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Feeding and migrations of the Roundnose grenadier, Macrourus rupestris, in the Northwest Atlantic and Iceland waters

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This report summarizes the results of a study of some aspects of the feeding and migrations of the roundnose grenadier, Macrourus rupestris[1], in the Northwest Atlantic and Iceland waters.

The material for the study was collected from 1967 to 1970 in the Iceland, West Greenland, Baffin Island, Labrador and the northern Newfoundland Bank areas.

Earlier papers by the same author (Podrazhanskaya, 1968, 1969; Podrazhanskaya, Konstantinov (in print) give detailed analyses of the locality and diurnal rhythm of feeding, changes in the feeding habits with growth, and feeding habits at different depths as well as the food relations of the roundnose grenadier and other deep-water commercial fish species occurring within the same depth range, such as deep-water redfish and Greenland halibut. Therefore, this paper will be limited to a general description of feeding and its seasonal dynamics. This will enable us to proceed to the pattern of feeding and spawning migrations of the roundnose grenadier.

The stomach contents of the roundnose grenadier show quite a number of forage species (52) represented mostly by planktonic and nectobenthic forms (Themisto, copepods, Euphausiidae, squid, fish). Only representatives of the order of Polychaeta are associated with the bottom; shrimps (P. borealis, genus Pantophieus) also live close to the bottom. Sand, mud and stones are sometimes observed in the stomachs of the roundnose grenadier, which suggests that they may go to the bottom in search of food.

The qualitative composition of forage organisms and the frequency of their occurrence vary considerably within the months of observations. However the data do not show any consistent pattern, except that the total indices and the degree of fullness of the stomachs increase from September to December (Fig.1).

The possibility of the feeding of the roundnose grenadier becoming more intensive from September to December is supported by the fatness dynamics (Fig. 1). In the Northwest Atlantic the fat content of the roundnose grenadier increases from August reaching a maximum in December. In the Icelandic area, the fat content follows a downward trend from June and reaches a minimum in August.

Material collected on the fatness of the roundnose grenadier in some areas within the Northwest Atlantic (northern Newfoundland Bank and Baffin Island) has also been analysed. Figure 2 shows that in the northern Newfoundland Bank area, the fat content increases with the size of fish. This is typical of all Gadidae.

In the Baffin Island area, the fat content is somewhat stabilized irrespective of the size of fish. In this area the fish seem to accumulate and store a certain amount of fat.

It seems appropriate here to consider the question of the migration of the roundnose grenadier in some detail. Investigations conducted by PINRO in the North Atlantic over the past few years (1965-1970) have not revealed the spawning areas of the roundnose grenadier.

[1] Common and scientific name as used in ICNAF Statistical Bulletin

Zakharov and Mokanu (1970) suggested that the roundnose grenadier spawned in Icelandic waters. This seems quite likely and the material collected suggests that the eggs and larvae are carried passively by the Irminger Current from Iceland to the waters south of Greenland. From there the western branch of the West Greenland Current takes the young fish to Baffin Island and the waters of the Canadian and then the Labrador Currents take them to the northern Newfoundland Bank where they stay at depths of 600 to 900 m. On reaching a length of 40 to 50 cm, the roundnose grenadier start migrating back to their spawning grounds (Fig.3).

Unfortunately, it does not seem possible to check and confirm the suggested pattern of migration by tagging experiments because the fish in trawl catches are always severely injured as a result of a sharp drop in the pressure.

The suggested pattern of migration is based on the analysis of feeding, fatness, length-weight composition and sex ratio.

The fish, which have accumulated a certain amount of fat at Baffin Island, seem to start their pre-spawning migration to Icelandic waters. It is quite likely that here we have a situation similar to that for the Barents Sea haddock (Sonina, 1969). During the years when haddock feed on benthos, the duration of the feeding period and the time when the fish leave their feeding grounds usually depend on fatness. Haddock leave their feeding grounds having a fat content of not less than 4.5-5.0%. The sooner they accumulate sufficient fat, the earlier they leave the feeding grounds. i.e. the cessation of feeding and the migration from the feeding grounds are related to the accumulation of a certain amount of fat. The area where the roundnose grenadier feed before they leave for the spawning grounds appears to be the Baffin Island area. This is supported by the data presented in Table 1.

Table 1. The mean index of the degree of fullness of the stomachs of Macrourus rupestris in different areas of the North Atlantic.

Area	1967	1969	1970
Iceland	0.8	0.8	1.3
West Greenland	0.9	1.4	1.5
Baffin Island	1.5	1.8	2.4
Northern Labrador	1.5	1.8	1.7
Northern Newfoundland Bank	1.3	-	0.6

The size composition of the roundnose grenadier caught in the areas surveyed is shown in Fig. 4. It shows that the smallest fish occur on the northern Newfoundland Bank where the modal length is 45-47 cm. In the Baffin Island area, the modal length is 60-62 cm and at West Greenland it is 78-80 cm. The largest fish occur at Iceland where they are on the average 20 cm longer than in the above areas. These data are in agreement with those obtained earlier (Savvatimsky, 1969; Pechenik, Troyanovsky, 1970) and may be taken as confirmation of the suggested migration pattern if it is assumed that as they grow they move back to their spawning grounds. Many fish species, for example the Labrador cod, are known to perform migrations of this kind (Serebryakov, 1967). The Labrador cod spawn mainly along the slope off northern Labrador, the larvae and young fish in earlier developmental stages drift southward to the northeastern slope of the Grand Newfoundland Bank and as they grow they come back to the northern Newfoundland Bank and Labrador areas.

Roundnose grenadier caught at 145-900 m in the northern Newfoundland Bank, Northern Labrador, Baffin Island and West Greenland areas in July-August 1970 were immature even at their maximum length of 108-110 cm.

At southeast Iceland the population consisted of fish in the pre-spawning and spawning state in May and of spawning and spent fish in August (Table 2).

Thus, it is quite likely that the waters of the Canadian and Greenland slopes are the feeding grounds for the roundnose grenadier and the areas from which the grown fish migrate to Iceland, the area where they were born. A similar migration pattern is followed by the Barents Sea herring which spawn mainly outside the Barents Sea along the northwest coast of Norway. From here the larvae and young fish are brought by the North Cape Current and are widely distributed within the Barents Sea (Marty, 1956).

Table 2. Maturity stages of Macrourus rupestris in Iceland waters.

Month	Sex	Total number of fish	including fish at maturity stages						
			1	2	3	4	5	6	6-2
May	males	38	3	28	3	2	2	-	-
	females	17	-	14	1	2	-	-	-
August	males	54	-	39	5	-	-	7	3
	females	106	-	59	11	1	-	1	34

It should be noted that the male-female ratio was found to be 2 to 1 in Canadian waters (Fig. 5) and 1 to 2 in Iceland waters.

The material available at present does not permit any definite conclusions but the females seem to mature and to arrive in the spawning area earlier than males.

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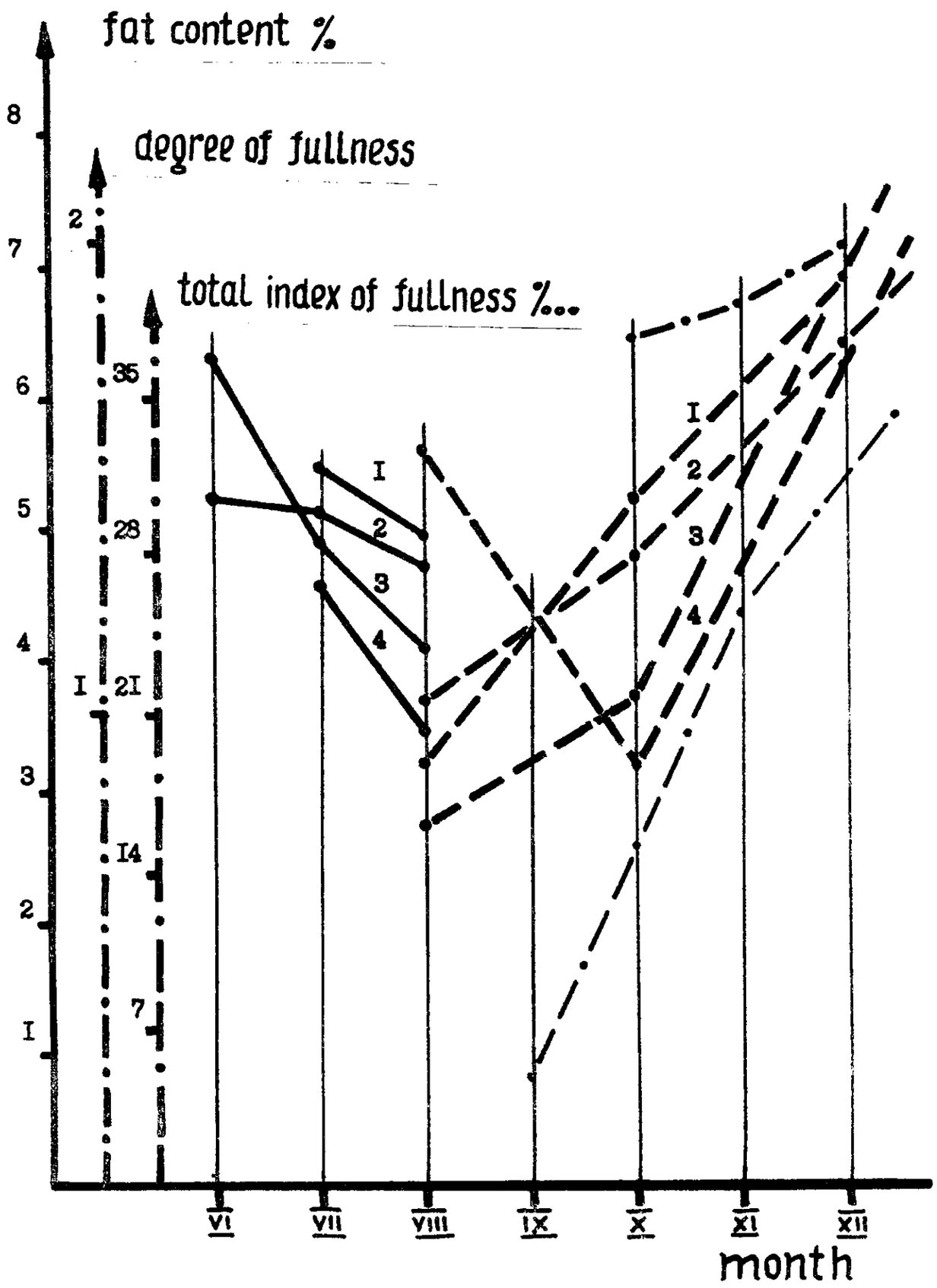

Fig. 1. Changes in the intensity of feeding and in the fat content of Macrourus rupestris in different areas of the North Atlantic in summer-winter 1967.

———————— Iceland

---------- Northwest Atlantic

Size-groups: 1. 40-50 cm
2. 51-60 cm
3. 61-70 cm
4. 71-80 cm

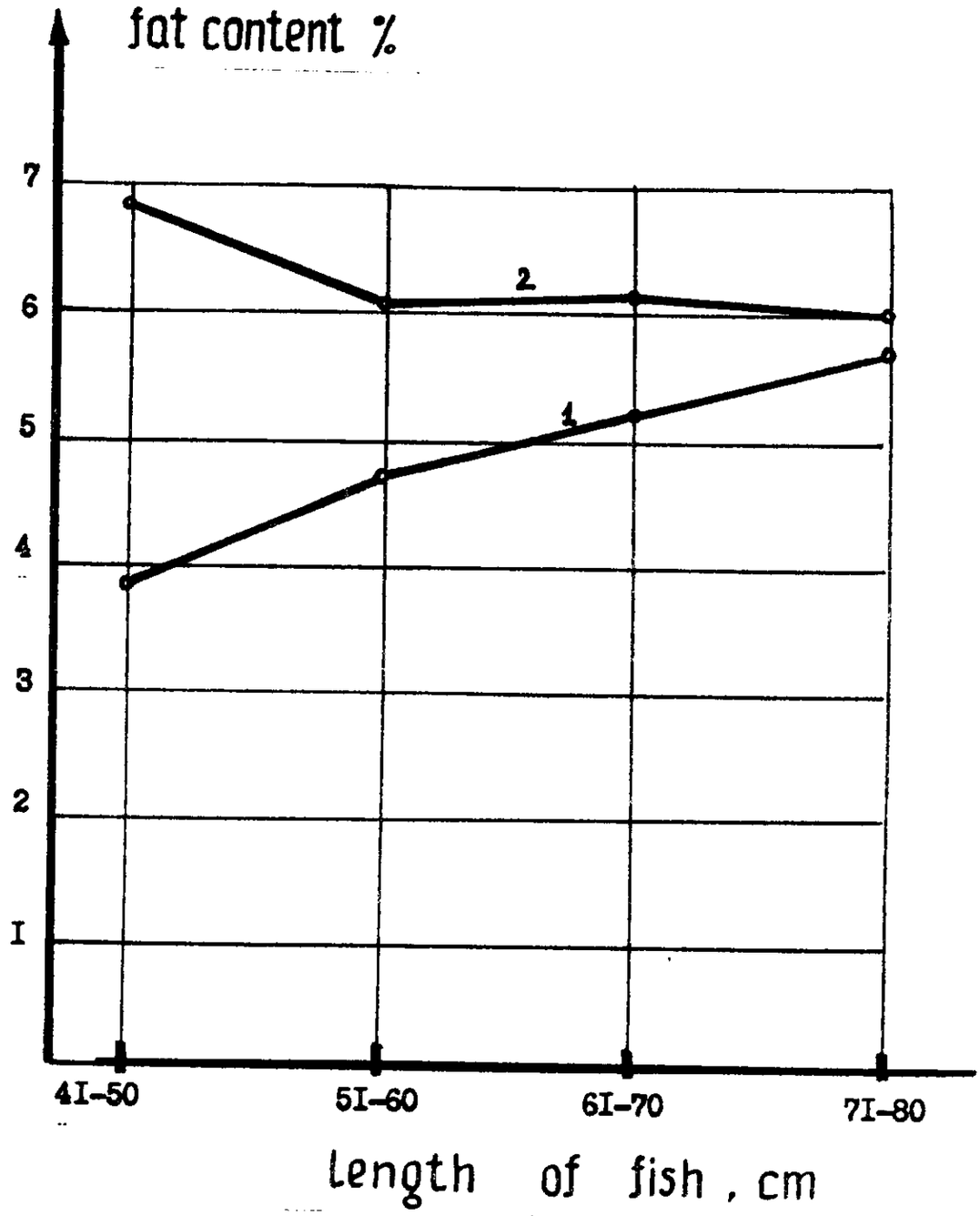

Fig. 2. Changes in the fat content of Macrourus rupestris in different areas of the Northwest Atlantic (July-August 1970).
1. Northern Newfoundland Bank
2. Baffin Island

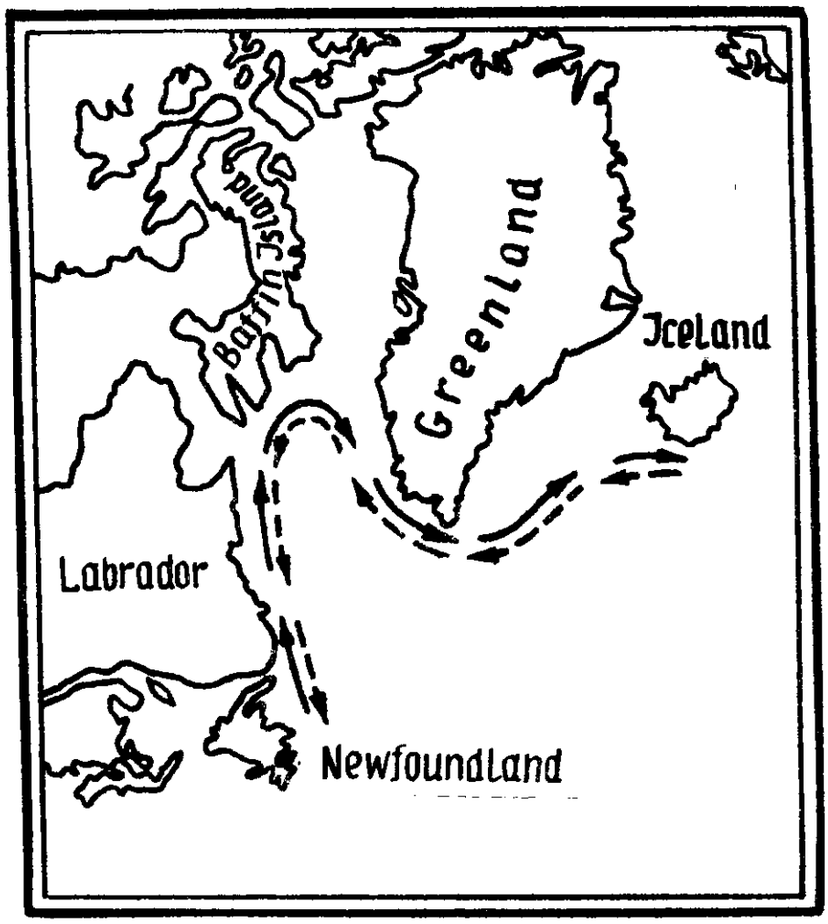

Fig. 3. Suggested spawning and feeding migrations of Macrourus rupestris of North Atlantic

——————→ spawning migration
- - - - - - - - - - - - → feeding migration

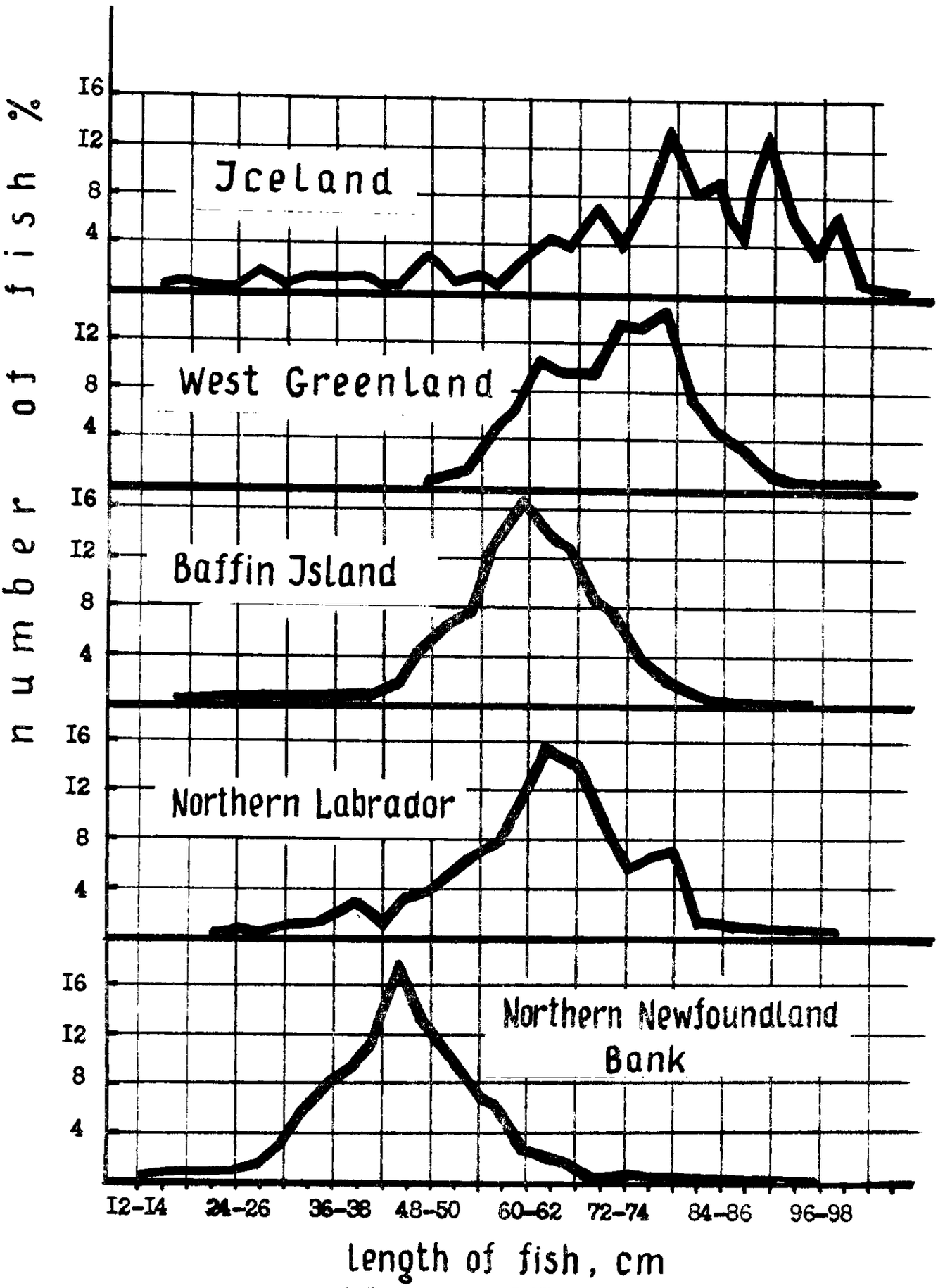

Fig. 4. Size composition of Macrourus rupestris caught in different areas of the North Atlantic in the summer of 1970.

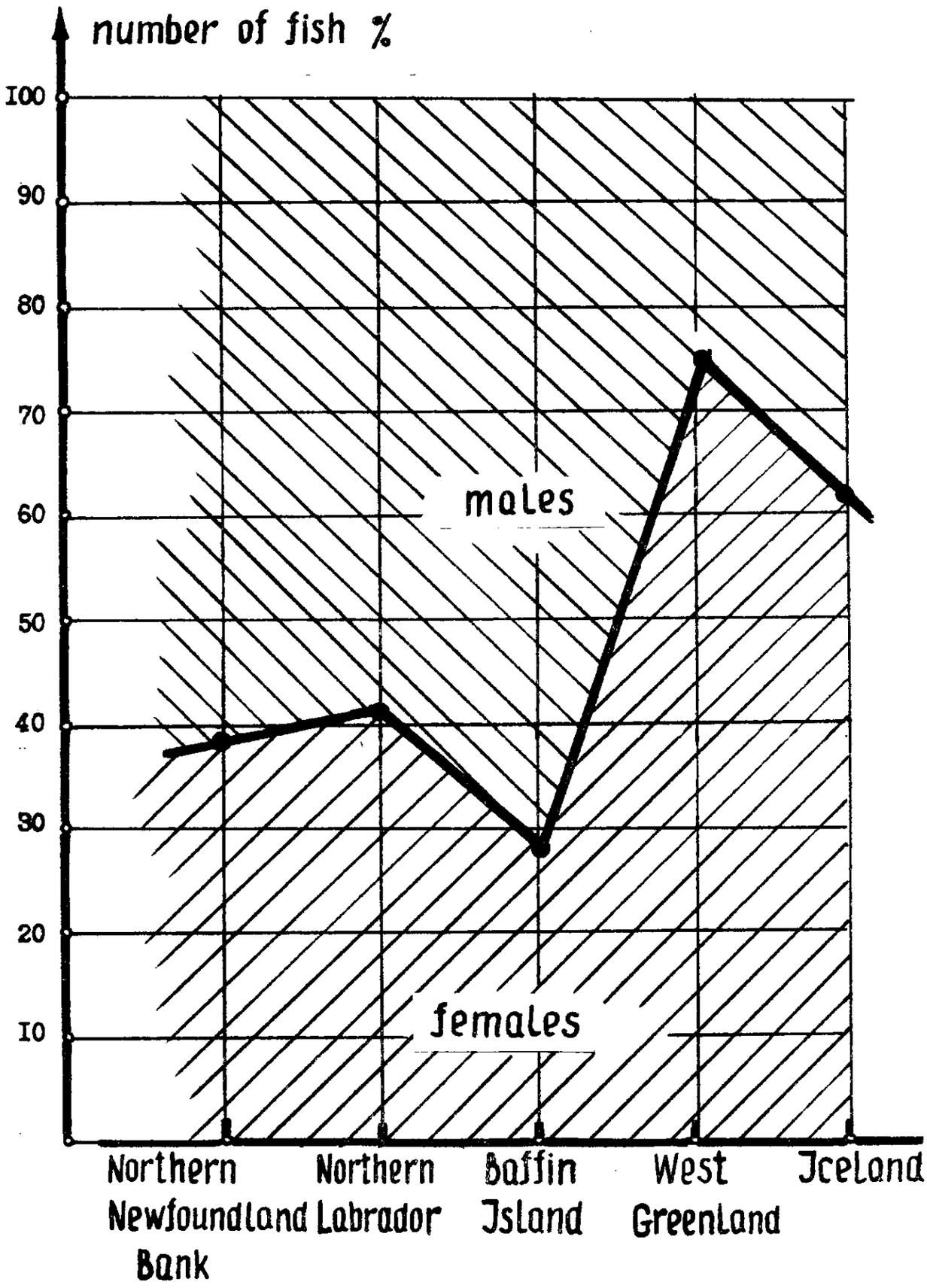

Fig. 5. Sex ratio of Macrourus rupestris in different areas of the North Atlantic in the summer of 1970