

## New Indicator Species in the Baltic Zooplankton in 1972

T. Radziejewska, J. Chojnacki and J. Maślowski

Institute of Marine Resources Exploitation, Academy of Agriculture; Szczecin, Poland

### Abstract

The occurrence of zooplankton species, indicating a saline-water influx from the North Sea into the Baltic Sea in 1972, is described. Particular attention is paid to 8 species so far unknown in this region (*Ectopleura dumortieri*, *Rosacea plicata*, *Tomopteris kefersteini*, *Aetideus armatus*, *Centropages typicus*, *Eucalanus elongatus*, *Metridia lucens*, *Electra pilosa*). The appearance of these zooplankters in the Southern Baltic Sea is discussed in relation to the hydrographic changes taking place in this area in 1972. Based on these data, assessments are made regarding the intensity of dynamic exchange processes in the Baltic and North Atlantic waters in 1972.

### Introduction

The hydrography of the Baltic Sea exhibits many specific features, including influxes of North Sea waters of salinities greater than its own (Głowińska, 1967; Filarski, in preparation). Each influx causes a change in the actual hydrographic regime of the Baltic waters, increasing the salinity of the bottom layers, changing their temperature and improving their oxygen conditions. The planktonic fauna of the Baltic Sea, impoverished in species number, is also affected by such influx. The inflowing waters introduce

a number of typically marine planktonic organisms, normally absent from the Baltic Sea area. Most of these organisms are inhabitants of North Sea and Atlantic Ocean waters. Since they are observed in the Baltic Sea only under the circumstances described above, Mańkowski (1960, 1962) regarded them as biological indicators of water influx. In planktonic studies carried out in the Southern Baltic area (e.g. Mańkowski, 1951, 1955, 1959; Segerstråle, 1957; Ciszewski, 1962; Friman and Krievs, 1964; Siudziński, 1966; Drzycimski *et al.*, 1972) they are treated as a special group.

The present paper describes the occurrence of the indicator species in 1972. Special attention is paid to species recorded in the Baltic Sea for the first time.

### Material and Methods

The indicator species examined were recorded in plankton samples taken during studies on the quantitative and qualitative composition of plankton in the Gdańsk Deep and on the ecology of the Southern Baltic zooplankton. The samples were collected at

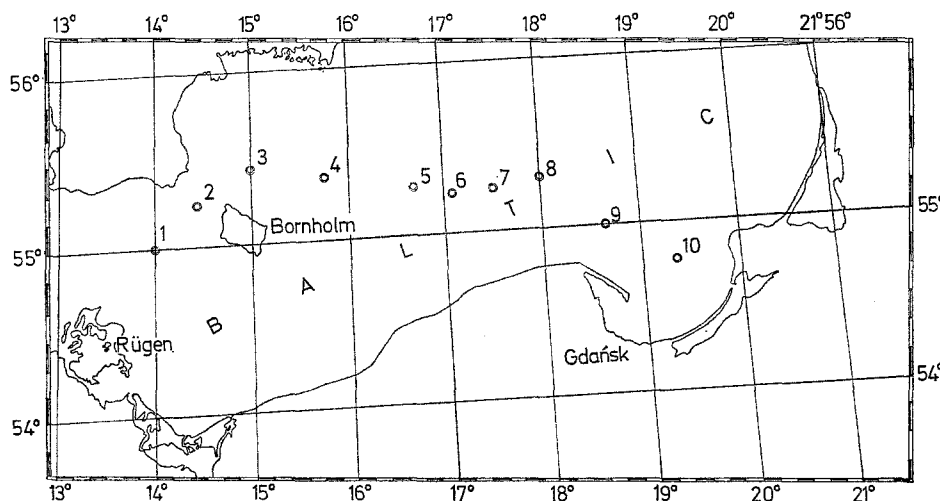


Fig. 1. Station locations within region investigated. Distribution of stations within Southern Baltic deeps: Station 1: Arkona Deep; Stations 2—4: Bornholm Deep; Stations 5—8: Słupsk Trough; Stations 9—10: Gdańsk Deep

permanent research stations running along the transect of the Southern Baltic Sea (Fig. 1). For sampling, Nansen nets were used once in each season (in February, May, August, and November, 1972) and Nansen bottles at 2 to 3-week intervals throughout the whole year.

The hydrography of the Southern Baltic Sea was observed synoptically at the same stations (Filarski, in preparation).

## Results and Discussion

### *Biological Indicators in the Southern Baltic Sea in 1972*

The samples collected contained the following species, not usually present in the Baltic fauna: *Ectopleura dumortieri* (van Beneden) (Hydromedusae), *Hybocodon prolifer* Agassiz (Hydromedusae), *Stenstrupia nutans* (M. Sars) (Hydromedusae), *Rosacea plicata* Bigelow (Siphonophora), *Tomopteris kefersteini* Greef (Polychaeta), *Aetideus armatus* (Boeck) (Copepoda: Calanoida), *Calanus finmarchicus* (Gunner) (Copepoda: Calanoida), *Centropages typicus* Kröyer (Copepoda: Calanoida), *Eucalanus elongatus* Dana (Copepoda: Calanoida), *Metridia lucens* Boeck (Copepoda: Calanoida), *Electra pilosa* L. (Bryozoa), *Sagitta setosa* J. Müller (Chaetognatha), *Oikopleura dioica* Fol (Appendicularia).

Mańkowski (1960, 1962) published a list of indicator species found in the Southern Baltic zooplankton during the years 1900–1960. The comparison of his list with that given above reveals that 8 species out of the 13 mentioned above had not been noted in the zooplankton of the Baltic Sea before, i.e., *Ectopleura dumortieri*, *Rosacea plicata*, *Tomopteris kefersteini*, *Aetideus armatus*, *Centropages typicus*, *Eucalanus elongatus*, *Metridia lucens*, *Electra pilosa*.

### *Hydrographic Conditions and the Occurrence of New Indicators*

Changes in the hydrographic conditions of the Southern Baltic waters in 1972 are now considered, in order to determine the factors which enabled these rare guests to appear in this region.

The hydrographic observations (temperature, salinity, oxygen content) indicate a saline water inflow into the Baltic Sea. The data obtained are presented in detail by Filarski (in preparation), hence a brief description will suffice. As will be seen, the hydrographic variations are paralleled by changes in the zooplankton composition.

Measurements and analyses made in winter (until the end of February, 1972) revealed only slight hydrographic changes in the bottom waters, i.e., local water movement and an increase in temperature. The presence of single specimens of *Ectopleura dumortieri* in the Arkona Deep was noted during this season.

The spring season introduced essential hydrographic changes, i.e., bottom-water salinity increased to 22 and 18‰ in the Arkona and Bornholm Deep, respectively. This indicated that large amounts of the North Sea waters had entered the Southern Baltic Sea; at the same time, a defined water mass from the Bornholm Deep had moved eastwards into the Shupsk Trough. These changes led to alterations in zooplankton composition: addition of the typical influx indicators *Oikopleura dioica*, *Sagitta setosa* and *Hybocodon prolifer* to the Arkona Deep, and of *Calanus finmarchicus* and *O. dioica* to the Gdańsk Deep. No new indicators were noted during this season.

The summer data on the Baltic water temperature, salinity, and oxygen content indicated a continuous eastward shift of the saline waters flowing from the west. Considerable hydrographic changes (rise in salinity, drop in temperature, and improvement of oxygen conditions) were particularly marked in the deep and bottom layers of the Gdańsk Deep. In the zooplankton, *Electra pilosa* was noted in the Arkona Deep as well as the most common indicator species *Oikopleura dioica*.

During the autumn-winter season of 1972, the inflow of water masses into the Western part of the Baltic Sea was intensified, as evidenced by the increased temperature and oxygen content in the bottom layers along the whole transect investigated. The salt content of this water did not undergo, in general, any changes, and remained at its previous high level. The zooplankton composition paralleled these changes, and indicator species were still present. Apart from the typical indicators, the following new species were noted in the Gdańsk Deep in November: *Rosacea plicata*, *Tomopteris kefersteini*, *Aetideus armatus*, *Centropages typicus*, *Eucalanus elongatus*, *Metridia lucens*. The latter species appeared also in December in the Arkona Deep.

Since the 8 species mentioned earlier were noted in the Baltic Sea fauna for the first time, it is important to consider biological features related to their distributions in their native Atlantic waters.

The new indicator-species group comprises forms of oceanic, mixed oceanic-coastal, and marine origin. *Ectopleura dumortieri*, *Tomopteris kefersteini* and *Aetideus armatus* normally live in the oceanic habitat of the North Atlantic Ocean (Russell, 1949; Vervoort, 1952; Muus, 1956), and the other oceanic forms, *Rosacea plicata* and *Eucalanus elongatus*, are regarded as components of the so-called "Lusitanian fauna" (Totton and Fraser, 1956; Raymont, 1963). The normal habitat of *Centropages typicus* and *Metridia lucens* is of mixed oceanic-coastal character (Fraser, 1962; Raymont, 1963), while the cyphonautes larvae of *Electra pilosa* belong to the marine zooplankton (Ryland, 1965).

Generally speaking, the new indicators were observed in the Southern Baltic Sea during the whole

of the year 1972, except the spring season. These species spread as far east as Gdańsk Bay. This proves that the 1972 influx was greater in intensity than influxes noted in the Southern Baltic area during several preceding years, when the biological influx indicators were found mainly in the Arkona Deep and Bornholm Basin, and occasionally in the Ślupsk Trough. Only rarely was the current of inflowing waters strong enough to introduce new zooplankton species into the Gdańsk Deep (Mańkowski, 1962). In 1972, however, the influx was stronger and wider-reaching, and a great many indicator species, including the new ones, were observed even in the Gdańsk Deep.

### Summary

1. Zooplankton samples collected during 1972 in the Southern Baltic Sea contained 13 species accompanying the saline-water influx from the North Sea into the Baltic Sea; 8 of these species were noted in this area for the first time: *Ectopleura dumortieri*, *Rosacea plicata*, *Tomopteris kefersteini*, *Aetideus armatus*, *Centropages typicus*, *Eucalanus elongatus*, *Metridia lucens*, *Electra pilosa*.

2. The new indicator species were present during almost every season (except spring) of 1972; their distribution range reached to the Gdańsk Deep, i.e., the eastern limit of the investigation area.

3. The species composition of the indicator fauna, as well as its wide range of distribution, indicated the influx to be of unusual intensity; this was confirmed by hydrographic data.

4. Normal distributions of the new indicators allow us to conclude that the water inflow into the Baltic Sea was of considerable intensity during 1972, and resulted in the introduction of forms normally living far away in the open Atlantic Ocean.

### Literature Cited

- Ciszewski, P.: Southern Baltic zooplankton [Polish, Engl. Summ.]. Pr. morsk. Inst. ryb. Gdyni 11A, 37—58 (1962).
- Drzycki, I., J. Chojnacki and M. Radziun: Ecology of the Southern Baltic zooplankton. In: Marine ecosystems, Vol. 2. Biology [In Polish]. pp 73—146. Ed. by K. Siudziński. Opracowania morsk. Inst. ryb. Gdyni 1972.
- Filarski, J.: Hydrographical changes in the Southern Baltic in 1972. [In preparation].
- Fraser, J. H.: Nature adrift. The story of marine plankton, 178 pp. London: G. T. Foulis & Co. 1962.
- Friman, S. O. and H. K. Krievs: Characteristics of zooplankton (Crustacea) in the Baltic and the Gulf of Riga in 1963 and some regularities of the population dynamics of the main Baltic zooplankton components. Int. Counc. Explor. Sea, C. M., Plankton Comm. 83, 1—5 (1964).
- Głowińska, A.: Studies on the Southern Baltic hydrographic conditions during 20 years of the People's Republic of Poland [Polish]. Studia Mater. morsk. Inst. ryb. Gdyni 4A, 53—81 (1967).
- Mańkowski, W.: Biological changes in the Baltic during the last fifty years [Polish, Engl. Summ.]. Pr. morsk. Inst. ryb. Gdyni 6, 91—118 (1951).
- Plankton investigations in the Southern Baltic in 1952 [Polish, Engl. Summ.]. Pr. morsk. Inst. ryb. Gdyni 8A, 197—230 (1955).
- Polish macroplankton observations in 1959. Annls biol., Copenh. 16, p. 83 (1959).
- Macroplankton as indicator of saline influx of North Sea waters into the Baltic. Annls biol., Copenh. 17, p. 90 (1960).
- Biological macroplankton indicators of the inflow of salty waters from the North Sea into the Baltic Sea [Polish, Engl. Summ.]. Przegl. zool. 6, 38—42 (1962).
- Muus, B. J.: Annelida, Polychaeta: Tomopteridae, Typhlocoleidae. Fich. Ident. Zooplancton 53, 2—5 (1956).
- Raymont, J. E. G.: Plankton and productivity in the oceans, 660 pp. Oxford: Pergamon Press 1963.
- Russell, F. S.: Hydromedusae: Tubulariidae. Fich. Ident. Zooplancton 2, 2—4 (1949).
- Ryland, J. S.: Polyzoa (Bryozoa). Cheilostomata: cyphonautes larvae, Membraniporidae. Fich. Ident. Zooplancton 107, 2—5 (1965).
- Segerstråle, S. G.: Baltic Sea. In: Treatise on marine ecology and paleoecology. Vol. 1. Ecology, pp 751—800. Ed. by J. W. Hedgpeth. Geological Society of America 1957.
- Siudziński, K.: Zooplankton of the Baltic Sea, the Vistula Firth and the Szczecin Firth as viewed on the background of variable conditions of salinity. Int. Counc. Explor. Sea, C. M., Plankton Comm. 8, 1—8 (1966).
- Totton, A. K. and J. H. Fraser: Siphonophora. Fich. Ident. Zooplancton 58, 2—4 (1956).
- Vervoort, W.: Crustacea, Copepoda: Aetideidae. Fich. Ident. Zooplancton 42, 2—3 (1952).
- First author's address: Miss T. Radziejewska  
Akademia Rolnicza  
Wydział Rybactwa Morskiego  
Instytut Eksploatacji Zasobów Morza  
71-550 Szczecin  
ul. Kazimierza Królewicza 3  
Poland