Seasonal changes in the Curonian lagoon (Baltic Sea) phytoplankton community structure

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Objectives:

❑to construct the general scheme of seasonal changes in phytoplankton community structure in the eutrophic coastal lagoon;

❑to outline the relationship between the nutrient concentration and phytoplankton succession.

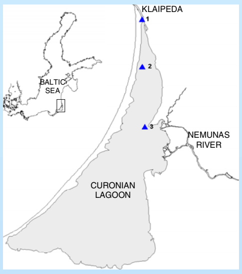


***Fig. 1**. Study area.*

Material and Methods

Study area. The Curonian lagoon (south-eastern Baltic Sea) is the transitional mostly freshwater eutrophic water body with irregular salinity fluctuations from 0 up to 8 PSU. Mean water temperature ranges from 0.1-0.2º C in winter to 5-15º C in spring and reaches the highest values in July-August (up to 19.1-19.3º C).

Material. Long term (1987 to 2000; 1-2 times per month observations) phytoplankton and hydrochemistry data, originated from the national monitoring programme performed by Environmental Ministry Marine Research Centre.

Data analysis. Since stochastic brackish water inflows could bias freshwater community characteristics, the samples taken at salinity > 0.5 PSU were excluded from the study.

To obtain a more holistic picture of phytoplankton succession, successional groups were derived instead of using separate species. The relative biomass values of four phytoplankton taxonomical groups (Cyanophyta, Cryptophyta, Chlorophyta, Diatomophyceae) and one cumulative group containing the rest of the phytoplankton species were used for the hierarchical clustering procedure with group-average linking based on Bray-Curtis similarity coefficient.

Results and Discussion

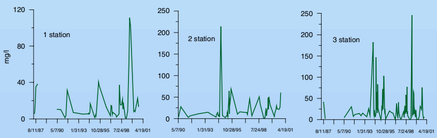
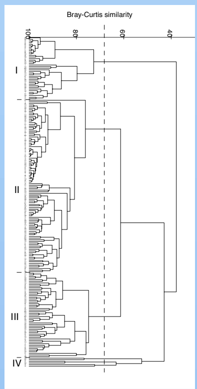


***Fig. 2.** The interannual phytoplankton biomass dynamics at the three monitoring stations.*



Four groups of samples were revealed using the cluster analysis (**Fig. 3**). The 4th group was excluded from the further analysis due to low number of samples and low similarity between them.

***Fig. 3.** Dendrogram for hierarchical clustering (group average linking) of 206 seasonal phytoplankton samples based on Bray-Curtis similarity. The approx. 70 % similarity level and four corresponding groups of samples are marked.*

The phytoplankton community structure for each group of samples is presented in the **Fig. 4.**

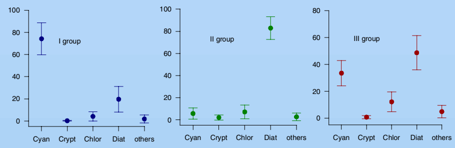


***Fig. 4.** The relative biomass of the Cyanophyta, Cryptophyta, Chlorophyta, Diatomophyceae and other phytoplankton species in the three groups of samples derived from clustering procedure; n= 39, 108 and 53 for the I, II and III group respectively. Values are means ± 1SD.*

The monthly relative frequency of each successional group (% of total number of samples per month) was calculated and placed along the temporal axis (**Fig 5**.).

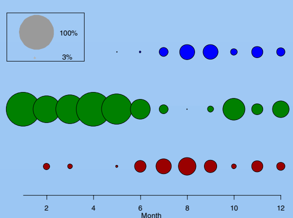


***Fig. 5.** The sequence of the phytoplankton seasonal succession in the three stations. Blue bubbles- I group (Cyanophyta dominated), green bubbles- II group (Diatomophyta dominated), red bubbles- III group (Cyanophyta&Diatomophyta dominated). The size of the bubble represents monthly relative frequency of the group.*

According to Sommer (1999), the phytoplankton community structure could be determined by the ratio of limiting nutrients. The threshold values are:

Si:P- 3:1 to 20:1;
Si:N- 0.3:1 to 1:1;
N:P- 15:1.
High Si:N & Si:P- dominance of diatoms;
Low N:P- dominance of cyanobacteria;
High N:P- dominance of green algae.

This is true for diatom-dominated community both in January- June and October-December:

diatoms

	January-June	Oct-Dec
Si:P	47:1	46:1
Si:N	1.5:1	4:1
N:P	69:1	23:1

Both cyanobacteria and cyano/diatom dominated communities could be found from July to October and even at November-December. In contrary to Sommer predictions, the Si:P and Si:N ratios are higher for cyanobacteria dominated community:

cyanobacteria:

	July-Oct	Nov-Dec
Si:P	26:1	61:1
Si:N	4:1	2:1
N:P	11:1	32:1

cyano/diatoms:

	July-Oct	Nov-Dec
Si:P	16:1	48:1
Si:N	3:1	1.8:1
N:P	11:1	25:1

Conclusions:

❑momentary measurements of nutrients could not be used to explain phytoplankton community structure;

❑deciding from nutrient ratios, P could be regarded as a possible limiting nutrient both in spring and autumn;

❑the influence of other physical factors should be tested to explain seasonal changes in the Curonian lagoon phytoplankton community.

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