DOI: 10.2428/ecea.2012.19(10)123 ECOL CHEM ENG A. 2012;19(10):1279-1288

Małgorzata OSTROWSKA[1]

# CHARACTERISTICS OF INDICATORY ALGAE AGAINST THE BACKGROUND OF PHYSICAL-CHEMICAL CONDITIONS IN SMALL WATER BODIES ON THE EXAMPLE OF AN EXCAVATION IN BIESTRZYNNIK

## CHARAKTERYSTYKA GLONÓW WSKAŹNIKOWYCH NA TLE WARUNKÓW FIZYCZNO-CHEMICZNYCH W MAŁYCH ZBIORNIKACH WODNYCH NA PRZYKŁADZIE WYROBISKA W BIESTRZYNNIKU

**Abstract:** The paper presents the results of the researching of microflora (phytobenthos and plankton) and physical-chemical indicators in the water region created after extraction of sand in the locality of Biestrzynnik. The excavation is not a place for rest and recreation. It used to be available for anglers only for a period of several years. The water region has a well developed littoral zone and numerous species of fish attractive for anglers are found in its waters. Samples for microscopic examination and physical-chemical examinations of water were collected. The participation of indicatory species was 50 %. They belonged to *Bacillariophyceae*, *Chlorophyta*, *Cyanophyceae* and *Chrysophyceae.* Among them, species from the ecological group of saproxenes were dominant. With regard to adopted 5-degree scale, *Cymbella ventricosa*, *Nitzschia hungarica*, *Navicula radiosa*, *Cocconeis placentula*, *Nitzschia acicularis*, *Nitzschia hungarica*, *Cosmarium botrytis* had very large population. The results of physical-chemical analyses indicated low polluted water. Selected taxa of indicatory algae with large populations were linked with the values of water pollution indicators. The algae mainly belonged to the group of saproxenes and singly to saprophiles. The examined water body has natural, aesthetic and recreational values.

**Keywords**: phytomicrobenthos, diatoms, index organisms, water quality, physical and chemical indexes

The examined excavation in Biestrzynnik (a village in Opole province, municipality of Ozimek) is located about 10 kilometres north-east of the locality of Turawa near a storage reservoir (impoondment lake). The reservoir, together with surrounding forests, is a part of Protected Landscape Area. In this area numerous species of wild animals are found, *ia* roe-deer, beaver, wild boar and heron. The area where the village of Biestrzynnik is located is a part of Stobrawsko-Turawskie Forests complex.

[1] Division of Environmental Development, Opole University, ul. R. Dmowskiego 7–9, 45–365 Opole, Poland, phone: +48 77 401 67 00, fax: +48 77 401 67 01, email: ost-mal@wp.pl

The aim of the conducted research was to determine whether and to what extent the values of physical-chemical indicators and the composition of plant organisms in benthos and plankton change. The paper presents the characteristics of indicatory taxa of numerous populations in relation to the values of water pollution indicators.

## Description of the research area

Even in the 1980s in the XX century a sand mine operated in Biestrzynnik. The material was obtained with the use of open-cast method. Some small water bodies were created in former sand excavations, including several fishponds. The water regions are situated below underground water level, whose table is at the depth of 1.3–2.5 metres [1]. The examined excavation is filled mainly with ground water and rainwaters. It is a 2-hectare water body without flow. The average depth is 2 metres, and the maximum is 4 metres. The water body is surrounded by a mixed forest with prevailing pine (Fig. 1 and 2).

The excavation is not open for general recreational use. In the years 1995–2005 the water body was only available for anglers, whose admission and fishing were under control. The lure of fish was allowed. The times of fishing were a period of an intense development of watermilfoil (*Myriophyllum* sp.) which occupied a lot of places, creating underwater meadows.

From the beginning of the 1990s a rational stocking of fishponds was implemented, which resulted in the presence of numerous fish species attractive for anglers: rudd (*Scardinius erythrophthalmus*), roach (*Rutilus rutilus*), carp (*Ciprinus carpio*), bream

Fig. 1. Research area in Biestrzynnik – water body (photo by M. Ostrowska)

Fig. 2. A part of a developed excavation in Biestrzynnik (photo by M. Ostrowska)

(*Abramis brama*), perch (*Perca fluviatilis*), pike-pearch (*Sander lucioperca*), pike (*Esox lucius*), eel (*Anguilla anguilla*), ide (*Leuciscus idus*), crucian (*Carassius carassius*), white amur (*Ctenopharyngodon idella*).

The water body has a well-developed littoral zone broadleaf cattail (*Typha latifollia*) and narrowleaf cattail (*Typha angustifolia*), common reed (*Phragmites communis*), manna grass (*Glyceria aquatica*), sweet flag (*Acorus calamus*), sedges (*Carex* sp.), spike rush (*Heleocharis palustris*), common rush (*Juncus conglomeratus*), soft rush (*Juncus effusus*) and meadow rush (*Juncus inflexus*). In water, watermilfoil (*Myriophyllum* sp.) is dominant, and shining pondweed (*Potamogeton luceus*) and various-leaved pondweed (*Potamogeton gramineus*) are also found.

Nearby the water body, kingfishers (*Alcedo atthis*) reside, mallards (*Anas platyrhynchos*) stop during flights, as well as black-headed gulls (*Larus ridibundus*). There are a lot of edible frogs (*Rana esculenta*), and grass snakes (*Natrix natrix*) are found in water. Insolated edges of the excavation are the residence of sand lizards (*Lacerta agilis*), and on the forest margin blindworm (*Anguis fragilis*) resides.

## Material and methods

Samples for microscopic and physical-chemical examinations of water were collected from 1997 to 2006. The researching did not spread over the whole vegatation- and non-vegetation seasons.

Microbenthos was collected in the same place regardless of water level from the bottom of the reservoir covering the area of about 10 $cm^2$. Plankton was sampled with a plankton net made of miller's gauze number 25 by pouring 50 litres of water through it. In a laboratory, three liquid microscopic preparations were made from each sample. 2–3 drops of sludge or sample water with plankton were placed on a slide and the solution was covered with 24 × 24 mm cover glass. The species were identified, individual specimen were counted in each preparation with the magnification of 200 and 400 x. Dry preparations were also made for precise marking of diatoms [2–4]. The algae were tested with the qualitative-quantitative method in a 5-degree scale, examining the whole glass with the magnification of 200 x, and species were marked on the basis of the keys of several authors: [2, 5–9]. Basic groups and species of benthic and planktonic algae were listed and compared.

Samples of water for analyses were collected 4 metres away from the shore at the depth of about 50 cm with Ruttner water sampler. The range of the analysis of physical--chemical indicators of water included: the temperature of water, reaction, dissolved oxygen, biochemical oxygen demand ($BOD_5$), forms of nitrogen and phosphorus, calcium, iron [10]. Marking was done with a MERCK laboratory set for water examination and a photometer.

## The results and discussion

In the water body in Biestrzynnik, 126 species of algae were identified in phytobenthos and plankton altogether (Fig. 3). 63 indicators of water quality were found. Saproxenes were dominant – 50 species, which accounts for 79 % of all indicators (Fig. 4), (Table 1).

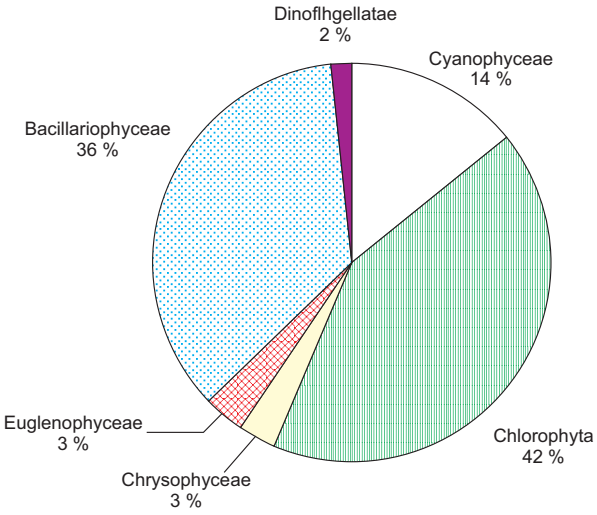


Fig. 3. Higher systematic units at algae in the excavation in Biestrzynnik

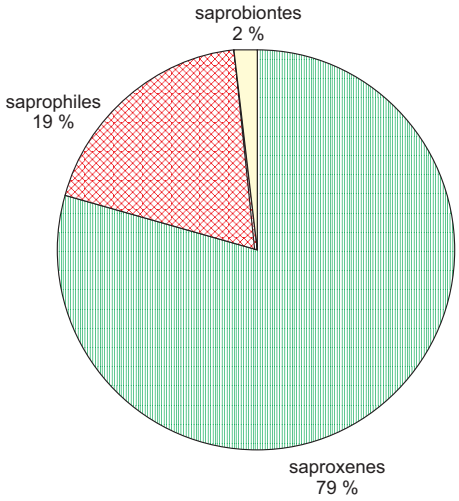


Fig. 4. Indicatory algae in the excavation in Biestrzynnik

Table 1

The list of benthic and planktonic indicatory algae in the excavation

| Systematic unit | Ecological unit | Benthos | Plankton |
|---|---|---|---|
| **CYANOPHYCEAE** | | | |
| *Anabaena spiroides* Klebahn | sn | + | |
| *Aphanizomenon flos-aquae* (L.) Ralfs | sn | + | + |
| *Microcystis aeruginosa flos-aquae* Kützing | sn | + | + |
| *Nostoc linkia* (Roth) Born. et Flah. | sn | + | |
| *Oscillatoria chalybea* (Mertens) Gomont. | sl | + | + |
| *Oscillatoria princeps* Vaucher | sl | + | |
| *Oscillatoria splendida* Greville | sl | + | |
| *Oscillatoria tenuis* Agardh. | sl | + | |
| *Pseudanabaena constricta* (Szafer) Lauterborn syn. | st | + | |
| **CHLOROPHYTA** | | | |
| ***Chlorococcales*** | | | |
| *Ankistrodesmus falcatus* (Corda) Ralfs. | sn | + | |
| *Crucigenia tetrapedia* (Kirchn.) W. et G.S. West | sn | + | |
| *Pediastrum boryanum* Menegh. | sn | + | |
| *Pediastrum duplex* Meyen. | sl | + | |
| *Scenedesmus acuminatus* (Laherh.) Chodat. | sn | + | |
| *Scenedesmus quadricauda* (Turp) Breb. | sn | + | |
| ***Chaetophorales*** | | | |
| *Stigeoclonium tenue* (Ag.) Kütz. | sl | + | |

Table 1 contd.

| Systematic unit | Ecological unit | Benthos | Plankton |
|---|---|---|---|
| ***Ulothrichales*** | | | |
| *Ulotrix zonata* Kütz. | sn | + | |
| *Cladophora glomerata* (L.) Kütz. | sn | + | + |
| ***Conjugatophyceae*** | | | |
| *Closterium acerosum* (Schrank) Ehrenb. | sl | + | + |
| *Closterium ehrenbergii* Menegh. | sn | + | |
| *Cosmarium botrytis* Menegh. | sn | + | + |
| *Spirogyra crassa* (Kützing) Czurda | sn | + | |
| **CHRYSOPHYCEAE** | | | |
| *Dinobryon divergens* Imhoff | sn | + | + |
| *Synura uvella* Ehrenberg | sn | + | |
| *Uroglena volvox* Ehrenberg | sn | + | + |
| **EUGLENOPHYCEAE** | | | |
| *Euglena acus* Ehr. | sn | + | |
| *Euglena viridis* Ehr. | sl | + | |
| **BACILLARIOPHYCEAE** | | | |
| ***Centrophycideae*** | | | |
| *Melosira granulata* (Ehr.) Ralfs. | sn | + | |
| ***Pennatophycideae*** | | | |
| *Amphora ovalis* Kütz. | sn | + | |
| *Asterionella formosa* Hass. | sn | + | |
| *Caloneis amphisbaena* (Bory) Cl. | sn | + | |
| *Cocconeis placentula* Ehr. | sn | + | + |
| *Cymatopleura elliptica* (Breb.) W. Sm. | sn | + | |
| *Cymbella cistula* (Hemp.) Grun. | sn | + | |
| *Cymbella ventricosa* Kütz. | sn | + | |
| *Diatoma elongatum* (Lyngb.) Ag. | sn | + | + |
| *Diatoma vulgare* Bory | sn | + | |
| *Epithemia turgida* (Ehr.) Kütz. | sn | + | |
| *Epithemia sorex* Kütz. | sn | + | |
| *Fragilaria capucina* Desm. | sn | + | |
| *Fragilaria construens* (Ehr.) Grun. | sn | + | |
| *Fragilaria crotonensis* Kitt. | sn | + | |
| *Gomphonema constrictum* Ehr. | sn | + | |
| *Gomphonema parvulum* (Kütz) Grun. | sn | + | |
| *Meridion circulare* Ag | sn | + | |
| *Navicula cryptocephala* Kütz. | sl | + | |
| *Navicula exiqua* (Greg.) O. Mull | sn | + | |
| *Navicula gracilis* Ehr. | sn | + | |

Table 1 contd.

| Systematic unit | Ecological unit | Benthos | Plankton |
|---|---|---|---|
| *Navicula radiosa* Kütz. | sn | + | |
| *Navicula viridula* Kütz. | sl | + | |
| *Nitzschia acicularis* W. Sm. | sl | + | |
| *Nitzschia hungarica* Grun. | sn | + | |
| *Nitzschia sigmoidea* (Ehr.) W. Sm. | sn | + | |
| *Nitzschia vermicularis* (Kütz.) Grun. | sn | + | |
| *Nitzschia palea* (Kütz.) W. Sm. | sl | + | |
| *Pinnularia maior* (Kütz.) Cl. | sn | + | + |
| *Stauroneis phoenicentron* Ehr. | sn | + | |
| *Suriella ovata* Kütz. | sn | + | |
| *Synedra acus* Kütz. | sn | + | |
| *Synedra ulna* (Nitzsch.) Ehr. | sn | + | + |
| *Tabellaria fenestrata* (Lyngb.) Kütz. | sn | + | |
| *Tabellaria flocculosa* (Roth.) Kütz. | sn | + | + |
| **DINOFLHGELLATAE (PYRROPHYTA)** | | | |
| *Ceratium hirundinella* (O.F.M.) Bergh. | sn | + | + |

sn – saproxene, sl – saprophile, st – saprobiont.

They belonged to *Bacillariophyceae*, *Chlorophyta*, *Cyanophyceae* and *Chrysophyceae*. *Cymbella ventricosa*, *Navicula radiosa*, *Cocconeis placentula*, *Nitzschia acicularis*, *Nitzschia hungarica*, *Cosmarium botrytis* were numerously represented in the samples with regard to adopted 5-degree scale [2, 9].

The values of selected physical-chemical indicators in the water of the region were as follows:

– pH: 6.8–8.2.
– Dissolved oxygen content: 8.0–13.0 $mgO_2 \cdot dm^{-3}$.
– Water temperature: 6.5–24 °C.
– Biochemical oxygen demand in waters of the river: 0.3–3.8 $mgO_2 \cdot dm^{-3}$.
– Ammonium nitrogen: 0.039–0.16 $N\text{-}NH_4$ mg $\cdot dm^{-3}$, ammonia: 0.05 $mgNH_4 \cdot dm^{-3}$.
– Nitrate(III) nitrogen value: 0.003–0.0076 $mgN\text{-}NO_2 \cdot dm^{-3}$, nitrates(III) in concentration 0.01–0.025 $mgNO_2 \cdot dm^{-3}$.
– Nitrate nitrogen: 0.45–1.81 $mgN\text{-}NO_3 \cdot dm^{-3}$. Nitrates(V): 18–23 $mgNO_3 \cdot dm^{-3}$.
– Phosphates content: 0.032–0.l $mgPO_4 \cdot dm^{-3}$.
– Total iron: in concentration 0.01–0.23 $mgFe \cdot dm^{-3}$.
– Calcium concentration ranged: 12–28 $mgCa \cdot dm^{-3}$.

Subject to analysis were selected species of indicatory algae [2, 9, 11] represented by large populations in relation to values of water pollution indicators. The algae mainly belonged to the group of saproxenes and singly to saprophiles and were represented by *Chlorophyta*, *Bacillariophyceae*, *Cyanophyceae* i *Chrysophyceae*:

*Cosmarium botrytis* is a widely spread species resistant to organic pollution [9]. It was present in large numbers in the reservoir when the values of physical-chemical

indicators equalled: pH 7.8–8.2, dissolved oxygen content 8.0–8.5 $mgO_2 \cdot dm^{-3}$, $BOD_5$ within the limits 1.0–1.2 $mgO_2 \cdot dm^{-3}$ and the content of nitrates(V) 18 $mgNO_3 \cdot dm^{-3}$, phosphates 0.032 $mgPO_4 \cdot dm^{-3}$, and iron 0.01 $mgFe \cdot dm^{-3}$.

*Nitzschia acicularis* were identified in a very large number only with the following values of selected physical-chemical indicators: pH 6.8–7.2, dissolved oxygen content $mgO_2 \cdot dm^{-3}$, $BOD_5$ 0.2–3.8 $mgO_2 \cdot dm^{-3}$, nitrates(III) concentration 0.025 $mgNO_2 \cdot dm^{-3}$, nitrates(V) concentration 23 $mgNO_3 \cdot dm^{-3}$, iron 0.0l $mgFe \cdot dm^{-3}$ and the lack of phosphates.

*Cymbella ventricosa* was numerously represented on the research stand with the pH slightly above 8, oxygen content 8.5 $mgO_2 \cdot dm^{-3}$, $BOD_5$ 1.0 $mgO_2 \cdot dm^{-3}$ the lack of ammomum nitrogen, nitrate(V) nitrogen content 1.81 $mgN\text{-}NO_3 \cdot dm^{-3}$, phosphates 0.032 $mgPO_4 \cdot dm^{-3}$.

*Navicula radiosa* is a common benthic species, mainly of the litoral zone of stagnant and flowing waters [9]. It developed most intensely by the pH 8.2, dissolved oxygen content 8.5 $mgO_2 \cdot dm^{-3}$, $BOD_5$ 1.0 $mgO_2 \cdot dm^{-3}$, nitrates(III) 0.003 $mgN\text{-}NO_2 \cdot dm^{-3}$, nitrate(V) nitrogen 1.81 $mgNO_3 \cdot dm^{-3}$ and phosphates 0.032 $mgPO_4 \cdot dm^{-3}$.

*Nitzschia hungarica* developed very intensely and intensely only by the following values of physical-chemical indicators: pH 7.2–8.2, dissolved oxygen content 8.2–8.5 $mgO_2 \cdot dm^{-3}$, $BOD_5$ 0.3–1.0 $mgO_2 \cdot dm^{-3}$, nitrate nitrogen 0.003 $mgN\text{-}NO_3 \cdot dm^{-3}$, nitrate nitrogen 1.13–1.81 $mgN\text{-}NO_3 \cdot dm^{-3}$and phosphates 0.032 $mgPO_4 \cdot dm^{-3}$.

*Cocconeis placentula* and *Navicula cryptocephala* were numerously represented only when the physical-chemical indicators in water achieved the following values: pH 7.8, dissolved oxygen – 8.0 $mgO_2 \cdot dm^{-3}$, $BOD_5$ – 1.2 $mgO_2 \cdot dm^{-3}$, ammonia – 0.05 mg $NH_4 \cdot dm^{-3}$, nitrates(III) – 0.025 $mgNO_2 \cdot dm^{-3}$, nitrates(V) – 18 $mgNO_3 \cdot dm^{-3}$ and iron – 0.01 $mgFe \cdot dm^{-3}$.

*Tabellaria flocculosa* i *Dinobryon divergens* were numerously represented when the water pH was 6.8, dissolved oxygen content was 13 $mgO_2 \cdot dm^{-3}$, $BOD_5$ 3.8 $mgO_2 \cdot dm^{-3}$, concentration of ammonium nitrogen 0.078 $mgN\text{-}NH_4 \cdot dm^{-3}$ and nitrate(V) nitrogen 0.45 $mgN\text{-}NO_3 \cdot dm^{-3}$.

*Oscillatoria splendida* and *Oscillatoria tenuis* are species found throughout the year in benthos and plankton of stagnant and flowing waters [9]. They developed intensely in the reservoir when the water pH was 7.2, dissolved oxygen content 10.5 $mgO_2 \cdot dm^{-3}$, $BOD_5$ 1.5 $mgO_2 \cdot dm^{-3}$, ammonium nitrogen concentration 1.5 $mgN\text{-}NH_4 \cdot dm^{-3}$, nitrate(III) nitrogen 0.008 $mgN\text{-}NO_2 \cdot dm^{-3}$, nitrate(V) nitrogen 1.81 $mgN\text{-}NO_3 \cdot dm^{-3}$, phosphates 0.l $mgPO_4 \cdot dm^{-3}$and iron – 0.23 $mgFe \cdot dm^{-3}$.

*Aphanizomenon flos-aquae* is a common alga that forms blooms in water bodies in summer [9]. An intense development of this blue-green alga in the excavation took place in June 1997, when water pH was 6.8, dissolved oxygen content 8.2 $mgO_2 \cdot dm^{-3}$, $BOD_5$ 1.8 $mgO_2 \cdot dm^{-3}$, ammonium nitrogen concentration 0.039 $mgN\text{-}NH_4 \cdot dm^{-3}$.

In the researched reservoir, out of 53 taxa of green algae there were 23 species of *Chlorococcales*, which accounted for 43 % of the total number of this class of algae. The presence of species from the order of *Chlorococcales* may be connected with a greater concentration of nitrogen compounds in water [12]. Blue-green algae, on the other hand, need a considerable concentration of phosphorus to develop. The low ratio

N : P is favourable for them [13]. A smaller number of *Cyanophyceae* species in relation to *Chlorococcales* species (23) observed in tests suggests a lower content of phosphorus compounds in comparison with nitrogen compounds.

Some species of diatoms indicate a good oxygenation of water, especialIy *Cymbella* and *Fragilaria* are considered to be indicators of a large oxygen content [2, 5, 7, 14]. Species indicating good oxygenation of water in a water region: *Meridion circulare*, *Cymbella cistula*, *Fragilaria construens*, *Cymbella ventricosa*, *Diatoma vulgare*, *Diatoma elongatum*, *Navicula radiosa*, *Fragilaria capucina* were found in the samples.

Among species of algae occurring mainly in polluted waters, representatives of *Euglena,* blue-green algae of *Oscillatoria* type and species of diatoms *Nitzschia acicularis*, *Nitzschia palea* were identified. The populations of these species were not significant.

## Conclusions

*Chlorophyta* and *Bacillariophyceae* were the basic groups of alga during the examinations of the water of the reservoir, with the largest number of types and species and the most frequent occurance of their populations in large numbers.

The participation of indicatory species was 50%. Among them, species from the ecological group of saproxenes were dominant. The remaining indicatory species belonging to other ecological groups occurred sporadically and in small populations. On the basis of species composition of algae and their indicatory value, the waters of the examined reservoir can be regarded as low polluted. Indicatory algae significantly represented in the reservoir are: *Cosmarium botrytis*, *Nitzschia acicularis*, *Cymbella ventricosa*, *Navicula radiosa*, *Nitzschia hungarica*, *Cocconeis placentula*, *Navicula cryptocephala*, *Tabellaria flocculosa*, *Dinobryon divergens*, *Aphanizomenon flos-aquae*, *Oscillatoria splendida* and *Oscillatoria* tenuis. They belonged mainly to saproxenes.

Ranges of values of physical-chemical indicators in the years of the research conducting were at a low level. The results of physical-chemical analysis indicated insignificant variability of water quality. The water reaction did not favour the development of acidophilic species of algae. Environmental conditions (water poor in nutrients) did not favour the development of numerous species of algae.

The reservoir has natural, aesthetic and recreational value. It seems proper to take these types of water ecosystems into consideration in hydrobiological research.

### References

[1] Projekt techniczny: Projekt rekultywacji składowiska odpadów komunalnych w Biestrzynniku, gmina Ozimek. Wrocław: WAMECO s.c.; 1996.
[2] Kawecka B. Zarys ekologii glonów wód słodkich i środowisk lądowych. Warszawa: Wyd Nauk PWN; 1994.
[3] Rakowska B. Studium różnorodności okrzemek ekosystemów wodnych Polski niżowej. Łódź: Wyd Uniwer Łódzkiego; 2001.
[4] Rakowska B: Kosmos. 2003;52(2-3):307-314
[5] Hindak F. Sladkovodne riasy. Bratislava: Slovenske Pedagogicke Nakladatelstvo; 1978.
[6] Kadłubowska JZ. Zarys algologii. Warszawa: PWN; 1975.

[7] Siemińska J. Flora słodkowodna Polski: Bacillariophyceae, Okrzemki. Warszawa: PWN; 1964.
[8] Starmach K. Plankton roślinny wód słodkich. Metody badania i klucze do oznaczania gatunków występujących w wodach Europy Środkowej. Warszawa-Kraków: PWN; 1989.
[9] Turoboyski L. Hydrobiologia techniczna. Warszwa: PWN; 1979.
[10] Hermanowicz W, Dojlido J, Dożańska W, Koziorowski B, Zerbe J. Fizyczno-chemiczne badanie wody i ścieków. Warszawa: Arkady; 1999.
[11] Turoboyski L. The indicator organisms and their ecological variability. Acta Hydrobiol. 1973;15(3):259-274.
[12] Spodniewska I. Formy azotu i fosforu w wodzie a wymagania pokarmowe glonów. Wiad Ekol. 1973;19(3):238-244.
[13] Kajak Z. Hydrobiologia – limnologia. Ekosystemy wód śródlądowych. Warszawa: Wyd Nauk PWN; 2001.
[14] Schoeman FR. A systematical and ecological study of the diatom flora of Lesotho with special reference to the water quality. Pretoria: V&R Printers; 1973.

## CHARAKTERYSTYKA GLONÓW WSKAŹNIKOWYCH NA TLE WARUNKÓW FIZYCZNO-CHEMICZNYCH W MAŁYCH ZBIORNIKACH WODNYCH NA PRZYKŁADZIE WYROBISKA W BIESTRZYNNIKU

Zakład Kształtowania Środowiska
Uniwersytet Opolski

**Abstrakt:** Praca prezentuje badania mikroflory (fitobentosu i planktonu) oraz wskaźników fizyczno-chemicznych wody akwenu powstałego po wydobyciu piasku w miejscowości Biestrzynnik. Wyrobisko nie jest miejscem wypoczynku i rekreacji. Było jedynie przez kilka lat udostępnione dla wędkarzy. Akwen ma silnie rozwiniętą strefę brzegową, a w wodzie jest wiele atrakcyjnych dla wędkarzy gatunków ryb. Pobierano próbki do badań mikroskopowych i fizykochemicznych wody. Udział gatunków wskaźnikowych wynosił 50%. Należały do *Bacillariophyceae, Chlorophyta, Cyanophyceae i Chrysophyceae*. Wśród nich przeważały gatunki z grupy ekologicznej saproksenów. Bardzo liczne populacje w próbkach pięciostopniowej skali miały: *Cymbella ventricosa*, *Nitzschia hungarica*, *Navicula radiosa*, *Cocconeis placentula*, *Nitzschia acicularis*, *Cosmarium botrytis*. Wyniki analizy fizyczno-chemicznej wskazywały na mało zanieczyszczoną wodę. Powiązano z wartościami wskaźników zanieczyszczenia wody wybrane gatunki glonów wskaźnikowych o dużych populacjach. Glony należały głównie do grupy saproksenów i pojedynczo do saprofili. Badany akwen ma walory przyrodnicze, estetyczne oraz rekreacyjne.

**Słowa kluczowe**: fitomikrobentos, okrzemki, organizmy wskaźnikowe, jakość wody, wskaźniki fizyczno-chemiczne