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Results of a Stratified Random Bottom Trawl Survey off West Greenland in 1993

by

M. Ogawa

Japan Marine Fishery Resource Research Center
3-27 Kioi-cho, Chiyoda-ku, Tokyo 102, Japan

and

K. Yokawa

National Research Institute of Far Seas Fisheries
7-1 Orido, Shimizu 424, Japan

and

O. Jorgensen

Greenland Fisheries Research Institute
Tagensvej 135, DK-2200 Copenhagen N, Denmark

Introduction

Since 1987 Japan Marine Fishery Resource Research Center (JAMARC) and Greenland Fisheries Research Institute (GFRI) have conducted cooperative trawl surveys off West and East Greenland (Yamada et al, 1988a: Yamada et al 1988b: Yastu and Jorgensen, 1989: Jorgensen and Akimoto, 1990: Jorgensen and Akimoto, 1991: Yano and Jorgensen, 1992: Satani et al, 1993). In 1993 one stratified random bottom trawl survey was carried out off West Greenland. The aim of survey was to estimate stock sizes of groundfishes and to obtain information on distribution, size composition and biology of Greenland halibut(*Reinhardtius hippoglossoides*), beaked redfish (*Sebastes mentella*) and roundnose grenadier (*Coryphaenoides rupestris*) on the continental slope between Div. 1A (south of 70°N) and 1D.

Materials and Methods

One stratified random bottom trawl survey was conducted by the R/V Shinkai Maru (3395 GRT) in August and September 1993. although the survey was planned to cover from Div. 1A (south of 70°N) to 1D at depth between 400m and 1,500m, Div. 1A was not covered due to ice. The Divisions were subdivided into strata by isobaths of 600m and 1000m. The number of trawl stations in each stratum was allocated in proportion to the area of each stratum with a minimum of two stations per stratum. The trawl stations were selected at random within each stratum.

Trawl operations were made in daytime only. Towing duration and speed were 30 minutes and 3.5 knot. The net was equipped with a 140mm mesh codend with a 30mm mesh liner. Wing spread was approximately 40m. Detailed information on the vessel and gear is given in Yamada et al.(1988a). Area swept method was applied to for biomass estimation, assuming the catchability coefficient as 1.0. The coefficient of variation (C.V.) is standard error of estimate divided by estimate.

Greenland halibut and beaked redfish were measured as total length to cm below and roundnose grenadier as anal fin length to half cm below. Size compositions were grouped into intervals of 3cm for Greenland halibut, 1cm for beaked redfish, and 0.5cm for roundnose grenadier. The size composition in a stratum was calculated as the average of standardized size composition of each station (fish/km^2 swept area). Size composition by Division was calculated as the average of the size composition of each stratum, using the stratum area as weighting factor.

Results

Trawl operations were successfully made at 87 stations out of 100 designed (Table 1). Biomass estimates for 35 species or species groups are obtained (Table 2).

1. Greenland halibut

(1) Distribution and biomass

Greenland halibut was the most abundant species and was caught at all stations except one (Fig. 1). The biomass for Divs. 1B-1D was estimated as 37,700 tons (C.V.=15%) which has dropped from 62,000 tons (C.V.=11%) in the survey 1 of 1992 (Table 3). This is mainly due to decreases of the biomass at depths of 601-1000m in Div. 1C (6,600 tons) and 1001-1500m in Div. 1D (17,900 tons) from 19,700 tons and 24,100 tons in the survey 1 of 1992.

The distribution of the catches was similar to that in survey 1 of 1992. While the density (kg/km^2) was relatively higher at depths greater than 1000m, there were also observed good catches at depths between 401-600m in Div. 1B.

(2) Size composition

The size composition is given by division in Fig. 2. Densities of the middle-sized fish (30-60cm) was lower than that in the survey 1 of 1992 in all divisions. A high density of small-sized fish (less than 30 cm) was observed in Div. 1B as seen in the previous surveys. In Div. 1B, there were observed three modes at 9-12cm, 15-21cm, and 39-42cm, and the smallest mode did not appear in the survey 1 of 1992. Two modes at 24-30cm and 33-39cm which had observed at Div. 1B in the previous surveys were not appeared in the present survey. The size compositions in Div. 1C and 1D were unimodal with a mode around 44cm in Div. 1C and 47cm in Div. 1D. In comparison to the previous August/September surveys, there are recognized a small but significant tendency of the movement of the mode towards the left. The mode has thus shifted from around 50cm in 1988 to 47cm in 1993.

2. Beaked redfish

(1) Distribution and biomass

Beaked redfish was mainly caught at depths less than 600m in Divs. 1BC as in the survey 1 of 1992 (Table 4, Fig. 3). The biomass was estimated as 1,200 tons (C.V.=41%) which decreased to one third from 3,700 tons (C.V.=36%) in survey 1 of 1992. This is mainly due to the biomass decrease in Div. 1C.

(2) Size composition

As in the previous August/September surveys, the density of small-sized fish was higher in Div. 1B but its value decreased to less than two thirds of that in survey 1 in 1992 (Fig. 4). A few larger fish with am mode around 35 cm were observed in Div. 1B and 1D.

3 Roundnose grenadier

(1) Distribution and biomass

More than 95% of the total biomass of roundnose grenadier was observed at depths of 1000-1500m in Div.1D (Table 5, Fig. 5). The biomass was estimated as 8,200 tons (C.V.=24%) which decreased to one-fifth from 40,200 tons in survey 1 of 1992.

(2) Size composition

The size compositions of Div. 1C and 1D were very similar to those in the previous surveys(Fig. 6). Modes at 6-7cm in Div. 1C and 1D, and at 8-10cm in Div. 1D were observed as in previous surveys.

Discussion

In comparison to the results of the survey 1 of 1992, the estimated biomasses of almost all the species had decreased in some notable scale. The estimated biomasses of Greenland halibut, beaked red fish and roundnose grenadier are the lowest estimate obtained in comparable surveys in the time series. The reason of these decreases is not clear, but substantial decreases in estimated biomass of species not commercially fished, such as beaked redfish and roundnose grenadier, suggest that there may be factors other than fishery. For example, the proportion of by-catch in Japanese offshore trawl directed toward Greenland halibut in Subarea 1 is extremely low (less than 1%). The extent of the influence of recent anomalous environmental conditions, which may change the distribution pattern of fishes, should be investigated.

References

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Table 1. The extent of survey area by NAFO Division and depth stratum. Their number of hauls planned and number of successful hauls in the brackets.

NAFO DIV.		Depth(m) 401-600	601-1,000	1,001-1,500	Total
1A					
Area	(Km^2)	1.683	793	1,271	3.747
Proportion	(%)	2.96	1.39	2.24	6.59
Hauks planned/(attempted)		3(0)	2(0)	2(0)	7(0)
1B					
Area	(Km^2)	5,120	2,649	23	7,792
Proportion	(%)	9.00	4.66	0.04	13.70
Hauls planned/(attempted)		9(7)	5(3)	0	14(10)
1C					
Area	(Km^2)	3,131	17,611	603	21,345
Proportion	(%)	5.51	30.97	1.06	37.54
Hauls planned/(attempted)		5(4)	31(30)	2(2)	38(36)
1D					
Area	(Km^2)	888	5,451	17,643	23,982
Proportion	(%)	1.56	9.59	31.03	42.18
Hauls planned/(attempted)		2(2)	8(8)	31(31)	41(41)
Total					
Area	(Km^2)	10,882	26,504	19,540	56,866
Proportion	(%)	19.03	46.61	34.37	100
Hauls planned/(attempted)		19(13)	46(41)	35(33)	100(87)

Table 2. Biomass estimate (x1000 tons) of each species or species group with the coefficient of variation (C.V.) in survey.

English name	Scientific name	Biomass(C.V.)
G. halibut	*Reinhardtius hippoglossoides*	37.71(15.1)
Roundnose grenadier	*Coryphaenoides rupestris*	8.19(18.2)
Beaked redfish	*Sebastes mentella*	1.19(41.3)
Other fishes		2.44
Pink shrimp	*Pandarus borealis*	0.72
Dogfish	Squalidae	1.19(37.0)
Roughhead grenadier	*Macrourus berglax*	1.90(23.5)
Skates	Rajidae	0.51
Other codfishes	Gadiformes	0.75
Halibut	*Hippoglossus hippoglossus*	0.55
Octopus	Octopoda	1.47
Spiny eel	Notocanthidae	0.45
Greenland shark	*Somniosus microcephalus*	
Northen catfish	*Anarhichas denticulatus*	0.21
American plaice	*Hippoglossoides platessoides*	0.15
Eels	Anguilliformes	0.28
Other shrimps		0.31
Ratfish	*Hydrolagus affinis*	0.26
Eelpouts	Zoarcidae	0.20
Golden redfish	*Sebastes marinus*	0.01
Grenadier	*Coryphaenoides guentheri*	0.12
Sculpins	Psychrolutidae	0.28
Spotted catfish	*Anarchias minor*	
Other crustacea		0.08
Polar cod	*Boreogodus saida*	0.07
Grenadiers	Macrouridae	0.00
Squids	Teuthoidea and Sepioidea	0.10
Snailfishes	Liparidae	0.03
Atlantic cod	*Godus morhua*	0.00
Hagfish	*Myxine glutinosa*	0.03
Sculpins	Cottidae	0.01
Blue ling	*Molva dipterygia*	
Pricklebacks	Stichaeidae	
Lumpsuchers	Cyclopterydae	0.00
Other mollusks		0.12
Total		59.33

Table 3. Biomass estimates (x1000 tons) of Greenland halibut by strata.

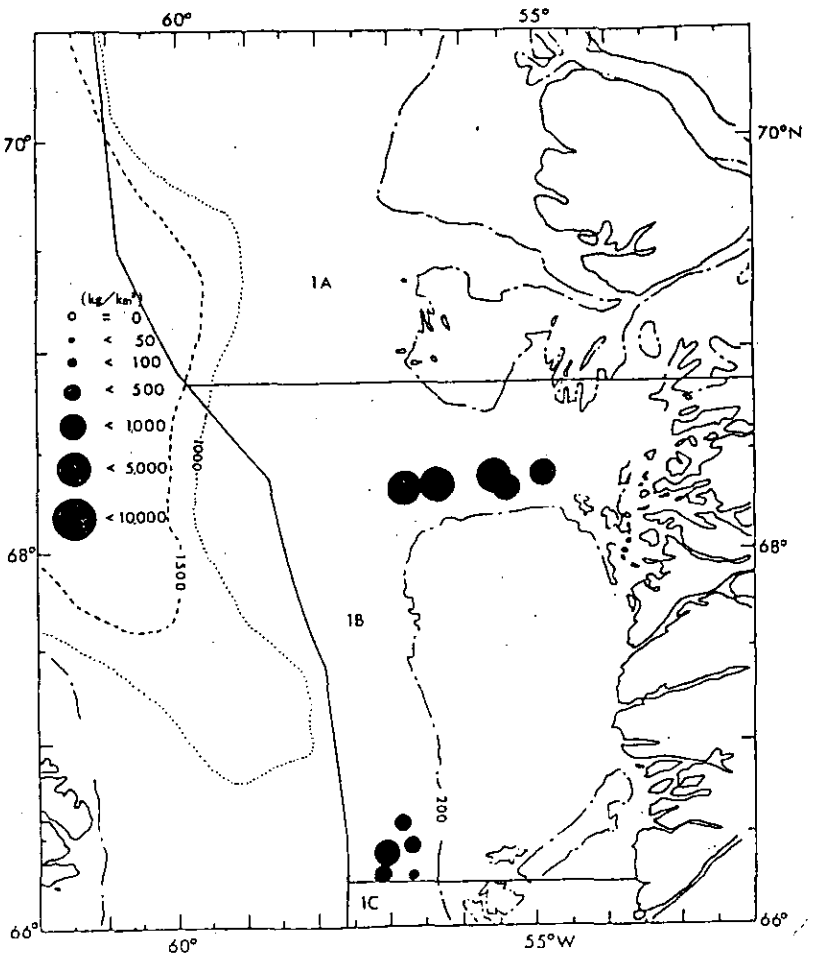
NAFO DIV.	Depth stratum (m)			Total
	401-600	601-1000	1001-1500	
1B	4.43	1.39	-	5.82
1C	0.58	6.59	1.88	9.05
1D	0.34	4.59	17.91	22.84
Total	5.35	12.57	19.79	37.71

Table 4. Biomass estimates (x1000 tons) of beaked redfish by strata.

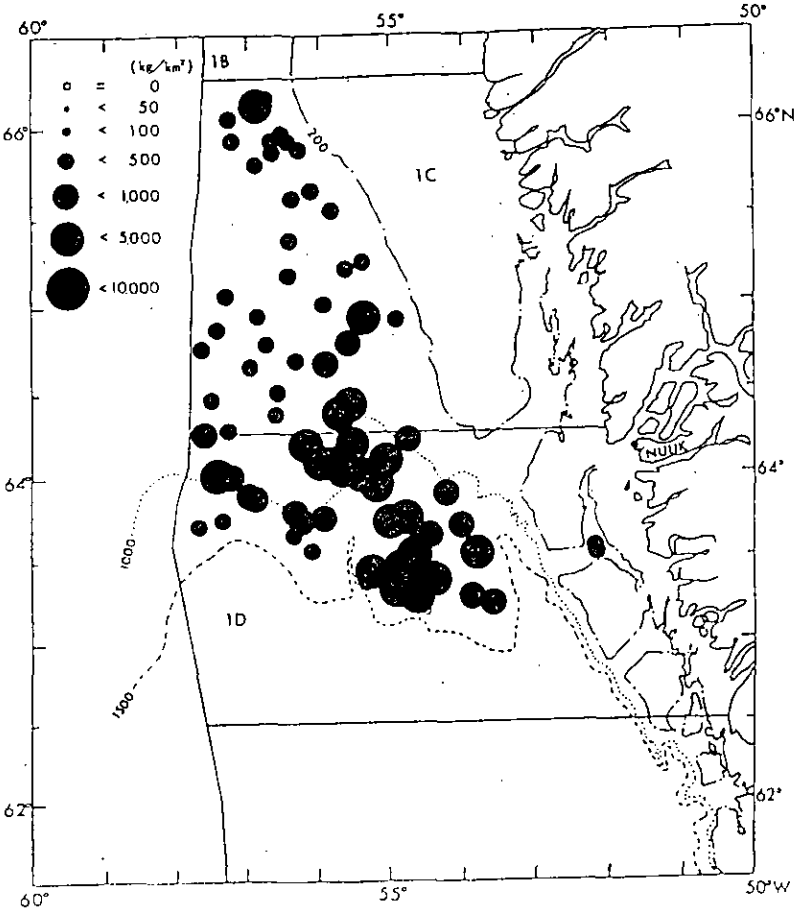
NAFO DIV.	Depth stratum (m)			Total
	401-600	601-1000	1001-1500	
1B	0.30	0.11	-	0.41
1C	0.35	0.37	0.00	0.72
1D	0.04	0.00	0.02	0.06
Total	0.69	0.48	0.02	1.19

Table 5. Biomass estimates (x1000 tons) of roundnose grenadier by strata.

NAFO DIV.	Depth stratum (m)			Total
	401-600	601-1000	1001-1500	
1B	0	0	-	0
1C	0	0.27	0.25	0.52
1D	0.02	0.69	6.96	7.67
Total	0.02	0.96	7.21	8.19

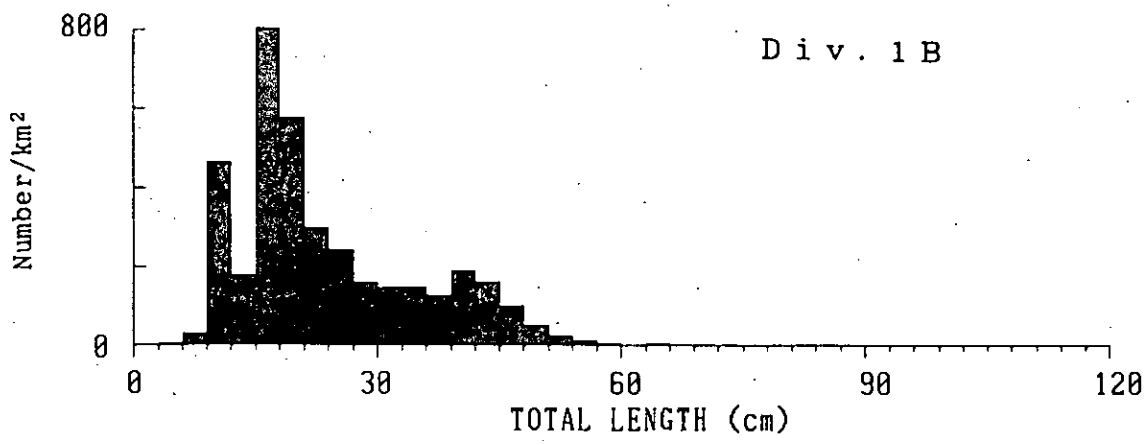


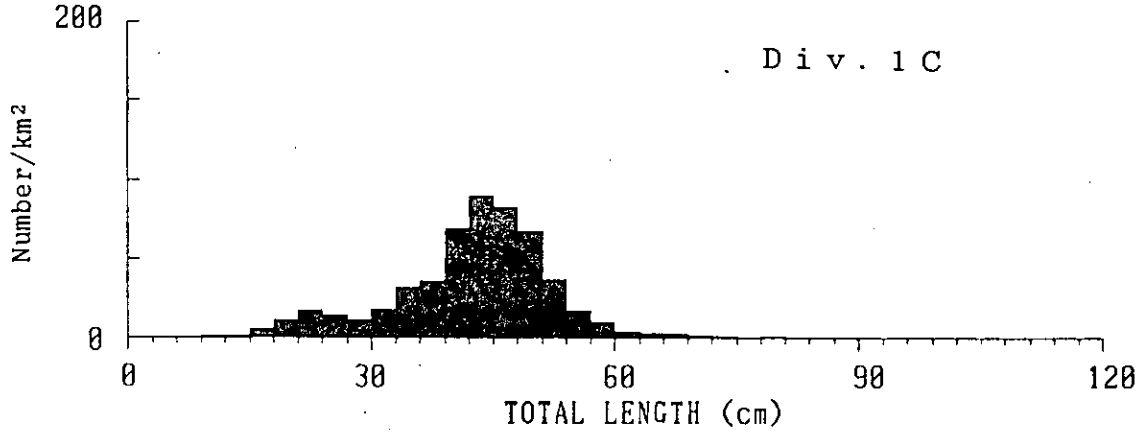
Div. 1A - 1B
(south of 70° N)



Div. 1C - 1D

Fig. 1. Catches (kg/km²) of Greenland halibut.





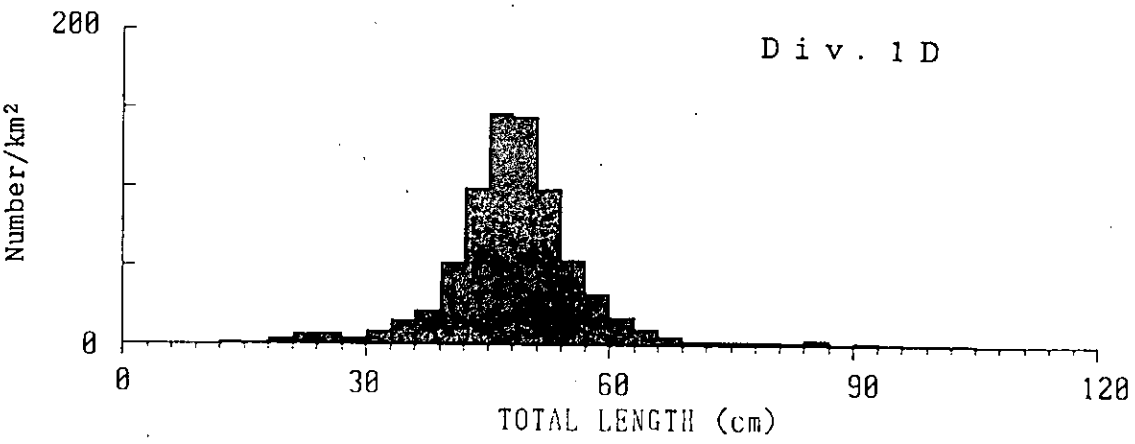
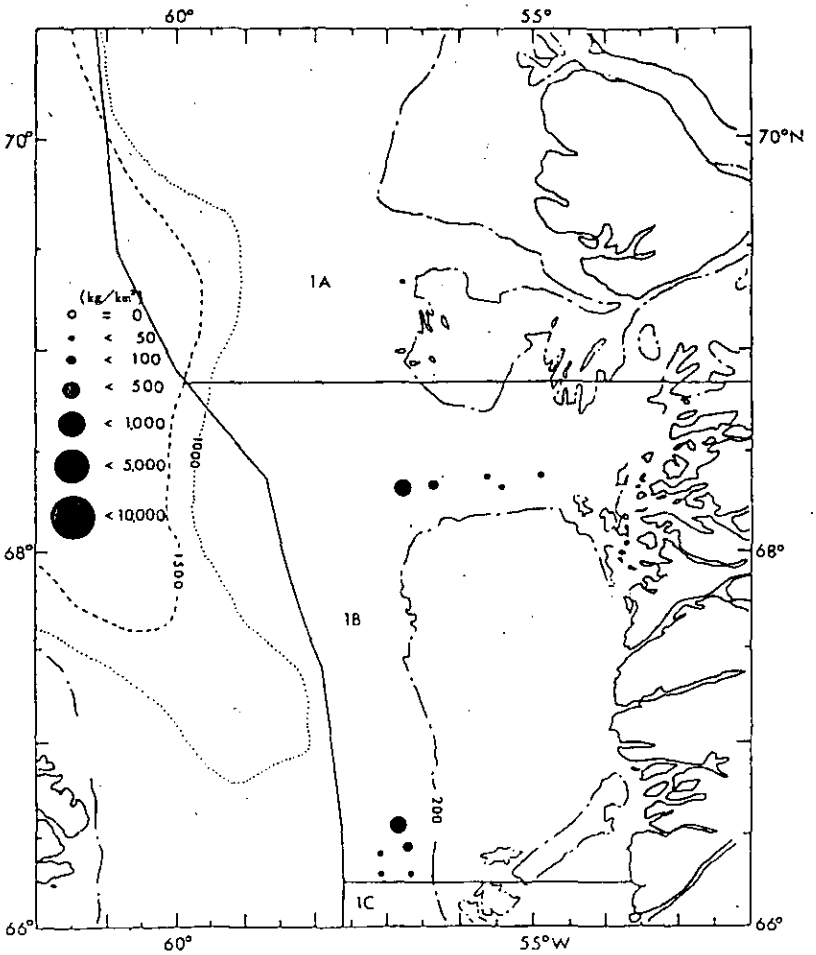
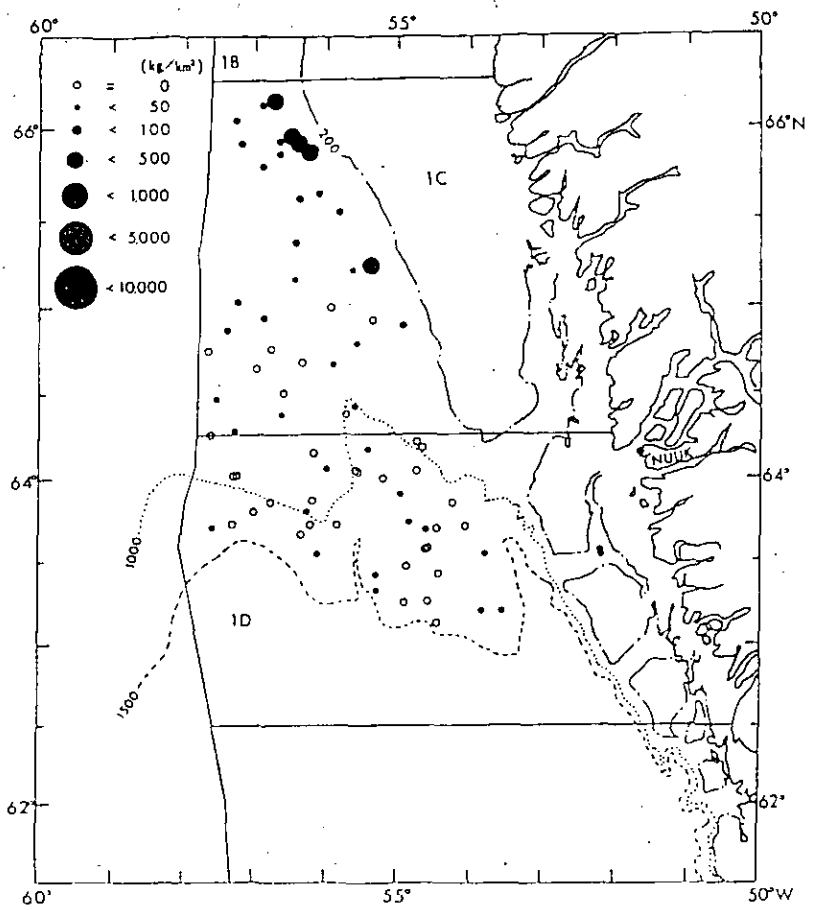


Fig. 2. Size composistions of Greenland halibut.

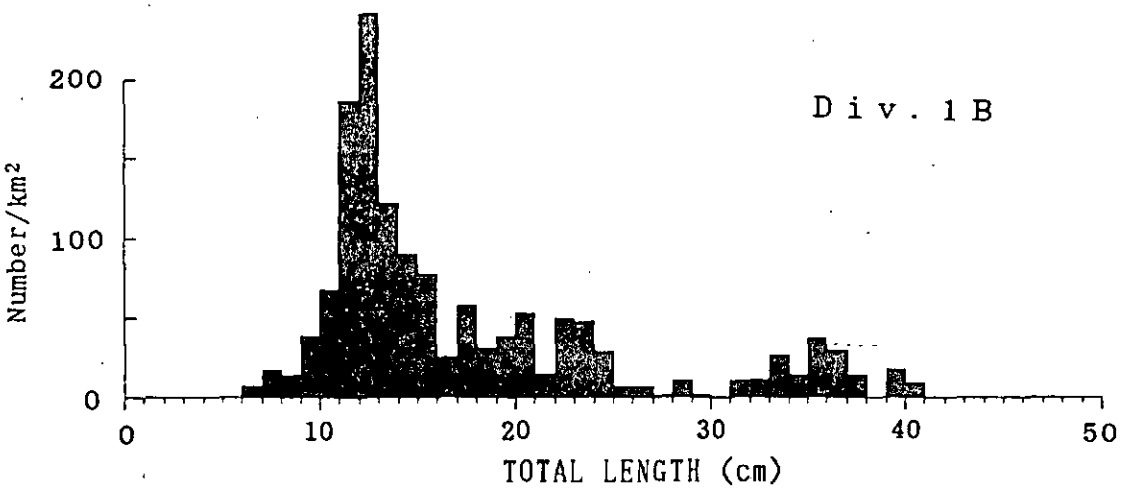


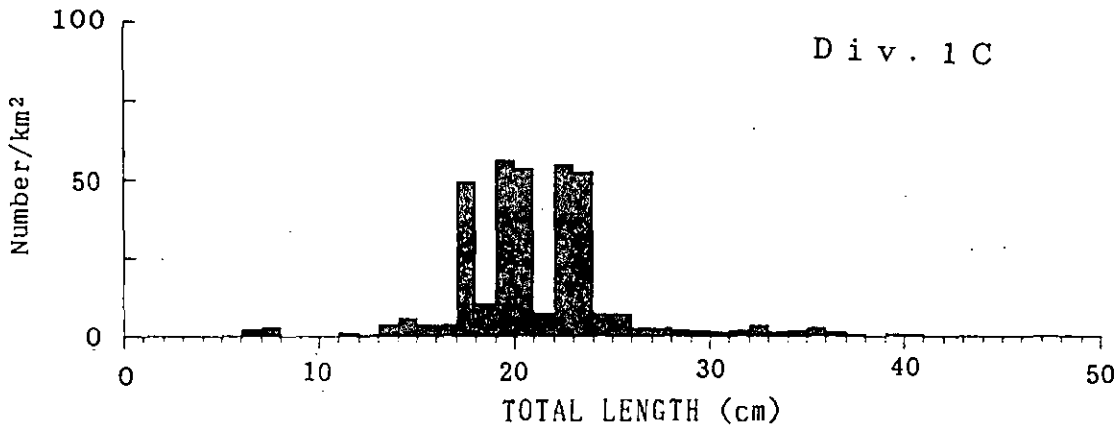
Div. 1A–1B
(south of 70°N)



Div. 1C–1D

Fig. 3. Catches (kg/km²) of beaked redfish.





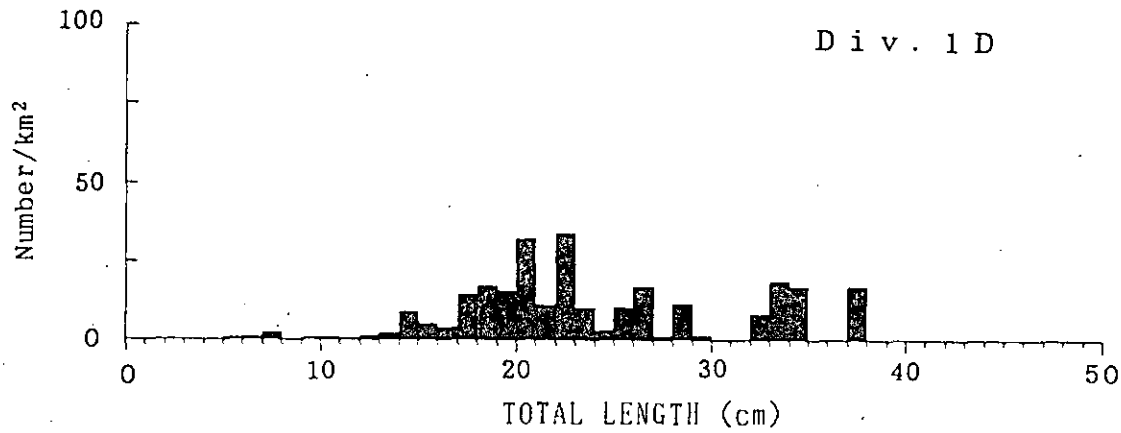
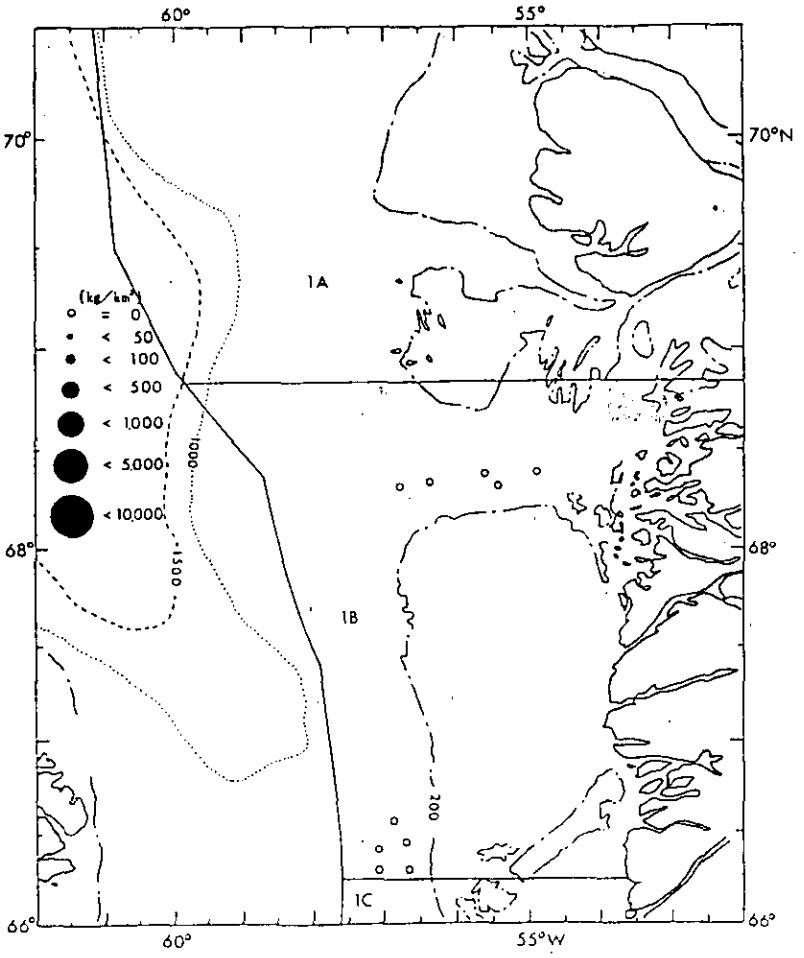
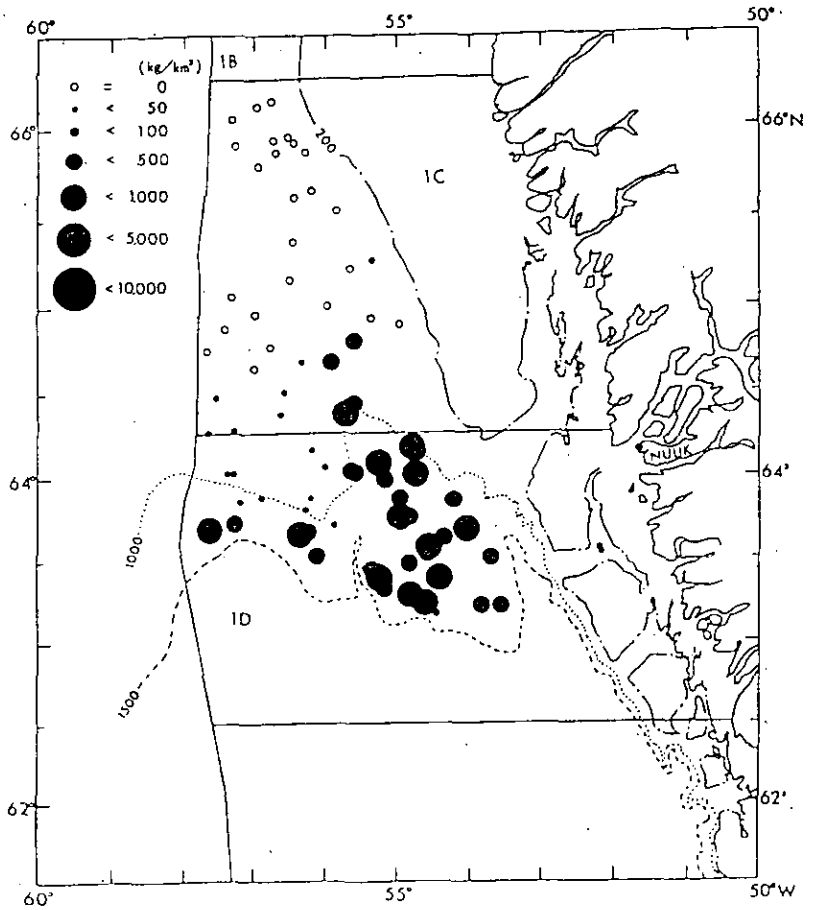


Fig. 4. Size compositions of beaked redfish.

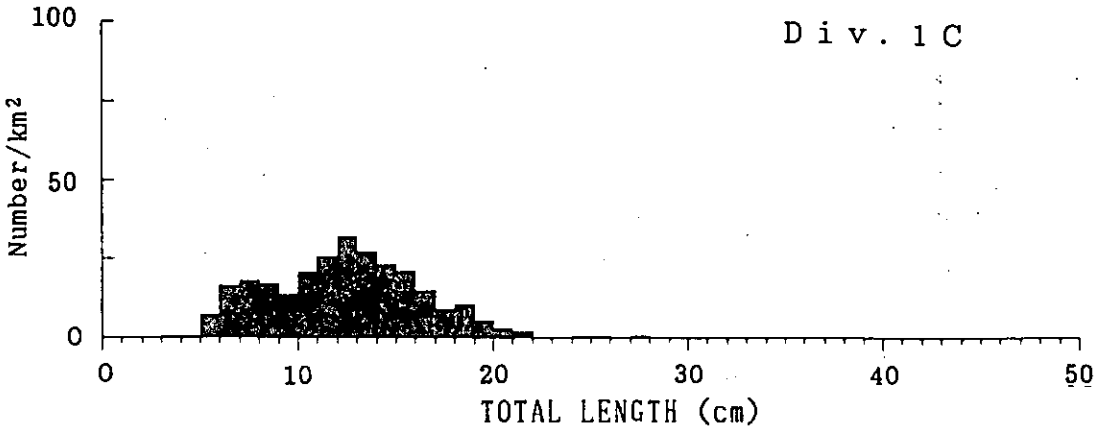


Div. 1A–1B
(south of 70°N)



Div. 1C–1D

Fig. 5. Catches (kg/km²) of roundnose grenadier.



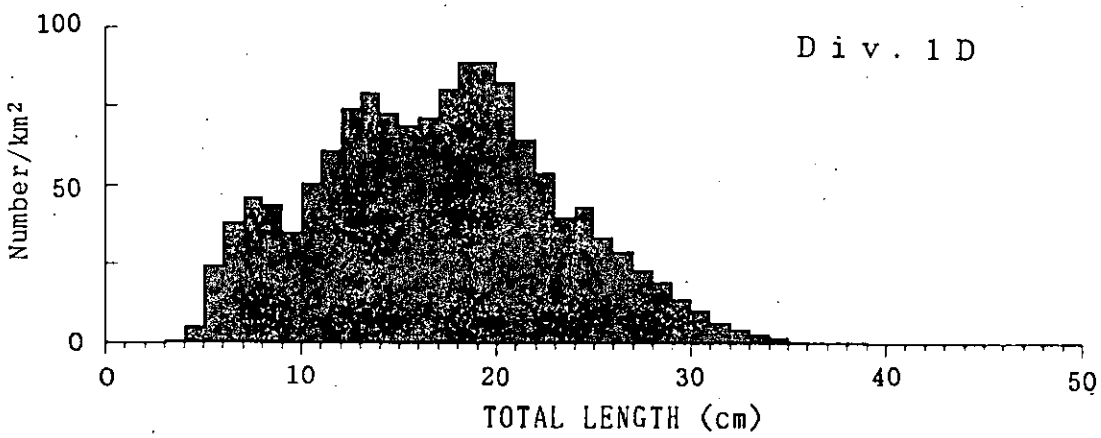


Fig. 6. Size compositions of roundnose grenadier.