Expeditions in Siberia in 2003

Edited by Lutz Schirrmeister

Russian-German Cooperation SYSTEM LAPTEV SEA: The Expedition Lena-Anabar 2003

Edited by Lutz Schirrmeister, Mikhail N. Grigoriev,
Lars Kutzbach, Dirk Wagner and Dmitry Yu. Bolshiyanov

The Russian-German TRANSDRIFT IX Expedition of RV "Ivan Kireyev" 2003

Edited by Carolyn Wegner, Jens Hölemann and Vladimir Churun

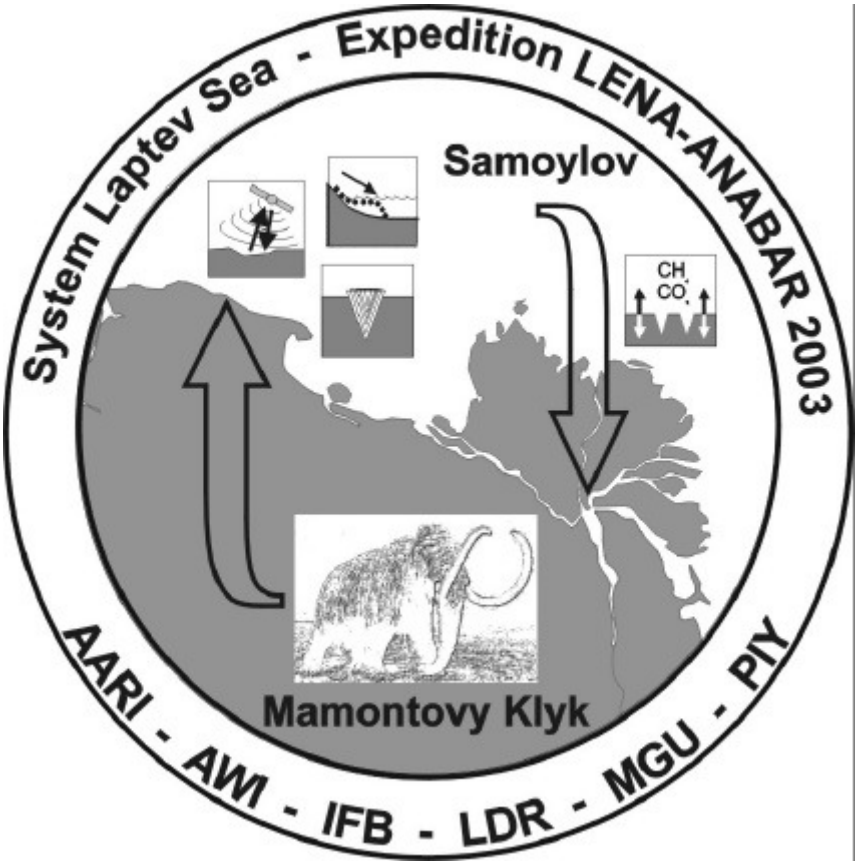
Ber. Polarforsch. Meeresforsch. 489 (2004)
ISSN 1618 - 3193

Russian-German Cooperation SYSTEM LAPTEV SEA:

The Expedition Lena-Anabar 2003

by the participants of the expedition

edited by Lutz Schirrmeister, Mikhail N. Grigoriev, Lars Kutzbach, Dirk Wagner and Dmitry Yu. Bolshiyanov



3.8 Hydrobiological investigations in the Lena Delta in summer 2003

Ekatarina N. Abramova, Irina Akhmetshina, Guenther Stoof and Waldemar Schneider

3.8.1 Objectives

About 58700 lakes are situated in the Lena Delta, on average every 1000 km^2 incorporate 2120 small and big lakes (Mostakhov, 1973). Undoubtedly, the latter play a significant role in the delta ecosystem. Pelagic fauna of the lakes is characterized by the great variety and abundance. Among 106 zooplankton taxa found during our research last year in different reservoirs of the delta, more than 90% occurred in lakes (Abramova, 2003). Taxonomic composition of zooplankton of the Lena River itself and its channels is poor and its abundance is low. Considerable stream velocity and high concentration of suspended particulate matter hamper formation of stable zooplankton assemblages. Lake species brought into the Lena Delta and the Laptev Sea bays during flood play an important role in composition of their zooplankton associations (Gukov, 2001). Freshwater organisms constitute about 50% of the summer total zooplankton abundance in the shallow brackish water bays of the Laptev Sea (Olenek, Tumat and Yana bays) (Abramova, 2000).

Small thermokarst lakes are the most abundant type of water bodies in the Lena Delta. Polygonal tundra occupies about 1/3 (9,600 km^2) of the total Lena Delta area (Grigoriev, unpublished data). The annual primary biomass production in these lakes is known to be low, but this is mainly caused by the short ice-free season. However, our preliminary data suggest that, compared to other tundra water basins, zooplankton abundance, biomass and production in small thermokarst lakes are rather high. For example, the daily production of only one dominant species *Daphnia pulex* varied from 4.3 mg/l to 5.3 mg/l during summer 2001 (Akhmetshina & Abramova, 2002). The average daily zooplankton production for different polygons changed from 0.01 to 1.5 g/m^{-3}. The total absolute daily production of a medium size pond with the water volume about 82 m^3 changes from 11 g to 121g a day and reaches its maximum in the periods of the most intensive reproduction of the dominant species. The average seasonal zooplankton production for an average size polygon may reach 6-7 kg. For the whole polygonal tundra of the Lena Delta, this will equal to many tons of organic material.

During the expedition "Lena-Anabar 2003" the monitoring of zooplankton in the Lena Delta was continued. We have collected zooplankton samples in different types of lakes on the Samoylov and Buor-Khaya Islands; and in the region of Cape Mamontov Klyk.

3.8.2 Research tasks

- To study species composition and distribution of zooplankton of the Lena Delta lakes;
- To investigate ecological affinity of certain species, primarily their temperature limits;
- To study biology of development of the mass Copepoda species (number of generations per season, age structure, diapausal stages, etc.)
- To analyze seasonal dynamics of zooplankton abundance and biomass in polygon lakes on the Samoylov Island
- To reveal temperature - abundance/biomass dependences;
- To determine the daily and seasonal production of zooplankton in the different lakes of the Lena Delta

3.8.3 Material and methods

Seventy-six zooplankton samples were collected during the whole period of investigation (July – October 2003) on Samoylov Island: 11 samples – from a flood-plain lake, 20 – from a deep polygon, 14 – from a shallow polygon, and 13 – from a crack between polygons. Six samples of zooplankton were collected from alases and polygons on Buor-Khaya Island and 12 from the Mamontov Klyk region (lakes and nearshore area of the Laptev Sea). Also, four samples of benthic organisms were collected to define species composition, abundance and biomass from the flood-plain lake and polygon on the Samoylov Island.

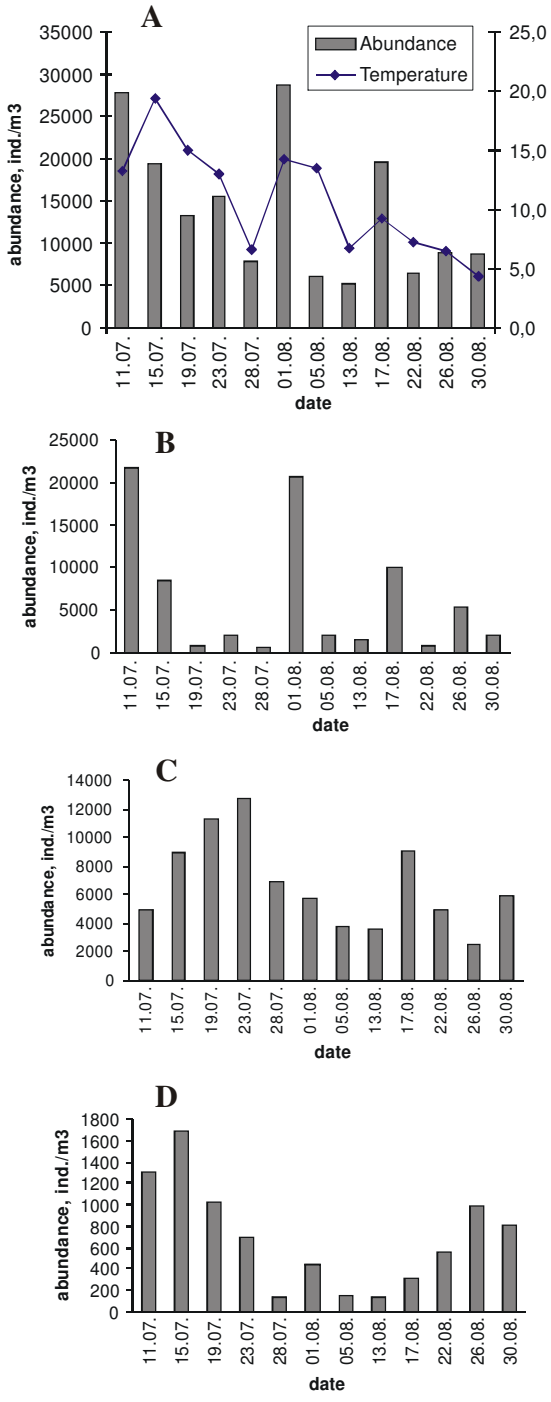
As in the previous years, sampling of zooplankton was performed by filtering of 100 litres of water through a 100-µm mesh size net with periodicity of 5-10 days and fixation with 70% alcohol. Either the whole sample or part of it was analysed in a Bogorov chamber under a binocular microscope WESSEX WSP2. Detailed taxonomic analysis and measurements of plankton organisms (with an accuracy of one hundredth of micron) were carried out using Olympus SZX9 and Olympus BX60 microscopes with the adjusted camera and computer program “Analysis” in the Otto Schmidt Laboratory in St.-Petersburg. To identify individual weights of organisms, we used the formula: $W=ql^b$, where W is body weight, l – body length (mm), q – weight at 1 mm body length, b – index.

For benthic organisms collection Peterson grab sampler was used with the catchment area of 0.0225 m^2. Sediments were washed through a set of sieves ranging from 100 to 60 µm All organisms were fixed with 70% alcohol and analysed using binocular WESSEX WSP2. The definition of individual masses of benthos was carried out using the analytical balance Sartorius LA 230S in the Otto Schmidt Laboratory in St.- Petersburg.

To study the life cycles of two mass species of Cyclopoida a natural experiment was applied: 50-60 exemplars of naupliar stages of every species were put into two 1-liter jars covered with fine kapron gauze (mesh size - 20µm), which were

placed into the natural reservoir. Every two days the jars content was filtered and organisms were analysed under binocular in a small amount of water in order to define the presence or absence of the next age stages. Then the organisms were put into the jars again, and the jars were returned to the reservoir. Simultaneously, quantitative samples of zooplankton were collected, and water temperature was measured.

3.8.4 Preliminary results



Polygons are well suited for hydrobiological studies since they are small, almost closed water basins with short trophic chains, and limited active ice-free period. Species variety of zooplankton in polygons has been described earlier (Abramova, 2003). In average 30 zooplankton species occur in this type of lakes, where Copepoda, Cladocera and Anostraca are the main components of zooplankton community. Seasonal dynamics of both abundance and biomass of pelagic fauna in polygons have their own peculiarities. The maximums of the quantitative characteristics and its number usually depend on environmental conditions on a certain year and live cycle of the common zooplankton species. For instance, in summer 2001 and 2002 during the whole study period on the deep and shallow polygons of Samoylov Island Calanoida (*Heterocope borealis* and *Mixodiaptomus theeli*) predominated in the total abundance (Abramova, 2003). In summer 2003, three well-determined maxima of zooplankton abundance (first half of July, beginning and middle of August) (Figure 3.8-1A) corresponded to the appearance of young Cladocera, mainly *Daphnia pulex*. Parthenogenetic reproduction was observed for this species at least two times during the two months (in the beginning of July and August) (Figure 3.8-1B).

Figure 3.8-1. Seasonal dynamic of the total zooplankton abundance and temperature (A); and seasonal abundance fluctuation of the main zooplankton groups: Cladocera (B), Calanoida (C) and Cyclopoida (D) in the deep polygon on Samoylov Island.

Calanoida was dominated in zooplankton abundance during the second half of July (Figure 3.8-1C), in September and in the beginning of October in the deep polygon. The juvenile stages of *H. borealis* and several species of Diaptomidae were numerous in the end of summer. Cyclopoida were the most inconsiderable group in terms of abundance and biomass in our collections in summer 2003 (Figure 3.8-1D), as their intensive reproduction is usually observed in June. No investigations were carried in June 2003. The total average abundance of zooplankton for the two months (July-August) was 14000 ind./m^{-3} in the deep polygon. Maximum abundance (about 30 thousand ind./m^{-3}) was recorded at 15°C water temperature (Figure 3.8-1A). The total average abundance of zooplankton in July-August was higher (17130 ind./m^3) in the shallow polygon with maximum (31 thousand ind./m^{-3}) at 15°C water temperature also. The calanoids *H. borealis*, *M. theeli, Leptodiaptomus angustilobus* and immatures stages of this genus, accounted for most of the organisms found in shallow polygon in summer 2003.

One good pronounced peak of the total zooplankton biomass was recorded in deep polygons with maximum (12 g/m^{-3}) in the beginning of August (Figure 3.8-2). *Daphnia pulex* and two species of Anostraca (*Polyarthemia forcipata* and *Branchinecta paludosa*) composed more than 95% of total zooplankton biomass in this time. The average summer biomass was 3,3 g/m^{-3} in the deep polygon and 2,4 g/m^{-3} in the shallow polygon.

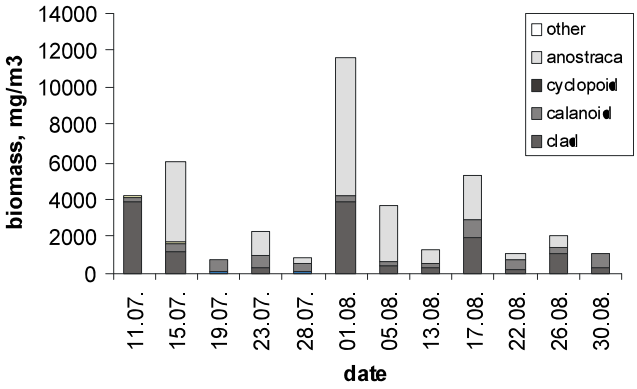


Figure 3.8-2. Seasonal dynamic of the total zooplankton biomass and the biomass of different groups of organisms in the deep polygon on the Samoylov Island in 2003

The highest zooplankton abundance (more than 40 thousand ind./m^3) and lowest biomass were observed in flood-plain lakes on Samoylov Island due to the high concentration of numerous Rotatoria (>50% of the total density) and Calanoida (about 30% were made up by different stages *Eurytemora bilobata* and *Eurytemora sp.*).

In the nearshore area of the Mamontovy Klyk region (see chapter 4) the zooplankton species composition was dominated by the brackish-water complex (15 species), but fresh-water fauna was well represented too (12 species). The copepods of brackish-water complex were also dominated in abundance, especially *Eurytemora raboty*, *Tachidius* sp., *Drepanopus bungei*, *Limnocalanus macrurus*, *Pseudocalanus* sp.juv. were numerous. *Bosmina longirostris* (Cladocera) and Rotatoria of genus *Synchaeta*, *Keratella* and *Notholca* occupied the second position in abundance.

A relatively low species diversity and abundance of benthic organisms were discovered in the lakes on the Samoylov Island. A total seven taxa were identified in the flood-plain and polygon lakes. The benthic community of the flood plain lakes were dominated of Ostracoda and Nematoda (about 73% of the total abundance) and mollusc was responsible for nearly 40% of the total biomass (Table 3.8-1). The similar situation was observed in the benthic assemblage of the polygon lake on the Samoylov Island.

Table 3.8-1. Composition, abundance and biomass of the main groups of benthic organisms in the flood-plain lake on Samoylov Island.

Taxa	abundance (ind./m^{-3})	biomass (g/m^{-3})
Harpacticoida	48	0.00144
Ostracoda	265	0.00053
Gammariidae	3	0.108
Mollusca	24	0.158
Hyronomidae	13	0.0177
Nematoda	146	0.00584
Annelida	60	0.0592
Other		0.0153
Total:	**559**	**0.36601**