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LONG-TERM CHANGES IN THE BOTTOM MACROFAUNA OF THE PUCK LAGOON

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Since mid-1970s, benthic communities in the Puck Lagoon have been subject to considerable adverse changes. Firstly, a marked reduction of underwater meadows and phytal invertebrate communities appeared, accompanied by changes in fish fauna. Biomass of the macrozoobenthos increased as a result of increasing inflow of allochthonous organic matter and progressing siltation of the bottom. The bivalve biomass increased, while that of the Crustacea, Gastropoda, larval Insecta, and Nemertini decreased.

INTRODUCTION

The bottom of the Puck Lagoon, the western part of the Gulf of Gdańsk, used to be overgrown with luxuriant benthic vegetation until early 1970s. Multispecies vegetation of the underwater meadows consisted of, i.a. *Furcellaria lumbricalis, Fucus vesiculosus,* and several species of the *Characeae.* The meadows were inhabited by abundant and diverse invertebrate communities and ichthyofauna preferring phytal biotopes (Żmudziński 1967). In about mid-1970s, environmental degradation of the meadows in terms of reduction of their species richness and spatial cover began (Błędzki and Kruk-Dowgiałło 1983). A number of algal species disappeared from the Puck Lagoon, e.g. *Furcellaria lumbricalis* and *Fucus vesiculosus.*

The originally two-tier underwater meadows, with *Zostera marina* and other vascular plants in the top tier and *Furcellaria lumbricalis* and *Fucus vesiculosus* in the bottom tier, gave way to single-story meadows with *Zannichellia palustris* as a dominant species (Kruk-Dowgiałło 1991).

Ecological degradation of the underwater meadows in the Puck Lagoon resulted in changes in animal communities, especially in the phytal macrozoobenthos and fish fauna.

MATERIALS AND METHODS

Samples of benthic macrofauna were collected at 12 stations in summer 1987. At every station, 2 samples were collected with an 0.02 m^2 van Veen grab. Each sample was sieved through an 0.5 mm mesh size sieve. The benthos samples were preserved in 4% borax-buffered formaldehyde. Average abundances and wet weights of the animals were calculated; bivalves were weighed with shells.

RESULTS AND DISCUSSION

The paper compares results of studies carried out by Żmudziński (1967), Legeżyńska and Wiktor (1981), and the authors in 1962, 1977, and 1987, respectively. A considerable increase in average biomass of macrozoobenthos, occurring from early 1960s until late 1980s was observed. The increase is related mainly to a progressing siltation of the bottom caused by inflowing allochthonous organic matter. In the 1960s, sandy bottoms prevailed in the Lagoon, while at present the bottom is covered by a layer of particulate organic matter. In early 1960s, up to 60% of the Lagoon's area were

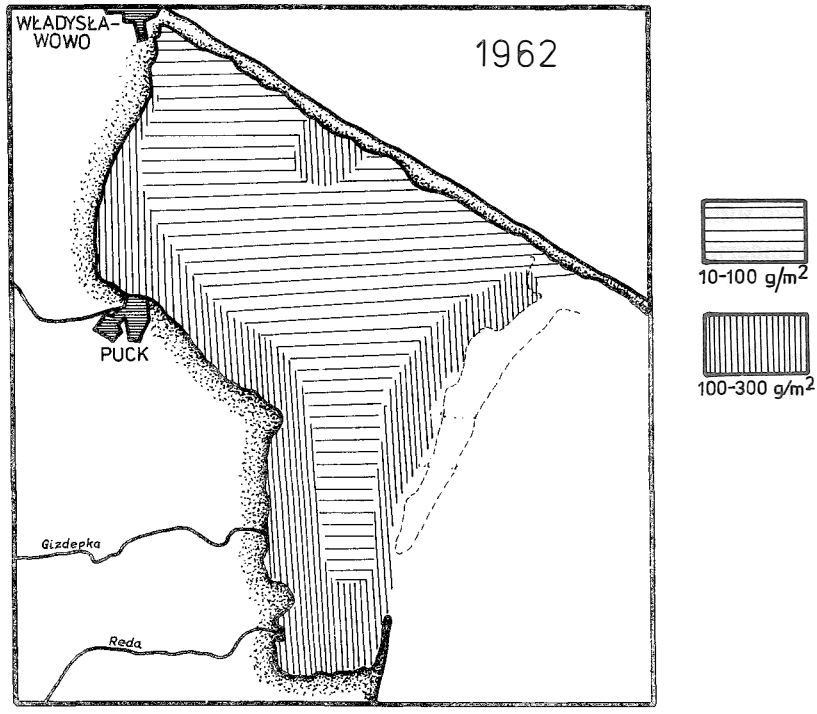

Fig. 1. Distribution of macrozoobenthos biomass in the Puck Lagoon in 1962 (after Żmudziński 1967)

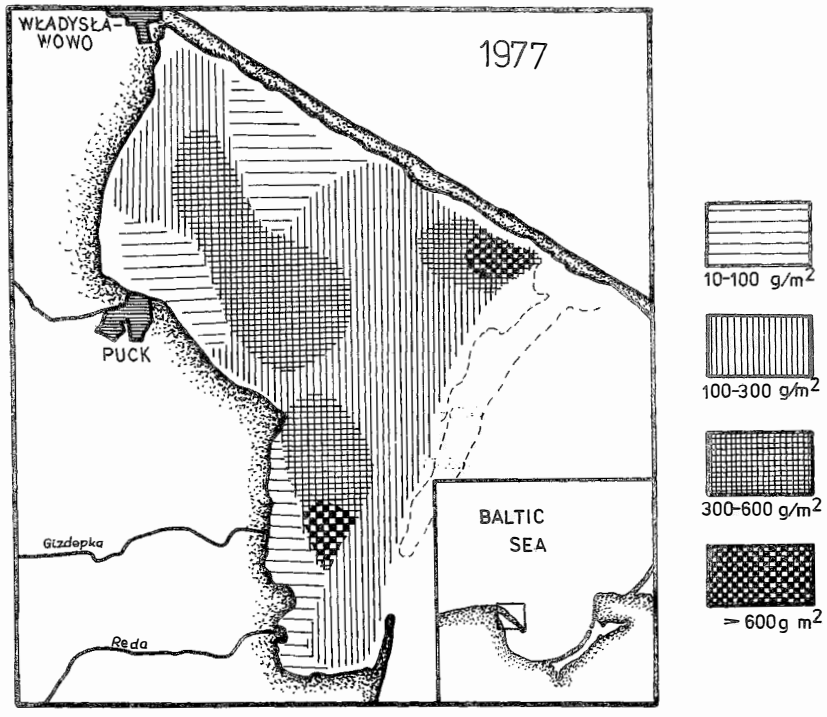

Fig. 2. Distribution of macrozoobenthos biomass in the Puck Lagoon in 1977 (after Legeżyńska and Wiktor 1981)

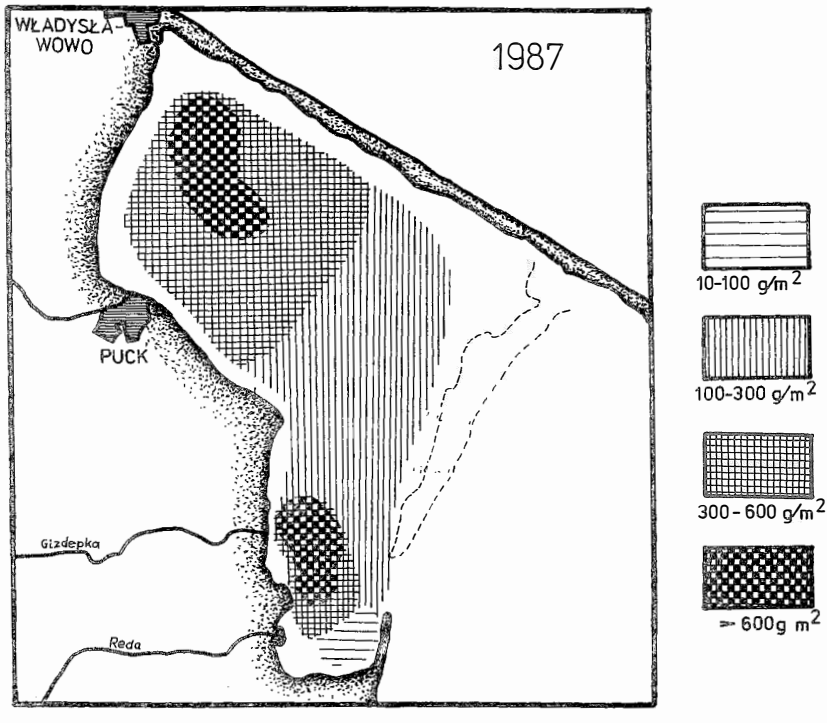

Fig. 3. Distribution of macrozoobenthos biomass in the Puck Lagoon in 1987

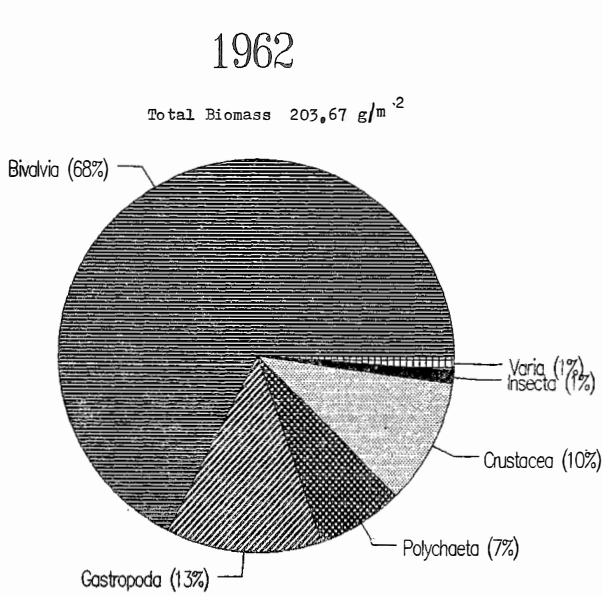

Fig. 4. Partitioning of macrozoobenthos biomass in the Puck Lagoon in 1962 (after Żmudziński 1967)

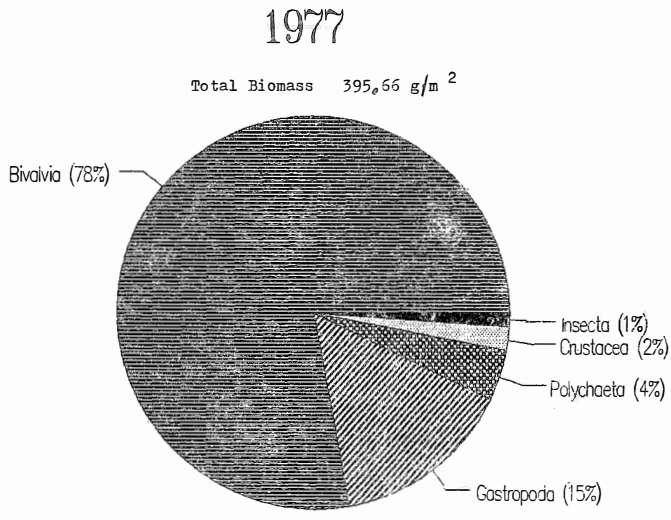

Fig.5. Partitioning of macrozoobenthos biomass in the Puck Lagoon in 1977 (after Legeżyńska and Wiktor 1982)

inhabited by macrofauna the biomass of which was less than 100 g/m^2, the maximum biomass values not exceeding 300 g/m^2 (Fig. 1). The percentage of the bottom area with biomasses of less than 100 g/m^2 decreased to below 20% in the second half of the 1970s; at the same time, some parts of the bottom housed macrofauna with biomasses exceeding 600 g/m^2 (Fig. 2). A further increase in the macrozoobenthos biomass was observed in the second half of the 1980s (Fig. 3).

Table 1

Mean biomasses and total biomass percentages of the bottom fauna in the Puck Lagoon

Year	1962 (Żmudziński 1962)		1977 (Legeżyńska and Wiktor 1981)		1987 (this study)	
Taxon	g/m^2	%	g/m^2	%	g/m^2	%
Bivalvia	137.50	67.6	308.74	78.2	322.92	81.61
Gastropoda	26.17	12.8	60.95	15.5	28.64	7.24
Polychaeta	15.00	7.3	13.95	3.5	38.86	9.82
Crustacea	20.60	10.2	9.44	2.4	4.35	1.09
Insecta	2.40	1.2	1.85	0.4	0.17	0.04
Oligochaeta	0.70	0.3	0.10	–	0.58	0.15
Nemertini	1.00	0.5	–	–	0.11	0.03
Varia	0.30	0.1	0.60	–	0.05	0.01
Total	203.67	100	395.66	100	395.68	100

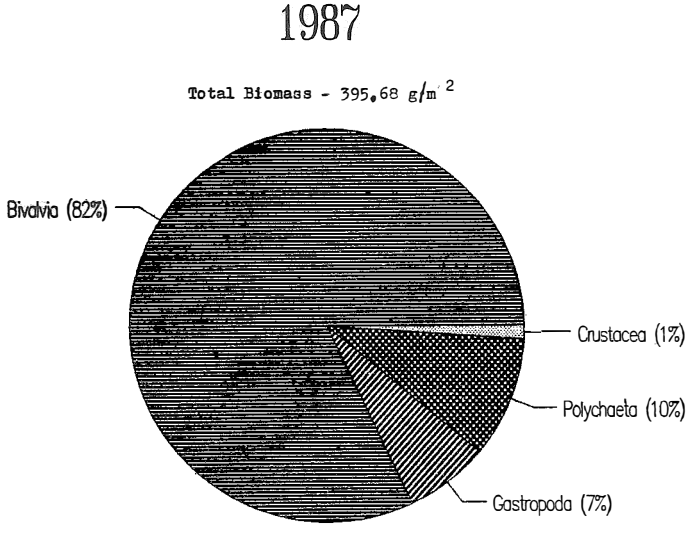

Fig. 6. Partitioning of macrozoobenthos biomass in the Puck Lagoon in 1987

The contribution of bivalves to the biomass showed a progressive increase, while a substantial decrease in the crustacean and gastropod contributions was observed at the same time. The contribution of larval insects and Nemertini to the biomass diminished remarkably, too (Table 1; Figs 4–6). The polychaete contribution to the biomass has remained at a more or less unchanged level.

Throughout the period of study, 3 bivalve species, i.e. *Macoma balthica, Mytilus edulis,* and *Mya arenaria* contributed most to the biomass, while 2 gastropod species (*Hydrobia ventrosa* and *H. ulvae*) contributed most to the abundance.

Environmental degradation of the underwater meadows of the Puck Lagoon resulted in a considerable decline in the abundance and biomass of the phytal invertebrate and verterbrate communities. Invertebrates are represented mainly by crustaceans (of the genera *Heterotanais, Idotea, Asellus, Jaera, Leptocheirus,* and *Palaemon*) and fishes by the genera *Esox, Nerophis, Syngnathus, Pungitius, Spinachia,* and others.

Of the commercially important fish, the once-predominant pike (*Esox lucius*) was replaced by the roach (*Rutilus rutilus*) which is of little commercial value only.

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