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DANISH RESEARCH REPORT

The Danish Research in Subarea 1 in 1953.

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Three Danish research ships operated in Subarea 1 in 1953. The research ship "Dana" worked in Davis Strait from 3 July to 11 August. The research cutter "Adolf Jensen" worked on offshore banks and in coastal waters and fjords from 29 May, while the research cutter "Immanuel" worked in coastal waters and fjords from June. The research cutters' work has been continued during the winter season.

1. Hydrography.

The hydrographic results are given by Mr. Frede Hermann in the second part of this report.

Compared with the season 1952, the season 1953 may be considered as a warm one. The polar current was only weakly developed and the temperatures on the fishing banks were higher than normal. On Fylla Bank, for instance, the temperatures in July were about 2° higher than at the same time in 1952.

2. Occurrence of cod eggs and larvae. (See Fig. 1)

It appeared from information given by Greenland fishermen, together with fishing for cod eggs and larvae with 1 and 2 m. stramin bags from the "Adolf Jensen" and the "Dana", that the cod spawned earlier than usual.

At the end of June practically no cod eggs and larvae were found in the Godthåbfjord, in the coastal area outside the fjord, or on Fylla Bank. At that time the cod fry had already been transported by the current out of the fjord and northwards.

The catches of cod larvae from the "Dana" hauls with the 2 m. stramin bag are given in Fig. 1, with the number of larvae taken in hauls by a 0-100 m. wire and by a 100-200 m. wire given above and below the line respectively.

It is seen that the largest numbers of larvae are taken between 65°N and 68°20'N, which is a rather northerly distribution.

In contrast with 1950 and 1952, no larvae were taken south of 64°N, which indicates that there has been no transport to Davis Strait of cod fry from spawning grounds situated east of Cape Farewell (e.g. Iceland).

The length of the cod larvae are between 9-31 mm., the mean length being 16.8 mm.

3. Composition of year-classes in catches of cod. (See Figs. 2 and 4 and tables 1 and 2).

a. Offshore banks.

In all, 2,573 cod otolith samples have been collected in offshore waters. Included in these samples are 2,187 collected by the "Dana" from catches taken with handlines in depths between 30-75 m. on the fishing banks.

The remaining 386 samples are taken with longlines by fishing experiments carried out in offshore waters by the "Adolf Jensen".

The results of the age analysis are given in Fig. 2 and in the tables 1 a and b. As would be expected, only three rich year-classes occurred in the catches in 1953.

It appears from Fig. 2 that the year-class 1947 has been the predominating year-class in all the samples with exception of one (No. VIII).

On the banks from about 68°10'N to 64°30'N, the year-class 1947 has been exceptionally strong, amounting to more than 60% in three and between 50 and 60% in two of the samples.

The year-class 1945, which has been of some importance in the catches in the previous years, has only been strong in the three southern samples. On Fiskenæs Bank (VIII) it was the strongest year-class in the catch. As in 1952, this year-class was most richly represented in the southern part of the region.

The year-class 1942 was only found to dominate in the sample taken off the southern side of Disko (see Fig. 4A), where it amounted to more than 35% of the catch. In the other samples it was of slight importance, with exception of the longline catch in the Holsteinsborg Deep (IV)(depth 120-200 m.) and on Fiskenæs Bank (VIII), where it amounted to 20.4, and 24% respectively.

Length measurements of cod from the banks.

In Fig. 3 are given length distributions in 5 cm. groups of cod taken on the offshore banks. The roman numerals correspond with those given on the map in Fig. 2. The last curve shows the measurements from all the samples. The peaks of the curves correspond well with the occurrence of the dominating year-classes. In Table 1 are given the mean lengths of cod belonging to the different year-classes in the samples from the offshore banks. It is evident that the mean lengths are very low. For the 1947 year-class the mean lengths are from 55.8 cm. to 59.6 cm. on the Store and Lille Hellefiske Banks, while it is a little more than 60 cm. on the southern banks. On the northern part of Store Hellefiske Bank these small cod were very lean and with small livers, which indicates a bad condition. In the catch from the northernmost station many specimens were badly infected in the gills by parasitic copepods. Probably a large number of cod belonging to the year-class 1947 have immigrated to the northern banks from the Disko Bay and the Umanak Fjord, where they have grown up in their first four years of life.

b. Coastal waters and fjords.

A total number of 5,482 samples of otoliths have been collected, partly by fishing experiments from the "Adolf Jensen", and partly from the Greenlanders' catches at the different fisheries stations along the Greenland coast from Cape Farewell to Umanak. The results of the age analyses of these samples are given in Fig. 4. Many of the analyses given on the map include samples taken at different times in the season from May to November (mostly July to September). The samples from each station, however, are very similar according to composition of year-classes, even when taken at different times during the season, so that there can be no objection to treating them together.

It can be seen that the year-class 1942 dominates in the samples from the northern part of Disko Bay and in the catches west and south of Disko (J,A), while the year-class 1947 is the dominant year-class in the coastal area from about 68°N to about 64°N (B, C, D, E, F). South of 63°N, the dominating year-class is the year-class 1945, which amounts to about 56% in the catches from Julianehåb district (I).

These results agree very well with the age analyses from the offshore banks (see Fig. 2). From Godthåbsfjord we have two different samples, one from May and June from the outer part of the fjord (M), and one from October - November from the inner part of the fjord (L). In the first sample the year-class 1947 dominates with 22.8%, the second best is the year-class 1945 (18.3%), while the year-class 1940 comes as the third biggest (12.0%).

The sample from the interior part of the fjord has the year-class 1940 as the richest one (32%), the year-class 1942 as the next best (26.2%), and the year-class 1938 as third (12.1%). In this sample the otoliths are of the special "fjord type" with many secondary rings, while the otoliths from other samples are rather similar to those found in the coastal area. It may be assumed that the sample from the interior part of the fjord consists of cod belonging to the special fjord population, while the sample from the outer part of the fjord mainly consists of cod from the coastal area.

The Ameralik Fjord is a fjord where cod from both the coastal region and from the banks spawn in the springtime and pursue the capelin just after the spawning. In 1953 a pound net fishery on cod was carried out by The Royal Greenland Board of Trade. The output of the fishery was unsuccessful, owing to the early spawning of the cod, together with the fact that the capelin spawned in other places of the fjord than in the warm interior part, where the pound net fishery was carried out. The fishery was stopped in the beginning of June, when most of the fishes caught in the nets were undersized cod belonging to the year-class 1947 (N).

In one of the small branches of Umanak Fjord, Sermerdlit, 70°34'N, 50°43'W (not shown on the map in Fig. 4), was found a large number of cod belonging to the year-class 1947. In a sample of 78 otoliths, 93.6% belonged to this year-class. The cod were taken by jigs and by net. The mean length of cod belonging to the year-class 1947 was only 54.9 cm., which is the lowest mean length for that year-class to be found in 1953. It

is the first time cod of medium age have been seen in Umanak district, where previously only very old cod and codlings of an age of one and two years were found since 1948. The cod belonging to the year-class 1947 were still immature in 1953. Spawning of cod has never been observed in this northern district. Owing to this fact, it may be expected that when cod belonging to the year-class 1947 reach maturity, which will probably happen in 1954 or 1955, a migration to spawning places in the southern part of Davis Strait will take place in these years.

4. Tagging experiments with cod.

A total of 1,539 cod were tagged on the offshore banks onboard the "Dana" in 1953. The number of cod tagged on the different stations are given in brackets on the map in Fig. 2. Ebonite tags were used in the experiments, with exception of 37 cod, which were tagged with yellow Nocathene tags. In coastal waters and in fjords a total of 941 cod were tagged onboard the "Adolf Jensen". On the map in Fig. 4 are given in brackets the numbers of cod tagged in the different localities. Besides the numbers given on the map, 151 cod were tagged in the interior part of Umanak Fjord (about 70°34'N).

A total of 50 of the cod tagged in 1953 were recaptured in the same year. Nearly all were recaptured near the place of the tagging. Only in three cases were recaptures taken in some distance from the tagging locality, namely, one recaptured on Store Hellefiske Bank, which was tagged on Lille Hellefiske Bank, and two tagged in Ameralik Fjord, recaptured later on Fylla Bank and on Store Hellefiske Bank respectively.

Among the recaptures taken near the tagging place, 23 were taken on Store Hellefiske Bank, one on Lille Hellefiske Bank (Banana Bank), and five on Fylla Bank, while 18 were taken in Ameralik Fjord.

Recaptures from tagging experiments in other years were distributed as follows:

Year of tagging	Recaptured in 1953	
	Greenland	Iceland
1948	4	-
1949	11	6
1950	10	-
1951	10	2
1952	111	7
Total	146	15

As in 1952 there were only few recaptures from Iceland compared with the number of recaptures from the Greenland area.

Of the cod recaptured at Iceland, 10 had been tagged in Julianehåb district, one on Lille Hellefiske Bank, one on Fylla Bank, one in Disko Bay, one in Frederikshåb, and one in Ameralik Fjord.

Otoliths were taken from eleven of the cod recaptured in Icelandic waters. These eleven cod belong to the following year-classes:

Year-class	Year of tagging			
	1949	1951	1952	Total
1942	3	1	1	5
1943	1	-	-	1
1945	-	1	4	5
	4	2	5	11

It is seen that nearly all the cod recaptured at Iceland belong to the rich year-classes 1942 and 1945.

In the report from 1952 it was mentioned that small cod tagged with Lea tags in 1949 in the northern part of the area, Umanak Fjord and Disko Bay, were recaptured in more southerly localities in 1951 (two recaptures) and in 1952 (one recapture). In 1953 two cod more from these experiments were recaptured a long distance south of the tagging locality. One tagged in Umanak harbour 70°40'N, 52°00'W on 6 August 1949 was recaptured on Fylla Bank 64°09'N, 52°57'W 11 August 1953. It was 24 cm. when tagged and must have belonged to the year-class 1947. The reported length at recapture was not reliable. The distance of migration was about 460 miles. The other cod was tagged off Christianshåb, 68°50'N, 51°10'W, on 26 August 1949. The length when tagged was 24 cm. and the cod must have belonged to the year-class 1947. The cod was recaptured on Store Hellefiske Bank 67°41'N, 55°00'W, 18 July 1953, 120 miles south of the tagging locality. The length of the cod at the time of recapture was reported to be 46 cm. These two cod were recaptured by Portuguese fishermen. As mentioned in the report from 1952, these recaptures in southern localities were from tagging experiments in 1949 with small cod in the northern localities, where enourmous quantities of small cod of the year-class 1947 occurred in that year, and indicate that intensive southward migrations have taken place in the last years. Besides showing this phenomenon, these successful experiments prove that Lea tags are very useful tags for tagging of cod belonging to the youngest year-classes.

In 1952 a tagging experiment was carried out with 368 cod, which mainly belonged to the year-class 1947. The cod were taken in pound nets in Amerdlok Fjord and transported to Holsteinsborg harbour, where they were tagged and released. Up to the present 20 recaptures have been reported. They have been distributed as follows:

Year of recapture	Recaptured		
	Banks	Fjords	Total
1952	7	4	11
1953	5	4	9
	12	8	20

It is seen that twelve of the recaptures have been from the offshore banks, eleven from Store Hellefiske Bank and one from Fylla Bank.

It appears from the experiment that the stock of small cod, growing up in the fjord and coastal area, seems to have contributed to the dense aggregation of cod of the 1947 year-class on the adjacent bank.

From the age analyses it appears that the year-class 1947 has been especially rich in the coastal area from about 69°N to about 64°N, and therefore it may be assumed that the year-class 1947, which now is the dominating year-class on the Store Hellefiske Bank, Lille Hellefiske Bank and Fylla Bank must have got an important recruitment from the adjacent coastal areas; furthermore it may be expected that the amount of the year-class 1947 on the banks will be augmented in number in the nearest following years by migration from the coastal waters and the fjords.

Hydrographic Conditions in the Eastern Part of Labrador Sea and Davis Strait, 1953.

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During July 1953 the hydrographic stations shown in Fig. 5 were worked by the Danish R/V "Dana".

The distribution of the temperature in 50 metres given in Fig. 5 shows that the arctic component of the West Greenland Current was very weak and its water masses were off Southwest Greenland restricted to a narrow strip over the banks.

The warm Irminger Current was well developed, its core was found off the slope of the banks with temperatures above 6° north to the Frederikshåb section and above 4° north to the Fylla Bank section.

From Southwest Greenland a tongue of the warm water is stretching southwestwards towards 56°W. Long., where it meets the cold water masses of the Labrador Current.

North of the Fylla Bank, section II, the Irminger Current is mainly found as an undercurrent. Relative warm conditions are prevailing also over the northern banks.

Phosphate determinations were carried out in the upper 100 metres. Fig. 6 shows the distribution of phosphate in 20 metres. It is seen that many of the general features from the distribution of temperature are repeated in the distribution of the phosphate.

Thus the highest concentrations of phosphate are found off the slope, i.e. at the same locality as the core of the warm current. The most probable reason for this phenomenon seems to be that the turbulence in the strong current causes vertical mixing, which carries phosphate-rich deep water to the upper layers. From here the warm and phosphate-rich water spreads out in a tongue towards southwest.

North to Fylla Bank good conditions should thus prevail for the plankton production off the western side of the banks. In the northern part of the area only small concentrations of phosphate are encountered except on the westernmost station of section IV, which is lying at the boundary of the Canadian Polar Current.

The conditions are further illustrated by the vertical sections I to VI, (Figs. 7-12), the location of which is shown on Fig. 5. In all the sections the temperatures are above normal and considerably higher than those found in 1952. Over the shallow part of Fylla Bank the temperatures were thus 1.5° to 2° higher and west of the bank in the upper 100 metres even 2° to 3° higher than the temperatures found in July 1952.

- THE END -

Table 1a.

Year-class	Age	Store Hellefiske Bank 68°01'N 55°04'W and 67°54'N 55°20'W 29 and 30 July		Store Hellefiske Bank 67°29'N 54°42'W and 67°22'N 54°16'W 30 and 31 July		Store Hellefiske Bank 66°51'N 54°38'W and 66°51'N 54°20'W 1 August		Holsteinsborg Deep 66°30'N 53°55'W 19 July	
		%	cm.	%	cm.	%	cm.	%	cm.
1950	III	-	(37.1)	-	-	-	(35.7)	-	-
1949	IV	0.6	(43.8)	0.4	(41.5)	-	-	0.7	(45.0)
1948	V	8.3	50.9	9.2	52.8	10.3	51.5	2.1	(50.0)
1947	VI	75.1	57.5	67.2	59.3	69.4	59.6	37.6	55.8
1946	VII	6.2	64.2	3.7	69.2	5.5	64.7	7.1	64.8
1945	VIII	3.5	71.0	9.6	74.7	10.6	69.9	5.0	68.5
1944	IX	1.0	73.2	1.4	78.3	0.9	(73.5)	6.4	71.1
1943	X	1.2	72.5	2.1	80.2	0.6	(75.0)	4.3	76.2
1942	XI	2.5	77.7	5.1	83.0	2.1	86.5	20.6	77.4
1941	XII	-	-	1.0	88.7	0.3	(90.0)	2.8	(81.0)
1940	XIII	0.2	(81.0)	-	-	0.3	(90.0)	2.8	(72.5)
1939	XIV	-	-	0.4	(93.0)	-	-	5.0	82.2
1938	XV	-	-	-	-	-	-	0.7	(82.0)
1937	XVI	-	-	-	-	-	-	1.4	(78.5)
1936	XVII	1.2	87.0	-	-	-	-	0.7	(77.0)
1935	XVIII	-	-	-	-	-	-	-	-
1934	XIX	-	-	-	-	-	-	2.8	(100.2)
Number:		482		513		330		141	
Depth in m.:		40		32 - 29		33 - 38		120 - 200	
Temperature °C :		3.6		4.2 - 3.9		4.5		-	

Table 1b.

Year-class	Age	Lille Hellefiske Bank 65°02'N 53°24'W 4 and 5 August		Banana Bank 64°28'N 53°13'W 5 August		Fylla Bank 64°07'N 52°40'W 5 August		Fiskenæs Bank 63°29'N 52°03'W 11 August		Dana Bank 62°45'N 51°11'W 11 August	
		%	cm.	%	cm.	%	cm.	%	cm.	%	cm.
1950	III	-	-	-	-	-	(37.0)	-	-	-	-
1949	IV	0.7	(46.0)	-	-	0.6	(47.0	0.6	(50.0)	2.5	(47.0)
1948	V	3.6	49.3	7.5	52.9	4.3	53.6	1.7	(52.0)	1.3	(51.0)
1947	VI	58.4	58.9	62.7	60.0	51.7	61.4	16.8	61.7	35.4	60.5
1946	VII	5.1	63.2	3.0	(66.5)	5.8	66.4	3.4	66.7	8.9	64.5
1945	VIII	16.1	72.4	9.7	71.7	29.8	72.8	38.5	72.3	31.6	69.8
1944	IX	1.5	(77.5)	2.2	(76.5)	1.2	(74.9)	2.8	80.0	3.8	(70.7)
1943	X	1.5	(74.5)	1.5	(77.5)	0.6	(76.0)	5.0	73.7	5.1	(69.5)
1942	XI	8.8	77.4	6.7	82.6	4.6	76.9	24.0	77.5	8.9	76.0
1941	XII	-	-	1.5	(78.5)	-	-	2.2	(79.9)	1.3	(83.0)
1940	XIII	-	-	0.7	(87.0)	0.3	(77.0)	1.1	(84.5)	-	-
1939	XIV	1.5	(87.0)	-	-	-	-	-	-	-	-
1938	XV	-	-	-	-	0.3	(79.0)	1.1	(83.5)	-	-
1937	XVI	-	-	-	-	-	-	0.6	(92.0)	-	-
1936	XVII	2.9	(87.5)	3.0	(87.5)	0.6	(85.0)	1.7	(85.7)	-	-
1935	XVIII	-	-	-	-	-	-	-	-	-	-
1934	XIX	-	-	1.5	(83.0)	-	-	-	-	1.3	(99.0)
1933	XX	-	-	-	-	-	-	0.6	(99.0)	-	-
Number:		137		134		325		179		79	
Depth in m.:		52		48		40		53		58	
Temperature °C :		2.6		3.0		3.9		2.4		1.8	

Table 2

Year-class	Age	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1949	IV	-	-	5.1	-	0.3	0.2	4.8	0.5	3.7	-	0.2	-	11.6	2.9
1948	V	-	5.4	1.4	1.6	17.8	12.6	5.7	0.5	0.5	-	2.3	-	8.3	1.3
1947	VI	2.3	68.4	33.1	45.9	69.7	40.0	29.4	14.2	19.9	-	42.1	2.9	22.8	28.4
1946	VII	-	2.8	3.1	9.0	2.0	2.9	3.6	1.0	1.0	-	4.2	0.5	2.1	3.3
1945	VIII	10.7	6.8	17.0	13.1	7.4	9.1	36.3	27.4	56.2	7.1	18.3	5.8	18.3	23.9
1944	XI	2.7	2.6	3.1	-	-	1.9	1.7	3.0	2.6	3.0	3.4	1.9	2.1	1.0
1943	X	7.3	3.2	1.7	5.7	-	2.4	1.7	4.6	1.5	7.6	4.7	2.4	2.5	0.7
1942	XI	36.6	7.8	21.5	13.9	1.7	17.7	12.2	17.8	9.7	33.5	17.5	26.2	10.8	13.4
1941	XII	3.1	1.0	0.3	2.5	-	2.5	0.7	1.0	-	5.6	1.1	2.4	0.4	-
1940	XIII	13.0	0.5	6.1	7.4	0.6	5.2	1.4	11.7	0.8	12.7	1.4	32.0	12.0	16.7
1939	XIV	1.5	0.4	0.7	-	-	0.3	0.5	2.0	0.5	4.6	0.9	4.4	3.3	1.3
1938	XV	1.5	-	-	-	-	0.8	1.0	4.1	1.8	0.5	-	12.1	3.7	3.9
1937	XVI	-	-	-	-	-	-	-	1.5	0.3	1.5	0.3	0.5	0.4	1.0
1936	XVII	10.7	0.7	5.5	0.8	0.3	3.5	1.0	9.6	1.3	9.6	2.2	6.3	1.2	2.0
1935	XVIII	0.4	-	-	-	-	-	-	-	-	4.1	-	0.5	-	-
1934	XIX	9.5	0.2	1.4	-	-	0.8	0.2	1.0	-	9.1	0.8	1.9	-	0.3
1933	XX	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1932	XXI	0.4	-	-	-	-	-	-	-	-	0.5	-	-	0.4	-
1931	XXII	0.4	-	-	-	-	-	-	-	-	0.5	-	-	-	-
Number:		262	1072	293	122	297	593	419	197	381	197	639	206	241	306

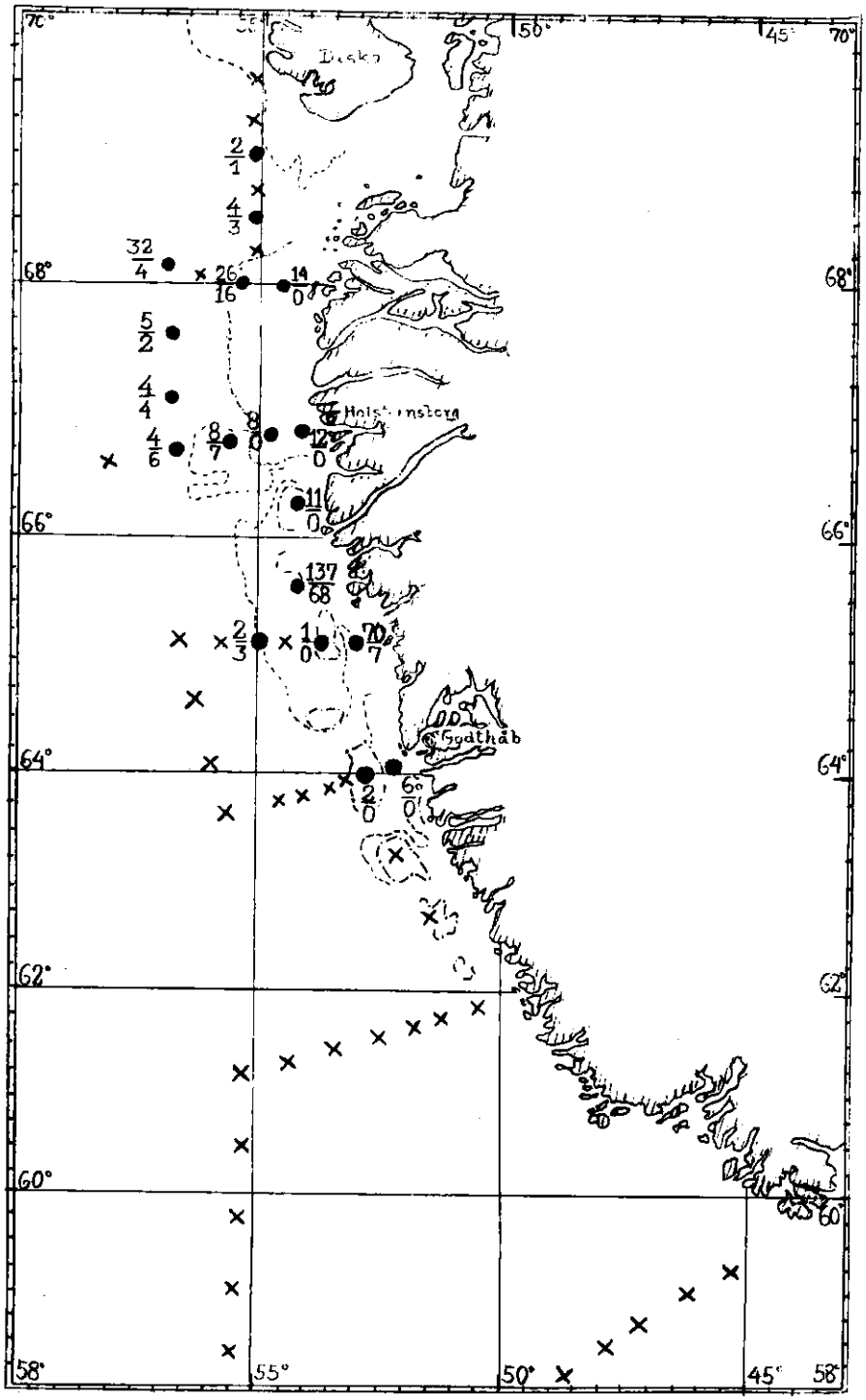

Figure 1. Catches of cod larvae per 30 minutes from the "Dana" with 2 m. stramin bag. Numbers in hauls with a 0-100 m. wire and with a 100-200 m. wire are shown respectively above and below the line.

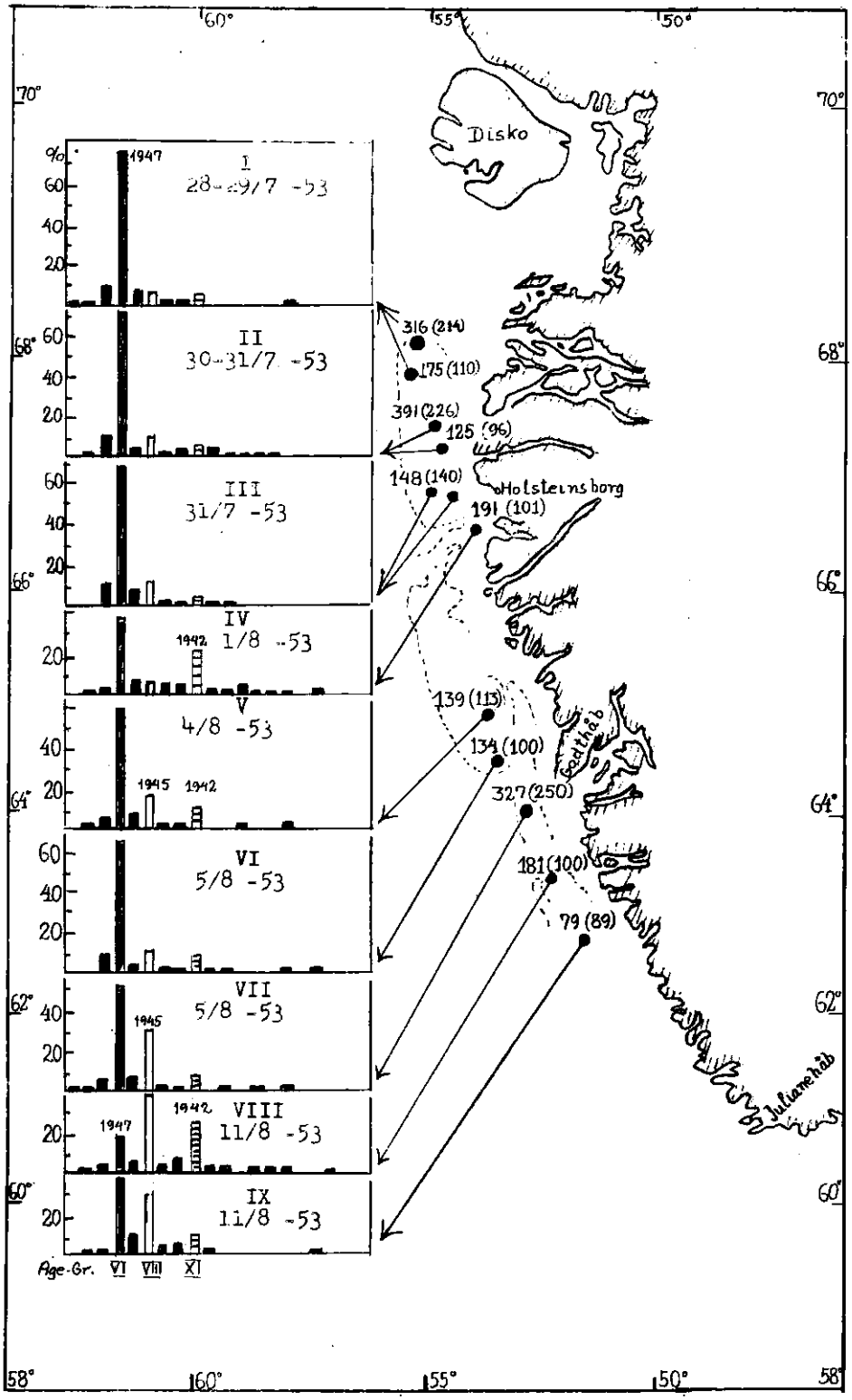

Figure 2. Age analyses of Cod caught on the Greenland Banks in July-August 1953. Numbers in brackets denote number of cod tagged.

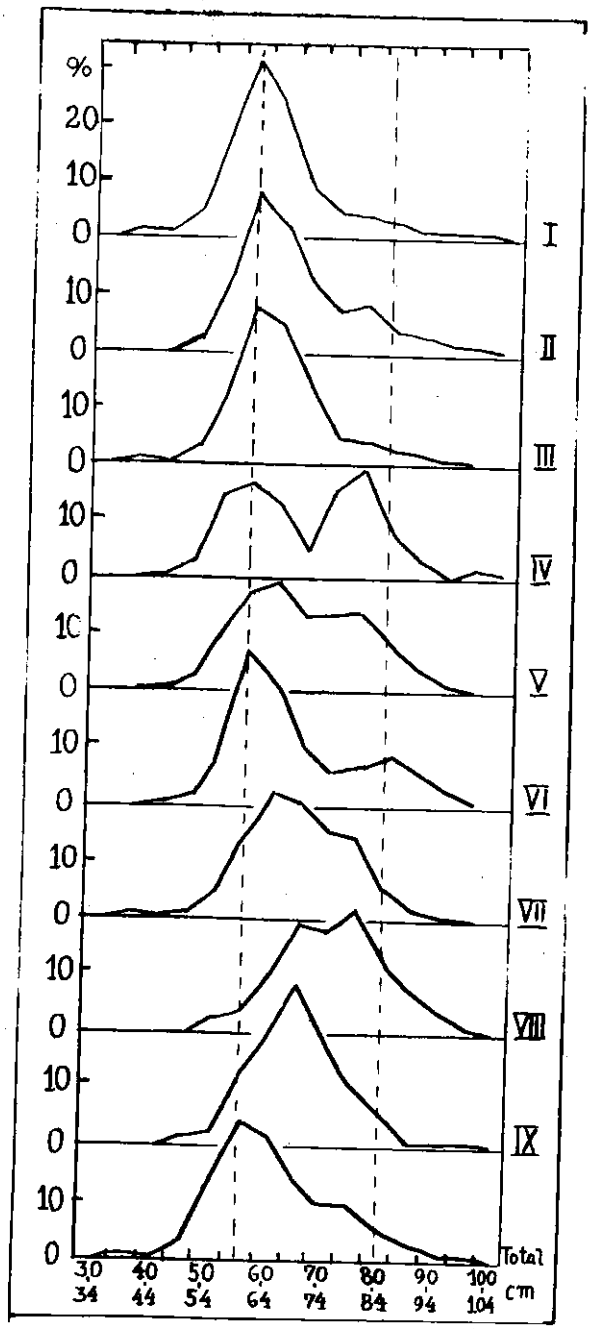

Figure 3. Length composition by 5 cm. groups of cod caught on the offshore banks in 1953. The Roman numbers correspond to those given on the map, Fig. 2. The curve at the bottom of the figure gives the total of the samples I-IX.

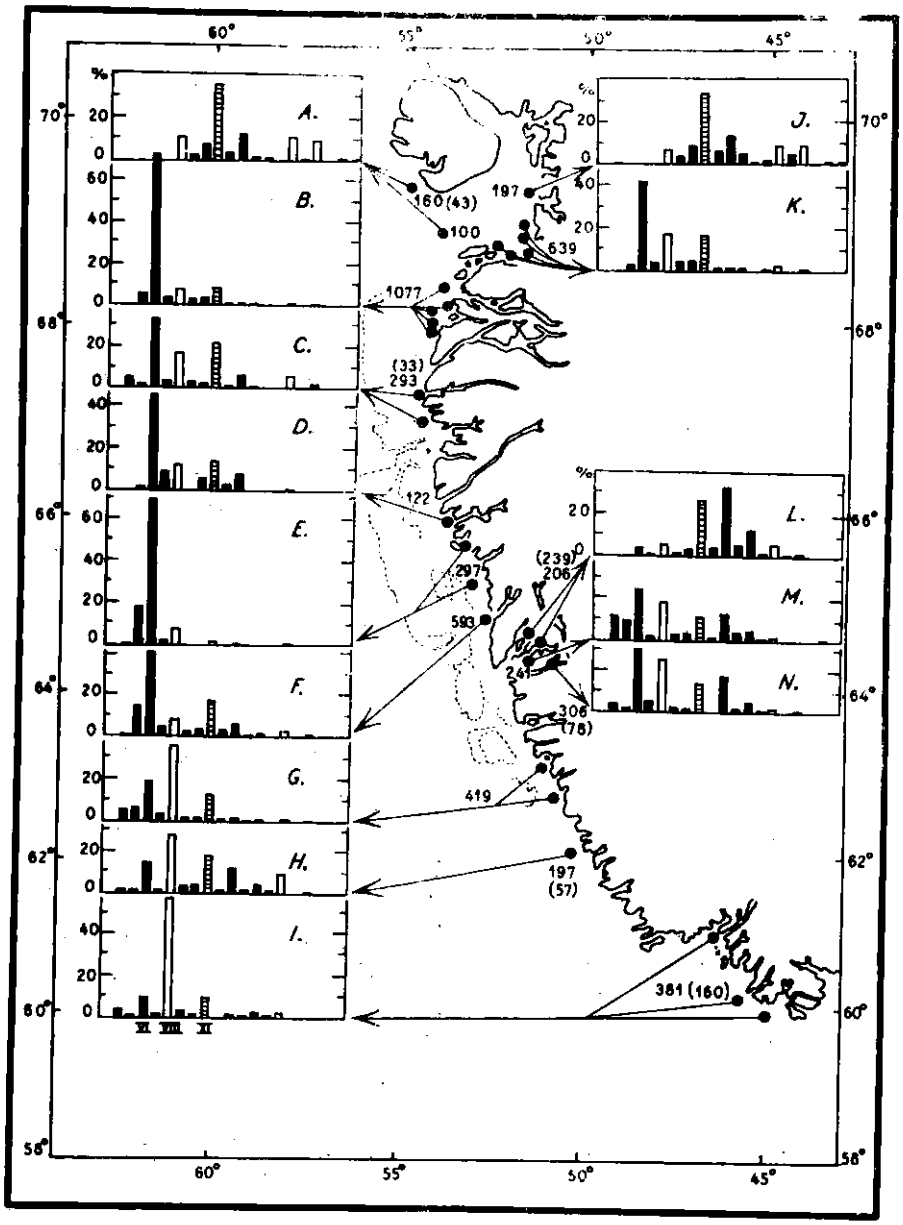

Figure 4. Age analyses of cod caught in the coastal waters and fjords of West Greenland in 1953. Numbers in brackets denote number of cod tagged.

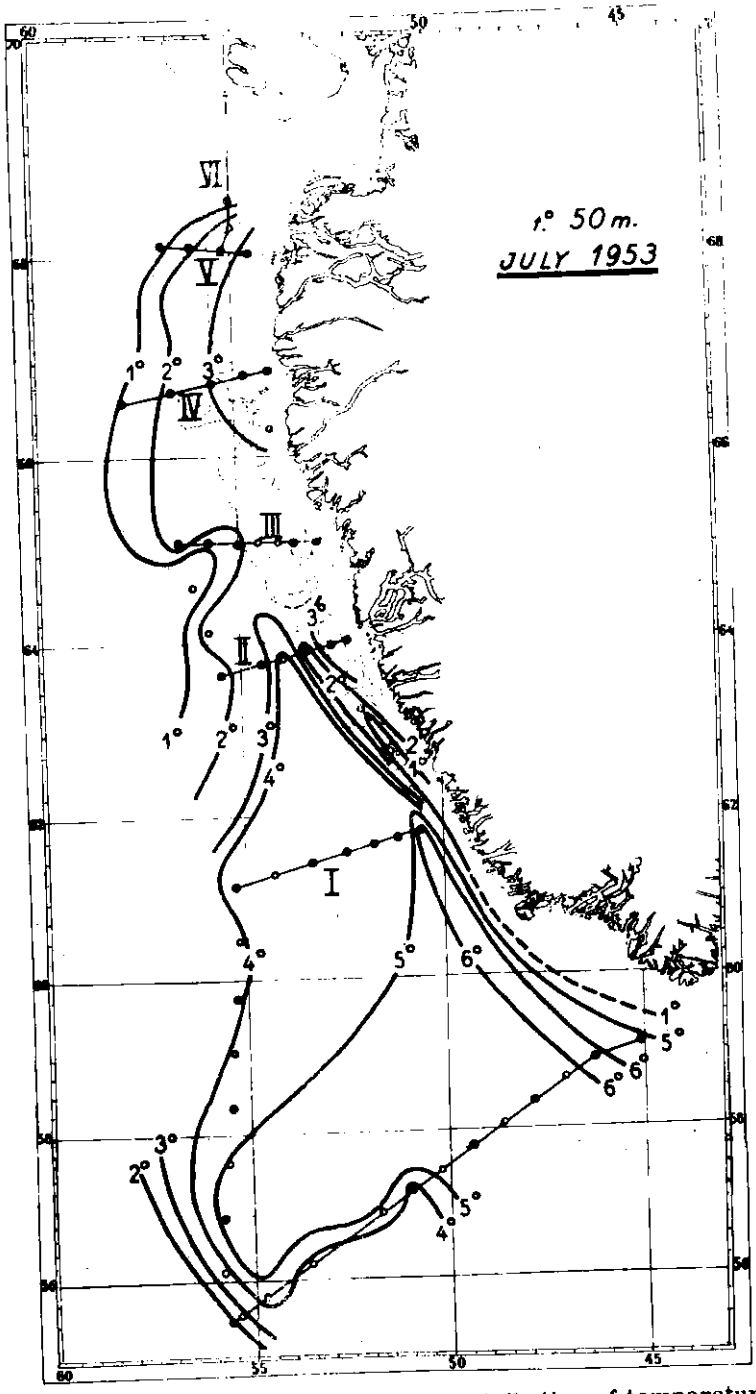

Figure 5. Location of sections and distribution of temperature in 50 metres. Open circles indicate bathythermograph stations. Full circles indicate regular hydrographic stations.

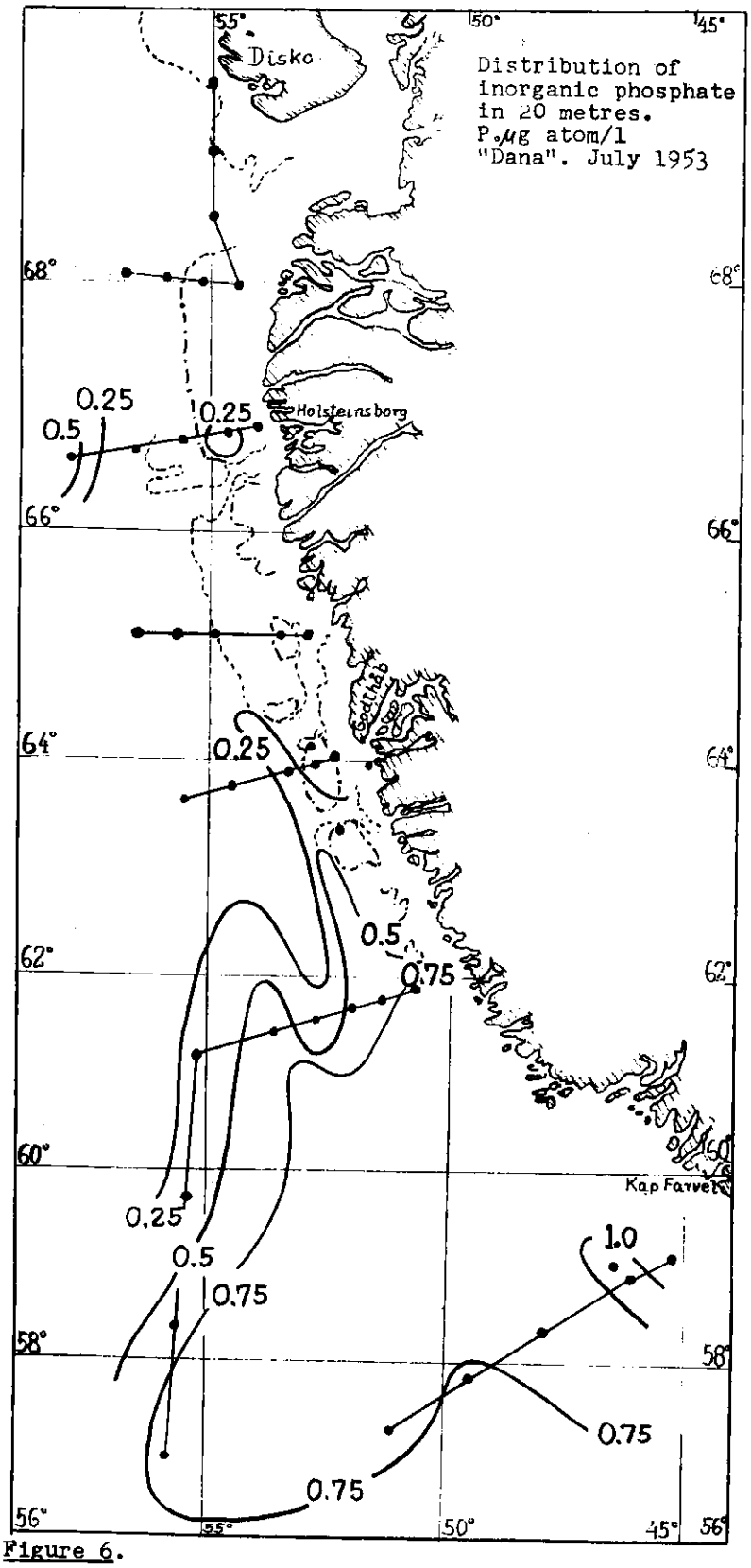
Distribution of
inorganic phosphate
in 20 metres.
P.µg atom/l
"Dana". July 1953
Disko
Holsteinsborg
Kap Farvel
55°
50°
45°
68°
66°
64°
62°
60°
58°
56°
0.25
0.5
0.75
1.0

Figure 6.

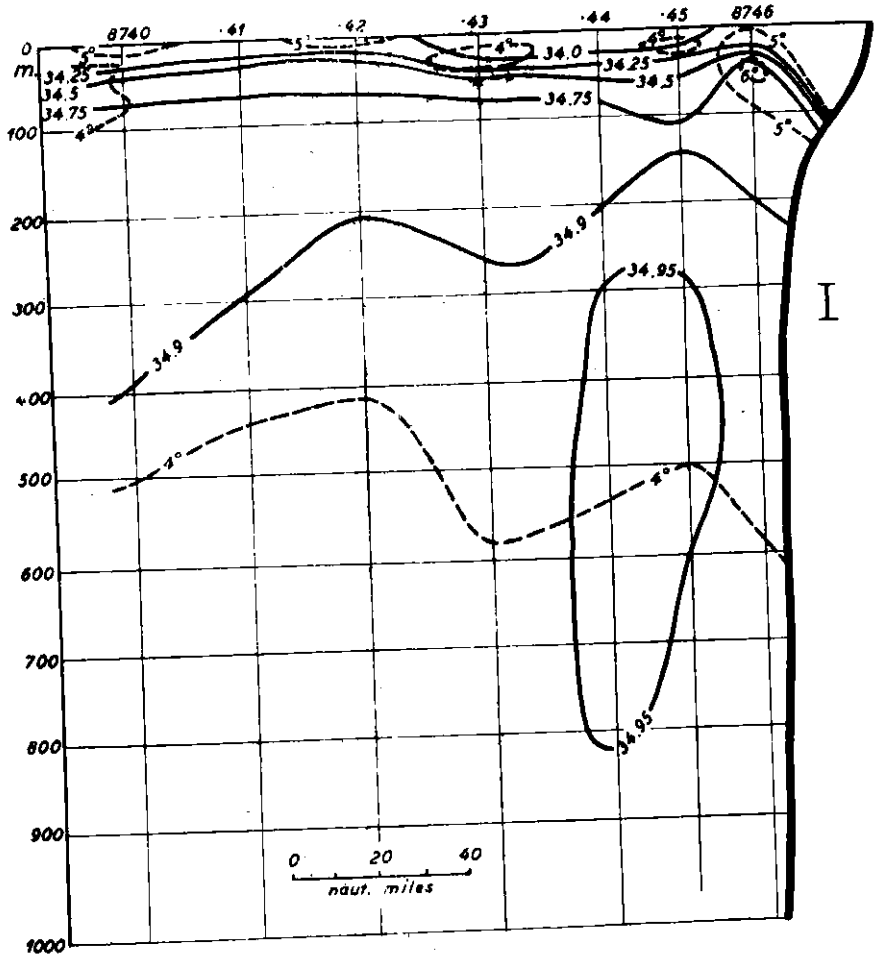

Figure 7. Section I off Frederikshåb. 6/7-8/7 1953.

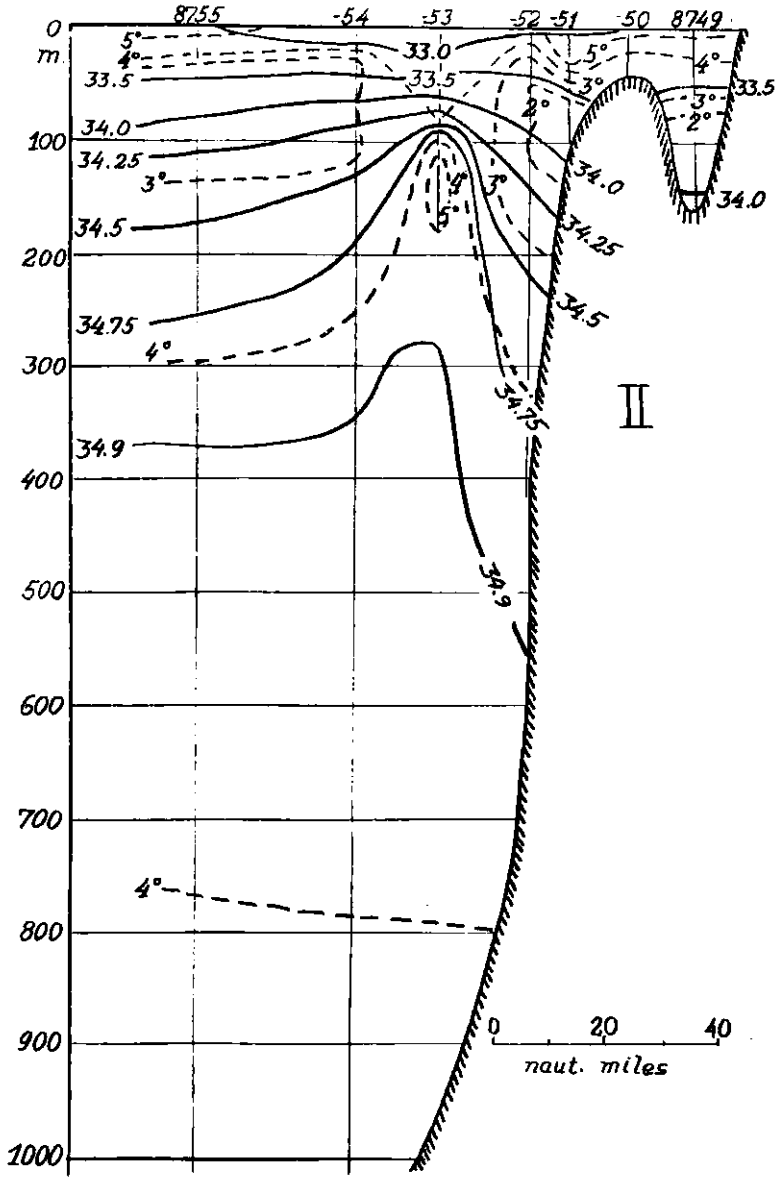

Figure 8. Section II across Fylla Bank, 15-16 July, 1953.

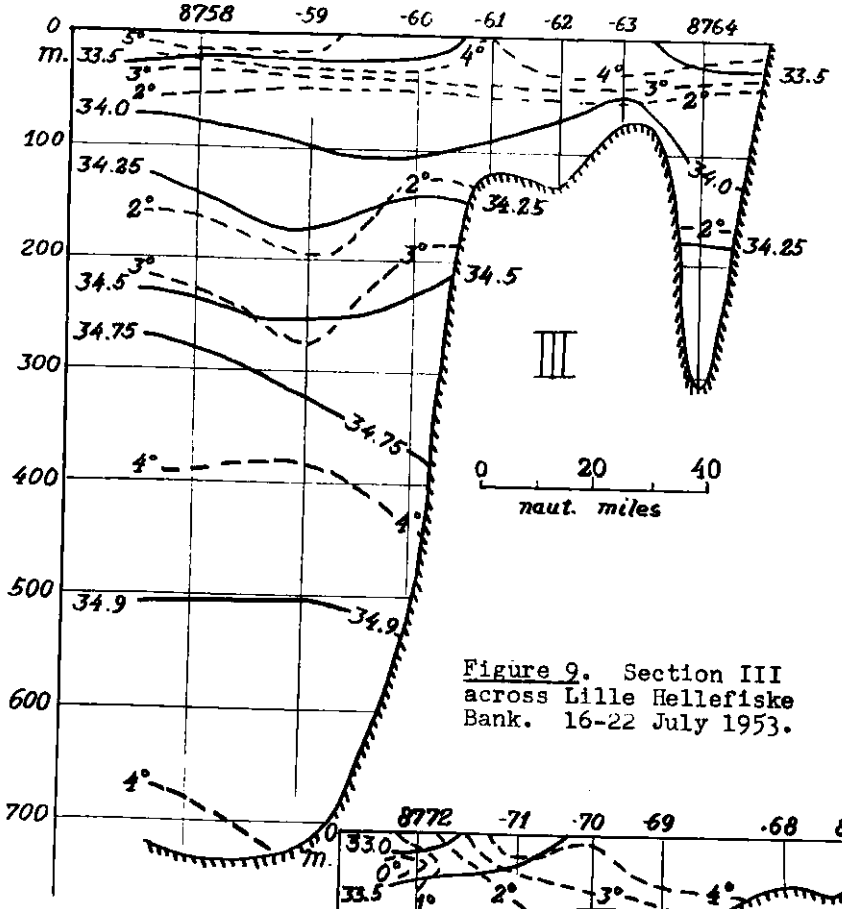

Figure 9. Section III across Lille Hellefiske Bank. 16-22 July 1953.

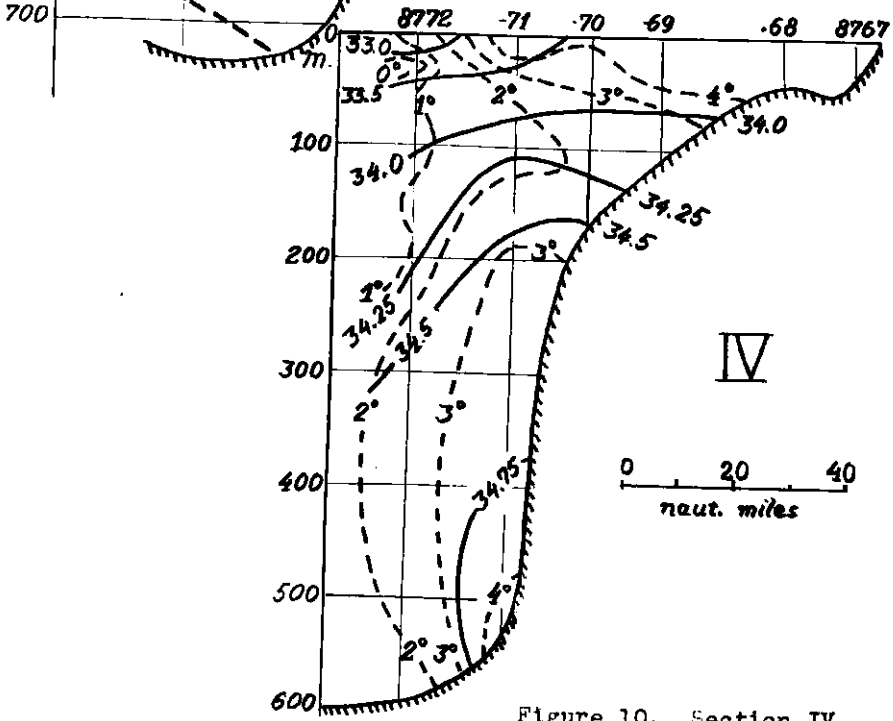

Figure 10. Section IV off Holsteinsborg. 23 July 1953.

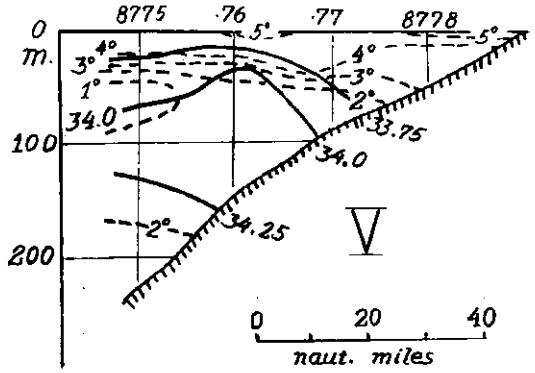

Figure 11. Section V across northern part of Store Hellefiske Bank. 24 July 1953.

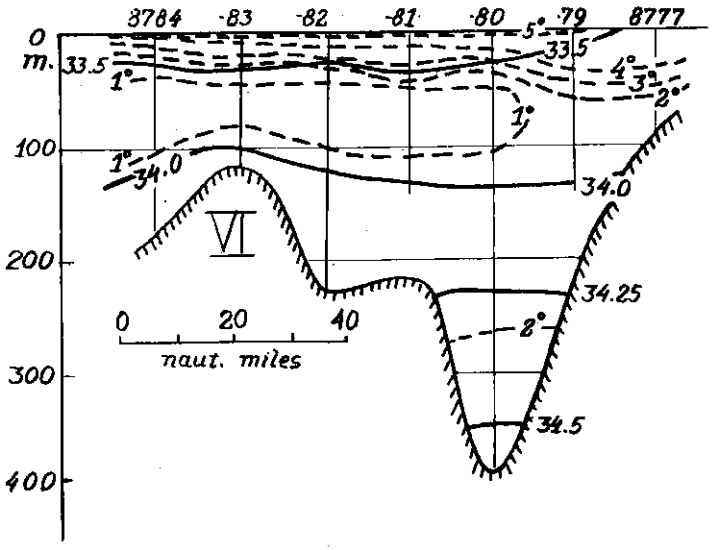

Figure 12. Section VI. Store Hellefiske Bank to Disko. 24-25 July 1953.