International Council for the Exploration of the Sea

C.M.1968/L:12
Plankton Committee

Influence of the Environmental Conditions on Distribution of Zooplankton in the Bay of Gdańsk

by

K. Siudziński[x)]

The investigation area is a brackishwater basin (β-mesohaline, ± 5 °/oo to ± 10°/oo salinity). It is subject to pronounced seasonal changes of temperature (0° - 22°C). These environmental features influence quite markedly the qualitative and quantitative occurrence of particular ecological species and groups of zooplankton in the Bay of Gdańsk both with respect of time and space.

The temperature is one of the most important factors controlling the geographical distribution of marine organisms, and must be considered as the primary cause of the essential differences as to the life in the warms seas compared with that in the cold seas. Together with the salinity it constitutes in the area investigated the main factor, which restricts the occurrence of some species and their appearance in different seasons.

In winter, when the temperature is nearly uniform amounting to about 1°C, the distribution of micro-zooplankton, especially of the oligothermic, kryophile forms which essentially occur in the open and deep Baltic waters, is also homogenous all over the area (e.g. the distribution of Acartia longiremis).

Kryophile marine species such as Pleurobrachia pileus, Frittilaria borealis and Pseudocalanus elongatus reach as far as the reef Ryf Mew, but they never exceed it. The other species found apart from the above-mentioned, which make up the winter composition of species, are also distributed rather uniformly, for example, Acartia bifilosa.

In winter the plankton becomes the poorest, both as regards the number of species and the number of individuals. The thermophile forms are then absent: the copepod Acartia tonsa, the whole group of Cladocera, as well as the larvae of benthic animals such as Nemertini, Cirripedia, Bryozoa and Mollusca.

In spring as the temperature rises (in April 7-9°C, in May 10-12°C) a reproduction takes place within the whole community of planktonic animals, and the species composition is more and more enriched. Above all, the young stages of the copepods(nauplii and copepodites of the order I and II) develop most abundantly, and in late spring the young stages of Cladocera are prevailing in the composition of the zooplankton.

The greatest abundance of individuals of particular groups is observed in the most shallow and warmest area, i.e. in the Firth of Puck. In the deeper region, however, where the bottom temperature is about 2°C, the individuals of particular species are far less numerous. As a proof the distribution of Acartia bifilosa, A. tonsa, Evadne nordmanni, the rotatoria and the larvae of Mollusca may be mentionned. These animals reach at this time their first maximum. Besides, freshwater crustaceans, copepods and Cladocera are found as well.

x) Mr. K. Siudzinski,
Sea Fisheries Institute,
1, Aleja Zjednoczenia,
Gdynia, Poland.

Together with the increase in temperature, the kryophile species disappear in shallow, warm waters, while over the deep bottoms, at which the temperature is as low as 1-2°C, they continue to occur. In these deep waters are found: Acartia longiremis, Frittilaria and kryophile species.

The summer period is the season of maximum development of the micro-zooplankton.

The temperature in the shallow areas is then uniform from the surface to the bottom, amounting to about 18°C. However, in deeper bottom water layers, temperatures as low as 3,6° are observed.

The intensive development of species in shallower areas, taking place in the spring period results in summer in comparatively the highest quantity of individuals within the particular species.

However, in the open sea the strongest development is observed in the warmest top-water layer. The maximum occurrence is indicated by Acartia bifilosa, A. tonsa, Bosmina coregoni maritima (Evadne nordmanni) and other Cladocera such as Podon polyphemoides, P. leuckarti and P. intermedius, and further by some freshwater forms of Cladocera.

The kryophile forms disappear completely from the shallow places, where the temperature is comparatively high within the whole water column (18°C), but they occur in deep cold waters (for example: Acartia longiremis).

The most striking feature of the biological autumn is the end of the mass development of the typical summer forms, and partially also of the spring forms. At the same time the boreal marine forms become activated, and this causes the second increase in occurrence of copepod species.

The second increase in the number of nauplii during this period may be considered a proof.

Later on, the temperature of the surface and subsurface waters decreases and is still uniform, particularly in the layer from the surface to 20 m depth. It then ranges between 5°C near the shore and 9°C in the open sea.

About the end of autumn the thermophile species from the spring and summer period disappear (for example, Acartia bifilosa), while the kryophile species such as Acartia longiremis move from the deep waters of the open sea towards the shore and the reef Ryf Mew.

Another important factor controlling the distribution of marine plankton species is the salinity conditions. In the area investigated these may be described as follows:

a) The average surface salinity in the vicinity of the river mouth oscillates between 5,5 °/oo and 6°/oo; in the Firth of Puck between 6,5 and 7°/oo, and in the central part of the Bay it amounts to more than 7°/oo.

b) However, the salinity of the bottom water increases from the 6°/oo found near the river mouths in the Firth of Puck and along the shores, to more than 8,5°/oo towards the Deep of Gdańsk.

The salinity minimum in the river mouths is 1°/oo, the maximum in the bottom water layer of the open sea being about 10°/oo.

Three ecological types have been distinguished with regard to their dependence of salinity:-

a. a freshwater type,

b. a brackishwater type, and

c. a marine type (Table 1).

a. The freshwater species occur in river mouths, as well as within the zone quite near to the shore and in lagoons of the Firth of Puck, where the salinity does not exceed 4-5°/oo (6°/oo).

b. The brackishwater species occur mainly over the littoral zone and sometimes penetrate into the rivers. (7°/oo).

c. The marine species live in the open and rather deep waters of the Bay of Gdańsk. (7-10°/oo)

Recapitulation - It has been stated that the zooplankton in the Bay of Gdańsk mainly consists of thermophile brackishwater species, which are more or less uniformly distributed all over the area investigated.

Such a composition of zooplankton ommunity determines the biological character of this specific environment.

Lp.	Freshwater species	Brackishwater species	Marine species
1.	Alona affinis	Bosmina coregoni maritima	Pseudocalanus elongatus
2.	Alona rectangula	Evadne nordmanni	Pleurobrachia pileus
3.	Diaphanosoma brachyurum	Podon sp.	
4.	Chydorus sphaericus	Acartia bifilosa	
5.	Bosmina longirostris	Acartia tonsa	
6.	Alonella nana	Acartia longiremis	
7.	Daphnia cuculatta	Eurytemora sp.	
8.	Daphnia cristata	Temora longicornis	
9.	Leptodora Kindti	Centropages hamatus	
10.	Eucyclops serrutatus		
11.	Megacyclops viridis		
12.	Halicyclops magniceps		
13.	Halicyclops neglectus		
14.	Mesocyclops leuckarti		
15.	Endiaptomus graciloides		
16.	Macrocyclops albidus		
17.	Cyclops strenuus /group/		
18.	Acanthocyclops biscuspidatus		
19.	Acanthocyclops bisestosus		
20.	Acanthocyclops vernalis		
21.	Ectocyclops phaleratus		
22.	Eurytemora lacustris		

Table 1. List of Species

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