 7.5 ml/l. Concentrations of phosphate-phosphorus ranged from 1.0 to 1.5µg atom P/L.

b) Plankton. Within the framework of the ICNAF coordinated survey programs a survey on herring larval distribution was carried out during 2-28 October 1972 in Div. 5Y and 5Z at the standard stations (Fig. 1), using the 61 cm Bongo net. A brief summary of the results of the survey is shown in Table 8. A more detailed account is given by S. Grimm in Res.Doc. 73/16.

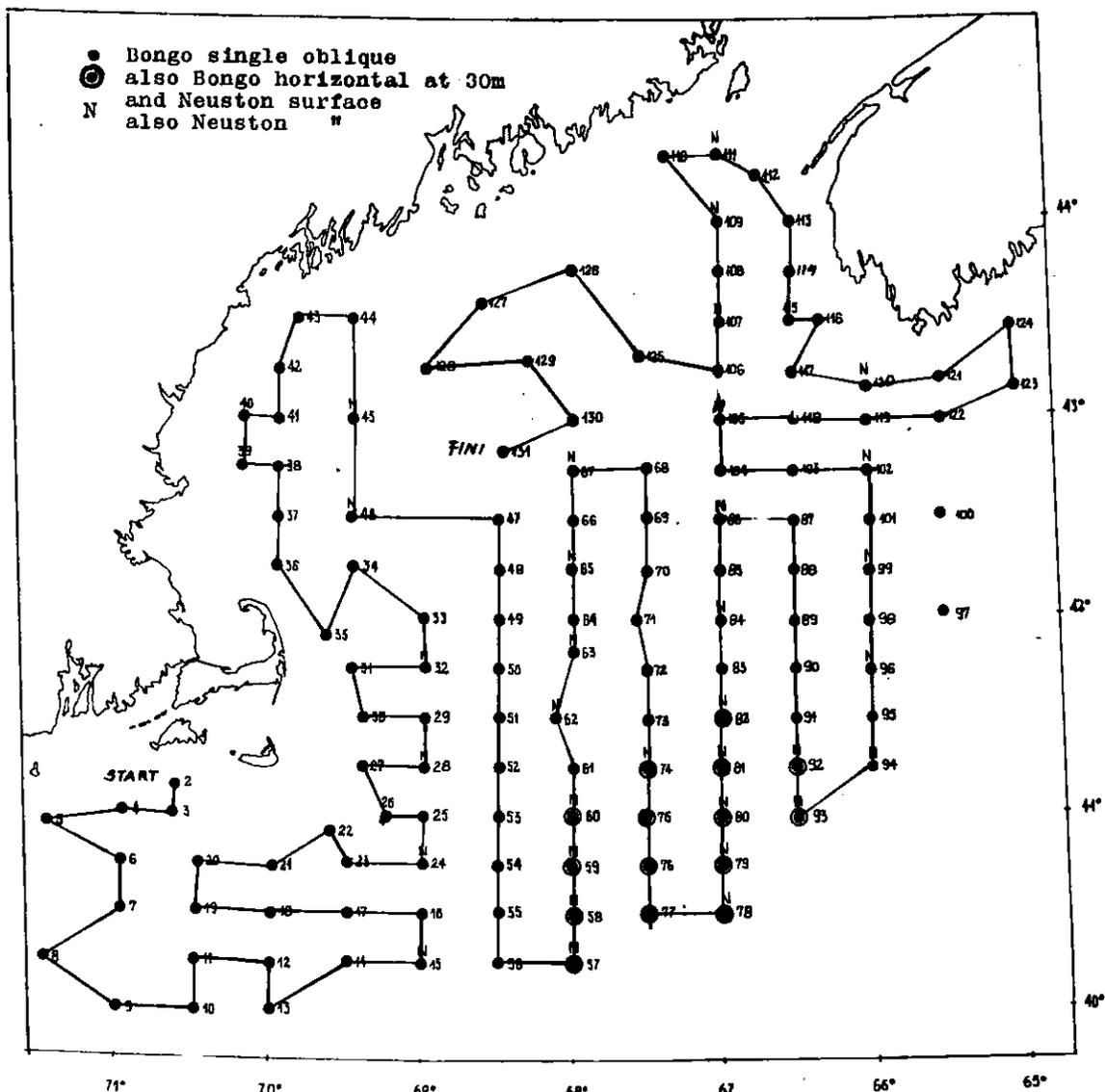


Fig. 1. Cruise tract and ichthyoplankton station ICNAF cooperative larval herring survey, 2-28 October 1972.

Table 8. Percent composition of herring larvae by size group and area in October 1972 survey.

Region	10 mm %	10-15 mm %	15 %	Total number herring larvae
Nantucket Shoals	67.0	30.6	2.4	5,121
Gulf of Maine	10.6	44.3	45.1	99
Georges Bank	25.7	58.6	15.7	4,353

In the Georges Bank area the greatest quantities of herring larvae were detected at stations 83 and 90. Near Nantucket a significant number of larvae was found at station 26 (5 larvae per m<sup>3</sup>). Most of the specimens were in the length range of 6-10 mm, indicating relatively late spawnings.

Herring larvae were observed in the coastal zone in the Gulf of Maine but none in the central part of the Gulf.

## 2. Biological Studies

a) Herring. Biological studies included the measurement of 23,379 herring and the collection of 2,510 otoliths for ages. Size varied considerably depending on the fishing ground. In the western part of the Gulf of Maine (Div. 5Y near Cape Cod), herring ranged from 20 to 38 cm in August and September, with a predominance of 20-24 cm fish. In September herring taken on the grounds between 40°30' and 40°20'N and between 68°45' and 69°30'W ranged from 30 to 37 cm, most of which were 30-33 cm long.

Catches consisted mostly of 1965, 1966 and 1967 year-classes, with those of 1968 and 1969 being quite poor. On the Cape Cod grounds 2-year-old herring (1970 year-class) made up 89% of the catches, but in the Georges Bank spawning area the samples consisted of older fish (5 and 6 years). Table 9 shows the relative importance of the various year-classes in Subarea 5 and Stat. Area 6.

Table 9. Year-class composition of herring in the catches in Subarea 5 and Stat. Area 6 in 1972.

	Year-classes								Total	
	1970	1969	1968	1967	1966	1965	1964	1963		1962
Millions of fish	19	13	24	58	42	32	15	12	6	221
%	86	59	108	261	189	144	68	58	27	

b) Mackerel. In Subarea 5 a total of 6,143 mackerel were measured and 1,591 otoliths taken for age readings. The lengths ranged from 28 to 49 cm and the ages from 2 to 10 years. The mean length was 35.2 cm. Fish in the 34-39 cm length group dominated in the catches; these were mostly 6 and 7 year old fish (1966 and 1965 year-classes). Table 10 shows the relative age compositions in Subarea 5 in 1972.

Table 10. Age composition of mackerel catches in Subarea 5 in 1972.

Year-class	1970	1969	1968	1967	1966	1965	1964	1963	1962	1961
%	76	29	118	50	406	190	83	10	14	24

An increase in mean length of mackerel was observed in the catch between 1970 and 1972. This was due to the abundant 1966 and 1965 year-classes, which were dominant in the catches in 1972. Mackerel stock

estimates are presented separately as a research document (Res.Doc. 73/98).

### Statistical Area 6

#### A. STATUS OF THE FISHERIES

The Polish catch in Stat. Area 6 of nearly 93,000 tons in 1972 consisted of 80,500 tons of mackerel and 8,400 tons of herring (Table 1).

#### B. SPECIAL RESEARCH STUDIES

Research carried out in Stat. Area 6 is included in the section under Subarea 5.

PORTUGUESE RESEARCH REPORT, 1972

by

M. Lima Dias

The total Portuguese cod catch in the ICNAF Area in 1972 was 129,705 tons (Table 1), which was nearly 23,000 tons less than in 1971. The trawl fleet caught 99,831 tons against nearly 20,000 tons by gillnet vessels and 10,000 tons by dory vessels.

Table 1. Portuguese cod catch (metric tons) in the ICNAF Area, 1972.

Subarea	Trawl			Line	Gill	Total
	Side	Stern	Total	Dory vessel	nets	
1	-	-	-	-	8,485	8,485
2	13,428	5,957	19,385	-	-	19,385
3	48,183	20,446	68,629	8,852	11,483	88,964
4	4,239	7,578	11,817	1,054	-	12,871
Total	65,850	33,981	99,831	9,906	19,968	129,705

Side and stern trawlers fished in Subareas 2, 3 and 4 taking a total of nearly 100,000 tons over all quarters of the year. The best fishery occurred in Subarea 3 (68,629 tons) and the best catches were recorded in the second quarter of the year with the lowest catches in the fourth quarter. In 1972 nearly two thirds of the trawl catch was taken by side trawlers (65,850 tons) against 33,981 tons by stern trawlers. Relative to 1971 the trawl fleet catch in 1972 was nearly 24,000 tons less, the greatest difference being in the side trawl catch (19,000 tons).

The gillnet fishery took place in Subareas 1 and 3 with landings of 8,485 and 11,483 tons respectively. In Subarea 1 the fishery occurred in the second and third quarters (June-August), but the season extended over all four quarters in Subarea 3. In 1972 the gillnet fleet consisted of a higher number of vessels than in 1971, and this was expressed by an increase in catch from 12,000 tons in 1971 to nearly 20,000 tons in 1972. For the first time in 1972 the catch by gillnets exceeded that by dory vessels.

The dory vessel fishery took place only in Subareas 3 and 4 with catches of 8,852 and 1,054 tons respectively, against a total dory vessel catch of 17,000 tons in 1971. The dory vessel fleet is gradually being converted to gillnet fishing, and the disappearance of dory vessel fishing is eminent in the near future.

This report, in addition to reviewing the status of the fisheries, presents data on length, age, maturity and probable age at first maturity, obtained from random sampling on board of a commercial gillnet vessel. Detailed information on length and age samples are included in the ICNAF Sampling Yearbook.

Subarea 1

A. STATUS OF THE FISHERIES

Only the gillnet fleet fished in this subarea taking 374 and 8,111 tons of cod in the second and third quarters respectively (Table 3). The fishery took place in Div. 1B, C, D and E with the best results in 1C and D (Table 2). The most productive months were July and August

Table 2. Cod catch (tons) and effort of the Portuguese fleet by divisions and type of fishing in 1972.

Div.	Dory Vessel		Gillnet		Side		Trawl		Total		Total catch
	Tons	Dory hours	Tons	Hours out	Tons	Hours fishing	Tons	Hours fishing	Tons	Hours fishing	
1B	-	-	1,966	1,568	-	-	-	-	-	-	1,966
1C	-	-	2,932	1,973	-	-	-	-	-	-	2,932
1D	-	-	3,515	2,148	-	-	-	-	-	-	3,115
1E	-	-	72	42	-	-	-	-	-	-	72
Total	-	-	8,485	5,731	-	-	-	-	-	-	8,485
2H	-	-	-	-	73	86	100	96	173	182	173
2J	-	-	-	-	13,355	10,784	5,857	4,234	19,212	15,018	19,212
Total	-	-	-	-	13,428	10,870	5,957	4,330	19,385	15,200	19,385
3K	-	-	-	-	3,636	3,486	2,990	1,584	6,626	5,070	6,626
3L	6,751	3,080	1,830	2,315	22,063	26,640	7,456	7,357	29,519	33,997	38,100
3M	131	110	-	-	22,064	23,962	9,555	9,021	31,619	32,983	31,750
3N	1,844	887	6,593	6,688	45	69	-	-	45	69	8,482
3O	-	-	3,055	3,460	-	-	-	-	-	-	3,055
3Pn	17	12	5	10	375	491	445	471	820	962	842
3Ps	109	95	-	-	-	-	-	-	-	-	109
Total	8,852	4,184	11,483	12,473	48,183	54,648	20,446	18,433	68,629	73,081	88,964
4R	-	-	-	-	2,227	1,675	5,773	2,098	8,000	3,773	8,000
4S	-	-	-	-	119	117	494	406	613	523	613
4T	115	63	-	-	216	315	33	33	249	348	364
4Vn	459	225	-	-	1,301	1,539	1,278	1,039	2,579	2,578	3,038
4Vs	480	104	-	-	376	433	-	-	376	433	856
Total	1,054	392	-	-	4,239	4,079	7,578	3,576	11,817	7,655	12,871
Grand total	9,906	4,576	19,968	18,204	65,850	69,597	33,981	26,339	99,831	99,936	129,705

Table 3. Cod catch (tons) and effort by Portuguese trawl, gillnet and dory vessel fleets in 1972.

Gear	Sub-area	Quarter 1		Quarter 2		Quarter 3		Quarter 4		Total	
		Catch	Effort <sup>1</sup>	Catch	Effort <sup>1</sup>						
OTSI	2	3366	2634	4864	2737	23	49	5175	5450	13428	10870
	3	11651	11810	15265	16018	14818	17420	6449	9400	48183	54648
	4	3424	2969	815	1110	-	-	-	-	4239	4079
	Total	18441	17413	20944	19865	14841	17469	11624	14850	65850	69597
OTST	2	1845	1028	1081	658	-	-	3031	2644	5957	4330
	3	5604	4209	8268	6108	5365	6100	1209	2016	20446	18433
	4	6458	2656	1120	920	-	-	-	-	7578	3576
	Total	13907	7893	10469	7686	5365	6100	4240	4660	33981	26339
Trawl Total		32348	25306	31413	27551	20206	23569	15864	19510	99831	95936
GN	1	-	-	374	180	8111	5551	-	-	8485	5731
	3	419	582	4839	5013	4039	3824	2186	3054	11483	12473
	Total	419	582	5213	5193	12150	9375	2186	3054	19968	18204
DV	3	-	-	1637	1293	7215	2891	-	-	8852	4184
	4	-	-	1054	792	-	-	-	-	1054	792
	Total	-	-	2691	1685	7215	2891	-	-	9906	4576

<sup>1</sup> Effort is given in "hours fished" for trawls, "hours out" for gillnets and "dory hours" for dory vessels.

B. SPECIAL RESEARCH STUDIES

Samples for biological study were collected from a gillnet vessel in the second and third quarters of the year in Div. 1C as follows:

Div.	Samples	Date	Depth (m)	No. of cod measured	No. of otoliths
1C	A	8-13 June	146-156	2,314	150
	B	1-26 July	70-146	9,965	375
	C	2-11 August	73-101	3,291	200
	Total			15,570	725

Lengths ranged from 52 to 118 cm; mean lengths were 84.5 cm in sample A (June), 85.2 cm in sample B (July) and 84.5 cm in sample C (August). Ages ranged from 5 to 19 years, with a significant dominance of 7-year-olds followed by 11- and 12-year-olds (Table 4); mean ages were 9.4, 9.5 and 9.1 years in June, July and August respectively. The average length (cm) at age of cod caught by gillnets in June, July and August 1972 are given in Table 4.

Table 4. Age composition and growth of cod sampled from the gillnet fishery in Div. 1C in 1972.

Year-class	Age-group	Second quarter		Third quarter		
		Mean length (cm)		Mean length (cm)		No. of fish
		June	No. of fish	July	August	
1967	V	66	2	60	62	2
1966	VI	67	16	71	71	47
1965	VII	77	39	78	78	175
1964	VIII	82	18	81	80	62
1963	IX	85	9	85	84	37
1962	X	85	14	90	90	38
1961	XI	90	25	90	89	102
1960	XII	94	21	93	93	84
1959	XIII	95	5	97	97	13
1958	XIV	103	1	98	97	8
1957	XV	-	-	96	95	6
1956	XVI	-	-	-	-	-
1955	XVII	-	-	-	-	-
1954	XVIII	-	-	-	-	-
1953	XIX	-	-	112	112	1
			150			575

From a study of the maturity stages of the cod in the samples there was a higher proportion of females in the post-spawning stage than males in each of the three months: 65 and 49% in females and males respectively in June, the corresponding percentages being 83% and 65% in July, and 64% and 55% in August. Other maturity stages were observed in relatively lower proportions: in June both the spawning stage and the developing stage were observed in almost equal proportions in females, whereas in males the spawning stage was found in a much higher proportion than the developing stage; in July females in the developing and the resting or recovering stages were observed with the latter at the low value of 3%, but males consisted of 32% in the resting or recovering stage and 3% in the spawning stage; in August 32% of the females were in the spawning stage and 5% in the resting or recovering stage, compared with 39% of males in resting or recovering stages, 2% in the spawning stage and 4% in the developing stage.

During the study of the ages attempts were made to identify maturity rings on the otoliths. While many of the otoliths did not permit definitive conclusions, some of the better ones showed the age at first maturity as 6, 7 and 8 years but mainly ages 6 and 7.

Subarea 2

A. STATUS OF THE FISHERIES

As in 1971, only trawlers fished in this subarea, and they landed a total of 19,385 tons of cod (13,428 tons by side trawlers and 5,957 tons by stern trawlers) (Table 1). The fleet operated in Div. 2H and J with most of the catch being taken in the latter division (Table 2). Some fishing occurred in all four quarters of the year but the highest landings were recorded for the fourth quarter (8,206 tons) followed by the second (5,945 tons) and the first (5,211 tons) (Table 3).

B. SPECIAL RESEARCH STUDIES

No sampling or other studies were carried out in this subarea during 1972.

Subarea 3

A. STATUS OF THE FISHERIES

The Portuguese cod fishery was most intensive in this subarea with 68,629 tons landed by trawlers, 11,483 tons by gillnet vessels and 8,852 tons by dory vessels, the total cod catch being about 89,000 tons, or 68.6% of the total Portuguese cod catch in the ICNAF Area.

The catch by the trawl fleet was about 2,000 tons lower than in 1971. The fleet operated in Div. 3K, L, M, N and Subdiv. 3Pn with by far the best fishing in Div. 3L (29,519 tons) and Div. 3M (31,619 tons) (Table 2). Seasonally the best catches occurred in the second quarter (23,533 tons) followed by the third quarter (20,183 tons), the first quarter (17,255 tons) and the fourth quarter (7,658 tons) (Table 3).

The gillnet fishery took place mainly in Div. 3L (1,830 tons), 3N (6,593 tons) and 3O (3,055 tons), the total cod catch for the subarea being 11,483 tons (Table 2). Seasonally the best catches occurred in the second and third quarters (4,839 and 4,039 tons respectively) (Table 3). The best monthly catch occurred in June (3,198 tons) followed by September (2,741 tons).

The dory vessel fishery (8,852 tons in the subarea) was carried out mainly in Div. 3L (6,751 tons) followed by Div. 3N (1,844 tons). Of the total, 7,215 tons were taken in the third quarter.

B. SPECIAL RESEARCH STUDIES

Samples for biological study were collected from the gillnet fishery in Div. 3L, 3O and Subdiv. 3Ps as follows:

Div.	Samples	Date	Depth (m)	No. of fish measured
3L	A	23 August	73	50
3L	B	4-30 September	27-55	784
3L	C	2 October	27	665
Total				1,499
3O	D	31 May	82	50
3O	E	2-10 June	70-128	2,485
3O	F	21-31 August	71-75	1,057
3O	G	1-25 September	70-75	4,213
Total				7,805
3Ps	H	26-27 August	97	552
Subarea 3 Total				9,856

Length of cod ranged from 49 to 133 cm; mean lengths of cod in the Div. 3L samples ranged from 82.4 to 93.7 cm in the Div. 3L samples, 89.7 to 100.1 cm in the Div. 3O samples, and 87.4 in the Subdiv. 3Ps sample (Table 5).

Table 5. Length composition (%) of cod sampled in Subarea 3 in 1972.

Length (3 cm)	3L			30				3Ps
	Aug (A)	Sep (B)	Oct (C)	May (D)	Jun (E)	Aug (F)	Sep (G)	Aug (H)
49	-	-	2	-	1	-	-	-
52	-	-	3	-	-	-	-	-
55	-	-	6	-	2	-	-	4
58	-	-	6	-	1	-	-	11
61	-	-	8	-	4	-	-	16
64	-	6	14	-	2	-	-	24
67	-	33	41	20	9	-	-	27
70	20	64	90	-	43	10	7	36
73	40	112	107	40	44	25	14	62
76	-	131	110	40	88	45	30	69
79	100	140	126	60	109	63	46	127
82	160	105	110	160	97	61	54	98
85	-	83	98	140	95	55	54	63
88	100	86	72	80	81	71	65	71
91	60	55	41	100	62	80	62	58
94	40	47	21	100	59	80	56	63
97	100	32	29	60	58	80	54	38
100	80	36	24	-	42	89	67	54
103	40	15	21	20	33	88	83	36
106	60	10	14	-	30	65	71	34
109	120	18	24	60	30	55	78	24
112	60	10	9	60	31	46	67	15
115	-	5	14	20	29	42	60	24
118	20	6	8	20	27	34	56	22
121	-	3	6	-	8	6	33	9
124	-	3	2	-	11	6	22	9
127	-	-	-	20	4	-	14	4
130	-	-	-	-	2	1	9	4
133	-	-	-	-	1	-	1	-
136	-	-	-	-	-	-	-	-
Total	1,000	1,000	1,006	1,000	1,003	1,002	1,003	1,002
Mean length	93.7	83.3	82.4	90.8	89.7	95.7	100.1	87.4

#### Subarea 4

##### A. STATUS OF THE FISHERIES

Portuguese vessels landed a total of 12,871 tons of cod from this subarea with 11,817 tons by trawls, and 1,054 tons by dory vessels (Table 1).

The trawl fishery took place mainly in Div. 4R (8,000 tons) followed by Subdiv. 4Vn (2,579 tons) (Table 2). Seasonally most of the fishing occurred in the first quarter (9,882 tons) (Table 3). The dory vessel catches were taken mostly in Div. 4V during the second quarter of the year.

##### B. SPECIAL RESEARCH STUDIES

No sampling or other studies were carried out in this subarea in 1972.



SPANISH RESEARCH REPORT, 1972

by

J. Rucabado, E. Lopez-Veiga and M. G. Larrañeta

The total catch by Spanish otter and pair trawlers in Subareas 1-5 and Stat. Area 6 in 1972 was 233,685 tons, a decrease of 35,500 tons from 1971. Cod constituted the bulk of the catch (218,000 tons), followed by squids (7,662 tons) and haddock (5,594 tons). Except for squids, which were caught in a specialized fishery in Subarea 5 and Stat. Area 6, the remaining catches were taken in the cod fisheries in Subareas 1-5.

Table 1. Spanish nominal catches by species in Northwest Atlantic, 1970-72.

Species	1970	1971	1972 <sup>1</sup>
Cod		254,188	218,159
Haddock		7,876	5,594
Flatfish		1,054	30
Pollock		1,378	1,013
Squids		4,197	7,662
Other species		446	1,227
-----			
Total		269,139	233,685

<sup>1</sup> Preliminary

The most important codfishing grounds are in Subarea 3 where 72% of the cod were caught, followed by Subarea 4 (18%), Subarea 1 (6%) and Subarea 5 (3%). The pattern of fishing by subarea was very similar to that in 1971. However, in all subareas the 1972 cod catches were somewhat less than in 1971 (Table 2).

Table 2. Spanish nominal catches of cod by subareas, 1970-72.

Subarea	1970	1971	1972 <sup>1</sup>
1		22,086	12,949
2		5,612	1,664
3		169,458	157,589
4		49,413	39,254
5		7,619	6,700
6		-	3
-----			
Total		254,188	218,159

<sup>1</sup> Preliminary

Subarea 1

A. STATUS OF THE FISHERIES

The main fishing activity in 1972 took place in Div. 1C and 1D (5,817 and 6,021 tons of cod respectively) which accounted for 91% of the cod taken in the subarea. In 1971 nearly 20,000 tons were taken in those two divisions.

B. SPECIAL RESEARCH STUDIES

No sampling or other research studies were undertaken.

Subarea 2

A. STATUS OF THE FISHERIES

The Spanish fishery in this subarea was small (1,664 tons in 1972 against 5,612 tons in 1971). All of the 1972 catch was taken in Div. 2J.

B. SPECIAL RESEARCH STUDIES

No sampling or other research studies were carried out.

Subarea 3

A. STATUS OF THE FISHERIES

This is by far the most important subarea as far as the Spanish cod fishery is concerned (157,600 tons in 1972 against 169,500 tons in 1971). Catches by division were 54,100 in Div. 3L, 42,600 in Div. 3O, 33,700 in Div. 3N, 18,500 in Subdiv. 3Ps and the remainder from Div. 3K, 3M and Subdiv. 3Pn. The haddock catch in the subarea was 2,399 tons, against 3,191 tons in 1971.

B. SPECIAL RESEARCH STUDIES

During 1972 cod sampling was carried out in both Subareas 3 and 4 from the side trawler *Solano* (1358 GRT). A total of 10,372 cod were measured and 508 taken for age determination.

In Subarea 3 samples were taken in the latter part of the first quarter and in late summer (3rd quarter); divisions sampled were Div. 3L, 3M and Subdiv 3Ps.

Length frequencies of the combined Subarea 3 data by quarters are given in Table 3. The mean age of all samples was about 5.5 years, the main contribution being the 1968 year-class followed by the 1966 and 1967 year-classes. The contributions of recent year-classes in the past 3 years are given in Table 4.

Table 3. Length frequencies (%), Subarea 3, by quarters, 1972.

Length Group (cm)	Quarters	
	I	III
27-29	-	2
30-32	1	18
33-35	8	41
36-38	18	62
39-41	39	76
42-44	53	94
45-47	64	94
48-50	79	88
51-53	95	97
54-56	165	90
57-59	154	86
60-62	111	76
63-65	83	55
66-68	51	37
69-71	56	32
72-74	17	23
75-77	3	15
78-80	2	8
81-83	-	3
84-86	1	3

Table 4. Partial year-classes composition (%), 1970-72.

Year of catch	Year-class			
	1965	1966	1967	1968
1970	260	303	96	35
1971	312	267	107	16
1972	70	245	193	263

During winter and spring there seems to be a very high sex segregation which is greater for mature fish (deviations from 50% sex proportion with a probability less than 0.1).

#### Subarea 4

##### A. STATUS OF THE FISHERIES

The 1972 cod catch was 39,250 tons which was 10,150 tons less than in 1971. Over 28,000 tons were taken in Div. 4V, followed by 7,100 tons in Div. 4W, 1,500 tons in Div. 4X and 2,300 tons in Div. 4RST. The haddock catch in this subarea was 3,175 tons.

##### B. SPECIAL RESEARCH STUDIES

At about the same time that cod samples were taken in Subarea 3, they were also taken in Subarea 4 (Div. 4R and Subdiv. 4Vn). Length frequencies of the Subarea 4 data by quarters are given in Table 5.

Table 5. Length frequencies (%), Subarea 4, by quarters, 1972.

Length Group (cm)	Quarters	
	I	III
30-32	6	-
33-35	17	-
36-38	58	19
39-41	89	66
42-44	109	81
45-47	103	99
48-50	114	121
51-53	115	128
54-56	125	114
57-59	97	98
60-62	68	69
63-65	48	74
66-68	28	67
69-71	11	43
72-74	4	16
75-77	5	5
78-80	2	-
81-83	1	-

Age data taken in 1972 give a mean age of the 1972 Spanish otter trawl catch of 5.5 years; however, the mean age was lower at 4.8 years in late summer (September) (Table 6). In late winter the modal age was 6 years (1966 year-class) but in late summer the 1968 year-class (age 4) was the dominant one. Overall the 1966, 1967 and 1968 year-classes were the most important ones. In September there was a large decrease in the contribution of the 1965 year-class (age 7) compared with February and March.

Table 6. Partial age composition (%.) by months.

Month	Age			
	7	6	5	4
Feb	157	338	148	202
Mar	141	269	259	142
Sep	36	198	256	398

A summary of the year-class composition of catches in 1970-72 is given in Table 7. In 1970, more than 30% of the catch was supplied by age 5 fish (1965 year-class), and the same year-class was the dominant one in 1971. In 1972, age 6 fish (1966 year-class) was the most important contributor, followed by fish of ages 5 and 4 (1967 and 1968 year-classes respectively).

Table 7. Partial year-classes composition (%.), 1970-72.

Year of catch	Year-class					
	1963	1964	1965	1966	1967	1968
1970	186	276	350	179	6	
1971	49	149	355	248	127	47
1972		58	119	268	230	221

Except in early spring, the data show sex deviation from 50:50 ratio. For mature cod, segregation is very high (probability less than 0.1).

USSR RESEARCH REPORT, 1972

by

K. G. Konstantinov and A. S. Noskov

The total USSR catch in the Convention Area in 1972 was 1,053,190 tons (Table 1), 150,979 tons higher than in 1971. The overall USSR catch in the Northwest Atlantic Ocean in 1972 was 1,150,038 tons, 128,326 tons greater than in 1971.

Table 1. Species composition of USSR catches (tons) in the Northwest Atlantic, 1972.

	Nominal catches by statistical areas in 1972						SA 1-5 Total		NW Atlantic Total		
	Baffin	1	2	3	4	5	6	1971	1972	1971	1972
Total	15207	3523	133096	309604	199614	407353	81641	902211	1053190	1017006	1150038
Argentine	-	-	-	105	5412	32610	-	5535	38127	5535	38127
Capelin	-	-	17814	48362	-	-	-	750	66176	750	66176
Atl. halibut	-	-	-	121	-	-	-	241	121	241	121
Gre. halibut	9397	245	5928	4376	-	-	-	9813	10549	10053	19946
Amer. plaice	-	-	4863	16946	3610	439	-	28490	25858	28490	25858
W. flounder	-	-	-	-	617	2517	14	3593	3134	3707	3148
S. flounder	-	-	-	-	-	393	-	843	393	904	393
Yellowtail	-	-	-	11931	445	4813	61	14755	17191	15584	17252
Witch	-	-	569	12204	5207	2533	35	30477	20513	30601	20548
Cod	-	1021	89580	80917	4676	1837	52	111996	178031	111996	178083
Haddock	-	-	-	342	116	141	-	1425	599	1425	599
Pollock	-	-	-	60	2452	1043	-	2322	3555	2322	3555
White hake	-	-	-	1749	-	-	-	4588	1749	4588	1749
Red hake	-	-	-	-	1388	56629	14704	27152	58017	35437	72721
Silver hake	-	-	-	-	113774	94151	7735	210148	207925	217209	215660
Grenadier	5577	2164	2867	21157	-	-	-	78287	26188	78882	31765
Redfish	119	24	7500	104841	11858	4639	2	100763	129862	100763	129983
Wolfish	-	-	1943	1761	1	-	-	2596	3705	2596	3705
Sculpins	-	-	-	-	-	4217	2337	1095	4217	1538	6554
Ocean pout	-	-	-	-	4	975	92	3725	979	3911	1071
Scup	-	-	-	-	-	314	359	198	314	570	673
Sea robin	-	-	-	-	-	283	3489	46	283	838	3772
Angler	-	-	-	-	2872	4092	-	17182	6964	17182	6964
Butterfish	-	-	-	-	-	435	1413	400	435	486	1848
Bluefish	-	-	-	-	-	1	-	-	1	16	1
Atl. saury	-	-	-	-	-	3415	-	2144	3415	2144	3415
Herring	-	-	-	-	23961	43764	4564	92951	67725	110306	72289
Alewife	-	-	-	-	160	4645	2048	9014	4805	11289	6853
Mackerel	-	-	-	-	5769	103686	30371	68566	109455	137320	139826
Sharks	-	-	-	-	2452	12486	8364	9045	14938	12042	23302
Skates	-	-	-	370	5241	7957	-	21423	13568	21423	13568
Other fish	114	69	2032	4355	7775	11925	5406	28949	26156	32680	31676
Squid	-	-	-	7	1824	6381	595	12885	8212	13364	8807
Other mollusks	-	-	-	-	-	30	-	814	30	824	30

Subarea 1

A. STATUS OF THE FISHERIES

In 1972 the Soviet catch in this Subarea was 3,523 tons (Table 1). Most of the ships operating there were research and scouting vessels.

E. SPECIAL RESEARCH STUDIES

1. Environmental Studies

As was indicated by the results of hydrological observations made from the research vessel *Perseus III*, water temperature of the Atlantic component of the West Greenland current was lower than in the same period of 1962, 1963 and 1966 (Table 2). The temperature in the Arctic component of the West Greenland current was lower than in 1962 and 1964, roughly at the 1966 level, and higher than in 1963. In November 1972, the water temperature in the northern Davis Strait was also lower than in the same period for a number of previous years (Table 3). The years 1971 and 1972 can be considered to be analogous.

Table 2. Mean water temperature (°C) in the Greenland end of the hydrographic section 8-A in October.

Depth (m)	Atlantic component of W. Greenland current (58°10'W, 47°00'W to 59°25'N, 44°25'W)					Arctic component of W. Greenland current (59°30'N, 44°10'W to 59°35'N, 44°05'W)				
	1962	1963	1964	1966	1972	1962	1963	1964	1966	1972
0-50	6.26	4.71	6.60	6.34	5.16	3.44	0.11	4.56	2.60	2.12
0-200	5.99	5.20	6.43	6.14	5.24	4.10	0.15	4.93	3.08	4.16
200-500	4.86	5.15	5.27	5.86	4.38					

Table 3. Mean water temperature (°C) in section 11-A (between 64°02'N, 52°45'W and 63°10'N, 58°56'W) in November.

Depth (m)	1963	1964	1966	1971	1972
0-50	1.89	3.07	3.62	1.60	1.81
0-200	3.05	4.52	4.80	3.50	3.11
200-500	5.01	5.99	6.13	4.65	4.94

2. Biological Studies

a) Cod. Trawling and biological analysis of cod were carried out on scouting and research vessels. Fish of 40-65 cm were prevalent at 150-300-m depths on the western slopes of Fyllas and Bananen Banks in January (Fig. 1). The results of age determination indicate that the fish of 4, 5 and 6 years (1968, 1967 and 1966 year-classes) were by far the most abundant. In February on the same banks (Div. 1C and D), cod were somewhat larger and older. Individuals of 7 years (1965 year-class) were important in trawl catches. Immature cod actively fed on sandlance, young redfish and various invertebrates. The feeding of immature pre-spawning cod was not intensive. In March mature cod on Bananen Bank contributed substantially to the catches, but, after they left for spawning in April, immature fish of 4 and 5 years became dominant. Large post-spawning cod appeared again on Bananen and Fyllas Banks in May. In Div. 1E of the southern part of the Subarea, mainly immature individuals occurred. Year-classes of 1966 (32%), 1967 (22%), 1968 (19%) and 1965 (14%) were, on the whole, abundant in the trawl catches during the first six months in the Subarea.

b) Grenadier. Mass measurements of roundnose grenadier, *Macrurus rupestris*, were made on board scouting and research vessels between July and September. Hauls were made at 600-800-m depths mainly on the southern slope of the Greenland Canadian sill (Div. 1C). As in previous years, males were more abundant than females and somewhat smaller in size (Table 4).

c) Tagging and return of commercial species. As many as 400 cod were tagged in Div. 1D, and 344 Greenland halibut in Div. 1C. Among the tagged fish caught in 1972, a cod with tag number 208189 is most remarkable. It was released from a USSR scouting vessel on 12 May 1970 at 61°34'N, 50°30'W, and was caught by Danish fishermen on 6 September 1972 at 65°25'N, 52°48'W. When released, its overall length was 56 cm, but when returned it was 85 cm long and weighed 4.9 kg. During the 28 months, the cod grew 29 cm. This period covers three seasons of intensive feeding and growth (May to September).

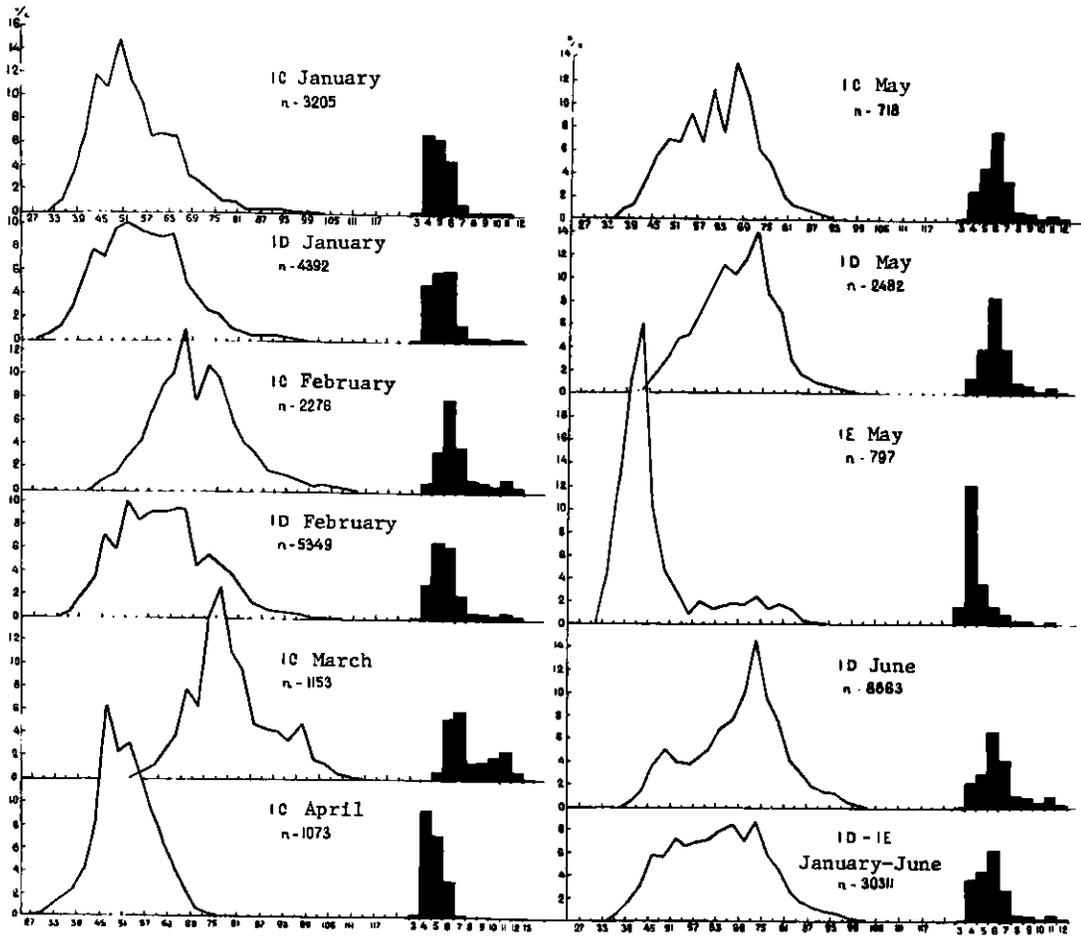


Fig. 1. Age and size composition of cod in Subarea I.

Table 4. Size composition (%.) of grenadier in trawl catches in Subarea 1 in 1972.

Length (cm)	July		August		September	
	Males	Females	Males	Females	Males	Females
<24	-	-	-	-	1	4
24-26	-	-	-	-	2	-
27-29	-	-	-	-	1	1
30-32	-	-	2	2	2	2
33-35	6	2	15	10	5	5
36-38	15	11	24	22	13	18
39-41	20	26	40	45	22	15
42-44	29	20	50	55	34	25
45-47	46	44	62	56	29	25
48-50	61	57	81	66	36	36
51-53	79	54	87	76	68	59
54-56	97	87	104	93	84	66
57-59	151	151	139	129	138	115
60-62	120	118	114	112	153	126
63-65	114	110	93	104	168	162
66-68	87	81	63	82	115	121
69-71	69	72	48	53	52	73
72-74	40	47	34	36	38	56
75-77	34	51	22	27	23	36
78-80	19	26	17	20	11	30
81-83	9	26	4	7	3	10
84-86	3	14	1	4	2	8
87-89	1	3	-	1	-	5
90-92	-	-	-	-	-	1
93-95	-	-	-	-	-	1
No. measured	4,040	1,989	5,704	3,841	2,760	1,707
Mean length (cm)	59.48	61.21	56.93	57.66	59.70	61.54

## Subarea 2

### A. STATUS OF THE FISHERIES

In 1972 the USSR catch in Subarea 2 was 133,096 tons (Table 1), including 89,580 tons of cod, 17,814 tons of capelin, 5,928 tons of Greenland halibut, 7,500 tons of redfish, 2,867 tons of grenadier, 5,432 tons of other flatfish, and a small quantity of wolffish and other bottom species. In the period from February through April, the cod fishery off Labrador was greatly hampered by the severe ice conditions.

As forecast in 1972 (USSR Research Report, *Redbook* 1972, Part II), further improvement of the trawl fishery for cod off Labrador was observed in the spring of 1973. This was the result of recruitment of the strong 1968 year-class into the commercial stock, and of the rise in water temperature on the Labrador Shelf.

In 1974, the total biomass of the Labrador cod stock will remain at quite a high level. Fish of the strong 1968 and 1967 year-classes will be prevalent. The mean length, mean weight and average age of cod will increase to some extent. The future environmental conditions are more difficult to forecast. However, considering the 3-4 year fluctuations in hydrological conditions, it is probable that some rise in water temperature will occur off Labrador in the winter of 1973-1974, as compared to the winter of 1972-1973.

### B. SPECIAL RESEARCH STUDIES

#### 1. Environmental Studies

The standard hydrographic section 8-A was made in late October 1972. At the AB part of this section which traverses the Labrador Shelf between 53°40'N, 55°44'W and 54°50'N, 53°32'W, the water temperature was lower than the average for many years (Table 5).

Table 5. Mean water temperature (°C) at the AB part of the hydrographic section 8-A over Hamilton Bank (on 1 November).

Depth (m)	1964	1965	1966	1967	1968	1969	1970	1971	1972
0-50	0.98	1.30	2.41	2.00	2.29	0.82	1.34	0.88	0.35
50-200	-0.18	1.06	1.44	0.89	-0.18	0.36	0.31	0.43	-0.39
0-200	0.17	1.13	1.72	1.19	0.50	0.50	0.60	0.57	-0.17
200-500	0.98		2.47	0.95	0.31	1.64		1.58	1.19

Estimates obtained by the dynamic method indicated that in 1972 the intensity of the Labrador current in the Hamilton Bank area exceeded that in any previous years. It may have been the increased water flow which caused the negative anomalies in water temperature, and the more expanded drift of floating ice around Labrador (see also ICNAF Res.Doc. 73/43 and 73/44).

## 2. Biological Studies

a) Cod. The length measurements (26,000) obtained during January through June were combined in order to obtain the characteristics of the size composition of cod in Div. 2J. Figure 2 shows that fish of 40-60 cm prevailed in trawl catches. The catches taken in April are most representative as far as the age composition of cod is concerned. Both immature and mature cod concentrate in Div. 2J at this month. The mature cod return from the main spawning grounds located to the north (USSR Research Report, *Redbook* 1972, Part II). Fish aged 5, 6, 7 and 8 years of the 1967, 1966, 1965 and 1964 year-classes were predominant (Table 6). The age of 699 individuals was determined, including 377 males and 322 females.

In 1974 the commercial stock of cod around Labrador will remain abundant because of the strong 1967 and, particularly, 1968 year-classes. Some increase in the mean length, mean weight and mean age of cod can be expected since the newly recruited young fish of the 1969 year-class are not very abundant. It is difficult to anticipate the future changes in hydrological conditions. Probably, the period of extreme cooling will come to an end and another warming period will start. This may somewhat diminish the density of cod concentrations on the continental slope of Labrador during the first months of 1974.

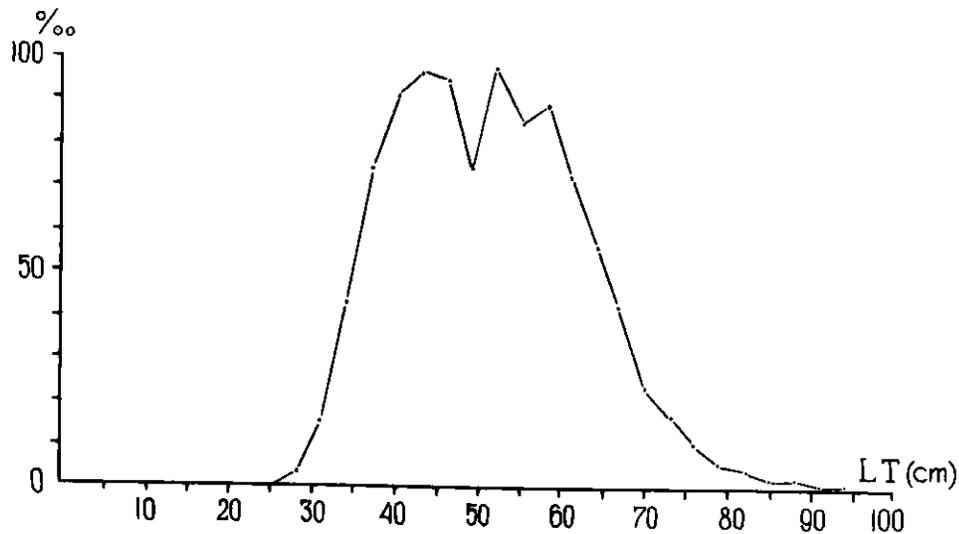


Fig. 2. Size composition of cod in Div. 2J.

Table 6. Age composition and mean length of cod in Div. 2J, April 1972.

Year-class	Age	Number (‰)	Mean length (cm)
1968	4	54	34.99
1967	5	193	40.12
1966	6	194	45.88
1965	7	205	51.88
1964	8	139	57.82
1963	9	88	62.11
1962	10	61	65.53
1961	11	34	67.12
1960	12	19	70.39
1959	13	5	71.02
1958	14	3	77.83
1957	15	1	73.00
1956	16	1	70.00
1955	17	1	76.00
1954	18	2	80.00

b) Tagging and return of commercial species. In 1972 the tagging program off Labrador involved 2,001 cod and 309 Greenland halibut. The tags applied were hydrostatic transparent tagging tubes with a note inside. The tag was fixed on the fish with a flexible synthetic thread run through the back muscles. Cod tagging was conducted in Div. 2J, mainly in December, from the *Perseus III*.

Returns of tagged fish, as of January 1973, indicated the cod's fast southward migration along the continental slope, since a cod tagged on 23 December 1972 at 54°36'N, 53°38'W was caught on 3 January 1973 at 53°25'N, 53°03'W, and a cod tagged on 23 December 1972 at 54°26'N, 53°28'W, was caught on 26 January 1973 at 51°54'N, 50°47'W. Indeed, the peculiarity of the winter of 1972/73 in general was an early retreat of the basic concentrations of Labrador cod farther southward than usual to Div. 3K (because of extreme cooling of water masses in the Labrador area).

### Subarea 3

#### A. STATUS OF THE FISHERIES

The 1972 total USSR catch in Subarea 3 amounted to 309,604 tons, including 104,841 tons of redfish, 80,917 tons of cod, 48,362 tons of capelin (for investigations, see ICNAF Res.Doc. 73/26), 41,081 tons of flounder, 21,157 tons of roundnose grenadier, 4,376 tons of Greenland halibut, 1,749 tons of white hake, together with modest catches of haddock, pollock, wolffish and other demersal species.

The outlook for the 1973 fishery in Subarea 3, as presented a year ago (USSR Research Report, *Redbook* 1972, Part II), does not require any change. In 1974, the 1968 year-class will still be of primary importance in the trawl catches of cod in Div. 3N, 3O and 3P. On Grand Bank and Saint Pierre Bank haddock will be very scarce, except as a minor by-catch in cod and flounder fisheries.

#### B. SPECIAL RESEARCH STUDIES

##### 1. Environmental Studies

Hydrographic surveys were carried out from research vessels *Procion* (January-February and April-June) and *Perseus III* (April-June). Water temperatures were taken at standard depths of sections 2-A, 3-A, 4-A, 6-A, 7-A and 44-A. Impressive negative anomalies in the water temperatures from -0.1° to -2.2°C were observed in almost the whole of Subarea 3. The extreme cooling was caused, mainly, by an intense surge of Labrador Current water. Figure 3 shows distinctly the main stream of the Current running along the eastern slope of the Grand Bank. Negative temperatures extended to a depth of 400 m. In contrast, water temperature anomalies on the southern and southwestern slopes of Grand Bank and Cabot Strait were found to be markedly positive, apparently on account of an increased inflow of warm Gulf Stream waters (see also ICNAF Res.Doc. 73/43 and 73/44).

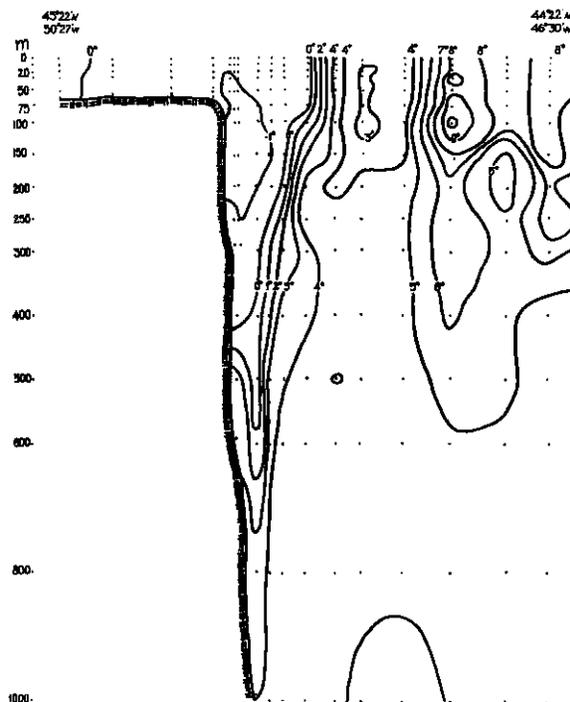


Fig. 3. Water temperature at hydrological section 3-A, 21-24 April 1972.

## 2. Biological Studies

a) Collection of ichthyoplankton. From 21 April through 31 May, eggs and larvae were collected by the *Procion* throughout Div. 3K, 3L, 3M and 3N. Samples were taken chiefly from the standard hydrological sections with concurrent water temperature measurements at standard depths. With a net of 80 cm diameter opening as the primary catching tool, three hauls (vertical, surface and oblique) were taken at each of 196 stations. Because similar programs to collect eggs and larvae were also undertaken in previous years, comparable data were available. Thus, the number of American plaice eggs in 1972 was found to be twice their number in the two previous years (likely due to the anomalous cooling of water masses conducive to the breeding of cold-water species).

b) Numbers of young cod and haddock. In April-June 1972, a count of young fish was made from *Perseus III* in all divisions of Subarea 3. It involved 241 check-up trawlings of one-hour duration each, made at standard stations. A total of 24,937 young cod were caught and measured for length; of these, age determinations were made of 3,967 individuals; the figures for young haddock were 1,795 and 882 respectively. The counts for 1972 and some previous years are found in Tables 7 and 8. They reveal a high concentration of the 1968 year-class of cod, both off Labrador (from the numbers of young cod caught in Div. 3K) and in the southern portion of the Grand Bank and Saint Pierre Bank. All the more recent cod year-classes were found to be much poorer (for distribution and abundance, see ICNAF Res.Doc. 73/22).

Young haddock aged one year appeared to be more numerous over southern Grand Bank in 1972 than in any of the previous years. This may be viewed as a sign of progressive recovery of the Newfoundland haddock stock. This assumption looks more probable because the cod and haddock stocks on the Grand Bank fluctuate in reverse, namely, years of abundant year-classes of cod resulted in, as a rule, poorer year-classes of haddock, and vice-versa.

The past decade witnessed an increase in numbers of Newfoundland cod with a contiguous decline in the quantities of haddock. In all likelihood, a change in the opposite direction is about to occur in the area; the reason: periodicity of variations in the oceanological environment.

Table 7. Mean catch (in numbers) of young cod (age-groups 1-4) per one-hour haul by control trawl.

Year-class	1 year				2 years				3 years				4 years			
	3K	3N	3O	3P	3K	3N	3O	3P	3K	3N	3O	3P	3K	3N	3O	3P
1958	-	-	-	-	-	-	-	-	-	-	-	-	10	1	0	2
1959	-	-	-	-	-	-	-	-	21	8	1	4	15	1	1	1
1960	-	-	-	-	5	3	0	3	11	1	2	5	11	1	0	1
1961	1	1	1	6	3	4	3	6	20	5	1	6	27	4	1	1
1962	1	1	7	42	2	8	2	7	15	18	2	12	24	6	1	2
1963	1	1	1	3	1	5	1	13	36	30	1	17	17	7	3	4
1964	1	41	24	31	3	137	13	22	8	73	42	58	28	16	7	10
1965	1	1	1	5	1	14	12	21	15	23	20	25	22	60	9	9
1966	1	2	15	7	3	27	17	32	27	37	34	28	40	10	4	4
1967	1	1	2	1	8	3	4	20	34	32	14	10	12	2	2	6
1968	1	6	18	40	7	109	28	66	40	91	23	64	26	28	5	13
1969	1	2	4	15	4	11	6	50	13	26	12	25	-	-	-	-
1970	1	6	1	6	1	24	3	9	-	-	-	-	-	-	-	-
1971	0	4	2	5	-	-	-	-	-	-	-	-	-	-	-	-

Table 8. Mean catch (in numbers) of young haddock (age 1-3 years) per one-hour haul by control trawl.

Year-class	1 year		2 years		3 years	
	3NO	3P	3NO	3P	3NO	3P
1963	-	-	-	-	2	17
1964	-	-	4	55	6	153
1965	1	13	1	41	1	4
1966	3	110	8	191	1	20
1967	1	183	1	16	1	2
1968	4	25	8	10	2	4
1969	4	35	4	38	1	5
1970	1	32	1	8	-	-
1971	9	2	-	-	-	-

c) Trawl survey. Along with the commitment to survey the young stock in Subarea 3 (ICNAF Res.Doc. 73/40), *Perseus III* completed a total enumeration of all demersal fishes. Deep-water redfish (*Sebastes mentella*) were found to exceed in both biomass and numbers of all other species in Div. 3K, 3N, 3O and 3P. Also, cod and American plaice outnumbered other species in Div. 3L. Of the non-commercial fish, thorny skate (*Raja radiata*) was quite numerous, an example being in Div. 3P where it ranked third in biomass after deep-water redfish and cod.

d) Tagging of commercial species. There were 1,510 individuals of cod tagged in Div. 3K and 3L, and 513 individuals of Greenland halibut in Div. 3K.

e) Redfish. On the southern slopes of Grand Bank, similar to previous years, fish aged 7-10 years (i.e. those in the mature age bracket) made up the largest single group in the trawl catches of deep-water redfish (*Sebastes mentella*) (Table 9). As will be noted, the deep-water redfish has a markedly short life which explains why the Newfoundland population is relatively fast in replacing the losses to the commercial fishery and is less susceptible to the effects of intense fishing than the northern populations of deep-water redfish which have a longer life span. Despite the continued increase in redfish catches in Div. 3N, 3O and 3P from year to year, no depletion of the stocks has been observed to date.

Recently, Soviet ichthyologists (V. Barsukov and G. P. Zakharov) have shown that one other species, *S. fasciatus* together with *S. mentella* (and very similar to it) is found in the southern portion of Subarea 3. This redfish features a still shorter life. As a result, the Grand Bank fisheries rely on a mixture of the two species, both of which are fast maturing and can quickly replenish their stocks.

Table 9. Age composition and mean length of deep-water redbfish in Div. 30 on 27 May 1972.

Year-class	Age	Males		Females		Males and Females	
		Number of fish (%.)	Mean length (cm)	Number of fish (%.)	Mean length (cm)	Number of fish (%.)	Mean length (cm)
1966	6	31	25.5	58	21.3	45	21.4
1965	7	156	23.3	117	23.3	136	23.3
1964	8	240	24.7	203	24.0	222	24.4
1963	9	302	26.3	203	25.9	251	26.1
1962	10	198	27.5	175	27.9	186	27.7
1961	11	31	28.3	117	28.3	75	28.3
1960	12	42	29.8	107	29.8	75	29.8
1959	13	-	-	10	34.0	5	34.0
1958	14	-	-	10	33.0	5	33.0

f) White hake. In Div. 30 and 3P white hake are found in commercial concentrations chiefly at depths of 100-250 m and in water temperatures of 3° to 8°C. Spawning in May-June, it normally feeds on fish and less often on crustacea. Commercial trawl catches consisted in 1972 of 3-7-year-old individuals (see also Res.Doc. 73/39).

#### Subarea 4

##### A. STATUS OF THE FISHERIES

The 1972 USSR catch of all species in the Subarea was 199,614 tons (Table 1) compared with 270,059 tons in 1971.

##### 1. Silver hake

The 1972 silver hake fishery was quite successful, with an annual catch of 113,800 tons, as against 128,600 tons in 1971, and greatly in excess of the 1967-1969 catches. The high concentration of silver hake in 1972 came about through a recruitment of the comparatively abundant 1968, 1969 and 1970 year-classes. These year-classes provided the bulk of the silver hake catches off Sable Island (Div. 4W). The contribution of 3-year-old fish of the 1969 year-class was 39.4% and those of 4-year fish of the 1968 year-class and 2-year fish of the 1970 year-class were 23.9% and 22.2% respectively (Table 10).

Table 10. Age composition (%) of silver hake catches in Subarea 4 in 1970-72.

Year	Age									Total	Mean age
	1	2	3	4	5	6	7	8	9		
1970	7.0	11.6	35.9	33.1	10.1	1.4	0.5	0.3	0.1	100	3.6
1971	-	8.8	43.2	36.8	8.8	1.2	0.5	0.5	0.2	100	3.4
1972	0.6	22.2	39.4	23.9	11.1	2.0	0.8	-	-	100	3.3

From the trawl survey data collected in the autumn of 1972, the hake stocks in Subarea 4 toward the end of 1972 showed an increase over 1971. Thus, the catch per 30-min trawl haul was 13.9 kg in 1968, 8.9 kg in 1970, 13.3 kg in 1971, and 30.3 kg in 1972. The abundant 1969 and 1970 year-classes are expected to provide the basis for stock size and catches in 1973.

##### 2. Haddock

No special haddock fishery was undertaken in 1972 or in the past few years. Haddock was caught incidentally while fishing for other species. The overall catch in Subarea 4 was 116 tons in 1972. While somewhat larger in 1972, the stocks of haddock will remain at a fairly low level in 1973 because of the numerical scarcity of all haddock year-classes before 1971.

3. Argentine

Argentine were caught on the slopes as a by-catch in the silver hake fisheries in Div. 4W and 4X mainly in April on their spawning grounds. The total catch was 5,400 tons, compared to 3,600 tons in 1971 and 1,600 tons in 1970. The argentine catch was made up largely of specimens 29-35 cm long and 8-12 years of age. The argentine stocks are barely usable, due especially to the ban placed on demersal fisheries in March-May to protect haddock stocks. To expand argentine catches, it will be necessary to authorize its fishery during the pre-spawning concentrations on the slopes of Browns Bank and the eastern slopes of Georges Bank.

4. Herring

Following a decline in fishing effort, catches of herring decreased somewhat in 1972 to 23,961 tons, as against 29,000 tons and 70,200 tons respectively in 1971 and 1970, but were still much above the 1963-1968 catch figures. Herring fisheries, being carried out for the most part on the slopes of Emerald and Middle Banks, made use of purse seines and occurred in April and May and on a more limited scale in June and July. Individuals 7-12 years old made up the bulk of the herring catches from Banquereau Bank, as did 4-9-year-olds from Emerald and Middle Banks (Table 11).

Table 11. Age composition (%) of herring in catches from Banquereau Bank (Div. 4V) and off Nova Scotia (Div. 4WX) in 1970-72.

Stock	Year	Age															Total	Mean age
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
4V	1970	-	-	-	-	0.2	1.1	6.8	9.7	17.8	17.5	17.2	14.4	9.8	5.5	-	100	10.3
	1971	-	-	0.1	1.4	5.0	6.8	16.5	13.9	13.9	19.3	14.2	6.6	1.8	0.3	0.2	100	8.8
	1972	-	-	-	2.1	5.5	7.3	13.0	15.8	20.0	12.2	9.9	9.1	4.8	0.3	-	100	8.8
4WX	1970	0.1	0.2	1.8	10.1	26.3	19.1	23.6	10.7	5.0	1.9	1.2	-	-	-	-	100	6.2
	1971	-	-	41.4	12.0	20.4	9.2	8.2	4.8	2.4	0.8	0.2	0.6	-	-	-	100	4.6
	1972	-	-	2.5	17.9	24.9	15.3	15.9	11.8	7.7	1.8	2.0	0.2	-	-	-	100	6.1

Observations from scouting vessels revealed an increase of the young herring of the 1970 year-class off Nova Scotia in 1972 which shows this year-class as apparently very abundant and very likely to replenish the stocks of adult herring in 1974.

B. SPECIAL RESEARCH STUDIES

1. Environmental Studies

a) Oceanography. Close observation of the thermal regime in 1972 shows clearly that the anomalous conditions which set in last winter on the Nova Scotian Shelf were caused by an enormous outflow of cold waters from Cabot Strait and their subsequent expansion over the entire eastern part of the Shelf. Indeed, in January the water temperature in the 0-100-m layer never exceeded 0.5° to 2.5°C, and in March it was plainly negative in the same layer in the area of Canso, Misaine and Banquereau Banks. The 0° isotherm extended along Cabot Strait to the Gali depression. At the same time floating ice was observed in great quantities on the northern slopes of Canso, Misaine and Artiman Banks. In the winter of 1972, in Cabot Strait, the water temperature in the 0-100-m layer was the lowest since 1967.

2. Biological Studies

a) Argentine. In 1972, the study to locate argentine stocks was completed. As a result, individual populations have been found to exist on Browns (Div. 4X) and Sambro (Div. 4W) Banks. Using the Bertalanffy equation, the parameters of the latter's growth rate have been determined, together with their total instantaneous mortality rate which appeared to be 0.23 (see ICNAF Res.Doc. 73/24 and 73/25).

b) Trawl surveys. In August, a trawl survey was completed under the ICNAF program from MRT *Blesk*. The survey covered the entire shelf from Banquereau to Browns Banks. From 120 trawlings of 30-minute duration each, using a 27.1-m trawl, preliminary results indicating an increase in the biomass of silver hake toward the end of 1972, as against the end of 1971. SRV *Argus* performed 20 follow-up trawlings in the Emerald hollow in late October. Young silver hake aged 1 and 2 years were found in great quantities, thus indicating that the 1970 and 1971 year-classes were strong.

Subarea 5 and Statistical Area 6

A. STATUS OF THE FISHERIES

The 1972 USSR catch of all species in Subarea 5 was 407,353 tons and in Stat. Area 6 was 81,641 tons (Table 1), compared with 1971 catches of 292,754 and 113,960 tons respectively.

1. Silver hake

In 1972 silver hake catches, because of increased stock sizes and a more intense fishery, showed an increase to 94,100 tons in Subarea 5 as against the 1971 catch of 81,500 tons and the 1970 catch of 29,000 tons. A total of 7,700 tons was taken in Stat. Area 6. The most productive fishing was in Subdiv. 5Ze, on the slope of Georges Bank and Nantucket Shoals, and took place from June through September. Catches consisted for the most part of 3- and 4-year-olds of the 1968 and 1969 year-classes on Georges Bank, and of 2-, 3- and 4-year-olds of the 1968, 1969 and 1970 year-classes on the Nantucket Shoals. While these year-classes can be rated comparatively good, the 1971 year-class may be expected to be still better and more abundant, and one can, therefore, expect a further increase of the commercial stock in 1973 and 1974.

2. Haddock

Haddock were seldom found in the catches. The total catch was 141 tons in 1972. There is little hope for expansion of the stock until 1974, since all year-classes before 1970 are numerically scarce, but the 1972 year-class rates well above average.

3. Red hake

The considerable increase in hake catches in 1972 can be ascribed to an increase in stock size and a more intense fishery. The 71,300 tons of red hake caught in 1972 exceeds by a wide margin the catches in 1970 and 1971. In 1972 the hake fisheries were prosecuted mainly by the BMRT-type vessels along the slopes of Georges Bank and the Nantucket Shoals from June through December. The bulk of the hake catches consisted of 3- to 5-year-olds on Georges Bank and 2- to 4-year-olds on the Nantucket Shoals. The average age composition for each year from 1969 to 1972 in Subarea 5 is given in Table 12. The Georges Bank stock, as of the early part of 1973, was assessed at 24,000 tons, and for the stock inhabiting the area west of 69°W 132,000 tons. Assuming the fishing rate to be optimal (i.e., close to 50%), it could be recommended that the 1973 catches be maintained at 12,000 and 65,000 tons respectively for the northern and southern stocks. Because the 1971 year-class was assessed as abundant and certain to replenish the stocks by 1974, the quota of 75,000-80,000 tons for both stocks makes a sound recommendation for 1974.

Table 12. Age composition (%) of red hake catches in Subarea 5 in 1969-1972.

Year	Age									Total	Mean age
	1	2	3	4	5	6	7	8	9		
1969	3.4	17.5	35.8	35.4	7.6	0.3	-	-	-	100	3.27
1970	-	2.5	63.8	29.2	4.2	0.3	-	-	-	100	3.36
1971	0.4	47.7	29.0	14.4	6.9	1.5	0.1	-	-	100	2.85
1972	-	13.4	40.6	23.0	11.8	6.5	3.9	0.6	0.2	100	3.72

4. Argentine

Argentine catches were limited in Subarea 5 until April 1972, when dense pre-spawning accumulations of argentine were located in the Georges Basin, immediately adjacent to Div. 4X. These accumulations were caught effectively by vessels of the BMRT class. The total catch amounted to 32,600 tons. Because the Georges Basin concentrations belong properly to the Browns Bank stock, it is not surprising to see the composition of catches in both areas essentially the same. The large number of age-groups, which make up the commercial portion of the stock, validate the view that fluctuations in abundance of this species are fairly small and will not imbalance the relatively stable condition of the argentine stock in the area for some years to come.

5. Herring

In the Subarea 5 and Stat. Area 6 fisheries, there exists a single herring stock (the Georges Bank stock). In these areas the USSR herring catch totalled 48,300 tons in 1972, compared with 81,000 tons in 1971. The decline in USSR catches in 1972 is due to the established quota of 48,200 tons. The winter and

spring fisheries were conducted in shallow waters of Stat. Area 6, and the summer and autumn fisheries on Georges Bank. Essentially, the Georges Bank catches were made up of 5-7 years old fish and the Stat. Area 6 catches of 5-8 years old fish (Table 13).

Table 13. Age composition (%) of herring catches in Subarea 5 and Stat. Area 6 in 1970-72.

Area	Year	Age											Total	Mean age
		1	2	3	4	5	6	7	8	9	10	11		
SA 5	1970	-	2.8	7.3	28.3	32.1	12.0	9.2	5.0	3.0	0.3	-	100	5.99
	1971	-	1.5	28.7	31.5	17.9	10.2	7.0	2.6	0.5	0.1	-	100	4.41
	1972	-	1.2	1.8	5.5	42.2	25.9	15.9	5.7	1.4	0.4	-	100	5.70
SA 6	1970	-	-	2.9	7.8	29.7	15.3	14.9	14.5	14.9	-	-	100	6.10
	1971	-	-	0.8	5.9	38.1	23.9	24.0	4.9	2.4	-	-	100	5.57
	1972	-	-	-	1.3	27.3	25.2	25.2	16.0	3.9	0.9	0.2	100	6.44

The catch per purse seine haul was 9.0 tons in 1972, compared with 11.9 tons in 1971, 9.6 tons in 1970, 6.0 tons in 1969 and 13.6 tons in 1968. There was no marked downward trend in recent years. Catch per hour by SRT and SRTR trawlers remained at 16.7 tons in both 1971 and 1972. The 1970 year-class is rated to be numerically above average and should provide a broad replenishment for the herring stocks by as early as 1973.

#### 6. Mackerel

Mackerel catch in Subarea 5 and Stat. Area 6 (one stock inhabiting both areas) reached 134,100 tons in 1972, as against 116,700 tons in 1971 and 124,500 tons in 1970. In most of the catches, individuals 3-6 years of age of the abundant 1966, 1967 and 1968 year-classes appeared in great numbers. The 1968 year-class is far more numerous than any other year-class which appeared in 1960-1965. This indicates that the mackerel stock has been under-utilized and that it is advisable to increase catches in 1973 and 1974 over the 1972 level.

#### 7. Atlantic saury

Atlantic saury is proposed now as an object for future fisheries. Its aggregations occur mainly in summer and autumn over a large area along the shelf slopes off New England and Nova Scotia. Atlantic saury fisheries have been maintained on a limited scale in October-December since 1970, using side-trap nets with attracting electric light, on the slopes of Georges Bank. The catches were 1,100 tons, 2,100 tons and 3,400 tons respectively in 1970, 1971 and 1972. The length of the fish in these catches varied from 20 to 39 cm but were mainly 26-32 cm and weighed 30-70 grams.

### B. SPECIAL RESEARCH STUDIES

#### 1. Environmental Studies

a) Oceanography. Temperature observations on Georges Bank and adjacent areas, during the summer and autumn from the SRV *Argus*, show the temperature of the 0-50 m surface layer to be substantially lower than in 1971. For the intermediate (50-100 m) and bottom (100 m-bottom) layers, temperatures were either the same as, or above, those for 1971.

In June-October, SRV *Argus* completed hydrochemical surveys to determine the diluted oxygen, oxidability (permanganate), phosphates, silicon nitrites and biochemical consumption of oxygen, as well as the primary production using the oxygen method. The oxygen content of the water was found to decrease with depth; indeed, oxygen oversaturation to 105-115% was observed in the 0-30 m layer. In October, the proportion of oxygen rose somewhat, following a drop in water temperatures and more frequent gales leading to intense agitation of the water.

The biogenous elements found in the water coincided with the seasonal development of phytoplankton. The phosphate concentrations were observed to have reached 2.5-5.0 mkg/l in August south of Cape Cod, and a maximum of 70-90 mkg/l at depths of 300-500 m, with an average phosphate concentration rate of 10-20 mkg/l. In June, the concentrations throughout the entire water layer stood at 35-45 mkg/l to the east of the 68° meridian. The concentration of nitrites was 2-4 mkg/l at bloom and in some spots was as high as 7-8 mkg/l. The silicon concentration was 90-130 mkg/l at the surface and 120-250 mkg/l in the bottom layer, but reached its maximum values of 400-500 mkg/l in June east of the 68° meridian and at the offshore stations at a depth of 400-500 m.

Analysis of the biogenous element content leads one to remark on the extended time of phytoplankton blooming; indeed, the spring bloom in the south continued well into the month of June and in the north was not over until July; the autumn bloom began in the south in July-August and ended in the north in late October. One of the foremost factors affecting the development of primary production in 1972 was a dramatic shortage of light on account of frequent fogs.

b) Zooplankton. In June-October 1972 collection of zooplankton was undertaken in the spawning areas for silver hake and red hake, in the 0-50 m layer, using the Bongo plankton collector (small-size model, gauze No. 38). The subsequent data processing and analysis are scheduled for 1973.

In 1972 analyses were conducted to discover the regularities governing the development of zooplankton during the vegetation period from 1964 through 1970 on the strength of collections made with a small-size model of the Judey net.

It was found that, with a high rate of eutrophicity in the plankton community, there were four distinctly predominant copepod types of mesozooplankton, namely, *Calanus finmarchicus*, *Pseudocalanus elongatus*, *Oithona similis* and *Centropagus typicus*. These species provide the basic edible organisms for planktophages (herring, young mackerel, hake, etc.).

The nature of seasonal change in the total number and biomass of plankton remains identical in different years. The peak values of both plankton number and biomass are observed to occur in June-July. The seasonal development pattern of the indicated mass copepod species follows a certain regularity not dissimilar to the one observed in the Gulf of Maine. Figure 4 shows plots of the biomass ( $\text{mg}/\text{m}^3$ ) in August and October each year from 1964 to 1970. These show a gradual fall-off of the biomass of net sestone. The data cited above have been found to show a good fit with the changes (growth) of the thermal background index and with an enlarged number of tropical species in the zone of exploration.

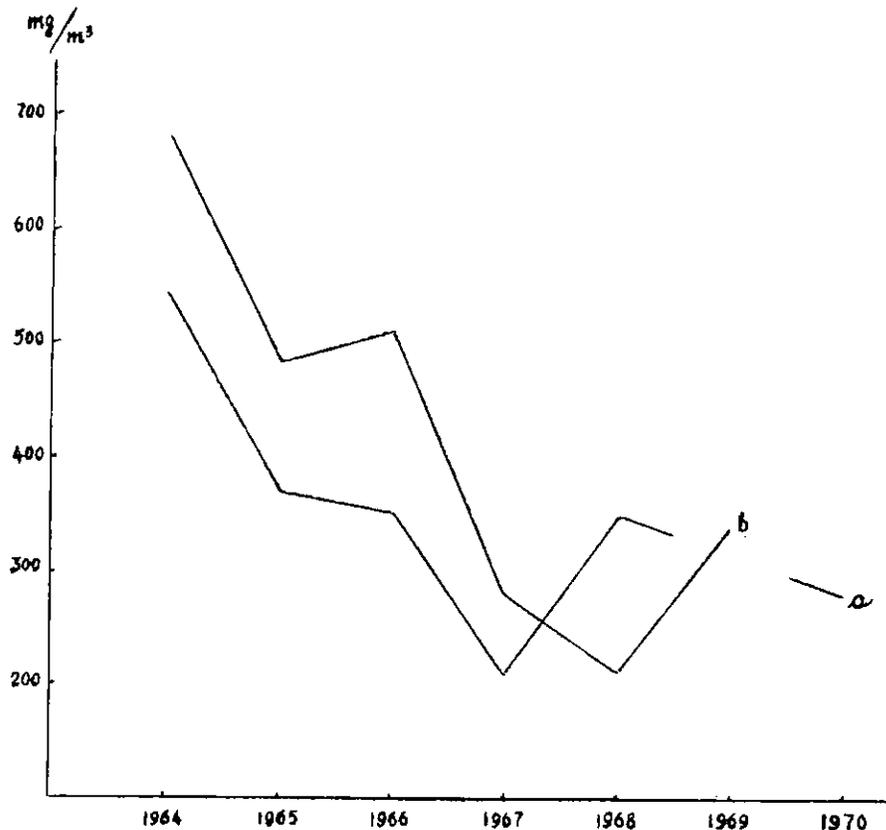


Fig. 4. Variation of plankton biomass on Georges Bank in (a) August and (b) October, 1964-70.

It is interesting to note that the decline in the plankton biomass is synchronous with the decline in herring stocks.

c) Ichthyoplankton. From June-October in 1972, SRV *Argus* carried out a series of successive surveys on Georges Bank, using the Bongo plankton collector to enumerate eggs and larvae of silver hake, red hake and herring. Preliminary analysis of the survey data on herring larvae showed that in the survey period from 22 September to 30 September 1972, 1,342 herring larvae were caught, all from the northeast portion of Georges Bank, with only one larva (22 m long) caught off southwestern Nova Scotia. In the survey period larvae were caught in great numbers on the spawning grounds. Their average length was 9.4 mm. As the survey proceeded to the east and northeast, there was an abrupt decline in the number of larvae together with an increase in their average length to 10.3 mm. All the evidence at hand indicates, therefore, that spawning occurred on the northern side of Georges Bank and that the larval drift had barely begun.

During 12-28 October larvae were observed over a more extensive area. This indicated that the larvae had dispersed from the Georges Bank spawning area as well as from another spawning area off Nantucket, which had smaller larvae (average length, 8.6 mm) in impressive numbers. In all, 10,393 herring larvae were caught during the survey period in October.

## 2. Biological Studies

a) Nutrition studies of silver hake and herring larvae. For the purpose of elucidating the relation between the food supply and survival rates of silver hake and herring larvae, the samples collected on Georges Bank in 1965 and 1971 were analyzed. As in previous years, the larvae were feeding on the nauplia *Calanoida*, *Pseudocalanus* sp., *Centropages* sp., *Oithona* sp. and other organisms. Data on the frequency rates of individuals without food in their intestines give convincing evidence of more intense feeding of larvae in 1971 than in 1970 (Table 14).

Table 14. Number of larvae (%) with empty intestines.

Species	1965	1966	1967	1968	1969	1970	1971
Herring	84.5	99.9		92.0	80.5	95.8	87.1
Silver hake	30.0	32.8	45.2	33.3		13.7	12.2

In 1971 the spawning stock of silver hake was found to be less abundant than in the previous few years, while the number of larvae produced and fecundity of the stock was higher, and they fed more intensely, by comparison. This leads one to believe that the availability of food at the earlier development stages is a determinant of the fecundity of silver hake in the area studied.

b) Surveillance of daily feeding cycles and rations of demersal fish. In July 1972 samples were obtained on the Nantucket Shoals to establish the feeding patterns of demersal fish (silver hake, red hake, yellowtail flounder, longhorn sculpin, small skate, ocean pout and goosefish) at various intervals during a 24-hour period. It appears that *Cancer borealis* and *Microdentopus dammonensis* form a major part of the ration of demersal species in that period, while the predators feed mostly on young silver hake, squid, mackerel and longhorn sculpin. The 24-hour cycles were found to have two distinct peaks of feeding intensity: the morning peak from 0600 hours to 1300 hours, and the nocturnal peak from 1900 hours to 0300 hours. The daily rations were at a fairly modest level in that period due to inter alia, low bottom water temperatures (6°C).

c) Mackerel. From the age composition data, the linear and weight growth parameters have been determined for mackerel, using the Bertalanffy equation, together with the total instantaneous mortality ratio of 0.6 (ICNAF Res.Doc. 73/23).

d) Alewife. In 1972 age determinations were made from the otoliths of *Alosa pseudoharengus*. The results showed that the alewife is represented in the catches by 2- to 8-year-old individuals, with 4- and 5-year-olds of the 1965 and 1966 year-classes being by far the most numerous in 1970. The average length of the fish was estimated to be 22.6 cm and the weight 162 g at age 3, 25.3 cm and 230 g at age 5, and 28.0 cm and 300 g at age 8.

e) Shortfin squid. Studies of the size composition of Georges Bank squid have shown that this species tends to be represented normally by one generation in each particular year, as its average length of 14 cm increases from May through October to 22 cm, while in the next spring again only small squid are found. Summer catches often consist of immature individuals; it appeared that in October males have gonads in the 3rd and 4th maturity stages and females in the 1st and 2nd stages (on a five-point scale). Most probably,

the female ovaries reach maturity during the period when the squid migrate for spawning to the open ocean. The primary food of the shortfin squid is euphausiids and fish fry (5-10 cm in length). The smaller squid feed mainly on small crustaceans and larger squid feed on fish and other squid.

f) Trawl surveys. In September and October trawl surveys were carried out from the east slopes of Georges Bank to Cape Hattaras. SRTM *Blesk* completed a comparative test program, using 27.1 m and Yankee-41 trawls. It was established that the increase in the number of silver and red hake is due to the abundant 1970 and 1971 year-classes. The stocks of yellowtail flounder remained about the same in Georges Bank and increased in the southern portion of New England.



UNITED KINGDOM RESEARCH REPORT, 1972

Subareas 1-5

A. STATUS OF THE FISHERIES  
(by D. J. Garrod)

Although it increased from 9,500 hours in 1971 to 24,100 hours in 1972, the level of the UK fishing effort was still much below that in 1968 and earlier years. Freezers accounted for 23,200 hours and wet-fishers the remaining 900 hours.

Total nominal catches of cod were 13,295 metric tons, 6,200 more than in 1971. Just over 60% was from Subarea 3, nearly 25% from Subarea 2 and the remainder from Subareas 4 and 1 (Table 1). There was no fishing activity in Subarea 5 and Stat. Area 6.

Table 1. Hours fishing, number of arrivals and nominal catches of cod in the Northwest Atlantic.

Year	Subarea				Total
	1	2	3	4	
	<u>Landings (metric tons)</u>				
1971	2,432	-	4,634	-	7,066
1972	846	3,116	8,153	1,080	13,295
	<u>Hours fished</u>				
1971	3,154	-	6,356	-	9,510
1972	1,843	6,921	13,908	1,399	24,071
	<u>Number of arrivals</u>				
1971	23	-	13	-	36
1972	17	23	35	10	85

B. SPECIAL RESEARCH STUDIES

1. Environmental Studies

a) Hydrography (by H. W. Hill)

Subarea 1. During 2-11 December 1972 R/V *Cirolana* worked five hydrographic sections off the west coast of Greenland at Cape Farewell, Cape Desolation, Noname Bank, Danas Bank and Fyllas Bank, the first and last being worked in cooperation with the Fed.Rep. Germany's R/V *Anton Dohrn*. The hydrographic data are being coordinated with those of the other vessels by Frede Herman, and will appear under the Danish Research Report.

Subarea 3. As part of a cooperative investigation of the Gulf Stream system south of Grand Bank by the Woods Hole Oceanographic Institute, the Bedford Institute of Oceanography and the Fisheries Laboratory, Lowestoft, R/V *Cirolana* carried out a hydrographic survey of the area south of Flemish Cap and east of Grand Bank between 17 April and 1 May 1972. Temperature, salinity, oxygen and silicate were sampled on two sections extending in a southeasterly direction from the edge of Grand Bank to approximately 41°W. A third section, across the Labrador Current between Flemish Cap and Grand Bank, also included three recording current meter rigs. Details of these observations are given in the paper by H. W. Hill, P. G. W. Jones, J. W. Ramster and A. R. Folkard (Res.Doc. 73/116, presented at this meeting).

b) Plankton (by G. A. Robinson)

The survey with Continuous Plankton Recorders operated from the Oceanographic Laboratory, Edinburgh, was continued in 1972 on the same basis as in other years. The survey was financed by the UK Natural Environment Research Council.

Recorders are towed at a depth of 10 metres, at monthly intervals, along standard routes by cutters of the US Coast Guard and by merchant ships from Denmark, Iceland and the United Kingdom. Recorders towed

by the Coast Guard Cutters are now maintained and managed by the US National Marine Fisheries Service at Narragansett. During 1972 recorders sampled for 2,500 miles in Subarea 1, 4,500 miles in Subarea 2, 12,400 miles in Subarea 3, 2,800 miles in Subarea 4 and 500 miles in Subarea 5. This sampling forms part of the laboratory's standard survey of the North Atlantic and the North Sea.

The data processing of the results from the survey is fully automated (Colebrook, *Bull. mar. Ecol.*, in press). The survey area is divided into statistical rectangles, each 2° of longitude by 1° of latitude, which are then grouped into a system of standard areas (see Annual Report of the Scottish Marine Biological Association for 1970-71) and also the ICNAF Subareas. The monthly distributions of all species, or groups of species, are plotted as mean numbers per statistical rectangle, standard area and ICNAF Subarea. At the end of every year the annual and seasonal fluctuations in abundance of each entity are calculated for each standard area in the North Sea and northeastern Atlantic for the period 1948 onwards and for each standard area and ICNAF Subarea in the western Atlantic from 1962 onwards; routine statistical analyses, such as Principal Component Analysis, are then carried out. Further details may be obtained on application to the Director, Institute for Marine Environmental Research, Oceanographic Laboratory, 78 Craighall Road, Edinburgh EH6 4RQ.

In 1972, the spring outbreak of phytoplankton was slightly late in Subarea 2 and both the oceanic and Grand Bank regions of Subarea 3. Diatoms were much above average in April in the oceanic regions, but scarce until July and August when numbers were high again. *Thalassiothrix longissima* was abundant earlier than usual (in March) over the Grand Banks, but otherwise was scarce, while numbers of *Thalassiosira* spp. and *Phaeoceros* spp., two dominant spring species, were above average in the oceanic region but below average in the coastal regions.

Copepods were also slightly late in the oceanic section of Subarea 3 with low numbers in April, but thereafter numbers were about average; they were less abundant than usual over the Grand Banks. Numbers of adult *Calanus finmarchicus* were above average in the oceanic parts of Subareas 1, 2 and 3 in March and from May to August, but lower than usual in the coastal regions. Euphausiids were less abundant than the long-term mean in Subarea 2, but, like *Calanus finmarchicus*, were extremely abundant in the oceanic parts of Subarea 3 in all months from March to August except April. They were also common in the coastal regions of Subareas 3 and 4 in March and July.

As in 1971, numbers of the larvae of *Sebastes* spp. were low in all areas. The non-pigmented variety was present in Subareas 1 and 3 from June to August and Subarea 2 in August only. No specimens of the pigmented variety were found.

## 2. Biological Studies

### a) Cod (by T. Williams)

Serological studies to assist quantitative estimates of the link between cod at Greenland and at Iceland were carried out by R/V *Cirolana* in the West Greenland area between 9 and 12 March 1972.

Between 29 November and 10 December R/V *Cirolana* carried out a groundfish survey at West Greenland, working in company with R/V *Anton Dohrn* during the latter part of the period.

### b) Salmon (by K.A. Pyefinch)

UK scientists participated in the International Salmon Tagging Experiment which was conducted in West Greenland during August, September and October 1972 and they collaborated with scientists from Canada, Faroes, France, Denmark, Iceland and Norway. Eight scientists from the DAFS Fisheries Laboratories (Pitlochry and Aberdeen) and one scientist from Iceland, on board R/V *Scotia*, were in Greenland during August and two scientists from MAFF (London) joined R/V *Adolf Jensen* and one of the commercial vessels later in the period.

A total of 2,364 salmon was tagged during this experiment; 1,553 by observers working on commercial vessels and 811 by scientists on research vessels from Canada, Denmark, France and Scotland. Up to 10 January 1973, 124 recaptures, all from Greenland waters, had been recorded. A total of 127 tagged fish was released from the *Scotia* and 333 from the *Adolf Jensen*.

Blood samples were taken from part of the research vessel catch unsuitable for tagging.

Eleven of the 105 salmon tagged in 1971 have been recaptured. Two of these were recaptured in Greenland within about a month of tagging and the remaining nine were recaptured during 1972, four in Canada, two in Ireland, two in England and one in the River Sella in northern Spain.

Up to the end of December 1972, 105 recaptures have been recorded at West Greenland from wild smolts tagged in UK rivers in 1971 as well as 10 recaptures from smolts reared in hatcheries in the UK.

Smolts were again tagged during the spring of 1972. In England and Wales the total tagged was 13,126 (1,780 wild and 11,346 hatchery-reared) and the corresponding figure for Scotland was 32,951 (19,883 wild and 13,068 hatchery-reared).



UNITED STATES RESEARCH REPORT, 1972

The United States landed fish from ICNAF Subareas 4 and 5 and Statistical Area 6. Research was conducted in Subareas 1, 3, 4 and 5 and Statistical Area 6. Table 1 gives a summary of US finfish and sea scallops nominal catches for 1971 and 1972.

Table 1. United States finfish and sea scallops nominal catches for 1971 and 1972<sup>1</sup> (metric tons, round fresh).

Species	Year	4	5	6	Total
Haddock	1972	521	4771	1	5293
	1971	1248	8500	8	9756
Cod	1972	665	19704	266	20635
	1971	335	23175	484	23994
Redfish	1972	13476	13161	1	26638
	1971	10967	16267	-	27234
Pollock	1972	493	5233	1	5727
	1971	164	4727	5	4896
Yellowtail	1972	4	24206	8774	32984
	1971	12	22341	6867	29220
Other flounder	1972	189	12888	4421	17498
	1971	141	15925	4698	20764
Silver hake	1972	-	8036	277	8313
	1971	1	13332	2989	16322
Red hake	1972	1	1711	818	2530
	1971	-	2783	821	3604
Sea herring	1972	-	40473	522	40995
	1971	-	33890	1423	35313
Mackerel	1972	-	1020	976	1996
	1971	-	1593	813	2406
River herring <sup>2</sup>	1972	-	1057	10610	11667
	1971	-	1005	11799	12804
Menhaden	1972	-	8962	320137	329099
	1971	-	6355	234396	240751
Other finfish	1972	142	11789	29493	41424
	1971	181	17408	25390	42979
Total finfish	1972	15491	153011	376297	544799
	1971	13049	167301	289693	470043
Sea scallop	1972	-	11226	10884	22110
	1971	-	14142	7455	21597

<sup>1</sup> Preliminary data.

<sup>2</sup> Alewife and blueback herring.

Subarea 1

B. SPECIAL RESEARCH STUDIES

Atlantic Salmon

Four US scientists took part in the International Salmon Tagging Program off West Greenland (Subarea 1) during the summer and autumn of 1972. They participated on board the Canadian research vessel *A. T. Cameron*. The program included research vessels from Denmark, France and the United Kingdom, as well as observers on fishing boats. About 2,500 adult Atlantic salmon were tagged in the area of the high seas

drift-net fishery. At year's end, 100 tags had been recovered off West Greenland, as had been anticipated by the ICES/ICNAF Salmon Committee. Recoveries are expected in the West Greenland, European, and North American fisheries in 1973, and in the European and North American fisheries in 1974.

Subarea 3

B. SPECIAL RESEARCH STUDIES

The US Coast Guard conducted oceanographic surveys in support of the International Ice Patrol in Div. 3N, L, and O.

Subarea 4

A. STATUS OF THE FISHERIES

1. Haddock

The US nominal catch of haddock from Subarea 4 in 1972 was only 521 tons, a 58% decrease from 1971. Div. 4X landings in 1972 were 448 tons, a decrease of 40% from 1971, while landings from Browns Bank, the principal area fished by US vessels in Div. 4X, decreased 36% from 1971 (Table 2). Commercial landings per day fished for Browns Bank increased slightly in 1972 from 1971; however, this is based on a limited amount of effort. Research survey YOY (young of the year) index increased in 1971 but decreased for 1972, and indications are that abundance will continue low.

Table 2. US haddock statistics, Div. 4X (metric tons, round fresh).

Year	Division 4X		Browns Bank		
	Landings	YOY Survey Index <sup>1</sup>	Landings	Days fished	Landings/day fished
1965	3,685	1.51	1,786	275	6.5
1966	2,473	1.32	939	200	4.7
1967	5,014	1.10	2,059	381	5.4
1968	3,156	1.51	2,278	506	4.5
1969	1,830	3.31	1,305	389	3.4
1970	1,744	1.03	1,576	493	3.2
1971	751	6.08	605	242	2.5
1972	448	2.28	387	117	3.3

<sup>1</sup> Mean catch per haul (linear scale retransformed from log<sub>10</sub> scale).

2. Cod

The US fleet landed 665 tons of cod from Subarea 4 in 1972, 330 tons more than in 1971. *Albatross IV* survey abundance estimates for the Scotian Shelf improved in 1971 over 1970. The 1972 index was similar to 1971.

3. Redfish

US landings of redfish in 1972 from the Gulf of St. Lawrence (Div. 4R, S, and T) were 1,111 tons, 76% below 1971 (Table 3). Landings from the Scotian Shelf (Div. 4V, W, and X) by US vessels were 12,365 tons, an increase of 97% (Table 4). Commercial landings per day indices are not very precise, probably because of limited fishing; however, research survey abundances for the Scotian Shelf indicated declines in 1971 and again in 1972 after increases in 1969 and 1970.

Table 3. US redfish statistics, Div. 4R, S and T (metric tons, round fresh).

Year	Landings	Days fished	Landings/day fished
1965	17,099	803	21.3
1966	12,766	608	21.0
1967	15,482	622	24.9
1968	16,437	740	22.2
1969	12,122	689	17.6
1970	7,592	593	12.8
1971	4,706	490	9.6
1972	1,111	104	10.7

Table 4. US redfish statistics, Div. 4V, W and X (metric tons, round fresh).

Year	Landings	Days fished	Landings/day fished	Survey Wt/Tow <sup>1</sup>
1965	13,082	1,246	10.5	28.7
1966	16,680	1,183	14.1	20.2
1967	6,407	593	10.8	33.4
1968	4,635	297	15.8	15.3
1969	1,142	75	15.3	42.6
1970	1,949	135	14.2	50.4
1971	6,261	404	15.5	39.7
1972	12,365	840	14.7	25.7

<sup>1</sup> Weight in pounds.

## B. SPECIAL RESEARCH STUDIES

### 1. Environmental Studies

Environmental studies in Div. 4X are part of a larger program carried out in Subarea 5 and Stat. Area 6. They are reported under Subarea 5.

### 2. Biological Studies

a) Haddock. A cooperative study was continued with Canadian scientists from the Biological Station at St. Andrews, New Brunswick, Canada, on the age-length-fecundity relationships for haddock stocks on Georges and Browns Banks. Differences in egg-counting techniques have yet to be resolved.

b) Sharks. US scientists participated in a cooperative research cruise with Canada to tag blue and mako sharks and collect internal organs for reproductive studies. Twelve long-line sets were made along the north wall of the Gulf Stream (Virginia Capes to south of Sable Island) yielding 835 fish and 12 species; 150 sharks were examined on deck and 500 were tagged.

## Subarea 5

### A. STATUS OF THE FISHERIES

#### 1. Haddock

Haddock landings from Subarea 5 in 1972 were again limited by quota regulations set by the Commission, and US vessels landed 4,771 tons, 44% less than in 1971 (Table 5). Landings per day fished figures in Table 5 were adjusted for effects of closures by deleting March, April, May, and the calendar quarter 4, when fishing was curtailed in 1970 and 1972, and were calculated using a two-factor AOV model.

Table 5. US haddock statistics, Subarea 5 (metric tons round fresh).

Year	Subarea 5 landings	Div. 5Y landings	Subdiv. 5Zw landings	Subdiv. 5Ze	
				Landings	Adjusted landing/ standard day fished
1965	57,027	4,204	26	52,797	5.68
1966	57,497	4,579	31	52,887	5.27
1967	39,580	4,852	37	34,691	4.02
1968	28,887	3,418	16	25,453	3.11
1969	18,858	2,402	15	16,441	2.47
1970	9,872	1,457	15	8,400	1.82
1971	8,500	1,194	5	7,301	1.72
1972	4,771	901	3	3,867	1.77

Age compositions from commercial landings still reflect the large 1962 and 1963 year-classes: these continued to account for over 50% of the catch (Fig. 1). The *Albatross IV* autumn groundfish survey did show limited improvement in the 1971 and 1972 year-classes over previous years; however, the 0-group index continues low (Table 6). Poor reproduction now extends to nine years, and recruitment will continue to be low through 1974.

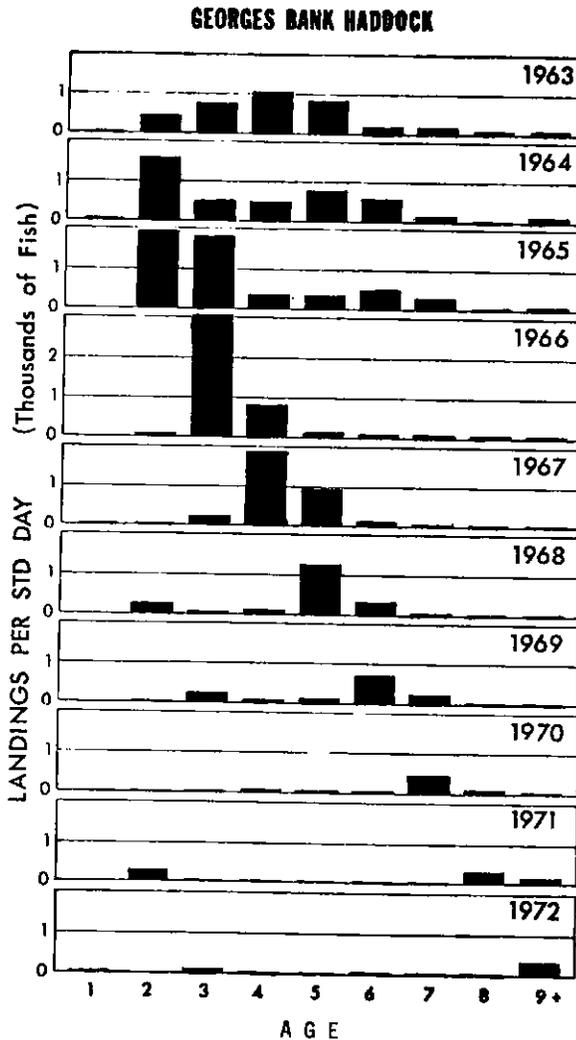


Fig. 1. Age composition of Georges Bank haddock, 1963-72.

Table 6. US research vessel index of relative year-class abundance of Georges Bank haddock based on autumn catches of 0-group fish.

Year	Index	Year	Index
1959	9.6	1966	1.7
1960	2.4	1967	1.0
1961	1.4	1968	1.0
1962	2.6	1969	1.1
1963	12.6	1970	1.0
1964	2.0	1971	1.4
1965	1.2	1972	1.6

## 2. Cod

US landings of cod from Subarea 5 in 1972 declined 15% from 1971 (Table 7). Total catches by all countries in recent years have been high, exceeding or being close to the sustainable yield. US commercial landings per day fished from Georges Bank have increased since 1968; however, this is probably a reflection of change in fishing practices (i.e. a greater directed fishery for cod in the absence of haddock). The research survey index has remained relatively constant between 1968-1971, indicating a somewhat stable abundance. The 1972 index did show an increase; and with a catch quota beginning in 1973, abundance should continue at its present level or increase slightly.

Table 7. US cod statistics, Subarea 5 (metric tons, round fresh).

Year	Subarea 5 landings	Div. 5Y landings	Subdiv. 5Zw landings	Subdiv. 5Ze		
				Landings	Landings/day fished	Survey Wt/Tow <sup>1</sup>
1965	15,011	3,780	215	11,016	0.9	15.9
1966	15,343	4,008	345	10,990	1.1	11.1
1967	18,057	5,527	684	11,846	1.0	18.5
1968	21,045	6,360	836	13,849	1.4	11.7
1969	24,175	7,823	1,143	15,209	1.7	10.9
1970	22,347	7,812	1,182	13,353	2.1	17.1
1971	23,175	7,380	796	14,999	2.0	13.4
1972	19,704	6,564	662	12,478	2.6	31.3

<sup>1</sup> Weight in pounds.

## 3. Silver hake

Total US silver hake landings from Subarea 5 in 1972 decreased about 5,300 tons (40%) from 1971 (Table 8). The decline was greatest in Subdiv. 5Ze (71%) followed by 33% and 20% in Div. 5Y and Subdiv. 5Zw respectively. The commercial catch/effort index from food fish landings underwent a 65% increase in 1972 over 1971 in Div. 5Y and Subdiv. 5Ze in spite of decreased landings. A catch/effort index from Subdiv. 5Zw based on landings for industrial use was unavailable due to insufficient data.

Research vessel data from 1972 autumn survey cruises (Table 9) indicate greatly improved stock abundance in Div. 5Y as the result of the strong 1971 year-class and the presence of a good 1972 year-class in all parts of Subarea 5. High percentages of discard of undersized fish were reported in Subdiv. 5Ze during July-August relative to actual landings. Similar high removals of fish of the 1971 year-class during 1972 by other nations fishing silver hake could have a detrimental effect on the stock abundance in 1973 and years following.

Table 8. US silver hake statistics, Subarea 5 (metric tons, round fresh).

Year	Subarea 5 landings	Food Fish			Industrial Fish	
		Div. 5Y landings	Subdiv. 5Ze landings	Landings/day fished	Subdiv. 5Zw landings	Landings/day fished
1965	41,809	22,605	11,169	11.3	8,035	4.4
1966	40,771	21,323	16,222	12.7	3,226	1.4
1967	30,986	14,390	12,692	9.3	3,904	3.4
1968	35,919	24,706	6,451	14.0	4,762	4.0
1969	20,333	14,609	1,654	4.9	4,070	4.6
1970	19,379	11,384	4,238	3.7	3,757	2.2
1971	13,332	8,263	3,069	2.6	2,000	3.4
1972	8,036	5,548	879	4.3	1,609	

Table 9. Silver hake abundance indices (mean catch/tow in pounds) from US autumn survey cruises.

Year	Div. 5Y (Gulf of Maine)	Subdiv. 5Ze (Georges Bank)	Subdiv. 5Zw-Div. 6A (S. New England)
1965	18.9	3.8	16.8
1966	9.4	4.3	7.9
1967	2.8	5.9	9.8
1968	2.8	6.9	10.5
1969	4.3	5.3	5.1
1970	5.4	4.9	5.7
1971	5.4	4.0	10.1
1972	13.8	5.2	8.8

#### 4. Redfish

US landings of redfish from Subarea 5 in 1972 were 19% less than in 1971 (Table 10). No assessment has been made on current status of the Subarea 5 stocks. The fishing character of the US redfish fleet has changed, especially over the last two years: there have been changes in the number and size of vessels and ports of operation, more diversity in species composition, and new localized fishing areas. A greater percentage of the landings from Subarea 5 are being taken from northwest Georges Bank and off Cape Cod.

*Albatross IV* autumn groundfish surveys show variable abundance over the last five years for Georges Bank and Gulf of Maine with no clear trends (Table 11). Commercial catch/day indices for the Gulf of Maine shows a downward trend beginning in 1969. Good catches will probably continue to be made over Subarea 5 in 1973 but without the frequency of former years.

Table 10. US redfish statistics, Subarea 5 (metric tons, round fresh).

Year	Total Subarea 5 landings	Div. 5Y (Gulf of Maine)		
		Landings	Days fished	Landings/day fished
1965	6,986	5,045	742	6.8
1966	7,204	4,719	429	11.0
1967	10,442	6,746	649	10.4
1968	6,576	4,060	292	13.9
1969	12,038	9,637	824	11.7
1970	15,534	13,551	1,473	9.2
1971	16,267	12,541	1,695	7.4
1972	13,161	7,150	1,132	6.3

Table 11. Redfish abundance indices from US autumn survey cruises.

Year	Div. 5Y (Gulf of Maine)		Subdiv. 5Ze (Georges Bank)	
	Wt/Tow <sup>1</sup>	No/Tow	Wt/Tow <sup>1</sup>	No/Tow
1965	30.8	62.1	2.5	4.1
1966	69.9	96.8	4.4	11.4
1967	56.7	100.8	5.8	18.3
1968	95.3	154.7	7.7	11.3
1969	47.0	66.5	14.4	17.6
1970	74.5	96.3	10.2	13.3
1971	56.0	50.8	4.1	6.2
1972	55.0	54.8	8.5	10.8

<sup>1</sup> Weight in pounds.

#### 5. Yellowtail

The US total catch of yellowtail (including discards) from Subarea 5 in 1972 was about 27,000 tons (Table 12), 7% below that of 1971. Yellowtail landings for food increased 10%, while landings of yellowtail for industrial purposes declined 18% to a negligible amount.

Research survey abundance indices for the Georges Bank stock (east of 69°) suggest a slightly lower abundance in 1972 than in 1971 (Table 13), although the commercial catch/day index remained constant. The survey pre-recruit index (age 1+) declined for the fourth year, so indications point to a decreased abundance on Georges Bank for 1973 and possibly for 1974.

The Southern New England (west of 69°) survey abundance index was considerably higher in 1972 than in 1971; however, this sharp increase is very likely due to sampling error since pre-recruit indices in the previous two years have declined rather than increased, and catch rates have not reflected any increase. The fact that the increase in 1973 survey catches occurred for all size groups, not just incoming sizes, supports the contention that the greater abundance index reflects sampling variation. It is probable that abundance will decline for the Southern New England stock in 1973.

Table 12. US yellowtail statistics, Subarea 5 (metric tons, round fresh).

Year	Food landings	Landings/day fished	Estimated discards	Est. indus. landings	Total catch
1965	36,218	3.1	12,893	972	50,083
1966	28,656	2.0	8,253	2,364	39,273
1967	20,819	2.2	14,407	4,587	39,813
1968	28,645	3.0	10,627	3,939	43,211
1969	28,739	2.7	5,202	4,265	38,206
1970	29,825	2.5	10,689	2,095	42,608
1971	21,700	2.1	7,124	397	29,221
1972	23,886	2.1	3,100	327	27,313

Table 13. Yellowtail abundance indices from US survey cruises.

Year	S. New England (W of 69°)		Georges Bank (E of 69°)	
	No/Tow	Wt/Tow <sup>1</sup>	No/Tow	Wt/Tow <sup>1</sup>
1963	50.6	32.1	30.1	22.0
1964	60.8	41.9	23.0	23.4
1965	38.7	28.0	15.0	15.7
1966	50.3	20.8	14.8	6.7
1967	57.7	31.0	19.2	13.0
1968	40.2	22.1	25.6	18.1
1969	54.8	31.7	23.1	16.0
1970	39.8	24.7	13.4	8.6
1971	41.7	20.2	15.2	11.0
1972	73.3	44.3	14.6	10.9

<sup>1</sup> Weight in pounds.

6. Red hake

Red hake landings by US vessels from Subarea 5 in 1972 decreased 38% from 1971 to only 1,711 tons (Table 14). A 50% decrease in landings used primarily for industrial purposes in Subdiv. 5Zw resulted in insufficient data from which to calculate a satisfactory catch/effort index.

The 1972 autumn research vessel survey cruise indicated a strong improvement in stock abundance in Subdiv. 5Zw and a slight decline in Subdiv. 5Ze. The survey abundance index has improved steadily in Div. 5Y since 1968 and in 1972, for the first time, was higher than in Subdiv. 5Ze (Table 14).

Table 14. US red hake statistics, Subarea 5 (metric tons, round fresh).

Year	Subarea 5 landings	Food Fish		Industrial Fish	
		Div. 5Y landings	Subdiv. 5Ze landings	Subdiv. 5Zw landings	Landings/day fished
1965	13,493	192	385	12,916	9.1
1966	4,280	634	845	2,801	2.3
1967	5,759	92	169	5,498	5.6
1968	6,216	82	161	5,973	7.0
1969	4,923	140	225	4,558	8.2
1970	4,281	249	100	3,932	6.3
1971	2,783	268	111	2,404	8.4
1972	1,711	373	160	1,178	-

Table 15. Red hake abundance indices (mean pounds/tow) from US autumn survey cruises.

Year	Div. 5Y	Subdiv. 5Ze	Subdiv. 5Zw
1965	2.7	3.4	12.4
1966	2.1	2.4	6.4
1967	1.0	1.3	5.9
1968	0.6	2.2	9.7
1969	0.7	3.3	10.6
1970	1.0	1.1	8.6
1971	2.8	3.5	8.8
1972	4.7	2.2	14.6

7. Sea Herring

The US herring catch from Div. 5Y in 1972 exceeded the catches for all years since 1963, except for 1968 (Table 16). While the catch from the adult fishery in Div. 5Y was less than in 1971, it was greater than all previous years and the catch of herring from the Maine juvenile fishery increased to 19,513 tons in 1972 compared to 15,617 and 12,960 tons in 1970 and 1971 respectively. The catch of age 2 fish (1970 year-class) along the Maine coast in 1972 was substantially greater than in the previous three years although less than in 1968 (1966 year-class). In terms of numbers, the 1970 year-class may be no greater than perhaps half to three-quarters the abundance of the 1966 year-class. The mean size of herring of the 1970 year-class was quite large, however: 18.4 cm in total length in June in Western Maine at age 2 compared with an average of 15.5 cm over year-classes 1960-1966 for the same month. Such unusually fast growth may produce early or more complete recruitment to the adult fishery. The age composition of the adult fishery in Div. 5Y indicates the continued decline in older fish and a greater dependence on recruitment and younger year-classes. The good year-classes of 1960-1963 produced 53%, 21% and 3% of the total catch (by weight) during 1970, 1971, and 1972. The very poor year-classes of 1968-1969 produced 2%, 13% and 23% during the same period for this fishery.

The US catch of herring from Div. 5Z and Stat. Area 6 was 2,884 tons, about 25% below the 1971 catch.

Table 16. US sea herring landings from Subarea 5 (metric tons, round fresh).

Year	Subarea 5	Div. 5Y	Subdiv. 5Ze	Subdiv. 5Zw
1965	34,495	33,634	861 <sup>1</sup>	...
1966	30,589	29,365	1,224 <sup>1</sup>	...
1967	31,778	31,158	620 <sup>1</sup>	...
1968	42,083	41,476	9	598
1969	30,780	28,687	832	1,261
1970	30,484	29,181	272	1,031
1971	33,890	31,491	1,194	1,205
1972	40,473	38,211	11	2,251

<sup>1</sup> Div. 5Z.

Table 17. US research cruise indices of herring abundance (mean number/tow).

Year	Autumn cruises	Spring cruises	Spring cruises
	Georges Bank	S. New England	Mid-Atlantic
1963	7.02		
1964	1.13		
1965	6.45		
1966	10.41		
1967	3.26		
1968	1.36	120.6	17.4
1969	1.14	45.8	6.4
1970	0.66	34.7	1.2
1971	0.55	4.1	3.7
1972	1.06	5.1	2.5

8. Industrial Groundfish Fishery

New England landings for industrial purposes from Subarea 5 (predominantly Subdiv. 5Zw) declined about 33% in 1972 (Table 18) due primarily to market conditions in the industrial industry. Eel pout continued to be the most important species caught while the flounders (other than yellowtail) increased in importance. Both silver and red hake registered decreases in 1972.

Table 18. New England groundfish landings from Subarea 5 for industrial purposes (metric tons, round fresh).

Year	Total landings	Species composition (%) for Subdiv. 5Zw				
		Silver hake	Red hake	Flounder	Eel pout	Other
1965	33,990	20.4	38.0	6.9	1.8	32.9
1966	27,461	9.6	10.2	18.2	25.0	37.0
1967	37,400	10.2	14.7	18.5	18.9	37.7
1968	34,729	9.9	17.2	16.5	24.2	32.2
1969	26,813	9.5	17.0	21.3	20.8	31.4
1970	20,696	6.3	17.9	16.7	28.3	30.8
1971	8,823	10.1	25.8	6.6	33.7	26.3
1972	5,944	2.1	17.9	10.3	35.3	35.8

### 9. Sea Scallops

US sea scallop landings from Subarea 5 in 1972 were 11,226 tons (1,347 tons, meat weight), a decrease of 20% from 1971 (Table 19). Because of low abundance, the number of US vessels fishing for scallops has declined significantly in recent years.

Table 19. US sea scallop statistics, Subarea 5 (metric tons, weight of adductor muscle only).

Year	Landings	Days fished	Landings/ day fished
1965	1,509	2,156	0.7
1966	901	1,001	0.9
1967	1,309	1,870	0.7
1968	1,163	1,938	0.6
1969	1,465	2,930	0.5
1970	1,553	2,588	0.6
1971	1,697	3,394	0.5
1972	1,347	2,694	0.5

## B. SPECIAL RESEARCH STUDIES

### 1. Environmental Studies

The Oceanographic Observation Post Program was continued through the cooperation of the Woods Hole Oceanographic Institution and the United States Coast Guard. Oceanographic observations were made continually at ten lightships and light stations situated off the east coast of the United States. The data are under analysis and will be published by the United States Coast Guard. This project terminated in January 1973.

The diving team began underwater surveys of proposed sand and gravel mining areas on Stellwagen Bank in order to make preliminary assessments of the living and non-living resources. Substrate and associated bottom fauna were photographed and documented at key locations on the bank. Scallops, sand dollars, skates, and longhorn sculpins were the dominant species in the proposed mining areas. Estimates of abundance of these species were made from visual counts by divers over half-mile transects while being towed just over the sea-bottom by their tender.

Temperature and salinity data collected on six offshore research cruises are being processed and plotted. The cruises were conducted in the area from Cape Hatteras to Western Nova Scotia (Stat. Area 6, Subarea 5 and Div. 4X) within the period from March (spring groundfish survey) to December (ICNAF larval herring survey).

## 2. Biological Studies

a) Haddock. Studies of fecundity and spawning of fishes in the Northwest Atlantic were continued, with emphasis on haddock and other gadoids. A survey to evaluate the size of the spawning stock and to obtain gonad samples was conducted at the end of February on Georges Bank, when the haddock were starting to spawn, cod were midway through spawning and pollock were nearly finished. Monitoring of the progress of haddock spawning for 1972 ended in late June when all fish in the samples were spent.

Haddock spawning stocks on Georges and Browns Banks now consist largely of the 1963 and older year-classes and the 1969 year-class. There is some indication that haddock are now spawning at an earlier age compared to ten years ago, when the population was very much larger and consisted of many more year-classes. Preliminary analysis also suggests possible changes in fecundity in relation to size.

About 1,100 young-of-the-year haddock stomachs have been examined for a comparison of growth and feeding of juvenile haddock before the major decline in total fish biomass (mid-1960) and after (1970). Food habits of juvenile fish of other species are also being studied as part of an investigation of the recruitment process.

Comparative studies of the effects of temperature and salinity (2 to 12°C and 26 to 36‰) on embryo mortality of cod and haddock were completed.

Experiments relating to the influence of temperature on respiration and energy utilization of haddock from fertilization to complete yolk absorption were conducted at 4, 7 and 10°C. Daily specific growth rates for cod and haddock larvae were studied at 4, 7 and 10°C.

b) Herring. Studies on the spawning ecology and early life history of the Atlantic sea herring in the area of Jeffreys Ledge were conducted over a six-week period in early autumn. These operations were conducted by two vessels; one did otter-trawl sampling of herring concentrations, dredge sampling of the substrate and herring eggs, and related oceanographic studies; the other served as a dive platform for SCUBA surveys.

Trawl collections of pre-spawning, spawning, and post-spawning herring showed that the 1967, 1968, and 1969 year-classes were dominant in the samples (651 fish from 9 samples), followed in percentage occurrence by the 1966, 1970, and 1965 year-classes respectively. Herring eggs were found at two sites; at one, they were collected with a naturalist dredge; at the second, from the stomachs of trawl-caught cod-fish. All dredged eggs were obtained from pebble, rock, and boulder-strewn bottom.

Paired bongo tows were made at 69 stations and yielded a total of 4,461 herring larvae ranging in length from 5 to 25 mm (total length). Incidence of ripe and spent fish in close proximity to the egg beds and subsequent capture of yolk-sac larvae indicate that the peak of spawning occurred during 8-18 October.

SCUBA surveys and photographs of the seabed were made in potential spawning areas to depths of 20 fathoms.

Procedures for the aging of herring by means of otoliths were discussed by Canadian and United States scientists at the Biological Station at St. Andrews, New Brunswick, in December 1972; and an ICNAF research document was prepared proposing standard methods for aging herring.

Biochemical studies on the stock structure of herring in the Gulf of Maine, Georges Bank, and adjacent areas were continued. Analysis of variance of PHI allele frequencies (angular transformation) shows significant differences of area-allele interaction for the three major herring spawning groups (Southwest Nova Scotia, Northeast Georges Bank and Southwest Gulf of Maine).

Two cruises were conducted in May in the Gulf of Maine, Georges Bank and Nantucket Shoals to study distribution and abundance of pelagic stages of larval fishes (particularly, sea herring) and to compare the sampling efficiency of bongo plankton nets with that of mid-water trawls. Larval densities were low; no herring larvae were observed caught over Georges Bank. The bongo nets and Isaacs-Kidd mid-water trawl apparently captured the same assemblages of plankton. Juvenile fish, however, were not captured in any more significant numbers by the mid-water trawl than by the bongo nets.

From September through November, four inshore cruises were conducted in the Gulf of Maine to supplement the 1972 ICNAF autumn survey of abundance and distribution of larval herring. The US part of the offshore larval herring survey was conducted in December. Preliminary results are presented in ICNAF Res.Doc. 73/11 and 73/12.

c) Yellowtail. Biochemical studies were initiated on yellowtail to provide a better understanding of stock structure in this species. Two enzyme systems were found to be extensively polymorphic and useful for our studies. Nine phenotypes have been distinguished in each system. One system shows significant

differences between Browns Bank samples and those from other areas. Gene frequency differences and population genetic analysis of the data obtained from the other system lead to the following preliminary interpretation. In the areas sampled, there are at least three stocks: Browns Bank, Georges Bank-Nantucket Shoals, and south of Hudson Canyon. Samples taken in the autumn south of Long Island conform to the Georges Bank-Nantucket Shoals complex. In the spring there appears to be intermixing of Georges Bank and southern stocks from south of Long Island to the vicinity of Hudson Canyon. The single sample available from the Cape Cod ground was not significantly different from the Georges Bank-Nantucket Shoals group. Further sampling and analysis will be required to fully clarify the stock structure and the extent of intermixing.

The effects of temperature and salinity in the respective ranges of 6 to 18°C and 28 to 38‰ on embryo mortality of yellowtail were examined in laboratory studies.

d) Assessment studies. The major assessment efforts were devoted to the evaluation of the relationship between total effort and total catch (Res.Doc. 73/8). It was concluded that 1971 effort levels in Subarea 5 and Stat. Area 6 exceeded 1954 levels by between 20 and 30%.

Preliminary mackerel assessment studies were conducted and presented as a research document. A MSY of 310,000 tons was estimated; however, current sustainable yield would be in the neighborhood of 150,000 and 200,000 tons. The 1969 year-class, while apparently larger than any since 1967, was estimated to be only 20% of the strength of the 1967 year-class.

e) Other biological studies. The prototype of a density gradient fractionation for the separation of fish eggs and larvae from invertebrate plankton has been fabricated. Initial tests indicate that we may soon be able to automatically sort fish eggs and larvae from the bulk of invertebrate zooplankton on a routine basis.

Information on biomass collected over the past ten years on macrobenthic invertebrate fauna has been prepared, assembled and checked for a quantitative study of invertebrate fauna and relationships to bottom sediments, water depth and geographical area.

Biomass estimates of long-finned squid, calculated on the basis of catches during 1967-71 groundfish surveys, were correlated with water temperature, water depth and geographical area. A life history synopsis of long-finned squid is under preparation.

On a longline cruise from Hudson Canyon to southern Georges Bank for biological studies on large marine gamefish, shark and swordfish stomachs were found to contain the remains of squid, octopus, Atlantic and snake mackerel, butterfish, silver hake and sea herring.

On the annual spring and autumn bottom trawl surveys between Nova Scotia and Cape Hatteras, all groundfish were processed as follows: length and weight data were recorded, scale and otolith samples were taken, stomach samples were collected and preserved, and gonad maturity data were recorded. The autumn survey was again conducted in cooperation with AtlantNIRO of the USSR. Selected species indices were used in stock assessment studies and given in the Status of Stock Section of this report.

Hematological studies have revealed piscine erythrocytic necrosis (PEN: confirmed in 1971 as a viral lesion of fish erythrocytes) in 6.6% of 256 cod taken from east of Nantucket Shoals to the northeast peak of Georges Bank. This is the first report of PEN in cod off the United States coast.

### 3. Gear and Selectivity Studies

The United States has initiated a study of the effect of lost pots on the lobster resource and is testing methods of escapement in conventional pots and investigating the possibility of non-entrapment pots.

The New England Fisheries Association has received an Economic Development Administration grant assistance from the National Marine Fisheries Service, Northeast Fisheries Center, to conduct pelagic trawl experimental fishing for herring, pollock, redfish and mackerel. Expert advice was also provided by a Canadian pelagic trawl fisherman. Trawl comparison experiments were conducted between *Albatross IV* and a Canadian vessel and between *Delaware II* and a Soviet vessel. In July *Albatross IV* towed side-by-side with the Canadian research vessel *A. T. Cameron* for 25 stations on the Canadian groundfish survey to test the relative fishing power of the two standard groundfish survey trawls. Preliminary analysis indicates that, although there were no significant differences for important species, the difference in total catch was significant; the Canadian gear caught twice as much as the *Albatross IV*. In September *Delaware II* and *Blesk* conducted an experiment to test the relative fishing power of a modified two-seam high rise Yankee 41 trawl and the Soviet 27.1 trawl. Final analysis of the results has not been completed, but preliminary results show that, in terms of fishing power, the two nets are comparable. In a comparison of the four-seam modified 41 high opening bottom trawl on *Albatross IV* with the standard 36 groundfish survey trawl on *Delaware II*, the fishing power of the modified 41 was 1.5-3.0 times better than the 36 for most species.

Statistical Area 6

A. STATUS OF THE FISHERIES

See Table 1 for finfish and sea scallop landings in Statistical Area 6.

B. SPECIAL RESEARCH STUDIES

1. Environmental Studies

On ichthyoplankton sampling cruises between Cape Cod and the Caribbean for the Marine Resources monitoring and Prediction Program (MARMAP), plastic and oil contaminants were found during July and August in Statistical Area 6.

2. Biological Studies

Biological studies, where pertinent, are reported under Subarea 5.

