

ANNUAL MEETING - JUNE 1955NORWEGIAN RESEARCH REPORTFOR 1954Notes on the Composition of the Catch by Norwegian Long-Liners off West Greenland 1954

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During the 1954 fishing season, altogether 67 Norwegian long-liners participated in the fishery off West Greenland. Four of the vessels were fishing for halibut, while the rest were engaged in the cod-fishery. In addition, nine Norwegian trawlers carried out one or two trips each to these fishing grounds. Two of the trawlers were rather small, below 300 br. tons. The total Norwegian catch in West Greenland waters in 1954 is at a preliminary estimate 16,000 tons salted cod, with an additional 500 to 600 tons of halibut.

The Norwegian long-liners started their fishing at the end of April. During the first part of the season they were fishing on the western edges of Danas, Fiskenes and southern Lille Hellefiske Banke. The fishery was carried out in depths between 250 and 280 meters. According to the fishermen, the upper layers in the sea were very cold, and fishing in such deep water was thus necessary. In the latter half of June and early July, the fish entered more shallow water and could be caught in satisfying numbers higher up on the slopes. But in July the fishery also here decreased.

When the fishery started in April, the cod were in good condition with a high content of liver. In July the fish had become thinner and were decidedly of inferior quality. In July the fishery started with pelagic lines in the Holsteinsborg Deep between Lille Hellefiske and Store Hellefiske Banke. In August and September the fishery was extended to the northern banks: Fyllas Banke, Store and Lille Hellefiske Banke northward to Disco Banke. By this time the quality of the fish started improving again.

As in earlier years the Norwegian Institute of Marine Research collected material for the investigation of the composition of the cod population in 1954, and likewise studied the temperature conditions in relation to fishing. Scientific assistant E. Bratberg and technical assistant A. Frøland arrived at Faeringehavn at West Greenland on June 23rd. On July 11th the two observers left for the fishing grounds on board the long liner M/S "Polhavet", the same ship which has been employed during the last few years. The first cod sample was taken from a long-line setting on the northern part of Lille Hellefiske Banke. Later in the season our vessel was fishing on the south-western and northern slopes of Store Hellefiske Banke. However, during most of the observation period, the vessel was fishing with pelagic long-lines in the Holsteinsborg Deep.

Hydrographic Conditions

On July 24-26, 1954, three hydrographic sections (see Figs. 1, 2, 3 and the Appendix) were taken by means of bathythermograph and ordinary Nansen water-bottles. The bathythermograph registered only to 137 meters. The data of the three sections in tabular form are appended. The hydrographic sections are: (A) from the northern part of Lille Hellefiske Banke westwards, (B) from the shallow part of Lille Hellefiske Banke westwards, and (C) from Fyllas Banke westwards.

The hydrographic sections show that the temperatures in the different depths were generally somewhat lower than in 1953. In the particular depths where the bottom lines usually are set, 150-200 meters, the bottom temperatures showed the following trend: On the section westwards from Lille Hellefiske Banke, the bottom temperature in 150-200 meters was 1-2° C., i.e. conditions similar to those found in the summer of 1950. In 1953, the bottom water had been warmer, viz. 2-4° C. On Fyllas Banke the temperature in 1954 was 3-4° C. in these depths, while the year before it had been warmer (4-5° C.). In 1954 no water with temperature below 0° C. was found along the western slope of the banks during the period of observation. Above the rather cool lower layers was found a relatively warm upper strata with temperature 3-5° reaching from surface down to about 50 meters.

#### Fishing Conditions in the Holsteinsborg Deep

In early July the fishery along the western slopes of the southern banks became relatively poor. On July 8th shoals of cod were observed 60 meters below surface in the deep channel between Store and Lille Hellefiske Banke. In this locality, the Holsteinsborg Deep, the fish seem to concentrate pelagically every year in the middle of the summer after the fishery has become unprofitable in deeper waters. In 1954 the long-liners started fishing in the Holsteinsborg Deep with pelagic long-lines on July 11th, and the fishery here was continued till the end of August.

In 1953 an examination of the pelagic long-line fishery in the Holsteinsborg Deep was instituted. This investigation was continued in 1954. From July 11th to July 24th the variation in temperature was noted together with observations on the catches made. During this period the surface temperature varied between 3 and 4.5° C. This is about 1° colder than the year before. Below surface the temperature fell rapidly to about 1° C. in 80-90 meters depth, and still deeper the temperatures varied between 0.4 and 1.2° C. These deeper layers also showed temperatures about 1° below those found in 1953.

During the pelagic fishery in the Holsteinsborg Deep, a count was made of the number of cod on different sections of the line on four settings totalling 12,800 hooks. The counts showed that the cod were not particularly numerous in the warm surface water. The greatest concentrations of cod were found in the cold water below the thermocline. Fig. 4 shows the variation in the catches in the different depths expressed as deviations from the mean catch of the whole line. The figure shows the results both for 1953 and 1954. The two curves have the same trend in spite of the fact that the temperature conditions in the two years are quite different. Disregarding the warm surface water, the temperature in 1954 generally lies about 1.5° C. below the temperature in 1953. Furthermore the figure indicates that the greatest catches are made in the upper part of the cold water and below the warm surface water. In 1953 there is a decided increase in catch below 100 meters, in 1954 below 120 meters. After reaching a maximum below the thermocline the fish concentration decreases towards greater depths.

Apparently the level of temperature is of minor importance for the pelagic concentration of cod. It seems rather to be the stratification of the watermasses which determines where the fish will shoal. As was mentioned in the report for 1953, we find below the thermocline usually great concentrations of food organisms, e.g. capelin, sandeels, squid, jellyfish and larvae of fish. Apparently it is not the temperature which attracts the cod, but more the accumulation of food organisms due to current conditions in these

particular layers.

The Composition of the Cod Population

In 1954 samples of cod were obtained from the northern banks and from the pelagic fishery in the Holsteinsborg Deep. The cod caught on long-lines on the different banks shows the following mean lengths:

Northern part of Store Hellefiske.....	74.75	cm.
SW part of Store Hellefiske.....	74.36	"
Holsteinsborg Deep.....	72.36	"
Lille Hellefiske Banke.....	75.15	"
Total average .....	73.21	"

The size-distribution of the cod caught on long-lines on the different banks in 1954 is illustrated in Fig.5. The curves for Store Hellefiske Banke and Lille Hellefiske Banke show two maxima, one approximately at 65 cm. and one about 77 cm. These maxima are mostly due to the prominence of the two year classes 1947 and 1942 as indicated in the lower part of the figure.

Fig.6 shows the total age distribution of the cod in Norwegian long-line catches in the period 1948-1954. In recent years the 1942 year class has dominated the Norwegian catches. In 1954, however, the 1947 year class for the first time shows greater strength than the 1942 class. These 7 year old fish constitute 27.9% of the catch, while the 1942 class (12 year olds) constitute 23.1%. These two year classes together make up for 51% of the Norwegian long line catches.

The 1947 class has during the last 2-3 years been dominant in the catches of other countries, while it is not till 1954 that it has superceded the 1942 class in the Norwegian catches. The 1947 class is, according to investigations by the different countries, estimated to be one of the richest ever produced in Greenland waters. The cod belonging to the 1947 class have now reached such a size that they, in all probability, will carry the Norwegian long-line fishery in years to come, replacing the 1942 class.

The 1947 year class consisted in 1954 of still relatively small fish which could not give a satisfactory product for salted fish according to Norwegian demands. The 1947 class had, at an age of seven years, a mean length of 64.2 cm. The 1942 class had, at the same age, an approximate size of 70 cm. A similar difference in size at an age of 6 years in these two year classes was also found during investigations in 1953. (Year class 1942: 66.5 cm. 1947: 59.9 cm.). This difference in rate of growth in the two year classes seems to confirm the view that the growth conditions have not been so prosperous after 1947 as they were before that time. The reasons for decrease in growth rate might be many and very complex. It can, however, hardly be attributed to changes in temperature conditions only. It is more likely that there is not enough food present for the cod population in West Greenland waters. The cod born in 1947 constitute perhaps the largest single year class ever born in Greenland waters, and the competition for food is therefore at present perhaps greater than ever before. The fact that the cod is in good condition when the fishery starts early in spring indicates that enough food probably is present in fall and winter. But in the summer when the cold melting-water from Cape Farewell overflows the bank slopes, the fish do not seem able to feed properly on the bottom fauna. Great masses of cod therefore have to seek their food pelagically. The quality of the fish from early July to the end of August is usually very poor. When the ice

melting period is over and temperatures along the banks again are normal in August-September, the feeding range is extended. Seasonal changes in feeding conditions apparently have a rapid effect on the quality of the fish, and it may be assumed that the growth is also affected by these conditions.

On the different banks we find variations in the size distribution and the mean size of the fish. Similar variations can also be found as regards age composition. In Table 1 the age-composition of cod in Norwegian long-line catches from different areas is shown. The table indicates that the number of young fish belonging to the 1947 group, and likewise fish of the 1942 group, increase in number from the northern part of Store Hellefiske Banke southwards towards Holsteinsborg Deep. Further south towards Lille Hellefiske Banke the influx of these two year classes decreases somewhat. Instead the catches show an influx of 17-18 years old fish which here is found in comparatively deep water along the western slope of the bank. This also explains why the mean size of the fish on Lille Hellefiske Banke was considerably above that of other localities.

Table 1.

Age	Northern Slope St.Hellefiske %	Southern slope St.Hellefiske %	Holsteinsborg Deep %	Lille Hellefiske %	Total %
5	0.1	0	0.3	-	0.2
6	2.3	1.6	3.3	3.0	2.9
7	<u>22.8</u>	<u>25.6</u>	<u>30.5</u>	<u>24.2</u>	<u>27.9</u>
8	4.6	5.2	4.8	1.5	4.7
9	8.6	8.0	10.5	10.6	9.8
10	6.1	6.0	4.7	4.5	5.5
11	12.1	5.6	9.4	4.5	9.7
12	<u>20.7</u>	<u>21.2</u>	<u>24.5</u>	<u>22.8</u>	<u>23.1</u>
13	6.1	7.2	3.6	7.6	4.6
14	4.8	4.0	2.2	3.0	3.0
15	2.4	4.8	2.1	4.5	2.5
16	0.7	0.8	0.4	-	0.5
17	1.7	2.8	0.9	6.1	1.4
18	3.2	1.6	1.4	6.1	2.0
19	1.3	2.4	1.0	1.5	1.2
20	2.3	2.8	0.5	-	1.2
21	0.1	-	-	-	-
22	0.1	0.4	-	-	0.1
Total	745 ind.	250 ind.	1827 ind.	66 ind.	2888 ind.

Of particular importance for the Norwegian fishery is the pelagic schools of cod found in the Holsteinsborg Deep. The following table gives the mean age of the fish caught in this area during the last three years, the mean size, and how much the two year classes 1942 and 1947 have contributed to the catches.

Year	Mean age	Mean length	% of year class	
			1942	1947
1952	11.1	75.99	37.2	0.5
1953	10.0	73.58	28.5	19.1
1954	9.9	72.36	24.5	30.5

In the Holsteinsborg Deep, the mean age of the fish has decreased from 11.1 to 9.9 years and parallel with this the mean size has also gone down. The reason for this decrease is the steadily mounting influx of the 1947 year class. The 1942 class has in these years decreased from 37.2 to 24.5 percent of the catch, while the 1947 class has increased in strength from 0.5 to 30.5 per cent of the catch.

#### Marking Experiments

In 1954 a total of 431 cod were marked partly on Store Hellefiske Banke (33 ind.) and partly in the Holsteinsborg Deep (398 ind.). From the taggings in 1954 we have received 20 recaptures taken within the same fishing season between 7 and 53 days after tagging. Fig.7 shows the localities of recaptures of the fish tagged in the Holsteinsborg Deep. When the cod leaves the Holsteinsborg Deep they undertake a northward migration spreading over Store Hellefiske Banke. This picture of the late summer and autumn migration is exactly the same as obtained by the tagging experiment in the Holsteinsborg Deep in the summer of 1953. However, this northward migration is only a partial picture of the wanderings of the bank cod in West Greenland waters as is indicated by the 1954 recaptures from the marking experiment in 1953.

In late July and early August 1953 a total of 512 cod were tagged in the Holsteinsborg Deep. Recaptures in the fall of the same year show a northward migration and a spreading of the cod over Store Hellefiske Banke. In the following season, 1954, we have 21 recaptures from this tagging experiment with the following distribution as to time and locality: In May 2 recaptures, one from Iceland and one from Fyllas Banke. In June 13 recaptures from Danas-Fiskenes-Fyllas Banke, mainly on the latter. In July one recapture from Fyllas Banke. In August 4 recaptures from Holsteinsborg Deep and Store Hellefiske Banke. In October one recapture from Danas Banke.

The tagging experiment of 1953 may possibly indicate the following seasonal movements of the Holsteinsborg cod: The northward migration to Store Hellefiske Banke in late summer is a feeding migration. Probably the cod leaves Store Hellefiske Banke in early winter and start a southward movement. This is presumably mostly a spawning migration. According to Faeroese fishermen, spawning areas are found in the area of Danas-Fyllas Banke where spawning takes place in April. Most of our tagged fish have been recaptured in this area in May-June when the Greenland fishery starts. The recaptures at Holsteinsborg and Store Hellefiske in August indicate a possible northward feeding migration again which should complete the circle. One of the specimens has migrated to Iceland where it was taken on the spawning ground in May. Another recapture on Danas Bank in October indicates that the cod may linger in the southern areas after completion of spawning. A tentative sketch of the possible routes of migration is given in Fig.8.

The tagging experiment 1953 has to date given 36 recaptures or 7 per cent. It is hoped that the marking experiment of 1954 will cast more light on the migrations of the Holsteinsborg cod.

- THE END -

Appendix

A. Hydrographic Section from Northern Part of  
Lille Hellefiske Banke

Bt - Bathythermograph, Wb - waterbottle, S - Salt

I, N 66°06', W 54°28'  
24/7 -54. 93 m

M	Bt	Wb	S°/‰
0	-	4.67	33.02
15	4.4	-	-
30	1.9	-	-
50	-	1.2	33.64
85	-	1.0	33.62
91	0.9	-	-

II, N 66°06', W 54°48'  
24/7 -54. 147 m.

M	Bt	Wb	S°/‰
0	-	4.50	33.39
15	4.5	-	-
30	2.2	-	-
50	-	1.00	33.72
76	0.6	-	-
107	0.6	-	33.72
122	0.7	-	-
140	-	0.96	33.97

III, N 66°06', W 55°09'  
24/7 -54. 173 m

M	Bt	Wb	S°/‰
0	3.4	-	33.68
15	3.4	-	-
30	1.9	-	-
50	1.3	-	33.80
76	1.2	-	-
100	-	1.18	34.03
122	1.1	-	-
137	1.1	-	-

IV, N 66°06', W 55°28'  
24/7 -54. 197 m.

M	Bt	Wb	S°/‰
0	-	4.10	33.61
15	4.2	-	-
30	3.1	-	-
50	-	2.38	33.68
76	1.2	-	-
100	-	0.8	33.90
122	1.0	-	-
190	-	0.7	34.06

V, N 66°06', W 55°48'  
25/7 -54. 205 m.

M	Bt	Wb	S°/‰
0	-	3.75	33.63
15	2.9	-	-
30	0.9	-	-
46	0.6	-	-
76	0.2	-	33.67
100	-	0.87	-
122	0.7	-	33.81
137	1.0	-	-
195	-	1.97	34.21

B. Hydrographic Section from Southern Part of

Lille Hellefiske Banke

Bt - Bathythermograph, Wb - waterbottle, S - salt

I, N 65°06', W 55°24'

25/7 -54. 600 m.>			
M	t°C	Wb	S°/∞∞
0	-	4.75	33.31
15	4.8	-	-
30	1.7	-	-
50	-	0.64	33.54
76	0.7	-	-
100	-	0.75	33.76
122	0.9	-	-
137	1.0	-	-
200	-	1.81	34.01
340	-	4.01	34.73

II, N 65°06', W 54°58'

25/7-54. 600 m.>			
M	t°C	Wb	S°/∞∞
0	-	4.30	33.34
15	4.3	-	-
30	2.9	-	-
50	-	0.93	33.54
76	0.9	-	-
100	-	0.82	33.88
122	0.7	-	-
137	0.8	-	-
200	-	1.24	-
350	-	3.80	34.64

III, N 65°06', W 54°40'

25/7 -54. 210 m.			
M	t°C	Wb	S°/∞∞
0	-	4.10	33.29
15	4.3	-	-
30	4.2	-	-
50	-	2.11	-
76	1.2	-	-
100	-	0.87	33.91
122	1.2	-	-
137	1.5	-	-
200	-	2.85	-

IV, N 65°06', W 54°20'

25/7 -54. 120 m.			
M	t°C	Wb	S°/∞∞
0	-	4.20	33.34
15	4.3	-	-
30	2.9	-	-
50	-	1.56	33.42
76	1.0	-	-
100	-	0.69	33.76
119	1.0	-	-

V, N 65°06', W 53°52'

25/7 -54. 65 m.			
M	t°C	Wb	S°/∞∞
0	-	5.40	32.27
15	4.2	-	-
30	4.1	-	-
50	-	2.02	33.50
64	1.9	-	-

C. Hydrographic Section from Fyllas Bank

Bt - Bathythermograph, Wb - waterbottle, S - salt

I, N 63°55', W 53°56'  
26/7 -54. 660 m.>

M	t°C	t°C	S°/∞
0	Bt	Wb	33.35
15	4.6	4.70	
30	3.3	-	
50	-	3.0	-
76	3.4	-	
100	-	3.70	34.60
122	4.3	-	
137	4.3	-	
200	-	4.21	-
350	-	4.24	34.89

II, N 63°55', W 53°33'  
26/7 -54. 660 m.>

M	t°C	t°C	S°/∞
0	Bt	Wb	33.28
15	5.3	4.45	
30	5.0	-	
50	-	3.27	33.86
76	3.2	-	
100	-	3.26	-
122	3.8	-	
137	4.0	-	
200	-	4.27	-
350	-	4.39	34.89

III, N 63°55', W 53°01'  
26/7 -54. 90 m.

M	t°C	t°C	S°/∞
0	Bt	Wb	32.92
15	3.7	3.94	
30	3.0	-	
50	-	1.23	33.38
76	1.0	-	
87	1.0	-	

IV, N 63°55', W 52°42'  
26/7 -54. 45 m.

M	t°C	t°C	S°/∞
0	Bt	Wb	32.66
15	4.5	4.42	
30	3.60	-	33.04
40	2.68	-	



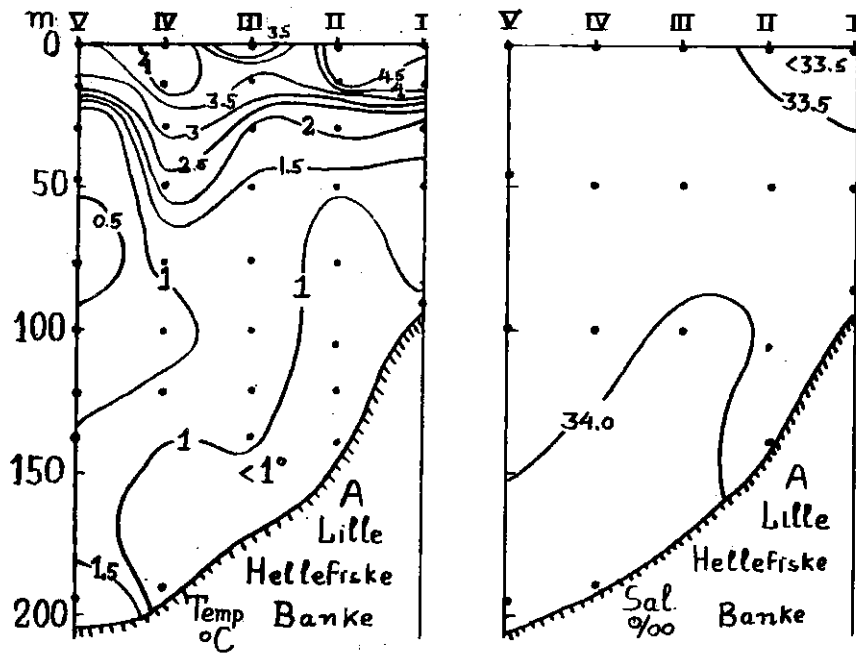
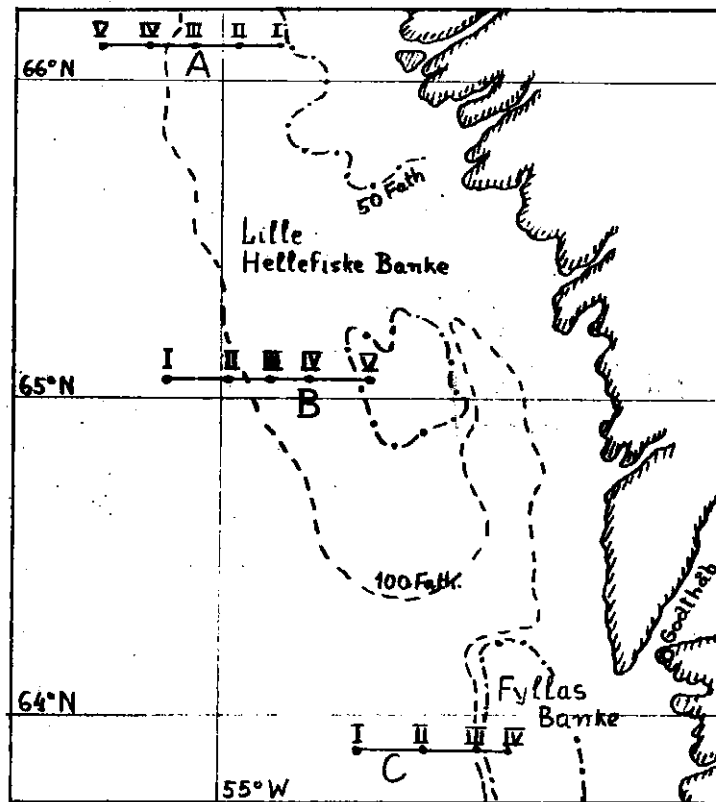


Fig. 1 A. Hydrographic section from northern part of Lille Hellefiske Banke, 24-26 July 1954.



Above map shows the position of the three Norwegian sections A, B and C.

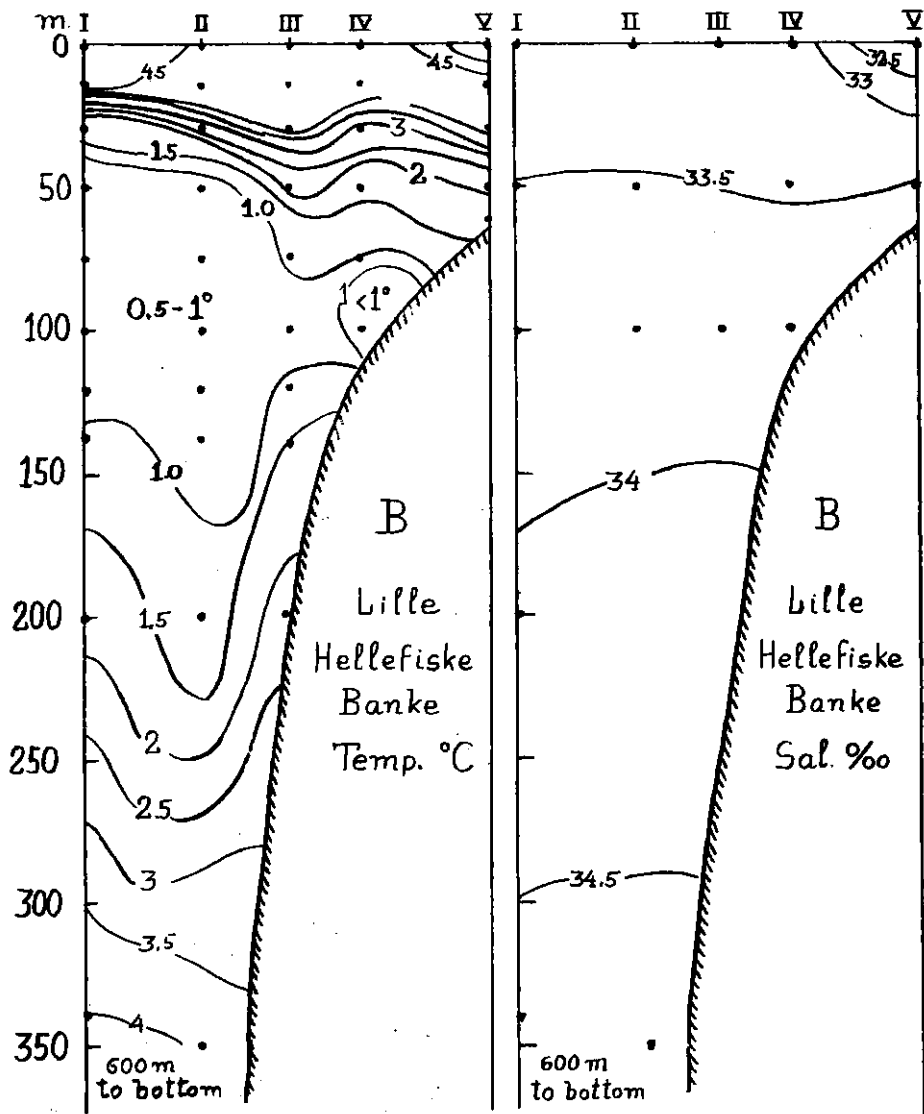


Fig. 2 B. Hydrographic section from southern part of Lille Hellefiske Banke, 24-26 July 1954.

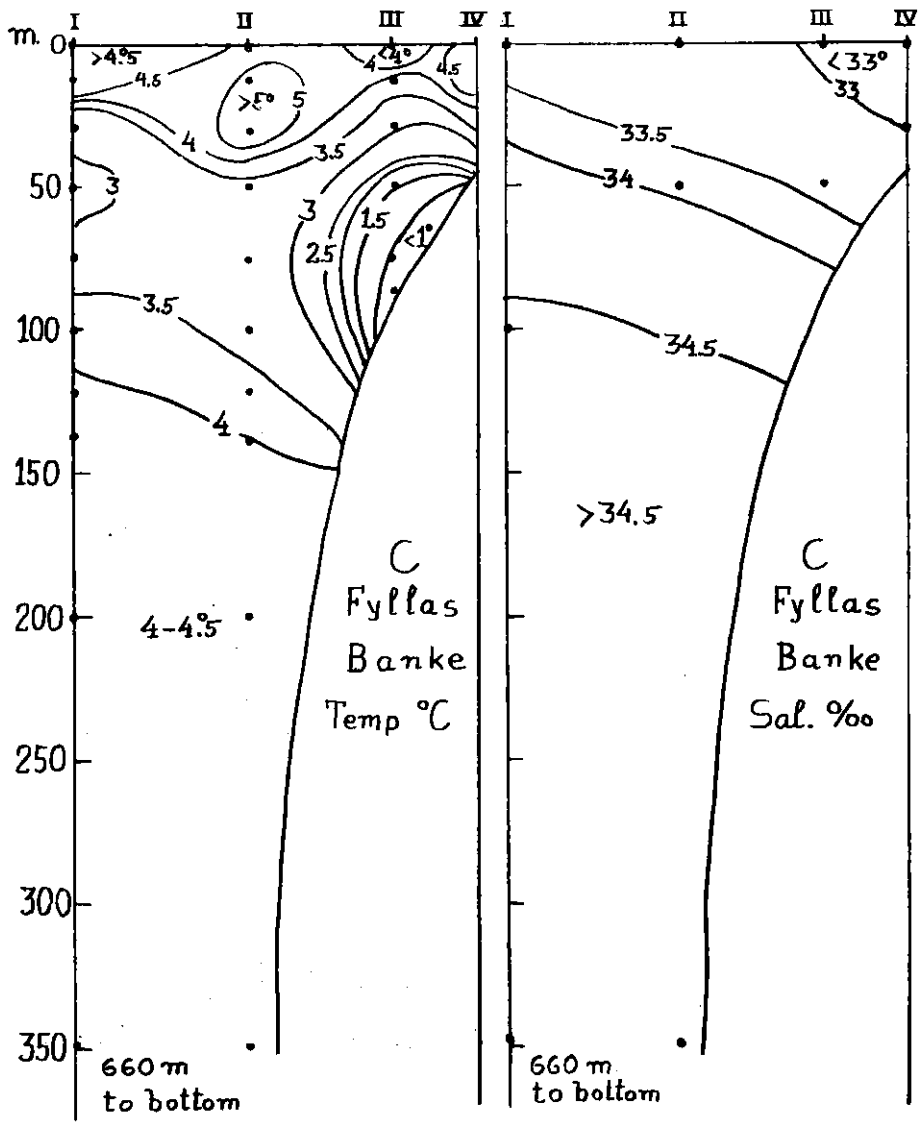


Fig. 3 C. Hydrographic Section from Fyllas Banke, 24-26 July 1954.

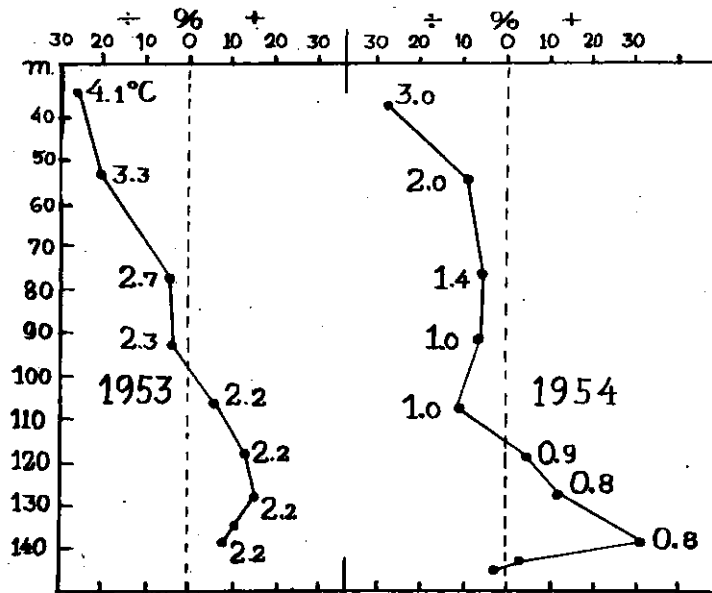


Fig. 4 Catch of cod on pelagic long-lines in different depths expressed as deviations from the mean. The average temperatures in the different depths during the fishing period are inserted.

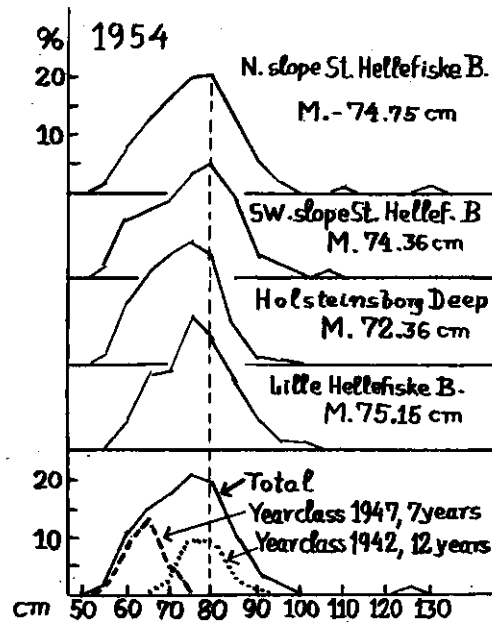


Fig. 5 Size distribution of cod caught on longlines in different areas 1954.

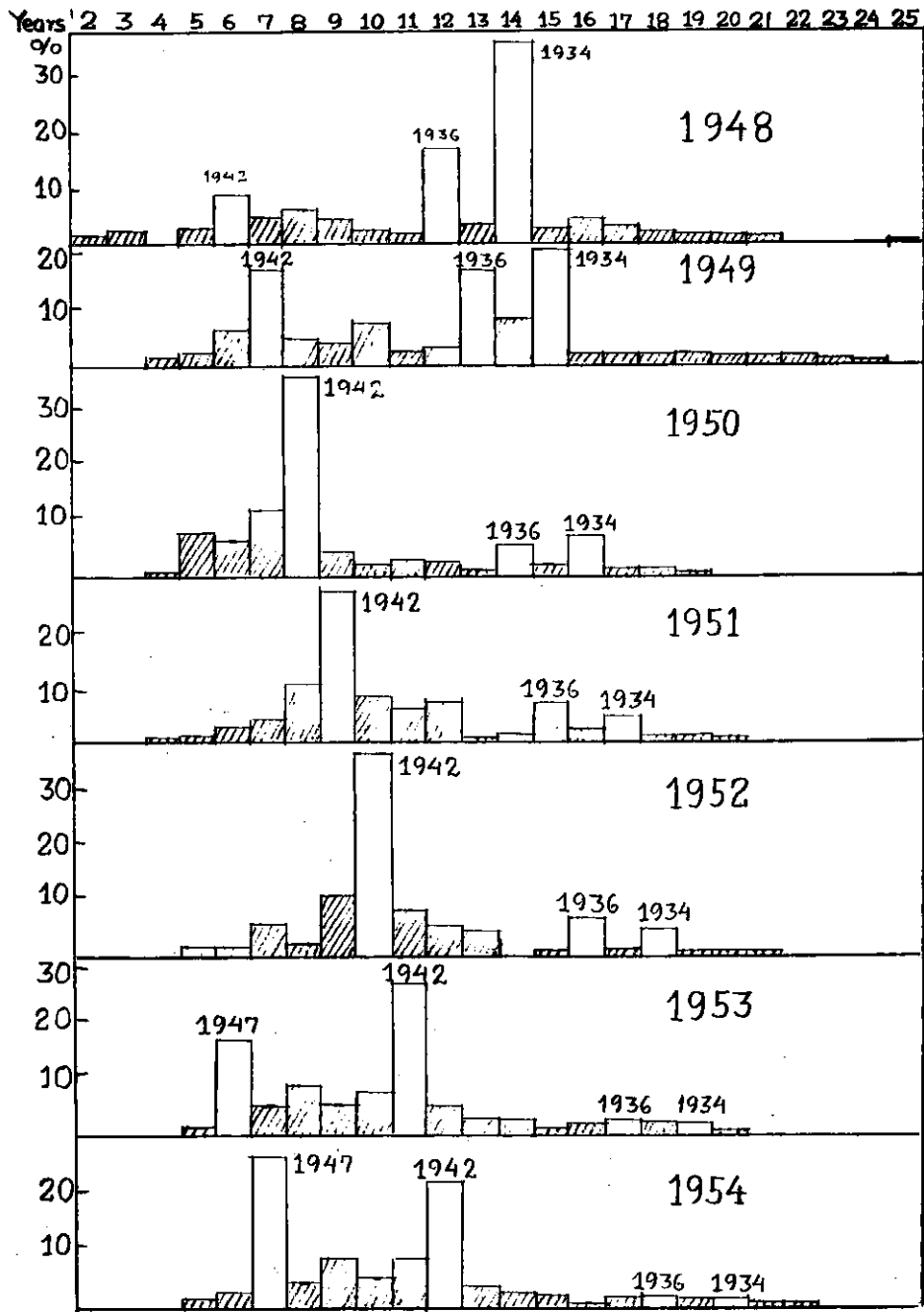


Fig. 6. Age distribution of cod in Norwegian long-line catches in the different years from 1948 to 1954.

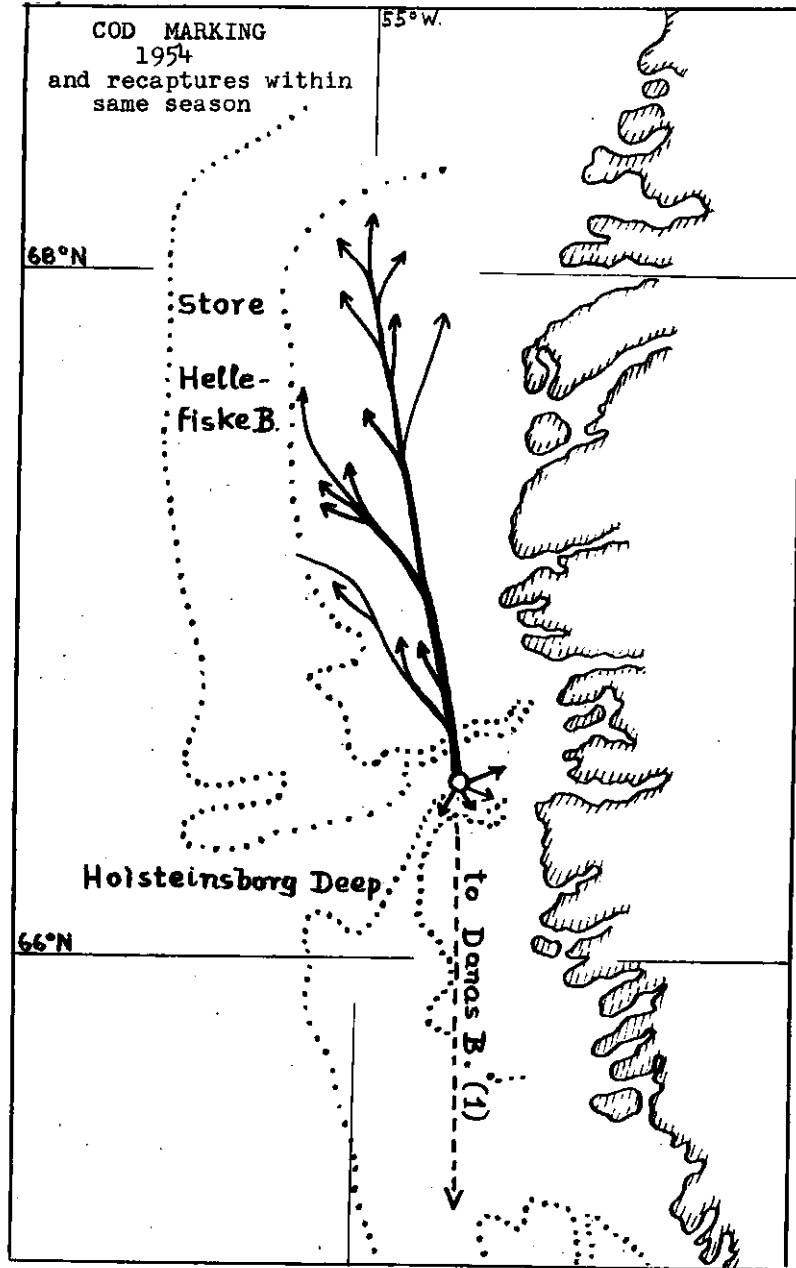


Fig. 7 Tagging of cod in 1954 in the Holsteinborg Deep with recaptures within the same season.

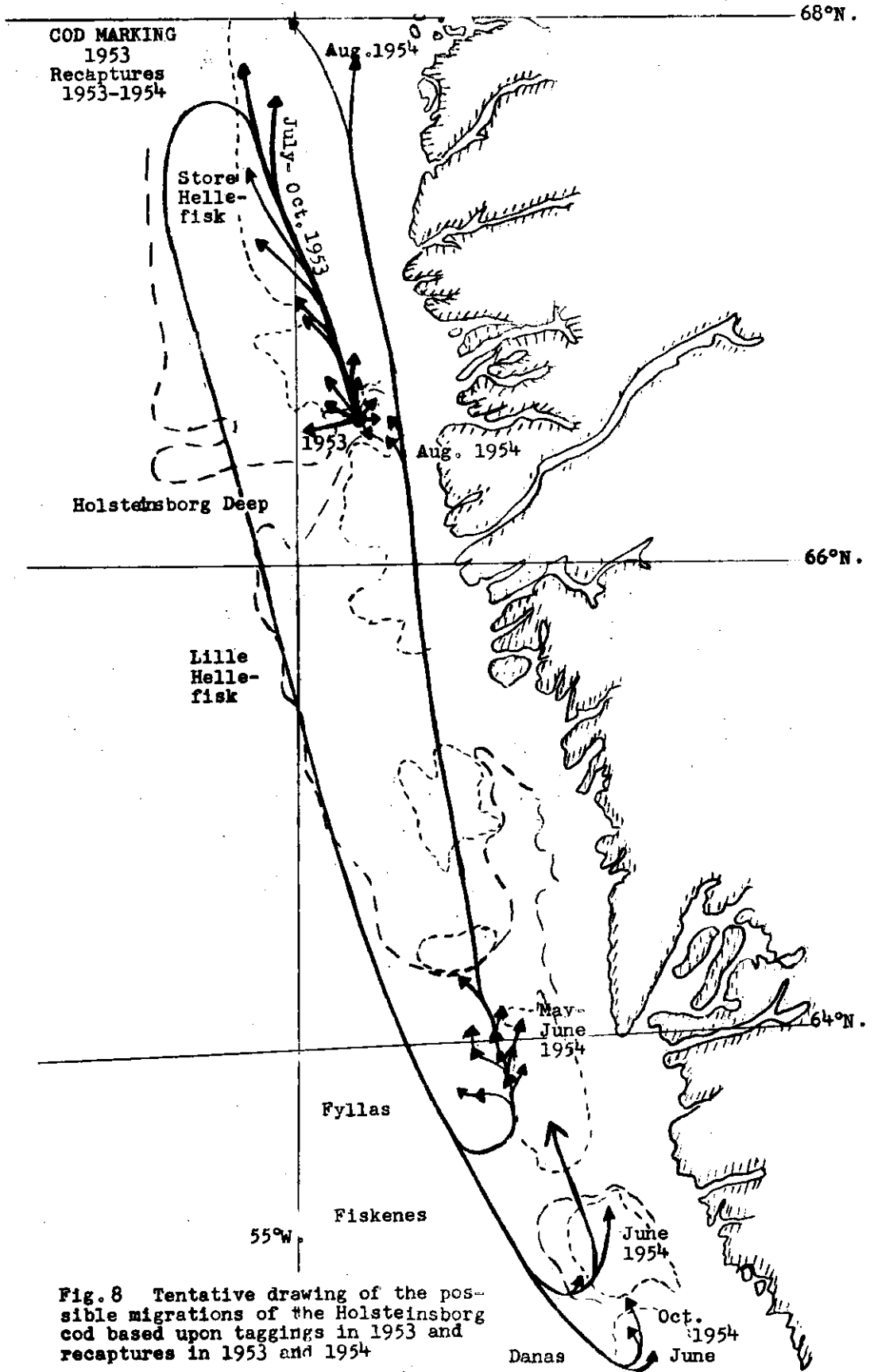


Fig. 8 Tentative drawing of the possible migrations of the Holsteinsborg cod based upon taggings in 1953 and recaptures in 1953 and 1954

