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Problems in the Researches of Redfish in European Waters

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(Translated from the German Original)

First, it must be stated that our knowledge of the redfish, which only in recent years has become of special importance, is still rather incomplete. Concerning its biology, the kind of food, the migrations, the spawning habits, etc., only little is known and part of this little is rather uncertain. However, for the mercantile fishing for this species, some of these points are of special importance.

As to the results of age determinations, certain disagreements exist between various investigators. The differences found do not seem to be caused by different rates of growth in various areas but sooner by a disagreement in the reading of the zones in the otoliths (Fig.1). Some investigators, among them those from the United States, state that the redfish is slow-growing and that it only becomes mature at an age of more than ten years. Other scientists, however, look upon the redfish as a fast-growing fish which already becomes mature at an age of 3-4 years. Others again have a standpoint more or less midway between these two extremes. This problem ought to be solved by direct discussion between the various scientists. The problem is of the utmost importance for judging the productivity of the various stocks of redfish, the amount of fishing that the stocks can suffer, and for the consideration of the possibilities for recruitment within more or less depleted stocks.

Of the same importance is the question of the distribution of this species. According to Täning, the redfish lives in the whole North Atlantic to the north of the Gulf Stream, but within this vast region it can only be fished where the stock lives near the continental shelves or directly on the shelves. If this is so, then it would be completely impossible to overfish the redfish stock as a whole, and the extent of the fishery would be almost unlimited as soon as we have learned to use pelagic fishing methods. How far this idea is correct ought to be investigated as soon as possible. But even if the distribution or density of the pelagic redfish stocks should be much more restricted, it is well possible that we do not yet know the whole extent of the area of distribution or make use of all fishing possibilities.

Since the beginning of the 30's the catch of the redfish has increased in the same degree as trawlers started to work in greater depths. New fishing grounds have been found from time to time, yielding large catches of redfish. The first of these fishing grounds was the 4-500 m. deep ridge between Iceland and the Faroes. This ridge was even named "The Rose Garden" because of the rich occurrence of redfish there. A little later a redfish fishery was started on the slopes of the Roestbank (Lofoten). Later came the following two new fishing grounds: 1951, the Finnmarken Coast; 1952, the Bear Island Deep.

For these two latter areas, it is perhaps a possibility that redfish stocks of a size permitting fishery only have appeared in recent years. In these areas special research cruises by German ships took place in 1937 and 1938 in order to find out to what degree redfish could be caught. Further redfish grounds on which fishery has started in most recent years are: 1953, the northern slope of the Reykjanes Ridge; 1954, the north and east slope of the Faroe-Continental Shelf. Icelandic and

apparently also British and German trawlers have further fished for redfish on the east coast and the south-west coast of Greenland, as far north as Lille Hellefiske Bank. Further discoveries of redfish grounds can very probably be expected.

Off large parts of the East Greenland coast, off the north coast of Iceland and at the edges of the Norwegian Sea, we do not yet know the possible fishing grounds. Also the depths in which the redfish live in greater quantities vary between 300 and up to over 500 m. Extended knowledge and experience will thus probably also in the future be able to ensure of further development of this fishery. So much is certain that the area of distribution, and especially what part of it can be fished, is up to now not completely known. Therefore this fishery must be regarded as one that is still in full development.

The question which now arises is to what degree the stock within this whole area of distribution between the Barents Sea and Davis Strait is one single stock only, or if it falls into various distinct groups. The investigations up to now have not yet given any definite proof as to this problem. We know, however, that a small separate species of redfish, Sebastes vivinarous, lives nearer to the coast. This small species is the most common one around the Faroes, and in the North Sea it is - when we disregard rare visitors of the bigger species - the only one. Also the American redfish seems to be a somewhat smaller, isolated form. Already from the beginning of the deep sea fishery for redfish, a form, different in appearance from those formerly known, was found in various parts of the NE Atlantic. Since then this new form has been described by Travin as a new species, Sebastes mentella. Kotthaus is considering this as a probable new species. This deep sea form is in its outward appearance distinguished by its especially big eyes, the trunk-shaped appendix to the lower jaw, and the lack of yellow pigment (Fig.2). This form or species has up to now been found in the deep water to the south of the Bear Island, on the north west Norwegian Shelf, and on the eastern slope of the Faroe-Shelf, and on the ridge between the Faroes and Iceland. There is, however, the possibility of a still more western distribution along the Reykjanes Ridge and to West Greenland. Observations from fishermen seem to show that this deep sea redfish there is found in smaller numbers in the schools of the common species. In this case the area of distribution of the two species would be very nearly the same, the only difference will be that the common redfish lives at somewhat lower depths than the deep sea form. Apart from the points mentioned above (Kotthaus, Travin) there seems not, in outward appearance, to be any further marks of difference between the two species.

The frequently observed schooling in separate schools of the two sexes seems to be connected with the mode of propagation, especially the mating at least one month before the young are born. But also at other seasons, there seem to occur irregular and changing schoolings of redfish of certain sizes and ages. This makes it difficult to establish the true age composition of the stocks. Even by a combination of many samples, it is not always possible to get a clear picture of the age composition.

A very peculiar picture is shown by the German researches in the north-east European seas during 1937-38. On the Continental Shelf were found almost exclusively larger individuals. However, samples from the slope of the Continental Shelf showed a length curve with two peaks, the intervening lengths of 25-30 cm. being only very poorly represented (Fig.3). This size group was in fact never found in the stocks fished upon and it can be supposed that the individuals of this group - as it is the case with the Norwegian herring - form an "oceanic" stage just before the attaining of maturity.

Now it has been shown that from the year 1951 and onwards, especially in 1952-1954, an invasion occurred to these areas of this size group, which for more than ten years had been absent. The frequent occurrence of the size group 24-28 cm. in 1951, and of about 30 cm. in the following year, was very obvious. The fact that it now no longer appears in the length distribution curves of landed redfish (Fig.4), now having just one peak at 30 cm., is due to the very low market value of such small redfish. A considerable redfish fishery was developed off the coast of Finnmark and in the Bear Island Deep, and from this fishery considerable large quantities of these uncommonly small redfish were landed. Had it not been so difficult to dispose of these small redfish in the market, the quantities landed would have been even larger.

We have no observation, not even ideas, about the reasons for this, but it would obviously be false to consider the decrease in average size of redfish as an indication of overfishing. On the contrary the length curves from year to year show in cases a gradual moving of the peaks toward the right. This seems to indicate the presence of one or several rich year classes. These findings are, however, not always very conspicuous and irregularities occur. The length curves from Bear Island rather often give the impression of a repetition of peaks with two year intervals.

An overfishing of the redfish stocks can hardly, apart from the American area, be expected. However, Fridriksson has shown that, together with a decrease in catch per unit, a decrease in average size has occurred. He agrees with Tåning in that the redfish has a very large area of distribution, and therefore feels that his observations show that only in few distinct places a thinning-out of the stocks takes place, caused by a too-intensive fishery. The German results do not confirm these findings.

Also around Iceland it looks as if the catch of smaller redfish has increased considerably since 1950. A more strict culling towards bigger sizes, than that used in Norway, has almost completely hindered the landing of these small redfish. The separate curves of the length distribution in samples of landings since 1950 are very similar to one another and show no steady variation (Fig.5). Neither has the catch per unit of effort decreased. The statistics give the following data for catch per fishing day in tons for the German trawlers:

Year	Iceland	Norwegian Coast	Bear Island	Barents Sea
1938°	4.1	5.5	5.1	1.1
1946	1.5	-	0.4	-
1947	1.2	(8.7)	2.5	0
1948	1.4	3.6	0.2	0.1
1949	3.3	3.5	1.3	0.4
1950	5.7	3.8	3.0	1.7
1951	6.5	4.1	12.0	10.9
1952+	6.9	4.2	12.9	15.6
1953++	9.2	2.3	14.9	12.1
1954+++	7.8	5.2	28.7	0.6

° Spitzbergen 1.0
+ Greenland 7.4
++ " 1.8 Newfoundland 0.1
+++ " 2.1 Faroes 6.2

When we look at these figures it should not be forgotten that they do not show conclusively the redfish abundance of these areas and the variations of the same. They are in reality influenced by the seasonal and yearly variations in the extension of the fisheries. Especially we must consider the increase that has taken place in the

size and fishing capacity of the trawlers. Furthermore the increased demand for and search for redfish should be borne in mind.

However, in no way do these figures give reason for assuming a decrease in the yields (the possibilities) of the redfish fisheries. The increase of the landings in Iceland that could be expected has no doubt taken place; this is an indication of the fact that the redfish stock there is unchanged in size. However, the very big increase in landings of redfish from off Finnmarken and right up to the Bear Island cannot be explained from the above-mentioned reasons alone, but must be attributed to the appearance of smaller redfish. Therefore in no case can the decrease in the average size be taken as an index of overfishing but rather as a considerable increase of that part of the stock of redfish which can be fished upon, caused by the migration to the Continental Shelf of those size (and age) groups, which formerly did not appear in the shelf-area.

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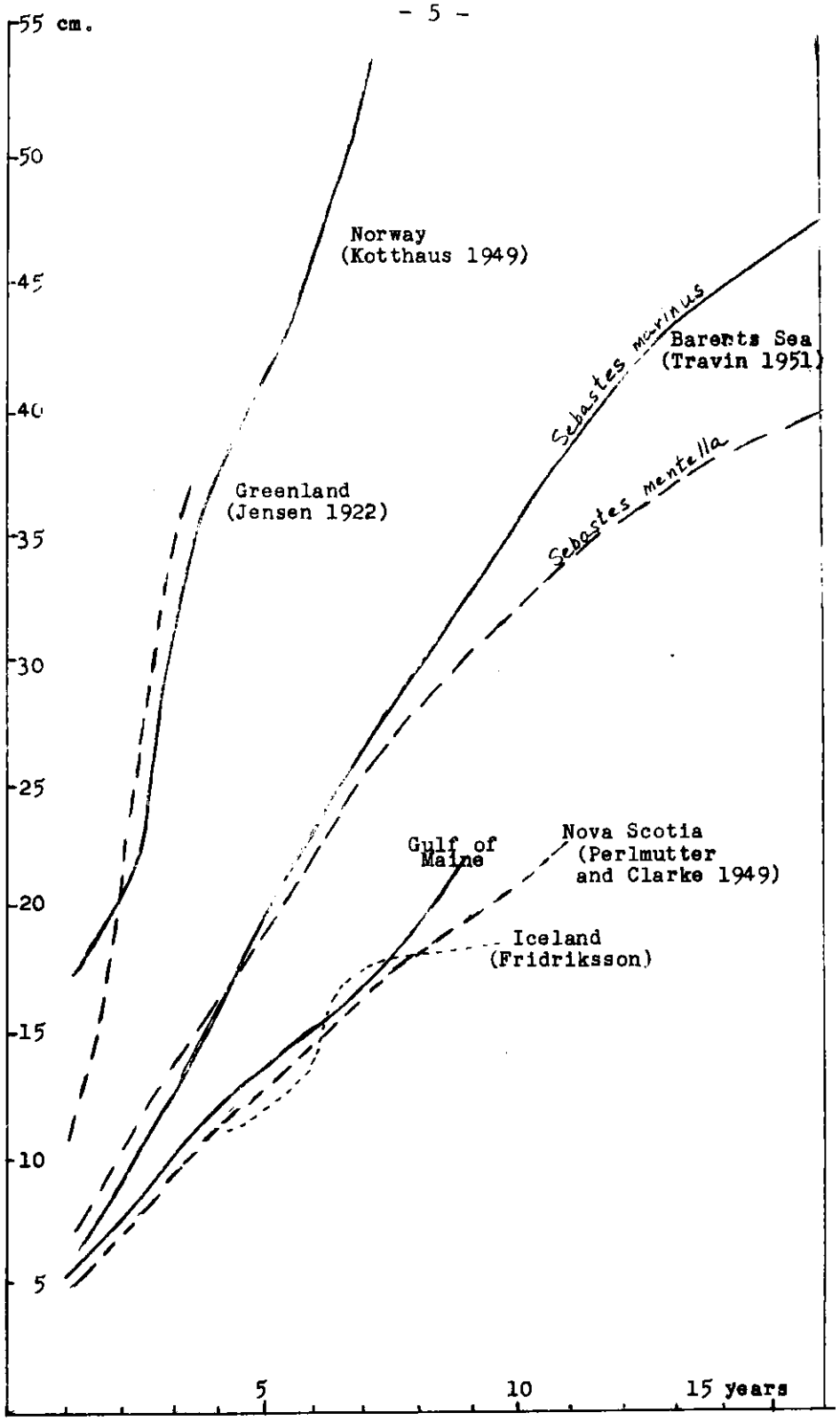

Fig.1 - Growth curves for redfish (based on various authors).

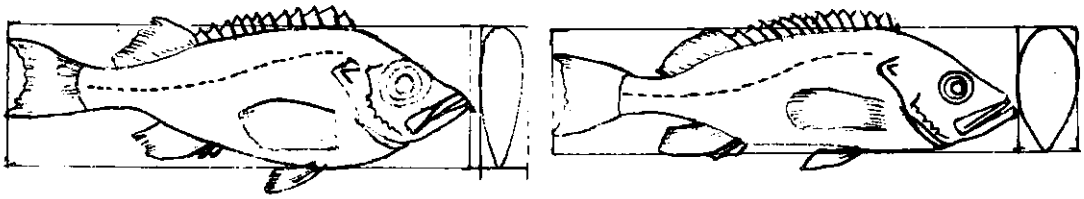

Fig.2 - Sketch of Sebastes mentella (left) and Sebastes marinus (right)

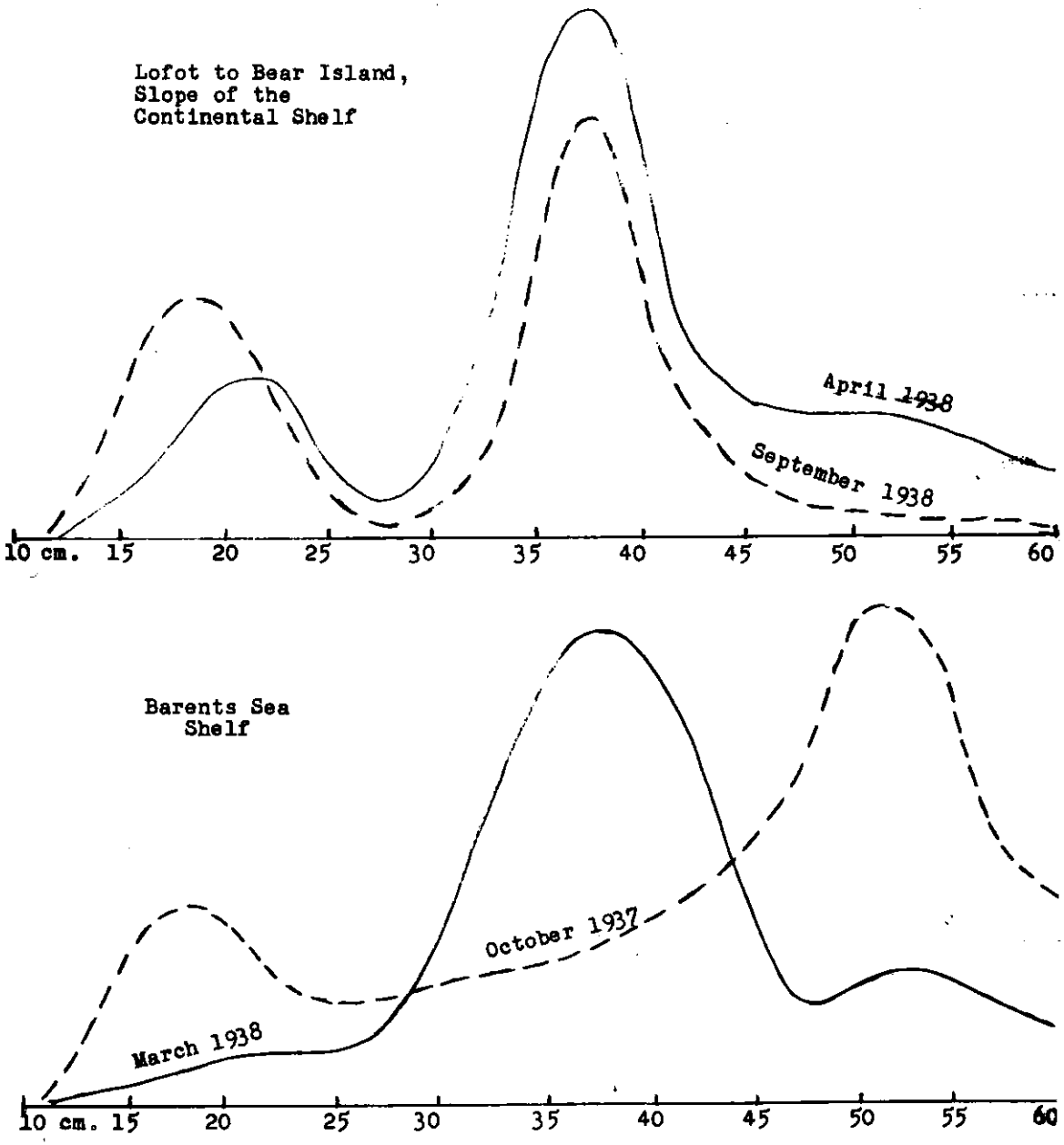

Fig.3 - Length distribution of redfish samples from German research cruises in the north Norwegian waters 1937-38 (trawl catches - no market cullings).

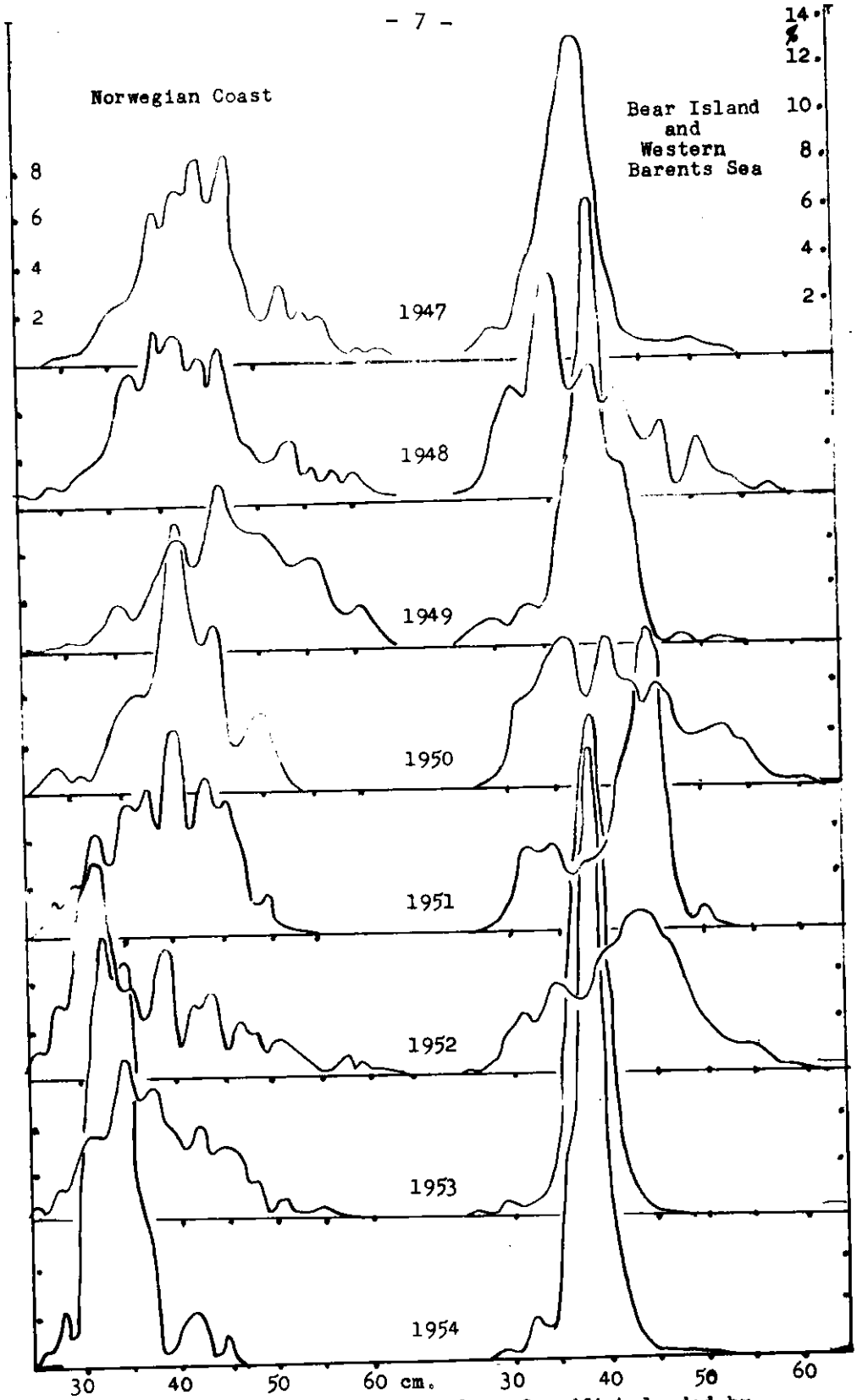

Fig.4 - Length Distribution of samples of redfish landed by Germany in the NE-Area 1947-54. (after market cullings; 1 cm. length groups)

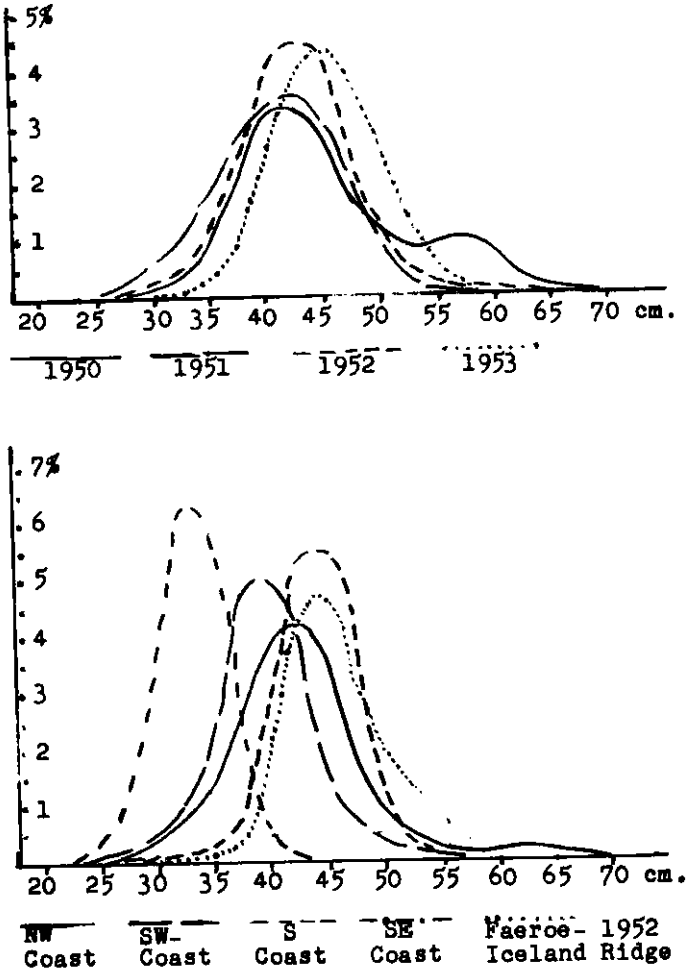

Fig.5 - Length Distribution from German Redfish Landings (5 cm. groups)