

5.1 Phytoplankton distribution in the Ob and Yenisei estuaries and adjacent Kara Sea

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Materials and methods

Water samples for species composition studies and phytoplankton abundance and biomass estimation were collected on the majority of the «main» stations over the whole area of investigation. Sampling was carried out on standard depths from the surface layers (with the metallic zinc coating bucket), from the density change layer and from the near bottom layer (with the sampler of the «Rosette» system; parallel with the hydrological probing). Concrete stations and sampling depths are presented in Table. 88 samples on 31 stations were collected. Besides, on the majority of «short» stations located in the most variable areas from the point of view of hydrodynamics phytoplankton samples were collected (more than 20) from the surface layer for obtaining a more detailed picture of microalgal communities development in these areas.

Primary processing and preservation of samples were carried out according to accepted hydrobiological methods. Water samples collected (usually of 1 liter volume) were subjected then to concentrating by a standard inverse-flow method and fixed with 40% buffered formalin (final concentration is 1-2 %) for the microscopy to receive exact data on the taxonomic composition of the communities and biomass and abundance of each species of microalgae. This is in its turn will allow to estimate reliably the directions and rate of development of pelagic phytocenoses in different parts of the investigation area, to give description of the interrelation processes of phytoplankton of different origin (fresh water or sea water) species complexes and to give conclusions on lesser or greater significance of the of the biological chain in biogeochemical cycles upon the whole in this area.

Phytoplankton samples for the isotope analysis were collected from either the surface layer by the way of filtration of large volumes of water (in the range 100-1000 liters) through the plankton net with the mesh of 10 mcm diameter or in the fresh water areas, where phytoplankton was in the state of vigorous blossom was represented mainly by long filamentous forms -with the zooplankton net with mesh diameter 200 mkm. Then the samples obtained were fixed with the mercuric chloride solution and were subjected to standard preparation for the subsequent analysis. 21 samples were collected all in all (concrete stations are presented in Table).

Preliminary results

Preliminary investigation of samples collected from the surface water layer on separate stations allows in this very moment to give a short qualitative estimation of the phytoplankton communities state in different parts of the investigated area.

In the southern parts of the estuary zones in the coastal area the micro- algae species complex is represented exclusively by the forms of fresh water and estuary origin which occurred traditionally there during several years of investigation. Diatom algae *Melosira granulata* and *M. varians* prevail. The minor part is composed of green algae, distinguishing by significant species diversity (filamentous forms of genera *Rhizoclonium* and *Ulothrix*, unicellular ones of genera *Pediastrum*, *Scenedesmus* etc.), diatoms *Asterionella formosa* and *Fragilaria crotonensis* and blue-green algae. The latter group is diverse as in respect of its representatives and includes greater in comparison to previous years number of filamentous forms (at the dominance of the genus *Oscillatoria*), which is more typical of the most mouth parts of the estuaries, especially for the Enisei bay. Upon the whole significant differences between the estuarine zones of the Ob and Enisei in respect of phytoplankton in species composition are not observed.

This uniform complex is distributed in the near Enisei part of the shallow water area. (Stations 8, 4, 11 and 19) up to 73° latitude, where already as singular amounts marine species occur – diatoms of genus *Chaetoceros* (Station 19). To the north the part of fresh water and estuary forms falls sharply: on station 23 they constitute not more than 70 % as for biomass and on Station 26 (74° latitude) – not more than 10 %. This per cent falls more in the north-east direction. (Stations 43 and 28) though at the significant decrease of species diversity. Though already in the more northern part of the area (Stations 45 and 31) their single representatives (mainly *Melosira granulata*) occur.

Sea water complex of microalgae in this eastern part of the investigation area is typical for the summer stage of the Arctic phytoplankton communities development. It includes diatoms of genera *Chaetoceros* and *Thalassiosira* and numerous representatives of the Phylum *Dinophyta*. The latter prevail insignificantly in the more southern (and more coastal at that!) part (Stations 23, 26, 43 and 28). For the northern (off-sea) area some dominance of diatoms is typical (mainly *C. diadema* and *T. nordenskiöldii*), which might be considered as the earlier stage of development (either early summer or late spring), which in the coastal zone began earlier, and during the moment of investigation a typically summer complex was observed there with prevalence of dinoflagellates. It is interesting to note Station 48, where one species of diatoms, *C. diadema*, dominated absolutely, – the phenomenon is absolutely untypical for the plankton phytocenoses of the Nordic seas.

On the Ob bay area the marine species occur more to the south in comparison with the near Enisei part of the shallow water area. – already on Station 70 dinoflagellates are distinguished by species diversity, though observed in the insignificant amounts. As for the off- sea part of the near Ob area to the north of 74° latitude (Stations 67 and 68) – quite a unique community which has never been described yet was found: the main part of the biomass in it (on station 67 is up to 95 %!) consists of the diatom *Nitzschia delicatissima*. This species (at the moment specialists consider is «composed», i.e. a group of close species) is typical for the Barents Sea coastal zone and even there it does not reach that part by biomass, and in the Kara Sea it is not typical at all. It might be

supposed that we are confronted with the anomaly during development of the community which is not a rare phenomenon.

In the north-western part of the investigation area a summer sea phytoplankton complex differing to some extent from those in the eastern part is observed. On Stations 56 and 46, located more to the north up to 80 % of biomass is constituted of dinoflagellates, the rest are mainly diatoms *Thalassionema nitzschioides* and species of genus *Chaetoceros*: *C. borealis* and *C. convolutus*. These microalgae occurred and in the eastern part of the area but in the lesser concentrations. The representatives of genus *Chaetoceros* mentioned are the oceanic species and are typical for the summer phytoplankton community in the off-sea area. It is interesting to note that on Station 61, located farther to the south, their part in biomass is about 30 %, species *Chaetoceros diadema*, constitutes more than half of biomass, and per cent of dinoflagellates is quite insignificant. This community is more similar to that found on Station 48, that with phytocenoses in the nearest parts of the area.

As seen from the description the spatial structure of phytoplankton communities in the western part of the investigation area is rather complicated, differs significantly from observed earlier in the neighboring areas situations and at the moment is rather difficult for the unequivocal explanation. Phytocenoses with dominance of one microalgae species cause special interest. All these phenomena might be caused by the impact of different (probably several) natural factors: changes in the ice situation, manifestation of the Ob river run-off effect, other climatic and hydrodynamic processes. Real reasons might be revealed only after the detailed analysis of the whole material obtained during the expedition.

Table 5.1: The phytoplankton investigations during the "Boris Petrov" cruise on the Ob-Yenisei shallow-water region at August-September 2001.

Station No.	Depths of phytoplankton sampling	Sampling for isotope analysis
1	0; 18; 35	
4	0; 19	+
8	0; 27	+
11	0; 7; 8.3	+
14	0; 18,4	
16	0; 27,3	
19	0; 4,5; 23	+
23	0; 4; 8; 18	+
26	0; 5,5; 30	+
28	0; 17	+
30	0; 12; 46	
34	0; 19; 90	+ (on the nearest Station No.31)
35	0; 17; 150	
40	0; 9; 43	
43	0; 10; 40	+
45	0; 18; 80	+
46	0; 20; 50; 300	+
48	0; 15; 188	+
51	0; 10; 138	
55	0; 15,5; 70	
56	0; 16; 170	+
61	0; 20; 100	+
64	0; 10; 95	
66	0; 10; 45	
67	0; 6; 40	+
68	0; 6; 20	+
70	0; 7,5; 15	+
72	0; 20	+
73	0; 9	+ (on the nearest Station No.79)
80	0; 7; 10	+
82	0; 7; 20	+