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German Research Report, 1965

Subarea 1 and East Greenland

by Arno Meyer

A. Status of the Fisheries

I. General

Fishing was again carried out off West Greenland throughout the year. In 1966 there was a further decrease in nominal catch to 83,000 metric tons (Table 1) which is only 51% of the 1962 catch. For the last 5 years, the catch per fishing day has decreased steadily from 30.5 tons in 1962 to 21.7 tons in 1966. The decrease from 1965 to 1966, however, was less pronounced than in preceding years. But this cannot be taken as a first sign that the Greenland fish stocks have recovered somewhat. This lessening of the decrease in catch per effort can only be ascribed to the further decrease in numbers of side trawlers fishing off West Greenland, the rapid increase of stern trawlers (more fishing hours per day fished than of side trawlers) and factory ships, the increase of average gross tonnage (Table 3), catching power, daily capacity for production of frozen products and fish meal, and, as a consequence of the increase in capacity of the fish meal plants, a decrease in discards.

Also, off East Greenland, the nominal catches decreased considerably to 32,000 tons, only 45% of the 1964 top landings and the lowest yield since 1959. The catch per fishing day which decreased from 24.7 tons in 1962 to 17.5 tons in 1965, for the first time in 1966 remained at the same level.

With a total output of only 134,000 tons (1963: 251,000 tons) from both East and West Greenland, Greenland lost its top position in the German fishery to the fishing grounds off Iceland.

II. Cod

A total of 83,000 tons of cod, 54% of the 1963 catch, were caught in Subarea 1. The share of cod fished on the northern banks in 1B and 1C was somewhat lower than in the preceding year. Fishing for cod in Div. 1E and 1F increased. The catches of cod off East Greenland, 7,200 tons only, were the lowest since 1959 and were only 25% of those in 1964.

III. Redfish

The catches of redfish off West Greenland decreased from 58,000 tons in 1962 to 15,000 tons in 1966. The catch per fishing day decreased steadily from 14.9 tons in 1959 to 3.1 tons in 1965. In 1966 it was 3.2 tons. This leveling off of catch per effort is due partly to some stabilization at a low level - experienced too in other redfish fisheries - and partly to the fact that in 1966 the southern Div. 1E and especially 1F (these divisions are nearer to the breeding area in the Irminger Sea) were fished more heavily than in 1965. About 51% of all redfish fished in Subarea 1 came from Div. 1F.

Off East Greenland also the redfish catches dropped by 11,000 tons to 23,000 tons in spite of the increased market demand. The catch per fishing day seems to stabilize at a level of about one-third of that of 1955, when fishing for redfish began off East Greenland. It is also interesting to note that the percentage of industrial redfish in the catches has grown steadily over the last 5 years (Table 1). This is obviously a sign that the percentage of small unmarketable redfish is increasing.

Table 1

German nominal catches in tons (industrial fish included) off Greenland, 1962-1966

	Year	days fishing	Cod catch per fish.day	% ind.cod	Redfish catch per fish.day	% ind.redfish	Total catch per fish.day	% ind.total
West Greenland (Subarea 1)	1962	6584	20.3	5.1	57,902	5.2	200,932	7.7
	1963	7,175	21.3	4.2	44,355	4.7	202,923	8.6
	1964	5639	19.1	7.7	22,933	10.2	137,794	10.9
	1965	2232	16.2	13.3	19,473	10.3	131,443	11.7
	1966	4696	17.7	12.8	14,911	6.1	102,029	13.1
East Greenland	1962	1,960	8.6	0.5	25,059	1.2	40,999	1.2
	1963	2,182	6.3	0.5	31,339	1.1	17,700	2.1
	1964	3,287	8.9	0.2	29,154	1.5	71,364	2.5
	1965	2,734	4.3	0.6	23,434	1.3	47,577	4.4
	1966	1,827	4.0	0.7	23,299	3.3	32,006	6.0
Total Greenland	1962	8,244	17.9	4.6	83,961	4.0	241,931	6.6
	1963	9,357	17.8	3.9	75,723	3.9	250,623	7.4
	1964	8,926	15.4	6.1	61,110	6.8	209,158	8.0
	1965	6,966	13.8	12.1	51,967	9.0	179,522	11.9
	1966	6,523	15.8	11.8	38,133	6.2	134,035	11.4

Table 2

Discarded fish in Subarea 1 in 1966

	Cod	Redfish	Spec. unknown	Total
1B	155	-	-	155
1C	258	25	24	307
1D	376	13	58	447
1E	39	15	29	83
1F	175	53	64	272
Total 1003	86	175		1264

Table 3

Average gross tonnage of German trawlers fishing in Subarea 1 from 1962 - 1966

1962	852 BRT	(589 - 1561)
1963	864 BRT	(566 - 1561)
1964	890 BRT	(648 - 1561)
1965	1015 BRT	(651 - 2557)
1966	1094 BRT	(537 - 2557)

IV. State of Fisheries in the first 4 months of 1967 and forecast for the remainder of 1967

Poorer catches than ever before experienced were made during the last 5 months of 1966. Monthly averages for the catch (without industrial fish) per fishing day was down to 11.5 and 11.4 tons. In the first 4 months of 1967, however, big concentrations of cod were found. The fishery was carried out in the beginning in 1D and the southern part of 1C, later mainly in Div. 1E. At the same time heavy ice drift hampered the fishery off Southeast Greenland. In March/April 1966 big concentrations of spawning cod were fished in deep water down to 750 m far west of Banana Bank but in 1967 shoals of spawning cod were reported only from Bille and Fylkir Bank and from the Heimland Ridge.

In 1967, the strong 1961 year-class, which is already very heavily fished, will be the only year-class of real commercial importance. Owing to the weakness of the following year-classes the cod fishery off Greenland will experience a difficult situation, especially during the second halves of the coming years, when the cod are widely distributed on their feeding grounds. There seems no hope that the redfish, even those not off East Greenland, could fill to some extent the coming gap in the fishery for cod.

B. Special Research Studies

I. Environmental Studies

1. Hydrography. Little hydrographic work could be done during the net-selection studies carried out from R/V Anton Dohrn in October 1966. Although a direct comparison with the preceding year is impossible, for in 1966 the temperatures were measured one month earlier, it nevertheless may be said that the Atlantic component of the West Greenland Current flowing northward along the slope had about the same temperature (up to 6.3-6.4°C) as in 1965. However, this warm water lay considerably deeper than in 1965 (Fig. 1 and 2). Thus the banks in 1966 were covered by cooler water. This holds true especially for the southern banks, covered by water of 2 to 4°C against 4 to 6°C in 1965. Off Nanortalik Bank the 6° isotherm was found in October 1966 at more than 600 m, while, in November 1965, it was found at 160 m! On the western slope of Fyllas Bank, in 1966, water of 6°C was found beyond 500 m, in 1965 Atlantic water with 35‰ salinity reached northward as far as Danas Bank at a depth of 300 m.

II. Biological Studies

1. Cod

a. Age and size of cod in commercial stock in Subarea 1. The age determinations of the 1966 catches made by factory trawlers, some wet-fish trawlers and by R/V Anton Dohrn, verify the findings of the 1965 research report that the rich and promising 1960 year-class was so heavily fished during its immature stage that it was not able to provide the expected yields in 1966 when spawning for the first time. The predominant year-class in the fishery off West Greenland in 1966 was the strong but still immature 1961 year-class. It was obviously strong in both Greenlandic stocks.

Only in the fishery for real concentrations of spawning cod (to the west of Banana Bank in very deep water down to 750 m) and in the fishery for shoals of post-spawners in May/June in Div. 1E (partly returning from spawning off East Greenland) did the 1960 year-class make up 30 to 50% of the catch (Fig. 3). The older strong West Greenlandic 1957 and 1953 year-classes had only very little commercial importance.

In all other fisheries the 1961 year-class was predominant especially off Kitsigsut (west of Cape Farewell), when in the second half of the year almost nothing but 5-year-old cod were found. The percentage of this year-class varied between 87 and 96% (average 93%), an unusually high figure, never found before, and very characteristic for the present state of the stock of cod off Greenland.

The catches made by R/V Anton Dohrn for selection studies and the studies on board a factory ship (Fig. 5) provided a good opportunity to study

the strength of the 1962 and 1963 year-classes. Both year-classes are, at best, moderate and probably poor. On Fyllas Bank the 1963 year-class was stronger than the 1962 year class; off Thorvaldsen it was the opposite.

When fishing with a mesh size of 110 mm (manila), all cod of 3 and more years of age are retained by the net. All 3-year-old cod and at least 50% of those of 4 years of age are so small, however, that they cannot be filleted and must be turned into fish meal or be discarded (Fig. 5). On board wet-fish trawlers even a considerable quantity of the 5-year-old cod is too small for the wet-fish market. The pending increase in mesh size to 130 mm (manila) will have very little effect and will only allow the smaller 3-year-old cod to slip through the meshes except when a poorly adjusted chafer hinders them from doing so.

Tables 1 and 3 show the percentage of industrial cod (cod turned into fish meal) - it must be stressed that the figures in Table 1 given for the percentage of "industrial fish" are minimum figures - increased steadily to 1965. In 1966 the share of industrial cod was a little lower. This can be ascribed to four reasons: 1) In 1965, the strong 1961 year-class made up the bulk of the industrial cod; 2) In 1966, the 3- and 4-year-old cod were less in number; 3) In 1966, all factory ships had "succeeded" in getting machines for filleting small cod; and 4) In 1966, the number of wet-fish trawlers fishing in Subarea 1 decreased further.

Considering that, to 1966, all year-classes which follow the rich 1961 year-class are probably poor, it is more than regrettable and also very uneconomic for the future international yield of the cod fishery in Subarea 1 that, with 110 mm and even with 130 mm mesh size, so many small cod of these incoming poor year-classes are wasted (discarded or turned into fish meal). Owing to the very fast rate of growth during the immature stage, even these poor year-classes could still give a relatively good yield if given the chance to grow and become 6 years of age (see ICNAF Res.Doc.67/55: Meyer, A.; The estimation of efficiency of use, a simple method to show how fishery should be carried out to get the highest output from fish stocks).

(b) Onset of maturity of cod in Subarea 1. In the winter of 1965/66 and of 1966/67, several samples of ungutted cod were examined to determine the age at first maturity. According to our findings the percentage of mature cod was as follows:

Year-class	1962	1961	1960	> 1959
Age-class	V	VI	VII	> VII
percentage of spawners	9	61	90	100

The fact that 61% and 90% of the strong 1961 and 1960 year-classes spawned in March/April 1967, was the main reason for the exceptionally good fishing results off West Greenland during the first four months of 1967. Probably this will have been the best winter season off West Greenland for many years to come! If the two successive strong year-classes, the 1961 year-class apart from this rich also off South Greenland (East Greenlandic origin), had not been fished so hard as small immature fish, the 1967 winter season would probably have broken all previous catch records for the cod fishery off West Greenland.

(c) Age and size of cod in commercial stock off East Greenland. Since 1959 the output of cod fishery off East Greenland has never been as small as in 1966 (Table 1). Since most of the East Greenland cod spawn at 8 years of age, the 1958 year-class (Fig. 4) was, as expected, predominant (by weight) in 1966. The average length in late winter of 1966 was 77.2 cm off Southeast Greenland and 83.5 cm on Dohrn Bank. Compared with the exceptionally rich East Greenland 1956 year-class, the 1958 year-class was, at best, moderate. On Dohrn Bank the 10-year-old cod of the 1956 year-class were - owing to its weight and length of 90 cm - still of great commercial importance. Off Southeast Greenland, the 1961 year-class, still immature, was predominant numerically.

2. Redfish. No special studies on redfish were carried out. When possible, small redfish were collected for age studies.

III. Studies on Selectivity

Again studies on selectivity - in 1966 by R/V Anton Dohrn - were carried out. For reports of these studies see:

Res.Doc.67/31, H. Bohl: Selection of cod by bottom trawl codends in Southwest Greenland waters;

Res.Doc.67/32, H. Bohl: Selection experiments with a large-meshed topside chafer.

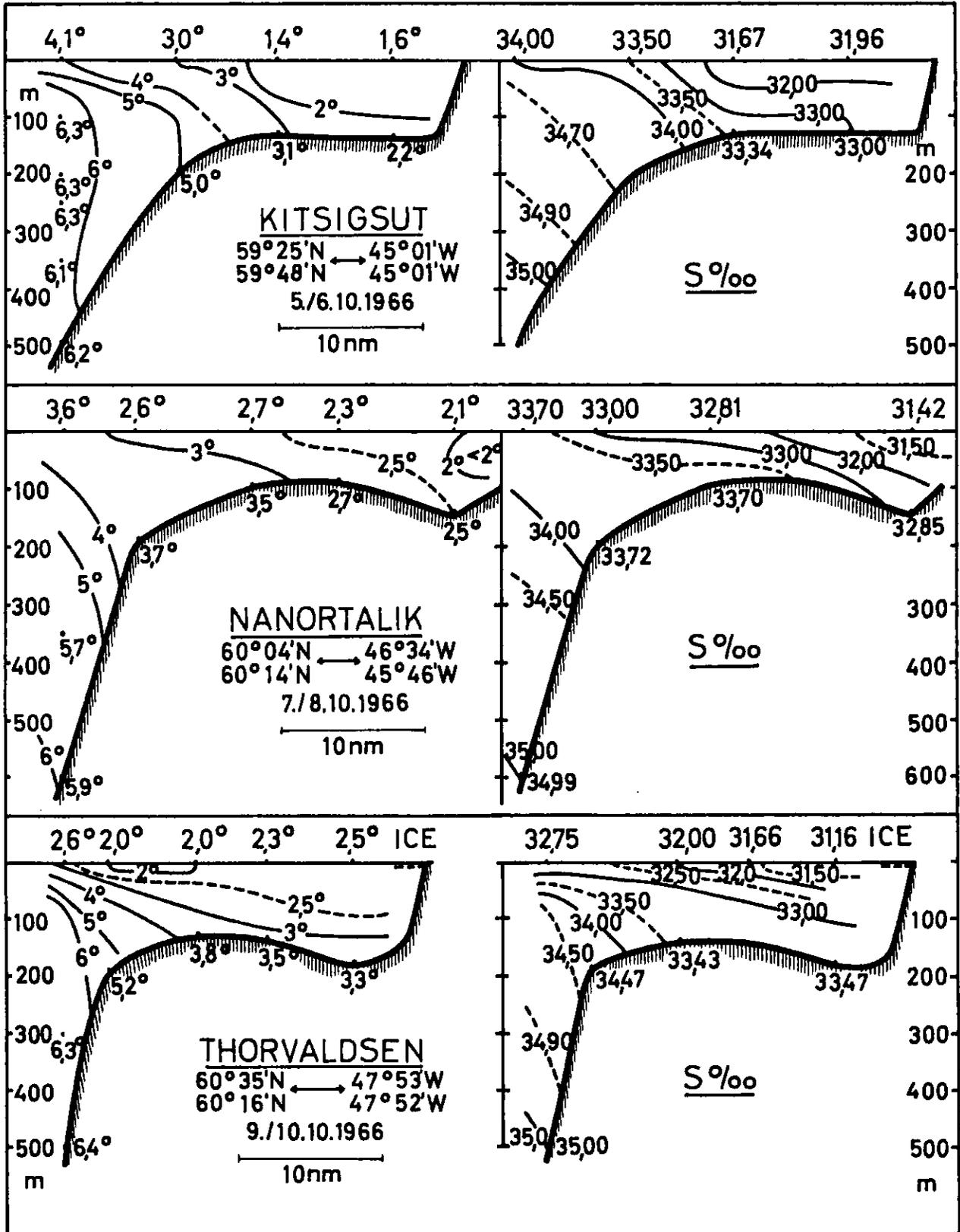


Fig. 1. Hydrographic sections off South Greenland (temperature and salinity) in October 1966.

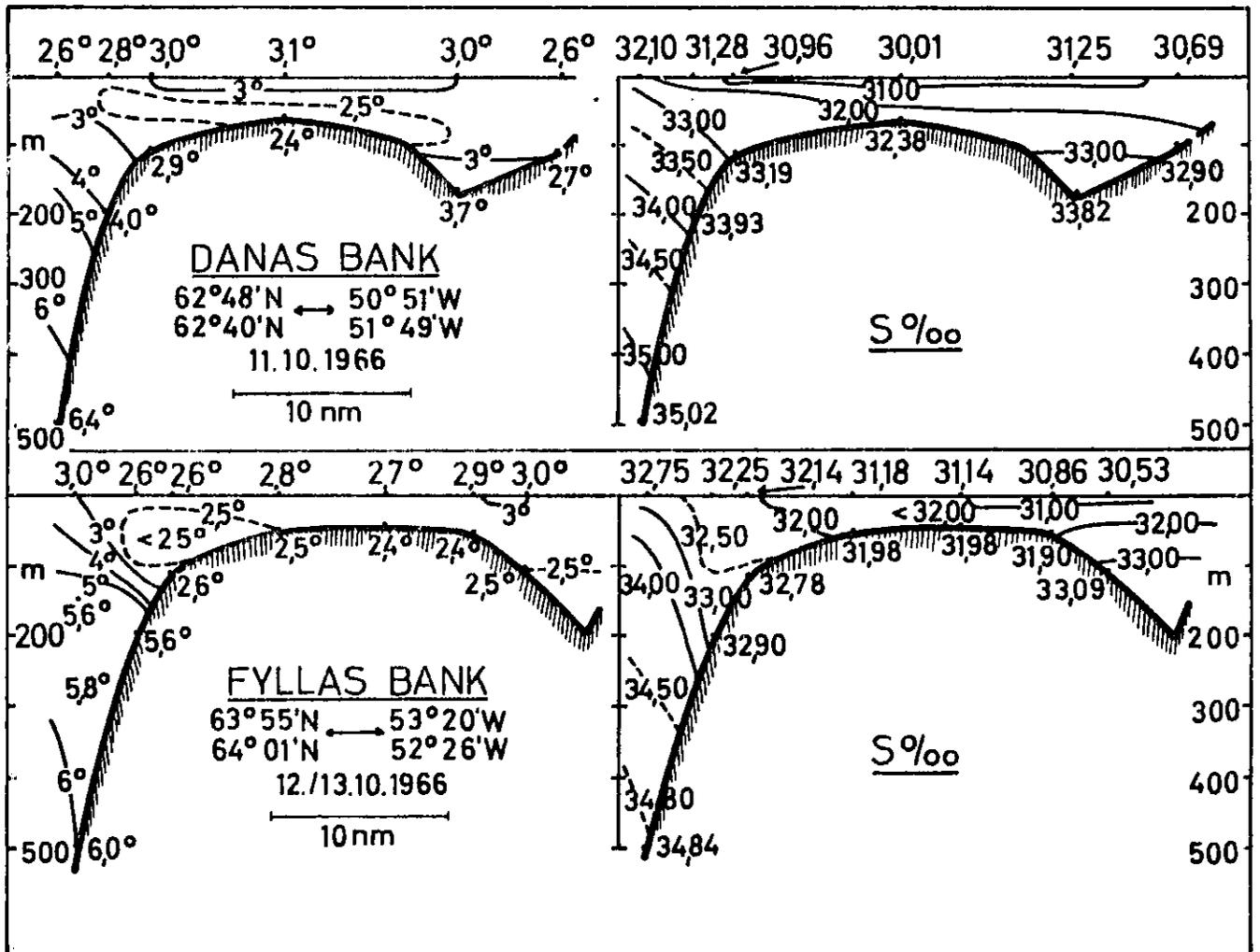


Fig. 2. Hydrographic sections off Danas Bank and Fyllas Bank (temperature and salinity) in October 1966.

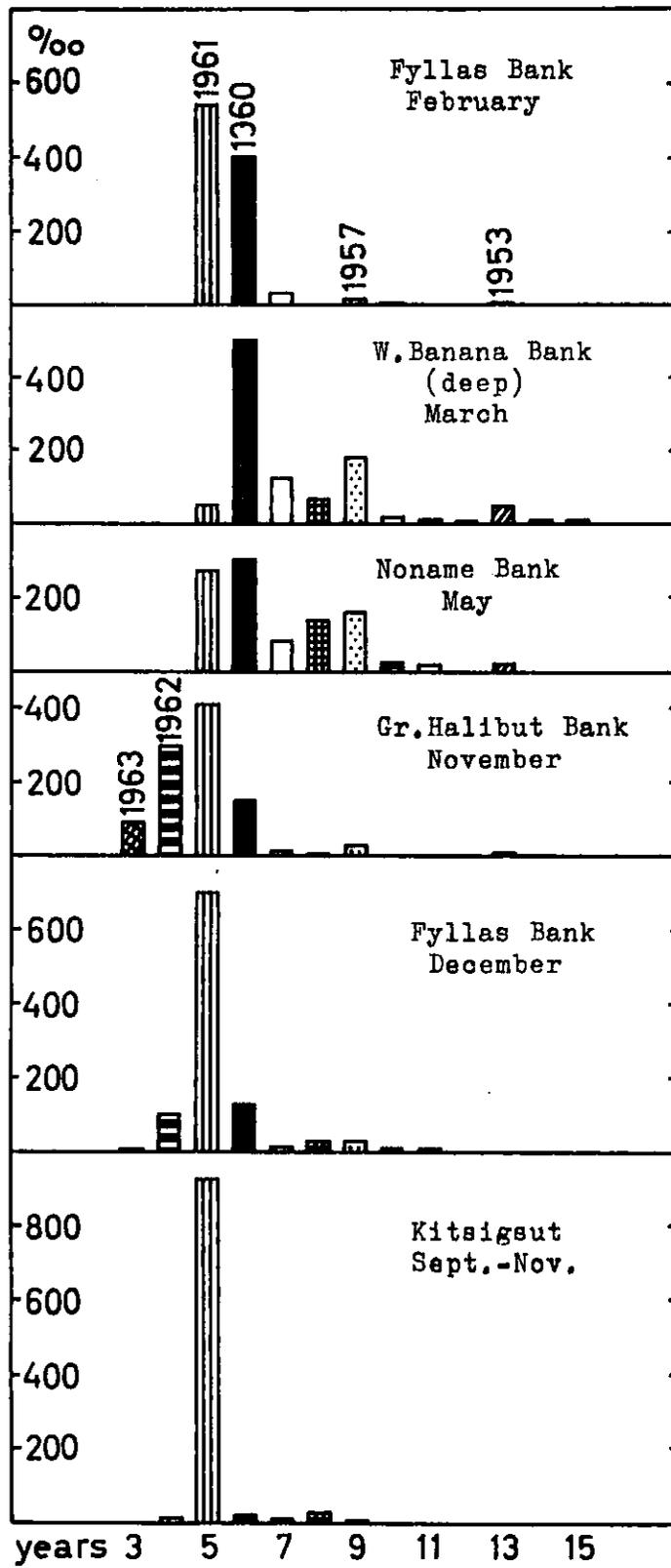


Fig. 3. Cod, age composition of commercial catches in 1966 (Subarea 1).

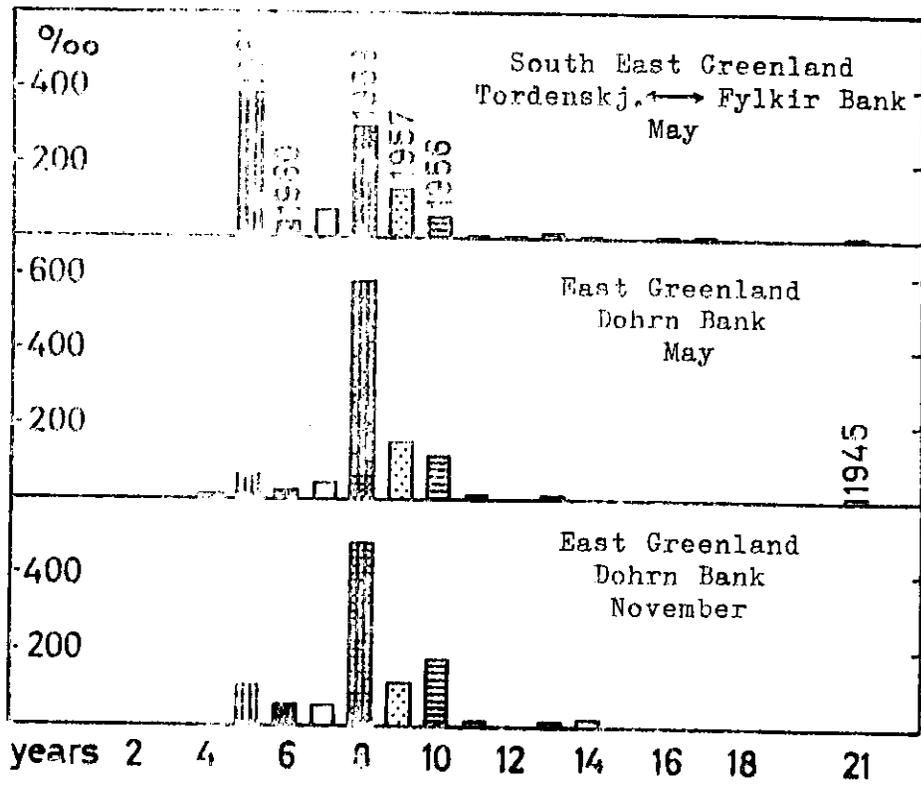


Fig. 4. Cod, age composition of commercial catches in 1966 (East Greenland).

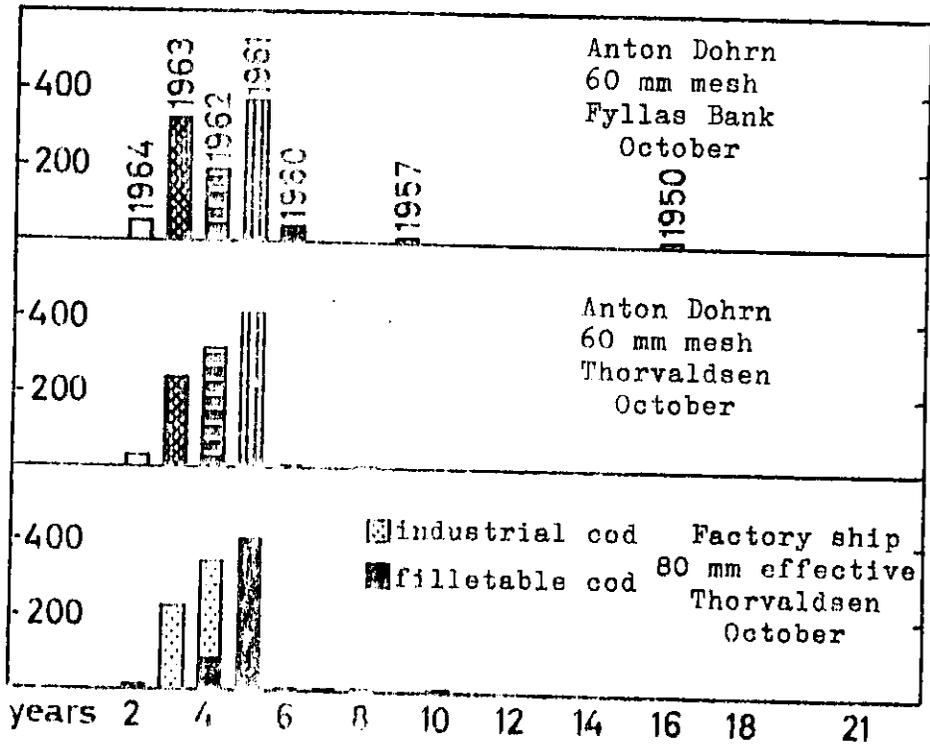


Fig. 5. Cod, age composition of Anton Dohrn on Fyllas Bank and off Thorvaldsen and catch of a factory trawler off Thorvaldsen.

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SUBAREAS 2 - 5

by J. Messtorff

General remarks:

Nominal catches and catch per day fished of German trawlers are given in table 1 (Subarea 2), table 2 (Subarea 3) and table 3 (Subarea 4 + 5). For the first time the quantities of fish converted to fish meal on board are included in the nominal catches. For comparison with the preceding years the corresponding statistical data since 1962 have been recalculated in the same way as for 1966. Not included are the quantities of fish discarded at sea which are given separately in table 4.

It has to be stressed, however, that the calculated amounts of industrial cod contained in the given nominal catches are suspected to be higher to some extent in practice because quantities of fish converted to fish meal on board are sometimes not specified and reported as "other fish". The given percentages of industrial fish should therefore be regarded as minimum values.

SUBAREA 2

A. Status of the fisheries

The increase of German fishing activity off Labrador already stated for 1965 was also continued in 1966 and resulted in an increase of the total catch by 22000 t (about 50 % of the 1965 total catch). But in spite of a considerable increase of fishing effort in 1966 the average total catch per day fished did not drop very significantly.

As in 1965 the main fishing operations took place at the beginning of the year from January to the middle of March. During this time the bulk of the German sterntrawler fleet was concentrated off Labrador. For the following time of the year until the end of November only occasional visits of single vessels were paid to Subarea 2 and trawlers often changed fishing grounds several times during one trip between Labrador and Greenland. There was scarcely one vessel which landed an entire catch from Subarea 2 during this period. The Labrador season of the German fleet started again in December 1966.

1. Cod

As already in 1965 the increased fishing activity in the Subarea was due to a pure off-shore cod fishery (94 % of the total catch) which took place during the season mentioned above namely in Divisions 2 H and 2 J along the edge of the continental shelf between Cape Mugford and Hamilton-Inlet-Bank. Favoured by very good fishing conditions especially during the early months of the year the fishing effort as well as the nominal catch of cod increased considerably by more than 50 % of the last years values whereas the average catch per day fished decreased only slightly by 1.6 t. (table 1 and fig. 2).

The quantity of cod discarded at sea (table 4) decreased from 5.5 % in 1965 to 0.9 % of the nominal catch in 1966.

2. Redfish

No special redfish fishery was carried out by German trawlers in Subarea 2. The redfish catches reported in table 1 have been entirely taken as by-catch of the off-shore cod fishery in Division 2 J and amounted to only 4 % of the total catch from the Subarea. In spite of the increased fishing effort a further decrease of the nominal catch of redfish as well as of the catch per day fished was to be observed (table 1, Fig. 2).

B. Special Research Studies

I. Environmental Studies

During the successful commercial fishery on dense prespawning concentrations of cod off Labrador, R.V. "Walther Herwig" visited the fishing area (Div. 2 H - J) in January 1966. Experimental fishing combined with an echo sounder survey and hydrographic observations showed that the formation of catchworthy cod concentrations were restricted to areas along the slope of the continental shelf where near bottom temperatures of at least 3.5 °C could be observed. During the survey the best echo traces as well as the most successful catches have been obtained at the northeastern slope of Hamilton-Iglet-Bank between 290 to 450 m depth and near bottom temperatures of about 4 °C. Already in 250 m temperatures measured just only 2.5 °C and no more fish traces could be observed. Water temperatures around 0 °C reached the bottom at a depth of 175 m.

II. Biological Studies

Market sampling of commercial catches have been continued as far as possible. Because of the decreasing number of trawlers catching for fresh fish in the Subarea steps have been taken to develop the sampling of factory trawlers at sea. Research vessel investigations were restricted to one cruise of R.V. "Walther Herwig" in January 1966.

As shown in Fig. 1 cod length frequencies ascertained by market sampling of commercial catches taken off Labrador during the main fishing period from January until March 1965 and 1966 proved to be almost exactly the same in both years. The corresponding age compositions, however, were evidently different. In 1965 75.5 % of the commercial catches consisted of only three year-classes (1955 - 57) respectively 10 - 8 year old fish, whereas in 1966 these year-classes contributed to barely 44 % of the catches. As no strong new year class had entered the fishery the yield could only be maintained respectively increased by further exploitation of the older age groups. If stock recruitment fails it may well be that this tendency will result in a significant decrease of the catch per unit effort in the very near future.

SUBAREA 3

A. Status of the fisheries

Fishing activity of German trawlers was restricted to Divisions 3 K and mainly 3 L. As in the preceding year the major part of the total catch was taken in summer (June - August). The total nominal catch decreased somewhat in comparison with 1965 and reached only 14 % of the Labrador catches. However, a slight increase of the average catch per day fished was recorded.

1. Cod

The cod fishery yielded 94 % of the total catch from the Subarea against 75 % in 1965 and only 41 % in 1964. In spite of reduced fishing effort against 1965 the nominal catch as well as the average catch per day fished increased significantly.

2. Redfish

Redfish catches decreased very sharply and amounted to just only 3 % of the total catch from the Subarea. The average catch per day fished dropped from 25 t in 1962 to 0.5 t in 1966. Both, less availability of redfish concentrations and a shift of fishing effort on cod will have caused this remarkable decrease.

B. Special Research Studies

As already reported in the 1965 Research Report (Res. Doc. 66/33b) Environmental and Biological Studies were carried out by R.V. "Walther Herwig" only in January 1966 to a limited scale in all Divisions of the Subarea. No further field work was carried out later in the year. Market sampling was not possible because the entire commercial catches were processed at sea.

SUBAREA 4 and 5

A. Status of the fisheries

No commercial fishery was carried out in 1966. The nominal catches taken from the Subareas since 1962 by German trawlers are given in table 3.

B. Special Research Studies

As already reported in the 1965 Research Report (Res. Doc. 66-33b) Environmental and Biological Studies were carried out by R.V. "Walther Herwig" only in Jan./Febr. 1966 and were restricted to Divisions 4 V and 4 W. No further field work was carried out later in the year.

Of 99 cod tagged on January 27, 1966 in Division 4 V north up to now already 7 instructive recaptures by Canadian fishermen have been reported. The first recapture was taken within few days after tagging near the release position. The second returned tag was recovered in May 1966 at Cape St. George (4 R) and later in Aug./Sept. 1966 three tagged cod were recaptured in the northwestern Gulf of St. Lawrence off Gaspé (4 T). The hitherto latest recaptures were recovered in October 1966 and January 1967 not far from the release position (4 Vn). These results confirm Canadian tagging experiments during which tagged cod were released in the northern Gulf in autumn and recaptured in the Cabot Strait area in winter and prove the remigration of cod into the Gulf in spring and summer.

Of 12 cod tagged on February 3, 1966 in Division 4 V south near Sable Island up to now one fish was recovered in inshore waters of Nova Scotia near Cape Lahave (4 X) in October 1966.

Table 1: Subarea 2, nominal catches in tons 1962 - 1966 (including industrial fish = fish converted to fish meal on board)

year	days fished	COD		REDFISH		OTHER FISH		TOTAL	
		catch	% industrial	catch	% industrial	catch	% industrial	catch	% industrial
1962	93	882	4.1	1939	15.9	0	0	2889	31.1
1963	76	1050	12.3	941	12.0	0.8	67.8	2050	27.0
1964	495	3559	14.4	5079	10.5	2.1	91.3	9667	19.5
1965	1323	41556	13.3	2891	2.2	0.9	60.0	45598	34.5
1966	2132	63610	7.8	2750	1.3	0.7	46.4	67901	31.8

Table 2: Subarea 3, nominal catches in tons 1962 - 1966 (including industrial fish = fish converted to fish meal on board)

year	days fished	COD		REDFISH		* Pollock		OTHER FISH		TOTAL	
		catch	% industrial	catch	% industrial	Haddock	Pollock	catch	% industrial	catch	% industrial
1962	85	779	37.6	2124	15.2	-	-	62	0.7	2965	34.9
1963	113	1822	3.5	757	7.8	13	-	133	1.2	2725	24.1
1964	282	2344	**	2495	8.8	8	7	702	2.5	5556	19.7
1965	724	8147	3.1	1057	4.2	44	6	1420	2.0	10674	14.7
1966	572	8806	15.6	305	36.7	-	-	268	0.5	9379	16.4

*) Catch per day fished not calculated, because days fished not splitted into Divisions where Haddock and Pollock are abundant. - Industrial fish not known.

**) Included in "Other Fish".

Table 3: Subarea 4 + 5*, nominal catches in tons 1962 - 1966 (including industrial fish = fish converted to fish meal on board)

year	days fished	COD		REDFISH		HADDUCK**		PCLLOCK**		OTHER FISH		TOTAL		
		catch per day fished	% indust.	catch per day fished	% indust.	catch	catch p.day fished	catch	catch p.day fished	catch	catch p.day fished	catch	catch p.day fished	indust.
1962	No fishing	-	-	-	-	-	-	-	-	-	-	-	-	-
1963	65	5.1	31.9	13	0.2	1049	16.1	113	1.7	89	1.4	1593	24.5	11.9
1964	178	5.4	2.6	69	0.4	2004	11.3	439	2.5	110	0.6	3576	20.1	3.2
1965	33	8.4	25.0	10	0.3	140	4.2	275	8.3	33	1.0	734	22.2	10.8
1966	No fishing	-	-	-	-	-	-	-	-	-	-	-	-	-

*) Subarea 5 only occasionally visited by single trawlers chiefly fishing in Subarea 4.

**) Industrial fish not known.

Table 4: Subarea 2 - 5, discarded fish in tons 1962 - 1966 (not included in nominal catches of tables 1 - 3!)

year	Subarea 2		Subarea 3		Subarea 4 + 5	
	REDFISH	OTHER FISH TOTAL	REDFISH	OTHER FISH TOTAL	REDFISH	OTHER FISH TOTAL
1962	49	11	-	60	-	-
1963	65	-	-	-	-	-
1964	434	-	-	-	-	-
1965	13	55	22	26	-	-
1966	32	110	16	6	30	30
Div.						
2 G	40	8	5	2	7	7
2 H	200	39	11	4	15	15
2 J	324	63	-	-	-	-

Discards per Division only for 1966.

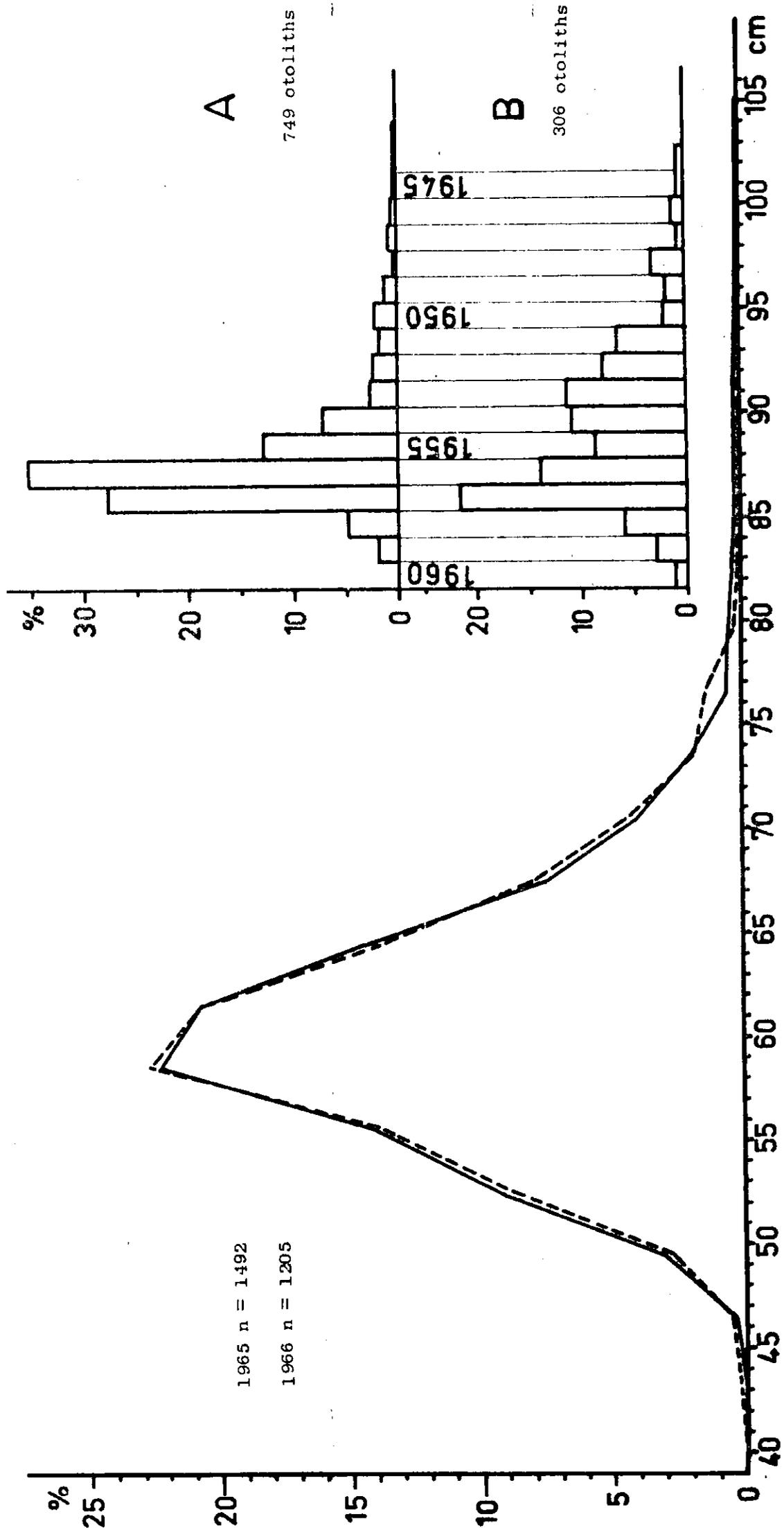


Figure 1: Cod length and age frequencies of German trawler catches off Labrador (Divisions 2 H and 2 J) from January - March 1965 (solid line and A) and 1966 (broken line and B).

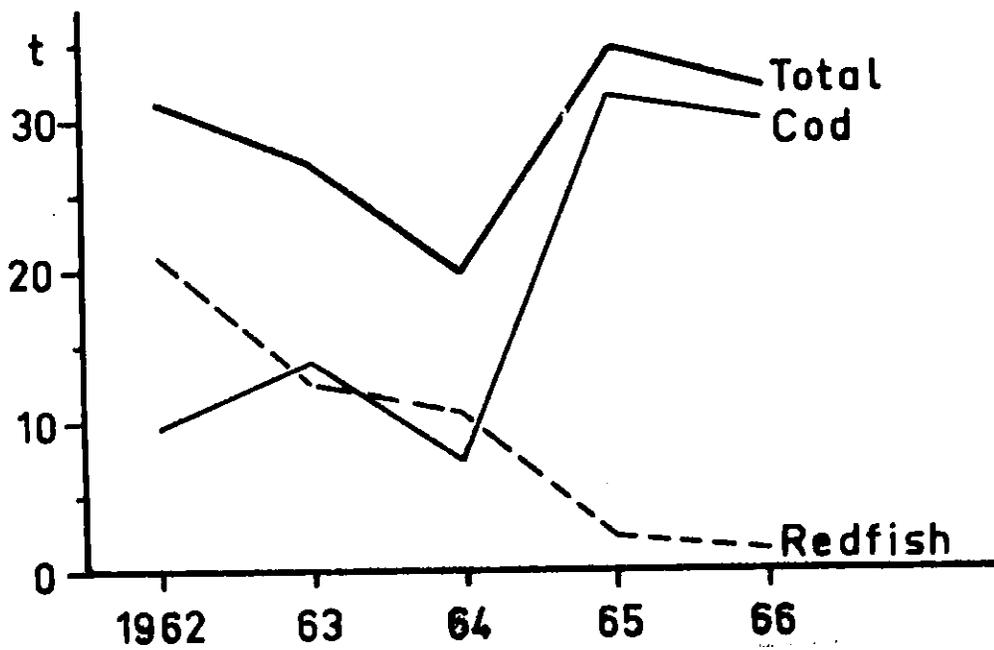


Figure 2: Average nominal catch per day fished by German trawlers off Labrador (Subarea 2) 1962-1966.