ACTA SOCIETATIS
BOTANICORUM POLONIAE
Vol. XLII — nr 1
1973

Diatoms of the concrete embankment of the Zegrze Lake

HANNA BORZDYŃSKA

Institute of Botany, Warsaw University

(Received: March 30, 1972.)

Abstract

It has been established that conditions for the development of diatoms on a concrete embankment are favourable. Beside organisms permanently or periodically connected with the solid substrate, typical planktons also occurred. The following species were most numerous: *Cymbella affinis, Nitzschia kützingiana, Amphora ovalis* var. *pediculus* and *Navicula gracilis*. The most intensive development of diatoms was observed in April, May, July and October. The total number of organisms depended on pollution of water in the Żerań Canal, increased water temperature in autumn in the section between the Canal and Białobrzegi and intensity of waves.

INTRODUCTION

Chemical and biological studies on the waters of the Narew and Bug rivers as well as those of the Zegrze Lake were carried out in 1962—1965 in the Institute of Water Control and Exploitation in Warsaw. Diatoms and other groups of algae were studied only summarily (Dojlido, Jakubowska et al. 1967). Górska (personal communication) performed more detailed analyses of diatoms. No data are available on epiphitic algae occurring in this new water body. In view of this, studies were undertaken on periphyton algae occurring on the concrete embankments of the water body in the vegetation season of 1967. These studies were performed in order to establish which algae of the class *Bacillariophyceae* are most frequent, what quantitative proportions occur between them as well as to analyse the differentiation of the material in dependence on the time and site of sampling.

This work was performed in the Department of Plant Systematic and Geography, Warsaw University, under the direction of Professor Alina Skirgiełło, to whom the author is greatly indebted. The author is also grateful to Assistant Professor Zbigniew Podbielkowski for his valuable advice and instructions.

DESCRIPTION OF THE AREA

The Zegrze retention lake was formed in 1963 owing to the construction of a dam on the Narew and Bug rivers. It is one of the largest lowland barrier lakes in Poland. Its total area, together with the backwater of the rivers Narew and Bug, is about 3300 sq km; its volume amounts to about 100 million cu. m of water. The average depth of the lake is 3—4 m, near the dam in Dębe — 5.7 m; larger depths (6—7 m) are observed in the former river beds. The water body has an arched shape. Its right bank consists of the former high bank of the Narew river, whereas the left one — of an artificial embankment mostly strengthened with concrete. The lake consists of waters of the Bug (about 58 percent) and Narew (about 42 percent). The contribution of the waters of the Żerań Canal as well as those of the rivers Rządza and Prut is but slight.

METHODS

The material was collected on selected observation station from April to November, 1967. Small fragments of concrete covered with algae were split off from the surface of the constantly submerged concrete embankments and immediately fixed in 4 percent formalin. In the laboratory, the entire periphyton was carefully collected from a 1 sq cm surface and placed in a small beaker. Then the fixing fluid was removed with distilled water and the sample was treated with 30 percent hydrogen peroxide solution or, in the case of a thick coating ($>$ 2 mm) of periphyton algae — with concentrated sulphuric acid and was boiled for 5—20 min in order to destroy completely the organic matter. Next, several potassium nitrate crystals were added to the beaker in order to decolorize the solution and then the preparation was washed until hydrogen peroxide or sulphuric acid were completely removed. The thoroughly washed material containing valves of the diatoms was concentrated to the volume of 1 ml. Then, three preparations were made from each sample. An 0.03 ml drop of the solution was placed with a graduated delivery pipette on a coverglass and spread on the surface with a glass rod. After drying, the preparations were embedded in styrax or pleurax, and both qualitative and quantitative analyses were performed. Nonmacerated material was observed parallelly. The diatoms were measured, described and drawn by means of a drawing apparatus. After qualitative elaboration the samples were studied quantitatively. Two bands (longitudinal and transversal) were selected at random and all the valves of diatoms lying within these bands were counted under 200 $\times$ magnification. The number of diatoms was counted in 120 fields of vision (avoiding intercrossing fields) constituting 2 percent of the total surface area of the glass. In the case of 450 × magnification the diatoms were counted in 360 fields of vision. The number of individual species of diatoms occurring on 1 sq cm of concrete was calculated according to the following formula:

$$\text{Number of diatoms} = K \cdot \frac{S \cdot 100}{P \cdot 6}$$

where: K = number of valves
S = surface area of coverglass
P = surface area of fields examined

The results were made even to 500. They should be treated as provisional since they involve a certain error which arose in the course of analyses. A part of the valves was destroyed in the course of scraping off and roasting. Sometimes the valves did not separate and could be counted as one instead of two elements. Also the distribution of the material on the glass was not always uniform. Despite these inaccuracies the results are comparable since analyses of all the samples were carried out in an identical way.

ALGOLOGIC CHARACTERISTIC OF OBSERVATION STATIONS

Seven observation stations were selected on the left bank of the Zegrze Lake along the section Dębe (Bug—Narew) — Holendry (Narew) (Fig. 1). They involved a 33 km long bank line. Features characteristic of the water body, such as the mouths of the rivers Bug, Narew and Rządza, as well as the possible influence of the macroscopic structure of concrete embankments, of the intensiveness of waving and the influence of the waters of the Żerań Canal on the diatom flora were taken into account in the selection of observation stations.

The concrete plates, from which the material for analyses was collected, were covered with a layer of specific sediment composed of living and dead minute aquatic organisms. At all the observation station (with the exception of station 6) a belt of algae (mainly *Cladophora glomerata, Ulothrix zonata* and *Oedogonium* sp.) occured on this substrate directly beneath the water surface. Numerous *Chlorococcales* were observed among the thalli of these algae. Downward from this belt a smooth and slippery coating occurred. It consisted mainly of *Cyanophyta* and *Bacillariophyceae*. The group of diatoms was analyzed in detail.

O b s e r v a t i o n s t a t i o n 1. Concrete embankment coarse, readily crumbling. Bottom sandy. Waving weak.

Representatives of the following genera were most numerous: *Navicula* (18 taxons), *Fragilaria* (10 taxons), *Cymbella* (9 taxons), *Nitzschia*

(9 taxons) and *Synedra* (8 taxons). The following common diatoms occurred in large numbers during the entire period of sampling: *Cymbella affinis, Nitzschia kützingiana, Amphora ovalis* var. *pediculus, Navicula*

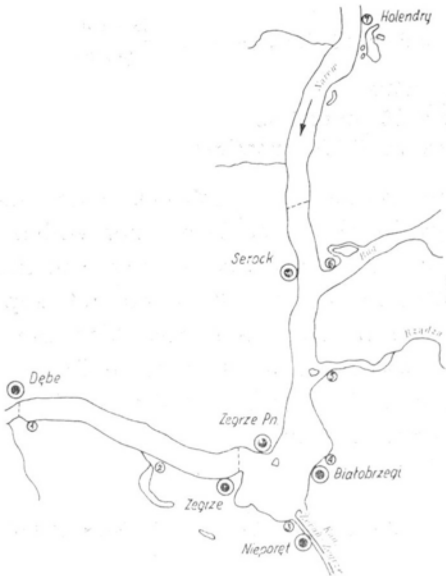


Fig. 1. Distribution of observation stations: 1 — Dębe, 2 — Dębe—Zegrze, 3 — Żerań Canal, 4 — Białobrzegi, 5 — mouth of Rządza River, 6 — Bug River backwater, 7 — Holendry

cryptocephala var. *veneta, Melosira varians, M. granulata. Cyclotella meneghiniana, Navicula gracilis, Cocconeis placentula* var. *euglypta, Diatoma vulgare* var. *productum, Cymbella prostrata* and *Synedra ulna*. Also *Cymbella parva* occurred abundantly, but it was not observed in May and June, whereas *Synedra vaucheriae* was also common, but was not found in October and November.

The following species occurred in small numbers but throughout the period of sampling: *Cymbella ventricosa, Achnanthes lanceolata, Cocconeis pediculus, C. placentula, Epithemia sorex, Fragilaria construens* var. *venter, F. pinnata* var. *lancettula, Synedra ulna* var. *oxyrhynchus*.

The following diatom genera prevailed per 1 sq m of the concrete surface and mostly contributed to the formation of periphyton: *Cymbella, Nitzschia* as well as *Diatoma, Navicula* and *Amphora* (Table 1). Representatives of these genera prevailed quantitatively throughout the period of sampling.

Observation station 2. Concrete surface coarse.

Table 1

Contribution of predominating genera of diatoms /in percents/ per 1 sq of concrete surface

Species	Month															
	IV				V				VI				VII			
	Station															
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Achnanthes	2,0	0,1	2,5	-	0,3	0,4	0,7	0,2	3,0	0,6	0,9	0,2	3,0	0,1	0,1	0,2
Amphora	11,0	2,0	0,8	-	0,6	1,2	0,6	-	4,0	2,8	2,2	1,1	14,9	1,5	0,4	0,7
Cocconeis	4,5	0,7	0,6	0,5	0,3	0,6	0,2	0,6	2,4	1,1	1,4	1,8	2,6	0,6	2,1	1,4
Cyclotella	1,5	1,3	0,1	0,7	0,8	2,7	2,0	1,1	4,6	5,3	1,5	1,4	1,4	1,8	2,9	6,4
Cymbella	24,3	66,0	10,2	3,7	66,0	40,0	13,2	42,0	40,0	21,0	38,7	47,8	57,0	60,5	74,2	38,5
Diatoma	2,7	6,2	1,0	1,4	19,0	24,5	15,6	14,2	6,3	32,6	8,8	21,8	5,5	16,6	0,5	30,6
Fragilaria	0,6	0,7	0,8	0,7	0,3	1,6	1,6	0,2	6,5	0,6	0,9	0,9	3,3	0,1	1,5	1,9
Gomphonema	0,1	0,4	42,4	18,2	1,0	9,5	5,3	17,8	0,4	1,9	5,7	1,6	0,1	-	0,5	1,1
Melosira	1,4	2,2	1,9	7,5	1,0	3,5	13,2	-	4,6	4,1	15,0	1,1	1,7	2,3	5,7	4,1
Navicula	3,2	3,0	9,7	3,6	2,3	8,4	8,5	3,3	10,0	7,2	7,8	2,1	4,6	2,4	5,6	3,3
Nitzschia	47,0	15,4	6,0	19,2	2,4	1,0	20,3	5,0	11,4	21,5	15,3	1,6	4,1	11,8	3,6	2,6
Synedra	1,5	0,2	18,7	40,5	5,8	3,3	13,9	14,0	6,5	0,8	1,6	11,2	0,6	0,1	1,0	1,2
Others	0,2	1,8	5,3	4,2	0,5	0,3	5,1	1,6	0,2	0,5	0,2	7,4	0,2	2,2	1,9	8,0

Species	Month															
	VIII				IX				X				XI			
	Station															
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Achnanthes	1,0	0,1	-	-	1,6	0,2	0,4	1,6	1,0	0,1	0,3	-	0,1	-	0,6	-
Amphora	8,0	3,1	0,6	1,0	11,8	5,0	0,8	11,8	9,6	2,5	2,1	5,8	1,5	2,5	1,8	1,1
Cocconeis	1,7	1,5	0,7	0,8	1,5	1,3	0,1	1,5	1,9	0,8	0,4	0,5	1,3	0,7	1,1	0,4
Cyclotella	1,3	1,8	8,0	1,0	1,2	2,6	34,1	1,2	0,5	0,9	35,1	0,4	0,5	1,0	13,8	0,4
Cymbella	33,0	67,5	13,0	44,7	11,7	61,0	2,5	11,7	29,6	64,0	2,1	31,3	50,0	53,0	28,2	37,8
Diatoma	1,6	6,3	1,5	2,5	5,0	4,4	3,8	5,0	3,7	3,6	4,5	8,3	3,0	3,4	3,7	1,0
Fragilaria	2,2	0,7	1,8	0,6	1,6	0,5	0,7	1,6	0,8	0,4	0,4	0,1	0,6	0,5	0,2	0,6
Gomphonema	0,5	-	2,6	0,7	0,8	0,1	1,1	0,8	0,4	0,1	0,3	-	1,0	-	1,3	0,7
Melosira	5,5	3,0	9,5	0,5	9,3	2,2	6,0	9,3	8,9	1,6	16,0	1,0	2,2	1,4	5,0	1,0
Navicula	1,6	2,0	33,6	5,1	2,4	7,1	20,4	2,4	4,1	6,2	14,2	32,1	22,5	12,7	32,2	27,6
Nitzschia	4,1	6,0	10,0	13,1	50,0	11,8	13,4	50,0	37,3	17,0	20,4	20,0	16,0	18,4	9,6	24,7
Synedra	1,2	1,6	16,0	0,4	1,8	1,2	14,6	1,8	1,3	0,4	3,4	-	0,7	1,4	1,6	0,2
Others	0,4	6,4	2,7	29,6	0,3	2,6	2,1	0,3	0,9	2,4	0,5	0,5	0,6	5,0	0,8	5,5

Most taxons were distinguished in the following genera: *Novicula* (15), *Fragilaria* (9), *Synedra* (9) and *Nitzschia* (6). The following species were abundant throughout the period of sampling: *Cymbella affinis, Nitzchia kützingiana, Navicula gracilis, Cymbella parva, Diatoma vulgare* var. *lineare, D. vulgare* var. *productum, Cyclotella meneghiniana, Navicula cryptocephala* var. *veneta.* Common were: *Melosira granulata, Cocconeis placentula* var. *euglypta, Cymbella ventricosa, C. prostrata.* The following species occurred in small numbers throughout the period of sampling: *Amphora ovalis, Cocconeis diminuta, C. pediculus, Cyclotella comta, Gyrosigma attenuatum, Melosira italica, M. varians, Rhoicosphenia curvata, Stephanodiscus astrea. Diatoma vulgare* var. *breve* was frequent but not observed in May.

Analogously as in station 1 (Table 1) species of the following genera were most numerous: *Cymbella, Nitzschia, Diatoma, Navicula* and *Amphora.* The genus *Cymbella,* the representatives of which constituted invariably (with the exception of May and June) over 50 percent of diatoms, prevailed distinctly. *Cymbella affinis* predominated. The contribution of the genera *Achnanthes, Amphora, Cocconeis, Fragilaria, Melosira* and *Synedra* oscillated within the limits of 0.1 to 5.3 percent. Representatives of the genus *Gomphonema* were most numerous in May constituting 9.5 percent of all the diatoms occurring in this month.

Observation station 3. This post was situated at the junction of the Żerań Canal and the Zegrze Lake. Water invariably turbid, heavily polluted. From September to November the coating layer adjacent to the concrete decayed. After removal of the external layer of the coating, the deeper one exhibited a green-black colour and reeked. On other sites, in late autumn the coating flaked off and was washed off by the water; no decomposition processes of organic substance were observed.

Most taxons were distinguished in the following genera: *Navicula* (20), *Nitzschia* (12), *Gomphonema* (11), *Synedra* (11), *Cymbella* (9) and *Fragilaria* (7). The following species occurred most frequently: *Cyclotella meneghiniana* nad *Navicula mutica* (not observed in April), *Cymbella affinis, Melosira varians, Nitzschia palea, N. kützingiana, N. dissipata, N. linearis* (not observed in April and November) and *Diatoma vulgare* var. *productum. Gomphonema olivaceum, Synedra vaucheriae* and *Navicula viridula* occurred abundantly in spring, whereas *Synedra amphicephala* and *S. tabulata* developed intensively in September and October.

It is interesting, that *Gomphonema* develops in masses in April (42.4 percent of the total number of diatoms), whereas in other months its quantitative contribution is very low. No distinct dominants occur in May; the genera *Nitzschia, Diatoma, Synedra* as well as *Cymbella* and *Melosira* were relatively most abundant (Table 1). In June and July

Cymbella and in August *Navicula* dominated, whereas in September and October *Cyclotella meneghiniana* developed, constituting about 35 percent of all diatoms at this period. In November *Navicula* and *Cymbella* reappeared in considerable numbers.

Observation station 4. Concrete coarse, crumbling. Waving somewhat more intensive than at stations 1—3. A tourist centre is situated nearby.

Most taxons were distinguished in the following genera: *Navicula* (10), *Fragilaria* (7), *Synedra* (7), *Cymbella* (6) and *Nitzschia* (6). The following species were abundant from April to November: *Cymbella affinis, Nitzschia kützingiana, Navicula gracilis, N. cryptocephala* var. *veneta, Diatoma vulgare* var. *lineare*. The following species were also frequent: *Diatoma vulgare* var. *productum* (absent in May), *Cyclotella meneghiniana, Cocconeis placentula* var. *euglypta* and *Amphora ovalis* var. *pediculus* (absent in April and May). In spring *Synedra vaucheriae, Gomphonema olivaceum* and *G. angustatum*, and in autumn *Epithemia sorex* and *Cymbella parva* occurred frequently. The genus *Cymbella* was the most frequent from May to November, constituting from 31 to 47.8 percent of diatoms (Table 1) and absolutely dominating in September (72 percent). The genera *Synedra, Nitzschia* and *Gomphonema* prevailed in April. The representatives of the genus *Diatoma* were frequent in May, June and July, whereas the genera *Navicula* and *Nitzschia* were abundant from August to November. The genus *Epithemia*, represented by *E. sorex* has been omitted in the Table. The frequency of this species distinctly increased in August amounting to about 1.3 mln individuals per 1 sq cm, i.e. to 28.8 percent of the total number of diatoms occurring on this surface.

Observation station 5. Concrete compact, smooth. Waving moderate. Samples were collected from the site where the waters of the Bug and Rządza rivers intermix.

Similarly as at stations 1—4 *Cymbella affinis* and *Nitzschia kützingiana* were most frequent. *Epithemia sorex* exhibited three developmental maxima: in July, September and the highest in October (about 1.2 million individuals per 1 sq cm). The following species were also frequent: *Amphora ovalis* var. *pediculus* (more frequent than var. *ovalis*), *Navicula gracilis, N. cryptocephala* var. *veneta and Cymbella ventricosa*. The following species were common: *Fragilaria pinnata, Melosira granulata, Cocconeis placentula* var. *euglypta, Amphora ovalis, Cymbella prostrata, Diatoma vulgare* var. *productum* and *Cymbella parva* — most frequent in October and November. The genus *Cymbella* exhibited the highest contribution in spring and autumn (Table 2). It was particularly abundant in April, whereas in May and June it decreased in favour of *Nitzschia* and *Diatoma* (May) and *Cocconeis, Epithemia* and

Table 2

Contribution of predominating genera of diatoms /in percents/ per 1 sq of concrete surface

Species	Month																							
	IV			V			VI			VII			VIII			IX			X			XI		
	Station																							
	5	6	7	5	6	7	5	6	7	5	6	7	5	6	7	5	6	7	5	6	7	5	6	7
Achnanthes	-	-	2,8	1,0	0,2	6,1	1,1	0,5	3,0	0,4	-	0,8	1,9	3,0	0,6	0,3	-	0,4	0,1	-	0,6	0,3	-	1,5
Amphora	1,2	-	4,9	2,0	0,4	1,6	8,8	1,0	5,3	7,0	0,9	8,9	6,0	8,0	31,6	7,3	19,0	4,0	5,2	-	3,3	1,8	4,2	10,6
Cocconeis	1,7	0,1	1,8	0,6	0,7	2,2	12,9	1,6	4,0	5,2	3,2	4,2	9,8	9,4	1,1	1,9	14,4	0,6	1,5	2,0	0,5	1,3	11,6	1,6
Cyclotella	-	0,4	-	2,7	0,9	0,5	1,7	1,6	-	1,0	3,0	0,3	8,8	1,5	-	1,0	1,9	-	0,8	3,9	0,6	0,5	1,3	0,4
Cymbella	68,0	3,3	3,1	32,2	33,5	3,8	27,2	5,6	5,3	13,8	0,5	4,1	12,0	4,9	0,5	33,5	1,9	0,9	43,6	5,5	11,1	50,0	4,1	6,0
Diatoma	0,2	0,6	1,9	7,7	4,0	0,5	2,5	3,5	-	-	0,5	-	18,6	-	-	1,0	9,5	-	2,7	20,2	0,1	1,2	23,8	0,1
Epithemia	2,8	-	2,7	0,9	0,9	1,6	11,3	21,1	4,3	58,0	76,2	56,0	5,8	11,4	34,9	12,3	16,9	59,5	16,6	16,8	33,7	9,8	23,4	35,5
Fragilaria	2,8	48,0	4,5	6,6	15,3	4,4	3,4	22,9	3,0	1,6	2,5	6,6	6,4	4,5	8,5	3,3	0,3	12,5	4,4	-	5,8	1,0	-	13,9
Gomphonema	3,9	40,5	14,5	3,3	6,4	3,8	2,3	4,0	-	-	-	0,1	0,2	21,4	-	0,6	0,5	-	0,7	-	0,3	0,9	1,6	0,6
Melosira	2,3	1,0	1,8	4,5	1,9	2,9	11,3	3,9	5,9	3,7	3,5	0,3	14,7	8,0	-	3,2	6,7	1,2	2,8	11,3	3,0	3,0	5,0	-
Navicula	7,4	0,1	22,7	7,5	12,2	38,7	6,0	14,3	37,6	3,2	0,9	10,8	2,9	4,5	10,7	5,7	15,2	3,9	7,1	14,4	14,1	5,7	9,6	16,5
Nitzschia	4,5	0,3	25,4	23,0	11,7	18,3	5,6	7,8	21,7	4,2	2,5	6,5	7,3	6,0	3,0	28,0	2,0	3,3	13,4	6,5	20,3	22,3	5,5	8,1
Synedra	2,7	2,5	3,9	7,1	9,2	8,2	4,2	7,4	2,0	0,1	0,9	0,5	2,8	1,5	-	0,7	3,9	0,2	0,2	[illegible]	0,2	0,9	2,8	1,1
Others	2,5	3,2	10,0	0,9	2,7	7,4	1,7	4,8	7,9	1,8	5,4	0,9	8,2	15,8	9,1	1,2	4,8	13,5	0,9	10,5	[illegible]	0,1	7,3	4,1

Melosira (June). *Cymbella* dominated once more in autumn. From September to November its quantity increased steadily. In this period *Nitzschia* and *Epithemia* constituted 30—40 percent of the total number of diatoms. Owing to the intensive development of *Epithemia sorex* in July the genus *Epithemia* constituted 58 percent of the total number of diatoms. After the period of mass occurrence, in August its frequency diminished (5.8 percent) and *Diatoma, Melosira* and *Cocconeis* prevailed.

Observation station 6. The concrete embankment involving both banks of the Bug river backwater. The concrete is compact, smooth, fine-grained. Waving of the water in the course of sampling was very intensive. The direction of movement of the superficial water layer depended on the wind and was parallel to the main current of the Bug river, i.e. from the backwater to the Zegrze Lake or inversely. The studies of Dojlido, Jakubowski et al. (1967) seem to indicate that despite the changing direction of movement of these water layers the waters of the Narew and Bug rivers do not intermix here and the composition of the diatom population exhibits features characteristic of the flora of the Bug river.

It was observed that the diatom flora was both qualitatively and quantitatively poor here. This was due probably to the very intensive, periodically changing waving as well as to the smoothness of the concrete. Most taxons were observed in the genera *Navicula* (8) and *Nitzschia* (8). The following species dominated in spring: *Fragilaria intermedia* (about 1.7 million individuals per 1 sq cm), *Gomphonema angustatum* var. *productum* (0.7 million) and *Cymbella affinis* (0.4 million). *Epithemia sorex* was common and frequent throughout the sampling period. *Melosira granulata, Navicula gracilis, Nitzschia kützingiana, Rhoicosphenia curvata* and *Synedra vaucheriae* were also common and frequent. The following genera dominated on this site (Table 2): *Fragilaria* (in spring), *Epithemia* (from June to November; maximum occurrence in July), *Navicula* (May, June, September, October), *Gomphonema* (April and August) and *Diatoma* (October, November).

Observation station 7. Concrete compact, smooth. Waving very weak. Samples were collected on a site separated from the river current by willows submerged after the construction of the dam on the river Narew.

Representatives of the genera *Navicula* (21 taxons), *Nitzschia* (12) and *Fragilaria* (9) were frequent. *Rhopalodia gibba* (together with var. *ventricosa*) occurring abundantly in autumn was specific for this site. *Epithemia sorex* and *Nitzschia kützingiana* dominated here. *Fragilaria pinnata, Amphora ovalis* var. *pediculus, Navicula cryptocephala* var. *veneta* and *N. gracilis* occurred frequently.

Cymbella affinis, common on other sites, was not numerous here and only in October belonged to dominants (0.7 million individuals per 1 sq cm).

The following genera prevailed quantitatively in spring: *Nitzschia*, *Navicula* and *Gomphonema* (absent in June). They constituted about 60 percent of the total number of diatoms (Table 2). *Epithemia* dominated from July to November and was most abundant in July and September. The genus *Amphora* (mainly *A. ovalis* var. *pediculus*) was frequent in August, whereas the genera *Fragilaria*, *Navicula* and *Nitzschia* were abundant in autumn.

GENERAL NOTES ON OBSERVATION STATIONS 1—7

A total of 161 taxons from 31 genera were found at all the observation stations. The representatives of the following genera were most frequent: *Navicula* (31), *Nitzschia* (17), *Fragilaria* (13), *Synedra* (13), *Cymbella* (12) and *Gomphonema* (12).

The following species are particularly interesting: *Fragilaria virescens* Ralfs var. *subsalina* Grun. — this diatom occurs in brackish water (Siemińska 1964). The author observed it several times at stations 1 and 2: length of valves 18 μ, width 5.2 μ, 18 transversal stripes per 10 μ (Siemińska 1964: about 20 stripes per 10 μ) (Fig. 2a).

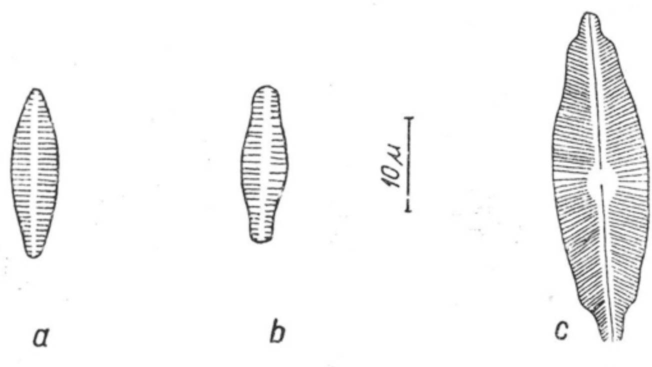


Fig. 2. *Fragilaria virescens* Ralfs var. *subsalina* Grun. (a), *Fragilaria bicapitata* Mayer (b), *Navicula integra* (W. Sm.) Ralfs (c)

Fragilaria bicapitata Mayer — found in the seston of the Biała Przemsza and Dunajec rivers (Siemińska 1964), noted only once in the periphyton of the Zegrze Lake at station 3: length of valves 16.4 μ, width 4.8 μ, 14—16 transversal stripes per 10 μ (Fig. 2b).

Navicula integra (W. Sm.) Ralfs — a species frequently observed on sea shores and in silt of inland brackish waters (Siemińska, 1964); it was found but once on station 7: length of valves 35.8 μ width 10 μ, 19—23 stripes per 10 μ (Fig. 2c).

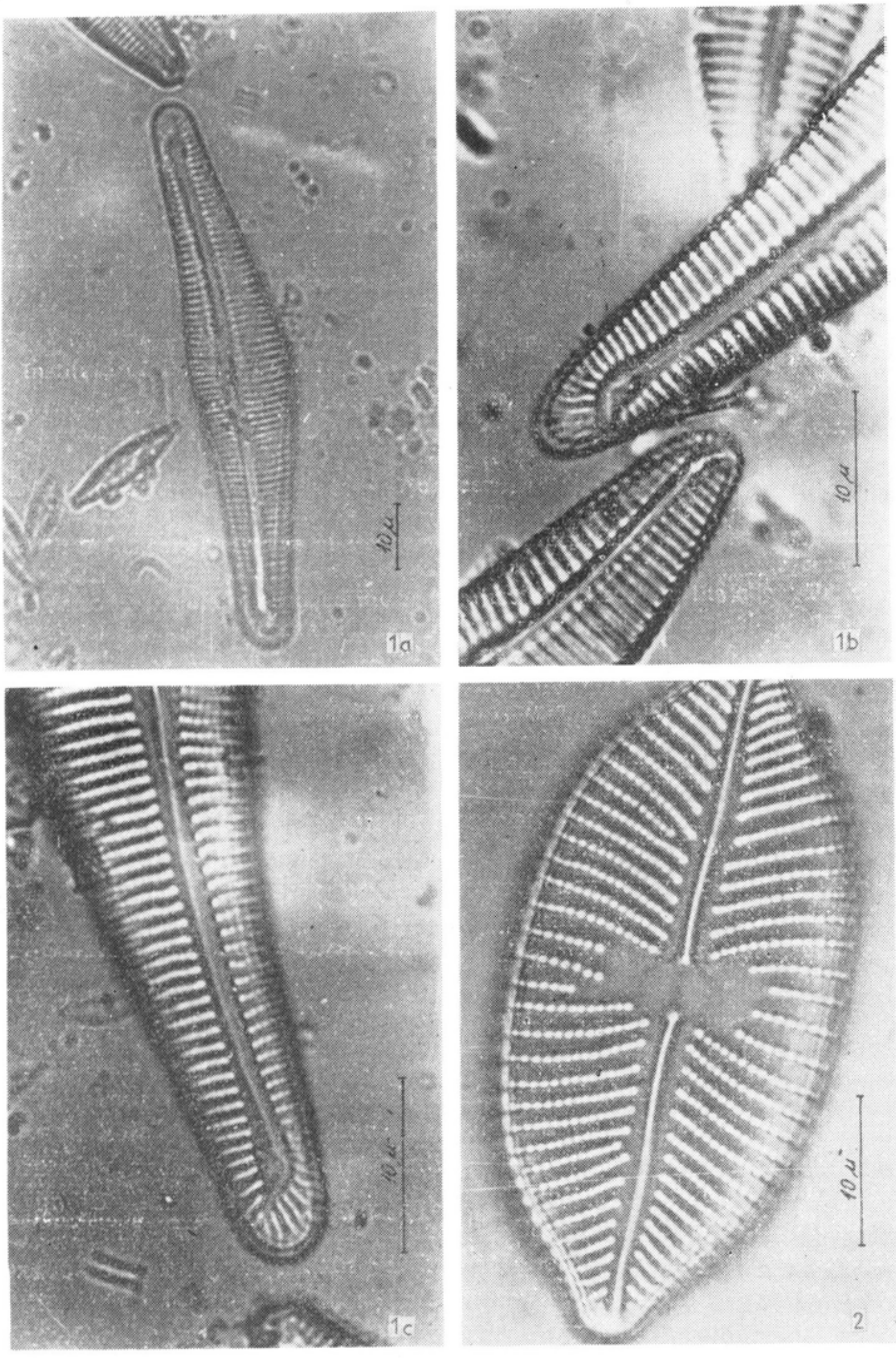
Navicula amphibola Cl. — according to Siemińska not observed in Poland, it was found in the peat-bog Całowanie (Rozum, personal communication) and on a *Polygonum* stem in the Bytuń Lake (Bohr 1967); in the Zegrze Lake it was found twice at station 2; length of valves 48 and 50 μ, width 21,5 and 22 μ, 5—10 transversal stripes per 10 μ (Siemińska 1964: 7—9, Topachevskii 1960: 7—10, Hustedt 1966: 5—10 per 10 μ) (Plate I, 2).

Cymbella parva (W. Sm.) Cl. — dorsal margin convex, ventral margin straight, sometimes slightly concave, in the center invariably convex. Length: 65—81 μ (Siemińska 1964: 25—70 μ, Topachevskii 1960: 25—78 u), width 12—14 μ (Siemińska 1964: 8—12 μ, Topachevskii: 8—15 μ). Stripes transversal, in the centre radial, further perpendicular, at the ends several convergent stripes. Polar ends of the fissure surrounded with stripes, often alternately short and long. Transversal stripes on the dorsal side 9—11, on the ventral side 10—11, at the ends about 13 per 10 μ. Plate I, 1 a, b, c.

The lowest number of taxons was observed at stations 6 (Bug backwater — 68) and 4 (Białobrzegi — 72), whereas the highest number at stations 3 (Żerań Canal — 114) and 7 (Holendry — 106). The number of taxons at the other stations was more or less similar. Thus, probably the conditions were more favourable for diatoms in Holendry and at the outlet of the Żerań canal than on the other sites. This seems to indicate differences in the complex of agents influencing the development of these organisms.

The lowest number of organisms was found in the periphyton of the Bug backwater although (according to the studies of the Institute of Water Control and Exploitation, 1967) the waters of this river are richer in mineral and organic components than those of the River Narew. Probably this is attributable to the intensive waving at the mouth of the Bug backwater. Waves splashing on the concrete embankments prevent the settlement of organisms and wash off any sediment. This process is facilitated by the very smooth, fine-grained structure of the concrete. The material carried by the River Bug is intermixed with that of the River Narew at the height of Zegrze (Dojlido, Jakubowska et al., 1967). This favours an intensive development of diatoms at the site near Białobrzegi. Their maximum development at this site in October and November (as compared with others) is probably attributable to the influence of warm water from the Żerań canal. The difference between water temperature in Białobrzegi and Dębe reaches 6°C in autumn. In spring and summer the temperature is more or less even in the entire water body. The Żerań canal is supplied with warm water from the heat and power plant "Żerań". Its influence on the increase of temperature in the Zegrze Lake is manifested mainly in winter. After flowing into the lake this water prevents the formation

Plate I



1 *a, b, c* — *Cymbella parva* (W. Sm.) Cl.; 2 — *Navicula amphibola* Cl.

Table 3

Chemical analysis of the waters of the Żerań Canal and Zegrze Lake performed by the Institute of Water Control and Exploitation /1967/

	Date															
	April 14,		May 12,		June 12,		July 14,		August 28,		August 31,		October 4,		November 30,	
	Station															
	Białobrzegi	Żerań Canal	Białobrzegi	Żerań Canal	Białobrzegi	Żerań Canal	Białobrzegi	Żerań Canal	Białobrzegi	Żerań Canal	Białobrzegi	Żerań Canal	Białobrzegi	Żerań Canal	Białobrzegi	Żerań Canal
pH	7,9	7,6	7,9	7,6	7,9	7,9	8,3	8,1	8,2	8,5	8,1	7,8	8,0	7,8	7,9	7,7
Soluble oxygen mg/1	8,9	7,6	10,3	8,6	8,2	8,0	7,6	7,6	8,1	12,2	9,2	6,0	8,0	6,9	13,1	9,7
BOD_5 *	1,0	4,3	3,9	3,9	2,7	2,4	4,3	4,8	4,1	6,6	4,8	4,2	1,9	2,7	4,5	4,1
Oxidation capasity mg/O_2	16,9	11,3	20,8	11,4	18,6	17,0	15,2	10,8	13,8	15,2	12,0	11,2	8,8	11,5	11,9	11,0
Ammonia nitrogen N_{NH_3}	.	.	0,06	0,13	.	.	.	.	.	.	0,13	0,17	.	.	.	.
Nitrite nitrogen N_{NO_2}	.	.	0,00	0,05	.	.	.	.	.	.	0,001	0,001	.	.	.	.
Nitrate nitrogen N_{NO_3}	.	.	0,07	0,05	.	.	.	.	.	.	0,10	0,50	.	.	.	.
Organic nitrogen N_{org}	0,75	0,60	1,00	0,90	0,80	0,75	0,80	0,70	0,60	0,70	1,05	0,70	0,75	0,90	.	.
Chlorides mg/1	.	.	12,6	24,6	.	.	.	.	.	.	12,6	79,1	.	.	.	.
Total iron mg/1	.	.	0,3	0,4	.	.	.	.	.	.	0,3	0,7	.	.	.	.
Manganese mg/1	.	.	0,07	0,06	.	.	.	.	.	.	0,08	0,00	.	.	.	.
Calcium mg/1	.	.	70,3	69,2	.	.	.	.	.	.	61,1	63,2	.	.	.	.
Total dry residue mg/1	269	341	287	287	302	284	317	438	344	304	267	460	.	.	300	468
Phosphates mg/1	.	.	0,1	0,1	.	.	.	.	.	.	0,3	0,3	.	.	.	.
Sulphates mg/1	.	.	24	40	.	.	.	.	.	.	20,1	75,3	.	.	.	.
Magnesium mg/1	.	.	8,2	10,7	.	.	.	.	.	.	12,0	15,0	.	.	.	.

* Biological oxygen demand

of an ice cover on a length of 2 km. The waters of the canal flow towards Białobrzegi, they also carry industrial wastes from the factory "Bacutil". Their influence on the pollution of the lake's waters is slight and is distinct only at the mouth of the canal. Hydrochemical studies performed by the Institute of Water Control and Exloitation in the course of several years indicate that the waters of the canal contain considerable amounts of sulphates and chlorides as well as compounds of magnesium and iron. The results of analyses of the Żerań canal waters and those of the lake near Białobrzegi are compared in Table 3.

Quantitative and qualitative analyses of diatoms occurring in the periphyton at the mouth of the canal proved that the species indicated by Kolkwitz (1935) and Liebmann (1951, 1962) as characteristic of heavily polluted waters (α-mesosaprobes) such as *Nitzschia palea, Navicula viridula* and *Cyclotella meneghiniana* were very numerous here. In the systems of saprobes according to Hanuška (1956) and Sladeček (1963) they are classified as α-β- /or β-α/ mesosaprobes (*Nitzschia palea, Cyclotella meneghiniana*); *Navicula viridula* according to these authors belongs to α-mesosaprobes. These species occurred abundantly during the entire period of sampling and particularly in autumn — *Cyclotella meneghiniana* (X — 2.2 million individuals per 1 sq cm), *Nitzschia palea* (X — 0.9 million individuals per 1 sq cm) and in spring — *Navicula viridula* (V — 0.15 million individuals per 1 sq cm). *Navicula viridula* occurred in low quantities only at stations 1 and 7; *Nitzschia palea* and *Cyclotella meneghiniana* at all the stations, but not in such masses as near the Żerań canal. Moreover some species developed much more intensively at the mouth of the canal than on other sites, e.g. *Nitzschia dissipata, Navicula mutica* (only sporadicaly it was observed at stations 1, 2, 4 and 7). *Bacillaria paradoxa* occurred only at this station (from June to November), with maximum development in September and October. This indicates, that the canal supplying polluted, warm waters, exercises a considerable influence on the specific composition and abundance of diatoms at its mouth.

SEASONAL OCCURRENCE OF DIATOMS

Quantitative analyses of the material collected indicate that the development of diatoms is not uniform in the particular months: their number oscillated within wide limits — from 0.1 million (Bug backwater in August) to 8.8 million individuals per 1 sq cm (Białobrzegi in October). Observations were not carried out in winter, but from April to November two periods of particularly intensive development were observed: the spring and autumn maximum. A similar phenomenon was observed in plankton diatoms by a number of authors (Humblet-Pawłowska 1939; Luer-Jeziorańska 1939; Górska 1968).

Wysocka (1951) and Bohr (1962, 1967) reported an analogous phenomenon in diatoms developing in the periphyton. According to Bohr (1962) and other authors quoted by him the development of periphyton algae is both quantitatively and qualitatively most exuberant in September. The number of species is the highest then, since thermo-

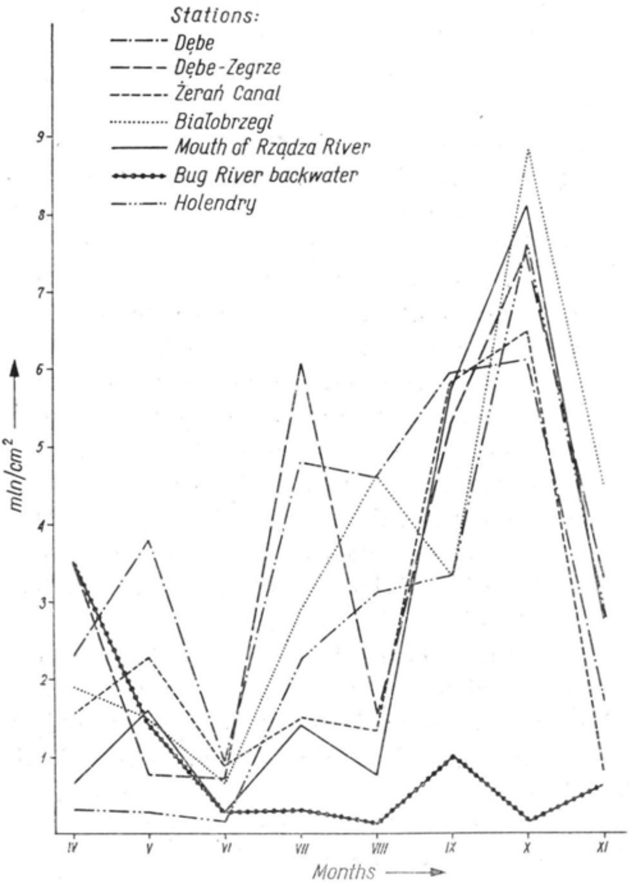


Fig. 3. Number of diatoms (in milions) per 1 sq cm of contrete surface

philous species still occur, while those developing in colder waters already appear. A similar phenomenon was observed in the Zegrze Lake: diatoms developed most intensively in autumn. Since September their numbers gradually increased, reaching in October a frequency of 8.1 million individuals per 1 sq cm at the mouth of the Rządza River and 8.8 million individuals per 1 sq cm near Białobrzegi. On the other hand, the number of taxons was not the highest in September (this could be due to the specific character of the lake and different ecological conditions on individual sites). The number of taxons depended on the site of sampling. The richest material in this respect was found in Holendry in November, in Białobrzegi in July and in April and May at the other posts. In November the number of diatoms as well as that of species decreased on all sites (with the exception of station 7). This was attributable to the occurrence of unfavourable conditions and particularly to the decrease of water temperature. The favourable conditions appearing in spring promote a mass development of these organisms (Fig. 3). The number of diatoms in the periphyton in spring amounted to 3.5 million individuals per 1 sq cm in Dębe, on the Dębe—Zegrze stretch, in the river Bug backwater, on other stations it oscillated within the limits of 0.3—2.8 million. After a decrease in June, their number once more increased in July and August. On most stations (with the exception of 6 and 7) this increment was very distinct, it was manifested particularly at stations 1 and 2 (July) as well as at station 4 (August), where the number of diatoms was considerably higher than that in spring and amounted to 4.6 (Białobrzegi), 4.8 (Dębe) and 6.0 million individuals per 1 sq cm (Dębe—Zegrze). The summer maximum was less distinct near the Żerań canal (1.5 million), at the mouth of Rządza River (1.4 million) and in the river Bug backwater (0.3 million individuals per 1 sq cm). In August the number of diatoms decreased considerably, e.g. on the stretch Dębe—Zegrze — from 6 to 1.5 million per 1 sq cm. At other stations this decrease oscillated within the limits of 0.2 (stations 1, 3. 6) to 0.6 million (station 5). No summer maximum was observed at station 7, where the number of diatoms steadily increased from June to September and amounted in October to 7.6 million individuals per 1 sq cm.

This tremendous number of periphyton diatoms represented in the Zegrze Lake a large number of species. *Cymbella, Navicula, Nitzschia, Epithemia* and *Diatoma* belonged to the most common genera. The following genera were as frequent, but the numbers of their representatives were smaller: *Amphora, Gomphonema, Fragilaria, Cocconeis, Synedra, Cyclotella* and *Melosira*. The contribution of representatives of individual genera to the periphyton depended on the season and sampling station. The following genera prevailed in spring: *Cymbella* and *Nitzschia* (stations 1, 2 and 5), *Gomphonema* and *Synedra* (stations 3 and 4), *Fragilaria* and *Gomphonema* (station 6) as well as *Navicula* and *Nitzschia* (station 7). *Cymbella* (stations 1—5) and *Epithemia* (stations 5—7) as well as *Navicula, Nitzschia, Diatoma* and *Fragilaria* were most frequent in summer. *Cymbella* and *Nitzschia* (stations 1, 2, 4, 5) as well as *Epithemia* (stations 6, 7) predominated in autumn.

The following species belonged to the most common, abundantly occurring on all the posts: *Cymbella affinis, Nitzschia kützingiana, Amphora ovalis* var. *pediculus* and *Navicula gracilis*. These species generally occurred throughout the vegetation period, from spring to autumn, only their numbers varied in individual months. The following species were also frequent: *Diatoma vulgare* var. *productum*, *D. vulgare* var. *lineare*, *Melosira varians*, *Epithemia sorex*, *Cymbella parva*, *Amphora ovalis*, *Cocconeis diminuta*, *C. pediculus*, *C. placentula* var.

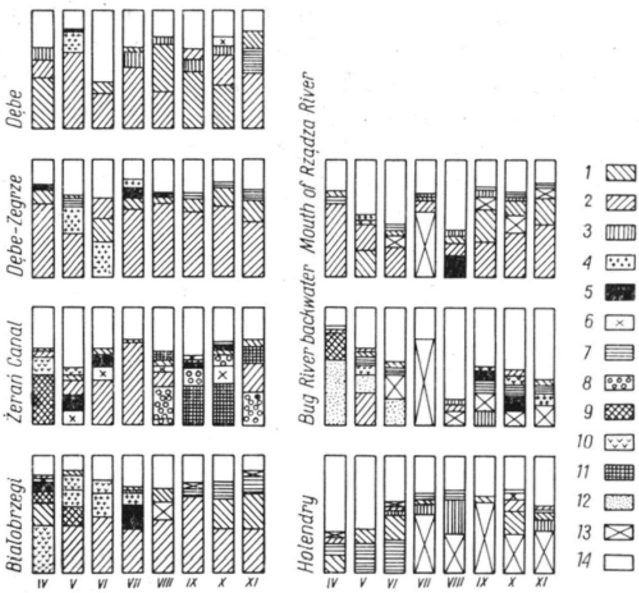


Fig. 4. Contribution of predominating species of diatoms (in percents): 1 — *Nitzschia kützingiana*, 2 — *Cymbella affinis*, 3 — *Amphora ovalis* var. *pediculus*, 4 — *Diatoma vulgare* var. *lineare*, 5 — *Diatoma vulgare* var. *productum*, 6 — *Melosira varians*, 7 — *Navicula gracilis*, 8 — *Navicula mutica*, 9 — *Gomphonema olivaceum*, 10 — *Synedra vaucheriae*, 11 — *Cyclotella comta*, 12 — *Fragilaria intermedia*, 13 — *Epithemia sorex*, 14 — others

euglypta, *Cymbella prostrata*, *C. ventricosa*, *Fragilaria construens*, *F. pinnata*, *Gomphonema angustatum* var. *productum*, *G. olivaceum* var. *calcareum*, *Navicula hungarica* var. *capitata*, *Gyrosigma attenuatum*, *Nitzschia dissipta*, *N. palea*, *Rhoicosphenia curvata* and *Synedra ulna*. *Melosira granulata* and *Cyclotella meneghiniana*, according to Cabejszek and Malanowski (1956) most characteristic of the river Bug, were also frequent.

Cymbella affinis and *Nitzschia kützingiana* were the two most common diatoms of the periphyton in the Zegrze Lake and prevailed almost throughout the vegetation season on most of the stations (Fig. 4). They were particularly frequent near the dam in Dębe, on the Dębe—Zegrze stretch, near Białobrzegi and at the mouth of the Rządza River. Their number decreased beginning from station 5. At the mouth of

Rządza River the numbers of *Epithemia sorex* greatly increased in July and its contribution to the total number of diatoms amounted to about 52 percent. In other months *Cymbella affinis* and *Nitzschia kützingiana* still prevailed. The contribution of *Epithemia sorex* was the highest at this period in the Bug River backwater and amounted to about 75 percent. Thus, we can speak of its mass appearance at this period. At the station near Holendry in summer and autumn *Epithemia sorex* was the most frequent species. Its numbers oscillated from 1.3 (July) to 2.5 million individuals per 1 sq cm (October), constituting about 30—60 percent of the diatoms occurring here.

Analyses of the material proved that the mass development of certain species is connected exclusively with a definite season of the year:

Spring (April—June)	Autumn (September—November)
Synedra vaucheriae	*Navicula gracilis*
Gomphonema olivaceum	*Diatoma vulgare* var. *breve*
Fragilaria intermedia	
Gomphonema angustatum var. *productum*	

In spring the number of *Fragilaria intermedia* amounted to 1.6 (station 6), that of *Gomphonema olivaceum* — 0.5 (station 3) and that of *Synedra vaucheriae* — 0.7 million individuals per 1 sq cm. In other months, these species were rare or even absent. Their development was rapid but short lasting. Only in this period were these diatoms closely connected with the solid substrate. The phenomenon observed confirmed the observations of Wysocka (1952) on the settlement of periphyton organisms on submerged glass plates. This author established that after a period of intensive development *Fragilaria intermedia* and *Gomphonema olivaceum* abandon the solid substrate. Probably this occurs owing to their detachment caused by ageing, waving or other mechanical factors.

Table 4
List of species and their frequency

Species	Frequency	Station
1	2	3
Melosira varians Ag.	+++	1-7
M. granulata /Ehr./ Ralfs	++	1-7
v. angustissima		
/O. Müll./ Hust.	++	1-7
M. italica /Ehr./ Kütz.	o	1-7
Cyclotella kützingiana Thw.	+	4-7
C. meneghiniana Kütz.	++	1-7
	+++	3
C. comta /Ehr./ Kütz.	++	1-3
	+	4-7
Stephanodiscus astrea	++	1-6
/Ehr./ Grun.	•	7
Meridion circulare Ag.	+	1-7
v. constricta /Ralfs/ V. H.	o	3-7
Diatoma vulgare Bory	+	3,4,6
v. breve Grun.	+++	1-5
	o	6-7
v. productum Grun.	+++	1-6
	o	7
v. lineare Grun.	+++	1,2,4,6
	o	3,5
D. elongatum /Lyngb./ Ag.	+	1,3,6,7
Opephora martyi Herib.	+	1-7
Fragilaria capucina Desm.		
v. mesolepta Rabh.	•	2,5,7
F. intermedia Grun.	++	1-7
F. construens /Ehr./ Grun.	+	1-5,7
v. venter /Ehr./ Grun.	+	1-5
v. binodis /Ehr./ Grun.	+	1-5,7
	•	4
F. pinnata Ehr.	++	1-6
	+++	7
v. lancettula /Schum./ Hust.	+	2,4-6
	++	1-7
F. virescens Ralfs		
v. elliptica Hust.	+	1,5,7
v. oblongella Grun.	•	1,7
v. subsalina Grun.	•	1,2
F. bicapitata Mayer	•	3
F. brevistriata Grun.	++	7
	+	1,2,5
	•	3-4
v. inflata /Plant./ Hust.	•	2
Ceratoneis arcus /Ehr./ Kütz.	•	3
Synedra vaucheriae Kütz.	+++	1,3-6
v. capitellata Grun.	+	1-5
S. ulna /Nitzsch/ Ehr.	++	1-7
v. oxyrhynchus /Kütz./ V. H.	+	1-5,7
v. contracta Qstr.	+	1-3,5
	•	4
v. aequalis /Kütz./ Hust.	•	3,5,7
v. amphirhynchus Grun.	o	3
S. acus Kütz.	+	1-3,5-7
S. amphicephala Kütz.	o	1,2,4
	++	3
S. rumpens Kütz.		
v. scotica Grun.	•	2,3,5-7
v. meneghiniana Grun.	•	1
S. parasitica /W. Sm./ Hust.	•	4
S. tabulata /Ag./ Kütz.	o	2
	++	3
Asterionella formosa Hass.	o	3,6

Species	Frequency	Station
1	2	3
Cocconeis diminuta Pant.	++	1-5,7
	o	6
C. placentula Ehr.	++	1-5,7
	o	6
v. euglypta /Ehr./ Cl.	+++	1-7
C. pediculus Ehr.	++	1-7
Achnanthes exiqua Grun.	+	1-3,5,7
A. lanceolata /Breb./ Grun.	+	1-7
f. capitata O. Müll.	o	1
v. rostrata /Qstr./ Hust.	++	1,7
	o	2-5
v. elliptica Cl.	+	1,7
	o	2-6
Rhoicosphenia curvata /Kütz./		
Grun.	++	1-7
Diploneis elliptica /Kütz./ Cl.	o	1,3,5
	+	7
Anomoeoneis sphaerophora		
/Kütz./ Pfitz.	•	6
Stauroneis acuta W. Sm.	•	4
S. phoenicentron Ehr.	•	3
S. smithii Grun.	•	7
Navicula cuspidata Kütz.	•	7
N. mutica Kütz.	o	1,2,4,7
	++++	3
v. nivalis /Ehr./ Hust.	•	1
v. ventricosa /Kütz./ Cl.	•	1-3
N. bacillum Ehr.	o	1,2,6,7
N. pupula Kütz.	••	1,3,7
v. rectangularis	•	7
N. protracta Grun.	•	3,6
N. integra /W. Sm./ Ralfs	•	7
N. cryptocephala Kütz.	o	2
v. veneta /Kütz./ Grun.	+++	1-7
v. intermedia Grun.	+	1-7
N. rhynchocephala Kütz.	+	1,3
N. viridula Kütz.	+	1,7
	+++	3
N. costulata Grun.	•	1,7
N. hungarica Grun.	o	3
v. linearis Qstr.	•	3
v. capitata /Ehr./ Cl.	+	3,7
	o	1,2,4-6
N. cincta /Ehr./ Kütz.	o	1-3,7
N. radiosa Kütz.	o	1,2,4-6
	+++	7
N. gracilis Ehr.	++++	1-7
N. menisculus Schum.	o	1,3-4,7
N. reinhardtii Grun.	o	2,3,7
N. anglica Ralfs	o	1-4,7
N. gastrum Ehr.	o	2,3,6,7
N. exiqua /Greg./ O. Müll.	++	1,7
	o	2-4
N. lanceolata /Ag./ Kütz.	o	5,7
N. oblonga Kütz.		
v. subcapitata Pant.	•	7
N. tuscula /Ehr./ Grun.	o	2,3,5,7
N. amphibola Cl.	•	2
Pinnularia interrupta W. Sm.		
f. minutissima Hust.	•	3
P. microstauron /Ehr./ Cl.	•	7
P. maior /Kütz./ Cl.	o	2,5,7

1	2	3
Pinnularia gibba Ehr.		
v. parva /Ehr./ Grun.	.	5
Neidium dubium /Ehr./ Cl.	.	1
Caloneis amphisbaena /Bory/ Cl.	o	3,6,7
C. bacillum /Grun./ Mer.	o	3,6,7
C. silicula /Ehr./ Cl.	o	1,5,7
C. schumanniana /Grun./ Cl.		
v. biconstricta Grun.	o	1,5,7
Gyrosigma attenuatum	++	1,2,5,7
/Kütz./ Rabh.	o	3,4,6
G. kützingii /Grun./ Cl.	.	1,2
Amphora ovalis Kütz.	++	1-7
v. pediculus Kütz.	+++	1-7
Cymbella naviculiformis Auersw.	.	1,3
C. cuspidata Kütz.	.	7
C. prostrata /Berceley/ Cl.	++	1-7
C. ventricosa Kütz.	++	1-7
C. aequalis Kütz.	.	3
C. affinis Kütz.	++++	1-7
C. parva /W. Sm./ Cl.	+++	1,2,4,5
	+	3,6,7
C. cistula /Hemp./ Grun.	+	1,5,7
	o	3,4
C. lanceolata /Ehr./ V. H.	+	1-4,5,7
C. helvetica Kütz.	o	3
C. aspera /Ehr./ Cl.	o	1
C. tumida /Breb./ V. H.	+	1,3,5,7
Gomphonema acuminatum Ehr.	o	3,5
v. coronatum /Ehr./ W. Sm.	o	3,5,6
v. trigonocephalum		
/Ehr./ Grun.	.	7
G. augur Ehr.	o	1,3,5
G. angustatum /Kütz./ Rabh.	o	3,4
v. productum Grun.	o	1,2,5,7
	++	3,4,6
G. intricatum Kütz.		
v. vibrio /Ehr./ Cl.	.	3
G. lanceolatum Ehr.		
v. insigne /Greg./ Cl.	o	3,7
G. constrictum Ehr.	o	3
G. capitatum Ehr.	o	4,7
	+	1,3,5
G. olivaceum /Lyngb./ Kütz.	++	1-7
v. calcareum Cl.	+	1-7
Epithemia zebra Grun.		
v. saxonica /Kütz./ Grun.	o	7
v. porcellus /Kütz./ Grun.	o	3,5-7

1	2	3
E. turgida /Ehr./ Kütz.	o	1-3
	++	5-7
f. vergatus /Kütz./ I. Kiss.	o	5,7
E. sorex Kütz.	o	1-3
	+++	6
	++++	4,5,7
Rhopalodia gibba /Ehr./	o	6
O. Müll.	+++	7
v. ventricosa /Ehr./ Grun.	o	2,4
	+++	7
Hantzschia amphioxys		
/Ehr./ Grun.	o	2,5
Bacillaria paradoxa Gmelin	++	3
v. tumidula Grun.	o	3
Nitzschia trybionella Hantzsch		
v. victoriae Grun.	.	1,6
v. levidensis /W. Sm./ Grun.	o	3,4,7
N. apiculata /Greg./ Grun.	.	3
N. angustata /W. Sm./ Grun.	o	5,7
N. denticula Grun.	o	3,5,7
N. sinuata Grun.		
v. tabella Grun.	o	7
N. linearis W. Sm.	o	1,4
	+++	3
N. recta Hantzsch	+	2,3,5-7
N. dissipata /Kütz./ Grun.	+	1,2,4-7
	+++	3
N. amphibia Grun.	+	1-4
	o	5-7
N. heufleriana Grun.	.	3
N. romana Grun.	o	1,2,5,7
N. palea /Kütz./ W. Sm.	++	1,2,4-7
	+++	3
N. kützingiana Hilse	++++	1-5,7
	+++	6
N. gracilis Hantzsch	o	3,5-7
N. sigmoidea /Ehr./ W. Sm.	o	1,3,5-7
N. filiformis /W. Sm./ Hust.	o	1,3,5
Cymatopleura solea		
/Breb./ W. Sm.	o	1,3-5
C. elliptica /Breb./ W. Sm.	o	1,2,4-7
v. nobilis /Hantzsch/ Hust.	.	1,7
Surirella biseriata Breb.		
v. bifrons /Ehr./ Hust.	.	7
S. angustata Kütz.	o	5-7
S. ovata Kütz.	o	1,2,4-7
	++	3
v. pseudopinnata Mayer	o	1-3,5,6

++++ - very numerously
+++ - numerously
++ - frequently
+ - seldom
o - very seldom
. - sporadically

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Okrzemki obwałowań betonowych Jeziora Zegrzyńskiego

Streszczenie

Na obwałowaniach betonowych Jeziora Zegrzyńskiego wyznaczono 7 stanowisk, z których od kwietnia do listopada 1967 r. pobierano próby peryfitonu. Zebrany materiał poddawano analizie jakościowej i ilościowej. Stwierdzono, że obwałowanie jeziora, uzbrojone płytami betonowymi, stanowi podłoże, na którym licznie osiedlające się organizmy znajdują dogodne warunki rozwoju; mniej lub bardziej chropowata powierzchnia betonu sprzyja osadzaniu się glonów niesionych przez wody zbiornika.

W skład peryfitonu wchodziły nie tylko okrzemki stale lub okresowo związane z podłożem, ale także typowe planktony (Siemińska 1964, Bohr 1967): *Melosira granulata, Cyclotella comta* i *Stephanodiscus astrea* oraz, sporadycznie, *Asterionella formosa.* Gatunki te, a także *Cyclotella meneghiniana, Fragilaria crotonensis, Melosira granulata* var. *angustissima, M. varians* i *Synedra ulna*, należą, zdaniem Górskiej (inf. ustna), do najbardziej charakterystycznych okrzemek planktonowych Jez. Zegrzyńskiego w 1967 r. Do okrzemek najliczniej występujących w peryfitonie należały: *Cymbella affinis, Nitzschia kützingiana, Amphora ovalis* var. *pediculus* oraz *Navicula gracilis*, a więc inne gatunki niż w planktonie; prawdopodobnie są one typowe dla peryfitonu zbiornika.

Ogółem na wszystkich stanowiskach stwierdzono występowanie 161 jednostek taksonomicznych z 31 rodzajów.

Najintensywniejszy rozwój okrzemek nastąpił w kwietniu i maju, w lipcu oraz październiku. Stwierdzono, że na ogólną liczbę organizmów na poszczególnych stanowiskach miały wpływ takie czynniki, jak zanieczyszczenie wód Kanału Żerańskiego, wzrost temperatury wody w okresie jesiennym na odcinku kanał — Białobrzegi, intensywne falowanie.