

**The development of perceptions of aquatic eutrophication and its control**

*Colin S. Reynolds*

*Centre of Ecology and Hydrology Windermere, The Ferry House, GB-LA22 0LP  
AMBLESIDE, Cumbria, UK, e-mail [csr@ceh.ac.uk](mailto:csr@ceh.ac.uk)*

**Abstract**

The paper attempts to present a modern view of aquatic eutrophication in terms of the metabolism of the impacted systems. The significance of increased phosphorus loadings, highlighted by Vollenweider, is upheld, although the importance of site-specific reactions to external loads is emphasised. The behavioural conformity of the biota of many lakes to the Vollenweider regression is, in many ways, more remarkable than the departures. The diagnosis of the biomass-carrying capacity of the available phosphorus and the phosphorus-dependency of the accumulated biomass are reviewed and deductions are offered concerning the responsiveness of the internal systems to changes in external loading. Not until the soluble, molybdate-reactive fraction of the internal phosphorus pool is reduced to the limits of conventional analytical detection does the phytoplankton biomass become sensitive to the supply. Other factors affecting the sensitivity of systems to altered loads are considered (flushing, alkalinity, water depth) and a new index of sensitivity is proposed, distinguishing among highly-sensitive, high-quality sites where eutrophication should be jealously resisted, impacted sites where the eutrophication is reversible and others that are effectively irreversible and where other techniques of restoration should be considered. These other methods include biomanipulation, for which a growing experience, philosophical base and strategic approach to implementation is now available. To induce more of the phosphorus investment into the biomass of fish and macrophytes than into microphytic producers is a sound objective in many instances but the thresholds of critical system behaviour are still reached rather pragmatically.

**Key words:** lake metabolism, phosphorus loading, chlorophyll, carrying capacity, restoration, sensitivity.

**The origin of humic substances and their role in the aquatic environment**

*Barbara Szpakowska*

*August Cieszkowski Agricultural University of Poznań, Department of Landscape Architecture  
Dąbrowskiego 159, 60-594 Poznań, Poland,*

*e-mail: bszpa@owl.au.poznan.pl*

**Abstract**

This study, carried out in the Wielkopolska lowland where intensive farming predominated, indicated that humic substances (HS) are the main component of dissolved organic compounds, particularly in surface waters (34.0 mg dm<sup>-3</sup> in mid-field and 20.0 mg dm<sup>-3</sup> in drainage canal). HS from surface water were richer in fulvic acids, have a lower E<sub>4/6</sub> coefficient and lower a H/C ratio (which indicated a higher degree of condensation and aromaticity of HS in surface water). HS in ground water were less humified and contained less aromatic character. HS isolated from ground water possessed stronger chelating properties towards cadmium, lead and copper than HS from surface water, which indicated stronger potential to modify the mobility of heavy metals. Control over the input of humic substances to water was effected by buffer zones; a 20 m wide belt of meadow decreased HS concentrations in ground water flowing through it by 52%. Limiting the free migration of humic substances, which can contribute to excessive pollution of waters, is particularly important in areas where light soils predominate.

**Key words:** humic substances, surface and ground waters, heavy metals, nutrients

**Change of physico-chemical conditions and phytoplankton composition in a humic lake caused by liming and fertilisation**

*Andrzej Hutorowicz*

*The Stanisław Sakowicz Inland Fisheries Institute, Oczapowskiego 10, 10-719 Olsztyn, Poland*

*e-mail: ahut@infish.com.pl*

**Abstract**

The changes in abundance and composition phytoplankton in Lake Smolak against a background change in selected physico-chemical properties of water caused by liming and fertilisation were presented. The data were compared to the results obtained for algae plankton communities and analogous parameters in acidic lobelia lakes and humic lakes of North Poland.

The most frequently noted values of Secchi disc visibility, the concentrations of calcium and ammonium nitrogen in the Lake Smolak water in the period before liming were quite similar to the values observed in acidic lobelia lakes. In the period after liming and fertilization the values were similar to the data for humic lakes. Clear tendency of the reconstruction of phytoplankton species composition along with the change in physico-chemical properties of water was confirmed. Phytoplankton structure of the dystrophic Lake Smolak was, in the period after liming and fertilisation, more similar to phytoplankton of humic lakes than to that of acidic lobelia lakes of North Poland.

**Key words:** humic lakes, physical and chemical condition, composition and abundance of phytoplankton

**The influence of hydrology and water quality on phytoplankton community composition and biomass in a humo-eutrophic reservoir, Siemianówka reservoir (Poland).**

*Magdalena Grabowska, Andrzej Górniak, Elżbieta Jekatierynczuk-Rudczyk, Piotr Zieliński  
Department of Hydrobiology, Institute of Biology, University of Białystok, ul. Świerkowa 20  
B, 15-950 Białystok, Poland*

*e-mail: [magra@uwb.edu.pl](mailto:magra@uwb.edu.pl), [hydra@uwb.edu.pl](mailto:hydra@uwb.edu.pl)*

**Abstract**

There was a significant relationship between the structure of algae and the water quality over four years in a polymictic reservoir in a lowland peat-forest catchment. High phytoplankton biomass in the reservoir was related to the enriched content of natural dissolved organic carbon and also nitrogen and phosphorus compounds associated with them. The access of light is limited by dissolved humic substances and long period of water retention. The constant accessibility of nutrients from decomposing mineral-organic polymers favours the dominance of blue-green bacteria in summer and of diatoms in cooler seasons of the year. The structure and biomass of the summer phytoplankton, manifested by water blooms, depended upon the spring load of dissolved organic carbon fed to the reservoir.

**Key words:** water bloom, humic substances, ecohydrology, *Microcystis*

**The diversity of the species composition and the life strategy of algae in peatbogs surrounding two dystrophic forest lakes**

*Urszula Jacuńska*

*Institute of Ecology and Environmental Protection, Department of Plant Ecology and Nature Conservation, Nicholas Copernicus University, ul. Gagarina 9, 87-100 Toruń, Poland*

*e-mail: ujakub@biol.uni.torun.pl*

**Abstract**

One hundred and seventy six taxa of Cyanoprocaryota, Rhodophyta, Cryptophyta, Chromophyta, Chrysophyta, Euglenophyta and Chlorophyta were identified in 1998 and 1999 in peatbogs in the Dury Reserve in Tuchola Forest. The number of taxa decreased with distance from the open water. Desmidiaceae were the commonest. Species such as *Penium silvae-nigrae* f. *parallelum* (W. Krieg.) Kossinsk., *Tetmemorus brebissonii* (Menegh.) Ralfs var. *brebissonii* or *Chroococcus turgidus* [Kützing] Nägeli displayed *K* strategy features, whilst *Anisonema ovale* Klebs and *Petalomonas sphagnophila* Christen could be characterized *r* adaptation strategy.

**Keywords:** autecology, Desmiales, Euglenophyta, biomass

**The similarities and differences of phytoplankton structure in the chosen eutrophic water bodies – southern Poland. A review**

*Halina Bucka, Elżbieta Wilk-Woźniak, Grażyna Pająk*  
*Zakład Biologii Wód PAN*  
*ul. Sławkowska 17, 31-016 Kraków*

**Abstract**

The structure of phytoplankton in ponds, lowland and submontane reservoirs of southern Poland was investigated in different years and time intervals. Many planktonic species existed within all water bodies. The structure of phytoplankton in the ponds depended on the kind of pond and its management. Differences in the phytoplankton structure and dynamics in dam reservoirs were attributed (*inter alia*) to the type of the reservoir. The structure of phytoplankton of the lowland reservoir was similar to that in ponds, e.g. strong blooms caused by Cyanoprokaryota - *Aphanizomenon flos-aquae*, however such trends as seasonal algal succession were similar to those in submontane reservoir. It means: in spring - the dominant group were diatoms, in summer – green algae and cyanoprokaryota, in autumn – again diatoms. The structure of phytoplankton in the submontane reservoir was quite different in comparison to that in ponds. The seasonal succession in the submontane reservoir was manifested by dominance: in spring – diatoms, in summer - green-algae/cryptophytes/chrysophytes, in autumn – cyanoprokaryota/cryptophytes/dinophytes/diatoms. No presence of filamentous cyanoprokaryota was stated. The blooms of cyanoprokaryota were not so intensive as in ponds and in the lowland reservoirs. Differences in the trophic status of the water were reflected in the phytoplankton structure and differences in the use of the water bodies were reflected in the phytoplankton dynamics.

**Key words:** phytoplankton, spawning ponds, transfer ponds, rearing ponds, artificial reservoirs

**Phytoplankton – formation reflecting variation of trophic status in dam reservoirs**

*Elżbieta Wilk-Woźniak*

*Institute of Freshwater Biology, Polish Academy of Sciences, ul. Ślawkowska 17, 31-016*

*Kraków, Poland*

*e-mail: wilk@zbw.pan.krakow.pl*

**Abstract:**

Changes in the dynamics of phytoplankton during nine years of study of a submontane reservoir in southern Poland are described. The changes in the succession of species corresponded with three stages of the ageing of the reservoir. In the first stage the phytoplankton was dominated by small fast growing species of a “r” type life strategy (small diatoms and cryptophytes). The second stage of preliminary eutrophication was characterized by increase of cyanoprokaryota biomass. while the third “oligotrophication” stage, by decreasing biomass of cyanoprokaryota. The replacement of some species (e.g. of *Microcystis* by *Woronichinia*) indicated changes of trophic status. Shifts in the density, biomass and dominant species suggested variation trophic status of the water during the studied years and particular season. The presented changes confirmed useful the whole assemblages and relations between particular species as the tool, which determine the processes in the reservoirs.

**Key words:** algae, dynamics, replacement, trophic status, submountaine reservoir, southern Poland

**The influence of acetylcholine and taurine on the content of some metabolites in the alga  
*Chlorella vulgaris***

Romuald Czerpak<sup>\*</sup>, Andrzej Bajguz<sup>\*\*</sup>, Paula Jewiec, Małgorzata Muszyńska-Garstka  
University of Białystok, Institute of Biology, Swierkowa 20 B, 15-950 Białystok, Poland  
czerpak@uwb.edu.pl<sup>\*</sup>, abajguz@uwb.edu.pl<sup>\*\*</sup>

**Abstract**

Comparative studies of the effect of acid aliphatic amines, acetylcholine and taurine as chemical analogues on the dynamic of growth (expressed as the number of cells) of *Chlorella vulgaris*, chlorophyll *a* and *b*, monosaccharides and water-soluble protein contents. Both amines displayed the highest stimulative activity on the biochemical parameters analysed in the range of concentration  $10^{-4}$  -  $10^{-5}$  M on the 3rd day of the alga culture except for chlorophylls which are most stimulated between the 6th and 9th day of cultivation. Acetylcholine has a far greater stimulating effect than taurine on the soluble protein and monosaccharides content of the alga cells. However, the stimulating action of both amines on the intensity of cell multiplication and their chlorophyll *a* and *b* content is more or less the same.

**Key words:** chlorophylls, growth, metabolism, proteins, saccharides

**Effect of allantoin and creatine on the growth and content of some metabolites in**

***Chlorella vulgaris* (Chlorophyceae)**

Romuald Czerpak<sup>\*</sup>, Andrzej Bajguz<sup>\*\*</sup>, Agnieszka Joszczyk, Agnieszka Nosal

University of Białystok, Institute of Biology, Swierkowa 20 B, 15-950 Białystok, Poland

E-mail: czerpak@uwb.edu.pl<sup>\*</sup>, abajguz@uwb.edu.pl<sup>\*\*</sup>

**Abstract**

These studies of a comparative nature concern the effect of allantoin (a cyclic diureid) and creatine (an aliphatic monoureid) on the dynamics of growth, expressed as the number of cells, of the alga *Chlorella vulgaris*. Their dry weight, monosaccharide, soluble protein and chlorophyll *a* and *b* contents were analysed. Both ureids revealed their greatest stimulating activity on the biochemical parameters studied in a concentration of  $10^{-5}$  M and on the protein content in a concentration of  $10^{-4}$  M. Under the influence of allantoin most of the parameters analysed were stimulated between the 3rd and 6th day of the alga culture and by creatine on the 3rd day. On the other hand, the greatest stimulation of the chlorophyll *a* and *b* contents under the influence of both ureids occurred between the 6th and 9th day of the *C. vulgaris* culture. In comparison with creatine, allantoin was found to have a markedly stronger stimulative effect on the growth of the algae and on the content of the biochemical parameters analysed.

**Key words:** growth, chlorophylls, metabolism, proteins, saccharides