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Norway. Fisheries Investigations in Greenland Waters in 1959.

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In 1959 Norwegian fishery research vessels made two cruises to Greenland waters.

The first cruise was with the research vessel "Johan Hjort" and started from Bergen March 31 and ended in Bergen April 30. The actual working days on the banks off West Greenland were between April 8 and April 22.

The second cruise took place with the research vessel "G.O.Sars" between June 26 and September 4. The main working area on this cruise was East Greenland waters from Cape Farewell to the Storfjord Deep, but between July 25 and August 15 fishery investigations also took place in West Greenland waters.

Figs. 1, 2 and 3 show the routes and stations of the two cruises.

West Greenland

Hydrography

On the first cruise six hydrographical sections were taken between April 10 and 17 (Fig.1). Temperature registrations were in addition made by means of a bathythermograph on all fishing stations. Figs. 4 to 9 show the isotherms in the sections.

The surface water is cold in all sections and of Arctic origin. This cold Arctic water, with temperature below 2° C, covers the bank tops and the upper slopes of the banks. On the southern banks we find the cold water deepest down, on the Noname Bank down to about 200 m. Further north, on the Banan Bank, the cold water penetrates only down to about 90 m. Below this cold layer we find warmer water, more suitable for the cod.

On the second cruise seven hydrographic sections were taken between July 27 and August 11 (Fig.2). The isotherms in each section are shown in Figs. 10 to 16. The hydrographical situation at this time of the year differs in some cases from the one in April.

The surface water is characterized in the south by two strong north-going currents, one of Arctic and one of Atlantic origin (Figs.10-12). Here we find that the cold water in late summer still covers the bank tops and the inshore slopes of the banks, while the deepgoing Atlantic water covers the offshore slopes of the banks. On the northern banks the situation has changed more between April and August (Figs.13-16). Here the surface layer has not been so very much influenced by the Arctic water. Mixed water, with temperatures above 2°C, covers the tops of the banks, while on the western slopes we find a core of Arctic water with temperatures below 2°C. The origin of this water is probably the Labrador Current. Below this cold water Atlantic water again covers the bank slopes.

Cod Investigations

In April no fish were registered with the echo sounder on the tops of the banks, except on Frederikshaab Bank and Fylla Bank where the bottom temperature was between 1° and 2°C. Samples of cod were taken here

with handline. The cod were immature and comparatively small. The mean lengths of the cod on these two banks were respectively 67.79 and 64.12 cm.

On the other hand shoals of fish, partly in heavy concentrations, were registered at the bottom on the western slopes of the banks. The depth varied from 200 to 450 m. The temperature was always 4°C or above. The catches here, taken by means of bottom long line and trawl, consisted of cod and redfish. The redfish dominated in the trawl catches.

Nearly all the cod were sexually mature. Some were already spent but most of them were ready for spawning. A few had flowing milt or roe (just extruding).

The sampled material shows that the cod can spawn on all the banks, from the Noname Bank in the south to the Banan Bank in the north. The spawning probably starts first on the northern banks. Almost all the mature cod from the Banan Bank had completed the spawning and the percentage of spent cod decreased on the other banks from north to south. The spawning temperature seems to have a lower limit at 4°C.

Fig.17 shows the length distribution of the cod caught with various types of gear on the different banks. The curves hardly give a true, but at least a rough picture of the length distribution of the cod population at this time of the year. In spite of the different selectivity of the gears, it nevertheless seems safe to conclude that (1) relatively small fish dominate the population, and (2) the mean length of the cod decreases from south to north.

The length distribution of the total catch of cod taken with hand line and bottom long line is shown in Fig.18. The mean length is relatively small, viz. 69.69 cm.

In Fig.19 the age composition of the cod is shown in a similar manner, based on the total catch with hand line and bottom long line. A new year class, 1953, dominates the total catch. This year class is, however, not as strong as indicated by the figure; the relatively large catches of immature cod from Frederikshaab Bank and Fylla Bank influence the picture too much.

The registrations with echo sounder, and the results of the fishing experiments on the cruise in July-August, showed that the distribution of cod in 1959 was almost the same as in previous years. Very few cod were found on the southern banks, even in localities with favourable temperatures. The first good concentration of cod was located in the middle part of Lille Hellefisk Bank. Really good concentrations were found in the northern part of Lille Hellefisk Bank, where the cod was feeding heavily on sand eels and capelin. Here the cod were standing near the bottom. No pelagic shoals of cod were found in the Holsteinsborg Deep in spite of great concentrations of sand-eels and capelin in the intermediate water layers where the temperature conditions were also favourable.

Fig.20 shows the length distribution of cod in the total long line and hand line catches on the different banks. We still notice that to some degree the mean length of the cod shows a decrease from south to north. Exceptions are the cod samples from the Cape Farewell region and Fiskeøes Bank. On Lille Hellefisk Bank, where the good concentrations of cod were found, there is a very marked variation in the mean lengths. The cod in the catches from the middle part of the bank has a mean length of 74.91 cm while the mean length on the northern part of the bank is 67.30 cm. The mean length in the total samples of cod off West Greenland is 72.22 cm.

The age composition of all cod taken by hand line and bottom long line in July-August is shown in Fig.21. The picture differs from the one obtained in April and probably gives a more true impression of the

factual age composition. The 1953 year class with an overall mean length of 66.17 cm is for the present not so very strong in the hook- and line catches, which are still influenced very much by the 1950 and 1957 year classes.

Comparing with the 1958 catch, we find that both the 1947 and the 1950 year class have diminished in strength. The number of fish belonging to the 1953 year class will probably increase in the hook- and line catches next year. On the other hand the mean length of the fish in the catches is expected to decrease still more due to the increase of the 1953 year class and the decrease of the 1947 and 1950 year classes.

East Greenland

Hydrography

In East Greenland waters four hydrographical sections were taken (Fig.3). Temperature registrations were made by means of bathythermograph on all fishing stations and in other localities. Figs.22-25 show the isotherms in the sections.

The water masses off the coast of Southeast Greenland are marked by two parallel west- and southwestgoing currents. The western current is of Arctic origin (the East Greenland Polar Current), the eastern parallel of Atlantic origin (a branch of the Irminger Current). The cold Arctic water does not, at this time of the year, penetrate to any great depth. Only in few localities we find the 2°C isotherm below 125-150 m. In other words, we find temperatures suitable for the occurrence of fish nearly all over the investigated area. Only the highest peaks of some banks, and the upper part of the slope of the coastal shelf, are covered by water with temperatures unfavourable for commercial species of fish.

Cod Investigations

In Tables 1 and 2 are listed the bottom long line stations and the hand line stations. From the tables it will be seen that only in few localities a complete absence of cod was noted. Good concentrations of cod were found in some localities. Two areas with good concentrations of saithe, and one locality with concentration of haddock were also found.

On the Cape Dan Bank, August 26-28, the concentrations of cod were much better than indicated by Table 1. We had the impression that the cod would not take the bait. Trawling in the same locality gave reasonably good catches.

Fig.26 shows the length distribution of all cod taken on bottom long lines off the coast of East Greenland. The mean length is 86.07 cm. In other words, the cod has the proper commercial size for Norwegian long line fishermen.

Fig.27 shows the age composition of cod taken by hand line and bottom long line, and Fig.28 the age composition of cod taken by trawl. The 1947 and 1950 year classes dominate the hand line and bottom long line catches. Generally all the cod are of relatively high age, between 9 and 14 years. In contrast to West Greenland the 1953 year class does not appear to have any strength in the hand line and bottom long line catches off Southeast Greenland.

The age composition of the cod taken by trawl on the Cape Dan Bank is different. Here all the year classes between 1949 and 1953 are relatively strong, and the 6-10 year old fish belonging to these five year classes constitute most of the catch.

Tagging Experiments

Tagging of cod and halibut in West Greenland waters was continued in 1959. This year both Lea tags and yellow plastic disks were used. 392 cod were tagged with Lea tags and 229 with yellow plastic disks. A total of 123 halibut were tagged off West Greenland.

In East Greenland waters tagging experiments were started in 1959. A total of 617 cod were tagged, 307 with Lea tags and 310 with plastic disks. Besides 99 halibut were marked with yellow plastic disks in the gill cover.

Table 1. "G.O.Sars". East Greenland, July-August 1959. Bottom long line stations..

Date	Position		Depth (m)	Number of hooks	Bottom Temp. °C.	Catch in number of fishes				
						Cod	Haddock	Hali-but	Red-fish	Tusk
1/7	N63°10'	W40°04'	320	2000	4.86	16	0	2	9	78
2/7	N63°29'	W39°18'	250	2000	5.1	34	0	4	12	171
3/7	N63°33'	W37°50'	200	2000	4.5	58	0	25	5	66
4/7	N63°59'	W38°23'	250	1800	4.5	15	0	2	3	60
6/7	N64°58'	W36°58'	230	2000	4.9	49	0	0	2	61
7/7	N65°35'	W33°30'	270	2000	3.0	156	0	0	0	20
8/7	N65°40'	W31°54'	250	2000	5.0	207	0	2	1	6
9/7	N66°02'	W32°31'	285	2000	2.89	55	0	1	0	14
10/7	N66°02'	W29°27'	315	2000	0.89	Part of gear lost				
11/7	N65°50'	W29°39'	350	2000	2.77	Gear lost				
23/7	N64°18'	W39°55'	200	2000	3.6	64	0	11	0	3
23/7	N63°58'	W39°32'	240	1200	4.5	36	0	3	0	54
15/8	N59°49'	W43°11'	170	2040	2.9	87	0	7	0	0
17/8	N60°37'	W62°07'	190-200	2040	4.6	15	0	9	18	9
18/8	N61°07'	W42°20'	180	2040	3.0	86	part of	5	gear lost	
19/8	N61°35'	W41°15'	200	1600	4.5	21	0	17	33	22
20/8	N62°04'	W40°43'	165	1800	3.2	92	54	63	25	0
23/8	N63°13'	W40°48'	240	1800	4.2	82	0	2	0	0
26/8	N65°13'	W36°32'	200	1800	3.0	163	0	4	0	1
27/8	N65°13'	W36°39'	210	1800	3.1	39	0	1	0	0
28/8	N65°16'	W36°47'	190	1800	3.1	57	0	3	0	

Table 2. "G.O.Sars". East Greenland, July-August 1959. Hand line stations

Date	Position		Depth (m)	Number of hand lines	Time fished (min)	Bottom Temp. °C.	Catch in number of fishes				
							Had-Cod	Red-fish	Sai-the	Other fishes	
1/7	N63°10'	W40°04'	320	4	120	4.86	0	1	20	0	1
2/7	N63°25'	W39°45'	240	4	45	5.8	5	0	0	0	0
2/7	N63°29'	W39°18'	250	4	150	5.1	2	2	9	0	4
3/7	N63°39'	W38°21'	210	3	20	4.5	1	0	1	0	0
3/7	N63°44'	W38°27'	250	4	15	4.5	0	0	1	0	0
3/7	N63°30'	W37°51'	200	2	20	4.5	0	0	0	0	0
3/7	N63°33'	W37°50'	210	4	150	4.5	5	0	0	23	0
6/7	N65°14'	W36°08'	230	4	30	4.07	15	0	1	0	0
6/7	N65°19'	W37°15'	180	4	70	4.5	5	0	0	0	0
6/7	N64°58'	W36°58'	230	4	200	4.9	3	0	20	0	0
7/7	N65°22'	W33°56'	250	3	40	2.9	0	0	1	0	0
8/7	N65°40'	W32°02'	240	4	60	5.0	2	0	0	33	0
22/7	N65°26'	W37°49'	170	4	180	3.3	45	0	0	0	0
22/7	N65°04'	W38°34'	170	4	40	3.9	38	0	0	0	0
23/7	N64°50'	W39°54'	200		25		Good catch				
25/7	N59°41'	W43°22'	200	3	15		3	0	0	0	0
18/8	N61°07'	W42°20'	180	4	120	3.0	68	0	0	0	0
19/8	N61°19'	W41°34'			30		0	0	0	0	0
19/8	N61°35'	W41°15'	200	3	120	4.5	1	0	70	0	0
26/8	N65°13'	W36°32'	200	2	60	3.0	15	0	0	0	0

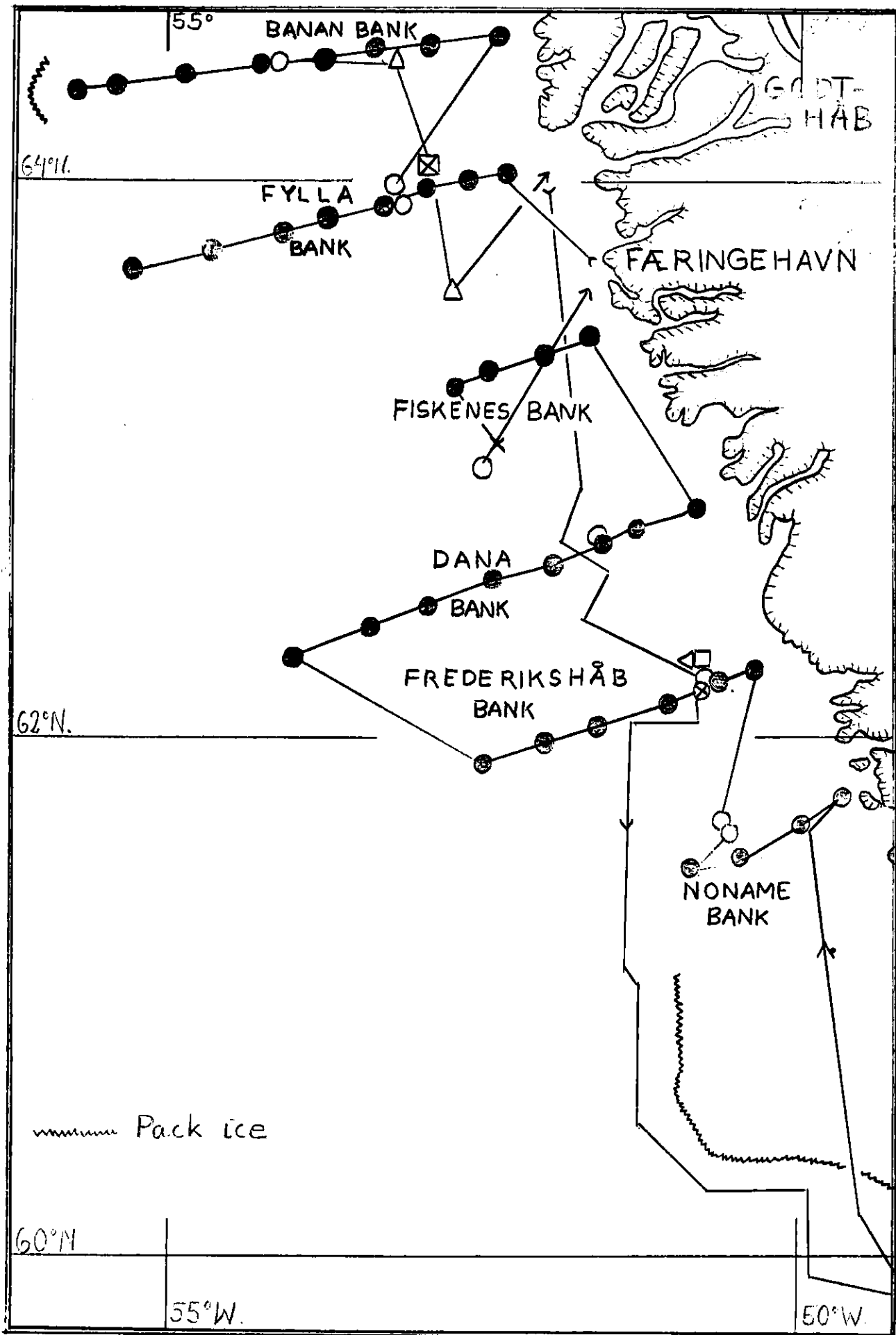


Figure 1. "Johan Hjort", West Greenland, April 1959. Routes and stations.
● Hydrographic station, ○ Trawl st., △ Bottom long line st., X Bathy st., □ Hand line st.

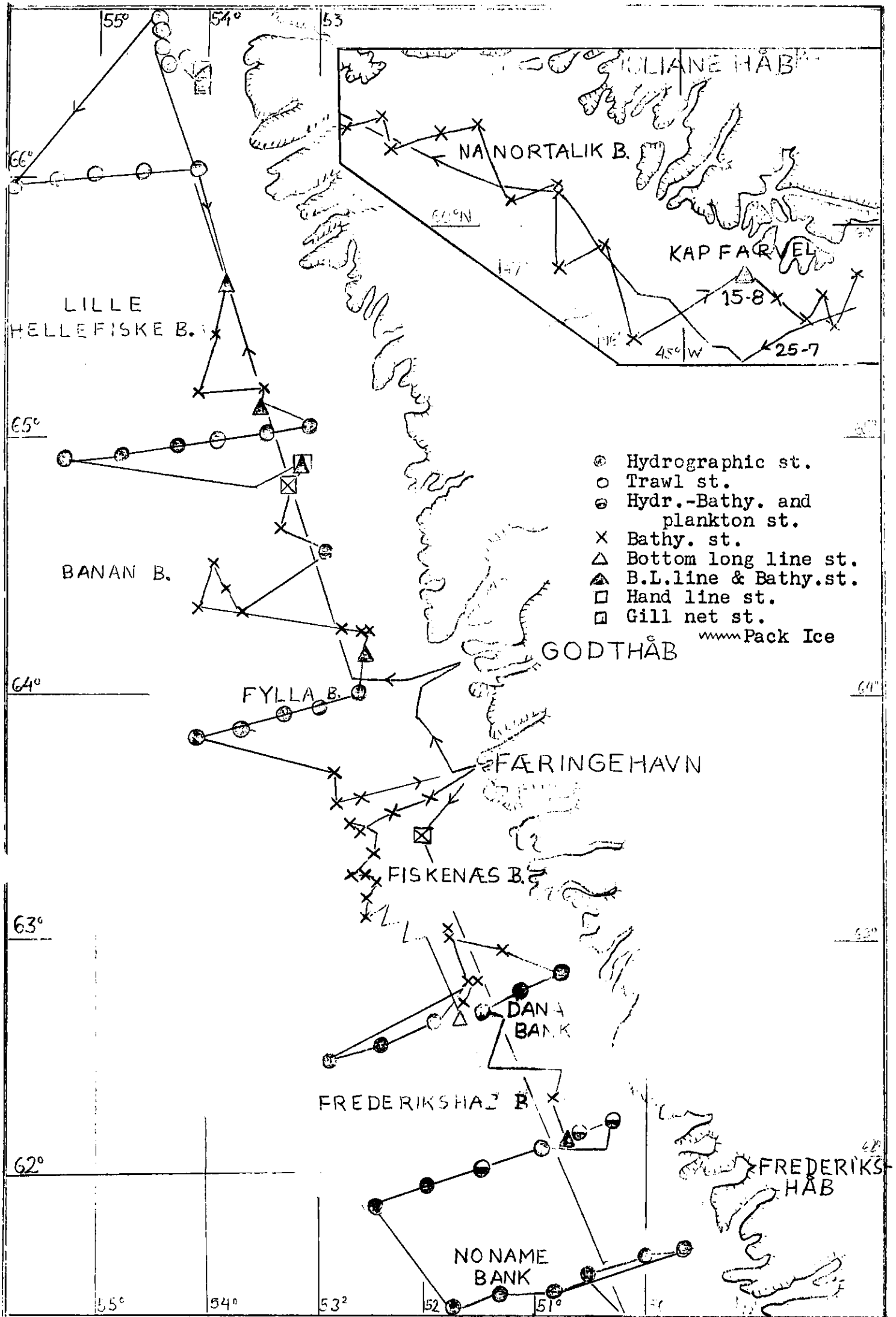


Figure 2. "G.O.Sars", West Greenland, July-August, 1959. Routes and stations.

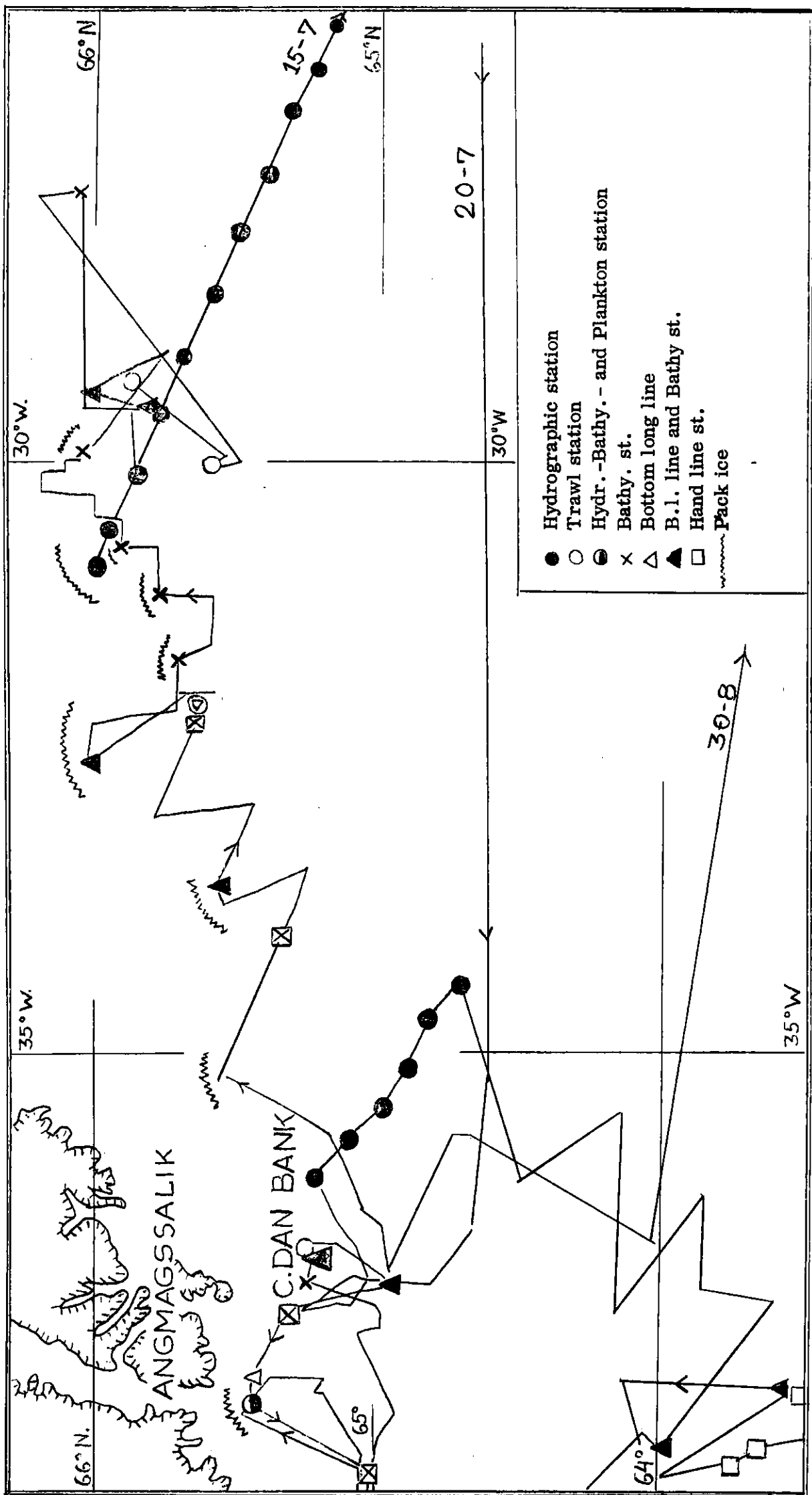


Figure 3a. "G.O. Sars", East Greenland, July-August 1959. Routes and stations. Region - Cape Farewell-Umivik.

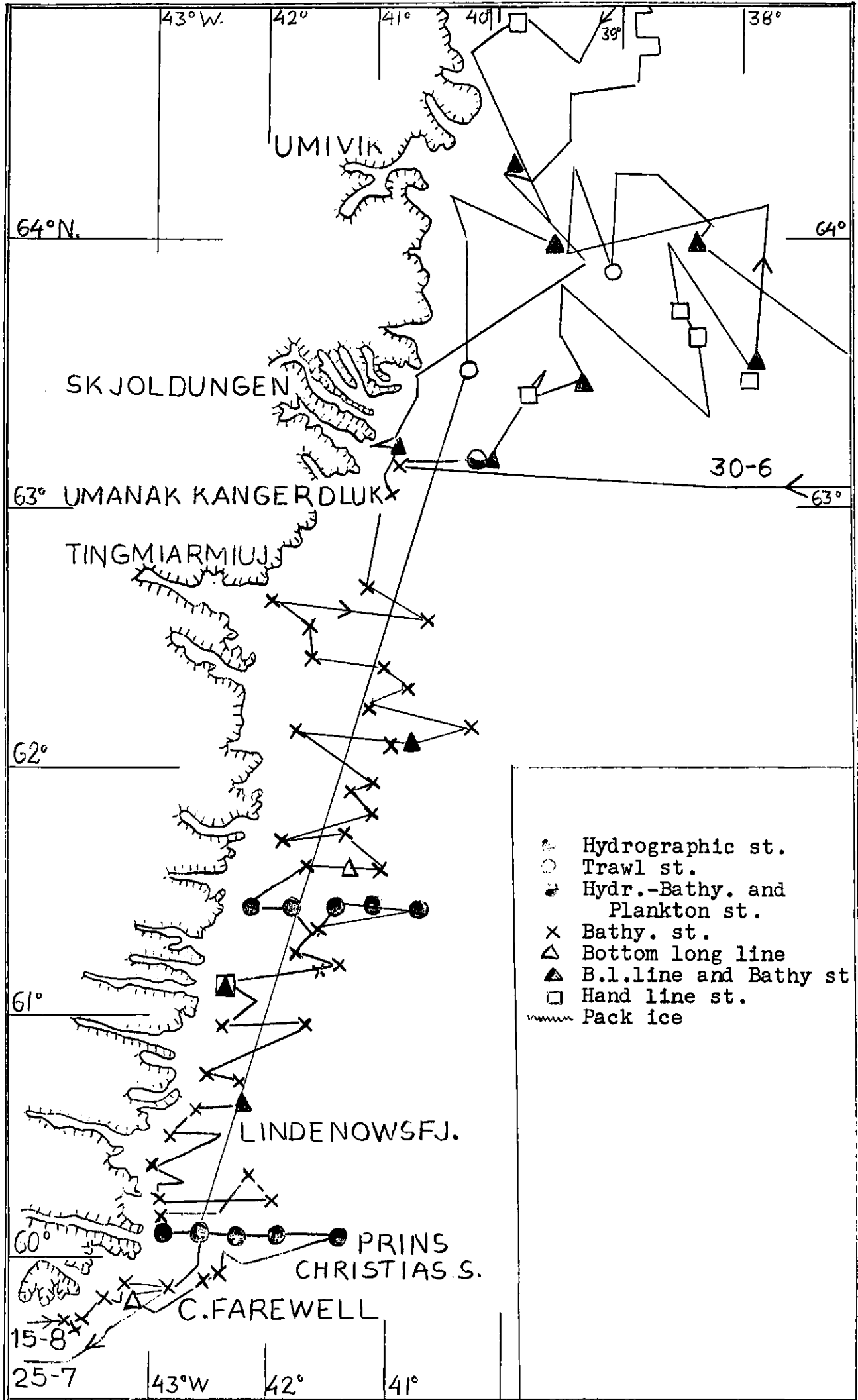


Figure 3b. "G.O.Sars", East Greenland, July-August 1959. Routes and stations. Region - Angmagssalik-Iceland

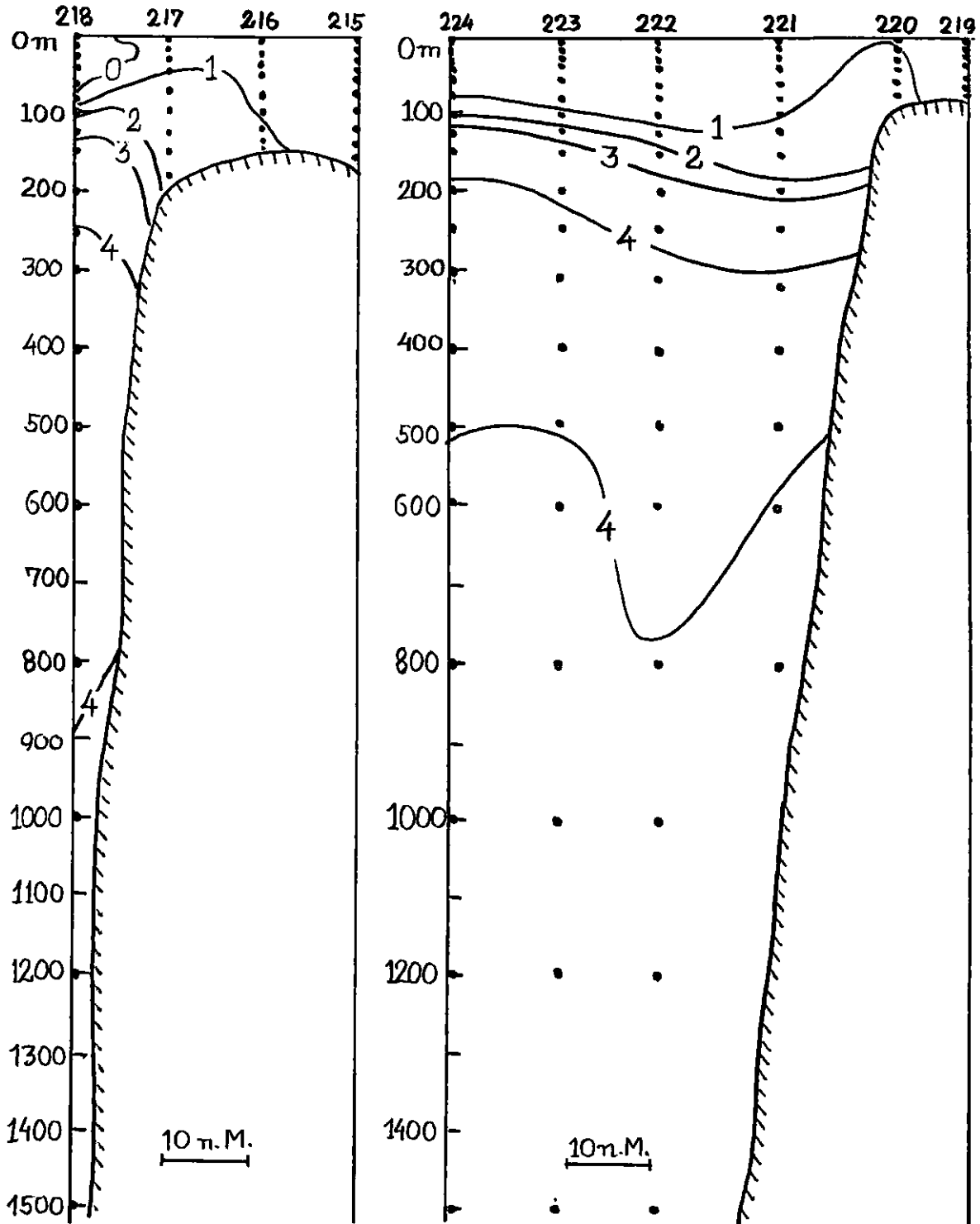


Figure 4. "Johan Hjort", West Greenland, April 1959. Temperature section from Noname Bank - westward.

Figure 5. "Johan Hjort", West Greenland. April 1959. Temperature section from Frederikshaab Bank - westward.

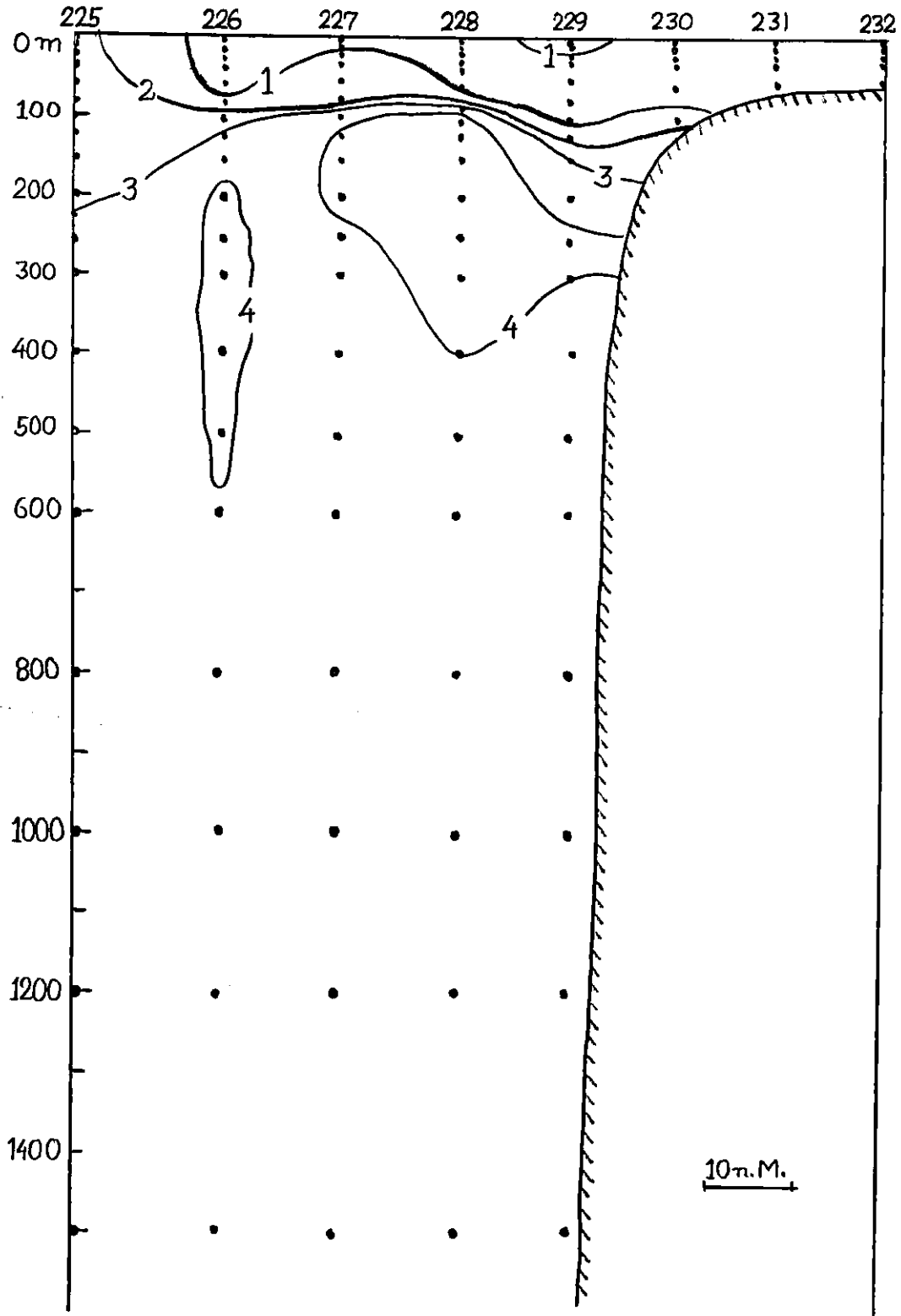


Figure 6. "Johan Hjort", West Greenland, April 1959.
Temperature section from Danas Bank -
westward.

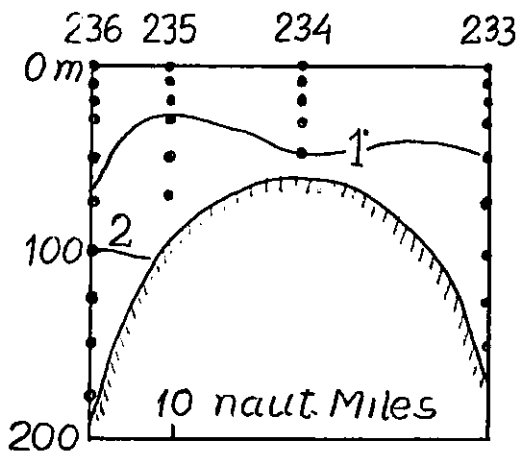


Figure 7. "Johan Hjort". West Greenland, April 1959. Temperature section across Fiskenes Bank - westward.

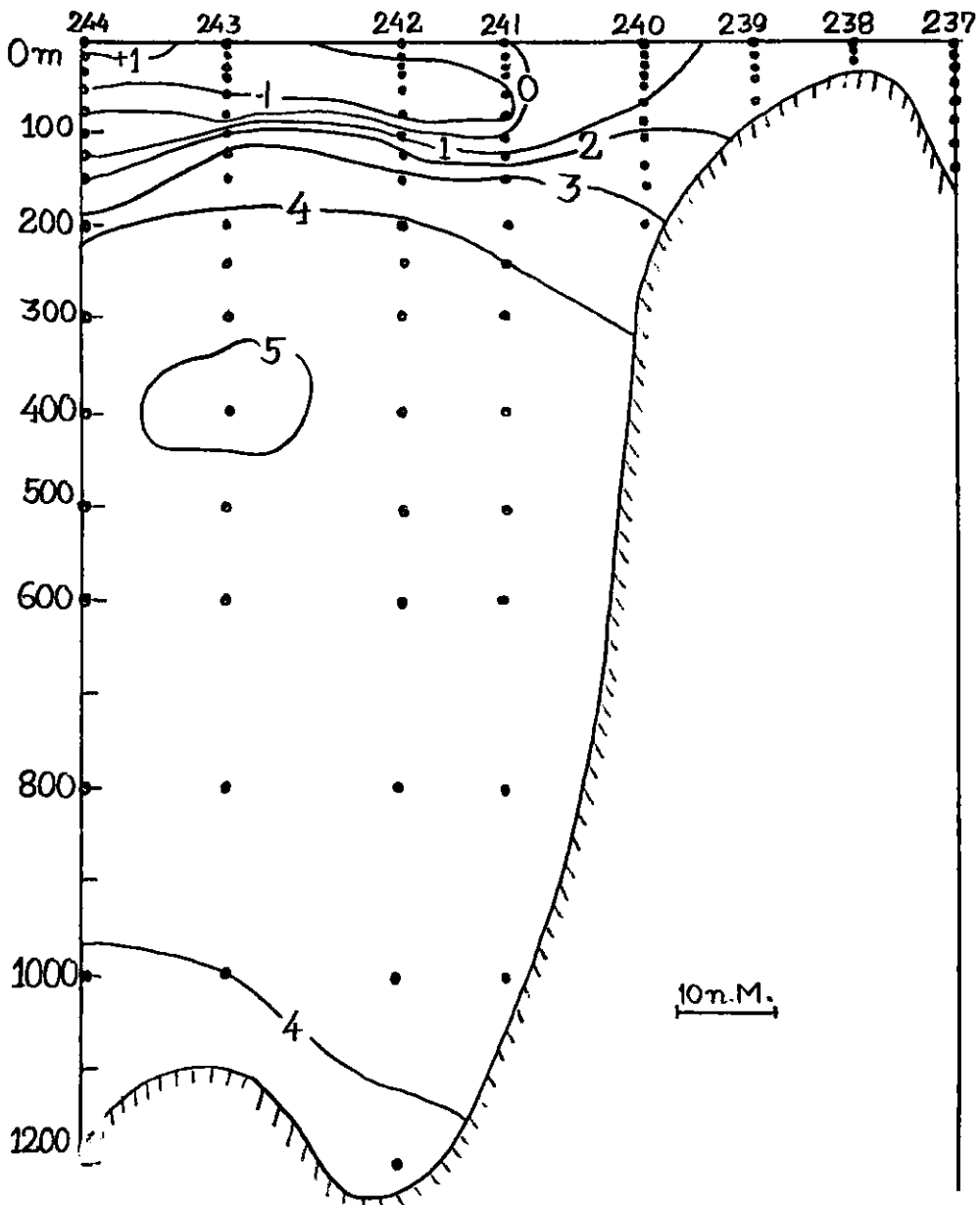


Figure 8. "Johan Hjort", West Greenland, April 1959. Temperature section from Fylla Bank. - westward.

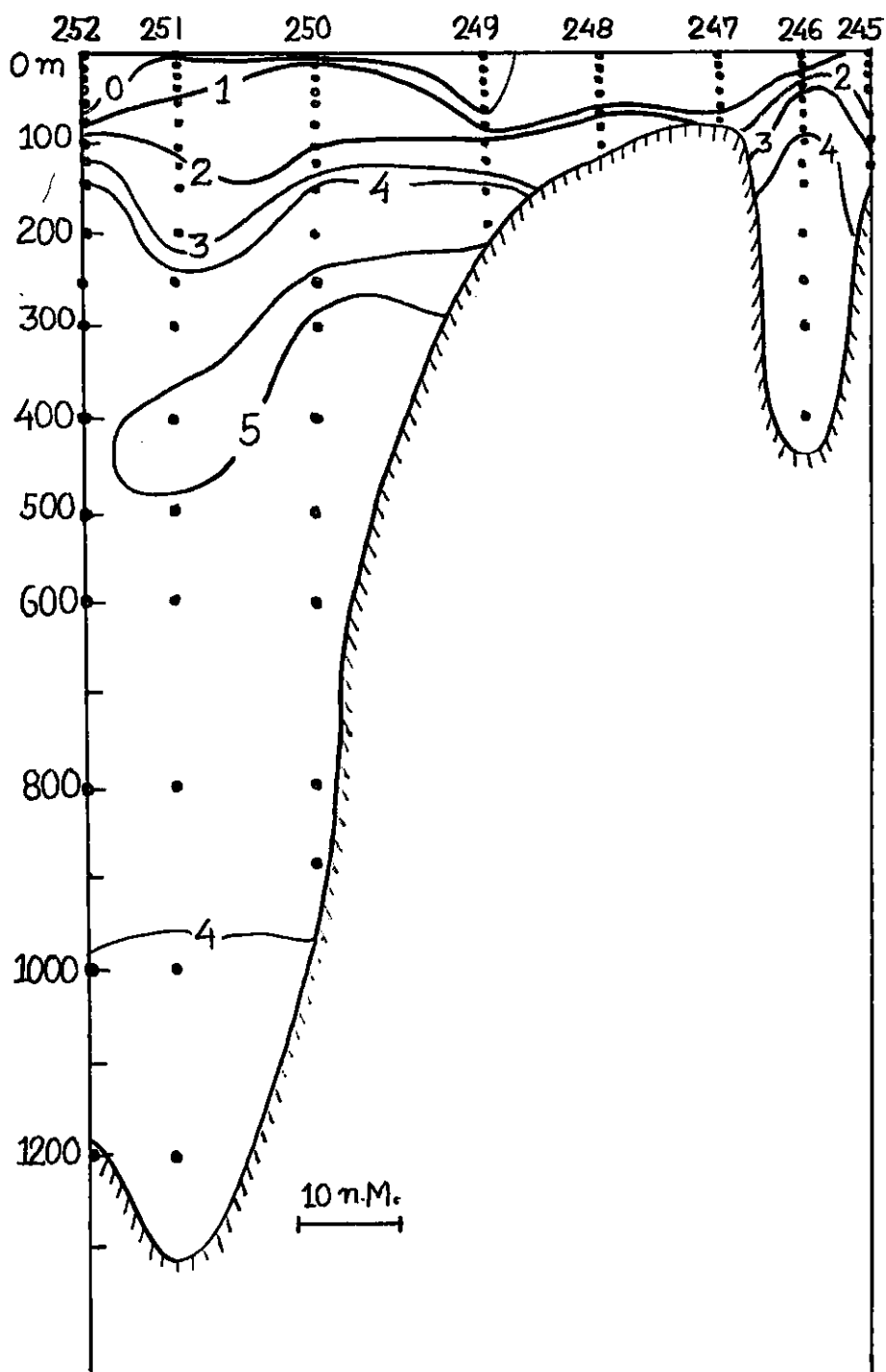


Figure 9. "Johan Hjort", West Greenland. April 1959. Temperature section from Banan Bank - westward.

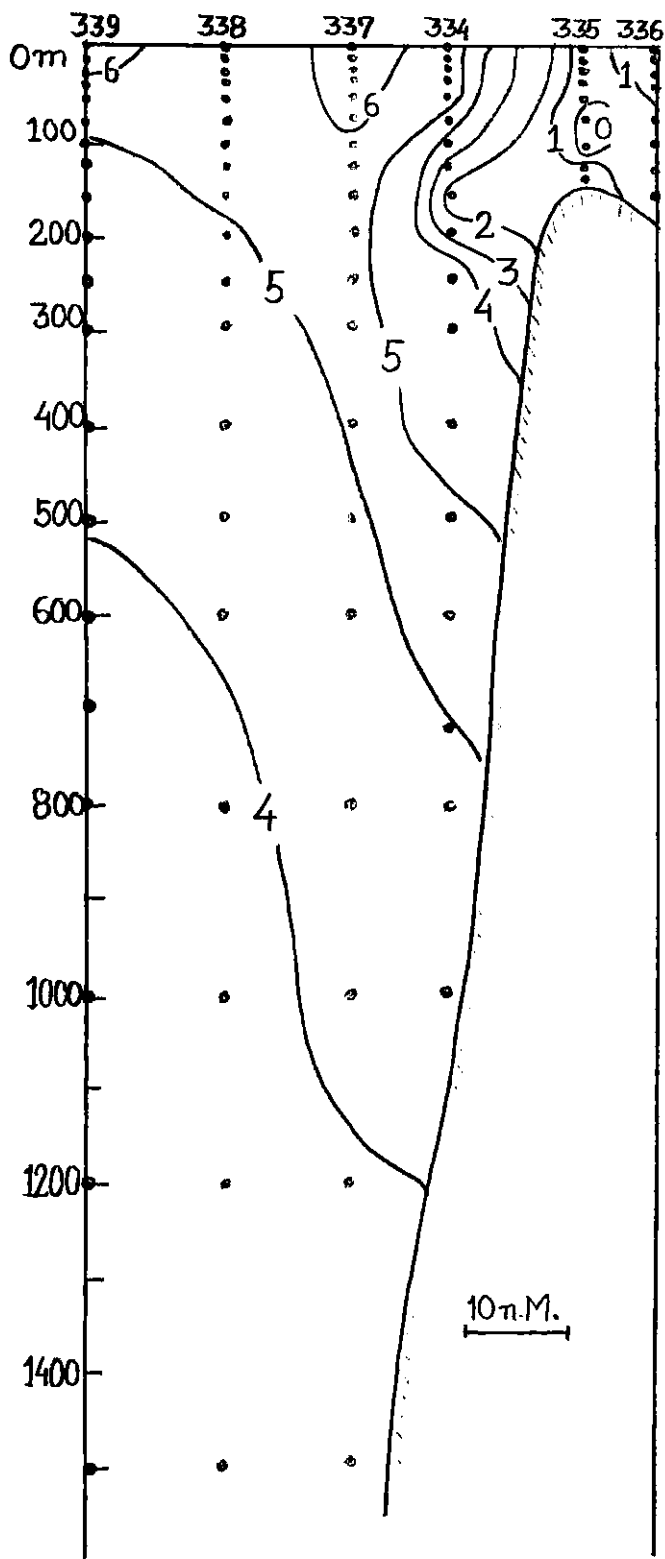


Figure 10. "G.O.Sars". West Greenland. July 1959. Temperature section from Noname Bank - westward.

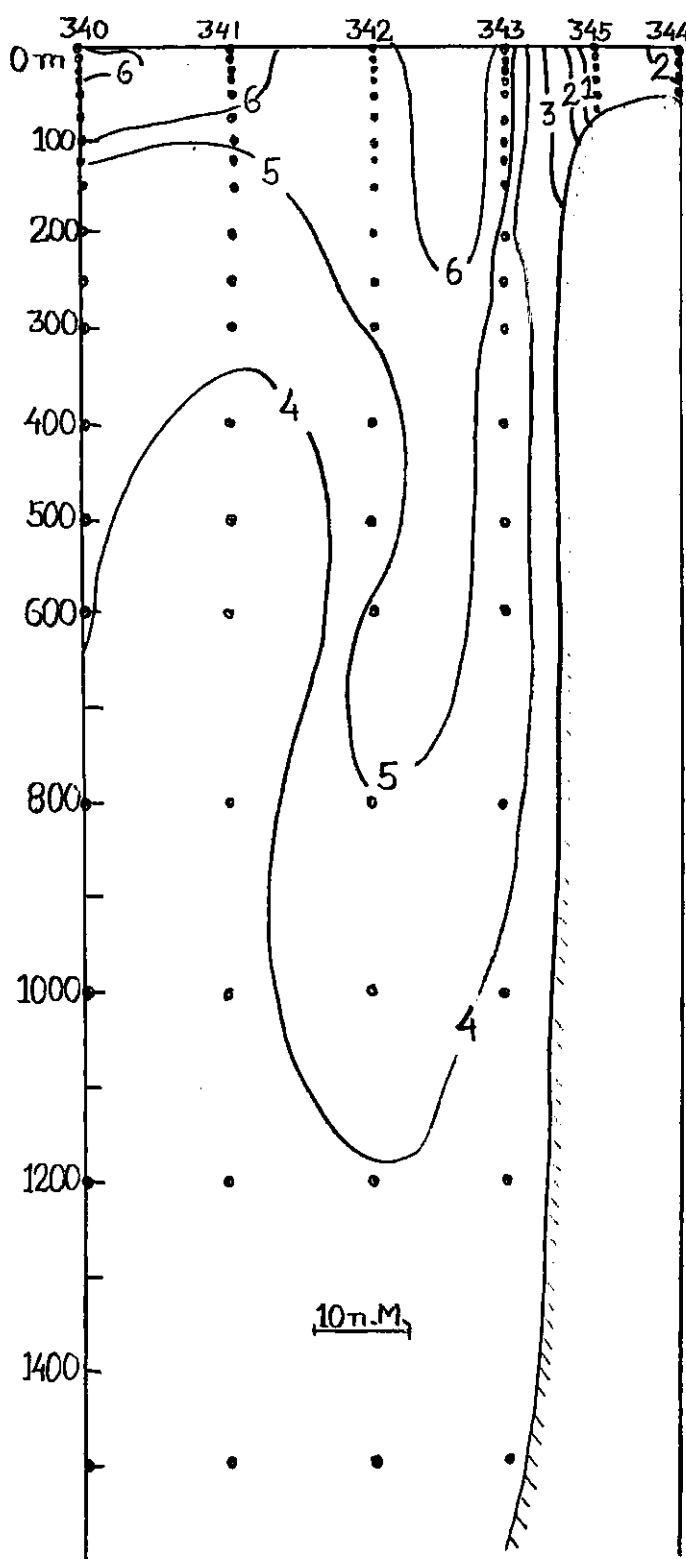


Figure 11. "G.O.Sars", West Greenland. July 1959. Temperature section from Frederikshaab Bank - westward.

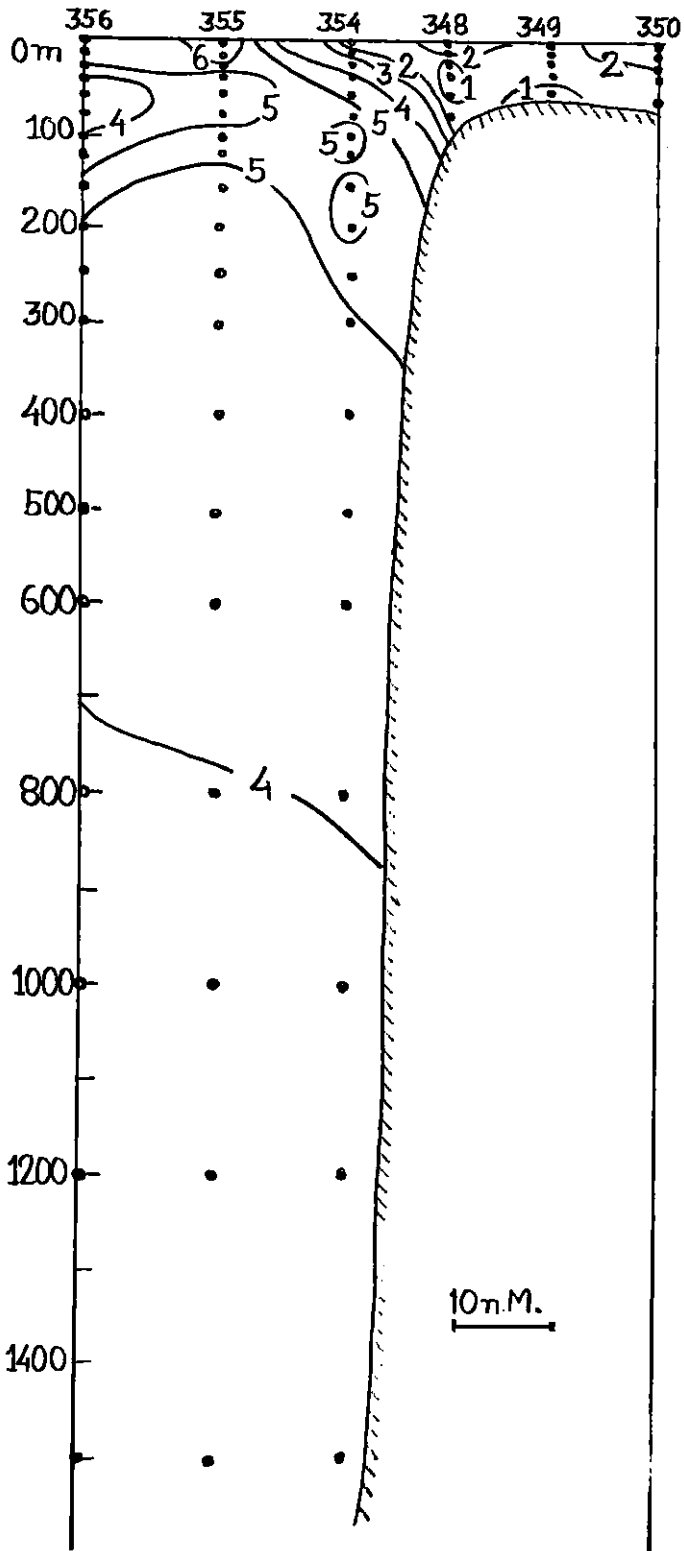


Figure 12. "G.O.Sars", West Greenland, July 1959. Temperature section from Danas Bank - westward.

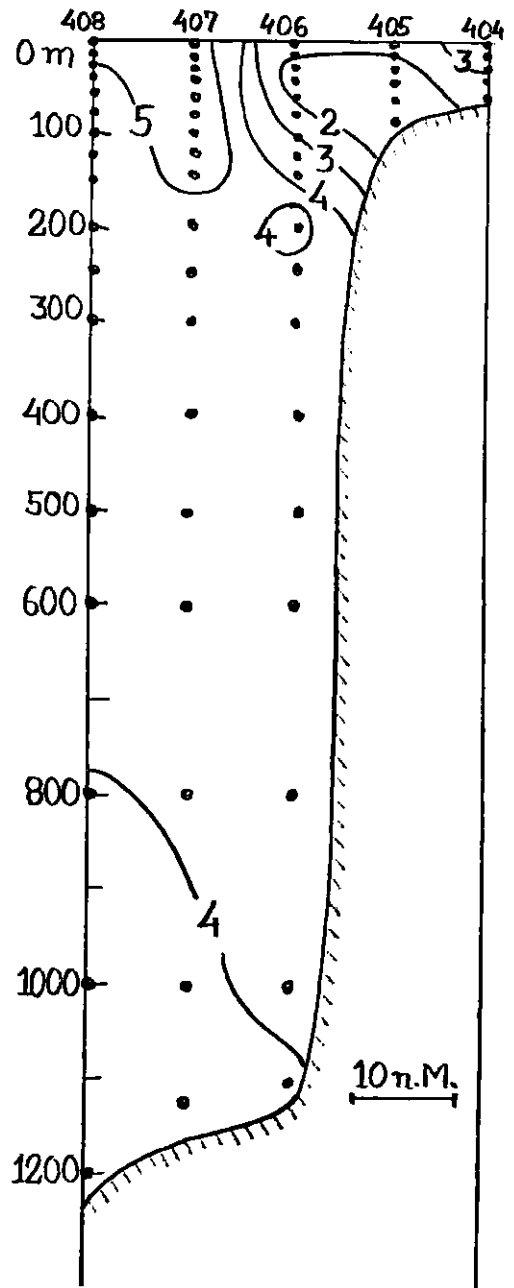


Figure 13. "G.O.Sars", West Greenland, August 1959. Temperature section from Fylla Bank - westward.

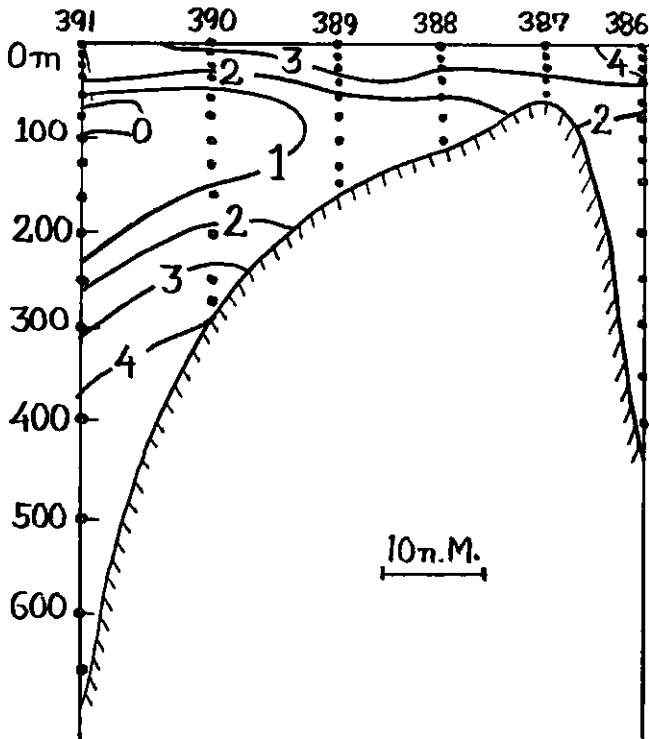


Figure 14. "G.O.Sars", West Greenland. August 1959. Temperature section from the middle part of Lille Hellefisk Bank - westward.

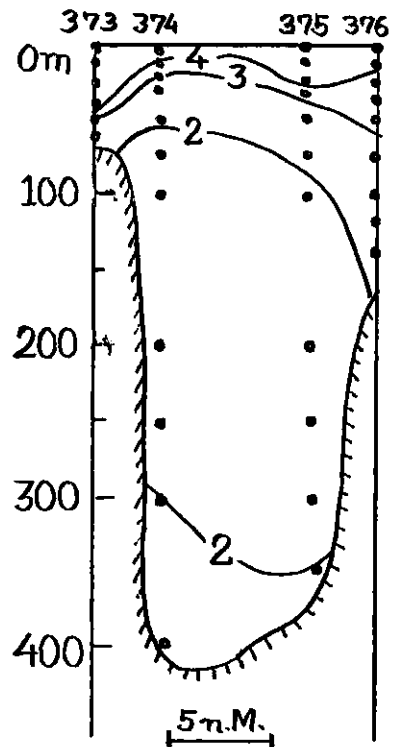


Figure 16. "G.O.Sars", West Greenland. August 1959. Temperature section across Holsteinsborg Deep.

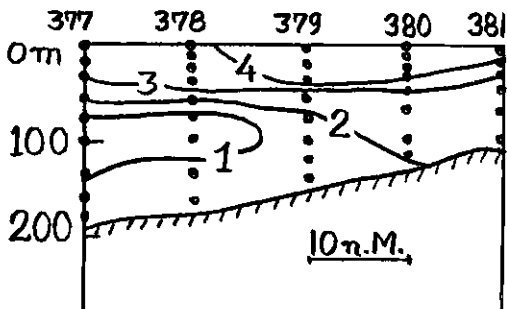


Figure 15. "G.O.Sars", West Greenland, August 1959. Temperature section from the northern part of Lille Hellefiske Bank - westward.

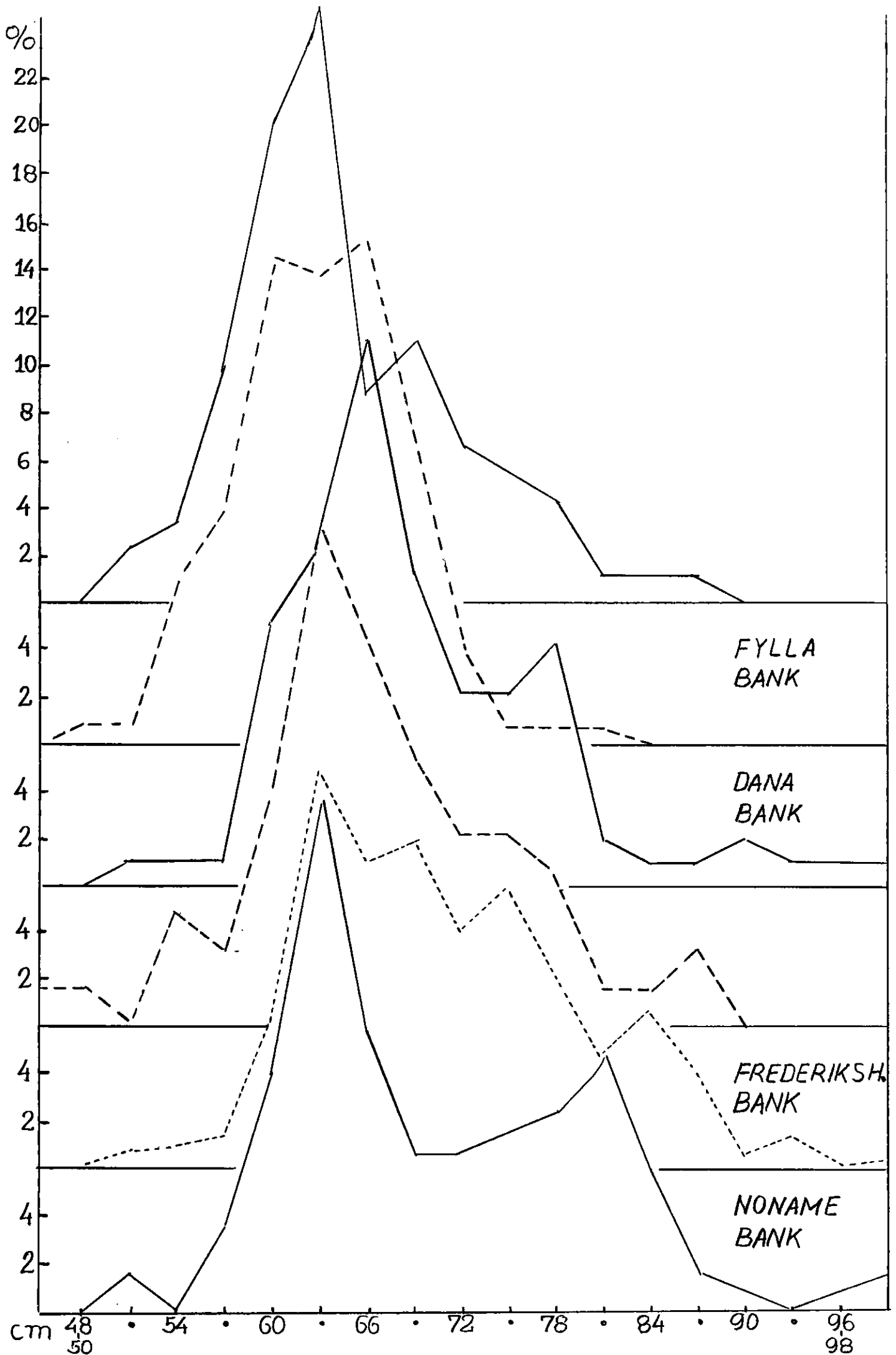


Figure 17. "Johan Hjort", West Greenland, April 1959. Cod. Length distribution, total catch on the different banks. —=Trawl, - - - - =Hand line,Bottom long line.

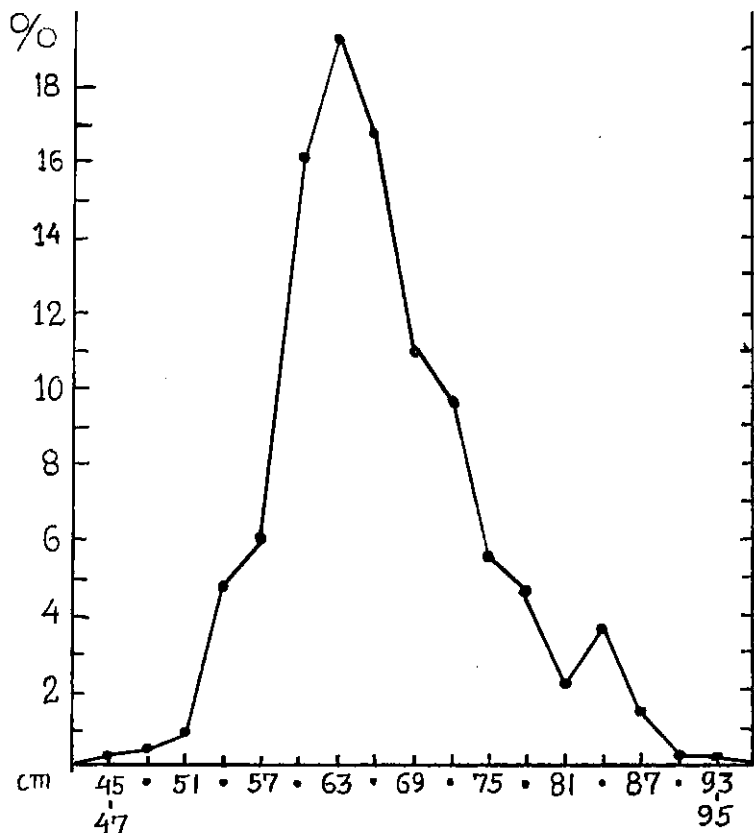


Figure 18. "Johan Hjort", West Greenland, April 1959. Cod. Length distribution. Total catch, hand line + bottom long line.

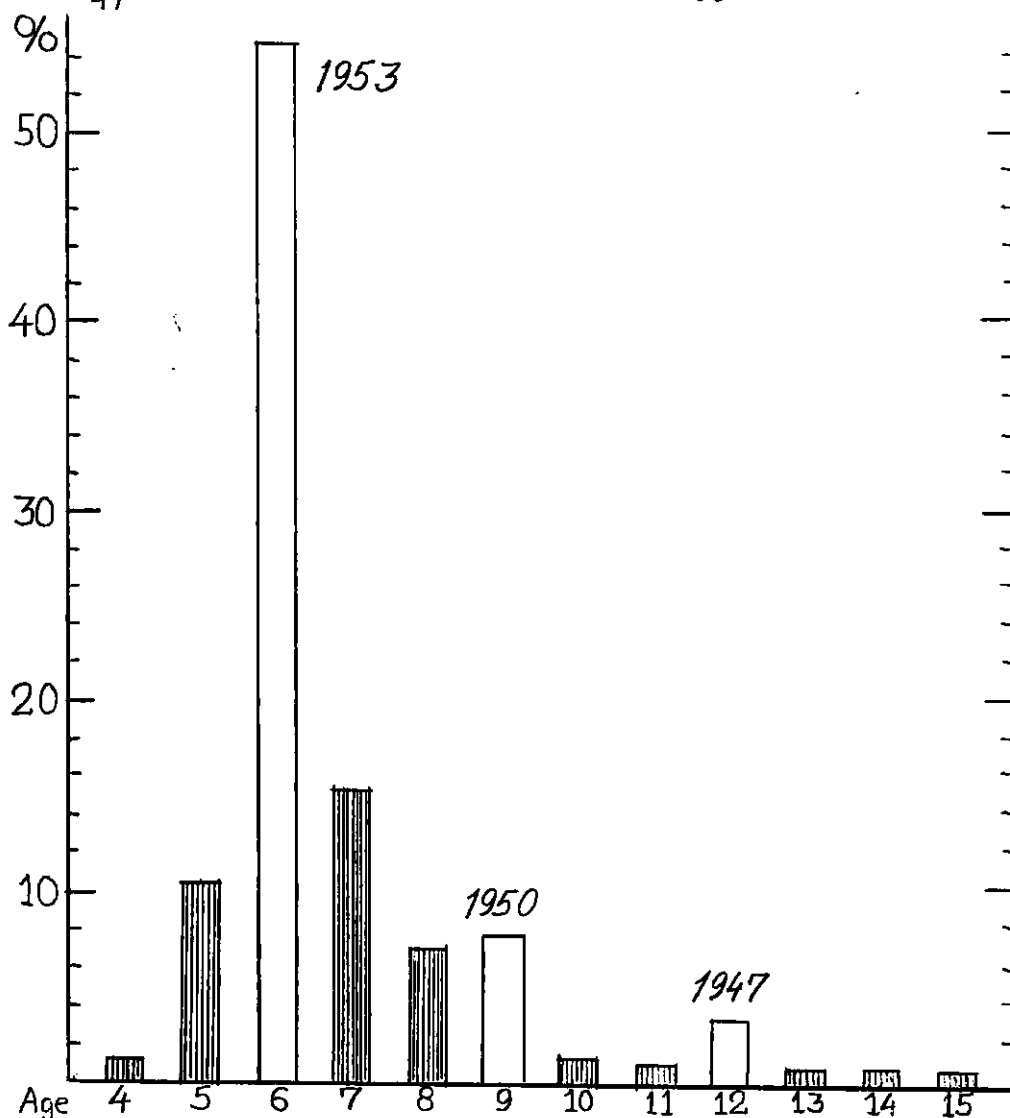


Figure 19. "Johan Hjort", West Greenland, April 1959. Cod. Age composition. Total catch hand line and bottom long line.

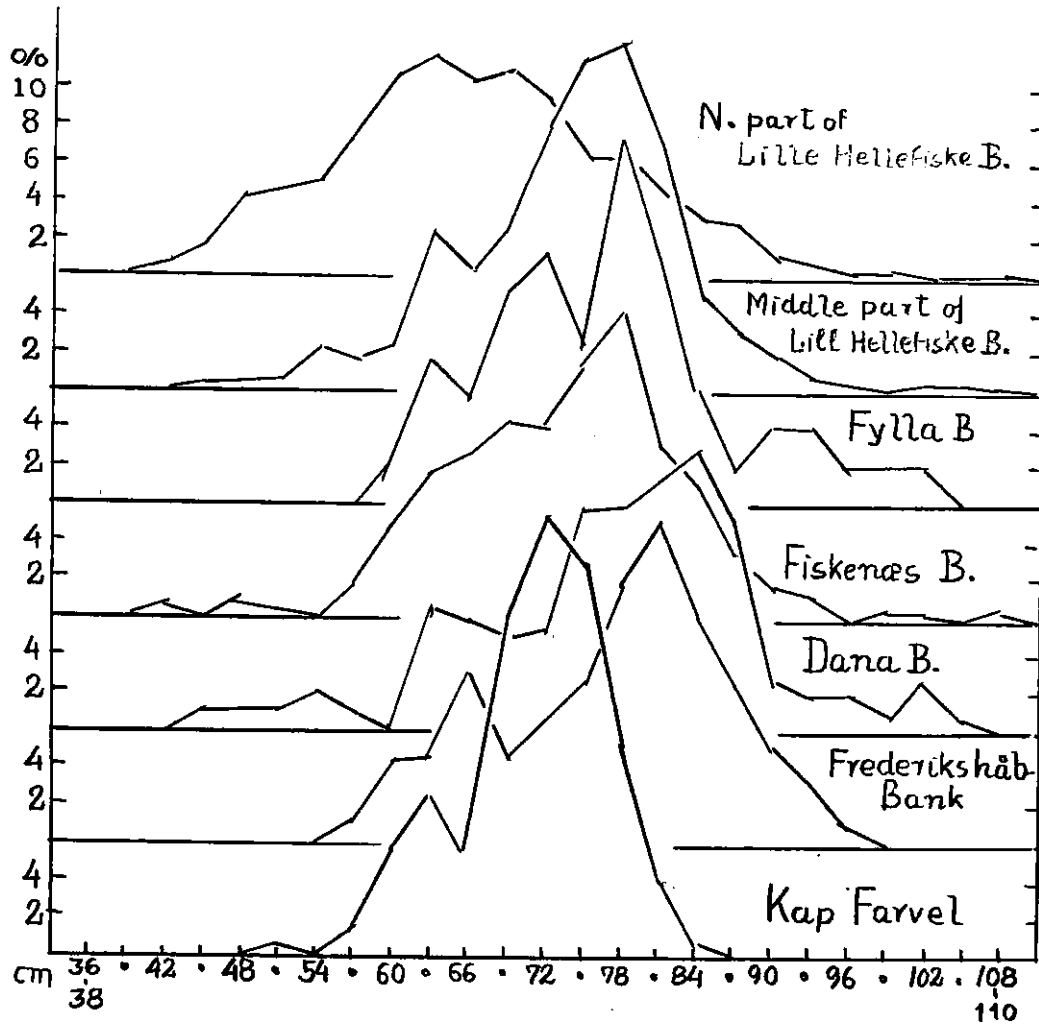


Figure 20. "G.O.Sars", West Greenland, July-August 1959. Cod. Length distribution. Total Catch on the different banks.

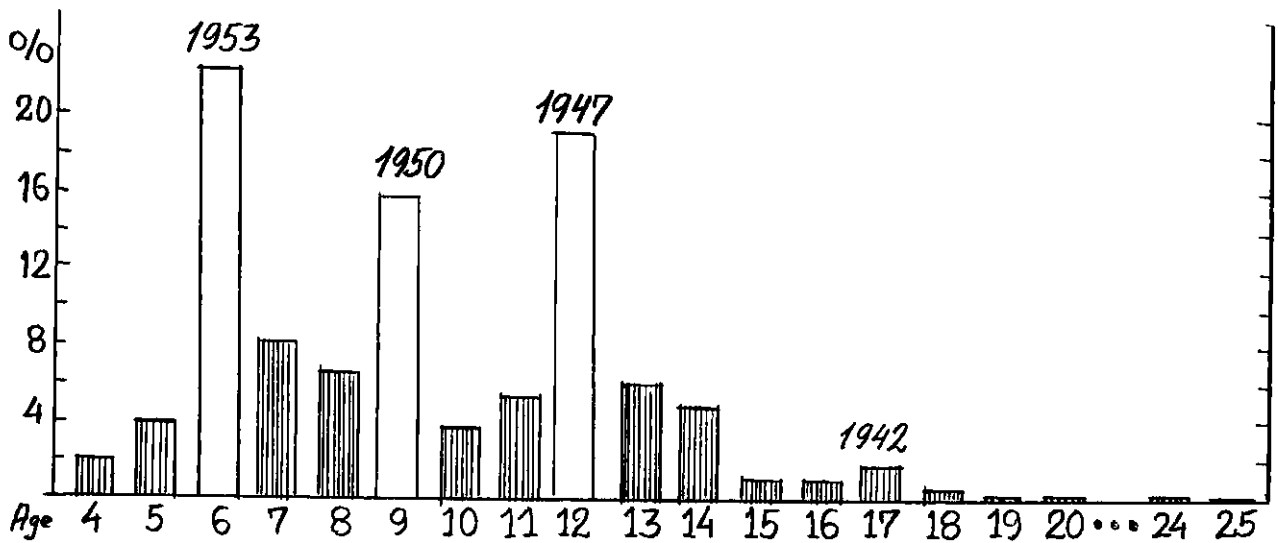


Figure 21. "G.O.Sars", West Greenland, July-August 1959. Cod. Age composition, total catch hand line and bottom long line.

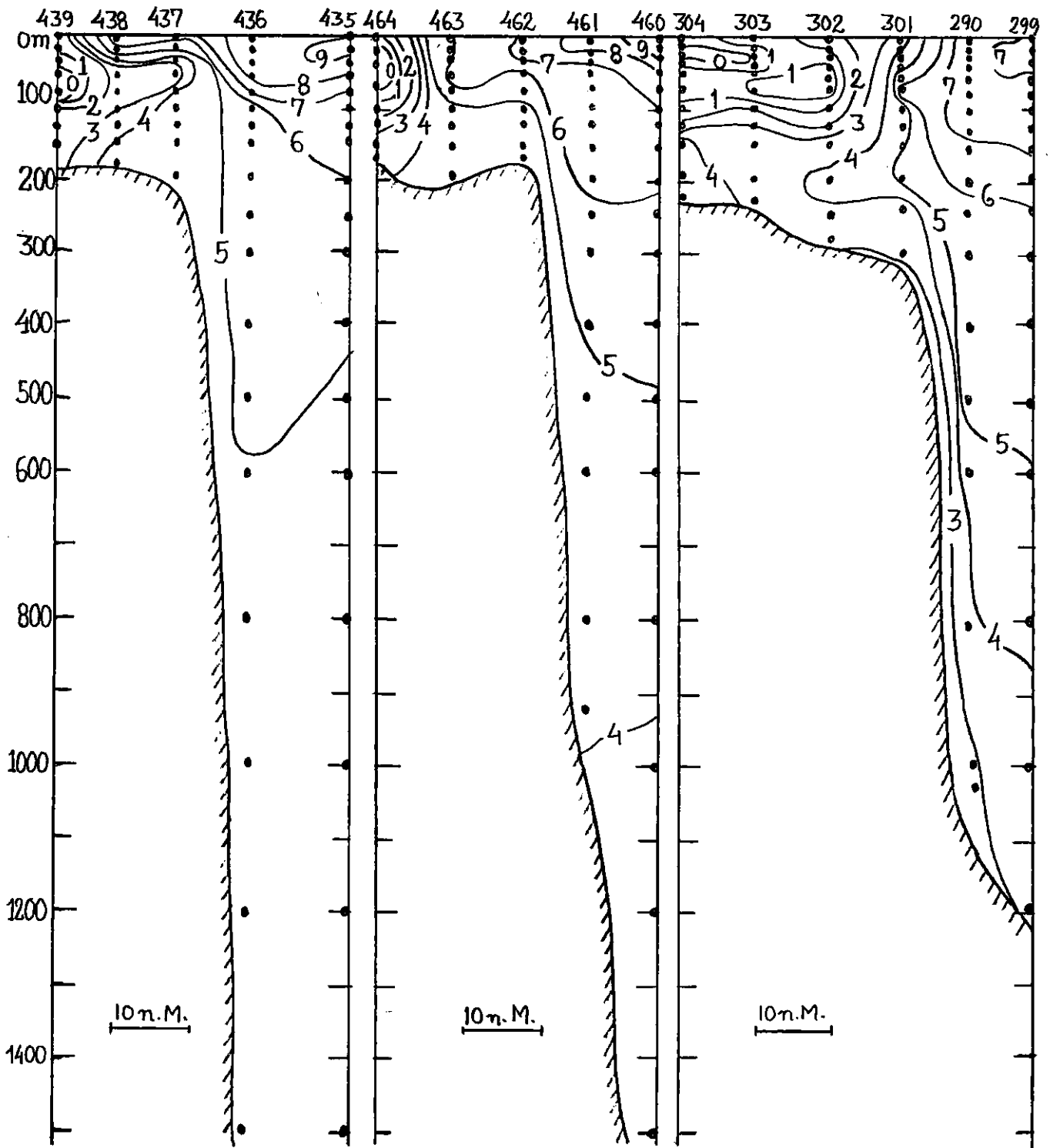


Figure 22. "G.O.Sars", East Greenland. August 1959. Temperature section from Prins Christians Sound - eastward.

Figure 23. "G.O.Sars" East Greenland. August 1959. Temperature section from Cape Tordenskjold eastward.

Figure 24. "G.O.Sars", East Greenland. July 1959. Temperature section from Angmagssalik - eastward.

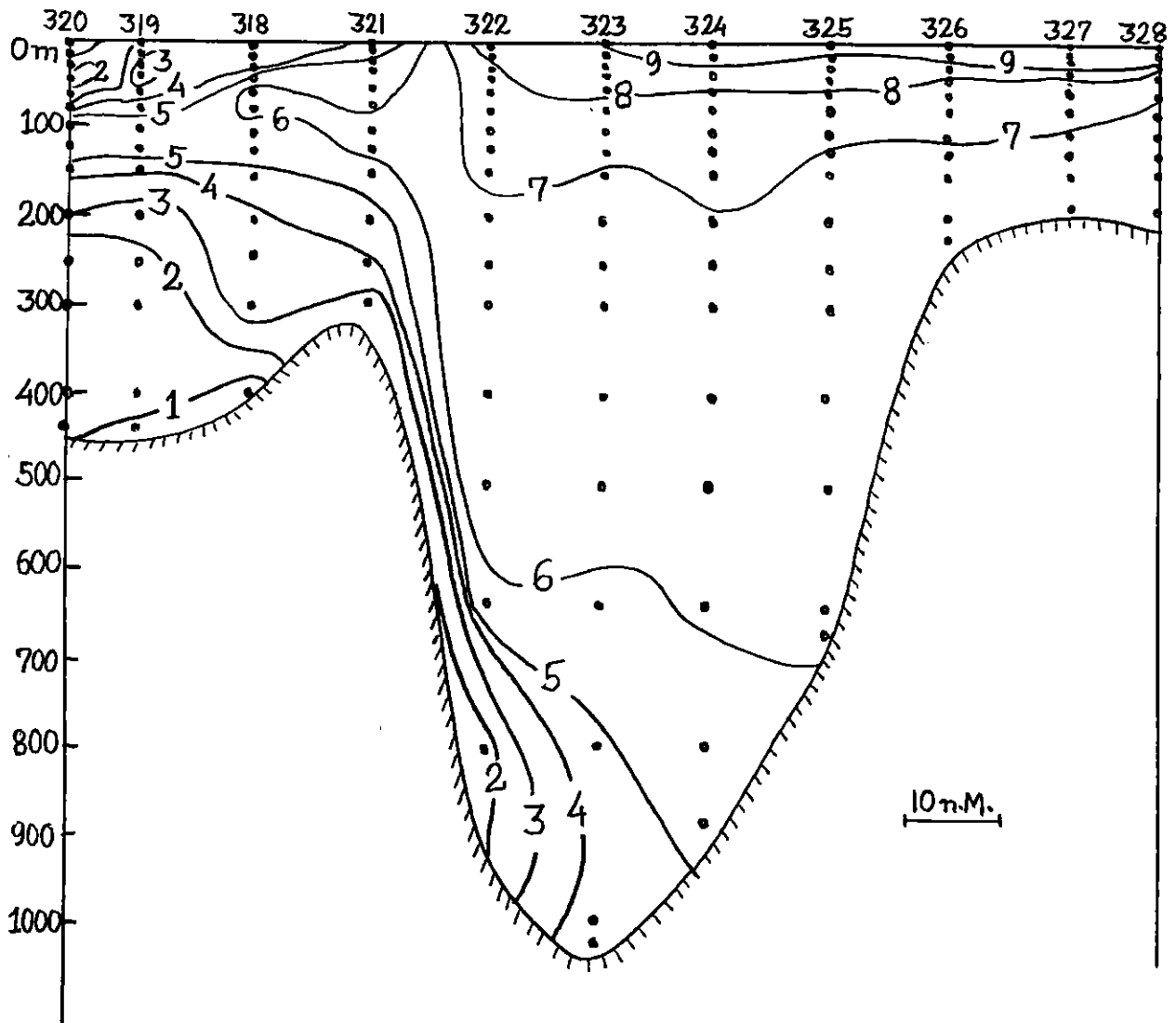


Figure 25. "G.O.Sars", East Greenland. July 1959. Temperature section across the southern part of Denmark Strait.



Figure 26. "G.O.Sars", East Greenland, July-August 1959. Length distribution, total catch, bottom long line.

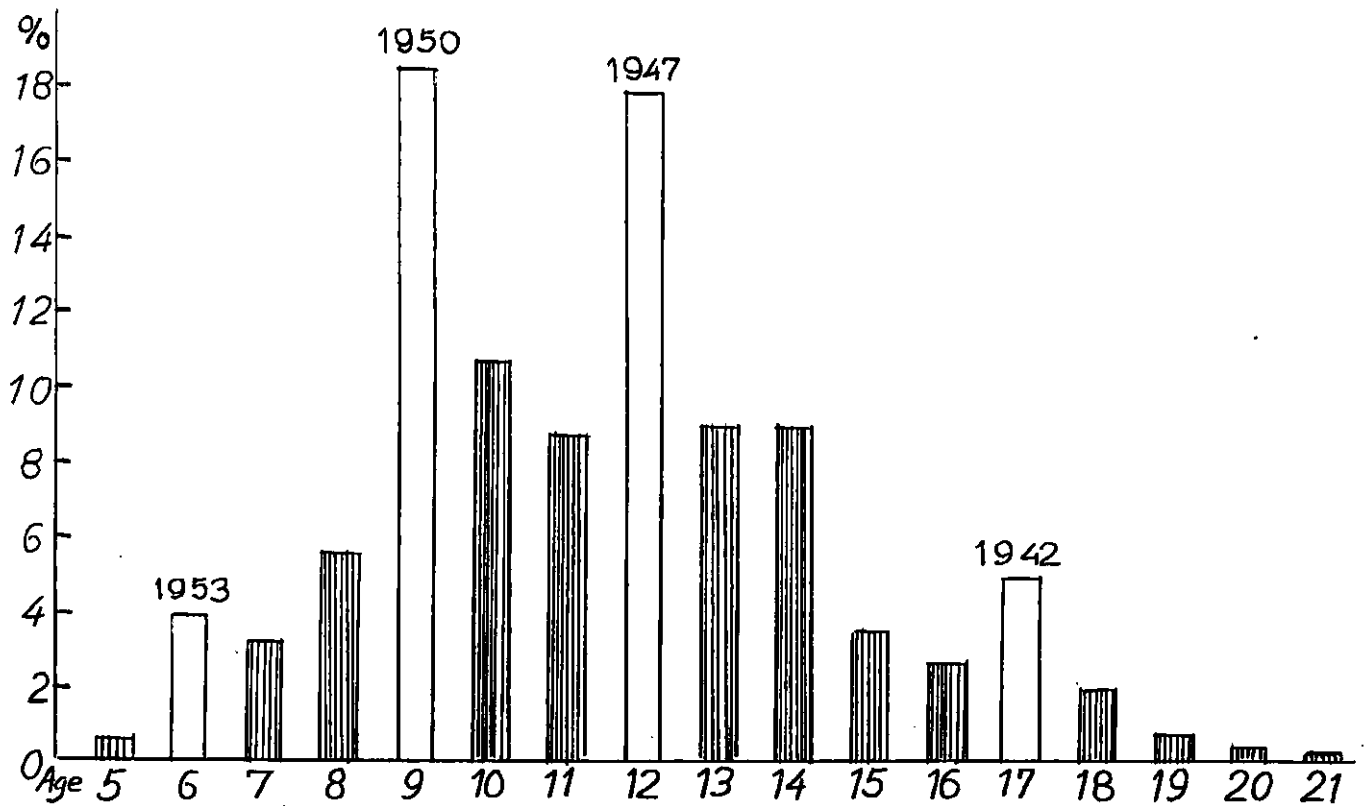


Figure 27. "G.O.Sars", East Greenland, July-August 1959. Cod. Age composition, total catch hand line and bottom long line.

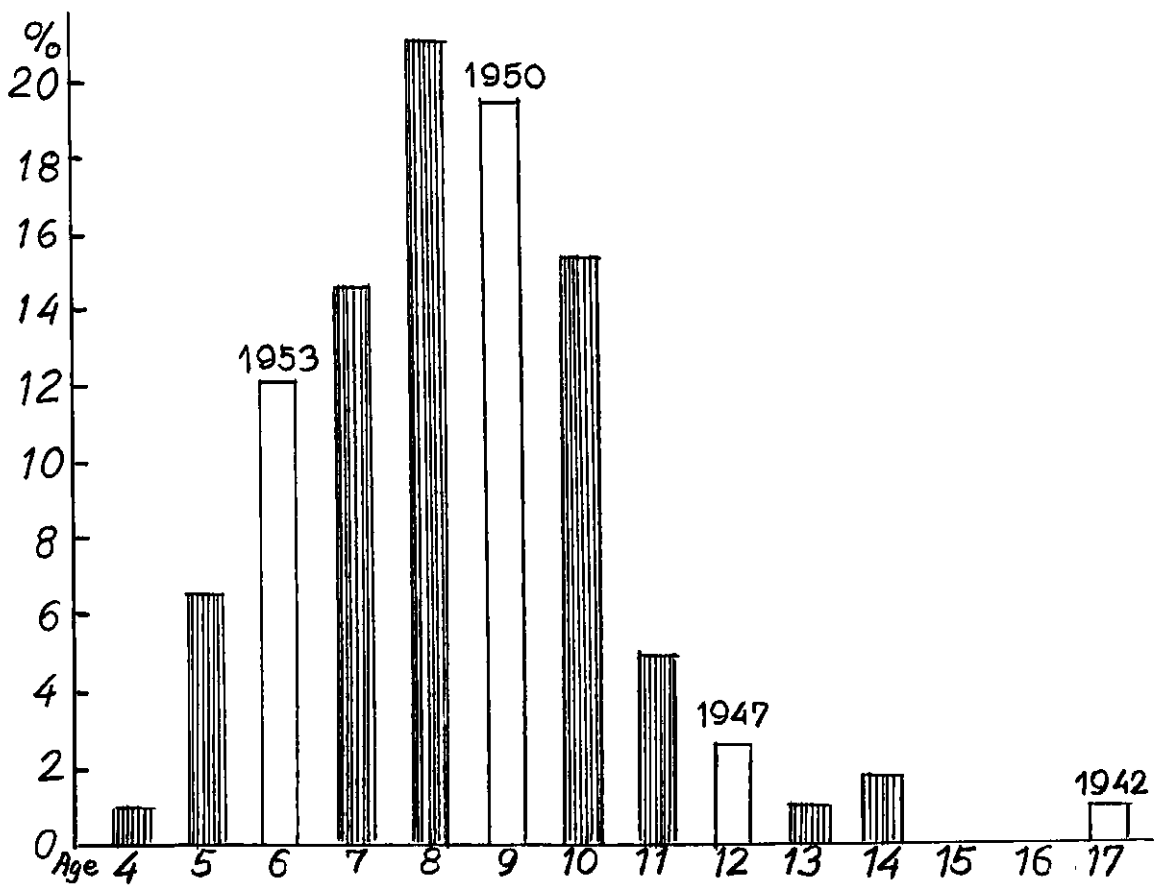


Figure 28. "G.O.Sars", East Greenland, August 1959. Cod. Age composition, trawl. Cape Dan Bank.