

3.13 Species composition, ecology, population structure and seasonal dynamic of zooplankton from tundra water basins in the Lena Delta

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3.13.1 Objectives

Information concerning pelagic fauna of the lakes and rivers at extreme latitudes in the Russian Arctic is still limited, and the Lena Delta is no exception. Investigations of zooplankton in the Lena Delta started at the beginning of the XX century, during Russian Polar expedition 1901-1903. However, the knowledge about the structure and functioning of zooplankton community in this big region is insufficient numbering only several papers (Rylov, 1928; Bening, 1942; Urban, 1949; Pirozhnikov & Shulga, 1957; Pirozhnikov, 1958; Botvinnik & Vershinin, 1958; Ammosov, 1961; Kerer, 1968; Serkina, 1969, Sokolova, 1984, Abramova, 1996; Stepanova & Abramova, 1997; Abramova & Sokolova, 1999; Gukov, 2001; Akhmetshina & Abramova, 2002) that offer certain information about species composition and abundance of zooplankton from some parts of the Lena Delta. Generalization of the special investigations is still lacking. This primarily concerns seasonal variations in the structure of zooplankton assemblages.

In the present study, we examined the zooplankton assemblages in channels, terrace lakes, big and small thermokarst lakes from the different regions in the Lena Delta. The data on species composition, distribution, population structure, and seasonal dynamic of zooplankton abundance in relation to water temperature were analyzed.

3.13.2 Materials and Methods

In July – September 2002, 75 quantitative and qualitative zooplankton samples were collected as a part of biological investigations in the Delta-2002 expedition. The samples were obtained in water basins of different type on the Samoilovskii, Tit-Ary, Amerika-Khaya, and Buor-Khaya islands in the Lena Delta (Table 3-27). Regular investigations were carried out on the Samoilovskii Island only.

Table 3-27. Location and number of zooplankton samples.

	Samoilovskii	Tit-Ary	Amerika-Khaya	Buor-Khaya
Oleneskaya channel	9			
Terrace lake	13	5		
Big thermokarst lake	4	3		
Deep polygon without plants	10			
Shallow polygon with plants	9	2		2
Crack between two polygons	9			
Alass			4	5

Sampling was performed by filtering of 100 liters of water through a 100 μm meshsize net with periodicity of 5-10 days and fixation with 70% alcohol. The whole sample or its part was studied in the Bogorov's camera under microscope, and the abundance of organisms was calculated. We determined species, sex and moulting stages. The data were recalculated to 1 m³ of water. Water temperature was measured simultaneously with plankton sampling.

3.13.3 Preliminary results

Species composition

In the water pools of the Lena Delta, 106 taxa of zooplankton belonging to 2 types (Rotatoria and Arthropoda) were determined: Rotatoria – 61 taxa, Arthropoda, subclass Crustacea – 45 species, among them: Copepoda – 30 species (Cyclopoida – 14, Calanoida – 14, Harpacticoida – 2), Cladocera – 13, Phyllopora – 2 (Appendix 3-14). There are well-manifested differences in species composition in water basins of different types. The highest species diversity was recognized in the terrace lake on the Samoilivskii Island (54 taxa), and the lowest species diversity was determined in the alas on the Amerika-Khaya Island (11 taxa). Zooplankton species composition was clearly dominated by Rotatoria. The latter reached maximum diversity in the channel, terrace lakes, and alases, where they constituted up to more than 60% of the total species richness (Fig. 3-57). Copepoda (about 45% of the total species number) and two species of Phyllopora were the main component of zooplankton in the polygon lakes. Cladocera was widely distributed in all types of water pools, especially *Chidorus sphaericus*, but species diversity of this group was comparatively low.

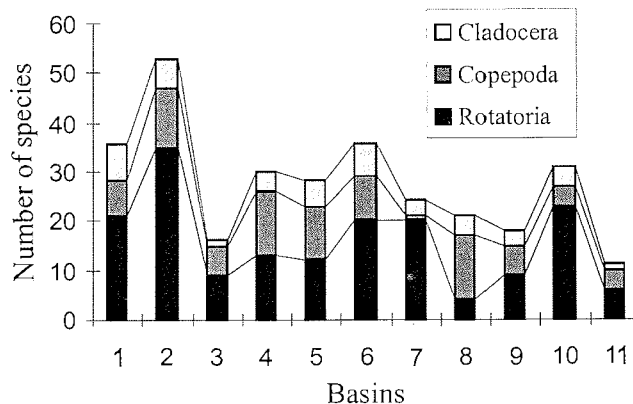


Figure 3-57. Distribution of species numbers in the different water basins in the Lena Delta: Samoilovskii Island: 1 – Oleneskaya channel, 2 - terrace lake, 3 – big thermokarst lake, 4 - polygons, 5 - crack between polygons; Tit-Ary Island: 6 - flood-plain lake, 7 – big thermokarst lake, 8 - polygons; Buor-Khaya Island: 9 - polygons, 10 – alas; Amerika-Khaya Island: 11 - alas.

Variations in the species composition and abundance dynamics

Seasonal variations in the species composition and zooplankton abundance were well manifested in the water basins on the Samoilovskii Island. Rotatoria demonstrated high density in zooplankton communities of the Olenekskaya channel and terrace lake during the whole period of our investigation. Maximum zooplankton abundance in the Olenekskaya channel (16860 ind.m^{-3}) had been observed at the beginning of July at 14°C of water temperature and was related to reproduction of common species of Rotatoria: *Asplanchna priodonta*; *Keratella cochlearis* and *K. quadrata*, which composed about 60% of the total abundance. Later, a decrease in the total zooplankton abundance and a change in the dominant species were observed (Fig. 3-58).

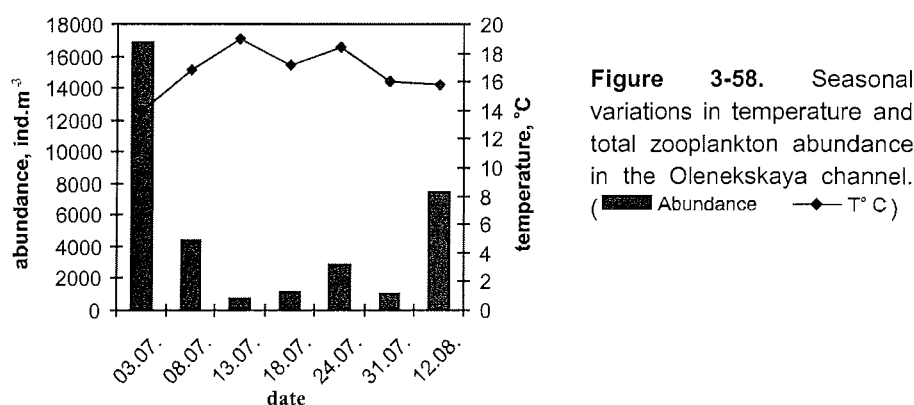


Figure 3-58. Seasonal variations in temperature and total zooplankton abundance in the Olenekskaya channel. (■ Abundance —◆ T° C)

Several species of *Euchlanis* genus became dominant instead of the above-mentioned. In August the increase in abundance was marked again. *Trichocerca cylindrica* had reproduction period and demonstrated the high density during this period. The average summer zooplankton abundance in the Olenekskaya channel was 4907 ind.m^{-3} .

Strong variations in the total zooplankton abundance were observed in the terrace lake on the Samoilovskii Island (Fig. 3-59). The lower density (less than 700 ind.m^{-3}) was recorded at the beginning of July at 9°C of water temperature. *Synchaeta sp.* was the dominant species. The first peak of the total zooplankton abundance was observed at the end of July (24560 ind.m^{-3}), when four *Euchlanis* species were numerous. The highest abundance (about 50000 ind.m^{-3}) was marked in middle August, when water temperature was 14°C . This maximum corresponded to the reproduction of several Rotatoria species belonging to *Keratella*, *Polyarthra* and *Euchlanis* genera. The average zooplankton abundance in the terrace lake throughout summer was 12018 ind.m^{-3} .

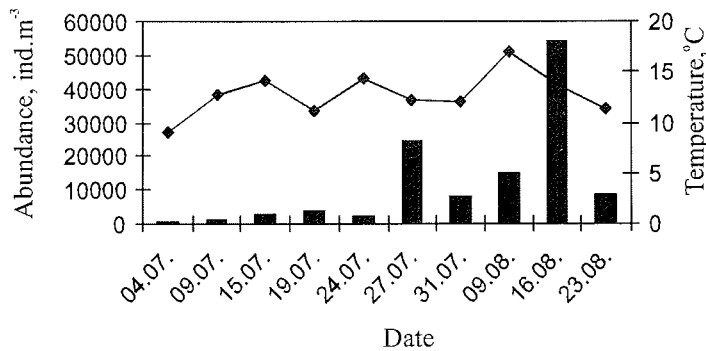


Figure 3-59. Seasonal variations in temperature and total zooplankton abundance in the terrace lake on the Samoilovskii Island. (■ Abundance —◆ T° C)

Copepoda predominated in zooplankton communities of the small polygon lakes of two different types, deep polygon without plants and shallow polygon with plants, and, also, the crack between polygons. Cladocera and Rotatoria occurred in comparatively small amounts. In these types of the water pools seasonal fluctuations in the total zooplankton abundance were insignificant (Fig. 3-60).

Calanoids *Hetercope borealis* and *Mixodiaptomus theeli* were the most numerous copepods during the whole period of investigation. Only in the crack cyclopoids were dominant in mid-August. Variations in zooplankton density were connected with the life cycles of the common Copepoda species. The maximums of the total abundance coincided with appearance of juvenile stages of these species. Three peaks of the total zooplankton abundance were recorded in the deep polygon with maximum (7000 ind. m⁻³) in the second decade of July at 11.2°C water temperature (Fig. 3-60A). The average summer density was 5018 ind. m⁻³.

Two peaks of the total zooplankton abundance were observed in the shallow polygon and the crack. In the first case, maximum of the total abundance (14580 ind. m⁻³) was marked at the beginning of July at 15.2°C water temperature (Fig. 3-60B). The average summer density was comparatively high - 9557 ind. m⁻³. Opposite, in the crack, maximum zooplankton density (7280 ind. m⁻³) was recorded in the second decade of August, when water temperature was 13.4°C. The average abundance during the whole period of investigation equaled to 4578 ind. m⁻³.

It is well known, that zooplankton organisms are susceptible to variations of a wide number of environmental factors including water temperature, light, food, chemistry, etc. According to our results, there was no evident correlation between temperature conditions and dynamics of zooplankton abundance during the period of investigation. Considerable variations in zooplankton density and species composition occurred seasonally due to changes in the life cycles of different populations.

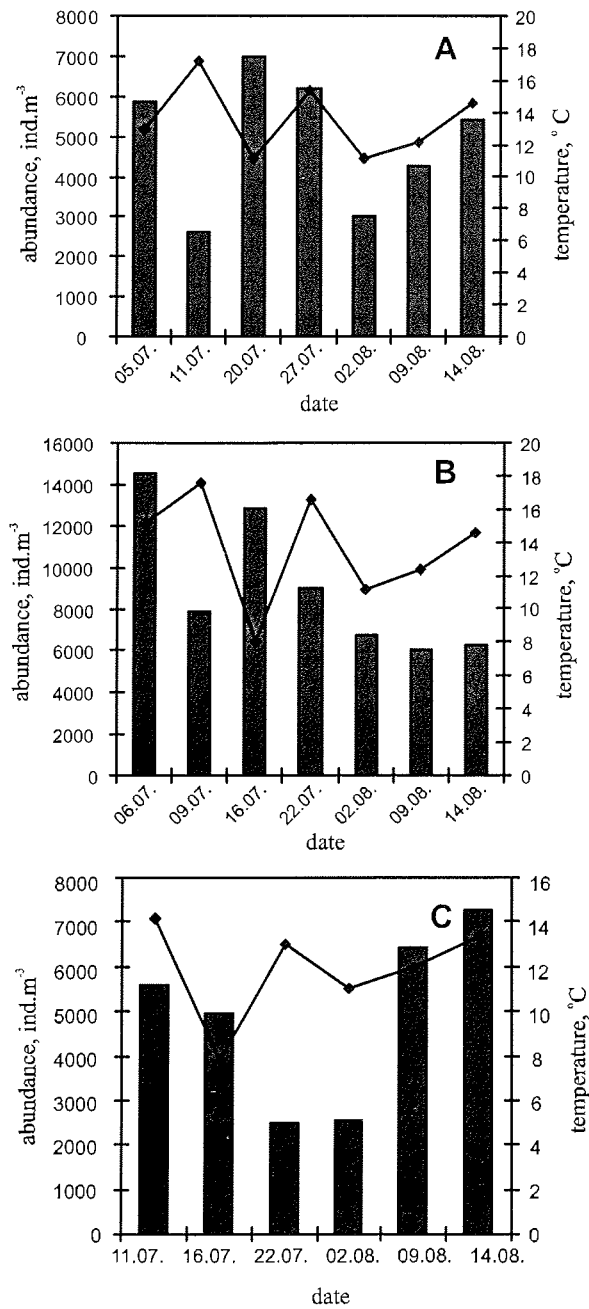


Figure 3-60. Seasonal variations in temperature and total zooplankton abundance in the deep polygon lake (A), shallow polygon lake (B) and in the crack between polygons (C) on the Samoilovskii Island (■ Abundance ◆ T° C)

3.14 Appendix