ECOLOGICAL STATE OF LAKE DUROWSKIE

ALGAE AS AN ASSESSMENT INDICATOR

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Introduction

Wagrowiec is a town situated northwest of Poland. This town is known for tourism destination because this city has a beautiful lake - Lake Durowskie. Tourism has been one of the major incomes generating sector for the city. In addition, people also highly rely on the lake for water consumption, irrigation, and other water-based activities. Lake Durowskie is the last of a five chain lakes that a connected together.

Due to heavy use of the lake for recreational activities and the discharge of nutrient rich water from the upper lakes there was a sudden bloom of cyanobacteria in Lake Duroskie. Cyanobacteria in a high density can be harmful for lakes as they produce toxins that are harmful for human and aquatic wildlife. As a result cyanobacteria bloom the beach area along the lake was closed down because it was described as unhealthy for human use (fishing, swimming etc). Water quality deteriorated in time. Algal bloom is a typical characteristic of lakes, rivers and other water bodies that have been heavily polluted. Bloom may lead to oxygen depletion, fish gill clogging and the production of bad odours (Svirčev et al. 2014).

Due the social and economic importance of Lake Durowskie to the people of Duroskie there was a need to device restoration and subsequent management of the lake. Mitigation actions were suggested to restore Lake Duroskie into a good quality state and in 2009 restoration of the lake begun. Since the commencement of restoration there has been the need to monitor the recovery of the lake. Monitoring has relied on the use of biological and chemical indicators to assess the ecological state of the lake. Biological indicators include the use of phytoplankton, macrophytes and macro-invertebrate communities. Several studies have suggested the importance of using phytoplankton as indicators of water quality (Bianchi et al. 2003). Due to their sensitivity to environmental conditions, phytoplankton presents as a useful species group to evaluate changes in water bodies and as early warning signals of water pollution (Tas et al. 2009). Phytoplankton is therefore used in this study to assess the ecological state of the lake in the course of eight years of restoration. Periphyton is also taken into account as an indicator of water quality. Periphyton occupy submerged surfaces and are usually found on stones and submerged plants. Since they have special habitat requirement they are particularly good indicators for polluted waters.

Aims and objectives

The main aim of this project is to assess the ecological state of Lake Durowskie using phytoplankton and periphyton as bio-indicators. Also a comparative analysis was done to assess the trend and progress of restoration.

Materials and Methods

Study area

The study was conducted in Lake Durowskei. Lake Durowski lies with the coordinates N 52^{o} 49’ 06” and E 17^{o} 12’ 01” in the Polish city Wągroweic and is the final lake in a chain of five lakes that are connected by rivers. The profile of Lake Durowskie are given below (Table 1).

Table 1: Profile of Lake Durowskie.

Morphometric parameter		**Measurements**
Surface Area (ha)		143.7
Volume (m^3)		11322900
Maximum depth (m)		14.6
Average depth (m)		7.9
Total catchment area (km^2)		236.1
Direct catchment area (ha)		1581.3
Land use of surrounding area	Agriculture (%)	58.26
	Forest (%)	33.52
	Urban (%)	8.25

Sampling design

Phytoplankton sampling was carried out at 8 sites in the lake while periphyton sampling was done in 12 sites along the shore (Figure 1). Water samples were taken from depths of 0 m, 1 m, 2 m and 3 m to analyse the vertical distribution of phytoplankton. Thirty litres of water was sampled from the various depth using a water sampler. Water collected was then filtered with a plankton net. Filtrates collected (periphyton and phytoplankton) were fixed with Lugol's iodine in the field.

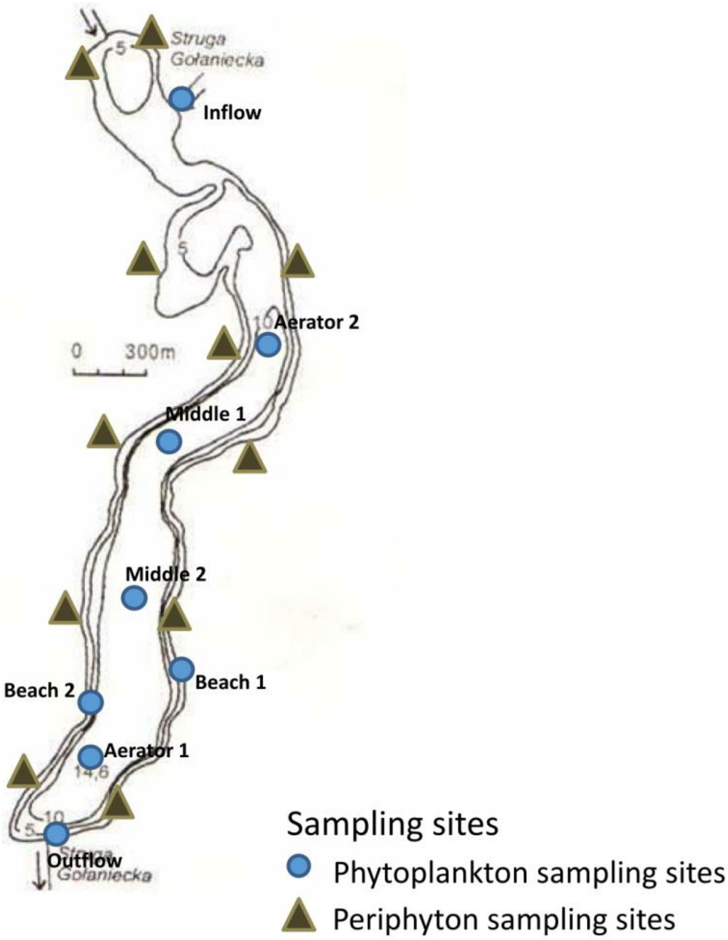

Figure 1: Phytoplankton and Periphyton sampling sites.

In addition to the phytochemical and periphyton samples taken, physico-chemical parameters were also measured (Table 2).

Table 2: Physico-chemical parameters measured in different sampling locations in Lake Durowskie.

Parameter	**Unit**
Temperature	^{o}C
pH	
Conductivity	μScm^{-1}
Transperancy	M
Conductivity	μScm^{-1}

Laboratory analysis

Phytoplankton and periphyton that were sampled were identified and counted as the number of individuals per litre of water (number/L)

The number of individuals for each species group was counted in 100 cells under the microscope. Conversion factor was determined using the following equation.

ample concentration 30 mL from 30 L; 30 000 mm^3: 1.25 mm^3 = 24 000

24 000 – 30 L

x – 1L

x = 800 – factual concentration

Counts of individuals in 100 cells was multiplied by 800 to obtain the individual number of cells per liter.

Biomass Measurements (mg/L)

To estimate the biovolume of 1 cell of particular algal species,

- Multiplying biovolume of 1 cell with the cell count in 1mL
- Divide by 10^9 to make it under the unit of mgL^{-1}

The biomass was always given to 4 decimal places.

Data analysis

Data received from periphyton sampling was used to map the distribution of red algae and subsequently the calculation of Trophic Diatom Index. Data obtained from phytoplankton survey was used in calculating Mixed index, Jaccard index, Shannon-Weaver Diversity index and PMPL index. Background of each index is given blow.

Periphyton

Diatom Index

Diatom index is an informative tool used in determining the ecological state of lakes. This index requires that at least 10 species that are sensitive to trophic level should be present in a given sample. To calculate Diatom index, trophy index (TJ), the index of referential species (pGR) and their standardization are needed.

Trophy index (TJ)

$$TJ = \frac{(TJi \times wTJi \times Li)}{(wTJi \times Li)};$$

Where,

TJi - sensitivity of species for the trophic state;

wTJi - range of the tolerance of the algal species;

Li - number of specimens of the determined species divided by the number of all identified individuals in the sample

Index of referential species (pGR)

$$pGR = \frac{NB - (NC + ND)}{NB + NC + ND};$$

Where,

NB - number of referential species for all lakes;

NC - number of referential species for deep lakes and of degradation species in shallow lakes; *ND* - number of degradation species for both kinds of lakes

Transformation of standardized value in the range from 1 to 0,

Z - TJ = 1 – ((TJ -1) · 0.25)

Z – pGR = (pGR + 1) ·0.5

Finally Diatom index (D) was calculated by the following equation,

DI = (Z-TJ + Z-pGR) / 2

The value obtained from Diatom index describes the ecological state of a lake as given below.

Diatom index value	Class
> 0,83	Very good
0,55 - 0,82	Good
0,30 - 0,54	Moderate
0,15 - 0,29	Poor
< 0,15	Bad

Phytoplankton

Mixed Index of Nygaard

This method depends on number of species from all different taxonomical groups.

$$\text{Mixed Index} = \frac{\text{Cyanobacteria} + \text{Chlorococcales} + \text{Centric diatoms} + \text{Euglenoids}}{\text{Desmids}}$$

The value obtained for mixed index implies different trophic level classes as described below.

Dystrophy	0.0 - 0.2
Oligotrophy	0.2 - 1.0
Mesotrophy	1.0 - 3.0
Eutrophy	3.0 – 5.0
Hypertrophy	5.0 – 43.0

Jaccard Index (Jaccard, 1912)

This index is used in comparing species across different study sites. Absence and presence data of species is used.

$S_J = a/(a + b + c)$

Where,

S_J = Jaccard similarity index;

a = number of species common to (shared by) site;

b = number of species unique to the first site;

c = number of species unique to the second site.

Diversity Index

Shannon-Wiener diversity and evenness indices

The diversity and evenness of phytoplankton species was measured across different sites. The formula for Shannon diversity and evenness is given below.

$H' = -\sum_{i=1}^{s} p_i \log(p_i);$

Where,

H' - Shannon index;

p_i – relative abundance of each species in the site

$$E = \frac{-\sum p_i \times \log(p)}{\log(S)};$$

E – Evenness (equitability);

S – Total number of species in each site

Phytoplankton Multimetric for Polish Lakes (PMPL Index)

The PMPL is an ecological state indicator that was used to implement the European Water Framework Directive for Lakes in Poland. Computing this index requires three parameter which include Chlorophyll a, Total biomass and Cyanobacteria biomass. All three single metrics and PMPL index value ranging from 1 to5.

$$PMPL = \frac{[YCh + YBm + YCy]}{3}$$

Where,

YCh - Chlorophyll-a concentrations

YBm - General biomass of phytoplankton

YCy - Biomass of cyanobacteria

Value obtained for PMPL is indicating different classes of tropic levels as below:

Ecological status	**PMPL**
very good	0,0 - 1,0
good	1,01 - 2,0
moderate	2,1 - 3,0
poor	3,1 - 4,0
bad	4,01 - 5,0

Results

Distribution of periphyton

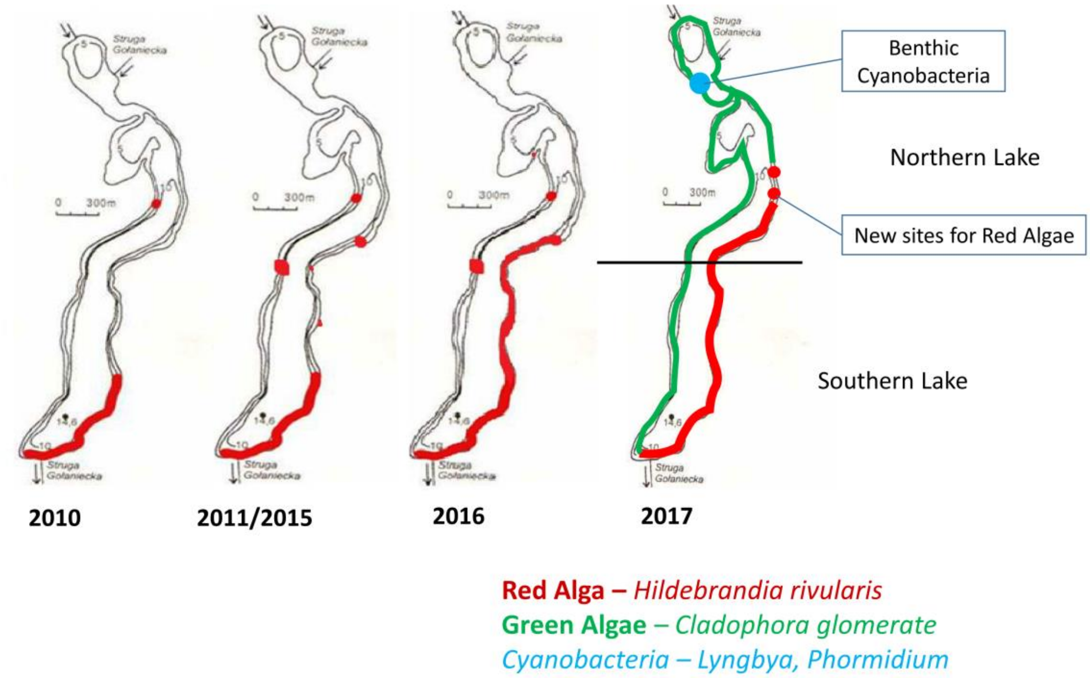

Figure 2: Distribution of periphyton in Lake Durowskie

As shown in Figure 2, the distribution of red algae (*Hildebrandia rivularis*) remains in similar spot as last year mainly in the East bank of the lake but their coverage has a northward growing pattern along the East bank. Green algae (*Cladophora glomerate*) was found in the perimeter of the lake. They have a wide range of habitat and can grow in different ecological system (Pikosz and Messyasz 2016). Benthic cyanobacteria *Lyngbya* and *Phormidium* were also found in the north-west bank of the lake, sitting opposite to the inflow of the river.

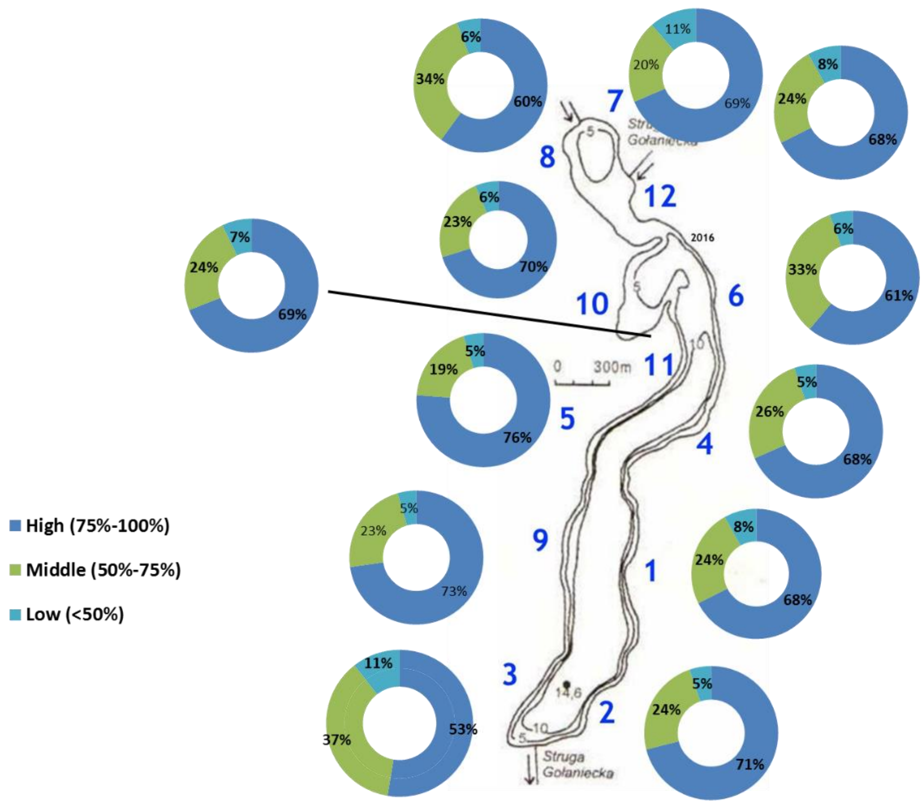

Figure 3: Periphyton Species Oxygen preference

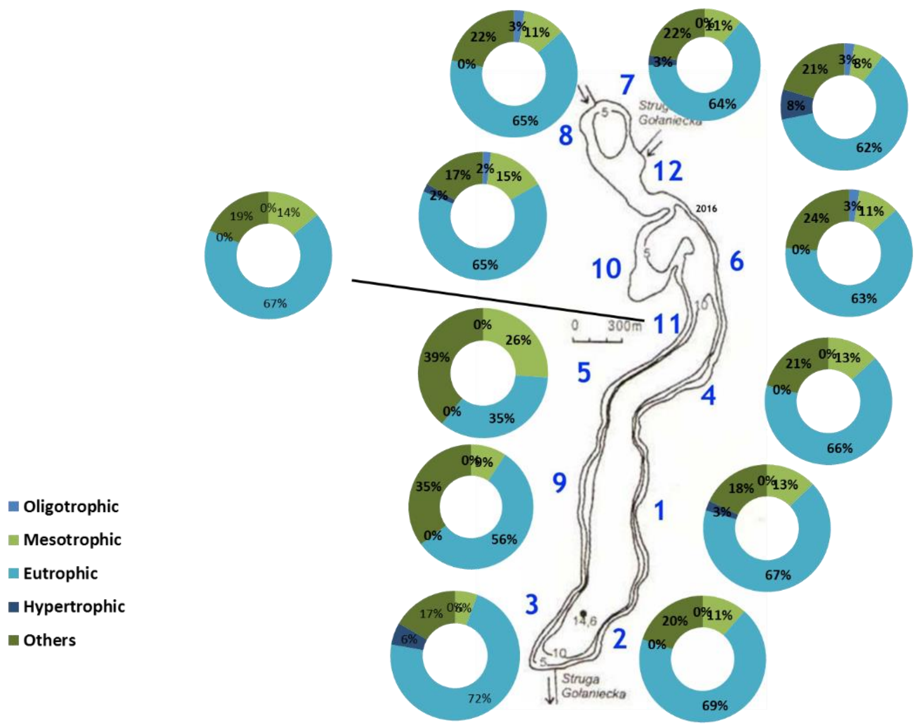

Figure 4: Periphyton Species Trophic Preference

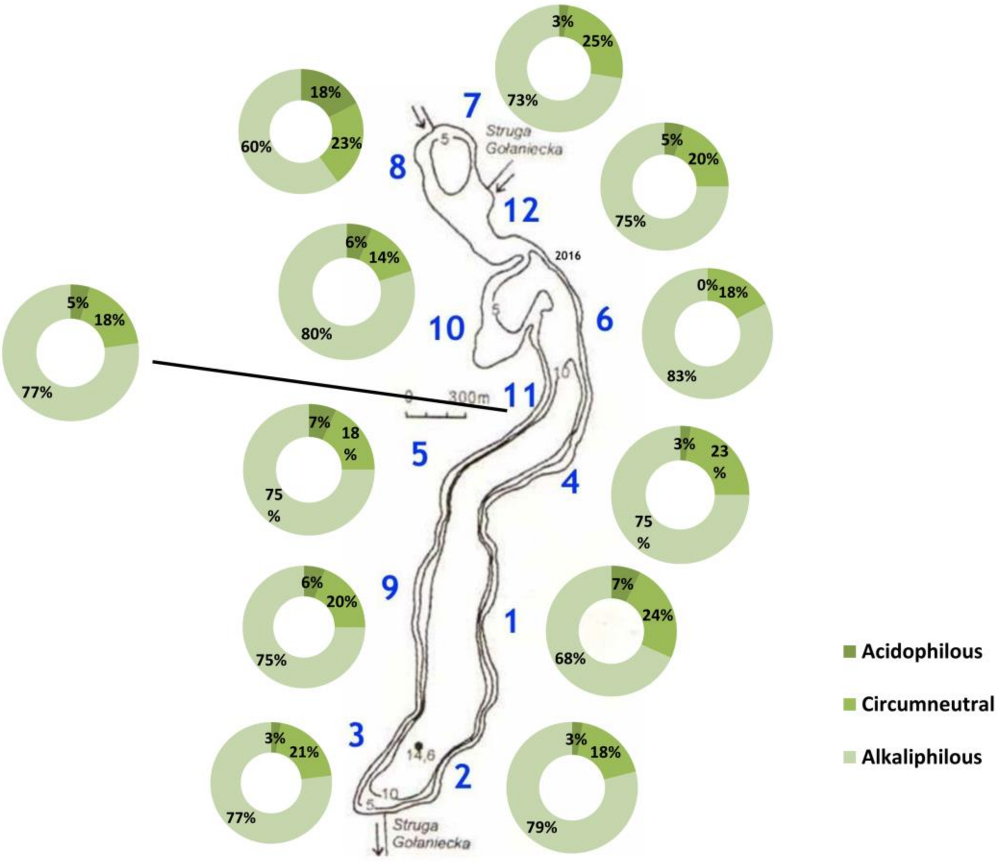

Figure 5: Periphyton Species pH Preference

Trophic Diatom Index (TDI)

The trophic diatom index shows more or less the same as it was in the last year, showing poor to moderate status of water. The remarkable drop of TDI in Site 1 (Beach 1) has shown possible negative effects from anthropogenic activities and input causing upwelling of water and mobilization of nutrients from the bottom of the water bodies. South-east part of the lake with a public beach is the most densely populated area for recreation and the TDI this year shows the area remains in a bad state of water. Still, some of the parts start getting better, implying the restoration has given positive impacts. Moreover, in Site 4, where the area has recorded increase of red algae population, shows also the greatest improvement of TDI.

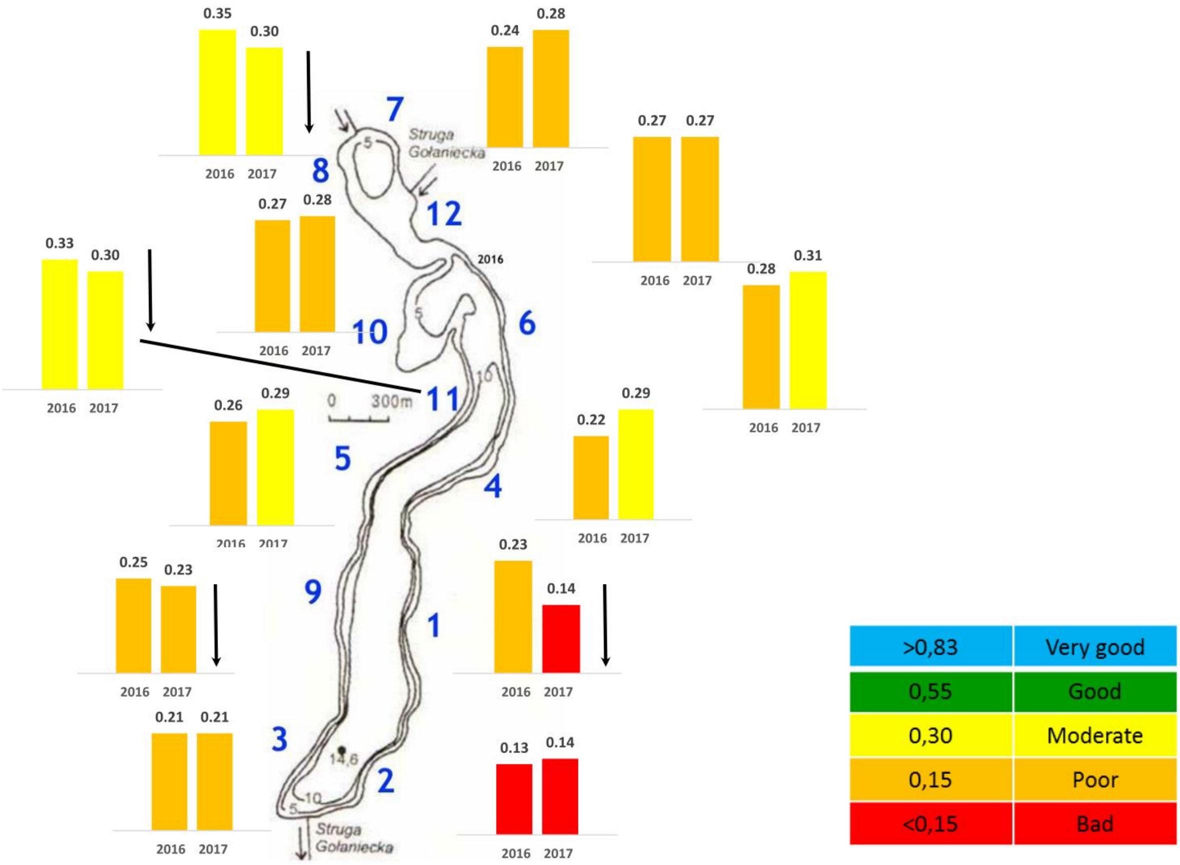

Figure 6: Trophic Diatom Index of Lake Durowskie

According to the index, the average of species is similar. Compared to the last year's result, the number of the oxygenated group increased. It means that state of littoral water improved. It occurred with almost the same number between the north and south part of the lake.

For the trophic preference, the eutrophic species still dominated in every site, compared to the last year's result, the number increased in several areas. However, from the result of pH preference, the alkaliphilous species is dominant in all parts of the lake. It could probably be a good indicator of low number of *Cyanobacteria* that can cause bloom.

Number of Species

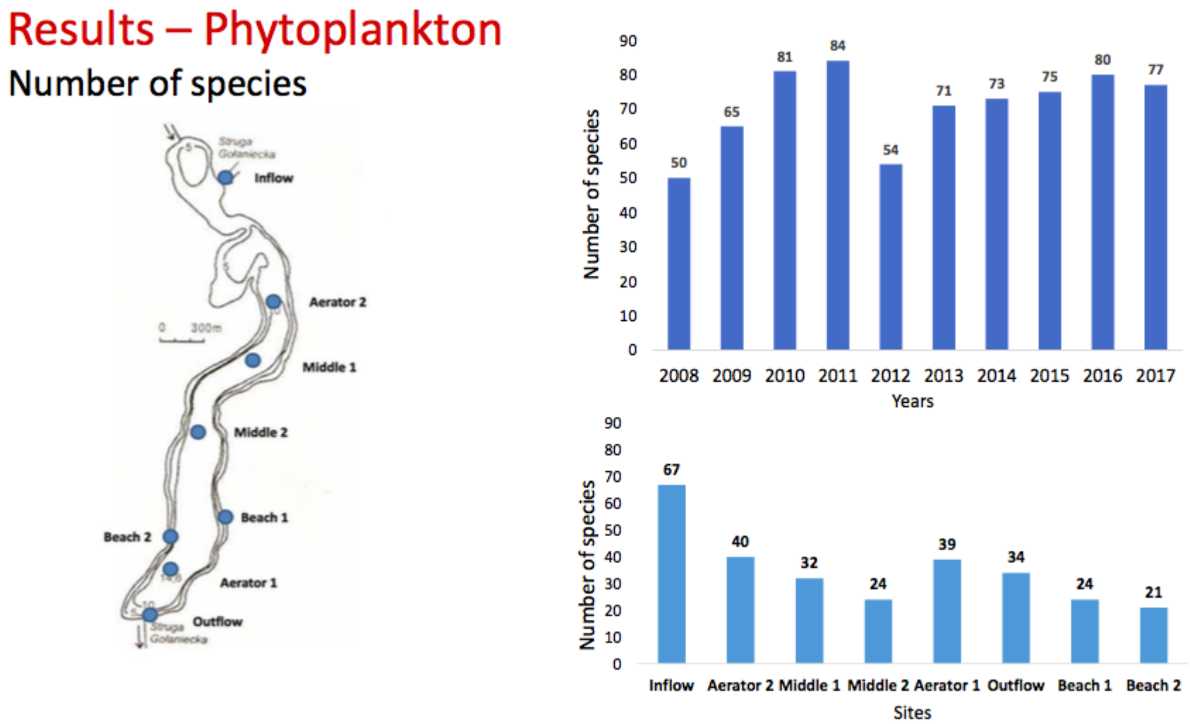

Figure 7: Number of species across years and fro individual sites

The results are interpreted in terms of year and sites respectively:

- **By year**

There are as many as 77 species found in this year. In comparison to the last year, the number of species is lower. However, if we take a look at the trends from 2013-2017, the number of species is comparable. It means that the number of species over the last five years is stabilised. We can also assume that there has been a change within the community and also shift of species, but the number remains stable.

- **Per sites**

According to the graph, the highest number of the species was concentrated at the inflow area. It is significantly different from other sites over the lake area. It can obviously be understood that the inflow is the area where there is river influence in which has carried nutrient loads from the upper stream areas. Furthermore, this area is where the turbulence occurs, so that all the sedimented part would potentially be lifted to the upper layer and later mixed with the surface layer. In addition, weather also played important role, since during the sampling activities the weather was in rainy condition, therefore, it caused an increasing speed on current and gave implication to bigger turbulence.

Phytoplankton Diversity

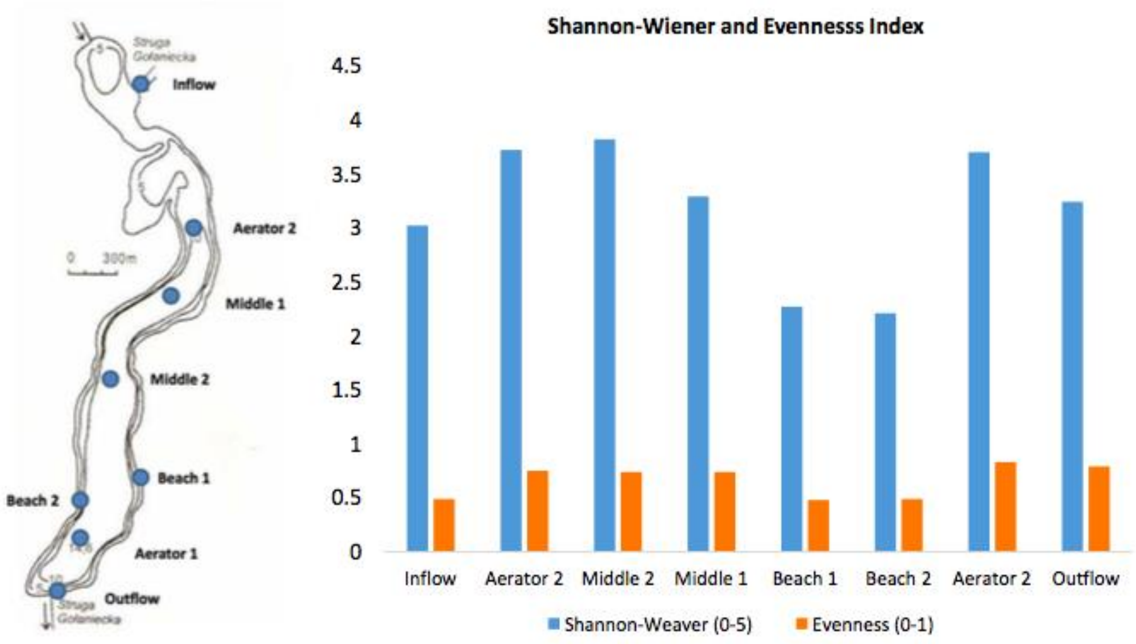

Figure 8: Species diversity and evenness of phytoplankton.

The graph shows about the distribution number of cells between taxa. According to the graph, the inflow area has very high number of species, but low number of biodiversity. It implies that there is dominant species concentrated in this area. In several parts, for example in Aerator 2, Middle 2, and Middle 1, the number of species and biodiversity is high. It shows better condition in terms of species. In contrast, in Beach 1 and Beach 2, the number of species and biodiversity is low. It could probably because those areas have high intensity of anthropogenic activities such as recreation, motor boat, and swimming activities which make some species sedimented.

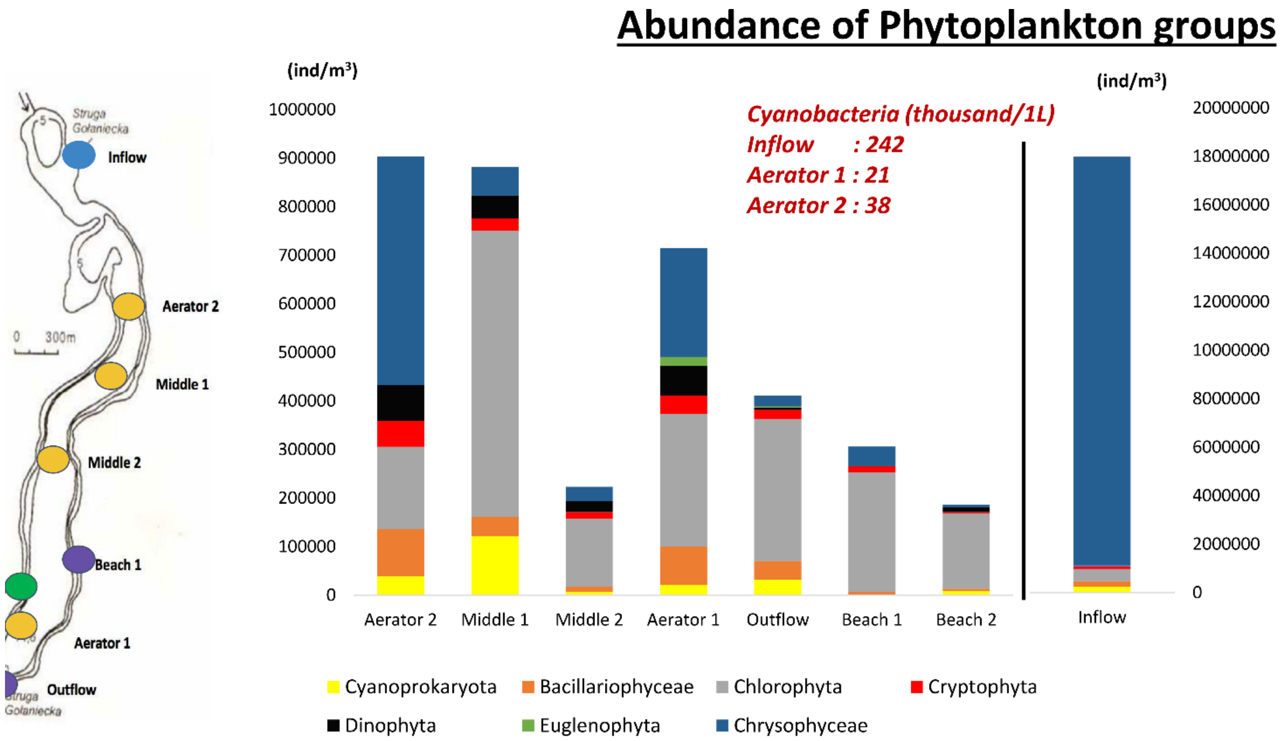

Figure 9: Abundance of phytoplankon species in Lake Durowskie.

Abundance of Phytoplankton Groups

The graphs show two different scales which compare the abundance between the groups in the lake and the groups in the river. The species which has the highest abundance was *Chrysophyta* which had almost 20 million cells/liter. It was 20 times more than those concentrated on the lake (1 million cells/liter). The reason of the abundance of this species was probably because of the late spring. It made the weather had more rainy and colder in the water area. This condition was a preference for the species of *Chrysophyta* such as *Dinobryon divergens* to thrive within such state. Furthermore, that species also has the ability to do photosynthesis, eat small bacteria, and filtrate water to increase the water visibility. There was also a high number of *Chlorophyta*. However, it was found mostly in the lake area. The other reason of this abundance of the species was also because those species built big colonies, so that the zooplankton were no able to eat them.

According to the data also, there were *Cyanobacteria* found in the river and the lake area even though only small number compared to the dominant species. There we 242/liter *Cyanobacteria* in the river. It is much higher than that of in the lake area. In addition, there were Cyanobacteria species like

Figure 10: Total number of individuals for phytoplankton species groups.

Anabaena flos-aqua, *Mycrocystis aeruginosa*, *Woronichinia nägeliana* found in the river area. They typically do not grow in Lake Durowskie area. Based on this, we can get an idea that the river is the source of Cyanobacteria, because the river carries nutrient loads from the upper stream, so that the water state in the river area is relatively highly affected by the upper stream.

Similarity Index

Table 3: Phytoplankton similarity index (Jaccard index - expressed as a percentage) over the monitoring years in Lake Durowskie.

YEAR	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
2008	84	51	43	33	40	52	82	35	**40**
2009	-	48	28	20	29	35	39	13	**34**
2010	-	-	42	42	62	47	37	35	**38**
2011	-	-	-	34	58	47	50	40	**38**
2012	-	-	-	-	77	49	59	47	**38**
2013	-	-	-	-	-	52	78	45	**46**
2014	-	-	-	-	-	-	57	40	**48**
2015	-	-	-	-	-	-	-	43	**47**
2016	-	-	-	-	-	-	-	-	**42**

This index illustrates the number of species which is notably similar before and after the restoration has been done. For instance, in the first year of restoration in 2009, there was as much as 84% similar species which meant that the difference in species at that time was as much as 16%. Moving to further comparison, between 2008-2017 there is as much as 40% similar species which means that as much as 60% of species are different. It implies that after the restoration has been done for nine years, there has been an increasing number of different species. Closer look to the last year, between 2016-2017 the similarity index is 42% and the different species is 58%. It shows that there is still species shifting under the ongoing restoration.

Results – Phytoplankton

Mixed Index of Nygaard

- Q = (Cyanobacteria + Chlorococcales + Centric diatoms + Euglenoids) /Desmids

Station \ Year	2009	2010	2011	2012	2013	2014	2015	2016	2017
Inflow	-	1.8	17	9	19	3.8	17	7	9
Aerator 2	26	11.5	5	8	14	20	4.3	12	8
Middle 1	9	12.5	13	3	5.5	11	4.8	7.7	6
Middle 2	-	8.3	18	9	7.5	20	4	8.5	6
Beach 1	-	-	3	9	7	5	5,5	-	3
Beach 2	-	-	-	5	6	10	12	-	5
Aerator 1	16	8.3	9	7	8	9	6.7	-	7
Outflow	-	6.5	5	-	12	8	8	14	5

Dystrophy	0.0 - 0.2
Oligotrophy	0.2 - 1.0
Mesotrophy	1.0 - 3.0
Eutrophy	3.0 – 5.0
Hypertrophy	5.0 – 43.0

Figure 11: Mixed index from periphyton analysis

Mixed Index of Nygaard

This index was determined by the species preference to the trophic level of water. This consists of *Cyanobacteria+Chlorococcales* and *Centric diatoms+Euglenoids/Desmids*. According to the table, eutrophic species is still dominant, however, it is now lower compared to the last year. It means that there was an increasing number of *Desmids*. Because the higher number of *Desmids*, the lower smaller index will be. It also shows that the restoration has given improvement.

PMPL Index

Results – Phytoplankton

PMPL Index

PMPL = [YCh + YBm + YCy] / 3

where:

YCh - Chlorophyll-a concentrations

YBm - General biomass of phytoplankton

YCy - Biomass of cyanobacteria

PMPL

	Inflow	A2	M1	M2	A1	Outflow
2017	3.40	2.74	2.78	2.78	2.78	2.50
2016	3.70	2.78	2.76	2.76	2.67	2.53

Ecological status	PMPL
very good	0,0 - 1,0
good	1,01 - 2,0
moderate	2,1 - 3,0
poor	3,1 - 4,0
bad	4,01 - 5,0

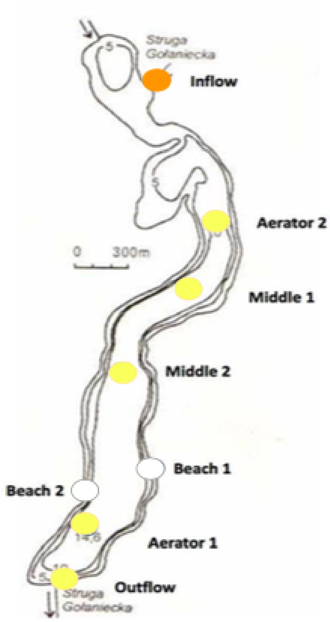

Figure 12: Trophic state of Lake Durowskie in the vertical profile indicated by PMPL index

The index is based on three different parameters (chlorophyll-a concentration, biomass of phytoplankton, and biomass of Cyanobacteria) in the vertical profile. According to the result, the data is still similar to the last year's, however, the value decreased a little bit. Overall, the water condition is in moderate state and the inflow is still in poor condition, but the value this year is lower than the last year's. In spite of the small changes, it can be concluded that the restoration has been working. Likewise, it also implies that the number of Cyanobacteria decreased. There are still Cyanobacteria found in the metalimnion, it can be taken into account for removing them in the further lake management.

Discussion

Periphyton assessment

Summarizing from periphyton measurements, the trophic state of the lake remain classified as eutrophic. Periphyton refers to organism attaching to the surface of submerged or underwater macrophytes or rocks such as algae, cyanobacteria and microbes. Compared to physical-chemical parameters, they react slower but with higher consistency to the trophic state of the lake. The results from periphyton assessment this year reflects several phenomenon. Summarizing from periphyton assessment, the species environmental preference and trophic diatom index (TDI) shows that the lake is in general under eutrophic state, alkali and oxygenated condition.

Species abundance

As shown in Figure 9 the inflow is dominated by Chrysophceae by around 80%. When compared with results from last year, inflow area contributed to a large amount of Cyanoprokaryote. The difference might be explained by the late-spring this year when the temperature remain low in May that is not a suitable habitat for cyanobacteria, which prefers to be in warmer water. It is possible that for a delayed cyanobacteria bloom when water is warm enough for them to build colony.

Nevertheless, when looking at the amount of cyanobacteria from the inflow, Aerator 1 and Aerator 2, the count from the inflow is 242 thousands per Litre, almost 10 times the amount recorded in the aerators, implying the high amount of cyanobacterial input from the upper lake through the river. It is important to notice that even the composition of cyanobacterial in the inflow is relatively low compared to other species, its actual quantity has outweighed other areas for several times.

Bio-manipulation

By measuring the abundance of phytoplankton in different water depth, one can observe how their distribution trend develop according to their habitat preference. Water samples at 0m, 1m, 2m and 3m was been collected and the vertical distribution of Chlorophyta, Nauplius, Rotifier, Cladoera and Copepod from Aerator 1 is shown in below Figure.

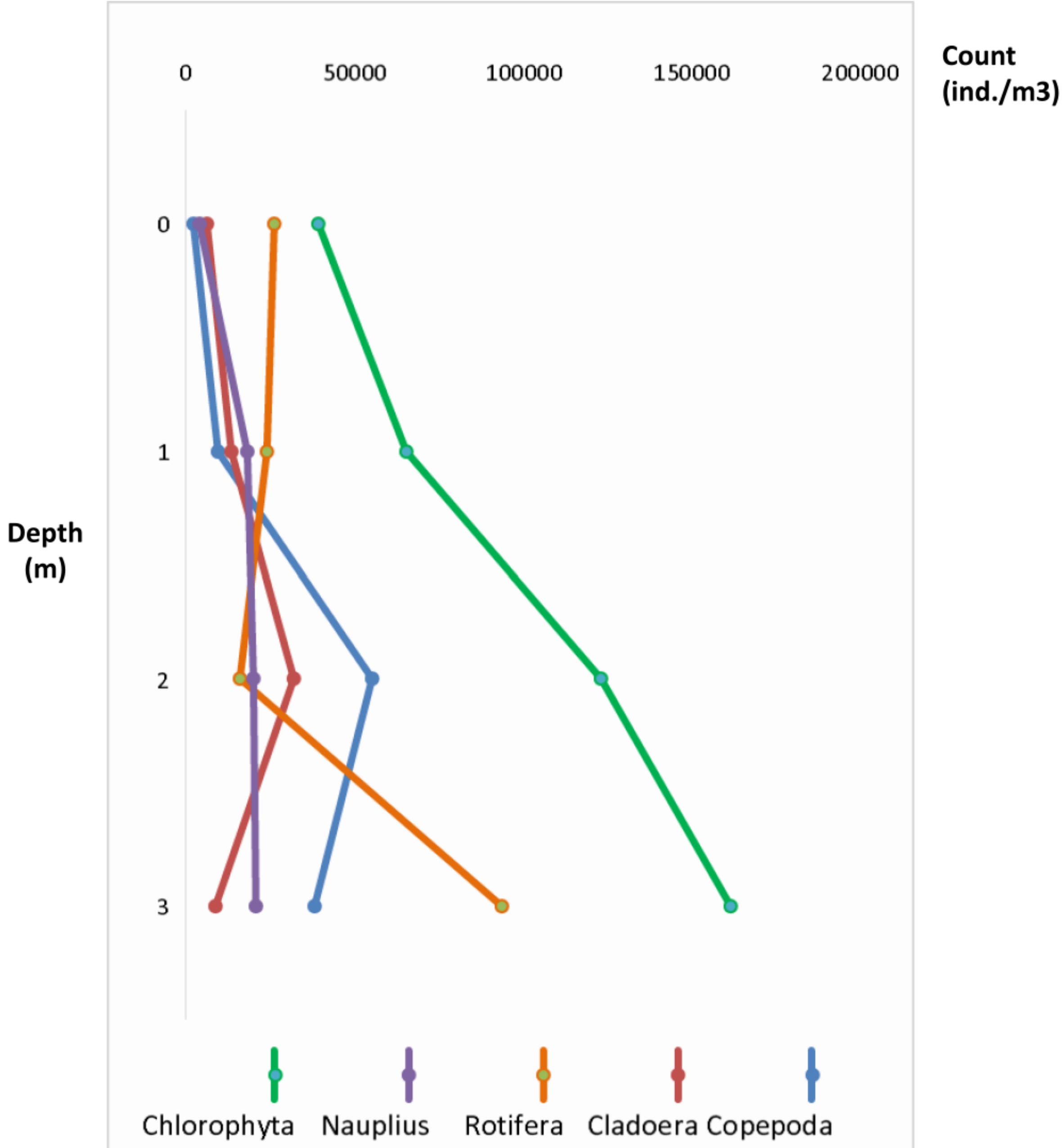

Figure 13: Vertical distribution of different phytoplankton groups at Aerator 1.

Phvtoplankton and zooplankton group occupy different water depths depending on their habitat or ecological requirement. Results of vertical distribution analysis shows that there was a general decrease in the abundance of species groups at the zero meter depth. At the 1 m depth the abundance of cladocera, copepod and nauplius increased slightly while that of chlorophyta increased marginally. At the 2 m depth the abundant of all group increased except Nauplius which stayed the same while that of Rotifers decreased. At the 3 m depth the abundance of Nauplius remained as previous while that of copepods and cladocera decreased. The abundance of chlorophyta increased at this depth. The general decrease in abundance of cladocera and copepods may be linked to the reduced amount of oxygen as depth increases. It was expected that as the number of zooplankton increases the number of phytoplankton should decrease due to perceived grazing pressure, however, this may not be implied in the figure above (Fig 11). We add that the species group that make up the chlorophytes are those that are able to form colonies and live inn large masses. These are usually not the preferred food for zooplankton as they are difficult to consume. This the reason why the figure shows an increasing amount of chlorophyta. This hypothesis is confirmed during identification of species as a lot of colony formed chlorophytes were found. Only a few individual cells were found signifying heavy grazing pressure on these individuals cells by zooplankton. Grazing of zooplankton on phytoplankton can be confirmed.

Bio-manipulation effectiveness

By stocking the lake with pike to control perch which in a way to stabilize the amount of zooplankton was one of the restoration measures for Lake Duroskie. As perch is controlled the population of zooplankton is increased to control phytoplankton. To measure the effectiveness of this restoration measure it is important to understand the vertical distribution of algae in relation to zooplankton. Form the description above zooplankton density decreased at the 0 m depth but increased between the 1 and 2 meter depth. The decrease in the abundance of zooplankton at the 0 meter depth can be explained by the intensive predation by predatory fish=perch and this may be the reason for the limited abundance of zooplankton. With the availability of colony forming cholophytes and higher abundance of this groups supported by data we confirm the effective grazing on single cell chlorophyta. This confirms the improvement of Lake condition through bio-manipulation.

Highlights from 2017

Enhancement in Species diversity and new species

Despite of the slight decrease number of species discovered this year, there are four new species found in the lake. As shown by Shannon-Wiener Index and Evenness index, the species diversity improved for most of the site. Most of the species were found in the inflow of the lake because the inflow consists of nutrient-rich water, for example, number of diatom species found in the inflow and water bodies of the lake is 28 and 8 respectively.

Shifting of cyanobacteria

Cyanobacteria has been the major concern of the lake and benthic cyanobacteria was discovered this year at the north-west bank of the lake at a position opposite to the inflow point, as shown in Figure 6. It is possible that under the effect of wind and current, the influx of cyanobacteria from inflow being flushed towards the north-west bank. Besides, the distribution of cyanobacteria shows downward movement trend to aerators. It might due to the upwelling of water by waves induced by wind and anthropogenic recreational activities.

Northward spreading of red algae

Red algae *H. rivularis*, mainly inhabited eutrophic and alkali water (Eloranta and Kwandrans 2004), has been classified as an indicator for good water quality state (Gutowski et al. 2004). Red algae existed in Lake Durowskie for several years and their coverage kept growing every year. They have a northward spreading trend along the lake bank, indicating good water quality and eutrophic state in the area. The distribution of red algae can be explained by their preference to shaded area (sensitive to sunlight), alkali and oxygenated water and under the wind direction of the lake from the West, inducing current to push red algae to the western bank of the lake.

Similar species preference in North and South

By using species composition, the oxygen preference, trophic preference and pH preference of the species show the lake water state as a bio-indicator. After comparing results from the northern and southern part of the lake, they are found to have very similar results, as shown in (Figure 12). The result implies that the water from the north and the south tends to be oxygenated, alkali and eutrophic.

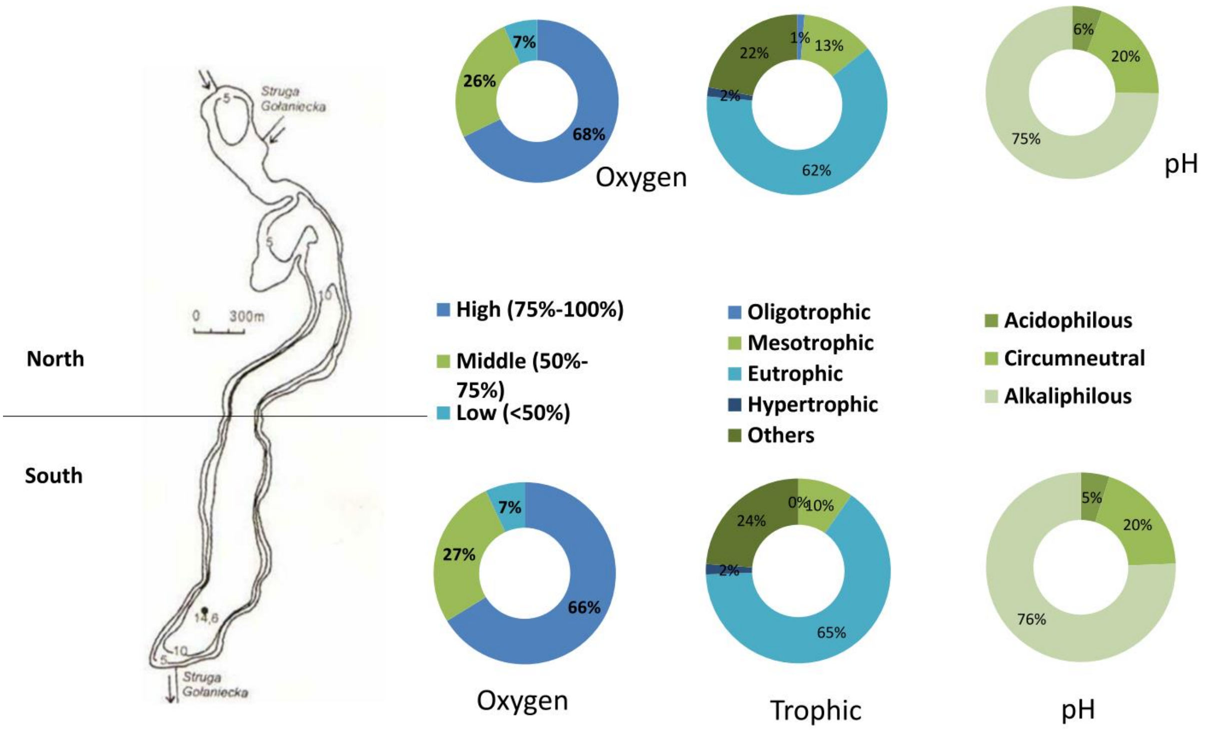

Figure 14: Summary of species preference between north and south part of the Lake Durowskie

Reduced effectiveness in bio-manipulation

The practice of restocking pike has implemented for several years in order to recover the top-down control mechanism in the lake. Although last year recorded a positive result on bio-manipulation, this year has become less effective due to the delay of the restocking and the size of the restocking pike is too small to sustain in the control mechanism.

Conclusion

To sum up, different parameters from algal species supported that the lake is still in eutrophic status but showing improvements from last year. Existence of red and green algae as well as the environmental preference of periphyton indicate improving water. Nevertheless, the influx from upper lake Struga Golaniecka, which contains lots of nutrients such as nitrogen and phosphorus remains a problem as this year cyanobacteria was found at the northwest of the lake, a site parallel to the inflow. Moreover, the effect of human activities concentrated in the southern part of the lake also indicated by a noticeable drop of diatom index in the Beach 1 position. On the other hand, with four new species found in this year, the diversity of phytoplankton species also improved significantly from last year. The PMPL indicates a moderate trophic state for Lake Durowskie and there are also evidence for effective grazing of zooplankton towards phytoplankton where relatively greater portions of zooplankton contributes to Rotifers. Due to the growing colony formed by chlorophyta which is too big to be preyed by zooplankton, a large amount of chlorophyta are found in deeper water and hence, further control for phytoplankton is suggested to maintain effective top-down control mechanism in the lake. Finally, bio-manipulation has shown lower effectiveness due to the delay schedule of the pike stocking and the inappropriate size of the pike. As a result, coordination and mutual efforts between different working parties are critical to the status of the lake and remedial measures shall keep implementing to ensure the stable water quality for sustaining tourism and human activities in the lake.

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Annexes

ANNEX 1. Comparison of phytoplankton species composition in different investigated years in June/July in Lake Durowskie.

Phytoplankton taxa	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
***Cyanoprokaryota* – cyanobacteria**										
Anabaena affinis Lemm.							+		+	
Anabaena flos-aquae Brebisson		+				+			+	+
Aphanizomenon aphanizomenoides (Forti) Hort. &Kom.	+				+					
Aphanizomenon flos-aquae (L.) Ralfs	+	+	+	+			+	+		+
Aphanizomenon gracile Lemmerman	+									
Aphanizomenon isatschenkoi (Usacc.) Pros. - Lavrenko	+	+	+							
Aphanocapsa grevillei(Ber.) Rabenhorst		+								
Aphanocapsa incerta (Lemm.) Cronberg et Komarek	+	+	+			+				+
Arthrospira massartii Kuff.		+								
Chroococcus limneticus Lemm.	+	+		+						+
Chroococcus turgidus (Kűtz.) Naeg.		+		+			+	+		+
Cyanogranis feruginea (Wawrik) Hind.		+	+							
Gloeocapsa minuta Lemm.							+			+
Jaaginema pseudogeminatum (Schmid) Anagn. et Kom.			+	+						

Phytoplankton taxa	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Limnothrix lauterbornii (Schmidle) Anagn.		+								
Limnothrix redekei (Van Goor) Meffert	+		+	+	+	+	+	+	+	+
Lyngbya hieronymusii Lemm.		+						+		
Microcystis aeruginosa Kützing	+			+	+	+	+	+	+	+
Microcystis flos-aquae (Wittrock) Kirchner			+			+				
Jaaginema gracils (Bocher) Anagn. et kom.		+						+		
Phormidium granulatum Gardn. Anagn.	+	+	+		+					
Phormidium tenue (Agards ex Gomont) Anagn. et kom.		+								+
Phormidium autumnale Gomont									+	+
Planktolyngbya limnetica (Lemm.) Kom. – Legn. Et Cronenberg		+	+	+	+	+	+	+	+	+
Planktothrix agardhii (D.C. ex Gom.) Anagn. Et Kom.	+	+	+	+	+	+	+	+	+	+
Pseudanabaena limnetica (Lemm.) Kom.	+	+	+				+	+		+
Woronichina naegeliana (Unger)Elenkin								+	+	+
Spirulina laxissima (W. West)			+							
Spirulina maior Kütz.					+					
Oscillatoria grossegranulata Skuja						+				
Bacillariophyceae – diatoms										
Achnanthes exigua Grun.			+							

Achnanthes minutissima Kützing	+		+	+		+		+		+
Phytoplankton taxa	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Amphora copulate (Kutz.) Schoeman & Archibald								+		
Amphora ovalis Kützing	+	+	+	+						+
Amphora pediculus (Kütz.) Grun.			+							
Asterionella formosa Hasall		+		+	+	+	+	+	+	+
Caloneis amphisbaena (Bory) Cleve								+		
Cocconeis euglypta (Ehr.) Clevei	+									
Cocconeis pediculus Ehr.										+
Cocconeis placentula Ehr.	+		+	+	+	+		+	+	+
Cyclotella atomus Hustedt		+								
Cyclotella meneghiniana Kütz.	+	+	+			+				+
Cyclotella ocellata Pant.	+		+	+	+	+	+	+	+	+
Cyclotella operculata (Ag.) Kützing	+	+	+			+				+
Cyclotella radiosa (Grun.) Lemm.	+	+	+	+	+	+	+	+	+	+
Cymatopleura solea (Breb.) W. Smith							+			+
Cymbella affinis Kützing				+						
Cymbella amphicephala Naegeli ex Kütz.										+
Cymbellalanceolata(Ehr.) Kirchner										+

Cymbella microcephala Grun.				+		+				
Cymbella minuta Hilse ex Rabenhorst	+		+	+	+	+	+	+	+	+
Phytoplankton taxa	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Diatoma vulgare Bory				+				+		
Fragilaria capucina (Desm.) Rabenhorst				+		+				
Fragilaria crotonensis Kitton	+	+		+	+	+	+	+	+	+
Fragilaria pinnata Ehr.	+			+			+	+		
Fragilaria ulna (Nitzsch) Lange-Bertalot	+	+	+	+	+	+	+	+	+	+
Fragilaria ulna var. *Angustissima* Sippen	+	+	+	+	+	+	+	+		+
Gomphonema acuminatum Ehr.					+	+	+			
Gomphonema olivaceum (Horn.) Breb.			+	+			+			+
Gomphonema parvulum (Kütz.) Kütz.				+					+	
Melosira varians Ag.	+									
Hippodonta capitata (Ehr.) L-B, Metz. et Witk.						+		+	+	
Navicula cincta (Ehr.) Ralfs	+	+	+			+	+	+		+
Navicula mensiculus Schumann	+									
Navicula radiosa Kützing			+	+	+	+	+		+	+
Navicula lanceolata Ehr.									+	
Naviula tripunctata (O.F. Muller) Bory de Sain. Van.			+			+		+		+

Nitzschia palea (Kütz.) W. Smith				+	+	+	+	+		
Nitzschia recta Hantzsch ex Rabenh.						+				
Nitzschia sigmoidea(Ehr.) W. Smith				+			+	+		
Phytoplankton taxa	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Nitzschia sinuata (W. Sm.) Grunow				+						
Pinnularia maior (Kütz.) Rabenhorst									+	
Pinnularia viridis (Nitzsch) Ehr.				+			+	+		
Placoneis gastrum (Ehr.) Meresch.		+								
Rhopalodia gibba (Ehr.) Muller						+		+		+
Staurosira construens Ehr.		+							+	
Chlorophyta - green algae										
Actinastrum hantzschii Lagerh.									+	
Ankistrodesmus falcatus (Corda) Ralfs		+								+
Botryococcus braunii Kütz.						+	+	+	+	+
Characium aqngustatum A. Braun		+		+	+	+	+	+	+	
Chlamydomonas globosa Snow	+	+	+	+		+				
Chlamydomonas passive Skuja			+			+	+	+		
Chlamydomonas reinchardtii Dangeard		+						+		
Closteriumacutum var. *variabile* (Lemm.) Krieg.	+		+	+				+	+	+

Coelasrum astroideum De Notaris			+	+	+	+		+	+	+
Coelastrum microporum Naegel.			+							+
Coelastrum reticulatum (Dang.) Senn	+	+					+		+	+
Coenocystis planctonica Korshikov									+	
Phytoplankton taxa	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Cosmarium abbreviatum Raciborski	+		+	+	+	+	+			
Cosmarium exiguum W. Archer		+								
Cosmarium formulosum Lund								+		
Cosmarium trilobulatum Reinsh								+		
Cosmarium margaritatum (Turp.) Ralfs				+					+	
Cosmarium phaseolus Brebisson in Ralfs	+		+	+		+	+	+	+	
Cosmarium leave Rabenhorst					+					
Cosmarium regnellii Wille	+	+	+		+		+	+	+	+
Crucigeniella rectnagulrais (Naeg.) Kom.						+				
Crucigenia tetrapedia (Kirchner) W. et G.S. West			+							+
Desmodesmus communis (Hegew.) Hegew.	+	+	+	+	+	+	+	+	+	+
Desmodesmus grahneisii (Heynig) Fott				+						
Desmodesmus naegellii (Meyen) Hegew.			+							
Desmodesmus opoliensis (Rchter) Hegew.			+			+				

Desmodesmus subspicatus (Chod.) Hegew. et Schmidt	+		+			+	+	+		
Dicellula geminate (Printz) Kors.									+	
Dictyosphaerium pulchellum Wood	+	+	+	+						+
Didymocystis planctonica Korsikov				+		+				
Elkatothrix gelatinosa Wille			+	+		+	+	+	+	+
Phytoplankton taxa	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Franceia ovalis (France) Lemm.			+				+			
Golenkinia radiata Chodat	+		+	+	+	+	+	+	+	
Kirchneriella contorta var. *elegans* (Schmidle) Bohlin	+					+	+	+		+
Kirchneriella incurvata Belcher et Swale									+	
Kirchneriella obesa (West) West & West									+	
Koliella longiseta (Vischer) Hindak	+									
Lagerheimia ciliata (Lag.)Chodat							+			
Micractinium crassisetum Hortobagyi				+						
Micractinium pusillum Fresenius				+					+	
Mougeotia sp.				+	+					
Monoraphidium arcuatum (Kors.) Hindak	+									
Monoraphidium circinale (Nyg.) Nygaard	+									
Monoraphidium contortum (Thur.) Kom.-Legn.	+	+	+	+	+	+	+	+	+	+

Monoraphidium griffithii (Berk.) Kom.-Legn.	+		+				+	+		
Monoraphidium irregulare (G.M. Sm.) Kom.-Legn.	+		+							
Monoraphidium komarkovae Nygaard	+	+	+				+	+		+
Monoraphidium minutum (Nageli) Kom. - Legn.		+								
Monoraphidium obtusum (Kors.)Kom. - Legn.	+									
Nephrocytiuma gardhianum Naegeli									+	
Phytoplankton taxa	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Nephrocytium limneticum (G. M. Sm.) G. M. Sm.				+						
Oocystis lacustris Chodat	+	+	+	+	+		+	+	+	+
Oedogonium sp.								+		+
Palmelochette tenerrima Kors.				+						
Pandorina morum (O.F. Müller) Bory			+			+				+
Pediastrum biradiatum Meyen									+	
Pediastrum boryanum (Turpin) Meneg.			+	+	+	+	+	+	+	+
Pediastrum simplex Meyen						+			+	+
Pediastrum duplex Meyen						+	+	+	+	+
Pediastrum duplex var. gracillium West									+	
Pediastrum tetras (Ehr.) Ralfs			+				+			
Phacotus lendneri Chodat.				+	+					

*Phacotus lenticularis (*Ehr.) Stein	+			+	+	+	+	+	+	+
Plankosphaceeria gelatinosa Meyen									+	
Provasoliella saccata (Skuja) Ettl					+					
Provasiorella sp.							+			
Pteromonas angulosa (Carter) Lemm.		+	+						+	
Pteromonas cordiformis Lemm.			+						+	
Scenedesmusa cuminatus (Lager.) Chodat			+		+		+	+	+	+
Phytoplankton taxa	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Scenedesmus bicaudatus Dedusenko			+	+	+				+	
Scenedesmus dimorphus (Turp.) Kütz.		+		+						
Scenedesmus ecornis (Ehr.) Chod.			+	+	+		+		+	
Scenedesmus obtusus Meyen				+						+
Scenedesmus regularis Swirenko		+								
Scenedesmus verucosus Roll				+						
Sphaerocystis planctonica (Korsikov) Bourrelly				+	+	+	+	+	+	+
Staurastrum gracile Ralfs			+	+	+	+	+	+	+	+
Staurastrum paradoxum Meyen							+			
Staurastrum tetracerum Ralfs ex Ralfs									+	+
Tetraedron caudatum (Corda) Hansgirg	+		+					+		

Tetraedron minimum (A. Br.) Hansgirg	+	+	+	+	+	+	+	+	+	+
Tetraedron triangulare (Chod.) Kom.	+	+		+		+			+	
Tetrastrum glabrum (Roll) Ahlstr. et Tiff			+	+			+			+
Tetrastrum staurogeanieforme (Schroed.) Lemm.			+	+		+	+	+	+	+
Treubaria schmidlei (Schroeder) Fott et Kovacik		+	+	+		+	+			
Cryptophyta - cryptophytes										
Chroomonas acuta Uterm.	+				+		+			
Cryptomonas erosa Ehrenberg	+	+	+	+	+	+	+	+	+	+
Phytoplankton taxa	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Cryptomonas gracilis Skuja		+								
Cryptomonas marssonii Skuja	+	+	+	+	+	+	+	+	+	+
Cryptomonas ovata Ehrenberg	+	+	+	+	+	+	+	+	+	+
Cryptomonas rostrata Troitzskaja emend I. Kiselev	+		+	+	+	+	+	+	+	+
Rhodomonas minuta Skuja	+	+	+	+	+	+	+	+	+	+
Dinophyta - dinophytes										
Ceratium hirundinella (F. B. Müller) Bergh	+	+		+	+	+	+	+	+	+
Ceratium cornutum (Ehr) Clap.& Lachman								+		
Gymnodinium aeruginosum Stein	+					+		+		
Peridiniopsis cuningtonii Lemm.	+	+	+	+	+	+	+	+	+	+

Peridinium cinctum (O.F. Müller) Ehrenberg	+	+	+	+	+	+	+	+	+	+
Peridinium gatunense Nygaard						+				
Peridinopsis berolinense (Lemm.) Bourrelly	+	+	+	+	+	+	+	+	+	+
Peridinopsis elpatiewskyi (Ostenf.) Bourrelly	+		+	+	+	+	+	+	+	+
Peridinopsis kevei Grig. &Vasas									+	
Euglenophyta - euglenoids										
Colacium vesiculosum Ehr.		+		+		+		+		
Euglena caudata Hübner					+				+	
Euglena pisciformis Klebs		+		+				+	+	
Phytoplankton taxa	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Phacus caudatus Hubner								+		
*Phacus pusillus*Lemm.								+	+	
Phacus orbicularis Hubner	+	+								
Trachelomonas hispida (Perty) Stein	+		+	+	+	+	+	+	+	+
Trachelomonas intermedia Dangeard									+	
Trachelomona splanctonica Swirenko	+		+	+						
Trachelomonas volocina Ehrenberg	+		+	+	+	+	+		+	
Chrysophyceae - chrysophyces										
Chrysococcus rufescens Klebs			+	+						

Dinobryon bavaricum Imhoff		+	+	+	+	+	+		+	
Dinobryon crenulatum W. et G.S. West		+	+	+						
Dinobryon divergens Imhof		+	+		+	+	+	+	+	+
Dinobryon sociale Ehrenberg	+		+	+		+			+	
Erkenia subaequiciliata Skuja	+	+	+		+	+	+	+	+	+

ANNEX 2. List of phytoplankton species from different taxonomical algal groups and their frequency in Lake Durowskie from 26 th June to 30th June 2017 (Inf – inflow; A2 – Aerator 2; Mid. 2 – Middle 2; Mid.1 – Middle 1; Outf – outflow; B1 – Beach 1; B2 – Beach 2; F – frequency).

	n=1	n=4	n=4	n=4	n=4	n=2	n=1	n=1	n=21
Depth	**0m**	**0-3m**	**0-3m**	**0-3m**	**0-3m**	**0-1m**	**0m**	**0m**	**%**
Site	**Inf**	**A2**	**Mid.1**	**Mid.2**	**A1**	**Outf**	**B1**	**B2**	**F**
***Cyanoprokaryota* - cyanobacteria**									
Aphanocapsa incerta (Lemm.) Cronberg et Komarek	+	+	+	+	+	+		+	52
Anabaena lemmermanii P. Richter	+								5
Anabaena flos-aquae Brebisson	+								5

Aphanizomenon flos-aquae (L.) Ralfs	+	+	+						29
Chroococcus turgidus (Kűtz.) Naeg.							+		5
Limnothrix redekei (Van Goor) Meffert	+	+	+	+	+	+		+	71
Microcystis aeruginosa Kützing	+	+							10
Merismopedia punctata Meyen							+		5
Chroococcus limneticus Lemm.		+							5
Planktolyngbya limnetica (Lemm.) Kom. – Legn. Et Cronenberg		+				+		+	14
Planktothrix agardhii (D.C. ex Gom.) Anagn. et Kom.	+	+	+	+	+				48
Pseudanabaena limnetica (Lemm.) Kom.		+				+		+	14
Woronichina naegeliana (Unger) Elenkin	+								5
***Bacillariophyceae*- diatoms**									
Amphora ovalis Kützing	+					+		+	14
Achnanthes minutissima Kützing					+				10
Asterionella formosa Hasall	+								5
Cocconeis placentula Ehr.	+								5
Site	**Inf**	**A2**	**Mid.1**	**Mid.2**	**A1**	**Outf**	**B1**	**B2**	**F**
Cocconeis pediculus Ehr.	+								5
Cyclotella ocellata Pant.	+	+	+	+	+	+			76
Cyclotella radiosa (Grun.) Lemm.	+	+	+	+	+	+	+		71
Cyclotella meneghiniana Kützing	+								5
Cymbella amphicephala Grun.	+								5
Cymbella lanceolata (Ehr.) Kirchner	+								5
Cymbella minuta Hilse ex Rabenhorst	+	+		+	+	+	+		38
Cymatopleura solea (Breb.) W. Smith	+								5
Epithemia sorex Kützing	+								5

Fragilaria construens (Ehr.) Grunow	+								5
Fragilaria crotonensis Kitton	+	+			+	+	+		29
Fragilaria ulna (Nitzsch) Lange-Bertalot	+	+	+	+	+	+		+	52
Fragilaria ulna var. *angustissima* Sippen	+					+			10
Gomphonema olivaceum (Horn.) Breb.	+								5
Hippodonta capitata (Ehr.) L-Bert., Metz. & Witkowski						+			5
Meridion circulare (Grev.) C. Agardh	+		+						10
Navicula cincta (Ehr.) Ralfs	+					+			10
Navicula lanceolata (Agardh) Ehr.	+								5
Navicula radiosa Kützing	+	+			+	+	+	+	38
Navicula reinhardtii Grun.	+								5
Naviula tripunctata (Muller) Bory	+					+			10
Nitzschia palea (Kütz.) W. Smith	+								5
Nitzschia recta Hantzsch	+								5
Nitzschia sigmoidea (Ehr.) W. Smith	+								5
Pinnularia viridis (Nitzsch) Ehr.	+								5
Rhopalodia gibba (Ehr.) Muller	+								5
Stephanodiscus astrea (Ehr.) Grunow		+							5
***Chlorophyta*- green algae**									
Site	**Inf**	**A2**	**Mid.1**	**Mid.2**	**A1**	**Outf**	**B1**	**B2**	**F**
Botryococcus braunii Kutzing	+	+			+	+			29
Cladophora glomerata (L.) Kutzing			+						5
Closterium acutum var. *variabile* (Lemm.) Krieg.		+							5
Coelastrum astroideum De Notaris	+	+	+	+	+	+	+	+	71
Coelastrum microporum Naegel.	+	+		+					19
Coelastrum reticulatum (Dang.) Senn	+	+	+		+	+			33

Cosmarium regnellii Wille	+		+						10
Crucigenia tetrapedia (Kirchner) W. et G.S. West			+						10
Desmodesmus communis (Hegew.) Hegew.	+	+			+		+		19
Dictyosphaerium pulchellum Wood	+								5
Elkatothrix gelatinosa Wille	+				+	+	+		29
Eudorina elegans Ehr.				+			+		10
Eutetramorus planctonicus (Kors.) Bourr.	+	+	+	+	+	+	+	+	95
Kirchneriella contorta var. *elegans* (Schm.) Bohlin	+	+			+				14
Monoraphidium contortum (Thur.) Kom.-Legn.	+	+	+		+				19
Oocystis lacustris Chodat	+	+	+	+	+	+		+	76
Pediastrum boryanum (Turpin) Meneg.	+	+	+	+	+		+	+	71
Pediastrum duplex Meyen	+	+	+	+	+	+	+		52
Phacotus lenticularis (Ehr.) Stein	+	+	+	+	+	+	+	+	90
Scenedesmus acuminatus (Lager.) Chodat	+	+			+				14
Scenedesmus obtusus Meyen								+	5
Sphaerocystis planctonica (Korsikov) Bourrelly	+	+	+	+	+	+	+	+	95
Tetraedron minimum (A. Br.) Hansgirg	+	+			+				19
Tetrstrum komarekii Hindak			+						5
Tetrastrum staurogeanieforme (Schroed.) Lemm.	+		+		+	+	+		29
Staurastrum gracile Ralfs	+	+	+		+	+	+		57
***Cryptophyta*- cryptophytes**									
Site	**Inf**	**A2**	**Mid.1**	**Mid.2**	**A1**	**Outf**	**B1**	**B2**	**F**
Cryptomonas erosa Ehrenberg	+	+	+	+	+	+	+	+	76
Cryptomonas marssonii Skuja	+		+		+			+	19
Cryptomonas ovata Ehrenberg							+		5
Cryptomonas rostrata Troitz. emend I. Kiselev	+	+	+	+	+	+	+	+	67
Rhodomonas minuta Skuja	+	+	+	+	+	+	+		67

***Dinophyta*- dinophytes**									
Peridinopsis berolinense (Lemm.) Bourrelly	+		+	+	+			+	33
Ceratium hirundinella (F. B. Müller) Bergh	+	+	+	+	+	+	+		67
Peridiniopsis cuningtonii Lemm.	+	+	+	+	+	+	+	+	76
Peridinium cinctum (O.F. Müller) Ehrenberg	+	+	+	+	+	+		+	81
Peridinopsis elpatiewskyi (Ostenf.) Bourrelly	+	+		+	+				33
***Euglenophyta*- euglenoids**									
Trachelomonas hispida (Perty) Stein	+		+		+				24
Euglena acus Ehr.					+				10
Colacium vesiculosum Ehr.						+			5
***Chrysophyceae*- chrysophyces**									
Erkenia subaequiciliata Skuja	+	+	+	+	+	+	+	+	86
Dinobryon divergens Imhof	+	+	+		+	+	+	+	76

ANNEX 3. Average number of the most abundant phytoplankton species cells (ind./L) from different depth in Lake Durowskie from 26th June to 30th June 2017 (Inf – inflow; A2 – Aerator 2; Mid. 2 – Middle 2; Mid.1 – Middle 1; Outf – outflow; B1 – Beach 1; B2 – Beach 2).

Depth	**0m**	**0-3m**	**0-3m**	**0-3m**	**0-3m**	**0-1m**	**0m**	**0m**
Site	**Inf**	**A2**	**Mid.1**	**Mid.2**	**A1**	**Outf**	**B1**	**B2**
***Cyanoprokaryota* - cyanobacteria**								

Anabaena lemmermanii P. Richter	3200	.	.	.	.	.	.	.
Anabaena flos-aquae Brebisson	35200	.	.	.	.	.	.	.
Aphanizomenon flos-aquae (L.) Ralfs	11200	1200	3733.3	.	.	.	.	.
Aphanocapsa incerta (Lemm.) Cronberg et Komarek	46400	3600	800	4000	4533	12800	.	4000
Chroococcus turgidus (Kűtz.) Naeg.	.	.	.	.	.	.	800	.
Chroococcus limneticus Lemm.	.	2400	.	.	.	.	.	.
Limnothrix redekei (Van Goor) Meffert	31200	3200	21200	1200	2800	800		400
Microcystis aeruginosa Kützing	1600	800	.	.	.	.	.	.
Merismopedia punctata Meyen	.	.	.	.	.	.	800	.
Planktolyngbya limnetica (Lemm.) Kom. – Legn. Et Cronenberg	.	11200	.	.	.	.	.	.
Planktothrix agardhii (D.C. ex Gom.) Anagn. et Kom.	112000	2000	6000	800	800	.	.	.
Pseudanabaena limnetica (Lemm.) Kom.	.	800	800	.	.	.	.	.
Woronichina naegeliana (Unger) Elenkin	800	.	.	.	.	.	.	.
Total	241600	25200	31733	6000	8133	13600	1600	4400
***Bacillariophyceae*- diatoms**								
Amphora ovalis Kützing	4800	.	.	.	.	.	.	.
Achnanthes minutissima Kützing	.	.	.	.	.	.	.	.
Asterionella formosa Hasall	40000	.	.	.	.	.	.	.
Cocconeis placentula Ehr.	2400	.	.	.	.	.	.	.
Site	**Inf**	**A2**	**Mid.1**	**Mid.2**	**A1**	**Outf**	**B1**	**B2**
Cocconeis pediculus Ehr.	1600	.	.	.	.	.	.	.
Cyclotella meneghiniana Kützing	800	.	.	.	.	.	.	.
Cyclotella ocellata Pant.	8800	22933	4400	1600	8800	4000	.	.
Cyclotella radiosa (Grun.) Lemm.	26400	5600	3200	4000	5400	5200	.	.
Cymbella amphicephala Grun.	1600	.	.	.	.	.	.	.

Cymbella lanceolata (Ehr.) Kirchner	800	.	.	.	.	.	.	.
Cymbella minuta Hilse ex Rabenhorst	12000	1200	.	800	1600	800	800	.
Cymatopleura solea (Breb.) W. Smith	800	.	.	.	.	.	.	.
Epithemia sorex Kützing	800	.	.	.	.	.	.	.
Fragilaria construens (Ehr.) Grunow	47200	.	.	.	.	.	.	.
Fragilaria crotonensis Kitton	47200	3200	.	.	.	.	4000	.
Fragilaria ulna (Nitzsch) Lange-Bertalot	8000	4000	4400	1200	1000	2000	.	400
Fragilaria ulna var. *angustissima* Sippen	1600	.	.	.	.	.	.	.
Gomphonema olivaceum (Horn.) Breb.	3200	.	.	.	.	.	.	.
*Hippodonta capitata (*Ehr.) L-Bert., Metz. & Witkowski	.	.	.	.	.	.	.	.
Meridion circulare (Grev.) C. Agardh	8800	.	800	.	.	.	.	.
Navicula cincta (Ehr.) Ralfs	3200	.	.	.	.	.	.	.
Navicula lanceolata (Agardh) Ehr.	800	.	.	.	.	.	.	.
Navicula radiosa Kützing	6400	800	.	.	.	.	800	.
Navicula reinhardtii Grun.	800	.	.	.	.	.	.	.
Naviula tripunctata (Muller) Bory	1600	.	.	.	.	.	.	.
Nitzschia palea (Kütz.) W. Smith	800	.	.	.	.	.	.	.
Nitzschia recta Hantzsch	800	.	.	.	.	.	.	.
Nitzschia sigmoidea (Ehr.) W. Smith	800	.	.	.	.	.	.	.
Pinnularia viridis (Nitzsch) Ehr.	800	.	.	.	.	.	.	.
Rhopalodia gibba (Ehr.) Muller	3200	.	.	.	.	.	.	.
Stephanodiscus astrea (Ehr.) Grunow	.	800	.	.	.	.	.	.
Site	**Inf**	**A2**	**Mid.1**	**Mid.2**	**A1**	**Outf**	**B1**	**B2**
Total	**236000**	**38533**	**12800**	**7600**	**16800**	**12000**	**5600**	**400**
***Chlorophyta*- green algae**								
Botryococcus braunii Kutzing	16800	2133	.	.	.	.	.	.

Closterium acutum var. *variabile* (Lemm.) Krieg.	.	800	.	.	.	.	.	.
Coelastrum astroideum De Notaris	10400	2000	22133	1200	3200	7200	8800	19200
Coelastrum microporum Naegel.	1600	1600	.	800	.	.	.	.
Coelastrum reticulatum (Dang.) Senn	800	2133	800	.	.	.	.	.
Cosmarium regnellii Wille	800	.	800	.	.	.	.	.
Crucigenia tetrapedia (Kirch.) W. et G.S. West	.	.	2400	.	.	.	.	.
Desmodesmus communis (Hegew.) Hegew.	6400	1600	.	.	.	.	800	.
Dictyosphaerium pulchellum Wood	4800	.	.	.	.	.	.	.
Elkatothrix gelatinosa Wille	4800	.	.	.	.	.	800	.
Eudorina elegans Ehr.	.	.	.	800	.	.	4000	.
Kirchneriella contorta var. *elegans* (Schm.) Bohlin	3200	800	.	.	.	.	.	.
Monoraphidium contortum (Thur.) Kom.-Legn.	16800	2400	800	.	.	.	.	.
Oocystis lacustris Chodat	22400	4000	2133	1200	2400	2400	.	400
Pediastrum boryanum (Turpin) Meneg.	4000	2800	1867	1200	3200		3200	800
Pediastrum duplex Meyen	800	1600	800	800	2667	34400	800	.
Phacotus lenticularis (Ehr.) Stein	23200	12200	4400	20800	10400	6800	31200	11600
Scenedesmus acuminatus (Lager.) Chodat	2400	800	.	.	.	.	.	.
Scenedesmus obtusus Meyen	.	.	.	.	.	.	.	.
Sphaerocystis planctonica (Korsikov) Bourrelly	338400	14000	118600	2987	41800	107200	187200	30133
Staurastrum gracile Ralfs	31200	1867	1600	.	.	.	800	.
Tetraedron minimum (A. Br.) Hansgirg	11200	1200	.	.	.	.	.	.
Tetrastrum staurogeanieforme (Schroed.) Lemm.	.	.	3200	.	.	.	.	.
Tetrstrum komarekii Hindak	2400	.	800	.	.	.	8000	.
Total	**502400**	**51933**	**160333**	**56667**	**63667**	**158000**	**245600**	**62133**
***Cryptophyta*- cryptophytes**								
Site	**Inf**	**A2**	**Mid.1**	**Mid.2**	**A1**	**Outf**	**B1**	**B2**

Cryptomonas erosa Ehrenberg	31200	11467	4000	4000	9067	6000	4800	800
Cryptomonas marssonii Skuja	16000	.	800	.	.	.	.	.
Cryptomonas ovata Ehrenberg	.	.	.	.	.	.	3200	.
Cryptomonas rostrata Troitz. emend I. Kiselev	11200	1400	1200	800	2800	2000	800	1600
Rhodomonas minuta Skuja	44800	4533	1867	4000	1333	2400	3200	.
Total	**103200**	**17400**	**7867**	**8800**	**13200**	**10400**	**12000**	**2400**
***Dinophyta*- dinophytes**								
Ceratium hirundinella (F. B. Müller) Bergh	9600	8800	2200	1600	5200	800	800	.
Peridinopsis berolinense (Lemm.) Bourrelly	1600	.	3200	2400	2400	.	.	800
Peridinium cinctum (O.F. Müller) Ehrenberg	32000	11200	4400	1333	10133	1600	.	533
Peridiniopsis cuningtonii Lemm.	13600	2933	3400	2400	6400	2400	800	2133
Peridinopsis elpatiewskyi (Ostenf.) Bourrelly	6400	1200	.	1600	1867	.	.	.
Total	**63200**	**24133**	**13200**	**9333**	**26000**	**4800**	**1600**	**3467**
***Euglenophyta*- euglenoids**								
Colacium vesiculosum Ehr.	.	.	.	.	.	800	.	.
Euglena acus Ehr.	.	.	.	800	.	.	.	.
Trachelomonas hispida (Perty) Stein	1600	.	800	.	.	.	.	.
Total	**1600**	**.**	**800**	**.**	**.**	**.**	**.**	**.**
***Chrysophyceae*- chrysophyces**								
Dinobryon divergens Imhof	16720000	87442	13800	.	.	.	36000	.
Erkenia subaequiciliata Skuja	114400	30200	2000	9867	14600	8400	4000	533
Total	**16834400**	**117642**	**15800**	**9867**	**14600**	**8400**	**40000**	**533**

ANNEX 4. Average biomass of the most abundant phytoplankton species (mg/L) from different depth in Lake Durowskie from 26th June to 30th June 2017 (Inf – inflow; A2 – Aerator 2; Mid. 2 – Middle 2; Mid.1 – Middle 1; Outf – outflow; B1 – Beach 1; B2 – Beach 2).

Depth	**0-3m**	**0-3m**	**0-3m**	**0-3m**	**0-3m**	**0-3m**	**0-3m**	**0-3m**
Site	**Inf**	**A2**	**Mid.1**	**Mid.2**	**A1**	**Outf**	**B1**	**B2**
***Cyanoprokaryota* - cyanobacteria**								
Anabaena flos-aquae Brebisson	0.1090	-	-	-	-	-	-	-
Anabaena lemmermanii P. Richter	0.0060	-	-	-	-	-	-	-
Aphanizomenon flos-aquae (L.) Ralfs	0.0220	0.0020	0.0070	-	-	-	-	-
Aphanocapsa incerta (Lemm.) Cronberg et Komarek	0.0150	0.0144	0.0004	0.0010	0.0220	0.0040		0.0010
Chroococcus turgidus (Kűtz.) Naeg.	-	-	-	-	-	-	0.0002	-
Chroococcus limneticus Lemm.	-	0.0002	-	-	-	-	-	-
Limnothrix redekei (Van Goor) Meffert	0.0090	0.0021	0.0063	0.00015	0.0009	0.0012		0.0010
Merismopedia punctata Meyen	-	-	-	-	-	-	0.0001	-
Microcystis aeruginosa Kützing	0.0010	0.0004						
Planktolyngbya limnetica (Lemm.) Kom. – Legn. Et Cronenberg	-	0.0040	-	-	-	-	-	0.0010
Planktothrix agardhii (D.C. ex Gom.) Anagn. et Kom.	0.1410	0.0025	0.0075	0.0010	0.0010	-	-	-
Pseudanabaena limnetica (Lemm.) Kom.	-	0.0003	-	-	-	0.0010	-	0.0010
Woronichina naegeliana (Unger) Elenkin	0.0010	-	-	-	-	-	-	-
Total	**0.0380**	**0.0032**	**0.0053**	**0.0007**	**0.0081**	**0.0018**	**0.0002**	**0.0010**
***Bacillariophycee* - diatoms**								
Achnanthes minutissima Kützing	-	-	-	-	0.0011	-	-	-
Amphora ovalis Kützing	0.0240	-	-	-	-	0.0040		0.0090
Asterionella formosa Hasall	0.0070	-	-	-	-	-	-	-
Cocconeis pediculus Ehr.	0.0110	-	-	-	-	-	-	-
Cocconeis placentula Ehr.	0.0160	-	-	-	-	-	-	-
Cyclotella meneghiniana Kützing	0.0010	-	-	-	-	-	-	-

Site	Inf	A2	Mid.1	Mid.2	A1	Outf	B1	B2
Cyclotella ocellata Pant.	0.0090	0.0240	0.0040	0.0020	0.0090	0.0040	-	-
Cyclotella radiosa (Grun.) Lemm.	0.0330	0.0067	0.0040	0.0050	0.0068	0.0065	-	-
Cymatopleura solea (Breb.) W. Smith	0.0200	-	-	-	-	-	-	-
Cymbella amphicephala Grun.	0.0090	-	-	-	-	-	-	-
Cymbella lanceolata (Ehr.) Kirchner	0.0080	-	-	-	-	-	-	-
Cymbella minuta Hilse ex Rabenhorst	0.0220	0.0020		0.0010	0.0030	0.0010	0.0010	
Epithemia sorex Kützing	0.0010	-	-	-	-	-	-	-
Fragilaria construens (Ehr.) Grunow	0.0180	-	-	-	-	-	-	-
Fragilaria crotonensis Kitton	0.0010	0.0010			0.0070	0.0020	0.0020	
Fragilaria ulna (Nitzsch) Lange-Bertalot	0.0110	0.0030	0.0060	0.0015	0.0035	0.0025		0.0010
Fragilaria ulna var. *angustissima* Sippen	0.0040	-	-	-	-	0.0010	-	-
Gomphonema olivaceum (Horn.) Breb.	0.0020	-	-	-	-		-	-
*Hippodonta capitata (*Ehr.) L-Bert., Metz. & Witk.	-	-	-	-	-	0.0010	-	-
Meridion circulare (Grev.) C. Agardh	0.0140	-	0.0010	-	-		-	-
Navicula cincta (Ehr.) Ralfs	0.0020	-	-	-	-	0.0010	-	-
Navicula lanceolata (Agardh) Ehr.	0.0040	-	-	-	-		-	-
Navicula radiosa Kützing	0.0160	0.0020	-	-	0.0020	0.0030	0.0020	0.0040
Navicula reinchardtii Grun.	0.0050	-	-	-	-	-	-	-
Naviula tripunctata (Muller) Bory	0.0040	-	-	-	-	0.0020	-	-
Nitzschia palea (Kütz.) W. Smith	0.0010	-	-	-	-	-	-	-
Nitzschia recta Hantzsch	0.0080	-	-	-	-	-	-	-
Nitzschia sigmoidea (Ehr.) W. Smith	0.0090	-	-	-	-	-	-	-
Pinnularia viridis (Nitzsch) Ehr.	0.0060	-	-	-	-	-	-	-
Rhopalodia gibba (Ehr.) Muller	0.0160	-	-	-	-	-	-	-
Stephanodiscus astrea (Ehr.) Grunow		0.0060		-	-	-	-	-
Total	**0.0101**	**0.0063**	**0.0038**	**0.00238**	**0.0046**	**0.0025**	**0.0017**	**0.0047**
***Chlorophyta* - green algae**								

Botryococcus braunii Kutzing	0.0170	0.0011	-	-	0.0090	0.0020	-	-
Cladophora glomerata (L.) Kutzing	-	-	-	-	-	-	-	0.0030
Site	**Inf**	**A2**	**Mid.1**	**Mid.2**	**A1**	**Outf**	**B1**	**B2**
Closterium acutum var. *variabile* (Lemm.) Krieg.	-	0.0004	-	-	-	-	-	-
Coelastrum astroideum De Notaris	0.0330	0.00675	0.0707	0.0040	0.0105	0.0230	0.0280	0.1240
Coelastrum microporum Naegel.	0.0050	0.0055	-	0.0030	-	-	-	-
Coelastrum reticulatum (Dang.) Senn	0.0030	0.0073	0.0030	-	0.0080	0.0030	-	-
Cosmarium regnellii Wille	0.0001	-	0.0001	-	-	-	-	-
Crucigenia tetrapedia (Kirch.) W. et G.S. West	-	-	0.0001	-	-	-	-	-
Desmodesmus communis (Hegew.) Hegew.	0.0060	0.0010	-	-	0.0007	-	0.0010	-
Dictyosphaerium pulchellum Wood	0.0230	-	-	-	-	-	-	-
Elkatothrix gelatinosa Wille	0.0050	-	-	-	0.0030	0.0020	0.0010	-
Eudorina elegans Ehr.	-	-	-	0.0220	-		0.0700	-
Eutetramorus planctonicus (Kors.) Bourr.	-	0.0550	-	-	-	-	-	-
Kirchneriella contorta var. *elegans* (Schmidle) Bohlin	0.0003	0.0006	-	-	0.0002	-	-	-
Monoraphidium contortum (Thur.) Kom.-Legn.	0.0030	0.0040	0.0001	-	0.0008	-	-	-
Oocystis lacustris Chodat	0.0570	0.0100	0.0053	0.003	0.006	0.0060		0.0020
Pediastrum boryanum (Turpin) Meneg.	0.1180	0.0828	0.0547	0.0355	0.0943		0.0940	0.0470
Pediastrum duplex Meyen	0.0230	0.0470	0.0230	0.0280	0.0853	1.0110	0.0240	
Phacotus lenticularis (Ehr.) Stein	0.0180	0.0097	0.0035	0.0165	0.0083	0.0055	0.0250	0.0190
Scenedesmus acuminatus (Lager.) Chodat	0.0020	0.0006	-	-	0.001	-	-	-
Scenedesmus obtusus Meyen								0.0010
Sphaerocystis planctonica (Korsikov) Bourrelly	0.772	0.0313	0.26975	0.0677	0.0955	0.2445	0.4270	0.2060
Staurastrum gracile Ralfs	0.0800	0.0047	0.0040	-	0.0060	0.0020	0.0020	-
Tetraedron minimum (A. Br.) Hansgirg	0.0010	0.00015		-	0.0004	-	-	-
Tetrastrum staurogeanieforme (Schroed.) Lemm.	0.0004	-	0.0001	-	0.0001	0.0020	0.0010	-
Tetrstrum komarekii Hindak	-	-	0.0003	-	-	-	-	-
Total	**0.0614**	**0.0157**	**0.0334**	**0.0225**	**0.0206**	**0.1301**	**0.0673**	**0.0574**

Cryptophyta - cryptophytes								
Cryptomonas erosa Ehrenberg	0.0510	0.0187	0.0063	0.0060	0.0147	0.0095	0.0080	0.0010
Cryptomonas marssonii Skuja	0.0200	-	0.0010		0.0010	-	-	0.0010
Site	**Inf**	**A2**	**Mid.1**	**Mid.2**	**A1**	**Outf**	**B1**	**B2**
Cryptomonas ovata Ehrenberg	-	-	-	-	-	-	0.0030	-
Cryptomonas rostrata Troitzskaja emend I. Kiselev	0.0240	0.0030	0.0020	0.0020	0.0060	0.0045	0.0020	0.0030
Rhodomonas minuta Skuja	0.0320	0.0033	0.0010	0.0030	0.0009	0.002	0.0020	-
Total	**0.0317**	**0.0083**	**0.0026**	**0.0037**	**0.0056**	**0.0053**	**0.0037**	**0.0017**
***Dinophyta* - dinophytes**								
Ceratium hirundinella (F. B. Müller) Bergh	0.9290	0.8510	0.2123	0.1547	0.5030	0.0707	0.0770	-
Peridiniopsis cuningtonii Lemm.	0.0510	0.0340	0.0393	0.0278	0.074	0.0280	0.0090	0.0740
Peridinium cinctum (O.F. Müller) Ehrenberg	0.8490	0.2973	0.1163	0.0350	0.269	0.0420	-	0.0430
Peridinopsis berolinense (Lemm.) Bourrelly	0.0150	-	0.0285	0.0170	0.0200	-	-	0.0150
Peridinopsis elpatiewskyi (Ostenf.) Bourrelly	0.0510	0.0095	-	0.0130	0.0150	-	-	-
Total	**0.3790**	**0.2979**	**0.0991**	**0.0495**	**0.1762**	**0.0490**	**0.0430**	**0.0440**
***Euglenophyta* - euglenoids**								
Colacium vesiculosum Ehr.	-	-	-	-	-	0.0020	-	-
Euglena acus Ehr.	-	-	-	-	0.0060	-	-	-
Trachelomonas hispida (Perty) Stein	0.0020	-	0.0010	-	0.0059	-	-	-
Total	**0.0020**	**-**	**0.0010**	**-**	**0.0059**	**0.0020**	**-**	**-**
***Chrysophyceae* - chrysophyces**								
Dinobryon divergens Imhof	7.6240	0.0375	0.0060	-	0.0188	0.0030	0.0160	0.0020
Erkenia subaequiciliata Skuja	0.0060	0.0016	0.0003	0.0012	0.00075	0.0005	0.0002	0.0001
Total	**3.815**	**0.0196**	**0.00313**	**0.0012**	**0.0098**	**0.0017**	**0.0081**	**0.0010**

ANNEX 5. Comparison of periphyton species composition in different investigated sites from 26th June to 30st June 2017 in Lake Durowskie.

Diatom taxa	**Site**												**pH**	**O**	**T**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**			
Achnanthes conspicua Mayer							+								
Achnanthes exigua Grun.		+	+	+	+	+	+	+	+	+	+	+	4	1	7
Achnanthes hungarica (Grunow) Grun. in Cleve				+								+	4	4	6
Achnanthes lanceolata (Breb.) Grunow	+	+	+	+		+		+				+	4	3	5
Achnanthes lanceolata v. *elliptica* Cleve sensu Straub		+				+	+	+					4	-	-
Achnanthes lanceolata var *lineate* Hustedt						+							-	-	-
Achnanthes minutissima Kützing	+	+	+	+	+	+	+	+	+	+	+	+	3	1	7
Achnanthes minutissima var. *affinis* (Grun.) Lange-Bertalot						+	+	+		+		+	4	-	-
*Achnanthes minutissima*var. *gracillima* (Meister) Lange-Bertalot						+		+					4	-	1
Achnanthes rostrata Lange-Bertalot				+									-	-	-

Amphipleura pellucida (Kützing) Kützing		+											4	2	2
Amphora ovalis Kützing	+	+	+	+	+	+	+	+	+	+	+	+	4	2	5
Amphora pediculus (Kütz.) Grunow	+	+	+	+	+	+	+	+	+	+	+	+	4	2	5
Asterionella formosa Hass	+	+			+				+	+	+		4	2	5
Aulacoseira granulate (Ehr.) Simonsen		+							+				4	3	5
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**pH**	**O**	**T**
Caloneis bacillum (Grun.) Meresz.	+	+	+	+		+		+				+	4	2	4
Caloneissilicula (Ehr.) Cleve		+											4	2	4
Cocconeis pediculus Ehr.	+	+	+	+	+	+	+	+	+	+	+	+	4	2	5
Cocconeis placentula Ehr.	+	+	+	+	+		+	+	+	+	+	+	4	3	5
Cocconeis placentula var. linearis Ehr.		+	+	+		+							-	-	-
Cocconeis placentula var. lineate Ehr.			+	+		+		+					4	3	5
Cocconeis placentula var. pseudolineata Geitler	+					+	+	+					-	-	-
Craticula cuspidate (Kützing) Mann W Round	+												4	3	5
Cyclotella meneghiniana Kütz.			+	+	+	+	+	+	+	+	+		4	5	5
Cyclotella ocellata Pant.	+	+	+	+	+	+	+	+	+	+	+	+	4	1	4
Cyclotella operculata (Ag.) Kützing		+	+		+		+		+	+	+	+	-	-	-
Cyclotella radiosa (Grun.) Lemm.	+	+	+	+	+	+	+	+	+	+	+	+	4	2	5
Cymatopleura solea (Breb.) W. Smith					+	+			+	+	+		4	3	5

Cymbella affinis Kützing	+		+	+	+	+	+	+	+	+	+	+	4	1	5
Cymbella caespitosa (Kützing) Brun.												+	0	-	7
Cymbella cistula (Ehr.) Kirchner	+	+	+	+	+				+		+		4	2	5
Cymbella lanceolata (Ehr.) Kirchner					+				+	+	+		4	1	7
Cymbella microcephala Grun.	+	+	+	+	+	+	+	+	+	+	+	+	4	1	4
Cymbella minuta Hilse ex Rabenhorst	+	+	+	+	+	+	+	+	+	+	+	+	3	-	-
Cymbella prostrata (Berkeley) Cleve					+	+	+		+	+	+		4	1	5
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**pH**	**O**	**T**
Cymbella tumida (Bréb.) Van Heurck	+	+	+						+	+			4	1	4
Cymbella turgida (Greg.) Cleve	+												-	-	-
Diatoma tenuis Agardh					+					+	+		4	3	5
Diatoma vulgaris Bory	+			+	+		+	+	+	+	+	+	5	2	4
Diatoma vulgaris Bory Morphotyp *ovalis*		+				+							-	-	-
Diploneis elliptica (Kützing) Cleve					+				+	+	+		4	1	3
Eunotia bilunaris Ehr.							+	+					-	-	-
Eunotia exigua (Breb.) Rabenh.	+				+				+	+			1	2	7
Eunotia faba (Ehr.) Grun.					+				+		+		2	1	2
Eunotia intermedia (Krasske) Noerpel & Lange - Bertalot													2	-	1
Eunotia praerupta Ehr.	+	+	+		+	+	+	+	+	+	+	+	2	1	2

Eunotia tenella (Grun.) Hustedt												+	2	1	1
Fragilaria capitata Ehr.		+	+	+							+		-	-	-
Fragilaria capucina (Desm.) Rabenhorst	+		+	+	+	+	+	+	+	+	+	+	3	-	3
Fragilaria constricta Ehr.													2	-	1
Fragilaria construens (Ehr.) Grun.			+		+		+		+				4	1	4
Fragilaria crotonensis Kitton	+	+	+	+	+	+	+	+	+	+	+	+	4	2	3
Fragilaria martyi (Heribaud) Lange-Bertalot		+			+				+	+	+		-	-	-
Fragilaria pinnata Ehr.	+	+	+	+	+	+	+	+	+	+	+	+	4	1	7
Fragilaria ulna (Nitzsch) Lange-Bertalot	+	+	+	+		+	+	+	+	+	+	+	4	3	7
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**pH**	**O**	**T**
Fragilaria ulna var. *angustissima* Sippen	+	+		+	+	+			+	+			4	2	7
Fragilaria vaucheriae (Kütz.) Carlson											+		-	-	-
Gomphonema acuminatum Ehr.	+				+	+		+	+	+	+	+	4	2	5
Gomphonema angustatum (Kütz.) Rabenhorst										+		+	-	-	-
Gomphonema augur Ehr.	+												4	1	4
Gomphonema gracile Ehr.	+	+			+				+	+	+		3	1	3
Gomphonema intricatum Kützing					+				+		+	+	-	-	-
Gomphonema micropus Kütz.					+				+	+	+		4	2	5
Gomphonema olivaceoides Hustedt	+	+			+	+			+	+	+	+	-	-	-

Gomphonema olivaceum (Horn.) Breb.	+	+	+	+	+	+	+	+	+	+	+	+	5	2	5
Gomphonema parvulum (Kütz.) Kütz.	+	+			+		+		+	+	+	+	3	4	5
Gomphonema truncatum Ehrenberg		+											4	2	4
Hantzschia amphioxys (Ehr.) Grunow					+		+		+		+		3	2	7
Mastogloia smithii Thwaites						+		+					4	-	-
Meridion circulare Ag.		+	+	+		+	+	+		+		+	4	2	7
Navicula agrestis Hustedt					+		+						3	-	-
Navicula capitata Patrick in Patrick & Reimer		+	+	+	+	+	+	+	+	+	+	+	4	3	4
Navicula cincta (Ehr.) Ralfs	+		+	+	+	+		+	+	+	+	+	4	3	5
Navicula cryptocephala Kütz.	+				+	+		+	+	+	+		3	3	7
Navicula dicephala (Ehr.) W. Sm.	+												-	-	-
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**pH**	**O**	**T**
Navicula gastrum (Ehrenberg) Kützing											+		4	2	5
Navicula gregaria Donkin						+	+	+					4	4	5
Navicula oblonga Kützing											+		4	2	5
Navicula placentula (*Placoneis*) (Ehr.) Grunow					+				+	+	+		4	2	5
Navicula radiosa Kützing	+	+	+	+	+	+	+	+	+	+	+	+	3	2	4
Navicula reinhardtii Grun.			+	+			+			+			5	2	5
Navicula tenella Hustedt													-	-	-

Navicula tripunctata (O. F. Müller) Bory	+	+	+	+	+	+	+	+	+	+	+	+	4	2	5
Navicula veneta Kützing				+									4	4	5
*Navicula viridula (*Kütz.) Ehr.					+		+		+		+		4	2	5
Nitzchia acicularis (Kützing) W. Smith	+	+	+	+									4	4	5
Nitzschia amphibian Grunow	+	+		+	+				+	+	+	+	4	3	5
Nitzschia incospicua Grun.						+	+	+		+	+		4	3	5
*Nitzchia linearis (*Agardh) W.Smith												+	4	2	4
Nitzschia micropus(Kütz.)													-	-	-
Nitzschia palea (Kütz.) W. Sm.	+		+	+			+					+	3	4	6
Nitzschia paleacea Grun.			+	+		+	+	+				+	4	3	5
Nitzschia recta Hantzsch	+				+	+	+	+	+		+	+	4	2	7
Nitzschia sigmoidea (Ehr.) W. Sm.			+	+	+		+	+	+	+	+	+	4	3	5
Pinnularia maior (Kützing) Rabenhorst												+	3	2	4
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**pH**	**O**	**T**
Pinnularia viridis (Nitzsch) Ehr.		+	+	+		+	+	+				+	3	3	7
Rhoicosphaenia abbreviate (Ag.) Lange-Bertalot		+										+	4	2	5
Rhoicosphaenia curvata (Kütz.) Grun.			+	+									-	-	-
Rhopalodia gibba (Ehr.) Müller	+	+	+			+			+	+			5	3	5
Stauroneis phoenicentron Ehr.	+		+	+		+		+					3	3	4

Stephanodiscus astraea (Ehr.) Grunow					+		+		+		+		-	-	-
Stephanodiscus hantzschii Grun.			+							+		+	5	4	6
Surirella minuta Breb.			+	+									4	3	5
Surirella ovalis Breb.					+				+		+		4	4	5
Tabellaria fenestrata (Lyngb.) Kützing	+	+				+	+	+		+			3	1	2