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Progress report on the Swedish Investigations on Whiting in the Skagerrak and the Kattegat

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In the latter half of 1954, the Marine Research Laboratory of Lysekil entered upon an investigation of the stock of whiting in the Skagerrak and the Northern Kattegat. Thus, this investigation is only in its initial stage, and the material collected is as yet small. However, as the investigation has some bearing on the question of the influence on the fish-stocks of the fishery for industrial purposes, it has been thought justified to make known the results reached up to now.

Jensen (1952, p.55) estimated that in 1950 the fishery for industrial purposes in the Skagerrak and the Northern Kattegat caused a decrease in the catch of whiting for human consumption by about 10 %. On this account it appeared to be of particular interest to compare the stock of whiting in an area where the fishery for industrial purposes is carried on, with the stock of whiting in another area not too far away, where such fishery is negligible. Investigations as simultaneous as possible have therefore been made in two areas, in the following called "the Höjen area" and "the Swedish coastal area". By "the Höjen area" is meant the sea between 9°50' E.Long. and 10°50'E.Long. from the Skaw Bank out to a depth of about 100 metres. This area is a large part of what is in Danish investigations called "the Northern area" of the fishery for industrial purposes (cf Jensen 1952, pp 14-15). This material is compared with that from an area off the west coast of Sweden from the Bight of Laholm to the Norwegian border. In this area no fjords and no waters within the belt of skerries are included. In "the Swedish coastal area" the fishery for industrial purposes is insignificant.

In the years 1938 and 1939 Swedish experts carried out investigations for other purposes in these two areas. From these older investigations at least something may be learnt concerning the catches of whiting, and it is possible to make comparisons between the catches of 1955 and the catches during the years 1938-39. During 1955 comparative investigations within these two areas

have been made partly during February and partly during the end of July and the beginning of August. The gear used was mainly a 70-foot "svecia"-trawl with a cod-end mesh-size of 22 mm. Usually at the investigations during the earlier period there were used herring trawls of 80-90 feet with a cod-end mesh-size of 33 mm. These trawls thus had a bigger mouth than the "svecia"-trawl, but were not equipped with V.D.-gear, and the otterboards were attached directly to the trawl wings.

In January - April 1938-39 the average catch per trawling-hour was 531 whiting in the "Swedish coastal area" and 462 whiting in "the Höjen area" (cf table 1). The material, which is fairly comprehensive, shows that at this time the density of the stock was of the same order in the two areas. In February 1955 the catch in "the Swedish coastal area" showed an average of 550 whiting per trawling-hour. The corresponding figure for "the Höjen area" was 50. It must be mentioned, however, that on this occasion the total trawling time within "the Höjen area" was relatively short. At the end of May 1955, however, 79 whiting was the average catch per hour during four trawlings of one hour each in this area. Unfortunately, there was no time for comparative trawling in "the Swedish coastal area" on this occasion.

The investigations in July - August 1955 show in both areas a decidedly smaller number of whiting than in February. The causes must be partly an emigration from the areas near the coast that were investigated, partly a spreading of the stock to higher levels of water during the warm season. The results of the trawlings, however, show that the ratio between the catches from "the Swedish coastal area" and "the Höjen area" has not changed from the February results. Per trawling hour the catch from the first area was 53 whiting and from the second area 4 whiting. In these numbers no regard has been paid to the 0-group, which at that time were drifting in in great numbers from the North Sea, but only to the I-group and older fish.

For the comparison based on the material accounted for in table 1 between the catches in "the Swedish coastal area" and "the Höjen area" the question of the magnitude and the emigration of the year classes seems to be of little consequence, as the comparison refers to the stock of whiting at one and the same time within two adjacent areas. In 1938-39 the stock of whiting was roughly the same in the two areas. The fact that this is not the case now, in 1955, indicates that the heavy taxation is exercising a strong influence on the stock in "the Höjen area".

A heavy taxation of the whiting stock within "the Höjen area" may also be

traced by comparing the length distributions of the whiting in this area and in "the Swedish coastal area". In the latter area 34 % of the whiting had a minimum length of 20 cm in January-April 1939 (cf table 2). The corresponding figure for this area was in February 1955 32 %. In "the Höjen area" 25 % of the whiting had in January 1939 a minimum size of 20 cm. The figure for February 1955 is 7 % only. The percentage of whiting exceeding the minimum size prescribed in the Convention, 20 cm., was thus, in 1939 about the same in "the Swedish coastal area" and in "the Höjen area". In 1955, on the other hand, there was a marked difference between the two areas with regard to the percentage of whiting above minimum size.

That the whiting stock of "the Höjen area" tends to show a lower average length seems also to be confirmed by the investigations in this area in May 1955. Of the material collected, 316 whiting, 20 % showed a minimum length of 20 cm. This is, of course, a considerable higher percentage than the one found in February of the same year, but a certain growth has taken place in the meantime. In May, 1955, 13 % of the whiting from "the Höjen area" had a minimum length of 21 cm., 8 % of 22 cm., and only 4 % of 23 cm.

In table 2 also the percentage, in "the Höjen area", of whiting above 20 cm. in catches from the years 1941 and 1944, 1945-48 and 1949-51 is included. This material comes from Danish investigations, in 1941 and 1944 by Blegvad (1945) and in 1945-48 and 1949-51 by Jensen (1952). Blegvad's material comes from catches by fish trawls, herring trawls and Danish seines. The sizes of the meshes are not given. Jensen's material was caught by trawls and Danish seines with a mesh size of 9-18 mm. from knot to knot. Unfortunately, no investigations were made in "the Swedish coastal area" during these periods. On account of variations in the magnitude of the year classes a comparison of the material from these years with that of 1939 and 1955 may be misleading. The length compositions in the whiting stock during the time covered by Blegvad's and Jensen's investigations show, however, little fluctuation from year to year, and the figures can no doubt be considered as indicative of the true proportions of a stock subjected to a taxation of moderate size by fishery for industrial purposes.

The diminishing average length of the whiting stock in "the Höjen area" cannot, in my opinion, have the same cause as the decrease in average length of the fish-stocks which has been found in other areas where fishery for industrial purposes is not carried on. In most fishery one aims at catching fish for humen cinsumption, and this fish must, if the quality is to be

satisfactory, have a certain minimum length. For the whiting, however, this minimum size is not in all countries laid down according to the statutes of the Convention, and in certain cases it is put considerably higher. Thus, in Sweden the limit is set at 28 cm. for whiting intended for human consumption, this by the fishermen's own decision. The more intensely the fishery is carried on, the fewer specimens are allowed to reach a length substantially exceeding the minimum length prescribed for fish for human consumption. The average length of the stock diminishes, of course, with intensified fishery, but that part of the stock which has not reached the minimum length for fish for human consumption is protected, because it is an indispensable condition for future fishery, that as many specimens as possible reach a size of use for human consumption.

At the fishery for industrial purposes with small-meshed gear fish are caught of all sizes. If intensive fishery is carried on, fry and yearlings are taken toll of to such an extent that the regrowth in the fishing area is hindered. The reduction of the recruitment stock which the fishery of undersized whiting implies will entail a diminished supply of full-sized whiting both in the industrial fishing areas and in the areas to which these full-sized whiting would normally have emigrated.

It may, finally, be of interest to discuss the proportion of the different year classes, in the whiting stock of later years. As I have no material of my own concerning age compositions in the whiting stock earlier, I shall in the main have to refer to material from the Danish investigations.

In "Fiskeri-Beretning for Åren 1952" (Report on Fishery for 1952), p. 80 the following is said of the whiting stock in inner Danish waters: "In the Belt the stock of young whiting was abundant, considerably exceeding the average for the years 1927-39 and much greater than the stock last year. The same state of things prevailed in the Kattegat, though the increase was not so pronounced there. In spite of the very extensive fishery for fish for processing, a large proportion of which are small whiting, there does not seem to be any decrease, for this reason, in the stock, which in later years, though fluctuations from year to year are great, has, almost every year, been considerably denser than 10 or 15 years ago."

"Fiskeri-Beretning for Året 1953", p. 87: "The whiting stock was considerably greater than normally in all water areas. Nearly all specimens belonged to the 0-group. There seems stills to be a considerable supply of fry, and the drifting in of larvae and 0-group specimens from the Skagerrak and the

North Sea during the summer must have been very considerable."

"Fiskeri-Beretning for Året 1954", p. 93: "At a fishery with 2 m. ring-net in June whiting larvae were found even in the southern Kattegat, and later in the summer and all the autumn there were also large numbers of 0-group whiting in the western Baltic. In inner waters there were only small numbers of older whiting (I-group and older)."

At the Third Meeting of the Permanent Commission in Copenhagen in May 1954 it was pointed out that year class 1953 was by far the greatest that had ever been experienced in the inner Danish waters.

According to the Danish reports quoted there was, thus, in both 1952 and 1953 a very extensive immigration to the inner Danish waters of 0-group whiting. In 1953, however, year class 1952 was, according to the same reports, scarce in these waters, and so was year class 1953 in the year 1954. My investigation confirms these observations. In February 1955 I found in "the Höjen area" extremely few specimens of the I-group (year class 1953) and older year classes.

The main part of the abundant year classes 1952 and 1953 thus disappeared already at an early stage from the waters round Denmark ih the Skagerrak and the Kattegat, and it is not far-fetched to assume that the reason is too heavy a taxation of the stock of young whiting through the intensive fishery for industrial purposes. In "the Swedish coastal area", which is practically unaffected by such fishery, I-group whiting (year class 1953) was, on the other hand, abundant in February 1955. The investigation material comprises 6558 specimens, and of these nearly 30 % belonged to year class 1953.

Knudsen (1950) has shown that immigration of whiting from the North Sea to the Skagerrak and Kattegat takes place not only in spring, in the form of larvae and young specimens of the 0-group, but in other seasons, too, there is a considerable drifting in of specimens of groups 0 and I. If in the areas, where the fishery for industrial purposes is carried on, the immigrating whiting is heavily taxed, the stock of whiting there will probably not only be smaller than in areas not affected by this fishery but also be to a higher extent dependent on casual fluctuations in the magnitude of the immigration. In "Fiskeri-Beretning for Året 1954", p. 98 it is stated that the investigations in the North Sea this year showed a very scanty supply of year class 1953. But the earlier Danish investigations have shown that year class 1953 as 0-group invaded the Skagerrak and Kattegat in expeptionally large numbers. In "the Swedish coastal area" year class 1953 has had good

growth possibilities and is abundant in 1955, whereas in "the Höjen area" the fishery has all but finished it. If in 1954 year class 1953 is scanty in the North Sea, the further immigration of this year class to the Skagerrak and Kattegat will be small. The decrease in the immigration to these waters must, of course, most seriously affect the stock in areas where the taxation is heavy.

It is possible that the exceptional qualities of year class 1953 partly explain why the differences observed between the catches in "the Swedish coastal area" and "the Höjen area" are so conspicuous.

Also concerning the stock of Norway lobsters the investigation in "the Höjen area" has given some results worthy of note. At the trawlings carried out in this area in January-April in the years 1938-39 the stock of Norway lobsters was plentiful, the catch being on an average 205 specimens per trawling-hour (cf table 3). In February and May 1955 no Norway lobsters at all were caught in the area, and in July-August 1955 an average of only 2 specimens per trawling hour. The poor result in 1955 cannot a priori be ascribed to a thinning out of the stock of Norway lobsters through fishery for industrial purposes, so it seems justified to try and make clear in how far different factors have contributed to the results of the trawlings.

The catches of Norway lobsters seem to vary in one and the same place with the hours of the day. Swedish fishermen thus maintain that in the summer half year catches are best at sunrise and at sunset. The catches are said to be 50 % better at those hours than in the time in between. In winter, on the other hand, fishery by day is held to be most successful.

The abundant material of table 3 concerning the Norway lobster in "the Höjen area" in January-April 1938 and 1939 comes, with the exception of one haul, from catches taken between 7 a.m. and 6 p.m. The remaining haul, which yielded 16 Norway lobsters, was made between 11 and 12 p.m. In February 1955 the hauls were carried out between 9 a.m. and 5 p.m. With the same trawl were caught, in February 1955, between 10 a.m. and 3 p.m., off the Swedish coast at Grisbådarna and Persgrunden, 632 Norway lobsters in four hauls of together 190 minutes. In July-August 1955 the eight hauls in "the Höjen area" were made between 6 a.m. and 5 p.m.

In a locality at 57°59' N.Lat. and 10°10' E.Long. the water temperature

was on the 3rd of February, 1955, at a depth of 50 metres 6.80 C°, at a depth of 75 m. 6.37 C° and at 90 m. 6.30 C°. In a locality at 57°44.5'N. Lat. and 9°58' E. Long. the water temperature was on the 27 of July, 1955, at a depth of 65 m. 7.21 C° and at 80 m. 7.10 C°. Six of the eight trawlings in "the Höjen area" in July-August 1955 were made at depths exceeding 65 m. and four of these at depths exceeding 80 m. It is not very likely that an animal with the range the Norway lobster has can to this extent be driven away in summer by so slight a rise in temperature in the area in question. By the way, in "the Höjen area" the highest water temperature at the depths discussed here is probably, as a rule, to be found in November. Also in the deeper areas bordering on "the Höjen area" the Norway lobster was absent in July 1955. Thus not a single Norway lobster was caught in four trawlings of together 480 minutes between 22 and 30 nautical miles north of Hirtshals at depths between 100 and 234 m. It would seem, therefore, that no emigration to this area has taken place.

It should also be pointed out that Swedish fishermen have reported good catches of Norway lobsters during July-September 1955 at a depth of 50 to 70 metres along the west coast of Bohuslän and in day-time too.

When we keep in mind all these circumstances connected with the investigation of 1955 we find it evident that the poor catches of Norway lobsters in "the Höjen area" this year, compared with those of 1938-39, cannot be explained away be allegations that the trawlings may have been made with the wrong gear or at the wrong time of the day or that temperature conditions may have been unfavourable to the Norway lobster in the trawling area. It seems more likely that the stock has been reduced to a minimum by the intensive fishery for industrial purposes.

Though the material up to now brought together by Swedes is still comparatively small and though the interpretation of it may on that account in some cases be a matter of dispute, this material as a whole and especially when seen in relation to the material published by the Danes, gives us a rather gloomy picture of the present situation, a picture which should exhort us to stop and reconsider the way in which the fishery for industrial purposes has been developing of later years. Of interest in this connection are not only whiting and Norway lobster but also other species such as herring, sprats and dabs. As

for the last-mentioned species Jensen (1952, p. 56) has estimated that the fishery for industrial purposes in the year 1950 led to a reduction, in the Skagerrak and Kattegat, of the stock of dabs for human consumption by 15-20 %. Since 1950 the annual catches of fish for industrial purposes have more than doubled in this area and it is also to be feared that the damage inflicted on the stock of dabs has increased. In the Skagerrak and the Kattegat Swedish fishermen now catch about the same quantities of dabs as of plaice, as the fishery for dabs is of increasing in importance since filleting and freezing began.

TABLE 1

Catch of whiting

Area	"The Swedish coastal area"			"The Höjen area"			
Year	1938-39	1955		1938-39	1955		
Month	Jan.-Apr.	Febr.	July-Aug.	Jan.-Apr.	Febr.	May	July-Aug.
No. of hauls	13	21	14	14	4	4	8
Depth, m.	48-70	31-117	19-82	46-106	22-81	18-72	17-93
Total time of trawling, min.	810	715	765	720	230	240	900
Total catch of whiting, no.	7168	6558	673	5539	197	316	57
Catch of whiting pro trawling hour, no.	531	550	53	462	50	79	4

TABLE 2

The distribution of the catches of whiting by size and weight

Area	"The Swedish coastal area"		"The Höjen area"					
Year	1939	1955	1939	1941,44+)	1945-48++)	1949-51++)	1955	
Month	Jan.-Mar.	Febr.	Jan.	Jan.-May	Jan.-May	Jan.-May	Febr.	May
No.of samples	3	21	1	11	-	-	4	4
Total no. of whiting	442	6558	218	1951	4421	1763	197	316
% 20 cm.lenght	34	32	25	16	13	16	7	20
% 20 cm.by weight	62	64	59	43	42	44	31	35

+) According to Blegvad 1945 ++) According to Jensen 1952

TABLE 3

Catch of Norway Lobster

Area	"The Höjen area"			
Year	1938-39	1955		
Month	Jan.-Apr.	Febr.	May	July-Aug.
No.of hauls	14	4	4	8
Depth, m.	46-106	22-81	18-72	17-93
Total time of trawling, min.	720	230	240	900
Total catch of Norway Lobster, no.	2460	0	0	24
Catch of Norway Lobster pro trawling hour, no.	205	0	0	2

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