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The Handline-Fishery off West Greenland, 1957

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### The Fishery

In 1957 a Norwegian fleet of 51 long-liners fished partly on the Newfoundland banks and partly off West Greenland. The reason for this shifting of fishing grounds was that on the Grand Banks the cod was larger and of a better quality than off West Greenland. The Grand Banks were visited for the first time by Norwegian vessels in 1956 when two ships tried the fishery. In 1957 most of the ships went to the Grand Banks, and therefore the Norwegian catch of cod taken off West Greenland naturally declined in that year. It is estimated that about 6,000 tons of salted cod and 400 tons of halibut were landed from Subarea 1 as compared with 14,000 tons of salted cod and 700 tons of halibut in 1956.

The West Greenland fishery started in 1957 in early May on the southern banks between the Julianehåb and Fiskenes Banks. During the early part of the season the fishing was good and the cod was of large size. Satisfactory fishing for the long-liners on the Fyllas Bank and Banan Bank did not occur before the latter half of July. From the beginning of August shoals of cod were registered by means of echosounder both on the Fyllas Bank and off Holstenborg, where excellent catches were made with handlines in the upper water-layers. During the early part of the season the quality of the fish was rather poor with small liver content. Towards the end of August the liver content increased considerably, and the quality of the fish improved. When towards the autumn the pelagic shoals of cod were formed, the fish were feeding heavily on sand eels, fish larvae and small squid.

As in earlier years an observer was sent to West Greenland by the Norwegian Institute of Marine Research. The observer worked on board a commercial fishing vessel. Material was collected for the study of the age- and size-composition of the commercial cod catches and for the study of the temperature conditions on the banks in relation to the fishery. The temperature registrations were made by means of a bathythermograph. Three temperature sections westwards from the banks were taken on August 24-25. They showed no exceptional features compared with earlier years.

On the Fyllas Bank and southern part of Lille Hellefiske Bank, a core of cold arctic water with temperature 1.5 - 2° C. was lying along the upper part of the bank slope. On the Fyllas Bank this cold core of arctic water was lying between 25 and 100 meters, and on the southern part of Lille Hellefiske Bank between 50 and 150 meters. On the northern part of Lille Hellefiske Bank the bottom water on the bank-plateau was somewhat colder. In the particular depths along the slope where long-liners usually worked (150-200 meters) the temperatures were all above 2° C. and thus satisfactory for fishing. The temperature conditions for long-line fishing seem to have been somewhat more favourable in 1957 than in the two preceding years.

The Holstenborg Deep is of relatively great importance to the Norwegian fishing fleet. Here the cod usually concentrate in large pelagic shoals in early August. In this area the surface water usually is warm in August while the deeper water is colder, with a sharp thermo-

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cline dividing the cold and warm water masses. Earlier investigations have shown that the cod usually concentrate pelagically against the ceiling of warm surface water.

In 1957 two sections were taken across the Holstenborg Deep on August 19 and 23. The temperature observations in these sections are shown in the appended tables. The surface water in the Holstenborg Deep had a temperature above 5° C. Between 25 and 50 meters a sharp thermocline is found where the temperature drops to 3° C. with colder water below. Heavy concentrations of cod were recorded by echo-sounder in depths between 25 and 50 meters, especially in the southern part of the Deep. The handline fishing was excellent in this locality in August.

#### Cod Investigations

In 1957 were collected samples of cod caught on handlines only in the Holstenborg Deep and on the northern slope of Lille Hellefiske Bank. A few Norwegian vessels were fishing here with handlines during August. The catches varied from 3,000 to 6,000 fish per day. Altogether, four samples of cod were obtained during August 11-20 and a total of 1,091 length measurements and otoliths were collected. On August 12 the temperature in the southern part of the Deep was 6.7° C. at the surface, decreasing to 3.9° C. at the bottom (60 meters). On August 22 the surface temperature in the same locality was 5.2° C. and bottom temperature 2.8° C. A decided thermocline was present at 20 to 25-50 meters depth. The echo-sounder registered shoals of cod between 25 meters and the bottom. The handline fishing was excellent, with mean daily catches on the observation vessel of about 3,000 fish.

The age, together with maturity and size distribution, of the cod at the Holstenborg Deep is shown in Fig. 1. As indicated by the age figure, the cod in West Greenland water reach maturity at a relatively young age. In the 1957 material three individuals, or 0.3 per cent, are first-time spawners already when 6 years old. Of the year class 1950, or 7-year old fish, about 50 per cent are spawning for the first time.

In 1957 the cod were of a good commercial size for the Norwegian needs. The mean length of the fish in all samples was 73.57 cm. and mean age 8.85 years. The previous year (1956) the mean size of the cod in the same locality had been only 66.53 cm. and mean age 7.5 years.

In 1957 we find two year classes dominating in the fishery, viz. the 1947 year class (10 years old) and the 1950 year class (7 years old). The 1947 year class constitutes 34 per cent of the catch as compared with 31.4 per cent the preceding year. The mean length of this year class is 76.09 cm. as compared with 72.76 cm. the preceding year, when the same fish was 9 years old. This gives an increment of 3.23 cm. during the last year.

In 1957 the 1950 year class constitutes 23.4 per cent of the catch, as compared with 34.3 per cent in the same locality in the preceding year. The mean length of the 1950 year class is 70.29 cm., as compared with 61.52 cm. in 1956 when the cod was 6 years old, i.e. a growth increment of 8.77 cm. Such a great growth increment between the 6th and 7th year must be characterized as rather unusual. For comparison it may be mentioned that according to our material the 1947 year class had a mean length of 64.2 cm. when 7 years old, and the 1942 year class measured 70 cm. at the same age. It is possible that the rapid growth of the 1950 year class during the last year is a result of improved growth conditions in West Greenland waters during the winter of 1956-57.

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Fig. 2 shows the age composition of the 1957 samples compared with preceding years. It will appear from the figure that the rich 1942 year class, which was dominating the catches for a number of years, has now practically disappeared from the Norwegian catches. The 1947 year class is still very strong, while the 1950 year class is of increasing importance to the fishery. During the next fishing season (1958) it is expected that the 1950 year class will reach dominance and that the 1947 class will be receding somewhat. The commercial catch will therefore be composed of relatively large fish.

#### Tagging of Cod

Tagging of cod was continued in 1957. During the first half of August a total of 400 cod were tagged in the Holstenborg Deep where most of our tagging has been performed for a number of years. Of these 400 fish, only 5 were recaptured within the same season. All recaptures hitherto are from the same area where tagged.

From the 1956 marking experiments we have received altogether 59 recaptures out of 491 taggings, i.e. 12%. The locality of recaptures is shown in Fig. 3. The recaptures made during the same season show a decided northward migration during late summer and autumn. In winter the cod apparently undertake a southward spawning migration to Frederikshåbs, Danas, Fiskenes and Fyllas Banks. According to the fishermen the southward migration route is over the more shallow parts of the banks. On the southern banks, mentioned above, we have recaptures of spent fish in May and June, and also a few in July. Later in the season recaptures are made further north. According to the fishermen this northward migration has a course along the slopes of the banks. The recaptures from the 1956 taggings confirm the picture of seasonal movement of the West Greenland cod, which was indicated by the 1953 and 1955 taggings previously reported upon, namely a southward spawning migration to about 62° N. lat. in winter, and a northward feeding migration in summer to 68° or 70° N. lat.

In order to illustrate further the movement of the West Greenland cod the recaptures from the marking experiments 1953-56 are recorded as to date and latitude in Table I. From these taggings a total of 227 tags have been returned with information as to exact position and date. As indicated by the table, there obviously is a correlation between date of recapture and latitude where caught. In May and June most recaptures are registered from the southern banks, with a maximum around 63-65° N. lat. In August-September the majority of the recaptures are made in 66-68° N. lat. From these taggings only seven specimens have migrated to Iceland and one to Newfoundland. The material indicates that the West Greenland area north of 62° N. lat. is dominated by an almost separate population of cod, with a more or less closed migration pattern. Only very few cod of this true West Greenland stock seem to migrate to Iceland. For the further study of this problem it would be of the greatest interest to perform large scale taggings in the area south of 62° N. lat., for instance, near Cape Farewell, in order to study the migration pattern of the cod population found in that area.

Danish marking experiments showed that during the 1930's there was a heavy migration of cod from Greenland to Iceland. Paul Hansen in his "Studies on the biology of the cod in Greenland Waters" (1949) mentions that the great spawning migrations of cod to Iceland take place mainly from the southern districts, Frederikshåb and Julianehåb, where over 70 per cent of the tagged cod was recaptured in Icelandic waters. In my opinion there are at least two stocks of cod in West Greenland, one with a distribution pattern as shown by our tagging results, the other and southern one belonging to the Icelandic or an East Greenland stock. Some recaptures of the true West Greenland stock are also made at present in Icelandic waters, but they are rather exceptional. During the 10 years from 1948 to 1957 the Norwegian investi-

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gations have tagged a total of 3,263 cod in West Greenland waters. Of these, 431 or 13.3 per cent have been recaptured. Only 27 or 0.8 per cent of the total number of cod marked have been recaptured at Iceland. In Table II are shown the details of the annual taggings.

As will appear from the table, it is particularly from the taggings in 1950 and 1952 that many recaptures are made in Iceland. From Iceland we have also received otoliths of some of the recaptured fish. From the 1950 taggings, of which eight were taken at Iceland, we have age determinations from four fish. Three of these belong to the 1945 year class, while one belongs to the 1946 year class. Of the three recaptures from the 1952 taggings taken at Iceland, two belong to the 1945 year class and one to the 1946 year class.

As mentioned in an earlier report, the 1945 year class has been of no importance to the Norwegian long-line fishery. This is probably a year class not belonging to the true West Greenland stock, but only visitors on a feeding migration. This may be the reason for the heavy migration back to Iceland of this particular year class upon reaching the age of maturity. As regards the 1947 year class, which apparently belongs to the true West Greenland stock, not a single individual of this year class has as yet been returned from Iceland. Many individuals belonging to the 1947 year class have been tagged at the Holstenborg Deep. Thus in 1954 we tagged 431 fish at this locality, of which 30.5 per cent belong to the 1947 year class according to the sample taken simultaneously. Although we have received a recapture from Iceland from the 1954 tagging, this specimen belongs to the 1945 year class. Our tagging experiments show no indication of a large-scale emigration from Greenland of the 1947 year class.

#### Tagging of Halibut

As mentioned in earlier reports, a program of halibut tagging was instituted in the Davis Strait in 1955. This tagging program has been continued both in 1956 and 1957. During the 1957 season altogether 79 specimens were tagged over an area stretching from West Greenland to Baffins Land, Labrador and Grand Banks.

Hitherto a total of 325 halibut have been tagged in this area. From all taggings 15 recaptures have been reported, viz. nine from the 1955 taggings, five from the 1956 taggings and one from the 1957 taggings. Most of the recaptures are made in the same area where the halibut have been tagged. However, as mentioned in an earlier report, the 1955 tagging showed one halibut migrating from the Labrador coast to West Greenland waters.

A list of our taggings of both halibut and cod in 1957 is appended to this report as Table III.

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Table I. Recaptures of Tagged Cod off West Greenland - Tagging Years 1953-54-55-56

	Degrees North Latitude									To Iceland	To Newfld.	Total
	61- 62	62- 63	63- 64	64- 65	65- 66	66- 67	67- 68	68- 69	69- 70			
March	-	-	-	-	-	-	-	-	-	1	-	1
April	-	-	-	-	-	-	-	-	-	5	1	6
May	2	7	6	8	-	-	-	-	-	1	-	24
June	-	17	20	20	12	6	-	1	-	-	-	76
July	-	1	6	3	2	6	9	3	-	-	-	30
Aug.	-	-	1	1	1	29	24	2	2	-	-	60
Sept.	-	-	-	-	-	16	6	1	-	-	-	23
Oct.	-	1	-	1	-	2	1	2	-	-	-	7
Total	2	26	33	33	15	59	40	9	2	7	1	227

Table II. Summary Table of Norwegian Taggings 1948-1957 in West Greenland Waters

Year of Tagging	No. Tagged	Total Recaptures	% of Total	Recaptures at Iceland	
				No.	% of Recaptures
1948	387	50	12.9	3	6
49	143	33	23.0	4	12.1
50	300	47	15.7	8	17.0
51	200	46	23.0	3	6.5
52	124	19	15.3	3	15.7
53	512	81	15.8	4	4.9
54	431	53	12.3	1	1.9
55	275	38	13.4	1	2.6
56	491	59	12.0	0	0
57	400	5	1.2	0	0
	3,263	431	13.3	27	6.3

Table III. Cod and Halibut Tagging by Norway, Subarea 1, 1957

Cod Taggings, 1957

Yellow plastic discs fastened in gill cover with silver wire. Serial No. 5100-5499. All tagged in the Holstenborg Deep, approximate position 66° 23' W 54° 23'.

Halibut Taggings, 1957

Yellow plastic discs fastened in gill cover with silver wire. Serial No. 4546-4599, and 6000-6024.

Tag No.	Date	No. ind.	Tagging Locality
4546-4561	28/7-31/7	16	Julianehåbs Bank
4562-4574	1/8-3/8	13	Frederikshåbs Bank
4575-4599	29/8-17/9	25	Grand Banks, Newfld.
6000-6001	26/7	2	off Cumberland Sound (Baffinsland)
6002	1/8	1	off Hudson Strait
6003-6007	7/8	5	off Labrador
6008	3/9	1	Lille Hellefiske Bank
6009-6024	22/9	16	off Cumberland Sound (Baffinsland)
	26/7-22/9	79	Subdivisions 1C, 1E, 1F, 2C, 2H, 3M

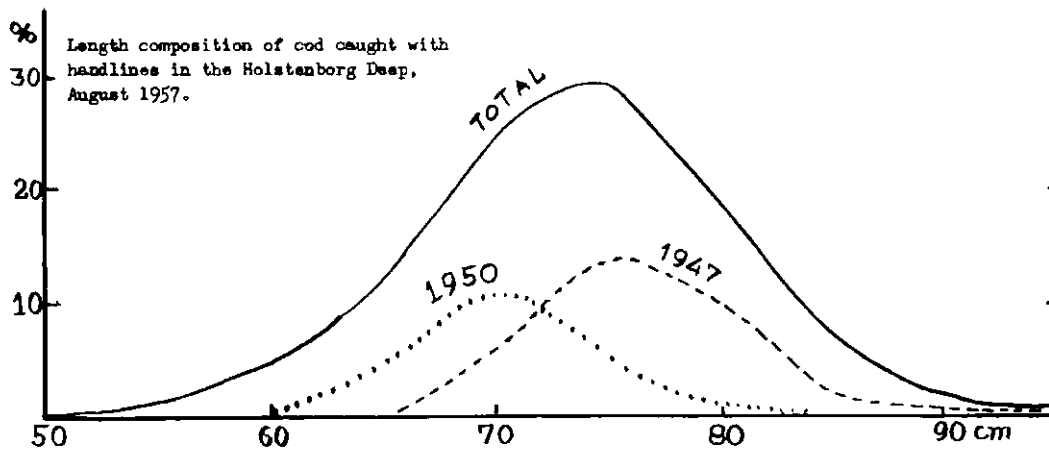
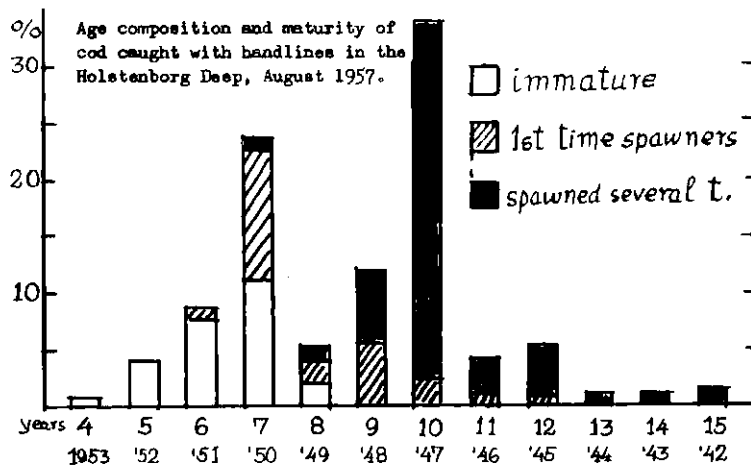


Figure 1. Age, maturity and size distribution of cod caught with handlines in the Holstenborg Deep, August 1957.

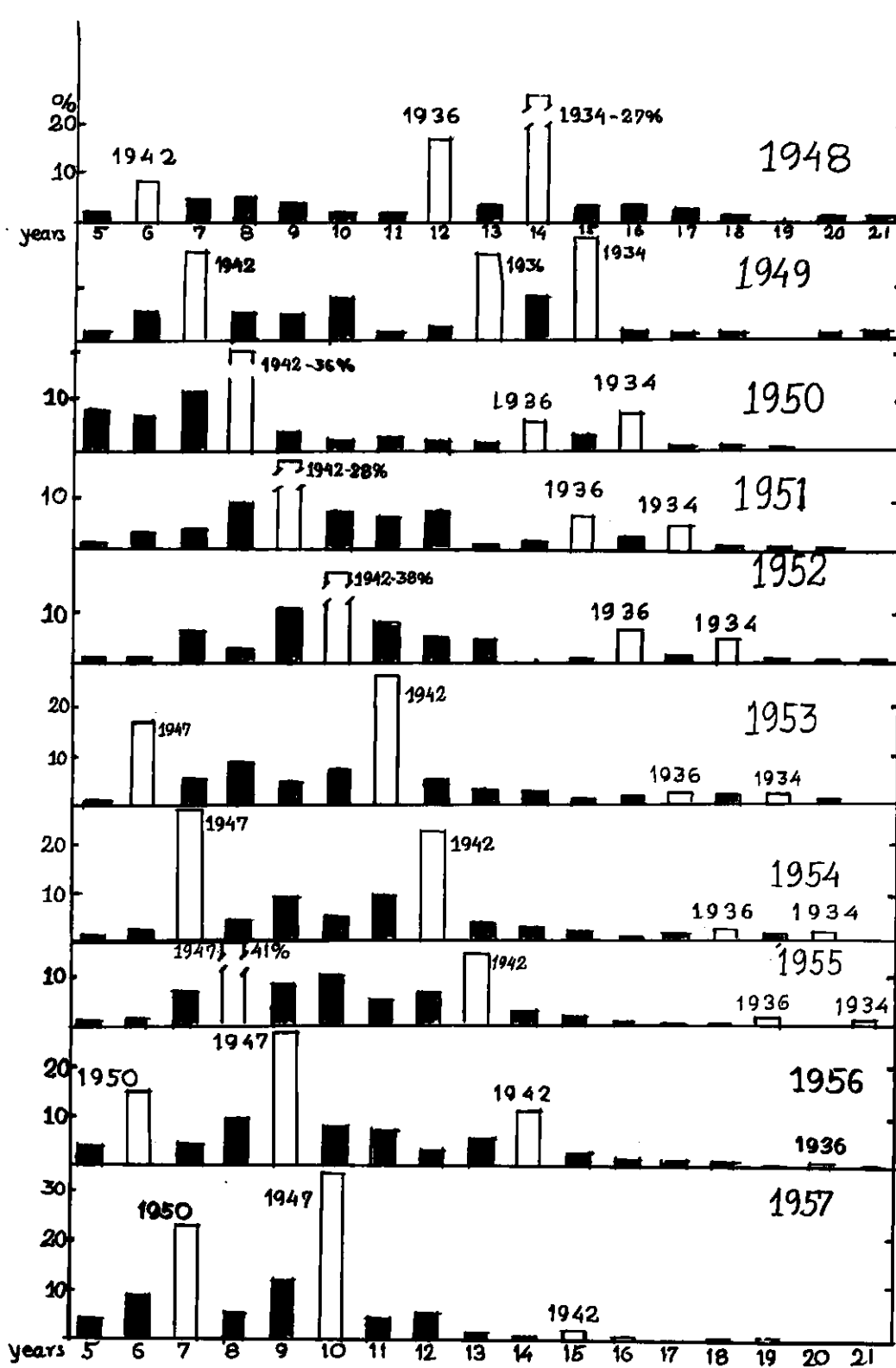


Figure 2. Age distribution of cod in Norwegian commercial catches in the different years from 1948 to 1957. (The very scarcely represented youngest and oldest age-groups not shown.)

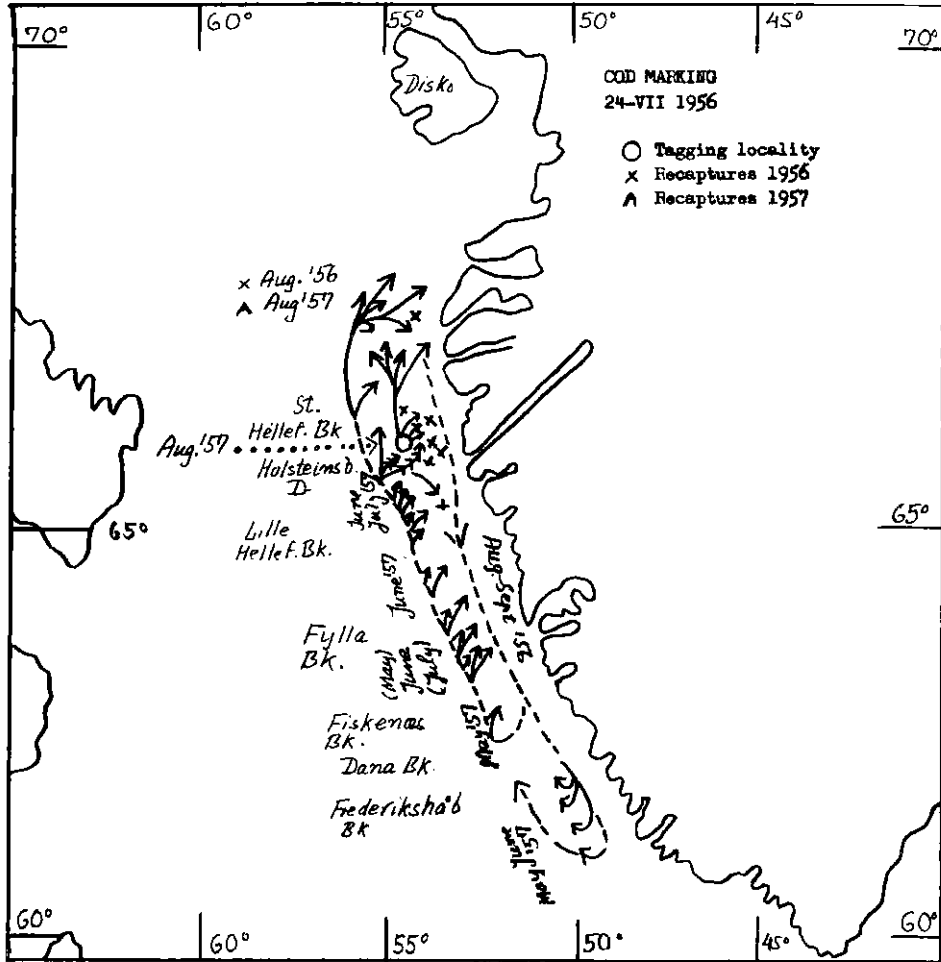


Figure 3. Migration patterns of the West Greenland cod as indicated by the 1956 marking experiments in the Holstenborg Deep.