International Council for the Exploration of the Sea

C.M.1968/L:8
Plankton Committee

Effects of Climatic Conditions on the Occurrence of Micro-Zooplankton in the Southern Baltic

by

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The material for this contribution was collected in 1956 and 1959. These years could be considered the most extreme in respect of the climate. The year 1956 was one of the coldest, while 1959 belonged to the warmest years of this century. The minimum temperature of the surface-water layer in the winter of 1956 was -0,4°C, while the corresponding temperature in 1959 was 1,5°C. The maximum summer temperature in 1956 was about 16°C, and in 1959 about 22°C. The measurements of insolation, carried out at Gdynia, also show that the spring insolation of the sea was almost one and a half time greater in 1959 than in 1956 (Figure 1). The material from these two years is rather rich, namely 382 samples, collected in particular water layers all over the area of the southern Baltic.

The number of individuals of the different species in a given water layer was calculated per m^3 of water, and the total mass of zooplankton was determined by the method of 24-hour sedimentation and expressed in cm^3.

The investigations covered the groups constituting the micro-plankton. These were Rotatoria, larvae of Annelida, Cladocera, Copepoda, larvae of Mollusca and larvae of Appendicularia. The results obtained indicate that in the warmer of the two years, the total biomass of the zooplankton was larger (Figure 2). The same correlation was found in respect of the particular water layers (Figure 3). In the warm 1959, higher numbers of individuals of all the species per unit of volume were observed as well (Figure 4). This was also the case with nauplii of copepods (Figure 5), and it may be considered an effect of the increased activity of development and reproduction processes.

In these two years, which were opposite with respect to thermal conditions, quantitative differences were observed in the vertical distribution of Cladocera and Copepods in the surface layer (Figure 6).

The influence of the warmer climate on the occurrence of zooplankton is very evident with respect to the increase in number of such surfacial, thermophileous species of Cladocera as Bosmina coregoni maritima and Evadne nordmanni as well as of the copepod Acartia bifilosa (Figure 7). Besides, it is characteristic that in the warm year even oligothermic species such as Pseudocalanus elongatus and Frittilaria borealis occur in larger quantities, particularly in the spring period (Table 1).

Table 1. Number of individuals in 1 m^3 water in particular seasons of the years 1959 and 1956.

Year	Pseudocalanus elongatus				Frittularia borealis			
	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn
1959	539	1898	1201	427	130	360	274	40
1956	252	530	1130	850	20	163	8	27

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It may also be said that in the two years a marked effect of the two correlated factors, temperature and insolation, upon the development and reproduction of the different species was observed.(Figure 1). In the warm year the Rotatoria, the bulk of Cladocera (Bosmina coregoni maritima, Evadne nordmanni, Podon intermedius) and some of the copepods (Acartia longirenis, Tenora longicornis, Pseudocalanus elongatus) started their reproduction and development much earlier in comparison to the cold year.

It is concluded that a year's climate influences the occurrence and development of the plankton considerably, through the differences in temperature and insolation. An increase in the mean temperature during the period of development of the zooplankton is accompanied by an increase in the quantitative occurrence of particular species, both with respect to the number of individuals and with respect to the total biomass.

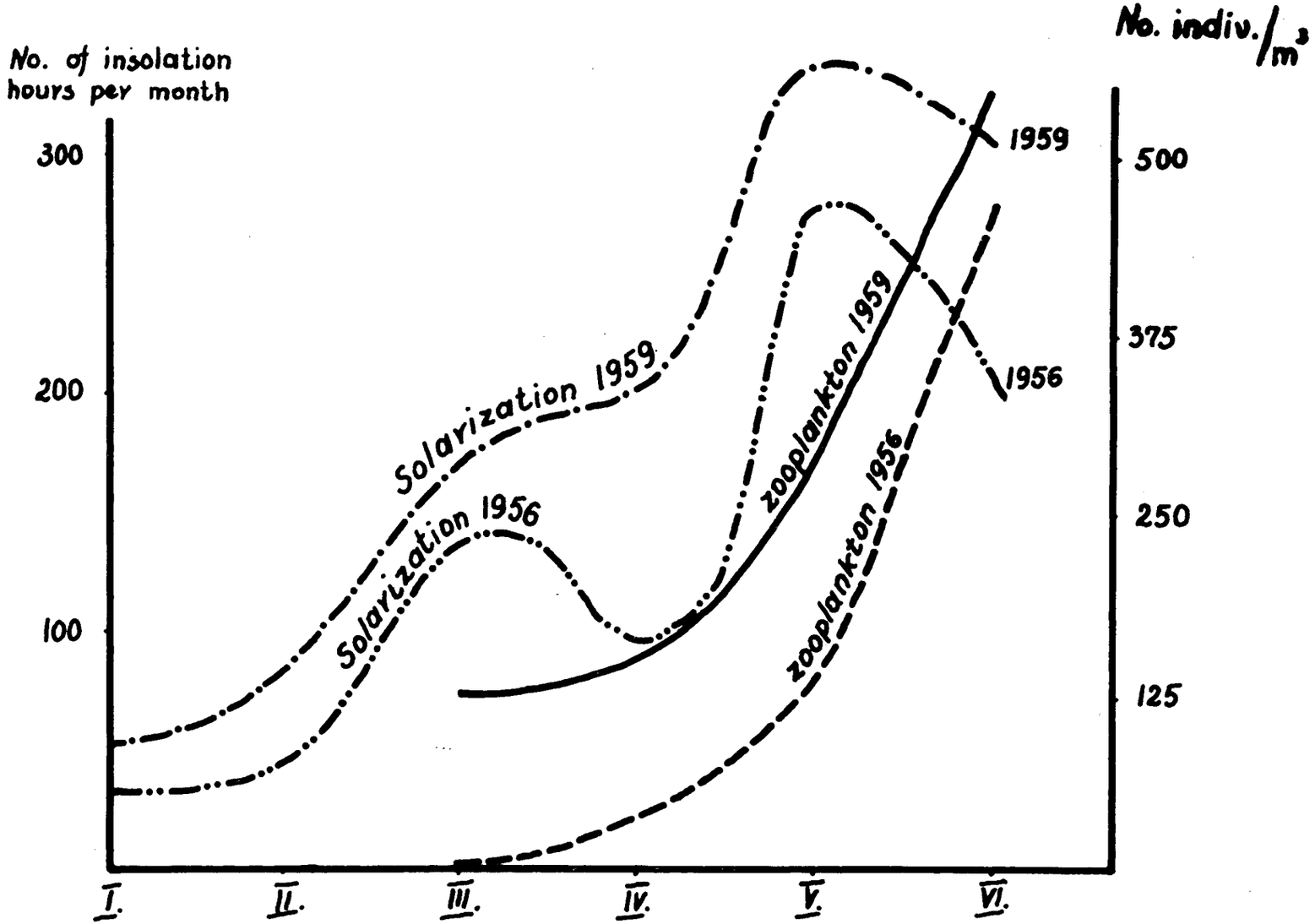

Figure 1. Relation between the insolation and the total number of microplankton individuals in 1956 and 1959.

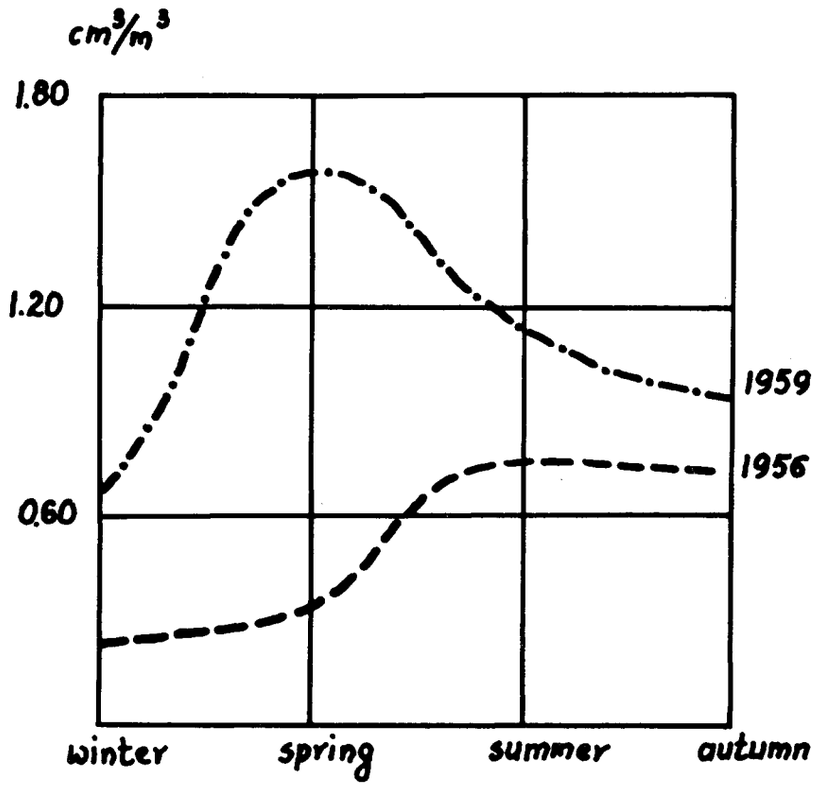

Figure 2. Seasonal variations in the biomass of microplankton in 1956 and 1959.

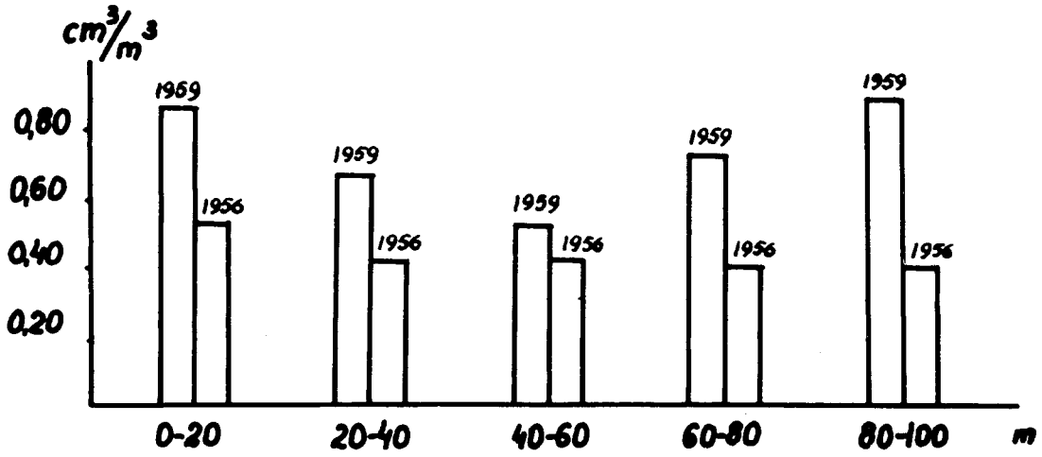

Figure 3. Distribution of biomass of microplankton in particular water layers in 1956 and 1959.

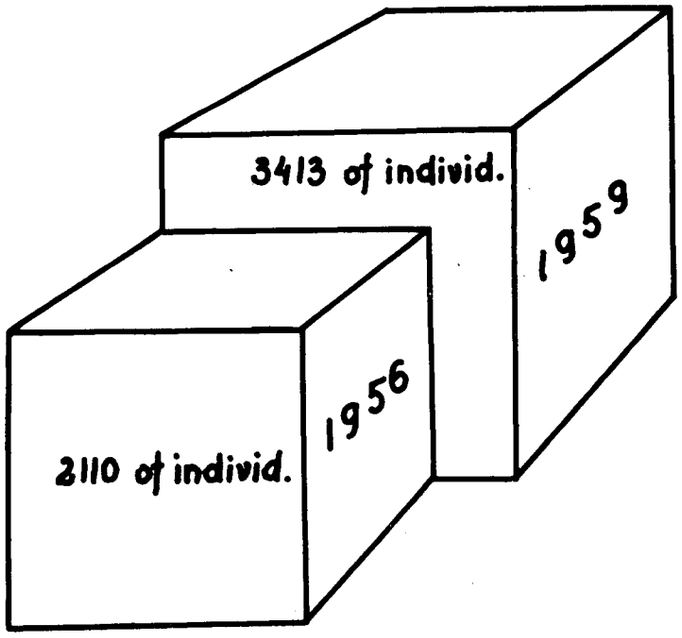

Figure 4. Mean number of individuals of all species oer 1 cm^3 of water in 1956 and 1959.

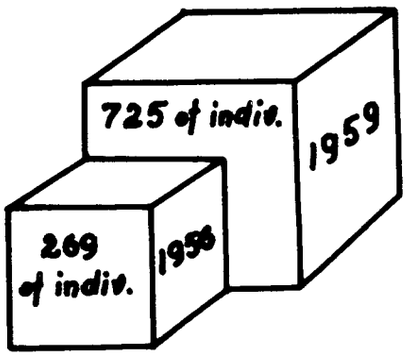

Figure 5. Mean number of the copepod Nauplii per 1 cm^3 of water in 1956 and 1959.

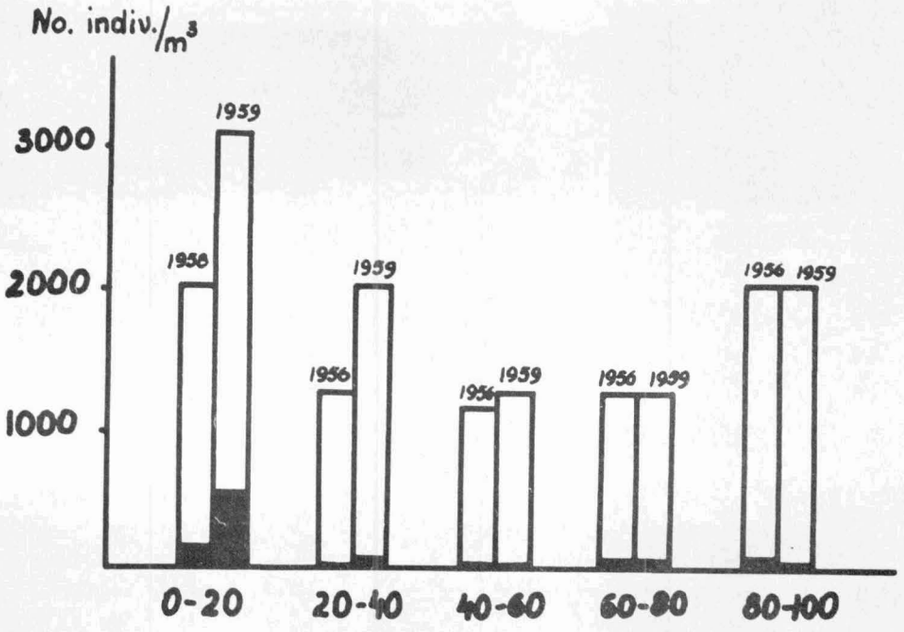

Figure 6. Vertical distribution of Cladocera and Copepoda in particular water layers in 1956 and 1959.

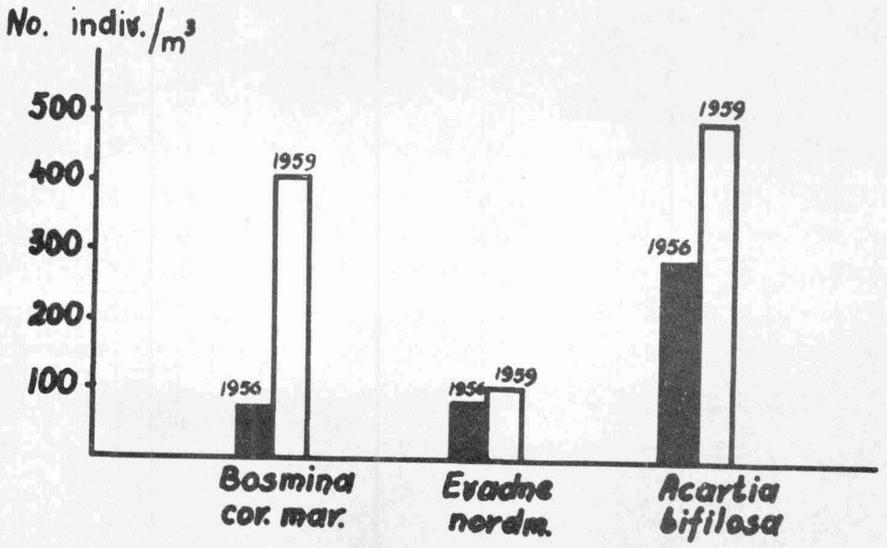

Figure 7. Occurrence of polythermic species in surface water layer (0 to 20 m depth) in 1956 and 1959.