Northwest Atlantic Fisheries Organization

Serial No. N1919

NAFO SCR Doc. 91/39

SCIENTIFIC COUNCIL MEETING - JUNE 1991

A Comparison of Selectivity in Longlines and Gillnets in the Fishery for Greenland Halibut in West Greenland

by

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1. Introduction.

Traditionally, the fishery for Greenland halibut in the fjords of West Greenland, were carried out by means of longlines, as a summer fishery from small boats and as a winter fishery from the sea-ice by means of dog-sledges. The present longline fishery has not changed much in terms of new technology.

In the middle of the 80'ies gillnets operated in the same way as longlines were introduced to the fishery for Greenland halibut. Of the inshore catches of Greenland halibut in Subarea 1, averaging about 8000 tons in the period 1987-1990, catches taken by gillnets composed about 35-45% in weight.

Local authorities in West Greenland have been concerned about the influence of the use of gillnets on the long term exploitation of the local stock components of Greenland halibut. This paper compares gillnet and longline catches and relate the results to a possible exploitation exclusively by one of the gears.

2. Materials and methods.

Data were obtained from simultaneous fisheries by longlines and gillnets in winter as well as in summer at Ilulissat and Uummannaq (Div.1A, see Fig. 1) in the years 1986-1990. In age group comparisons as well as in age distributions, each of the comparisons of the simultaneous fisheries as well as each distribution were weighted equal, to avoid dominans by the larger samples. The age-length key applied, were obtained by pooling data from the period 1986-1989 from the areas sampled.

In a description of the effects on the long-term exploitation exclusively by one of the gears, catch projections were made for both a solely gillnet- and a longline fishery, using the relative F-at-age pattern associated to the gears assuming that M=0.15 and F=0.4. Catch projections were run using a constant recruitment until equilibrium of the stock was reached. Mean weight-at-age data used in the projections, were pooled data from the years 1986-89.

3. Results

3.1 Exploitation pattern.

In Fig.2 are given length frequencies of Greenland halibut representing mean values of equally weighted samples from gillnets and longline catches, respectively. The samples were taken at Ilulissat and Uummannaq during the years 1986-89 from simultaneous fisheries by means of place and time of the year with the two gears. Both length frequencies peaks at about 70 cm and have the same range from about 45 cm to 115 cm. However, longlines catch a larger proportion of the fish in the length range 50 - 65 cm, while gillnets catch a larger proportion of fish in the length range 65 - 85 cm. Above lengths of 85 cm both gears seems equal in efficiency, but with a tendency for longlines to be most efficient. Applying an age-length key of data pooled for the two areas in 1986-89, results in the age distributions given in Fig.3. Catches by both gear types are in the range 5 - 18 years, but longline catches peaks at age 11, while gillnet catches peaks at age 12. Fig.4 presents the proportion of fish in the longlines in relation to gillnets by age groups based on 9 simultaneous samples, of which the mean values are given in Fig.3. Due to few observations in the younger age groups, the proportion factor varies considerably below 10 years old fish. However, below age-group 11 the relative catchability by longlines is higher than for gillnets. In the age-groups 12-14 gillnets have highest catchability, while for age-groups above 15 years longlines again dominates.

In order to estimate relative F-at-age for the two gear types, the stock distribution was estimated by means of a catch-curve on the basis of the log(catch) for the age-groups 12-17 from the longline catches (Fig.5). Assuming that 12 years old fish are fully recruited to longlines, relative F-at-age was set to 1 for this and older age-groups. F-at-age pattern for age-groups younger than age 12 was estimated by dividing the observed relative catch numbers (expressed in %) by the estimated relative catch numbers from the catch curve for each age-group. The achieved selection curve for longlines is shown in Fig.6. Weighting the relative F-at-age values for longlines in Fig.6 with the longline proportion factors (Fig.4), results in the relative F-at-age pattern for gillnets, shown as a selection curve in Fig.7.

3.2 Long-term exploitation.

In order to express the consequences of a fishery exclusively by one of the two gear types, catch projections were carried out for both a solely gillnet- and a longline fishery, using the relative F-at-age pattern from Figures 5+6 assuming that natural mortality (M)=0.15 and fishing mortality (F)=0.4. Mean weight-at-age data used in the projections, were pooled data from the years 1986-89. Catch projections were run keeping the recruitment constant until equilibrium was reached, achieving the long-term yield. Differences in catch-at-age and yield-at-age between the two catch projections are expressed as proportions of the estimated catches in two weight categories used when Greenland halibut is landed in Greenland, namely smaller fish (1.5 - 3.5 kg, age 9-11) and bigger fish (>3.5 kg, age 12-18) (Table 1). A solely gillnet fishery have a higher proportion of the bigger fish (86% by weight) than a longline fishery (73% by weight).

4. Discussion.

As no CPUE data are available from any of the two fisheries by longlines and gillnets, the estimated exploitation pattern only express a relative selection on the age-groups, thus overall efficiency of the two gear types cannot be judged from the estimations. However, keeping the catch level sustained in the inshore fishery for Greenland halibut in West Greenland, an exclusive fishery by gillnets will provide greater catches of larger Greenland halibut than longlines, but stock distribution is little affected..

The skew selection pattern by the gillnets, with a higher selction than expected of the larger fish assuming a modal age of about 13 (i.e. the age group most efficiently caught), probably is caused by a capture of the larger fish other than by the gills. A change in mesh size may assume to alter the proportion of the capture of the larger fish.

Table 1. Proportions of Greenland halibut in the weight ranges 1.5-3.5 kg and >3.5 kg in a exclusively gillnet fishery and longline fishery, respectively, estimated from catch projections

weight group/gear	gillnets		longlines	
	% n	% wgt	% n	% wgt
1.5-3.5 kg	24	14	43	26
>3.5 kg	76	86	56	73

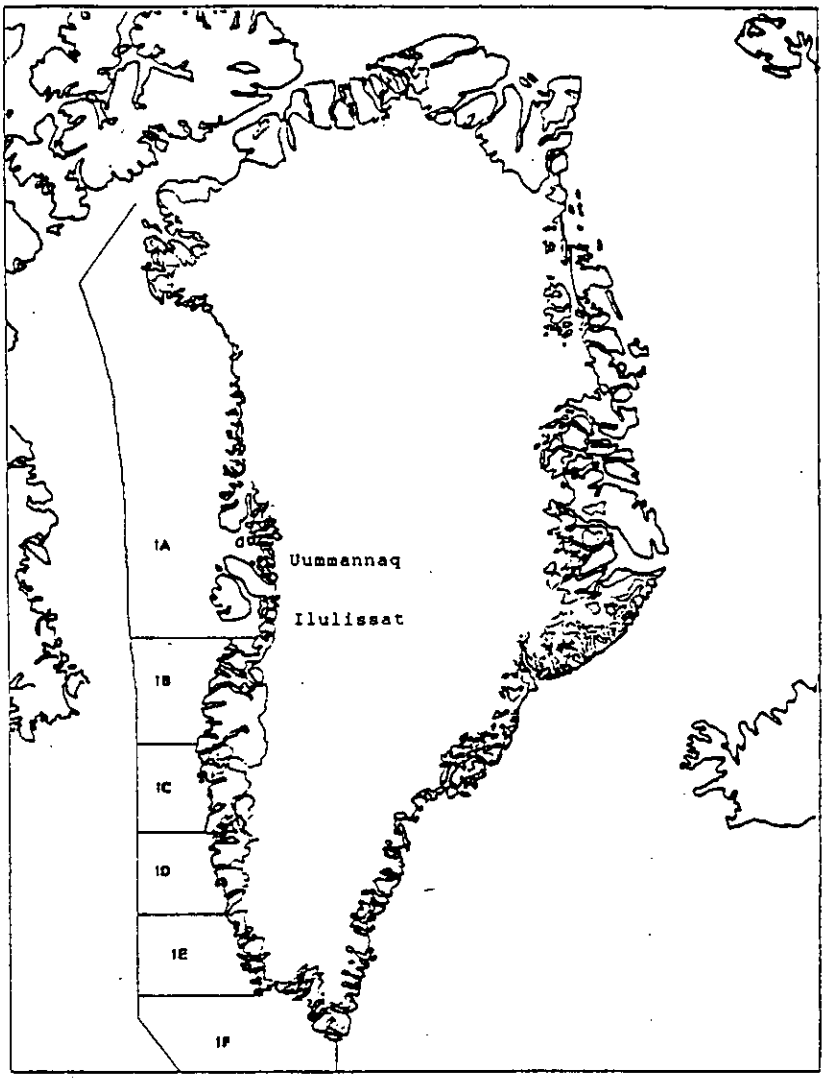

Fig.1. Map of Subarea 1 showing localities mentioned in the text.

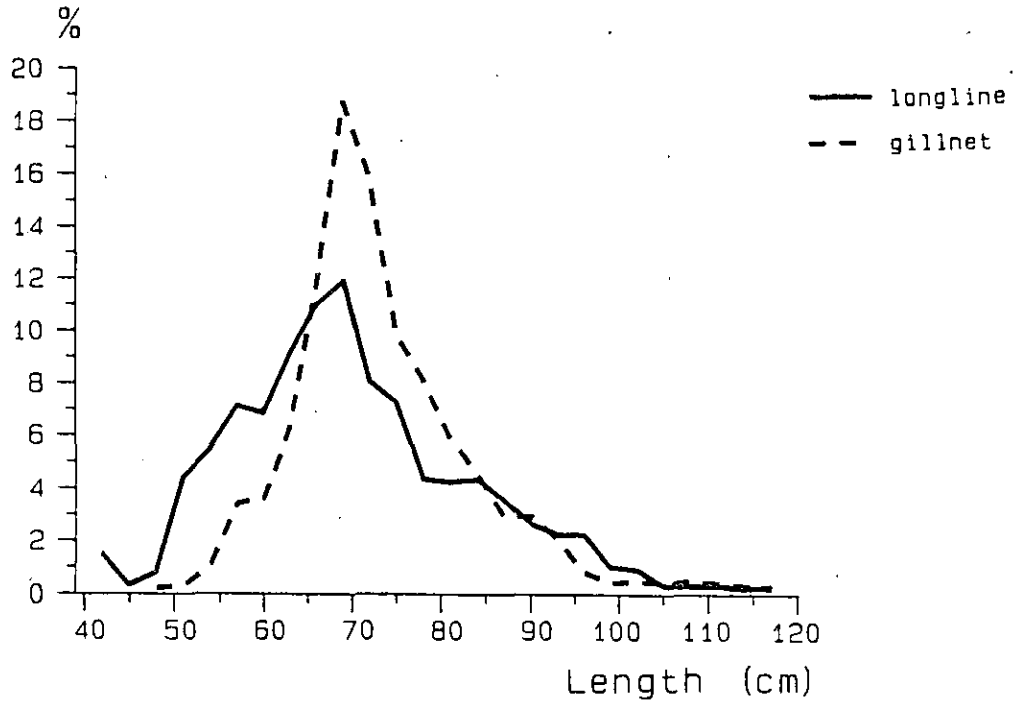

Fig.2. Length frequencies of Greenland halibut in longline- and gillnet catches in the areas Ilulissat and Uummannaq (Div.1A) obtained 1986-90. Values represents mean percentages from equally weighted length samples.

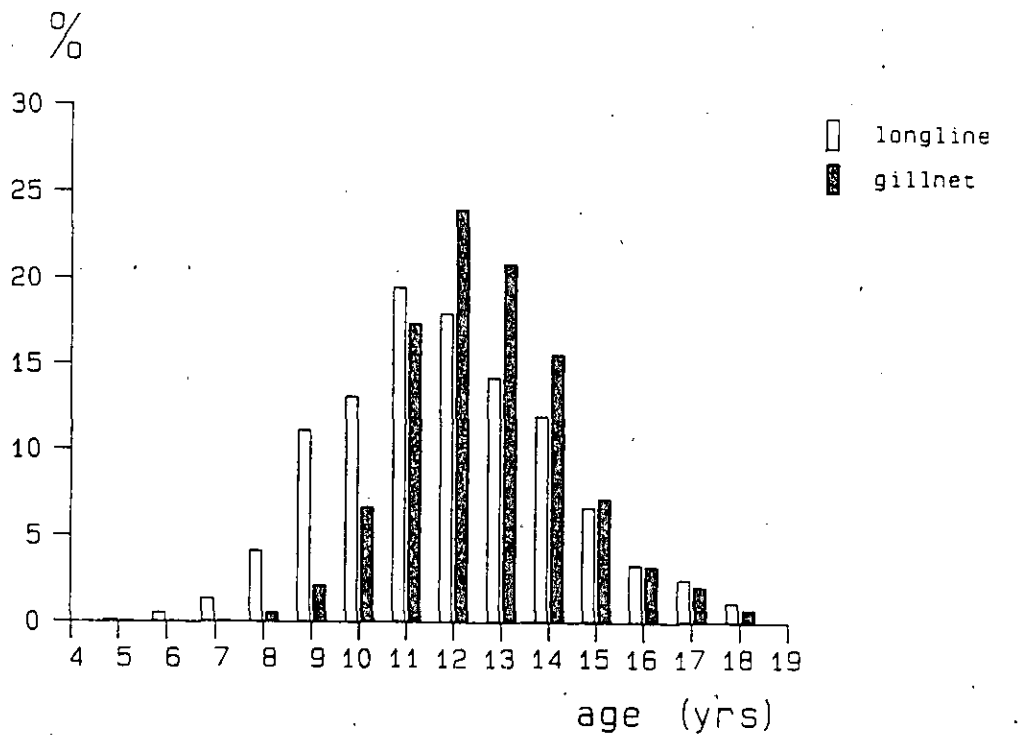

Fig.3. Age distributions of Greenland halibut in longline- and gillnet catches in the areas Ilulissat and Uummannaq (Div.1A) obtained 1986-90. Values represents mean percentages from equally weighted age samples.

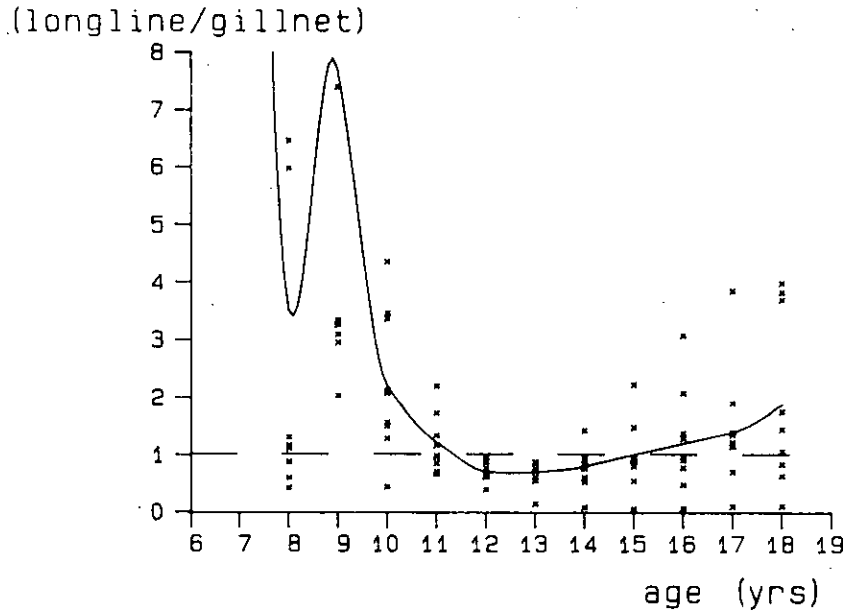

Fig.4. Porportion of Greenland halibut in longline catches in relation to gillnet catches based on 9 simultaneous samples. A smoothed curve is fitted the arithmetric means per age-group.

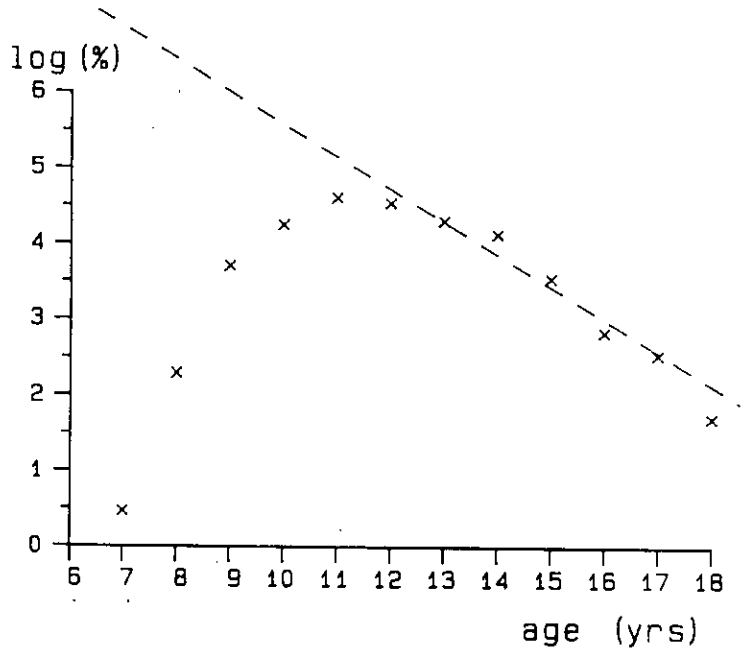

Fig.5. Catch-curve (log-transformed age distribution, Fig.3) of Greenland halibut in longline catches 1986-90. Based on age-groups 12-17 a linear regression are shown as a dashed line (y=-0.429x+9.851).

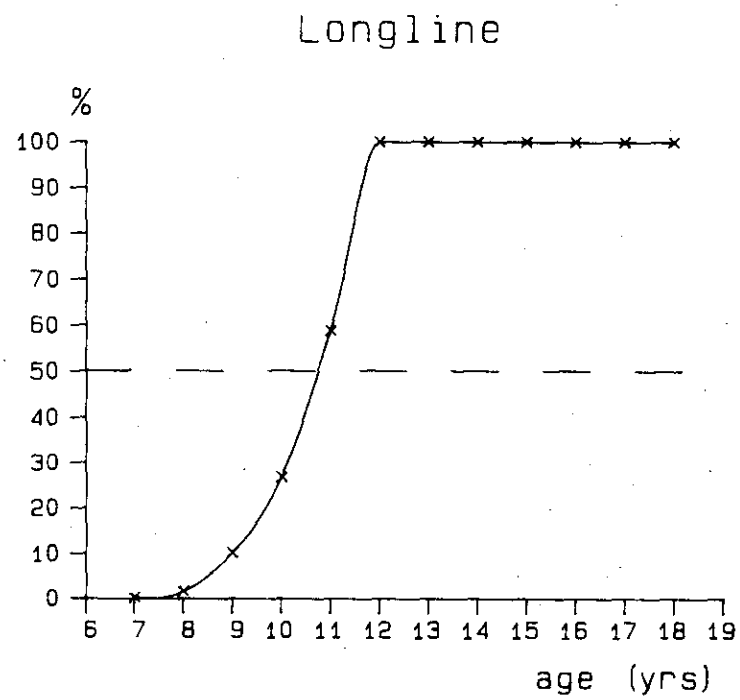

Fig.6. **Relative F-at-age values for Greenland halibut in longline catches. A smoothed selection curve is fitted the points.**

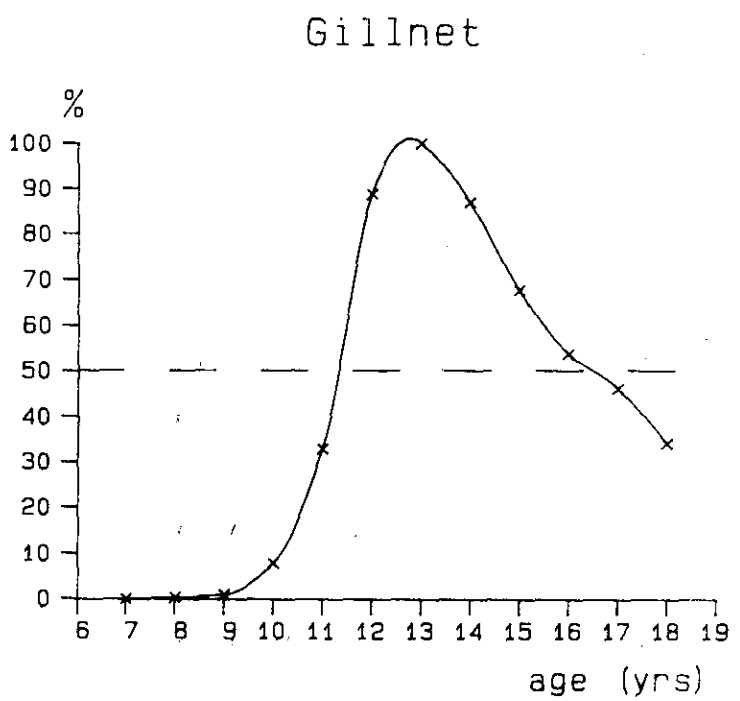

Fig.7. **Relative F-at-age values for Greenland halibut in gillnet catches. A smoothed selection curve is fitted the points.**