

INDUSTRIAL FISHERIES

The effect of the Danish industrial fishery on the North Sea
catch of whiting for consumption (i.e. above 20 cm.)

A. Theoretical Studies

Not enough is known about the whiting of the North Sea and adjacent waters to enable any precise assessment to be made of the probable effects of the Danish industrial fishery for whiting. The following comments are based on analogy with other better known fisheries and such information on whiting as is available.

The effect of the Danish industrial fishery on the fishery for adult whiting (larger than 20 cm.) in the North Sea depends essentially on two factors:-

- (a) The proportion which the young fish in Danish waters form of the total recruitment of small whiting to the North Sea fishery.
- (b) The proportion of these immature whiting in Danish waters which are taken by the industrial fishery.

Jensen's (1954) report to the Liaison Committee gives the number of whiting caught in the industrial fishery in the Skagerrak - Kattegat as 525 million, the majority of which were below the legal size limit of 20cm.

The precise effect of this on the North Sea catch of whiting is impossible to assess, although it is known that the small whiting in the Kattegat and Skagerrak proceed to the North Sea when adults. It is relevant, nevertheless, to compare the number estimated above with a rough estimate of the number recruited annually to the North Sea stock.

The European catch of whiting for consumption (i.e. above 20 cm.) from the North Sea and Kattegat was about 70,000 tons in 1951. These probably averaged about 25-30 cm. in length, and from measurements in English markets number about 4,000-6,000 per ton. The number caught was therefore probably between about 250 and 500 million; this agrees with Jensen's estimate of 400 million.

What this represents in terms of the number of annual recruits depends on the relative magnitudes of fishing and natural mortality in whiting, on which we know of no direct evidence. However, the fishing mortality is probably rather less than in haddock, as whiting is not usually so deliberately sought: on the other hand, small whiting are an important food of larger fish and the natural mortality is almost certainly higher than in haddock.

It is probably a fairly extreme assumption to take the fishing mortality of whiting to be about one-third, and the natural mortality about three times, that of haddock. In this event, fishing mortality in whiting would be about one-third of all mortality, so that the number caught would represent about one-third of the total number dying each year, an estimate of the latter therefore being about 1,000 million. Under steady conditions this is also the number recruited each year.

It therefore appears that the number of whiting less than 20 cm. caught annually by the Danish industrial fishery is about half the number above 20 cm. recruited annually to the adult North Sea stock. Allowing for a natural mortality of 50% between 15 cm. (the average length in the Danish fishery) and 20 cm. - which is probably an overestimate, if anything - means that the Danish fishery is catching a number of whiting equivalent to about a quarter of the numbers recruited to the adult stock each year.

If this is so, the whiting catches would be expected ultimately to drop to 75% of their previous value. Even allowing for the unavoidably coarse estimates which have been used, it is difficult to accept Jensen's (1954) estimate of a reduction as small as 5-15%.

B. Observed effects on the English fishery

The catch, effort and catch per unit effort of whiting for English steam trawlers fishing in the North Sea for 1936-38 and 1946-54 are given in Table 1.

Table 1. English Steam Trawl Whiting Catches in the North Sea

<u>Year</u>	<u>Catch (cwt.)</u>	<u>Hours' Fishing</u>	<u>Cwt./100 hours</u>
1936	120,312	1605,268	7.49
1937	104,357	1486,387	7.02
1938	123,362	1261,843	9.78
1946	90,683	663,184	13.67
1947	72,710	730,344	9.96
1948	61,327	752,679	8.15
1949	42,154	734,328	5.74
1950	55,164	698,174	7.90
1951	72,212	678,265	10.65
1952	63,861	644,869	9.90
1953	45,206	617,340	7.32
1954	34,540	517,153	6.68

The catch per unit effort shows very considerable fluctuations from year to year, the changes from one year to the next often being up to 30-40%. Thus, unless the industrial fishery causes a reduction markedly greater than this, the catches and catch per unit effort taken over only one or two years cannot provide proof that much reduction is or is not taking place. In fact, an appreciable reduction in the catch per unit effort of whiting has taken place since 1951, which is in fair agreement with the suggestion that the industrial fishery would ultimately reduce the catch of whiting for human consumption by 25%; however, the observed decline could be merely a chance effect.

A rather more sensitive test is obtained by observing the changes in the catch per unit effort of whiting in separate areas of the North Sea. The seven sub-areas chosen, and the changes in catch per unit effort from 1951 to 1954, are tabulated below. For this table the catch per unit effort was calculated for each of the four months February, May, August, and November, for each year and sub-area; unless stated the year to year changes were consistent for all four months.

- Area 1. South of $53^{\circ}30'N$.
Little change 1951 to 1954
- Area 2. $53^{\circ}30'N$, to $55^{\circ}N$. West of $3^{\circ}E$.
Steady but slow decline 1951 to 1954
- Area 3. $53^{\circ}30'N$, to $55^{\circ}N$. East of $3^{\circ}E$.
Steady but slow decline 1951 to 1954;
(except February - a slight increase).
- Area 4. $55^{\circ}N$, to $57^{\circ}30'N$. West of Greenwich
Steady increase 1951 to 1954
- Area 5. $55^{\circ}N$, to $57^{\circ}30'N$. 0° to $3^{\circ}E$.
Increase 1951 to 1952, then marked decrease
- Area 6. $55^{\circ}N$, to $57^{\circ}30'N$. East of $3^{\circ}E$.
No consistent results due to inadequate sampling;
probably decrease.
- Area 7. North of $57^{\circ}30'N$.
Peak in 1952 (1953 for May), then marked decrease.

There are considerable differences between the areas, and it may be significant that, omitting area 6, the only two areas not showing a decrease are area 1, - the most distant from the industrial fishery, and area 4, - at some distance. This is of course consistent with the theory that the reduction in the other areas is due to the industrial fishery.

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