

ANNUAL MEETING - JUNE, 1963.Serial No. 1080  
(D.a.62)Document No. 13.CANADIAN RESEARCH REPORT, 1962

## A. Subareas 2 and 3

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This report describes the Canadian researches on ground-fish carried out by the Biological Station of the Fisheries Research Board of Canada at St. John's. Hydrographic work is done by the Bedford Institute of Oceanography and by the St. John's Station. For location of the places mentioned in this report the reader is referred to the place name map in the Canadian Report for 1961, p. 4 of the ICNA Redbook, Part 2 (1962).

Cod, Gadus morhua L. Although cod catches by the various inshore gears fluctuated widely throughout the fishing season, the fishery generally was considered to be reasonably good with total landings above the low level of 1961. To the north, early in the season, fishing operations were hampered and delayed by the presence of ice. The weather throughout the summer season was generally good but there were long stormy periods in the autumn which kept fishing activities at a low level. Squid only appeared inshore spasmodically, and in small numbers, so that there was a serious lack of bait in many areas for parts of the season.

Information on catch and effort was gathered in various areas where the commercial catches were sampled.

On the northeast coast of Newfoundland at St. Anthony and La Scie fishing by all gears was poor throughout most of the season. In Twillingate, for short periods, catches by codtraps and by linetrawl (Longlines hauled by hand from a small boat) were moderately good but by gillnets and handlines they were very poor.

At Bonavista total landings by all gears were about 50% higher than in 1961. This increase was due largely to a successful handline fishery, averaging 1,200 pounds of cod per boat per day compared with 600 pounds in 1961. The traps did not consistently yield good results and, although the total trap landings were somewhat higher than in 1961, the average catch per haul was somewhat below the 1961 level. In the longline fishery the tendency seems to be for the catch to remain stable at the low level to which it has declined in the past few years, around 40 pounds of cod per line of gear for the deep-water fishery and 30-40 pounds for the shallow-water fishery.

At St. John's the codtrap is the main gear used. There was a short period of successful catches averaging 4,000 pounds of cod per haul in July but the fishery declined rapidly in August. The overall fishery was only moderately successful in comparison with other years.

The fishery in the Burin area was poor. Codtrap catches early in June gave indications of a successful fishery to follow but, although catches in late June were good, there was a rapid decline to an extremely low level for the remainder of the season.

Total codtraps landings in the Burin area were 1.3 millions pounds compared with 2 million pounds in 1961. For the linetrawl fishery the total catch was at about the same level as in 1961. Highest average daily catches per boat (800-1,000 lb) occurred in June but, similar to the codtrap results, declined afterwards and remained low for the rest of the season.

Sampling of the inshore cod fishery was carried out in the summer and autumn of 1962 at several of the larger Newfoundland fishing centres on the east and south coasts. Approximately 40,000 cod were measured, 5000 pairs of otoliths collected and supporting biological data recorded from the various inshore gears.

In samples from codtraps, 80-95% of the fish were 4-7 years old (1955-1958 year-classes). Cod first appear in the trap fishery in significant numbers as 4-year-old fish and pass out of this fishery as important contributors at 8 years of age.

The main age-groups supporting the handline and jigger fisheries are the 5-, 6- and 7-year-olds but 8- and 9-year-old fish sometimes remain in the fishery in fairly large numbers, also. Cod aged 9 years and older were somewhat better represented in linetrawl samples than in handline and jigger samples.

In contrast to the shallow-water trap, handline and line-trawl fisheries which depend mostly upon young fish, the deep-water longline catches are maintained by fish of older age-groups together with cod of younger ages which have remained in deep water.

The 1962 observations indicate that there has been a high survival of young fish in recent years (1952-1958) and cod hatched in 1957 were especially numerous in the catches. Thus, the potential supply of cod for the inshore fishery is great enough to ensure successful fishing if environmental conditions make the fish available to the various gears.

The annual survey to obtain information on the inshore distribution and relative abundance of small cod of pre-commercial sizes was carried out from Sept.17 to Oct.26. Beaches were surveyed beginning in St. Mary's Bay and extending northward along the east coast to Green Bay on the northern part of Notre Dame Bay using a small Danish seine with the codend lined with fine-meshed nylon.

The survey consisted of 150 sets. In the majority of sets in which young cod were taken, cod of the year (Zero cod) were dominant. Only in the southern areas, Trepassey and St. Mary's Bays, where catches were small, were the numbers of zero cod less than 50% of the total cod catch. To the north of these areas, from the southern shore of the Avalon Peninsula to Notre Dame Bay the zero cod were more numerous than the other groups (1- and 2-year-old cod) caught, ranging from 55% to 97% of the catch in the various regions.

In the total cod catch for all areas in 1962, zero cod made up over 80% by number. Only in 1959, when they made up 88% of the total catch by number, were the zero cod as plentiful. The survival of the 1959 year-class was quite good as was later demonstrated by the entrance in abundance of this year-class in the commercial fishery. It seems quite probable, therefore, that the 1962 year-class is a strong one as well.

The relative scarcity of one-year-old fish in 1962 supports the assumption, which was made following the 1961 survey, that the 1961 year-class probably did not survive well.

Sampling of the inshore Labrador commercial cod fishery was resumed during July and August of 1962 and extended to settlements on the Labrador side of the Strait of Belle Isle. Approximately 7,000 cod were measured and 2,000 pairs of otoliths collected between Anse au loup and Nachvak Fjord.

These included collections from the commercial trap fishery in southern Labrador (2J), from the jigger fishery in 2H and by jigger in 2G where there is no commercial fishery at present. Additional collections, involving some 3,900 length measurements and 360 pairs of otoliths, were made at 3 inshore localities in conjunction with tagging experiments.

A comparison of the length distributions from the commercial inshore fishery in 2H and 2J in 1959, 1960 and 1962 shows that the average size of fish taken has increased since 1959. The fishery in these years was based mainly on fish hatched in the years 1946-1953, and growth of these year-classes has caused the upward trend in average lengths. There has been no significant contribution to the Labrador inshore fishery by new year-classes since that of 1953.

Investigations of cod distributions and abundance were carried out on a number of cruises of the A.T. Cameron, using a No.41 otter trawl with the codend either lined or covered with small-meshed netting. These surveys covered various parts of Hamilton Inlet Bank, the Northeast Newfoundland Shelf, the costal shelf off the Newfoundland west coast, the southern Grand Bank and St. Pierre Bank. Detailed examinations of cod samples, including otolith collections, were made on most cruises.

A number of survey sets on Hamilton Inlet Bank in mid August failed to reveal the presence of any large cod concentrations, but fairly consistent catches of approximately 1,000 pounds per hour were taken in depths of 120-140 fathoms at bottom temperatures mainly between 2.0 and 3.0°C. Superficial examination of stomach contents indicated that cod were feeding pelagically on amphipods and ctenophores.

Age and length distributions of these fish were found to be unlike those seen in 1960. In 1960 the fish taken were relatively old and large in comparison with those taken in 1962, the 1962 catches consisting almost entirely of small fish of ages 3-6. In this respect the fish taken offshore in 1962 seemed to be quite a distinct group from those available to the inshore fishery at the same time. The younger ages found in quantity offshore were apparently not available to the inshore fishery and, conversely, the older age-groups which were most abundant inshore were scarce on Hamilton Inlet Bank.

Cod catches from 6 sets in depths of 75-129 fathoms on the costal part of the Northeast Newfoundland Shelf in mid August were in each case less than 700 pounds per 30-minute tow. One set off Belle Isle in 98 fathoms at 0.1°C produced a catch of 1,850 pounds in 30 minutes. Approximately 50% of the fish taken in this area were of ages 5-7. The 1957 year-class (age 5) was most prominent, as it was also in the otter-trawl catches from Division 2J.

Groundfish survey cruises to the southern Grand Bank were made in February, May and October. Cod catches were generally very small, averaging less than 300 pounds per 30-minute tow. Only 3 catches in excess of 1,000 were obtained, 1 in February at 145 fathoms and 2 in May at 80 and 125 fathoms, although several catches of 500-700 pounds per 30-minute tow were obtained south of the Virgin Rocks in May. The catches in February and May were heavily dominated (more than 50% in each case) by fish of ages 3 and 4 (1959 and 1958 year-classes). These will reach commercial size in 1964 and 1963 respectively. Fish of the 1955 year-class (age 7) were most plentiful among the commercial-sized fish, as was also the case in 1960 and 1961. Cod older than age 10 are generally scarce in this area. Temperature conditions on the southern and southwestern slopes were extremely variable: highest bottom temperatures occurred in February.

Cod were very scarce in 13 sets in depths of 21-150 fathoms on St. Pierre Bank in May. Only 306 cod were taken in the thirteen 30-minute tows, the average weight of catch being 65 pounds per tow. It is apparent from age and length distributions of cod from surveys in 1958-1962 that the summer cod population in this area at present consists chiefly of small numbers of juvenile fish.

Catches are composed mainly of fish less than 6 years of age. It is thought that the older and larger cod of this area move inshore in summer, and by winter retire to deep water near the north cape of St. Pierre Bank and in the channels. On a cruise to the Halibut Channel (western Gully) in January 1963, the A.T. Cameron located good catches (1,600-2,000 lb per 30-minute tow) in 65-85 fathoms at bottom temperatures of 0.6 to 3.0°C.

Age reading of some 21,000 pairs of otoliths collected from the Grand Bank and St. Pierre between 1946 and 1962 has been completed, and the data transferred to cards for IBM processing.

Cod tagging was resumed, after a 7-year interval, mainly to study the inter-relationships of inshore and offshore cod populations. About 7,000 cod were tagged along the east coast of Newfoundland, inshore Labrador and on Hamilton Inlet Bank.

Haddock, Melanogrammus aeglefinus (L). Otter-trawling surveys over the southern half of the Grand Bank were carried out in February and in May. During the February cruise the best catches were obtained in depths between 125 and 160 fathoms on the southern part of the southwest slope. Three catches of 2,040-3,300 pounds per 30-minute tow were obtained; the bottom temperature ranged between 4 and 5°C. In contrast with the hydrographic conditions of March 1961, when most of the stations shallower than 65 fathoms had bottom temperatures less than 1°C, in February 1962 bottom temperatures of 8 to 10°C were prevalent at the 65- and 80-fathom stations and generally over 5°C as shallow as 45 fathoms.

The regular spring survey in May resulted in poor catches of haddock throughout the entire area. The best catch of 860 pounds was obtained on the northern part of the south-western slope in 50 fathoms at 3.7°C. Near the central part of the slope in 80 fathoms at 3.9°C a catch of 640 pounds consisted mainly of small haddock averaging 19 cm in length. Associated with this was a large catch of cod which were found to be preying on the small haddock.

An abbreviated survey of St. Pierre Bank in May produced very low haddock catches. At 2 stations near the southern slope of this bank in 80 and 100 fathoms, catches of 260 and 430 pounds consisted largely of baby haddock averaging 21 cm in length. The bottom temperatures were 4.3 and 6.7°C. It is too soon to predict whether or not these small haddock are sufficiently abundant to sustain a fishery in the future.

From the catch-length frequencies and age determination of otolith samples obtained during the survey in February 1962, the most abundant group present was the 1955 year-class (mode at 38-39 cm) which accounted for about 60% of the research-vessel catches. A small group with a mode at 32-33 cm belongs to the 1959 year-class, but it will probably not be of much importance in sustaining the fishery. The year-class picture was not very different from that of the spring of 1961 when over 80% of the catches by number consisted of haddock of the 1955 and 1956 year-classes, the former being about 4 times as abundant as the latter.

From the length and age composition of the commercial haddock landings by Newfoundland trawlers, the fishery is at present almost entirely dependent on the 1955 and 1956 year-classes.

Fecundity estimates obtained from 229 ovaries of female haddock collected in the springs of 1957-1961 reveal that the rate of increase in fecundity with length is considerably greater than that previously reported for North Sea haddock. For fish of the same length there is evidence of considerable variation in fecundity. Also, the larger fish of a year-class have more eggs than the smaller ones.

There is evidence that considerable variation in fecundity may occur from year to year, as indicated by the low fecundity of haddock in 1959 and the higher-than-average fecundity in 1960. Evidence from the work of earlier investigators indicates that about 2 years elapse between the initial formation of eggs and subsequent spawning and that fecundity may be determined at the early period of egg formation. If this is true for haddock, then the unusually low temperature conditions during the spring of 1957 and the higher-than-normal temperatures in 1958 probably had the effect of determining indirectly the fecundity in 1959 and 1960 respectively, the food supply being the direct determining factor.

Redfish, Sebastes mentella Travin and Sebastes marinus (L). In 1962 the A.T. Cameron surveyed the southwestern slope of the Grand Bank. A standard No. 41 otter trawl with the codend lined with 1 1/8-inch nylon mesh was used. Trawling was limited to daylight hours and tows to 30 minutes.

On the southwestern slope of the Grand Bank catches of redfish were low in the southern part of the area, the best catches being obtained at the 150-175- and 200 fathoms levels where catches of 1,400 to 1,600 pounds per tow occurred. These fish were rather small in size.

In the central part of the area (43°39' to 43°45' N; 52°14' to 52°24' W) catches of redfish greater than 2,600 pounds per tow were obtained at all depth levels between 125 and 250 fathoms. In general, the sizes of redfish increased with depth and whereas best catches (about 5,000 lb per tow) occurred around 200 fathoms the fish were, on the whole, rather small in size; at 250 and 300 fathoms, where catches of 3,580 and 2,220 pounds of redfish per tow were obtained, the fish were much larger in size (average weight per fish greater than 1 lb).

In the northern part of the area, redfish again were less abundant and catches greater than 2,000 pounds per tow were limited to depths of 150, 175 and 200 fathoms.

American plaice, Hippoglossoides platessoides (Fabricius). The catch per unit effort for Newfoundland trawlers in all 3 major commercial plaice-fishing areas of the Grand Bank was approximately 1,500-1,800 pounds per hour in 1961. During 1961 the fishing effort along the eastern slope of the Grand Bank between Lat. 45° and 47°N was higher than in either of the areas to the north and south.

The size of plaice landed by the commercial fleet at Newfoundland ports has changed very little in the period 1954-1961. There appears to be no reduction in the larger sizes of plaice in the commercial landings.

Fecundity studies of American plaice indicate that the rate of eggs production is slightly greater than the cube of the length.

Hydrography. Six hydrographic sections from southern Labrador to the southern Grand Bank were taken by the Investigator 11 between July 24 and Aug. 20.

In the section extending off Seal Islands, Labrador (Fig.1) surface temperatures were a little higher than in 1961 but yet lower than usual. (The low 1961 surface temperatures in this area were possibly produced by the greater than usual abundance of ice). In the intermediate layer there was more water with temperatures below -1°C than in 1961. Temperatures in the deep water at the continental slope were about the same in both years, but on the top of Hamilton Inlet Bank temperatures were lower in 1962.

In the triangular section eastward from Cape Bonavista and then southward to the northern Grand Bank ( Fig.2) surface temperatures were lower and less water below 0°C (and especially below -1°C) was present in 1962. Deep-water temperatures at the continental slope were slightly lower than in 1961.

In the St. John's-Flemish Cap section (Fig. 3A) surface temperatures were lower than in 1961 but there was less water with temperatures below 0°C and particularly below -1°C. The bottom temperatures, however, were distinctly higher than in 1961 on both the Grand Bank and the western side of Flemish Cap.

Compared with 1961 the section from St. John's to the southeastern edge of the Grand Bank (Fig. 3B) showed considerably lower surface temperatures with about the same amount of cold water in the Avalon Channel but with higher bottom temperatures over the surface of the Grand Bank.

In the section at about 75m (40 fath) extending along the southwestern slope of the Grand Bank (Fig. 4A), surface temperatures were considerably lower than in 1961 but bottom temperatures on the Grand Bank and in the Haddock Channel were slightly higher.

In the section at 275 m (150 fath) along the southwestern edge of the Grand Bank (Fig. 4B) surface temperatures were much lower and, except on the slope, the remaining temperatures slightly lower than in 1961. Also, more cold water was present in the central part but not as much on the eastern part of the section.

In October, C.G. S. Labrador with scientists of Bedford Institute of Oceanography covered Baffin Bay and Davis Strait to study oceanographic conditions and to collect biological samples in the area.

A study of the circulation and the mixing in the deep waters south of the Grand Banks was initiated in February and March 1962 by the Bedford Institute of Oceanography and continued in July.

The most noticeable general picture was the occurrence of low temperatures over the whole area due to the cold weather and lack of sunshine in the summer of 1962.

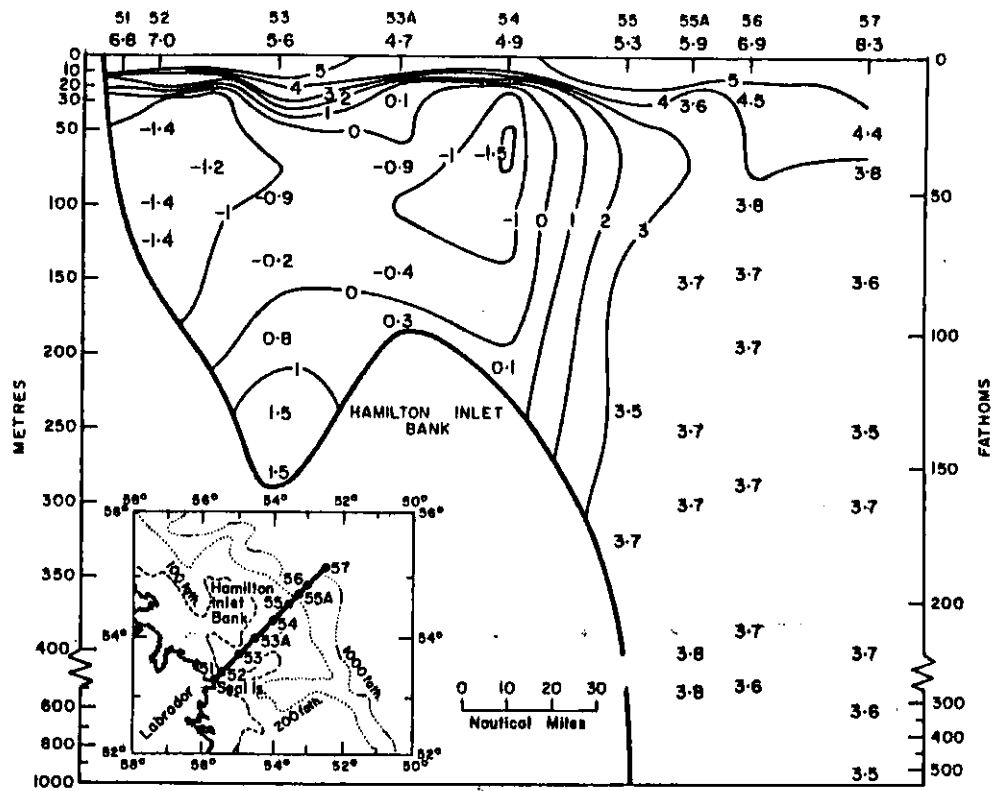


Fig. 1. Temperature section, °C, off Seal Islands across the southern tip of Hamilton Inlet Bank, Labrador, Aug. 1-2, 1962.

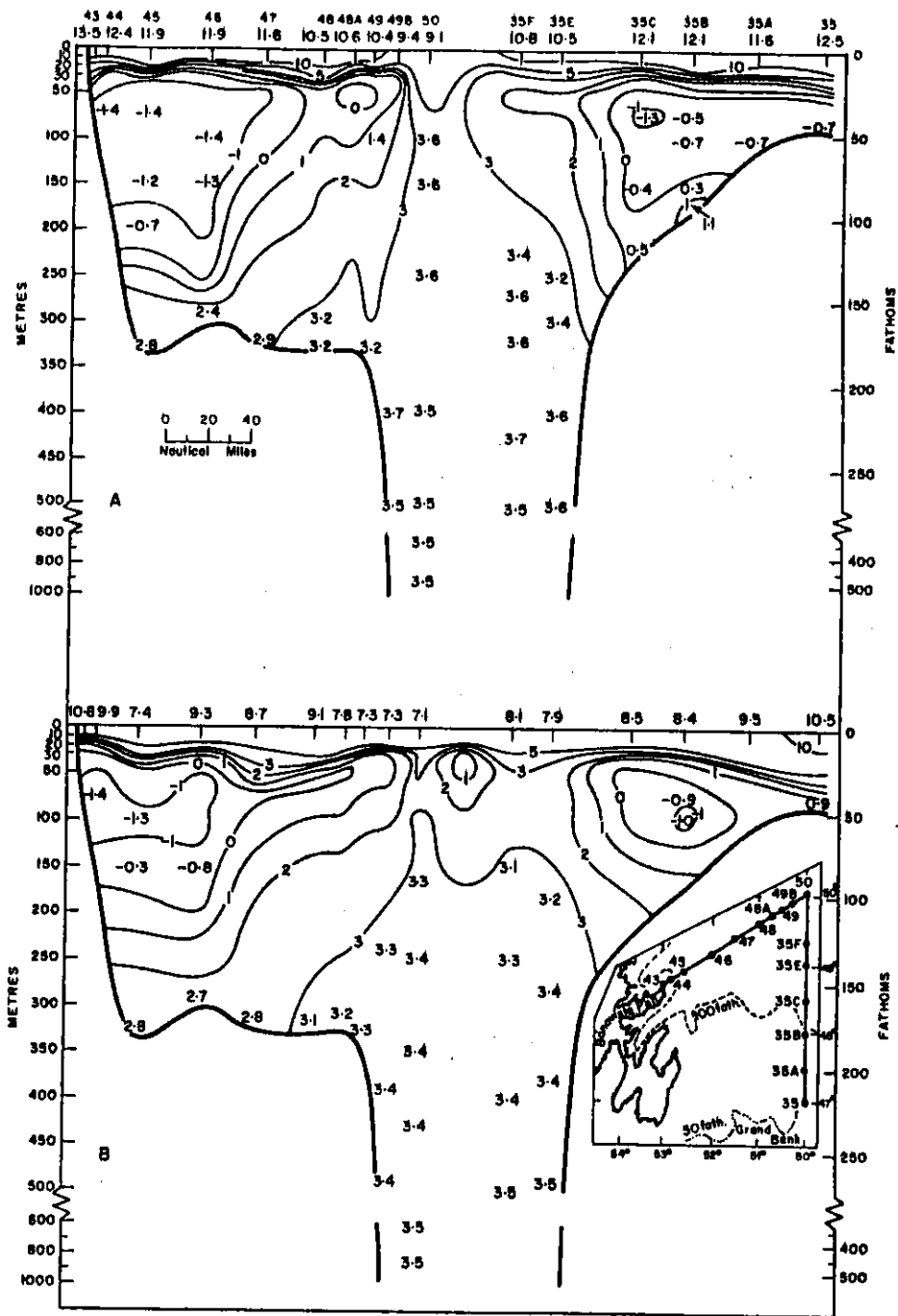


Fig. 2. Temperature sections, °C, off Cape Bonavista and southward to northern Grand Bank: A, July 26-28, 1961; B, July 25-30, 1962.



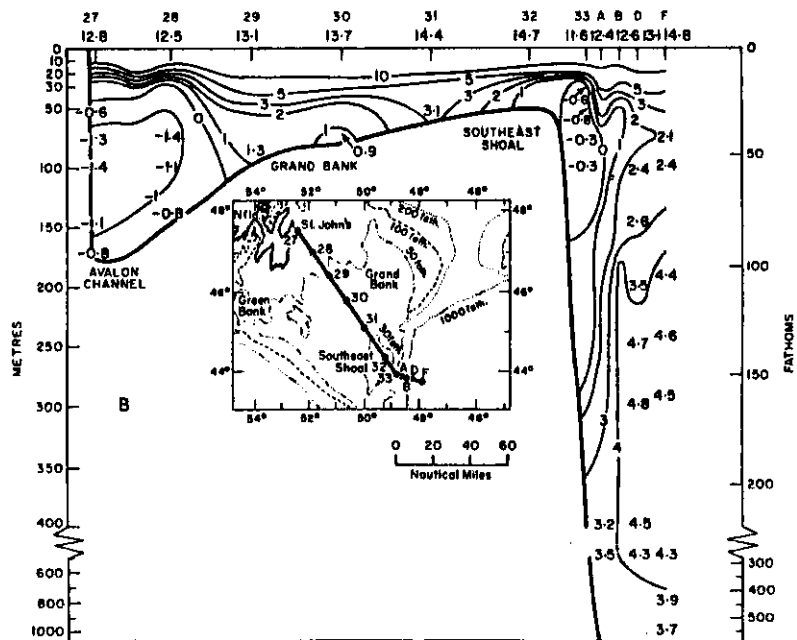
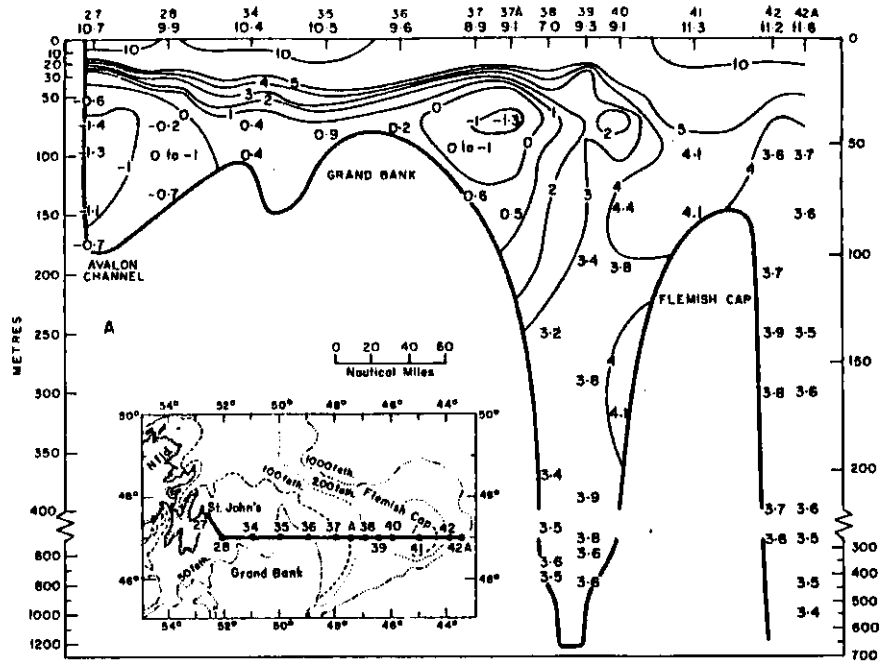


Fig. 3. Temperature sections, °C: A, St. John's-Grand Bank-Flemish Cap, July 24-26, 1962; B, St. John's-SE slope Grand Bank, Aug. 14-16, 1962.

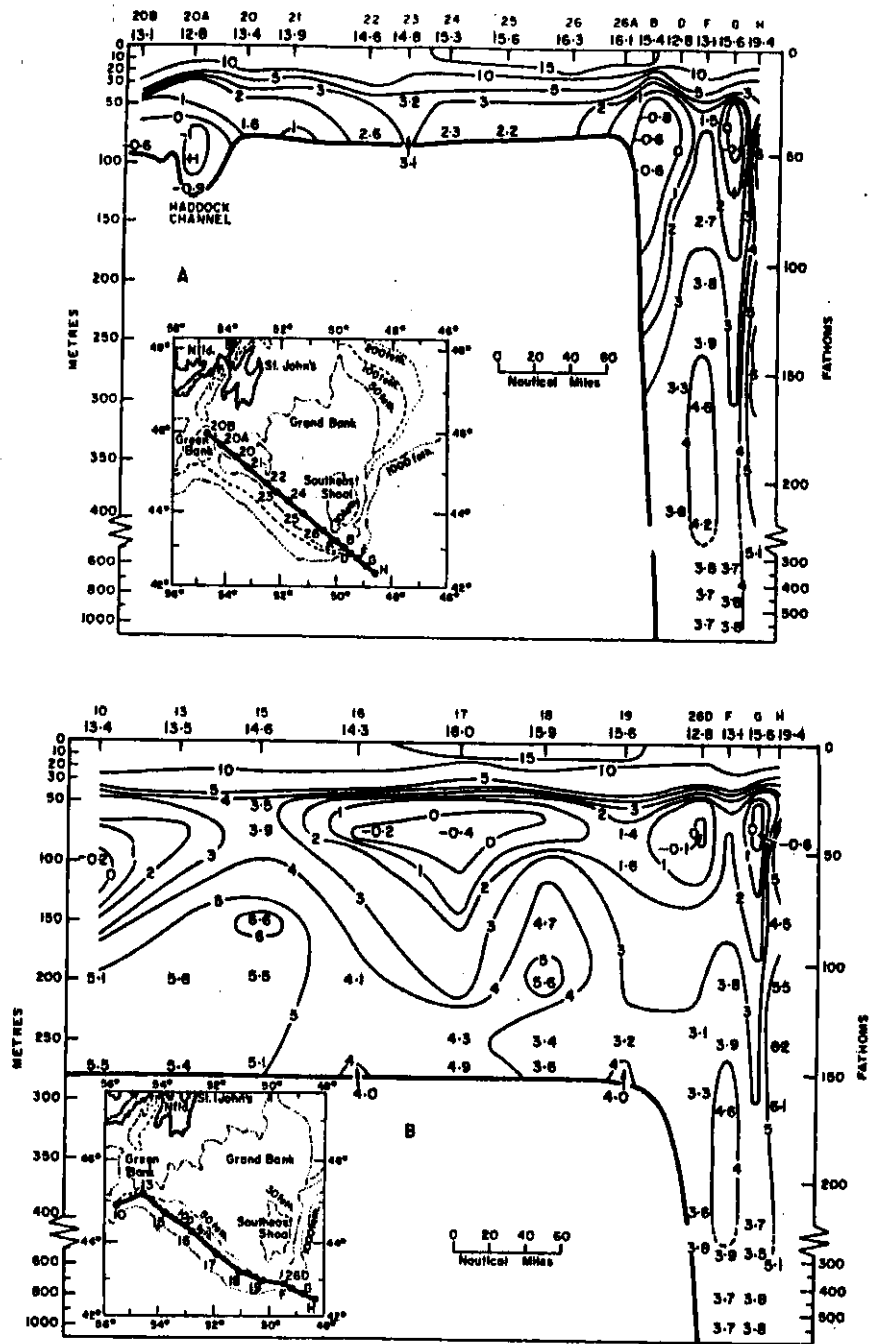


Fig. 4. Temperature sections, °C: A, Green Bank-SE Grand Bank, Aug. 17-20, 1962; B, along the southwestern slope of the Grand Bank, Aug. 17-20, 1962.