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Results of a Stratified Random Bottom Trawl Survey off West Greenland in 1994

by

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

and

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

and

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

and

H. Yamada
Seikai Natioanl Fisheries Research Institute
49 Kokubu, Nagasaki, Nagasaki 850, Japan

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: Ogawa et al., 1994). In 1994 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 1994. Although the survey was planned to cover from Div. 1A to 1D at depth between 400 to 1500 m, bad bottom condition in parts of the survey area and shortage of time prevented the survey to cover Div. 1A. The Divisions were subdivided into strata by isobaths of 600 m and 1000 m. 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 140 mm mesh codend with a 30 mm mesh liner. Wing spread was approximately 40 m. Detailed information on the vessel and gear is given in Yamada et al. (1988a). The 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 0.5 cm below. Size compositions were made in 1.0 cm groups for Greenland halibut and beaked redfish, and 0.5 cm groups 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 80 stations out of 100 designed (Table 1). Biomass estimates for 35 species or species groups are shown in Table 2.

1. Greenland halibut

(1) Biomass and distribution

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 31,300 tons (C.V.=12%) which was a slightly decrease (17%) from 37,700 tons in the survey of 1993 (Table 3, Fig. 1). The estimated biomass of Divs. 1B and 1D showed decrease in the ratio of 70% and 17% from that of 1993, but in Div. 1C the estimated biomass was increased in 16%.

61% of the total biomass was found at depths between 1000 and 1500 m in Div. 1D, where the bulk of the biomass is usually found. Altough, the density (kg/km^2) was relatively higher in deeper waters, there were also observed some good catches at depths between 401-600 m in Div. 1B.

(2) Size composition

The size composition is given by division in Fig. 2. Division by division the length compositions were very much like that in 1993. Two notable peaks in small-sized fish (11-13 and 16-19 cm) were observed in Div. 1B as in 1993, but the density of these fish has decreased. The size compositions of Div. 1C and 1D was mono-modal and the peaks of those modes were around 47 cm in both divisions.

2. Beaked redfish

(1) Biomass and distribution

Beaked redfish was mainly caught at depths less than 600 m in Divs. 1BC and depth stratum of 601-1000 m in Div. 1C as in the survey of 1993 (Table 4, Fig. 3). The estimated biomass has decreased to one third (400 tons, C.V. =20%) of that of in 1993. This is mainly due to the biomass decreases in depth stratum of 401-600 and 601-1000 m in Divs. 1BC. The pattern of the disribution of the catches was comparable to that in 1993, but its density has decreased remarkablly (Figs. 3, 4).

(2) Size composition

As in the previous August/September surveys, high density of small-sized fish was observed in Div. 1B but its value decreased remarkably from that of in 1993 (Fig. 4). Larger fish (more than 35 cm) has almost disappeared from survey area.

3 Roundnose grenadier

(1) Distribution and biomass

As in the survey of 1993, more than 80% of the total catches of roundnose grenadier were obtained from depth stratum of 1000-1500 m in Div. 1D (Table 5, Fig. 5). The biomass was estimated as 3,000 tons (C.V.=16%) which was 64% lower than that of in 1993.

(2) Size composition

The size composition is given by division in Fig. 6. There were observed one mode in Div. 1C and two modes in Div. 1D as in previous surveys. The position of peak of each mode was very similar compared to last years surveys except for the smaller mode in Div. 1D. Densities of fish were decreased notably in both of two divisions.

Discussion

The estimated biomass of most species were lower compared to 1993 and the lowest observed in the time series (Figs. 7, 8, 9). Extraordinary decrease in the biomass of many species suggest a decline of the productivity in this area. A large and long scale variability in abundance of marine organisms were reported in North Pacific Ocean in relation to the regime shift of the productivity (e.g.; Brodeur and Ware, 1992). To see the biological mechanism behind the decrease in the fish biomass in the west Greenland area is important for a long term forecast of the changes of fish stock abundance.

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(8)	5(4)	0	14(12)
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(26)	2(2)	38(32)
1D					
Area	(Km^2)	888	5,451	17,643	23,982
Proportion	(%)	1.56	9.59	31.03	42.18
Hauls planned/(attempted)		2(0)	8(6)	31(30)	41(36)
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(80)

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*	31.34(11.7)
Roundnose grenadier	*Coryphaenoides rupestris*	2.97(15.7)
Beaked redfish	*Sebastes mentella*	4.06(20.2)
Other fishes		2.91(14.2)
Pink shrimp	*Pandarus borealis*	0.53(35.0)
Dogfish	Squalidae	0.60(18.7)
Roughhead grenadier	*Macrourus berglax*	0.73(12.0)
Skates	Rajidae	0.09(42.9)
Other codfishes	Gadiformes	0.79(14.3)
Halibut	*Hippoglossus hippoglossus*	0.16(83.3)
Octopus	Octopoda	1.24(16.2)
Spiny eel	Notocanthidae	0.40(16.5)
Greenland shark	*Somniosus microcephalus*	-
Northen catfish	*Anarhichas denticulatus*	0.03(76.2)
American plaice	*Hippoglossoides platessoides*	0.02(36.9)
Eels	Anguilliformes	0.31(8.2)
Other shrimps		0.46(8.3)
Ratfish	*Hydrolagus affinis*	0.20(40.5)
Eelpouts	Zoarcidae	0.03(31.3)
Golden redfish	*Sebastes marinus*	0.02(100.0)
Grenadier	*Coryphaenoides guentheri*	-
Sculpins	Psychrolutidae	0.05(31.1)
Spotted catfish	*Anarchias minor*	0.01(100.0)
Other crustacea		0.02(51.2)
Polar cod	*Boreogodus saida*	0.03(40.3)
Grenadiers	Macrouridae	0.01(86.7)
Squids	Teuthoidea and Sepioidea	0.07(15.9)
Snailfishes	Liparidae	0.01(31.1)
Atlantic cod	*Godus morhua*	-
Hagfish	*Myxine glutinosa*	0.00(100.0)
Sculpins	Cottidae	0.00(100.0)
Blue ling	*Molva dipterygia*	-
Pricklebacks	Stichaeidae	-
Lumpsuchers	Cyclopterydae	0.01(100.0)
Other mollusks		2.36(13.2)
Total		59.33(8.6)

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

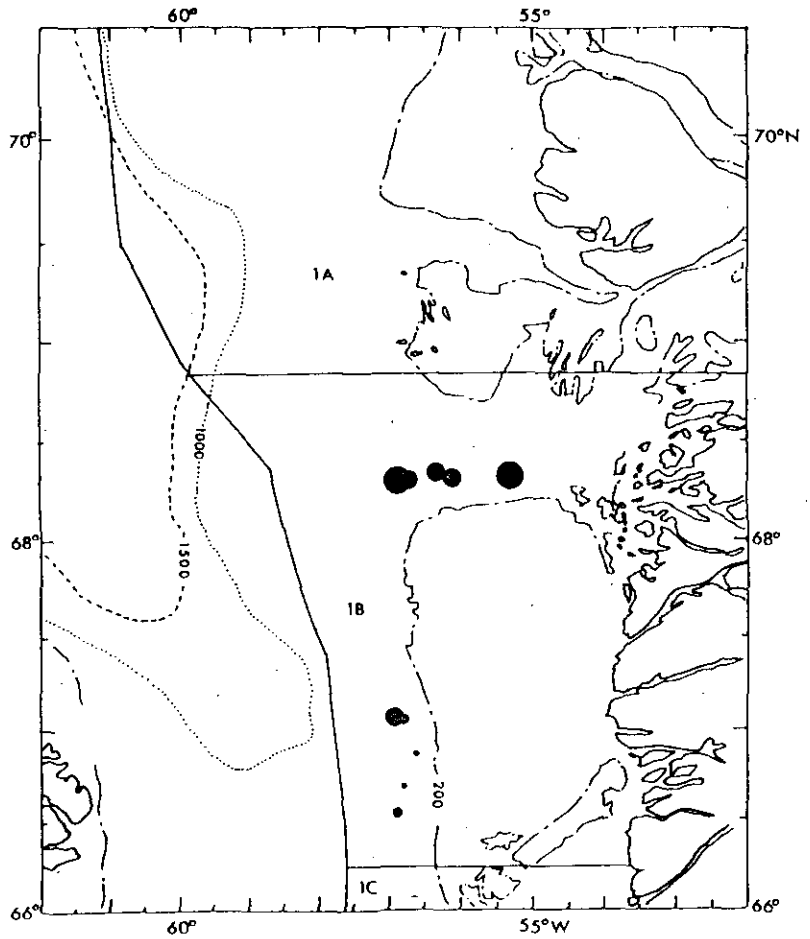
NAFO DIV.	Depth statum(m)			Total
	401-600	601-1000	1001-1500	
1B	1.53	0.24		1.77
1C	0.14	8.37	1.99	10.51
1D		3.07	16.00	19.06
Total	1.67	11.68	17.99	31.34

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

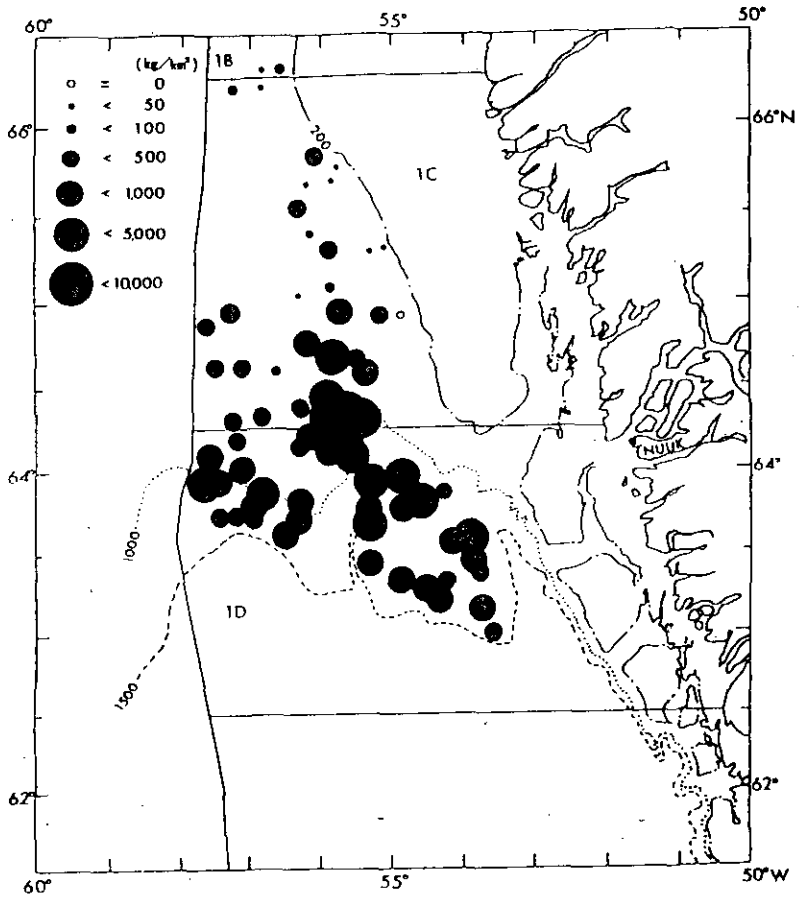
NAFO DIV.	Depth statum(m)			Total
	401-600	601-1000	1001-1500	
1B	0.18	0.01		0.19
1C	0.11	0.08	0.00	0.19
1D		0.00	0.02	0.02
Total	0.29	0.09	0.02	0.41

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

NAFO DIV.	Depth statum(m)			Total
	401-600	601-1000	1001-1500	
1B	-	-		0
1C	-	0.32	0.20	0.52
1D		0.03	2.42	2.45
Total	-	0.35	2.62	2.97



Div. 1B



Div. 1C-1D

Fig. 1. Catches (Kg/Km^2) of Greenland halibut.

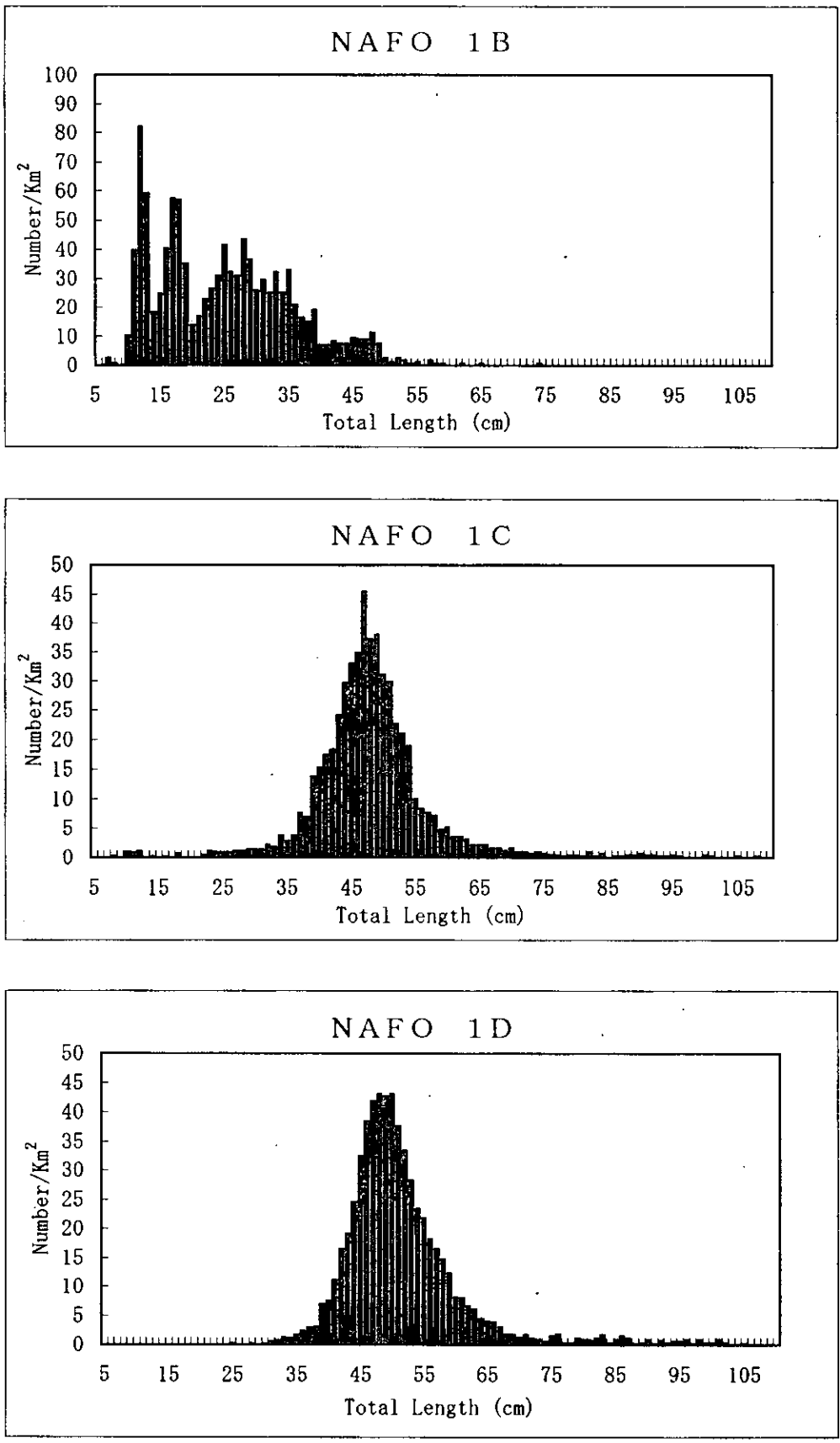
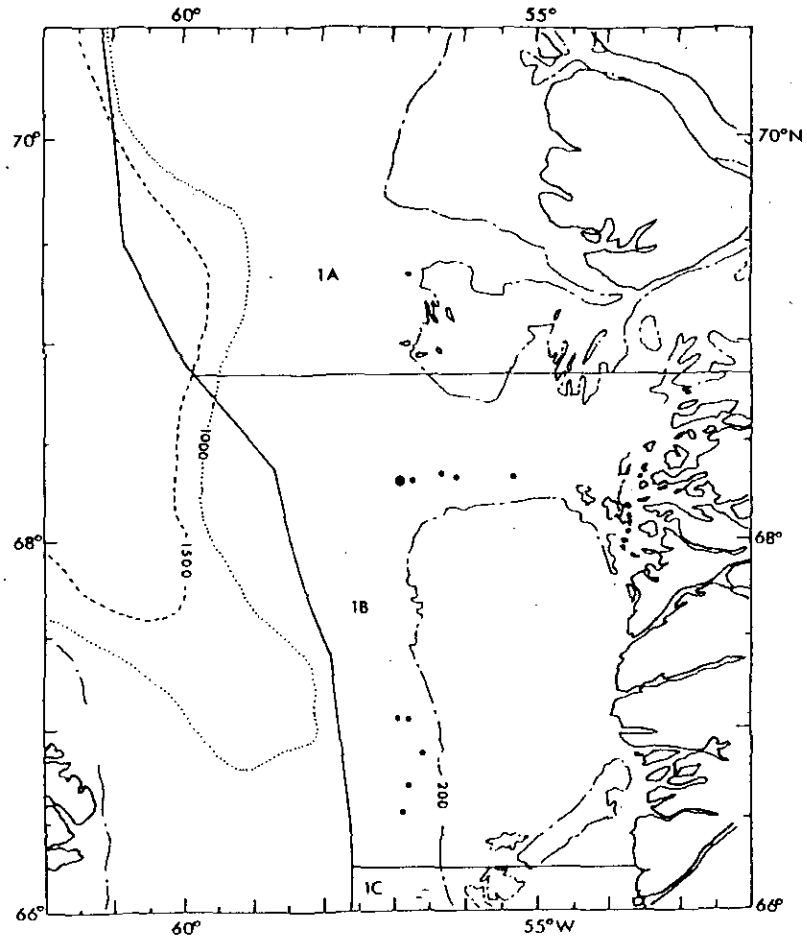
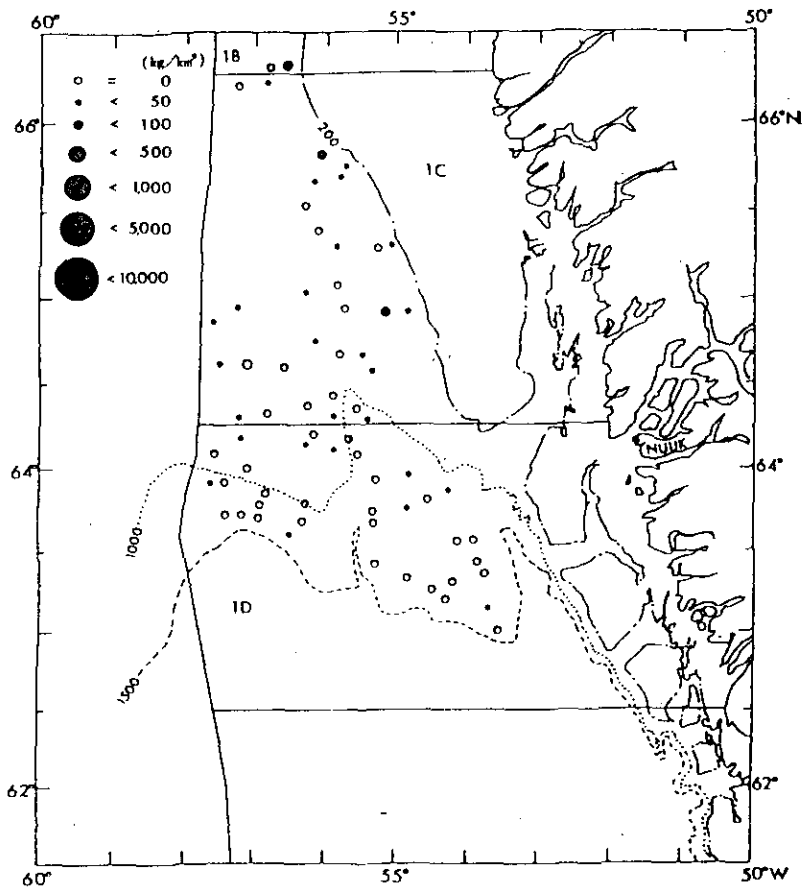


Fig. 2. Size compositions of Greenland halibut.

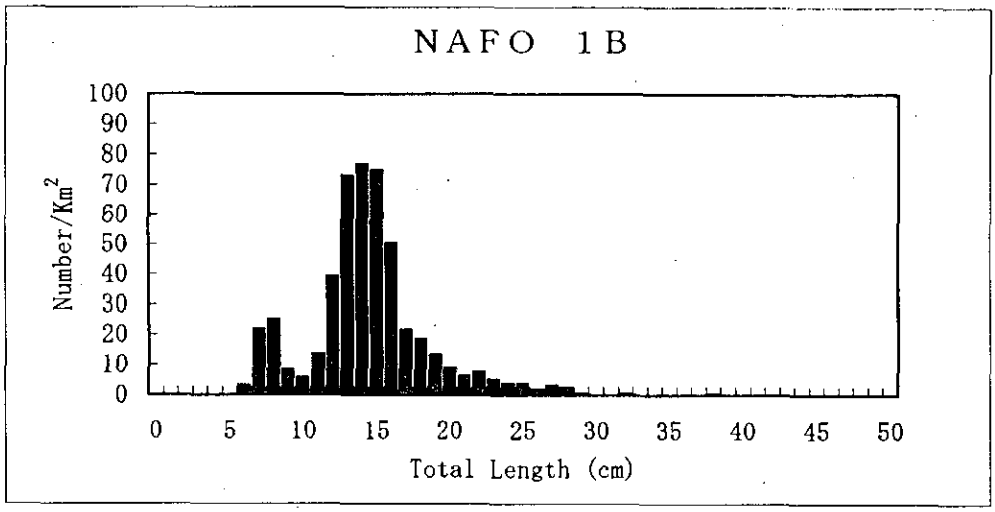


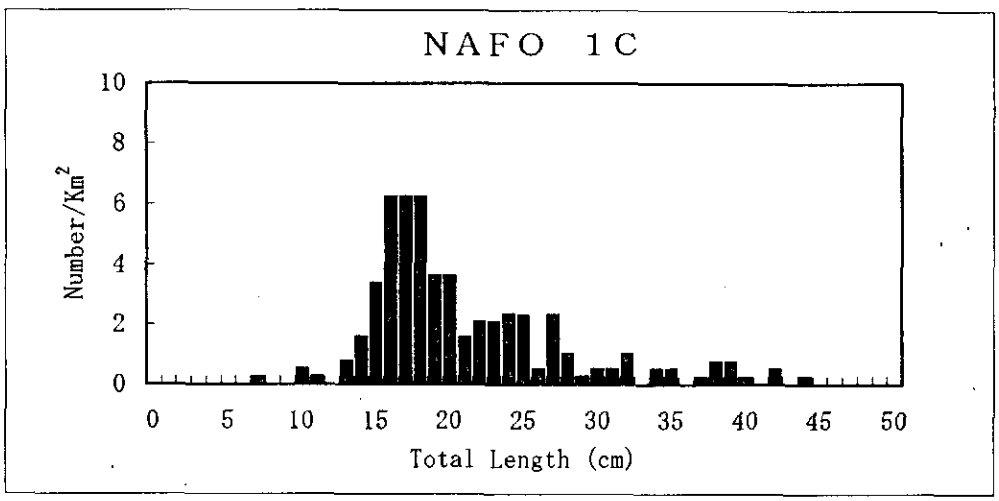
Div. 1B



Div. 1C-1D

Fig. 3. Catches (Kg/Km^2) of beaked redfish.





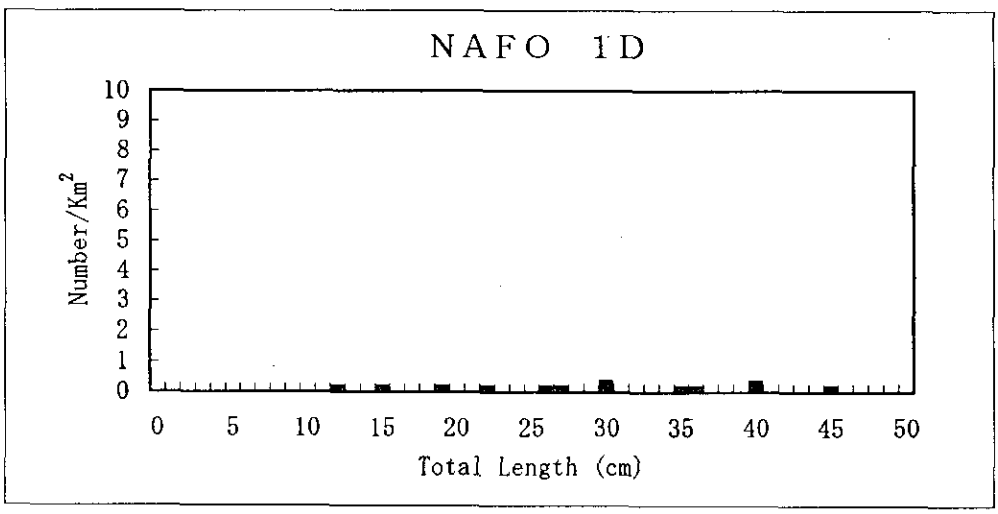
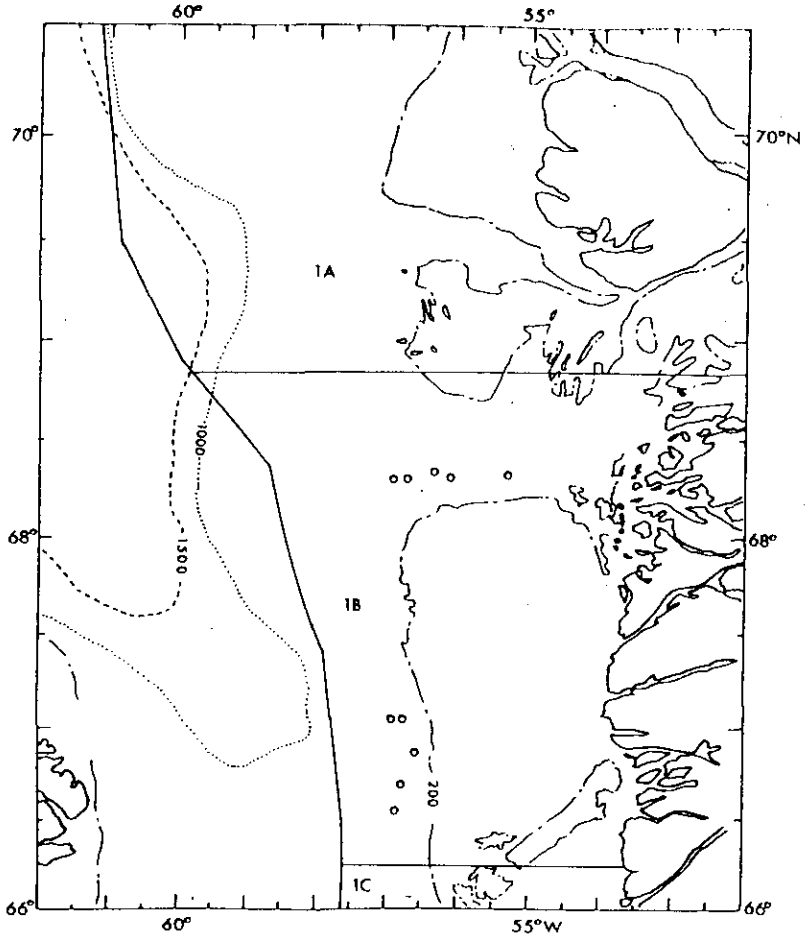
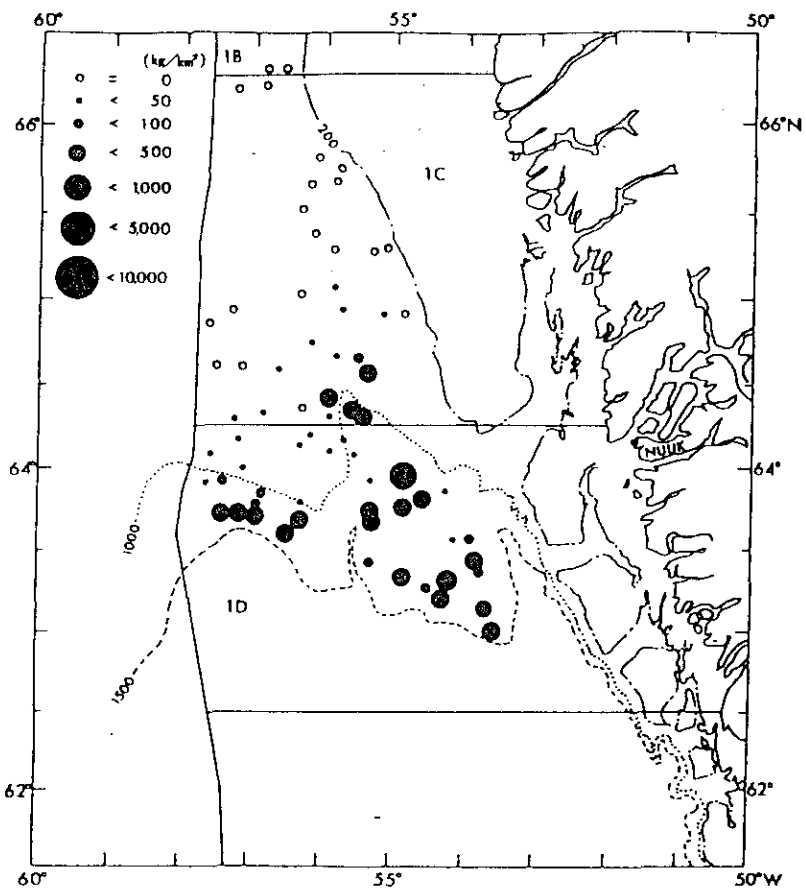


Fig. 4. Size compositions of beaked redfish.



Div. 1B



Div. 1C-1D

Fig. 5. Catches (Kg/Km^2) of roundnose grenadier.

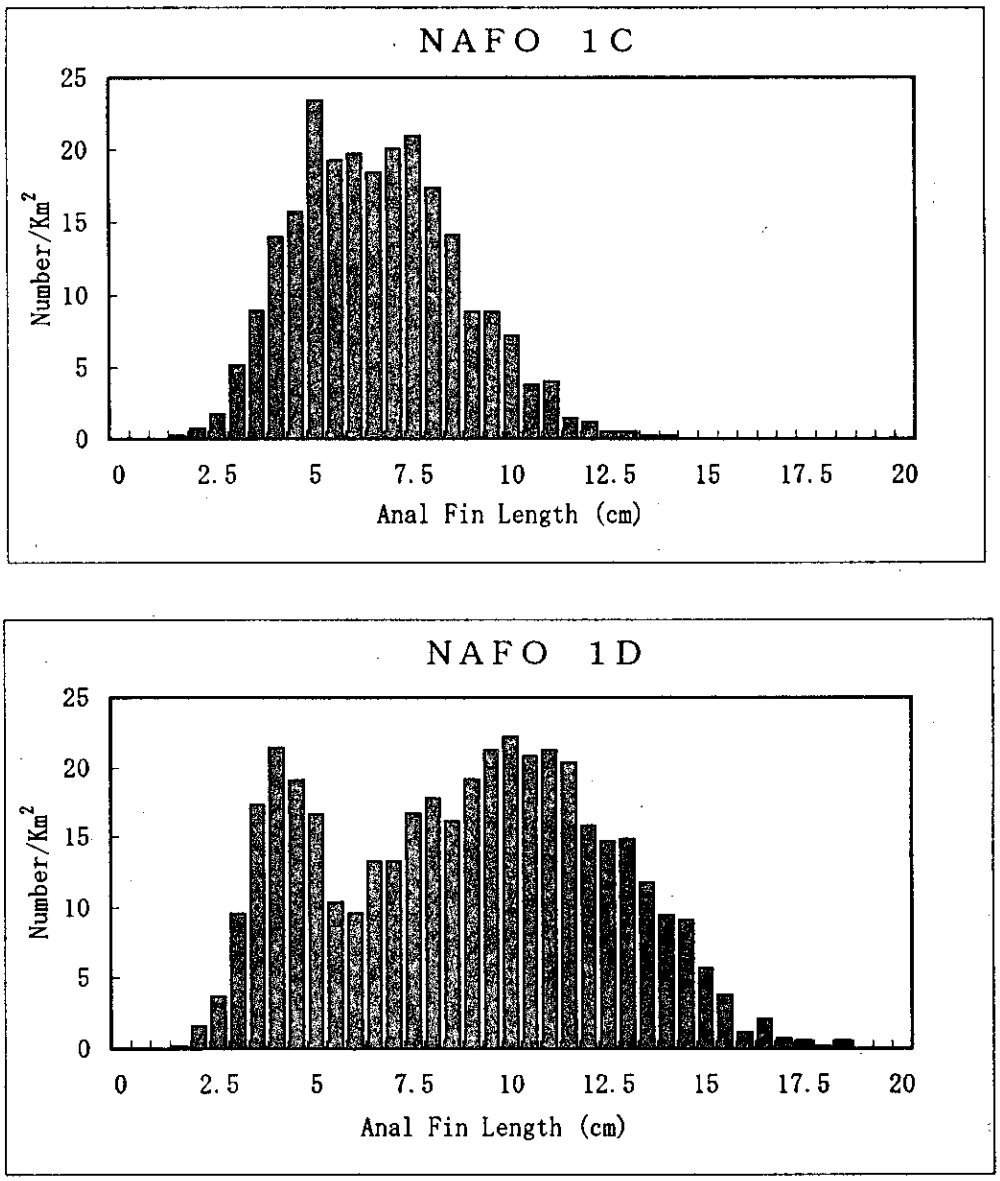


Fig. 6. Size compositions of roundnose grenadier.

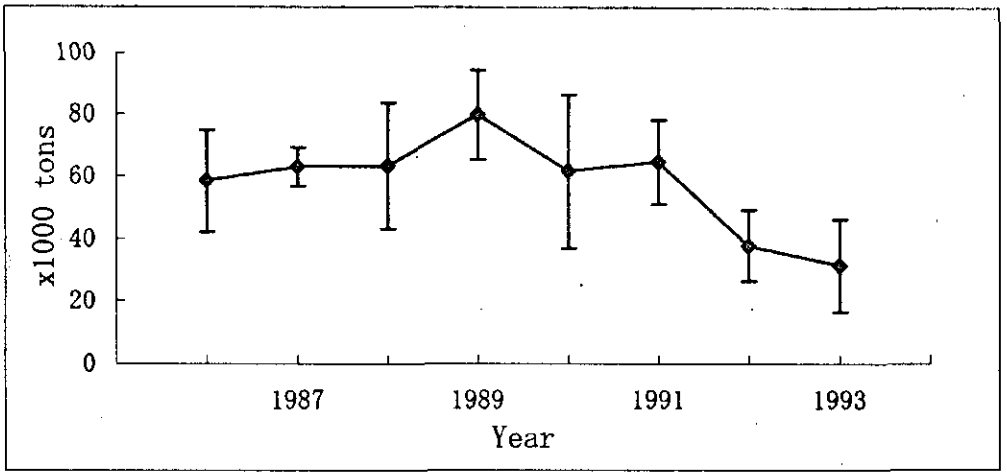


Fig. 7. G. hlibut biomass estimates with approximate 95% confidence intervals in Divs. 1BCD. Value for 1987 does not contain data of the depth stratum 1001-1500 m.

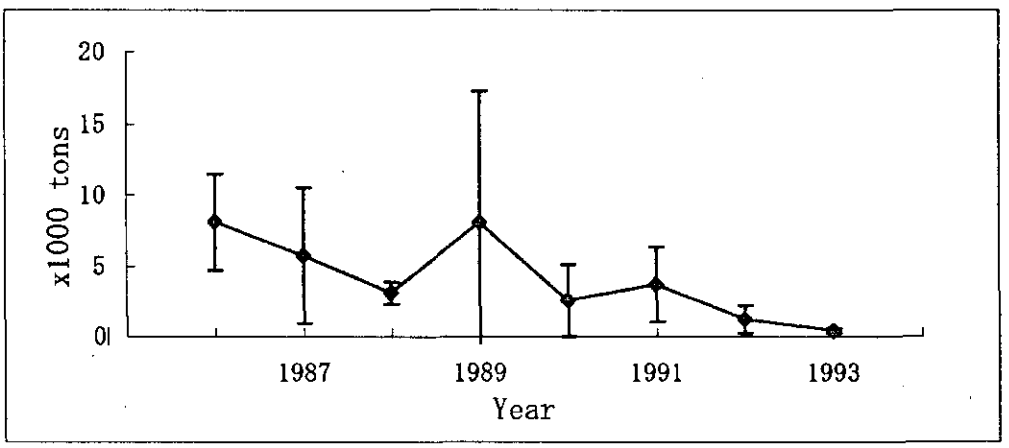


Fig. 8. Beaked redfish biomass estimates with approximate 95% confidence intervals in Divs. 1BCD. Value for 1987 does not contain data of the depth stratum 1001-1500 m.

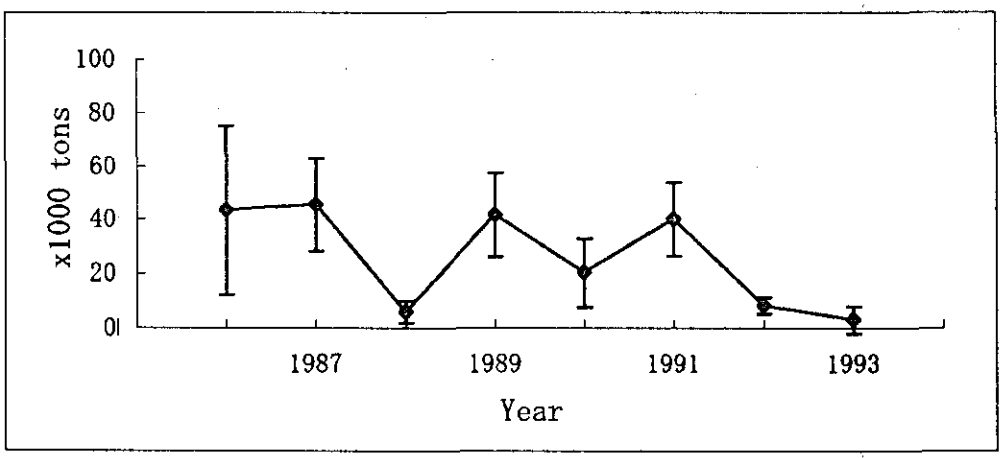


Fig. 9. Roundnose grenadier biomass estimates with approximate 95% confidence intervals in Divs. 1BCD. Value for 1987 does not contain data of the depth stratum 1001-1500 m.