DEPARTMENT OF BOTANY AND PLANT ECOLOGY
Wrocław University of Environmental and Life Sciences

"The past, present, future of phycological research. Its signification for man and environment protection"

Book of Abstract
30th International Conference
of the Polish Phycological Society

Edited by
Jan Matuła, Dorota Richter and Jacek Urbaniak

Wrocław – Pawłowice, Poland
19–21st May 2011

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Rector of the Wrocław University of Environmental and Life Sciences
Prof. Roman Kołacz
Head of the Department of Botany and Plant Ecology
dr hab. Teresa Brej prof. nadzw.
Director of the Karkonosze National Park
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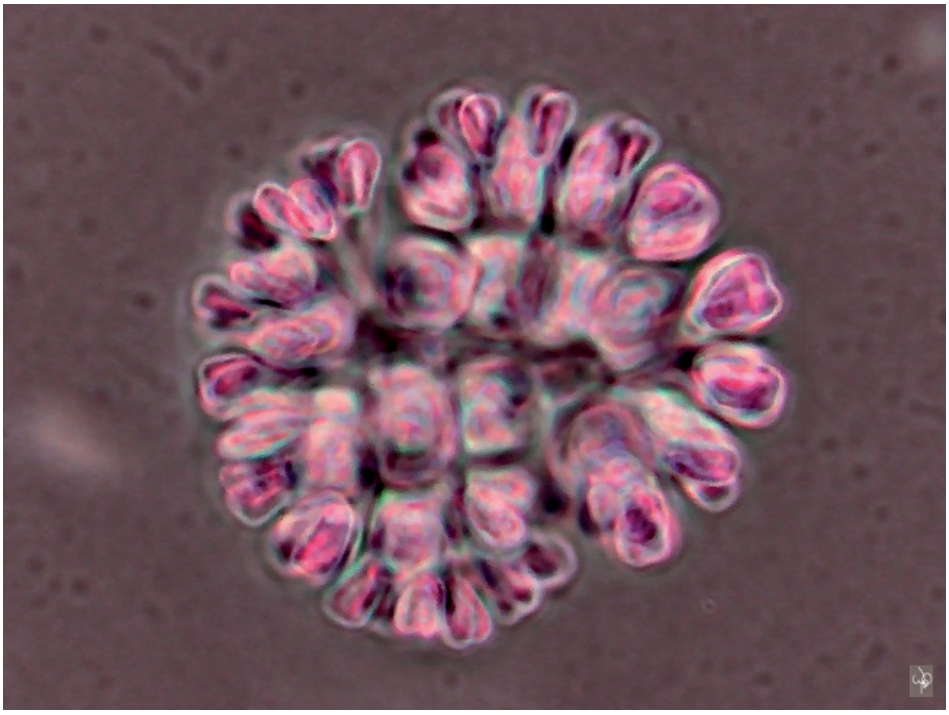

DEAR COLLEAGUES

On behalf of The Organizing Committee, Polish Phycological Society, the Wrocław University of Environmental and Life Sciences, The Karkonosze National Park and all those who contributed to organizing the 30th Conference of Polish Phycological Society, it is my great honor to greet you all here in Wrocław, a beautiful city and the capitol of Lower Silesia.

The organization of this conference was entrusted by the Polish Phycological Society to Wrocław's group from the Department of Botany and Plant Ecology of the Wrocław University of Environmental and Life Sciences. It is our great pleasure to have so many distinguished guests from Poland and abroad.

This year's conference is of particular significance for at least two reasons. It is the 30th anniversary and meeting of Polish phycologists and, at the same time, it is a part of the celebrations of the 60th anniversary of our University.

Dear colleagues and friends! This is a wonderful opportunity not only to sum up previous achievements but also to discuss at such a wide, international assembly the future and the significance of phycological studies.

The conference topics and program will be partially devoted to the achievements of Polish phycologists from the main Polish research centers. As a result, the plenary session on the first day will be dedicated to presenting the hitherto work of Polish Phycologists.

After the historical part of the conference the following sessions will be devoted to the rapid progress in the current pro- and eukaryotic algae research. There are many reasons for such an interest in the subject. Recently the studies of prokaryotic and eukaryotic algae have advanced rapidly and the growing interest in algae has many reasons. As the oldest groups of organisms on Earth they were studied for the purpose of learning the history of life and the biogenesis of cells, and also to determine the phylogenetic structure of the world of plants. Algae were also the concern of ecologists because of their role in environment both natural and influenced by man. As a result of the algae unique capabilities to create large amounts of biomass, their chemical, physiological, biochemical and genetic properties or the potential risk posed to man or the environment, the organisms are also intensely studied for utilitarian reasons. The knowledge gained through such research is used for various genetic manipulations; in biotechnology and bioenergetics; in medicine; food production and in the protection of natural environment and animal life. Algae and cyanobacteria in particular show a vast capability to cumulate nitrogen and, especially, atmospheric carbon [xxx] contribute significantly to eliminating it from circulation. Due to these characteristics cyanobacteria are considered to have a big influence on shaping global climate.

The growing amount of data, both detailed and fragmentary, creates a need for exchange of information, for its systematization and for determining the future course of research. Our conference will present the work of, especially, Polish phycologists. It will also provide an opportunity to exchange contemporary Polish and foreign achievements and to determine the course of future research of cyanobacteria and algae, organisms of key importance to the environment and of potentially practical use for humanity.

We hope that your stay in Wrocław will allow you to enjoy his dynamically growing city along with its inhabitants, culture and monuments.

Professor Jan Matuła Ph.D. D. Sc.

PROGRAMME OF 30TH INTERNATIONAL CONFERENCE OF THE POLISH PHYCOLOGICAL SOCIETY WROCŁAW 19–22 MAY 2011

Thursday, 19th May 2011

09:00 –14:00	Registration (Wrocław University of Environmental and Life Sciences, pl. Grunwaldzki 24a, ground floor)
11:00–11:20	Opening Ceremony of the Conference (John Paul II Hall, 2nd floor) by prof. Jan Matuła – Chairman of the Organizing Commitee, prof. Roman Kołacz – Rector of the Wrocław University of Environmental and Life Sciences, prof. Lubomira Burchardt – President of the Polish Phycological Society

Plenary Session
Chairman: Prof. Jan Matuła

Plenary Lectures

11:20 – 11:40	Burchardt L. Activity of the Polish Phycological Society
11:40 – 12:10	Wołowski K. The Cracow school of phycology – Genealogical tree
12:10 – 12:25	Burchardt L. Prof. Izabela Dąmbska – founder of the Poznań school of hydrobiology
12:25 – 12: 40	Rakowska B., Szulc K. Prof. Joanna Kadłubowska – founder of the Łódz school of phycology
12:40 – 12:55	Czernaś K., Krupa D., Banach B. Prof. dr hab. Iwo Wojciechowski – founder of the Lublin school of phycology
12:55 – 13:10	Kowalski W. Dr Andrzej Oleksowicz – Desmidiologist, researcher of water ecosystems of the Tuchola Woods
13:10 – 14:10	Lunch (pl. Grunwaldzki 24a, 1st floor)
14:10 – 14:30	Coffe brak
14:30 – 18:00	Guided tour on Wrocław
18:00 – 19:00	Supper (Wrocław University of Environmental and Life Sciences, pl. Grunwaldzki 24a, 1st floor)
19:00 – 19:30	Journey to Pawłowice

Friday, 20th May 2011

07:30 – 08:15	Journey to Pawłowice (for Participants accommodated in Wroclaw)
07:30 – 09:00	Breakfast (7:30 – 8:15 for Participants accomodated in Pawłowice; 8:15 – 9:00 for Participants accomodated from Wrocław)

Session (9.00 – 11.00)

Chairman: Prof. Konrad Wołowski

Oral presentations

9:00 – 9:20	Eloranta P. Conflict between taxonomy based on morphological features and results from molecular studies – examples from freshwater Rhodophyta
9:20 – 9:40	Komárek J. Changes in the cyanobacterial system based on modern polyphasic (molecular and phenotypic) approach
9:40 – 10:00	Kowalska J., Wołowski K. Past and recent studies on Pediastrum Meyen (Chlorophyta) in Poland
10:00 – 10:20	Kokociński M. Past, present and the future of the Cylindrospermopsis raciborskii in western Poland
10:20 – 10:50	Schubert E. Defining the taxonomy and systematics of Desmodesmus using a polyphasic approach: exploring the conundrum of phenotypic plasticity
10:50 – 11:00	Karnkowska-Ishikawa A., Milanowski R., Zakryś B. Delimiting species from two morphologically similar genera – Euglena and Euglenaria (Euglenida)
11:00 – 11:15	Introducing sponsors – Precoptic
11:15 – 11:30	Coffe break

Session (11.30 – 13.00)

Chairman: Prof. Jiří Komàrek

Oral presentations

11:30 – 11:50	Hutorowicz A., Napiórkowska-Krzebietke A., Pasztaleniec A., Hutorowicz J. Phytoplankton Metric for Polish Lakes – new approach in the ecological status assessment for routine monitoring
11:50 – 12:10	Pasztaleniec A., Hutorowicz A., Napiórkowska-Krzebietke A., Skjelbred B. The use of different ecological requirements of phytoplankton species in the water quality assessment of Polish lowland lakes
12:10 – 12:20	Bakieva G.R., Gaysina L.A., Sukhanova N.V., Fazlutdinova A., Safiullina S.Y., Mansurova A.R. Cyanobacteria of coniferous forests of Bashkir State Natural Reserve (South Ural, Russia)

12:20 – 12:30	Jakubowska N., Zagajewski P., Gołdyn R. "Cyanobacteria of selected lakes in the Wielkopolska Region: species identification and assessment of toxicity, using molecular methods"
12:30 – 12:40	Cao X., Wilk-Woźniak E., Pociecha A., Zhou Y. Pattern of phytoplankton composition during the bloom of cyanobacteria in two lakes in China
12:40 – 13:00	Mądrecka B., Szeląg-Wasielewska E. Cyanobacteria and eukaryotic algae in the middle section of the Warta River (Poland)
13:00 – 14:30	Lunch (13:00–13:45 first group, 13:45–14:30 second group)

Session (14.30 – 15.30)

Chairman: Prof. Elliot Shubert

Oral presentations

14:30 – 14:40	Szeląg-Wasielewska E. Phycological research in Lake Strzeszyńskie (Poznań, Poland): a review
14:40 – 14:50	Lengyel E., Crossetti L. O. & Stenger-Kovács C. Unique diatom flora of the Hungarian small saline lakes
14:50 – 15:00	Hindák F, Wołowski K. & Hindáková A. Aerophytic epilithon of photosynthetic microorganisms overgrowing concrete walls of a cooling tower of the power plant at Bełchatów , Central Poland
15:10 – 15:20	Bąk A., Bociąg K., Rekowska E. Morphological responses of Chara globularis Thuillier to hydrodynamic disturbances in the shallow littoral zone
15:20 – 15:30	Hindák F. Some rare Cyanobacteria and Glaucophyta from two peat – bogs in Orava, Northern Slovakia
15:30 – 15:50	Coffe break

Session (15.50 – 17.20)

Chairman: Prof. Marcin Pliński

Oral presentations

15:50 – 16:10	Pawlik-Skowrońska B. Algae in habitats polluted with heavy metals
16:10 – 16:30	Pełechaty M., Apolinarska K., Andrzej Pukacz A., Krupska J., Boszke P. Stable δ13C and δ18O isotope composition of thalli and oospore carbonate encrustations of chosen charophyte species (Characeae)
16:30 – 16:50	Pukacz A., Pełechaty M., Pełechata A., Siepak M. Spatial heterogeneity of hydrochemical parameters and phytoplankton communities in charophyte-dominated Lake Jasne (mid-Western Poland)

16:50 – 17:10	Kulikovskiy M., Lange-Bertalot Horst, Witkowski A., Khursevich G., Kociolek P. Lake Baikal Diatom Studies: Current Approaches and New Perspectives
17:10 – 17:20	Bąk M. Witkowski A. Diatoms in forensic applications: a case study

Poster Session Group 1

Chairmen: Prof. Ryszard Gołdyn, prof. Jiří Komàrek, prof. Barbara Pawlik-Skowrońska

17:20 – 19:00	Poster session
20:00	Bonfire, barbecue
Late Night (24:00)	– Journey back to Wrocław

Saturday, 21th May 2011

07:30 – 08:15	Journey to Pawłowice (for Participants accommodated in Wroclaw)
07:30 – 09:00	Breakfast (7:30–8:15 for Participants accomodated in Pawłowice; 8:15–9:00 for Participants accomodated from Wrocław)

Session (9.00 – 11.10)

Chairman: Barbara Pawlik-Skowrońska

Oral presentations

9:00 – 9:20	Rekowska E., Bąk A. Growth of Chara rudis under different light conditions
9:20 – 9:40	Toruńska A., Kotlarska E., Kowal P., Mazur-Marzec H. Allelopathic interactions – an important factor controlling the growth of Baltic Cyanobacteria?
9:40 – 10:00	Üveges V., Padisák J. Photosynthesis of winter phytoplankton dominated by Aphanizomenon flos-aquae in Lake Stechlin (Germany)
10:00 – 10:20	Wojtal A. Diatoms (Bacillariophyta) from 67 springs in southern Poland
10:20 – 10:30	Safiullina L. M., Boldina O. N., Kabirov R. R. The ultrastructure of the CALU 11 strain and the isolate of Eustigmatos magnus (Eustigmatophyta) from Bashkir State Natural Reserve (South Ural)
10:30 – 10:40	Toporowska M., Pawlik-Skowrońska B. Cyanobacteria and their influence on zooplankton, zoobenthos and ichthyofauna in the hypertrophic Lake Syczyńskie (E. Poland)
10:40 – 10:50	Hindáková A. The diatom flora of the peat-bog Klinské rašelinisko in Orava, N Slovakia

10:50 – 11:10 – Komulaynen S. Phytoperiphyton community structure and distribution in rivers flowing into Barents Sea

11:10 – 11:30 Coffe break

Session (11.30 – 13.00)

Chairman: Prof. František Hindák

Oral presentations

11:30 – 11:50 Błaszczyk A., Mazur-Marzec H. First report on the occurrence of BMAA in Cyanobacteria from Polish waterbodies

11:50 – 12:10 Kobos J., Błaszczyk A., Błońska M., Budzyńska A., Grabowska M., Hebel A., Kalinowska R., Kokociński M., Kownacka J., Messyasz B., Napiórkowska-Krzebietke B., Nawrocka L., Pełechata A., Rybak A., Toporowska M., Toruńska T., Zagajewski P., Złoch I., Mazur-Marzec H., Pliński M. Distribution of hepatotoxic cyanobacterial blooms in Poland

12:10 – 12:30 Skácelová O. Cyanobacteria and algae in human food

12:30 – 12:40 Musiewicz K., Kosakowska A. Cell immobilization technique and its application in biological tests on microorganisms of Baltic Sea

12:40 – 12:50 Solak C.N., Barninova S., Acs E., Dayioglu H. Diatom Indicators of Environment in the Felent Creek (Sakarya River Basin), Turkey

12:50 – 13:00 Żak A., Kosakowska A. The influence of cyanobacterial metabolites on growth of microalgae Chlorella vulgaris

13:00 – 14:30 Lunch (13:00 – 13:45 first group, 13:45 – 14:30 second group)

Poster Session Group 2

Chairmen: prof. Lubomira Burchardt, prof. Pertti Eloranta, prof. Konrad Wołowski

14:30 – 16:00 Poster session

16:00 – 18:00 Meeting of the Polish Phycological Society

18:00 – 19:00 Closing Ceremony of the Conference

20:00 The festive supper

Late Night (24:00) – Journey back to Wrocław

Sunday, 22th May 2011

07:30 – 09:00 Breakfast for Participants accomodated in Pawłowice

9:30 Journey back from Pawłowice to Wrocław Railway station

DEDICATED TO THE MEMORY
OF DISTINGUISHED POLISH
PHYCOLOGISTS
AND THEIR CONTRIBUTION
TO WORLD SCIENCE

Ryszard Bohr

born: 15 I 1926, Kołomyja
died: 19 XII 1987, Toruń

High school: 1946–1952 Nicolaus Copernicus University.

Description of career:

Already during his studies he was a teacher in high school and an assistant at the Chair of Plant Taxonomy and Geography of the N. Copernicus University. In 1960 he obtained his Ph. D., in 1966 made his postdoctoral degree, in 1974 became assistant professor and in 1986 – a full professor. Since 1969 R. Bohr was the Head of the Department of Taxonomy, Plant Ecology and Nature Protection at the N. Copernicus University. 1969–1972 Dean of the Faculty of Biology and Earth Sciences; 1972–1978 Vice-Rector of the N. Copernicus University; 1978–1981 Rector Magnificus of the N. Copernicus University. As an academic teacher Professor R. Bohr promoted and/or reviewed numerous masters' theses, over 20 doctoral theses and nearly 10 postdoctoral theses.

Research subject, science achievements:

Taxonomy and phylogenesis of thallophytes
Periphytic and nannoplanktonic algal communities
Phytosociological methods for the ecological research of algal communities and whole lake ecosystems.
Professor Bohr also worked on fundamental ecological theories concerning the systemic comprehension of nature. He was a creator and coordinator of an ecological project made in collaboration with Lund University (Sweden).

Publications:

He is an author of over 60 scientific publications.

Prof. dr hab. Izabela Dąmbska

born: 1927 in Rudna Wielka near Rzeszów
died: 29 VII 1984 a tragic death in a car accident

Studies: Professor Dąmbska followed university studies in Poznań, from 1946 to 1950

Description of career:

The MA dissertation, entitled "Stoneworts of the Poznań area", was submitted for evaluation by Prof. Dąmbska in 1950. Prof. Czubiński was the thesis supervisor. Since that time she was employed at the Department of Systematics and Plant Geography at the University of Poznań, as a junior lecturer.
In 1959, she submitted for evaluation a PhD thesis entitled "Lake plant communities in the surroundings of Sieraków and Miedzychód", with Prof. Czubiński as supervisor.
The relatively long time given for doctoral dissertations, was associated with Prof. Dąmbska involvement in a 3-year support campaign aimed at repatriates returning from Russia.
Having defended the dissertation, already in the capacity of a lecturer, she became Head of Hydrobiological Lab.
Her scholarly and educational activity was a reason for which Prof. Czubiński, after mere 3 years, in 1963, applied to the Rector to create a Department of Hydrobiology. The motion received approval only after 15 years.
In 1966 Prof. Dąmbska published her habilitation work, entitled "Stonewort communities of Poland".
The degree of professor came only after 10 years, i.e. in 1976.
Two years later, in 1978, she was appointed to the post of the head of the Department of Hydrobiology. This was 33 years ago.

Research subject, science achievements, publications

The scope of Prof. Dąmbska's activity converged initially on stoneworts only, later it shifted towards floristic-phytosociological studies, which frequently supplement a complete ecological characteristics of stonewort habitats, as well as their role as markers. The interest in a little known group of macroalgae was reinforced by a scientific internship in France with Prof. Bourrelie. In later years, Prof. Dąmbska, already as a widely recognised authority on that algae group, on many occasions confirmed and verified taxonomic identification of stoneworts sent over by researchers from Poland and abroad.
The abundant assortment of floristic materials gathered from various water ecosystems of Poland and Europe enabled Prof. Dąmbska to create an outstanding collection of stoneworts, which today constitutes a taxonomic-genetic assembly which is second to none. In 1954–1966 Prof. Dąmbska published a herbarium entitled CHAROTHECA POLONICA, which includes descriptions of 25 stonewort species and their 100 lower grade taxons.
Presently, "The Stonewort Collection of Professor Izabela Dąmbska" available to specia-

lists at the Department of Hydrobiology, Adam Mickiewicz University in Poznań, comprises 14 thousand sheets, with sites of all taxons found in those years. At the same time, it is a collection which serves as an illustration to Prof. Dąmbska's key, published in 1964, entitled *Charophyta – Ramienice. Flora Słodkowodna Polski. Tom 13 [Charophyta – Stoneworts. Freshwater Flora of Poland. Volume 13],* edited by Karol Starmach.

In the last 10 years, the Department of Hydrobiology has organised stonewort workshops on two occasions already, as part of the International Summer School of Ecology. Also, September this year will see a symposium of the International Charological Group.

To sum up, one might say that the richness of materials collected by Prof. Dąmbska is still alive and offers excellent comparative material for studies in taxonomy, ecology and genetics. Regardless of these assets, one should particularly emphasise the tremendous bioindicative role of this small group of algae in the light of the ecological condition of lakes we assess today.

All those of you who are interested in these macroalgae, are invited to the Department of Hydrobiology of the Adam Mickiewicz University in Poznań, a department created 33 years ago by Prof. Dąmbska.

Roman Gutwiński

born: 4 VII 1860 Pagorzyna, Gorlice District
died: 27 X 1932 Kraków

Studies:

1878–1972 Jagiellonian University, Faculty of Philosophy, Natural Sciences.

Description of career:

1882–1885 assistant in the Department of Botany of the Jagiellonian University (to professor Rostafiński); 1885 – 1924 teacher of biology in secondary schools in Lviv, Ternopil and Krakow.

Research interests and achievements of research:

The flora of algae in Galicia, Tatras and other regions of Poland, the flora of Jawa (samples gathered by M. Raciborski), Lake Baikal and Kamchatka (B. Dybowski), Bosnia (J. Karliński and E. Brindis), Gobi Desert, Tibet, China (Ph. D. Holdered, a German phycologist) and Cameroon (Bohner); the anatomy and morphology of *Telomophyta*; zoology. One of the most distinguished Polish phycologists – described 496 species, varieties and forms of algae new to science (some later considered synonyms).

Research excursions, collections:

1881 – 1884 algal excursions in Galicia and other regions of Poland; 1898 describing the flora in Karlove Vary (81 species including 2 previously unknown).

Publications:

Over 40 scientific works in phycology with the most important entitled *Prodromus florae algarum Galiciensis* („Rozpr. Wydz. Mat.-Przyr. AU" 28, 1895, where Gutwiński described 1057 species of algae; additionally *Przyczynek do znajomości okrzemek tatrzańskich* (*Bacillariaceae tatrenses*) („Spraw. Komisji Fizjogr." 34, 1888), *Flora glonów okolic Tarnopola* (Spraw. Komisji Fizjogr." 30, 1894), *Algae in itinere per montem Babia Góra collectae* (Spraw. Komisji Fizjogr. 33, 1898) *Flora glonów tatrzańskich* („Bull . Int. Acad. Crac. Sc." Cl. Sc. Math. Nat. 1909; the descriptions of 625 species *Flora i plankton glonów Morskiego Oka* („Kosmos" 38, 1913); a couple of works in zoology.

Some taxa new to science and named after his:

Bullbichaete gutwinskii Mrozińska
Cosmarium ocellatum Eichl. & Gutw. var. *gutwinskii* Wołoszyńska
Cymbella ehrenbergii Kütz. var. *gutwinskii* Schmidl.
Peridinium gutwinski Wołoszyńska

Joanna Zofia Kadłubowska

born: 23 V 1923, Pabianice
died: 24 VII 2009, Łódź

Studies: Studies at the University of Łódź 1945–1951; MA in botany 1951; PhD in 1960; postdoctoral degree in 1964.

Description of career:

assistant professor at the Department of Systematics and Geography of Plants – 1965; head of the Department of Algology 1966–1991; head of the Department of Systematics of Cyptogamous Plants 1992–1993; associate professor at the University of Łódź 1973; full professor there in 1986; retired in 1993.

Research subject, science achievements: Taxonomy and morphology of algae with particular insight into *Zygnemataceae.* The role of *Bacillariophyceae* in assessing water pollution. Microscopic algae from the *Erysiphales* family and fungi parasites on algae.

Science achievements: Studies of the taxonomy and morphology of the Zygnemataceae algae occurring in Poland, Denmark and Norway. Describing 782 taxa (*Spirogyra, Zygnema i Zygogonium*), including 15 previously unknown species (*Spirogyra costata, S. costulata, S. czubiński, S. czurdiana, S. danica, S. lodzien.sis, S. miranda, S. pseudodaedaloides, S. pseudotetrapla, S. pseudosahnii, S. pseudomaxima, S. silesiaca, S. venosa, Zygnema argillarii* i *Zygogonium norvegicum)*, as well as 15 species unknown in Poland and 69 in Denmark. Was a distinguished specialist in Poland and in the world. Described two fungi previously unknown to science - *Chytridium caloneides* i *Micromyces bulbosus.*

Publications: 72 scientific works including four books.
Okrzemki rzeki Pilicy i ich znaczenie w ocenie czystości wody (1964)
Flora Słodkowodna Polski. Zygnemaceae, Zrostnicowate, Chlorophyta V. Conjugales (1972)
Zarys algologii (1975)
Süsswasserflora von Mitteleuropa. Conjugatophyceae I. Zygnemales. Bd.16(1984)
3 monographs
Cooperated with research centers both in Poland (Kraków, Warsaw, Poznań, Toruń) and abroad (Denmark, India, Japan, France, Germany and Russia).

Andrzej S. Oleksowicz

born: 4 IV 1952, Gdańsk
died: 23 IX 1989, Toruń

High school: 1969 – 1974 Nicolaus Copernicus University.

Description of career:
already during his studies he was a junior member of staff and from 1980 a senior member at the Department of Taxonomy, Plant Ecology and Nature Protection at Nicolaus Copernicus University in Toruń. He worked at the University until his untimely death.

Research subject, science achievements:

At first A. S. Oleksowicz was interested in the problems of primary production in lakes and periphyton phytosociology, however, after obtaining his Ph. D., he was mainly concerned with the flora and taxonomy of algae, especially desmids.

Travels, expeditions, collections: International Congresses in Sweden and Denmark; Expeditions: 1987/88 – King George Island in the Antarctic, 1989 – Spitsbergen.

He collected immense iconographic materials referring to desmids morphology (now in the archives of the Department of Plant Ecology and Nature Protection at the University of Toruń).

Publications:

During a very short period of his scientific activity, Ph. D. Oleksowicz published nearly twenty dissertations, articles and reports. He died on the eve of his examination for the postdoctoral degree. His dissertation entitled "The dynamics of algal communities in the Kaszuby Lake District; in lakes with differentiated trophy" was highly appraised by the reviewers.

Marian Raciborski

born: 16 IX 1863, Brzóstowa near Ostrowiec Świętokrzyski
died: 24 III 1917, Zakopane

Studies: 1881–1886, 1889–1891 Jagiellonian University.

Description of career:

1885–1892 assistant to professor Rostafiński at Jagiellonian University and in the Botanical Garden; 1893–1896 assistant to Karl Goebel at the University of Munich; 1896–1900 Botanical Garden; research stations to study sugar canes and tobacco on Java; 1900–1903 associate professor in the National School of Agriculture (later the University of Agriculture) in Dublany; 1903–1909 associate professor at the University of Lwów, continued his work in Dublany; 1900–1909 head of the Botanical Garden in Dublany; 1909–1912 full professor at the Jan Kazimierz University in Lwów; 1912–1917 full professor and the director of the Botanical Garden at the Jagiellonian University.

Research subject, science achievements: gathered materials to study plants from all systematic groups. Apart from Tracheophyta he studied various type of algae. One of the first Polish paleobotanists.

Research excursions, collections: 1896–1900 Java; gathered and published herbaria along with his students, including three tomes containing samples of *Phycotheca Polonica*.

Publications: a total of over 100 publications in various fields of botanics, including phycological studies:
Opisy nowych desmidyjów polskich („Pamiętn. Akad. Umiej. Krak.", Wydz. mat.-przyr. 10, 1885);
Materyjały do flory glonów Polski („Spraw. Komis. Fizyogr." 22, 1888);
Przegląd gatunków z rodzaju Pediastrum („Rozpr. spraw. pos. Wydz. Mat.-Przyr. Akad. Umiej." 20, 1890);
Desmidya zebrane przez Dr. E. Ciastonia w podróży na około ziemi („Rozpr. Akad. Umiej.", Wydz. Mat.-Przyr. 22, 1892);
Die Desmidienflora des Tapakoomasees („Flora" 81, 1895);
Parasitische Algen und Pilze Java's. I., II., III Theil (Herausgegeben vom Botanischen Institut zu Buitenzorg, Batavia, Staatsdruckerei, 1900);
Phycotheca polonica. Część I. Nr 1-50 („Kosmos" 35, 1910);
Phycotheca polonica. Część II. Nr 51-100 („Kosmos" 35, 1910);

Taxa new to science and named after him:

Anabaena raciborskii Wołoszyńska
Anabaenopsis raciborskii Wołoszyńska
Cylindrospermopsis raciborskii (Wołoszyńska) Seenayya & Subba Raju
Cladophora raciborski Gutwiński
Conferva raciborskii Gutwiński
Cosmarium pseudopyramidatum var. *raciborskii* Playfair
Cosmarium raciborskii Lagerheim
Cosmarium subraciborskii Taft
Gloeotrichia raciborskii Wołoszyńska
Haplozyga armata var. *raciborskii* Förster & Eckert
Lepocinclis glabra var. *raciborskii* Dreżepolski
Oscillatoria raciborskii Wołoszyńska
Planktothrichoides raciborskii (Wołoszyńska) Suda & Watanabe
Pediastrum integrum var. *raciborskii* (Raciborski) Ergashev
Peridinium palustre var. *raciborskii* (Wołoszyńska) M. Lefèvre
Peridinium raciborskii Wołoszyńska
Phacus raciborskii Dreżepolski
Planktothrichoides raciborskii (Wołoszyńska) Suda & Watanabe
Planktothrix raciborskii (Wołoszyńska) Anagnostidis & Komárek
Pleurotaenium raciborskii var. *engleri* (Schmidle) M. I. Claassen
Raciborskia Wołoszyńska
Raciborskiella Wisłouch
Scenedesmus raciborskii Wołoszyńska
Staurastrum raciborskii R. Gutwiński
Staurastrum sebaldi var. *brasiliense* f. *raciborskii* (R. Gutwiński) G. Nygaard
Staurastrum sebaldi var. *raciborskii* (R. Gutwiński) R. L. Grönblad
Trachelomonas hispida var. *raciborskiiformis* M. Koczwara
Trachelomonas raciborskii Wołoszyńska
Tribonema raciborskii (Gutwiński) Heering
Ursinella raciborskiana (De Toni) Kuntze
Ursinella raciborskii (Lagerheim) Kuntze
Xanthidium acanthophorum var. *raciborskii* R. Gutwiński
Xanthidium pseudoraciborskii N. Woodhead & R. D. Tweed
Xanthidium raciborskii R. Gutwiński

Józef Tomasz Rostafiński

born: 14 VIII 1850, Warszawa
died: 5 V 1928, Kraków

Studies: 1866 – 1869 the Main University in Warsaw.

Description of career:

University of Strasburg: 1874–1875 Assistant at the Institute of Botany; 1875–1877 assistant professor at Jagiellonian University; 1877–1878 lecturer; 1878–1910 and 1919–1921 professor; 1878–1910 the head of the Department of Botany and the head of the Botanic Garden of the Jagiellonian University; 1876–1923 lecturer of botanics at the Advanced Science Courses for Women.

Research subject, science achievements: One of the pioneers of phycology in Poland. Also studied floristics and the systematics of Tracheophytae. He was a humanist who linked natural studies with history, linguistics and ethnography (ethnobotany). The creator of Polish botanical vocabulary.

Research excursions, collections: 1874–1875 Biology Sea Station in Cherbourg (Francja); 1876 Londyn, Paris, Petersburg and Stockholm; 1887 and 1888 North Africa; 1889 Madera.

Publications: over 553 works, including 179 scientific ones, mostly phycological:
O podzielności jaja (dividua ovi natura) i zapłodnieniu u morszczynów („Rozpr. Wydz. Mat.-Przyr. AU" 4, 1877);
Rzut oka na rodzinę listownic (Laminariaceae) *i pierwsze zasady naukowej ich klasyfikacji* („Rozpr. Wydz. Mat.-Przyr. AU" 4, 1877);
a) O czerwonym i żółtym śniegu w Tatrach, b) O nowo odkrytej grupie wodorostów brunatnych znalezionej w Tatrach („Rozpr. Wydz. Mat.-Przyr. AU" 8, 1881);
Hydrurus *i jego pokrewieństwo* („Rozpr. Wydz. Mat.-Przyr. AU" 10, 1883);
O nowym rodzaju brunatnych wodorostów w Tatrach odkrytym, a nazwanym Chalubinskia („Rozpr. Wydz. Mat.-Przyr. AU" 10, 1883);
Sphaerogonium *nowy rodzaj wodorostów sinych* („Rozpr. Wydz. Mat.-Przyr. AU" 10, 1883);

Taxa new to science and named after him:

Ankistrodesmus longissimus var. *rostafinskii* Kol
Centronella rostafinskii Wołoszyńska
Chamaesiphon rostafinskii Hansgirg
Chlamydomonas rostafinskii K. Starmach & B. Kawecka
Chloromonas rostafinskii (Starmach & Kawecka) Gerloff & Ettl
Cosmarium rostafinskii Gutwiński

Cosmarium speciosum var. *rostafinskii* (Gutwiński) West & G. S. West
Phacus rostafinskii Drężepolski
Staurastrum rostafinskii R. Gutwiński
Trachelomonas pulchra var. *rostafinskii* (R. Drężepolski) Skvortzov
Trachelomonas rostafinskii Drężepolski

Karol Starmach

born: 22 IX 1900, Mszana Dolna
died: 2 III 1988, Kraków

Studies: 1921, 1923 – 1925 Jagiellonian University.

Description of career:
Affiliated mainly with Jagiellonian University: 1925 deputy assistant, 1926 junior assistant, 1929 senior assistant in the Department of Botany at the Faculty of Agriculture of the Jagiellonian University (by K. Rouppert), 1935 assistant professor in the Faculty of Ichthyobiology and Piscatorial Sciences at the Department of Agriculture, 1939 assistant professor, 1945–1947 head of the above-mentioned Department as well as head of the Experimental Fishing Station in Mydlniki; 1951–1954 assistant professor at the Krakow representation of the Institute of Inland Fishing Research in Olsztyn; 1951–1957 lecturer at the Institute and Department of Sanitary Biology at the University of Silesia; 1953–1954 assistant director, 1954–1965 director; 1965–1976 and also after 1982 head of the Scientific Council; 1954–1958 Algae Laboratory in the Institute of Botany at the Polish Academy of Sciences; 1958–1970 head of and lecturer at the Faculty and Department of Hydrobiology at the Department of Biology and Earth Sciences at the Jagiellonian University; other occupations, e.g. 1928–1931 teacher in various schools in Kraków.

Research subject, science achievements: One of the most famous Polish phycologists and hydrobiologists. Described many new algae taxa. Created the basis of modern hydrobiology in Poland. Developed an original method of describing algal communities, a system of classifying rivers and a plan of hydro-biological managing and utilizing water basins.

Research excursions, collections: 1936 Dahlem (Germany) – specialization in sanitary and biological methods of examining water; 1939 Drottninghol (Sweden) – specialization in piscatorial assessment of streams and rivers; 1963 Switzerland – scientific internship.

Publications: published over 220 works, with more than 100 regarding phycology. Founder and editor of *Acta Hydrobiologica*. Co-author of the series *Polish Freshwater Flora*.
Some of the most important phycological works:
Badania sestonu górnej Wisły i Białej Przemszy („Spraw. Komisji Fizjogr.” 73, 1939; rozprawa habilitacyjna);
O rozmnażaniu się krasnorosta Hildebrandia rivularis (Liebm.) („Acta Soc. Bot. Pol.” 21, 1952);
Metody badania planktonu (1955);
Nowe i rzadkie sinice w planktonie stawu rybnego („Acta hydrobiol.” 4, 1962);
Blue-green alga from the Tremadocian of the Holy Cross Mountains (Poland) („Acta Paleontol. Polon.” 8, 1963);

Glony na wilgotnych skałach nadmorskich w Warnie („Acta hydrobiol." 6, 1964);
Chrysophyceae and Haptophyceae. Süßwasserflora von Mitteleuropa (1985);
Some taxa of freshwater red algae (Rhodophyta) from Cuba („Fragm. Flor. Geobot." 31–32, 1986);
Plankton roślinny wód słodkich (1989);

Taxa new to science and named after him:

Bicoeca starmachi Hamar
Chamaesiphon starmachii Kann
Cyathochrysis starmachi Czosnowski
Eucapsis starmachii J. Komárek & F. Hindák
Kephyrion starmachii (Czosnowski) Bourrelly
Navicula starmachii A. Witkowski & Lange-Bertalot
Navicula starmachioides A. Witkowski & Lange-Bertalot
Oedogonium starmachii Mrozińska
Phacus starmachii Starwiński
Pseudanabaena starmachii Anagnostidis
Vaucheria starmachii Kadłubowska
Xenococcus minimus var. *starmachii* Geitler
Xenotholos starmachii (Geitler) M. Gold-Morgan, G. Montejano & J. Komárek

Kazimierz Jan Wasylik

born: 12 XI 1925, Chomiakówka (pow. Czortków, woj. tarnopolskie)
died: 5 XI 2000, Kraków

Studies: 1950–1953 Krakow University of Pedagogy;
1953– 1955 Jagiellonian University.

Description of career:

1946 – 1956 teacher, head of several primary and secondary schools (e.g. Public Schools in Młynarzowice and Grabin, Highschool in Świebodzin); Krakow University of Pedagogy (former Public University of Pedagogy in Krakow); Department of Botany: 1953–1954 lecturer, 1954–1957 assistant, 1958 – senior assistant; Adult College at the University of Pedagogy: 1958 senior assistant, 1966/1967 contract courses; Jagiellonian University: 1958 ancillary employee at the Department of Hydrobiology at the Faculty of Biology and Earth Sciences, 1958–1962 senior assistant at the Department of Hydrobiology, 1962–1974 lecturer at the Department of Hydrobiology, 1972–1974 lecturer at the Institute of Zoology, 1974 assistant professor; 1977–1991 Institute of Environmental Biology; Institute of Botany at the Polish Academy of Sciences in Krakow: 1955–1958 postgraduate student, 1958–1961 senior assistant, 1961–1962 lecturer.

Research subject, science achievements: Studied mainly desmids and diatoms, their systematics, ecology, phytosociology, algal remains in bottom communities. The history of botany.

Research excursions, collections: 1959 – 1960 Northern Finland; 1959 Denmark; 1965 USA; 1970 Iran and Turkey.

Publications: 20 publications, among them the most important are:
Desmidiaceen der Moore in der Umgebung von Korvanen in Sodankylä, Finnisch-Lappland („Societas Scientiarum Fennica, Commentationes Biologicae“ 23, 1961);
Przezroczyste otoczki na komórkach desmidii („Acta Hydrobiologica“ 4, 1962);
Communities of algae from the Soła river and its tributaries („Acta Hydrobiologica“ 7, Supplementum 1, 1965);
Remnants of algae in bottom sediments of the lakes Wielki Staw and Morskie Oko in the Tatra Mountains (“Limnological investigations in the Tatra Mountains and Dunajec River basin. Komitet Zagospodarowania Ziem Górskich PAN” 11, 1965);
Notes on the freshwater algae of Iran („Fragmenta Floristica et Geobotanica” 21, 1975);
The algae of the raised peat bogs of the Orawa-Nowy Targ Basin with special reference to the peat bog “Na Czerwonem” ("Polish Botanical Studies, Guidebook Series" 10, 1993).

Iwo Wojciechowski

born: 13 XII 1935, Kraków
died: 22 III 2006, Lublin

Studies:

1948–1952 student at Jan Zamoyski Secondary School
1952–1957 studies on Faculty of Biology and Earth Sciences of the Maria-Curie Skłodowska University in Lublin;

Description of career:

1957–1959 – technician, and later a research technical assistant at the Department of Plant Systematics and Geography of the Maria-Curie Skłodowska University (specialization in lichen taxonomy and ecology); 1959–1960 research and teaching assistant at the Department of Biology of the Medical University in Lublin (his main interest – human parasitology, the central nervous system of insects, ecology of centipedes);
From 1960 – employment at Agricultural University in Lublin, Department of Botany where he went all the way from an assistant to a full professor;
1995–2005 the head of Department of General Ecology Agricultural University in Lublin,

Research interests and achievements of research:

In his scientific work, his main interest was in phycology and hydrobiology issues; he specialized in taxonomy and ecology of algae, but was also engaged in research on the functioning of aquatic and peatland ecosystems, phytosociology, and general ecology. The Lublin Phycological School was set up thanks to his idea and many years of grassroots work.
He was the founder, organiser and long-term chairman of the Phycological Section of the Polish Botanical Society, a member of the Polish Hydrobiological Society, Polish Association for Ecology, Society of International **Limnologists** "SIL", International Association for Ecology "INTECOL" as well as a member of the Scientific Council of the Institute of Freshwater Biology, Polish Academy of Science, in Kraków.
Iwo Wojciechowski was an environmental protection expert and a member of the Regional Committee for Environmental Protection in Lublin. He collaborated with the Polesie National Park, being a member of the Polesie NP Scientific Council from the time of its establishment and with the Roztocze National Park.

Publications: the author of more than 100 scientific publications and popular science publications as well as textbooks. The most important of them was:
Wojciechowski I. 1967. *Centronella Rostafinskii* Wołosz. aus Seen im Lubliner Land (Polen). Schweiz. Zeitschr. Hydrol., 29: 311-332.

Więckowski K., Wojciechowski I. 1971. Zmiany charakteru limnologicznego jezior sosnowickich [The changes in limnological characteristics of the Sosnowickie Lakes]. Wiad. ekol., 17: 239–247.
Lecewicz W., Sokołowska W., Wojciechowski I. 1973. The changes of winter phytoplankton in relation to the light climate in the lakes with various trophy. Ekol. pol., 21: 193–208.
Brzęk G., Kowalczyk Cz., Lecewicz W., Radwan S., Wojciechowska W., Wojciechowski I. 1975. Influence of abiotic environmental factors on plankton in lakes of different trophy. Pol. Archiw. Hydrobiol., 22: 13–139.
Wojciechowski I. 1976. Influence of the drainage basin on the eutrophication of the a-mesotrophic Lake Piaseczno and diseutrophication of the pond Lake Bikcze. Acta Hydrobiol., 18: 23–52.
Czernaś K., Krupa D., Wojciechowski I., Galek J. 1991. Differentiation and activity changes of algal communities in the shore zone of mesotrophic Piaseczno Lake in years 1983–1985. Ekol. pol., 39, 3: 323–341.
Zemanek A., Wojciechowski I. 2000. Pionierskie badania glonów [Pioneering study of algae] [W:] Zemanek A. (red.). Józef Rostafiński botanik i humanista [Józef Rostafiński botanist and humanist]. Wyd. Pol. Akad. Umiejętn., Komisja Historii Nauki, Monografie 1, Kraków: 147–159.

Jadwiga Wołoszyńska

born: 5 IV 1882, Nadwórna na Pokuciu (Ukraine)
died: 30 VIII 1951, Kraków

Studies: 1903–1907 University of Lviv.

Description of career:

1912–1920 assistant at the Institute of Biology and Botany, University of Lviv (by Prof. M. Raciborski); 1920/21 teacher at the Women's Public Seminar in Inowrocław; 1921–1923 assistant in the Hydro-biological Station at Lake Wigry; since 1924 senior assistant at the Botanical Institute of the Faculty of Philosophy of Jagiellonian University; since 1930 professor and head of the Department of Pharmaceutical Botany in the Medical Faculty of the University; During the German occupation of Poland during the Second World War teacher of botany at an underground university.

Research subject, science achievements: One of the most famous Polish phycologists. She described 126 taxa of extant algae and, as the first in Poland, several dozen of fossil ones. Her research primarily focused on dinoflagellates and desmids, but she also studied other groups of algae. She carried out extensive taxonomic work based on material from Poland, as well as some collected in Ukraine, Lithuania and outside of Europe (Lake Victoria in Africa, southeast Asia). She paid much attention to the biology, ecology and biogeography of algae.

Research excursions, collections:
She researched lowland and mountain lakes from various regions of Poland.

Publications: over 50 papers; among them the most important are:
Zmienność i spis glonów planktonowych stawów polskich („Rozpr. Wydz. Mat.-Przyr. AU" B(51), 1912; dissertation);
Glony stawów i młak tatrzańskich (cz. 1 „Rozpr. Wydz. Mat.-Przyr. AU" B(18), 1918; cz. 2 „Bull. Int. Acad. Pol. Sc." Cl. Sc. Math. Nat., 1935; cz. 3 „Archiwum Hydrobiologii i Rybactwa" 10, 1936; cz. 4 „Acta Soc. Bot. Pol." 16, 1939);
Studja porównawcze nad jeziorami tatrzańskiemi i Pojezierzem… („Sborník I Sjezdu Slovanských Geografů a Ethnografů v Praze 1924", 1926);
Asterionella formosa *Hass. var.* tatrica *n. var. w jeziorach tatrzańskich* („Acta Soc. Bot. Pol." 11, 1934);
Bruzdnice Tatr i Karpat Wschodnich („Acta Soc. Bot. Pol." 21, 1951–1952).

Taxa new to science and named after her:
Woloszynskia R. H. Thompson and the family Woloszynskiaceae
Cosmarium woloszynskae Coesel & Meesters
Cryptomonas woloszynskae J. Czosnowski

Katodinium woloszynskae (Schiller) Loeblich III
Massartica woloszynskaae Schiller
Peridinium woloszynskae W. Conrad
Protoperidinium woloszynskae (Conrad) Parke & Dodge *Stephanodiscus astraeae* f. *woloszynskae* S. Wisłouch *Trachelomonas woloszynski* Skvortzov

THURSDAY PLENARY SESSION

**"The past, present, future of phycological research.
Its signification for man and environment protection"**
Wrocław – Poland, 19–21st May 2011

PROF. IZABELA DĄMBSKA – FOUNDER OF THE POZNAŃ SCHOOL OF HYDROBIOLOGY

Lubomira Burchardt

Department of Hydrobiology, Adam Mickiewicz University,
Institute of Environmental Biology,
Umultowska 89, 61 – 614 Poznań, Poland

Izabela Dąmbska

I have the honour of acquainting you with a brief academic history of Prof. Izabela Dąmbska, creator of the Poznań hydrobiology, specialist in the domain of macroalgae from the Charophyta group, as well as a co-organiser of the first interdisciplinary hydrobiological research in Poznań, conducted simultaneously at three universities, namely, the Adam Mickiewicz University, the Academy of Agriculture and the Poznań Polytechnic. These ideas still hold valid, despite almost 30 years since She passed away.

The formidable personality of Professor Izabela Dąmbska, attracted interesting scholars, bold discussants and excellent people. Her scientific achievement is a testimony of sound academic concepts related to the protection of environmentally valuable water ecosystems, including stonewort meadows, which frequently vanish due to poorly developed drainage basins. Prof. Dąmbska associated these phenomena, especially poignant in our region of the Greater Poland, with the eutrophisation caused by intensive cultivation, fertilization, and artificial rain irrigation utilised in crop husbandry. These facts were confirmed in floristic-phytosociological monographs of 141 lakes, numerous ponds, old river beds, clay pit ponds, peat bogs, artificially dammed up reservoirs, post-meteorite ones in Morasko in Poznań, as well as many lobelian lakes in Pomerania, of which only few received the denomination of the „Natura 2000" area.

Thanks to Prof. Dąmbska's research, the academic milieu, as well as officers of the Environmental Protection Departments in Poland, have now the ability to employ the most sensitive tool in hydrobiological work that the stoneworts provide. These macroalgae, which form underwater meadows only in waters which function well in terms of ecology, are an excellent marker of good biological and ecological condition. Taxonomic

studies of stoneworts in the Poznań area, in the lakes of the north-eastern Poland and the lakes of the Western Pomerania (Masurian Lake District) published in 1952–1971 constitute a fundament of the present day ecological research.

The sites of rare stonewort species contributed by Prof. Dąmbska, such as e.g. Lychnotamnus barbatus from the Sieraków-Międzychód lakes, or the description of the new taxon Tolypella glomerata var. leonhardi from the Lednica lake were included in the Charophyta identification key in 1964 (Flora Słodkowodna Polski. Vol.13).

Prof. Dąmbska's numerous field research expeditions, devoted to stoneworts and their habitats, which were characteristic of various water ecosystems on the territory of Poland and neighbouring countries produced Europe's sole collection, preserved at the Institute of Hydrobiology, Department of Environmental Biology, Faculty of Biology, Adam Mickiewicz University in Poznań. Materials comprised in this collection are Europe's only database from the 1950s–1960s.

The present-day relevance of Prof. Dąmbska's collection of stoneworts pertains to further possibilities of genetic, phytosociological and ecological research. Habitat data contained in the array of characteristics within the collection constitute a valuable material for bioindication. They correlate with broadly construed environmental protection and application studies devoted to preservation and conservation of ecologically balanced water ecosystems. They are a worthwhile body of material in the research on lobelian lakes, which are particularly sensitive to environmental change.

I wish you all an agreeable time within the walls of our university, a fruitful discussion when inspecting the stonewort collection of Prof. Dąmbska and later many gratifying scholarly experiences.

**"The past, present, future of phycological research.
Its signification for man and environment protection"**
Wrocław – Poland, 19–21st May 2011

ACTIVITY OF THE POLISH PHYCOLOGICAL SOCIETY

Lubomira Burchardt

Department of Hydrobiology, Adam Mickiewicz University,
Institute of Environmental Biology,
Umultowska 89, 61–614 Poznań, Poland

Mr Rector, Mr President, Honourable Guests and phycologists, who are present here today at our 30th, jubilee conference,

I have the pleasure of presenting to you certain significant historical facts and scholarly aspirations of our Society.

The first motion to establish a Phycological Section with The Polish Botanical Society was submitted to the Board of the Cracow Branch of the Polish Botanical Society in 1971. Prof. Starmach and Prof. Siemińska were the motion's authors.

Next year, in 1972, the Phycological Section obtained its legal status and rules at the 40th Anniversary Scientific Conference in Warsaw.

The first organisational session of the Section took place in 1974, at the Institute of Botany in Cracow, where Prof. Starmach discussed a questionnaire prepared by Prof. Bohr, which informed of a fairly substantial group of Polish phycologists.

The second session of the Phycological Section was held in Toruń in 1975 where the first board of the phycological section was appointed. Prof. Starmach became the first President of the Section, Prof. Bohr the vice-president while Prof. Wojciechowski became secretary. During the term of this Board, three phycological conferences took place. Professor Starmach held the function for the next 13 years, until his death.

The first conference of Polish phycologists was held in Mikołajki in 1980, with dr Spodniewska from the Institute of Ecology, Polish Academy of Sciences, organising, the second on the Bachotek lake in May 1981, the event being organised by dr Luścińska and dr Oleksowicz from the Nicolaus Copernicus University in Toruń. The third conference of phycologists took place only after martial law had ended (13 December 1981 – 22 July 1983), in Iława in 1984. That one was organised by Prof. Bohr's team. During the conference, the second board of the phycological section was appointed, still presided over by

Prof. Starmach, with Prof. Bohr and dr Oleksowicz acting as vice-presidents, and Prof. Wojciechowski as secretary. The board thus composed performed its functions throughout the next term, until 1990. During this period we suffered the loss of Prof. Ryszard Bohr, in 1987, Prof. Karol Starmach in 1988, and dr Andrzej Oleksowicz in 1989. During that 6-year term of the board, conferences were held in Gołysz (1985), Charzykowa (1986), Gdańsk (1987), on lake Piaseczno (1988), and on lake Wigry (1989). In May 1990, at the conference in Poznań and Czerniejewo, Prof. Wojciechowski was appointed for the Section President and dr Simm for secretary. The First Jubilee meeting of phycologists, the 10th, was organised by the colleagues from Cracow, taking place in Bukowno, on the Kraków-Częstochowa Uplands.

In the summing up of the 10-year long activity of Polish phycologists gathered in the Phycological Section, presented by Prof. Siemińska in a publication entitled *A summarization of the activity of the phycological section of the Polish Botanical Society* (1971–1991). In: Jubilee X-Conference of the Phycological Section of the Polish Botanical Society, Polish Botanical Studies, 1991, we find a list of phycologists taking ever greater part in phycological meetings, organised within the framework of successive conferences.

The next three terms of the Section Board, under direction of Prof. Wojciechowski – president, dr Czernaś – vice-president and dr Gałka – secretary, eventuated each year in scientific conferences, organised by subsequent academic centres in Poland. The conferences were held in Płociczno (1993), Kruszwica, Lednogóra and Biskupin (1994), Cracow (1995), Lublin, Krasnobród and Zwierzyniec (1996), in Kaszuby and Wdzydze Kiszewskie (1997), Szczecin, Łukęcin and Gdańsk (1998), Kielce and Wólka Milanowska (1999), Bydgoszczy and Toruń (2000), Poznań (2001), Sosnówka and Karpacz (2002), Olsztyn and Mierki (2003), Bydgoszcz and Toruń (2004), Krynica Morska (2005), Poznań, Słubice and Łagów (2006), Lublinie and Nałęczów) (2007).

In 2007, at the phycological meeting in Toruń, efforts were embarked upon aiming to establish an independent scientific organisation, the Polish Phycological Society. Having registered the society, the meetings of Polish phycologists and their collaborating colleagues from abroad can also be held as part of conferences organised by the Polish Phycological Society. The composition of the board includes Prof. Lubomira Burchardt – president, Prof. Marcin Pliński – vice-president, dr Beata Messyasz and dr Elżbieta Wilk-Woźniak – secretaries, dr Mikołaj Kokociński – treasurer.

The continually growing circle of members of the Polish Phycological Society ties in with the ever greater number of papers published in various significant hydrobiological, limnological and botanical periodicals. At the present moment, efforts are being made to enable publication of phycological works in Poland. The *Phycologica Polonica*, published twice (2007, 2008) by the University of Gdańsk as a supplement to *Oceanological and Hydrobiological Studies* has been suspended. We have high hopes that Polish Phycologists will be more and more often used the possibility to press their works in the international journals with high Impact Factor. The membership of Polish Phycological Society within Federation of European Phycological Societies should help with it as well as of participating in its conferences. The participation in the III FEPS Congress on Rhodos certainly will start the further, scientific skill-sharing.

The considerable scientific activity of Polish phycologists has been manifest in recent years during the conferences in Łódź and Spała (2008) – organised by dr hab. Barbara Kawecka and team, in Szczecin and Cieszyn Drawski (2009) – organised by dr Wojciech Kowalski and team, and in Cracow (2010) – organised by Prof. Konrad Wołowski and team. Polish Phycological Society members present the results of their research not only at the conferences of the Polish Phycological Society. They participate actively in the conferences of the Polish Botanical, Hydrobiological and Limnological Societies. They will certainly be very much in action at the 20th anniversary phycological conference in Wrocław, organised by Prof. Matuła with team, and at the Congress of the European Federation of Phycological Societies in Rhodes.

In the last 5 years, a substantial career progression among the phycologists in Poland has been observed. Numerous PhDs, eminent habilitations and professor's degrees reflect the advance in phycological studies, the application of ever more varied research methods and the scholarly development of individual research centres at the universities and Polish Academy of Science establishments.

PROF. DR HAB. IWO WOJCIECHOWSKI – LUBLIN SCHOOL OF PHYCOLOGY FOUNDER (13 DECEMBER 1935 – 22 MARCH 2006)

Krzysztof Czernaś, Danuta Krupa, Barbara Banach

Zakład Ekologii Ogólnej, Uniwersytet Przyrodniczy w Lublinie,
ul. Akademicka 15, 20–950 Lublin

Iwo Wojciechowski was born on 13 December 1935 in Kraków. He attended school in Lublin and passed a secondary school leaving exam in 1952 in Jan Zamoyski Secondary School. He also finished primary music school and 3 classes of secondary music school, for piano. Having passed the secondary school leaving exam, he started university studies at the Faculty of Biology and Earth Sciences of the Maria-Curie Skłodowska University in Lublin. He was awarded the degree of Master of Biology in botany after writing a master's thesis on lichens under the direction of Prof. Józef Motyka in 1957. Even before he graduated from the university, he took up a job as a technician, and later on as a research technical assistant at the Department of Plant Systematics and Geography of the Maria-Curie Skłodowska University, specializing in lichen taxonomy and ecology. In 1959 he was employed as a research and teaching assistant at the Department of Biology of the Medical University in Lublin, where he his main interest was in human parasitology, the central nervous system of insects, and ecology of centipedes.

From 1960 he was associated with the Agricultural University in Lublin, where he went all the way from an assistant to a full professor, initially at the Department of Botany, but from the time when the Department of General Ecology was established in 1995, he was the head of this Department.

In his scientific work, his main interest was in phycology and hydrobiology issues; he specialized in taxonomy and ecology of algae, but was also engaged in research on the functioning of aquatic ecosystems. During a later period of research work, his work focused on the functioning of peatland ecosystems, phytosociology, and general ecology.

The effect of many years of scientific work of Professor Wojciechowski is more than 80 scientific publications as well as textbooks; he also prepared 86 entries for *Wielka Encyklopedia Powszechna PWN* (Great Universal Encyclopaedia PWN).

He was an excellent university teacher, primarily in the fields of botany, phycology, hydrobiology, environmental protection, and general ecology. He developed many proprietary curricula and lectured not only at his home university, but also, among others, at the Faculty of Philosophy of the Catholic University of Lublin and the Faculty of Biology and Earth Sciences of the Nicolaus Copernicus University in Toruń.

He was the founder, organiser and long-term chairman of the Phycological Section of the Polish Botanical Society, a member of the Polish Hydrobiological Society, Polish Association for Ecology, Society of International Limnologists "SIL", International Association for Ecology „INTECOL" as well as a member of the Scientific Council of the Institute of Freshwater Biology, Polish Academy of Science, in Kraków.

Professor Wojciechowski was actively involved in environmental protection, showing great commitment in this area. He was an environmental protection expert and a member of the Regional Committee for Environmental Protection in Lublin. He collaborated with the Polesie National Park (being a member of the Polesie NP Scientific Council from the time of its establishment) and with the Roztocze National Park. He was in charge of the preparation of the following conservation management plans: the conservation management plan for aquatic ecosystems in the Roztocze NP Conservation Plan, and the conservation management plan for peatland ecosystems in the Polesie NP Conservation Plan.

Prof. dr hab. Iwo Wojciechowski died on 22 March 2006 in Lublin.

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PROF. JOANNA KADŁUBOWSKA – FOUNDER OF THE ŁÓDŹ SCHOOL OF PHYCOLOGY

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Department of Algology and Mycology, University of Łódź,
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Outstanding scientist, botanist-algologist, the creator of the Łódź algological school of thought, was born in the town of Pabianice in the year 1923. During her whole life she was connected with the Łódź City. In 1945 she started studying biology at newly established Lódź University, at the Faculty of Mathematics and Natural Sciences. In 1948, being then at the 3rd year of study, she was employed by Professor Jakub Mowszowicz, habilitated doctor, as a junior assistant at the Department of Systematics and Plant Geography. She was granted the title of Master of Philosophy in the field of botany in 1951 on the basis of the study *Nemertea of the peat-bog at Marysin III*. In 1960 she was awarded the title of Doctor on the basis of the study *Algae of water reservoirs of the Łódź City and its vicinities* edited under the supervision of Professor J. Mowszowicz, habilitated doctor. As the only scientist engaged in the study of algae at the Department of Systematics and Plant Geography she established the scientific and organizational foundations of the first academic Chair of Algology in Poland. It was created in 1965, and the initiator of its creation was Professor Zygmunt Czubiński, habilitated doctor, when Professor Józef Piątkowski, habilitated doctor, was the President of Łódź University. In 1965–1991 Professor Kadłubowska continuously held the Chair, when its profile were the taxonomy, floristics, morphology and ecology of algae living in freshwater ecosystems. In 1973 the Council of State of the Polish Republic awarded Professor Z. Kadłubowska with the title of Associate Professor, and in 1986 of Full Professor. The main specialties of her research were taxonomy and morphology of algae, particularly *Zygnemataceae, Bacillariophyceae* – their function in the assessment of water purity, microfungi of the family *Erysiphales*, and fungi parasitizing on algae.

The most outstanding scientific achievements of Professor Kadłubowska are studies on the taxonomy and morphology of algae of the *Zygnemataceae* family occurring in Poland, Denmark and Norway, identification of 782 taxa of the genera *Spirogyra*, *Zygnema*

and *Zygogonium*, including 15 species new to science such as *Spirogyra costata, S. costulata, S. czubiński, S. czurdiana, S. danica, S. lodziensis, S. miranda, S. pseudodaedaloides, S. pseudotetrapla, S. pseudosahnii, S. pseudomaxima, S. silesiaca, S. venosa, Zygnema argillarii* and *Zygogonium norvegicum*, 15 new to Poland, 69 new to Denmark and two species new to science: *Chytridium caloneides* and *Micromyces bulbosus.*

The scientific achievements of Professor Kadłubowska comprise 72 research publications, four of which are distinct owing to being books: *Okrzemki rzeki Pilicy i ich znaczenie w ocenie czystości wody* [Diatoms of the Pilica River and their importance in water purity assessment] (1964), *12 tom Flory Słodkowodnej Polski. Zygnemaceae, Zrostnicowate, Chlorophyta V. Conjugales* [12th volume of the Freshwater Flora of Poland. *Zygnemaceae, Zygnemataceae, Chlorophyta V. Conjugales*] (1972), *Zarys algologii* [Outline of Algology] (1975), 16th volume of *Süsswasserflora von Mitteleuropa. Conjugatophyceae I. Zygnemales* (1984), and three monographs: *Glony zbiorników wodnych Łodzi i okolicy* [Algae of water reservoirs of the Łódź City and its vicinities] (1961), *Okrzemki rzeki Pilicy i ich znaczenie w ocenie czystości wody* [Diatoms of the Pilica River and their importance in the assessment of water quality] (1964), *Współzależność między liczbą taksonomicznych okrzemek a niektórymi właściwościami wody rzek* [Interdependence between the number of diatom taxonomic levels and the selected parameters of riverine water] (1970). Professor J. Z. Kadłubowska taught the systematics of botany, algology and microbiology, including course lectures in the systematics of lower plants at the microbiological specialty of study (1954–1956 and 1966–1971); mycology for microbiologists (1956–1964 i 1971–1979); and for ten and several yearts the systematics of plants for full-time and extramural students. In 1984–1987 she was the Vice-Dean for student education of the Faculty of Biology and Earth Sciences. Professor J. Z. Kadłubowska supervised 150 master of science and nine doctoral dissertations. Her PhD students were Marcin Pliński (1970), Zbigniew Kącki (1976), Barbara Rakowska (1977), Ryszard Ligowski (1977), Teresa Lesiak (1986), Ewa Kalinowska-Kucharska (1988), Małgorzata Sitkowska (1988), Joanna Żelazna-Wieczorek (1996) and Janusz Rozum (1974) from the Warsaw Technical University.

She was granted various awards by His Magnificence the President of the Łódź University, the Golden Badge of the Łódź University (1971), Golden Cross of Merit (1973), Order of Poland Restored (1974), Golden Badge of the Polish Teachers Union (1980), Medal of Łódź University for Service for Society and Science (1983), Medal of the Committee for National Education (1983), and Łódź University 50 Anniversary Medal (1995).

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THE CRACOW SCHOOL OF PHYCOLOGY – GENEALOGICAL TREE

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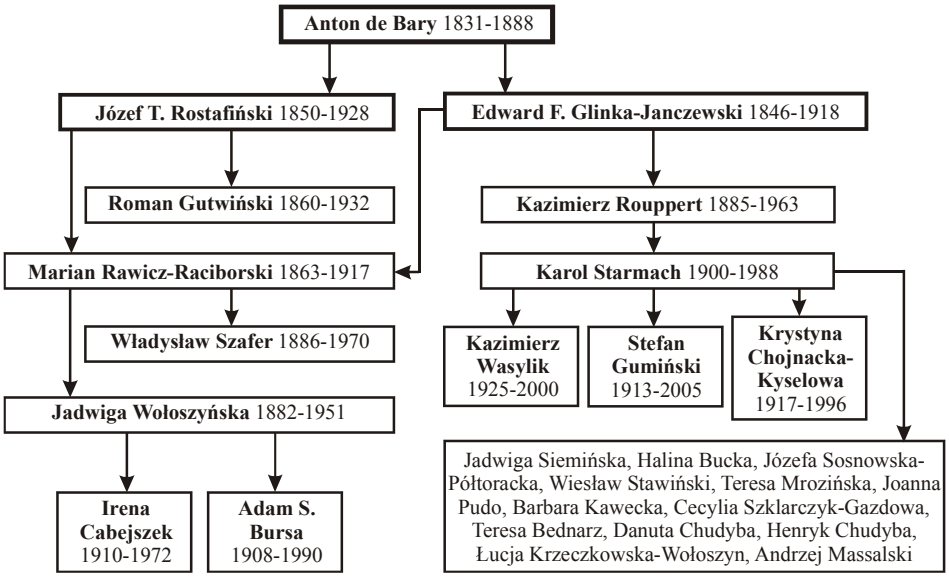
In the book *Prominent Phycologists of the 20th Century* by D.J. Garbary and M.J. Wynne there appear the names of two eminent Polish phycologists, Jadwiga Wołoszyńska and Karol Starmach, whose scientific achievements are described in works by Jadwiga Siemińska. These Polish surnames are strongly connected with the Cracow school of phycology. Phycological research in Cracow traces its origins to Anton de Bary, professor at Halle University and later Strasburg University in Germany. His personality strongly influenced two young Polish botanists, Józef Rostafiński and Edward Glinka-Janczewski, who worked in his laboratories in 1870–1873 studying freshwater and marine algae. Afterwards they both undertook phycological research in Cracow at the Jagiellonian University, Rostafiński as professor of botany in the Faculty of Philosophy, and Janczewski as a professor in the Department of Plant Anatomy and Physiology (now the E. Janczewski Department of Botany) of the Faculty of Agriculture of the Jagiellonian University.


Anton de Bary 1831-1888
Józef T. Rostafiński 1850-1928
Edward F. Glinka-Janczewski 1846-1918
Roman Gutwiński 1860-1932
Kazimierz Rouppert 1885-1963
Marian Rawicz-Raciborski 1863-1917
Karol Starmach 1900-1988
Władysław Szafer 1886-1970
Kazimierz Wasylik 1925-2000
Stefan Gumiński 1913-2005
Krystyna Chojnacka-Kyselowa 1917-1996
Jadwiga Wołoszyńska 1882-1951
Irena Cabejszek 1910-1972
Adam S. Bursa 1908-1990
Jadwiga Siemińska, Halina Bucka, Józefa Sosnowska-Półtoracka, Wiesław Stawiński, Teresa Mrozińska, Joanna Pudo, Barbara Kawecka, Cecylia Szklarczyk-Gazdowa, Teresa Bednarz, Danuta Chudyba, Henryk Chudyba, Łucja Krzeczkowska-Wołoszyn, Andrzej Massalski

LECTURES

**"The past, present, future of phycological research.
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CYANOBACTERIA OF CONIFEROUS FORESTS OF BASHKIR STATE NATURAL RESERVE (SOUTH URAL, RUSSIA)

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A. Fazlutdinova, S.Yu. Safiullina, A.R. Mansurova**

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The aim of the present work was to investigate the species diversity and distribution of cyanobacteria in the soils of coniferous forests the Bashkir State Natural Reserve (BSNR). BSNR is situated in the Republic of Bashkortostan, on the slopes of the Southern Urals.

The taxonomic composition includes a total of 25 species and infraspecific taxa of cyanobacteria from 3 orders: Chroococcales – 2 taxa, Nostocales – 5 taxa, Oscillatoriales – 18 taxa. The greastest biodiversity was in the families Phormidiaceae, Nostocaceae. Other 5 families had a small amount of taxa (less than the average).

Cyanobacteria were founded on the surface and in horizons of soils. The comparison of species composition of investigated plots showed they were different. The mostly rich in a species composition were the plots of softwoods with an impurity of a birch located in a valley of the Uzyan river. Ground was characterized by a heavy mechanical structure with prevalence of silt and were well humidified. *Phormidium, Leptolyngbya, Oscillatoria* were the most rich in species. On the second place were plots also situated in a wide valley of the Uzyan River. There were softwoods with an impurity of a birch too. Soils were good developed and were enough humidified. The genera *Phormidium* came into a dominant position, *Nostoc* и *Trichormus* were also very active. The third place took plots located on slopes of the foothills of a mountain range with a prevalence of softwood and with a small impurity of a birch. Here stony ground prevailed. Cyanobacteria here were presented singly, sometimes dropped out of the soil microbiota. Representatives of *Nostoc* and *Leptolyngbya* were met.

The dominant species were *Leptolyngbya foveolarum* (Rabenhorst ex Gomont) Anagnostidis et Komárek, *Nostoc commune* Vaucher sensu Elenkin, *Nostoc linckia f. linckia* (Roth) Bornet ex Bornet et Flahault, *Nostoc punctiforme* (Kützing) Hariot, *Phormidium autumnale* (Agardh) Gomont, *Phormidium ambiguum* Gomont, *Microcoleus vaginatus* (Vaucher) Gomont

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DIATOMS IN FORENSIC APPLICATIONS: A CASE STUDY

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In addition to their utility and numerous applications in ecology and palaeoenvironmental recostructions, diatoms are used as a forensic tool, primarily for establishing the cause of death of corpses found in water reservoirs and when the actual drowning site is unknown. The procedure performed to establish the presence of diatoms in lungs and other circulatory system organs, i.e., kidneys, liver, and bone marrow is termed the diatom test. It involves determining the quantity of diatom flora found in the organs examined and identification of the species present. The data are then compared to the diatom flora present in water at the actual corpse finding site and at other sites that could have been potential sites of the drowning.

The case study presented involves a corpse of a middle-aged woman; the diatom test was performed to verify the death-by-drowning hypothesis and to identify, based on the diatom flora, the area the drowning occurred in.

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MORPHOLOGICAL RESPONSES OF *CHARA GLOBULARIS* THUILLIER TO HYDRODYNAMIC DISTURBANCES IN THE SHALLOW LITTORAL ZONE

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Chara globularis is a cosmopolitan freshwater plant with a broad ecological range. In terms of structure and habit it is one of the most variable stonewort species. The variability of charophytes is shaped by many different environmental factors, including the mechanical effect of water movement (e.g. Murphy et al. 1990, Cellot at al. 1998, Combroux et al. 2001, Bornette, Arens 2002). The aim of this study was to determine the morphological responses of *C. globularis* individuals to hydrodynamic disturbances caused by wind-induced wave activity in the shallow littoral zone.

50 individuals were collected from each of four lakes in the Kashubian Lakeland in areas disturbed by wind-induced wave activity and sheltered from such disturbances. The following features of individuals were determined: allocation of biomass to generative, above- and underground structures, as well as architectural features, such as number of nodes, length of internodes, number and length of branchlets growing from the node, number of thalli growing above the sediment, number of 1st, 2nd and n-level branches and their length, presence or lack of holdfasts and total length of above- and underground parts. The deformation degree of a studied feature from the standard one (the feature under conditions free from disturbances) was regarded as the measure of response to disturbances.

C. globularis individuals growing in the area exposed to disturbances caused by wind-induced wave activity differed in a statistically significant way with respect to many features from those found in the sheltered area. Individuals exposed to wave pressure locate more biomass to underground structures. They consist of more above- sediment thalli, which have more branches, nodes and internodes. These individuals have shorter branches, internodes and branchlets. The morphological response of individuals to hydro-

dynamic disturbances consists in size reduction and thallus growth close to the bottom, where the disturbance force is weaker. What is more, the increased number of branchings and presence of holdfasts reduce the risk of pulling the plant out.

Bornette G., Arens M. F. 2002. *Charophyte* communities in cut-off fiver channels. The role of connectivity. Aquatic Botany 73:149–162.

Cellot B., Mouillot F., Henry C. P. 1998. Flood drift and propagule bank of aquatic macrophytes in a riverine wetland. Journal of Vegetation Science 9: 631–640.

Combroux I., Bornette G., Willby N. J., Amoros C. 2001. Regenerative strategies of aquatic plants in disturbed habitats: The role of the propagule bank. Archiv für Hydrobiologie 152: 215–235.

Murphy K. J., Rørslett B., Springel I. 1990. Strategy analysis of submerged lake macrophytes communities: an international example. Aquatic Botany 36:303–323.

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FIRST REPORT ON THE OCCURRENCE OF BMAA IN CYANOBACTERIA FROM POLISH WATERBODIES

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BMAA, is a novel cyanobacterial neurotoxin, that was suggested to be a possible cause of ALS/PDC syndrome in the Chamorro people of Guam Island (Pacific Ocean). According to Cox *et al*. (2005), BMAA is produced by a large number of cyanobacterial genera (95%). These authors also reported a biomagnification of BMAA within the Guam ecosystem. Studies on the occurrence of BMAA and their toxicity have been conducted by many researchers all over the world. In this work, the presence of the BMAA in Polish water bodies has been studied for the first time.

Cyanobacterial bloom material (37 samples) was collected from fresh and brackish waters in northern Poland (2007–2009). 44 isolated strains of cyanobacteria were also examined. Additionally, BMAA was sought in tissues from blue-mussels (*Mytilus trossulus*), fish (*Platichthys flesus, Abramis brama, Rutilus rutilus*) and nutritional supplement "*Spirulina"*. BMAA extraction was performed as described by Cox *et al*. (2005). The presence of BMAA was analyzed by LC-MS/MS techniques, using IP (*Ion Product*) and MRM (*Multiple Reaction Monitoring*) modes. Biological activity of BMAA was tested using mouse hippocampus cell lines HT22 and aquatic invertebrates: brine shrimp *(Artemia franciscana)* and freshwater crustaceans (*Thamnocephalus platyurus, Daphnia magna*).

BMAA was detected at trace amounts (<0,3 μg/g d.w.) and only in 20% of cyanobacteria belonging to *Anabaena*, *Limnothrix*, *Leptolyngbya*, *Nodularia*, *Planktothrix* and *Spirulina* genera. BMAA was neither detected in fish nor in mussel tissues. The *in vitro* tests performed on the hippocampus cell line did not reveal any toxic effects of BMAA. During the test performed on the invertebrates, only *Daphnia magna* showed sensitivity to the presence of the high BMAA concentrations. The obtained results are contradictory to documented occurrence and activity of the BMAA.

Cox P.A., Banack S.A., Murch S.J., Rasmussen U., Tien G., Bidigare R.R., Metcalf J., Morrison L.F., Codd G.A., Bergman B. Diverse taxa of cyanobacteria produce β-N-methylamino-l-alanine, a neurotoxic amino acid. PNAS 2005 102 (14): 5074–5078.

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This research was supported by the Ministry of Science and Higher Education in Poland (2651/P01/2008/34).

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PATTERN OF PHYTOPLANKTON COMPOSITION DURING THE BLOOM OF CYANOBACTERIA IN TWO LAKES IN CHINA

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[2] Institute of Nature Conservation, Department of Freshwater Biology, Polish Academy of Sciences, Kraków, Poland

Eutrophication is a world-wide phenomenon. Eutrophic lakes are characterized by high level of biomass of algae and frequent occurrence of algal blooms, especially those created by cyanobacteria. Problem of heavy cyanobacterial blooms is also well known in China. The aim of our study was to describe composition of phytoplankton during the bloom and check pattern of plankton composition in two shallow lakes: Donghu Lake and Chaohu Lake. Donghu Lake is located in Hubei Province, in the Wuchang Ward of Wuhan City P.R. China: $30^0$33'N, $114^0$23'E. Chaohu Lake is a lake located at the juncture of Chaohu and Hefei cities in Anhui Province, China: $31^0$30'N, $117^0$30'. It is one of the five largest freshwater lakes in China. About 5 million people live near the lake, and use it for irrigation, transportation and fishing. Due to China's rapid economic growth, the lake is now one of China's most polluted lakes. The samples for water analyses were taken in August 2010. There were dense blooms created mainly by *Microcystis aeruginosa* Kütz. and accompanied by other species of cyanobacteria, in both lakes. Beside cyanobacteria other algae were common in the phytoplankton assemblages, e.g. species belong to green-algae, euglenoids, diatoms, desmids. Among zooplankton dominated Rotatoria, which are also characteristic for high eutrophic lakes. They probably tolerant for cyanobacterial toxins and they might feed on bacterias and detritus, which are result of blooms. The significantly positive relationship between phosphorus concentration and Chl *a* suggested that phosphorus was the limiting factor of primary production in Lake Donghu. It is known, that algae can excrete phosphatase to compensate phosphorus deficiency. As evidenced by Enzyme Labelled Fluorescence (ELF) technique, we found that several

species of algae, including dinoflagellates, diatoms, green algae, and euglenoids excreted extracellular phosphatase in Lake Donghu. The percentage of active cells (with phosphatase labelled) was regulated by ambient phosphorus concentration, e.g. some green algae was labeled completely (100%) in the "oligotrophic" part of the lake, while non-labeled in the eutrophic part. Cyanobacteria, including *Microcystis*, was never detected active. The variation of active cells among planktic algae suggested that the release of cell-attached extracellular phosphatases was not a general response of the phytoplankton assemblage but at a species or even single cell level to phosphorus deficiency.

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CONFLICT BETWEEN TAXONOMY BASED ON MORPHOLOGICAL FEATURES AND RESULTS FROM MOLECULAR STUDIES – EXAMPLES FROM FRESHWATER RHODOPHYTA

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During the last three decennia new methods and technology in electron microscopy and in cell molecular genetics have explained the paths of evolution of numerous organism groups and also of many algal groups. In many cases taxa described using traditional morphological features fit very well with results received from molecular studies. In some cases with molecular methods several new taxa are split from a single traditional species. Maybe more common are cases when morphologically different and tradationally described separate species are shown to be genetically more or less similar and therefore proposed to be synonymised.

Among freshwater rhodophytes we have some preliminary results from the genus *Sirodotia*, which occurs in the northern Europe, also in North America, Australia, New Zealand, East Asia and South Africa. According to literature ten species are described to genus, from which two occur also in Europe. According to the last gene sequencing results world wide collected samples of *Sirodotia suecica* are genetically very identical, including also samples of *Sirodotia tenuissima* from USA and Finland and *Sirodotia geobelii* from Australia. All those three have clear differences in morphological features.

In earlier molecular studies with North American materials *S. suecica* and *S. tenuissima* formed clearly separated groups and therefore those were kept as own taxa.

Sample, which was found from Finland and identified as *Batrachospermum pseudocarpum* Reis, was discovered to be genetically very similar with *S. suecica* materials, although the morphological features differed very much from *Sirodotia suecica*, especially in microscopic features.

This type of results opens considerable questions, how much more results we need to make changes in taxonomy and how much information we loose, if we put all these different forms under the same name.

The study was supported by the grant No. N N304 285937 from The Polish Ministry of Sciences and Higher Education.

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SOME RARE CYANOBACTERIA AND GLAUCOPHYTA FROM TWO PEAT – BOGS IN ORAVA, NORTHERN SLOVAKIA

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Cyanobacteria and glaucophytes from the peat–bog Klin and Habovské Bory, Protected Landscape Area Horná Orava, situated near of the town of Námestovo, N Slovakia, were studied in 2009-2011.

A peculiar representative of the genus Synechococcus Nägeli was found growing in hyalocystes of Sphagnum. From the Oscillatoriales, the species Dasygloea turfosa (Voronichin) Anagnostidis and Katagnymede accurata Geitler were recorded for the first time in territory of Slovakia. In a laboratory cultivated material from the peat–bog Klin, an Aphanizomenon–like agglomeration of hormogonia in common fascicles was recorded in the heterocytic cyanophyte Hapalosiphon fontinalis (Agardh) Bornet. In contrast to vegetative filaments, hormogonia in fascicles were without heterocytes, but had mucilaginous envelopes, were able to move and their cells contained aerotopes. This phenomenon has been observed in this species for the first time.

In the Habovské Bory peat-bog two rare species of the genus *Anabaena* Bory were observed: *A. lapponica* Borge and *A. tatarica* Kossinskaja.

An enigmated glaucophyte species, *Chalarodora azurea,* described by Pascher in 1929 from the *Sphagnum* littoral of a fishpond near Doksy, Bohemia, was found in the peat – bog Klin. Solitary broadly oval to ovoid cells were attached by one slightly attenuated end to the filaments of nostocalean cyanobacterium *Hapalosiphon fontinalis* (Agardh) Bornet or to the detritus. The protoplast was conspicuous by many parietal, short sausage–like cyanelles of bright blue–green colour and sometimes by a brownish to brown mucilaginous envelope; it contained two contractile vacuoles in antapical part and one central nucleus. Protoplasts divided longitudinally into two daughter cells which were liberated through a longitidinal rupture of the mother cell walls and envelopes. The species was originally classified in the tetrasporalean algae (Chlorophyceae), but is presently regarded as a representative of the Glaucophyta.

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AEROPHYTIC EPILITHON OF PHOTOSYNTHETIC MICROORGANISMS OVERGROWING CONCRETE WALLS OF A COOLING TOWER OF THE POWER PLANT AT BEŁCHATÓW, CENTRAL POLAND

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Diversity of photosynthetic microscopic epilithon in a sample taken in March, 2006 from concrete walls of a cooling tower of the power plant at Bełchatów, Poland, is presented. The aerophytic assemblages were strongly dominated by Scytonema myochrous (Dillwyn) Agardh, a nostocalean cyanobacterium, while other cyanobacteria or phototrophic microorganisms occurred very sporadically and in small abundance. Morphology of trichomes of S. myochrous growing in the field material and that of cultivated in laboratory conditions was considerably different. While the trichomes from field material were long, markedly sheathed, intensively brown, without ramification and with cylindrical cells/heterocytes, trichomes cultivated in laboratory conditions were larger but short, with thin, hyaline and not layered sheaths, commonly ramified, and cells/heterocytes were discoid.

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THE DIATOM FLORA OF THE PEAT-BOG KLINSKÉ RAŠELINISKO IN ORAVA, N SLOVAKIA

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Diatom assemblages from *Sphagnum* raised Klinské rašelinsko peat-bog in the Orava region, Northern Slovakia, has been studied under light and electron microscopes. The study area is a part of Protected Landscape Area of Upper Orava, which is up to present day essentially influenced by human activities, namely of the neighbourhood agricultural activities, as well as by the naturall attack by seeding of woody plants. Despite of various cumulative endangering activities, mostly excessive level of human disturbance, a specific diatom flora could be retained.

After 58 years from the last algological investigations, a detailed floristic diatomological study of the peat-bog Klinské rašelinisko is presented. Some of the diatoms observed by Fott (1952) and Juriš (1955) were affirmed again, however, a major part of list of diatoms was completed. The most rich genera at the Klinské rašelinisko peat-bog were represented by *Eunotia* and *Pinnularia*, the most rich populations were formed by species *Tabellaria flocculosa, Frustulia crassinervia, Brachysira brebissonii, Gomphonema gracile* and *Encyonema gracile*. The main part of algological material was collected from the squeezing of *Sphagnum* and thalli of the various algae and vascular plants. The examination of other parts of the peat-bog, e.g. sediment from the bottom of depressions, would increase the number of diatom taxa living in this biotop.

Comparing the diatomological studies of the *Sphagnum* peat-bogs in Poland (Wojtal, Witkowski & Metzeltin 1999, total 87 taxa in 26 genera), our list of taxa obtaines merely 37 diatom taxa belonging to the 17 genera, however, 9 taxa are new to the flora of Slovakia. On the other hand, Nováková & Poulíčková (2004) registrated low species richness of the moss diatom flora of the Nature Reserve Adršpašsko-Teplické Rocks in the Czech Republic.

A management of nature protection is needed to retain the remaining parts of peat-bog´s unique ecosystem in this area. This is not only an assumption, but also the requirement for the future observations of the Klinské rašelinisko peat-bog.

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PHYTOPLANKTON METRIC FOR POLISH LAKES – NEW APPROACH IN THE ECOLOGICAL STATUS ASSESSMENT FOR ROUTINE MONITORING

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The multimetric "Phytoplankton Metric for Polish Lakes" (PMPL) is the phytoplankton-based method in the ecological status assessment of lowland lakes in Poland. It was elaborated on the order of the Chief Inspectorate for Environmental Protection and it is still being developed. The presented method was developed on the basis of the large phytoplankton database including 2033 chemical and phycological results from 264 lakes (monitoring and scientific data). The PMPL includes three constituent metrics: "Chlorophyll a", "Total Biomass" and "Biomass of Cyanoprokaryota" calculated according to the specific mathematical formulas regarding abiotic typology of Polish lakes. The final value of PMPL is an average obtained from three metrics. The quality classes with equal ranges provide five categories for ecological status assessment with the demands of the WFD: high, good, moderate, poor, bad.

New PMPL method was tested using phytoplankton data obtained during studies of ten lowland lakes in the Wel river catchment (Central Poland) between April and October of 2009. Phytoplankton and chlorophyll a samples were collected from sixteen pelagic stations at the deepest parts of lakes and were analysed according to standard methods.

Simultaneously, the other Biological Quality Elements (macrophytes, phytobenthos, macroinvertebrates, fish), physical-chemical and paleolimnological studies (dating ^{210}Pb, algal pigments and diatom analyses) were conducted. The ecological status assessment based on these data was very useful to verify the PMPL. Evaluation of the uncertainty of the chlorophyll *a* and phytoplankton biomass results in three lakes and determination the

comparative error of mean phytoplankton biomass and chlorophyll *a* results (used to calculate the metrics "Chlorophyll *a*" and "Total Biomass") indicated a possibility to modify the multimetric PMPL equation.

The phytoplankton-based method elaboration was financed from the *Chief Inspectorate* for Environmental Protection and the study of lakes in the Wel river catchment from Norway Grants within the Norwegian Financial Mechanism (Project No. PNRF – 220 – A I – 1/07)

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„*CYANOBACTERIA* OF SELECTED LAKES IN THE WIELKOPOLSKA REGION. SPECIES IDENTIFICATION AND ASSESSMENT OF TOXICITY, USING MOLECULAR METHODS"

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All morphological features of *Cyanobacteria*, which can be verified by microscopic analyses, were until recently the base of current taxonomy. Unfortunately, more and more often they become insufficient in many research, in which enormous diversity and phenotypic variability of organisms, caused by external factors, play important role. One of such cases is cyanotoxin production by only part of strains of known species, present in the lake.

An increasing number of reports on water blooms caused by algae and poisoning caused by cyanotoxins became the reason for the thorough analyses, which allow the scientist to understand this problem better. Research was started also in Poznan, at the 6 local recreational lakes in 2004. During the study, frequent cyanobacterial water blooms were observed in these lakes, caused by potentially toxic species. Beside qualitative and quantitative analyses of species composition, HPLC detection of four microcistins were done. In 2009, an attempt to isolate some taxa from the environment and keep them in culture was made. Then the analyses of their phylogeny and properties for toxin production were made, using techniques of molecular biology.

The polymerase chain reaction (PCR) method was used, as it is the most frequently used method for the biochemical identification of organisms. It enables the specific amplification of a section of DNA and RNA, by using two primers, which are complementary to the matrix. Sensitivity of this reaction asserts not only the precision but also the quick estimation of the potential risks and removes the problem of phenotypic variability, which is determined by adaptation to environmental conditions.

After the identification of species, for example: *Microcystis aeruginosa*, *Planktothrix agardhi*, and *Calothrix sp*., tests were made for the presence of clusters of toxicity. The specific primers for *mcyA-C*, *mcyE* and areas of synthesis PKS and PS were used for this purpose. The presence of clusters *aoaA-C*, which could confirm synthesis not only cylindrospermopsin but also anatoksin, was checked. The possibility of neurotoxin production was not confirmed in any of samples in contrast to microcystin-LR which was secretioned by one of the strains.

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DELIMITING SPECIES FROM TWO MORPHOLOGICALLY SIMILAR GENERA – *EUGLENA AND EUGLENARIA* (EUGLENIDA)

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Based on molecular data and the results of phylogenetic analysis, a new genus *Euglenaria* Karnkowska, Linton & Kwiatowski has recently been excluded from the genus *Euglena*. The key argument for isolating the genus *Euglenaria* was provided by the results of phylogenetic estimations, while the genus had been described only based on molecular characteristics. Five taxa from the genus *Euglena* Ehrenb. have been reclassified to the new genus, but no suitable morphological diagnostic features were found for the *Euglenaria* genus. The spindle-like body shape and the presence of numerous lobed parietal chloroplasts with "diplopyrenoids", occur not only in reclassified taxa, but also in several other species of the genus *Euglena*. Our study fills this void and at the same time broadens the scope of research carried out to include species from the *Euglena* genus, morphologically similar to *Euglenaria*, and traditionally included within the group Catilliferae (Pringsheim 1956).

Morphological and genetic analyses of species with similar morphology belonging to the genera *Euglenaria* and *Euglena*, in relation to the data found in the literature, point to morphological features that make it possible to distinguish between the individual taxa. *Euglena granulata,* as the only species in this group, has spherical mucocysts. *Euglena velata* is distinguished by the largest cells and has the highest number of chloroplasts. *Euglenaria anabaena* has the fewest chloroplasts, and its cells are spindle-shaped, in contrast to the cells of *Eu. clavata*, which are club-shaped (clavate) while swimming. *Euglenaria caudata* is characterized by asymmetrical spindle-shaped cells.

However, we realize that these morphological differences are extremely subtle and that inexperienced researchers may continue to have problems with performing the identification correctly. In such cases, molecular characteristics may prove to be a great help.

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DISTRIBUTION OF HEPATOTOXIC CYANOBACTERIAL BLOOMS IN POLAND

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Cyanobacteria are found throughout the world in terrestrial, freshwater and marine habitats. Approximately 15 cosmopolitan bloom–forming cyanobacteria (e.g. Microcystis) are widely distributed throughout Europe. Some of the strains belong to toxin-producers. However, a certain geographical diversity can be observed, e.g. Dolichospermum (Anabaena) mainly occurs in Scandinavian countries, Planktothrix in Germany, Belgium and Luxemburg, tropical species of Cylindropermopsis are mostly recorded in the south part of Europe. For Nodularia the Baltic Sea is a main habitat. The aim of this study was to analyze the occurrence and biomass of potentially toxic cyanobacteria in different Polish water bodies.

In August and September 2009 cyanobacterial field samples were collected from 20 lakes (mainly Wielkopolska and Pomeranian regions), the Baltic Sea and the Vistula

Lagoon. Cyanobacteria were identified and counted microscopically. Identification and quantitative analyses of toxins were performed with HPLC, LC-MS/MS technics and ELISA, PPIA methods. In lake samples, *Planktothrix* and *Aphanizomenon* were the most frequent bloom formers, followed by *Microcystis* and *Dolichospermum* genera. *Cylindrospermopsis raciborskii* occurred only in 50% of the samples collected from Wielkopolska region but never dominated in phytoplankton. In this study, cyanotoxins were recorded in 33% of lake samples. Microcystin (MC) variants were characterized by LC-MS/MS based on mass to charge ratio (m/z) of molecular ions and their fragmentation spectra. In the samples following MC analogues were characterized: MC-RR, [D-Asp^3]MC-RR, [D-Asp^3]MC-LR, [Asp^3]MC-HtyR; [Dha^7]MC-YR; dmMC-FR; [Dha^7]MC-WR, MC-LR and MC-YR. The maximum MCs concentration in the samples amounted to 40 µg/L. *Nodularia spumigena* as well as nodularin (up to 42 mg/L) were present in 8 per 45 (4%) samples collected in summer from the Baltic Sea. The analyses were performed during IV Polish Cyanobacterial Workshop in September 2009 organized by Regional Centre of Cyanobacteria in Institute of Oceanography.

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PAST, PRESENT AND THE FUTURE OF THE *CYLINDROSPERMOPSIS RACIBORSKII* IN WESTERN POLAND

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Cylindrospermopsis raciborskii (Woloszynska) Seenayya and Subba Raju has recently attracted wide attention due to its toxigenicity and rapid invasion capabilities into new geographical regions. It is a filamentous, planktonic cyanobacterium that occurs in freshwaters and is a common species in tropical and subtropical regions. Blooms of *C. raciborskii* have been mainly reported from North and South America or Australia. However, it is also known to have invaded temperate zone habitats since the late 1960`s. It is of increasing concern due to its ability to produce highly toxic alkaloids, including neurotoxic saxitoxins and hepatotoxic cylindrospermopsins. Lately cylindrospermopsin has been detected also in several polish lakes.

Successful expansion of *C. raciborskii* in northern European lakes has occurred along with increasing water temperatures related to climate warming, eutrophication, and its ability to adapt to existing environmental conditions. This cyanobacterium is known from tolerance to variable temperatures and light, high storage capacity for phosphorus and ability to fix atmospheric nitrogen.

The first record of *C. raciborskii* in Poland was in 1973 in lakes that were artificially heated by electrical power plant. Than it was rarely observed in polish lakes. Recently, it was shown to occur more often in shallow, eutrophic, polymictic lakes of the Wielkopolska region in western Poland. The latest study indicated a broader distribution in the temperate zone of this region than was previously recognized. Although *C. raciborskii* was never a dominating species in the algal community its increasing contribution to phytoplankton biomass has been observed. It occurred in lakes that varied in their environmental characteristics, but the shallow and eutrophic lakes seem to be more preferred by this cyanobacterium rather than deep, stratified lakes with lower productivity. Therefore, further enhance of its contribution in these lakes is very likely in the near future.

The financial support was provided by Polish Ministry of Science and Higher Education through research grants: No. N 304 051 31/1855, N N 304 020 437.

CHANGES IN THE CYANOBACTERIAL SYSTEM BASED ON MODERN POLYPHASIC (MOLECULAR AND PHENOTYPIC) APPROACH

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Taxonomic classification is a method for recognition and registration of the diversity of various groups of organisms. The taxonomy of cyanobacteria has been substantially changed in the last decades, in agreement with the continually developed knowledge about evolutionary and ecological variation of cyanobacterial taxa. The current system must be therefore continually corrected and correlated with biochemical, ultrastructural, phenotypic and ecological data.

The methodology of the modern cyanobacterial taxonomy is based on molecular investigation of the phylogenetic relations, which are accepted as the basic criterion for the revision of the cyanobacterial system. Numerous phenotypic and ultrastructural markers are in coincidence and in correlation with the genetic background, but it was found that they must be re-evaluated in many cases. It was also found that the ecological adaptation and the following ecophysiological and biochemical modifications play an important role in the process of diversification of various populations. The relatedness of populations from restricted geographical areas was proved. The logical methodological premise is that the so called "polyphasic approach" is the main guideline in modern taxonomic work in cyanobacteriology. The molecular analyses must be a baseline for the re-evaluation of genera and species, but they should be also in agreement with cytomorphological and ecological variation of cyanobacterial genotypes (the definition of autapomorphic characters in extremely important). The presentation summarizes the main conclusions, which are important for the modern cyanobacterial classification.

In the presentation will be explained the main recent changes in cyanobacterial system and the guidelines for future development.

PHYTOPERIPHYTON COMMUNITY STRUCTURE AND DISTRIBUTION IN RIVERS FLOWING INTO BARENTS SEA

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The structural organisation of phytoperiphyton in 11 rivers of Barents Sea cost is described relying on the results of multiannual surveys. In total, 80 genera and 311 species were identified from different substrates, belonging to Cyanophyta (61 species), Bacillariophyta (205), Chrysophyta – (2), Chlorophyta (40) and Rhodophyta (3).

The taxonomic diversity of phytoperiphyton in the rivers studied, like that of any natural phytochoria, is due to the zonal position and history of the region, as well the landscape characteristics responsible for the morphometry of waterbodies. Most of the dominating algal species identified are typical of cold, oligotrophic waterbodies of Northern Europe.

The biomass of the attached communities is strongly dominated by green algae. Among them, filamentous algae Mougeotia sp., Oedogonium sp., Zygnema sp., Spirogyra sp. and Ulothrix zonata formed mass development in the streams. Their distribution in the watershed was patchy, with a total cover varying from less than 1 to 60% of the streambed. The most common was Zygnema, occurring in about 50% of the localities surveyed.

The most frequent species, found at about 50% of all stations, were *Achnanthes minutissima, Ceratoneis arcus, Cymbella affinis, C. silesiaca, Eunotia pectinalis, Frustulia rhomboides* and *Tabellaria fenestrata*, but only *Tabellaria flocculosa* was a persistent species found in all samples. In addition to the above mentioned species, genera *Gomphonema, Stigonema, Synedra, Tolypothrix* and *Zygnema* were most persistent. These taxa form the basis of the dominant complex of algal cenoses and represent a "*northern*" type of algal flora. Most species identified are epilithic and epiphytic algae, typical attached, colony-forming euperiphytic forms, morphologically adapted to settled life, prevailing

in all samples. However, most of the species are rare or very rare, i.e. have a frequency less than 2%, and some species were found in singular samples only. Those were mainly planktonic and benthic, non-attached forms.

Analysis of heavy metals (HM) concentration in phytoperiphyton makes it possible to evaluate their concentrations in the water body and identify polluted regions, streams, and their reaches. Higher HM concentrations in alga tissues were recorded in the same watercourses, for which higher concentrations in water are typical.

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PAST AND RECENT STUDIES ON *PEDIASTRUM* MEYEN (CHLOROPHYTA) IN POLAND

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It has been more than 180 years since Franz J.F. Meyen described the genus *Pediastrum* (Chlorophyceae, Sphaeropleales, Hydrodictyaceae) in 1829. Until recently the taxonomic systems of the genus have been based mainly on morphological characters, which are very variable. This is one reason why more than 350 names of *Pediastrum* species, varieties and forms have been given. Most of the names are synonyms. Modern taxonomic studies and classifications rely on morphological, ultrastructural and molecular characters. In the most recent *Review of the green algal genus Pediastrum: implications for pollen analytical research*, 24 species, 43 taxa of the genus if varieties are included, are described by Komárek and Jankovská.

There has been a great need to put the terminology of Polish *Pediastrum* taxa in proper order. In the *Catalogue of Polish prokaryotic and eukaryotic algae* about 160 *Pediastrum* names published up to 1990 are cited by Siemińska and Wołowski. Studies on field and cultured materials as well as analysis of the literature data between 2008 and 2010 presented an opportunity for taxonomic revision of the genus in Poland. Up to 2010, 200 *Pediastrum* names were used by Polish phycologists, only 32 of which (including 19 species names) are valid now. Among the 23 *Pediastrum* taxa from field materials, *P. musterii* is a new species for Central Europe and *P. privum* is reported from Poland for only the second time. Our taxonomic studies showed that *P. boryanum*, *P. duplex*, *P. simplex* and *P. tetras* are the most variable Polish *Pediastrum* species. The changes in their morphology are connected with age and environmental factors. On the basis of scanning electron micrographs, 7 types of cell walls in *Pediastrum* were identified. New ornamental characters were observed in several taxa.

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LAKE BAIKAL DIATOM STUDIES: CURRENT APPROACHES AND NEW PERSPECTIVES

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The diatom assemblages of Lake Baikal received much attention in early years of the 20th century. Intense taxonomic studies resulted in the description of more than three hundred species and infraspecific taxa all new for science (e.g. Dorogostaisky 1904, Skvortzov & Meyer 1928, Meyer 1930, Skabichevsky 1936, Skvortzov 1937). Taxonomical, morphological and floristic works were later continued by Skabichevsky (1952, 1975, 1981, 1983, 1984, 1985, 1987), Foged (1993), Williams (2004), Williams et al. (2002, 2006), Flower et al. (2004), Williams & Reid (2006), Genkal et al. (2008), Pomazkina et al. (2008). Centric diatoms are the best studied group of the Lake Baikal diatom flora. Taxonomy and morphology of recent and fossil centric diatoms was studied for a period exceeding one hundred years. Results of the tremendous research on the biodiversity and on evolution of centric diatoms were summarized in two recently published books (Popovskaya et al. 2002, Kuzmin et al. 2009). The situation is different regarding the pennate diatoms of Lake Baikal. Despite the high number of publications, to date, the pennate diatoms were less extensively studied (Kulikovskiy et al. 2011a,b). In this presentation we discuss history of diatom studies from Lake Baikal with comments on the state of the art. Our own investigations reveal species rich diatom assemblages in recent and fossil sediments. Here we also attempt to outline the new perspectives for the coming period with respect to studies of species composition, taxonomy, morphology and evolution of this fascinating microscopic eukaryotic organisms.

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UNIQUE DIATOM FLORA OF THE HUNGARIAN SMALL SALINE LAKES

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In Hungary, saline lakes can be found on large areas of two hydrological basins. One is the Duna-Tisza interfluve and the other is the area around the Neusiedlersee. These lakes are very special habitats, why from the nature conservation point of view these small saline lakes are specially important. However, diatom communities and ecological process of these lakes are less known.

These lakes have special physical and chemical features, why these small lakes have a special diatom flora. Most of the lakes may dry out completely by late summers. Their conductivity is high, it ranges from 3000 to 30000 μS cm^{-1}, and the dissolved organic phosphate concentration is also very high due to the guano of the migratory birds. The Secchi transparency is often only a few centimeters because of the inorganically turbidity. All of these features determine the biota of the small saline lakes.

In 2006 and 2008 altogether 91 diatom and water samples were carried out from small saline lakes in Hungary. The following species were found in the most samples: *Nitzschia austriaca*, *Nitzschia frustulum*, *Navicula veneta*, *Amphora veneta*, *Craticula buderi*. However, there were some species which occured only in one or two samples for example: *Nitzschia pusilla, Surirella brebissonii, Navicula cinta, Nitzshia vitrea, Nitzschia claussi, Navicula cari, Navicula oblonga, Ctenophora pulchella, Aneomastus tusculus, Aneomastus apiculatus*, *Nitzschia supralitorea, Amphora subcapitata, Rhopalodia gibberula*. The typical saline species were *Craticula halophila, Craticula halophilioides, Anomoeoneis shpaerophora, Navicula pygmea, Navicymbula pusilla.* These habitats allow only low--diversity assemblages because of the physical limitation.

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CYANOBACTERIA AND EUKARYOTIC ALGAE IN THE MIDDLE SECTION OF THE WARTA RIVER (POLAND)

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Introduction: The Warta River is a lowland, medium-sized, third longest river in Poland. In summer, an intensive growth of phytoplankton, main cyanobacteria causing a waterbloom is observed. It also appears in the Poznań Water-Gap. This phenomenon had not been noticed before the reservoir Jeziorsko was built in the middle course of the Warta River. The main aim of this study was to come to know the changes in the taxonomical structure of phytoplankton, its amount and biomass in the Warta River (from the Jeziorsko Reservoir to the city of Poznań) during an intensive occurrence of cyanobacteria.

Methods: The water samples were taken on July 28, 2009 from the current (on 504 – 243,65 km section of river). One of the stations was situated upon the river inflow to the reservoir Jeziorsko (station 10) and the rest of stations were placed below the outflow (stations 1–9). Samples for study of nano- and microplankton (>2 μm) were preserved with Lugol solution and analyzed using an inverted microscope after sedimentation. Water for picoplankton (<2 μm) study was preserved with glutaraldehyde, concentrated on 0.2 μm pore Nucleopore filters and analyzed with the epifluorescence microscope.

Results and Conclusion: Upon the river inflow to Jeziorsko, the dominance of *Chlorophyceae* in the biomass and cell abundance was noticed. *Desmodesmus communis* was the most numerous taxon there. Below the reservoir the most important groups were nano- and microplanktonic cyanobacteria with the main taxon – *Aphanizomenon flos-aquae*. Next significant group were diatoms. Their abundance was quite unstable on the investigated section of river. The main representatives were centric diatoms (*Aulacoseira granulata, Cyclotella meneghiniana, Stephanodiscus* spp.). Picoplanktonic cyanobacte-

ria and green algae were not abundant, and their contribution in the total biomass of phytoplankton was insignificant. The study shows that the Jeziorsko Reservoir plays an important role in forming the cyanobacteria and eukaryotic phytoplankton in the middle section of the Warta River.

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CELL IMMOBILIZATION TECHNIQUE AND ITS APPLICATION IN BIOLOGICAL TESTS ON MICROORGANISMS OF BALTIC SEA

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Microorganisms (algae, bacteria, cyanobacteria) play crucial role in aquatic ecosystems due to their position in aquatic trophic chain. On the other hand the use of those organisms in biological or biotechnological laboratories, cosmetic, pharmaceutical and food industries keeps increasing. Culturing and handling of their biomass suspended in medium may consume time and resources therefore various cell immobilization techniques have been developed and upgraded throughout the years.

One of the most common technique is gel-entrapment with use of natural polysaccharides as gelling agents. Sodium alginate, isolated from species from genus *Laminaria* and *Sargassum,* is one of such polysaccharides. It is a linear polymer build by two block--forming monomers - β-D-mannuronic acid and α-L-guluronic acid – and it forms gel instantly in presence of some metal ions (e.g. Ca^{2+}, Br^{2+}, Sr^{2+}). Composition and length of such blocks impacts gelling abilities of alginate. Due to its lack of toxic interactions with living cells, permeability, transparency and quick formation, sodium alginate its most widely used gelling matrix for immobilization of microorganisms.

Our goal in these studies was to test possible use of immobilization of living cells (entrapped in alginate beads) for various studies on microorganisms from different groups (bacteria, cyanobacteria, green algae, diatoms) and ecosystems (estuarine, marine). We focused not only on biological but also technical aspects of this method. Our secondary goal was to assembly automated unit capable of creating identical, possibly small beads which could also be applied to work in sterile conditions.

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THE USE OF DIFFERENT ECOLOGICAL REQUIREMENTS OF PHYTOPLANKTON SPECIES IN THE WATER QUALITY ASSESSMENT OF POLISH LOWLAND LAKES

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Recently, several new or modified phytoplankton indices were elaborated by the EU member states to serve the needs of WFD (2000/60/EC, EU 2000). The aim of the study was to analyze the sensitivity of phytoplankton-based assessment systems to changes in the taxonomic structure of planktonic algae communities. The newly developed Phytoplankton Metric for Polish Lakes (PMPL), the German phytoplankton lake index (PSI), the Norwegian phytoplankton trophic index (TI) and the Hungarian assemblage index (index Q) were applied. The present results are an attempt to determine how phytoplankton indices correlate with proxies of eutrophication and whether the tested indices are sensitive to phytoplankton seasonal and spatial variability, and identify the influence of taxonomic level determination on the final assessment of the ecological status of a lake. The quantitative and qualitative studies of phytoplankton were conducted on ten lakes of the lowland river Wel catchment (Central Poland). Phytoplankton data and environmental variables were collected from pelagic stations at the deepest parts of lakes monthly between April and November of 2009. A phycological analysis revealed that in summer period (July-September), Cyanobacteria prevailed in the total biomass in the most of studied lakes and, depending on the lake, the dominants included: *Aphanizomenon gracile*,

Anabaena circinale, *Gloeotrichia echinulata*, *Planktothrix agardhii*, *Limnothrix redekei* and *Pseudoanabaena limnetica*. The other groups of algae reached higher abundance in spring and autumn (Bacillariophyceae – the order Cenrales, Cryptophyceae – *Cryptomonas* spp., Dinophyceae – *Ceratium hirundinella*, *C. furcoides*). Although the traditional water quality indicators (TP, SD, chlorophyll *a* concentration) classified all the lakes as representing a narrow range of trophy levels, from meso-eutrophy to eutrophy, the phytoplankton indices based on phytoplankton taxonomy demonstrated a clear variation in the ecological status of the lakes. Depending on the applied method, the final assessments of the ecological conditions varied considerably, both among all the lakes and within one lake.

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ALGAE IN HABITATS POLLUTED WITH HEAVY METALS

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Despite the toxic influence of high concentrations of heavy metal/loids (e.g. Cd, Cu, Zn, Pb, Hg, Cr, As) on algae, some of them are able to inhabit degraded and polluted freshwater, marine and terrestrial environments. Algal species richness in metal-polluted sites is very low in comparison with unpolluted ones. Usually, in freshwaters and soils common coccoid and filamentous species of green algae dominate, however some species of other taxonomic groups (*e.g. Eustigmatos* sp, Heterokontophyta) also occur. Some recent data suggest that they are specific ecotypes of increased metal-resistance. In marine polluted environments, beside *Ulva* spp also some Phaeophyceae (*e.g*. *Fucus* spp) and Rhodophyceae are abundant. Mechanisms of their metal-resistance or even tolerance are still poorly known.

Heavy metal-resistance of algae may be a result of limited metal bioavailability and/or intrinsic morphological and biochemical features of organism. Two basic mechanisms may be involved: metal avoidance and intracellular metal detoxification. External cell structures (thick cell walls, multilayer polysaccharide envelopes) or regulated ion transport system may prevent only some algae from excessive internal metal accumulation. Big vacuoles help in keeping metals in metabolically inactive forms. Non-protein compounds rich in –SH groups (Cys, GSH, phytochelatins) in eukaryotic algae are involved in the intracellular metal binding and subsequent transfer to vacuoles or outside the cell. They are also able to scavenge reactive oxygen forms responsible for oxidative stress caused by metals in cells. In Cyanoprokaryota and Phaeophyceae metallotionein-like proteins can immobilize metal ions. Other mechanisms (*e.g.* increased enzymatic antioxidant activity, carotenoids) may also protect algae from metal toxicity.

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STABLE $\delta^{13}C$ AND $\delta^{18}O$ ISOTOPE COMPOSITION OF THALLI AND OOSPORE CARBONATE ENCRUSTATIONS OF CHOSEN CHAROPHYTE SPECIES (*CHARACEAE*)

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Charophytes (*Characeae*) precipitate large amounts of calcium carbonate and, thus, considerably contribute to the marl sediment deposition in lakes. We hypothesize that stable $^{13}C/^{12}C$ and $^{18}O/^{16}O$ isotope ratios in lacustrine carbonates can reflect environmental conditions under which the carbonates were precipitated. To use this specific archive it is necessary to explore the isotope composition of carbonate encrustation of modern charophytes under defined environmental conditions. Analysis of $\delta^{13}C$ and $\delta^{18}O$ isotope composition of thalli and oospore encrustations of chosen charophyte species and water above charophytes with known physical and chemical properties was the aim of the study presented. Material was collected in 3 lakes in W Poland: small mid-forest lakes Jasne (15.1ha, 9.5m) and Złoty Potok (32.8ha, 13.7m) in Ziemia Lubuska region, and large Lake Lednica (339.1ha,15.1m) in Wielkopolska region (all lakes with extensive charophyte meadows and clear waters with moderate fertility). 10 apical parts of 2 species at 2-3 sites per lake and water from above them were collected for isotope analyses monthly between spring and late autumn in 2008 and 2009. Oospores were collected once: at the end of study periods. A year-to-year (for *Chara rudis*), species-to-species (*C. rudis* in comparison to *Chara tomentosa*) and lake-to-lake variability (*C. tomentosa*) was analyzed. Both, carbonate and water isotopic ratios, clearly differentiated the studied lakes. This suggests that lakes conditions strongly determinate the isotopic signatures in carbonates precipitated therein. The differences in isotope ratios between oospores and water were generally greater than those between oospores and thalli carbonates. The pattern of

differences between oospore and water isotope composition was repeatable irrespective to the species studied, lake, site and year of study. Isotope ratios of oospores referred to that of water from spring or early summer months, when the oogonia turned into oospores. It was particularly sound for oxygen isotope ratio.

The study is a part of research project N N305 337534 financially supported by the Polish Ministry of Science and Higher Education in which – in general – 5 species were studied in 4 lakes.

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SPATIAL HETEROGENEITY OF HYDROCHEMICAL PARAMETERS AND PHYTOPLANKTON COMMUNITIES IN CHAROPHYTE-DOMINATED LAKE JASNE (MID-WESTERN POLAND)

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The aim of presented study was to characterize the significance of charophyte vegetation as a factor responsible for spatial heterogeneity of hydrochemical parameters and phytoplankton assembly.

Multidisciplinary investigations of a small (15.1 ha) and shallow (mean depth: 4.3 m) mid-forest and charophyte-dominated Lake Jasne (mid-Western Poland) were carried out. During the peak of vegetation season 2010 quantitative and qualitative structure of littoral vegetation was determined. Basic physical-chemical analyses were performed at 2 selected sites in littoral, above dense charophyte meadows (at 0,5 m and directly above the vegetation developed at 1,5 m of depth) and, as a background, at 2 pelagial sites (0,5 m and 1,5 m -consistent with the littoral sites). At the same sites water samples for further laboratory determinations, including phytoplankton analyses, were collected.

The obtained results revealed that over 60% of the littoral was overgrown by dense charophyte meadows. Out of 10 charophyte species stated, 7 build its own communities. The dominating component of the vegetation are communities build by big *Chara* species: *Chara rudis, Chara tomentosa* and *Chara polyacantha*. Moreover, charophytes were also defining the maximum depth extent of vegetation in Lake Jasne, reaching 7 m.

The physical-chemical and phytoplankton analysis reflected good ecological status of Lake Jasne. High SD visibility (over 5 m), low values of nutrient concentrations as well as high abundance of small flagellate forms of phytoplankton seem to emphasize the significant habitat-forming role of charophytes in this lake.

The results revealed also visible differences of physical-chemical parameters and phytoplankton structure between phytolittoral and pelagial waters as well as in the depth gradient.

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GROWTH OF *CHARA RUDIS* UNDER DIFFERENT LIGHT CONDITIONS

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Stoneworts show a number of morphological and physiological adaptations caused by the availability of light (Schneider et al. 2006; Asaedea et al. 2007). Light is a crucial factor for charophyte growth modifying e.g. internode elongation and the ability to propagate vegetatively. *Chara rudis* A. Br. is a perennial plant which occurs at a depth range from 1.0 to 7.0 m (Pełechaty, Pukacz 2008). Below the optimal light conditions, *C. rudis*, like other stoneworts, propagates vegetatively instead of generatively (Skurzyński, Bociąg 2011, Fernández-Aláez et al. 2002). The aim of this study was to assess the elongation growth and vegetative propagation of stoneworts under different irradiance conditions.

To examine the elongation growth of *C. rudis*, the experiment was carried out in 3 different variants. In the 1st one 20 thallus fragments of *C. rudis* were exposed to optimal light conditions (56.63 μmol $m^{-2}s^{-1}$). In the 2nd one 15 thallus fragments were exposed to an irradiance level lower by about 50% (26.18 μmol $m^{-2}s^{-1}$) than the one used in the 1st variant. In the 3rd one the irradiance level was reduced to 7% (4.19 μmol $m^{-2}s^{-1}$) of the optimal light. After a 7-day preincubation period, the height (distance from the holdfasts to the thallus tip) of each new ramet was measured every 4 days during the period of 7 weeks. The proportion of fragments producing new ramets (the ratio between the number of fragments giving rise to new ramets and number of thallus sections used in the experiment) and the regenerative potential (the ratio between the new ramets produced by a section and the number of thallus sections that resumed growth) were determined.

The fastest elongation rate of new individuals of *C. rudis* was observed under intermediate light conditions (2.8±1.8 cm/4 days). In the optimal irradiance conditions the growth of new individuals was slower and reached 1.3±0.8 cm/4 days. The lowest stonewort growth was found under slight irradiance conditions (1.0±1.2 cm/4 days). There were statistically significant differences between the individuals growing in the 1st and 2nd

variant and in the 1st and 3rd one (Kruskal-Wallis, $P<0.05$). All the thallus fragments of *C. rudis* used in the 1st variant formed new individuals. Their regenerative potential reached 2.5, which means that an average thallus fragment formed 2 new individuals. In the 2nd option, 93% of fragments sprouted but their regenerative potential reached only 1.43. In the 3rd one, 80% of thallus fragments produced new individuals but their regenerative potential was 1.8.

The conducted investigations showed that the stoneworts growing in suppressed light conditions had the highest elongation rate, but their regenerative potential was the lowest. The slowest growth characterized those under the poor irradiance conditions, but their regenerative potential was higher than the one from the 2nd variant. In the optimal irradiance conditions the elongation rate was average and their regenerative potential was the highest.

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THE ULTRASTRUCTURE OF THE CALU 11 STRAIN AND THE ISOLATE OF *EUSTIGMATOS MAGNUS* (EUSTIGMATOPHYTA) FROM BASHKIR STATE NATURAL RESERVE (SOUTH URAL)

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The aim of this research is to study the ultrastructural organization of the strains of *Eustigmatos magnus*: CALU 11 from the Collection of Algae of St.Petersburg (formely Leningrad) University and BGPZ isolate from the soils of Bashkir State Natural Reserve (the Republic of Bashkortostan, South Ural).

The general cellular organization of the two strains are similar. There is only one difference: the cytoplasm of the BGPZ isolate usually contains a large agglomeration of dense, rod-shaped, light formations like elongated vacuoles or starch grains. Cell wall in studied algae is rather thin and has three layers. The outer layer is represented by short perpendicular to the cell surface fibrils. The middle layer is dark dense and like the thin lamella. The inner layer is light, thick and has an amorphous structure; it closely adjacent to the smooth plasmalemma. Chloroplast consists of stacks of long thylakoids collected in groups of three and surrounded by the envelope and endoplasmic reticulum that is not associated with the nucleus. There is a small amount of round plastoglobules. Pyrenoid has a dense, homogeneous structure. It is large, polyhedral, bulging from the inner face of the chloroplast. Pyrenoid does not have lining, naked, however, sometimes is surrounded by different sizes vesicles with lamellate contents. Stigma in the cells locates outside of the chloroplast and consists by randomly distributed osmiophilic globules with different sizes those are not isolated by membranes. The entire mass of the globules is apparently surrounded by a membrane. The nucleus is complex chromocentric, peripheral usually and has a rounded shape often with projections. Nucleolus is central, sometimes dislocated to the

periphery (eg. in autospores). Mitochondria has the tubular cristae. In the cells is a lot of vacuoles. The number and type of vacuoles depend on the stage of cell development. The autospore formation of *E.magnus* was studied in detail. Thus, the set of the ultrastructural characters proves the unique organization typical for Eustigmatophyta.

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DEFINING THE TAXONOMY AND SYSTEMATICS OF *DESMODESMUS* USING A POLYPHASIC APPROACH: EXPLORING THE CONUNDRUM OF PHENOTYPIC PLASTICITY

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Desmodesmus is a cosmopolitan freshwater alga found in ponds and lakes worldwide. The presence of certain morphotypes indicates changing environmental conditions and may be a useful bio-indicator of stress. *Desmodesmus* exhibits cyclomorphogenesis in the field and in culture. Based on field observations, morphotypes (colonies and unicells: both spiny and spineless) have been given different generic and species names despite the fact that they have the same genotype as proven by culture studies. Identification from a field collection is a "snapshot" of the organism at that exact moment in its life cycle and an accurate taxonomic determination can not necessarily be made. There is a proliferation of species names, because a narrow morphological species concept ignores the possibility of plasticity. Phenotypic plasticity is often viewed as problematical, because correlations between environment and phenotype have not always been made. In many cases, the environmental "triggers" have not been identified, axenic cultures and rigorous experimentation are required to *prove* plasticity, and experimental evidence for new taxa may not be accepted, because plasticity is not recognised. There are also problems generating reliable taxonomic keys, because unstable morphological characters are being used. Resolving these problems will require a polyphasic experimental approach, which combines culturing, SEM ultrastructure analyses and molecular analyses to determine the range of morphotypes and genetic variability within and between species of *Desmodesmus*.

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CYANOBACTERIA AND ALGAE IN HUMAN FOOD

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In 2003, an exhibition named "Cyanobacteria and algae in human food" was created in the Moravian Museum, Brno. Its author (O. Skácelová), a museum curator of the algal collection, decided to provide information on algae to the wide public, especially how algae can positively affect human health, can be an important part of our nutrition and serve as prevention against civilisation diseases. A natural beauty of algae is shown in photos, drawings and herbarium items. Their occurrence and ecology, traditional use or reasons why algae were refused during the history of human civilization are described. Today's importance of algae in our diet is explained: algae as a source of vitamin B12 for vegetarians and a tool for cleaning of digestive system especially in cases when people consume too much meat and eat so called "fast food". An attention is devoted to latter--day food supplements made from algae or containing them. Some little-known facts are explained (e.g. the difference between algae and cyanobacteria) and disinformation given by some producers are corrected (e.g., Dunaliella salina being marked as "red seaweed" or "Spirulina" as blue marine alga). Referring to cyanobacteria, an attention is devoted both to traditional Asian specialities (Nostoc, Aphanothece) and today widely distributed "Spirulina"products, including health risk of their overconsumption. The travelling exhibition "Cyanobacteria and algae in human food" has been presented in a dozen museums in Czech Republic till now. Meals containing algae are served during opening ceremonies and also recipes are available to visitors. School trips can check gained knowledge answering questions of amusing tests.

A shortened version of exhibition is presented occasionally during lectures and discussions about algae as a part of our diet (at schools, student seminars, courses for graduated limnologists and also on the programs of the European Museum Night). In the last version of exhibition, information about algae used in cosmetics is added.

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DIATOM INDICATORS OF ENVIRONMENT IN THE FELENT CREEK (SAKARYA RIVER BASIN), TURKEY

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Diatoms are an important group of aquatic ecosystems, they form a large part of the benthos (often 90–95%) that is why they could become an important part of water quality monitoring. Totally, 117 taxa were identified between June 2006 and February 2007 from 5 stations along the creek. Species richness was rather stabile in each station over study period. All revealed taxa were can be used as environmental indicators. In relation to salinity indication, the diatoms of the Felent Creek are divided into four group comprising 84 indicator species (71.8 %) mostly of which affiliated to indifferents group and indicate low salinity environment. In respect to organic pollution indicators most of species were Class II and Class III that testifying to a medium concentration of organic substances in the river. Indication of water streaming and oxygenation on the 87 (74.4%) indicator species reflects moderate rates of low streaming water. Five groups of acidity indicators comprise 104 (88.9%) species and reflect low alkaline water with alkaliphiles predominate in communities over all river channel. CCA analysis showed that Craticula ambigua, Nitzschia vermicularis, Pinnularia borealis, Surirella tenera and Hantzschia amphioxys associated with temperature conductivity and Gyrosigma spencerii and Neidium iridis were high correlated with pH. Few species can be used as season indicators in communities of the creek: Stauroneis smithii and Luticola nivalis were abundant in winter communities and never present in summer, whereas Planothidium lanceolatum was found in all stations but never present in winter.

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PHYCOLOGICAL RESEARCH IN LAKE STRZESZYŃSKIE (POZNAŃ, POLAND): A REVIEW

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The history of phycological studies of Lake Strzeszyńskie reflects some general trends of development of such investigations in Poland Europe. They started from studies of single classes of algae, followed by research of the whole phytoplankton, and the methods used have progressed from morphological to molecular analyses. Initially, single environmental factors were monitored at a single trophic level, while currently a wide range of factors and trophic levels is taken into account. Results of such complex investigations are next used for modelling, evaluation, prediction of future development, and protection of this aquatic ecosystem. Lake Strzeszyńskie has an over 100-year-long history of phycological research, varying in frequency and scope. The first study, concerned with diatoms (Bacillariophyceae), was conducted by Torka (1909). In the lake littoral zone, he found 50 species, mostly of the genera *Navicula* (13 species) and *Cymbella* (3 species). In the growing seasons of 1949 and 1950, Dąmbska (1952) made the first observations of Charophytes in this lake. She reported 6 species of this group. The whole phytoplankton was studied in detail in the late 1970s and 1980s (Szeląg-Wasielewska 1991). The community was then composed of about 236 taxa. In respect of species diversity, the most important were diatoms (86 taxa), green algae (60), and chrysophytes (34). At that time, many topics concerned with phytoplankton were studied, e.g. seasonal variation, size fractions, relationships between environmental factors and both abundance and biomass. These studies, on a smaller scale, were continued in the 1990s. In 1999, they were expanded to include the smallest size fraction of the phytoplankton, i.e. picoplankton (Szeląg-Wasielewska 2004). Current research is focussed on the presence of picoplanktonic cyanobacteria and their colonies. In 2011, molecular methods will be used to identify their species composition.

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CYANOBACTERIA AND THEIR INFLUENCE ON ZOOPLANKTON, ZOOBENTHOS AND ICHTHYOFAUNA IN THE HYPERTROPHIC LAKE SYCZYŃSKIE (E. POLAND)

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Three-year study on development of Cyanobacteria in the hypertrophic Lake Syczyńskie and its consequences for zooplankton, zoobenthos and ichthyofauna was the aim of this work. Share of Cyanobacteria in phytoplankton community was analyzed. Microcystins (MC) and anatoxin-a (AN-a) were determined by means of GC-MS and HPLC in phytoplankton biomass, filtered water and some lake zoobionts. Ecotoxicological experiments, with pure AN-a, MC-LR and cyanobacterial extracts were carried out on planktonic crustaceans (Cladocera, Copepoda) and benthic Chironomus sp.

In 2006 and 2008, the AN-a-producing (0.05 – 3. 72 µg intracellular AN-a/l of water) Anabaena spp. (e.g. A. lemmermannii, A. flos- aquae) and Aphanizomenon issatschenkoi as well as other Cyanobacteria (Aph. gracile, Planktothrix agardhii, Planktolyngbya limnetica and Limnothrix redekei) developed abundantly in the lake (>1 x 106 ind./l, each). MC-producing P. agardhii dominated (1.38 – 140.22 x 106 ind./l) both in 2006 and 2008 and was found in high densities under ice. Concentrations of cell-bound MC were ca. 2-times higher in 2006 (0.04 – 123.62 µg eq. MC-LR/l of lake water) than in 2008 (0.46 – 67.06 µg eq. MC-LR/l). In 2007, a considerable decrease in Cyanobacteria abundance and biomass as well as MC and AN-a concentrations was observed. Daphnids differed in P. agardhii consumption rate; D. obtusa and D. pulex accumulated MC. Generally, the studied planktonic crustaceans and benthic chironomids were more sensitive to cyanobacterial extracts, containing toxins and other metabolites, than to pure toxins. Chironomus sp. and fish from the lake accumulated both MC and AN-a (e.g. roach up to 6.61 µg

MCs and 4.10 µg AN-a/g FW of liver). In the hypertrophic lake zooplankton, zoobenthos and ichthyofauna were seriously affected by Nostocales and Oscillatoriales producing MC and AN-a, as well as other metabolites.

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ALLELOPATHIC INTERACTIONS – AN IMPORTANT FACTOR CONTROLLING THE GROWTH OF BALTIC CYANOBACTERIA?

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During summer, the Baltic phytoplankton is dominated by filamentous N_2-fixing cyanobacteria (*Nodularia spumigena*, *Aphanizomenon flos-aquae*, *Anabaena sp*.) and accompanying picocyanobacteria (Stal et al., 2003). *N. spumigena* blooms are of a special concern due to its intensity and toxicity. As a consequence of complex environmental factors, bloom dynamics, intensity and taxonomical composition change irregularly from year to year. So far, substantial knowledge has been gathered on the influence of nutrients, weather conditions and water dynamics on the bloom initiation and development. However the role of biotic agents such as allelopathy, competition, predation and viral infections is poorly studied (Ortmann et al., 2002; Suikkanen et al., 2004).

The main goal of our research was to investigate the interactions among different species of cyanobacteria and bacteria.

In culture experiments, the influence of spend media and cell extracts of selected cyanobacterial strains (*Anabaena sp.* CCNP1405, *Nostoc sp.* CCNP1411, *Synechocystis sp.* CCNP1104, and *Aphanizomenon flos-aquae* KAC15), on the growth and NOD-production by *N. spumigena* CCNP1401 were tested. The results of the experiments showed significant activity of intracellular end extracellular compounds produced by *Nostoc sp*. and *Anabaena sp*. We also examined the effect of *N. spumigena* cultures on bacteria and cyanobacteria. For the purpose of these studies bacterial strains isolated from bloom sam-

ples (24) and *N. spumigena* cultures (15) were identified based on 16S rDNA fragments. Changes in microbial community during the *N. spumigena* bloom were screened by Denaturing Gradient Gel Electrophoresis (DGGE). Both inhibitory and stimulatory effects were recorded. What's more the strains isolated from *N. spumigena* filaments showed NOD-degrading activity.

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PHOTOSYNTHESIS OF WINTER PHYTOPLANKTON DOMINATED BY *APHANIZOMENON FLOS-AQUAE* IN LAKE STECHLIN (GERMANY)

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In winter of 2009/2010 *Aphanizomenon flos-aquae* bloomed in the ice and snow covered oligo-mesotrophic Lake Stechlin, Germany, which is a rather unusual event. The species prefers shallow, eutrophic water bodies and the optimum of its population grow can be found above 20°C. The appearance of *A. flos-aquae* at higher latitudes is known and there are some data about its high biomass in winter in temperate lakes, sometimes under ice cover. The unusual winter bloom of *Aphanizomenon flos-aquae* in Lake Stechlin needed research to explore not only its optimum but also the upper and lower light/temperature tolerance limits to understand the winter appearance.

The photosynthesis of the integrated samples was measured with the ^{14}C method at 8 temperatures (2, 5, 10, 15, 20, 25, 30, 35°C). For the P-I measurements the samples were incubated at 9 different light intensities in the range of 0-1320 μmol m^{-2} s^{-1} PAR for 2 hours.

At low light intensities the photosynthesis was in the temperature range 2–5°C the most intensive. This temperature range is similar to the *in situ* temperature in the upper layers of Lake Stechlin in winter. The low I_k enables the development of the DCM in summer, or the active photosynthesis under ice cover at lower light intensities.

The applied low temperatures (2 and 5°C) are the lowest experimental conditions ever, and the results of the P-I and P-T measurements provide novel information about the physiology of *A. flos-aquae.*

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DIATOMS (BACILLARIOPHYTA) FROM 67 SPRINGS IN SOUTHERN POLAND

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Diatoms in springs have received little attention until recently, despite the fact that springs provide specific conditions that cannot be found in any other aquatic system, and remain of great importance in terms of biodiversity, as well as, general environmental changes.

Extensive human modification (e.g., pollution, increasing water consumption, coal mining, melioration works, and agricultural practices) have diminished the water resources, directly and indirectly damaged and reduced the number of springs supplied by them.

Samples were collected from 67 springs, which location spanned from agricultural areas to high mountainous areas (the Tatra Mts) along with altitudinal gradient of 164–1519 m a. s. l. They ranged from mountain low alkalinity, ultraoligotrophic springs through most common bi-carbonate, meso- eutrophic springs to mineral ones with conductivity range from 10 up to 70 600 μS cm^{-1} and oxygen concentration with values from near 0 up to 12 mg l^{-1}. Water temperature and pH values ranged 4.7–8.0 $(26)^0$C and 5.3–8.4 respectively. The species composition of diatoms in the springs was related to environmental conditions. To describe variation in a structure of diatom assemblages with respect to the set of 19 measured environmental variables, Canonical Correspondence Analyses (CCA) was applied. Weighted average (WA) method was used to define species environmental tolerance ranges and their optima. The bi-carbonate, mesotrophic springs were dominated by common diatoms with a broad range of tolerance. Oligotrophic springs were found to have the highest species richness and diversity, with plenty of species found only here. These springs were dominated mainly by diatoms of the genera *Achnanthidium*, *Psammothidium*, *Tabellaria*, and *Diatoma*, although several other genera have been identified as well represented in terms of species richness. To date, little is known about diatoms in mineral springs. Within the area 20 mineral springs with large amount of carbon dioxide,

hydrogen sulfide, chlorides and sulphates were studied. The springs were dominated by *Achnanthidium minutissimum*, *Caloneis fontinalis* and *Cymbella leptoceros* s.l., *Gomphonema angustatum*, *Achnanthes thermalis*, *Amphora coffeaformis*-complex, *Navicula salinicola*, *N. salina*, and *Nitzschia liebetruthii*. The diatom assemblages from particular mineral springs differed distinctively in composition and structure in response to ionic composition of spring water and/or presence of high concentration of trace minerals.

Although springs make up a small percentage inland water bodies surface, they reflect the influence of natural and human induced changes in their much broader catchments. They have also important contribution in freshwater biodiversity and remain biodiversity refuges.

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THE INFLUENCE OF CYANOBACTERIAL METABOLITES ON GROWTH OF MICROALGAE *CHLORELLA VULGARIS*

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Allelopathy is a natural phenomenon occuring in both terrestrial and aquatic environments. This term refers to any process affecting growth and development of biological and agricultural systems induced by secondary metabolites. Allelochemicals could increase or reduce growth of other organisms, or trigger different physiological responses in target cells. Compared to land systems, knowledge about allelopathic interactions in freshwater and marine systems is poor. The studies about allelopathins are important in connection with their potential influence on aquatic ecosystems and practical application in different branches of industry.

The main concern of this work was to investigate the effect of cyanobacteria *Microcystis aeruginosa* on growth of green algae *Chlorella vulgaris*.

The cyanobacterial and microalgal axenic cultures were provided on respectively 616 (ATCC: 616 Medium BG-11 for blue-green algae) and BBM (Bold-Basal Medium), in 22ºC at continuous light. Cell-free filtrates were obtained by centrifugation (3800 x g, 20 min.), and filtering aliquots of cyanobacterial cultures through the glass-fiber filters (GF/C Whatman). Filtrates were added to batch cultures with target species, controls were made by adding equal volume of fresh medium. Response of *C. vulgaris* to cyanobacterial metabolites was described by cell counts, chlorophyll a and pheophytin concentration and viability measurements.

In this work allelopathic influence of cyanobacteria *Microcystis aeruginosa* on green algae *Chlorella vulgaris* growth was noticed.

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DIATOM COMMUNITY AND THE ECOLOGICAL STATUS OF THE CSIGERE STREAM, HUNGARY

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The aim of this study was to determine the seasonal change in the taxonomic composition of the epilithic diatom communities of the Csigere-stream (Hungary). The samplings were carried out between April and October 2008. Samples were collected in every 3 days in April, than weekly till the end of the sampling period.

In the colonization period the samples were dominated by *Amphora pediculus, Cocconeis pediculus, Cocconeis placentula, Gomphonema olivaceum, Mayamaea atomus* és *Eolimna subminuscula.* In the ripe epilithon *Amphora pediculus*, *Cocconeis placentula* and *Mayamaea atomus* were dominant. *Eolimna subminuscula* was not found in the samples collected in summer. Some species were abundant only for shorter or longer periods. The presence of *Cyclotella meneghiniana* between May and July, of *Nitzschia palea* from June to September and the appearance of *Stephanodiscus minutulus* in May could be related to the regulation of the water level of the fishing pond located on the upper section of the stream.

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INFLUENCE OF CYANOBACTERIAL TOXINS: ANATOXIN-A AND MICROCYSTIN-LR ON FISH IMMUNE SYSTEM

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Hepatotoxic activity of microcystin-LR and neurotoxic influence of anatoxin-a produced by common Cyanobacteria on vertebrates is well documented, however there is a lack of knowledge on the efects of these compounds on the immune system of fish. We initiated novel studies on this subject. The purpose of this study was to assess the *in vitro* influence of microcystin-LR and anatoxin-a on the pronephric leukocytes isolated from common carp (*Cyprinus carpio* L.). The leukocyte suspensions were exposed to these cyanobacterial toxins at different concentrations. The following cell parameters were assessed: intracellular level of ATP, DNA-fragmentation, proapoptotic caspase 3/7 activity. Additionally, the MTT (tetrazolium bromide) test was used to determine the proliferative response of T and B lymphocytes to mitogens: concanavalin A and lipopolysaccharide respectively. Anatoxin-a reduced the intracellular level of ATP in lymphocytes by 30% only at the highest concentration of 10 μg/ml. The DNA fragmentation test showed that anatoxin-a induced apoptosis in these cells at concentrations of 1 and 5 μg/ml. Apoptotic (60%) and also necrotic (40%) leukocytes were detected at the highest concentration of this cyanotoxin (10 μg/ml). Anatoxin-a at concentrations of 0.01, 0.1, 1, and 5 μg/ml stimulated activity of caspases 3/7 in leukocytes. Proliferative ability of T and B lymphocytes was diminished in a concentration-dependent manner after the exposure to anatoxin-a at a range of 0.1-10 μg/ml. Microcystin–LR at higher concentrations (0.5 and 1 μg/ml) induced slight necrosis of lymphocytes. The cyanotoxin at the same concentrations

elevated the activity of lymphocytic caspases 3/7. No suppressive effects of microcystin--LR on the lymphocyte proliferation were noted at any used concentration.

In summary, both cyanotoxins should be considered as natural toxic agents affecting fish immune system. Anatoxin-a but not microcystin-LR has the ability to diminish the lymphocyte proliferation. Anatoxin-a turned out to be a more potent inducer of leukocyte apoptosis than microcystin-LR. The cyanotoxin-induced immunosuppression could increase susceptibility of these animals to infectious and tumour diseases leading to higher mortality and, as a consequence, the disturbance in the prey-predator relationships in aquatic ecosystems and also causing significant losses in aquaculture.

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THE INFLUENCE OF NANOSILVER ON CHLOROFIL *A* FLUORESCENCE OF BALTIC MICROALGAE *CHLORELLA VULGARIS*

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Since many years silver is recognized as a precious metal, used not only as currency and worn as jewelry but also applied in medicine. Silver has been widely used as cutlery and in storage vessels for water and wine due to its antibacterial effects (Luoma, 2008). Nowadays, with the development of nanotechnology, silver in the form of nanosilver is being widely used in industry. Nanosilver is now applied in many products, such as washing machines, dishwashers, sportswear, toys and even in food supplements (Maynard et al., 2006). With this huge interest nanosilver will eventually appear in reservoirs, and among them, in Baltic Sea, hence it is important to assess the effect of this compound on marine microalgae.

In this study modulated PAM fluorometry was used to investigate toxic effect of nanosilver on Baltic green algae *Chlorella vulgaris*. The fluorescence parameters were analyzed after algae were treated with various concentrations of nanosilver and after different cultivation periods (2, 24, 72 hours and one week). The most useful fluorescent parameters for toxicity estimation of nanosilver were F_0 (fluorescence minimal) and F_m (fluorescence maximal). The values of examined parameters depended on the concentration of nanosilver used and the time of exposition.

The concentration of 0.5 μM of nanosilver for *C. vulgaris* after 2 hours of exposure caused F_0 drop to 90%, whereas the same concentration after 24 hours resulted in a decrease of this parameter to 75%. After 7 days the parameter value stayed on the same level, dropping to about 70%. The highest applied concentration (10 μM) after 2 hours of cultivation caused the descent of F_0 to 50%, after 24 hours it reached 20% and maintained this level for the rest of the experiment. The observed drop in the parameters' values provides information about the stressful effect of toxicant on plants. It is also strongly related to the physiological state of microalgae.

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PREBOREAL AND BOREAL DIATOM FLORA FROM LAKES IN SUWALSKI LANDSCAPE PARK (NE POLAND)

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The aim of this study was to investigate fossil diatom flora preserved in the sediments of lakes from Suwalski Landscape Park.

Two sedimentary cores were obtained from the study area and analyzed with respect to siliceous microfossils content. Lake Perty and Lake Kojle are located in NE Poland. The 700 cm long sediment core was retrieved from lake Perty and the 550 cm long sediment core – from lake Kojle.

Samples collected for analysis were taken at 2 cm intervals, each sample was 1 cm3 in volume. Samples of sediments were treated according to Battarbee's (1986) method in order to prepare permanent slides. Over 500 (300) valves of diatoms were counted in each sample. Habitat, pH and nutrient concentration were established based on the literature.

Diatom flora was very poor and represented by a small amount of taxa. There were many species of small sizes.

The analysis deposited in the sediments of Lake Perty and Lke Kojle indicated that water level, trophic status and water pH were subject to changes during Preboreal and Boral periods.

Diatom flora from Lake Perty was dominated by planktonic forms Cyclotella sp.and Stephanodiscus parvus, which prefer alkaline, eu/mesotrophic conditions. Diatom flora from Lake Kojle was dominated by eu/mesotrophic and eutrophic benthic diatoms. The species composition observed in sediments of this lake was dominatem by Staurosira, Staurosirella and Pseudostaurosira species with the accompanying Epithemia adnata and Achnanthidium minutissimum. Mass occurance of small forms Fragilaria is often obserrved in sediments of Younger Dryas and Preboreal period from the lakes in Northern part of Poland. Diatom flora, wchich represented Boral period was dominated by planktonic forms Cyclotella sp. which prefer indiferrent and nutrient-poor conditions.

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THE IMPACT OF TURBULENCE ON CYANOPHYTA BLOOM IN FILTRATION PONDS

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The object of the research was a system of four filtration ponds fed by the waters of the river Warta, found on the area of "Dębina" water intake site in Poznań. These are among the oldest reservoirs on the intake, interconnected in a strictly specified manner.

The research period spanned the season of summer and autumn vegetation. Samples were taken on 2nd and 16th July, 14th and 27th August and on 17th September. The influence of hydrotechnological factors was analysed, with particular focus on the impact of turbulence on quantitative and qualitative changes in Cyanophyta. The data concerning phytoplankton and physical-chemical condition of the water were taken as basis for the analysis of Cyanophyta population changes.

Research results demonstrated substantial impact of turbulence on the development of Cyanophyta biomass, which was particularly manifest in the ponds of final circulation (no. 3 and 3a). A distinctly deficient share of Cyanophyta, in terms of quantity and quality, was recorded in the pond with disturbed water flow (no. 3a). However, the organisms predominated intensively in the adjoining reservoir, where stable conditions existed (no. 3), frequently forming blooms.

The disturbed water flow was coupled with increasing share of cryptophytes. A group of these organisms, found in stress-inducing conditions (r strategy) was visible during the stage of phytoplankton structure transformation, and even played the role of a connector between successive taxonomic groups in the phytoplankton. Such changes were observed when the predomination of Cyanophyta went into clear decline. This phenomenon coincided with qualitative changes in individual groups of zooplankton and changes in the availability of biogenic compounds, orthophosphates in particular. The arrangement of such factors overlapped with the period of development and biomass increase of Cyanophyta.

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ALGAE OF DESNA RIVER AND ITS FLOOD-LAND WATER BODIES OF DESNIANSKO-STAROGUTSKY NATIONAL NATURE PARK (UKRAINE)

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Desniansko-Starogutsky National Nature Park is situated in northeast of Ukraine. Its territory belongs to Novgorod-Siverskyi District of Ukrainian Polissia. 60 algal samples from rivers Desna, Desenka (that is in fact a branch of Desna river) and theirs flood-land water bodies were analyzed.

Total of 354 species (376 intraspecific taxa – intr. taxa) of algae were found. They belong to 153 genera, 81 families, 42 orders, 19 classes and 9 divisions (according to system of higher taxa presented in Algae of Ukraine (2006, 2009) with the exception of Cyanoprokaryota, presented according to J. Komárek and K. Anagnostidis, 2005). Bacillariophyta is represented by 111 species (126 intr. taxa), Chlorophyta – 97 (101), Cyanoprokaryota – 48, Euglenophyta – 32 (35), Xanthophyta – 24, Streptophyta – 19, Chrysophyta – 16, Dinophyta – 5, Cryptophyta – 2 species. Distribution of algal species in different water bodies is following: 158 species (169 intr. taxa) were revealed in Desna river, 99 (104) – in Desenka and 261 (273) – in flood-land water bodies. Bacillariophyta dominated in all types of water bodies but its role was higher in rivers (up to 48.1% from total number of species in Desna) and decreased in flood-land water bodies (31.0%). The dominant (by number of species) genera are *Desmodesmus* (Chodat) An et al., *Phacus* Duj., *Navicula* Bory, *Nitzschia* Hass., *Gomphonema* (Ag.) Ehrenb.

Some species were very abundant in water bodies of national park. For example, water bloom, caused by the abundant growth of *Ceratium hirundinella* (O.F. Müll.) Bergh, is observed every year. Such species as *Geitlerinema acutissimum* (Kufferath) Anagn., *Anabaena subcylindrica* Borge, *Gloeotrichia natans* (Hedw.) Rabenh., *Collacium cyclopicola* (Gickl.) Woron. et T.G. Popova, *Cocconeis placentula* Ehrenb., *Pandorina morum*

(O.F. Müll.) Bory, *Chaetophora elegans* (Roth) C. Agardh et al. were characterized by high index of abundance (3-5 according to K. Starmach, 1955). During our study 21 taxa that are rare for Ukraine were revealed; among them *Anabaena oscillarioides* Bory f. *stenospora* (Bornet et Flahault) Elenkin, *Chrysocrinus irregularis* Pascher, *Chrysopyxis stenostoma* Lauterborn, *Lagynion simplex* (Fott) Fott, *Stephanoporos capillorum* Pascher, *S. scherffelii* Pascher, *Epipyxis lauterbornei* (Lemmerm.) D.K. Hilliard et Asmund, *E. leickii* F. Gessner, *Characiopsis obliqua* Pascher, *Ch. richiana* Pascher, *Chlorarkys reticulata* Pasch are new for Ukrainian Polissia.

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TEMPORAL CHANGES IN PHYTOPLANKTON STRUCTURE OF SMALL WATER BODIES

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In the agricultural landscape of the Wielkopolska Lakeland there are many small, astatic water bodies, with very specific phytoplankton structure. The cyclical nature of temporary waters creates habitats that are distinct from those found in permanent waters. Many astatic waters are repositores for species that do not occur elsewhere. The frequent changes of environmental parameters (due to limited depth and volume) are often reflected in the rich species diversity and the great dynamics of the phytoplankton community compared to large reservoirs. Wiliams (2006) also stated that in intermittent waters, where the dry period is cyclical and predictable, the communities should be species rich and consist almost exclusively of obligate temporary water forms, well adapted to environmental stress. The aim of this study was to examine the structure and temporal changes of phytoplankton communities in small, astatic water bodies (during the hydroperiod and after dry period), with reference to physical-chemical properties of water. Phycological and physico-chemical analyses were conducted from 9 field ponds of the Wielkopolska Lakeland (W Poland). Water samples (180 in total) were collected every two weeks from 11 February 2008 till 11 May 2009, from the surface water layer of open water zone.

In all examinated ponds 328 phytoplankton taxa were recorded in total. Euglenophyta (89 taxa) was the richest group of algal species and often the dominant group in phytoplankton abundance. The major genus was Trachelomonas. The hydroperiod length was different in particular ponds. In 6 of them (where the dry period was in the summer and autumn), great fluctuations in dominating (in abundance) systematic groups of algae were observed. In the other 3 ponds, without dry period during the year, the structure of dominating groups was more stable and phytoplankton community was usually dominated by Euglenophyta and Chlorophyta.

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ANIONS EFFECT ON THE TOXICITY ON BALTIC MICROALGAE OF IMIDAZOLIUM BASED IONIC LIQUIDS

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Ionic liquids are gaining attention as new class of solvents in different chemical processes. Although their physical and chemical properties are promising for industry, however, because of their high stability and solubility in water, they can become persistent pollutants.

The role of algae in aquatic environment is fundamental. In addition those primary producer are very sensitive to chemical compounds. In this study it is elucidated whether anions of imidazolium based ionic liquids are modifying toxic effect on algae strains. *Chlorella vulgaris* is recommended species by OECD guideline for testing of chemicals. Therefore this organisms was used for testing. Additionally, the study with one of the ionic liquid were carry out with three algae species (*Chlorella vulgaris*, *Skeletonema marinoi*, *Synechococcus* sp.) which were grown together in a culture vessel. Measurements of growth in different concentration of toxicants were applied. The results show that all of analyzed ionic liquids are toxic below 100 mg/l. The EC_{50} values were estimated. The most sensitive were analyzed diatom and cyanobacteria species. It indicates that those ionic liquids are potentially dangerous to aquatic organisms.

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NATURAL METABOLITES FROM *ANABAENA* SP. PCC 7120 AS STYMULATORS FOR PLANT GROWTH- PROMOTING

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Cyanobacteria are mainly associated with the problem of toxic blooms, but really they are very diverse group of pioneer organisms. They are able to synthesize and secrete a large number of bioactive compounds that can have a beneficial influence on growth and development of plants. Those compounds are: auxins, gibberellins, cytokines, vitamins, polypeptides and amino acids. Equally important is cyanobacterial ability to produce compounds that inhibit growth of harmful fungi and bacteria, and secrete mucilage and polysaccharides that improve structure and porosity of soil. *Anabaena* PCC7120 was cultivated in 250ml Erlenmeyer's flasks with BG11 medium. Cultures were cultivated in vegetation rooms at 27°C, with constant lighting. Cultures used in this experiment were in log growth phase and had specified number of cells. For experimental purposes BG11 substrate was replaced with distilled water. Homogenate was obtained by disintegrating cells in ultrasound homogenizer. Parameters and conditions for sonification were adjusted experimentally. Obtained homogenates were viewed under the light microscope. The influence of homogenates on seeds germination and growth of seedlings of *Panicum virgatum* was tested in plate and Phytotoxkit experiment. This results showed that the monocultures of Cyanobacteria promoted plant growth and development. We suggest that in the age of the existing climate change will be necessary in the future use of Cyanobacteria for improving the efficiency of seed germination.

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CHANGES IN THE STRUCTURE OF PHYTOPLANKTON COMMUNITIES OF THE LAKES IN THE ŁĘCZNA--WŁODAWA LAKELAND DURING THE PERIOD 1966–2008

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Regular research on the phytoplankton of the lakes in the Łęczna-Włodawa Lakeland started in the 1960s of the 20th century. Extensive data were collected as a result of these long-term studies and one can attempt, on the basis of these data, to determine the changes in the lake ecosystems and the factors affecting these changes.

Twelve lakes of different trophic states and varying levels of transformation, located in different parts of the Łęczna-Włodawa Lakeland, were selected as study sites.

The aim of the present research was to determine the structure of phytoplankton communities in the selected lakes in the years 2007 and 2008 and to compare the obtained results with the data from the previous years, starting from the year 1966. In the studied water bodies, basic physical-chemical parameters of the water were measured as well as the changes in the structure of algal communities and chlorophyll *a* concentration were analyzed.

This phycological study, which investigated the seasonal changes in phytoplankton species composition, was carried out in the summer and autumn of 2007 and 2008.

The data from the present study and their comparison with the results published by other authors over a period of several decades show that the qualitative structure of the phytoplankton communities in the lakes under investigation is constantly changing. In many cases, these changes are slow, while in some other cases they are very dynamic. This is the result of natural factors but, in the first place, this may be affected by anthropogenic factors.

In assessing the natural values of the studied lakes, a part of these lakes can be assigned to the following three groups: lakes with high natural values, characterized by a high degree of naturalness and most frequently located in legally protected areas (Lakes Moszne, Płotycze Sobiborskie, Brzeziczno, Orchów); deep lakes used intensively for tourism and thus vulnerable to degradation (Lakes Piaseczno, Białe); and lakes in which human intervention has caused a strong transformation of their ecological systems (Lake Mytycze). The other lakes are subjected to various anthropogenic effects and responses of particular ecosystems are very individual, depending on the characteristics of a given lake, the surrounding drainage basin, and anthropogenic pressure.

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PERSPECTIVES OF THE PROTECTION OF AEROPHYTIC ALGAE FROM CAVES IN OJCÓW NATIONAL PARK

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The protection of natural environment of very sensitive cave ecosystems is only feasibly on the basis of complex scientific investigations, based on which it is possible to determine the degree of changes taking place in the environment. However, the best results are obtained if the entire populations and ecosystems the most sensitive and strongly endangered are investigated. The protection of caves has a long tradition in Poland (Ponikiewicz 2008, Urban 2006) but practice of algae protection was considered as the most effective one. Biodiversity of extreme cave habitats considered at the level of intrapopulation, interpopulation, interspecific and ecosystematic is important, particularly in the contemporary strategies of nature protection. The contemporary criterion of evaluation and the motivation for the protection of caves are their scientific, practical and esthetic values (Urban 2006). This undoubted diversity of cave habitats characteristics and values cause that they are exposed to numerous dangers (such as: water and air pollution, change of microclimate, and destruction of algae and cyanobacteria growing on the caves walls). In the caves single mosses, liverworts, pteridophytes, vascular plants and mainly the aerophytic algae are most frequently occurring (Dobat 1970, Mulec 2005, Mulec et al. 2008). These organisms often play a key role in the food webs, and in the colonisation processes of rocky habitats causing the colourfull effects on the caves walls (Golubič 1967). These processes are favoured by a usually stable environmental conditions prevailing in the caves. All these factors cause that the caves often attract the cosmopolitan species, in consequence of which the native components are gradually eliminated (Pipan 2005).

The studies were conducted in the spring and summer 2008-2009 on the occurrence, distribution and endangerements of the aerophytic algae developing in the six caves

(Łokietka, Ciemna, Zbójecka, Sąspowska, Krakowska and Biała) of the Ojców National Park. In total 55 of algae taxa belonging to three taxonomic classes (that is *Bacillariophyceae*, *Chlorophyceae* and *Cyanophyceae*) were identified. Beyond taxonomy, ecological studies on cave algae are rare, although caves represent an almost ideal natural laboratory for algological studies with practically constant ecological parameters.

Local monitoring of the caves inside would be aimed at their constant control, and would be able to document the direction of biggest threats (e.g. development of algae on different forms of dripstone formations include flowstones, stalagmites and small stalactites), rational planning and realization such objects protection. But the protection of the natural environment of caves is, since many years, a difficult and important problem to realize effectively.

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THE INFLUENCE OF TWO MAN-MADE RESERVOIRS ON THE STRUCTURE OF PHYTOPLANKTON COMMUNITY

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The aim of our studies was to determine the influence of two distinct man-made reservoirs on the structure of phytoplankton community. Antoninek and Maltański reservoirs, both situated on the Cybina River, were the objects of research. Antoninek Reservoir is a first in a cascade of preliminary waterbodies, with surface area of ca 7 ha and mean depth of 0.5 m, while Maltański Reservoir is the last on Cybina before its inflow to Warta River, with surface area of 64 ha and mean depth of 3.1 m. Phycological analyses were conducted between April and November 2005, samples were gathered every two weeks from two sites – river inflow and outflow of each reservoir. Analyzed man-made waterbodies influenced dissimilarly on phytoplankton communities. Abundances noticed in Antoninek were lower than in Maltański Reservoir and decreased as a result of water flow through the reservoir. In inflowing waters *Cryptophyceae* and *Chlorophyceae* dominated, while in the outflow greater biodiversity was noticed. Waters flowing to Maltański reservoir were abundant in *Chrysophyceae*, *Bacillariophyceae*, *Chlorophyceae*. In the reservoir phytoplankton community structure changed and *Cyanophyceae* prevailed. Addidtionally, phytoplankton abundance increased in comparison with the inflow.

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ULTRASTRUCTURAL CHANGES IN UV-IRRADIATED CYANOBACTERIAL CELLS

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The effects of UV radiation (UV-A, UV-B) on ultrastructure and cell morphology of cyanobacterium *Nodularia spumigena* were studied. Cells were exposed to artificial UV radiation at intensities UV-A – 10 W m^{-2} and UV-B – 0,7 W m^{-2} in a period of 96-hour treatment. Light, scanning and transmission electron microscopic observation of *Nodularia spumigena* cells revealed significant alterations induced by UV irradiance. The UV-A treatment had significant negative effects on integrity of cell membrane. Increased number of lipid inclusions in the cells was also observed. Cultures of *Nodularia spumigena* showed an increase in cell size in response to UV-B radiation. Exposure to UV-B radiation led to breakage of the filaments into small pieces. In contrast no change in filament morphology was observed with the control treatment. The transmission electron micrographs showed disorganization in thylakoid lamellar structure of the cells. Additionally the amount of polyhedral bodies, as well as cyanophycin granules, has increased significantly after UV-B exposure. The distortion of cells and further cell lysis were also documented.

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VEGETATION OF DEEP *CHARA*-DOMINATED LAKES AND ENVIRONMENTAL GRADIENTS (WESTERN POLAND)

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We investigated the relationships between submerged vegetation versus depth of water, light conditions and water chemistry along environmental gradients in two deep Chara-dominated lakes: Budzyńskie and Wilczyńskie (Western Poland). The aim of the study was: (i) to identify the most significant environmental variables of studied lakes; (ii) to compare charophytes and vascular plants with respect to their responses on environmental variables.

In studied lakes 74 sampling sites were randomly selected. The species composition and relative abundance of all species was determined on each site. Simultaneously, water samples for physical and chemical analyses (27 parameters) were taken. Furthermore numerical analyses (DCA and CCA) of the main patterns in the vegetation and environmental data were performed. On the 74 vegetation plots were found 11 charophytes, 13 vascular plants and 2 mosses. Distribution of charophytes was clearly connected with gradient of light (underwater irradiance of PAR, 400-700 nm) and depth of water.

Among the 27 parameters of water only 7 (depth, light, CDOM, suspended solids, temperature, potassium and BOD_5) explained variation of floristic composition of lakes. Two different environment gradients define the occurrence of vascular plants: base-richness (Mg, Ca, alkalinity) and optical features of water (DOM, CDOM, Secchi disc visibility).

The autoecology of 11 charophytes: *Chara tomentosa, Chara rudis, Chara aspera, Chara filiformis, Chara contraria, Chara globularis, Chara delicatula, Chara polyacantha, Nitellopsis obtuse, Nitella opaca* and *Nitella flexillis* was also described. The study provides new look at ecology and typology of deep Chara-dominated lakes in Western Poland.

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THE EFFECTS OF LAKES DRYING – THE CHARACTERISTICS OF SUBMERGED MACROPHYTE VEGETATION, PHYTOPLANKTON STRUCTURE AND LIGHT CONDITIONS IN WILCZYŃSKIE LAKE (WESTERN POLAND)

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The constant drop of total annual precipitation registered in the past 10 years has caused a number of negative changes in the environment. The sinking ground water levels resulted, among others in the diminishing of water reserves in the lakes. Area many of them very reduced, revealed the banks and formed shallows. One of the lakes particularly strong exposed to the processes of drying out is the Wilczyńskie Lake in eastern Wielkopolska (western Poland). The basin of lake is naturally divided into two sub-basins: the deep one (max. depth 22 m) and shallower one (6.5 m). During 10 years the water level of lake dramatic drop – over 4 m. The water loss is probably being further exacerbated by an excessive water drainage into the cone of depression of the nearby brown coal mine. According to the posited thesis, the dropping water level should be accompanied by the increasing concentration of biogenic compounds in the water. Consequently, the risk of phytoplankton blooms would increase as well.

The relationships between light, water trophy and the structure of underwater vegetation and phytoplankton communities were investigated. Moreover, the influence of dry-

ing out on the diversity of phytoplankton and hydromacrophytes, especially *Charophyceae* were analyzed. Sampling and field measurements were conducted in August 2010. Optical features of the water and the depth of light penetration (underwater irradiance of PAR 400-700 nm) were tested using a spherical quantum sensor (LI-COR 193SA).

The phytoplankton communities of the Wilczyńskie Lake were characteristic for mesotrophic and alkaline waters. A significant biocoenotic role of submersed Charophyte meadows and their influence on the lake water quality was showed (Chara meadows occupy 52% of the lake's area). In the both lake basins were noted the strong differentiation of light conditions and water quality. Despite the drastic drop of water level in the deep basin the euphotic zone reached to 9.8 m (Secchi disk 6.8 m) and in the shallow basin to 5.8 m (Secchi disk 4 m). In the shallow basin the higher concentrations of biogenic substances, chlorophyll a and turbidity were found.

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ACCUMULATION AND EFFECTS OF NODULARIN ON ROUND THE ROUND GOBY (*NEOGOBIUS MELAOSTOMUS*)

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The Baltic filamentous cyanobacterium, Nodularia spumigena, is a rich source of nodularin (NOD) a cyclic peptide hepatotoxin. The compound is a strong protein phosphatases inhibitor. Animal poisoning attributed to the occurrence of N. spumigena have been documented in some areas of the Baltic Sea and Australian waters (Sivonen et al. 1999). NOD concentration in cyanobacterial bloom samples from the Gulf of Gdańsk, can temporarily reach over 25 mg/L. The round goby (Neogobius melanostomus), invasive fish species living in the Baltic, is repeatedly exposed to toxic N. spumigena blooms.. There is no data on the effect of sublethal NOD concentrations on the fish.. The aim of the present work was to study the level of NOD accumulation and effect of the compound on the Baltic round goby.

The round goby (three individuals per experimental tank) was treated with *N. spumigena* cell extract containing 500 μg l^{-1} of NOD. After 24, 48, 72 and 168 hours of exposition, gills and liver were dissected. The toxin contents in freeze-dried fish tissues were analyzed by enzyme-linked immunosorbent assay (ELISA) and PPase inhibition assay (PPIA). Glutathione-s-transferase (GST) activity, glutathione (GSH) and protein content was determined in fresh tissues of the fish.

PPIA and ELISA analyzes showed similar trend in the changes of NOD concentration. In liver, constant increase till the end of the experiment (168 h) was recorded. In gills, the highest concentration of the toxin was measured after 24 h and then it decreased during the next 6 days of the experiment.

The highest values of GSH : protein ratio in liver and gills were recorded after 24 h

and 48 h, respectively. During all days of the experiment, GST activity in organs of the fish exposed to *N. spumigena* cell extract was lower than in control (not treated). The highest GST activity was measured after 24 and 168 hours of exposure.

The higher concentration of NOD was determinate in liver what indicates the route of penetration into the body trough digestive system.

The results of the experiments indicate that *N. spumigena* blooms might have an effect on the round goby, at least at cellular level.

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SEASONAL DIVERSITY OF PICOCYANOBACTERIA DERIVED FROM DGGE ANALYSES OF ITS REGION OF RYBOSOMAL OPERON AND *CPCBA*-IGS

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Seasonal diversity of picocyanobacteria (PCy) in lakes belonging to the Great Mazurian Lakes system was studied on the basis of DGGE analyses of two molecular markers: non-coding region of the ribosomal operon (ITS) and part of phycocyanin operon (*cpcBA*-IGS). The study demonstrated seasonal succession of picocyanobacteria in lakes differing in trophic status from mesotrophy to hypertrophy. The results also showed that core-genome molecular marker (ITS) exhibited different succession pattern than phycocyanin operon – a marker better reflecting changes in the environment. Richness (operational taxonomic unit – OTU number), Shannon diversity index and evenness were higher in spring and lower in early and late summer and no statistically significant correlations were found between the studied markers and trophic status or PCy number. There were however significant negative correlations between diversity indices and time. The analysis of PCy community structure in studied lakes demonstrated a higher similarity between communities in lakes of various trophic status at the same time than in lakes of similar trophic status, or even the same lakes, in various time samples. It seems that time, understood as a phase in the vegetation season, was more important than trophic status in shaping the diversity of PCy community.

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PHYTOPLANKTON CHARACTERISTICS OF THE LAKE RESTORED BY THE METHOD OF HYPOLIMNETIC WATER REMOVAL (LAKE KORTOWSKIE, NE POLAND)

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The studies focused on phytoplankton of Lake Kortowskie that is restored by the method of selective removal of hypolimnetic water. The studies were carried out in 2010. Phytoplankton of Lake Kortowskie showed intensive development, variable domination structure and biomass that was a consequence of the two latter features. Algal biomass showed seasonal variations and changed from 8,7 mg/dm^3 to 27,1 mg/dm^3. The highest values were recorded in summer month: in early summer it reached 19,1 mg/dm^3, then increased to 27,1 mg/dm^3 and finally dropped to 17,3 mg/dm^3 at the end of summer. In the summer phytoplankton community *Cyanoprokaryota* and *Dinophyceae* convertibly predominated. The development of these algal groups determined overall phytoplankton biomass as they constituted from 30% to 70% of this quantity. *Cyanoprokaryota* predominated in June, August and September. It was recorded high species diversity among the blue-green algae which represented *Nostocales* as well as *Chroococcales* and *Oscillatoriales*. Among *Nostocales*, the highest biomass reached *Anabaena* and *Aphanizomenon*, regarding *Chroococcales – Woronichinia* and among *Oscillatoriales* - *Planktothrix* and *Planktolyngbya.* However, the most intensive growth was recorded in case of the following species: *Anabaena flos-aqae* and *Anabaena lemmermanii*, *Woronichinia naegeliana. Dinophyceae* was the group that predominated in July. Their biomass was determined by intensive development of *Ceratium hirundinella* and co-occurrence of some less signi-

ficant species. *Chlorophyta* were periodically more abundant (in June). The contribution of *Pandorina morum* to their overall biomass was the highest. In spring, the biomass ranged from 11,3 mg/dm^3 to 17,7 mg/dm^3 while in autumn it varied between 11,9 mg/dm^3 and 8,7 mg/dm^3. Both in spring and in autumn the rate of *Bacillariophyceae* development was significant and at that time they constituted from 60% to 90% of the overall biomass. The diatoms which achieved the highest share in wet weight were the species of *Fragilaria* genus in spring and *Aulacoseira* genus in autumn. *Fragilaria crotonensis*, *Fragilaria ulna var. acus, Aulacoseira granulata* and *Asterionella formosa* were the most numerous. The development of theses dominant species was accompanied by high diversity of others also less important taxa (*Euglenophyta* and *Chrysophyceae*).

The phytoplankton biocenosis characterized by such an intensive development, specific domination structure and seasonal dynamics is typical of eutrophic lakes, among which, Kortowskie Lake is categorized despite the fact that the pace of its eutrophication is successively inhibited owing to ongoing restoration by the method of selective removal of hypolimnetic water.

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PHOTOSYNTHESIS IRRADIANCE CURVES AND CHLOROPHYLL FLUORESCENCE OF THREE BALTIC PICOCYANOBACTERIAL STRAINS OF *SYNECHOCOCCUS*

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Chroococcoid cyanobacteria of the genus Synechococcus have been shown to be important components of marine and freshwater ecosystem. Picocyanobacteria comprise as much as 80% of the total cyanobacterial biomass in the Baltic and contribute as much as 50% of the total primary production of a cyanobacterial bloom. The chlorophyll fluorescence and photosynthesis irradiance curves (P-E) are commonly used to characterize photoacclimation. The experiments were carried out on three Baltic picocyanobacterial strains of Synechococcus (BA-132, BA-124, BA-120). The strains were isolated from the costal part of the Gulf of Gdańsk (The Southern Baltic) and are maintained as unialgal cultures in Culture Collection of Baltic Algae at the Institute of Oceanography in Gdynia (http://ocean.ug.edu.pl/~ccba/). Synechococcus strains were grown at four irradiances (10, 55, 100, 145 mmol photons m-2 s-1) and three temperatures (15, 22.5, 30°C). To determine the effect of the investigated factors and their interaction on photosynthetic activity of examined strains, factorial experiments and two-way analysis of variance ANOVA were carried out. The measurements of photosynthesis rate were carried out using Clark oxygen electrode, and chlorophyll fluorescence were measured using Pulse Amplitude Modulation (PAM) by fluorymeter Hansatech FMS 1. Based on P-E, two mechanisms of photoacclimation in Synechococcus were recognized. The maximum value of Pm expressed per biomass unit at 10 mmol photons×m-2×s-1 indicates a change in the number of photosynthetic units (PSUs) while the constant values of α parameter and the maximum value of Pm expressed per chlorophyll unit at 145 mmol photons×m-2×s-1 indicates the next mechanism – a change in the size of PSUs. These two mechanisms constitute the

base of significant changes in photosynthetic rate and its parameters (Pc, compensation point; α, initial slope of photosynthetic curve; Ek, saturation irradiance; Pm, maximum rate of photosynthesis; Rd, dark respiration) upon the influence of different irradiances and temperatures. The values of fluorescence parameters: Fv/Fm (maximum PSII quantum efficiency) and ΦPSII (effective PSII quantum efficiency) can provide additional information concerning the photosynthetic apparatus. High irradiance had a negative effect on both Fv/Fm and ΦPSII, but it was higher in the case of ΦPSII.

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SPATIAL VARIABILITY OF CHLOROPHYLL, NATURAL ORGANIC MATTER AND PAR EXTINCTION IN LARGE THROUGHFLOW LAKE (OSTROWIEC LAKE, NORTH-WESTERN POLAND)

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Vertical changeability of light penetration and optical features of water are important for many factors such as the heat budget of water bodies, the depth distribution of submerged macrophytes, productivity and species composition of plankton communities. The absorption and light scattering are regulated by the composition and concentration of various water constituents, which include water itself, and many dissolved and suspended compounds. In lakes especially composed with the many sub-basins, the differentiation of morphometric features of basins may leads to establishing different ecological states. An example is Ostrowieckie Lake on the Płociczna River in Drawa National Park (north-western Poland). The basin of Ostrowieckie Lake is naturally divided into two sub-basins: the shallow throughflow one (No I) and deep without flow one (No II).

The aim of this work was to characterize the spatial and vertical differentiation of phytoplankton biomass, dissolved organic matter (including optically active substances and CDOM), turbidity and suspended sediments in relation to attenuation of photosynthetically active radiation (PAR) with depth. Water samples ware taken from different depths and averages values of concentrations were calculated over the water column where the PAR measurements were made. Researches were made on one day in August of 2009 at four stations in both part of lake.

It was noted that each basin has different trophy status and ecological state. In the basin No I in comparison to No II the higher concentrations of chlorophyll (respectively 24.2 and 18.8 µg/l), turbidity (6.6 and 4.5 NTU), suspended sediments (8.6 and 7.4 mg/l) and water colour (27 and 14 mg Pt/l) were recorded. Lower differences in the case of dis-

solved organic matter were noted. Water transperency in basin No I reached 1.4 (euphotic zone 3 m) and in No II 2 m (euphotic zone 4.5 m). The average diffuse attenuation coefficient K_d for PAR region was higher in shallow basin (1.45 m^{-1}) than in deeper (1.0 m^{-1}).

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RESPONSE OF DIFFERENT SOIL MICROALGAE ISOLATED FROM HEAVY METAL-POLLUTED HABITATS TO EXCESS OF LEAD

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Mechanisms of Pb-resistance in soil microalgae: *Dictyococcus* cf. *varians*, *Chlamydomonas boldii* (Chlorophyceae), as well as, *Eustigmatos* sp. (E120) (Eustigmatophyceae) isolated from heavy metal polluted mining area in S. Poland were studied. Pb-toxicity, intracellular Pb-accumulation and production of thiol oligopeptides involved in intracellular metal complexing (glutathione - GSH, phytochelatins - PC_n) were examinated. The high values of ecotoxicological parameter (96-h EC_{50}; 38.9 - 48 μM Pb) determined for those three algal species indicated their high Pb-resistance. Pb distribution in cells of *D*. cf. *varians* and *C. boldii* suggest that their resistance may rely mainly on the metal accumulation in external cell structures (metal avoidance). The thick cell wall of *D*. cf. *varians* and mucilaginous envelope of *C. boldii* seem to play a protective role against Pb present in a complex medium, however, synthesis of thiol oligopeptides (GSH, PC_n) involved in intracellular metal detoxification is also essential. *D*. cf. *varians* revealed relative Pb-resistance dependent on conditions of metal exposure. In the case of high Pb-bioavailability to *D*. cf. *varians* cells (at metal non-complexing conditions) the level of GSH and PC_2 in cells completely decreased. At low Pb concentration (10 μM) *D*. cf. *varians* accumulated intracellularly ca. 3-times more Pb (30 μmol g^{-1} DW) than Pb-resistant *Eustigmatos* sp. (E120) under the same exposure conditions. *Eustigmatos* sp. (E120) produced also less PC_n but in contrary to *D*. cf. *varians* at concentration higher than 10 μM it maintained still high level of GSH, an antioxidant and precursore for phytochelatin synthesis. It seems possible that also other still unknown mechanisms may exist (i.e. regulation of intracellular metal level, chaperon-like proteins and specific carotenoids protecting from oxidative stress).

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ASSESSMENT OF BIOPOLLUTION CAUSED BY NON-NATIVE ALGAE AND CYANOBACTERIA IN LITHUANIAN FRESHWATERS

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Distribution range of non-native aquatic species and their ecological impact on environmental quality is an increasing demand over the last decades. A standardized biopollution assessment method (the biopollution level index (BPL); Olenin et al., 2007) was proposed to measure the magnitude of invasion impacts. The index is calculated based on estimation of the abundance and distribution range of alien species, and on their impacts on community, habitat and ecosystem level. The BPL approach also allows classify non-native species into "alien" (BPL = 0), "potentially invasive" (BPL > 0) and "invasive" (BPL > 1) ones.

Five cyanobacteria (*Anabaena bergii* var. *limnetica*, *Cylindrospermopsis raciborskii*, *Gloeotrichia echinulata*, *Raphidiopsis mediterranea*, *Geitleribactron periphyticum*), and one raphidophyte (*Gonyostomum semen*) and diatom (*Actinocyclus normanii* f. *subsalsum*) species were included into the list of non-native, cryptogenic algae and cyanobacteria species recorded in inland waters of Lithuania. Only for raphidophytes *Gonyostomum semen* was estimated moderate biopollution level (BPL = 2), and species could be defined as invasive ones. Raphidophytes occurred in humic lakes comprising over 20 % of total phytoplankton biomass in many (61% of 102 investigated lakes) of them. They caused moderate changes in phytoplankton communities and had moderate impact on physical and biological characters of habitats. The populations of non-native cyanobacteria and diatoms are small in Lithuanian inland waters. A weak BPL level (BPL = 1) was assessed for planktic *Raphidiopsis mediterranea*, *Gloeotrichia echinulata* and periphytic *Geitleribactron periphyticum* occurring in moderate abundance (up to 16%, 29% and 5% of total biomass, accordingly) in several localities. *Cylindrospermopsis raciborskii* was

recorded in 1988 but not found repeatedly up to date. Characteristic to brackish waters diatom *Actinocyclus normanii* f. *subsalsum* occurred in small amounts (up to 2 % of total phytoplankton biomass) in the karst lakes. The BPL as indicator of the non-native species is accepted tool for assessing the ecological status in marine environments as requested in EU WFD. The performed studies in inland aquatic ecosystems allowed applying and adapting the BPL approach in freshwaters and assessing the magnitude of impacts of alien algae and cyanobacteria species.

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ALIEN AND EXPANSIVE SPECIES OF FRESHWATER CYANOBACTERIA AND ALGAE IN THE CZECH REPUBLIC

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Biological invasions are of increasing interest to researchers, as they are recently considered one of the main drivers of global biodiversity loss. Spreading of non-native species of many different kinds of organisms is monitored worldwide; however, invasions of microscopic organisms are still poorly understood and their impact on the environment is probably underestimated. This study brings overview of the non-native algae and cyanobacteria in the Czech Republic. A total of 24 invasive/expansive species were found in the area: 10 species of Cyanobacteria, 9 species of Bacillariophyceae, 1 species of Dinophyta, 1 species of Ulvophyceae, 2 species of Chlorophyceae, and 1 species complex of Zygnematopyceae. Distribution of these alien species was mapped and their impact on native species and other real or potential risks linked to their spreading were assessed.

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PHYTOPLANKTON FUNCTIONAL GROUPS AS AN INDICATORS OF EUTROPHICATION IN LAGOON WATERS – APPLICATIONS UNDER THE WATER FRAMEWORK DIRECTIVE

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The analysis of phytoplankton structure has been applied in the trophy state assessment for many years. The community structure of these autotrophic organisms can be described by species dominance relationships, size groups, diversity indices, phytoplankton photosynthetic pigments, and functional groups. In the current study the qualitative and quantitative structure of phytoplankton was examined in the pelagic zone of the Vistula Lagoon in years 2007–2009. For this lagoon the Reynold's functional groups of phytoplankton were used as an indicator at eutrophication for the first time. We noted that organisms dominated in the surface water belong to 8 phytoplankton functional groups: S1, X1, F, J, K, H1, $L_{O,}$ M. We also discussed the effect of different on phytoplankton quantity and species composition. In this work the applicability of phytoplankton quantity indicators to the assessment of the trophic status of the Vistula Lagoon was evaluated. The values of the trophic state indices calculated based on the analyses of samples collected from surface waters in summer equaled to: TSI (Chla) 53-90, TSI (TP) 71-89, TSI (TN) 41-65, TSI (SD) 65-83. The phytoplankton abundance varied between 4.13×10^5 N cm^{-3} and 8.29×10^6 N cm^{-3}. The average phytoplankton biomass was from 5.67 mg dm^{-3} to 12.13 mg dm^{-3}. In this presentation some key concepts of Water Framework Directive were implemented.

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HILDENBRANDIA RIVULARIS (LIEBM.) J.A. AGARDH 1837 IN THE RIVER ECOSYSTEMS OF WESTERN POMERANIA

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Hildenbrandia rivularis (Liebm.) J.A. Agardh 1837 is one of the few red algae species in Poland strictly protected by law according to the order of the Minister of Environment from July 9th, 2004, (Dz. U. Nr 168, poz. 1764).

The order *Hildenbrandia* Nardo 1834 is represented in the northern hemisphere by two species, occurring in different habitats i.e. by the freshwater *Hildenbrandia rivularis* and the maritime *Hildenbrandia prototypus*.

Hildenbrantia rivularis occurs in clean waters, rich in oxygene. At the same time the thalii of the species do not tolerate too intensive sunlight, thus it's preferred habitats in streams and rivers are found in places partly shaded by the canopies of the trees.

Up till now only few localities of the species were recorded in Western Pomerania, mostly due to poor state of phycological investigation in this area. Several new stands of *Hildenbrandia rivularis* (Liebm.) J.A. Agardh 1837 were discovered during the course of field investigations on the fycoflora of freshwater red algae, performed in the years 2009 – 2010 within the framework of the grant N N304285937. They are situated in the various physiographic regions of Western Pomerania.

The highest concentrations of the taxon localities were found in the Pojezierze Drawskie meso-region. This is an area dissected by the river networks of two rivers: Pasęta and Drawa. Both of them, and their numerous tributaries, have still retained their highly natural character and good water quality.

The localities of *Hildenbrandia rivularis* in Western Pomerania were found in the following rivers and streams:

- Drawa River – northern section, southwards from Prosinko towards Żerdno and between the villages Rzepowo and Głęboczek;
- Drawa River – complete southern section within the borders of the Drawa National Park, from the outflow from the Lake Dubie to the Stare Osieczno village;
- Sitna Stream – along the forrested section in the vicinity of Drawno to the inflow to the northern part of Lake Dubie;
- Płociczna River – the upper course and within the borders of the Drawa National Park;
- Słopnica River – from the ruines of the water mill in Gładysz to the confluence with the Drawa River;
- Parsęta River – section between the villages Kolonia Storkowo I and Osówko;
- Bukowa Stream – lefthand side tributary of Parsęta, final section to the confluence with Parsęta;
- Bzeźniczka Stream - lefthand side tributary of Parsęta,within the village of Borzęcino;
- Dębnica River – in the upper course within the „Dolina Dębnicy" Nature Reserve, as well as in several lacalities between the Dębno Lake (jez. Damskie) and the Koprzywno Lake (jez. Dębnica);
- Grabowa River – several lacalities in the upper course from the sources to the Krąg village;
- Ina River – section in the vicinity of the Rybaki village;
- Krąpiel River - final section to the confluence with the Ina River;
- Świergotka River – section within the borders of the „Dolina Świergotki" Nature Reserve;
- Słupia River – lower course in the forested area of the Cedyński Landscape Park;
- Santoczna River – within the borders of the „Buki Zdroickie" Nature Reserve.

The synthetic study on the distribution of localities of *Hildenbrandia rivularis* in Northern Poland was presented by Rejewski (1966). In the light of the present data that study has lost it's validity, especially that it also included, recently unconfirmed, localities taken from older literature (sometimes dating back to the first decades of the 20th century).

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CHANGES IN THE PHYTOPLANKTON COMMUNITY STRUCTURE OF THE MALTAŃSKI RESERVOIR RESTORED WITH BIOMANIPULATION AND PHOSPHORUS INACTIVATION

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The Maltański Reservoir is localized in the city centre of Poznań. The studied site is a relatively small (64 ha) and shallow (maximal depth – 5 m, average depth – 3.1 m) reservoir. It is an urban reservoir built in the 1950s for sports and recreation. It was restored with both biomanipulation and phosphorous inactivation. In the period of 2005–2010 several doses of an iron-based coagulant (PIX-112) were spread over the lake surface.

The aim of this study was qualitative and quantitative analysis of phytoplankton community in the restored Maltański Reservoir in the years 2005–2010.

The phytoplankton analysis of algal community structure were studied. Samples were collected from the water column from the surface to a depth of 3 m with a 5 L sampler.

The cyanobacterial dominations in phytoplankton were noted in 2005 *(Aphanizomenon flos- aquae*) and 2007 (*Planktothrix agardhii, Pseudanabaena limnetica* and *Limnothrix redeckei*). In 2008–2009 the abundance of phytoplankton decreased. The most frequent were *Erkenia subaequiciliata*, *Fragilaria ulna* var. *acus*, *Cryptomonas marssoni* and *Asterionella formosa.*

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THOREA HISPIDA (THORE) DESVAUX – RECENT RECORDS OF AN INTERESTING AND RARE FRESHWATER RED ALGA IN EUROPE

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The Thoreales is a well-defined order containing the genus *Thorea* and is distinguished morphologically from other orders of freshwater red algae mainly by its multiaxial structure with lateral assimilatory filaments disposed along the main axis. There are only species known from European species are *Thorea violacea* and *T. hispida* which differ morphologically.

Thorea hispida (Thore) Desvaux 1818 *emend*. Sheath, Vis *et* Cole 1993 (Synonyms*: Conferva hispida* Thore 1799, *Conferva flexuosa* Bory 1804 nom. illeg., *Thorea ramosissima* Bory 1808 illeg., *Thorea lehmannii* Hornemann 1818, *Thorea andina* Lagerheim *et* Möbius in Möbius 1891) has been reported over the past century from scattered sites in Europe - Belgium, Bulgaria, Croatia, England, France, Germany, Hungary, Netherlands, Poland, Romania, Serbia and Lithuania. It occurs on various types of submerged hard surfaces mainly in rivers, however, it is known in zones of moving water within lakes and channels, often at somewhat greater depths (2–3m) than in rivers.

Recently *Thorea hispida* was discovered in the River Ouse at Houghton Mill, Cambridgeshire, Southern England. Only three individuals of the macroscopic stage were observed at this site in September 2010 and these formed very impressive, rope-like filaments (over 1 m long) growing in a shaded reach of the river on the natural stony bottom at a depth of ca. 30 cm. At the time of collection the water temperature was over 16^0 C, the pH 8 and the conductivity 889 $\mu S\ cm^{-1.}$. Two year earlier a single small individual of *Thorea hispida* was collected in the River Thames at a site near Maidenhead, Berkshire where it previously been recorded in the 1980s and before then in the 1840s. It appears that *Thorea hispida* might go unnoticed at a site for very long periods (possibly many decades) when in its inconspicuous Chantransia stage and is only is recorded when it

forms its distinctive macroscopic stage. As a result it is therefore difficult to assess its conservation status in England and yet in several European countries *Thorea* is included in Red Lists in the category of endangered or vulnerable. However, unknown are the factors threatening the sites where it occurs due to a lack of systematic collecting of data and it overlooked when in the Chantransia stage and growing in deeper water.

Studies are continuing with the aim of determining its phylogenetic position and the relation between the two Thorea species in Europe and those in other geographical regions. Further research is needed on the question of its conservation status in Europe.

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EFFECTS OF SALINITY CHANGES ON THE GROWTH AND PROTEIN EXPRESSION PROFILES OF THREE STRAINS OF BALTIC DIATOMS DIFFERING IN TOLERANCE TO SALINITY STRESS

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Salinity is one of the main factors having a great influence on the structure and functioning of marine ecosystems. The brackish character of the Baltic Sea, and the fact that organisms of different salinity tolerance are found in this environment, make it an exceptional field of studies on ecophysiological response to salinity stress in various aquatic species. Diatoms not only play a very important role in primary production and biogeochemical cycles in almost all water ecosystems, but are also believed to be sensitive indicators of water quality and inorganic salt concentrations. Therefore, they can be a valuable material for studies on mechanisms of adaptation to salinity changes.

The aim of this study was to analyse the influence of salinity on growth and protein composition in benthic diatoms varying in tolerance to salinity changes. Experiments were carried out on three strains: *Fistulifera saprophila* (Lange-Bertalot & Bonik) Lange-Bertalot (BA-56), *Navicula perminuta* Grunow (BA-30) and *Bacillaria paxillifer* (O.F. Müller) Hendey (BA-14), isolated from the Gulf of Gdańsk and maintained in the Culture Collection of Baltic Algae (CCBA, http://ocean.univ.gda.pl/~ccba/). Growth rate and changes in protein expression profiles were analysed in cultures grown under constant conditions of light and temperature and over a salinity gradient from 0 to 32 PSU and additionally 60 PSU. Cell counts were performed with the use of light microscope and Bürker chamber. The total protein contents were determined by the method of Bradford (1976). SDS PAGE electrophoresis was carried out in 4-20% gradient resolving gels. The results were analysed with Phoretix 1D Pro v11 and Statistica 8 software.

The experiment results revealed brackish and even marine-brackish character of the strains, as they grew best in 16-32 PSU. Some differences between the species concerning resistance to sudden osmotic stress were also observed. Generally, it was proved that salinity and prior acclimation of cells had influence on the analysed properties. The observed changes were more pronounced in less tolerant species – *Navicula perminuta* and *Bacillaria paxillifer,* than in the most tolerant taxon – *Fistulifera saprophila*. Four groups of proteins of different molecular weight induced during salinity stress and potentially involved in salt-adaptation were identified.

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XANTHOPHYLL CYCLE AND PHOTOSYNTHETIC ADAPTATION TO ENVIRONMENT IN THE MARINE PHYTOPLANKTON

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The aim of the investigations was to determine the effect of irradiance on the content of carotenoids involved in the xanthophyll cycle in natural algae community occurring in the Baltic Sea: diatom *Chaetoceros* cf. *lorenzianus* Grunow 1863 and dinoflagellate P*rorocentrum minimum (*Pavillard) Schiller 1933.

In the case of diatom *Chaetoceros lorenzianus*, chlorophyll a content decreased with the increasing irradiance: from 22.1 10^{-13} g/cell at 5 μmol $m^{-2}s^{-1}$ to 10.8 10^{-13} g/cell at 50 μmol $m^{-2}s^{-1}$. A similar effect was observed for fucoxanthin : from 8.1 10^{-13} g/cell to 4.7 10^{-13}/cell, respectively. A reverse situation occurred in diadinoxanthin and diatoxanthin, carotenoids directly involved in the xanthophyll cycle: their content grew when the irradiance increased from 2.9 10^{-13} g/cell to 4.2 10^{-13} g/cell.

In the natural population of diatom *Chaetoceros lorenzianus*, the highest fucoxanthin content was observed in the morning and afternoon hours (7.6 10^{-13} g/cell), unlike diadinoxanthin and diatoxanthin, for which a mean of 1.7 10^{-13} g/cell was found at dawn and at dusk, whereas maximum values were observed at noon (3.7 10^{-13} g/cell). Analogical tendencies related with diurnal variations in the content of xanthophylls involved in the xanthophyll cycle occurred also in dinoflagellate *Prorocentrum minimum*.

The investigations carried out have demonstrated the existence of two functionally different groups of xanthophylls. The members of the first group, such as peridinin and fucoxanthin, actively assist the photosynthesis at a low irradiance. The second group consists of carotenoids the role of which is to protect cell structures from excessive irradiance (diatoxanthin, diadinoxanthin).

Results discuss the irradiation effects on the xanthophyll cycle pigments and the key carotenoids of the primary production.

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FOSSILIZATION OF MODERN BENTHIC CYANOBACTERIA EXEMPLIFIED BY STROMATOLITES FROM ALKALINE VOLCANIC LAKES OF NIUAFO'OU ISLAND (TONGA, SOUTH PACIFIC)

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Niuafo'ou is a round volcanic island with 5-km-diameter caldera, that contains two larger lakes with actively growing stromatolites: Vai Lahi (121 m deep) and Vai Si'i (31 m deep). These low salinity lakes are autonomous hydrological system, without direct connection to the ocean. The water of both lakes is characterized by increased alkalinity comparing with seawater. This results in relatively high saturation with respect to calcium carbonate minerals (aragonite and calcite), much higher than in modern seawater. Temporal volcanic activities are probably responsible for oscillations of hydrochemical conditions in both lakes. They are reflected in the variety of textures observed in stromatolites accreting along the shores of the lakes. The crustal and brain-like domal stromatolites are growing in the lakes since c. 15,000 years ago. Some of the stromatolites are subaerially exposed on the shore, and some occur permanently underwater. The largest are over a meter in diameter and up to 80 cm tall. Coccoid and filamentous cyanobacteria participate apparently in the origin of the stromatolites by in vivo precipitation of calcium carbonates (mostly aragonite) in their mucilage sheaths. A large morphological diversity of filamentous and coccoid cyanobacteria was noticed both in the living mats and their subfossil remains preserved in the mineral matrix. Taxonomically they have been assigned to the genera Rivularia, Calothrix, **Myxosarcina** and Pleurocapsa. Apart from cyanobacteria, fungi, heterotrophic bacteria and diatoms have also been found. The cyanobacteria are most frequently preserved as mineralized mucilage sheaths. Generally, the micro-

organisms in the studied stromatolites are fossilized due to two mineralization processes: (i) in vivo calcification, associated often with transformation of aragonite into calcite, a process which, as a rule, almost completely destructs morphology of cyanobacteria, and (ii) post mortem silicification. The preservation of the silicified cyanobacteria depends on the degree of their post mortem decomposition at the time of silica permineralization. The silicified parts of stromatolites may enclose either nearly perfectly fossilized remains of cyanobacteria, or be free of their any recognizable traces.

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PHYTOPLANKTON COMMUNITIES IN RELATION TO WATER ECOSYSTEMS VARIETY IN THE WOLIŃSKI NATIONAL PARK

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Aquatic ecosystems of the eastern part of the Woliński National Park (WNP) generated during the last Baltic glaciation are showing hydrological different, small and close located water bodies. The research was carried out in the summer season (2009, 2010) in 11 lakes located within WNP which were divided into: closed lakes – Wisełka, Zatorek, Racze, Grodno; tunnel-valley lakes – Warnowskie, Rabiąż, Czajcze, Domysłowskie, Żółwińskie and Kołczewskie; and one anthropogenic calcareous deposits exploitation – Turkusowe Lake. The aim of the study was to examine the structure of phytoplankton and water plants communities in relation to physical-chemical parameters of water in different types of reservoirs.

The analysis of phytoplankton communities structure and its density distribution revealed significant changes in respect to various types of lakes as well as to the various nutrients concentrations with preference towards eutrophic reservoirs with cyanobacteria blooms. The lowest nutrient concentrations were found in the exploitation Turkusowe Lake where at the same time maximum value of $Fe_{tot.}$ (0.26 mgl^{-1}) was observed. At the other sites, NH_4 concentrations ranged from 0.06 mgl^{-1} (Grodno) to 1.78 mgl^{-1} (Domysłowskie). The great PO_4-P values were noted at the most tunnel-valley lakes: Domysłowskie (0.40 mgl^{-1}), Kołczewo (0.35 mgl^{-1}), Żółwińskie (0.26 mgl^{-1}) while in other lakes varied between 0.04 – 0.19 mgl^{-1}. Phytoplankton in WNP lakes was represented by 298 taxa and the characteristic species were also found to differ for particular lakes. The phytoplankton similarity was lowest in Grodno and Turkusowe lakes (0.30) and the

highest in Czajcze Lake (0.66). Furthermore, at Grodno and Turkusowe lakes, the chrysophytes and green algae were more abundant, representing about 13-60% and 24-84% of total algal biomass, respectively. A late summer blooms of *Anabaena affinis*, *A. flos-aquae*, *Aphanizomenon flos-aquae*, *Planktothrix agardhii*, *Planktolyngbya limnetica* were observed in lakes: Domysłowskie, Żółwińskie, Warnowskie, Kołczewskie and Wisełka. Examined lakes in spite of the connection between some of them were showed the great individuality in the dominant species structure.

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EPIPHYTIC COMMUNITY CHARACTERISTICS FROM FRESHWATER AND SEAWATER TAXA OF *ULVA*

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Green alga from genera *Ulva* reach macroscopic sizes and constitute real substratum for the development of epiphytic communities. It is generally considered that structure of the substratum surface (coarseness, hardness) is an important factor at settling by particular species of diatoms as well as their distribution in the community of epiphytes. The thalli of *Ulva* are covered on the all surface with large amounts of calcium crystals what is favorable for the development of settled diatoms. The studies reported here were undertaken to determine if *Ulva* taxa from freshwater and sea ecosystems were able to develop similar community of epiphytic diatoms in terms of the species structure.

The study was performed with thalli of *Ulva* from 9 inland sites in the Wielkopolska region (Laskownickie Lake, ponds Śródka and Tulce, 3 sites localised along the A2 highway, streams: Dworski Rów, Michałówka and Świątnica) and from 2 sea sites (Bornholm, Gdynia). Samples size for diatom analysis were 30 thalli per site each time.

In the process of examinations including all *Ulva* sites 93 taxa of diatoms were determined (*Bacillariophyceae* – 72 taxa; *Fragilariophyceae* – 18; *Coscinodiscophyceae* – 9). Diatoms *Achnantes lanceolata* (Brèb.) Grun., *Cocconeis placentula* Ehr., *Fragilaria ulna* (Nitzch.) Lange-Bertalot, *Gomphonema olivaceum* (Horn.) Brèb. and *Nitzschia palea* (Kütz.) W. Smith turned out to be dominating species on *Ulva* thalli from both water ecosystems. *Ulva* was the good substratum to the growth of *C. placentula* which has often created the monocultures. However, *G. olivaceum* reached the great size only on freshwater thalli. Moreover, numerous group of very constants (20%) and constants (28%) species is confirming that *Ulva* is a good substrate for the development of epiphytic diatoms both in inland as well as sea waters. Communities of diatoms from all sites were similar in the range of 40-60% (lack statistically significant differences). However, diatoms from fershwater taxa of *Ulva* was characterized by a smaller evenness rate (0.72), with more frequent presence of single species monocultures and numerous populations of eutrophic species. It seems that diatoms have no problems in the colonization of a new surface environment on *Ulva* thalli.

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THE EFFECTS OF NUTRIENT CONTENTS AND NUMBER OF CALCIUM CRYSTALS ON MORPHOMETRIC FEATURES OF FRESHWATER *ULVA*

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The morphometric characteristic of thalli is acknowledged as a useful feature of *Ulva* at the identification to the species. Factors which influence morphometric features of algae cells and thalli include individuality of species, stage of development, seasonality, nutrient contents in the water and presence of all sorts of particles (biotic, abiotic) on the surface. This study presents results of research on the morphometric characteristic diversity of freshwater *Ulva* which grows in waters with different contents of nutrients. An additional objective was to establish if some incrustation on the thalli surface (e.g. crystals, periphytic organisms) increased the effect of distortions on the length and the width of thalli, particularly at the mature stage.

The study was performed with thalli of *Ulva* from 16 sites in the Wielkopolska region from different habitats (lake, pond, river, stream). Analysis included the measurement of thalli and examination the morphology of cells (lengths, widths and the size of cells; number of pirenoids, the shape and arranging of cells) and crystals with using microscopes. Each time, water chemistry variables were determined.

The obtained results demonstrated that even though all water bodies habitats were enriched with N and P they differed from each other in *Ulva* morphology features development of the same species in many respects (size of cells and thalli, young and old thalli participation, presence of branches). Usually, there is a constant number of pirenoids in cells of particular taxon. Moreover, calcium crystals which constituted almost a 50% of a *Ulva* dry mass were in a direct contact with its cells and therefore they could have an influence on their development in a considerable degree. This phenomenon was most often appeared at *Ulva prolifera* Agardh. Thalli with the large content of calcium crystals and

epiphytic diatoms were characterized by a littleness of cells size (8-15µm x 4-11µm) than the ones with the sparseness of crystals (8-18µm x 7-13µm). On the other hand, changes also concerned cells arranging in the thallus which were concentrated around crystal in rays instead of to create characteristic elongated rows. Results of this study highlight the importance of affluence of water in nutrients which allows *Ulva* thalli to obtain good conditions for development shown in its morphometric features.

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GAS VESICLE GENE CLUSTER OF CYANOBACTERIA OF *ARTHROSPIRA* GENUS AS AN EXAMPLE OF MUTLICOPY GENES LOST IN GENOME ASSEMBLING

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The genus Arthrospira includes filamentous cyanobacteria with trichomes forming an open helix and containing gas vacuoles. Nutritional properties of Arthrospira have been known for hundred years. Moreover, it has immunomodulative, antioxidant, antiviral and anticancerogenic properties. The strain Arthrospira sp. PCC 8005 is a part of the life-sustaining system MELISSA (Micro Ecological Life Support System Alternative).

The gas vacuoles, whose main function is providing buoyancy, are made up of stacks of cylindrical gas vesicles. There are two main gas vesicle proteins: GvpA - a small hydrophobic protein whose amino acid sequence is highly conserved and GvpC - a larger hydrophilic protein with less conserved amino acid sequence containing 33-residue repeats. Moreover, 8 other gvp genes have been identified: gvpN, gvpJ, gvpX, gvpK, gvpF, gvpG, gvpV and gvpW. The sequences of genomes of three different strains of Arthrospira are available in Genbank: Arthrospira sp. PCC 8005 (Janssen et al., 2010), Arthrospira maxima CS-328, and Arthrospira (Spirulina) platensis NIES-39 (Fujisawa et al., 2010).

The aim of our study was to investigate the organisation of the gas vesicle gene cluster in cyanobacteria of the genus Arthrospira and assessment of genetic variations among gvp genes in Arthrospira strains isolated from different geographical regions.

The gas vesicle gene cluster was sequenced in 18 strains. The obtained results indicate that the arrangement of genes in the gas vesicle gene cluster in all tested strains is: gvpA1--gvpC1-gvpA2-gvpC2-gvpA3-gvpC3-gvpN. In Arthrospira PCC 8005, gvpJ gene, located downstream of gvpN gene, was also identified. Each copy of gvpA gene encodes a protein

of 71 amino acids. In the case of gvpC, there are two different length variants. Two genes, gvpC1 and gvpC2, encode a small protein of 151 amino acids, while the product of gvpC3 consist of 284 amino acid residues. The GvpC1, GvpC2, GvpC3 proteins contain contiguous repeats of 33 amino acids previously reported in Anabaena and Microcystis. The genes gvpN and gvpJ encode 394 and 127 amino acid residue proteins respectively. The comparison of selected regions of gas vesicle gene cluster of different strains of Arthrospira revealed that the sequences of gas vesicle genes are highly conserved.

In all three genome sequences of Arthrospira strains only one copy of gvpA and gvpC was identified, what may indicate problems with identification of multicopy genes in the process of sequencing and assembly of cyanobacterial genomes.

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EPILIMNETIC VERSUS METALIMNETIC PHYTOPLANKTON ASSEMBLAGES IN TWO MESOTROPHIC LAKES

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The deep water maximum of phytoplankton biomass is a characteristic feature for arctic, alpine and subalpine lakes connected with higher nutrient concentrations and more stable environmental conditions in metalimnetic layers. The establishment of a "metalimnetic niche" was observed in two mesotrophic lakes: Hańcza (the deepest lake in Poland) and Dejguny, where the diatoms and the filamentous blue-green algae can find their ideal growth conditions. The aim of the study was to determine epilimnetic and metalimnetic phytoplankton assemblages in these lakes.

The quantitative and qualitative analyses of phytoplankton were conducted in summer (June, August) in the years 2006–2008. The integrated water samples were taken from the epilimnetic and metalimnetic layers at the deepest place of the lakes. The analysis was carried out using an inverted microscope and a light microscope. Biomass was estimated from cell volume.

The total phytoplankton biomass in lakes Hańcza and Dejguny was relatively small, analogous to the values noted in alpine and subalpine lakes. The most intensive growth of planktonic algae was observed in metalimnia of both lakes. In lake Hańcza, the phytoplankton assemblages were dominated mainly by diatoms of the genus *Cyclotella*, typical representatives of the functional groups A and B with the tendency to increase their biomass in deeper layers. *Asterionella formosa* Hass. was only once the dominant taxon in the epilimnion (August 2006). The small-celled, colonial, non gas-vacuolated Cyanoprokaryota of the genera *Aphanocapsa* and *Aphanothece* (K) were the major biomass contributors in August in the years 2006–2008, both in the epilimnion and metalimnion layers. A different structure of phytoplankton assemblages was present in lake Dejguny, which mainly consisted of Cyanoprokaryota, e.g. particularly adapted to conditions of low irradiance *Planktothrix agardhii* (Gom.) Anagn. & Kom. (S1) with metalimnetic maxima.

A distinct predominance of pennate diatoms *Tabellaria fenestrata* (Lyngb.) Kütz. (N) occurred in June and August 2007 and small centric *Cyclotella* spp. in June 2008. Chrysophyte *Dinobryon sociale* Ehr., typical taxon of small, shallow and base poor lakes, was a major biomass contributor in June 2006.

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OCCURRENCE OF DIATOMS FROM THE GENUS *PINNULARIA* IN RIVERS AND STREAMS OF THE PODKARPACIE REGION

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The area of the Podkarpacie voivodship is located in the estuary of the Vistula (Wisła) and can be divided into four catchment areas, the San, Wisłoka, Wisłok and the Wisła itself.

Since 2007, research on the taxonomy and ecology of diatoms has been carried out in the Podkarpacie region, in the above listed catchment areas. Diatoms are indicator organisms, used to assess water quality in the rivers and streams of the study area. Most research has been carried out in the catchment area of the river Wisłok,in the Wisłok itself, or in its tributaries: Pielnica, Stobnica, Mleczka, Morwawa, Różanka, Lubcza, Szuwarka, Gołębiówka and Żołynianka. Some research is being done in the river San (mainly its middle course), some of its tributaries (Łubienka, Baryczka), and in the Wisłoka and its tributary – the Wielopolka.

Diatoms from the genus *Pinnularia* were found in all the investigated rivers and streams of the region. They are usually found sporadically, as single individuals. No mass appearance of *Pinnularia* were recorded, however these species are interesting from an ecological point of view as they are some of the rarest diatoms, indeed some of them appear on the *Red List of Algae in Poland*, in the category of Rare or Endangered taxa.

Altogether 46 taxa from the genus *Pinnularia* were recorded in the study area. The genus is best represented in the Żołynianka stream, a left tributary of the Wisłok. More than half of the recorded taxa were found there. The most frequently recorded species were: *Pinnularia brebissonii*, *P. lundii*, *P. obscura*, *P. viridiformis* and *P. viridis*. These are ubiquitous diatoms, found in most of the studied waters. The following species which have "endangered" (E) status on the *Red List* were found: *Pinnularia schoenfelderi*, *P. rupestris*,

P. subrupestris, *P. subgibba* and *P. viridifofmis*. A few species were found as single individuals in the uppermost courses of rivers and streams (*Pinnularia rupestris*, *P. septentrionalis*, *P. schoenfelderi* and *P. undulai*). These are diatoms characteristic for oligotrophic waters containing low levels of electrolytes.

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THECATE DINOFLAGELLATES OF LAKE BORÓWNO AND ADJOINING WATERS IN THE "UROCZYSKA KUJAŃSKIE" SPECIAL AREA OF CONSERVATION (SAC PLH300052 NATURA 2000, POLAND)

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In the „Uroczyska Kujańskie" Special Area of Conservation (SAC PLH300052 NATURA 2000, Poland) are located six lakes: eutrophic lakes Borówno (area 207 ha, max depth 18,5 m), Zielone (Wierzchołek; pow. 9,6 ha) and Kujan Mały (5,5 ha), distrophic lakes Mały Smólsk (area. 2,1 ha) i Czarcie (Czarciak; area 2 ha) and alloiotrophic lake Wielki Smólsk (area. 14,6 ha). The aim of study was the taxonomic description of the assemblages of thecate dinoflagellates. In 2010-2011 were collected samples of planktonic algae from surface water in several parts of lakes. Live and preserved by Lugol- and/or formaldehyde solution materials were recognized in light and fluorescence microcope.

The following thecate dinoflagellates were recorded: *Peridinium willei* Huitfeldt-Kaas 1900, *P. cinctum* (O.F.Müller) Ehrenberg 1832, *P. raciborskii* var. *palustre* Lindemann 1919, *P. bipes* Stein 1883, *P. umbonatum* Stein 1883, *P. inconspicuum* Lemmermann 1899, *P. gatunense* Nygaard 1925, *P. aciculiferum* Lemmermann 1900, *Palatinus apiculatus* (Ehrenberg) Craveiro, Calado, Daugbjerg et Moestrup 2009, *Tyrannodinium berolinense* (Lemmermann) Calado, Craveiro, Daugbjerg et Moestrup 2009, *Peridiniopsis elpatiewskyi* (Ostenfeld) Bourrelly 1968, P. polonicum (Wołoszyńska) Bourrelly 1968, *P. cunningtonii* Lemmermann 1907, *Kolkwitziella acuta* (Apstein) Elbrächter 1993, *Ceratium hirundinella* (O.F.Müller) Dujardin 1841 and C. furcoides (Levander) Langhans 1925 . Morphological data of all recorded species were done.

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PHOTOACCLIMATION IN THE GREEN ALGA *MONORAPHIDIUM CONTORTUM* (THURET) KOMÀRKOVÁ-LEGNEROVÁ

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The green alga *Monoraphidium contortum* (Thuret) Komàrková-Legnerová is a typical component of phytoplankton in the Baltic Sea, however, it can be also found in microphytobenthos (e.g. Pliński 1993, Witkowski 1993). Thus, it was interesting to recognize its photoacclimation processes which allow surviving in such dynamic environments.

The studies were carried out on *M. contortum* strain (BA-05; CCBA collection) which was isolated from the coastal waters of the Gulf of Gdańsk. In a 5-day experiment the green alga was cultured at two light intensities: 35 µmol photons m^{-2} s^{-1} (LL – low light) and 350 µmol photons m^{-2} s^{-1} (HL – high light) with the photoperiod 14:10 L:D at 20°C. In order to describe its photoacclimation, two techniques were employed, including measurements of oxygen evolution (using Clark oxygen electrode) and fluorescence (Serôdio et al. 2006). In addition, photosynthetic pigments were analysed using HPLC method (Jodłowska & Latała 2003). Student t-test was used to compare obtained data.

HPLC analysis showed that the concentration of most pigments decreased with the increase in light intensity. The concentration of zeaxanthin increased suggesting its photoprotection role, while violaxanthin content did not changed significantly. Steady-state light curves obtained from fluorescence measurements revealed that the increase in light intensity caused the decrease in the initial slope of the curve (α_{LC}) and the increase in the value of maximum electron transport rate ($rETR_{maxLC}$). In addition, E_{kLC} parameter ($=rETR_{maxLC}/\alpha_{LC}$) increased significantly under high light condition. The light-response curves obtained from the measurements of gas exchange (P-E curves) allowed identification of photoacclimation strategies revealing that *M. contortum* responds to changes in light intensity through changes in the number of photosynthetic units (PSUs).

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CYANOBACTERIAL BLOOMS, CYANOTOXINS AND THEIR ACCUMULATION IN ICHTHYOFAUNA OF ZEMBORZYCKI DAM RESERVOIR (E. POLAND)

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In recent decade, in the shallow Zemborzycki dam reservoir in Lublin (on nutrient--rich Bystrzyca river), strong summer/autumn water blooms formed by several common species of toxin-producing Cyanobacteria have been observed. In years 2005–2010 mass development of *Anabaena* spp (A. flos-*aquae , A. circinalis, A. spiroides, A. affinis), Aphanizomenon* spp (*Aph. flos-aquae, Aph. gracile*), *Planktothrix agardhii* and less numerous *Microcystis* spp (*M. aeruginosa, M. flos-aquae, M. viridis, M. wesenbergii*) occurred. The structure of toxinogenic cyanobactrial community differed from year to year. Very high abundances of *Anabaena* spp and *Aph. flos-aquae* were always present from spring to autumn. In some years (with increased $N\text{-}NH_4$ in water) very high abundance of *P. agardhii* was found. In all studied periods cyanotoxins (both cell-bound and extracellular) were present in the reservoir water. Microcystins (MC) were analysed by GC-MS and HPLC-DAD; anatoxin –a (An-a) by HPLC with fluorescence detection (phenyloalanine was used to avoid mis-identification). Cyanotoxins' concentrations were very variable similarly to the changes in Cyanobacteria abundance, however, An-a mostly exceeded the MC concentrations. In 2010 due to pulse increases in $P\text{-}PO_4$ two peaks of abundance of toxin-producing Cyanobacteria (mainly *Aphanizomenon* spp; *Anabaen*a spp, *P. agardhii*) occurred.

Concentration of cell-bound MC (-LR, -RR; -dmRR, -LA ,-LY, -LW) during the strongest development in July and September increased to 19.7 and 22.2 μg /L, respectively, while An-a concentration to 2.4 and 23.0 μg /L. The mass development of various toxin-producing Cyanobacteria is real threat for ichthyofauna and fish consumers. The planktivorous fish *Abramis brama,* feeding among others on Cyanobacteria, accumulated in their tissues relatively high amounts of An-a (*e.g.*10-30 μg/g FW of liver) and less microcystins (*e.g*. 0.5-2.5 μg MC/g FW of liver).

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CYANOPROKARYOTA OF TWO LAKES WITH DIFFERENT MIXING REGIME AND TROPHY STATUS

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In the years 2000-2009 studies of phytoplankton in two lakes, located in the Wielkopolska National Park were carried out. Whereas Lake Jarosławieckie is a shallow, tachymictic and slightly eutrophic water body, Lake Góreckie is deep, dimictic and highly eutrophicated. Water samples were taken from pelagic and litoral sites between spring and autumn. Generally 91 taxa of Cyanoprokaryota were identified (Lake Jarosławieckie 84, Góreckie 29 taxa) out of which 22 only were recorded in both lakes. The qualitative and quantitative analyses of blue-green algae shoved differences between the lakes.

Majority of taxa identified in Lake Jarosławieckie belonged to the order Oscillatoriales (50) mainly from the genera *Oscillatoria*, *Phormidium*, *Lyngbya* and *Pseudanabaena*. Chroococcales and Nostocales were less diverse: 23 and 11, respectively.

Most taxa of those identified in the other ecosystem, Lake Góreckie, belonged to the orders Chroococcales (11) and Oscillatoriales (11) especially from the genera *Chroococcus*, *Aphanosapsa, Microcystis, Planktothrix,* and *Pseudanabaena*. The genus with the greatest species richness was *Anabaena* (Nostocales).

Two invasive species were identified. *Cylindrospermopsis raciborskii* (Wołosz.) Seenayya et Subba Raju was detected in both lakes, but only twice in Lake Jarosławieckie: in early September 2001 and August 2003. In Lake Góreckie, the species was detected in August 2007 (one record only, in a qualitative analysis) but in 2009 it occurred in larger numbers from May to August. In contrast to *C. raciborskii*, *Anabaenopsis elenkinii* Miller was noted in Góreckie Lake, only. For the first time it was recorded in August 2007. More numerously the species occurred in August 2009.

The Cyanoprokaryota biomass ranged from 0,001 to 9,1 mg dm^{-3} in Lake Jarosławieckie and from 0,14 to 36 mg dm^{-3} in Lake Góreckie. In Lake Jarosławieckie mo-

nospecific dominance by *Pseudanabaena catenata* Lauterborn was noted in August or September only. In Lake Góreckie, by contrast, mixed blooms created by *Aphanizomenon flos-aquae* (L.) Ralfs ex Born. et Flah., *Planktothrix agardhii* (Gom.) Anagn. et Kom., *Pseudanabaena limnetica* (Lemm.) Kom. and *Limnothrix redekei* (Van Goor) Meffert were observed even from May to November.

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AGING OF *UTRICULARIA* TRAPS AND VARIABILITY OF MICROORGANISMS ASSOCIATED WITH THOSE MICROHABITATS

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Charles Darwin was one of the first scientists to notice many living organisms in the bladders of *Utricularia* which are not killed by the plant. Aquatic *Utricularia* plants may be carnivorous but they also have a complex microbial food web, with bacteria forming the main living microbial biomass in their traps. They supply the microbial community thriving there with organic carbon.

Various authors have described algae in aquatic *Utricularia* traps as commensals or prey. The aim of this study was to examine the diversity and abundance of organisms (prey, algae, protozoa and bacteria) in traps of *Utricularia reflexa* Oliv. in relation to prey occurrence and trap age. We also tested the correlation between the number of live and dead animals present and the presence of protozoa in the traps. The diversity and abundance of the trap community (bacteria, algae, ciliates) increased with trap aging. In young traps, 85% of all organisms were algae (*Scenedesmus* spp. and *Characiopsis* were most numerous) and 13% were protozoa (among which *Paramecium bursaria* dominated). In old traps, 60% of all organisms were algae (mainly *Scenedesmus* spp. and the palmelloidal forms of *Euglena* spp.) and 39% were protozoa (mainly *Paramecium bursaria*). Bacteria occurred in both young and old traps but were especially abundant in old traps, and covered the glands and

epidermis of the trap. The study revealed a strong correlation between the number of trapped live and dead animals and the presence of protozoa in old traps.

In the case of phytoplankton it cannot always be said that algae are either prey or commensals. There are two groups of phytoplankton: algal species that stay alive and even reproduce in the traps (some of them may be commensals), and algae that are killed and digested in the trap environment. As the number of *Paramecium bursaria* inside the traps increases together with the quantity of animal prey and bacteria, ciliates can be regarded as commensals but not the prey of the plant. The situation might be more complex in *U. reflexa* because *Paramecium bursaria* contains green algal symbionts which might provide oxygen and photosynthesis for these ciliates. Organisms that can be considered either commensals or intruders predominated in the traps, exceeding the number of captured prey.

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EUGLENOPHYTES OF TWO HUMIC LAKES – DIVERSITY AND HABITATS

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In many reservoirs with brown-coloured waters euglenophytes, besides different groups inclusive flagellates are the common component of planktonic algae assemblages. Co-existence of euglenophytes and dinoflagellates, as well as chrysoflagellates and cryptomonads was observed in two small humic lakes - Kuźnik Bagienny (53°12'5'' E – 16°44'0'' N) and Kuźnik Olsowy (53°12'4'' E – 16°43'5'' N) in NW Poland.

The research was focused on euglenophytes occurring in the lakes and adjacent peat bogs. Biodiversity of euglenophytes and assessment of similarity in euglenophyte composition between the lakes were taken into account. The studies were carried out from November 2007 to July 2008. The samples were collected monthly from surface water or water **squeezed** from **peat-bog plants** in chosen microhabitats in lakes and peat-bogs (e.g. charophyte patches, borders between lake water and peat mat, floating-leaved plants patches, free vegetation parts of lakes as well as from peat bog mousses). During the research 71 (Kuźnik Olsowy) and 68 (Kuźnik Bagienny) samples containing fresh material were analyzed. Altogether 64 taxa of euglenophytes were identified. They were represented by autotrophic as well as heterotrophic species belonging to the group. Most part of the group was made up by representatives of Euglena, Phacus, Lepocinclis and Trachelomonas genera (14, 12, 2 and 17 taxa, respectively). However, a large part of the group was composed of colorless species. Astasia and Menoidium genera should be mentioned as the most varied. The highest number of taxa (43) were observed in summer (June and July) and in most cases they were autotrophic. The colorless species were noted

more often in winter. The constant component of the community were Euglena mutabilis and colorless Astasia comma, Menoidium pellucidum as well as Anisonema acinus. Among common, cosmopolitan taxa, rarely reported for Polish flora were also observed, including, Phacus elegans, Trachelomonas raciborskii var. intermedia and Petalomonas sphagnophila.

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MASS OCCURRENCE OF *GONYOSTOMUM SEMEN* (EHR.) DIESING IN THE POLESIE LUBELSKIE REGION (EASTERN POLAND) – BIOGEOGRAPHICAL AND ECOLOGICAL ASPECTS

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Gonyostomum semen (Ehr.) Diesing is a flagellate species from the class Raphidophyceae often occurring in mass in various water bodies across Europe. It has been evidenced from some reservoirs in Poland since the early nineties of the 20th century. The first record of *G. semen* from the Polesie Lubelskie region was noted in 1996, when it was observed in Lake Płotycze. Mass appearance (biomass up to 245 mg dm^{-3}) of *G. semen* in eleven reservoirs in this area (lakes, ponds and peat-pits) has been identified in the period 2000-2010. The paper analyzes physical and chemical properties of habitats where mass development of *G. semen* was observed and discusses possible reasons for the species spreading into the area of the Polesie Lubelskie region. Waters with high values of *G. semen* biomass (>10 mg dm^{-3}) were characterized by specific conditions: values of water colour ranged from 60 to 1500 mg Pt dm^{-3} (mean: 277 mg Pt dm^{-3}; SD = 410); water reaction varied between 5.5 to 8.3 (mean: 6.5) and electrolytic conductivity values were between 62 and 228 µS cm^{-1} (mean: 149 µS cm^{-1}; SD = 62). Mass occurrence of *G. semen* was observed in dimictic lakes – both in the period of thermal and oxygen stratification (when the species often formed high biomass in the hypolimnion) and in the period of autumn water mixing. Apart from lakes the species massively occurred in very shallow,

polymictic reservoirs. Phytoplankton community in water bodies was often dominated by *G. semen* exclusively. In other cases the species was accompanied by some flagellates, most often cryptophytes and euglenophytes as well as by diatoms and green algae. The paper discusses biogeographical and ecological aspects of *G. semen* mass appearance in Polesie Lubelskie region in reference to other reports on this phenomenon both in Poland and Europe.

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SENSITIVITY OF *ANABAENA* SP. PCC7120 TO CADMIUM EXPOSURE (CULTURE *IN VITRO*)

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One of the main problems in the XXI century is environmental pollution. The main pollutants include toxic metals, the quantity of which permanently increases in the environment as the result of increased industrial activity. The aim of this research was to test the effects of cadmium(II) on growth, development and physiological activity of *Anabaena* sp. PCC7120 using free cells suspended cultures. Photosynthetic organisms are highly sensitive to metal compounds. Cadmium is not physiologically essential and it is toxic at very low concentrations for most living organisms. In metalloenzymes it can substitute for other metal ions like zinc(II), calcium(II) and copper(II). Cadmium(II) also shows a very strong affinity to biological structures containing −SH groups. Unlike complex organic pollutants, metal compounds like cadmium cannot be degraded by microorganisms. Instead they can be accumulated by organisms. *Anabaena* sp. PCC7120 was cultivated in 250ml Erlenmeyer's flasks with BG11 medium EDAT free and with addition of cadmium(II) in different concentrations. Cultures were cultivated in vegetation rooms at 27°C. Cultures used in this experiment were in log growth phase and had specified number of cells. The experiments were carried out during 28 days. Optical density at 680nm and 720nm was used to estimate cell density. Morphology of cells was inspected under the light microscope. Significant changes in growth speed and dynamics were observed.

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FRESHWATER *ULVA* AS INDICATOR OF HEAVY METAL POLLUTION

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Studies of the *Ulva* taxa describe these green macroalgae as good indices of increased concentration of chlorides and nitrogen as well as the contamination with heavy metals in seawaters. The current study aims at investigating the ability of the freshwater forms of *Ulva* (Ulvaceae, Chlorophyta) to the bioindication and the use in the biomonitoring of lakes and rivers waters contaminating with heavy metals.

Changes of the heavy metals concentration (Ni, Cd and Pb) we examined in the summer season of 2010. Water and green algae thalli samples were collected from two water ecosystems situated in the Wielkopolska region (Nielba River and Malta Lake). Three fractions of samples: water, sediment and *Ulva* thalli were collected at the same time. Additionally, a chemical composition of waters in which *Ulva* thalli appeared was measured. In our study ICP-MS method was used.

The ICP-MS analysis of freshwater *Ulva* thalli showed presence of nickel (22.99 – 417.06 $\mu g/g^{-1}$), cadmium (BDL – 1.03 $\mu g/g^{-1}$) and of lead (BDL – 14.73 $\mu g/g^{-1}$) in cells of macroalgae. The average concentrations of metals in macroalga' thalli and water were decreased in the following order Ni>Pb>Cd and Pb>Ni>Cd in the sediment.

The level concentrations of nickel in the *Ulva* thalli from Malta Lake were about 95 times higher than in the water and about 26 times higher than in the sediment. In the case of cadmium and lead appropriately 0.5 and 4.5 times higher concentrations of these metals were noted in the sediment than in *Ulva* cells. However, concentrations of nickel were on average about 62 times higher in *Ulva* thalli from the Nielba River than in water and 2.9 times higher in the cases of sediment. In the river higher concentrations of cadmium and lead were noted in the sediment than in cells of alga thalli. Moreover, average concentrations of lead were about 480 times and of cadmium 2.8 times higher in the sediment than in *Ulva* thalli. Our results are confirming the high ability to the bioaccumulation of heavy metals, especially nickel by freshwater *Ulva*.

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GENOTOXIC POTENTIAL OF THE TOXINS PRODUCED BY CYANOBACTERIA

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Toxins produced by many species of Cyanobacteria are a growing problem for human and animal health. According to the target organ or tissue, cyanotoxins are divided into hepatotoxins, neurotoxins, cytotoxins and irritating toxins influencing the gastrointestinal system. However, also other effects, of not fully understood mechanisms, such as immunotoxicity or genotoxicity, are described. There are some reports on the correlation between cancer incidences and the presence of toxic Cyanobacteria or their toxins in drinking water sources. While there is an evidence that microcystins are able to induce liver cancers, such effects of other cyanotoxins, e.g. anatoxin-a, in humans or animals are still not sufficiently estimated.

The aim of the work was to study genotoxic effects of microcystin-LR and anatoxin-a. It was demonstrated that these commonly produced toxins are able to exert genotoxic effects in the highly sensitive in detecting DNA damage umuC assay. The test reveals induction of the SOS genes in *Salmonella typhimurium* TA1535/pSK1002, which is a response to different kinds of genotoxic lesions in the DNA. Genotoxicity of both cyanotoxins, studied at the environmentally relevant concentrations, 0.25 – 2 μg/ml, separately or in the mixture, was observed. Anatoxin-a occurred to be a stronger SOS gene inducer than microcystin-LR. After metabolic transformation of the toxins, no effects were detected.

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THE INFLUENCE OF TWO TILLAGE SYSTEMS ON DIATOM COMMUNITIES IN WHEAT PLANTATIONS

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The studies on the diversity of soil diatoms were carried in the village of Krasne (Podkarpacie region). The study was performed on uniform dusty loams (płi type, pH: 5,0-6,7 in KCl). Winter wheat was grown using two tillage systems: traditional and reduced. The aim of study was to ass the effect of different tillage systems and moisture on the diversity of diatoms.

Soil samples were collected from April until November 2010. Soil moisture was measured once a month. Soils under simplified tillage were moister (22,2–38,1%).

Altogether 121 diatom taxa were found. Soils under the plantation with reduced tillage had more taxa (110), compared to 86 in the plantation with traditional tillage. The highest diversity was found in both tillage systems in April. Subsequently the species diversity was decreasing.

In both tillage systems *Hantzschia amphioxys, Mayamaea atomus* var. *permitis, Nitzschia pusilla, Pinnularia obscura, Stauroneis borrichii* and *S. nana* dominated. Under the traditionally tilled plantation *Hantzschia amphioxys* created larger populations, whereas in the plantation with reduced tillage *Nitzschia pusilla* was more frequent.

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ALGAL COLLECTIONS IN MORAVIAN MUSEUM, BRNO (CZECH REPUBLIC)

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Moravian Museum, Brno is the central institution of the Czech Republic, in which is deposited the main collection of cyanobacteria and algae. Till the end of 1980s, phycological material had been sporadically scattered in herbaria of various museums and universities.

In 1987 Algological Section of Czechoslovak Botanical Society proposed to create a central algal collection in Moravian Museum, because of the fact that the largest amount of the phycological collections was currently located in Brno museum (e.g. historical collections of F. Dvořák, F. Nováček). The presence of professional algologist in the staff guaranteed necessary care of collections and possible further work with them. Two historical collections were transmitted from the Institute of Botany, Třeboň: inheritance of desmidiologist J. Růžička and diatomotologist J. Bílý. Collection of J. Růžička, consisting from 2626 liquid samples preserved with formaldehyde, became a basis of the next collection. Liquid samples containing conserved algae and invertebrates in their natural assemblages proved to be more appropriate than only herbarium; not only from the taxonomical point of view (only several groups can be studied from dry material) but also as an important ecological subject. Samples are valuable as a picture of wetland status in a certain time and place and can be used for study of succession and comparison of the past and present state.

In 1996 Hydrobiological Laboratory was established as a new department of Moravian Museum due to its distinguished collections of the specific character focused on ecology From 1996, a new department of Moravian Museum, Hydrobiological Laboratory was established due to the specific character of collections focused on the ecology. Both formaldehyde samples, diatom slides and mineralized frustules in powder state usually

contain a number of species occurring in a certain time in one site together and being characteristic for them. Of course, also herbaria of charophytes or some cyanobacteria and algae are represented in our collection, however, monospecific items do not prevail. Both types are important for further research.stadia.

In 2003, the collection was registered as the number "24-hydrobiological subcollection" in the Central Registry of Museum-type Collections (CES) under the Ministry of Culture of the Czech Republic (http://ces.mkcr.cz/en/intro.php).

Till now, over 2500 items including 20 type specimens of cyanobacteria and algae labelled BRNM HY XXX have been registered in a computer system for documentation of museum collections DEMUS (http://www.citem.cz/en/projects/demus/).

An extensive material from the field research is continuously studied in details: algal species and samples of various kinds of water and wetland biotopes or localities and regions. Samples are prepared for registration to the official collection in cooperation of numerous specialists.

In 2009, according to a new concept of the new management of the Moravian Museum, the Laboratory of Hydrobiology was renamed to Algological Department. Unfortunately, the position of curator of phycological collection placed in the Moravian Museum has been stopped since 1 February 2011.

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ALLELOPATHIC EFFECTS OF THE PICOCYANOBACTERIA *SYNECHOCOCCUS* SP. ON GREEN ALGA *CHLORELLA VULGARIS* AND DIATOM *SKELETONEMA MARONOI*

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Allelopathy may be one of the factors contributing to the formation and maintenance of cyanobacterial blooms (Suikkanen et al., 2004) and picocyanobacteria of the genus *Synechococcus* have been shown to be important component of marine and freshwater ecosystems (Stal et al., 2003). In this study, the influence of allelopathic compounds on the growth, chlorophyll fluorescence and performance of photosynthesis of two phytoplankton species: *Chlorella vulgaris* and *Skeletonema marinoi* was investigated by addition of cell-free filtrate of *Synechococcus* sp. cultures grown under different light conditions (10, 100 and 190 μmol photons $m^{-2}s^{-1}$). The examined strains were isolated from the costal part of the Gulf of Gdańsk (southern Baltic Sea) and are maintained as unialgal cultures in the Culture Collection of Baltic Algae at the Institute of Oceanography in Gdynia (http://ocean.ug.edu.pl/~ccba/). To determine the effect of the investigated factor and their interaction on allelopathy activity of examined strains, one-way analysis of variance ANOVA were carried out. The culture density was estimated microscopically and by measurement of optical density at 750 nm. The measurements of photosynthesis rate were carried out using Clark oxygen electrode. Chlorophyll *a* fluorescence was measured fluorometrically using a Pulse Amplitude Modulation (PAM) by fluorymeter Hansatech FMS-1. Addition of cell-free filtrate from *Synechococcus* sp. cultures grown under varied irradiance inhibited the growth of *C. vulgaris* and *S. marinoi* and high irradiance affected the donor species by increasing its production of allelochemicals. The highest drop of

growth, chlorophyll *a* fluorescence and photosynthetic light response curves were observed after the addition of cell-free filtrate obtained from *Synechococcus* sp. grown at 190 μmol photons $m^{-2}s^{-1}$. Analyzed species of diatom *S. marinoi* was more sensitive to the influence of cell-free filtrate than species of green algae *C. vulgaris*. The longer the exposition time the lower the response of analyzed cells in comparison to control. At the seventh day of experiment the response of *S. marinoi* amounted to 40% and *C. vulgaris* to 80%. Allelopathic interactions can occur in all aquatic habitats (Suikkanen *et al*., 2004), but the influence of abiotic factors on allelopathic effects of cyanobacteria on other planktonic organisms are in many cases unknown. These findings suggest that *Synechococcus* sp. may reveal allelopatic activity and that the production of allelopathic substances is regulated by the availability of irradiance.

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POPULATION DYNAMICS OF *PLANKTOTHRIX AGARDHII* (GOM.) ANAGN. ET KOMAREK IN A SHALLOW HIGHLY EUTROPHIC RESERVOIR UNDER DIFFERENT WATER LEVEL

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Water management associated with the introduction and discharge water through the sluices is conducted in the shallow, eutrophic/hypertrophic reservoir Domaszne (A: 95 ha, $D_{max.}$ 3.1 m). Thus, the water level can change significantly from year to year or even within one year. The decrease of level (near 30 % of gauge height, ca. 50% of reservoirs' volume) in 2008 year (July-September) was followed, but a lack of so significant lowering in 2010 was observed. Presented studies were carried out in the both years. Water samples were taken biweekly from April to October. Basic physic-chemical parameters of water (temperature, pH, PE, K_d, phosphorus and nitrogen compounds) were measured. Species composition, numbers and biomass of phytoplankton were also determined.

Altogether 28 taxa constituted the community of Cyanobacteria and *Planktothrix agardhii* was constantly co- or dominating taxon in the both years. After the decrease of water level the abundance and biomass of *Pl. agardhii* was higher (2008: 9.78–40.49 10^6 dm^{-3}, 3.9–16.2 mg dm^{-3}; 2010: 0.18–16.64 10^6 dm^{-3}, 0.08–6.6 mg dm^{-3}). The mean length of trychoms was also shorter (246.1 vs. 311.9 μm). The differences between the both periods (July-September) in daily air temperature, sum of precipitation (lower in 2008) and total solar radiation (lower in 2010) were observed. After the decrease pH, K_d and $P\text{-}PO_4$, $N\text{-}NH_4$, TP, and TN were higher.

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POTENTIALLY HEPATOTOXIC CYANOBACTERIA IN A SHALLOW HIGHLY EUTROPHIC RESERVOIR: A SHIFT TO MASSIVE APPAERANCE INDUCED BY CHANGE OF WEATHER CONDITIONS

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Among Cyanobacteria some species can develop abundantly and they are able to produce microcystins. Their development in shallow reservoirs is often dependent on seasonal changes of meteorological conditions. Presented studies were carried out in the shallow, eutrophic/hypertrophic reservoir Domaszne (A: 95 ha, D_{max}.: 3.1 m; TSI_{TP}=68, TSI_{SD}=64, $TSI_{Chl\text{-}a}$=74). Water samples were taken biweekly from April to September 2010. Physic-chemical measurements comprised temperature, PAR (calculation of K_d), phosphorus and nitrogen compounds. Species composition, numbers and biomass of phytoplankton were also determined. Intracellular microcystins was determined by HPLC-DAD. Meteorological conditions were characterized by daily air temperature and mean total solar radiation.

Altogether 124 taxa were found in the phytoplankton: Chlorophyceae (56), Cyanoprokaryota (28), Euglenophyceae (14), Bacillariophyceae (12) and other (14). The total abundance of phytoplankton was 6.82–27.78 10^6 dm^{-3} and the total biomass was 6.8–21.0 mg dm^{-3}. In the development of Cyanobacteria two periods with different abundance and species composition can be distinguished. In April-June the abundance and biomass of Cyanobacteria were low (0.06–0.34 10^6 dm^{-3}, 0.03–0.13 mg dm^{-3}; respectively) with the most abundant *Planktothrix agardhii, Limnothrix redekei, Limnothrix planctonica, Planktolyngbya limnetica*. In July-September mass development of *Pl. agardhii*, *Anabaena*

planctonica and Ap*hanizomenon gracile* was observed. The abundance and biomass of Cyanobacteria were higher (8.46–10.50 10^6 dm^{-3}, 3.7–8.1 mg dm^{-3}; respectively). Twelve taxa of Cyanobacteria were potentially able for microcystins production: *Pl. agardhii*, *Anabaena* spp. and of less abundant *Microcystis* spp., *Woronichinia* spp., *Anabaenopsis* spp. Intracellular MC concentrations (14.31–23.61 μg dm^{-3}) were significantly higher than in the earlier period (1.14–2.43 μg dm^{-3}). Significant correlations were found for *Pl. agardhii* vs. MC-RR ($r > 0.90$), *Anabaena* spp. vs. MC-LW and *Microcystis* spp. vs. MC-LR ($r > 0.60$). The shift to mass appearance of Cyanobacteria was associated with an increase in weather conditions (daily air temperature, partially mean solar radiation), but also in water temperature, K_d and P-PO_4, N-NH_4, TP, TN.

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THE INFLUENCE OF TWO TILLAGE SYSTEMS ON DIATOM COMMUNITIES IN WHEAT PLANTATIONS

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Altogether 121 diatom taxa were found. Soils under the plantation with reduced tillage had more taxa (110), compared to 86 in the plantation with traditional tillage. The highest diversity was found in both tillage systems in April. Subsequently the species diversity was decreasing.

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FILAMENTOUS NITROGEN-FIXING CYANOBACTERIA IN THE BALTIC SEA AND THEIR COEXISTENCE WITH PICOCYANOBACTERIA

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Two species of diazotrophic cyanobacteria, *Nodularia spumigena* and *Aphanizomenon flos-aquae*, possess the capacity to proliferate in waters of the Baltic Sea during summer season when favorable weather conditions occur. The bloom formation and its intensity are stimulated by anthropogenic eutrophication and global increase in temperature. These two species are essential contributors to overall nitrogen load in the Baltic Sea. It is estimated that they add ca. 400.000 tones of this element per year. *N. spumigena* is additionally a matter of special concern, as it produces a potent hepatotoxin (nodularin). Negative impact of the compound on the environment and its accumulation in aquatic organisms were proven.

In the current study, phytoplankton composition, bloom dynamics and presence of toxins were analyzed in the summer season of 3 subsequent years (2008–2010). Additionally in 2008 and 2009, biomass of picocyanobacterium *Synechococcus* spp. was measured. Water samples were taken at six stations (GK1-GK6) during cruises of a ferry sailing from Gdynia to Karlskrona. Nutrients, chlorophyll and toxin concentration, as well as phytoplankton composition were analyzed.

In 2008, the peak biomass of *N. spumigena* equal to 279 μg C/L was recorded on 14th of July (station 2). In years 2009 and 2010 the maximum biomass values were lower and amounted to 204 μg C/L (02.07, GK6) and 36 μg C/L (05.07, GK4) respectively. Low value of biomass determined in 2010 was a surprise, as summer months were hot that year. Generally *A. flos-aquae* was less abundant. In subsequent years peak biomass of 148, 28 and 29 μg C/L was recorded. Nodularin concentrations were also declining in the study period. In 2008, the hepatotoxin was present in water from the beginning of July till

mid August, with the highest concentration determined on 14th of July – 4 μg/L. In 2009 hardly any toxin was detected in the study period. Only on the 2nd of July, nodularin was present at all 6 stations (with peak concentration 2.2 μg/L). In 2010 nodularin was only detected at two stations on 22nd of June.

In first two years of the study, *Synechococcus* spp. biomass was systematically growing when the bloom of filamentous cyanobacteria was developing. However just before the peak bloom of *N. spumigena*, the picocyanobacterium amount started to decline. This result is contradictory to the earlier studies indicating stimulatory effect of N-fixing *N. spumigena* on *Synechococcus* spp. growth.

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DIATOM COMPOSITION AND ECOLOGICAL STATUS OF LAKE BALATON, HUNGARY

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According to the preliminary studies the species number and the diversity of the epiphytic diatom communities were remarkable in Lake Balaton, Hungary. Because of the further investigations and the biomonitoring of its ecological status, the study of the species composition of these communities is very important.

The diatom samples grown on *Phragmites australis* were collected monthly from six sampling points in Lake Balaton (Badacsony, Balatonszepezd, Tihany, Siófok, Szántód, Fonyód) between March and November 2007 to study the seasonal change of the diatom assemblages.

39 species were dominant from the 96 diatom species identified in the 60 samples (eg. *Amphora pediculus, Achnanthidium minutissimum, Cymbella excisa, Cocconeis placentula, Navicula cryptotenella, Pseudostaurosira brevistriata, Fragilaria capucina* var. *vaucheriae, Rhoicosphenia abbreviata*).

The seasonal differences could be very well observed in Badacsony and Balatonszepezd in the northern part of the lake. The indicator species of mesotrophic water were dominant in spring (eg. *Diatoma tenuis, Diatoma moniliformis*), but in summer and autumn species preferring eutrophic waters were more abundant (eg. *Melosira varians, Cocconeis placentula, Achnanthidium minutissimum, Amphora pediculus*). However, the species composition was substantially different of the northern and the southern littoral regions. Some species (eg. *Diatoma vulgaris, Nitzschia dissipata, Cyclotella ocellata, Cocconeis placentula, Rhoicosphenia abbreviata*) were dominant in the northern, but were less abundant or totally absent at the sampling points in the southern littoral region. *Pseudostaurosira brevistriata, Fragilaria construens f. venter, Fragilaria capucina* var. *vaucheriae* were dominant in the southern part of the lake due to their shade adapted characteristic.

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RELATIONS BETWEEN THE APPEARANCE OF TAXA FROM THE *NAVICULA* SP. GENUS AND THE ENVIRONMENTAL PARAMETERS IN THE NER RIVER

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Polisaprobic water zone, characterised by high organic pollution, forced water organisms to specific adaptations. Benthic diatom communities, inhabitating strongly polluted waters, are distinguished by high abundance of very resistant species. Those taxa tolerate low level of oxygen concentration and high levels of $BOD_{5,}$ nitrates and phosphates. The aim of this study was the analysis of qualitative and quantitative diatom composition in Ner rivers.

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HETEROGENEITY IN PHYTOPLANKTON COMMUNITY STRUCTURE IN A TEMPERATE LAKE DURING SPRING

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In April-May 2010, we monitored the biological properties of pelagic waters in Lake Strzeszyńskie in Poznań, Poland (area 34.9 ha, max depth 17.8 m, volume 2.8×10^6 m^3). The aim of this study was to examine vertical fluctuations in phytoplankton abundance and species composition. Samples were collected at the deepest part of the lake, from the whole water column (from the surface to bottom) every two meters (9 levels). Samples were preserved with buffered formaldehyde or Lugol solution. All taxonomic and size groups were taken into account. Picoplankton was concentrated on polycarbonate black filters (0.2 um pore size) and counted under a BX-60 epifluorescence microscope. Nano- and microplankton were counted using an inverted microscope and the standard Utermöl method.

In both months, phytoplankton abundance varied widely: $15–257\times10^3$ cells/ml in April and $28–357\times10^3$ cells/ml in May. Thus the ratio of maximum to minimum value in the water column reached about 17 and 13, respectively. Thus it was higher in April, when thermal stratification was poorly developed. However, in both months, maximum phytoplankton abundance was recorded at the depth of 4 and/or 6 m. This was confirmed by deep chlorophyll-a maximum: 10 ug/l in April and 14 ug/l in May.

In April, in nanoplankton and microplankton (cell size >2 μm), percertage contribution of cryptophytes, diatoms, and chlorophytes were similar, but at the depth of ≥12 m, cyanobacteria prevailed (71–99%). In May, haptophytes dominated to the depth of 4 m (81–85%), diatoms at 6 m (90%), chrysophytes at 8 m (60%), while cyanobacteria at ≥10 m.

Picophytoplankton (cell size ≤2 um) were always most abundant, irrespective of sampling depth. Their contribution to total phytoplankton abundance in April ranged from 87 to 98%, and in May, to 97%. The communities of the smallest photoautotrophs were

composed of cyanobacteria and chlorophytes. The latter formed the largest populations in April (up to 70×10^3 cells/ml, accounting for 15–64% of total picophytoplankton abundance). However, their abundance decreased significantly in May, and remained high only in the cooler, deeper were layer.

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THE COMPARISON OF TWO DIATOM INDICES (IO, SPI) ON THE BASIS OF THE ASSESSMENT OF WATER QUALITY IN THE PILICA RIVER

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The following research was based on the 157 benthic samples collected from seven sampling sites located in the middle section of the Pilica River. The research was conducted from October 2005 to September 2007. Altogether 378 diatom species were identified in the collected material. The assessment of water quality in the Pilica River, based on the perfect bio indicative features of diatoms, was done using two indices: IPS – Specific Pollution Sensitivity Index and IO – Diatom Index. Achieved results were compared in order to define similarity in the evaluation of water quality between both indices.

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HABITAT PREFERENCES OF DIATOM TAXA AT FENN'S AND WHIXALL MOSSES IN THE UNITED KINGDOM – AN ANALYSIS WITH USING AN INDICATOR VALUE (INDVAL)

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The main aim of the study was identification of the diatom taxa which prefer specific physic-chemical and hydrological conditions using an easy and effective numerical tool such as Indicator Value (IndVal) (Dufrêne, Legendre 1997). The subjects of the study were six selected sampling sites located at Fenn's and Whixall Mosses in the United Kingdom. Altogether 92 benthic diatom taxa were identified in 72 samples collected from September to August 2009. Only 1% of identified species belonged to *Centrales* and the remaining 99% to *Pennales*. On the basis of the diatom composition samples were grouped into three clusters using a cluster analysis (Ward's method, Euclidean distance). Each cluster included samples collected at sites characterized by similar physic-chemical and hydrological conditions. Using the IndVal the clusters (with respective specific physic-chemical and hydrological conditions) most preferred by each taxon were identified.

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MOST ABUNDANCE DIATOM GENERA OF RIVERS IN TURKEY

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Abstract: The study of diatoms is necessary because they are the sources of oxygen in rivers, and also constitute the basic primary productivity chain and are used in determining water pollution levels. However, this study work on 27 river of Turkey and this study will contribute to the diatom flora of Turkey.

Most abundant diatom genera; 27 Nitzschia 21, Navicula and 12 Surirella in Samsun İncesu Creek, 14 Cymbellain Cip Stream, 10 Gomphonema in Akçay Stream was found. Most diatom species detected in Nilüfer Stream (Bursa) (122), Flent Stream (Kütahya) (115), İncesu Creek (Samsun) (108), in Tortum Stream (Erzurum) (113) and Çoruh River (Bayburt) (105). In the rivers, a lot of diatoms which are known as pollution indicator only *Achnanthes lanceolata, Caloneis ventricosa, Cyclotella meneghiniana, Diatoma elongatum, Gomphonema olivaceum, Nitzschia sigmoidea, Pionularia brebissoni, Rhoicosphenia curvata* and *Synedra ulna* were found in less numbers in the Turkeys rivers.

The diatom flora of the Çoruh River is similar to diatom flora of the Sakarya River, the Aras River, the Kızılırmak River, the Karasu River, the Samsun İncesu Stream, the Ankara Stream, the Çubuk Stream, Karasu River and the Meram Stream.

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AN SEM STUDY OF THE OOSPORE WALL ORNAMENTATION IN THE GENUS *TOLYPELLA* (CHARALES, CHAROPHYCEAE)

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Members of the charopytes (order *Charales*, family *Charophyceae*) produce a thick--walled zygote – the female sex organ – surrounded by five sinistrally wound spiral cells. After fertilization rapid changes occur in the walls of the newly formed zygote and the sterile ensheathing cells. These changes result in the formation of a thick wall that is multilayered, pigmented, and often overlaid by calcite. This structure is known as the spore, oosporangium or oospore, although the latter term should more correctly be reserved for the zygote. Of the eight oospore wall layers two are primary wall layers and the remainder are secondary wall layers. The outermost layer of the wall is deposited by the spiral cells and is called the ornamentation layer or the ectosporine, which has chemical properties similar to sporopollenin. Differential deposition in this layer of the wall is frequently sculptured and forms specific oospore wall ornamentation. Oospore characters e.g. length, width, number of striae and pattern of wall ornamentation , have been used since the very beginning of the taxonomic study of charophytes. In these studies the oospore wall ornamentation patterns were described based on light microscopic observations. In case of the genus *Tolypella*, taxonomic investigations are difficult because the morphological features are minute and require careful dissection of the fertile heads, the details are variable from one habitat to the next, and the oospores rarely mature (if at all) and in general do not exceed 400 μm in size. The aim of this study was to determine the type of oospore variation in different *Tolypella* species using SEM microscopy, to document the size of the oospore and type of oospore wall, and to determine whether differences between them can be helpful in taxonomy and the routine determination of material directly from seed banks. This study provides the first detailed report of oospore wall ornamentation patterns in the *Tolypella* genus, and the first description of the ornamentation present on the walls of several species of this genus.

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PHYTOBENTHOS AS INDICATORS OF STREAMS WATER QUALITY

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Phytobenthos was investigated in 23 Lithuanian streams and rivers of different water quality in summer 2009–2010. Totally 133 taxa belonging to four phylum were identified. Species number in the communities varied from 7 to 50. *Cyanobacteria* and *Chlorophyta* were the most diverse group and constituted respectively 59% and 33% of all recorded algae. Only six *Rhodophyta* and four *Ochrophyta* taxa were found.

Red-algae did not tolerate wide range of TN (4.650–9.360 mg/l) and TP (0.041–0.767 mg/l) concentrations and were found only in the streams of good-moderate water quality. Additionally, they formed the largest biomass under the lower values of nutrients. Good water quality streams were distinguished by high variation (from 8 to 34) of cyanobacteria species also.

Generally, phytobenthos communities based on species composition and their occurrence in the lotic ecosystems were similar. Epiphytic assemblages with *Chamaesiphon incrustans* Grunow in Rabenhorst, *Heteroleibleinia* cf. *leptonema* (Skuja) Anagnostidis et Komárek, *H. pusilla* (Hansgirg) Compère, *H. ucrainica* (Širšov in Elenkin) Anagnostidis et Komárek, *H. kossinskajae* (Elenkin) Anagnostidis et Komárek, *Stigeoclonium* sp. and metaphytic *Geitlerinema splendidum* (Greville ex Gomont) Anagnostidis were the most spread. Rare and sensitive red-algae *Audouinella hermanii* (Roth) Duby, *Batrachospermum sp.* formed abundant epiphytic and/or epidendric populations in siliceous streams, and were deemed to be useful for water quality indicators.

Classification categories of relevant indicator species were developed for the assessment of ecological status of the streams. *Spearman's correlation* coefficients were calculated to evaluate the relationship between phytobenthos species occurrence, abundance and environmental variables in Lithuanian streams and rivers. Water conductivity and current velocity had the most influence on prevailing species development. Significantly negative correlation was estimated between algal communities and NO_2-N amounts, meanwhile positive correlations – between biological parameters and pH.

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THE DYNAMICS OF CYANOBACTERIA AND CYANOTOXINS IN THE EUTROPHIC LAKES ON THE CATCHMENT AREA OF GULF OF FINLAND

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Cyanobacteria have been an important ecological component of aquatic systems. Increased eutrophication of water bodies has led to a growing trend in cyanobacterial bloom. Toxic water bloom have become common in North-West Russia lakes. The study was focused on the taxonomic structure and seasonal dynamics of phytoplankton algae and cyanobacteria, and determination of cyanotoxin in the shallow, eutrophic Lake Sestroretsky Razliv and Lake Suzdalskoe in Saint-Petersburg. The investigation of Lake Sestroretsky Razliv has been carried out from 2008 year. In Lake Suzdalskoe samples were collected from May till September in 2010.

The study cyanotoxins has been carried out using liquid chromatograph - mass-spectrometer - LTQ OrbiTrap ("Finnigan") with linear and orbital ion traps and electrospray--ionization in positive mode (ESI+).

Planktothrix agardhii (Gom.) Anagn.et Kom. and *Aphanizomenon flos-aquae* (L.) Ralf et Born et Flah. were dominant species in summer in the investigated lakes. Average total phytoplankton biomass in these lakes was usually above 30,0 mg L^{-1}.

Planktothrix agardhii was monodominant species during the bloom in the July and August in Lake Sestroretsky Razliv. Biomass of *Planktothrix agardhii* was over 70 %. The maximum concentration of anatoxin-a was 5,0 mg L^{-1} in 2008. During the cyanobacteria bloom in 2010 hepatotoxins were mainly detected in same sampling points.

In 2010 in Lake Suzdalskoe the water bloom was connected with the presence of toxic species of *Planktothrix* and *Aphanizomenon*. Anatoxin-a and microcystins were detected in all water samples of this lake.

It was established that the studied lakes poses a threat for human and animal health in the maximum warming up water period.

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CYANOBACTERIA – A SOURCE OF BIOACTIVE SUBSTANCES USEFUL IN PLANT PROTECTION AND BIOCONTROL

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One of the numerous interesting properties of Cyanobacteria is production of biologically active compounds. Among them, there are substances inhibiting growth of other organisms, as well as the enzymes that are able to inactivate signal molecules involved in the quorum sensing (QS) mechanism. QS is kind of cell-to-cell communication, between microorganisms that is mediated by chemical signals and dependent on the signal molecule concentrations. The most extensively studied QS systems rely on the use of *N*-acylhomoserine lactones (AHLs) signal molecules. AHLs are used by plant pathogenic bacteria to control the production of virulence factors and for plant colonization. Some bacteria produce enzymes that are able to inactivate AHL signals produced by others and hamper QS-mediated processes via a phenomenon known as quorum quenching (QQ). This mechanism seems to be a promising strategy to control bacterial plant diseases.

The aim of presented work was to assess whether 72 reference and 17 polar cyanobacteria strains have antimicrobial activities against 12 plant pathogenic strains belonging to *Pectobacterium, Dickeya* and *Brenneria* genera and if they produce enzymes which degrade the AHLs.

The antibacterial activity revealed seven strains of cyanobacteria, *Chroococcidiopsis* sp. PCC7203, *Pleourocapsa* sp. PCC7516, *Stanieria* sp. PCC7301, *Nostoc punctiforme* PCC73102, *Oscillatoria* sp. PCC7112, *Lyngbya* sp., *Phormidium laminosum Pho3*. The broadest spectrum of antimicrobial activity was observed for water extract of *P. laminosum*, which inhibited growth of all tested phytopathogens. In fact the substances inhibit-

ing the growth of plant pathogenic bacteria were produced by *Brevibacillus brevis* which grows in cyanobacterial sheets. Interestingly the substance with antibiotic activity was secreted only when the *B. brevis* was in consortium with cyanobacterium, phytopathogen and other *Bacillus* species.

All cyanobacterial strains showing antagonistic activity against plant pathogens were checked if they are not potentially toxic. None of them posses the genetic determinants (*mcyB* and *E* genes) responsible for synthesis of the most common cyanotoxin (microcystin).

The AHL degradation properties were observed in stationary phase of growth in case of four N-fixing cyanobacteria strains, *Anabaena* sp. PCC 7120, *Gloeobacter violaceus* PCC7421, *Nostoc punctiforme* PCC73102, and *Anabaena PCC7122*. The sequence comparison of *aiiC* gene encoding AHL-acylase from *Anabaena* sp. PCC 7120 with other cyanobacterial genomes available in the databases allowed for designing of the new PCR primers for detection of enzyme responsible for the degradation of AHLs. The presence of 1500 bp *aiiC* gene fragment was observed in case of *Anabaena* sp. PCC7120, *G. violaceus* PCC 7421, *N. punctiforme* PCC 73102, *N. punctiforme Hegewald 1971-108, Nostoc* sp. PCC7937*, Nostoc sp. UM3, A. variabilis* NIVA-CYA19 and Antarctic *Nostoc* sp. Strain S8. The sequencing of obtained PCR products confirmed that the new primes could serve for fast screening of cyanobacterial strains producing enzymes which degrade AHLs.

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HEAVY METALS IN WATER AND SEDIMENTS: HOW DO THEY INFLUENCE ON PHYTOPLANKTON?

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Pollution of freshwaters and sediments by potentially harmful metals is serious problem in many regions of the world. The major sources of contamination are mines. There is some part of Poland where problem is really important. This is e.g. Upper Silesia (Southern Poland), which is particularly influenced by such types of anthropogenic activities.

It is well known phenomenon that phytoplankton may assimilate metals from the waters and it is also well known that algae can contribute to the movement of metals from the polluted waters into the bottom sediments.

Our studies were focused on the phytoplankton in the five fish ponds (*MM*, *MS*, *MD*, *MDo*, *MK*), which are impoundment by the Matylda River. For more than 100 years, the Matylda River has been polluted by runoff containing zinc and lead ores from a mine in Chrzanów. Finally, the mine was closed in 1972. The sediments four of those ponds (*MM, MS, MD, MDo*) are highly contaminated with Cd, Zn and Pb. Their concentrations oscillate from several to a thousand times higher compare to the geochemical background. The sediments of the fifth pond (*MK*) are without high contamination of heavy metals, because they had been removed three years ago. The samples had been collected whole year during the 2009. We found that the highest average density of phytoplankton had been in the first of fish pond (*MM*), but the lowest in the third (*MD*) and fourth (*MDo*). The highest density of cyanobacteria had been found in the fourth pond (*MDo*). The highest density of chrysophytes, euglenophytes, and desmids had been found in the fifth pond

(*MK*). The highest density of diatoms, dinophytes and cryptophytes had been found in the first pond (*MM*). The last, the highest density of chlorophytes had been found in the third pond (*MS*). The highest value of concentration Cd, Fe, Mn, Pb and Zn in sediments had been found in one sampling point of the the third pond (*MS*). However, the average concentrations of those metals had not been the highest in that pond. The concentrations of metals in the waters also differ in particular ponds. Correlation of phytoplankton density and metals concentrations in water and sediments showed very strong positive correlation with Cd concentration, both forms, in water and sediments, but particular groups of algae showed correlations with different metals.

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DYNAMICS OF PHYTOPLANKTON COMMUNITY IN MESOTROPHIC BORÓWNO LAKE

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Borówno Lake is located near Bydgoszcz in ($53^0 08^{'}$ N; $18^0 00^{'}$ E Northern Poland). Situated on Świecie Hight it is surrounded by forest, fields and allotments. The nearby region is mainly agricultural area owing to fertile soils. Center of recreation is built near lake. The lake leaks affluent and has catchments area 43, 8 ha and its maximum depth is 14,1 m. Among four lakes in Dobrcz Parish the Borówno Lake is the only one mesotrophic while three others are strongly eutrophised.

The phytoplankton in Borówno Lake was never object of phycological studies. The aim of our work were it's qualitative and quantitative analyses with reference to recorded physico-chemical parameters. Qualitative and quantitative analysis of phytoplankton assemblages were done in years 2004 and 2009. In Borówno Lake 102 taxa were identified: Cyanoprocaryota –33 taxa, Chlorophyta- 32 taxa, Bacillariophyceae – 29 taxa, Chrysophyceae and Euglenophyta – 3, Dinophyceae –2. The bottom of shallow waters was covered with the meadows of Charophyceae with dominating species Chara vulgaris.

Biomass of phytoplankton varied in range from 1, 23mg dm^3 in April to 5,74 mg dm^3 in August 2009. Ceratium hirundinella was the dominating taxon for the whole season, but during summer another co dominating taxon Microcystis aeruginosa occurred .

The quality parameters, phytoplancton biomass, the chlorophyll a concentration and the TSI index indicate the mesothropic character of the lake. The blue-green algae blooms which are the greatest problem for good condition of water in lakes were no observed both in 2004 and 2009 years.

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BENTHIC DIATOMS IN THE BIOLOGICAL ASSESSMENT OF WATER QUALITY OF THE JASIEŃ RIVER

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The Jasień River is a right-bank tributary of Ner, which catchment area is about 79.5 km^2 and a general length is 12.660 km. Jasień has its beginning at the outlet of the drain pipe at the crossroads of the Giewont and Pomorska Streets. Apart from the spring section, the river flows in a covered channel below the ground. On the surface, it flows between the Widzewski Park and Przędzalniana Street.

Jasień carries small amounts of drainage water and existentially-economic sewages from the neighbouring buildings. Periodically, the channel of the river is filled with rain water, which is collected by the system of urban canalization in the drainage area, what results also in polluting the river.

Samples for research were taken at 5 sampling sites in 2010–2011. The sampling site 1 is at the springs of the Jasień River at crossroads of Giewont and Pomorska Streets. The site 2 is located in the Widzewski Park. The site 3 is situated below the tributary of the Karolewka River. The site 4 was created below the second tributary of Jasień (Olechówka). The site 5 is located in surroundings of Odrzańska and Zatokowa Streets, it is the outlet section of the Jasień River to Ner.

The collected samples were subjected to qualitative and quantitative analysis. In order to assess the quality of water three diatom indices such as IPS (Specific Pollution Sensitivity Index), GDI (Generic Diatom Index) and TDI (Trophic Diatom Index) were calculated using the OMNIDIA (Lacointe et. al. 1993, Version 4) software. The obtained results shown that *Navicula gregaria* and *Nitzschia palea* were dominat species in examined samples (about the 5%), and water was classified into III-IV class of water quality.

TEST -STRAINS OF MICROALGAE CHLAMYDOMONAS REINHARDTII TO ASSESS THE STATE OF POLLUTED WATER ECOSYSTEMS

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The model test-system development to assess the effect of ecotoxicants on cell systems and genetic consequences of its application is an actual problem.

Chlamydomonas reinhardtii Dangeard – is a green soil single-celled algae. It is a model organism for genetics including revealing the genetics events under ecotoxicant effects.

The purpose of the present work is to assess the state of wastewater on treatment facilities and car wash stations in Almaty; and wastewater in Pavlodar oil-refining factory as well. Toxicity and genetic activity of factors of aquatic environment were assessed on a base of obtained collection strains of *Chlamydomonas reinhardtii* microalgae. Quartz lamp BF 1.5 was used for UV light. Cells were not treated with UV light were control.

Investigation of mutagenic activity included assess of direct mutations occurrences – pigmental (in dark), resistant to grow inhibitors, to erythromycin (50 mg/l) and reverse mutations in light-sensible strains. We revealed three community types characterized by different colors: dark-green, light-green and lettuce green. Maximum mutative frequency was observed after three minutes under UV light. Direct mutations – pigmental and resistant to erythromycin – were distinctly higher. Obtained results can be used for positive control for defining toxicity of eco toxicants and polluted ecosystems under UV light.

We assessed some water pollutants by chemical analyses and biotesting with use of mutant cell wall less strain *Chlamydomonas reinhardtii GB-277.*

The medium water pollution and toxicity in "Big Almatynka" river and in Almaty treatment facilities were revealed. The samples of wastewater from car wash stations had high mutagenic activities; that was attested in high occurrence of light-resistant revertants. The samples isolated from wastewater of Pavlodar oil-refining factory were toxic and mutagenically actively as they induced occurrence of direct and reverse mutants. So,

the assess system of toxicity and genetic activity of factors of water ecosystems was developed. It was shown that strong mutagen UV light induced direct (pigmental and resistant to erythromycin), therefore, can be used as positive control.

So, system of water quality assess on a base of microalgae is perspective system and can be developed in future by development of new testing methods; moreover, a range of mutant strains can be extended, for example, envelope less, chlorophyll β or reparation system abnormality strains can be used.

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MACROPHYTOBENTHOS OF THE PUCK BAY (SOUTHWESTERN PART OF THE GULF OF GDAŃSK) AND ASSOCIATED EPIPHYTIC DIATOMS – PRELIMINARY RESULTS

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Waters of the Gulf of Gdańsk have been regarded as strongly eutrophic and ecologically impoverished since the late 1970s. The decline of the flora and fauna of this region has been the subject of a number of studies in the past. It was estimated that, amongst other changes, more than 75% of the underwater meadows have disappeared, causing significant transformation of the whole ecosystem.

In this paper we present our latest findings on the composition, structure and biomass of phytobenthos communities which suggest some revival of the Puck Bay within the Gulf of Gdansk. In contrast to latest publications (e.g. Kruk-Dowgiałło & Szaniawska 2008), a significant decrease in abundance of brown algae from genera *Pilayella* Bory and *Ectocarpus* Lyngbye was observed. Furthermore the biomass of macrophytobenthos increased to a maximum of 63 $g \cdot m^2$ but this was due mostly to significant amounts of rooted *Angiospermae*: the sea grass *Zostera marina* L. and the representatives of the pond weed *Potamogeton* L. Species of *Polysiphonia* Greville and *Cladophora* Kützing genera were frequent components of studied assemblages. In autumn they were accompanied by rarely reported *Lyngbya semiplena* (C.Agardh) J.Agardh ex Gomont, *Oedogonium* Link sp. and *Spirogyra* Link sp.

Diatoms dominated epiphytic communities, often forming thick layers on the surface of studied plants, forming loose aggregations which often resembled 'clouds' formed by brown algae as e.g. *Pilayella* and *Ectocarpus*. The most favourable substrata for diatoms were thalli of *Polysiphonia* sp. and *Ceramium* Roth sp. whereas *Ulva* L. sp. was hardly ever covered. Diatom assemblages were characteristic for each host genus. Generally, the most abundant epiphytic diatoms were: *Berkeleya rutilans* (Trentepohl) Grunow, *Cocconeis pediculus* Ehrenberg, *Tabularia fasciculata* (C.Agardh) D.M.Williams & Round, *Licmophora* sp. and *Rhoicosphenia abbreviata* (C.Agardh) Lange-Bertalot.

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