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ZOOPLANKTON SUCCESSION IN THE RIVER Odra ESTUARY

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Changes in the dominance structure of zooplankton in the river Odra estuary were studied over the years 1984–1988; samples were collected 4 times a year. Frequency distribution analysis of dominants and subdominants was carried out to outline a hypothetical pattern of succession in the area of study. The following filtrators were found to mainly influence the spatial structure of the zooplankton: *Daphnia cucullata*, *Bosmina coregoni* and *Bosmina coregoni maritima*, the advanced eutrophication of the estuary resulting in abundant food resources in the form of phytoplankton.

INTRODUCTION

The Szczecin Lagoon is the largest reservoir of organic matter in the River Odra estuary. Entering the Lagoon, the river Odra waters amounting annually to about 17 km<sup>3</sup> are subject to preliminary self-purification processes proceeding via the activity of micro-organisms, plankton, and benthos. A multidisciplinary study was conducted within 1984–1988 to determine the intensity of eutrophication in the Lagoon, using physical, chemical, and biological indices. The results obtained allowed to determine the extent of seasonal variations in hydrochemical factors which induce changes in, i.a. the composition and structure of zooplankton in the estuary.

The aim of the present work was to identify the zooplankton taxa participating in the seasonal succession, based on their densities and frequency of occurrence (Table 1).

Plankton samples were collected seasonally (4 times a year) over the period of 1984–1988 from 17 stations located along the river Odra and in the Szczecin Lagoon (Fig. 1).

Table 1

Species	1984	1985		1986			1987		1988	
	Sep. Nov	Apr. June	Sep. Nov.	Apr. June	Aug. Nov.	May July	Sep. Nov.	May June	Sep. Nov.	
<i>Acartia tonsa</i>										3.9
<i>Centropages hamatus</i>					1.8					
<i>Eurytemora hirundoides</i>	9.1		8.1 36.7							
<i>Acanthocyclops viridis</i>	20.7	85.1 21.4		57.7 9.9		44.0 3.7	2.2 3.3			
<i>A. vernalis</i>	8.9			24.0	12.0	11.9				
<i>Cyclops leuckartii</i>									16.1	
<i>Cyclops vicinus</i>				4.4						
<i>Cyclops lilljeborgi</i>									12.1 3.2	6.5
<i>Daphnia hyalina</i>	18.1									
<i>Daphnia cristata</i>					15.9					
<i>Daphnia longispina</i>		13.5		18.5						
<i>Daphnia culcullata</i>						16.4 16.4	15.0	37.1 52.3		
<i>Bosmina coregoni</i>		4.2	54.6 18.7		30.5 60.9	23.4 25.6	21.8			
<i>Bosmina coregoni coregoni</i>								16.6		
<i>Bosmina coregoni maritima</i>	51.9				21.4					14.0
<i>Bosmina longirostris longirostris</i>									9.5	14.6
<i>Bosmina longirostris cornuta</i>	17.1	30.9						5.5		
<i>Chydorus sphaericus</i>			21.5	23.3	18.5		38.8			

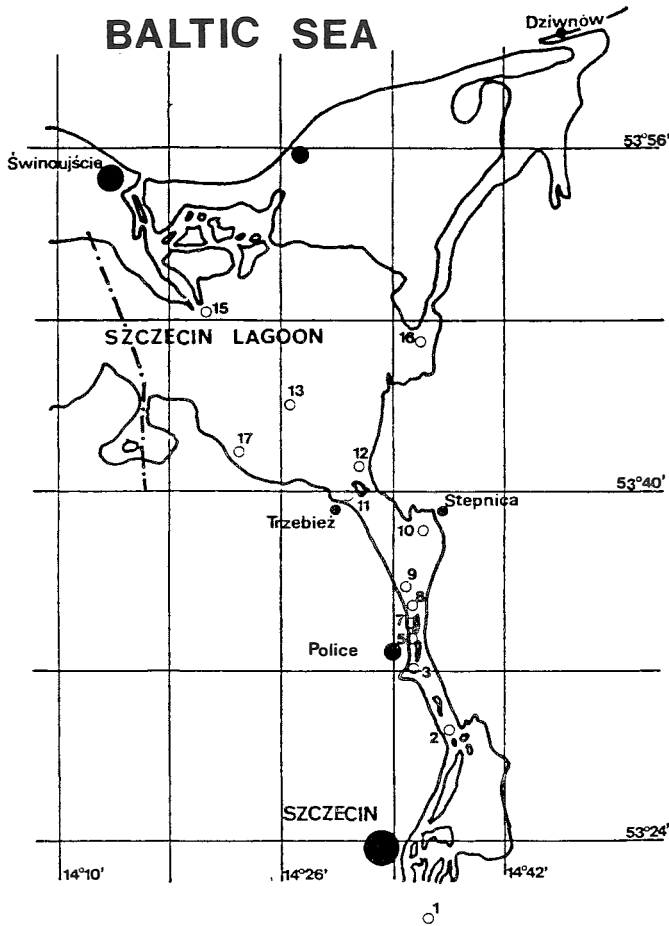


Fig. 1. Sampling sites in the River Odra estuary

## MATERIALS AND METHODS

Samples were collected with a 25 cm diameter 16 xxx mesh size Bongo net. The samples were preserved in 4% formaldehyde. Zooplankton densities (no. ind./m<sup>3</sup>) were calculated according to formulae given in Anonymus (1968), Chojnacki (1984), and McEvan and Johnson (1954) and subsequently used as complementary data in the analysis of succession pattern. Mean frequencies of different taxa from 14 stations were calculated for each season; the data obtained served to hypothesize on the seasonal zooplankton succession in the river Odra estuary.

## RESULTS

The seasonal succession in zooplankton community in the river Odra mouth area and in the Szczecin Lagoon was followed within 1984–1988 against the background of strong variations in the composition and abundance of zooplankton of the area.

Succession series were formed by 65 taxa of holoplanktonic animals, mostly fresh-water forms. Brackish water species appeared occasionally in the Szczecin Lagoon following storms, but disappeared shortly afterwards. A general pattern of the seasonal succession in the zooplankton is shown in outline in Fig. 2. Sampling sites having the highest mean frequency of maximum densities in each season are presented in Table 2.

In spring, omnivores were concentrated in the river Odra mouth area (Station 7, Policki Channel). Herbivores and carnivores strongly dominated in the area (most frequently at Stations 15 and 16) from June until September. In the final period of the seasonal succession, herbivores and carnivores mostly were recorded in the Odra mouth area (Station 8, Jasienicki Channel) (Fig. 2; Table 2).

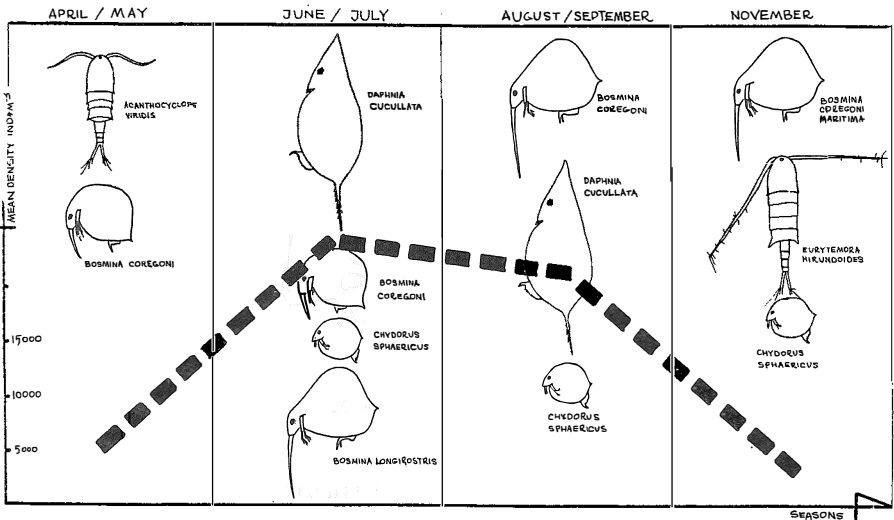


Fig. 2. Mean densities of zooplankton and the pattern of seasonal succession

## DISCUSSION AND CONCLUSIONS

In offshore and inshore waters of the Southern Baltic, the Copepoda dominate during cool seasons of the year, cladocerans taking over in summer (Chojnacki 1984). This finding is in contrast to the succession pattern found in the Odra estuary, the pattern being related to changes in phytoplankton concentrations (Chojnacka unpubl.

Table 2

Sampling sites in the river Odra estuary where the highest mean frequency of maximum densities was recorded (see Fig. 2)

Spring	Late spring	Summer	Autumn
Policki Channel Sta. 7	Piastowski Channel Sta 15	Skoszewska Bay Sta 16	Piastowski Channel Sta 15 Jasienicki Channel Sta 8

manuscript; Chojnacka et al. unpubl. manuscript). In spring, copepods (mostly *Acanthocyclops viridis*) dominated in the whole estuary, *Bosmina coregoni* being a subdominant. In summer, cladocerans *Daphnia cucullata* and *B. coregoni* were dominants, with *Chydorus sphaericus* and *B. longirostris* as subdominants. The cladoceran domination (*B.c. maritima*) was maintained in autumn, copepods (*Eurytemora hirundoides*) acting as subdominants.

A diagram of changes in the mean abundance of zooplankton (Fig. 2) shows the highest abundances to occur at a time when cladocerans were dominants. It can be inferred from Table 2 and Fig. 2 that the Szczecin Lagoon is the major collector of the autochthonic zooplankton biomass within the whole estuary.

In comparison with results of studies on the Szczecin Lagoon carried out in 1950's (Świerzawska-Wiktorowa 1957) it can be said that the taxonomic structure of the Lagoon's zooplankton changed markedly, the carnivorous copepods and small filtration-feeding rotifers dominating in the zooplankton in the 50's. On the other hand, changes in carrying capacity of the estuary must have changed slightly only as the total zooplankton densities found in the 80's were similar to those in the 50's (Chojnacki and Gruszka unpubl. manuscript). The domination of the filtration-feeding crustaceans in the zooplankton community is most probably related to the extraordinarily high densities of phytoplankton in the estuary (Chojnacka et al. unpubl. manuscript).

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