INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

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ANNUAL MEETING - JUNE 1961

German Research Report, 1960

A. Cod Investigations[1/]

by Arno Meyer

Subarea 1

The year 1960, with landings of 92,393 tons (37.4% cod and 54.7% redfish), was the best year up to now for the German Greenland fishery. As the cod catch off East Greenland - 15,378 tons - was almost the same as off West Greenland, 1960 proved also to be the best year for cod since the beginning of the German fishery off Greenland.

1. West Greenland (Division 1C-1E)

The fishery off West Greenland came to an end around mid-January, and, due to the good fishery off Labrador only began again by the end of March, and then as a fishery for redfish. Large quantities of cod were only caught from the end of April, and no information on the age-composition of the spawning stock can therefore be given.

From April to July the rich 1953 year-class predominated in the catches, as expected, with 51% (Table 1). The 7-year old cod had reached an average length of 70.7 cm. The two younger year-classes, 1954 and 1955, were the next richest with 12 and 11% respectively. The older 1950 and 1947 year-classes, which have hitherto been the more important, were met in the area of Noname Bank where large landings were made in June. The 1950 year-class, with a mean length of 79.1 cm, accounted for 17% and the 1947 year-class (81.7 cm) for 19%; following this, the mean length of the total catch reached 75.3 cm, which is a high figure for West Greenland.

In the large December landings, the younger 1954, 1955 and 1956 year-classes predominated for the first time, totalling almost 70%. The 1955 year-class was the strongest and, at the termination of the fifth feeding season, had reached a mean length of 65.0 cm.

The spring concentration of the older year-classes on the southern banks off W. Greenland appeared again from the "Anton Dohrn" catches in the Dana Bank area. Some of the younger cod, which as a rule concentrate for spawning later in the season, were still found spawning at the beginning of May in this area. A scouting trip provided further data on the maturity and spawning conditions at the end of April. On the Lille Hellefiske Bank, where the limit of the ice was along the northern edge at the end of April, 85% of the cod between 110 and 190 m were still immature; of the remainder, 87% of the mature cod were post-spawners and 13% spawners. In the area of Fylla Bank, 150-300 m depth, 37% were immature; of the mature cod, 17% were approaching spawning, 30% were spawning, and 53% had already spawned.

Experimental hauls in the area of Fiskenaes Bank showed clearly that the ripe cod were mainly concentrated on the outer slope of the bank and in deeper water. On the inner slope of the bank, 170 m, 80% of the cod were immature, whereas on the S.W. slope, 230-320 m, 72% were mature. Spawning here, as well as on Dana Bank, was more advanced than

1/ Tables showing length and age distribution will be published in Sampling Yearbook Vol.5

Table 1 - Length and age composition of cod of West and South Greenland, 1960 (°/oo).

	Commercial samples Trawler			Anton Dohrn	Research samples Scouting Trawler					
Length cm	Fyllas-Banana Bank April-July	Noname Bank June	Banana Bank Dec.	Danas Bank May 280-300m	Lille Hellef. Bank Apr. 140-190 m	Fyllas Bank Apr. 150-300 m	Fiskenaes Bank Apr. 170 m.	Fiskenaes Bank Apr. 230-320 m.	Danas Bank Apr. 70-220m	Nanor-talik Bank May 100-270m
30-34	-	-	-	-	20	-	-	-	-	4
35-39	-	-	-	-	24	5	-	-	5	18
40-44	-	-	-	-	24	-	9	-	52	162
45-49	2	-	9	15	44	32	61	-	169	74
50-54	16	6	35	41	88	18	167	11	109	42
55-59	77	18	93	41	157	55	166	-	56	49
60-64	154	93	258	104	137	151	86	34	81	106
65-69	240	173	300	212	208	312	148	213	171	137
70-74	232	226	138	282	162	239	164	292	183	173
75-79	149	206	105	160	76	101	139	157	100	130
80-84	67	156	30	90	40	64	34	169	41	70
85-89	32	61	23	39	8	9	17	79	28	28
90-94	18	31	4	7	8	14	9	34	5	7
95-99	7	17	1	7	4	-	-	-	-	-
100-104	3	4	2	-	-	-	-	-	-	-
105-109	2	7	1	2	-	-	-	11	-	-
110-114	1	2	1	-	-	-	-	-	-	-
average length	70.9	75.3	67.5	71.3	63.7	68.8	59.7	75.6	63.3	63.6
year-class:										
1957	-	-	12	-	56	5	39	-	5	-
1956	32	1	161	7	78	50	331	9	319	263
1955	109	18	396	71	297	18	76	2	52	40
1954	118	70	131	86	158	177	49	64	41	31
1953	512	284	248	345	327	546	420	519	403	383
1952	45	57	23	61	18	106	35	44	91	52
1951	38	87	8	79	19	43	27	119	16	65
1950	58	170	7	138	27	41	10	93	45	115
1949	6	21	-	23	-	-	2	10	-	10
1948	12	43	-	26	-	-	-	-	13	-
1947	51	189	6	131	8	-	8	62	10	41
1946	1	17	3	13	-	-	1	13	-	-
1945	10	27	-	14	8	7	2	54	-	-
before 1945	8	16	5	6	4	7	-	11	-	-

on Fylla Bank; on Fiskenaes Bank 74%, and on Dana Bank 83%, had already spawned. Maturity and age investigations further revealed that the following percentages of the various year-classes had reached full maturity: 1956 - 0; 1955 - 2; 1954 - 31; 1953 - 58; 1952 - 44(!); 1951 - 75; and 1950 - 88%.

Contrary to 1960, fishery was carried out in Subarea 1 through the whole of the winter 1960/61. A successful cod fishery developed in 1D and 1C by the end of February 1961, in spite of heavy icing on the trawlers and obstruction to the fishery by low temperatures (-20°C). First and foremost, great concentrations of spawning cod were encountered in March and April at the surprisingly great depth of 350-550m.

The lower limit of the spawning concentrations was in no way established at 550m, but trawling was not possible below this depth due to adverse bottom conditions. At this depth the cod were just as dense as at 400m. The location of spawning cod at the depth of 550m, and

Table 2 - Length and age composition of cod of East Greenland, 1960 (°/oo)

	Commercial Samples Trawler				Research Samples Scouting Trawler		
	Angmagssalik Jan.-Mar.	Tordenskjold Mar.-Apr.	Fylkir June-July	Dohrnbank Sept.-Nov.	Discord-Fylkir May	Mosting May	Angmagssalik May
Length cm	°/oo	°/oo	°/oo	°/oo	°/oo	°/oo	°/oo
40-44	-	-	-	-	-	17	-
45-49	-	-	12	-	-	14	-
50-54	-	-	45	-	16	4	12
55-59	10	3	105	2	-	8	12
60-64	47	53	160	18	8	29	107
65-69	123	141	172	42	16	115	190
70-74	238	245	189	110	72	157	274
75-79	274	247	146	209	233	236	190
80-84	202	196	79	239	265	181	119
85-89	75	79	47	189	162	128	48
90-94	21	24	30	104	116	61	48
95-99	8	7	10	56	40	12	-
100-104	1	2	3	16	40	4	-
105-109	1	1	1	6	8	4	-
110-114	-	1	-	-	-	7	-
115-119	-	1	1	-	-	-	-
> 119	-	-	-	-	24	23	-
average length	76.5	76.5	70.5	82.7	85.6	79.0	73.9
year-class:							
1956	-	-	39	17	-	35	24
1955	24	2	53	36	-	-	163
1954	57	22	59	59	16	47	343
1953	200	278	375	268	48	184	187
1952	90	83	171	108	16	71	13
1951	80	105	100	70	87	63	50
1950	378	256	132	314	231	287	207
1949	104	26	15	91	56	33	13
1948		38	7		40	14	-
1947		131	16		227	179	-
1946	47	5	3	37	32	10	-
1945		40	17		119	47	-
before 1945		14	13		128	30	-

even lower, may indicate that all previous scouting for spawning concentrations off W. Greenland remained unsuccessful because the search was not carried out in sufficiently deep water or far enough to the west. The frequently established western distribution of eggs and larvae in the Davis Strait further indicates that the spawning area of the West Greenland cod reaches still more to the west, off Fylla and Banana Banks, than observed by German trawlers in 1961, and that spawning, including pelagic, occurs in the warmer water of the left branch of the West Greenland Current flowing towards Cumberland Sound. The age composition of the 1961 spawning concentrations will be considered in the 1961 report.

2. South Greenland (Division 1F)

The fall concentration of 7-year old cod of the 1945 and the 1950 year-classes promised a successful fishery off S. Greenland in fall and winter, as in the years 1952/53 and 1957/58 during the Farvel season. This promise has, however, not been fulfilled. Although occasionally large concentrations of 7-year old cod of the rich 1953 year-class were found

between Cape Farvel and Nanortalik, these concentrations were so strongly mixed with smaller and younger cod that the trawlers turned to the more rewarding fishery for redfish off S. Greenland.

In the beginning of May, a scouting trawler made rewarding cod catches close to the ice border at Nanortalik Bank, in which - as could be expected - the 1956, 1953 and 1950 year-classes predominated with 26, 38 and 12% respectively (Table 1). The maturity investigations showed again that 88% of all cod caught here in May were immature, and, contrary to the west coast, that the cod off S. Greenland (and off E. Greenland) mature considerably later, as appears from the following summary:

Percentage numbers of immature and mature cod in the individual year-classes and ages off S. Greenland.

Year-class	Age	Immature %	Mature %
1956	4	100	0
1955	5	100	0
1954	6	100	0
1953	7	89	11
1952	8	88	12
1951	9	82	18
1950	10	77	23
1949	11	60	40
1947	13	27	73

Up to 12% of the mature cod in the catches had completed spawning. Again, not one spawning or pre-spawning cod was observed in the area Farvel-Nanortalik, although at the same time spawning cod were found in the neighbouring areas (S.E.Greenland and Noname Bank). This once again confirms the earlier observation that no spawning occurs on grounds off S. Greenland hitherto fished, which can also be concluded from the hydrographic conditions. The most recent observations off W. Greenland may indicate the possibility of a S. Greenland spawning farther from the shore, either pelagic or on the lower part of the steep slope in the region of the warmer Irminger Current. The post-spawners caught at the beginning of May on Nanortalik Bank are noticeable on their return trip from the E. Greenland spawning grounds (cf. tagging results).

3. East Greenland

The 1960 landings from E. Greenland total 49,421 tons, of which cod (15,000 tons) is the highest since the beginning of the fishery in 1955.

In 1960 the rich 1950 year-class was also the most important in the late winter catches off Angmagssalik, and in the fall catches from the Dohrn Bank; however, it was reduced from 52% to 38% in the former region, and from 41% to 31% in the latter. During 1960 the importance of the 1953 year-class increased (see Table 2), particularly on the difficult fishing grounds off S.E. Greenland where this year-class was the strongest in the spawning season, March-April, (28%), and during the summer (38%).

The spawning off Tordenskjold occurred from mid-March to early May in 1960, with its maximum in the first half of April.

Samples of ungutted cod showed that landings from Tordenskjold included not only spawning cod but also, on average, 29% immature cod - some up to 13 years old. Thus, the age distribution in Table 2 is not representative of the pure spawning stock. Of the stronger year-classes, the following percentages were still immature: 1953 - 30; 1950 - 24; and 1947 - 18%. This again reveals the long period required for the maturing of the S.E. Greenland cod, and how late maturity may be reached.

Very old cod, up to 92% of them mature, were encountered on a scouting trip early in May on the exceedingly uneven and cleft Discord Bank (fished for the first time) and on Bille

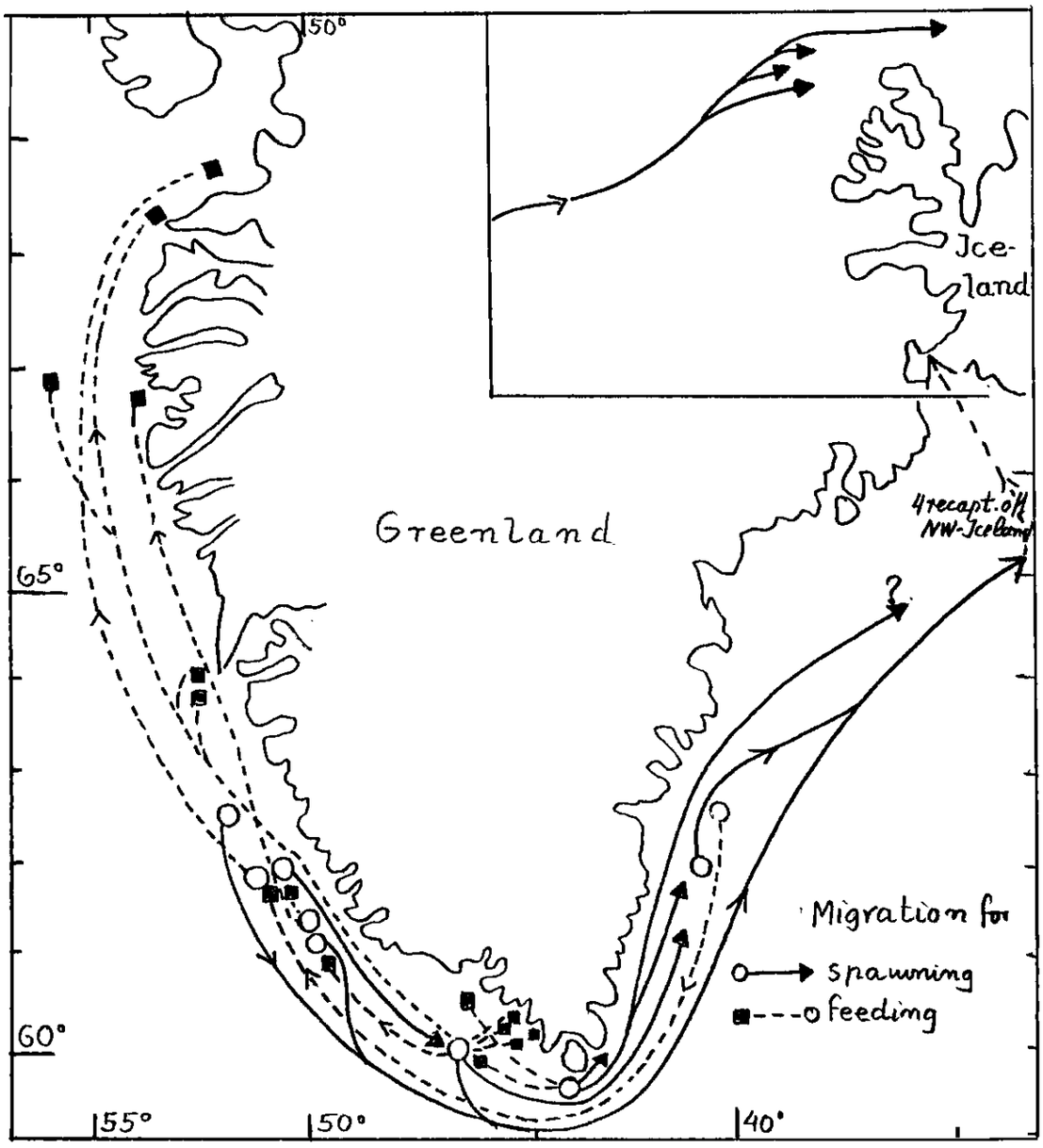

Figure 1 - Spawning and feeding migration of cod tagged off S.W., S. and S.E. Greenland in 1959/60.

Bank and Fylkir Bank (Table 2); 38% of these cod were spawning. On the Mosting ground, however, the scouting vessel observed a stock with as many as 65% immature fish, in spite of the high average age of 10 years. 73% of the 1950 year-class were still immature, and 32% of the 1947 year-class.

Among the cod caught during fishery for redfish off Angmagssalik, the 1954 year-class was the strongest; this year-class is also strong in Icelandic waters.

4. Cod Tagging

From October 1959 to October 1960, 1728 taggings were carried out off S.W., S. and S.E. Greenland (yellow DHb plastic tags with yellow or blue-white flaps) in order to study the migrations of the cod stock. Up to April 1961, 32 (1.85%) recoveries were recorded. All recovered cod had migrated as expected (see Figure 1). Cod tagged in October-December 1959, and recovered in February-June 1960, had all migrated against the current, from Dana Bank and Sermersut (S.W.Greenland), Nanortalik Bank (S. Greenland) and Bille Bank (S.E.Greenland) to northwest of Iceland. One cod tagged at Cape Farvel is probably recovered at Angmagssalik. Three others, tagged at the beginning of May or in September 1960, and recovered February-April 1961, had migrated in the same direction, from Cape Farvel and Nanortalik to Bille Bank and Tordenskjold Bank, and from Noname Bank to Nanortalik Bank.

All these cod, 8-14 years old and 71-92 cm long, were obviously on their spawning migrations to E. Greenland or Iceland.

All recoveries after the spawning season showed migrations following the current towards the feeding grounds. The longest migrations of these cod (tagged end of April-beginning of May, recovered June/Sept. 1960) were from Nanortalik Bank to Fylla Bank and N. St. Hellefiske Bank, and from Sermersut and Noname Bank to Holsteinsborg and Disko Bay.

Also from S.E. Greenland cod migrated west in early summer; one cod, 94 cm long, migrated as far as 430 miles (Fylkir Bank to Noname Bank) in 27 days. These feeding migrations, which also include the summer migrations to the coast and the fjords (German taggings), are carried out by both old and young cod (4-10 years).

B. Ice Conditions and Hydrography

by Arno Meyer

The varying ice conditions were studied during the scouting trips in December/January and April/May. During both trips the W. Greenland waters were completely ice free, except for a few bergs. At the end of April the northern ice border was along the north edge of Lille Hellefiske Bank. The early ice-covering off S. Greenland was surprising. In December 1959 the ice-tongue already reached 47°W and southwards to 58°40' N.

The ice conditions along the S.E. Greenland fishing grounds are dependent on the quantity of ice floating south from the Polar Sea and the E. Greenland fjords and, first and foremost, on the wind conditions as the ice is very wind-labil. Long-lasting west winds force the S.E. Greenland winter ice formations far towards the east over the continental slope, thus obstructing the fishery. Long-lasting east and north-east winds, however, press the ice toward the coast, leaving the banks ice-free. Prevailing north winds further the moving of ice from S.E. Greenland and impair the ice conditions off S. Greenland. The extent to which the wind can alter the ice-border in a short time appears from Figure 2.

The first extensive German winter trawl fishery off S.E. Greenland was mainly due to a favourable distribution of air pressure. In November 1959 and February 1960 particularly, the unusually high air pressure over S. Greenland, and also the unusually low air pressure over the eastern Atlantic, caused long-lasting N.E. winds (see Figures 3 and 4 showing mean air pressure, position of anomaly-centers and resulting winds).

In the future, it will be of interest to study the influence of the yearly variations in mean air pressure distribution on the fishery and possibly on the varying size of year-classes of recruits.

The measurements of temperature made during the scouting trips clearly show the relation between bottom-temperature and catch. Large cod concentrations were found in early winter and in spring with temperatures of over 3°C. Good catches of redfish were only made with temperatures above 4.15°C, mostly from 4.7 to 5.6°C.

The highest bottom temperatures off W. Greenland were found on the northern banks, 5.3°C from 250m and deeper on the western Banana Bank (23 Dec. 1959) and 5.0°C at 210m and deeper on the western part of Lille Hellefiske Bank (25 April 1960).

The temperature sections off S.E. Greenland (60°N-61°15' N) at the beginning of May 1960 show that the fishing grounds are situated in the area of the warm Irminger Current (Figures 5 and 6), that the temperatures increase rapidly with deeper and more offshore water, and that spawning of cod can only be expected at great depths.

C. Haddock

by Arno Meyer

Until now few haddock have been caught off W. and S. Greenland and, so far as is know these are all large fish - 50-75 cm. During a tagging trip, end of September-beginning of

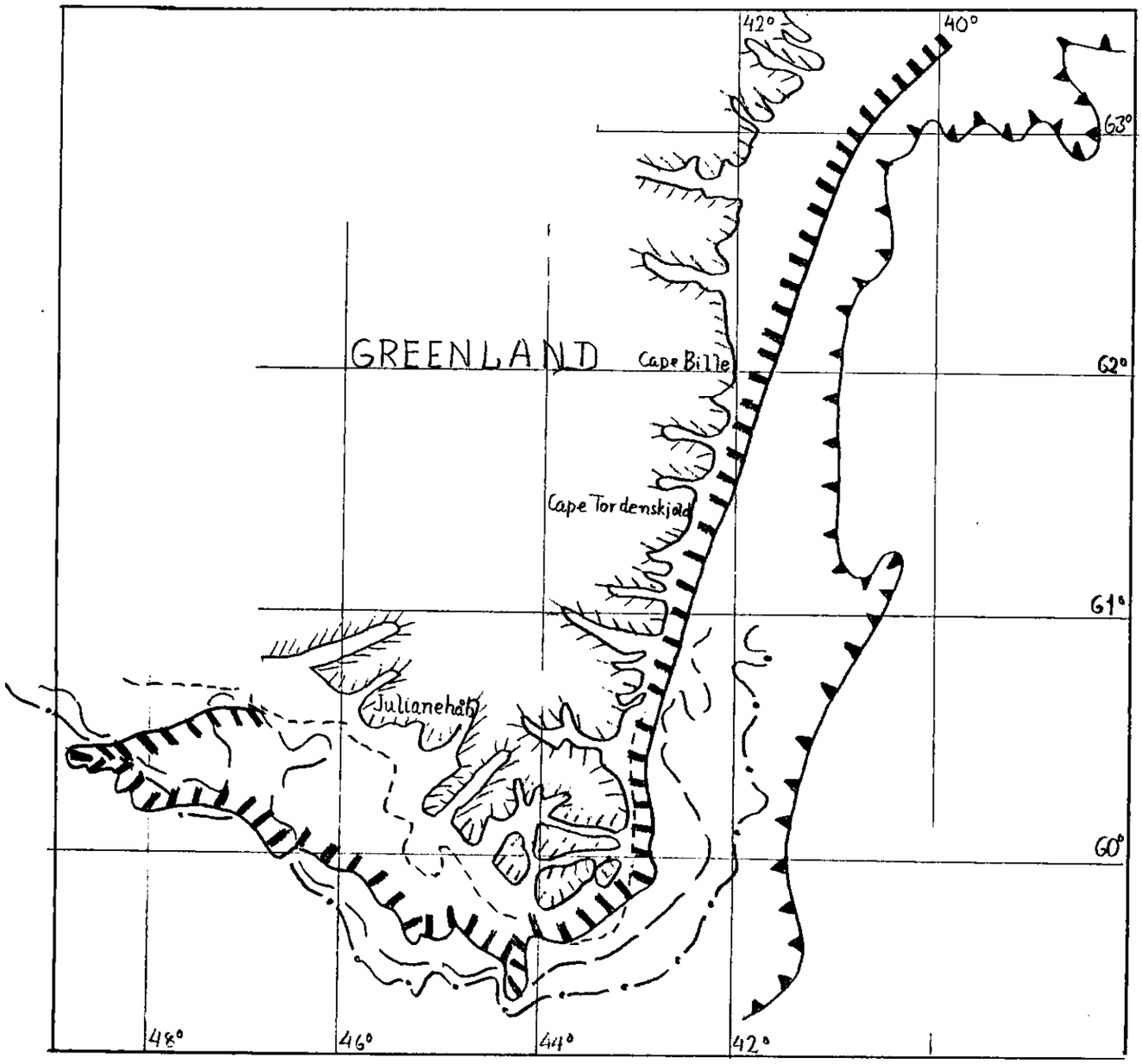

Figure 2 - Boundary of ice off S.E. Greenland, 19-21 April 1960 and 2-9 May 1960.

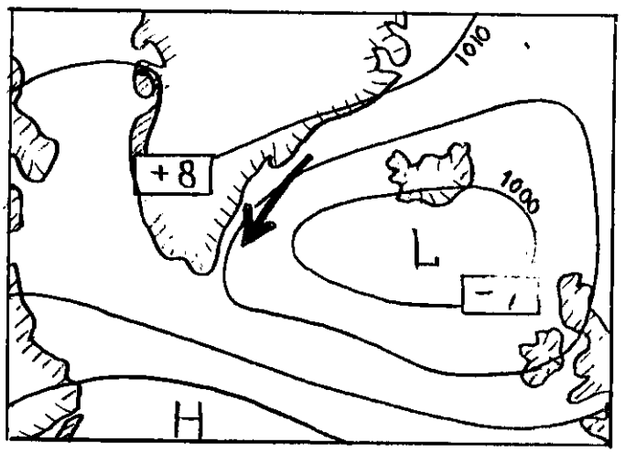

Figure 3 - Mean atmospheric pressure (in mb) and position of centres of anomalies in November 1959.

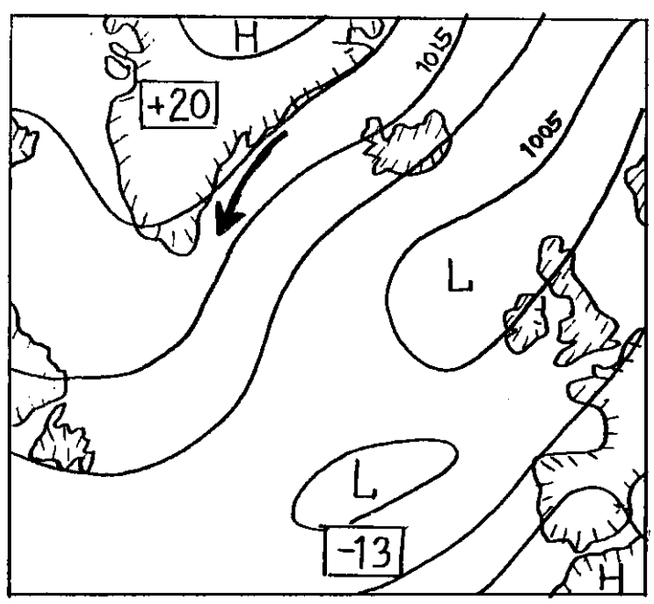

Figure 4 - Mean atmospheric pressure (in mb) and position of centres of anomalies in February 1960.

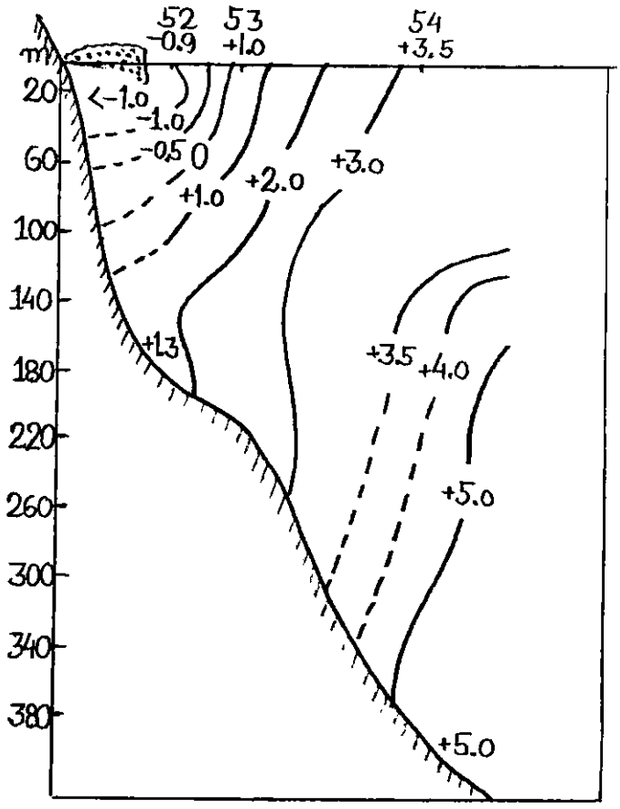

Figure 5 - Hydrographic section off S.E. Greenland, 60°N.

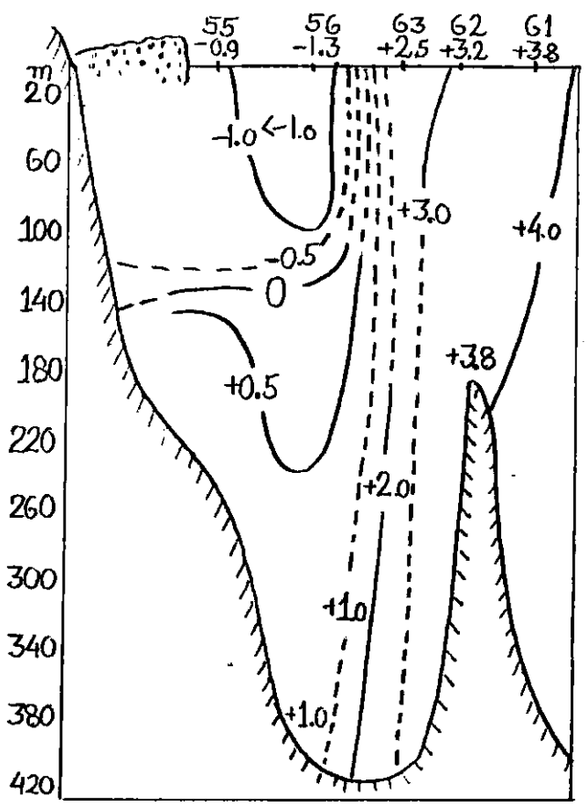

Figure 6 - Hydrographic section off S.E. Greenland off S.E. Greenland, 61°15'N.

October 1960, a number of small haddock (up to 25 in a haul) were caught in several cases. These haddock were 1-3 years old, mostly 2 (see Table 3) with the following sizes: I-Gr. - 25.4 cm; II-Gr. - 34.6 cm; III-Gr. - 43.0 cm. The growth had been rather fast; at the end of November 1960, the same age-groups in the Barents Sea were only 24.6, 30.4 and 40.2 cm long. The otoliths were readable but the winter zones were not so clear-hyaline as in haddock from Iceland and the North East Atlantic. This is surprising as the Greenland cod present clearly readable otoliths with well-developed winter zones.

Table 3 -

Length (cm)	°/oo	Year-classes	°/oo
20-24	77	1959	207
25-29	115	1958	557
30-34	321	1957	165
35-39	282	1956	32
40-44	51	before 1956	39
45-49	51		
50-54	64		
55-59	--		
60-64	26		
65-69	--		
70-74	13		

D. German redfish investigations in the ICNAF Area

by A. Kotthaus

Racial investigations on redfish were continued in 1960 and extended over the whole distribution area. In this connection all German redfish landings at the Bremerhaven fish market were registered according to type composition. The number of landings investigated was as follows: Subarea 1 (West Greenland) - 62; Subarea 2 (Labrador) - 84, Subarea 3 (Newfoundland) - 17; Total - 163. In addition, gill-raker counts were carried out on 411 fish from Subarea 1, 201 fish from Subarea 2 and 150 fish from Subarea 3. Measurements of fish and sampling of otoliths were continued as follows: Subarea 1: 16 samples, 4,997 measurements, 1,006 otoliths; Subarea 2: 6 samples, 1,611 measurements, 115 otoliths; Subarea 3: 4 samples, 987 measurements, 334 otoliths; Total: 26 samples, 7595 measurements, 1455 otoliths

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(continued)

ANNUAL MEETING - JUNE 1961

German Research Report, 1960

Subareas 2, 3, 4

by Joachim Messtorff

Field work was restricted to one search-trip in April/May 1960, and market sampling was carried out during the German trawl season in Northwest Atlantic waters. Because of a change in the expert staff detailed results of the investigations are not yet available but will be communicated in the next report (1961).

Subarea 2

In the middle of May 1960 a scouting trawler visited the Sundall area but at that time no noteworthy catches could be taken. From November 1960 till March 1961 German trawlers fished in the Sundall- and Hamilton Bank area (2J). At the beginning of the season catches of redfish as well as of cod were rather moderate and during December the trawlers mostly preferred the Newfoundland- or Flemish Cap area. But at the end of December fishery off South Labrador became more successful and especially the increasing proportion of cod is to be noted. Already in the season of 1959/60 a remarkable increase of cod landings from Labrador was observed. In January and February 1961 the proportion of cod reached a still higher level as at the same time of the year before with 60-80% of the landings. From several trips cod constituted even more than 90% of the landings.

Subarea 3

During the search trip in April/May 1960 fishery conditions in Divisions 3K, 3L, 3N, 3O, and 3P were examined. The proportion of cod in the catches in Divisions 3K and 3L was only about 3% and the fish were rather small (mean length 49.8 cm). Redfish catches too were not very successful (mean catch per one hour 1.5 t).

In October and December 1960 and January 1961 German trawlers fished for a time in Divisions 3K, 3L and 3M, mainly for redfish. Only in October there was a marked increase of the proportion of cod (30-40%) in the catches from the Newfoundland area.

At the southern part of the Grand Bank and off the south coast of Newfoundland fishery conditions were found unsatisfactory by a scouting trawler in late April 1960 (Division 3N, 3O and 3P). Catches of cod (mean length 55.2 cm) and haddock (mean length 43.3 cm) and coalfish (mean length 81.6 cm) proved not sufficient for a profitable commercial fishery. Redfish of this area were too small for German market conditions.

Subarea 4

On the same search trip in April 1960 fishing conditions in the Gulf of St. Lawrence as well as on the Nova Scotia Shelf have been examined. At that time the French and Portuguese salt-fish trawlers, which are usually fishing for cod in March/April in Division 4R, had already left the fishing grounds. The search fishery in 4R confirmed the poor density of cod at that time. Off Cape Ray and off Cape St. George (4R) catches of cod amounted only to about 1-1.5 t per hour trawling (mean length 56.3 cm). Somewhat better conditions were found off Cape Breton Island (4V North) with a mean catch of cod of 3 t per hour trawling (mean length 51.6 cm) All mature cod were found in advanced gonad stages (stage III-V). Search fishery in Div. 4S and 4T was completely unsuccessful. Also experimental hauls on the Nova Scotia Shelf (Div. 4V South and 4W) yielded only small catches of cod, haddock and coalfish which were not sufficient for a commercial fishery by German trawlers.