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Plankton Committee

On the distribution of fish eggs and larvae in the Skagerak

by

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Our studies of plankton in the Skagerak and North Kattegat during the months of May and June 1959-1963 showed that these areas are important for the reproduction for numerous species of fish. We found in our samples eggs and larvae of about forty species of fish. Of these, however, relatively few were abundant enought to play any role in our samples. The most important are the sprat and the mackerel, and of some importance are Callionymus, Onos and others. The eggs and larvae of certain other species were not numerous, but their spawning region was clearly restricted: e.g. Engraulis, Maurolicus, Solea, etc. A picture of the migrations and the spawning region of the mackerel is shown in Fig. 1.

All samples were taken in 1-metre nets, at depths of 50-0 metres. If samples from one depth only are required, a Gulf III Sampler should be used. We used this instrument several times, but, owing to a series of methodical difficulties, we reverted to the net.

Studies of the hydrography comprized a considerable part of our work. The anticlockwise water circulation in the Skagerak is permanent, the plankton drift with the current, and a glance at Fig. 1 will show that at least some of the larvae must be carried away from the Skagerak. The extent of this removal has not been possible to determine, for several reasons. In the first place, the larvae get older while drifting along the Norwegian coast, and it is therefore impossible to obtain comparable netting samples. Further, there is a counter-current at the mouth of the Skagerak in which larvae have been found. Nothing is known about the volume of water in this counter-current. This proves that not all larvae leave the Skagerak with the Norwegian current. However, not all the lar-

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vae return, for if such was the case, many more larvae of the sprat and the mackerel would have been found in the region of the Jutland current.

The assessment of the hydrographical situation makes special demands. On the one hand, it is not advisable to go into too great detail. Of course, many of the factors affecting the distribution of plankton are quite unknown. On the other hand, we understand the significance of currents for the distribution of eggs and larvae. The part played by the temperature of the water for the initiation of spawning and the rate of development of eggs and larvae is also understood. The density of the water is important for the bouyancy of the eggs. When, however, "different masses of water" are mentioned, they are often vaguely defined, but what is meant by these vague definitions is of fundamental significance.

Our work was seriously handicapped by the impossibility of obtaining simultaneous samples of plankton. Although everything possible was done to reduce the interval between samplings, the difference in time between the first and last stations on the cruise was between three and eight days. During this time we worked night and day without interuption. I cannot see any way of reducing the sampling time. Compared with many other investigations, our material, however, was collected during a very short period of time.

Only hydrographical features prevailing throughout the cruise are relevant. One may, therefore, speak of the Jutland Current, the Baltic Current, Norwegian Coastal Current and their importance for fish eggs and larvae, as well as the central mass of cold water. In the border region between the Skagerak and the Kattegat, and along the Swedish coast, the isotherms are very deep during this part of the year, which is also a factor prevailing for a long time, and therefore of great significance for the distribution of the organisms. Fig. 2 gives a survey of the various spawning regions, and provides,so to say, a synthesis of our investigation.

The drift of larvae from the Skagerak and the return drift into the Skagerak have already been mentioned. We know, from studies by HÖGLUND and NYBELIN during the 1930's that fish larvae also drift from the North Sea into the Skagerak. This concerns the following species: Glyptocephalus, Melanogrammus and Molva. The main spawning region of these species is in the northern North Sea, at the southern and western sides of the Norwegian Trench. The larvae of Merlucius and Micromesistius may come from still more distant regions.

Local spawning must be allowed for in the region of the Jutland Current (but not of the species mentioned above). It seems quite clear that Mer-

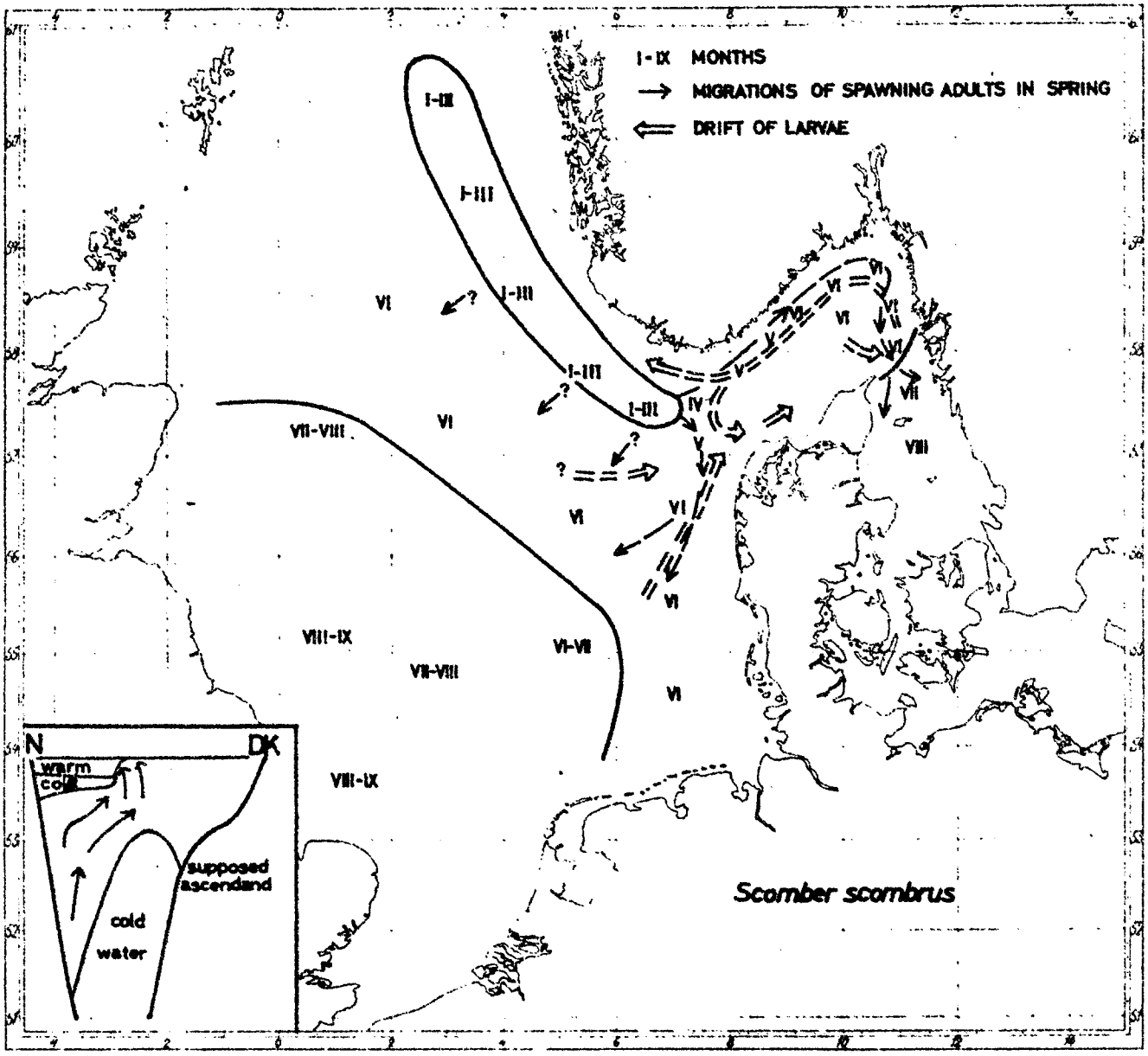
langius, for example, spawns in the Jutland Current. The total number of larvae in the Jutland Current is never as great as in the region of the Baltic Current, however, which is naturally associated with the geographical limits and intensity of spawning of the sprat and the mackerel.

If the species are divided into three groups according to their eggs, viz. (a) species with benthic eggs, (b) species with pelagic eggs with an oil droplet and (c) species with pelagic eggs without a drop of oil, the following geographical distribution will be found, which may be an expression of a generally valid principle. (1) All species we know from the central Skagerak have pelagic eggs with an oil droplet, (2) in coastal waters (off shore) to a depth of 100 metres three main groups are observed: A. species with pelagic eggs with a drop of oil, B. species with pelagic eggs without an oil droplet, and C. species with benthic eggs. (3) In the region of the archipelago species with benthic eggs from the largest group; only one species has pelagic eggs with a drop of oil, while two have pelagic eggs without a drop of oil. This is illustrated in Fig. 2. Thus a clear tendency is present for species with benthic eggs to become more common the nearer the coast one is. The open sea out to the 100-m isobath is a mixed area in which all three types of egg occur, and above the great depths only species with pelagic eggs with a drop of oil are found. The archipelago, shallow water and deep water areas are close together in the Skagerak, which explains these distinct differences. (In fresh water all eggs are benthic, with the possible exception of Pelecus cultratus.) Of some interest is the fact that there are differences within these groups: Sprattus, Scomber and Maurolicus spawn in a geographically restricted area, while Onos spawns in the whole of the Skagerak region; O. mustela nearer the coast, however, than O. cimbrius. Among species with benthic eggs are some which spawn near land, G. morrhua, while others avoid the fiords, Melanogrammus and others, for example.

The waters studied proved to be very differentiated, and divided into several subregions, a few of which are mentioned above. This is due to topographical conditions, the specific hydrography and the number of species.

Except for chaetognatha, we have not processed any other group of animals in our plankton material. A closer scrutiny of the nutritional organisms of fish larvae would have been of interest, but time and supply of labour were inadequate.

Fig. 1


I-IX MONTHS
MIGRATIONS OF SPAWNING ADULTS IN SPRING
DRIFT OF LARVAE
I-III
I-III
I-III
I-III
I-III
VI
VI
VI
VI
VI
VI
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VII-VIII
VII-VIII
VIII-IX
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VII
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N
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warm
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water
Scomber scombrus

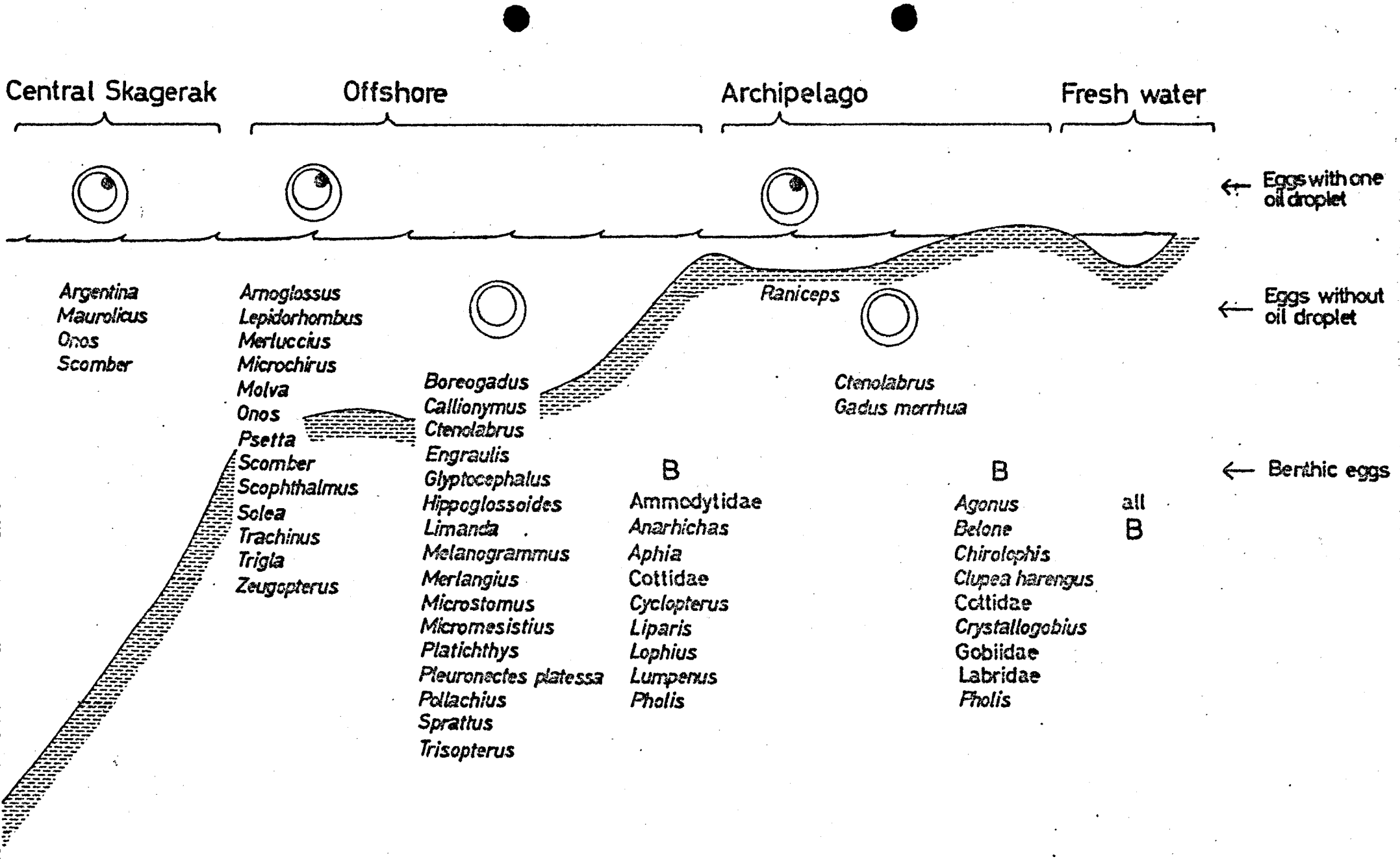
Central Skagerak
Offshore
Archipelago
Fresh water
Eggs with one oil droplet
Eggs without oil droplet
Benthic eggs
Argentina
Maurolicus
Onos
Scomber
Arnoglossus
Lepidorhombus
Merluccius
Microchirus
Molva
Onos
Psetta
Scomber
Scophthalmus
Solea
Trachinus
Trigla
Zeugopterus
Boreogadus
Callionymus
Ctenolabrus
Engraulis
Glyptocephalus
Hippoglossoides
Limanda
Melanogrammus
Merlangius
Microstomus
Micromesistius
Platichthys
Pleuronectes platessa
Pollachius
Sprattus
Trisopterus
Raniceps
Ctenolabrus
Gadus morrhua
B
Ammodytidae
Anarhichas
Aphia
Cottidae
Cyclopterus
Liparis
Lophius
Lumpenus
Pholis
B
Agonus
Belone
Chirolophis
Clupea harengus
Cottidae
Crystallogobius
Gobiidae
Labridae
Pholis
all
B

Fig.2