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DYNAMICS OF CHIRONOMUS F.L.SEMIREDUCTUS IN THE CURRISH LAGOON OF THE BALTIC SEA

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ABSTRACT

Dynamics of Chironomus f.l.Semireductus biomass in the Currish Lagoon during 1987-1993 is presented. The impact of abiotic (temperature) and biotic (pressure of benthophagous fishes) factors upon the annual dynamics of Chironomus biomass in the lagoon is discussed. The conclusion is made on the existance of a positive correlation between Chironomus biomass and water temperature in the lagoon; and negative one between the former and benthophagous fishes biomass. With respect to Chironomus distribution in the area, the decrease of biomass is found in the areas of high anthropogenous impact.

INTRODUCTION

Currish Lagoon of the Baltic Sea is one of the large and highly productive inland basins of the eastern coast. It is of a right-angled triangle shape, extended to about 97 km from the north southwards. The Lagoon area amounts to 1584 km^2 (Gudelis, 1959). The grounds are mainly silty or sand-silty. The Currish Lagoon belongs to highly productive basins with regulated fishery and is of great importance for fishery. Major fishery objects are benthophages, while bream (Abramis bramal) is the dominating species. The catch of the latter amounts to 1200 t in average. Demersal organisms are the major food items of benthophages fishes. Chironomus f.l. semireductus is the main food item of a bream. Chironomidae constitutes 90% of its total food consumption. (Kozlova, Panasenko, 1977). Besides control of commercial fishes stocks state AtlantNIRO monitors the benthophages forage resources. The task is to study the long-term dynamics of Chironomidae biomass in the Currish Lagoon and to reveal factors, affecting it.

MATERIALS AND METHODS

Material used in the work was collected by the scientists of Laboratory of Lagoons and the author at 20 stations, evenly distributed over the Lagoon area during research cruises of the vessel of RK-class in 1987-1992. Totally 523 samples were collected. Sampling was performed from March to October by means of Petersen's bottom-drag with cover area of 0.025 s .m. Samples were rinsed in netting bags, made from a mill's gause with mesh size 0.5 mm. Samples of invertebrates were collected from alive material in field conditions. Then samples were fixed in 4% solution of formaline. All subsequent treatment was carried out in the laboratory. Species identification was performed visually and under binocular (Pankratova, 1975; Chernovskiy, 1949; Borutskiy, 1960). Chironomides were measured individually and weight was estimated by means of a group method at torsion scales to the nearest 1 mlg. Abundance and biomass were calculated per 1 s .m. of bottom. Data on water temperature in the Currish Lagoon were available from Hydrometeorological service of Kaliningrad.

RESULTS AND DISCUSSION

Benthos of the Currish Lagoon is represented mainly by 3 groups of organisms such as chironomides, oligochaeta and molluscs. "Soft" benthos predominates: chironomidae - 70%, oligochaeta - 30%. Chironomides larvae constitute a significant component of benthos. Chironomus f.l.semireductus is the most common and abundant form. Most dense aggregations occure in south-western area of the Lagoon. In some periods its biomass amounts to 40 g sg.m. Five biocenosis are found in the Lagoon. They are Chironomus f.l.semireductus, Dressena polimorpha, Valvata piscinalis, Ostracoda, Polychaeta (Aristova, 1971). Chironomides distributes over entire Lagoon area and occures in all biocenosis.

Seasonal dynamics of chironomides biomass was studied on the basis of long-term material. Biological spring in the Lagoon continues from March when the ice-cover is broken, to May (Gudelis, 1958). Water temperature varies from 1.3° to 14°C later in the season (Fig. 1). This period is characterized by intense reproduction of bottom invertebrates. Average chironomides biomass in spring amounts to 12.1 g/sg.m. Biological summer continues from June to early September. Water temperature during summer varies from 16° to 20°C. Decrease of benthos biomass (Fig. 1), associated to chironomides cycle, is observed during the above period from the end of May. During this period transfer of larvae into pupae and abundant flight-out of imago are observed. After spawning in July chironomides biomass is recovered due to high growth rate of new generation. In the Currish Lagoon two flight-outs of chironomides are observed. The first one (full) is from middle of May at temperature of 18°C, the second one (partial) in July. After the first flight-out chironomides biomass decreases by about 70%. In the years of cold and late spring flight-out of chironomides delays till the second-third decade of June. A new generation has no time to grow and prepare to the second flight-out, and stay for wintering which negatively affects the state of forage benthos in the next year. Biomass decrease is observed also in the years of cool summer when the young individuals growth is delayed. Biological fall is continued from the middle of September to November. Average monthly temperature decreases to 9°C in October. In September the benthos biomass decreases as compared to that in August, due to its consumption by fishes. (Fig. 1). In October chironomides biomass increases (Fig. 1) due to fish feeding rate decrease (Kozlova, Panasenko, 1977). Bottom invertebrates reproduction is finished and larvae growth continues. Increament of benthos during the fall significantly exceeds losses due to consumption by benthophages. Seasonal variations of benthos biomass were mainly defined by biomass variations of chironomides, the dominating group. During major flight-out of imago in summer a sharp decrease of total benthos biomass is observed. Besides fish feeding pressure also has significant effect. Therefore, seasonal dynamics of chironomides in the Currish Lagoon show spring and summer biomass peaks. Maximum biomass is observed in August (22.8 g/m^2).

In long-term dynamics of chironomides in the Currish Lagoon three peaks were observed in 1989, 1990 and 1992 which define the total benthos biomass peaks (Fig. 2). During this period chironomides biomass amounted to 15.8, 21.1 and 14.5 g/sg.m., respectively. In 1987 and 1988 the minimum biomass value was observed (4.9, 6.9 g/sg.m). Average biomass of chironomides during the above period (1987-1992) amounted to 12.1 g/sg.m.

The regression analysis of abiotic and biotic factors effect on the chironomides biomass dynamics in the Currish Lagoon is performed. Average monthly spring (March-May) and annual water temperatures were used as independent variables. Feeding pressure of benthophage fishes (bream) was considered as a biotic factor. Bream stock size is used as an indicator of fish feeding pressure, as the former appears the major consumer of chironomides.
The exponential function $y = \exp(a + bx)$ (Table 1) defines most likely approximation of chironomides biomass and water temperature relation and fish feeding pressure. Correlation coefficient (g) of chironomides biomass and average annual water temperature is a positive one and amounts to 0.97, and that for spring temperature g=0.98 (Table 1). Dynamics of chironomides biomass is strongly affected by the negative impact of fish pressure.

(g = -0.75). Thus dynamics of chironomides biomass in the Currish Lagoon is mostly affected by spring water temperature and benthophage fishes pressure. Regression of chironomides biomass may be used to predict chironomides biomass in the Currish Lagoon for the current year.

CONCLUSION

1. Forage benthos in the Currish Lagoon is represented mainly by "soft benthos" - chironomides (70%) and oligochaetes (30%).

2. Two peaks of chironomides biomass are observed in seasonal dynamics, one in April and second in August.

3. Long-term average biomass of chironomides for a vegetation period amounts to 12.1 (from 4.9 to 21.1 g/sg.m).

4. Spring and long-term average water temperature have a positive impact on the long-term chironomides dynamics in the Currish Lagoon (r = 0.98 and 0.97, respectively).

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Table 1

Parameters regression equations y = exp (a + bx), related biomass of chironomides with environmental factors in the Currish Lagoon

Environmental factors	Coefficients of equation		Coefficients of correlation
	a	b	r
T_1^oC III-V	-0.221	0.335	0.98
T_2^oC I -XII	-3.3321	0.617	0.97
Fish pressure	3.954	-0.092	-0.75

Note: T_1^o CIII-V - water temperature in March-May

T_2^o C I-XII - average long-term water temperature

LEGEND

Figure 1. Long-term dynamics of benthos in the Currish Lagoon.

Legends: - biomass ($g\ m^{-2}$)

N - bream stock (mln individuals)

Numbers: 1 - total benthos biomass

2 - biomass of Chironomus f.l.semireductus

3 - bream stock

4 - average long-term water temperature

5 - water temperature in spring

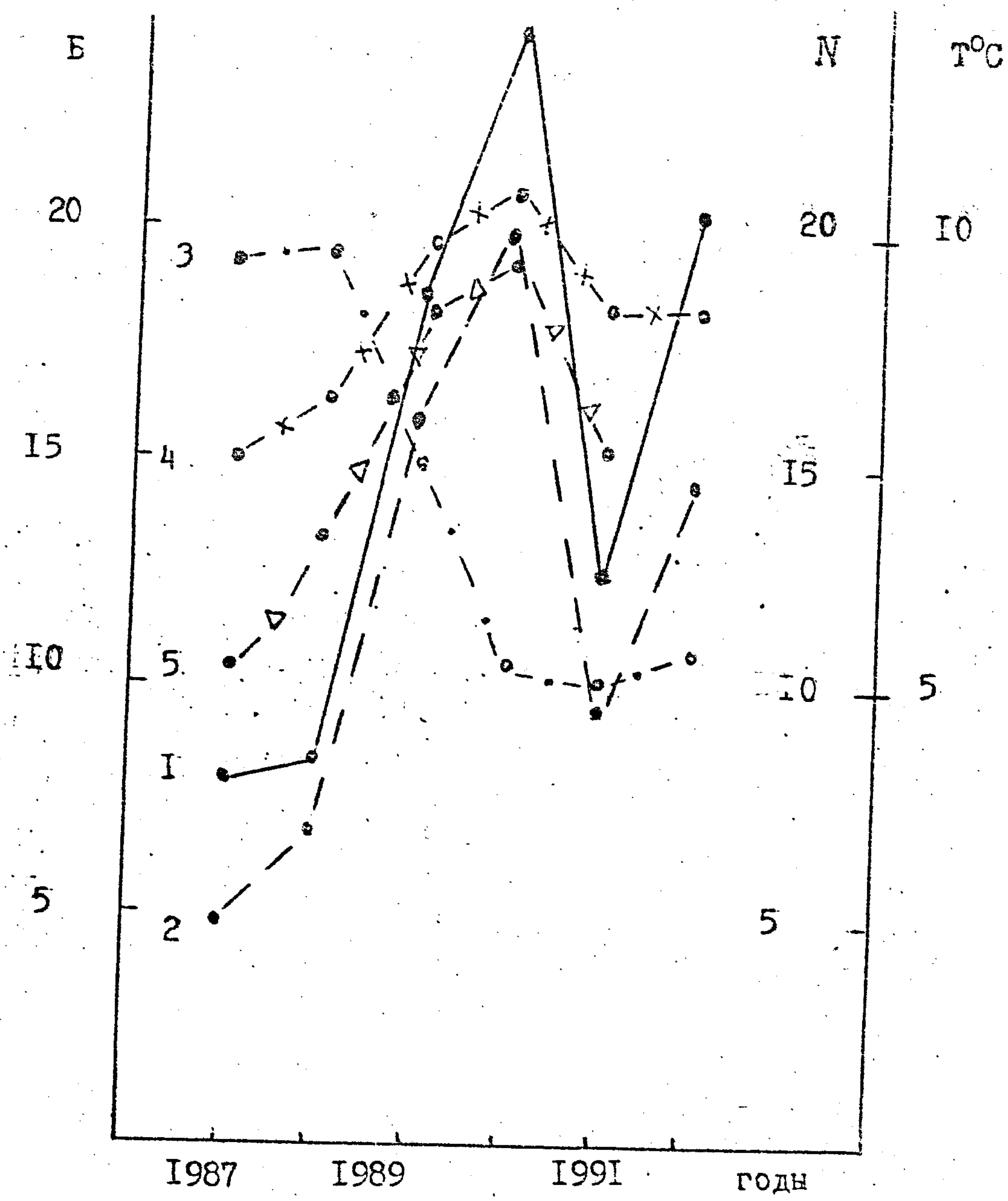

Fig. 1