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On the Size of the Spawning Area of Pelagic Spawning Fish

by

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During the years 1959-63 a number of egg surveys have been carried out in order to study the spawning of sprat in the boundary area between the Skagerak and the Kattegat (Figure 1 attached).

Year	Months	
	May	June
1959	1	1 x)
196o	-	1
1961	1	-
1962	-	4
1963	1	2
	3	7 (8)

x) incomplete due to rough weather

Net tows have been made with a ring net, diameter 1oo cm, total length 28o cm, of which 8o cm canvas and 2oo cm nylon gauze with a mesh size of 28o µ. The normal dip was from 5o m to the surface, twice at each station[1]. The general picture of occurrence of sprat eggs and larvae is shown in Figure 1. A sharp border line is found, on one side there are no eggs, on the other several hundreds of eggs are in the samples.

In general, the area investigated represents the "mouth" of the Kattegat and the Baltic and its hydrography is characterized by two permanent current systems: the Jutland current off the northern coast of Denmark, going to the east, and the Baltic current off the Swedish coast, going to the north. Tidal currents are comparatively weak and negligible in our discussion. Sprat eggs are drifting with the Baltic current to the north, developing into larvae (Lindquist, 1961). North and west of these two currents there is the water of the central Skagerak, which at this time of the year is considerably colder.

Figure 2 gives an example of observed figures for temperature and salinity, drawn as isotherms and isohalines through the area. Eggs (and larvae) have almost exclusively been found in the warmer water. To the north and to the west the warmer water is sharply limited and this limit coincides with the border line in the occurrence of sprat eggs. During our surveys we have found that in this way the size of the spawning area is depending on the hydrography of the area.

In the colder water of the central Skagerak eggs of other fish, e.g. mackerel and gadoids do occur. For this and other reasons it hardly seems to be an analogous case to the concentration of plaice eggs in the Channel. In our area numerous drift bottle experiments have been made to demonstrate the circulation of the surface water.

1) More correctly: the tows were 5o m through the water and finished at the surface, as currents made it difficult to compensate the wire angle of the net. Höglund (1958) has shown that sprat spawns in the surface layers.

The current system is most easily deflected by the wind and is, consequently, very instable. Easterly winds drive the Baltic current off the coast, in the case of westerly winds the reverse is true. At the same time the border line between the colder water of the central Skagerak and the warmer water off the Danish and Swedish coasts is moved and the size of the area in which spawning of sprat occurs is altered.

In our investigations we used a dense network of stations to get a synoptic picture in space and time. As the time of development from egg to larva is considered to be short, about 3 days, it will be an advantage to collect the samples without loss of time. In addition, one must reckon with alterations in the occurrence of shoals of spawning sprat [1] and in the hydrography of the area.

Figure 3 shows clearly that if sampling stations are not sufficiently close together when starting an investigation (coarser network or system of sections), it would be difficult to get a survey of the hydrographical situation and to find the reason why eggs do occur or not. On the other hand, a closer network of sampling stations than those would probably have been still better but could then no longer be considered to be "synoptic" (the whole area is covered by the research vessel in about 72 hours or less, sampling with water bottles included).

As the hydrographical status of the area clearly limits the geographical position of the spawning area, attempts have been made to get a better and a real synoptic survey of the boundary area by measuring the sea surface temperature from the air by an infra-red instrument (Svansson, 1962, and unpubl. work). Such a survey takes abt. 4 hours; there is, of course, no plankton sampling.

Naturally, an estimate of the total number of eggs will give weak results when from the beginning an unsuitable system of sampling stations is used. From this it seems quite clear that in areas with complicated water movements it is necessary to study carefully the factors limiting the spawning area. Daily short-time fluctuations of a border line have been observed especially during 1962, and this is another reason why sampling from fixed station (e.g. lightvessel) would give incomplete information as to the intensity of spawning.

The hydrographical and planktological material will be worked-up in detail and the results be published in extenso. Unfortunately, the southern limit of the spawning area cannot be studied, as large areas in the Kattegat are not swept for mines.

Summary

When studying the spawning area of sprat in the boundary area between the Skagerak and the Kattegat a sharp border line in the occurrence of sprat eggs and larvae has been found. North of this border line there are no sprat eggs and larvae and the water is considerably colder.

This border line is due to the hydrography of the area which is characterized by permanent currents, i.a. deflected by the wind. In this way a very important spawning area can be extended or concentrated.

Only a dense network of sampling stations (balanced by time to get a synopsis of the area) makes it possible to detect and study such details. In areas with a complicated hydrography these details are considered to be important when estimating egg numbers.

References

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[1] As is well-known, a female spawns repeatedly for at least a month (Heindrich 1925). The occurrence of shoals in the spawning area has been shown by a number of echo-

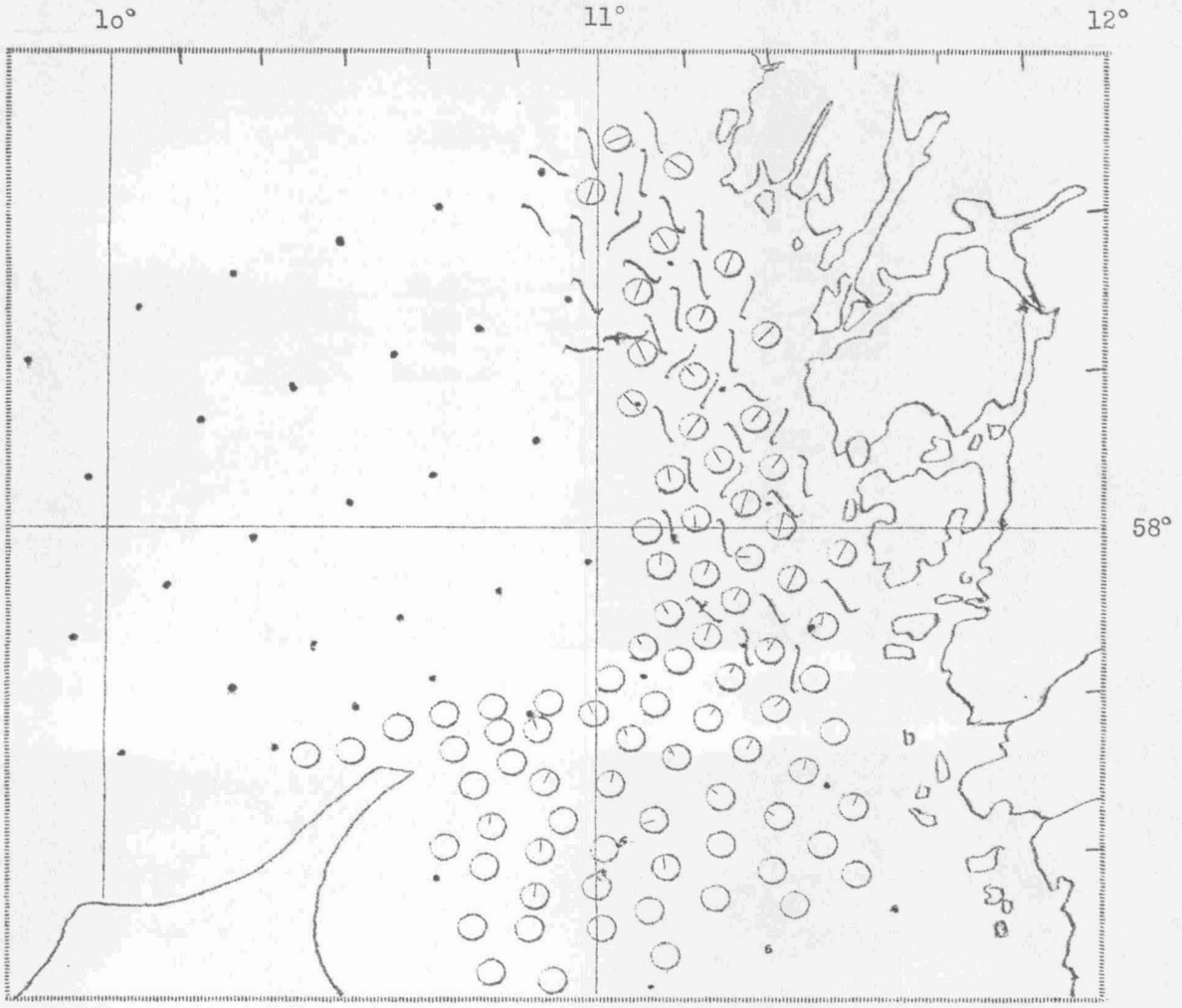

Figure 1. The spawning area of sprat in the boundary area between Skagerak and Kattegat; eggs and larvae.

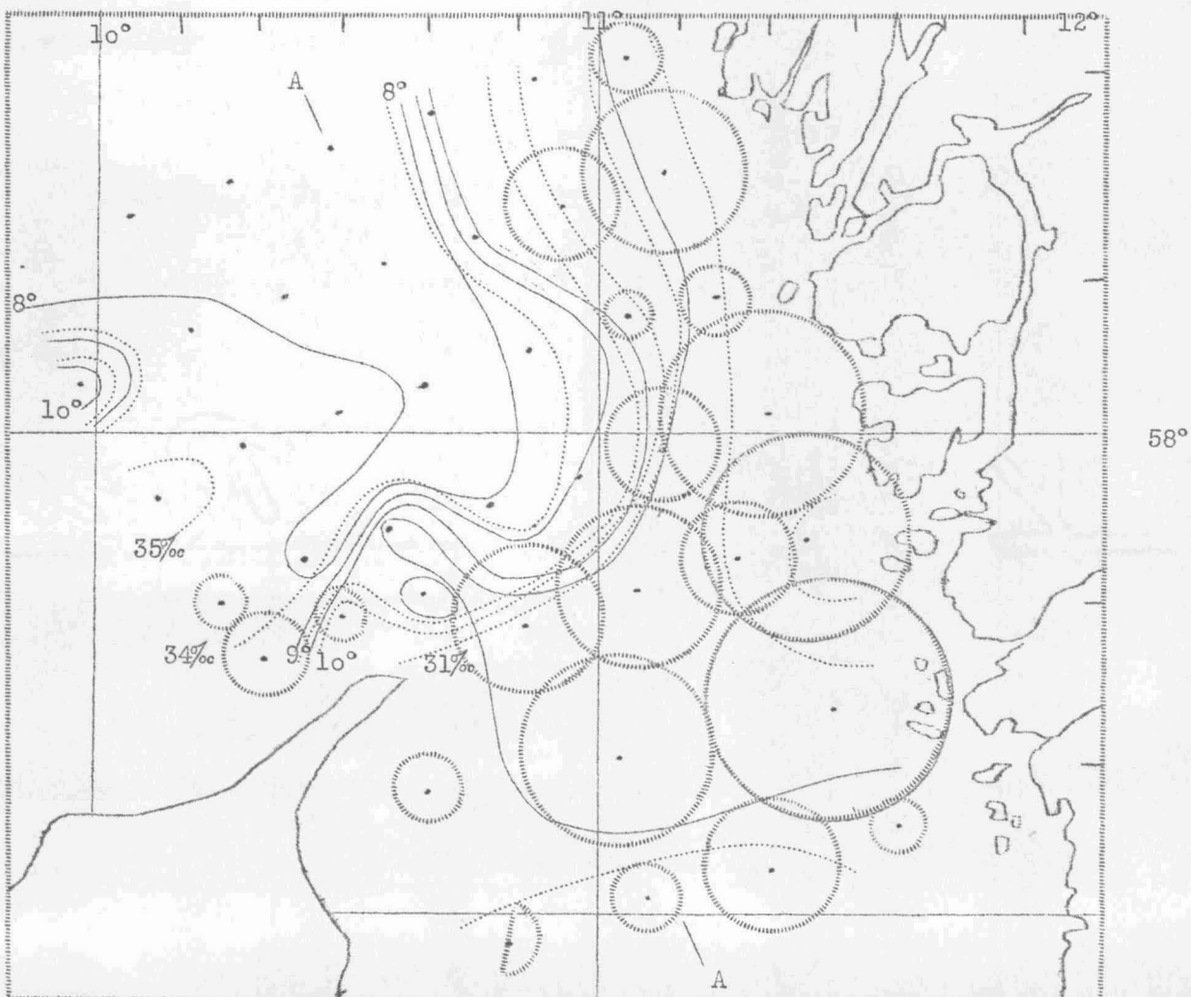

Figure 2. Isotherms (whole lines) and isohalines (stipled lines) during May 1961, 15 m depth; network of stations is seen and the catch of eggs of Clupea

Figure 3. Section A - A of Figure 2; isotherms; the number of eggs refers to hauls 50-0 m on each station.