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I. Cod in Coastal Waters and on the Offshore Banks of West Greenland 1956

by Paul M. Hansen

1. Occurrence of Cod Eggs

The number of cod eggs caught by "Adolf Jensen" from February to June with the 1m. stramin net are given in Table 1. The positions of the stations are shown in Figure 1. Six stations are situated in the interior part of the Godthaab Fjord, one in the entrance of the fjord and one in the inshore waters south of the fjord.

Table 1

Station	1	2	3	4	5	6	7	8
February 1-15								
February 15-28				30			0	
March 1-15				1600				0
March 15-31								
April 1-15	30	352	60	45000		65	0	
April 15-30								
May 1-15		280	260	40000	17000	10000	15	0
May 15-31	180			8000				
June 1-15							29	10
June 15-30								

From previous investigations it is known that there is a spawning place for cod at Station 4. This explains why the largest numbers of cod eggs have been taken on this station. It appears from the numbers of cod eggs caught in the different months on this station that only a poor spawning takes place in February. In April and in the first half of May the strongest spawning takes place. On the Stations 5 and 6 some spawning occurs in May but much less than on Station 4 and still less spawning seems to take place on the Stations 1, 2 and 3.

On the station in the entrance of the Godthaab Fjord, Station 7, no eggs were found before the end of April and then only in small numbers. Also on May 16 and June 7 small numbers of eggs were caught on this station. Probably these eggs had been transported out of the fjord by the surface current. On Station 8 no eggs were caught in April and only 10 were taken in the end of May.

The numbers of cod eggs caught in the Godthaab Fjord were very poor compared with the numbers caught in this fjord in previous years.

On the middle of Fylla Bank 4 cod eggs were caught April 23. On May 7, 5 cod eggs were caught in a haul between the bank and the coast. Three hauls with the 1m. stramin net, on June 5, one between the bank and the coast, one on the middle, another on the western edge of the bank gave respectively 0, 1 and 35 cod eggs. The comparatively large number of eggs caught over the western edge of the bank is not surprising as there is a spawning place for cod on the western slope of the bank.

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2. Occurrence of Cod Fry

The numbers of larval cod caught by "Dana" in July with the 2m. stramin net are given in Figure 2. The numbers are the smallest in all the six years hauls with the 2m. stramin net have been taken.

The largest number of cod larvae taken in half an hour's haul was twenty on a station west of Fylla Bank on 63°25'N 57°20'W. In all the other catches the numbers were below five and on many stations no larvae were caught.

The catch of 20 larvae on the station farthest towards west indicates a drift by a westgoing current of cod fry towards the Labrador Area from the spawning grounds on the western slope of the Greenland Banks. It is worth mentioning that also in 1955 cod larvae were caught in the same westerly position as in 1956.

The poor occurrence of cod eggs as well as larvae suggests that the 1956 year-class will be very poor.

3. Occurrence of Small Cod of Age-Groups I, II and III.

Small cod were taken in rather small numbers in hauls with the fine-mesh seine as well as with the shrimp trawl. The details of the catches are given in Table 2 and the length frequencies are given in Figure 3.

Table 2.

Sample	Position	Date 1956	Gear	Number of Fish
a	66°55'N, 53°40'W	16/7	Seine	787
b	64°21'N, 50°22'W	10/6	"	276
c	63°17'N, 51°05'W	28/8	"	456 (ages deter-
d	63°53'N, 51°28'W	10/2	Shrimp Trawl	59 " mined)
e	" "	10/3	" "	65 "

The II- and III-group appear as peaks of the length distribution curves from the catches c, d and e.

According to experience during many years small cod belonging to the III-group are much more difficult to catch with seine than cod belonging to the I- and II-group. This in connection with direct observations on occurrence of large shoals of small cod of sizes corresponding to the III-group in several inshore localities suggests that the 1953 year-class is the most important of the young year-classes of cod.

The average lengths of small cod belonging to the age-groups II and III were the following:

Station	Date	II	III
d	10 February	18.0 cm.	27.5 cm.
e	10 March	18.6 "	28.6 "

4. Commercial Fish. The Age Composition

a. Offshore Banks.

Age determinations were made on 1700 otoliths of cod from the banks, of which 551 (Nos. 3, 4 and 8 in Table 3, attached) were collected by the "Dana" from catches made by jig and 1149 collected by the "Adolf Jensen" mainly from long-line catches.

The age analyses of fish caught on the offshore banks are given in Table 3, together with the average lengths of males and females. Figure 4 shows the age compositions of eight catches from the banks (left-hand column). The 1947 year-class predominates in all the samples as in

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1955. It amounted to between 40 and 60% of the catches. In sample No.5, however, it only made up 32.3% of the catch.

Year-classes older than that of 1947, for instance the formerly rich 1942 and 1945 year-classes, were only very sparsely represented in the catches on the banks. In most of the samples the 1942 year-class was less than 5%. Only in sample No.7 does it amount to a little more than 20%. Among the year-classes younger than year-class 1947 only the 1950 year-class was of some importance. It did not, however, reach more than 30% in any of the samples.

The length distribution of cod in the samples (Figure 4, right-hand column), is very similar in the different samples. Most graphs having a maximum between 70 and 75 cm., corresponding to a mean weight of 3.5 to 4 kg.

#### b. Inshore Waters and Fjords.

Table 4, attached, gives the results of 4021 age determinations made with otoliths from samples from the inshore waters and the fjords. The samples came from Subdivisions 1A to 1F (Figure 5). Unfortunately no samples were collected in the important Subdivision 1C. Most of the samples were from catches made with cod hooks on long-lines. Nos.12 and 16 came from pound-net catches, Nos.14, 29 and 30 from trawl catches and Nos.13 and 31 came from catches with jig.

In the sample from Subdivision 1A (No.9) 1942 (Gr.-XIV) was the predominant year-class, with 42%. No samples are collected in the northern part of Subdivision 1B. From the southern part there are two samples (Nos.10 and 11) that differ very much in regard to age composition. No.10 was taken from a Greenlandic catch with long-lines from rather shallow water, No.11 with long-lines by "Adolf Jensen" in 100 to 200m. depth south of Holsteinsborg. In sample No.10 only the two year-classes 1950 and 1947 were of importance with respectively 35 and 24%. The sample No. 11 included mostly older year-classes with the 1942 year-class predominant with 25.9% and 1936, 1940 and 1947 amounting to 12% each.

The six samples Nos.12, 13, 14, 15, 16 and 17 from Subdivision 1D are collected in the Godthaab Fjord from catches with different gears as mentioned above. Very distinct differences in the composition of year-classes occur in catches taken with different gears. The small, young cod were taken by pound-nets (Nos.12 and 16); the 1950 year-class and younger year-classes amounted to 50 to 70% in these catches. Sample No.13, taken by jig from the ice at the spawning place for cod at Kapisigdlit, contained mostly spawning cod of the old year-classes 1940, 1942, 1945 and 1947. These four year-classes amounted to about 72% of the sample. These cod belonged to the fjord type with very slow growth rate. The same fjord type was also found in sample No.17, in which the year-classes older than 1945 were fairly well represented (43.5%).

Sample No.15, in which the three year-classes 1940, 1942 and 1947 amounted to about 66%, was taken by long-line on 60 to 260m. depth near the entrance to the fjord. The cod in this sample were as to growth rate of a quite different type from the cod of samples 13 and 17. Their growth rate was more similar to that of the cod found on the offshore banks. It is therefore possible that the cod found in the outer part of the Godthaab Fjord originate from the Fylla Bank.

The samples Nos.18 and 19 from Subdivision 1E were from Greenlanders' catches, probably caught with long-lines. Sample No.18 contained merely young cod with the 1949 year-class predominating (27%). This year-class has only been of importance in samples in Subdivisions 1E and 1F. In sample No.19 the 1947 year-class predominated and the older year-classes 1945 and 1942 were better represented than in sample No.18.

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Not less than 13 samples, containing a total of 2324 specimens were collected in Subdivision 1F. The 1950 year-class predominated in 7 samples while the 1947 year-class predominated in 6 samples. The 1945 year-class was not as well represented as in previous years. As in Subdivision 1E, the 1949 year-class seems to have been of some importance in some of the catches.

The growing importance of the 1947 year-class in the catches in Subarea 1 in 1956 suggests an immigration from the northern part of the subarea of the 1947 year-class. There is reason to fear that this very important year-class is going to emigrate gradually in the coming years to other areas as for example East Greenland and Iceland, as was the case with the 1945 year-class.

**Table 3 - Percentage Age Composition of the Cod on West Greenland Banks in 1956, together with the Mean Lengths of Males and Females at each Age**

Year- Class	Age- Group	1 Store Hellefiske Bank 66°51'N, 54°10'W Aug., 60m., 3.6°C.			2 Lille Hellefiske Bank 65°10'N, 53°16'W Aug., 90m., 1.1°C.			3 Barana Bank 64°19'N, 53°23'W July, 60m.			4 Fylla Bank 64°08'N, 52°45'W July, 45m.		
		%	Length cm.		%	Length cm.		%	Length cm.		%	Length cm.	
			♂♂	♀♀		♂♂	♀♀		♂♂	♀♀		♂♂	♀♀
1952	IV	1.4	46.5	43.0	-	-	-	0.3	46.0	-	-	-	-
1951	V	5.4	57.1	56.1	3.5	54.2	55.5	1.0	56.5	57.0	6.3	53.0	55.0
1950	VI	26.5	62.9	64.6	11.0	63.6	64.9	14.5	63.8	64.1	27.3	62.9	64.3
1949	VII	5.0	69.1	69.6	5.0	71.0	67.0	4.4	67.5	71.3	7.7	69.3	69.0
1948	VIII	7.9	69.3	70.7	3.5	71.8	69.0	7.4	69.8	71.5	8.4	68.4	70.0
1947	IX	39.8	72.4	74.7	52.0	71.3	72.1	59.9	73.4	75.2	42.7	71.6	-
1946	X	0.9	75.0	76.0	2.0	76.0	76.3	2.7	78.8	77.5	1.0	72.0	-
1945	XI	6.1	77.4	79.6	12.0	79.5	79.2	6.1	77.3	79.3	4.9	77.3	-
1944	XII	1.6	75.3	83.5	1.5	75.0	74.0	0.3	-	81.0	-	-	-
1943	XIII	1.1	78.0	78.3	1.0	84.0	77.0	0.7	84.0	80.0	-	-	-
1942	XIV	3.6	80.7	82.6	4.5	82.5	85.0	2.0	85.3	93.0	2.1	79.7	-
1941	XV	-	-	-	1.5	81.0	83.5	-	-	-	-	-	-
1940	XVI	-	-	-	1.5	83.0	85.5	0.3	111.0	-	-	-	-
1939	XVII	0.5	83.0	82.0	-	-	-	-	-	-	-	-	-
1938	XVIII	-	-	-	-	-	-	-	-	-	-	-	-
1937	XIX	-	-	-	-	-	-	-	-	-	-	-	-
1936	XX	-	-	-	0.5	-	90.0	0.3	-	97.0	-	-	-
1935	XXI	-	-	-	-	-	-	-	-	-	-	-	-
1934	XXII	0.2	91.0	-	0.5	-	103.0	-	-	-	-	-	-
Total number		442			200			297			143		

Year- Class	Age- Group	5 Fylla Bank 64°03'N, 52°27'W May, 120m.			6 Fylla Bank 64°02'N, 52°47'W Aug., 40m., 3.7°C.			7 Fylla Bank 63°53'N, 53°22'W June, 260m., 4.0°C.			8 Dana Bank 62°42'N, 51°20'W July, 50m., 1.1°C.		
		%	Length cm.		%	Length cm.		%	Length cm.		%	Length cm.	
			♂♂	♀♀		♂♂	♀♀		♂♂	♀♀		♂♂	♀♀
1952	IV	2.0	40.0	44.0	3.4	47.2	44.0	-	-	-	-	-	-
1951	V	4.9	54.0	54.3	7.2	56.5	57.3	0.6	-	45.0	-	-	-
1950	VI	29.4	60.8	63.1	20.3	63.5	64.2	4.1	60.5	60.0	10.8	60.2	63.0
1949	VII	2.0	77.0	72.0	9.3	70.6	70.6	0.6	71.0	71.0	12.6	68.2	68.5
1948	VIII	3.9	67.5	65.5	7.2	69.9	73.1	2.4	70.0	67.0	1.8	-	71.0
1947	IX	32.3	69.7	74.4	43.2	72.4	76.0	42.9	72.0	71.3	45.4	71.8	75.0
1946	X	1.0	-	81.0	1.3	77.5	83.0	0.6	-	73.0	5.4	69.8	67.5
1945	XI	11.8	79.0	79.9	4.7	77.4	77.0	11.2	77.5	76.9	16.2	77.1	76.5
1944	XII	2.9	79.0	87.0	0.8	96.0	69.0	1.3	77.3	77.3	0.9	-	76.0
1943	XIII	2.9	-	75.7	0.8	-	87.5	6.5	78.3	74.9	-	-	-
1942	XIV	4.9	91.0	83.3	1.7	83.0	84.5	22.4	80.8	81.1	5.4	77.0	89.0
1941	XV	1.0	-	86.0	-	-	-	1.2	-	77.0	0.9	77.0	-
1940	XVI	-	-	-	-	-	-	4.1	85.8	86.9	0.9	80.0	-
1939	XVII	-	-	-	-	-	-	1.2	84.0	84.0	-	-	-
1938	XVIII	-	-	-	-	-	-	-	-	-	-	-	-
1937	XIX	-	-	-	-	-	-	-	-	-	-	-	-
1936	XX	1.0	-	93.0	-	-	-	-	-	-	-	-	-
1935	XXI	-	-	-	-	-	-	-	-	-	-	-	-
1934	XXII	-	-	-	-	-	-	-	-	-	-	-	-
Total number		102			236			167			111		

Year- Class	Age- Group	9 Aug. Sept.	10 Aug. Sept.	11 Sept. Oct.	12 June July	13 Apr. May	14 Feb. Mar.	15 Oct. Nov.	16 June July	17 Dec. Jan.	18 June July	19 Oct. Nov.	20 Feb. Mar.	21 Sept. Oct.	22 June July	23 Apr. May	24 Sept. Oct.	25 Sept. Oct.	26 July Aug.	27 Oct. Nov.	28 May June	29 Jan. Feb.	30 Oct. Nov.	31 Aug. Sept.	32 Oct. Nov.
1952	IV	-	-	2.0	16.8	-	14.9	1.0	22.4	7.9	4.0	2.6	-	2.0	6.9	8.9	-	-	1.5	7.0	1.0	11.8	1.0	8.9	-
1951	V	0.7	-	6.0	26.9	0.9	26.6	1.0	10.5	5.0	4.0	4.2	1.5	3.1	9.5	4.9	4.5	-	4.0	10.6	7.5	7.6	4.0	14.9	1.8
1950	VI	1.4	0.5	35.0	26.9	7.3	22.3	9.0	26.3	12.9	21.9	22.2	10.3	12.8	33.6	53.7	44.0	4.7	37.5	36.2	23.1	28.6	8.1	50.1	14.7
1949	VII	-	-	5.0	6.7	4.5	8.5	4.0	11.4	10.9	26.9	13.2	2.9	10.7	9.5	9.9	17.5	5.3	28.5	12.6	29.6	22.7	15.1	14.9	11.2
1948	VIII	0.7	0.5	3.0	-	4.5	2.1	3.0	1.8	6.9	6.5	2.6	1.5	3.6	0.9	1.0	1.5	4.7	4.0	2.5	3.5	5.9	2.0	1.3	2.4
1947	IX	10.7	12.3	24.0	9.2	20.0	8.5	26.0	14.0	12.9	25.9	27.0	35.3	43.4	9.5	15.8	21.0	43.3	17.5	23.1	32.7	9.2	43.4	5.8	35.3
1946	X	-	2.7	2.0	-	2.7	1.6	-	0.9	-	1.5	1.1	-	2.6	-	-	-	2.7	-	-	-	1.7	-	0.5	4.7
1945	XI	12.9	5.9	5.0	4.2	18.2	10.1	7.0	6.6	15.8	6.0	12.7	26.5	8.2	14.7	3.9	7.5	19.3	5.5	3.5	1.0	12.6	22.2	2.8	19.4
1944	XII	4.3	5.5	4.0	-	2.7	1.1	2.0	-	2.9	-	1.6	4.4	2.0	4.3	-	0.5	1.3	0.5	-	-	-	-	-	1.8
1943	XIII	9.3	5.5	2.0	-	1.8	-	-	-	2.0	0.5	1.6	-	1.5	3.4	-	1.0	3.3	-	1.0	-	-	1.0	-	1.8
1942	XIV	42.1	25.9	5.0	2.5	14.5	3.7	22.0	3.5	8.8	1.5	7.9	10.3	6.1	6.0	2.0	2.0	8.0	-	2.0	1.0	-	3.0	0.8	2.9
1941	XV	6.4	5.5	-	-	-	-	-	-	-	0.5	-	-	-	0.9	-	-	2.0	-	-	-	-	-	-	1.8
1940	XVI	4.3	11.8	3.0	4.2	19.1	0.5	19.0	1.3	11.9	0.5	1.1	4.4	2.0	0.9	-	0.5	3.3	-	1.5	0.5	-	-	-	1.8
1939	XVII	1.4	7.3	-	-	1.8	-	2.0	0.4	1.0	-	0.5	1.5	1.0	-	-	-	1.3	-	-	-	-	-	-	-
1938	XVIII	-	2.3	-	0.8	0.9	-	1.0	-	-	0.5	0.5	1.5	-	-	-	-	-	0.5	-	-	-	-	-	0.6
1937	XIX	-	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1936	XX	5.7	11.8	2.0	1.7	0.9	-	3.0	-	1.0	-	0.5	-	1.0	-	-	-	-	0.5	-	-	-	-	-	-
1935	XXI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1934	XXII	-	1.4	2.0	-	-	-	-	0.9	-	-	0.5	-	-	-	-	-	0.7	-	-	-	-	-	-	-
Total Number		141	220	100	119	110	188	100	228	101	201	189	68	196	116	213	200	150	200	199	199	119	99	395	170

Table 4 - Percentage Age Composition from Inshore Waters and the Fjords of West Greenland 1956

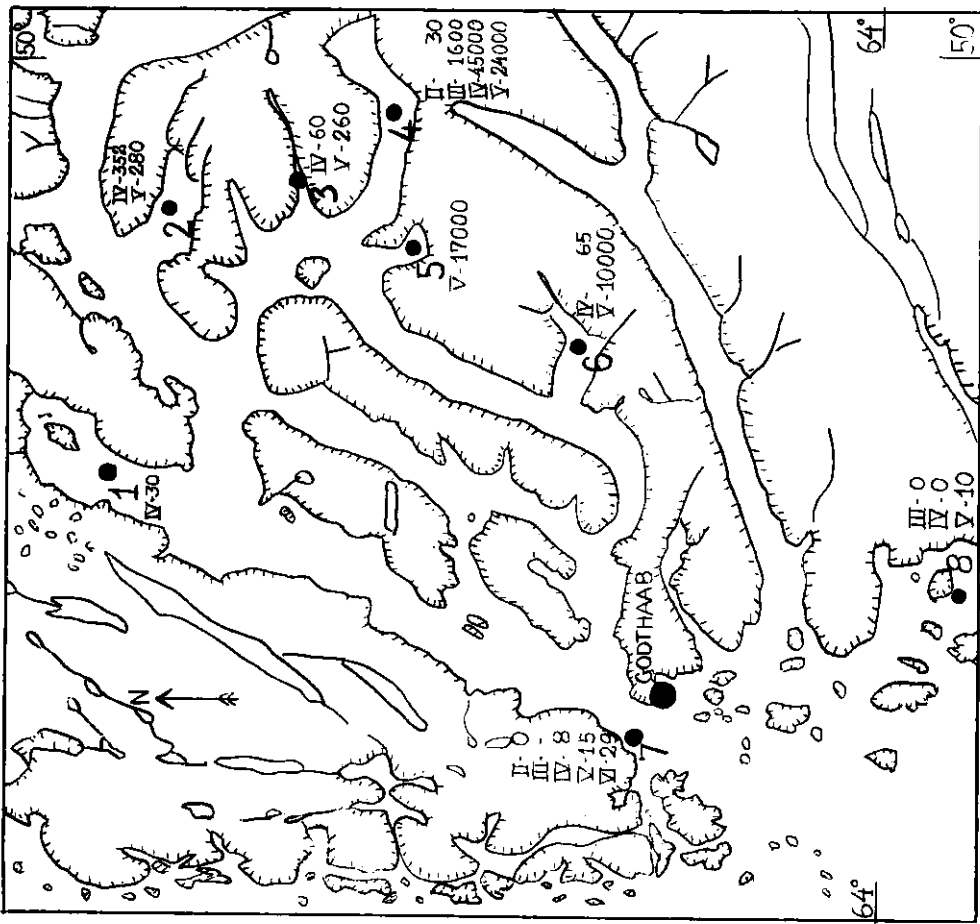


Fig. 1. The positions of the stations where cod eggs have been caught with a 1m streamin net per 30 minutes haul by the "Adolf Jensen" with a 100-50m. of wire out. Godthaab, position 64°11'N, 51°42'W. Off the stations are shown mean numbers of eggs caught per month (II-VI).

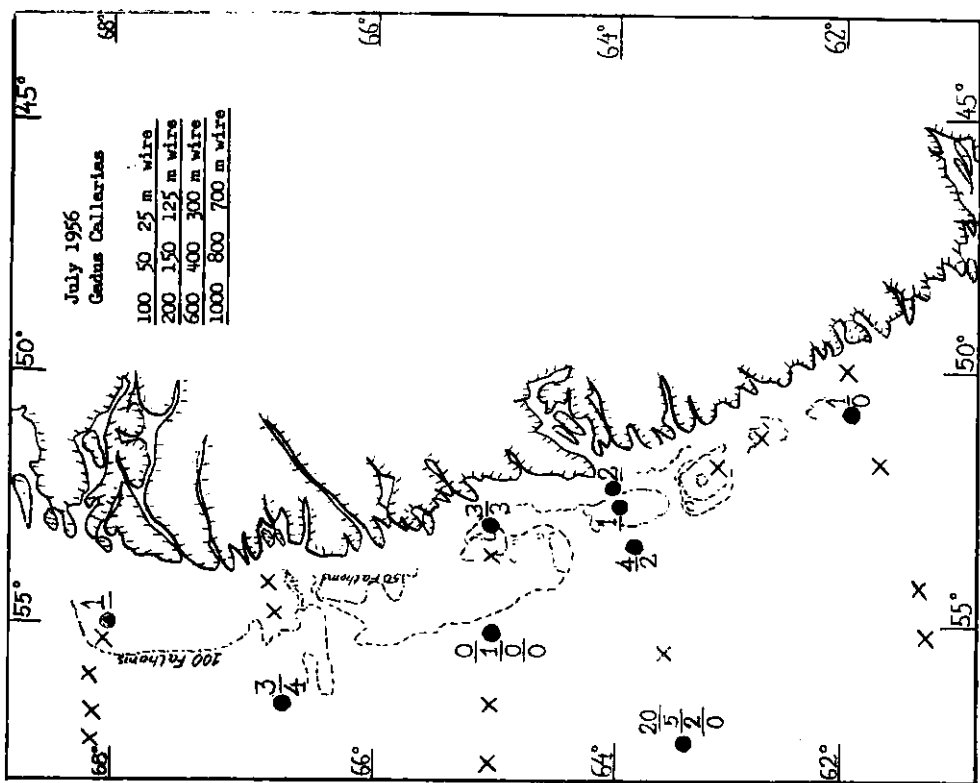


Fig. 2. Catches of cod larvae with a 2m. streamin net per 30 minutes haul by the "Dana".

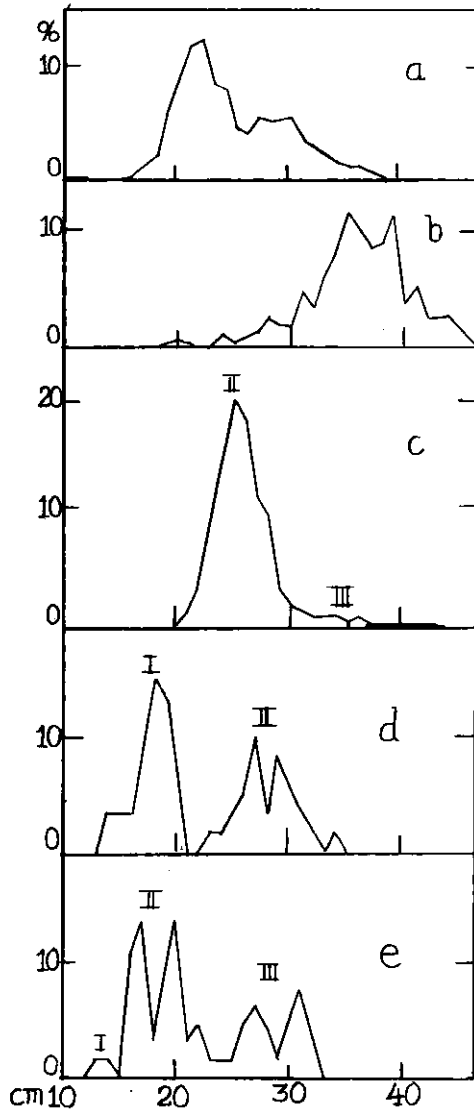


Fig. 3. Length frequencies of small cod, Age-groups I, II and III.

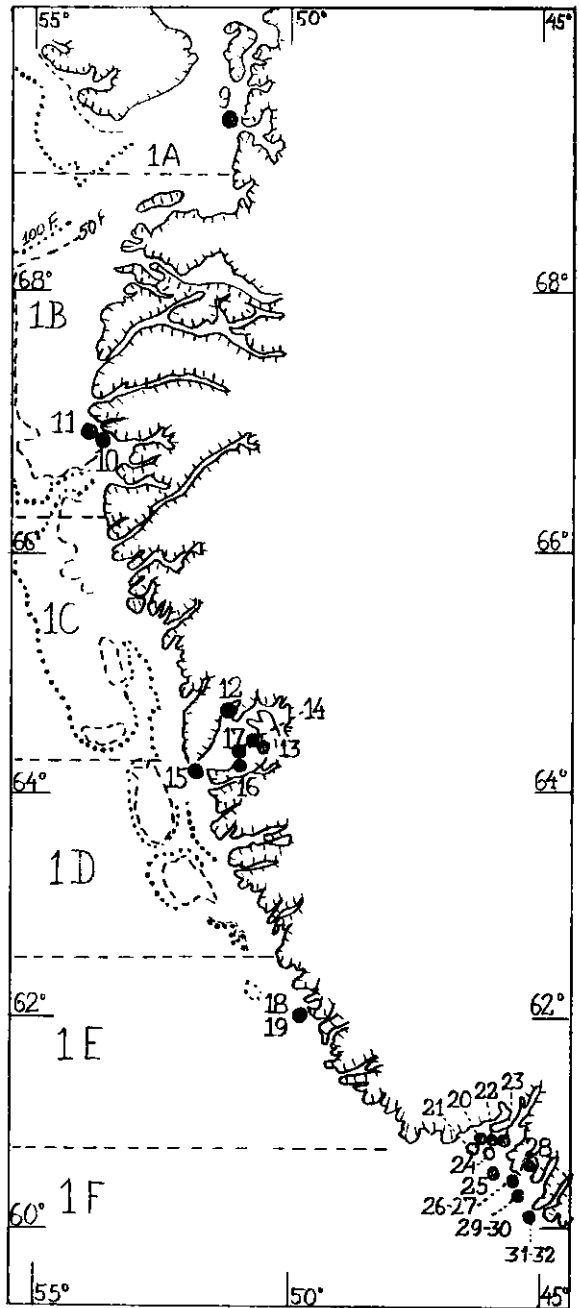


Fig. 5. Localities at which otolith samples were collected for age-analyses. The numbers correspond with those given in Table 4.



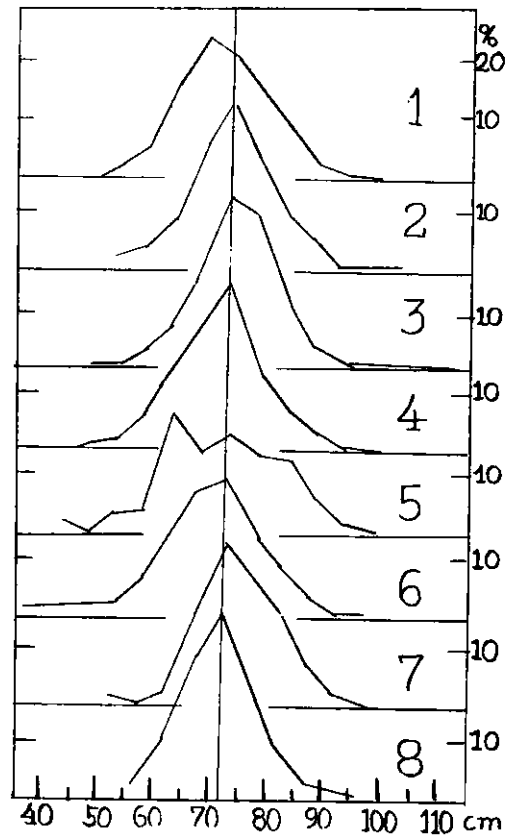
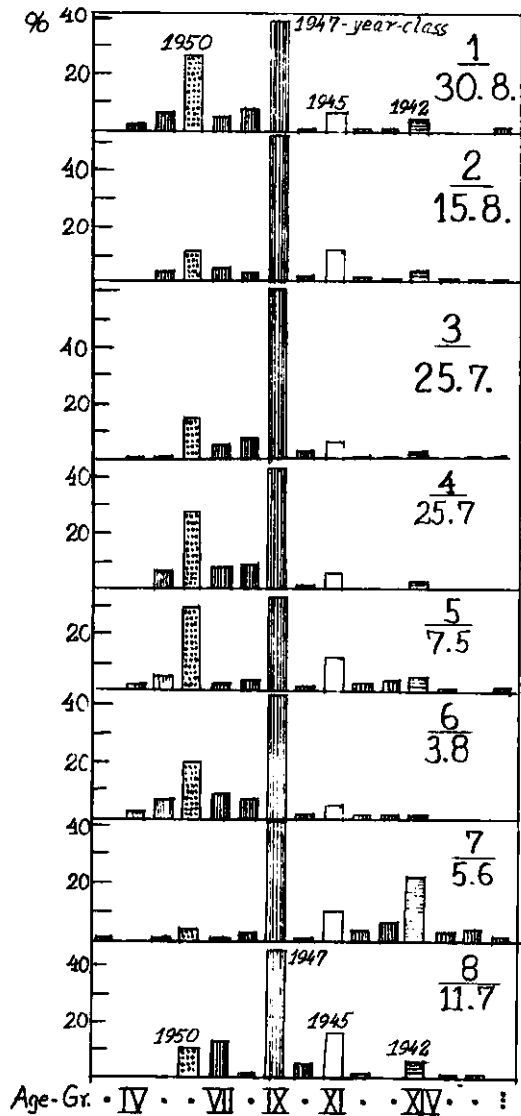
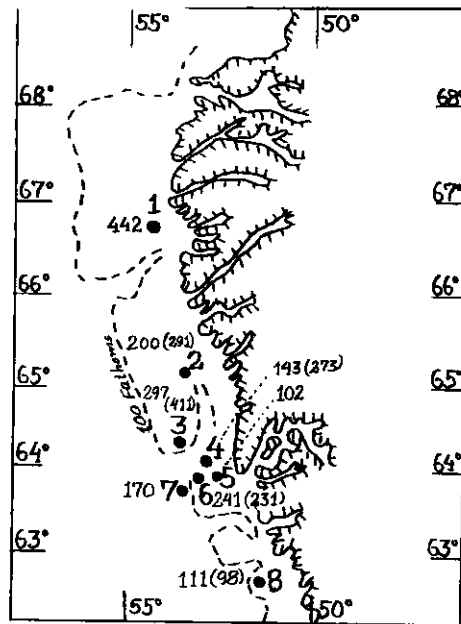


Fig. 4. Percentage age distribution (left above) and length measurements for 5 cm. groups (right above) of cod caught on the Greenland banks in 1956. The numbers of fish examined and of cod tagged (bracketed figures) are given for each station on the map (right below).



## II. Hydrographic Conditions in West Greenland Waters 1956

by Frede Hermann

As in the preceding years, hydrographic observations were carried out in the fjords and coastal area by M/K "Adolf Jensen" and M/K "Tornaq" and in the Labrador Sea and Davis Strait by R/V "Dana". Fig.1 shows the location of the sections and the distribution of temperature in 50 metres. The hydrographic conditions are further illustrated by Figs.2-7.

The "Storis" was nearly absent in West Greenland waters in July 1956 and the temperatures in the polar component of the West Greenland current were not very low. Only at the southernmost section a trace of water with negative temperature was found.

The Atlantic component of the current was well developed and transported great amounts of warm water up along the western slope of the banks. North to Lille Hellefiskebank water with temperature above  $4^{\circ}\text{C}$ . was found in thicker layer than has been found in many years.

The boundary of the Arctic Baffin Land current was found further eastwards than usually, specially at the section off Lille Hellefiskebank (section IV). The same was the case with the limit of the "Vestis".

A section over Fyllas Bank worked by M/K "Adolf Jensen" on 23rd April showed that water with negative temperature was not present either over the shallow part or over the edges of the bank. This indicates that the winter cooling has been less severe than usual which is in accordance with the fact that the winter was very mild.

When the section was repeated on 5th June the temperature over the shallow part of the bank had only increased to  $0^{\circ}\text{8}$ , which is considerably below normal. This low temperature is supposed to be due to low air temperatures in May and June and is possibly the main reason for the very low number of cod larvae caught in the summer 1956.

In July the temperatures over the shallow parts of the banks were about normal north to Great Hellefiske Bank where they were a trifle below normal.

Fig.8 shows the distribution of phosphate at 20 metres as found on the "Dana" cruise. The essential features were the same as found in previous years with one maximum off the banks of southwest Greenland and another at the boundary of the Baffin Land current. Over the Great Hellefiske Bank the phosphate concentration was somewhat higher than usual.

A fixed station at the entrance of Godthåbsfjord was worked 12 times during 1956. The variation of temperature at this station from October 1955 to January 1957 is given in Fig.9. In most years an inflow of warm and saline bottom water takes place in November-December. This was also the case in 1956 when the maximum bottom temperature exceeded  $4^{\circ}$ , which is higher than measured in 1954 and 1955. An extra inflow of warm water had occurred in February, which is quite extraordinary.

The effect of winter cooling was less pronounced than in the two previous years. No temperatures below zero were measured below 50 metres. In 1954 and 1955 temperatures below  $-0^{\circ}\text{5C}$  were found from surface to bottom in March.

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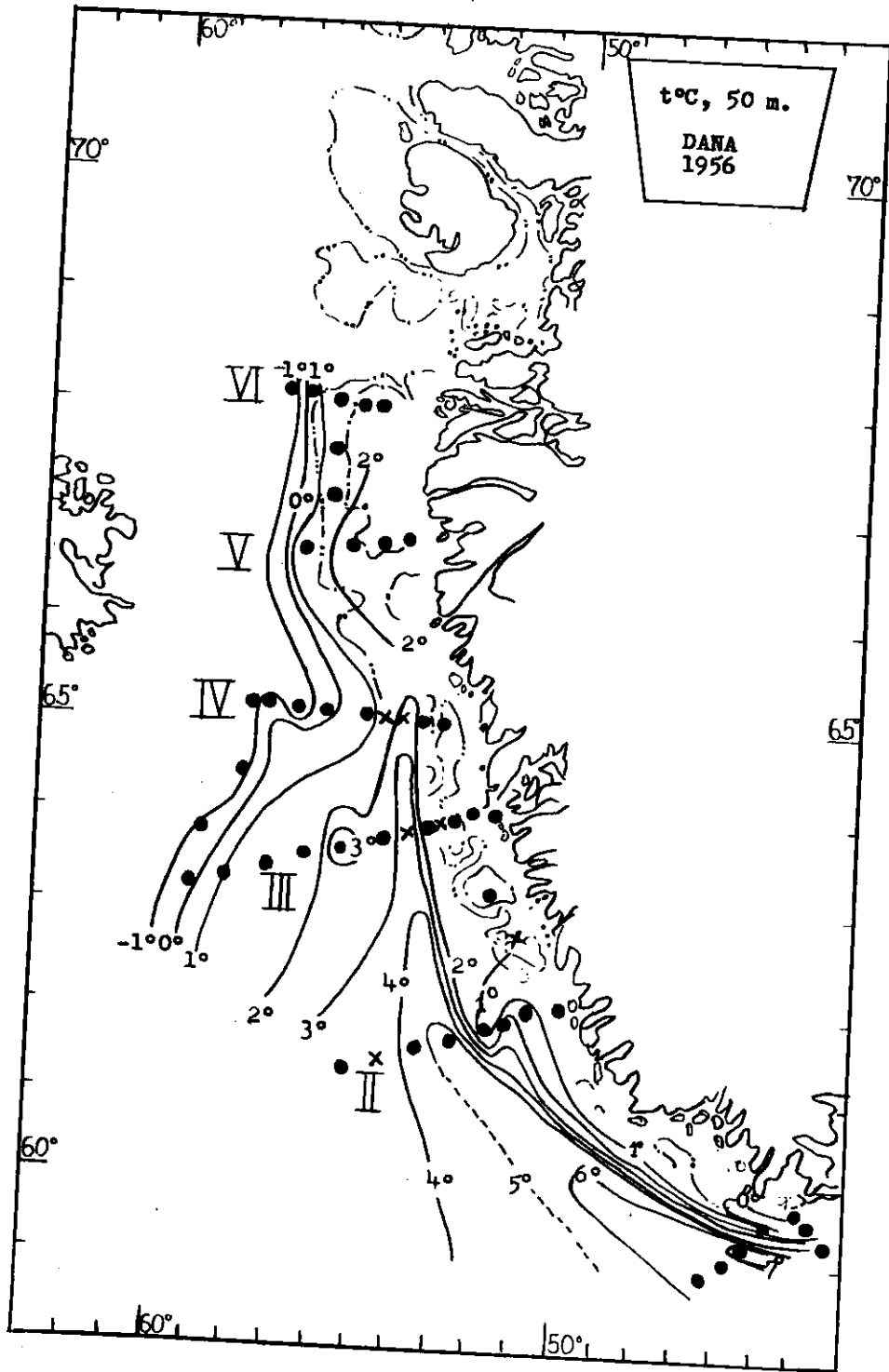


Fig. 1. Location of stations and distribution of temperature at 50 metres.

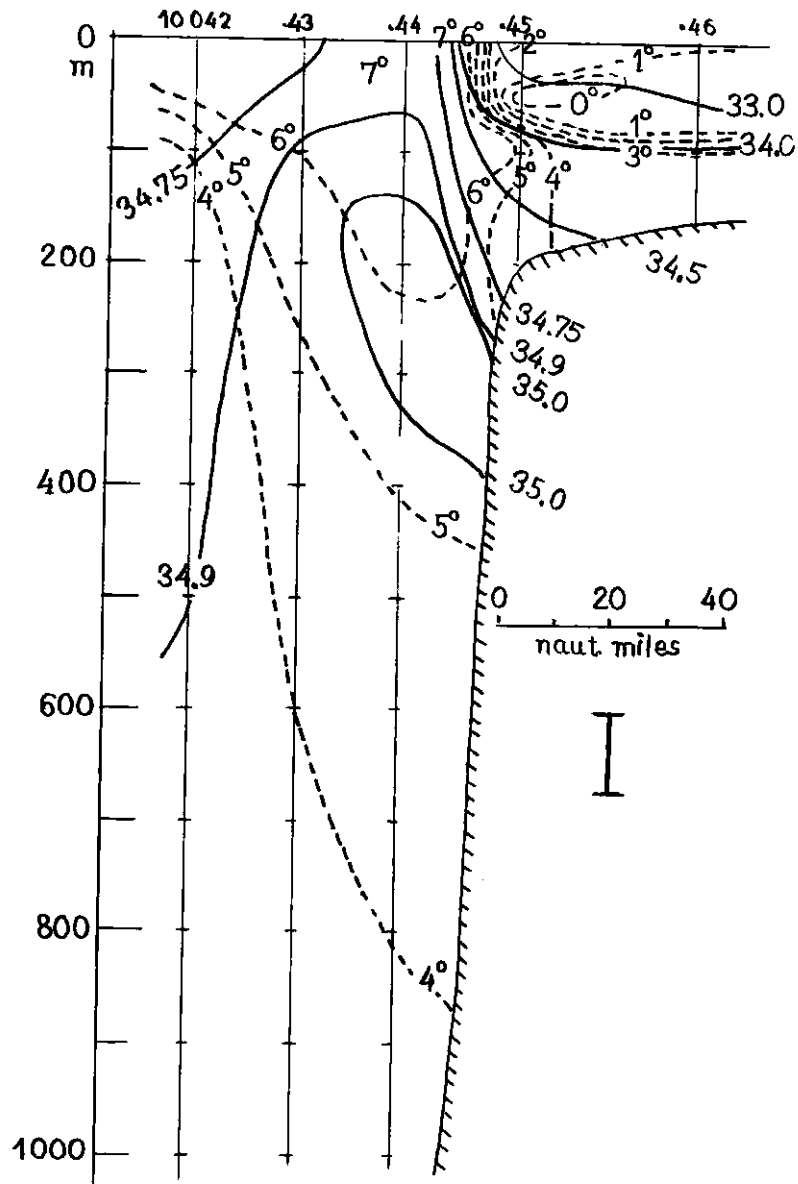


Fig. 2. Section 1 off Cape Farewell, August 1st to August 10th 1956.

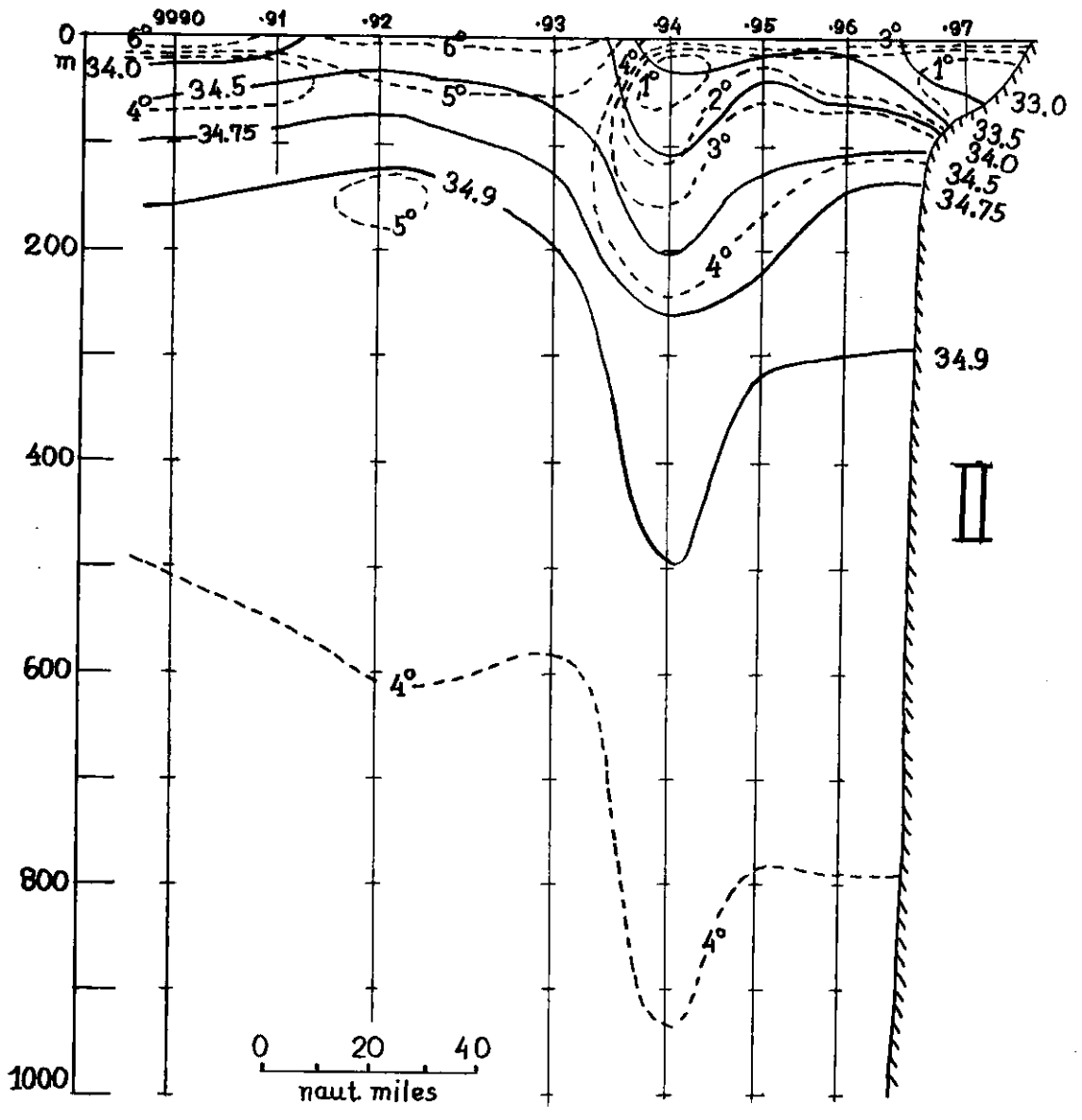


Fig. 3. Section II off Frederikshaab, July 10th to July 11th, 1956

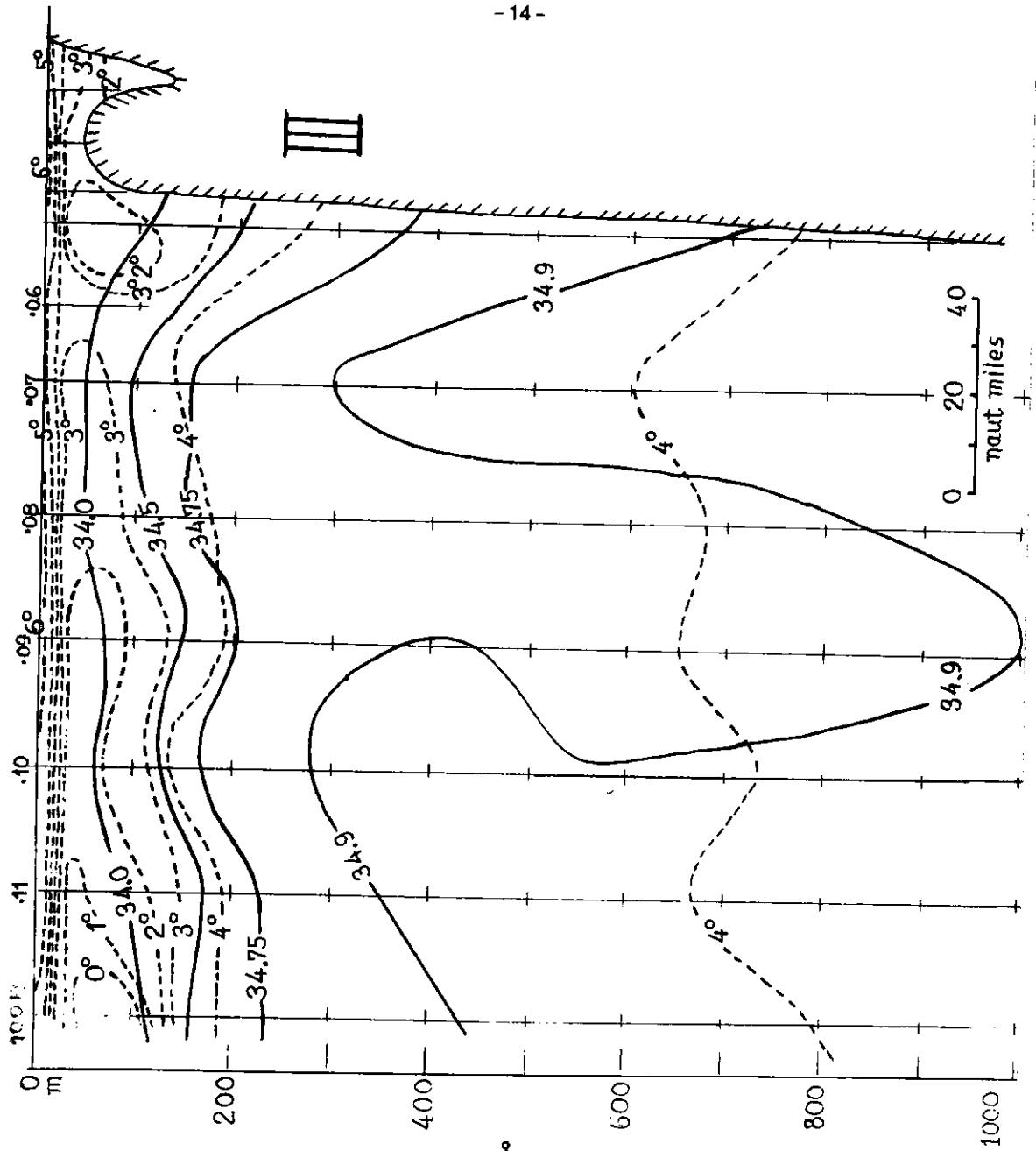


Fig. 4 - Section III off Fyllas Bank, July 16th to July 18th, 1956.

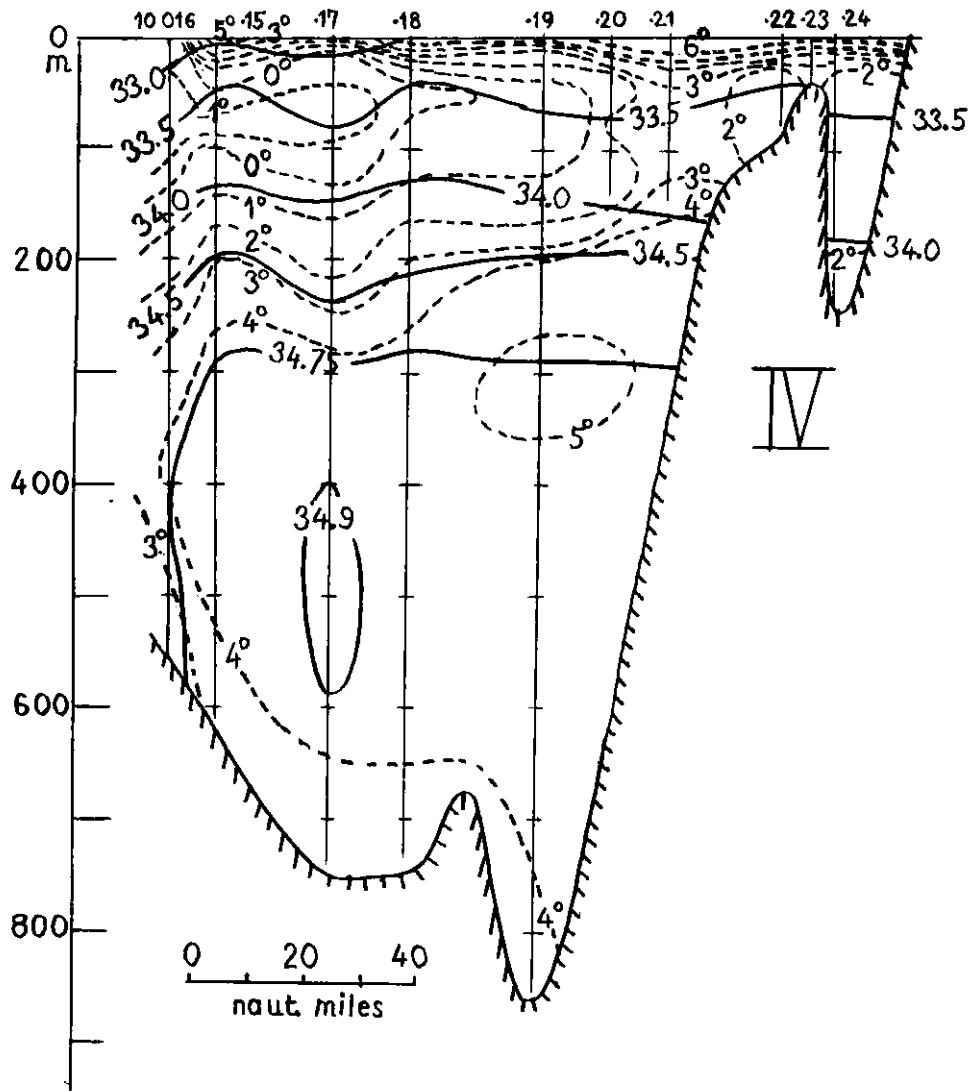


Fig. 5. Section IV across Lille Hellefiske Bank, July 19th to July 20th, 1956.

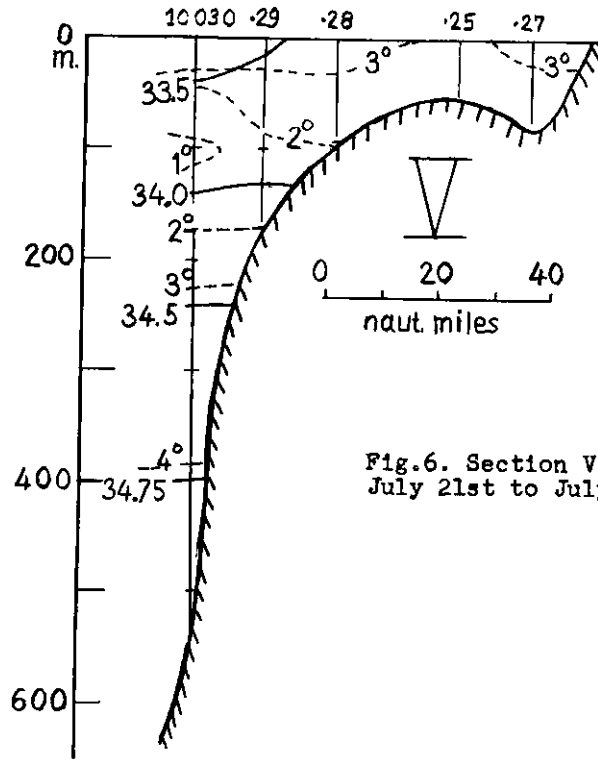


Fig. 6. Section V off Holsteinsborg, July 21st to July 23rd, 1956.

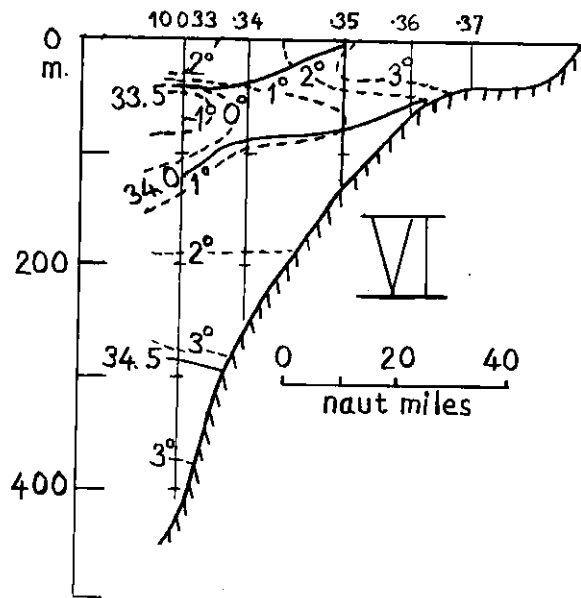


Fig. 7. Section VI off Egedesminde, July 23rd to July 24th, 1956.



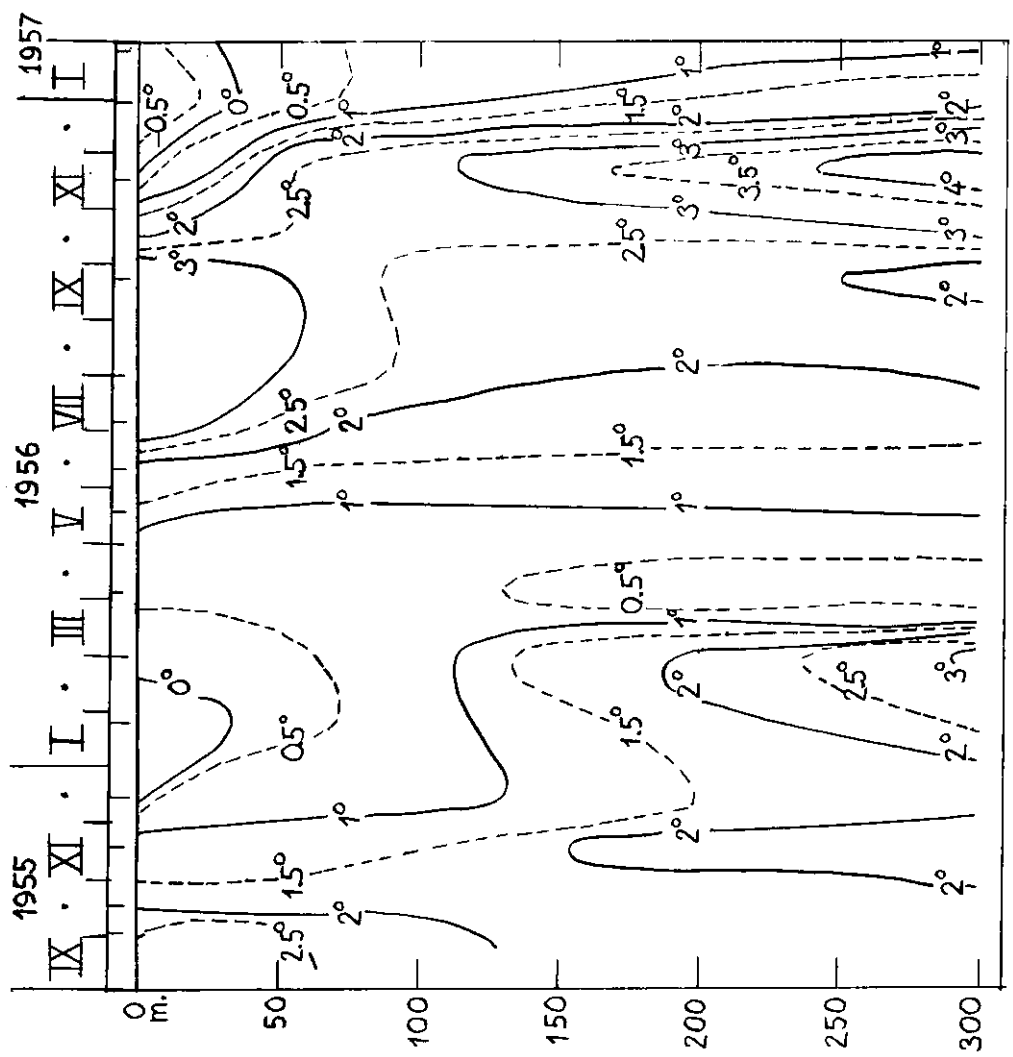


Fig. 9. Variation of temperature at the entrance of Godthaab Fjord (64° 07' N-51° 53' W).

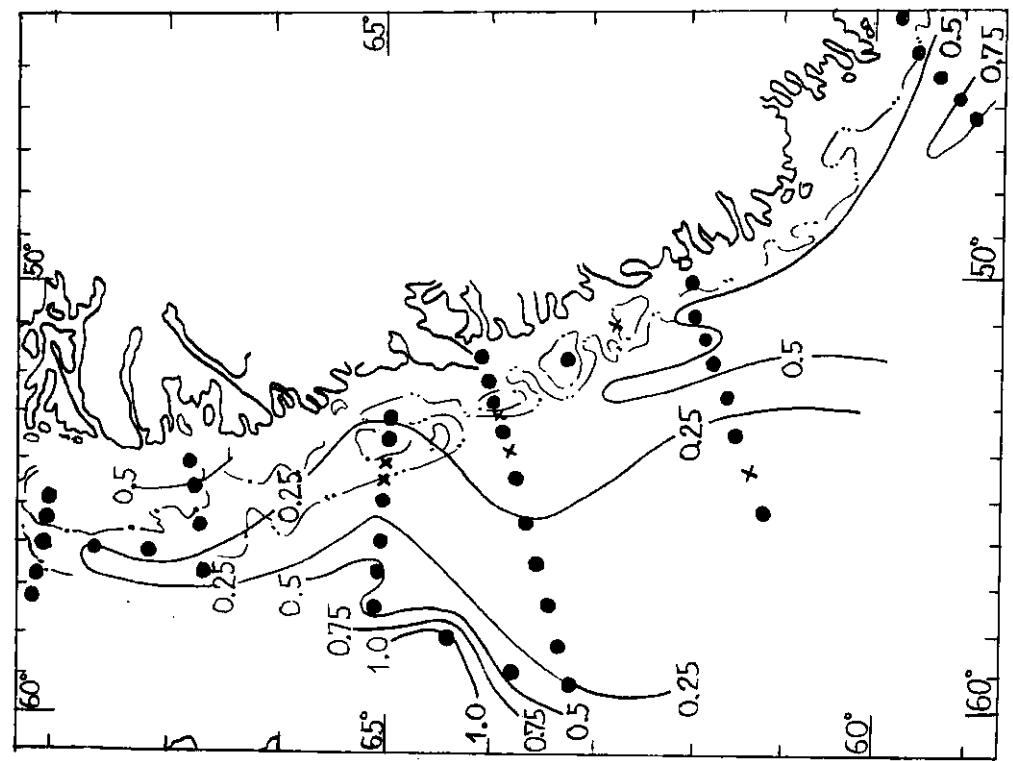


Fig. 8. Distribution of phosphate, July 1956.

