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Results of two Trawl Surveys in NAFO Subarea 1 in 1990

by

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Introduction

In June and August/September 1990 two trawl surveys were carried out at West Greenland by Japan Marine Resource Research Center (JAMARC) in cooperation with Greenland Fisheries Research Institute. The surveys were part of a joint venture program started in 1987 between JAMARC and the Greenlandic Home Rule. The main purpose of the two surveys was to estimate groundfish biomasses and to collect information on distribution, size composition and biology of major species off West Greenland. As in 1988 and 1989 the main interest was put upon Greenland halibut (*Reinhardtius hippoglossoides*) and roundnose grenadier (*Coryphaenoides rupertis*). During both surveys a part of the survey time was used for pelagic fishing in order to investigate the pelagic distribution of Greenland halibut, roundnose grenadier and redfish.

Materials and Methods

The surveys took place in the periods 31.5 - 28.6 and 26.8 - 20.9, respectively. The main part of each survey period was used for bottom trawling, while the last five days were used for pelagic trawling. Both surveys were conducted by the Japanese research vessel SHINKAI MARU.

Bottom survey.

The bottom trawl part of the surveys was carried out as stratified-random trawl surveys and were planned to cover NAFO Divisions 1A (south of 70°N) to Div. 1D at depths between 400 and 1500 m. Each division was subdivided into three depth strata by the 400, 600, 1000, 1500 m isobaths and trawl positions were randomly selected and allocated in proportion to the area of each stratum, but with a minimum of two planned hauls per stratum (Table 1). Towing speed was 3.5 kn and towing time was 30 min. The net was equipped with a 140 mm mesh codend with a 30 mm mesh-liner. Further information about vessel and gear is given in Yamada et al. (1988a). Trawling was carried out in daytime only. Biomass estimates were obtained by applying the swept area method taking the catchability coefficient of all species as 1.0. The coefficient of variation (C.V.) is calculated as:

C.V. = Standard error of estimate x 100/estimated biomass.

#### Pelagic survey.

During the pelagic part of the surveys fishing was carried out at positions where good catches of Greenland halibut and roundnose grenadier were obtained during the bottom trawl part of the surveys i.e. at 63°30'N 54°W in the first survey and at 64°04'N 54°37'W, 63°35'N 54°29'W and 64°19'N 55°38'W, respectively, in the second survey. At all positions the depth was about 1100 m. Being without experience in pelagic fishing for Greenland halibut and roundnose grenadier the first pelagic survey was used for experiments with the survey design, but generally, the water column was divided in 6 depth strata and all strata were covered at different time of the day. Towing time varied from 30 to 90 min. In the second pelagic survey the water column was divided in 5 depth strata and the 6 daily hauls were distributed as shown in Table II. Towing time was 60 min distributed on 20 min towing at three different depths within each depth stratum. i.e. the trawl being approximately 80 m high, almost the entire depth stratum on 250 m was covered. In the first survey a trawl with a circumference on 117 m was used. Due to poor catches in that survey a larger trawl with a circumference on 202 m was used in the second. Mesh size in the codend was 140 mm with a 30 mm meshliner in both trawls. Towing speed was 4.0 kn.

### Results and Discussion

#### Bottom trawl surveys

Due to ice the stations north of 68°30'N and a few stations near the midline against Canada were abandoned in the first survey. Totally 75 and 88 hauls were made, respectively, in the two surveys.

#### Greenland halibut

##### Biomass

Greenland halibut was recorded at all stations (Fig. 1 and 2), but the density was generally highest at depths above 900 m. In the first survey the highest densities were found in the central part of Div. 1D and around the border between Div. 1C and Div. 1D, while, in the second survey, high densities were found in Div. 1D only (Fig. 1 and 2 and Table IV). The biomass is estimated to 61.500 tons (C.V.=20%) in the first survey, but declined, almost exclusively due to a decline in Div. 1C depth stratum 600-1000 m, to 51.300 tons (C.V.=15%) in the second survey (Table III). However, the difference between the two estimates would probably have been larger if all the survey area was covered in the first survey. The two estimates are at the same level as found in 1987-1989 (53.500 - 63.700 tons) although a direct comparison between the estimates should be done with caution because of dissimilarities in coverage with regard to area, depths and time of year (Yamada et al., 1988 b; Yatsu and Jørgensen, 1989; Jørgensen and Akimoto, 1990).

##### Length distribution

Length ranged from 10 to 114 cm and 9 to 111 cm, respectively, in

the two surveys. As seen in previous years there is a distinct change in size by depth, with smaller fish dominating at shallower water and larger fish being relatively more abundant at greater depths (Table V). Furthermore the mean size is increasing from north to south, i.e. from Div. 1AS to Div. 1D (Table V and Fig. 3). The difference in length distribution between the two surveys noticed in Div. 1B is probably because only depth stratum 400-600 m was covered in the first survey, while depths between 600-1400 m, contributing a number of larger fish, were also included in the second survey. Comparing the length distribution in the two surveys in Div. 1C and Div. 1D, respectively, and in the overall length distribution, the number of larger fish (> 49 cm) seems to be somewhat higher in the first survey (Fig. 3 and 4). In both surveys a single mode at 49 cm (48 cm in 1989) was found in the overall length distribution (Fig. 4). The "left shoulder" in second survey stems from the contribution of small fish in Div. 1AS not covered by the first survey.

#### Roundnose grenadier

##### Biomass

Roundnose grenadier was exclusively taken south of 64°45'N, but the catches were low, especially in the first survey (Fig. 5 and 6). Total biomass is estimated to 7.000 tons (C.V.=56%) and 20.300 tons (C.V.=31%), respectively (Table VI). The estimates are in between the estimates from April/May 1989 and September/October 1988 on 5.900 tons and 45.500 tons, respectively. When combining the data from the last three years it is obvious that the increase in biomass during the year is implying an immigration into the area during early summer and an emigration during the winter. In the first survey the highest densities, 353 kg/km<sup>2</sup>, were found in Div. 1D depth stratum 1000-1500 m and in Div. 1C and Div. 1D in the same depth stratum (934 and 864 kg/km<sup>2</sup>, respectively) in the second survey (Table VII).

##### Length distribution

Length distributions in Div. 1C are rather similar in the two surveys with modes around 5 and 9-10 cm (Fig. 7). In Div. 1D in the first survey three modes at 5, 10 and around 14 cm are seen, which is corresponding to similar modes at 4, 9 and 13 cm in April/May 1989. The length distribution in Div. 1D in the second survey is dominated by a single mode around 9-10 cm and is in that respect resembling the distribution in September/October 1988 where a similar unimodal distribution was found.

Besides the occurrence of a few relatively large fish in depth stratum 400-600 m the mean size increases with depth and in the direction from north to south, except in Div. 1C in the first survey (Table VIII):

#### Pelagic surveys

24 and 35 hauls were made, respectively, during the two pelagic surveys. The catches were genererally poor (10 kg in average in the first survey, if one large catch of roundnose grenadier is excluded, and 48 kg in the second survey) and were mainly composed of *Bathylagus euryops* and Myctophidae. However, the figures are probably underestimated because especially Myctophidae are only restrained to some extend by the trawl due to their small size.

Greenland halibut

11 and 9 Greenland halibut > 8 cm were taken in the two surveys, respectively. The largest catch - 7 specimens - were taken near the surface (50-150 m) in the first survey, while the remainder were evenly distributed in the water column. The mean size of the pelagic caught fish were well below the mean size of the fish taken at same place on the bottom. In the second survey additionally 75 0-group fish (5-8 cm) were taken.

Roundnose grenadier

The catches of roundnose grenadier were small, too, except one catch at 390 kg (in one hour) in the first survey, while the best catch was 64 kg in the second survey. Generally CPUE was greatest near the bottom. Mean size in the pelagic and bottom hauls (in the same position) were almost the same in both surveys, indicating that the fish are migrating up into the water mass to forage. This is supported by the fact that copepods made up a large part of the stomach content.

Redfish

Also redfish (*S. mentella*) were scarce in the catches, the best being 3 and 8 kg, respectively. At least some of the specimens belonged to the 'oceanic' stock because of the black and orange patches on the skin typical for specimens in this stock.

References

- Jørgensen, O., and K.Akimoto. 1990. Results of a stratified random bottom trawl survey in NAFO Subarea 1 in 1989. NAFO SCR Doc., 90/39.
- Yamada, H., K.Okada, and O.Jørgensen. 1988a. West Greenland groundfish biomasses estimated from a stratified-random trawl survey in 1987. NAFO SCR Doc., 88/31.
- . 1988b. Distribution, abundance and size distribution of Greenland halibut estimated from a stratified-random trawl survey off West Greenland in 1987. NAFO SCR Doc., 88/35.
- Yatsu, A., and O.Jørgensen. 1989. Distribution, abundance, size, age, gonad index, and stomach contents of Greenland halibut (*Reinhardtius hippoglossoides*) off West Greenland in September/October 1988. NAFO SCR Doc., 89/31.

Table I. Areas of depth strata in sq. km, size of depth strata in percent relative to total stratification area, no. of planned hauls in brackets and no. of successful hauls in the first and the second survey, respectively. IAS: 68°15'N - 70°N.

| NAFO Div. |      | Depth stratum (m) |            |            | Total      |
|-----------|------|-------------------|------------|------------|------------|
|           |      | 401-601           | 601-1000   | 1001-1500  |            |
| IAS       | Area | 1683              | 793        | 1271       | 3747       |
|           | %    | 2.96              | 1.39       | 2.24       | 6.59       |
|           | Haul | (3),0,2           | (2),0,2    | (2),0,2    | (7),0,6    |
| 1B        | Area | 5120              | 2649       | 23         | 7792       |
|           | %    | 9.00              | 4.66       | 0.04       | 13.70      |
|           | Haul | (8),7,8           | (4),0,4    | (0),0,0    | (12),7,12  |
| 1C        | Area | 3131              | 17611      | 603        | 21345      |
|           | %    | 5.51              | 30.97      | 1.06       | 37.54      |
|           | Haul | (5),5,5           | (27),26,27 | (2),2,2    | (34),33,34 |
| 1D        | Area | 888               | 5451       | 17643      | 23982      |
|           | %    | 1.56              | 9.59       | 31.03      | 42.18      |
|           | Haul | (2),2,2           | (8),7,8    | (27),26,26 | (37),35,36 |
| Tot.      | Area | 10822             | 26504      | 19540      | 56866      |
|           | %    | 19.03             | 46.61      | 34.37      | 100.0      |
|           | Haul | (18),14,17        | (41),33,41 | (31),28,30 | (90),75,88 |

Table II. Distribution of pelagic hauls on depth and time in the second pelagic survey. Depth stratum A: 50-300 m. Depth stratum B: 301-550 m. Depth stratum C: 551-800 m. Depth stratum D: 801-1050 m.

| Haul no. | Local time                         | 64°04'N, 54°37'W |      | 63°35'N, 54°29'W |      | 64°19'N, 55°38'W |      |
|----------|------------------------------------|------------------|------|------------------|------|------------------|------|
|          |                                    | 14.9             | 15.9 | 16.9             | 17.9 | 18.9             | 19.9 |
| 1        | 07 <sup>30</sup> -08 <sup>30</sup> | A                | C    | B                | D    | A                | C    |
| 2        | 12 <sup>15</sup> -13 <sup>15</sup> | B                | D    | C                | A    | B                | D    |
| 3        | 14 <sup>15</sup> -15 <sup>15</sup> | C                | A    | D                | B    | C                | A    |
| 4        | 19 <sup>30</sup> -20 <sup>30</sup> | D                | B    | A                | C    | D                | B    |
| 5        | 00 <sup>15</sup> -01 <sup>15</sup> | A                | C    | B                | D    | A                | -    |
| 6        | 02 <sup>15</sup> -03 <sup>15</sup> | B                | D    | C                | A    | B                | D    |

Table III. Greenland halibut. Biomass (-000 tons) in the first and second bottom trawl survey, respectively, by NAFO-divisions and depth strata. 1AS: 68°50'N - 70°N. - No hauls.

| NAFO-Div. | Sur. | Depth stratum (m) |            |             | Total |
|-----------|------|-------------------|------------|-------------|-------|
|           |      | 401-600 m         | 601-1000 m | 1001-1500 m |       |
| 1AS       | 1    | -                 | -          | -           | -     |
|           | 2    | 0.2               | 1.2        | 0.7         | 2.1   |
| 1B        | 1    | 3.4               | -          | -           | 3.4   |
|           | 2    | 2.9               | 2.9        | -           | 5.8   |
| 1C        | 1    | 1.8               | 21.7       | 1.0         | 24.5  |
|           | 2    | 0.3               | 11.3       | 1.9         | 13.5  |
| 1D        | 1    | 0.1               | 9.3        | 24.2        | 33.6  |
|           | 2    | 0.2               | 6.0        | 23.7        | 29.9  |
| Tot.      | 1    | 5.3               | 31.0       | 25.2        | 61.5  |
|           | 2    | 3.6               | 21.4       | 26.3        | 51.3  |

Table IV. Grenland halibut. Biomasse in kg/km<sup>2</sup> in the first and the second bottom trawl survey, respectively, by NAFO-divisions and depth strata. 1AS: 68°50'N - 70°N. - No hauls.

| NAFO-Div. | Survey | Depth stratum |            |             |
|-----------|--------|---------------|------------|-------------|
|           |        | 401-600 m     | 601-1000 m | 1001-1500 m |
| 1AS       | 1      | -             | -          | -           |
|           | 2      | 114           | 1475       | 580         |
| 1B        | 1      | 659           | -          | -           |
|           | 2      | 568           | 1081       | -           |
| 1C        | 1      | 575           | 1231       | 1587        |
|           | 2      | 101           | 639        | 3122        |
| 1D        | 1      | 138           | 1715       | 1370        |
|           | 2      | 277           | 1099       | 1344        |

Table V. Greenland halibut. Mean length (cm) in the first and second bottom trawl survey, respectively, by NAFO-divisions and 200 m depth intervals. IAS: 68°50'N - 70°N. - No hauls.

| NAFO-Div. | Sur | Depth m |         |          |           |           |       |
|-----------|-----|---------|---------|----------|-----------|-----------|-------|
|           |     | 401-600 | 601-800 | 801-1000 | 1001-1200 | 1201-1400 | >1400 |
| 1AS       | 1   | -       | -       | -        | -         | -         | -     |
|           | 2   | 26.2    | -       | 39.8     | 43.0      | 38.2      | -     |
| 1B        | 1   | 30.7    | -       | -        | -         | -         | -     |
|           | 2   | 30.6    | 40.6    | 46.9     | -         | -         | -     |
| 1C        | 1   | 48.2    | 49.6    | 50.7     | 51.8      | -         | -     |
|           | 2   | 36.7    | 44.6    | 48.5     | 52.0      | -         | -     |
| 1D        | 1   | 44.0    | 50.3    | 50.2     | 53.0      | 55.2      | 61.1  |
|           | 2   | 46.5    | 49.7    | 50.2     | 52.4      | 53.8      | 61.4  |

Table VI. Roundnose grenadier. Biomass (-000 tons) in the first and the second bottom trawl survey, respectively, by NAFO-divisions and depth strata.

| NAFO-Div. | Sur. | Depth stratum |            |             | Total |
|-----------|------|---------------|------------|-------------|-------|
|           |      | 401-600 m     | 601-1000 m | 1001-1500 m |       |
| 1C        | 1    | 0.2           | 0.1        | 0.0         | 0.3   |
|           | 2    | 0.0           | 2.2        | 0.6         | 2.8   |
| 1D        | 1    | 0.1           | 0.3        | 6.2         | 6.6   |
|           | 2    | 0.2           | 2.0        | 15.3        | 17.5  |
| Tot.      | 1    | 0.3           | 0.4        | 6.2         | 7.0   |
|           | 2    | 0.2           | 4.2        | 15.9        | 20.3  |

Table VII. Roundnose grenadier. Biomasse in kg/km<sup>2</sup> in the first and second bottom trawl survey, respectively, by NAFO-divisions and depth strata.

| NAFO-Div. | Sur. | Depth stratum |            |             |
|-----------|------|---------------|------------|-------------|
|           |      | 401-600 m     | 601-1000 m | 1001-1500 m |
| 1C        | 1    | 74            | 7          | 4           |
|           | 2    | 7             | 123        | 934         |
| 1D        | 1    | 166           | 55         | 353         |
|           | 2    | 250           | 360        | 869         |

Table VIII. Roundnose grenadier. Mean length (cm) in the first and second bottom trawl survey, respectively, by NAFO-divisions and 200 m depth intervals. - No hauls.

| NAFO-Div. | Sur | Depth (m) |         |          |           |           |       |
|-----------|-----|-----------|---------|----------|-----------|-----------|-------|
|           |     | 401-600   | 601-800 | 801-1000 | 1001-1200 | 1201-1400 | >1400 |
| 1C        | 1   | 8.8       | 7.9     | 6.6      | 5.9       | -         | -     |
|           | 2   | 5.5       | 5.5     | 7.0      | 9.5       | -         | -     |
| 1D        | 1   | 8.2       | 4.0     | 7.9      | 8.0       | 12.0      | 14.0  |
|           | 2   | 8.6       | 7.2     | 7.8      | 9.8       | 12.7      | 13.1  |

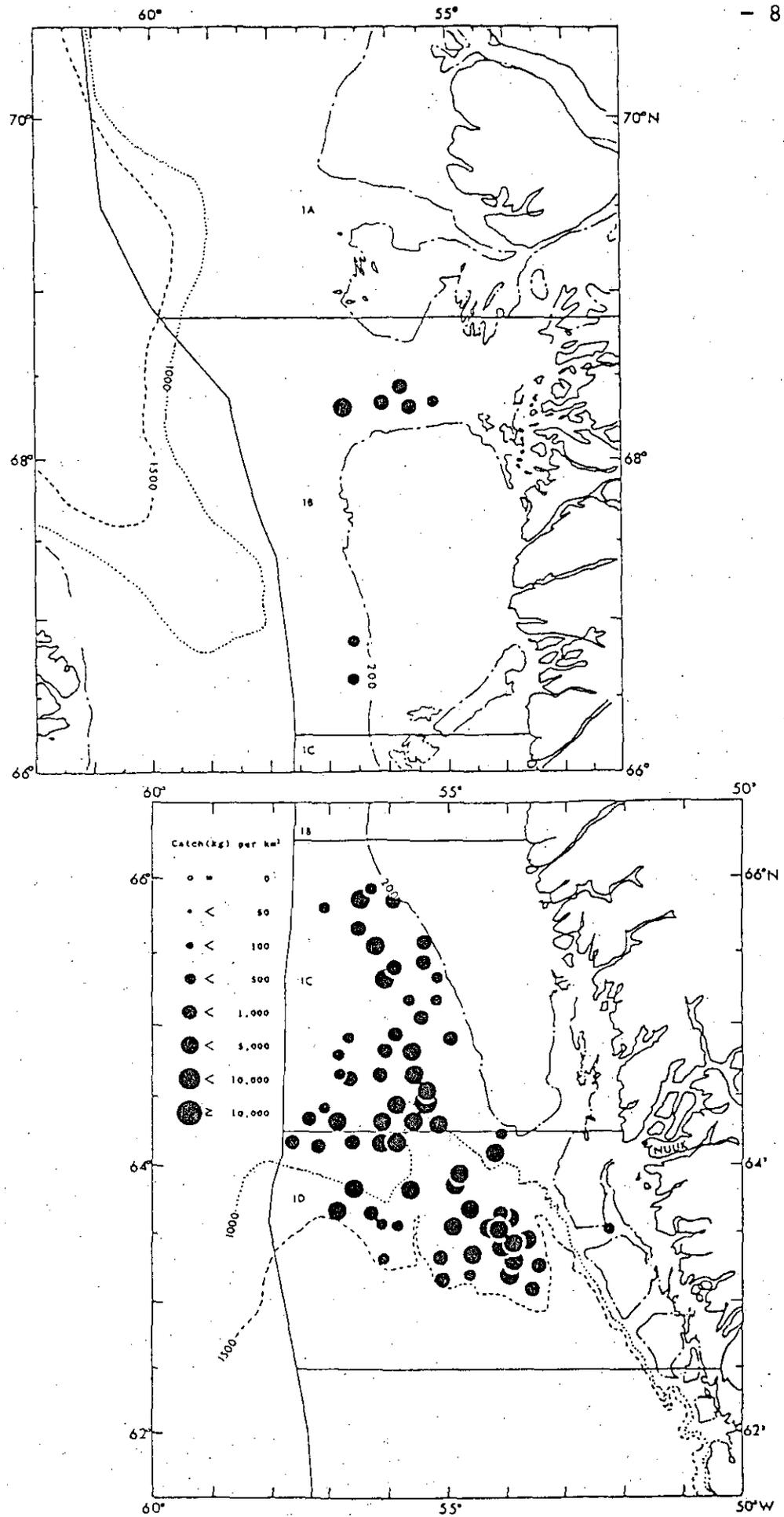


Fig. 1. Greenland halibut. Distribution of catches in kg per trawled km<sup>2</sup> in the first survey.

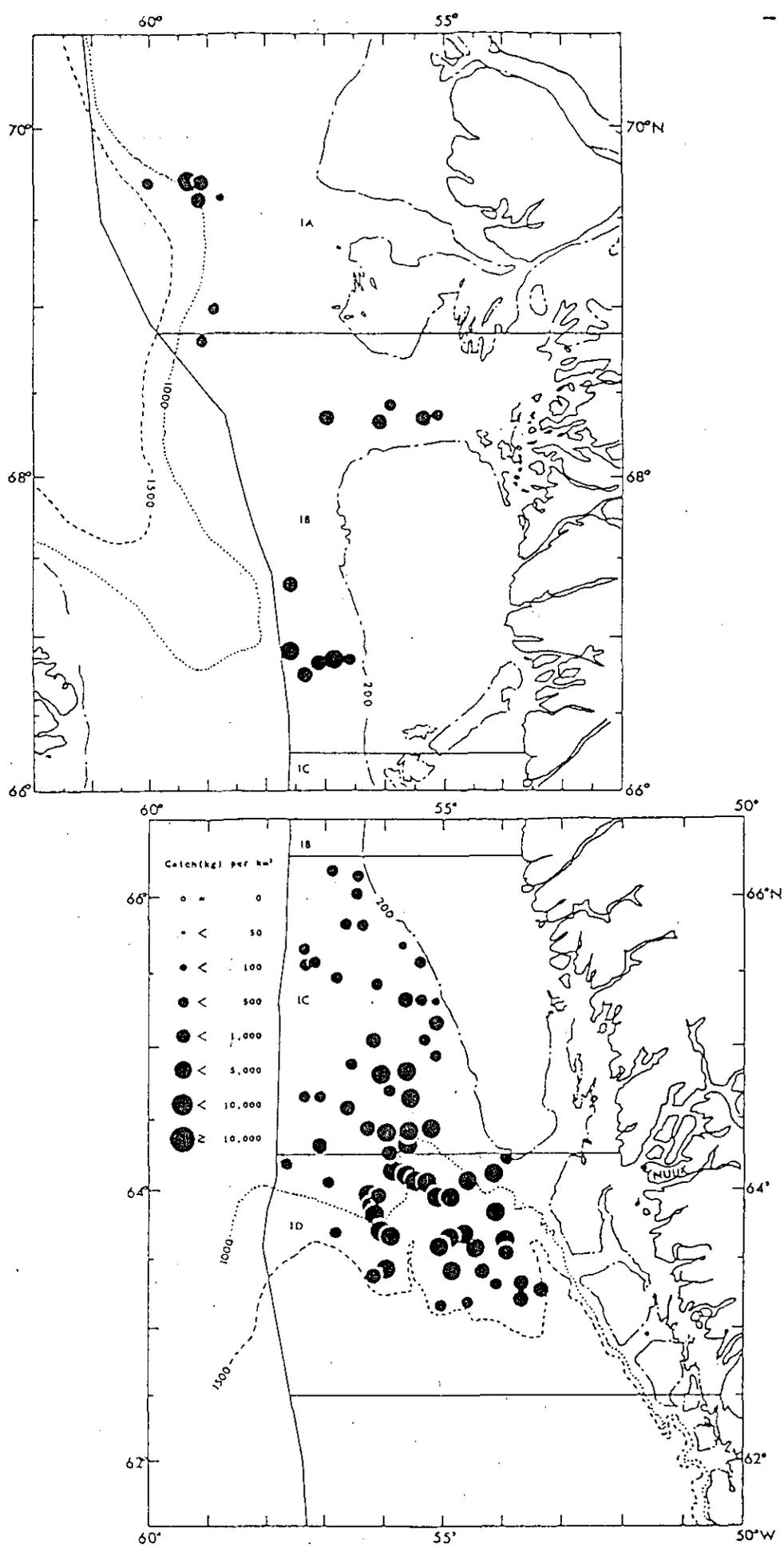
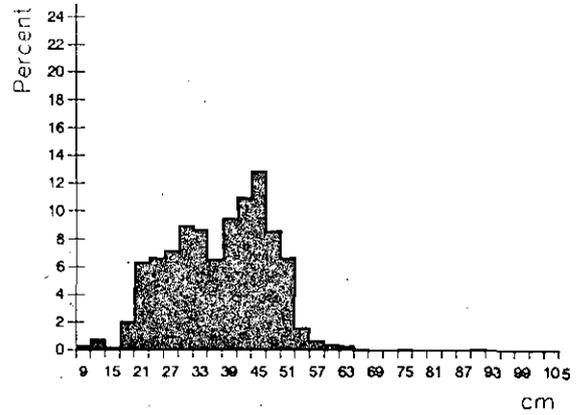


Fig. 2. Greenland halibut. Distribution of catches in kg per trawled km<sup>2</sup> in the second survey.

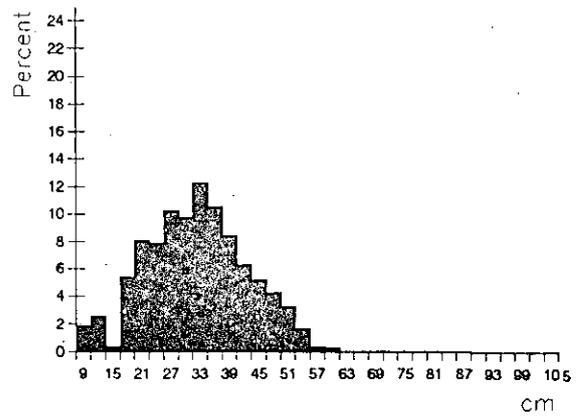
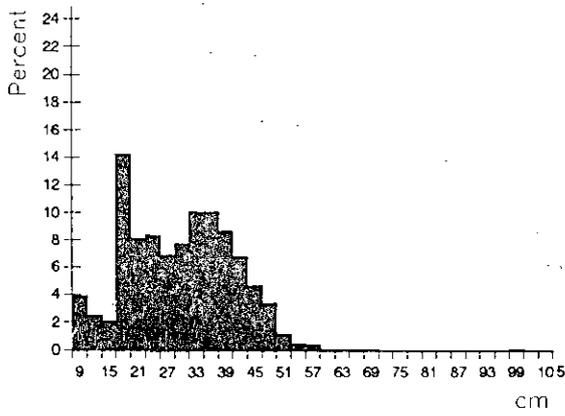
First survey

Second survey

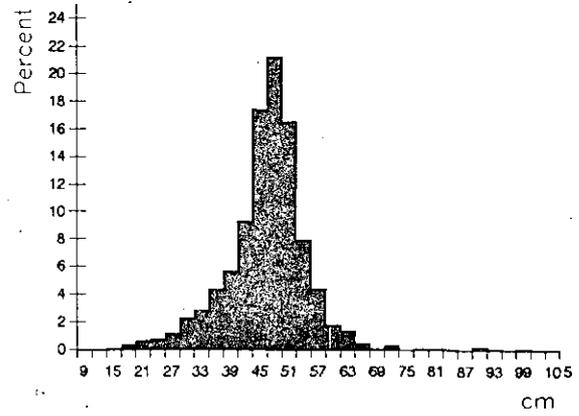
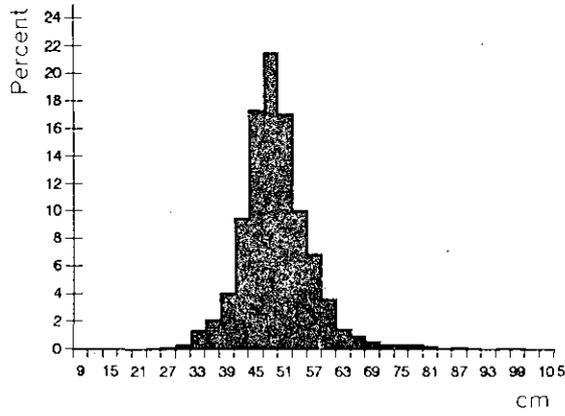
1A



1B



1C



1D

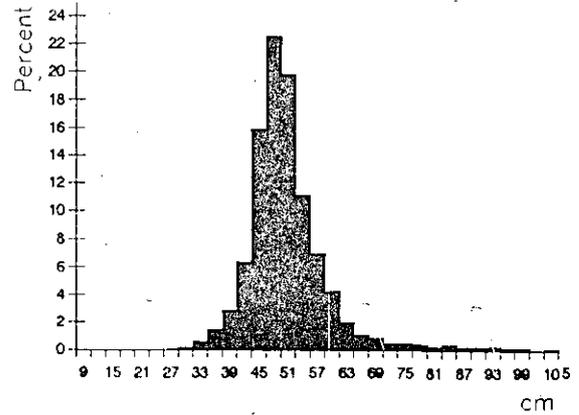
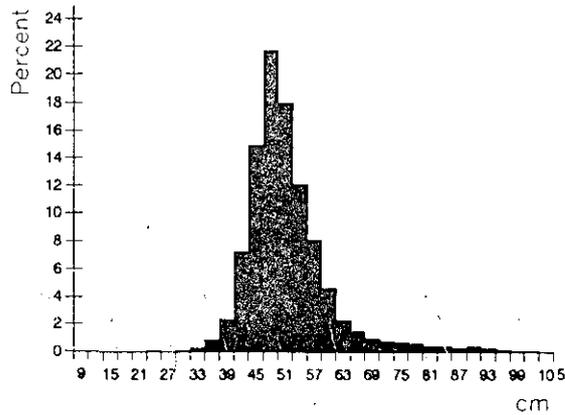
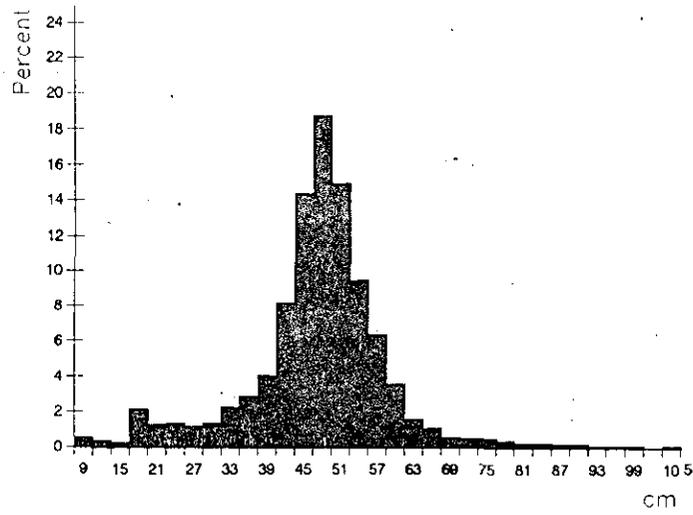


Fig. 3. Greenland halibut. Length distribution (3-cm groups) distributed on NAFO-divisions and surveys.

First survey



Second survey

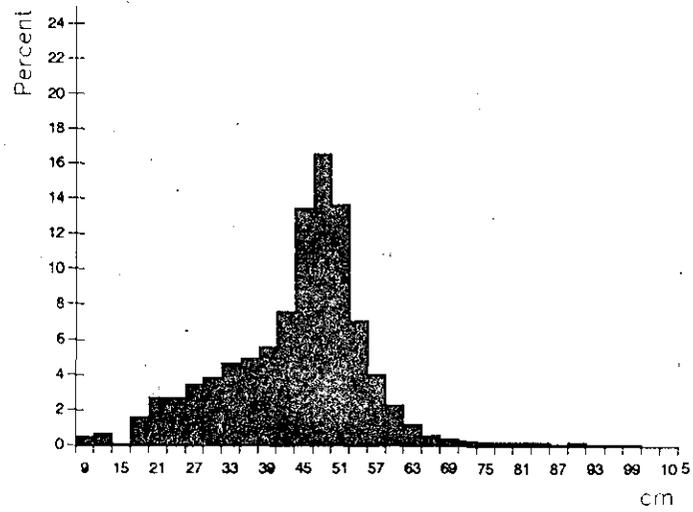


Fig. 4. Greenland halibut. Overall length distribution (3-cm groups) in the two surveys.

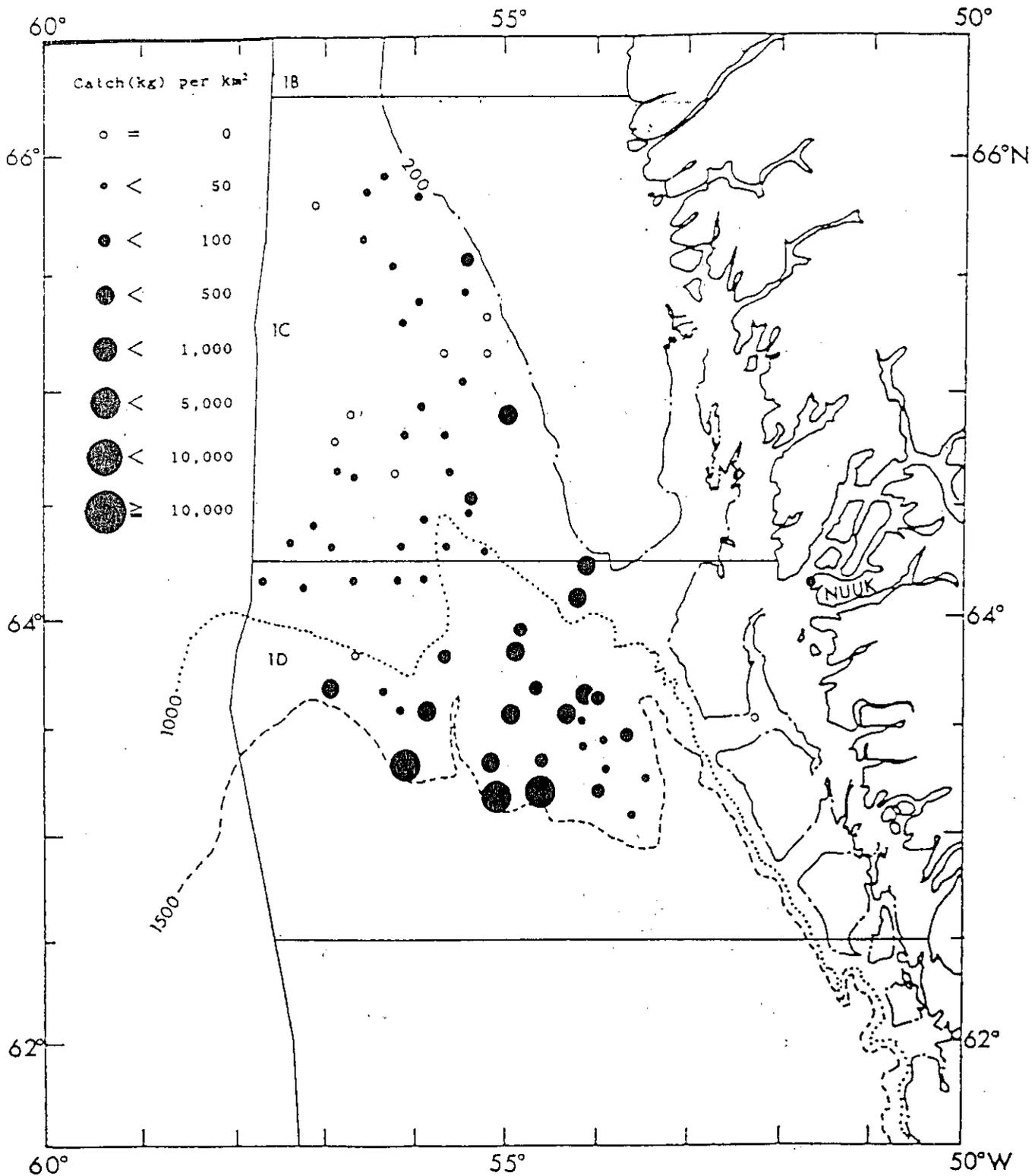


Fig. 5. Roundnose grenadier. Distribution of catches in kg per trawled km<sup>2</sup> in the first survey.

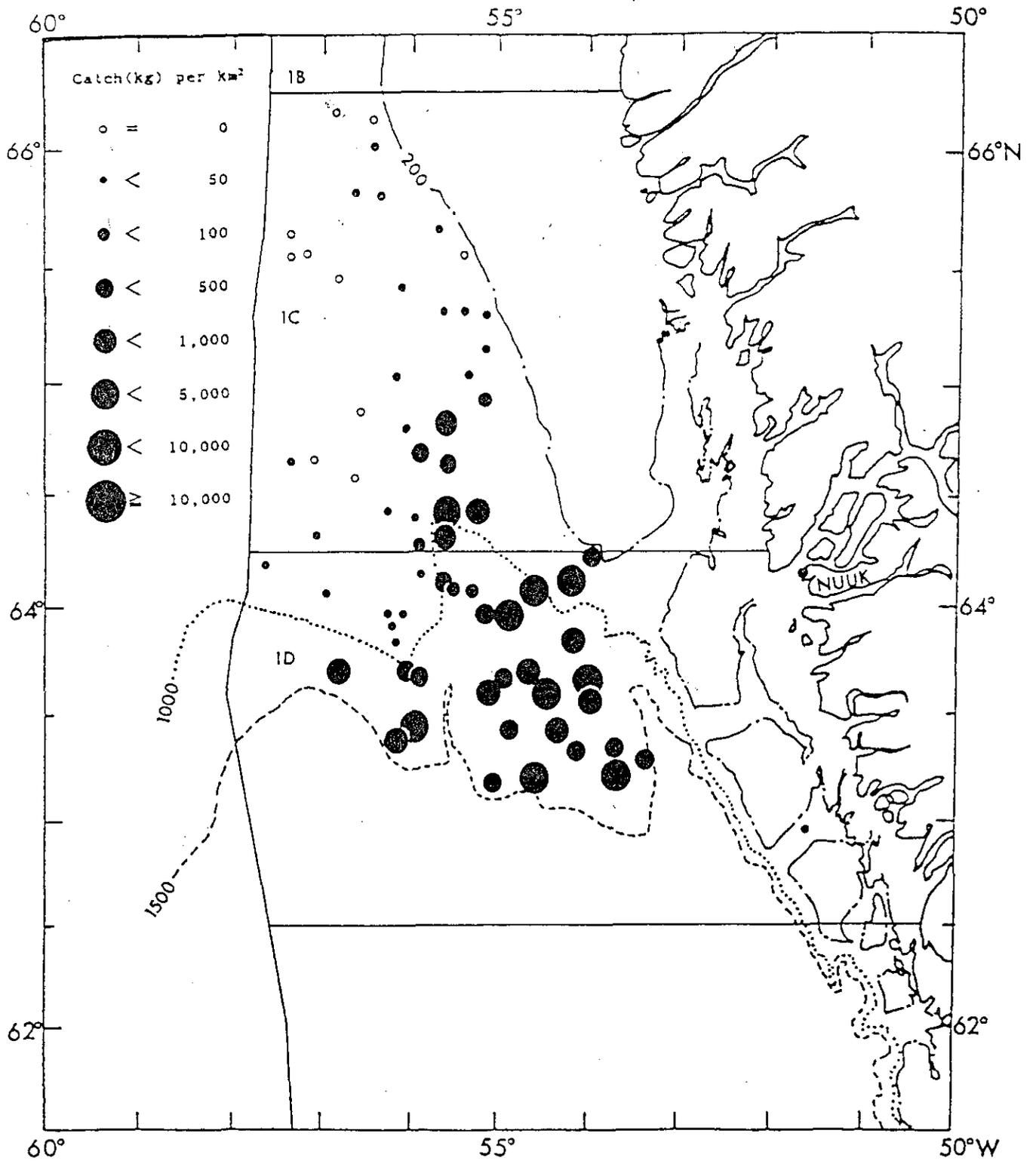


Fig. 6. Roundnose grenadier. Distribution of catches in kg per trawled km<sup>2</sup> in the second survey.

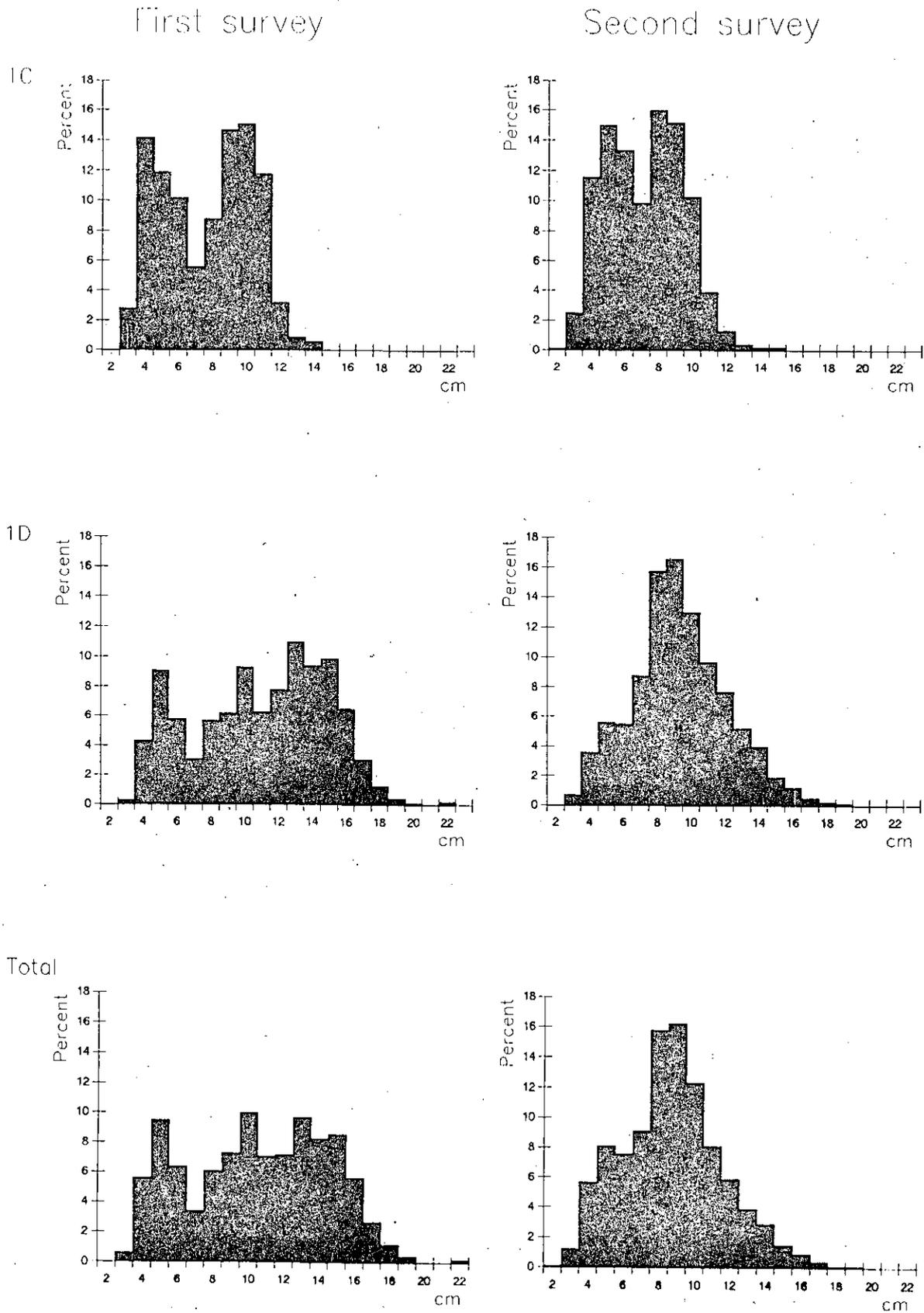


Fig. 7. Roundnose grenadier. Length distribution (1-cm groups) distributed on NAFO-divisions and for the total survey area in the first and second survey, respectively.