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A. Subareas 2 and 3

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Canadian researches on groundfish in Subareas 2 and 3 in 1961 were carried out mainly by the Biological Station of the Fisheries Research Board of Canada at St. John's. Hydrographic work was done by the Atlantic Oceanographic Group of the Fisheries Research Board and by the St. John's Station.

Cod, Gadus morhua L. The inshore cod fishery in most areas of Newfoundland was considered to be extremely poor. Although it is believed that the chances for a successful trap fishery are generally better in the hydrographic conditions subsequent to a cold winter, the 1961 fishery did not prove so, though the previous winter was very cold. Observations indicate that combinations of various factors probably resulted in the poor fishery in various areas. In many areas the weather was unusually sunny, warm and calm and the resulting brightness undoubtedly kept cod from the shallow fishing areas. Also, the surface layers of water warmed so rapidly that on the east coast during the trapping season in July temperatures were too high to expect that catches could be large. It was evident that for many cod of the inshore population spawning was delayed, many fish not having spawned by July. These fish were very likely in colder or deeper water than usual over winter. However, during the fishing season the inshore and deep-water temperatures in 1961 on the northeast coast of Newfoundland and off southern Labrador were not lower than usual. Cod pursue the capelin to the shore in June, but although capelin were fairly abundant in 1961 they only spawned on the beaches in most areas for short periods and then moved to deeper water to complete their spawning. Thus the cod could feed abundantly on capelin without coming into the shallowest inshore areas.

Sampling of the codtrap catches for age and length composition of cod was carried out in July-August at Quirpon-St. Anthony, La Scie, Seldom-Come-By, Bonavista, St. John's, Trepassey and Burin. Young cod are generally 4 years old when they appear in the commercial codtrap fishery. During 1961, 4-, 5- and 6-year-old fish of the 1957, 1956 and 1955 year-classes, respectively, together made up about 70-95% of the total numbers of fish caught in traps in the various areas.

From 1958 to 1961, 4-, 5- and 6-year-old cod comprised 77, 71, 89 and 80% respectively, of the trap catches of cod at St. John's and from 1959 to 1961, 93, 94 and 94%, respectively, at Burin.

Both at St. John's and Burin cod enter the trap fishery as 4-year-olds, are fully recruited at 5 years of age, have decreased in abundance at 6 and 7 years of age, and usually by 8 years of age are no longer important contributors to this fishery. Thus to maintain a trap fishery at a fairly high level a reasonably constant supply of new recruits to the fishery is necessary. A succession of poor year-classes or several poor year-classes occurring close together would undoubtedly cause a decrease in the codtrap fishery.

At St. John's and Burin the 1955 year-class showed considerable strength and contributed by number about 60% of the trap catches in 1960 and 30% in 1961.

In the line-trawl fishing the 6-year-old fish are usually of most importance with 5-year-old fish and older year-classes up to but rarely above 10 years of age contributing significantly.

At Isle aux Morts in 1961 the 1955 and 1954 year-classes dominated the catches in both March and April, but in June and July the 1954 and 1953 year-classes were dominant. Other year-classes fairly well represented were the 1956, 1953 and 1952 year-classes in March and April and the 1955, 1952 and 1951 year-classes in June and July. The younger age-groups seem to take part in the seasonal migration into the Gulf of St. Lawrence, whereas the older age-groups tend to remain in the Isle aux Morts area.

Catch-per-unit-of-effort statistics for codtraps in the Burin area show that the catch per haul in both weight and numbers may have been on the increase from 1953 to 1957. The catch per unit of effort decreased in 1958 owing to stormy weather but increased markedly in 1959 owing to the entrance of the 1955 year-class. It remained about the same in 1960 but decreased drastically in 1961, probably because of unfavourable hydrographical factors. The line-trawl catch per 100 lines decreased by about 50% from 1953 to 1961. The variations in numbers per 100 lines were not as great as in the numbers per haul in codtraps. Year-classes entering the line-trawl fishery in 1955 and 1959 caused temporary interruptions in the downward trend, while a year-class entering in 1957 had no effect on this decline, possibly because of the lesser proportion of older fish caught in 1957 than in 1956. The catch per unit of effort continued to decline in 1960 and 1961 because no good year-classes entered the fishery since 1959.

Comparisons of the weight per unit of effort contributed to the catch at Burin by each year-class of cod since it entered the fishery showed that for 1959-61 the 1955 year-class has contributed by far the most in weight to the trap fishery, followed by the 1954, 1953, 1956 and 1957 year-classes in that order. Similarly, in the line-trawl fishery in the years 1959-61 the 1955 year-class has again contributed most, followed in order of quantity by the 1953, 1954, 1952, 1951, and 1956 and 1957 year-classes.

Catch and effort data were collected for the Bonavista cod fishery during the 1961 season and sampling was carried out in July and September. At Bonavista the fishery was extremely poor and catches were below the level of the relatively poor fishery of 1960. Total cod landings amounted to about 6,800,000 pounds, of which 32% was from handlines (jiggers and baited hooks), 28% from codtraps, 15% from line trawls and 25% from longlines.

Calculations of catch per unit of effort at Bonavista have indicated for the handline fishery a small decline since 1957. In 1961 there was a further drop to a low of about 570 pounds per boat per day. The steady decline in the catch per haul for the trap fishery from 5,300 pounds per haul in 1954 continued in 1961 to a low of 1,960 pounds. It is possible, however, that the low yield in the trap and handline fisheries was greatly influenced by low availability of cod in the inshore areas due to the unusual hydrographic and other conditions prior to and during the 1961 fishing season. In the offshore longline fishery also, the steady decline in the average catch of cod per line (50 hooks) continued in 1961 to give the lowest yield since the beginning of the fishery in 1952. The catch per line in the offshore deep-water areas was only 35 pounds compared with over 100 pounds from 1952 to 1954 and about 85 pounds in 1957.

Observations on the year-class structure of the inshore cod catches have indicated that the potential supply of cod for the inshore fishery is good for the next few years so that, if favourable hydrographic conditions occur, the downward trend in the commercial trap and handline fishery could be reversed. For the longline fishery, however, it is apparent that each time a sufficiently large concentration of cod occurs on the deep-water grounds, the large European otter trawlers are attracted to the area and are able to reduce such concentrations before the local longlining fleet can reap the benefit of them.

The annual survey to gather information on the inshore distribution and relative abundance of small cod of the 0+, 1+ and 2+ age-groups was carried out in September and October. A small Danish seine, with a small-meshed, lined codend was hauled by hand to various beaches surveyed, beginning in St. Mary's Bay on September 8 and ending in the northern arms of Notre Dame Bay on October 23.

During the survey in 130 successful sets the 0+ age-group of cod occurred in small numbers, generally from 0 to 15% of the total cod taken in a particular area.

All age-groups of cod were generally caught in smaller numbers in 1961 than in 1960. This seems to indicate the possibility of the 1961 year-class being poor and supports the assumption made after the 1960 survey that the 1960 year-class is weak as well.

Temperatures in the St. Mary's Bay, Avalon-Southern Shore and Conception Bay areas were somewhat lower in 1961 than in 1960 and 1959 but from Bonavista Bay northward they were consistently higher in 1961 in areas surveyed in 1959 and 1960.

In the length distribution of the 0+ age-group of cod two groups were evident in the Notre Dame Bay area, one with a modal group at 4 cm, the other at 10 cm. In Trinity Bay, Conception Bay, Avalon-Southern Shore and St. Mary's Bay the small-sized 0+ cod were indicated by modal groups at 4-5 cm. Observations of adult cod during July revealed that, long after the regular spawning season, many cod not yet spawned would be spawning later in 1961. It is possible, therefore, that the smaller fish of the 0+ age-group indicated by the 4-cm mode in the length distribution are progeny of the late-spawning cod while the fish indicated by the 10-cm mode are from the earlier-spawning cod. The scarcity, in most of the survey areas, of the larger sizes of the 0+ age-group could indicate poor survival from the earlier-spawning fish.

Studies of cod distribution and abundance, as well as of age and length distributions of the catch, have been made from data collected on groundfish survey cruises of the A.T. Cameron over the past two years. Survey operations were carried out over most of the continental shelf and offshore banks of ICNAF Subareas 2 and 3 by means of half-hour tows with a No. 41-5 otter trawl having the codend lines with 1 1/8-inch nylon mesh, a 79-foot headrope and a 100-foot groundrope.

Age distributions of the cod obtained in the A.T. Cameron cruise to the Labrador Shelf in August 1960 showed that in the north (ICNAF Division 2H) 3-year-old fish (1957 year-class) made up almost 25% of the catch, while fish of ages 3-5 (1957, 1956 and 1955 year-classes) together accounted for more than 55% of the catch. Older fish were more prominent on Hamilton Inlet Bank (ICNAF Division 2J) where only 25% of the catch was of ages 3-5, while almost 50% was of ages 6-10. The 1955 (age 5) and 1953 (age 7) year-classes were most abundant in the southern part of the area. Growth is slow in the area as a whole

and although fairly old fish occurred in most of the catches, few were greater than 80 cm in length.

A survey cruise was also made to the northeast Newfoundland Shelf in August 1960 and five groups of stations were fished. Depths fished throughout the cruise ranged from 110-406 fathoms. Cod catches in the area of the Funk Island Deep were invariably small, everywhere less than 500 pounds per half-hour tow. Only three catches in excess of 1,000 pounds were obtained in the survey, those being taken on the northern slope of the Grand Bank in depths of 152-205 fathoms and at temperatures of 2.4 to 3.1°C. The catches during this survey consisted largely of young and small fish, the 1957 year-class alone (age 3) accounting for almost 40% of the catch for the whole cruise. Another 20% was 4- and 5-year-old fish (1956 and 1955 year-classes).

The 1955 year-class was strongest among cod of commercial size on the southern Grand Bank and the remains of a strong 1952 class are visible. The 1956 and 1957 year-classes are both moderately strong but, as in the north, the strongest young year-class is that of 1958 which comprises more than 30% of the catch in most samples.

The warmer water conditions of the southern Grand Bank cause cod to grow faster than those of the north and there were greater numbers of large fish in the southern catches. On few parts of the bank, however, were big cod abundant and fish over 10 years old seldom made up more than 10% of the catch.

St. Pierre Bank was only surveyed once during the 1960-61 period, in June 1960. The cod were found to be concentrated on the top of the bank, taking advantage of the warming of the surface water to move into the shallow feeding areas. Catches were everywhere rather small, however, and only one exceeded 1,000 pounds. At this time St. Pierre Bank had a remarkably young cod population, with very few fish older than 6 years or longer than 70 cm. The 1955, 1956 and 1958 year-classes comprised 75% of the catch and the bulk of the remainder was made up by the 1957 year-class.

In the cruise of the A.T. Cameron to Flemish Cap and northern Grand Bank, March 20-29, 1961 (Fig. 1) cod were scarce on Line I north of Flemish Cap--largest catch 510 pounds in 175 fathoms (4.6°C)- but were more plentiful south of Flemish Cap (Line II) with significant numbers at all depths from 100 to 216 fathoms and the greatest amount 1,900 pounds with 1,800 pounds of redfish at 216 (200-237) fathoms at a bottom temperature of 3.8°C. Most of the mature spawning cod were to the south of Flemish Cap rather than to the north.

There was a moderately good catch of large cod (2,300 lb) at 140 fathoms (3.5°C) on the NE corner of the Grand Bank (Line III).

On the northern Grand Bank (Line IV) a large catch of cod (8,000 lb per half-hour tow) was made at 100 fathoms (1.2°C) and a smaller catch (3,000 lb) at 120 fathoms (2.0°C). At greater depths and increasing temperatures there was a quick decrease in catch to 660 pounds at 150 fathoms (2.3°C) and to 100 pounds at 240 fathoms (3.6°C). In this area the cod on the 100- fathom contour formed a large body, readily visible on the Simrad echo sounder (Fig. 2) but, in spite of the large catch, to a great degree off the bottom and temporarily unavailable to the bottom trawl. As the vessel steamed deeper toward 120 fathoms the cod on the echo-sounder record gradually came off the bottom and in the 120-fathom set no accumulations were seen near bottom on the echo sounder in spite of the 3,000-pound catch in a half hour.

What is the cause of these accumulations of cod? One possibility is temperature. The maximum cod concentration north of Flemish Cap at 175 fathoms (4.6°C) and south of Flemish Cap at 200 fathoms (3.8°C) cannot be ascribed to temperature preference, the bottom temperatures between 100 and 200 fathoms ranging only from 3.4 to 4.6°C on the northern line of stations and between 3.4 and 4.1°C on the southern line. These Flemish Cap cod were mainly recently spent and feeding heavily. On the northern Grand Bank cod were most abundant at the lowest temperature, 1.2°C (100 fathoms), and moderately abundant at the next lowest, 2.0°C (120 fathoms). Again it is doubtful that the temperatures in the water deeper than 100 fathoms are restrictive, the range from 100 to 200 fathoms being 1.2 to 3.6°C. The cod were mainly maturing and would spawn in a month or two. They were feeding well. Where an overlying cold layer of water below 0°C exists, as in this area, cod are often numerous just below the overlying cold layer. The preference may be for low temperature, as shallow a depth as possible, a particular type of bottom, or food.

One possibility is that where temperatures are not restrictive these feeding cod are concentrated by food. In the Newfoundland area many of the cod concentrations are in areas where capelin abound. At Flemish Cap capelin were not present, probably because the water is too warm for this cold-water fish. There were abundant young cod and redfish, however, the cod concentrations in the shallower water, 95-130 fathoms, feeding mainly on small cod and those in the deeper water, 150-240 fathoms, almost entirely on small redfish. The cod concentrations on the northern slope of the Grand Bank on Line IV were in the shallower 100-120-fathom depths and were feeding almost entirely on young capelin. It is probable that in both of these areas, while seasonal or other habits and factors were presumably operating, food was more important than temperature in producing the cod concentrations encountered.

On Flemish Cap almost all the cod were spent, having spawned in March and some probably as early as February, because many of the male testes were in recovery stages with newly recovered pink testis at the edge. Most of the remaining females had some clear eggs and would spawn in April while a few would not spawn before May. On the northeast Grand Bank (Line III) and at the North Cape of the Grand Bank (Line IV), on the other hand, none of the cod had spawned and none of the females had clear eggs. All, except a small number which were still in the spent condition from the previous year's spawning, were in the early stages of egg development with egg diameters mainly about 0.3-0.4 mm and the first spawning could not be expected before May-June.

On Flemish Cap cod of ages 3-5 (1958, 1957 and 1956 year-classes) made up 75% of the catch. Age 6 cod (1955 year-class), abundant in other Newfoundland areas, were scarce on Flemish Cap. Old fish were also comparatively scarce.

On the northern slope of the Grand Bank the 1955 year-class with a modal length of 58 cm was the most abundant of the commercial-sized fish (40% of the catch). The 1957 year-class was also well represented and the 1958 year-class, below commercial size, very numerous.

Haddock, Melanogrammus aeglefinus (L). Otter-trawling surveys were carried out in March and in June over the southern half of the Grand Bank. During the March cruise it was found that most of the shallow area of the bank to a depth of 50 fathoms was covered with cold water, the bottom temperatures being close to 0°C, and haddock were scarce. Along the south-western slope of the Grand Bank bottom temperatures were higher and more favourable for haddock. The best catches were obtained in depths of 100-120 fathoms where the bottom temperatures were 2.5 to 3.5°C.

The regular spring survey was carried out in June about five to six weeks later than usual and no large concentrations of haddock were found. The best catches (1,000-1,300 lb) occurred in 40-50 fathoms. It appeared that the winter concentrations in the deep water along the southwest slope had dispersed and the haddock were well into their early summer migration northeast and eastward across the southern part of the bank.

During the summers of 1959 and 1960 large concentrations of haddock were located in shallow water of 25 fathoms on the Southeast Shoal of the Grand Bank, the catches averaging more than 10,000 pounds per hour's dragging. During the summer of 1961 two visits were made to this area, but haddock were not found in sufficient abundance to carry out the planned selectivity experiments.

From the catch-length frequencies and age determination of otolith samples obtained during the Grand Bank survey in June 1961, the most abundant group present was the 1955 year-class (with a mode at 36-37 cm), which accounted for nearly 65% by number of the research-vessel catches. The once very abundant 1949 year-class together with the 1952 and 1953 year-classes have become so reduced in numbers that they comprised less than 5% of the catches. The 1956 year-class, probably about one quarter as abundant as the 1955 year-class, survived only moderately well and all year-classes since then, with the exception of a small 1958 year-class, have been almost complete failures.

From the length and age composition of the commercial haddock landings by Newfoundland trawlers, it is evident that, as the 1955 and 1956 year-classes become reduced, the future of the haddock fishery is not bright. Up to 1961 no successful year-classes are evident since that of 1956, apart from a small 1958 year-class which is not expected to provide a very significant addition to the commercial fishery. Even if good survival occurs in 1962, it will be four to five years before the haddock of this brood grow to marketable size.

Redfish, Sebastes marinus mentella Travin and Sebastes marinus marinus (L). The comprehensive survey of the redfish of the Newfoundland area by the A.T. Cameron has been continued in 1961 with cruises to Flemish Cap, the North Cape of the Grand Bank and the eastern slope of the Grand Bank.

Three lines of stations on the eastern slope of the Grand Bank were examined from September 13-21, 1961, and on all lines peak redfish catches occurred in the general depth range of 125-200 fathoms. The largest catches, 8,400 and 7,200 pounds per half-hour drag, were taken at 150 and 175 fathoms, respectively, on the southernmost line (Lat. 43°30'N). These consisted mainly of small fish, with a preponderance of males. The centre of abundance of the large males on the northern line (Lat. 47° N) was at 175 fathoms while for the females it lay 25 fathoms deeper--at 200 fathoms. Only seven marinus-type redfish were taken during the trip. These occurred at 125 fathoms on the two northerly lines.

The A. T. Cameron carried out a survey cruise to Flemish Cap and northern Grand Bank in March 20-29, 1961 (Fig. 1). All catches were in half-hour drags in daylight sets. North of Flemish Cap on Line I marinus-type redfish were scarce, the best catches per half-hour's dragging being 140 pounds in 175 fathoms and 70 pounds in 200 fathoms with only 5 pounds at 150 fathoms. In the summer and autumn in this area the best catches of marinus are in 125-150 fathoms. (In a previous cruise of the A. T. Cameron to this area north of Flemish Cap in November 1958 two catches of about 3,000 pounds marinus and 1,500 pounds mentella, and 1,800 pounds marinus and

1,800 pounds mentella were obtained in two half-hour tows at 150 fathoms and only about 10 pounds of marinus to 2,300 and 2,600 pounds mentella in two tows at 200 fathoms.) Mentella-type redfish were most plentiful (3,400 lb) at 290 fathoms and the second best catch (2,300 lb) at 350 fathoms. The best of two catches at 250 fathoms was 1,800, and at 200 fathoms and shallower catches were very low (290-12 lb). There was an unusual abundance of large males at 350 fathoms. Usually females are more plentiful in these very deep sets.

These depths for good redfish catches are at least 50 fathoms deeper than we have found in this same area in previous years during summer-autumn. While this result is based on very few hauls, it corresponds approximately with Travin's observations (ICNAF Ann. Proc. 9: 81-85, 1959) that dense aggregations of redfish occur in Divisions 3M (Flemish Cap), 3K and 3L at depths of 300-450 metres (165-245 fathoms) and in the winter months on Flemish Cap to 600-650 metres (330-355 fathoms).

On the southern slope of Flemish Cap on Line II there was a fairly good catch of mentella (1,800 lb) equally mixed with cod at 200-240 fathoms but stormy weather prevented deeper fishing.

On Flemish Cap bottom temperatures and mid-water temperatures in the redfish range were between 3.7 and 4.6°C, little different from and no lower than those found during summer. The concentration of the Flemish Cap redfish at greater depths in winter is therefore due to some other factor than temperature.

On the northern slope of the Grand Bank on Line IV the best catch of mentella was 5,100 pounds at 240 fathoms with catches half this size at 200 and at 175 fathoms. All these good catches were made at bottom temperatures of 3.5 to 3.6°C. On all lines mentella sizes increased with depth.

In the northern Flemish Cap sets the mentella females with the best developed larvae in their ovaries were found in the deep water at 250 and 290 fathoms (March 21-22). Here usually a high percentage of the larvae were hatched, a few females were already spent and 5-10% of the females had larvae all hatched, fully developed and ready for extrusion.

At 200, 175 and 150 fathoms (March 22) there were very few ature mentella females in the catch and both mentella and marinus (encountered in moderate numbers at 175 fathoms) females were generally at least several weeks behind the mentella of 250-290 fathoms in development. Instead of having a large number of fish with 50-100% of the larvae in the ovary hatched as at 250-290 fathoms, at the shallow depths most of the females had larvae 2-10% hatched and this, in most cases, was presumably artificial hatching due to pressure changes and other physical shocks.

On the northern slope of the Grand Bank (Line IV) there was the same spawning picture for mentella as at Flemish Cap. The mentella females with the most highly developed larvae lay deep. At 275 fathoms (March 29) about 12% of 49 mature females examined had already spawned and about 45% had larvae 100% hatched and ready for extrusion. At shallower depths the percentages spent in the present year and 100% hatched and ready for extrusion, respectively, at 240, 200 and 175 fathoms (March 29) were approximately 10, 10; 3, 8; 0, 4% (numbers of mature females examined respectively 29, 38, 23).

Bottom temperatures on the northern slope of the Flemish Cap (Line I) at 290, 250, 200, 175 and 150 fathoms were respectively 3.75, 4.22, 4.36, 4.59 and 4.14°C and near the North Cape of the Grand Bank at 275, 240, 200 and 175 fathoms 3.71, 3.58, 3.48 and 3.59°C, respectively. On the northern Grand Bank (Line IV) although bottom temperatures at 275 fathoms were only slightly higher than at the shallower depths females migrating upward at night, if they went very far upward, would encounter considerably and progressively lower temperatures at the shallower depths than those at 275 fathoms. This, however, was not true of the Flemish Cap. Here the redfish rising at night from 300 and 250 fathoms would have encountered slightly higher temperatures whereas those rising from the higher temperatures at 200 and 175 fathoms probably would have encountered still higher temperatures.

It seems likely, therefore, that while the local temperatures at a depth range corresponding to the daily vertical migration must determine the speed of larval development in the ovary, there is apparently a tendency for the mature mentella females to move downward in winter and early spring to depths of 250-300 fathoms and that the tendency to move downward is triggered by ovarian development.

At Flemish Cap there were large numbers of small redfish 7½-15 cm long. These were scarce in the catches but very abundant in cod stomachs which often contained 4 or 5 little redfish of 7½-12 cm long in a single stomach. (Young cod of all sizes were also numerous, including the smaller sizes of about 10-25 cm which, although appearing in the catches, seemed to be relatively more numerous in cod stomachs.) A 1 1/8-inch mesh nylon codend liner was used and even the 8-10 cm redfish very abundant in cod stomachs should have been retained. Very likely, however, most of these young fish were higher off the bottom than the otter-trawl mouth and were being obtained by the cod by pelagic feeding at higher levels. Evidently the Flemish Cap circulatory system is excellently suited to retention of cod and redfish larvae and young fish.

On the northern slope of the Grand Bank (Line IV) there were some young cod, but young redfish below 24 cm were almost entirely absent.

Redfish food and feeding. Fishing experiments in Hermitage Bay have enabled extended collections of redfish stomach contents to be made at a single locality. The redfish is shown to be almost exclusively a pelagic feeder and in Hermitage Bay the feeding regime is based largely upon two species of euphausiid--Meganyctiphanes norvegica and Thysanoessa raschii.

In relation to their weight small redfish feed more intensively than the large and in addition the large redfish show a preference for larger food organisms, eating a high proportion of sub-adult capelin when these are available. Examination of the data relating to the problem of stomach eversion indicates that empty stomachs are more likely to evert than those containing food.

Seasonal variations in redfish feeding in Hermitage Bay are thought to be related to seasonal movements and the abundance of euphausiids. Superimposed upon this pattern are variations attributable to the physiology of the sexual cycle.

American plaice, Hippoglossoides platessoides (Fabr.). A survey of the commercial American plaice areas of the Grand Bank was carried out during 1961. Approximately 2,000 American plaice were tagged using Petersen disk tags and by February 1962 about 100 of these had been returned. The incidence of jellied fillets of plaice was found

to be very low. Otolith studies indicate that plaice are on the average as much as 10 cm smaller at comparable ages on the northern half of the Grand Bank than they are on the eastern and southeastern sections.

Commercial trawler catch and effort statistics indicate a sharp increase in effort in all major plaice fishing areas for the northern, eastern and southeastern parts of the Grand Bank. This has resulted in a gradual decline in the catch per unit of effort for the latter areas whereas for the northern half of the Grand Bank the catch per unit of effort has remained steady in spite of a sharp increase in the effort.

Hydrography. The hydrographic sections from southern Labrador to the southern Grand Bank were taken by the Investigator II and the A. T. Cameron between July 22 and August 21.

In the Seal Islands, Labrador section (Fig. 3A) in 1961 surface temperatures were generally several degrees lower than in 1960 but in spite of the unusually cold water there were no temperatures lower than -1.03°C in contrast to the usual existence of temperatures as low as -1.3 to -1.5°C. Bottom temperatures also of the inshore deep water and of the southern part of Hamilton Inlet Bank intersected by this section were higher than usual. In the deep water on the offshore seaward slope of Hamilton Inlet Bank where temperatures of over 4.0°C were present in 1960 and in 1957, temperatures had reverted to the normal below 4°C.

In the Cape Bonavista section (Fig. 3B) the temperature picture at all levels in 1961 was not much different from that in 1960. There were, however, no temperatures of -1.5°C and lower in 1961 whereas a small volume of this very cold water was present shoreward in 1960.

In the St. John's-Flemish Cap section (Fig. 4B) there was more water below -1.0°C and colder bottom water in the deep inshore layer and on the top of the Grand Bank in 1961 than in 1960 but the actual lowest temperatures to be found (-1.3°C inshore, -1.0°C offshore) were slightly higher in 1961 than the corresponding 1960 temperatures (-1.4 and -1.3°C). Over the western part of the Grand Bank the superficial layer of warmer water was thinner in 1961 but in the remainder of the section temperatures were little different from those of 1960.

In the section from St. John's across the Grand Bank and the northern part of the Southeast Shoal of the Grand Bank (Fig. 5A) temperatures were not widely different from those in 1960 but the water with temperatures below 0°C and below -1.0°C lay considerably deeper shoreward in 1961 and the volume of cold water below 0°C and below 2°C in the eastern branch of the Labrador Current was considerably less in 1961. The lowest temperatures were slightly lower in 1960 (-1.5°C inshore and -1.2°C offshore) compared with -1.4 and 1.1°C, respectively, in 1961.

In the section at about 40 fathoms (75 m) extending close to the southwestern slope of the Grand Bank (Fig. 5B) in 1961 there was a little more water below -1.0°C in the Haddock Channel than in 1960 but in the eastern branch of the Labrador Current the coldest water was -0.8°C whereas there was a small volume at -1.1°C present in 1960. Otherwise the water temperatures in the two years were fairly similar.

In the section at 275 metres (150 fathoms) fringing the south-western slope of the Grand Bank (Fig. 6) in 1961 there was much less water below 0°C and below 2°C than in 1960 in the eastern branch of the Labrador Current and above-bottom temperatures toward the tail of the bank were several degrees higher than in 1960.

In all the sections in the intermediate layer (on bottom in the shallower areas) little trace could be found of unusually cold water or an unusual volume of water below 0°C and below -1°C resulting from the much-below-average air temperatures with the unusual amount of ice formation observed in the winter of 1961.

In 1961 the St. John's-Flemish Cap section was done on March 25-27 (Fig. 4A) as well as at the usual time in late July. The winter of 1961 in the St. John's area was very cold with a most unusual amount and thickness of ice. The ice extended seaward on this section to Station 34A, over 80 nautical miles from St. John's. Deep-water temperatures east of and at the top of Flemish Cap in March were close to those in July (Fig. 4B) but on the western slope of Flemish Cap temperatures between 200 and 300 metres were approximately a degree centigrade higher and at 400-500 metres a half degree centigrade higher in March than in July. In the deep water of the eastern slope of the Grand Bank bottom temperatures were only slightly lower in March than in July. On the surface of the Grand Bank, however, in 100 metres and less very low temperatures of -1.6 to -1.7°C were found in March compared with -0.7 to -0.9°C in August. Most of the mass of water from the top of the Grand Bank to shore had temperatures of -1.6 to -1.8°C in March compared with lowest temperatures of -1.1 to -1.3°C for a much smaller mass of water below 1°C situated shoreward in July. Surface temperatures were of course much lower, ranging from -1.4 to -1.6°C shoreward in March to 3.8 to 5.7°C over Flemish Cap while in July all surface temperatures were between 11.5 and 12.5°C.

The Atlantic Oceanographic Group conducted an oceanographic cruise in Subareas 2 and 3 in co-operation with Lamont Geological Observatory, Columbia University, during August and September. While emphasis was given to geophysics and marine geology, physical, chemical and biological observations were carried out throughout the cruise.

The Division of Oceanographic Research, Department of Mines and Technical Surveys, occupied a series of oceanographic stations in the Labrador Sea (Subarea 1) and Baffin Bay (Subarea 2) during the late summer of 1961 in C.M.S. Labrador. The data, primarily physical, will be published in a data record.

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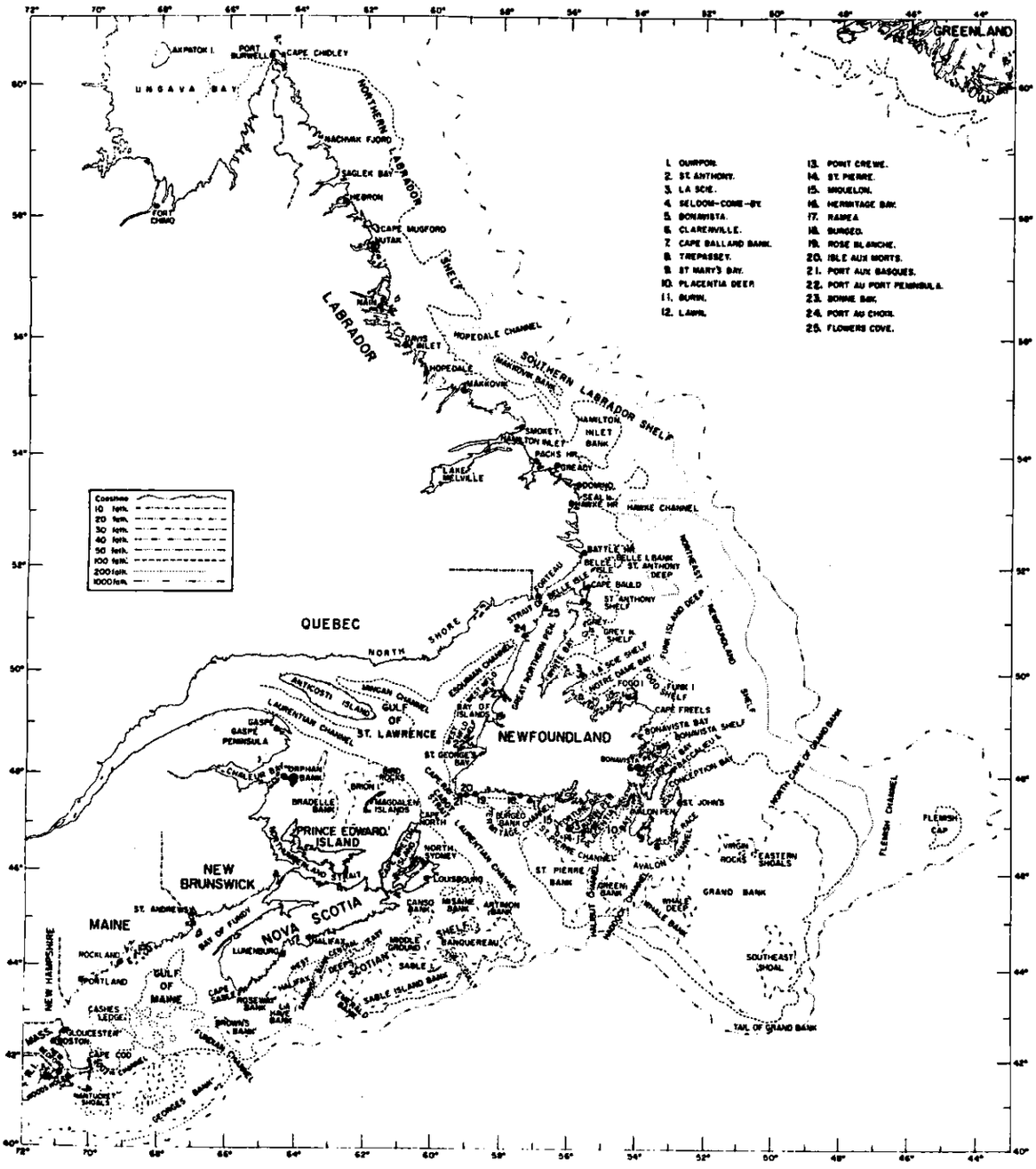

Map showing names mentioned in the text as well as recognized names for some localities related to fishing and chief fishing grounds of Subareas 2, 3, 4, and 5 and, also, suggested names for other features of the fishing grounds chiefly in Subareas 2 and 3.

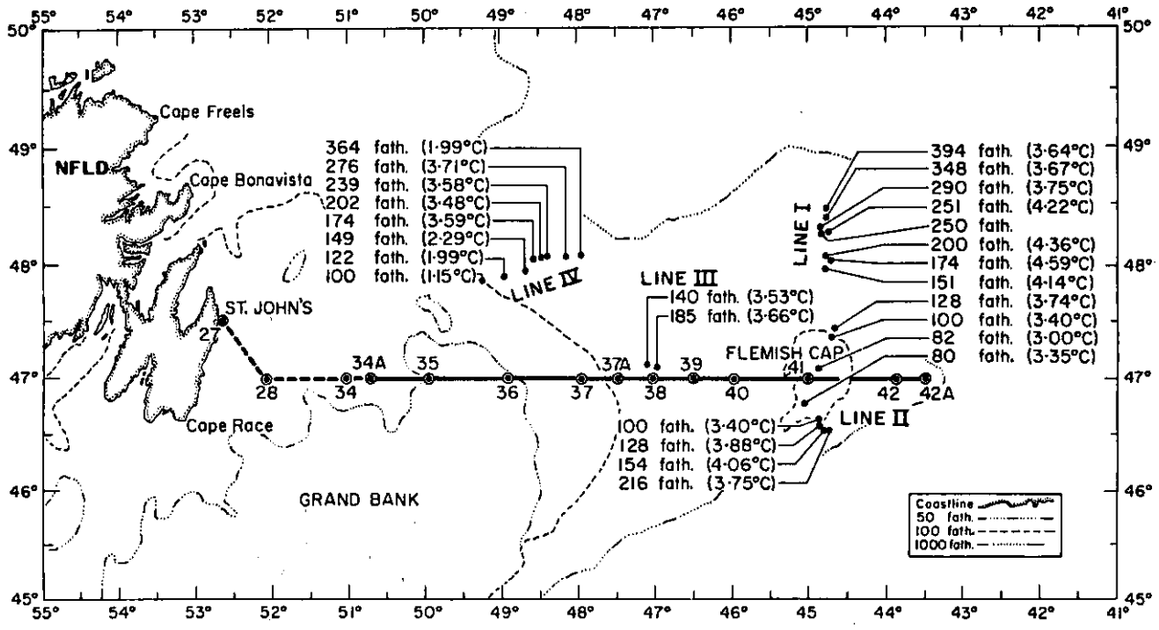

Fig. 2 Echo-sounder record of cod and possibly capelin, Line IV northern Grand Bank, March 28, 1961: A, half-hour drag at 100 fathoms (8,000 lb cod); D, half-hour drag at 122 fathoms (3,000 lb cod); B and C, ranging from end of A (100 fathoms) to beginning of D (122 fathoms).

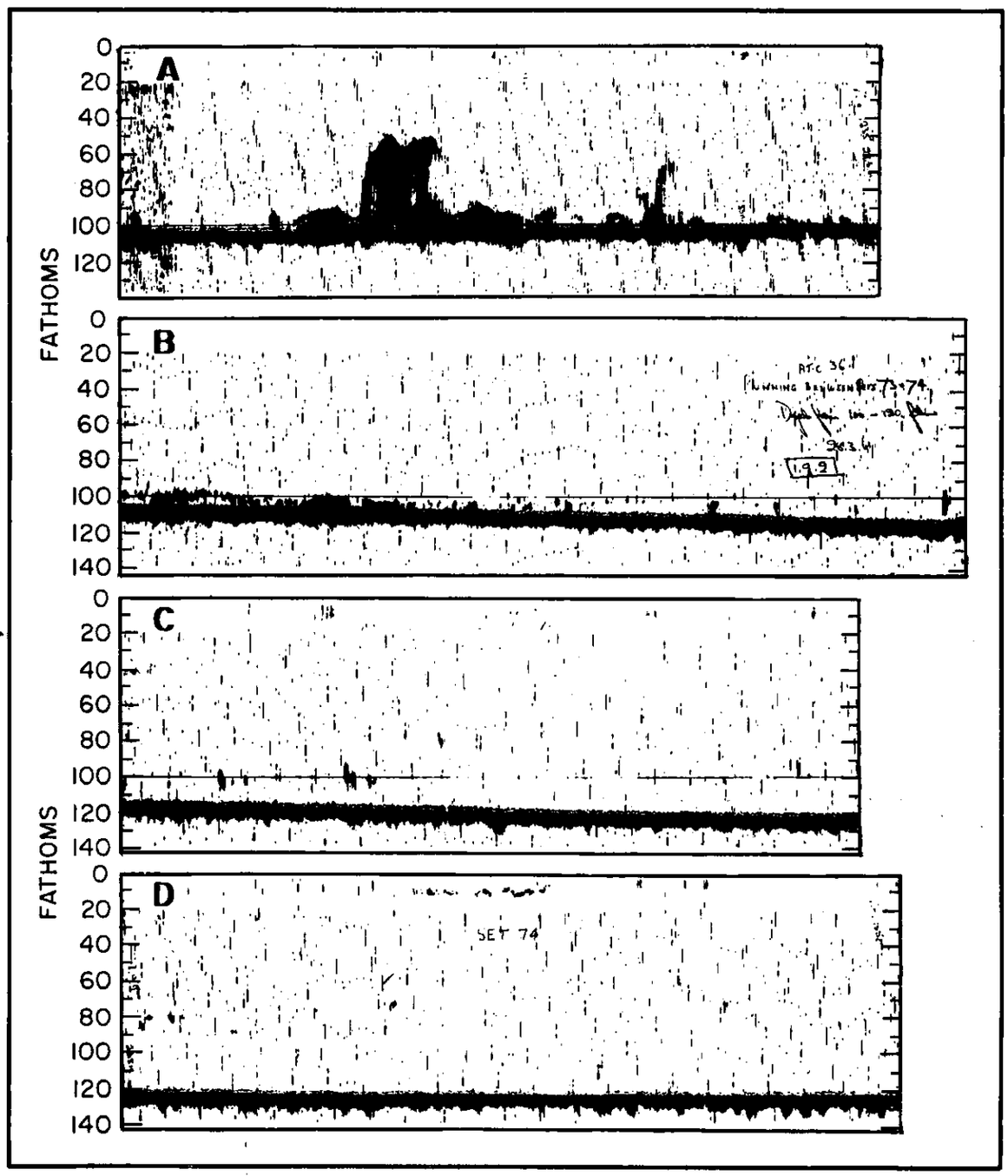

Fig. 1 Stations, fathom depths and bottom temperatures where half-hour otter-trawl drags were made by the A. T. Cameron, March 20-29, 1961. (Note the line of Hydrographic Stations 27-42A and see Fig. 4A for temperature section taken during this cruise.)

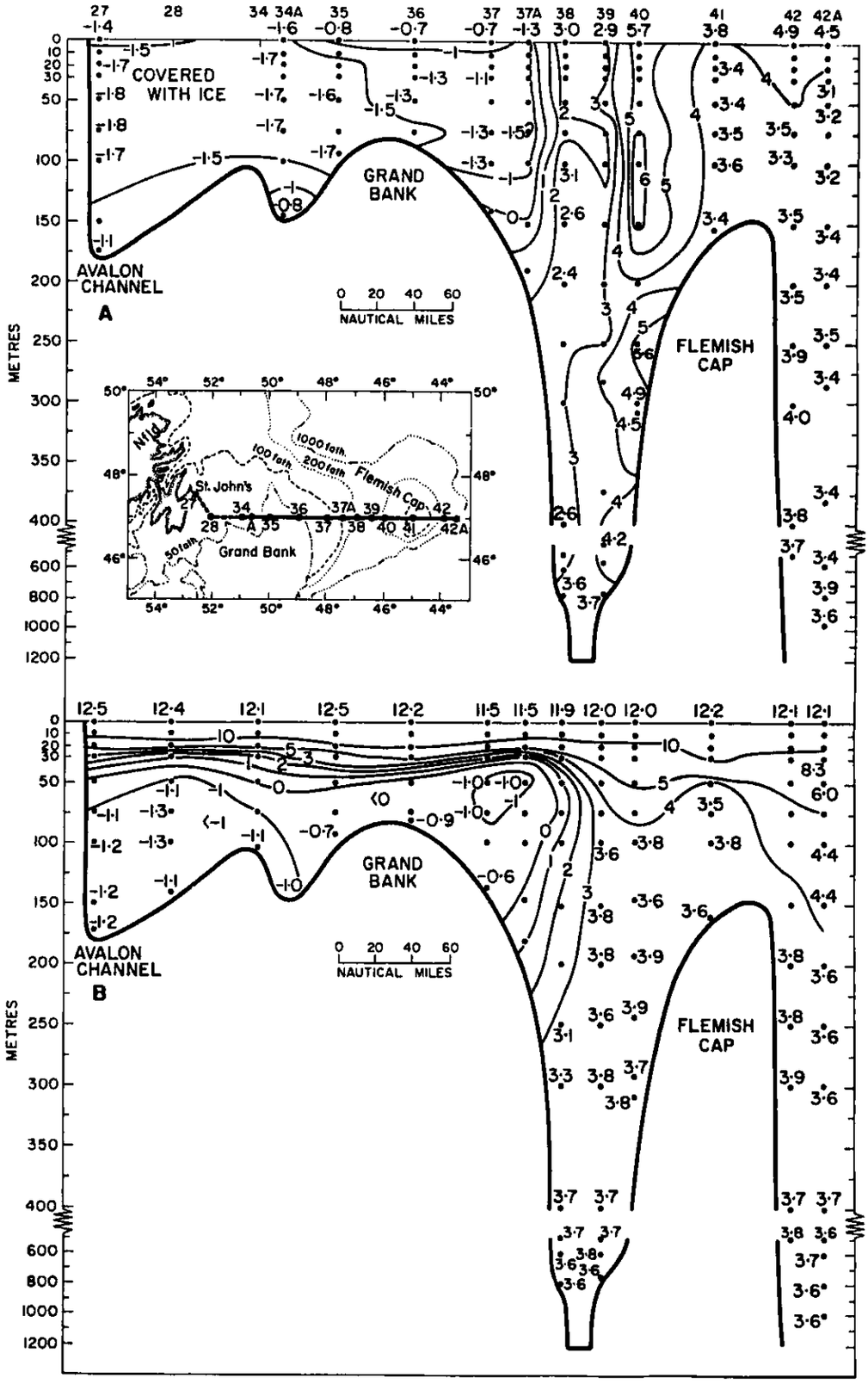

Fig. 4 Temperature sections, °C, St. John's-Grand Bank-Flemish Cap: A, March 25-27, 1961; B, July 22-25, 1961.

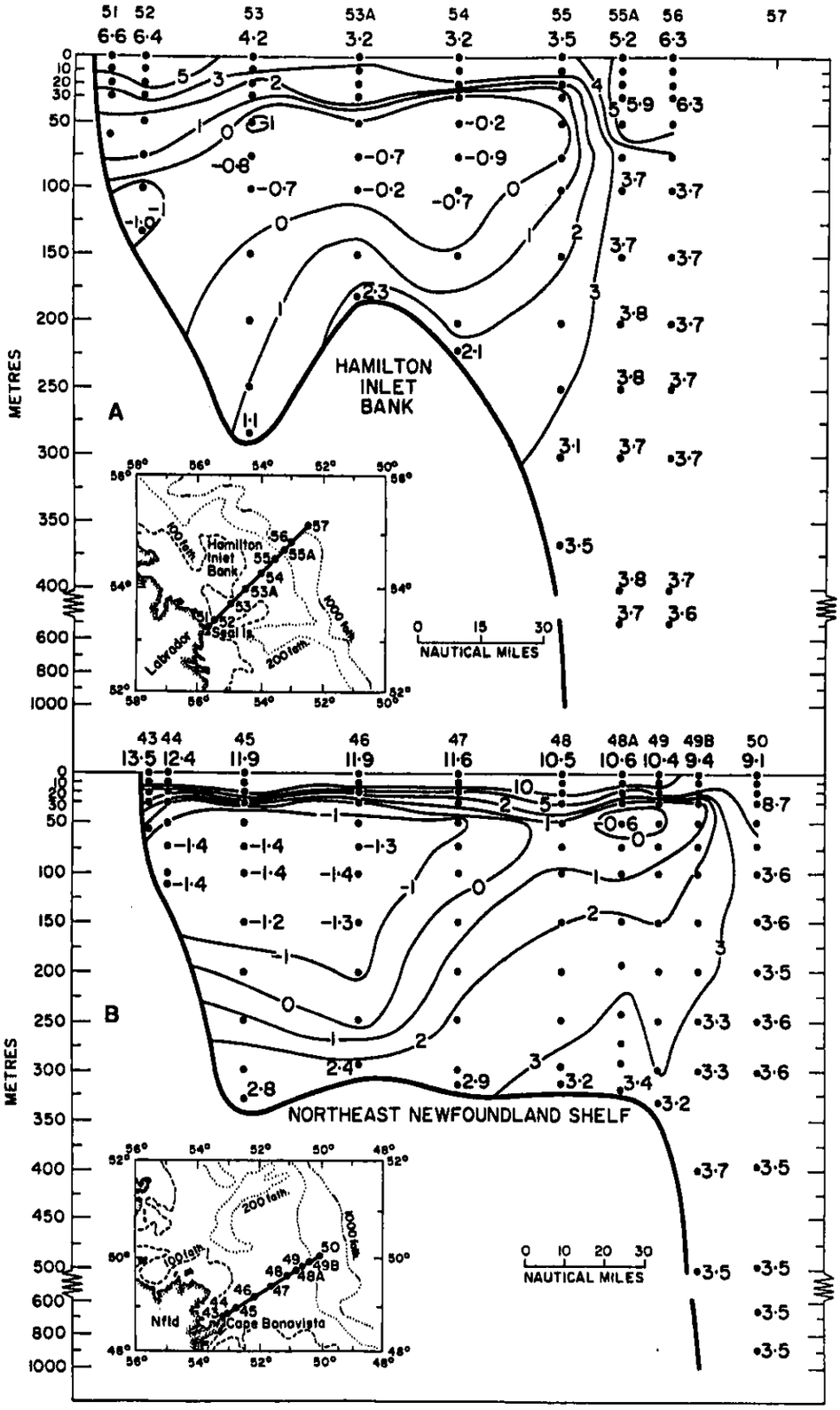

Fig. 3 Temperature sections, °C: A, off Seal Islands across the southern tip of Hamilton Inlet Bank, Labrador, July 31-August 1, 1961; B, off Bonavista, July 27-28, 1961.

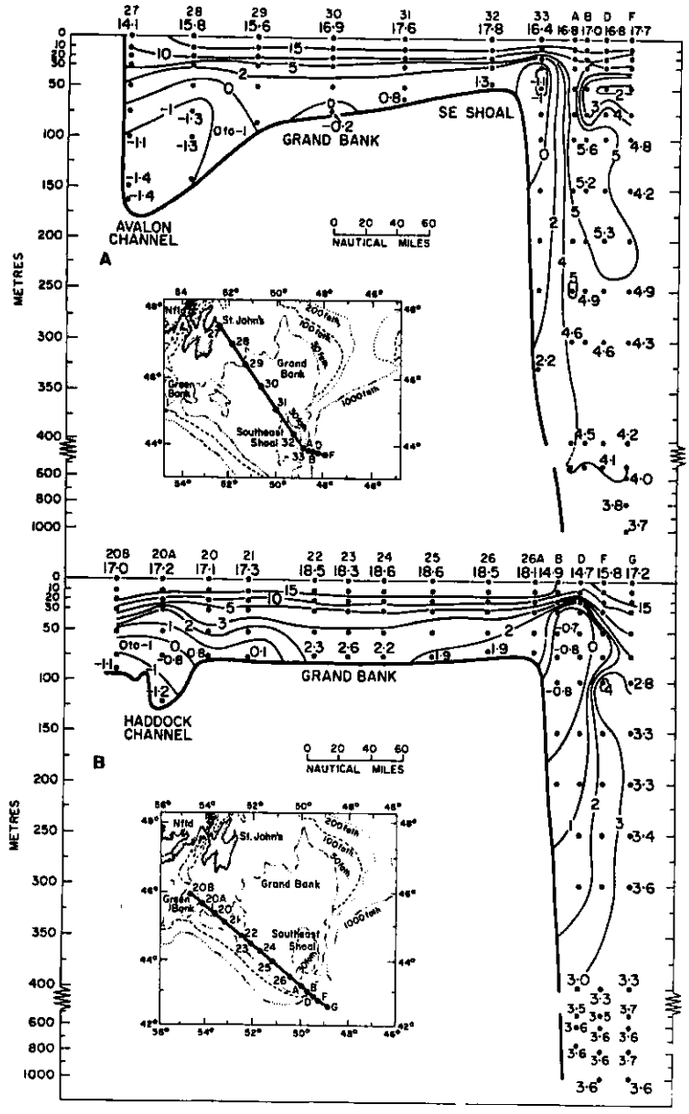

Fig. 5 Temperature sections, °C: A, St. John's-SE slope of the Grand Bank, August 16-18, 1961; B, Green-Bank-SE Grand Bank, August 18-21, 1961.

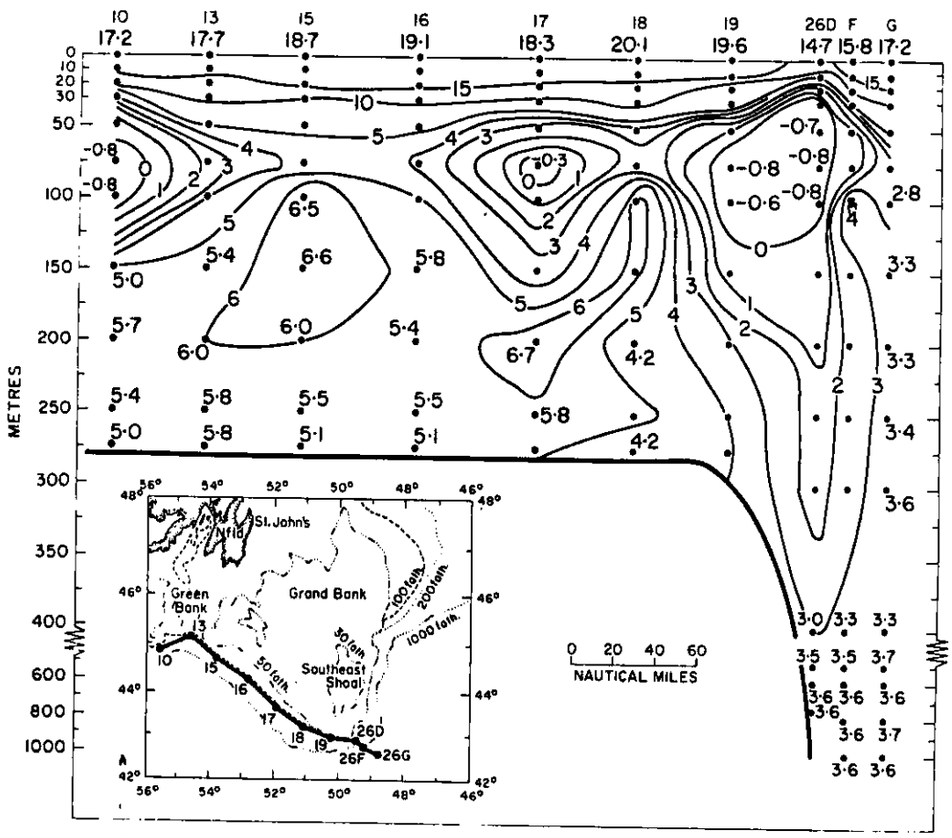

Fig. 6 Temperature section, °C, along SW edge of the Grand Bank, August 18-21, 1961.