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Biology and Fishery of Greenland Halibut in the Gulf of St. Lawrence

by

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1. INTRODUCTION

A developing interest has occurred around the biology of this stock as the fishery has gone from a traditional by-catch of otter trawlers in the late 1970s to a high valued specie with a directed gill net fishery. Although a number of biological characteristics for this stock are generally recognized as being different from those of adjacent stocks, some indicate that this stock is not a biological entity. The purpose of this paper is to present a brief account of the current knowledge of this resource as it pertains to its biology and fishery.

2. BIOLOGY

2.1 Distribution

2.1.1 Geographical distribution

Results from winter research surveys in the Gulf (divisions 4RST, Figure 1) since 1978 (except 1982) indicate a stable location preferences. Three main concentrations are found in the Gulf all of which are in the deepest waters (Figure 2). One is situated in the Esquiman channel off Port-aux-Choix (Newfoundland), another is found along the lower portion of the Laurentian Channel close to the Cabot strait; finally a concentration can be found in the Sept-Iles area. This latter area has not been well covered during the winter surveys because of ice conditions; however results from Bowering (1982a) and Tremblay and Axelsen (1981) indicate that the highest catches were found in this area in the summer surveys. Catches of over 250 kg per hour tow were experienced in the maritime estuary of the St. Lawrence river close to Rimouski in July of 1980 and 1981 (Tremblay, 1982).

Catches of Greenland halibut have been reported from the Saguenay fjord (Drainville, 1970) these were found at depths of 150m. There is a winter sport fishery (Ste-Rose du Nord) from cabins set on the ice and using line and hook baited with smelt to capture Greenland halibut. The maximum depth of the fjord is 275 m with a sill at the mouth of the fjord of only 20m. This sill might prevent the winter spawning migration of Greenland halibut to take place outside the fjord. Jensen (1935) states that the fishery for this specie in Greenland occurs in fjords but no catches are made between the months of September to January due to the spawning migration. Fish are known to return to the deep waters of the Greenland fjords in February.

2.1.2 Depth and temperature preferences

A cross tabulation of the number of fish caught by temperature and depth from the winter surveys (Table 1) indicate that Greenland halibut of the Gulf of St. Lawrence is found in depths of 350 m and deeper and at temperatures of 5 to 7 degrees Celsius. For this temperature range the mean number if fish caught per half hour tow increases as the depth increases. Since the maximum depth in the Gulf is 543 m it can be generalized that abundance of this species during January increases as depth increases.

This conclusion is quite different to the previously described depth preference of Greenland halibut in the Gulf of St. Lawrence. Tremblay and Axelsen

(1981) mention that Greenland halibut prefer depths of 290 to 350 m and Lear and Pitt (1971) mention depths of 230 to 320 m. This may be attributed to the fact that the results are from summer and autumn surveys. The Greenland halibut is known to migrate to spawning grounds in deep waters (Bowering, 1982a).

2.2 Associated species.

According to the results from the winter groundfish surveys in the Gulf of St. Lawrence, the distribution of Greenland halibut is similar to that of witch flounder (Glyptocephalus cynoglossus). Other species which are encountered in even greater depths are grenadier (Nezumia bairdi), black dogfish (Centroscyllium fabricii) and longfin hake (Urophysis chesteri) (Figure 3). For these species, the occurrence increases as depth increases. Catches for these species are generally low except for the black dogfish where catches ranging from 100 to 500 kg per half hour tow have been experienced.

2.3 Maturity

A histological study (G. Ouellet Pers. Comm.) has shown that the Greenland halibut caught during the January surveys in the Gulf are ripe and can thus explain the depth preference observed in the winter surveys. Templeman (1970) and Lear (1970) concluded as well that a separate breeding population of Greenland halibut occurred in the Gulf.

2.4 Food preferences

A survey was undertaken in late July, 1985 aboard a shrimp otter trawler in the Sept-Iles area in order to provide information on the feeding habits of major commercial groundfish species. Results (Figure 4) indicate that Greenland halibut feed essentially on two species; shrimp (Pandalus borealis) and capelin (Mallotus villosus) and to a lesser degree, cod (Gadus morhua). Fish comprise 68 % of the diet and invertebrates 32%. These results are comparable to those described previously by Tremblay and Axelsen (1981) of 67 and 36% respectively.

2.5 Stock identification.

The stock status of the Greenland halibut within the Gulf of St. Lawrence is a major concern from a management point of view. The presence of a localized stock is generally accepted and a precautionary TAC is in effect since 1982 (Table 2) however, there is no clear evidence that this stock is isolated from the adjacent stock, 2J-3KL. Table 4 briefly describes the various methods and results of stock identification studies available to date on this stock. Many of these methods are considered to be environmentally influenced, a genetic characterization of these various stocks could provide a more definitive perception of the stock status.

Bowering (1981) considered that the similarity between year class abundance within the Gulf of St. Lawrence and those from the Labrador region might be explained by a immigration of young fish from the Labrador stock through the Strait of Belle-Isle and emigration from the Gulf of mature fish. This aspect has prevented CAFSAC to provide a biological advice for a level of exploitation.

3. FISHERY

3.1 History

The fishery of Greenland halibut in the Gulf of St. Lawrence was, in the years prior to 1977 mainly a groundfish fishery by-catch. Since 1977 there has been a directed fishery by gill nets, mostly based in the Gaspé peninsula. Two factors were contributing to this development, one was the stability in the availability of the resource (in comparison with the previously fished cod stock) and good market prices. In 1986, the value of the landings for this single specie has exceeded that of all marine pelagics landed in Quebec.

3.2 Landings

Landings for this stock for years prior to 1969 are considered unreliable because Greenland halibut were identified generically as "halibut" and landings were reported along another pleuronectid, the Atlantic halibut. Catch levels for the years prior to the development of the directed gill net fishery were between 700 t and 2000 t (Table 2).

Most of the recent landings for this stock can be attributed to Quebec based

gill nets (75% in 1986) operating from the Gaspé peninsula and fishing along its coast as well as in the Sept-Iles area once the shrimp fishery in this area is closed (Table 3). Marginal landings occur along the west coast of Newfoundland and in the Maritime provinces, these are mostly by-catch from cod and redfish directed otter trawl fisheries. Landings for this stock were at a low level between 1982 and 1985 with catches not exceeding 2500 t. However with the inclusion of strong year classes of 1979 and 1980 into the fishery, the landings for 1987 have increased substantially and have already reached precautionary TAC of 7500 t (August 19th preliminary information).

3.3 Assessment

The assessment of this stock is difficult because of possible influx of fish from the 2J-3KL Greenland halibut stock but the abundance estimates are well correlated between them as well as with the nominal landings (Figure 5). The research survey biomass estimates show a gradual decrease from 1978 to 1981 (no survey was done in 1982). The exploitable biomass estimates from the winter surveys are considered as minimum because the survey does not cover the Sept-Iles and lower St. Lawrence river areas where large concentrations have been identified (Tremblay and Axelsen, 1981) and where the fishery takes place. Commercial CPUE are estimated from catch and effort data of Quebec based otter trawlers. These have decreased from a high level in 1978 to a minimum value in 1982, the 1986 CPUE value is the highest since 1978.

Given this observation, a general production model (Schaefer) produces a transient yield close to the fitted parabola of the model (Figure 6). Results of this analysis indicate a maximum sustainable yield of 6868 t. It can be expected that with the recent high catches and important increase of effort, future catches will not produce proportional yield. This could place the 1987 point close to the previously observed 1979 data point.

4. CONCLUSION

This stock is caracterized by many biological features which make it stand out from other stocks from the North West Atlantic. However, without a clear conclusion about the stock identity in relation to the adjacent stocks, management will remain difficult.

The fishery has shown a marked devellopement by the introduction of the gill net but with the recent trends in market prices and the poor inshore cod fishery, there is likely to be an substantial increase in effort.

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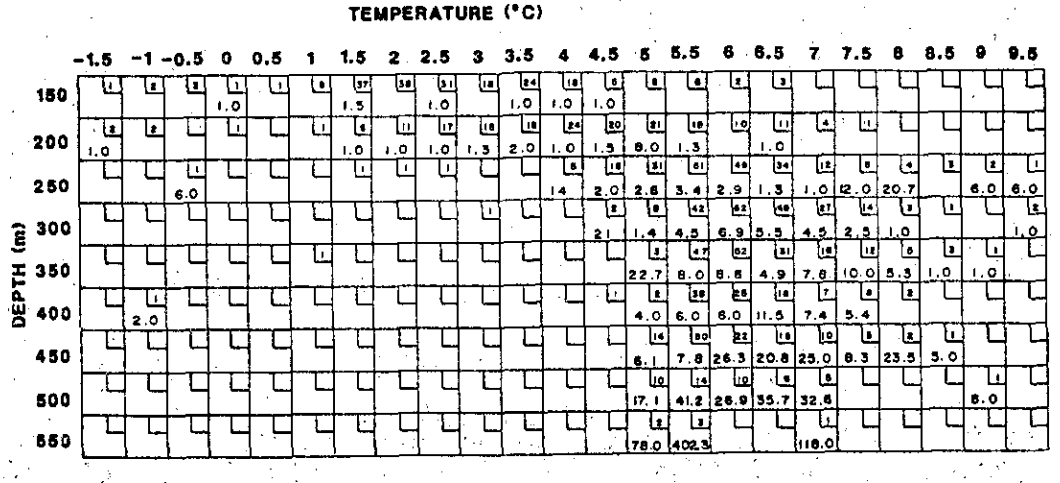


Table 1: Depth and temperature preference of Greenland halibut in the Gulf of St. Lawrence according to the winter groundfish surveys. Values in the margins indicate upper values of each interval. Number of fish caught per 30 min. trawl and number of successful sets are in dicated in each cell.

Table 2. Nominal landings (t) of gulf of St-Lawrence Greenland halibut by province

Year		Newfoundland	Maritimes	Quebec	Others	Total	TPA
1970		347	472	313		1132	
1971		271	281	402		954	
1972		125	141	404	13	683	
1973		164	163	436		763	
1974		114	273	624		1011	
1975		182	358	994	10	1544	
1976		517	357	1120	25	2019	
1977		990	85	2887		3962	
1978		1360	390	4497		6247	
1979		3049	260	5470	12	8791	
1980		1596	167	5243		7006	
1981		525	77	2574		3176	
1982		143	49	2077		2269	7500
1983		187	63	854		1104	5000
1984		196	398	1532		2126	5000
1985	*	207	132	2038		2377	5000
1986	*	119	203	6211		6533	5000
1987							7500

* Preliminary values.

Table 3. Nominal landings of gulf of St-Lawrence Greenland halibut by gear for the province of Quebec

Year		Gill net	Shrimp trawler	Groundfish trawler	Long line	Others	Total
1976		280	540	300			1120
1977		1542	993	352			2887
1978		3040	1210	247			4497
1979		4660	609	196	5		5470
1980		4495	686	23	39		5243
1981		2242	286	39	7		2574
1982		1716	330	29	2		2077
1983		421	311	29	93		854
1984		978	457	37	60		1532
1985	*	1409	493	88	48		2038
1986	*	4918	990	186	98	19	6211

* Preliminary values.

Table 4: Summary of various stock identification studies involving the Greenland halibut from the Gulf of St. Lawrence.

Type of Study	Author(s)	Major conclusions
Maturity	Bowering (1983)	50% fecundity is much lower than the eastern coast of Canada (Divs. 0B to 3K).
Meristic (vertebrae count)	Templeman (1970)	Possible separation of the Gulf of St. Lawrence from the N.W. Atlantic. ($P<0.001$).
Meristic (Multivariate)	Bowering (1984)	Clear distinction between the Gulf of St. Lawrence and Fortune Bay from the N.W. Atlantic and west Greenland.
Tagging	Bowering (1982b)	From tagging done outside the Gulf, no recaptures in the Gulf. No evidence of migration as adults.
Parasites (Trypanosome and piroplasm)	Khan et al. (1982)	Gulf of St. Lawrence were significantly different from Fortune Bay and N.W. Atlantic coast samples.
Biochemical Properties	Dey (1982)	The Gulf of St. Lawrence differed significantly from the N.W. Atlantic.
Biochemical (Genetic)	Fairbairn (1981)	3 groups were identified Gulf of St. Lawrence, N.W. Atlantic and Bering Sea.

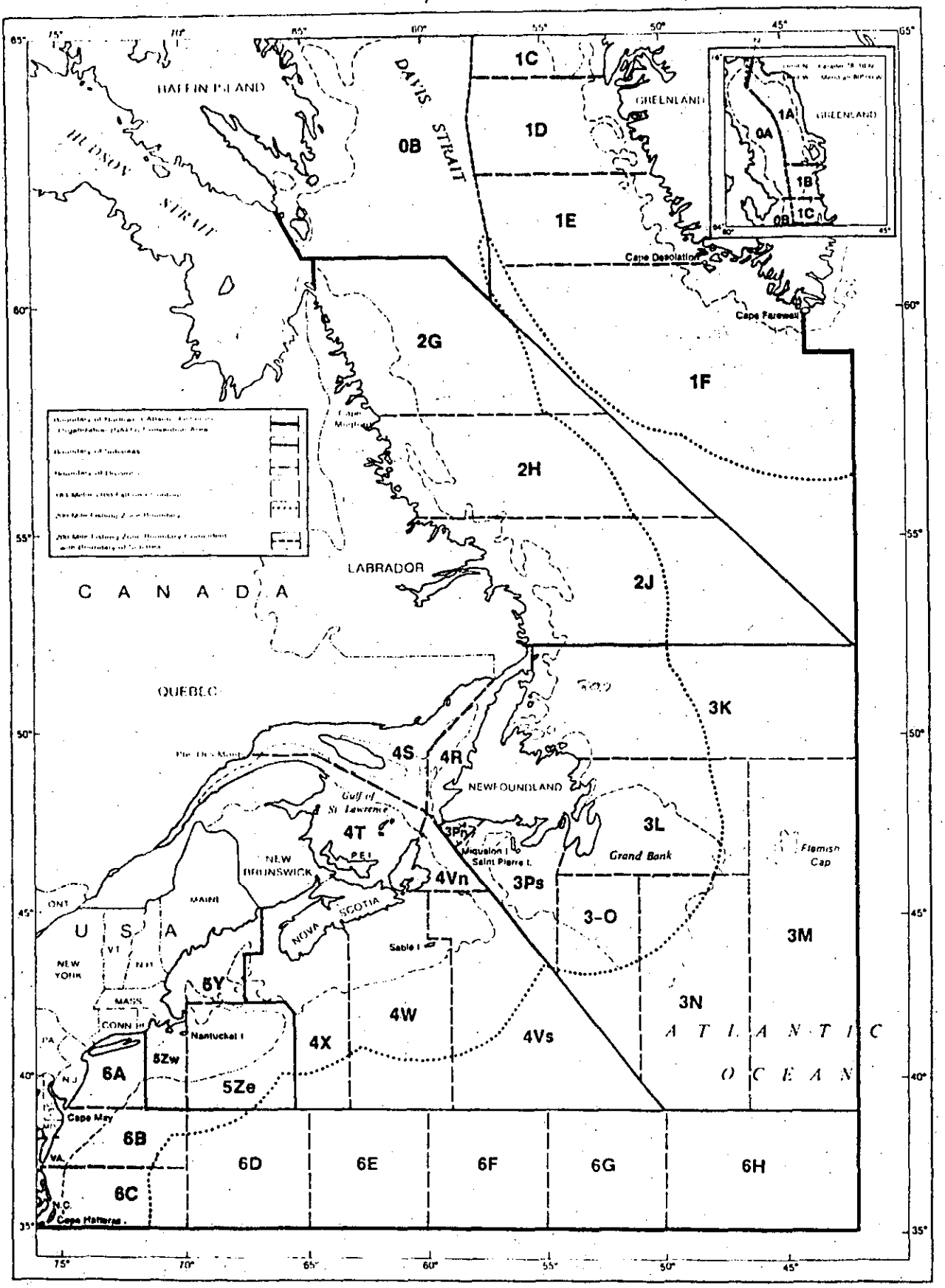
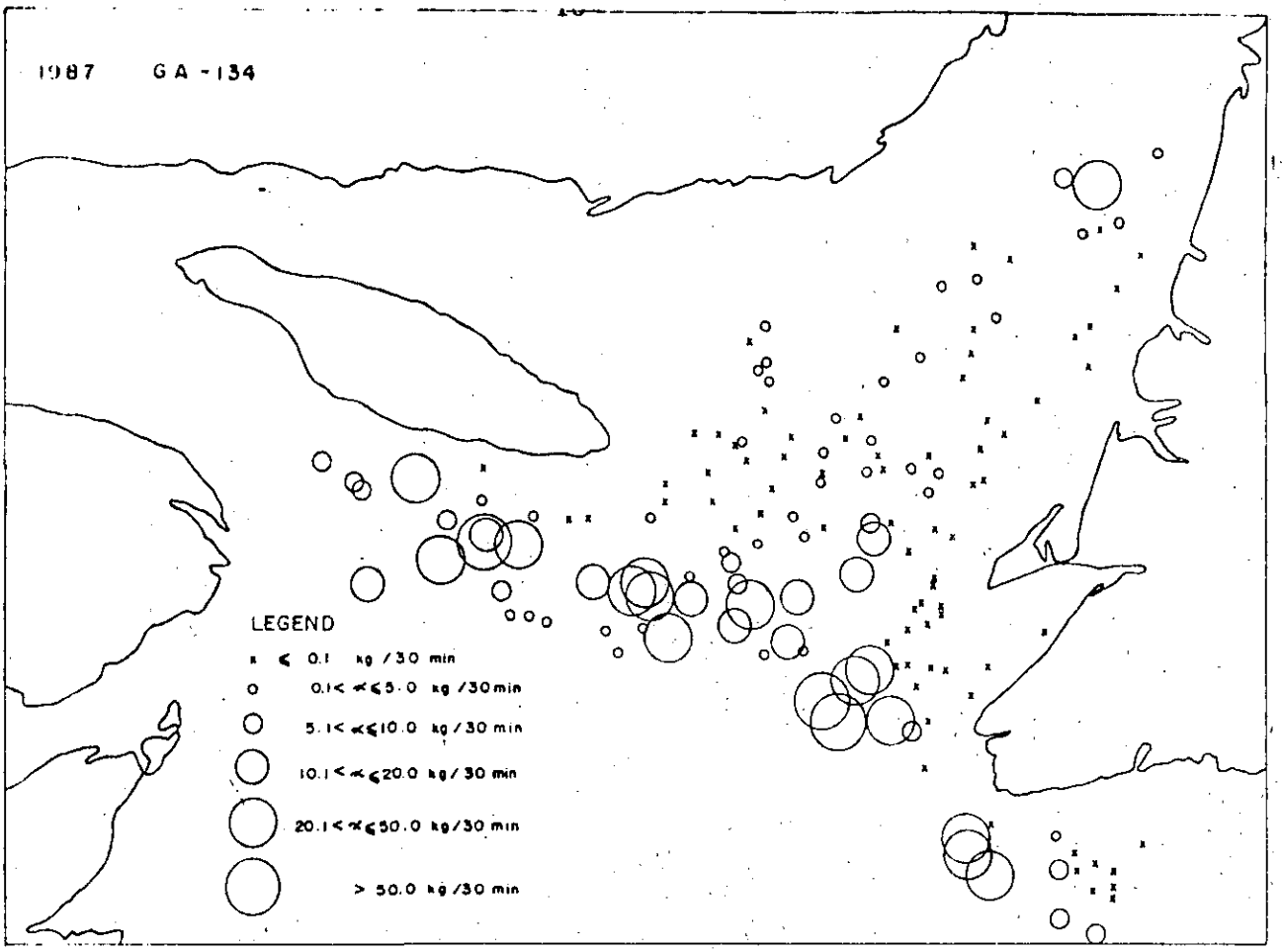


Figure 1: Map illustrating the Northwest Atlantic coast and NAFO divisions.



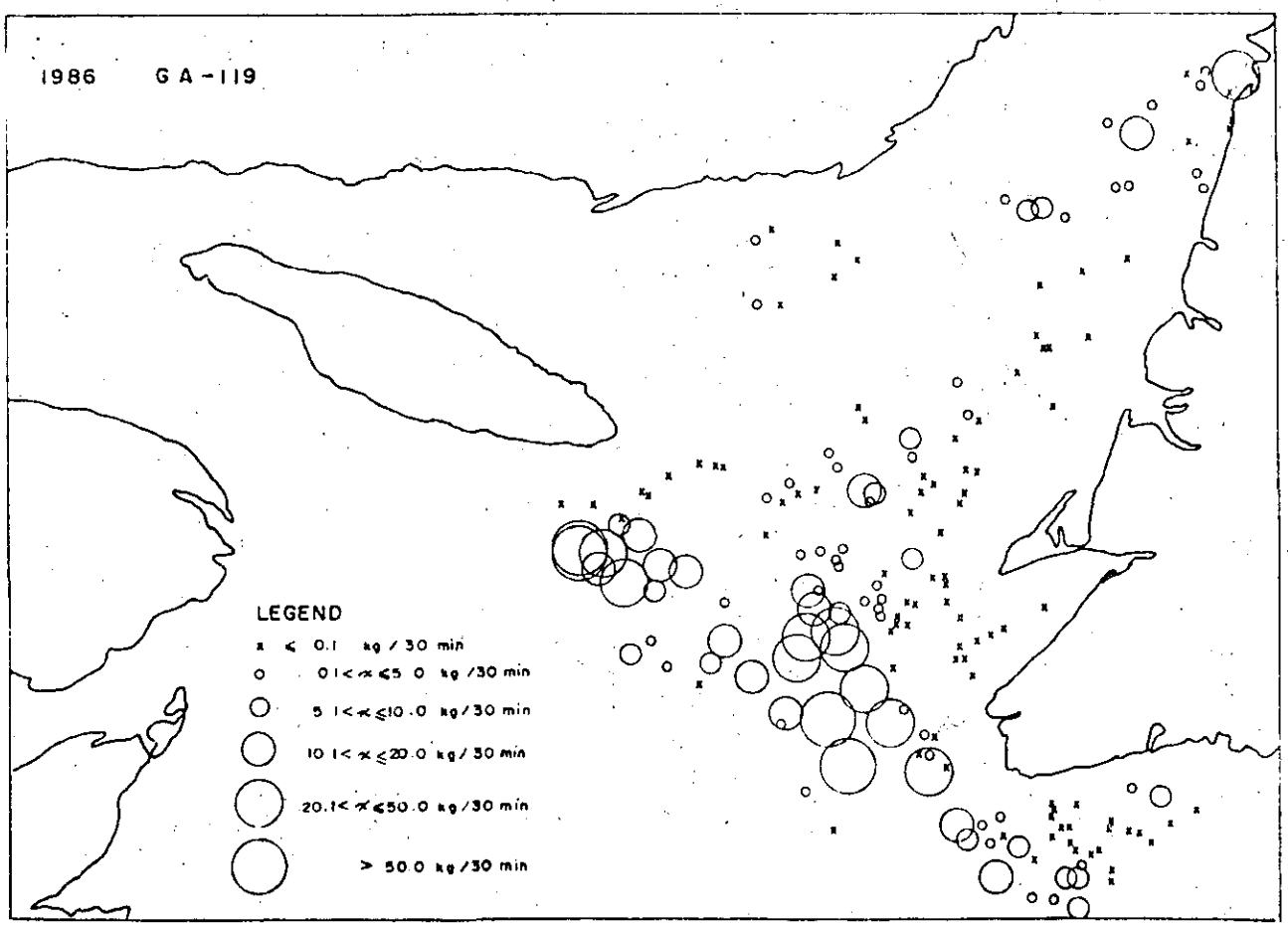


Figure 2: Map of the winter distribution of the Greenland halibut in the Gulf of St. Lawrence in 1986 and 1987.

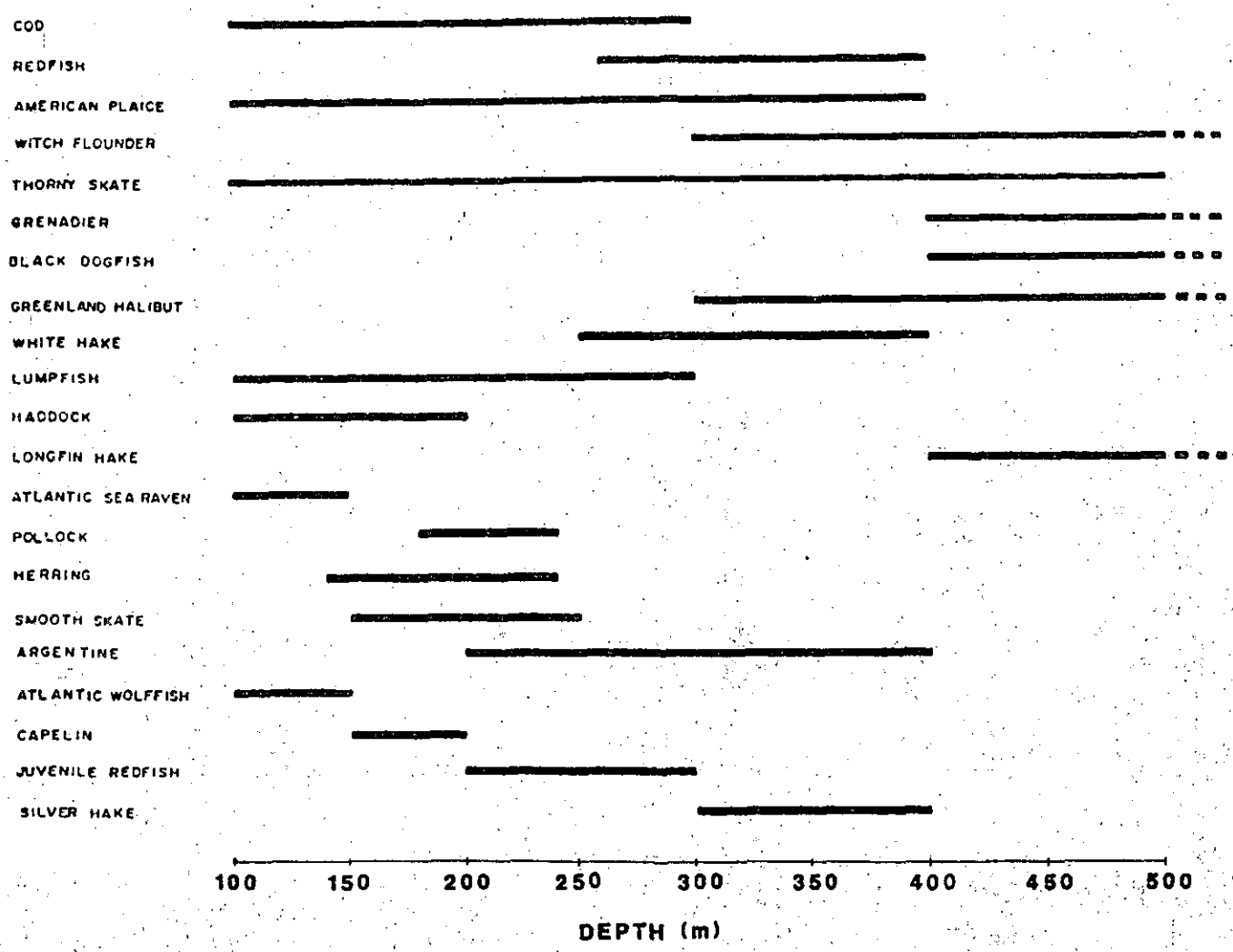


Figure 3: Associated species of the Greenland halibut by depth according to the winter groundfish surveys.

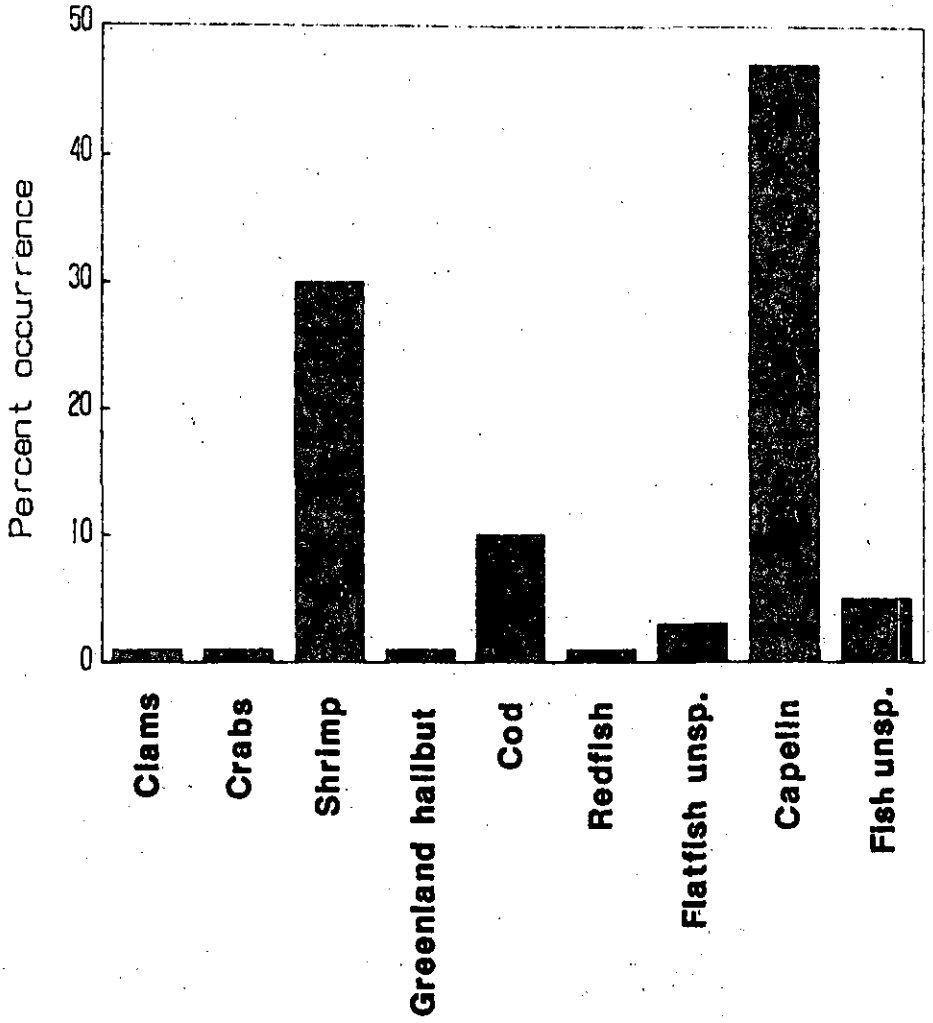


Figure 4: Food preference of Greenland halibut in the Gulf of St. Lawrence.

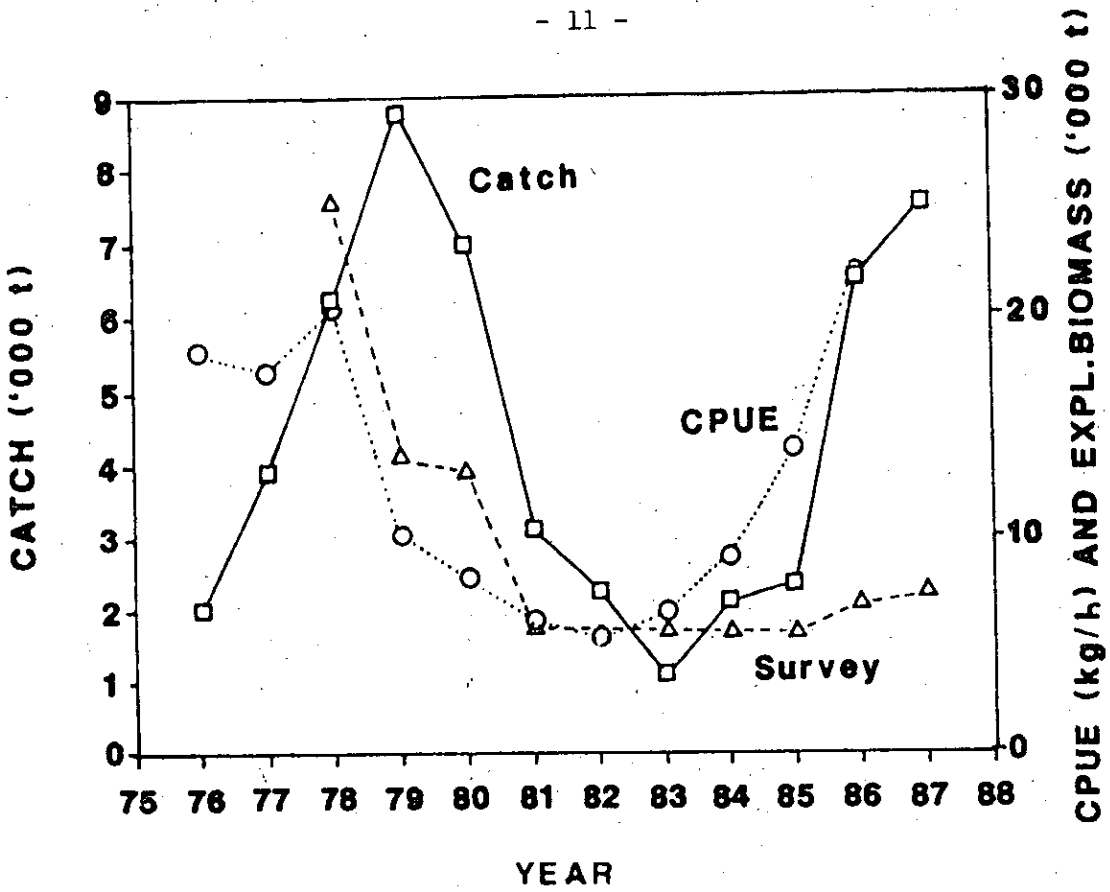


Figure 5: Catch ('000t), commercial catch per unit effort (kg/h) and winter research survey exploitable biomass estimates ('000t) of Greenland halibut in the Gulf of St. Lawrence.

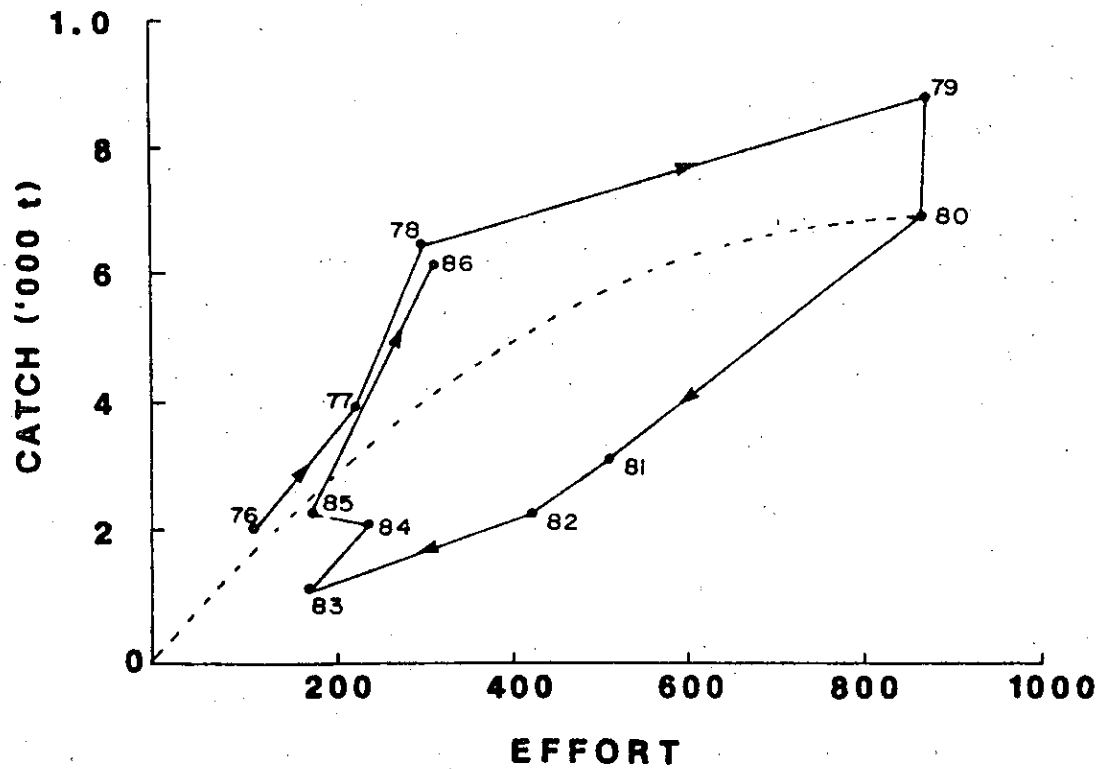


Figure 6: Results of the Schaefer general production model applied to the Gulf of St. Lawrence Greenland halibut catch and effort data.