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Biomass of Zooplankton and Distribution of Fish Larvae in the Shelf Waters off Northwest Africa in February 1970

by

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The plankton material was collected during a cruise of the RV "Wieeno" in the area between 28°06'N and 12°49'N. On the whole, 75 samples were taken in this area, the majority in waters between 18°50'N and 14°N. The distribution of samples according to water depth in this part of the shelf is shown in Figure 1. The samples were collected by vertical hauls from a depth of 100 m to the surface by means of a Hensen-typenet made of gauze no. 3. In more shallow water, the hauls were made from the botton. The material has so far been worked up mainly with regard to the zooplankton biomass distribution. The data concerning species composition and distribution of fish eggs and larvae should be considered as preliminary data.

Zooplankton biomass was determined by the displacement method. Biomass determination was carried out after preservation of the zooplankton in 4% formalin. Zooplankton biomass ranged from 0.013 ml/m^3 to 1.710 ml/m^3 according to the station of sampling.

It should be noted that the shelf waters of the northern part of the investigated area from 25°N to 22°N differed considerably from the rest of the area, because of their low content of zooplankton. The biomass was here, according to the depth from 0.014 ml/m^3 to 0.130 ml/m^3 (average 0.052 ml/m^3). A significant increase in the plankton biomass has been observed in this area in deeper waters (over 800 m depth) characterised by the different temperature regime, especially by higher surface temperatures. Biomass from two stations of this area situated on the continental slope was 0.942 ml/m^3 and 0.672 ml/m^3 which is from several to several hundred times greater than in the shelf waters of the same area. Such large biomass was mainly composed of salps which do not occur in abundance in the shelf waters.

The zooplankton biomass of the shelf waters south of Cape Blanc was considerably larger and, at the same time, more differentiated. The largest zooplankton biomass in the entire section on the shelf from Cape Blanc to the mouth of the Gambia River was observed in the shallow waters up to a depth of 30 m. It ranged from 0.567 ml/m^3 to 1.430 ml/m^3 (average 1.101 ml/m^3). With increasing depth of water, the quantity of zooplankton decreases and in waters with a depth from 90 to 300 m it was seldom over an average of 0.300 ml/m^3. A significant increase in the biomass of zooplankton was observed in the area of Dakar, in the waters beyond the shelf, above the continental slope and in the open ocean (Figure 1).

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Apart from the differences in biomass related to water depth, there were waters especially abundant in zooplankton in the surveyed section of the shelf waters. Thus, at the latitute of Banc d'Arguin (20°07'N to 20°19'N) the biomass varied from 0.650 ml/m^3 in waters of 120 m depth to 1.430 ml/m^3 in the shallow waters of 20 m depth. High zooplankton biomass figures also characterised waters south of Cap Timiris (between 19° and 18°N) where there was 1.710 ml/m^3 in the waters of a depth of 50 - 80 m. In the zone between 18°N and 15°N there was less zooplankton and decreasing to the south which was most pronounced in the shallow waters.

South of Cape Verde, in the area of the mouth of the Gambia River (12°49'N - 14°00'N) the biomass showed average quantities.

Great differences, according to water depth and the position of sampling were found both in biomass distribution and in species composition.

Calanoidae were a permanent component of the plankton, although not always a prevailing component. In the deep waters above the continental slope salps and Siphonophora and other medusae dominated.

In the shelf waters between Cape Blanc and Cape Verde Calanoidae and Euphausiacea constituted an integral part of the zooplancton. Euphausiacea were particularly numerous south of Cap Timiris to 17°N. In these waters there were remarkably favourable food conditions for planktonophagous fish, both as to the number of zooplankton as to its composition.

The zooplankton composition south of Cape Verde differed considerably. While Euphausiacea were lacking, numerous cladocerans occurred, mainly Penilia avirostris and also ostracods. Appendicularia were found in abundance and salps and medusae occurred in great numbers even in shallow waters.

Strong phytoplankton bloomings occurred in some areas; on the latitude of Banc d'Arguin (20°46'N to 20°07'N) these consisted of flagellates and - at the mouth of the Gambia River - of diatoms.

Between 15°37'N and 17°06'N a strong blooming of Noctiluca miliaris was observed in the second part of February.

The great differences of biomass and also of the species composition in the investigated section of the shelf is connected with the hydrographical conditions prevailing in the days of sampling, when upwelling was observed in a large area of the shelf waters. The water masses raised to the surface, moved from north to south in the direction of Cape Verde and differed depending upon the latitude. The different stages of upwelling affected differently the vital functions first of nectonic organisms, and thereby the quantity and distribution of plankton.

The most northern area from Cape Bojador to Cape Blanc was characterised by a long-standing and deep upwelling, where a great part of the shelf was occupied by waters brought up off the continental slope from a depth of 300 to 400 m, and very poor in living organisms. It was characterised by an especially low quantity of zooplankton. Offshore surface waters were found off the continental slope and could be identified by the hydrographical factors as well as by an increase in zooplankton biomass. This assumption was confirmed by the species composition of the zooplankton.

A zone between Cape Blanc and Cape Verde showed somewhat different hydrographical conditions - mainly in the southern part of the area where upwelling was in its initial stages and the influence of the Canary Current was conspicuous. Hence, it appears that these waters are strongly differentiated as to their zooplankton biomass.

As mentioned above, the data concerning fish eggs and larvae distribution (as well as data concerning zooplankton species composition) must be considered as preliminary and approximate. In the first place, attention was paid to the distribution of eggs and larvae of fish of commercial importance. It is evident that fish eggs and particularly larvae. were found in scarce abundance in the material collected during the cruise. The method used is of low efficiency as to the catching of fish larvae. However, the same method was used during the previous cruise of RV "Wieczno" in the same waters in June to August 1967 and then fish larvae were sometimes present in abundance (up to several hundred individuals per sample), while in February 1970, there were seldom up to several individuals per sample.

The small number of fish eggs and larvae in the collected material may therefore indicate a lack of intensive spawning in this period. Presumably the relatively low water temperature prevailing on the greater part of the shelf, the intensive water movements and the variability in the hydrographical condition were all unfavourable to the forming of spawning concentrations and to the process of spawning. Larger concentrations of fish eggs were only found in a few places. In most cases these were eggs of carangids(so far the author has not succeeded in identifying the species of Carangidae). Also, a great number of eggs of anchovy (Engraulis), more than 1 000 eggs/m^2 were found at one station, at the latitude of Banc d'Arguin (20°19'N), in waters of 20 m depth. The main period of intensive spawning of anchovy in the shelf waters of Northwest Africa is in the period of strong warming of these waters from June to August. Therefore, in the samples taken in summer 1967 fish eggs and larvae were found in abundance; they occurred mainly in the shallow waters of a zone between Cape Blanc and the mouth of the Senegal River. According to many authors, anchovy breed also at other times of the year, but not so intensively; therefore, it was not surprising that separate concentrations of fish eggs were found in February, especially in the shallow, strongly warmed waters.

Eggs of carangids, and chiefly of gilt sardine were found in abundance at several stations in waters south of Cape Verde and south of Cape Timiris. In the first of these regions concentrations of fish eggs were found at two centres :

1) South of the mouth of the Gambia River (12°49'N - 13°31'N) where eggs of the gilt sardine occurred in the shallow waters at a depth of 18-48m and eggs of carangids (Caranx rhonchus)in the deep water of 48 - 110 m.

2) North of the mouth of the Gambia River (14°00'N) in waters of 60-150 m depth. There the number of fish eggs decreased as water depth decreased.

Furthermore eggs of gilt sardine as well as eggs of a carangid species occurred in abundance by the end of February in waters of a depth of 100-120 m south of Cape Timiris (18°50'N - 17°27'N). Also in this case it was not possible to identify the species concerned. In the first days of February neither eggs of gilt sardine nor of carangids were recorded at these stations. However, single larvae of carangids occurred in all sections of the shelf between 18°50'N and 15°47'N in waters of 57 - 220 m depth. They were found in great numbers (several to several dozen individuals per sample) in the first part of February at three positions: 18°50'N (57m depth), 18°11'N (180 m depth) and 17°11'N (2 200 m depth). The occurrence of larvae of carangids even in abundance

at the last mentioned position is interesting. According to the data hitherto available, spawning grounds of carangids are mostly situated in the shelf waters. These larvae were presumably transported far off their spawning grounds together with the surface water masses under the influence of the strong NW winds prevailing at that time. All the larvae collected were in early developmental stages, their length oscillating between 3.5 and 5.0 mm so they were at most 4 to 5 days after hatching.

When considering the absence of greater concentrations of eggs of Carangidae and the relatively small number of larvae in the samples, it may be assumed that the main spawning of the two most numerous species of Carangidae in these waters - Trachurus trecae and Trachurus trachurus, took place in the period preceding the time of sampling.

In the northern part of the investigated area, i.e. between 24°44'N and 20°07'N eggs of Maurolicus pennanti occurred in abundance and were recorded in the waters of 84 - 150 m depth and most abundantly in the waters of 100 - 150 m depth. Moreover, in this area eggs and larvae of Sparidae, Soleidae and Lepidopus caudatus were found sporadically and in small numbers. Because of the low quantity of eggs of hairtail and also considering the gonad stage of this species, it was assumed that spawning was only in its initial stage.

From this short survey of the distribution of fish eggs and larvae it appears that in February spawning grounds of several commercial fish species are found mainly in two areas : in the shelf waters south of Cape Timiris (between 18°50'N and 17°00'N; 100 to 200 m depth) and in the region of the mouth of the Gambia River (between 14°00'N and 12°49'N). In the latter region, spawning grounds were found in shallow waters up to 60 m depth, as well as in deeper waters of 100 - 150 m. Spawning grounds of gilt sardine and carangids (the exact species unidentified) were localised in both areas.

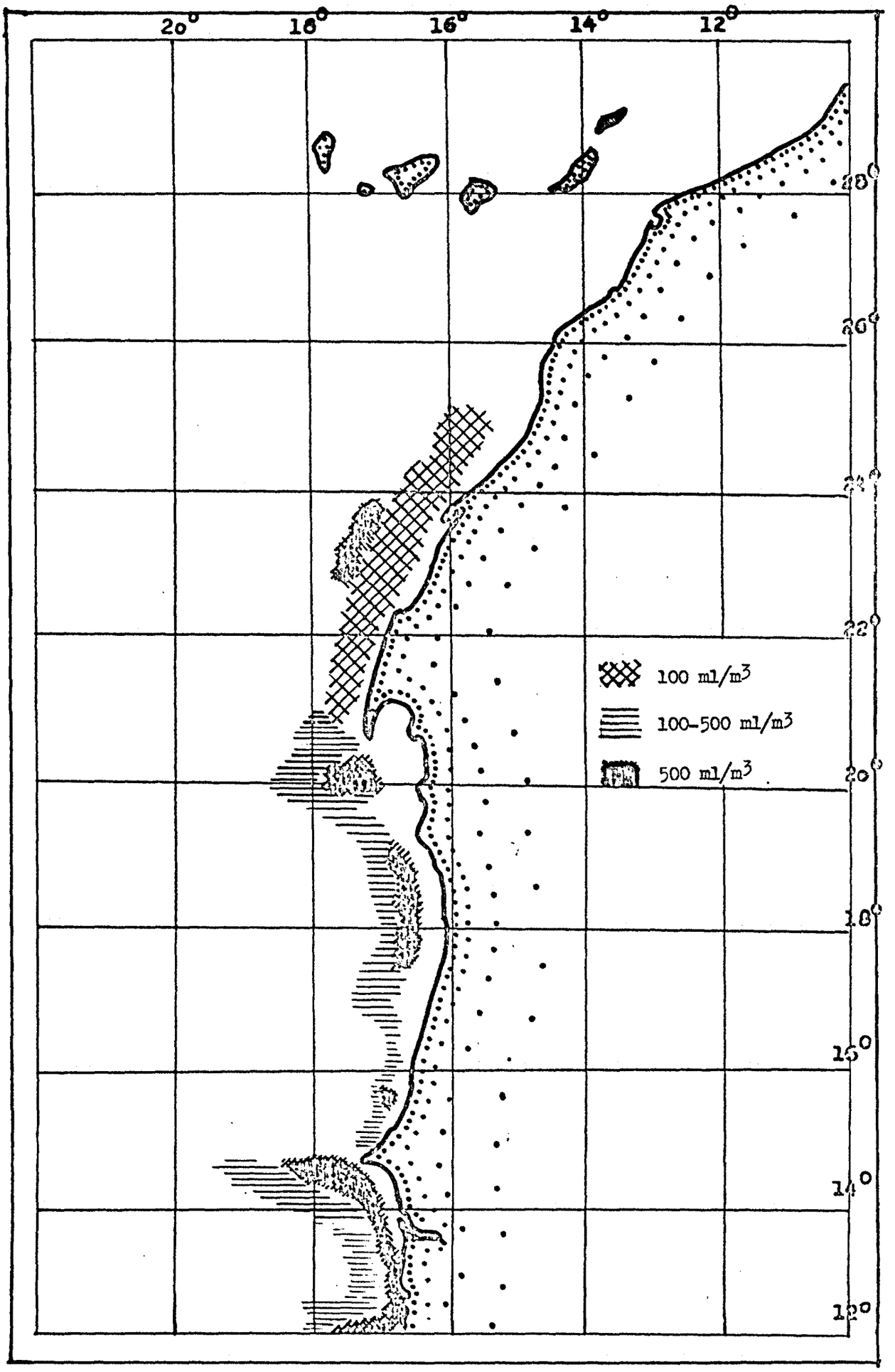

Figure 1. Biomass of zooplankton in the Shelf waters off north-west Africa in February 1970.