

## NOTES ON GREENLAND HALIBUT, *REINHARDTIUS HIPPOGLOSSOIDES* (WALBAUM), IN THE EASTERN NORWEGIAN SEA

By

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### DISTRIBUTION

Very little is known about the distribution and development of Greenland halibut, *Reinhardtius hippoglossoides* Walbaum 1792, in the Norwegian Sea and the Barents Sea. In the eastern Norwegian Sea the mature stock is distributed from the Norwegian coast along the slope of the continental shelf northwards W of Bear Island to Spitsbergen. Lower abundance is found off the coast of South Norway, and in the southern part of the Barents Sea eastwards to the Kanin Peninsula and the SW coast of Novaya Zemlya and at the coasts of Spitsbergen (Fig. 1). The species is rarely found in the Norwegian fjords. Greenland halibut is also distributed in the southern part of the Norwegian Sea between the Faroes past E and N of Iceland and the SE coast of Greenland.

In the fjords and along the coast of West Spitsbergen Greenland halibut was not very common in the first half of this century (HOGNESTAD

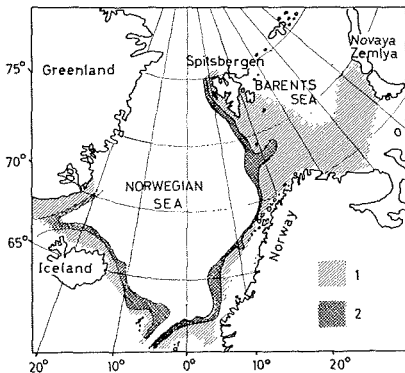


Fig. 1. 1 and 2. The distribution of Greenland halibut in the Norwegian Sea and the Barents Sea. 2. The area between 400 and 1000 m depth along the slope of the continental shelf.

1961), but later the abundance of young age groups seems to have increased considerably. The species was found in this area in 1946 and 1947 (DEVOLD pers. comm.), and in 1958 young age groups seemed to be quite common in the fjords (HOGNESTAD 1961). In recent years it has been frequently found in Spitsbergen waters. Young age groups (0-4) have not been found in other parts of the Barents Sea (ANDRIYASHEV 1954) nor along the Norwegian coast. Very little is known about spawning and development in this area, but some observations were made in 1964 and 1965 (SOROKIN 1967).

An increasing Norwegian fishery is taking place in the eastern part of the Norwegian Sea from February to September at depths between 400 and 800 m. The fishing grounds are located along the slope of the continental shelf from off the coast of North Norway to off the coast of Spitsbergen. In the W-E direction they are located in a relatively narrow band due to the depth conditions along the slope (Fig. 1). Similar conditions are found along the slope of the continental shelf N of Iceland (KONSTANTINOV 1968). Judging from the locations of the fishery from time to time, it seems that mature Greenland halibut migrate slowly from the area outside North Norway to the waters W of Bear Island and Spitsbergen from February to July. From the same area some migration takes place eastwards to the southern Barents Sea in the same period (SOROKIN 1967) but this is probably mainly the immature part of the stock.

#### OBSERVATIONS ON O- AND I-GROUP GREENLAND HALIBUT

Bottom-trawling was carried out with R/V *Asterias* during the summers of 1958 and 1960 on the banks and in the fjords of West Spitsbergen both along the W and N coasts. Juvenile Greenland halibut were found in the fjords at depths varying from 190-300 m, and in temperatures between

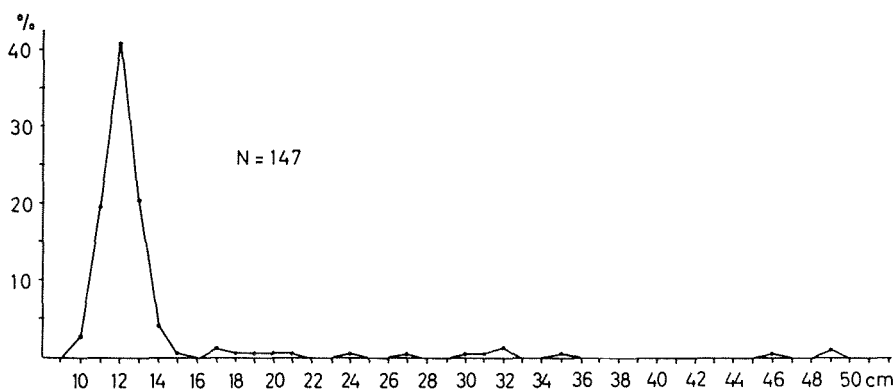


Fig. 2. The length distribution of Greenland halibut from the fjords of West Spitsbergen 1958.

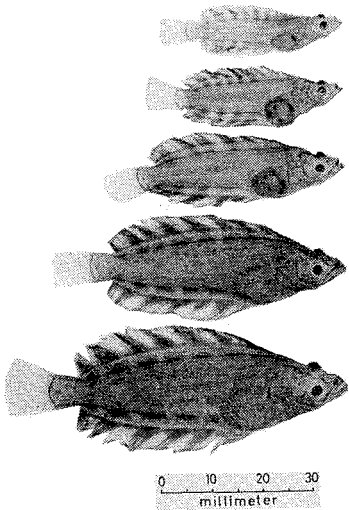


Fig. 3. O-group Greenland halibut of 36, 40, 47, 58 and 67 mm length from the Woodfjord, Spitsbergen, 10 August 1960.

1–2°C. Weak echo-recordings were made of a layer which consisted of planktonic organisms together with larvae of Greenland halibut, Long Rough Dab and Cottidae.

In 1966 a few O-group Greenland halibut were caught in early September with pelagic trawl at 25–35 m depth at almost 79°N, off the coast of West Spitsbergen (Fig. 4). In August–September 1968 some O-group Greenland halibut were taken with pelagic trawl both along the W coast of Spitsbergen and between Bear Island and Spitsbergen (Fig. 4). The catches were made at 10–50 m depth in temperatures from 0°–2°C. The highest abundance was recorded at approx. 78°N (Sentinellaflaket). The length distribution (Fig. 5) varied from 33–69 mm (mean 45.7 mm). The recordings in 1966 and 1968 were made during the combined

–0.7° and 1.3°C, mainly around 0°C. The size distribution varied between 10 and 50 cm, but generally more than 90% of the catches consisted of fish of 10–15 cm length (HOGNESTAD 1961, Fig. 2).

In August 1960 some O-group Greenland halibut of 36–67 mm length (mean 49.6 mm) (Fig. 3) were caught with mid-water trawl in Woodfjord on the N coast of Spitsbergen at 60–80 m depth (Fig. 4). Larvae of 36–40 mm length had not completed their metamorphosis, but showed signs of the imminent turning of the head. The larvae were half transparent, and their intestines were filled with red-coloured food, mainly small unidentified crustaceans. The temperature of the water layer where the larvae occurred varied from

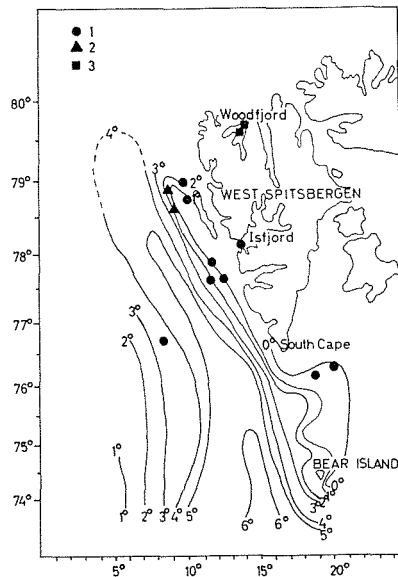
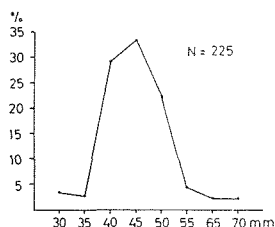


Fig. 4. Catch localities of O-group Greenland halibut in (1) 1968, (2) 1966 and (3) 1960. Isotherms at 50 m depth in early September 1968.

Fig. 5. The length distribution of O-group Greenland halibut from the Spitsbergen area August–September 1968.

English–Russian–Norwegian O-group fish survey in the Barents Sea. The above-mentioned observations of O-group Greenland halibut are the only ones known so far in the Barents Sea area.



#### DISCUSSION

The spawning and development of the Greenland halibut are described from West Greenland (JENSEN 1935). In these waters spawning takes place at 600–1000 m depth in temperatures between 3.5° and 4°C and a salinity of 34.5‰. Assuming that the Greenland halibut require the same hydrographical conditions for spawning in the Barents Sea area, which means temperatures between 2° and 4°C, one can to some extent locate the spawning grounds in this area.

According to ANDRIYASHEV (1954) Greenland halibut migrate to 800–1200 m depth for spawning. At the eastern parts of the Norwegian Sea these depths are only found along the slope of the continental shelf from the Norwegian coast northwards to W of Spitsbergen. Along this slope the temperature as a rule decreases to 0°C at 800–1000 m depth (HELLAND-HANSEN and NANSEN 1909). This has also been shown by several observations during recent years. In the same area the 2°C isotherm is located at 600–800 m, but W of Bear Island it can be found at 300–400 m (MORK 1968). The temperature range 2°–4°C is thus generally found at 300–800 m depth along the slope from the coast of Norway to West Spitsbergen.

The finds of O-group Greenland halibut indicate that spawning must take place along the slope of the continental shelf between North Norway and Spitsbergen, and recent Russian investigations also seem to confirm this (SOROKIN 1967). Judging from the locations of the temperature range 2°–4°C in this area, it is most likely that spawning takes place no deeper than 800 m.

The time of spawning in West Greenland waters is from April to June (JENSEN 1935). In the eastern Norwegian Sea area it is supposed to take place from March or April to July (MILINSKY 1944, ANDRIYASHEV 1954). The size of the O-group fish observed in August–September indicate that the main spawning takes place in April–June, but Soviet scientists have observed considerable spawning in November–December in the same area (NIZOVTSSEV pers. comm.).

Off West Greenland larvae with yolk sac of 10–18 mm length are found at 600–1000 m depth. Larvae longer than 16 mm are found near

the surface and near land. The larvae are still bilateral symmetrical at a size of 54–57 mm. In August–September the larvae reach the length of 60–70 mm at which size the pelagical period ends and the larvae seek bottom life. At the same time pigmentation on the blind side disappears, and does not appear again until the fish reaches about 15 cm (JENSEN 1935).

In the Barents Sea area young Greenland halibut (age groups 0 and 1) have been found in Spitsbergen waters only (HOGNESTAD 1961, Fig. 4), and the development seems to be similar to that in Greenland waters. In Spitsbergen waters, however, the movement of the left eye probably starts before the larvae reach a length of 35 mm and is found to be completed on larvae of 60 mm length compared with 85 mm in Greenland waters. In both areas the larvae seem to reach the maximum pelagical size in August–September, but the metamorphosis is completed before the larvae seek bottom. The observations of the pigmentation are the same in Spitsbergen and West Greenland waters.

The smallest larvae hitherto found in the investigated area is 33 mm, and the reason for the lack of smaller sizes is certainly that investigations have not been carried out in the deep layers where Greenland halibut are supposed to spawn. The only area where I-group fish have been found is in inshore Spitsbergen waters. This indicates that the nursery grounds are located here, and a southwards migration takes place later on.

The main spawning grounds must be located along the slope of the continental shelf between 70°N and 75°N at 400–800 m depth, judging both from the distribution of the O-group fish and the hydrographical conditions. If spawning took place further to the S, O-group fish should have been observed in the Barents Sea as well according to the prevailing currents.

#### SUMMARY

The distribution of *Reinhardtius hippoglossoides* (Walbaum), Greenland halibut, in the Norwegian Sea is described with special reference to the distribution in the eastern part of the area.

The only records of O- and I-group Greenland halibut in this area are made in Spitsbergen waters.

The distribution of O- and I-group fish together with the hydrographical conditions along the slope of the continental shelf between Norway and Spitsbergen lead to the conclusion that the main spawning area of Greenland halibut must be along the slope between 70°N and 75°N in April–June at depths between 400 and 800 m.

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