

Plankton in the Western Barents Sea and the Year-Class Strength of the Arcto-Norwegian Cod

By

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IN a recent paper on factors influencing the size of the year-classes in the Arcto-Norwegian stock of cod, WIBORG (1957) considered the numbers and distribution of the eggs and larvae near the spawning areas of the Westfjord and north-western Norwegian coast. He considered that there is no correlation between the abundance of eggs and larvae and the relative strengths of the corresponding year-classes, but he lists as conditions which seem to be important for establishing a rich year-class:— a long spawning period, prolonged hatching or late spawning, an extension or northward displacement of the spawning centre, and a successful transport of the eggs and larvae to the nursery grounds by currents. One factor not included in the list and which is probably important for the survival of larvae is the amount of food available during their pelagic period. This period lasts from hatching in March and April until the “Group 0” cod become demersal about September, and during this time they are dispersed by the currents over a wide area of the Barents Sea, as far north as the north of Spitsbergen and the Great Bank, north-east of Hope Island (CORLETT, 1958a). During this time the food is planktonic and mainly copepods.

During the past nine years that the “Ernest Holt” has been working in the Barents Sea, plankton samples have been taken on most cruises at fixed stations on two lines, west from Bear Island to 13°E. and south from Bear Island to 73°N., and for the last five years more extensive sampling has been carried out over a wider area from 72°30' N. to 79°30' N. and from 7° E. to 35° E. Details of the stations near Bear Island and of the other lines of stations and the quantity of zooplankton caught on each cruise for 1949 to 1956, expressed as dry weight, have already been published (CORLETT, 1953, 1958b). For each year a mean value has been calculated to represent the standing stock of zooplankton in the cruises between mid-April and the end of September, that is the months when the cod larvae are pelagic. In Table I these means are set out in order of decreasing magnitude and underneath each has been placed

Table 1

Summer plankton stock and cod year-class strength

Plankton dry weight									
(a) Near Bear Island									
mg./m ³	54	47	46	34	29	26	24	22	15
(b) North-West									
Barents Sea									
g./m ²	-	-	14.5	11.1	9.4	10.4	7.9	-	-
Cod year-class									
strength.....	very	good	(good)	-	-	average	(average)	poor	poor
	good								
Year.....	1950	1949	1954	1957	1956	1953	1955	1952	1951

N.B. From 1949 to 1952 the plankton samples were usually from 100 metres, and from 1953 to 1957 mostly from the bottom, (average depth 300 metres).
The appreciations in brackets are based on catches of juveniles.

an appreciation of the strength of the corresponding year-class of cod. The year-class appreciation is derived from the Finnmark spring fishery (SÆTERSDAL in WIBORG, 1957), from the "Ernest Holt's" catches in main trawl and cod-end cover (MAFF, 1956, 1957) and from the Russian work in the southern Barents Sea (MASLOV, 1958, USSR, 1957). The year-classes of 1954 and 1955 have not yet entered the fisheries, and the estimates for them are only provisional. The plankton values based on the wider area of the north-western Barents Sea are probably the more reliable indices of the standing stock in the area, but they are available only for the last few years.

It seems from the table that there is a good association between the standing stock of plankton and the strength of the corresponding year-classes. This would suggest that food supply is of some importance in larval survival. It may, of course, be that larval survival and plankton standing stock are influenced independently by some factor such as water temperature or water transport. For instance the two years 1950 and 1954, with high standing stock of zooplankton and good year-classes, were both warm years, hydrographically, in the western Barents Sea (LEE, 1957). HILL and LEE (1958) establish a correlation between the volume transport of the West Spitsbergen Current west of Bear Island and the strength of the southerly wind component during the preceding period: they then show, for the years 1937 to 1941 and 1948 to 1952, an association between the southerly wind component in April and May and the corresponding year-class strength of the Bear Island cod, with the suggestion that when the West Spitsbergen Current is strong the larvae would be expected to reach the nursery grounds quickly. Transport to the nursery grounds must be important, but survival in the pelagic stage during the months of transport depends on planktonic food.

If the association between plankton and year-class strength holds good for a number of years, there is a possibility of predicting the strength of a year-class at a very early stage. This was tentatively suggested two years ago (MAFF, 1956) when it was predicted that the 1954 year-class would be a good one. While it is yet much too early to be sure, there are indications already that this is so. One might further suggest that the year-classes of 1955 and 1956 will be of average strength and that of 1957 above average.

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