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by

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A. Work at Sea

During the International Geophysical Year the research ships "Anton Dohrn" and "Gauss" participated in the "Polar Front Survey" program sponsored by the ICES and ICNAF. Both vessels made two simultaneous cruises, one in March to April, and one in August-September. The investigations were carried out between the longitude 20°W (Iceland) and the meridian of Cape Farewell with a prolongation across Flemish Cap - Newfoundland Bank, and from Denmark Strait to the Azores in the South.

Lines of research:

Current registration of air temperature, surface salinity (tentatively), surface turbidity, surface currents (with G.E.K.), and echo depth.

At hydrographic stations:

Temperature, salinity, O_2-content at standard depths down to the bottom; bathythermograph records (partly between stations) salinity partly checked by salinometer and titration.

At selected stations and depths:

Seston dry weight, chlorophyll content, and albumine content. - Phytoplankton assimilation in constant temperature and lighting (^{14}C. method). - Total phosphorous. - Microplankton samples. - Zooplankton (by vertical and closing net hauls). - Quantity of organic matter in solutions. - Occurrence of fungi in bottom samples, in samples of water from bottom layers, in plankton etc. - Benthic fauna (with van Veen bottom sampler, in the shallower parts of the area only). - A small number of trawl catches, principally analysed for the occurrence of different forms of Sebastes. - Investigations on the blood of deep sea fishes and free amino acids in the muscle flesh of different species of fish (freshly caught and living, kept for different spans of time in aquarium tanks, kept dead at outdoor temperature, on ice, and deep frozen).

Temperature and salinity data of the 558 stations will be published in the "Bulletin Hydrographique du Conseil International pour l'Exploration de la Mer", and also distributed to the World Data Centres A and B of the IGY.

A first collection of 19 reports of the scientists, members of these cruises, is in print and will be published in June 1959 in a special volume of the "Deutsche Hydrographische Zeitschrift". These reports give first results of the cruises concerning bottom configuration, physics and chemistry of the sea water, suspended matter, organic production, mycology of bottom sediments, micro- and macroplankton, bottom fauna, biochemistry of commercial fishes.

(Prof. Dr. A. Bückmann, Dr. G. Dietrich)

A searching program was sponsored by the Union of the German Deep Sea Fisheries with relief of the Federal Government and participation of the Federal Fisheries Research Institute.

Facing unfavourable fishing conditions off Iceland and in the northeast European regions 4 ships went to E - S - W-Greenland in August-September, the season of hitherto least experiences. In order to extend the trips to 35 days at sea and to utilize the fishes caught in the experimental hauls, 4 large modern ships with fish meal processing plants were chosen:

1) "H. Everling", 9.8. - 4.9. to southern and western Greenland as far north as 69°56'N;

2) "Zephyros", 3.9. - 7.10. to eastern Greenland from 61°04'N to 67°41'N;

3) "Saarbrücken", 8.9. - 13.10. again to southern and western Greenland until 68°04'N;

4) "Saturn", 13.9. - 14.10. to eastern Iceland, Jan Mayen and eastern Greenland between 70°60'N and 63°32'N.

After recommendations and plans worked out by the "Institut für Seefischerei" these ships made a total of 273 experimental trawl hauls (145 on the western side), and besides, some temperature measurements on the sea surface and the fishes immediately after arriving on board. From the 21st day at sea forth they were free to fish in a commercial manner. In each trip two biologists took part in observations and samplings of the fish. The results will be published as soon as possible. A preliminary report concerning western Greenland can be summarized as follows:

a) The catches of cod in the southern regions - Cape Farewell, Sermersok, Nanortalik - were less favourable than in the year before and in 1952, when the first German fishery was performed there. That had been expected because of the age composition of the cod stock, but 1960 and perhaps already 1959 a greater density of the cod stock off southern Greenland is probable, especially based on the rich and for the first time maturing age group of 1953.

b) The searching revealed good catching possibilities for redfish off Cape Thorwaldsen and in the Bay of Julianehåb, but the bad bottom conditions require a rather detailed knowledge of the trawlable grounds. Meanwhile some short and successful commercial trips have been made there, which were almost as favourable as those to Labrador with their longer duration.

c) In the season April to July, especially in 1955 and 1957, very favourable catching conditions for redfish in the region of Fyllas Bank and Banana Bank have already been experienced. The searching confirmed that and proved the same to be the case also farther northward at the outer edge of the Lille Hellefiske Bank during late summer.

d) The Store Hellefiske Bank was examined rather thoroughly, and quite similar to earlier successes of foreign vessels and those present at that time, there is reasonable hope for German salting trawlers (especially if equipped with fish meal plants) and factory ships to extend their season until the early autumn by going more northward than up to the present time. Especially in 1959 an increase in average size of the cod is to be

expected, the rich year-class of 1953 then reaching about 60 cm in length.

e) Experimental hauls around the island of Disko were a complete failure quite similar to those of "Anton Dohrn" in 1955. Cod concentrations of commercial value were occasionally met north of the Store Hellefiske Bank, probably only within the territorial zone, and furthermore this northernmost region is inhabited predominantly by smaller cod.

(Dr. Arno Meyer)

B. Gear Technique

No experiments on mesh selection and other gear application have been performed at sea in the ICNAF area.

Concerning the request to examine the methods for measuring the trawl meshes which are now in use in Europe for accuracy and practical aptitude, this work has now been terminated. This survey included longitudinally working pressure gauges from Scotland, England and Poland in comparison with those of ICNAF. The result was, that the Scottish design offers the highest security, even if used independently by several persons. This gauge, too, proved to be best qualified for practical application. Accordingly the proposal is made here, that within the range of ICNAF activity, a longitudinal pressure gauge similar to the Scottish model should be adopted. The corresponding American report is not yet available, but the development of a new mesh measuring design has been announced.

(Prof. Dr. A. von Brandt)

C. Cod Investigations

Subarea 1

a. West Greenland.

Figure 1A presents the age- and size-distribution of the West Greenland cod during the spawning season, February - April 1958, in the western slope-area of Fylla Bank (Subdivision 1D). The cod at this season had attained an average length of 76.4 cm, which is extraordinarily high for West Greenland. Of the cod fished 85% were mature and 15% were immature. By mid April, 70% of the mature cod had spawned, 25% were spawning, the remaining 5% were preparing to spawn.

Of the spawning stock 40% belonged to ages 8 and 11, i.e. the 1950 year-class (19%) and the 1947 year-class (21%). The proportion of the older year-classes, which already had lost their importance for the summer fishery, were surprisingly high in the spawning stocks. These 13-22 year old spawning cod accounted in 1958 for no less then 37% of the spawning stock; one third of them belonged to the rich 1942 year-class. Almost all these 16 year old cod spawned in 1958 for the tenth time, and had attained an average length of 86.7 cm. Also specimens of the almost extinct 1936 and 1934 year-classes were still found on the spawning grounds.

The remaining year-classes of importance to the fisheries had the following average lengths: 1945 year-class: 82.3 cm, 1947 year-class: 78.6 cm, and 1950 year-class: 71.9 cm.

The investigations revealed that for the West Greenland cod 8% spawned for the first time at age 6, 44% at age 7, 29% at age 8, 17% at age 9, and 2% at age 10. This corresponds to a mean age at first maturity of 7.6 years.

The cod (Figure 1B) caught in the early-summer fishery, mid April to beginning of June, from fresh-fish trawlers (together with redfish) operating on the western edge of the Fylla and Banana Banks (1D-1C) were considerably smaller (mean 69.9 cm) than those of the spawning stock. This was in the first place due to the fact that the new rich 1953 year-class was included in this fishery. The three 1953, 1950, and 1947 year-classes accounted for 64% of the catches, whereas the older year-classes, still so important on the spawning grounds, only accounted for 4%.

The many samples collected by the scouting trawler in August and September rendered a good summary of the composition of the Greenland cod stock at this season of the year. On Store Hellefiske Bank 60% (see Figure 2A) consisted of the rich 1953 year-class. The average lengths of these 5 year old cod were in August 54.6 cm and in September 56.7 cm. Owing to their high percentage in the catches the average length of the total catch was only 59.8 cm. It is noteworthy that in Subdivision 1B the 63 cm long 1952 cod excelled in numbers;the 1950 year-class (8%) and the 1947 year-class (6%).

In late summer the densest stock of cod was observed on the feeding grounds of Store Hellefiske Bank, but at the same time only rather small catches were made in Subdivisions 1D and 1E. In these subdivisions, however, the cod were on an average larger, owing to the greater proportion of the 1950 and 1947 year-classes. The age- and length-distribution is shown in Figure 2B; it is rather similar to that observed for the early summer (Figure 1B). It is to be noted that larger concentrations of bigger and older cod were found in September on the eastern, shallower part of Fylla Bank, which also indicates a coastward migration of cod during the autumn.

b. South Greenland.

The 1950 year-class was the most important year-class in the winter-fishery off South Greenland in 1957/58 and 1958/59, amounting to 40 and 38% respectively. Following the emigration (probably mainly to East Greenland) of the older year-classes the proportion of the 1950 year-class in the spring fishery of 1958 increased, as far as up to 52%.

A comparison of Figures 1C and 1D shows clearly the renewal of the South Greenland stock through the young rich 1953 year-class; this is in good agreement with what could be predicted from the catches of "Anton Dohrn" in the summer of 1957 (see last year's Research Report). In the catches from the scouting trips in late summer (Figure 2C) the 1953 year-class was already nearly as strong as the 1950 year-class. In their entirety these observations indicate that the 1953 year-class also is very abundant in the southern region, and it may well be assumed that this year-class, when becoming mature will be of importance also for the cod fishery off East-Greenland, probably to the same extent as the 1945, 1949 and 1950 year-classes, which also were well represented in the South Greenland waters.

The proportionate rich occurrence (see Figures 2B and 2C) of 2 year old cod (1956 year-class) in the catches of the scouting trawler is striking, and the more so as the catches were made with 110 mm meshes and as these 2 year olds only have an average size of 26.5 cm. This may indicate that the 1956 year-class is considerably richer than the two preceding very poor 1955 and 1954 year-classes.

Observations were made on the stage of maturity of the cod concentrated in the winter of 1958/59 off South Greenland. The immature specimens accounted for 60%, 20% were preparing to spawn for the first time, and another 20% for the second (or more) time. Compared to the West Greenland cod the cod from South Greenland become mature at a later age. Only ca 10% of the 6-8 year old cod were mature. Of the 9 year old cod 65% were still immature and of the 10 year old 50%.

The growth is also slower in the colder South Greenland water than off West Greenland. This appears clearly from a comparison of the two growth-curves for West and South Greenland in Figure 4. These curves are based on the large material from the widely extended scouting trips in August and September. The growth is linear until the 6th year off West Greenland and until the 7th year off South Greenland. Thereupon follows a gradual decrease of the growth rate caused by the more frequently occurring ripening of the gonads and testes.

It is of interest to note the 'knee-bending' of the two growth-curves for the 11 year old cod of the 1947 year-class. However, it is a well known fact that the 1947 year-class, due to poor conditions during its first years (crowding), had a fairly slow growth. This fact is further elucidated in Figure 4 by the growth curve for the 1947 year-class from samples in Subdivision 1F in 1954 through 1958. Quite contrary to this is the growth of the 1945 year-class which grew up mainly in South Greenland waters. Its growth from its 7th year of age (from the start of the German fishery in Greenland in 1952) is well known. The striking variability of the growth figures is no doubt caused by step-like emigration of individuals to East Greenland upon attaining maturity.

c. East Greenland.

The yields of the spring-fishery as well as the length-distribution of the samples from this fishery are in the main determined by the proportion of the 1949 and 1950 year-classes in the catches: 66% for the Angmagssalik area and 69% for the Dohrn Bank (see Figure 3A). Still in the autumn these two year-classes together accounted for 65%. Compared to the preceding year the age-distribution had changed considerably as far as the 1945 year-class, which had dominated in the fishery since its start in 1955, had lost much in strength. The rich 1950 year-class, which entered the fishery in 1956, was in 1958 the richest year-class (40%). In spring 1958 the average length of the cod off Angmagssalik was 74.3 cm. On the Dohrn Bank the length was 74.1 cm in spring, and 81.3 cm in early autumn.

Figure 4 shows the mean lengths of the East Greenland cod observed for the spring seasons since 1956; for comparison a growth curve for the Icelandic cod is presented. The comparison reveals that the growth rate of the East Greenland cod is intermediary between those of the South Greenland and the faster growing Icelandic stocks. However, the curves of Figure 4 hardly reveal the growth of the East Greenland cod properly, as the catch from the areas along the slope fished by German trawlers probably presents a mixture of South Greenland, East Greenland, and Icelandic cod. This conception, which also has been expressed by Jón Jónsson, is supported by the fact that the Angmagssalik cod has a slower growth than the cod from the Dohrn Bank closer to Iceland.

Subarea 2

A number of cod samples from Labrador waters were available for age determinations. The otoliths of the cod from the cold bank-water were easy to read and interprete, but the interpretation of the otoliths of the cod from the somewhat warmer slope-water was more difficult; the age readings of 30% of these otoliths were considered as doubtful. A characteristic feature of the otoliths of the Labrador cod is the exceedingly clear delinitation of the spawning zones,

which facilitates the otherwise difficult determination of age when spawning.

The cod caught in the fishery for redfish in deeper water presents a fairly even age-distribution. Only the 1948, 1950 and 1952 year-classes predominated with percentages of 17, 14 and 13, respectively, over the 1945, 1946, 1947, 1949, and 1951 year-classes, which show percentages ranging only between 7 and 9.

The very slow growth of the Labrador cod is striking. In December, at the end of the feeding period, the three most abundant year-classes: 1952, 1950 and 1948 had only attained average lengths of 55.1, 60.6, and 65.0 cm respectively. This explains why the cod landed from Labrador in spite of its high average of 9.8 years only measure 63.4 cm in mean. This small size causes the Labrador cod to be not especially suitable for the fresh-fish trawlers.

Subarea 3

Age determinations of cod from Newfoundland waters were carried out. In a sample from February from Subdivision 3P south the following percentage frequencies were observed: 1952 year-class: 33%, 1953: 24%, and 1949: 17%. These three year-classes together thus accounted for ¾ of the sample. The growth of the Newfoundland cod is considerably faster than that of the Labrador cod: 1953 year-class: 51.1 cm, 1952: 58.0 cm, 1949: 77.0 cm. However, as cod over 9 years of age only accounted for 13.5% of the catch the mean length of the landed cod was only 65.7 cm.

(Dr. Arno Meyer)

D. Haddock Investigations

Subarea 3

The 1958 investigations on haddock showed that in Subdivision 3P south, the 1949 year-class accounted for 65% of the stock; this year-class had a mean length of 49.7 cm. The 1952 year-class was present with 23%; all the other year-classes were weak. The average length of the landed haddock of all year-classes was 49.1 cm.

(Dr. Arno Meyer)

E. Fishing Activities

The German fisheries in the ICNAF area increased in 1958 and were extended over wider regions. German trawlers are now operating in Subareas 1, 2 and 3. A preliminary summary of statistical data for 1958 presents the following figures: 143 trips to S. and W. Greenland with 37,390 tons landed weight, 85 trips to Labrador with 19,298 tons landed weight and 7 trips to Newfoundland with 1,329 tons. In these figures are included 26 trips for salt fish to W. Greenland with 5,076 tons salt-fish, and 277 tons salt-fillets, as well as 7 combined factory-ship trips (deep-freezing and fresh-fish), thereof three to Greenland and four to Labrador.

The year 1958 was the first year in which fishing operations were carried out in Subarea 1 through the whole of the year. When the difficult South Greenland fishery (almost exclusively for cod) ended in February, the fishery for spawning cod was started in the region of Fylla Bank and the fishery for redfish in the border-regions Fylla and Banana Banks was commenced. Cod made up 60% and redfish 40% of the catches in February and March. In April-May the proportion of cod decreased to 15%; in the period June-September it again increased and reached over 80%. When the fisheries of W. Greenland came to an end in September, the fisheries off South Greenland still continued, but to a lesser extent, first as a pure redfish-fishery off Cape Thorvaldsen, later - towards the end of the year - mainly as a cod-fishery off Cape Farvel and Nanortalik.

In 1957 redfish accounted for 60% of the German landings in 1958, however, the cod again (as in 1952, 1953, 1954 and 1956) made up a larger proportion, viz. 67%. With 24,417 tons cod (landed gutted weight) and 37,390 tons total landings, the year 1958 showed the largest landings achieved by the German fishery since its start in Subarea 1 in 1952.

The catch of the German trawlers from East Greenland decreased further to 15,000 tons (1955: 46,000 tons, 1956: 44,700 tons, 1957: 21,800 tons). Cod which at the start of this fishery in 1953 only accounted for 6.5%, made up 31% in 1958, i.e. a further increase (1956: 16.6%, 1957: 26.8%).

After the Icelanders had observed a rich occurrence of fish south-east of Hamilton Inlet Bank, German trawlers moved into Subarea 2 in August. Due to the extraordinarily large daily catches (33.9 tons), this fishery was very profitable in spite of the long trips of 2,150 nautical miles (15.9 days to and from). Proportionately small redfish made up 97% of the catches, the proportion of cod being exceedingly small.

Commercial fishing was tried again in the Newfoundland area in February and March. However, as the catch mostly consisted of average-sized pollock, and as the cod and haddock were too small-sized to satisfy the German market, the trips did not pay, in spite of a daily catch of 24.5 tons. The German trawlers operated mainly in Subdivision 3P south and 30; some experimental hauls in 4R and 4V north were unsatisfactory.

(Dr. Arno Meyer)

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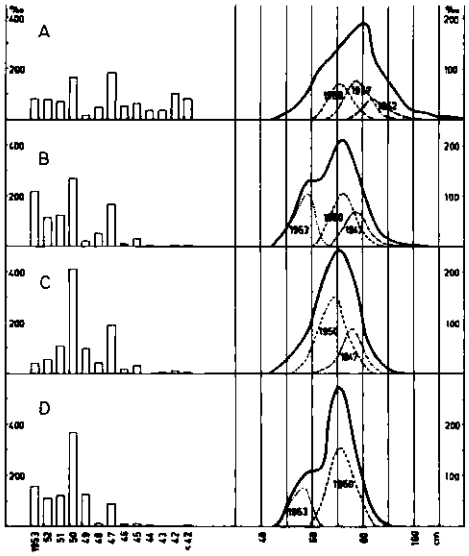

Figure 1. Age- and length distribution (‰) of cod from W. and S. Greenland landed by fresh-fish-trawlers, 1958. A - from Fylla Bank (1D), fished end of Feb. to beginning of April. B - from the border-area of Fylla Bank and Banana Bank (1D-1C), fished from mid April to beginning of June. C - from S. Greenland, Nanortalik to Cape Farewell (1F), fished end of Nov., 1957 to mid Feb. 1958. D - from S. Greenland, Nanortalik to Cape Farewell (1F), fished end of Nov. 1958 to end January 1959.

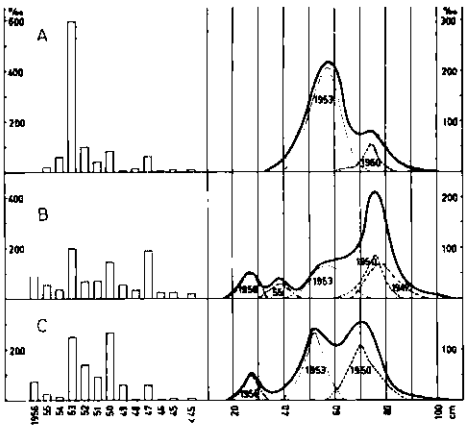

Figure 2. Age- and length distribution (‰) of cod from W.- and S. Greenland 1958, catch from the scouting-trawler in Aug. and Sep. A - Store Hellefiske Bank (1B). B - Southern Banks (1D-1E). C - S. Greenland (1F).

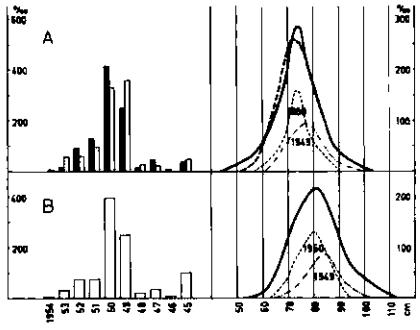

Figure 3. Age- and length distribution (‰) of cod from E. Greenland 1958, landed by fresh-fish-trawlers. A - Angmagssalik (age-distribution: black, length-distribution - striated) and the Dohrn Bank, fished in March. B - Dohrn Bank, fished in Aug. and Sept.

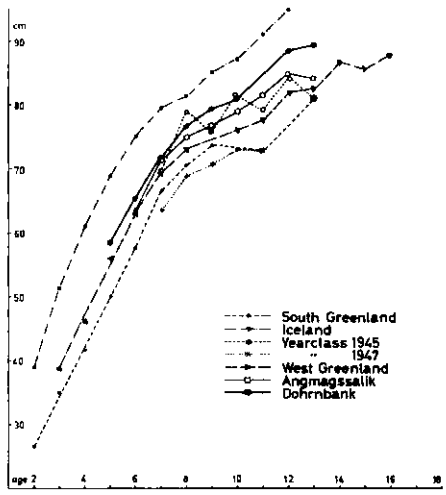

Figure 4. Average length of the various age-groups of cod from: W. Greenland S. Greenland, autumn; Angmagssalik and Dohrn Bank, spring; Iceland (after Jonsson), spring; and the 1947 and 1945 year-classes from S. Greenland in autumn.