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Part I

Subarea 1 and East Greenland

by

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A. Status of the Fisheries

Table 1 gives the nominal catch off West and East Greenland, taken by the fleet of the Federal Republic of Germany during the last 10 years from 1962 to 1971. Although the total output increased ~~in 1971~~ by 14% the catch in 1971 with 86,500 t is only 52% of the average of the 10 years period and only 35% of the maximum catch in 1963. The average catch per fishing day however in 1971 was the 3rd highest since 1962. But this could only be achieved by very heavy fishing during the very short season of highest concentration of the cod (March to June) and very little fishing during the other months when the fish is less concentrated. In contrast to this newly developed fishing pattern the fishery off West and East Greenland during the first half of the sixties was more or less regular fishing during the whole year round. A comparison with the high yearly average of the catch per fishing day in 1962 and 1963 achieved by a more or less annual fishing and this in addition with far smaller and less efficient trawlers (see Table 3) shows the considerable decrease in the size of the stocks as well of cod as especially of redfish.

I. Subarea 1 (West Greenland)

The fishing activity in Subarea 1 decreased further by 10%. However due to only seasonal fishing from January to the middle of June and due to very successful fishery in April on spawning cod in Division 1C and on postspawners in May and June in Divisions 1E and mostly 1F again 38,000 t of cod were caught. Thus with 24.6 t the highest yearly average per fishing day since 1962 was achieved. This catch per fishing day is of course no more a measure for stock abundance and of no use for assessment purposes. It is only an economic figure and shows the great availability of the concentrated cod during the spawning and postspawning season.

Again as in 1969 and 1970, ice - also in those parts north of Cape Desolation which up to 1968 were more or less free of ice during

Table 1. Subarea 1 and East Greenland. German nominal catches in tons (industrial fish included), 1962 - 1971

Year	Days fishing	Cod	Catches per fish.day		Reifish	Catches per fish.day		Total	Catches per fish.day		%
			fish.day	industrial		fish.day	industrial		fish.day	industrial	
1962	6,584	133,404	20.3	5.1	57,902	8.8	5.2	200,932	30.5	7.7	
1963	7,175	152,934	21.3	4.2	44,355	6.2	4.7	202,923	28.3	8.6	
1964	5,639	107,982	19.1	7.7	22,956	4.1	10.0	137,794	24.4	10.9	
1965	5,882	107,127	18.2	13.3	18,476	3.1	10.3	131,445	22.3	14.7	
1966	4,696	82,928	17.7	12.8	14,911	3.2	6.1	102,029	21.7	13.1	
1967	6,305	137,773	21.9	9.1	13,600	2.2	3.0	155,606	24.7	9.4	
(Subarea 1)	5,819	132,498	22.8	5.3	11,858	2.0	1.8	146,432	25.2	5.3	
1969	3,234	67,431	20.9	4.0	6,964	2.2	5.2	75,293	23.3	4.3	
1970	1,722	38,551	22.4	4.0	4,501	2.6	9.1	44,283	25.7	5.9	
1971	1,545	37,950	24.6	1.9	3,335	2.2	2.0	42,482	27.5	2.4	
1962	1,660	14,317	8.6	0.5	25,032	15.1	1.2	40,999	24.7	1.2	
1963	2,182	13,677	6.3	0.5	31,368	14.4	1.4	47,700	21.9	2.2	
1964	3,287	29,400	5.9	0.2	38,154	11.6	2.3	71,364	21.7	2.5	
1965	2,734	11,746	4.3	0.6	33,491	12.2	4.5	47,877	17.5	4.4	
1966	1,827	7,231	4.0	0.7	23,222	12.7	6.3	32,006	17.5	6.0	
1967	2,157	13,025	6.0	0.1	22,879	10.6	4.7	37,803	17.5	4.4	
1968	1,361	9,825	7.2	0.2	15,432	11.3	2.0	26,417	19.4	2.0	
1969	2,164	14,292	6.6	0.9	24,587	11.4	4.6	40,505	18.7	4.2	
1970	1,532	14,388	9.4	0.9	15,672	10.2	4.5	31,104	20.3	3.3	
1971	1,737	28,735	16.5	0.6	14,037	8.1	2.9	44,062	25.4	2.4	
1962	8,244	147,721	17.9	4.6	82,934	10.1	4.0	241,931	29.3	6.6	
1963	9,357	166,611	17.8	3.9	75,723	8.1	3.3	250,623	26.8	7.4	
1964	8,926	137,382	15.4	6.1	61,110	6.8	5.2	209,158	23.4	8.0	
1965	8,616	118,873	13.8	12.1	51,967	6.0	6.5	179,322	20.8	11.9	
1966	6,523	90,159	13.8	11.8	38,133	5.8	6.2	134,035	20.5	11.4	
1967	8,462	150,798	17.8	8.4	36,479	4.3	4.1	193,409	22.9	8.4	
1968	7,180	142,323	19.8	4.9	27,290	3.8	1.9	172,849	24.1	4.8	
1969	5,398	81,723	15.1	3.5	31,551	5.8	4.8	115,798	21.5	4.3	
1970	3,254	52,939	16.3	3.2	20,173	6.2	5.5	75,387	23.2	4.9	
1971	3,282	66,685	20.3	1.3	17,372	5.3	2.8	86,544	26.4	2.4	

Table 2. Discarded fish in Subarea 1 in tons, 1971

	Cod	Redfish	Species unknown	Total
1C	5	0	4	9
1D	4	1	1	6
1E	12	30	12	54
1F	16	22	16	54
Total	37	53	33	123

Table 3. Average gross registered tonnage of German trawlers fishing in Subarea 1, 1962-1971

Year	Average gross registered tonnage of German trawlers fishing in Subarea 1
1962	589 - 1561
1963	566 - 1561
1964	648 - 1561
1965	651 - 2557
1966	537 - 2557
1967	632 - 2557
1968	640 - 2557
1969	651 - 2684
1970	645 - 2684
1971	691 - 2684

the whole year - hampered the fishery to large extent. Otherwise probably more than 30 t per fishing day would have been achieved during the time of seasonal fishing.

Only 3,300 t of redfish were caught in 1971. This is by far the lowest catch and only 5.8% of the maximum of the last 10 years period. Redfish is now only a by-catch in fishing for cod or is caught on some very few trips of wet-fish trawlers in the Cape Thorvaldsen area.

II. East Greenland

As predicted in last years report the cod catches in 1971 exceeded those of the redfish for the first time since the beginning of the German fishery of East Greenland in 1955. The cod catches doubled and reached with 28,000 t nearly the maximum catch of cod in 1964. The catch per day increased by 76% and was by far the highest since 1955. This increase in output and catch per day was due to the good state of the East Greenland spawning stock and also due to increased fishing activity of nearly the whole fleet of German factory trawlers during the spawning season.

The redfish catches, mostly taken by wet-fish trawlers, decreased further to only 14,000 t, which is the lowest figure up till now and only 37% of the 1964 maximum.

III. Forecast for 1972

1. Subarea 1

Due to the reduced size of the stock of cod of West Greenlandic origin the catches in 1972 in Subarea 1 will as in the preceding year depend mainly on the cod of East Greenlandic origin when this cod in May and June is returning as shoals of postspawners from East Greenland. Although the stock of East Greenlandic spawners is in a rather good state the output of the fishery will be very much conditioned by the ice situation. If this fishery is again as in the last 3 years effected by ice the total output in Subarea 1 will be as small as in 1970 and 1971 or probably less. An unsolved question is whether the new quota regulation on herring in Subarea 5 and the announced closure of the Icelandic fishing grounds will compel the factory trawlers to reopen the fishery in Subarea 1 in the second half of the year, although there will be no chance to make this fishery paying.

2. East Greenland

The big spawning shoals of the 1961, 1962, 1963, and 1964 year-classes will again be very attractive especially for the fleet of factory trawlers. The total output will depend very much on the ice situation. The fishery will be very paying when N.E. wind prevail during the spawning season and the big ice belt is pressed against the shore and makes the rough banks free for fishing. As in 1971 again the cod catches will exceed those of redfish.

B. Special Research Studies

I. Environmental Studies

1. Hydrography (by W.Lenz)

In late fall 1971 (4.-11.December) hydrographic measurements have been done by the German R/V "Walther Herwig" off the west coast of Greenland. Five sections (Fig.2 and 3) have been worked from Little Halibut Bank to Cape Farewell; the positions are given in Fig.1.

The winter 1972 will bring probably ^{again} severe ice situations. This was indicated by the far progression of ice in late 1971: off South East Greenland ice ~~did~~ ^{id} already appear in late November, and in the middle of December ice was seen up to Fyllas Bank. In the first days of December ice bergs were seen up to Danas Bank and ice covered the fishing areas of Nanortalik, Kitsigsut, and Cape Farewell. Off Cape Farewell a tremendous conglomeration of ice bergs was found: 15 miles south of the Cape (Sta.211) 130 targets were visible in the radar within the 6-miles-range!

Although only a few comparisons with December 1970 are possible, it might generally be said that in December 1971 the hydrographic situation off West Greenland was found to be at least as bad as in the previous year, which means that the trend to a cooler hydro-climate continues.

Surface waters are below 0°C, sometimes below -1°C even 10 miles off the continental slope. The depth of the 0°-isotherm (corresponding to a salinity of 32.8‰) increases northwards but usually not exceeding 50 m. On top of the banks the temperature lies between 1° and 2°C. In the Irminger component of the West Greenland Current we found the following maximum values: 5.36°C at 550 m depth off Fyllas Bank and 34.964 S‰ at 600 m depth off Cape Farewell.

To give an idea of how much cooler it became since the warmer period we may compare our measurements from early December 1971 with those from early December 1963 (first cruise of R/V "Walther Herwig"), a year which is presumably representative for a medium warm year. The mean values shown below are calculated from Noname, Fyllas, and Little Halibut Bank:

		<u>1963</u>	<u>1971</u>	<u>Difference</u>
T _{min}	at the surface (°C)	0.1	-0.8	-0.9
S _{min}	at the surface (‰)	33.01	32.44	-0.57
T _{max}	in the Irminger component (°C)	5.6	5.3	-0.3
S _{max}	in the Irminger component (‰)	34.99	34.94	-0.05

The negative differences in the third column show that the increasing influence of the East Greenland Current did not only affect the waters at the surface but also in greater depths, which is stated by the lower salinities.

II. Biological Studies

In 1971 32,198 length measurements and 8,406 age determinations were made. They showed that in the northern Division 1C and 1D the 1965 and 1966 year-classes are dominating. Now for the 3rd time in the history of the German fishery off West Greenland big concentrations of spawning cod were found on the western slopes of Banana Bank. Most of the fishery took place as in the years 1961 and 1966 in very great depths of 500 to more than 1000 m. The 1965 year-class (av. length 70.6 cm) dominated with 54%, followed by the ^{cod fish} 1961 (14%), 1966 (13%), and 1960 (7%). The year-classes 1962, 1963, and 1964 were nearly missing, showing again how poor these year-classes are in the cod stock of West Greenland origin. All cod older than 6 years were mature. Of the 1965 year-class 94% and of the 1966 year-class 51% had reached maturity.

In the fishery on the Banana Bank in the second part of June the 1963 year-class, missing in the catches of spawners, was dominating with 29%, showing that in the meantime these East Greenlanders, after having spawned off East Greenland had reached Banana Bank on their northward feeding migration. The 1966 and 1965 cod made up 19 and 20% respectively. The average length of the 1965 year-class was 5 cm less than in spring in the spawning fishery, showing that only the quicker grown fish had reached maturity. Also the 5 years old cod were smaller than in the spawning fishery.

In the research catches of R/V "Walther Herwig" in December in Division 1C the 1966 and 1965 ^{cod} dominated with 27% and 21% respectively and in Division 1D for the first time the new, possible promising year-class 1968 (av. length 39.5 cm) was strongest with 33%.

Whilst the stock of cod of West Greenland origin is at present of rather small size due to high fishing effort in the sixties and due to pooriness of year-classes born after 1961 - also the 1965 and 1966 seem to be only of average size - the East Greenland stock (living off E. and S.W. Greenland) is in a rather good condition due to less fishing effort, protection by ice and a continuous succession of average to very rich year-classes (1960, 1961, 1962, 1963, 1964). This explains the shift of the German fishery since 1968 (see German Research Report for 1970) from the northern Division 1B to 1D to the southern Division 1E and 1F

and the increased importance of the East Greenlandic fishing grounds. In 1970 and 1971 75% and 62% respectively of the German cod catches in Subarea 1 were taken in Division 1E and 1F and this inspite of the increasing obstruction by ice just in this area.

In 1971 off S.W.Greenland the rich 1963 year-class dominated with 50% (41-65%) followed by the 1964 year-class with 28% (9-46%). The 1962 and 1961 year-classes in the meantime have lost much of their commercial importance (8% and 5% respectively). The 1965 and 1966 cod are nearly missing off S.W.Greenland; they are pure W.Greenland year-classes. However research catches in the Thorvaldsen area in December 1971 revealed that the 1968 year-class is also well presented in the south (average length 3.2 cm less than on the northern banks). This means that in the last warmer year 1968, before the increase in ice flow startet, as well off East Greenland as off West Greenland a possible more promising year-class was born. The gap of 3 years with poor recruitment (1965, 1966, 1967) off East Greenland will in the coming years negatively effect the fishery off S.W. and E.Greenland and will also reduce the emigration to the spawning places in Iceland waters.

In the catches of migrating and spawning cod off East Greenland during the first half of the year the rich 1963 year-class dominated with 47% off S.E.Greenland and with 41% in the more northern Angmagssalik - Dohrn Bank area. The 1964, 1962, and 1961 year-classes were off S.E.Greenland of nearly equal strength (14-17%). However in the northern part of East Greenland the older year-classes 1962 and 1961 reached 24 and 21% respectively, whilst the share of the 1964 year-class, which in 1971 and 1972 recruits to the spawning stock was still small (7%).

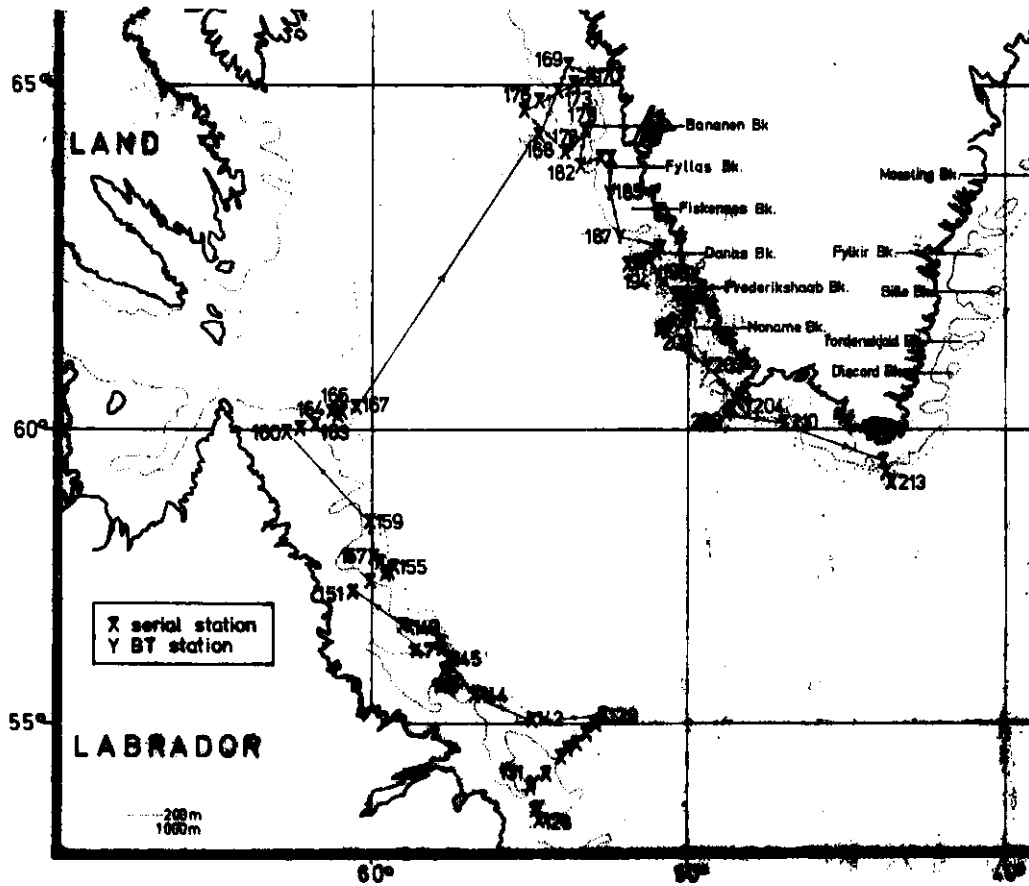


Figure 1: Cruise track of the German R/V "Walther Herwig", 24.11. - 11.12.1971

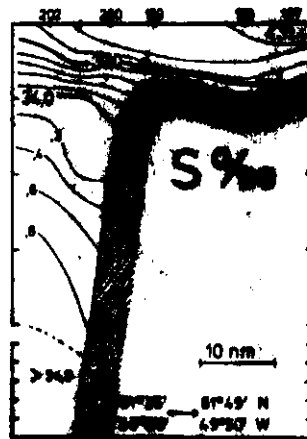
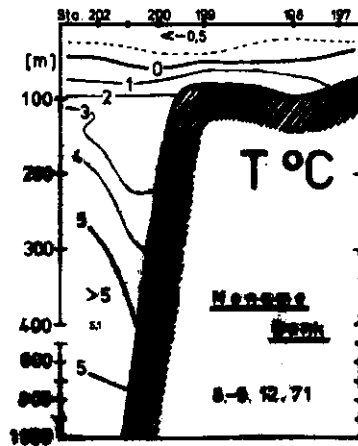
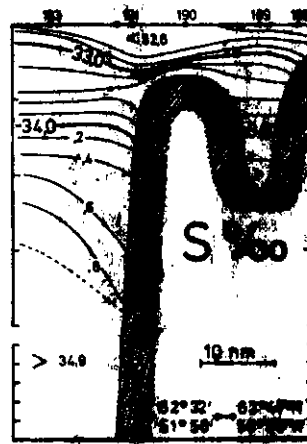
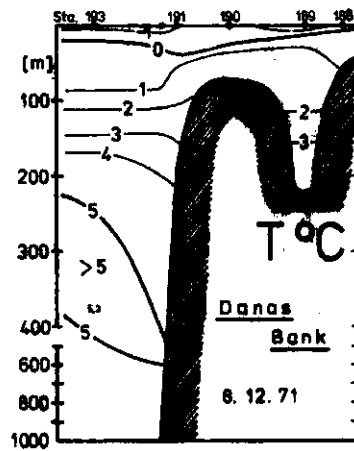
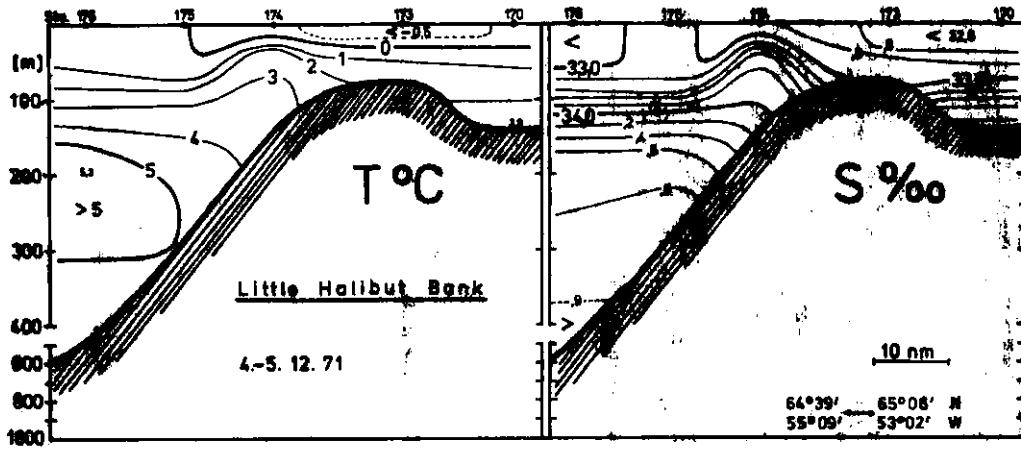


Figure 2: Temperature and salinity sections across Little Halibut, Danas, and Noname Bank for December 1971

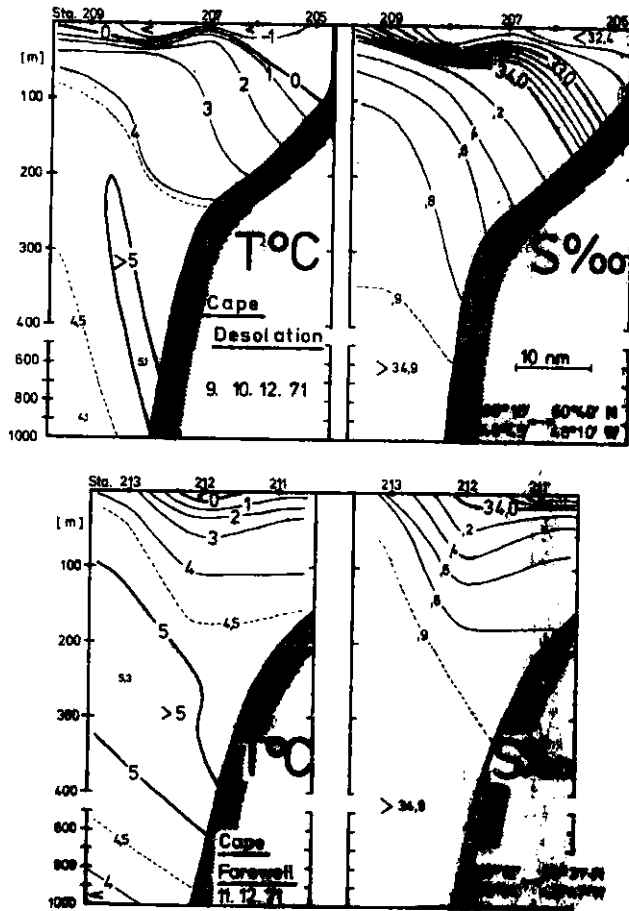


Figure 3: Temperature and salinity sections off Cape Desolation and Cape Farewell for December 1971

Part II

GERMAN (FRG) Research Report, 1971

Subareas 2 - 3 (excluding herring)

by

J. Messtorff and W. Lenz

Subarea 2

A. Status of the Fisheries

The upper part of table 4 gives the nominal catches taken by trawlers of the Federal Republic of Germany off Labrador from 1958 to 1971. During this time three different periods of fishing activity can be distinguished.

The first period from 1958 - 1960 was characterised by a successful redfish fishery at the slope of the shelf mainly in Division 2 J. On average 83 % of the total catch consisted of redfish.

During the following years 1961 - 1964 fishery activity of German trawlers was relatively low in Subarea 2 due to the preference given to the extremely good fishing conditions in Greenlandic waters. Apart from year to year variations the total catch taken from Subarea 2 during this second period consisted of cod (47 %) and redfish (46 %) at almost equal quantities.

The third period from 1965 onwards is marked by a considerable increase in fishing effort and catches in connection with a shift to a pure off-shore cod fishery. Up to the present the average proportion of cod amounted to 95 % of the total German catches. The peak of this fishing activity was reached in 1969 with a maximum catch of over 70 000 t of cod. In the following year the German cod catch decreased considerably by 32 % and continued by decline even more pronounced in 1971 by 60 % against 1970.

The sharp decline of the Subarea 2 catch of cod during the last two years was due to a considerable reduction of fishing effort (days fished) by 25 % and 53 % as compared to 1969 and 1970 respectively. This effort reduction was primarily effected by increasing severe ice conditions off Labrador in spring which forced the fleet to leave the fishing grounds much earlier than in former years. Even a shift of effort to the adjacent Division 3 K where more or less the same cod population was fished could by far not compensate the losses in Subarea 2 and even there fishing operations were handicapped by extended drift ice in spring 1971. As no noteworthy fishing activity of German trawlers took place in Subarea 3 Divisions farther south (except some negligible records from Div. 3 M) the combined nominal catches of Subareas 2 + 3 are given at the bottom of table 4 for comparison. In 1971 the combined catches of cod amounted to only 30 000 t or 52 % of the 1970 catch and only 42 % of the record catch in 1969. By the way this proved to be exactly the guessed maximum yield already forecasted in the last years' report (Redbook 1971, Part II, p.75).

Fishing activity was recorded in Subarea 2 only from beginning of January to 18. February, when ice stopped the operations. It started off Cape Mugford (Division 2 G/H) but ice forced the fleet to move southward to Division 2 J already in mid-January, where 95 % of the subarea 2 catch was taken during the remaining four weeks of the very short season. Compared to the average of the preceding three years the catch of cod per fishing day had decreased by 23 %. Fishing operations were exclusively carried out by factory trawlers of an average size of 1863 GRT (916 - 2684).

As in the three preceding years the redfish by-catch remained unimportant and amounted to only 2 % of the total catch in Subarea 2.

Forecast for 1972

Fishing operations of German trawlers in Subarea 2 and Division 3 K were again restricted by very severe ice conditions to the first quarter of 1972. After preliminary estimates their total catch of cod is not expected to exceed that of 1971, but will probably be even smaller (abt. 25 000 t).

B. Special Research Studies

I. Environmental Studies (by W. Lenz)

Hydrographic observations were carried out by R/V "Walther Herwig" between 25. and 30. November 1971 consisting of three sections across the shelf off southern (Division 2 J), middle (Div. 2 H) and northern Labrador (Div. 3 G) as shown in figure 5. For the position of these sections see the cruise track in Fig. 1 (German Research Report, Part I, Subarea 1).

Comparisons with earlier investigations by R/V "Walther Herwig" in October 1967 and 1969 (Redbook 1968, Part II, pp. 56-58, and Redbook 1970, Part III, p. 40) show that in general the water temperatures observed in 1971 were slightly lower by some tenths of a degree. Although the measurements in 1971 were taken four weeks later than in the previous years, the advanced winter cooling cannot be the only cause for the lower temperatures, because they were found down to 1000 meters ($T_{max} = 4.3^{\circ}C$ in the West Greenland component of the Labrador Current). Along with this we found also lower salinities: at the surface less than 32.6 ‰ and in deep water off the slope never exceeding 35.0 ‰. Therefore we suppose the lower values to be a consequence of the cold years 1969 - 70.

The cold water layer with temperatures below $0^{\circ}C$ was found to be 100 - 150 m thick off Cape Chidley, about 100 m off middle Labrador and to vanish somewhere at about $56^{\circ}N$ latitude. There was obviously no connection to the cold water body with temperatures below $0^{\circ}C$ observed on Hamilton Bank, which is supposed to be a residue of the previous winter cooling. This is indicated by considerably higher salinities ($> 33^{\circ}/\text{oo}$) than those observed in the cold water of polar origin ($< 32.2^{\circ}/\text{oo}$) in the northern sections. Attention is also drawn on some peculiarities in the structure of the isothermes as shown in fig. 5: Off Cape Chidley there are symptoms of a vertical eddy indicating the core of a strong current. At the outer part of Hamilton Bank a couple of complicated inversions were found in a matter very similar to 1969 (Redbook 1970, Part III, p. 40).

II. Biological Studies

R/V "Walther Herwig" carried out a one week groundfish survey off Labrador including Division 3 K in late November 1971. Of 26 hauls in varying depths 8 were obtained in Division 2 J and 6 each in Divisions 3 K, 2 H and 2 G. The total catch amounted to 17 522 kg fish (947 kg/trawling hour) of which 18% consisted of Cod (3 087 kg = 2468 fish, mean weight 1.25 kg). Length measurements were taken of all, otoliths of 1 414 cod.

Preliminary results indicate that over 80% of cod were 5-8 years old (year classes 1963-66). Mean lengths of cod were below 50 cm in all four Divisions (3 K = 47.8; 2 J = 47.5; 2 H = 43.8; 2 G = 49.4). Maximum length recorded was 80 cm and only 1% of cod measured between 70-80 cm.

Other priority species sampled for length frequency distribution were Redfish (16% of total catch weight), Greenland halibut (20%) and Roundnosed grenadier (37%). The rest (9%) consisted of further 37 species some of which were additionally sampled for length distribution.

Subarea 3

A. Status of the Fisheries

The nominal catches taken by trawlers of the Federal Republic of Germany from 1962-71 are given in the middle of table 4. The total catch given for 1971 was not exclusively taken in Division 3 K as stated in the ~~table~~ table but includes some catches from Flemish Cap (3 M) amounting to about 15%. These were taken during the first half of March when fishing operations in Division 3 K were stopped by ice. As in the year before fishing operations in Divisions 3 K and 2 J overlapped and were more or less directed towards the same cod population. About 78% of the total catch of Division 3 K was taken during a very short season of only 2-3 weeks after mid-February. For additional information see Section A. for Subarea 2.

B. Special Research Studies

See section B., II. for Subarea 2.

Subarea 4

A. Status of the Fisheries

Except for herring (see special Res. Rep.), there was no commercial fishery.

B. Special Research Studies

Selectivity experiments on cod were carried out by R/V "Walther Herwig" in August/September 1971 in Division 4 Vn (Dr. H.-J. Bohl).

Subarea 5

A. Status of the Fisheries

Except for herring (see special Res. Rep.), there was no commercial fishery.

B. Special Research Studies

I. Environmental Studies

Hydrographic observations were carried out by R/V "Walther Herwig" between 31 October and 12 November 1971 in connection with the joint ICNAF-Survey of larval herring in the Gulf of Maine - Georges Bank area. At each ichthyoplankton station BT-measurements plus surface and bottom temperatures and additionally at selected stations forming two N-S sections across the eastern and western part of Georges Bank on 67°W and 69°W respectively complete hydrographic casts were obtained.

The temperature and salinity distribution on Georges Bank as shown in figures 5 and 6 (eastern section) and figure 7 (western section) was found to be almost the same as observed in November 1969 (Redbook 1970, Part III, pp. 47-48) except that the temperatures on top of the bank were considerably higher in November 1971. The distribution of surface and bottom temperatures in the surveyed area (figures 8 and 9) show that the observed maximum temperatures of 13-15°C were found except west of 70°W only over Georges Bank, whereby they were restricted to the top of the bank at the bottom and extended somewhat beyond the slopes at the surface.

II. Biological Studies

R/V "Walther Herwig" took part in the joint ICNAF-Survey of larval herring in the Gulf of Maine - Georges Bank area from 31 October until 12 November 1971. At 118 stations oblique plankton tows using paired 60 cm bongo nets were made from a maximum depth of 200 m at a speed of 3.5 knots. At 101 stations additional surface tows with a neuston net were obtained at the same time.

Table 4

German nominal catches in Subarea 2, 1958 - 1971, and Subarea 3, 1962 - 1971, in tons (including industrial fish = converted to fish meal on board)

year	Days fished	COD			REDFISH			OTHER FISH			TOTAL		
		Catch	Catch per day fished	% industrial	Catch	Catch per day fished	% industrial	Catch	Catch per day fished	% industrial	Catch	Catch per day fished	% industrial
1958	622	618	1.0		22 909	37.0		516	0.8		24 043	38.7	
59	900	3 238	3.6		34 604	38.5		345	0.4		38 187	42.4	
60	1 156	12 145	11.4		29 181	25.2		1 305	1.1		42 631	36.7	
61	732	11 088	15.2		8 307	11.4		1 599	2.2		20 994	28.8	
62	93	882	9.5	4.1	1 939	20.8	15.9	68	0.7	0	2 889	31.1	11.9
63	76	1 050	13.8	12.3	541	12.4	12.0	59	0.8	67.8	2 050	27.0	13.8
64	495	3 559	7.2	14.4	5 079	10.3	10.5	1 029	2.1	91.3	9 667	19.5	20.5
65	1 323	41 556	31.4	13.3	2 691	2.2	1.2	1 151	0.9	60.0	45 598	34.5	13.8
66	2 132	63 610	29.8	7.8	2 750	1.3	13.2	1 541	0.7	46.4	67 901	31.8	8.9
67	1 251	30 589	24.5	8.4	1 616	1.3	17.1	310	0.2	80.0	33 115	26.5	9.3
68	1 489	53 186	35.7	1.5	301	0.2	4.7	747	0.5	24.8	54 234	36.4	1.9
69	2 099	71 735	34.2	3.4	400	0.2	28.5	1 088	0.6	25.8	73 223	34.9	3.8
70	1 585	48 232	30.4	2.1	650	0.4	29.5	945	0.6	50.4	49 827	31.4	3.3
71	752	19 256	25.6	4.0	463	0.6	7.1	589	0.8	42.8	20 308	27.0	5.2
1962	85	779	9.2	37.6	2 124	25.0	15.2	62	0.7	30.6	2 965	34.9	21.4
63	113	1 822	16.1	3.5	757	6.7	7.8	146	1.3	76.7	2 725	24.1	8.6
64	282	2 344	8.3	*	2 495	8.8	*	717	2.5	91.1	5 556	19.7	11.8
65	724	8 147	11.3	3.1	1 057	1.5	4.2	1 470	2.0	51.6	10 674	14.7	9.9
66	572	8 806	15.4	15.6	305	0.5	36.7	268	0.5	80.2	9 379	16.4	18.1
67	66	613	9.3	18.3	347	5.3	2.0	39	0.6	43.6	999	15.1	13.5
68	-	-	-	-	-	-	-	-	-	-	-	-	-
69	-	257	-	-	4	-	-	1	-	-	262	-	-
70	414	9 937	24.0	3.1	587	1.4	7.2	103	0.2	69.9	10 627	25.7	4.0
71	434	10 747	24.8	2.3	824	1.9	3.0	299	0.7	18.1	11 870	27.4	2.8
1962	178	1 661	9.3	19.8	4 063	22.8	15.5	130	0.7	14.6	5 854	32.9	16.7
63	189	2 872	15.2	6.7	1 698	9.0	10.1	205	1.1	74.1	4 775	25.3	10.8
64	777	5 903	7.6	8.7	7 574	9.7	7.0	1 746	2.2	91.2	15 223	19.6	17.3
65	2 047	49 703	24.3	11.6	3 948	1.9	2.0	2 621	1.3	55.3	56 272	27.5	13.1
66	2 704	72 416	26.8	8.7	3 055	1.1	15.5	1 809	0.7	51.4	77 280	28.6	10.0
67	1 317	31 202	23.7	8.6	1 963	1.5	14.4	349	0.3	75.9	33 514	25.4	9.6
68	1 489	53 186	35.7	1.5	301	0.2	4.7	747	0.5	24.8	54 234	36.4	1.9
69	2 099	71 992	34.3	3.4	404	0.2	28.2	1 089	0.5	25.8	73 485	35.0	3.8
70	1 999	58 169	29.1	2.3	1 237	0.6	18.9	1 048	0.5	52.3	60 454	30.2	3.4
71	1 186	30 003	25.3	3.4	1 287	1.1	4.5	888	0.7	34.5	32 178	27.1	4.3

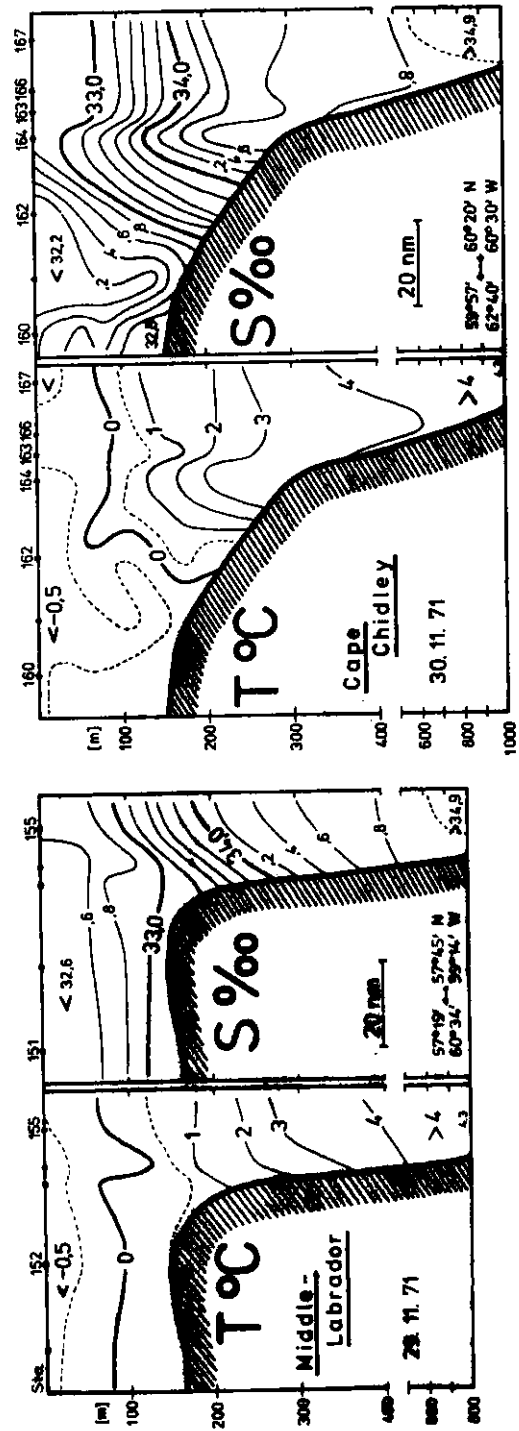
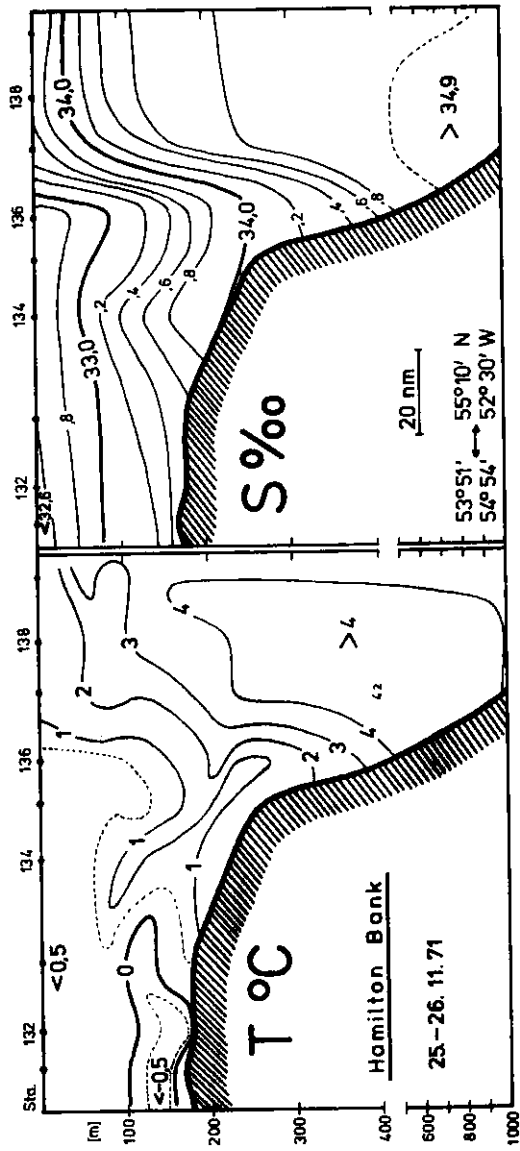
*) included in "OTHER FISH"

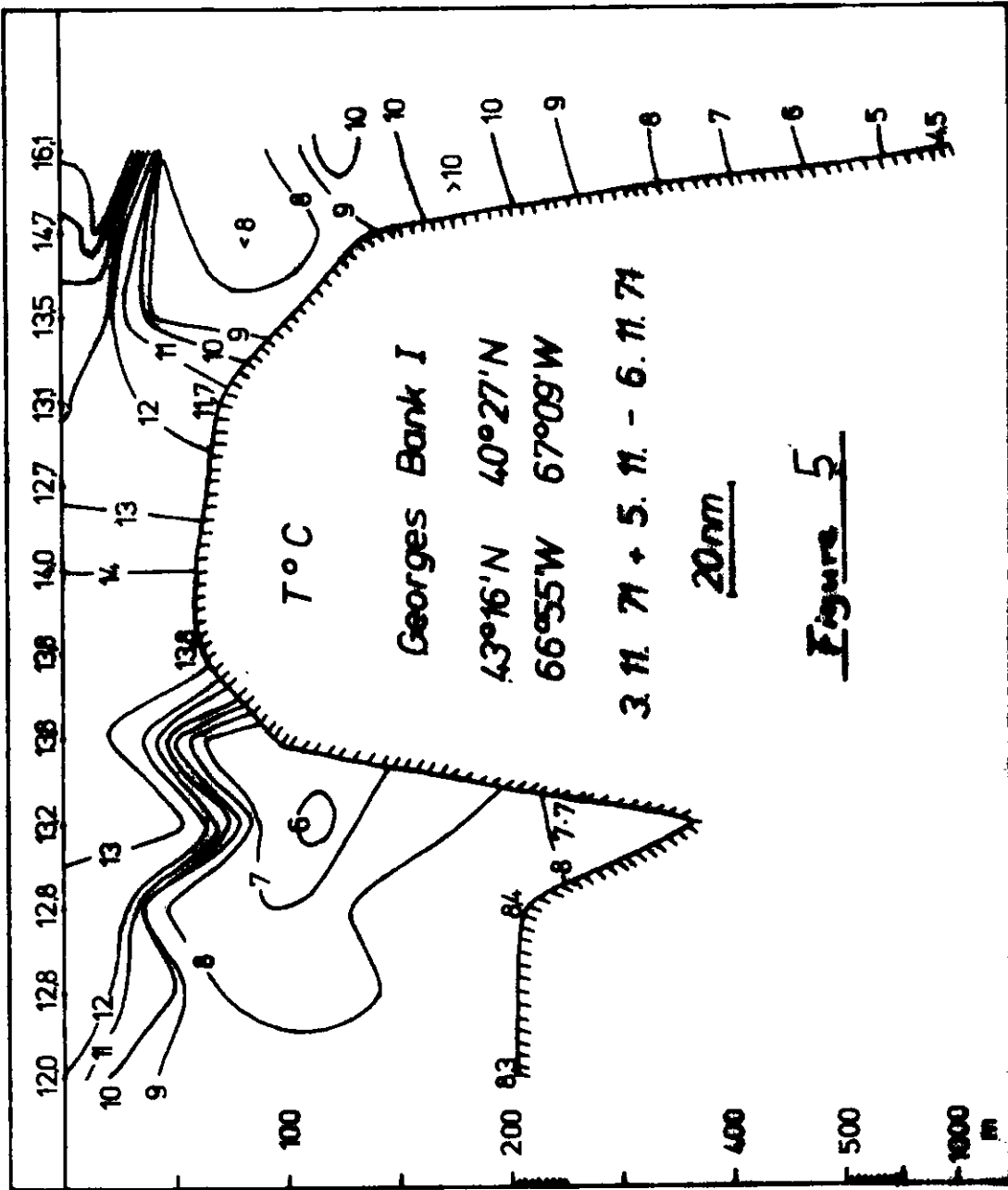
++) industrial catch from Subarea 2 only

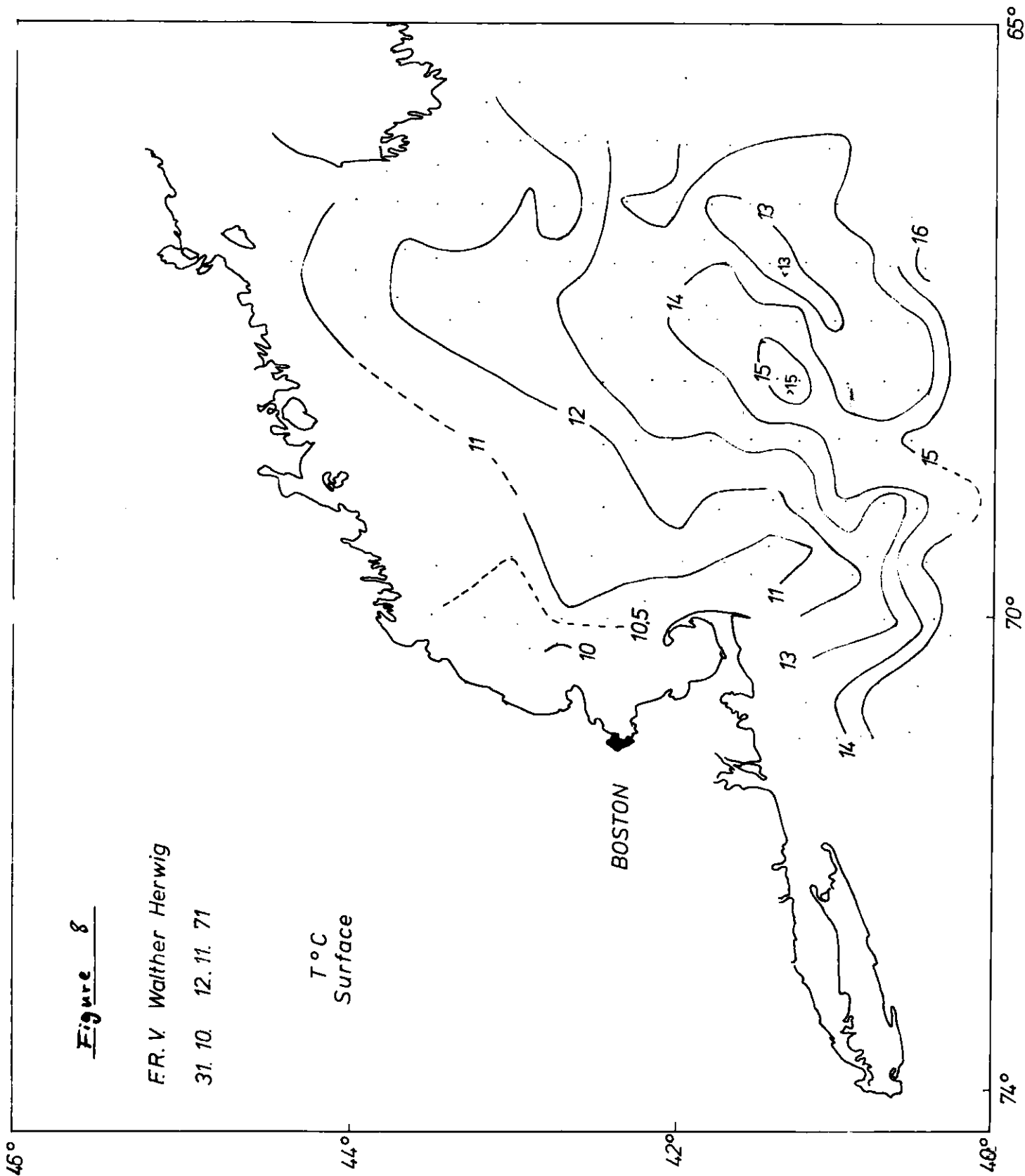
Table 5 Discarded fish in Subareas 2 and 3 in tons, 1971
(1970 in brackets)

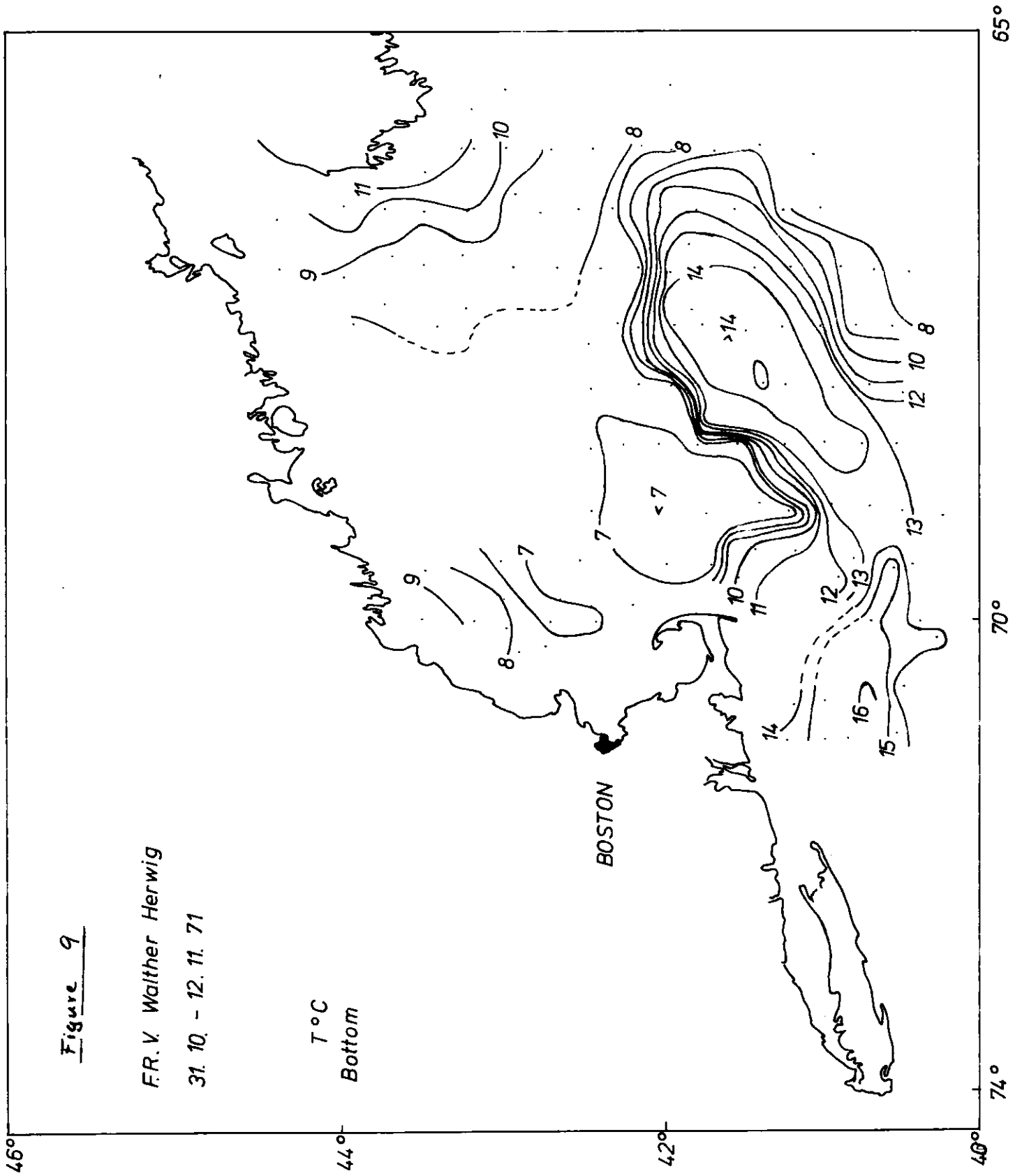
	COD	REDFISCH	OTHER FISH	ALL SPECIES
Div. 2 G	2 (-)	- (-)	- (-)	2 (-)
Div. 2 H	4 (42)	- (1)	2 (2)	6 (45)
Div. 2 J	57 (592)	7 (82)	35 (221)	99 (895)
Total	63 (634)	7 (83)	37 (223)	107 (940)
Div. 3 K	27 (-)	5 (35)	7 (15)	39 (50)

Figure 4









Part III

Subarea 4, 5 and 6 (Herring only)

by K. Schubert

A. Status of the Fisheries

Few trawlers (3) from the season 1970 were fishing in January in Subarea 4, 5 and 6. Fifteen stern freezer trawlers operated with pelagic nets in Subarea 5 from the middle of June to December 1971. The total catch in Division 4 Vn in January amounted to 68 t, in Division 5 Y 226 t, in Division 5 Zw 291 t and in Division 6 A 11 t. From July to December the fifteen trawlers yielded 52,680 t in Subarea 5. The main catch with 55,243 t came from Division 5 Ze and only 963 t (December) from 5 Y and 74 t (December) from 5 Zw.

In Subarea 5 the catch decreased from 88,561 t to 56,860 t. This decreasing was due to diminished effort which decreased from 2,056 to 1,250 fishing days, whereas the catch per day slightly increased from 42.5 t to 45.5 t.

Monthly catch, total catch, effort, catch per unit effort and discarded fish are given in Table 6.

Fig. ¹⁰ shows the catch per day in baskets (50 kg) on an average of about 5 days of 14 German freezer trawlers in 33 trips in 5 Ze from the end of June 1971 to the first decade of November. A large increase of the catches is to observe with the beginning of the spawning time.

B. Special Research Studies

On board of trawlers in 5 Ze 18,466 herring were measured (Table 7).

The average length was 26.51 cm (n = 366) in August, 29.93 cm (n = 11,347) in September and 28.53 cm (n = 6,753) in October.

From these measurements 12 samples were examined (August = 4, September = 5, October = 3). The average length of these measurements are in good agreement with the measurements on board of the trawlers. The average length in the different months was 26.51 cm, 29.40 cm and 28.11 cm (Table 8).

The length measurements of the spawning stock (Fig. 11) show that in the first time of the spawning season larger fish were in the area (curve A), whereas in the first decade of October the proportion of smaller herring increased considerably, and the number of larger herring decreased (curve B). The total curve (A+B) shows that the number of smaller herring were predominant in the spawning time.

Maturity stages 5 (418 ‰) and 4 (341 ‰) were dominant in August (Table 8). Some importance had also maturity stage 2 (161 ‰). In September only spawning herring (stage 6) were in the catches (1000 ‰) whereas in October the bulk of the catches was formed also from maturity stage 6 (997 ‰) with some spent herring (stage 7).

The age composition shows the predominance of the 3-year old herring (year-class 1968) with 618 ‰. Some importance had with 157 ‰ the 4-year old herring (year-class 1967). In September older herring were in the catches. 4-year (1967), 3-year (1968) and 5-year old specimens (1966) formed with 345 ‰, 251 ‰ and 220 ‰ the bulk. In September the age composition changed to more younger herring. 3-year old (year-class 1968) and 4-year old herring (year-class 1967) were dominant with 555 ‰ and 318 ‰ (Table 8).

The average number of vertebrae varied between 56.33 and 56.42, the keeled scales between 13.95 and 13.98 and the gillrakers between 48.93 and 49.44 (Table 8).

In Table 8 are further given the mean length and mean l_1 for age (cm).

Environmental Studies

During the spawning time some hydrographical measurements were made by a member of the staff of our institute on board of our fishery protection vessel "Poseidon".

The main spawning place was as in the observation years 1969 and 1970 situated on the northern edge of the Georges Bank in depth from 40 to 80 m. The spawning area extended from $41^{\circ}30'N-42^{\circ}20'N$ and $66^{\circ}W-68^{\circ}W$. From east to west the area was about 80 sm and from north to south about 30 sm long.

The first spawning was observed on the 28th of August. However, the main spawning started about 8-10 days later. The spawning happened first in the western part of the area ($67^{\circ}-68^{\circ}W$), where larger herring were caught and shifted with the beginning of October more to the east ($66^{\circ}30'-67^{\circ}W$), where younger fish were met.

The spawning places are situated in a narrow band from $10^{\circ}-13^{\circ}C$ in the bottom along the northern edge of the Bank. It seems that the herring was coming in from the northern and northwestern area with cooler bottom water temperatures.

Table 6. Nominal catch, effort, catch-per-unit effort and discards of German freezer trawlers Subareas 4, 5 and 6, in 1971

Subarea Month	4 Vn		5 Y		5 Ze		IX	X	XI	XII	5 Zw		6 A	6			
	Total	I	Total	I	Total	I					Total	I			Total		
Nominal catches(tons)																	
Herring	68	226	963	1189	63	3215	4682	21183	10423	2853	55306	291	74	365	56860	11	11
Mackerel	-	296	38	334	83	-	3	4	5	383	478	26	392	418	1230	1484	1484
Saithe	-	109	395	504	30	-	-	-	2	-	32	98	-	98	634	-	-
Total	68	631	1409	2040	176	3216	4739	21254	10438	3327	56211	420	467	887	59138	1495	1495
Effort																	
Days fishing	10	29	51	80	6	57	147	317	299	234	1147	12	11	23	1250	35	35
Catch per day (tons)																	
Herring	6.8	7.8	18.9	14.9	10.5	56.4	31.9	40.7	70.8	44.5	32.8	24.3	6.7	15.9	45.5	0.3	0.3
Mackerel	-	10.2	0.7	4.2	13.8	-	0	0	0	4.4	0.4	2.2	35.6	18.2	1.0	42.4	42.4
Saithe	-	3.8	7.8	6.3	5.0	-	-	-	0	-	0	8.2	-	4.3	0.5	-	-
Total	6.8	21.8	27.6	25.5	29.3	56.4	32.2	41.2	71.1	44.6	38.2	49.0	42.5	38.6	47.3	42.7	42.7
Discards (tons)																	
Herring	-	-	-	-	-	210	30	1223	4603	1235	80	7381	-	-	7381	-	-
Total	-	-	-	-	-	210	38	1331	4663	1235	90	7567	70	70	7637	-	-

Average gross registered tonnage of German trawlers fishing in Subarea

- 4 1842 GRT
- 5 2157 GRT { 1398-2684 }
- 6 1705 GRT { 1568-1842 }

Table: 7 Length composition (%) 1971 after measurements
on board of trawlers

Area 5 Ze

Month	August	September	October
cm			
20	11	-	-
21	16	-	-
22	27	-	-
23	68	-	-
24	140	+	+
25	233	11	18
26	162	74	174
27	79	138	306
28	82	146	185
29	79	169	120
30	52	161	87
31	19	111	48
32	19	81	27
33	8	60	14
34	5	36	11
35	-	12	7
36	-	1	3
Total %	1000	1000	1000
No.of Samples	4	28	12
No.measured	366	11347	6753
Mean length (cm)	26.51	29.95	28.53
Mean weight (kg)	0.178	0.221	0.200

Table 8

G. F. U. D. N. Y. A. R. E. A. 5. 72. Biological data 1971

Year-class	Age composition (%)			Length (cm)						L ₁ (cm)				
	Age	Month	VIII	IX	X	VIII	IX	X	VIII	IX	X	VIII	IX	X
1970	1	-	-	-	-	-	-	-	-	-	-	-	-	-
169	2	73	-	-	3	22.61	-	23.50	14.50	-	-	14.50	-	-
						\bar{x} 1.796 n	-	-	16.000	-	-	16.000	-	-
1968	3	618	251	553	-	25.48	27.02	26.94	14.31	15.72	15.46	4.003	2.451	5.959
						1.387 2.6	0.977 120	0.720 160	4.003 26	2.451 9	5.959 26	4.003 26	2.451 9	5.959 26
1967	4	157	345	318	-	28.43	28.91	26.86	17.06	16.20	16.75	10.803	6.910	7.804
						0.888 57	1.036 165	1.333 92	10.803 9	6.910 10	7.804 16	10.803 9	6.910 10	7.804 16
1966	5	66	220	79	-	29.42	30.42	30.37	13.17	14.83	15.10	4.359	7.264	12.340
						0.776 24	0.975 105	0.847 23	4.359 3	7.264 9	12.340 5	4.359 3	7.264 9	12.340 5
1965	6	32	90	17	-	30.32	31.73	31.30	13.50	13.40	16.00	13.50	13.40	16.00
						0.747 12	1.041 43	1.210 5	13.50 1	13.40 10	16.00 2	13.50 1	13.40 10	16.00 2
1964	7	11	21	3	-	31.00	32.40	32.50	11.50	12.50	-	11.50	12.50	-
						0.333 4	0.990 10	-	11.50 1	12.50 1	-	11.50 1	12.50 1	-
1963	8	30	19	3	-	32.23	32.61	34.50	13.00	-	-	13.00	-	-
						1.425 11	0.863 9	-	13.00 2	-	-	13.00 2	-	-
1962	9	-	10	-	-	32.50	32.50	-	15.00	15.00	-	15.00	15.00	-
						-	-	-	15.00 2	15.00 2	-	15.00 2	15.00 2	-
1962	>9	13	44	24	-	33.30	33.45	34.07	11.50	12.25	14.50	11.50	12.25	14.50
						0.710 5	0.748 21	1.316 7	11.50 1	12.25 4	14.50 2	11.50 1	12.25 4	14.50 2
Total	n	1000	1000	1000	-	26.51	29.40	28.11	14.63	14.72	15.81	14.63	14.72	15.81
						6.530 366	4.252 478	3.624 290	7.627 46	6.496 45	6.861 51	7.627 46	6.496 45	6.861 51

Table 8 - continued
 Germany, Biological Station 1971 - continued

Year-class	Age	Month	Vertebrae		Keel scales		Gill rakers		Sexual Maturity %			
			VIII	IX	IX	X	VIII	IX	X	VIII	IX	X
1970	1	-	-	-	-	-	-	-	1	1	-	-
1969	2	\bar{x} 56.19	-	-	56.00	15.00	48.48	-	-	50.00	-	-
		s^2 0.235	-	-	-	-	2.269	-	-	-	161	-
1968	3	\bar{x} 56.49	56.43	56.42	56.42	14.00	48.64	48.82	48.84	48.84	-	-
		s^2 0.399	0.481	0.372	0.372	0.589	2.196	2.858	2.246	2.246	77	-
1967	4	\bar{x} 56.40	56.35	56.18	56.18	13.87	49.53	49.51	49.70	49.70	-	-
		s^2 0.359	0.402	0.413	0.413	0.650	3.186	2.826	3.271	3.271	341	-
1966	5	\bar{x} 56.29	56.36	56.22	56.22	13.87	50.00	49.72	49.91	49.91	-	-
		s^2 0.393	0.465	0.453	0.453	0.468	2.267	2.578	2.455	2.455	418	-
1965	6	\bar{x} 56.08	56.41	56.60	56.60	13.94	49.67	49.58	49.80	49.80	-	-
		s^2 0.448	0.421	0.390	0.390	0.799	1.162	2.819	2.210	2.210	1000	997
1964	7	\bar{x} 56.25	56.22	56.00	56.00	13.80	49.50	50.60	47.00	47.00	-	-
		s^2 0.270	0.201	-	-	0.404	6.750	1.840	-	-	-	3
1963	8	\bar{x} 56.36	56.33	57.00	57.00	14.50	49.00	49.67	51.00	51.00	-	-
		s^2 0.468	0.264	-	-	0.750	1.400	3.514	-	-	-	-
1962	9	\bar{x} 56.20	56.20	-	-	13.80	50.20	50.20	50.20	50.20	1000	1000
		s^2 -	0.210	-	-	0.210	-	4.710	-	-	366	487
~1962	> 9	\bar{x} 56.40	56.29	56.57	56.57	14.00	49.80	49.81	49.57	49.57	-	-
		s^2 0.340	0.410	0.310	0.310	0.333	0.210	2.364	0.983	0.983	487	300
Total	\bar{x} 56.42	\bar{x} 56.37	56.37	56.33	56.33	13.98	48.93	49.44	49.24	49.24	-	-
		s^2 0.384	0.412	0.396	0.396	0.678	2.542	2.893	2.728	2.728	487	300
		n 358	473	288	288	288	365	478	290	487	300	

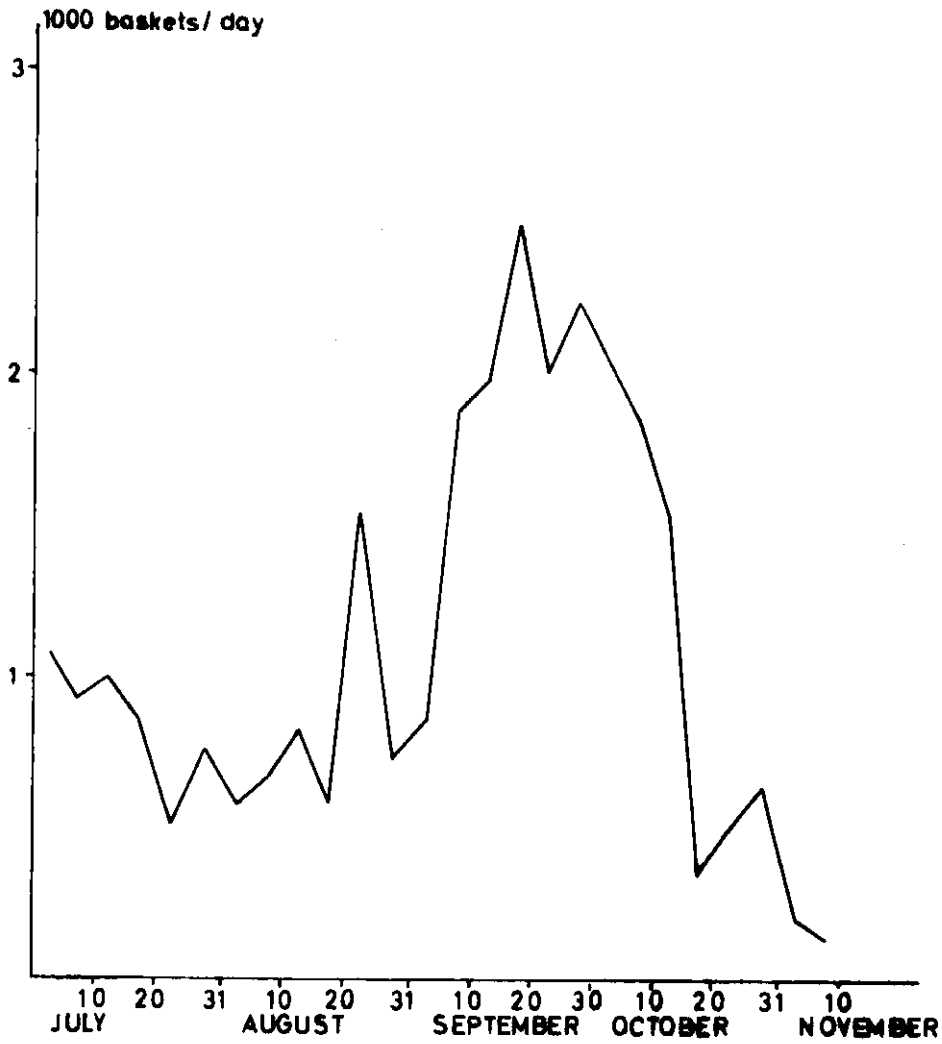


Fig.10. Herring catch/day (baskets) on an average of about 5 days of 14 German freezer trawlers in 33 trips in 5 Ze (total 37 trips), 1971

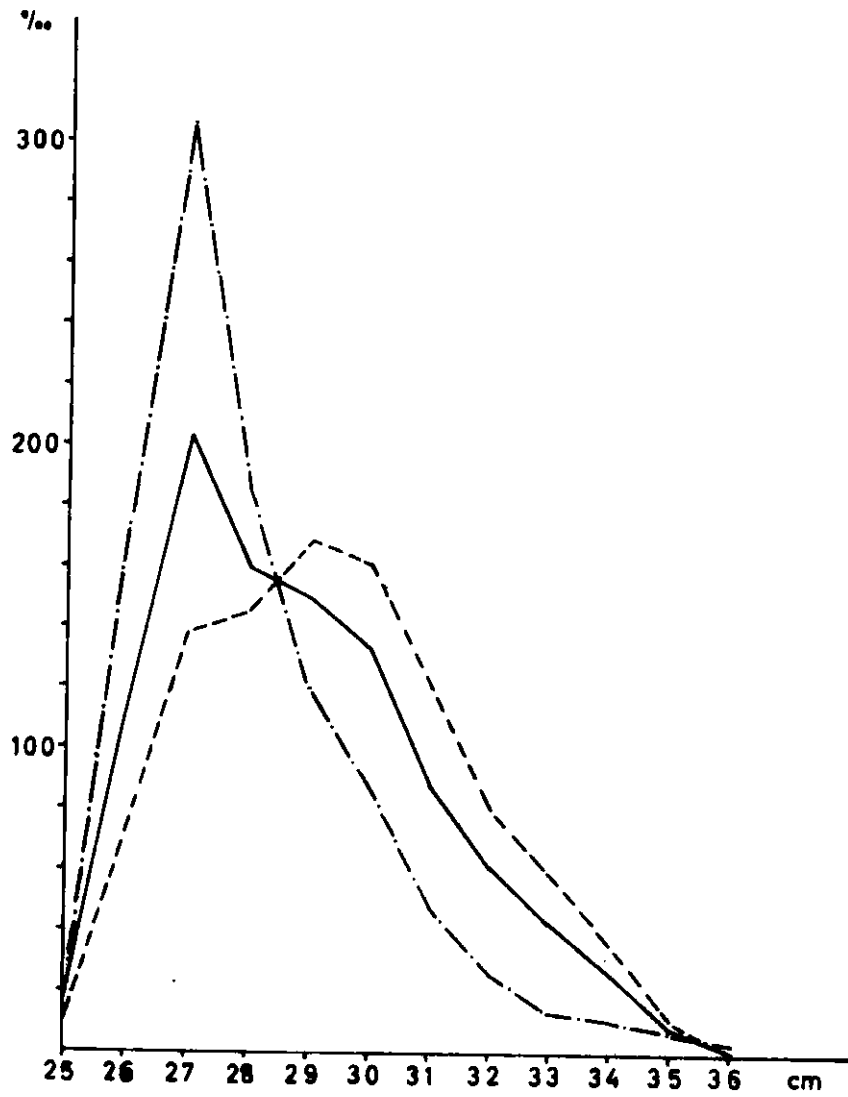


Fig. 11. Length measurements of spawning herring in Subdivision 5 Ze 1971 (%)
---- Trawler A (15.-28.9.71)
-.-.-Trawler B (3.-9.10.71)
—— A + B