

INTERNATIONAL COMMISSION FOR



THE NORTHWEST ATLANTIC FISHERIES

Document No. 16

ANNUAL MEETING - JUNE 1955

SUMMARIES OF CANADIAN GROUND FISH RESEARCH
IN THE CONVENTION AREA DURING 1954

Subarea 2

by W. Templeman

Redfish. In September, 1954, the "Investigator II" carried out exploratory fishing for redfish in the deep water east of Hamilton Inlet Bank in Labrador. A small net, the three-quarter 35 otter trawl (39 ft. headrope), was used on a single wire. A series of five drags, fairly well distributed over the daylight hours, was carried out at each of five depths between 160 and 400 fathoms. The average catch of redfish per hour's dragging at the different depths is shown in Table 1. There is at present no commercial fishery for redfish in this area.

Table 1. Observations on Redfish from Sets East of Hamilton Inlet Bank

	Depth Fathoms				
	160	200	250	300	390-400
Bottom Temp. °C.	2.1	3.1	3.9	3.9	-
Av. Catch per Hr. Dragged (lbs)	2,800	3,400	2,100	1,200	10
Av. Size (cm.)	32.5	33.7	35.3	39.0	-
Largest Immature Female (cm.)	37	-	-	47 *	-
Smallest Mature Female (cm.)	35	-	-	None*	-

* No mature specimens were found in a sample of 21 females of 32-39 cms. nor among 39 females of 40-47 cms.

Redfish sizes increased with depth. Some very large redfish of 60 to 70 cm. were present; one of 75 cm. and 19 pounds was captured. There was a very great difference in the size at sexual maturity of the fish in different depths. Whereas in a sample from 160 fathoms, the largest immature females were 37 cm. in length and the smallest mature spent females were 35 cm., only five and a half nautical miles distant in 300 fathoms there were no sexually mature specimens in a sample of 21 female redfish of 32-39 cm. or in a sample of 39 of 40-47 cm. Bottom temperatures are shown in the table. With the higher temperatures, which usually favour early maturity, occurring at the greatest depth, the lack of sexually mature specimens at 300 fathoms was apparently due not to temperature but to some other factor such as lack of light.

The area surveyed is the chief centre of infection of redfish in Canadian Atlantic waters by the copepod parasite Sphyrion lumpi. The data on parasitization by Sphyrion, collected from large numbers of redfish examined at sea, are shown in Table 2.

Table 2. Parasitization by Sphyrion lumpi

	Depth Fathoms			
	160	200	250	300
A. <u>Observed at Sea</u>				
% Parasitized by Living Sphyrion	5.8	6.2	1.3	0.8
No. of Sphyrion per 100 fish	8.7	9.2	1.4	0.8
B. <u>From Laboratory Samples</u>				
% Parasitized by Living Sphyrion	8.8	-	-	0.8
% of fillets with heads	10	-	-	8
No. of Heads per 100 fish	42	-	-	9

The great differences in the distribution of the parasite Sphyrion were in samples of fish only a few miles apart, only four miles in the case of the highly distinct redfish populations from 200 and 250 fathoms. Samples of redfish from 160 and 300 fathoms depth, from localities on Hamilton Inlet Bank only $5\frac{1}{2}$ nautical miles apart, were examined at the Research Station. 8.8% were infected externally with Sphyrion at 160 fathoms and 0.8% at 300 fathoms. The fillets of these samples, each of 120 fish, were examined on a candling table for old heads of Sphyrion. These dead Sphyrion heads encysted in the flesh are evidence of former infections. Internally, 19% of the fish at 160 fathoms and 8% at 300 fathoms had encysted Sphyrion heads. There were 42 encysted heads per 100 fish at 160 fathoms and only 9 at 300 fathoms and this in spite of the considerably greater size of the redfish at 300 fathoms.

The living Sphyrion most likely have a life history of at least a year and the differences in Sphyrion distribution in the samples only 4 to 6 nautical miles distant, but with 50 to 140 fathoms difference in depth, indicate extremely little interchange in the redfish at different depths in the same area and also indicate that the free-swimming stages of Sphyrion and the secondary host, if one exists, are largely restricted to depths above the 250 fathom line.

There was an absence of mature fish at 47 cm. length at 300 fathoms, while at 160 fathoms, five and a half nautical miles distant, the smallest mature female was 35 cm. and all females over 37 cm. were mature spent fish. This indicates a lack of mixing for many years.

It appears very likely, therefore, that once the redfish become adjusted, possibly at an early age, to depths of 160 to 200 or 250 to 300 fathoms it is very difficult for them to pass from one of these depth ranges to the other.

Hydrography The section across the Labrador Current off Domino Point, Labrador, was taken on July 30-31. The water in this section was much colder in 1954 than in 1953.

Subarea 3

by W. Templeman

Haddock. In May and early June the yearly haddock otter-trawl survey was carried out by the "Investigator II".

The 1949 year-class which formed most of the commercial catch was abundant on both banks. On the Grand Bank and St. Pierre Bank there was little evidence of the 1950 and 1951 year-classes. The 1952 and 1953 year-classes were abundant on the Grand Bank while on St. Pierre Bank the 1952 year-class was very scarce and the 1953 year-class abundant only in one small area.

Redfish. In Hermitage Bay, through the trawling of the "Marinus", a small-redfish frequency peak has been found with peak sizes at approximately $7\frac{1}{4}$ cm., December, 1953; $8\frac{1}{4}$ cm., June, 1954, and $8\frac{3}{4}$ cm. in September, 1954. These fish were most likely about $1\frac{1}{2}$ years old in December, 1953. There are three well defined groups of fish in this area and this will enable valuable observations and checks to be made on the age and growth of redfish. As in the Gulf of St. Lawrence there are, judging from growth studies in other areas, about eight years between the younger group of fish and the older successful group of redfish in Hermitage Bay with a peak of 22 to 23 cm. There was apparently very little settling of young redfish in

the area in the intervening years. Since the large-meshed trawl net with a shrimp-net cover probably does not catch the smallest group efficiently, it is difficult to know at present whether this group of tiny fish will represent a considerable stock.

Fishing for redfish usually ceases at night since redfish in many areas rise from the bottom and are no longer available in quantity to the trawls. During the last half of June and the first half of July, two trips were made to investigate the availability of redfish at night. The smallness of the crew and the roughness of the bottom rendered the work very difficult. In the southwest Grand Bank area there were indications that at 160 fathoms, catches were normal from 6 a.m. to 6 p.m. and dropped off to as low as 10 to 15% of the daytime catch by 1 a.m. In the northeastern Grand Bank region at 160 fathoms, a catch of 2,300 pounds in a half-hour's drag was obtained at 11.10 to 11.40 p.m. and one of 1,200 pounds from 2.35 to 3.05 a.m. These compared with catches ranging from 1,200 to 5,600 pounds or an average of 3,900 pounds during the daylight hours.

Tagging. Thirteen thousand cod were tagged in 1954. The tagging areas were Burgeo Bank, St. Pierre Bank, St. Anthony, La Scie, Bonavista, Fermeuse, Cape St. Mary's and Trepassey. Many varieties of tags were used in an attempt to find the most suitable tags for future work.

Five hundred American plaice, Hippoglossoides, were tagged in St. Mary's Bay and 1,000 on the northern slope of the Grand Bank.

Mesh selection. Covered net experiments for haddock were carried out on several trips of the "Investigator II". The 50% selection point for haddock was 36 cm. for a 4 1/8 inch mesh and 32 cm. for a 3 3/4 inch mesh cod-end. An attempt using similar trawlers to show that the large 4 1/2 inch mesh cod-end was more efficient than the below 3 inch mesh cod-end in common use, was unsuccessful since most fish were in the 35-46 cm. range with a modal size of 39 cm. The fish plants were accepting small round haddock down to 35 cm. and the large-mesh gear caught such low catches of these small haddock that it was unprofitable to use it.

Statistics and population sampling. Catch, location and effort data were obtained for offshore boats and the offshore catch was measured and sampled at St. John's and Burin and the inshore catch at St. John's, Burin and Bonavista. A new departure during the year was a change in the haddock fishery toward the landing of haddock in the round condition and toward landing smaller haddock. By the end of the year over 90% of the haddock were being landed round. The haddock catch during the year increased greatly and the cod were very abundant in the inshore areas and very close to the shore.

Hydrography. A hydrographic survey on the southern half of the Grand Bank and on St. Pierre Bank was carried out in April.

In July and August five hydrographic sections were taken across the Labrador Current and the banks from Bonavista to the southern edge of the Grand Bank.

Inshore, the surface layer of warm water was extremely shallow. The 0°C. line remained at twenty fathoms until the end of August and the 3°C. line above twenty fathoms till early September.

In the Labrador Current from Labrador to Cape Bonavista and in the inshore branch of the current from Cape Bonavista to the southern edge of the Grand Bank there was a considerably greater volume of below 0°C. water present in July-August, 1954, than in the same period of 1953.

Subarea 4

by W.R.Martin

Groundfish research in Subarea 4 was carried out by the Marine Biological Station of the Quebec Department of Fisheries and by both the Newfoundland Fisheries Research Station and the Atlantic Biological Station of the Fisheries Research Board of Canada. Studies of redfish, cod tagging, mesh selection, hook selection, fish larvae and hydrography were pertinent to ICNAF interests. Abundance, growth and mortalities of the most important groundfish species were followed by sampling commercial landings. Emphasis was placed on an assessment of the need for mesh regulation in Subarea 4 and to this end, the following submissions were made to the Commission:

Canadian Investigations of Subarea 4 stocks of cod and haddock.

- A. Factors affecting annual yield - by W.R.Martin (ICNAF Document No.5, Appendix 1).
- B. Gear selection in relation to sizes caught and landed - by F.D.McCracken (ICNAF Document No.5, Appendix 2).
- C. The effect of increased mesh size on yield - by J.E.Paloheimo (ICNAF Document No.8, Appendix 1).

Redfish. Seasonal and diurnal movements of redfish in the Gaspé area of the Gulf of St. Lawrence were studied from the "J.J. Cowie" during the period May to September.

Seasonal changes in the sex ratio of redfish taken in a 40-foot flounder drag conformed with 1953 findings. In May and June, males outnumbered females while in August and September, the sexes were equally represented on the bottom. Larvae are released during the period May to July, with a maximum occurring in mid-June. Surface and oblique plankton tows took maximum catches of larvae in mid-June, demonstrating that female redfish are in the area but off bottom at spawning time. Larvae are dispersed by the Gaspé current; the greatest numbers were taken off Cap Gaspé in early June and 30 miles south of this two weeks later.

Diurnal variation in redfish distribution was studied by alternating weeks of afternoon and pre-midnight drags with weeks of post-midnight and morning drags. The smallest catches were consistently made in the pre-midnight period. The largest catches of males were made in morning and afternoon periods. The largest catches of females were made in the post-midnight period. This diurnal variation in distribution of redfish is correlated with diurnal changes in the distribution of Meganctiphanes norvegica, the staple food of redfish in this area. These phosphorescent euphausiids were taken in smallest numbers, by a 40 foot shrimp drag with a one-half inch liner, during the pre-midnight period. Bottom catches of both redfish and Meganctiphanes were progressively smaller at 110, 120 and 130 fathoms.

Autumn redfish cruises have been carried out by the "Investigator II" in the Gulf of St. Lawrence more or less regularly since 1947. The depths investigated were between 120 and 200 fathoms.

The best catches were usually obtained between 140 and 160 fathoms, although there were occasional good catches at 120 and 180 fathoms.

In the early redfish frequencies obtained in the Gulf of St. Lawrence and on the western part of the south coast of

Newfoundland by the "Investigator II" in 1947-50, before commercial fishing for redfish had begun in the area, there was evidence from all the deep-water areas of the presence of an abundance of large redfish mostly between 30 and 42 cm. In 1953, after one summer of commercial fishing in the northern areas of the Gulf and several years fishing farther south, these large redfish were still abundant but, as a group, had essentially the same size distribution. In some cases they were slightly more grouped by some growth in the intervening years occurring at the smaller sizes, while there was no evidence of further growth at the upper part of the frequency. The peaks were essentially the same in 1953 as in 1947 and 1948.

While in 1947 and 1950 there was usually only slight evidence of sizes below 30 cm., there was in 1953 evidence of a group of redfish with peak sizes between 22 and 25 cm. as well as the larger group in which peak sizes for the males were 34 to 36 cm. and for the females 37 to 38 cm. These two groups of fish were completely separated in the frequency and with the very slow growth of the redfish there is at least a ten year difference in the ages of redfish at the peaks of the two groups. The younger redfish with peak sizes at 22 to 25 cm. were plentiful on the eastern side of the Gulf and on the western part of the south coast of Newfoundland and were scarce on the western side of the Gulf, north of Anticosti.

It is evident that, in spite of the redfish being viviparous, and in the absence of mortality of spawning fish through fishing, only rarely is there a good survival of redfish larvae to the settling stage in the Gulf of St. Lawrence or on the western part of the south coast of Newfoundland. In the intervening years there is apparently little or no larval settling in these areas. Presumably the redfish in the course of their long larval life in the upper water layers usually drift out of the Gulf.

Cod and haddock tagging. 1954 recoveries from the cod and haddock tagging carried out off southwestern Nova Scotia in 1953 are summarized in the accompanying table. Recaptures of cod have been high indicating that a high proportion of the total mortality is attributable to fishing. Recoveries of tagged haddock were surprisingly high in view of the higher tagging mortality for this species. Petersen disk tags gave the best returns.

Cod recoveries were, for the most part, taken in the tagging area. Few winter recoveries were made, although large catches of cod were taken at this season.

Haddock recoveries showed a seasonal movement to offshore grounds. During winter months, the majority of the recaptures were taken on LaHave and Browns Banks.

During 1954, 1,284 cod were tagged off Louisburg and Canso, in eastern Nova Scotia and 2,000 cod were tagged along the north shore of the Gulf of St. Lawrence. In both cases the majority of the recaptures taken to date have come from the tagging area.

1954 Recoveries from 1953 Cod and Haddock Tagging
off southwestern Nova Scotia

<u>Type of Tag</u>	<u>Maximum No. tagged fish Dec. 31/53</u>	<u>No. recovered to Dec. 31/54</u>	<u>% recovery during 1954</u>
<u>Cod</u>			
Hydrostatic	704	91	13
Red and white disks	191	78	41
Yellow disks	211	70	33
Strap	<u>231</u>	<u>43</u>	<u>19</u>
Total	1,337	282	21
<u>Haddock</u>			
Hydrostatic	263	30	11
Red and white disks	92	17	18
Yellow disks	79	9	11
Strap	<u>114</u>	<u>11</u>	<u>10</u>
Total	548	67	12

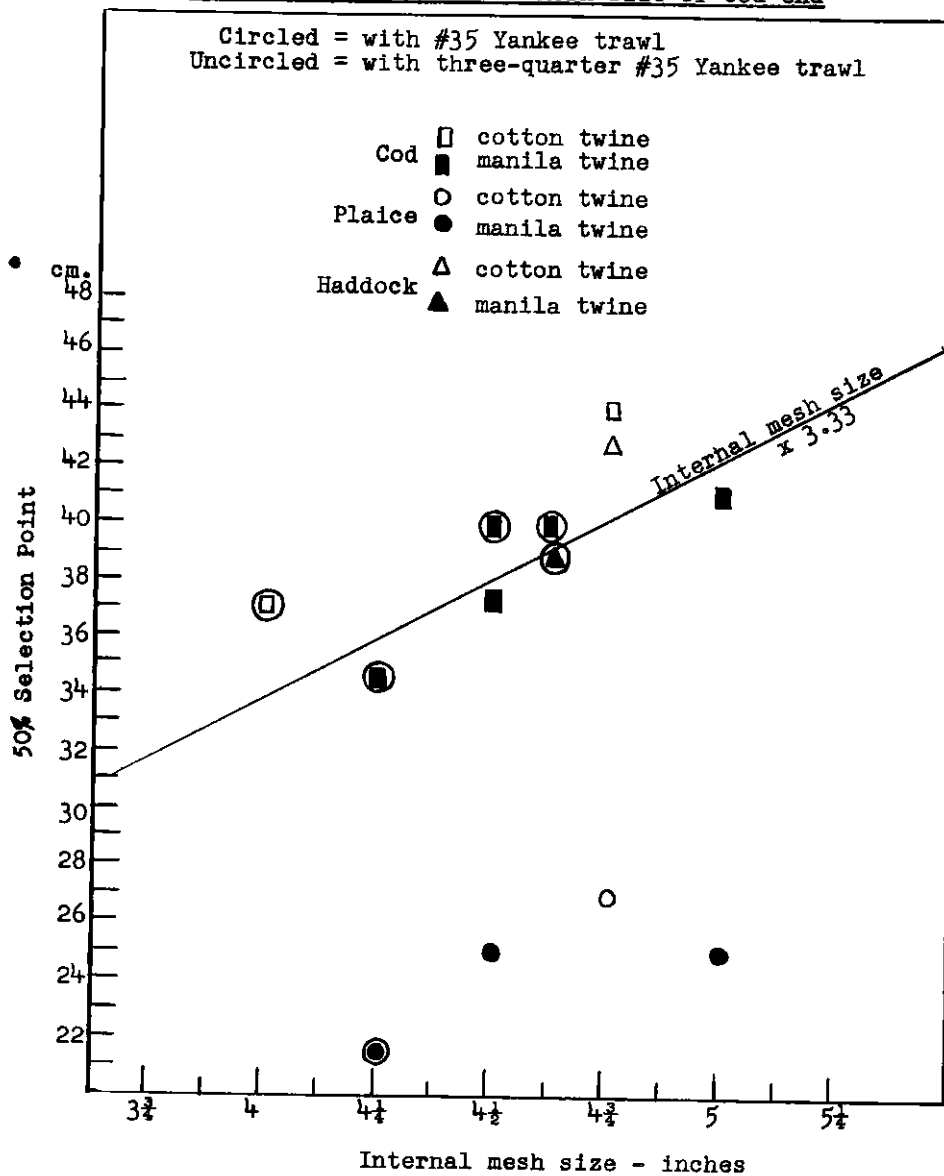
Mesh selection. The selective properties of large-mesh manila and cotton trawls were studied from the "Pandalus II" and the commercial dragger "Harry G." operating consecutively during the period June through August (in the southern Gulf of St. Lawrence). Cotton three-quarter #35 and #35 Yankee trawls were used by the two draggers. Cod-ends were made of 50-yard, four-ply, double-strand manila or single-strand, Lenco-treated, #96 to #120 thread cotton. Internal mesh sizes were measured with a United States gauge as defined in the Subarea 5 haddock mesh regulation. Escapement was measured by using a fine-mesh cover over the cod-end.

The results are shown in Figure 1. Fifty per cent selection points for cod taken with manila cod-ends conformed with results for haddock as established in these and earlier experiments. Cotton cod-ends released fish at larger sizes than did manila cod-ends of similar mesh sizes. As expected, the fifty per cent selection points for the plaice, Hippoglossoides, were much lower than those for cod and haddock.

The mesh experiments carried out during 1953-54 have demonstrated that the 4½ inch mesh size now used for haddock fishing in Subarea 5 would release large numbers of small cod, haddock and plaice in Subarea 4 and practically no cod, haddock, hake (Urophycis) or flounders (Glyptocephalus, Hippoglossoides, Limanda and Pseudopleuronectes) of the sizes landed commercially on the Canadian mainland. Some offshore trawlers and Gulf of St. Lawrence draggers are voluntarily adopting large-mesh nets.

Figure 1

Fifty per cent selection points for cod, haddock and plaice
in relation to internal mesh size of cod-end

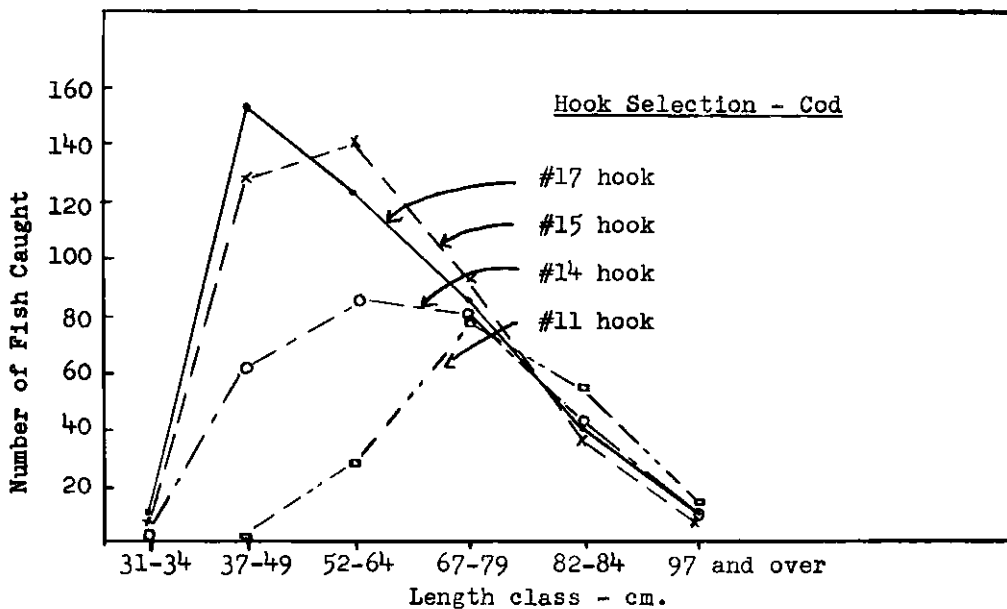


Hook selection. Fishing by hook and line is as important as otter trawl fishing in Subarea 4 and it is accordingly important to know the selective properties of the various sizes of hooks used in the fishery. Hook selection experiments, carried out off Lockeport, N.S., during 1954 demonstrated that larger hooks take fewer small fish. Four hook sizes were used, #17, #15, #14 and #11; #17 being the smallest commercial groundfish hook and #11 approximating the size of a halibut hook. The results for cod are shown in Figure 2.

The #17 hook caught some cod and haddock below acceptable commercial size and was effective in taking all commercial sizes. Available data suggest that selection with the #17 hook is comparable with that of a $4\frac{1}{2}$ inch mesh. The #11 hook caught few haddock and few small cod in comparison with the #17 hook. The #15 and #14 hooks showed intermediate selection.

If a mesh size greater than $4\frac{1}{2}$ inches is considered for conservation purposes, consideration must also be given to hook selection.

Figure 2



Fish eggs and larvae. The first of planned seasonal and annual samplings of Bay of Fundy, Scotian Shelf and Gulf of St. Lawrence waters was completed during August and September. Concentrations of larvae were found in Magdalen Shallows and on offshore banks to the northeast and southwest of Nova Scotia. Eggs were concentrated inshore off southwest Nova Scotia, off northeastern Cape Breton Island and on Quereau Bank. Cod larvae were taken in quantity in Magdalen Shallows ~~and off Canse~~, haddock off southwest Nova Scotia, and redfish off southwest Nova Scotia, on Quereau Bank and in the southern Gulf of St. Lawrence.

Hydrography. As a continuation of a long term program of seasonal surveys initiated in 1950, the Atlantic Oceanographic Group carried out four seasonal cruises in the Bay of Fundy, Scotian Shelf, and the Gulf of St. Lawrence areas. The winter cruise was extended to the head of the Bay of Fundy and included a large coverage of the area between Brown's Bank and the coast of Maine. During the summer survey, plankton tows were taken at strategic points and the Hardy Plankton recorder was used most of the time over the Scotian Shelf and in the Gulf of St. Lawrence.

Further study of the bottom temperatures on the Scotian Shelf has been made in comparing the data obtained between 1950 and 1953 with those from earlier surveys made over a somewhat more restricted network between 1934 and 1939. In general, bottom temperatures have tended to be higher during the recent period than they were prior to 1939, by as much as from one to three degrees (Centigrade) in the eastern sector and from two to three degrees on LaHave Bank. It would appear that the main reasons for the variations in bottom temperature over the Scotian Shelf have been changes in the intermediate layer which was colder and thicker in the early years than it has been since 1950.

Analysis of the long term temperature records of surface waters at St. Andrews, N.B., and Sambro L.V. off Halifax, N.S., has shown a marked correlation between the annual mean temperature in any year and the amount of cooling taking place in the previous winter. Low annual mean temperatures have followed periods of intense cooling during the previous winter and high annual means have been related to lack of cooling rather than to excessive warming in summer. Annual means can be predicted by March with a fair degree of accuracy.

The data obtained from continued observations of surface water temperatures at strategic points along the Canadian Atlantic coast have shown that, in 1954, the annual means were equal to or higher than the average during the preceding five-year period. In the southwestern Gulf of St. Lawrence, the 1954 mean was lower than the average of the preceding quinquenniad.

In the oceanographic surveys of the waters around the Gaspé peninsula and along the north shore of the Gulf of St. Lawrence, emphasis was given to fishing areas such as Bay Chaleur, Miscou and Orphan Banks and fishing banks along the north shore.

- THE END -

April 13, 1955.

Note:- Attached is an appendix to the Canadian Research Report showing Hydrographic Sections (Temperature and Salinity) off Halifax, across Grand Bank-Flemish Cap, and across Hamilton Inlet Bank, 1954. Tables with reported data and corresponding figures of sections prepared in the Secretariat.

Atlantic Oceanographic Group
St. Andrews, N.B., Canada

Section off Halifax, N.S. outwards over Emerald Bank and off the
Continental Shelf

1st Cruise, S-17 - February 19-20, 1954

<u>Station position- 44°24'N, 63°28'W,</u>			<u>Station position- 43°29'N, 62°27'W</u>		
<u>Depth-- 86 m., Date--19 Feb., 1954</u>			<u>Depth-- 85 m., Date--19 Feb., 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>	<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>
0	0.3	31.06	0	4.35	32.75
10	0.32	31.00	10	4.38	32.70
20	0.27	30.97	20	4.30	32.77
30	0.30	30.99	30	4.50	32.77
50	0.33	31.06	50	5.38	33.04
74	1.26	31.24	64	8.83	34.40

<u>Station position- 44°16'N, 63°19'W,</u>			<u>Station position- 43°11'N, 62°06'W</u>		
<u>Depth--144 m., Date--19 Feb., 1954</u>			<u>Depth-- 97 m., Date--20 Feb., 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>	<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>
0	0.7	31.35	0	4.2	32.70
10	0.62	31.36	10	4.24	32.70
20	0.62	31.40	20	4.19	32.72
30	1.57	31.60	30	4.28	32.72
46	1.49	31.58	50	4.35	32.72
68	1.75	31.78	79	5.31	33.10
90	2.03	31.92			
122	3.12	32.41			

<u>Station position- 43°53'N, 62°53'W,</u>			<u>Station position- 42°51'N, 61°45'W</u>		
<u>Depth--230 m., Date--19 Feb., 1954</u>			<u>Depth--970 m., Date--20 Feb., 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>	<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>
0	3.1	32.25	0	3.3	32.47
10	2.96	32.23	10	3.32	32.39
20	2.94	32.27	20	3.38	32.48
30	3.00	32.30	30	3.01	32.48
49	3.61	32.52	47	3.47	32.47
74	7.79	34.16	71	3.45	32.45
99	8.67	34.58	95	3.81	33.04
147	9.22	34.79	143	6.38	34.40
195	9.03	34.87	186	7.99	34.81
			273	7.15	34.96
			360	6.06	34.96
			458	5.19	34.99

<u>Station position- 42°32'N, 61°24'W</u>		
<u>Depth--3000 m., Date--20 Feb., 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>
0	10.5	34.54
10	10.79	34.63
20	10.91	34.63
30	11.12	34.70
59	12.07	34.88
83	12.74	35.14
106	13.39	35.32
153	12.38	35.53
169	12.14	35.53
257	9.28	35.16
355	7.15	34.97
454	5.65	34.97

TABLE 1. (cont'd)

2nd Cruise, S-19 - May 3, 1954

<u>Station position- 44°24'N, 63°28'W</u>			<u>Station position- 43°29'N, 62°27'W</u>		
<u>Depth-- 86 m., Date-- 3 May, 1954</u>			<u>Depth-- 83 m., Date-- 3 May, 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰</u>	<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰</u>
0	5.2	31.08	0	5.15	32.14
10	4.60	31.06	10	5.20	32.12
20	2.74	31.29	19	5.32	32.20
30	1.91	31.44	29	4.71	32.32
49	1.15	31.65	48	4.19	32.59
74	1.38	32.12	77	4.39	32.99

<u>Station position- 44°16'N, 63°19'W</u>			<u>Station position- 43°12'N, 62°07'W</u>		
<u>Depth--170 m., Date-- 3 May, 1954</u>			<u>Depth--102 m., Date-- 3 May, 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰</u>	<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰</u>
0	4.22	30.86	0	5.55	32.57
10	2.42	30.86	9	5.62	32.48
20	0.91	31.24	19	5.24	32.52
30	0.77	31.51	28	4.39	32.43
50	1.18	32.10	47	4.07	32.68
71	1.96	32.39	71	3.99	32.83
95	1.89	32.47	85	4.46	33.01
143	7.46	34.22			
157	7.70	34.40			

<u>Station position- 43°53'N, 62°53'W</u>			<u>Station position- 42°51'N, 61°45'W</u>		
<u>Depth--270 m., Date-- 3 May, 1954</u>			<u>Depth-over 800m., Date--3 May 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰</u>	<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰</u>
0	4.45	31.58	0	3.8	32.34
10	4.41	31.49	10	3.79	32.38
20	4.04	31.55	20	3.34	32.41
30	2.42	31.92	30	2.26	32.45
49	4.45	33.10	50	1.97	32.45
73	7.24	34.07	74	2.38	32.74
89	8.03	34.33	99	3.20	32.94
135	9.03	34.70	148	5.32	34.20
182	8.95	35.01	188	6.30	34.60
256	8.86	35.03	286	6.60	34.99
			384	5.55	34.99
			479	4.82	34.90

<u>Station position- 42°32'N, 61°24'W</u>		
<u>Depth--over 2000m., Date--3 May 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰</u>
0	6.95	32.77
10	6.90	32.79
20	6.93	32.83
30	7.00	33.03
50	10.15	34.65
75	12.31	35.14
100	12.61	35.46
150	11.46	35.28
200	9.58	35.16
300	7.95	35.08
400	6.45	35.12
500	5.11	35.10

TABLE 1. (cont'd)

3rd Cruise, S-23 - August 21-22, 1954

<u>Station position- 44°24'N, 63°28'W</u>			<u>Station position- 43°29'N, 62°27'W</u>		
<u>Depth-- 86 m., Date-- 21 Aug. 1954</u>			<u>Depth-- 75 m., Date--21 Aug. 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>	<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>
0	10.3	31.24	0	17.0	31.38
10	5.65	31.67	10	16.63	31.35
20	4.54	31.87	19	14.04	31.55
30	3.51	32.05	29	7.26	32.34
50	2.58	32.32	48	4.08	32.65
75	2.90	32.52	67	4.17	32.84
85	3.07	32.61			

<u>Station position- 44°10'N, 63°19'W</u>		
<u>Depth--125 m., Date--21 Aug. 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>
0	13.25	31.09
10	9.46	31.58
20	9.35	32.14
30	3.81	32.23
50	3.06	32.52
75	4.39	33.08
100	5.02	33.30
120	5.72	33.48

<u>Station position- 43°09'N, 62°05'W</u>		
<u>Depth-- 97 m., Date--22 Aug. 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>
0	17.3	31.40
9	17.14	31.47
18	14.68	32.36
27	10.84	32.94
46	5.83	33.03
68	5.66	33.40
82	6.34	33.60

<u>Station position- 43°53'N, 62°52'W</u>		
<u>Depth--255 m., Date--21 Aug. 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>
0	16.6	31.35
10	16.20	31.26
20	14.54	31.47
30	6.80	31.92
50	3.42	32.32
75	4.47	32.92
100	5.00	33.35
150	8.14	34.51
200	8.78	34.72
250	8.85	34.94

<u>Station position- 42°51'N, 61°45'W</u>		
<u>Depth--935 m., Date--22 Aug. 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>
0	18.4	31.92
10	18.09	32.21
20	16.19	32.83
30	12.85	33.40
50	11.59	34.00
74	7.89	33.84
99	8.63	34.34
149	8.76	34.87
198	9.08	35.21
240	8.34	35.10
287	7.33	35.03
383	5.99	35.05
479	5.28	34.97

<u>Station position- 42°32'N, 61°25'W</u>		
<u>Depth--over 2000m., Date--22 Aug. 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>
0	17.8	32.34
10	17.77	32.34
20	11.80	32.81
30	7.47	32.81
50	7.45	33.46
75	10.46	34.40
100	12.06	35.05
150	12.81	35.53
200	11.05	35.37
250	9.91	35.23
300	8.79	35.17
400	6.13	34.88
500	4.86	34.83

TABLE 1. (cont'd)

4th Cruise, S-25 - October 18-19, 1954

<u>Station position - 44°24'N, 63°28'W</u>			<u>Station position- 43°29'N, 62°26'W</u>		
<u>Depth-- 75 m., Date--18 Oct. 1954</u>			<u>Depth-- 68 m., Date--19 Oct. 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰</u>	<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰</u>
0	12.48	30.26	0	14.6	31.46
10	11.41	30.10	10	14.51	31.49
20	11.19	30.12	20	14.44	31.33
30	10.97	30.16	30	14.36	31.40
50	7.90	31.11	50	5.36	32.38
70	5.15	31.67	65	5.29	33.03

<u>Station position- 44°16'N, 63°19'W</u>			<u>Station position- 43°11'N, 62°06'W</u>		
<u>Depth--125 m., Date--18 Oct. 1954</u>			<u>Depth-- 93 m., Date--19 Oct. 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰</u>	<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰</u>
0	14.3	31.31	0	14.6	31.60
10	13.54	31.18	10	14.70	31.42
20	13.58	31.18	20	14.27	31.44
30	13.78	31.83	29	14.66	31.53
50	3.85	32.32	47	11.95	32.45
75	3.68	32.66	71	6.17	33.37
100	5.01	33.31	86	6.29	33.66
120	6.05	33.69			

<u>Station position- 43°54'N, 62°52'W</u>			<u>Station position- 42°51'N, 61°45'W</u>		
<u>Depth--220 m., Date--18 Oct. 1954</u>			<u>Depth--1000 m., Date--19 Oct. 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰</u>	<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰</u>
0	13.9	31.35	0	15.8	32.18
10	13.72	31.20	10	15.75	32.20
20	13.61	31.20	19	16.06	32.56
30	8.81	31.78	29	13.81	33.17
50	4.09	32.56	47	9.72	33.80
75	6.19	33.46	60	5.42	33.42
100	7.23	33.95	80	8.09	34.14
150	8.31	34.33	120	8.65	34.65
200	8.76	34.76	160		35.08
			175	8.50	35.01
			236	8.06	35.05
			310	6.36	34.97

<u>Station position- 42°31'N, 61°23'W</u>		
<u>Depth--over 2000m., Date--19 Oct. 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰</u>
0	16.2	32.36
10	16.2	32.30
20	16.18	32.38
30	16.13	32.52
50	12.02	33.17
74	5.88	33.28
99	5.67	33.80
147	7.41	34.63
195	7.88	35.03
290	5.93	34.85
385	5.04	34.97
485	4.60	34.96

Reporter: L. Lauzier

Newfoundland Fisheries Research Station
St. John's, Newfoundland

Location of Section: Off Domino Point, Labrador
July 30-31, 1954.

Section 3

<u>Station 51 - 53°14'N, 55°39'W</u>			<u>Station 55 - 54°29'N, 53°30'W</u>		
<u>Depth--50 m., Date--31 July 1954</u>			<u>Depth--340 m., Date--30 July 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>	<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>
0	7.16	29.76	0	8.65	30.17
25	-0.90	32.39	25	-1.09	32.75
48	-1.42	32.70	50	-1.44	32.98
			75	-1.37	33.17
			100	-1.28	33.35
			149	-1.14	33.58
			199	-0.38	33.89
			249	1.42	34.20
			299	2.78	34.52
			329	3.46	34.67
<u>Station 52 - 53°20'N, 55°30'W</u>			<u>Station 55A - 54°37'N, 53°14'30"W</u>		
<u>Depth--130 m., Date--30 July 1954</u>			<u>Depth--662 m., Date--30 July 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>	<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>
0	8.85	28.87	0	8.89	29.70
25	-1.35	32.57	25	-1.06	32.75
50	-1.60	32.79	50	-1.47	33.06
75	-1.65	32.92	75	-1.27	33.40
100	-1.62	32.93	100	-0.81	33.66
126	-1.61	33.01	150	0.65	34.13
<u>Station 53 - 53°37'N, 55°00'W</u>			<u>Station 55B - 54°37'N, 53°10'W</u>		
<u>Depth--303 m., Date--30 July 1954</u>			<u>Depth--over 660m., Date--30 July 54</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>	<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>
0	10.38	27.59	0	7.96	31.08
25	-0.01	32.59	25	1.38	32.99
50	-1.03	33.01	50	1.33	33.44
75	-1.34	33.33	75	0.57	33.77
108	-1.20	33.58	100	0.18	33.93
158	-0.70	33.80	150	1.67	35.05
207	-0.21	33.91			
256	-0.03	34.00			
292	0.14	34.00			
<u>Station 53A - 53°55'N, 54°30'W</u>			<u>Station 55C - 54°43'N, 53°05'W</u>		
<u>Depth--186 m., Date--30 July 1954</u>			<u>Depth--over 660m., Date--30 July 54</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>	<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>
0	9.28	31.26	0	8.26	31.24
25	-0.57	32.73	25	3.75	33.71
50	-1.19	33.10	50	1.39	33.91
75	-1.40	33.37	75	1.14	34.11
100	-1.24	33.53	100	1.70	34.25
150	-1.10	33.71	150	2.72	34.49
180	-0.82	33.78	200	3.74	34.69
<u>Station 54 - 54°12'N, 54°00'W</u>			<u>Station 56 - 54°47'N, 53°00'W</u>		
<u>Depth--216 m., Date--30 July 1954</u>			<u>Depth--over 730m., Date--30 July 54</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>	<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰/‰</u>
0	8.64	30.57	0	6.77	31.85
25	-0.91	32.70	25	2.74	33.87
50	-1.39	33.03	50	1.33	34.07
75	-1.30	33.24	75	1.88	34.40
100	-1.30	33.39	100	2.66	34.61
150	-1.19	33.64	150	3.41	34.67
212	-0.24	33.93	200	3.64	34.79
			250	3.48	34.78
			300	3.65	34.66
			400	3.50	34.81
			500	3.44	34.85

Section 4

<u>Station 27-47°32'50"N, 52°35'10"W</u>			<u>Station 37A (cont'd)</u>		
<u>Depth--174 m., Date--24 July 1954</u>			<u>Depth (m) Temp. °C. Sal. ‰</u>		
Depth (m)	Temp. °C.	Sal. ‰	74	-1.45	33.22
0	10.24	31.71	98	-1.44	33.37
25	0.99	32.30	148	-0.25	33.75
50	-0.72	32.72	187	0.44	33.96
75	-1.12	32.99			
100	-1.34	33.15	<u>Station 38- 47°00'00"N, 47°00'00"W</u>		
150	-1.32	33.33	<u>Depth--over 730m., Date--25 July 54</u>		
172	-0.96	33.45	Depth (m)	Temp. °C.	Sal. ‰
<u>Station 28- 47°00'00"N, 52°02'00"W</u>			0	10.76	32.56
<u>Depth--137 m., Date--24 July 1954</u>			25	2.28	33.49
Depth (m)	Temp. °C.	Sal. ‰	50	2.13	34.18
0	12.32	32.16	75	2.15	34.36
25	6.32	32.34	100	2.17	34.47
50	-0.84	32.83	150	2.59	34.58
75	-1.21	33.08	200	2.69	34.60
100	-1.45	33.17	250	2.89	34.65
133	-1.16	33.28	300	2.98	34.76
<u>Station 34- 47°00'00"N, 51°00'00"W</u>			400	2.99	34.74
<u>Depth--102 m., Date--24 July 1954</u>			500	2.95	34.81
Depth (m)	Temp. °C.	Sal. ‰	<u>Station 39- 47°00'00"N, 46°30'00"W</u>		
0	12.98	32.20	<u>Depth--over 730m., Date--25 July 54</u>		
25	3.70	32.62	Depth (m)	Temp. °C.	Sal. ‰
50	-0.82	32.90	0	13.28	32.74
75	-1.17	33.04	25	3.97	33.75
100	-0.96	33.28	49	3.91	34.29
<u>Station 35- 47°00'00"N, 50°00'00"W</u>			74	3.94	34.43
<u>Depth-- 87 m., Date--24-25 July 54</u>			98	3.84	34.52
Depth (m)	Temp. °C.	Sal. ‰	148	3.73	34.65
0	12.99	32.29	197	4.32	34.85
25	4.38	32.74	246	3.98	34.85
50	-0.23	32.94	295	3.82	34.88
75	-0.64	33.26	395	3.79	34.88
84	-0.60	33.26	493	3.55	34.92
<u>Station 36- 47°00'00"N, 49°00'00"W</u>			<u>Station 40- 47°00'00"N, 46°00'00"W</u>		
<u>Depth-- 88 m., Date--25 July 1954</u>			<u>Depth--314 m., Date--25 July 1954</u>		
Depth (m)	Temp. °C.	Sal. ‰	Depth (m)	Temp. °C.	Sal. ‰
0	12.57	32.34	0	13.18	33.17
25	3.35	32.75	25	8.72	33.62
50	0.23	32.86	50	3.75	33.80
75	-0.72	33.30	75	4.34	33.84
85	-0.58	33.46	98	3.60	34.42
<u>Station 37- 47°00'00"N, 48°00'00"W</u>			148	3.63	34.56
<u>Depth--136 m., Date--25 July 1954</u>			197	3.92	34.69
Depth (m)	Temp. °C.	Sal. ‰	246	3.85	34.76
0	11.85	32.41	306	3.95	34.88
25	2.62	32.77	<u>Station 41- 47°00'00"N, 45°00'00"W</u>		
50	-0.85	33.08	<u>Depth--158 m., Date--26 July 1954</u>		
75	-1.06	33.31	Depth (m)	Temp. °C.	Sal. ‰
100	-0.39	33.48	0	13.58	33.51
134	-0.41	33.75	25	10.33	33.60
<u>Station 37A-47°00'00"N, 47°30'00"W</u>			50	4.90	33.96
<u>Depth--192 m., Date--25 July 1954</u>			75	4.04	34.00
Depth (m)	Temp. °C.	Sal. ‰	100	3.74	34.13
0	10.84	32.07	154	3.87	34.45
25	7.03	32.43			
49	-1.19	33.10			

TABLE 2. (cont'd)

Section 4 (cont'd)

<u>Station 42- 47°00'00"N, 44°10'00"W</u>		
<u>Depth--365 m., Date--26 July 1954</u>		
<u>Depth (m)</u>	<u>Temp. °C.</u>	<u>Sal. ‰</u>
0	12.42	33.21
25	5.67	33.80
49	3.81	34.00
74	2.99	34.14
96	2.83	34.38
145	3.36	34.63
193	3.40	34.72
241	3.78	34.79
290	3.65	34.85
348	3.73	34.87

Reporters: G.L.Andrews and W. Templeman

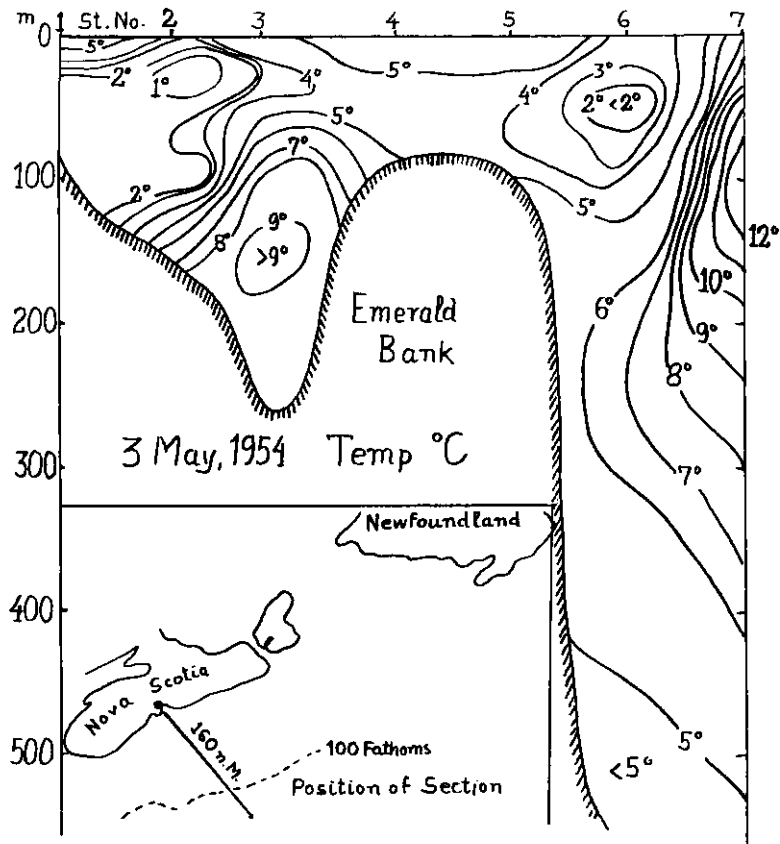
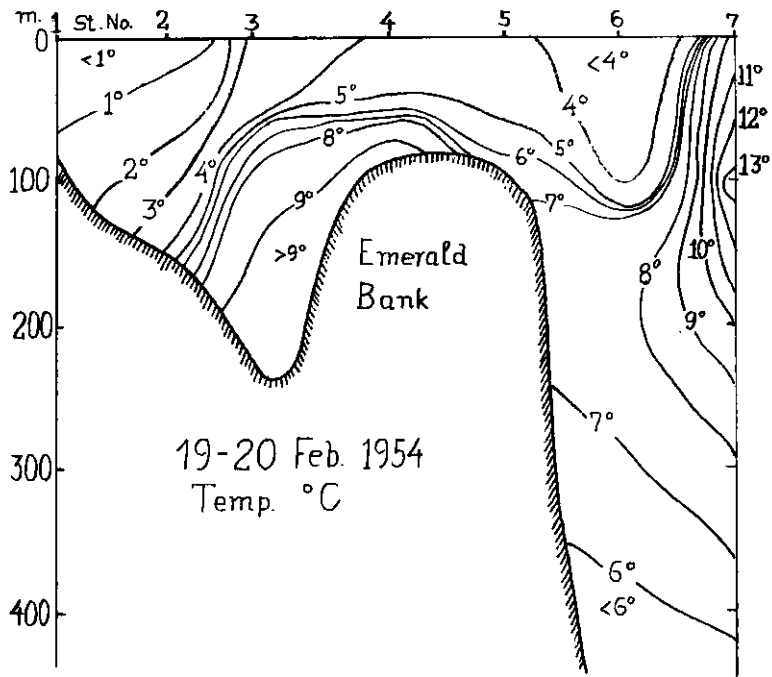


Fig.1 - Hydrographic Section off Halifax. Temperature. 19-20 Feb., 3 May, 21-22 Aug. and 18-19 Oct. 1954. (Position of section inserted).

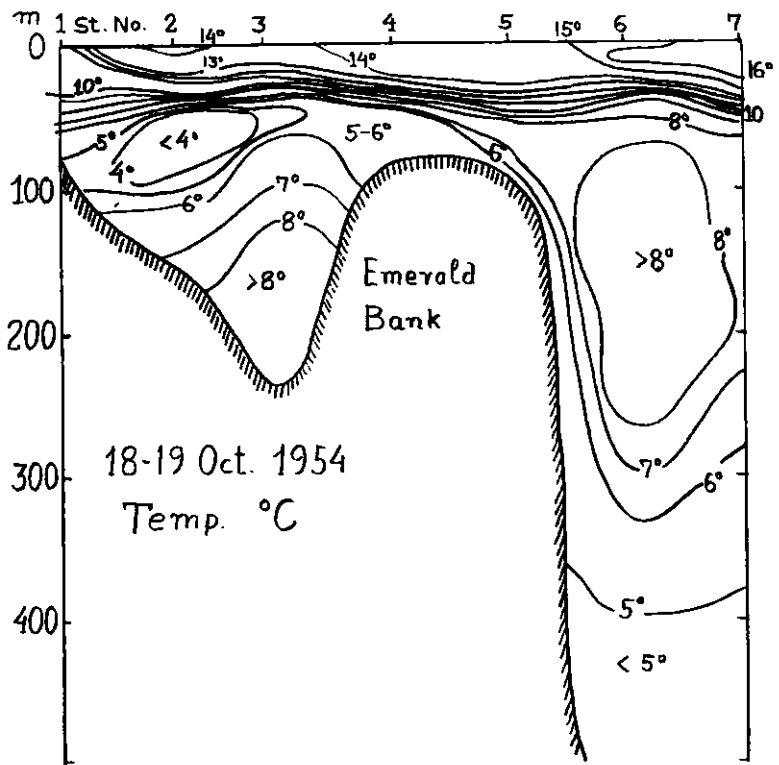
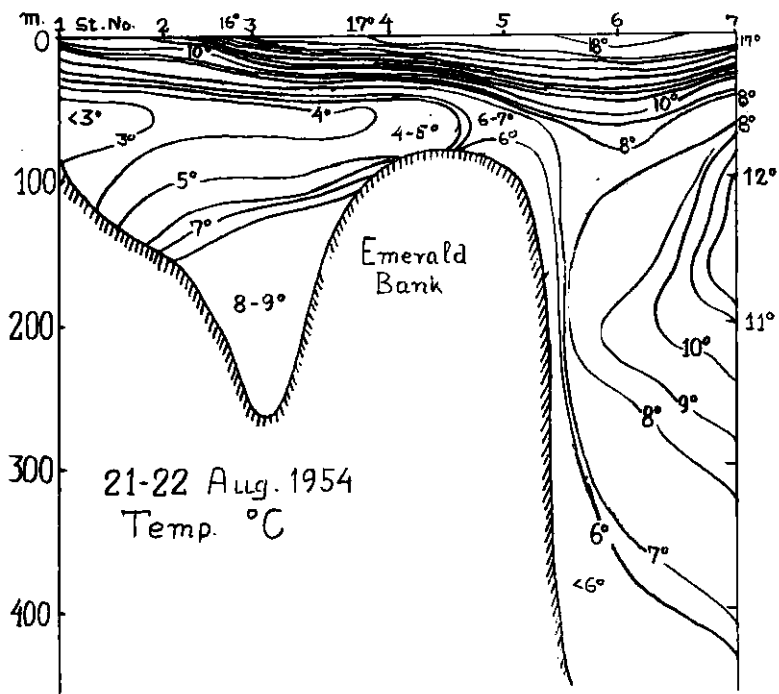


Fig.1 (cont'd) - Hydrographic Section off Halifax. Temperature. 19-20 Feb., 3 May, 21-22 Aug. and 18-19 Oct. 1954. (Position of section inserted).

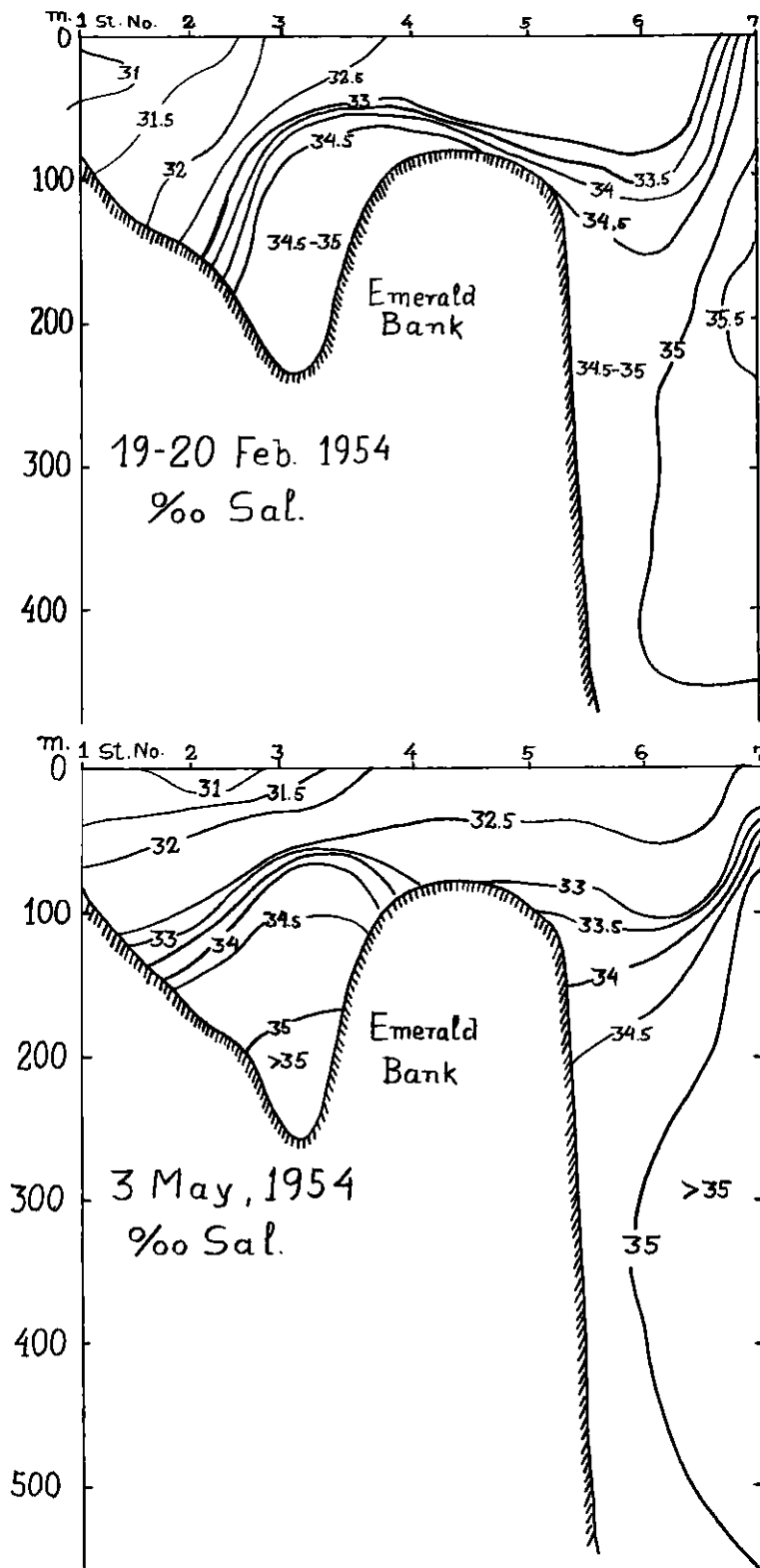


Fig. 2 - Hydrographic Section off Halifax. Salinity. 19-20 Feb., 3 May, 21-22 Aug. and 18-19 Oct. 1954.

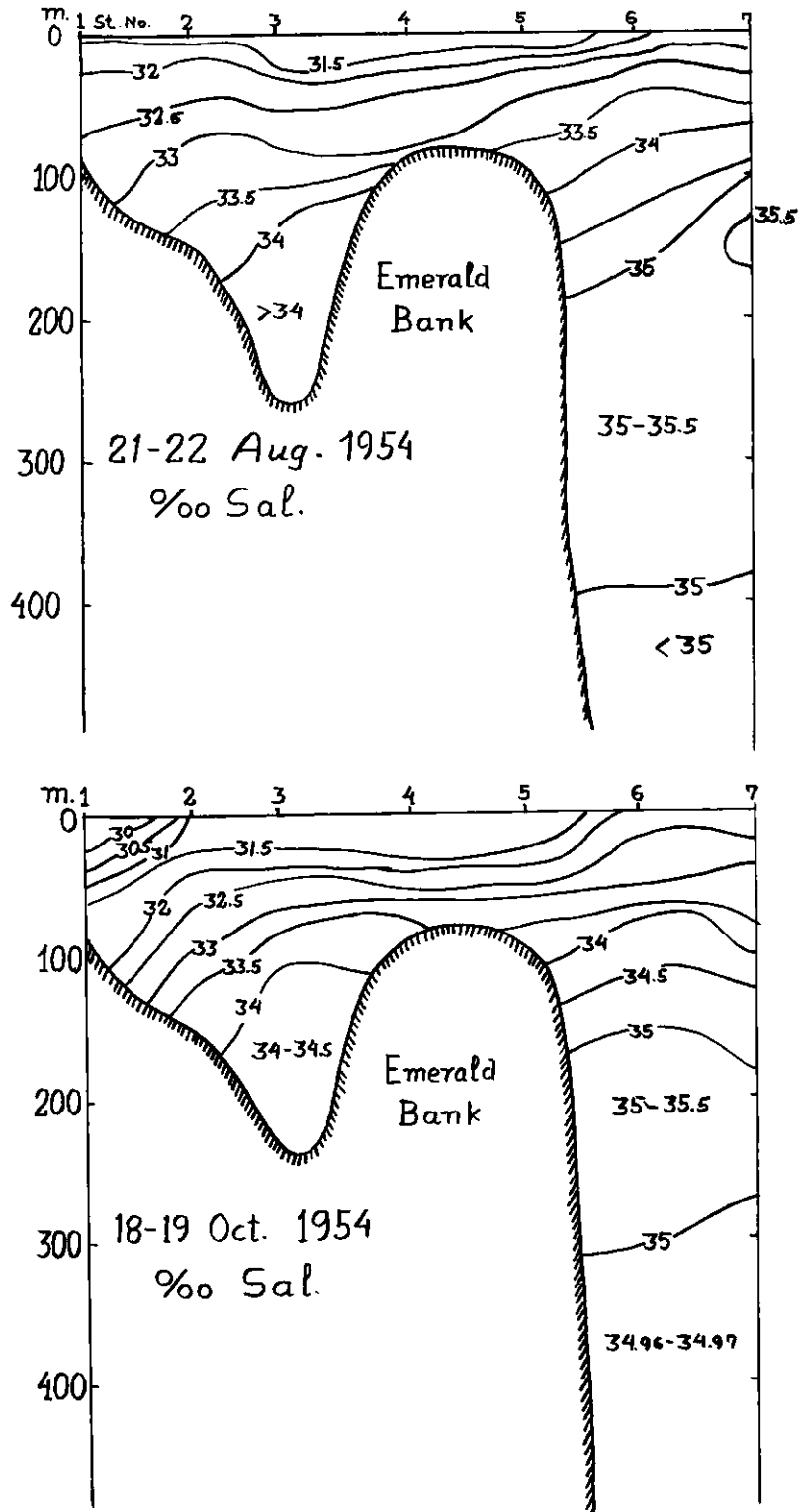


Fig.2 (cont'd) - Hydrographic Section off Halifax. Salinity. 19-20 Feb., 3 May, 21-22 Aug. and 18-19 Oct. 1954.

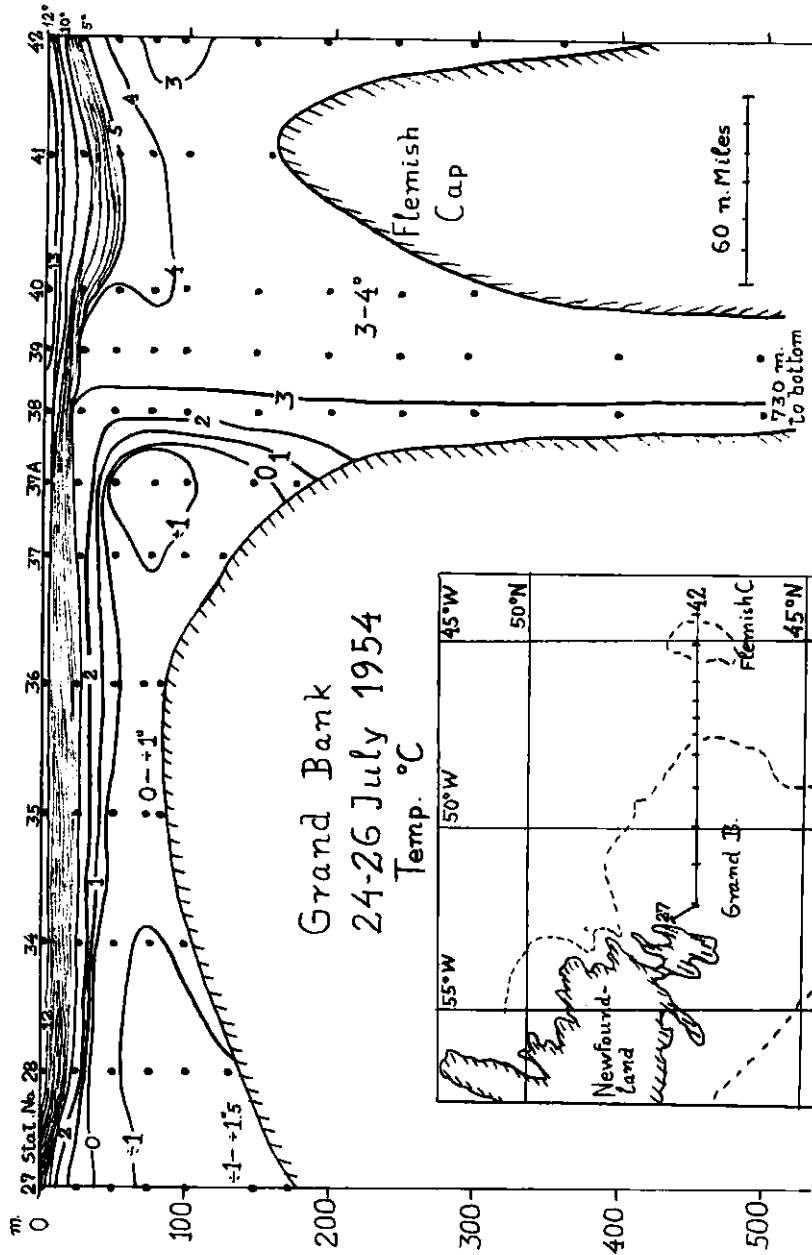


Fig.3 - Hydrographic Section, Grand Bank - Flemish Cap. Temperature. 24-26 July 1954. (Position of section inserted).

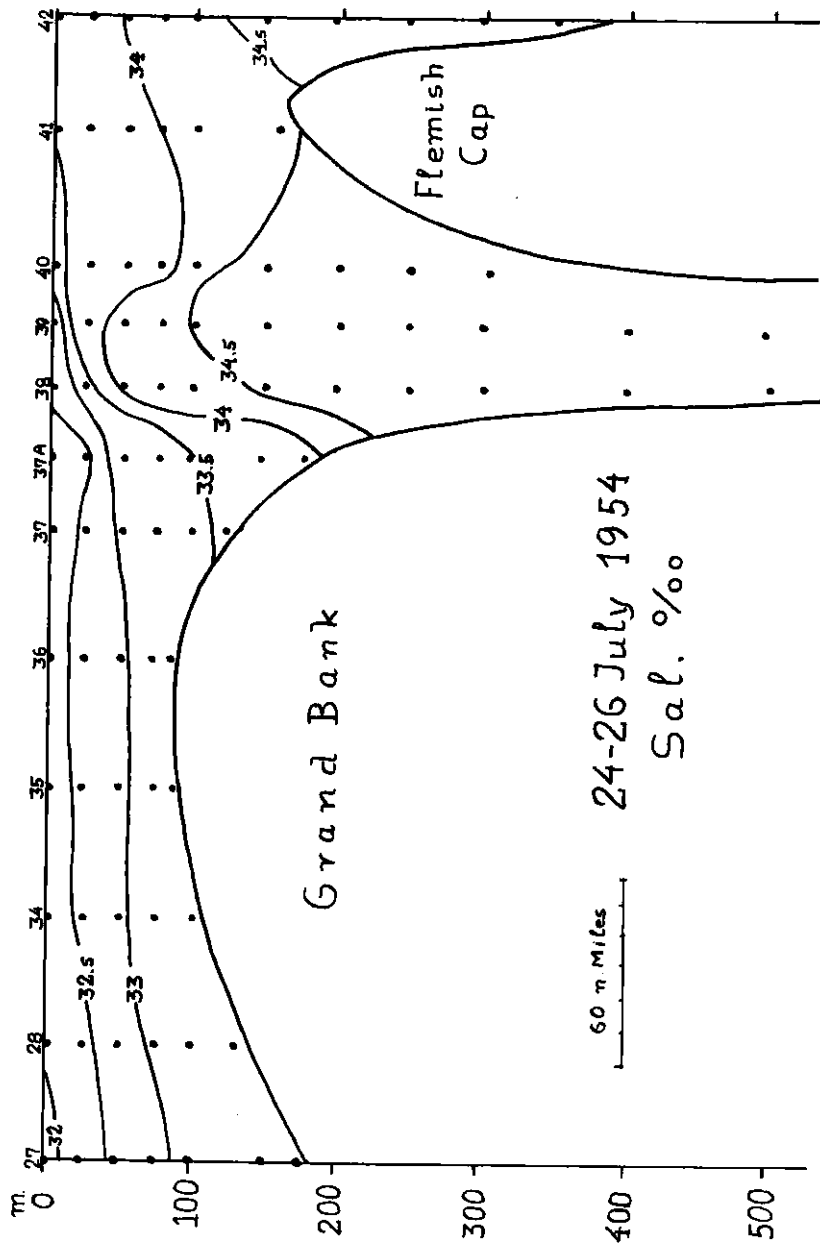


Fig.4 - Hydrographic Section, Grand Bank - Flemish Cap. Salinity, 24-26 July 1954.

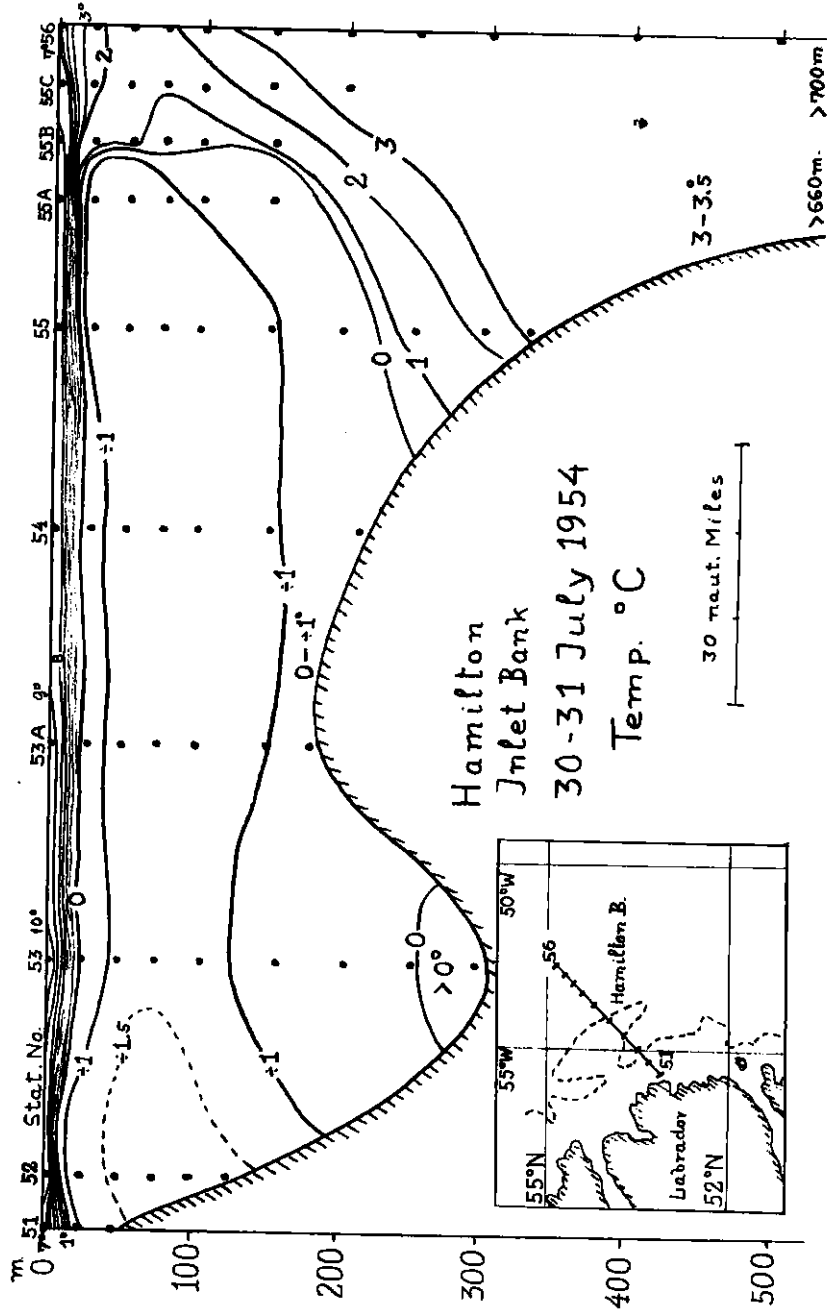


Fig. 5 - Hydrographic Section, Hamilton Inlet Bank. Temperature, 30-31 July 1954. (Position of section inserted).

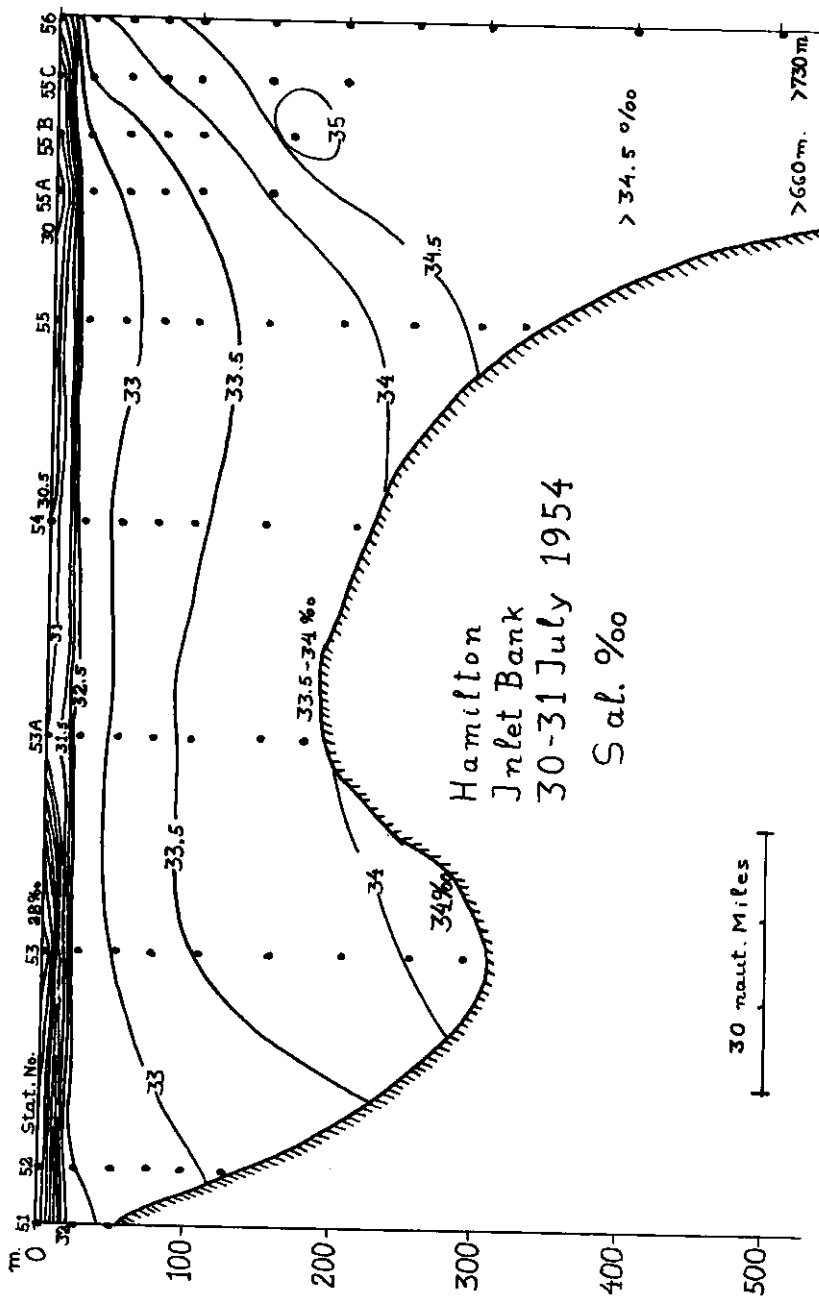


Fig.6 - Hydrographic Section, Hamilton Inlet Bank. Salinity, 30-31 July 1954.