EESTI NSV TEADUSTE AKADEEMIA TOIMETISED. 26. KÕIDE
BIOLOOGIA. 1977, NR. 2

ИЗВЕСТИЯ АКАДЕМИИ НАУК ЭСТОНСКОЙ ССР. ТОМ 26
БИОЛОГИЯ. 1977, № 2

https://doi.org/10.3176/biol.1977.2.06

УДК 577.472/28/.475

Anu MILIUS, Maia PORK

SEASONAL VARIATION OF PHYTOPLANKTON BIOMASS, CHLOROPHYLL *a* AND ALKALINE PHOSPHATASE ACTIVITY IN LAKE PANGODI

Lake Pangodi is situated in the southern part of Estonia, in a hilly cultivated moraine landscape, and is mostly boarded by fields and pastures. There are farms round the lake, and the number of summer cottages has increased during the last years. It is a shallow lake characterized by an irregular shape (Fig. 1). The area is ca 115 ha, the maximum depth 11.1 m and the mean depth 8.9 m (Eesti järved, 1968). The inflowing streams are small and the outflow is also inconsiderable. Lake Pangodi is a typical eutrophic lake (Mäemets, 1974), but during the last few years it has acquired some hyper-eutrophic features.

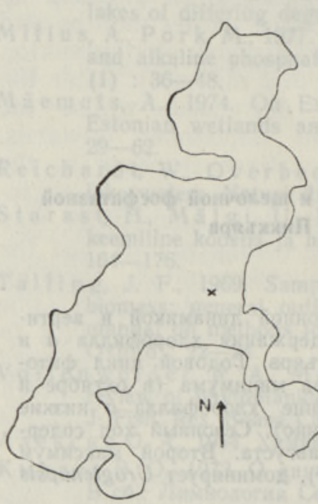

Fig. 1. Map of Lake Pangodi and the sampling site (×).

All-round hydrobiological investigations were carried out on Lake Pangodi in 1951, whereas phytoplankton studies were undertaken in 1958—1959 (Eesti järved, 1968) and during 1972—1974. A part of the investigations of the 70's has been summarized and published (Кывaск et al., 1975). Extensive hydrochemical investigations were carried out during 1973—1974.

The present investigation aims at studying the seasonal correlation between the phytoplankton biomass, the species composition, the chlorophyll *a* content and the phosphatase activity in Lake Pangodi, since Estonian lakes have not been investigated from this point of view as yet.

Material and methods

Water samples were taken once a month in the deepest area of the lake (depth ca 10—11 m) from March to November, 1974. The quantitative samples were collected with a Ruttner water sampler at the depth of 1, 3, 5, 7 and 9 m, while the samples for qualitative phytoplankton analysis were obtained by means of a plankton net. All samples were fixed in formalin. The quantitative samples were concentrated by sedimentation up to the volume of 10 ml (50×). The Goryayev haemacytometer was used for countings. The biomass calculations were based on the measurements of the phytoplankton species of Lake Pangodi and on the measurements calculated by Laugaste (Лаугасте, 1974a) and Kumsäre (Кумсаре, 1963). The results were expressed in g m^{-3}.

The chlorophyll *a*, the alkaline phosphatase activity and the inorganic phosphate samples were collected from the same depth as the phytoplankton samples. Chloroform was added to the alkaline phosphatase and the inorganic phosphatase samples, and both enzyme activities and chlorophyll concentrations were estimated as soon as possible after collecting. The alkaline phosphomonoesterase activity (EC. 3.1.3.) was determined using a slight modification of the methods by Reichard et al. (1967) and Jones (1972a, b), and the concentrations of chlorophyll *a* using the method and calculation described by Talling (1969). A detailed description is given in an earlier study by us (Milius, Pork, 1977). The seasonal data on the biomass, the chlorophyll *a* and the phosphatase activity are based on the average values of the vertical distribution. Inorganic phosphate was determined by the molybdate blue method (Алекин, 1954).

The dissolved oxygen was measured by the electrochemical method and the temperature by an electrothermometer. The pH values were determined in the field colorimetrically by means of a scale. The transparency was measured by a Secchi disc.

Results

Physical and chemical data

The basic observational programme for this study included the determination of the colour and transparency, the measurements of dissolved oxygen concentration and the temperature, the pH values and the content of inorganic phosphate.

The colour of the water in Lake Pangodi was greenish-yellow during the spring months, changing to yellowish-green in the summer and the autumn, and yellowish-brown in late November. The transparency was always small, varying between 1.0 and 3.0, and the water was turbid. The maximum visibility (3.0 m) occurred under the ice in March, while the minimum visibility (1.0 m) was noted at the end of November. The transparency during the ice-free period varied from 1.1 to 1.7 m.

The seasonal variation in the dissolved oxygen concentration and temperature are shown in Figs 2 and 3. The oxygen content of the water was at its maximum (12.0—12.5 mg $O_2 l^{-1}$) during the vernal and autumnal circulation, the degree of saturation of the water with oxygen being 113 per cent in May and 103 in October. Thermal and

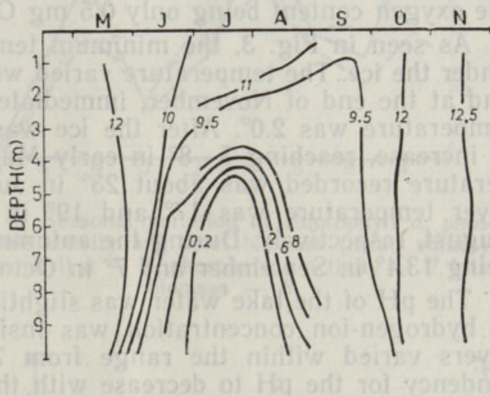

Fig. 2. Seasonal oxygen isopleths (mg l^{-1}).

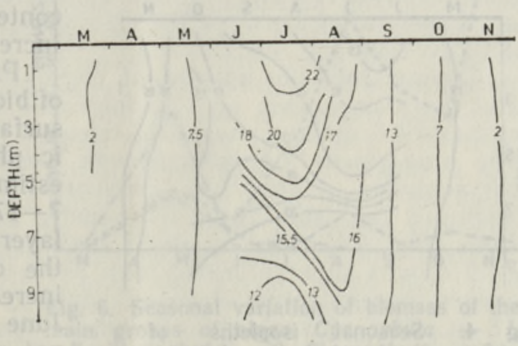

Fig 3. Seasonal temperature isopleths (°C).

oxygen stratifications were observed in June, the thermocline being between the 4—5-metre zone, and it remained in this zone till late July. The water of the surface layers between 1—2 m was supersaturated with oxygen during the summer period (in June, July, August) and the supersaturation was observed even up to 4 m in the middle of June. This is due to the phytoplankton production. The oxygen concentration below the thermocline dropped rapidly, and oxygen depletion occurred in the layers of water near the bottom; at 9 m depth the saturation with oxygen was 8 per cent. Oxygen content decreased below 3 m in July, declined rapidly, and oxygen depletion occurred already at the depth of 4.5 m (Fig. 2), the saturation with oxygen being only 2 per cent. In late August the thermocline disappeared and a complete homothermy was observed, while the vertical distribution of oxygen showed a gradual decrease with the increase in the depth, but oxygen extended up to the bottom (2 mg O_2l^{-1}). The complete circulation had not yet begun, and the values of pH were different in the surface layer and at the bottom.

The complete circulation was observed in September, the oxygen content being 9.5 mg O_2l^{-1}, and the degree of saturation of the water being 95 per cent. The oxygen concentration increased to 12 mg O_2l^{-1} in October and stopped at it in late November.

During the winter the oxidation at the bottom layer of the water consumed all the oxygen. In late winter (in March) the lake was unaerobic below the depth of 3.5 m. The oxygen concentration was relatively high in the surface layer (1 m), but dropped rapidly below the 2-metre zone; at the depth of 2 m the oxygen concentration was 2 mg l^{-1}; at 3 m it was 1 mg O_2l^{-1}; oxygen depletion was observed at the depth of 3.5 m; the oxygen content being only 0.5 mg O_2l^{-1}.

As seen in Fig. 3, the minimum temperature was observed in March under the ice. The temperature varied within the range from 1.5° to 2.5 °C, and at the end of November, immediately before the lake got frozen, the temperature was 2.0°. After the ice was broken, the temperature started to increase, reaching 7—8° in early May. The highest surface layer temperature recorded was about 23° in July (11° at the bottom). The top layer temperature was 17° and 19° in the middle of June and in late August, respectively. During the autumn the temperature dropped rapidly, being 13.4° in September and 7° in October.

The pH of the lake water was slightly alkaline. The seasonal variation of hydrogen-ion concentration was insignificant; the pH of the surface layers varied within the range from 7.8 to 8.6. There was a general tendency for the pH to decrease with the increase of the depth up to 7.4 during the summer period and to 7.2 in March. This is due to the free CO_2 content which increases with the increase of the depth.

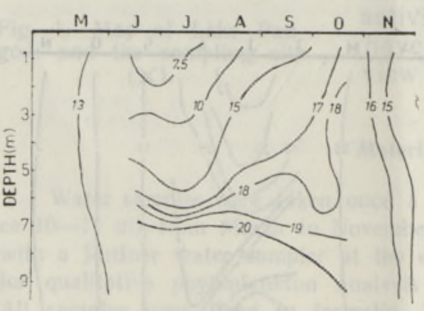

Fig 4. Seasonal isopleths of inorganic phosphate (μg l^{-1}).

Proceeding from the concentration of biogenic elements in the unpolluted surface water, the content of inorganic phosphate in the lake may be estimated as medium ranging from 7—17 μg P l^{-1} (Fig. 4). In the bottom layers between the depth of 9—10 m, the content of inorganic phosphate increased from 60 to 250 μg P l^{-1} in June and July, from where it could not return to circulation due to the summer stagnation. As compared to earlier studies, the content of phosphate has increased (Eesti järved, 1968). After May, due to the onset of the spring outburst of the phytoplankton, the nutrient concentration started to decrease, the phosphate content being 7—8 μg P l^{-1} in the surface layer in June and July (Fig. 4). From August to the end of October the phosphate content increased, evidently because of the biological destruction. In late November, a slight decrease in the phosphate content was observed; this was due to a mass development of *Oscillatoria redekei.*

Seasonal and vertical distribution

The phytoplankton of Lake Pangodi is rich in species, the biomass values varying from moderate to high. During the greater part of the year, the blue-greens predominate in the phytoplankton. The diatoms and chrysophytes are quite abundant in spring. The importance of the blue-greens in the phytoplankton, especially that of the species of *Oscillatoria*, has risen during the recent few years. If, during 1950—1960, the waterbloom was caused by the species of *Anabaena*, in recent years they have been replaced by *Aphanizomenon flos-aquae* and *Oscillatoria* sp. sp. *Oscillatoria redekei* predominating in the phytoplankton, especially in autumn, was not recorded in the 1950s in Lake Pangodi. The increase in the numbers of the species of *Oscillatoria* can be ascribed to artificial eutrophication. *Oscillatoria redekei* is considered to be a H_2S indicator (Huber-Pestalozzi, 1938), of a mass occurrence in highly eutrophic lakes.

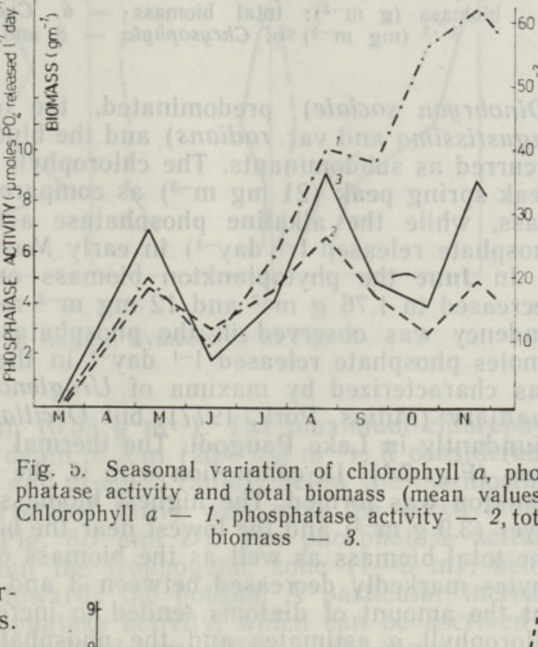

Fig. 5. Seasonal variation of chlorophyll *a*, phosphatase activity and total biomass (mean values). Chlorophyll *a* — *1*, phosphatase activity — *2*, total biomass — *3*.

During the winter there were very few phytoplankters in the lake. After the ice broke up in late April, the amount of phytoplankton started to increase. The seasonal variation of total biomass, chlorophyll *a*, phosphatase activity and biomass of main groups of algae are shown in Figs 5 and 6.

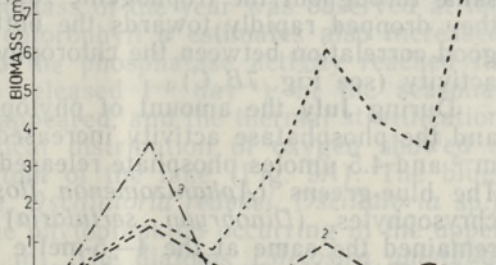

Fig. 6. Seasonal variation of biomass of the main groups of algae. *Cyanophyta* — *1*, *Bacillariophyta* — *2*, *Chrysophyta* — *3*.

The spring peak of phytoplankton biomass (7.1 g m^{-3}) was recorded in early **May** (Fig. 5), during the vernal circulation. The chrysophytes

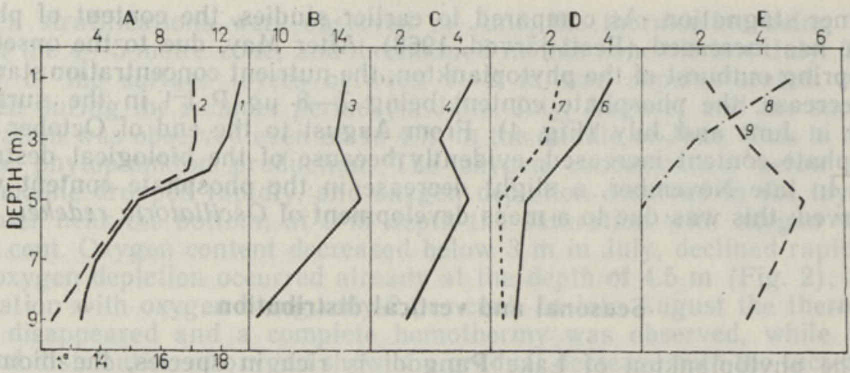

Fig. 7. Sampling in June.

A: temperature (°C) — *1*, O_2 (mg l^{-1}) — *2*; *B*: chlorophyll *a* — *3*; *C*: phosphatase activity (μmoles phosphate released l^{-1} day^{-1}): activity of unfiltered sample — *4*, activity of membrane-filtered sample — *5*; *D*: phytoplankton biomass (g m^{-3}): total biomass — *6*, *Cyanophyta* — *7*; *E*: Biomass (mg m^{-3}) of *Chrysophyta* — *8* and *Bacillariophyta* — *9*.

(*Dinobryon sociale*) predominated, the diatoms (*Synedra acus* var. *angustissima* and var. *radians*) and the blue-greens (*Oscillatoria redekei*) occurred as subdominants. The chlorophyll *a* pattern showed a relatively weak spring peak (21 mg m^{-3}) as compared with the phytoplankton biomass, while the alkaline phosphatase activity was high (4.9 μmoles phosphate released l^{-1} day^{-1}) in early May.

In **June** the phytoplankton biomass and the chlorophyll *a* content decreased to 1.76 g m^{-3} and 12 mg m^{-3} respectively (Fig. 5). The same tendency was observed in the phosphatase activity; it declined to 3.0 μmoles phosphate released l^{-1} day^{-1} in the middle of June. This period was characterized by maxima of *Uroglenopsis americana*, like in Lake Saadjärv (Milius, Pork, 1977), but *Oscillatoria redekei* was represented abundantly in Lake Pangodi. The thermal stratification was observed in June (Fig. 7*A*). In connection with it, the vertical distribution of phytoplankton was formed. The highest biomass was observed in the surface layer (3.9 g m^{-3}) and the lowest near the bottom (0.93 g m^{-3} in Fig. 7*D*). The total biomass as well as the biomass of the blue-greens and chrysophytes markedly decreased between 3 and 5 m (thermocline at 4.5 m), but the amount of diatoms tended to increase at the level of 5 m. The chlorophyll *a* estimates and the phosphatase activity were nearly the same throughout the trophogenic zone (1—5 m); below the thermocline they dropped rapidly towards the bottom. There appeared to be a very good correlation between the chlorophyll *a* estimates and the phosphatase activity (see Fig. 7*B*, *C*).

During **July** the amount of phytoplankton, the chlorophyll *a* content and the phosphatase activity increased considerably (4.13 g m^{-3}, 23 mg m^{-3} and 4.5 μmoles phosphate released l^{-1} day^{-1} respectively, see Fig. 5). The blue-greens (*Aphanizomenon flos-aquae, Oscillatoria redekei*) and chrysophytes (*Dinobryon sertularia*) predominated. The thermocline remained the same at the 4—5-metre zone as recorded in the middle of June (Fig. 8*A*). The water of the surface layers between the depth of 1—2 m was supersaturated with oxygen, but below the 2-metre zone the oxygen concentration dropped rapidly, and depletion was observed at 4.5 m. The phytoplankton biomass was highest in the surface layer (8.97 g m^{-3}), decreased sharply under the thermocline, and was quite

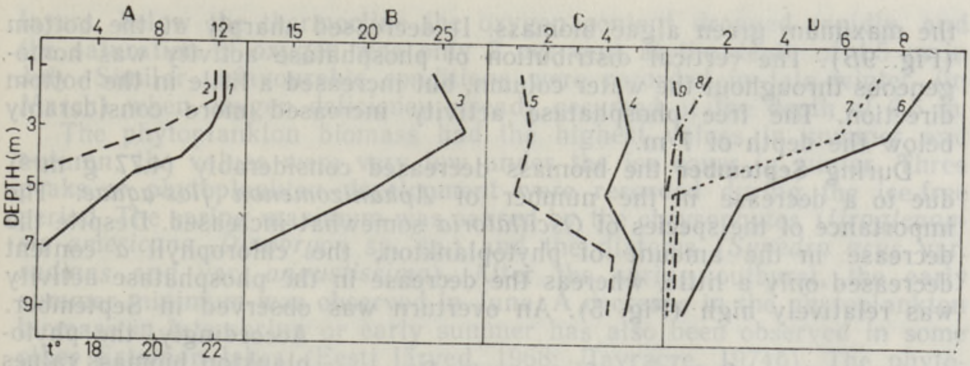

Fig. 8. Sampling in July. Symbols as in Fig. 7.

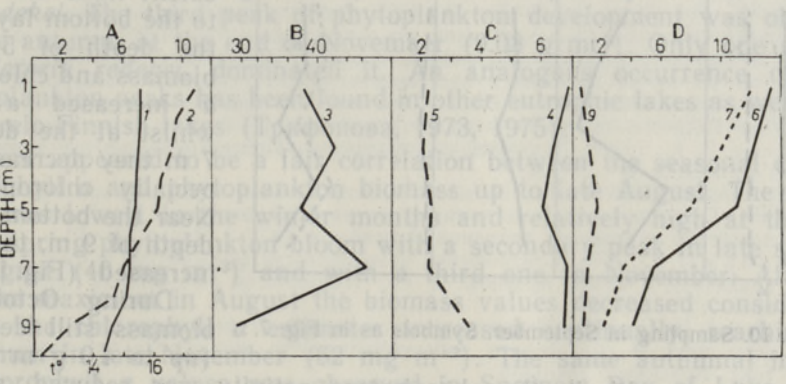

Fig. 9. Sampling in August. Symbols as in Fig. 7.

inconsiderable near the bottom (0.58 g m^{-3}). The maximum chlorophyll *a* content was recorded at the depth of 3 m (26.6 mg m^{-3}); it considerably decreased in the 5-metre zone and dropped rapidly below the thermocline. The chlorophyll estimates correlated fairly well with the curve of the phytoplankton biomass (see Fig. 8*B* and *D*). The phosphatase activity was about the same throughout the trophogenic zone (1—5 m); below the thermocline it increased towards the bottom. A particular increase was observed in the free phosphatase activity, which can be ascribed to the enzymatic activity released at the decomposition of the algae.

The maximum phytoplankton biomass of the year was observed at the end of **August** (9.28 g m^{-3}). The chlorophyll *a* estimates also increased considerably (to 40 mg m^{-3}), and the phosphatase activity reached its maximum (6.9 μmoles phosphate released l^{-1} day^{-1}) in the seasonal cycle (Fig. 5). The thermocline disappeared, and the thermal stratification was broken down, while the vertical distribution of oxygen showed a gradual decrease towards the bottom of the lake (Fig. 9*A*). The blue-greens (*Aphanizomenon flos-aquae, Oscillatoria redekei, Oscillatoria* sp.) had the most important place in the phytoplankton occurring in the upper layers of the water column (1—5 m). The diatoms (*Melosira ambigua, M. granulata*) were represented by a moderate biomass with the maximum value in the layer of 5—7 m. In August the green algae had their maximum biomass value of the year (0.72 g m^{-3}) at the level of 7 m. The maximum chlorophyll *a* content was recorded at the same level as the maximum green algae biomass. It decreased sharply at the bottom (Fig. 9*B*). The vertical distribution of phosphatase activity was homogeneous throughout the water column, but increased a little in the bottom direction. The free phosphatase activity increased more considerably below the depth of 7 m.

During **September** the biomass decreased considerably (4.77 g m^{-3}) due to a decrease in the number of *Aphanizomenon flos-aquae.* The importance of the species of *Oscillatoria* somewhat increased. Despite the decrease in the amount of phytoplankton, the chlorophyll *a* content decreased only a little, whereas the decrease in the phosphatase activity was relatively high (Fig. 5). An overturn was observed in September. Accordingly, the phytoplankton biomass values did not vary to a great extent from the surface to the bottom layers. At the depth of 5 m the biomass and chlorophyll *a* increased a little, whilst at the depth of 7 m they decreased, especially chlorophyll *a*. Near the bottom, at the depth of 9 m, they both increased (Fig. 10*B, D*).

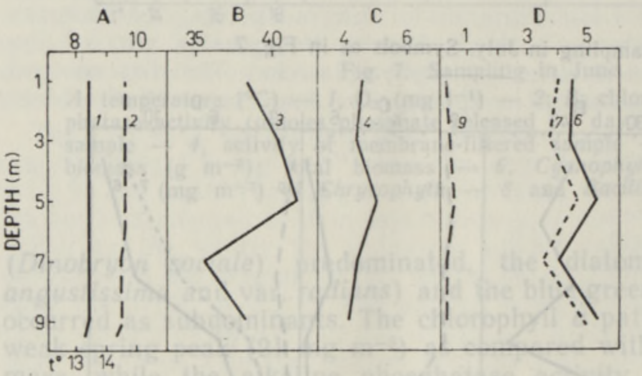

Fig. 10. Sampling in September. Symbols as in Fig. 7.

During **October** the biomass still decreased (up to 4.0 g m^{-3}), and in accordance with it, the phosphatase activity was reduced, as well (2.8 μmoles phosphate released l^{-1} day^{-1}, Fig. 5). On the other hand, the chlorophyll *a* estimates increased considerably (56 mg m^{-3}). *Oscillatoria redekei, O. geminata* and *Aphanizomenon flos-aquae* predominated. The biomass of diatoms increased, especially in the deeper layers. The numbers of species decreased considerably during October.

It may be assumed that the chlorophyll was partially detrital, whereas it is possible for chlorophyll to be preserved for long periods after cells are functionally dead in cold water (Vallentyne, 1955).

In late **November** at the water temperature of 2° the autumnal outburst of phytoplankton was recorded (9.08 g m^{-3}, Fig. 5). It was caused by *Oscillatoria redekei.* Only few specimens of other species were observed. The colour of the water had become yellow-brown. On the other hand, the chlorophyll content increased only a little as compared with the data for October, but the chlorophyll *a* maximum of the year (up to 62 mg m^{-3}) occurred in this month (Fig. 5). The chlorophyll content and the phytoplankton biomass were uniform throughout the water column. In early December the lake was covered with ice, and the amount of phytoplankton markedly decreased.

Discussion

The results of the investigation show that in recent years the process of eutrophication in Lake Pangodi has been intensive and the lake has acquired some features of hypereutrophy. Although the lake is shallow, the stratification of temperature and gas occurred during the summer months (June, July). Oxygen supersaturation was recorded in the surface layers; below the thermocline the oxygen content dropped rapidly, and the saturation of oxygen was only 2 per cent at the depth of 4.5 m in July. Similar unfavourable conditions were recorded in late winter (in March) when oxygen deficiency already occurred at the depth of 3.5 m.

The phytoplankton biomass had the highest values in summer and autumn; the values were very low under the ice cover in winter. Three peaks of phytoplankton development were recorded during the ice-free period. The spring maximum was caused by the chrysophytes (*Uroglenopsis americana, Dinobryon* sp. sp.) and the diatoms (*Synedra acus* var. *radians* and var. *angustissima*). After the spring outburst, the early summer minimum was observed in June. A decrease in the phytoplankton biomass in late spring or early summer has also been observed in some other Estonian lakes (Eesti järved, 1968; Лаугасте, 1974б). The phytoplankton biomass was highest in August (9.28 g m^{-3}). The summer peak was caused by the blue-greens *Aphanizomenon flos-aquae* and *Oscillatoria redekei.* The third peak of phytoplankton development was observed in late autumn, at the end of November (9.08 g m^{-3}). Only one species, *Oscillatoria redekei,* dominated it. An analogous occurrence of three phytoplankton peaks has been found in other eutrophic lakes as well, e. g., in Karelo-Finnish lakes (Трифонова, 1973, 1975).

There appeared to be a fair correlation between the seasonal cycle of chlorophyll *a* and phytoplankton biomass up to late August. The chlorophyll was lowest in the winter months and relatively high at the time of the spring phytoplankton bloom with a secondary peak in late summer in August (40 mg m^{-3}) and with a third one in November. After the summer maximum in August the biomass values decreased considerably, whilst the chlorophyll *a* estimates increased continually, reaching the maximum in late November (62 mg m^{-3}). The same autumnal increase in chlorophyll *a* values was observed in Saginaw Bay of Lake Huron (Glooschenko et al., 1973). It is difficult to explain the continuous increase of chlorophyll *a* in autumn because the degradation products are not determined. Moreover, it is possible for viable undegraded chlorophyll to be preserved for long periods after cells are functionally dead, particularly in cold water (Vallentyne, 1955). Therefore we assume that the chlorophyll was partially detrital in cold water during the autumn.

Our results for the alkaline phosphatase activity show that these values were dependent on the phytoplankton biomass, since the two variables were in a good positive correlation. The alkaline phosphatase activity showed the same peaks as the biomass; the highest peak was observed in late August, while the spring pulse was a little weaker. The late autumnal pulse was also recorded at the end of November. A positive correlation of biomass and alkaline phosphatase activity was also obtained by Jones (1972a, b). Similar features of the phytoplankton species content, the biomass and chlorophyll *a* were noted, e. g., in the highly eutrophic lake Lough Neagh in Ireland (Wood, Gibson, 1973).

REFERENCES

Eesti järved 1968. Tln. : 548.

Glooschenko, W. A., Moore, J. E., Vollenweider, R. A., 1973. Chlorophyll *a* distribution in Lake Huron and its relationship to primary productivity. Proc. 16th Conf. Great Lakes Res., Huron, Ohio. Ann. Arbon : 40—49.

Huber-Pestalozzi, G., 1938. Daș Phytoplankton des Süsswassers 1. Die Binnengewässer 16. Stuttgart : 342.

Jones, J. G., 1972a. Studies on freshwater bacteria: association with algae and alkaline phosphatase activity. J. Ecol. **60** (1) : 59—75.

Jones, J. G., 1972b. Studies on freshwater micro-organisms: phosphatase activity in lakes of differing degrees of eutrophication. J. Ecol. **60** (3) : 777—791.
Milius, A., Pork, M., 1977. Seasonal variation of phytoplankton biomass, chlorophyll *a* and alkaline phosphatase activity in Lake Saadjärv. ENSV TA Toimet. Biol. **26** (1) : 36—48.
Mäemets, A., 1974. On Estonian lake types and main trends of their evolution. Estonian wetlands and their life. Estonian Contributions to the IBP. 7. Tln. : 29—62.
Reichardt, W., Overbeck, J., Steubing, L., 1967. Free dissolved enzymes in lake waters. Nature **216** : 1345—1347.
Talling, J. F., 1969. Sampling techniques and methods for estimating quantity of biomass: general outline of spectrophotometric methods. IBP Handbook 12. A manual on methods for measuring primary productivity in aquatic environments. Oxford : 22—24.
Vallentyne, J. R., 1955. Sedimentary chlorophyll determination as a paleobotanical method. Canad. J. Bot. **33** : 304—313.
Wood, R. B., Gibson, C. E., 1973. Eutrophication and Lough Neagh. Water Res. **7** (1—2) : 173—187.
Алекин О. А., 1954. Химический анализ вод суши. Л. : 95—102.
Кываск В., Милиус А., Порк М., 1975. Сезонные изменения биомассы и содержания хлорофилла *a* фитопланктона в эвтрофных озерах Эстонии. В сб.: Основы биопродуктивности внутренних водоемов Прибалтики. Вильнюс : 132—133.
Лаугасте Р., 1974а. Размеры и вес наиболее распространенных водорослей в озерах Чудско-Псковском и Выртсъярв. Биология пресноводных организмов Эстонии. Гидробиологические исследования 6. Тарту : 7—25.
Лаугасте Р. А., 1974б. Динамика фитопланктона Псковско-Чудского водоема. Изв. ГосНИОРХ **83** : 33—37.
Кумсаре А. М., 1963. Расчет биомассы фитопланктона по суммарному объему клеток. Гидробиология и ихтиология внутренних водоемов Прибалтики. Рыбное хозяйство внутренних водоемов Латвийской ССР 7. Рига : 67—73.
Трифонова И. С., 1973. Соотношение интенсивности фотосинтеза и биомассы фитопланктона в озере Красном. В сб.: Лимнология Сев.-Запада СССР 3. Таллин : 137—140.
Трифонова И. С., 1975. Показатели продуктивности фитопланктона в озерах разного типа. В сб.: Основы биопродуктивности внутренних водоемов Прибалтики. Вильнюс : 184—185.

Academy of Sciences of the Estonian SSR,
Institute of Zoology and Botany

Received
Nov. 19, 1975

Anu MILIUS, Maia PORK

PANGODI JÄRVE FÜTOPLANKTONI BIOMASSI, KLOROFÜLLI *a* SISALDUSE JA ALUSELISE FOSFATAASSE AKTIIVSUSE SESOONNE DÜNAAMIKA

Resümee

1974. aastal uuriti Pangodi järve fütoplanktoni biomassi, liigilise koostise, klorofülli *a* sisalduse ja fosfataasse aktiivsuse sesoonset dünaamikat ja korrelatsiooni. Fütoplanktoni aastases tsüklis täheldati kolm maksimumi (kevadel, suvel ja hilissügisel) ning kaks miinimumi (suvel juunis ja talvel). Kevadise maksimumi (biomass 7,1 gm^{-3}, klorofüll *a* 21 mgm^{-3}) ajal moodustasid peamise hulga fütoplanktonist räni- (*Synedra acus* var. *radians* ning var. *angustissima*) ja koldvetikad (*Dinobryon* sp. sp., *Uroglenopsis americana*). Suvise maksimumi (biomass 9,3 gm^{-3}, klorofüll *a* 40 mgm^{-3}) ajal augustis domineerisid sinivetikad (*Aphanizomenon flos-aquae, Oscillatoria redekei*). Kolmanda, hilissügisese maksimumi põhjustas peamiselt üks liik — *Oscillatoria redekei*. Klorofülli *a* sesoonne dünaamika korreleerus hästi biomassiga kuni augusti maksimumini. Septembris-oktoobris biomass tunduvalt vähenes ja klorofülli *a* sisaldus tõusis pidevalt, saavutades maksimumi novembri lõpul (62 mgm^{-3}). Hea korrelatsioon esineb biomassi ja fosfataasse aktiivsuse vahel. Fütoplanktoni sesoonne dünaamika ja liigiline koostis ning klorofülli *a* väärtused näitavad, et Pangodi järv on viimastel aastatel veelgi eutrofeerunud ning muutunud hüpereutroofsete joontega veekoguks.

Eesti NSV Teaduste Akadeemia
Zooloogia ja Botaanika Instituut

Toimetusse saabunud
19. XI 1975

Ану МИЛИУС, Майа ПОРК

СЕЗОННЫЕ ИЗМЕНЕНИЯ БИОМАССЫ, СОДЕРЖАНИЯ ХЛОРОФИЛЛА *a* И ЩЕЛОЧНОЙ ФОСФАТАЗНОЙ АКТИВНОСТИ ФИТОПЛАНКТОНА В ОЗЕРЕ ПАНГОДИ

Резюме

В течение 1974 года в оз. Пангоди проводились наблюдения за сезонной динамикой и вертикальным распределением биомассы, видового состава, содержания хлорофилла *a* и фосфатазной активности фитопланктона. В сезонной динамике фитопланктона наблюдались три максимума (весной, летом, поздней осенью) и два минимума (летом (в июне) и зимой). Весенний максимум (биомассы 7,1 *г/м*³, хлорофилла *a* 21 *мг/м*³) вызван диатомовыми (*Synedra acus* var. *radians* и var. *angustissima*) и хризофитовыми (*Dinobryon* sp. sp., *Uroglenopsis americana*). В летний максимум в августе (биомассы 9,3 *г/м*³, хлорофилла *a* 40 *мг/м*³) доминируют сине-зеленые (*Aphanizomenon flos-aquae, Oscillatoria redekei*). Третий максимум в динамике фитопланктона, вызванный холодолюбивым видом *Oscillatoria redekei*, наблюдался в ноябре. Максимальное содержание хлорофилла *a* наблюдалось в то же время — 62 *мг/м*³ (биомассы 9,1 *г/м*³). Годовые изменения и вертикальное распределение биомассы, содержания хлорофилла *a* и фосфатазной активности в общем коррелируют. Наилучшим образом коррелируют показатели биомассы и фосфатазной активности. Сезонная динамика и видовой состав фитопланктона, а также показатели хлорофилла *a* оз. Пангоди характерны для сильно эвтрофных низких озер, имеющих черты гиперэвтрофии.

Институт зоологии и ботаники
Академии наук Эстонской ССР

Поступила в редакцию
19/XI 1975