This manuscript is contextually identical with the following published paper:
Borics, G., Tóthmérész, B., Várbíró, G., Grigorszky, I., Czébely, A., Görgényi, J. (2016) **Functional phytoplankton distribution in hypertrophic systems across water body size.** HYDROBIOLOGIA 764: (1) pp. 81-90. DOI: 10.1007/s10750-015-2268-3
The original published PDF available in this website:
http://link.springer.com/article/10.1007%2Fs10750-015-2268-3

Functional phytoplankton distribution in hypertrophic systems across water body size

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Abstract

Distribution of algae was studied in a series of water bodies ranging from 10^{-2} to ~10^{9} m^2 in the lowland region of the Carpathian basin in a late summer period. It has been demonstrated that lake size has pronounced impact on the morphological and chemical properties of the water bodies, and acting through these variables it shapes the distribution of the various algal groups in the water bodies of different sizes. Changes of the relative abundance of the various algal groups along the spatial scale showed four apparently distinct patterns. We found increasing relative abundance of heterocytic cyanobacteria, dinoflagellates and those taxa which have no capability of active locomotion and are characterized by high sinking rate in the large water bodies. The flagellated algae (*Chlamydomonas* spp., euglenophytes, *Synura* spp.) and the tichoplanktonic elements were characteristic for small-sized water bodies. Most of the chrysophytes and several other flagellated taxa showed hump-shaped distribution along the size scale of water bodies. The group of large colonial flagellated chlorophytes, non-heterocytic filamentous cyanobacteria and filamentous chlorophytes occasionally occurred in high relative abundance both in small and large-sized water bodies. Our findings suggest that water body size has pronounced impact on the composition of algal assemblages.

Keywords: island biogeography, algae, functional groups, water body size, size scale dependence

Introduction

Ecosystems are organised along several scales such as space, time, energy, or matter (Lemke, 2000). Variation and interaction of these scales results in the high diversity of lake ecosystems. It has been demonstrated in recent years that size does matter: it has important implications for the structure and functioning of the lake ecosystems (Winslow et al, 2014). Lake size has an effect on the nutrient status (Guildford et al., 1994) and photosynthesis (Fee et al., 1992) of phytoplankton, determines the food-chain length (Post et al., 2000) and also effects fish population and macrophyte abundance in lakes (Søndergaard et al., 2005; Scheffer & van Nes, 2007). Considerable attention has recently been given in the limnological literature to habitat size as the major determinant for species richness, but relatively few studies attempted to describe this relationship for planktonic algae (Smith et al., 2005; Søndergaard et al., 2005; Stomp et al, 2011). Although it seems also to be an interesting theme, none of the studies addressed specifically the question of whether algae are equally distributed in the various sizes of habitats, or the various groups prefer different sizes of the water bodies.

Planktonic algae inhabit all aquatic habitats where the hydraulic residence time is long enough for them to proliferate and sustain viable populations. If nutrient and energy demands of algae are satisfied, biological processes and physical constraints of the environment determine which are those distinctive traits of planktonic algae that make some groups successful in the given water body.

Most freshwater phytoplankters have an excess density compared to the surrounding water they live in, thus they have a natural tendency to sink downwards in undisturbed waters (Smayda, 1970). Mixing regime of the lakes, therefore, basically determines which taxa will constitute prevailing phytoplankton assemblages in the euphotic layers of lakes. Frequency, intensity and depth of mixing however are not independent of the size of the lakes. The larger the lake is the longer the fetch, and consequently, greater the turbulent kinetic energy which results in deeper mixing of the water column. The well-mixed water column provides suitable habitat for various phytoplankters independently of their sinking properties. In contrast, in small wind-sheltered lakes only those algae can remain in the shallow mixed layers, which (by having flagella, or low density intracellular ingredients) can control their vertical position in the water column. Since the environmental conditions act to filter traits rather than species (Keddy, 1992) the question of whether the various planktonic alga prefer different habitat sizes can be studied at the level of functional groups and not on the level of species.

Our aim was to study the functional composition of phytoplankton in pools and ponds of various sizes, focusing on the question of whether the various functional groups of algae prefer a certain habitat size or their distribution is independent of the spatial dimensions of the water bodies. Since previous studies imply that the relationship between area and phytoplankton species richness should be relevant if very large size scales are considered, it is reasonable to suppose that size preference of algae could also be studied, if regarding their size there are several orders of magnitude differences between the smallest and the largest water bodies involved in the analyses.
Our hypothesis was that similarly to macroscopic taxa, the various groups of algae have different preferences concerning the sizes of water bodies they occur in. We also hypothesized, that algae without active buoyancy regulations cannot dominate in the lowest size range of the standing waters.

Materials and methods

Site selection

Distribution of planktonic algae is influenced by differences in trophic conditions, altitude, latitude and other characteristics of the water bodies. To avoid biases caused by the differences in these factors we selected ponds and pools of various sizes and of similar hydromorphological and trophic characteristics in the Hortobágy Puszta (Hortobágy National Park (47°27′ 00.36″ N and 20°59′ 44.09″ K), where an extended grassland was used as bombing range between 1940 and 1990. The air to ground bombing resulted in an aquatic archipelago with more than 5000 bomb crater ponds of 10^0-10^2 m^2 surface area. The craters are filled with ground water and in humid years with water of the neighbouring marshland (Kunkápolnás). Since the bombing has finished, pasturage started again in the proximity of the shooting range and resulted in small (10^{-2}–10^{-1} m^2) water bodies in the footprints of animals. In the middle of the bombing range five water bodies were selected along a north-south transect from each size categories (in the range of 10^{-2}–10^{2} m^2). To increase the size scale of the systems to be analyzed data of larger ponds of the region and data of two large lakes (Lake Velencei and Lake Balaton) were also considered. Thus, there were 64 water bodies (218 samples) involved into the analyses. The covered size range spanned from 10^{-2} to ~10^{9} m^2.

Sampling and identification of phytoplankton taxa

During phytoplankton succession considerable changes in species composition can be expected. Because of the physical disturbances entering the lakes the species composition of the phytoplankton is not predictable, even at a local level. However, in Hungary frequency of disturbances is lowest in late summer (Padisák et al., 2003); therefore in this period of the year development of characteristic equilibrium assemblages is expected. We thus focused our attention exclusively on this period. Surface samples were collected from the centre of the pools and bomb crater ponds in September 2011. Phytoplankton samples (200 ml) were fixed with formaldehyde solution (final concentration 4%) on the spot and stored at 4°C until analyses. In case of larger ponds and lakes phytoplankton monitoring data from the Hungarian water authorities were used. Only data of the late summer period were considered.

Morphometric variables

To estimate the size of small pools and crater ponds, diameters of the water bodies were measured with tape measure. Depth of these water bodies was measured in the field with a stick and a ruler. Surface area and depth data for the larger ponds and lakes were provided by the National Hydrological Database. The shoreline lengths of the lakes were measured on the

Google Earth images of the lakes using the ruler tool. In case of the small circular pools perimeter data were calculated by the radius. Volume of the water bodies were calculated as the product of lake area and mean depth. To reflect the littoral effect, index of basin permanence (IBP; Kerekes, 1977) was calculated as the ratio of basin volume to shoreline length.

Most of the water bodies involved in this study have no outflow, and if they have, because of their low inflow/outflow ratios virtually behave as closed basins. Because in case of the lake Balaton the residence time is approximately 5 years (Tátrai et al., 2008) the flushing rate has no effect on the composition of phytoplankton.

Microscopic analyses

Depending on the cell number and the transparency, subsamples were sedimented in 1 or 5 ccm counting chambers. Taxonomic composition of phytoplankton and relative abundance of algal taxa were determined with a (ZEISS Axiovert-40 CFL) inverted microscope. A minimum of 400 algal units (cells or colonies) were counted along transects in each sample at 400-fold magnifications. To investigate the relative abundance of the rare, large-sized taxa area of the whole counting chamber was investigated at 100-fold magnification.

Physical and chemical variables

The specific electrical conductivity (Cond.) was determined using WTW LF539 conductivity meter. WTW pH 539 glass electrode was used to measure pH. Water temperature was measured by the same instrument. Both pH and Cond. were temperature corrected (20 °C). Total phosphorus was measured as PO_4 by colorimetry after digestion with sulphuric acid. Samples were kept at 4 °C in darkness until the start of measurements.

Statistical analyses

Because of the large number of the observed taxa in the samples (730) all species were assigned to functional groups proposed by Reynolds et al. (2002), Padisák et al. (2009) and Borics et al. (2007). A correspondence analysis ordination (CCA) was used to relate functional group distributions to each of the morphological, physical and chemical variables (Ter Braak, 1986). To check the suitability of a canonical correspondence analysis (CCA) we measured gradient length at first by detrended correspondence analysis (DCA). Since the gradient was 4.6 SD units long, linear method (RDA) was not appropriate. The CCA permits one to summarize data such that it is maximally correlated to environmental variation (Ter Braak, 1986). A Monte Carlo permutation test was used to assess the significance of the CCA gradients, their importance being measured by the eigenvalues of the first two axes (Ter Braak & Verdonschot, 1995). For the estimation of the area requirement of the various algal groups General Additive Model (GAM, Hastie & Tibshirani, 1990) was used. The GAM algorithm selects the best shape of given complexity (defined by degree of freedom) using the Akaike information criterion (AIC). In our model the quasi-Poisson distribution and the canonical log link-function were used by the CANOCO 5 package (Ter Braak & Šmilauer, 2012).

Results

All water bodies were alkaline and characterised by high conductivity and TP values (Fig.1). Strong linear relationship was found between the log area and depth and log area and log IBP scores. The relationship was negative in case of TP and Cond., while pH showed no relationship with log area (Fig. 1).

The results of the partial CCA and the correlation structure between phytoplankton community and lake morphology variables presented in Fig 2a. The eigenvalues for the first and second axes were 0.144 and 0.0398. The variable that highly correlated with axis 1 was log Area (r^2 = -0.55, p <0.001) and log Depth with axes 2 (r^2 = 0.3283, p<0.001). Partial variation was 8.02, explanatory variables account for 2.3% (adjusted explained variation is 1.4%). The correlation structure between phytoplankton community and chemical variables are presented in Fig. 2b. The eigenvalues for the first, second and third axes were 0.1373, 0.0728 and 0.0517. The variable that highly correlated with axis 1 was pH (r^2 = 0.42, p <0.001) and log Cond. with axes 2 (r^2 = 0.46, p<0.001). Partial variation was 8.104, explanatory variables account for 3.2% (adjusted explained variation is 1.9%).

Partial CCA was used to extract the variation in phytoplankton community based on the functional groups' abundance by each of the two sets of explanatory variables (lake morphology and chemical data) without the effect of the other, as well as the variation shared by these two explanatory variables. Lake morphology and chemical variables explained 29.2% and 30.9% of the variation of in phytoplankton community, whereas the variation shared was 39.9 % from the total explained variation.

The GAM revealed that relative abundance of the groups along the spatial scale showed four distinct patterns: (a) increasing, (b) decreasing, (c) unimodal and (d) "no relationship" (Table 1). Dinoflagellates (Lo), heterocytic cyanobacteria (H1, Sn), *Microcystis* spp. (M) and algae with high sinking rate: chlorococcaleans (J, F), planktonic diatoms (A, B, C, D), planktonic desmids (N) were almost absent in the lakes of lower (10^{-2} – 10^2 m^2) size range (Fig. 3a). Their relative abundance increased towards the larger water bodies (>10^2 m^2). An opposite, decreasing tendency was found in case of tichoplanktonic taxa (TC, TD, MP), and some large-sized flagellated organisms, e.g. euglenophytes (W1, W2), *Synura* spp. (WS) and *Chlamydomonas* spp. (X2) which preferred smaller water bodies (Fig. 3b). Distribution of small chlorococcaleans (X1), *Chrysococcus* (X3), *Aphanocapsa* and *Cyanogranis* (K) showed unimodal patterns (Fig. 3c). There were several groups viz.: *Dinobryon* spp. (E), *Uroglena* sp. (U), filamentous green algae from the Klebsormidiales order (T), cryptophytes (Y), non-heterocytic filamentous cyanobacteria (S1, S2), *Phacotus* sp. (YPh), *Gonyostomum semen* (Q), colonial flagellated green algae (G) purple sulphur bacteria (V), and *Synecococcus* spp. (Z), which either showed no affinity to any lake size categories, or if they showed some of the three patterns, because of the low number of occurrences the relationship was not significant. The grey area in Fig. 3 covers that part of the size scale where elements of the three patterns might occasionally achieve high relative abundance. At this range of the scale (10,000–100,000 m^2) ponds of couple of hectares can be found. This result implies that in this water bodies occasionally any functional groups of algae can dominate the phytoplankton.

Discussion

Lake size acts both directly and indirectly on the species composition of water bodies. The larger the lake is the greater the possibility of arrival of new invaders and the possibility of maintaining stable populations. Besides these direct effects lake size has pronounced impact on various other processes and key components of the environment. Index of basin permanence (Kerekes, 1977) must be one of the most important variables, which is affected directly by the lake size, because this reflects the strength of the so-called perimeter- related processes, such as dissolution of nutrients and other inorganic and organic compounds to water from the soil, or the allochthonous input from the surrounding terrestrial landscape. In accordance with these theoretical considerations, we found that lake size has pronounced impact on most of the other hydromorphological features of the water bodies and on the chemical variables. We of course cannot argue that distribution of the variables observed along the spatial scale in this study is of general validity. For example as to the nutrients, there can be considerable differences between the water bodies depending on the climate or type of bedrock material. While all the pools and ponds in this study were hypertrophic, Meier &

Soininen (2014) demonstrated that based on their nutrient contents the small subarctic rock pools are mostly oligotrophic. Similar differences might also be found in case of other chemical variables.

The size of the water bodies also influences the extent and/or intensity of several crucial physical constraints like fetch-length, (lake volume), surface to shoreline ratio, which however, directly influence the mixing regime, allochtonous nutrient load of lakes or the concentration of suspended material, and thus, the light climate. Most of the relevant variables (light, temperature, nutrients and currents) can change at 10^0 -10^1m scale vertically and, in some cases horizontally (Borics et al., 2011). These size-related physical constraints also have a direct effect on the occurrence of algae in limnetic ecosystems.

The strong negative relationship between water body size and TP might suggest that the size acts through the concentration of phosphorus. To avoid this kind of misinterpretation of our results the following should be considered. The role of nutrients, especially the phosphorus on the biomass of phytoplankton has been studied extensively in the recent decades. Analysis of large data sets revealed that biomass shows an increasing tendency up to 100 μgl^{-1} TP value, and in the range above this concentration the relationship is asymptotic (Phillips et al., 2008). Similar results were obtained when the relationship was investigated at level of the various algal groups (Watson et al., 1997). Although there were differences in the steepness of the various response curves of the different algal groups at the TP<100 μgl^{-1} range, at higher (TP>100 μgl^{-1}) concentration range the relationships seemed asymptotic for all algae. To date, there are no evidences in the literature showing that phosphorus has an effect on the composition of lake phytoplankton in the hypertrophic – extreme hypertrophic (TP: 10^2-10^4 μgl^{-1}) range. Therefore, inclusion of this variable in the model would lead to serious misinterpretation of results. This is clearly illustrated by the distribution of bloom forming cyanobacteria (H1, Sn, M) in Fig. 3a. These groups are known to show increasing biomass with TP even in the eutrophic range (Watson et al., 1997). In our dataset these groups dominated at the largest water bodies, which were characterised by the lowest TP values and decreased towards the smaller water bodies in which the highest TP values were measured (Fig. 1). We cannot say that all phytoplankters perform equally in the hypertrophic range, but we think that differences in the dominance structure are strongly associated to size-related physical and biological processes.

There are several physical characteristics of the water bodies which require a minimum spatial extent. Development of well mixed water column needs relatively large fetch length even in case of shallow lakes. Algae with high sinking rates (diatoms, chlorococcaleans, desmids) prefer well mixed water columns where turbulences keep them in the photic layer (Reynolds, 2006). In accordance with this view taxa from A, B, C, D, J, F and N functional groups were missing from small well-sheltered ponds.

Vertical stratification of lake is primarily a depth-dependent feature, but the development of vertically layered water column can also develop in shallow but well-sheltered small water bodies (Borics et al., 2011; Padisák & Reynolds, 2003). Typical representatives of this type are the oxbows which were in high number in our database in the 10^5-10^6 m^2 size range. In these systems those algae can be successful that are capable of active locomotion and can migrate vertically to avoid photoinhibition or to select the layer which is optimal for their photosynthesis (Whittington et al. 2000; Grigorszky et al., 2003). Dinoflagellates (Lo) and bloom-forming cyanobacteria (H1, Sn, M) frequently dominate these water bodies (Krasznai et al., 2010).

Aquatic systems are always open to invasions by algal propagula (Padisák et al., 2015), however success of these newcomers is higher under post-disturbance conditions (Reynolds, 2012). The smaller the habitat, the greater the possibility of disturbances that may enter the systems, therefore the dynamic balance which exists between the r-selected pioneer assemblages and habitat specialists frequently shifts in favour of the former groups. Although in the small habitats dominance of rapidly growing small-celled nanoplanktic species are expected, due to the stable late summer conditions besides the chlamydomonads large sized euglenophytes characterised the plankton of the small water bodies. In case of small water bodies the ratio of surface of the lake to the lake volume is considerably higher than in case of large lakes (Wetzel, 2001), and thus the ratio of benthic habitats is high in these waters. *Chlamydomonas* spp. (X2) and euglenophytes (W1, W2) are adapted to the small-scale spatial heterogeneity of the environment (Zakrys et al., 2004). Species of these groups migrating between the epipelon and the water column make the best of these habitats (Poulicková et al., 2008). Besides the above mentioned three functional groups the large ratio of benthic habitats resulted the larger relative abundance of benthic algae (TC, TD, MP) in pools and small ponds.

The common feature of those algae that were characterised by hump-shaped distribution is the small size. These groups were characteristic for the well-sheltered oxbows in the 10^5-10^6 m^2 size range. It is reasonable to suppose that these algae do not prefer this size of water bodies. Instead, they are simply outcompeted by other better performing species both in smaller and larger water bodies.

The fact that several groups showed no lake-size preference suggests that algae considered truly planktic organisms occasionally survive and proliferate in benthic environments (Borics et al., 2003). Having both benthic and planktonic life forms are quite characteristic for cyanobacteria (Komarek, 2013).

Regarding the functional classification of algae there are various approaches. Some systems define more than 30 groups (Reynolds et al., 2002; Salmaso & Padisák, 2007), while other systems apply only a few categories for the planktonic algae (Kruk et al, 2010). Our results suggest that over-emphasising of simple morphological characteristics of algae may lead to an oversimplified system which is not suitable to interpret ecological processes. For example the group of large flagellated algae proposed by Kruk et al. (2010) cannot be considered homogeneous regarding their spatial affinity. Compared to dinoflagellates, which prefer large water bodies, the other representatives of large flagellates, e.g. euglenophytes, *Chlamydomonas* spp. or *Synura* sp. occurred in smaller habitats.

The grey column in Fig. 3 covers the size range of water bodies in which theoretically any of the groups can dominate the phytoplankton. Since most of the freshwater studies cover this part of the size range, the area preference of algae does not have significant impact on the dominance patterns, and thus in this size range this issue can be omitted.

In terrestrial ecology the term "area sensitive taxa" refer to those species that are frequently absent from small landscape fragments (Herkert, 1994). Our results suggest that in case of algae area-preference refer to three distinct patterns. Some algae prefer large, others small or middle-sized habitats.

Here we demonstrated that size has pronounced impact on the dominance of phytoplankton groups. We showed that compositional responses of phytoplankton to size of the standing waters can be predicted at the level of functional groups of algae. We know that neither all possible distribution patterns can be shown, nor all explanations can be provided within a single study, but we think that our results will encourage further researches on this interesting part of phytoplankton ecology.

Acknowledgements

This research was supported by the Hungarian National Science Foundation (OTKA Nr. 104279) and by the Bolyai Fellowship of the Hungarian Academy of Sciences. The authors were supported by TÁMOP-4.2.4.A/2-11-1-2012-0001, TÁMOP-4.2.1./B-09/1/KONV-2010-

0007, TÁMOP-4.2.2/C-11/1/KONV-2012-0010 and TÁMOP-4.2.2/B-10-1-2010-0024 projects. The authors are grateful for the referees for their very constructive comments.

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Legends for tables

Table 1

Functional groups of algae which showed similar habitat size preference.

Table 1

Patterns	Functional groups	Name of the characteristic species
Decreasing	TC	*Oscillatoria amphibia, Nostocales* sp., *Phormidium* sp.
	MP	*Achnanthes* sp., *Nitzschia palea, Cocconeis placentula*
	W1	*Pyrobotrys incurva, Menoidium pellicidum, Euglena texta*
	W2	*Trachelomonas volvocina, Gonium sociale, Strobomonas fluviatilis*
	WS	*Synura petersenii, Synura* sp.
	TD	*Spirogyra* sp., *Zygnema* sp.
	X2	*Chlamydomonas* sp., *Rhodomonas minuta, Nephroselmis olivacea*
Increasing	A	*Rhizosolenia longiseta, Rhizosolenia eriensis, Acanthoceras zachariasii*
	B	*Aulacoseira italica, Cyclotella bodanica, Cyclotella comta*
	C	*Aulacoseira distans, Cyclotella meneghiniana, Nitzschia acicularis*
	D	*Stephanodiscus minutulus, Chaetoceras muelleri, Fragilaria acus*
	H1	*Aphanizomenon flos-aquae, Anabaena circinalis, Aphanizomenon issatschenkoi*
	Sn	*Cylindrospermopsis raciborskii, Cylindrospermum* sp.
	M	*Microcystis aeruginosa, Microcystis flos-aquae, Microcistys smithii*
	Lo	*Chroococcus minutus, Merismopedia tenuissima, Peridiniopsis borgei*
	F	*Dictyosphaerium* sp., *Botryococcus* sp.
	N	*Cosmarium tenue, Staurastrum gracile, Staurastrum tetracerum*
	J	*Coelastrum pseudomicroporum, Scenedesmus quadricauda, Westella* sp.
Humpshaped	X1	*Chlorella* sp., *Crucigenia tetrapedia, Monoraphidium contortum*
	X3	*Chrysococcus rufescens, Koliella tenuis, Ochromonas viridis*
	K	*Aphanocapsa delicatissima, Cyanocatenula calyptrata, Cyanogranis libera*
No relationship	V	*Chromatium* sp., *Crenothrix fusca, Siderocapsa geminata*
	G	*Eudorina elegans, Pandorina morum, Paradoxia multiseta*
	Q	*Gonyostomum latum, Gonyostomum semen*
	S2	*Spirulina jenneri, Spirulina* sp.
	U	*Uroglena volvox*
	Z	*Synechococcus nidulans, Synechococcus* sp.
	E	*Dinobryon divergens, Mallomonas caudata, Poteriodendron petiolatum*
	YPh	*Phacotus lenticularis, Phacotus* sp.
	P	*Aulacoseira granulata* var. *angustissima, Closterium acutum, Fragilaria crotonensis*
	T	*Microsporopsis* sp., *Mougeotia* sp., *Planctonema lauterbornii*
	Y	*Chroomonas acuta, Cryptomonas marssonii, Ochrobium* sp.
	S1	*Limnothrix redekeii, Planktolyngbya limnetica, Pseudanabaena limnetica*

Legends for figures

Fig. 1

Distribution of the environmental variables in the given size categories. The box plots indicate the median, the quartiles and the range of data. The numbers of samples and sites in the size categories are as follows: -2: 5/5; -1:8/8; 0:9/9; 1-2: 12/12; 2-3:3/3; 3-4:12/3; 4-5:23/5; 5-6:89/10; 6-7:32/7; 7-8;13/1; 8:12/1 .

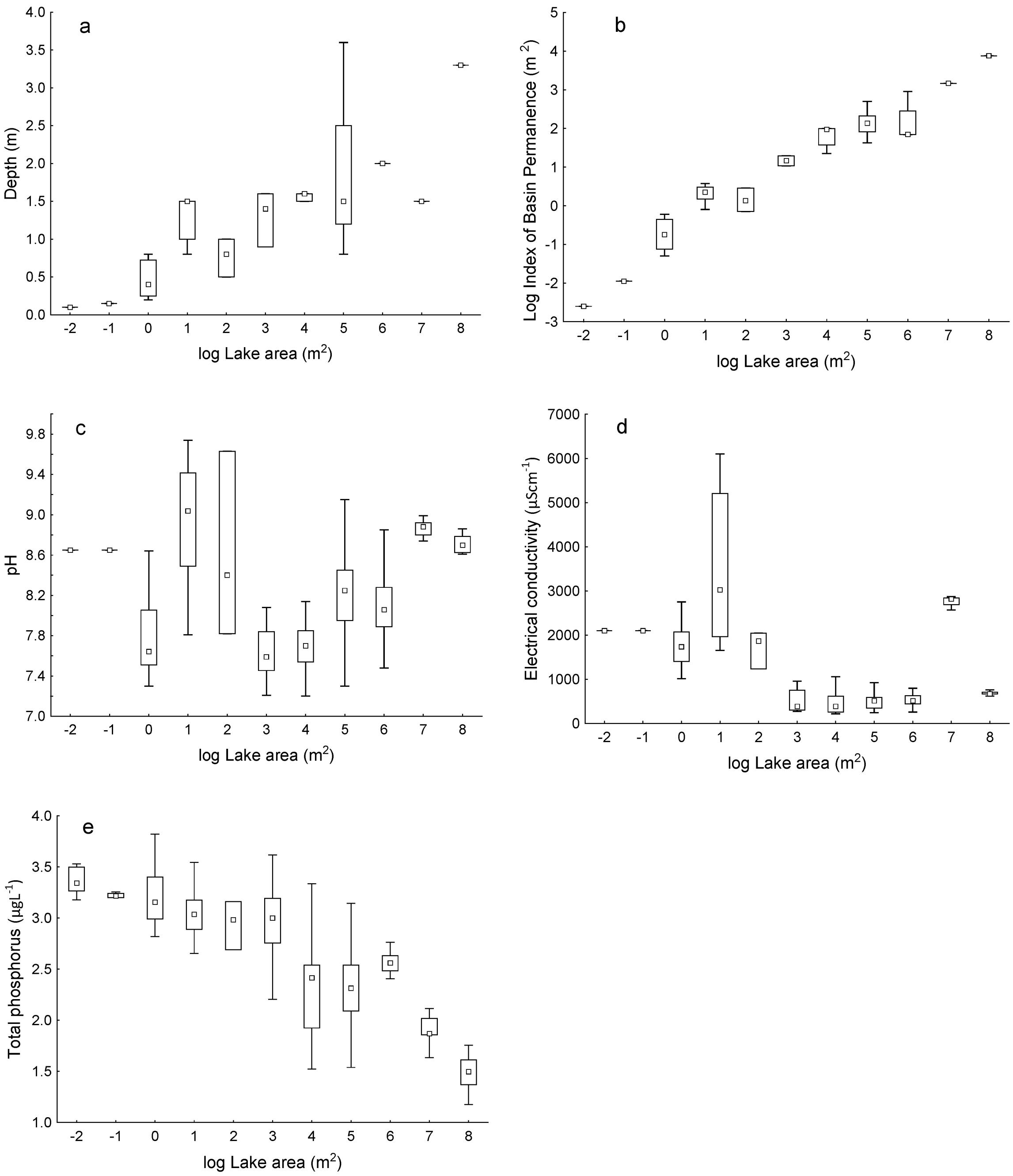


Fig. 2

Biplot diagrams of the CCA analyses showing the importance of lake morphology and chemical variables on the relative abundance of the various functional groups of algae in the water bodies. Abbreviations: Depth = mean depth of the water bodies (m); area = area of the water bodies (m^2), Cond = electrical conductivity ($\mu S\ cm^{-1}$); P= total phosphorus ($\mu g\ l^{-1}$). Functional groups of algae are represented as circles and codes.

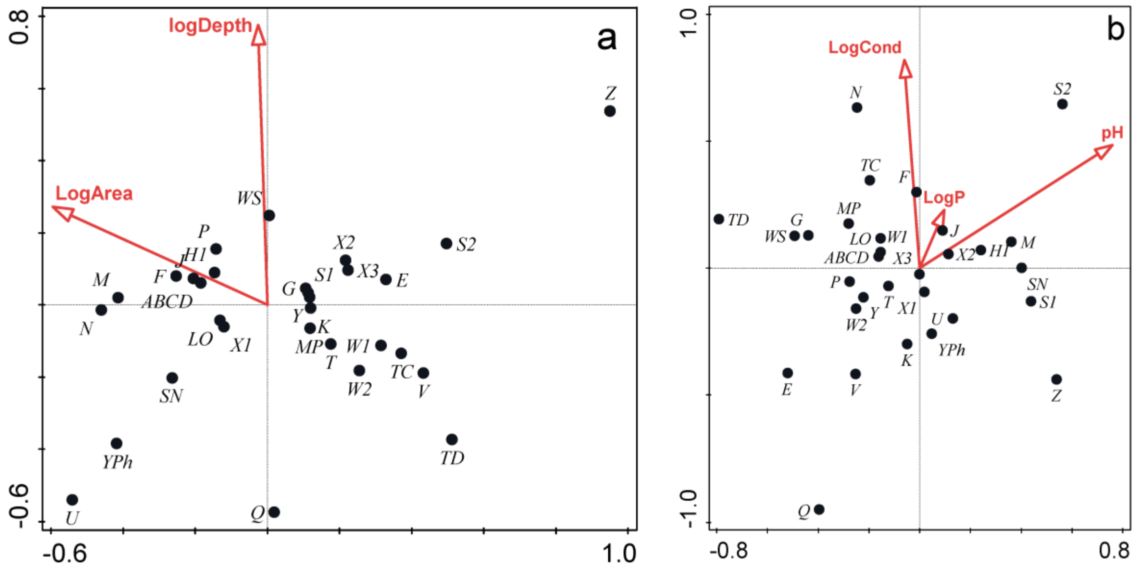
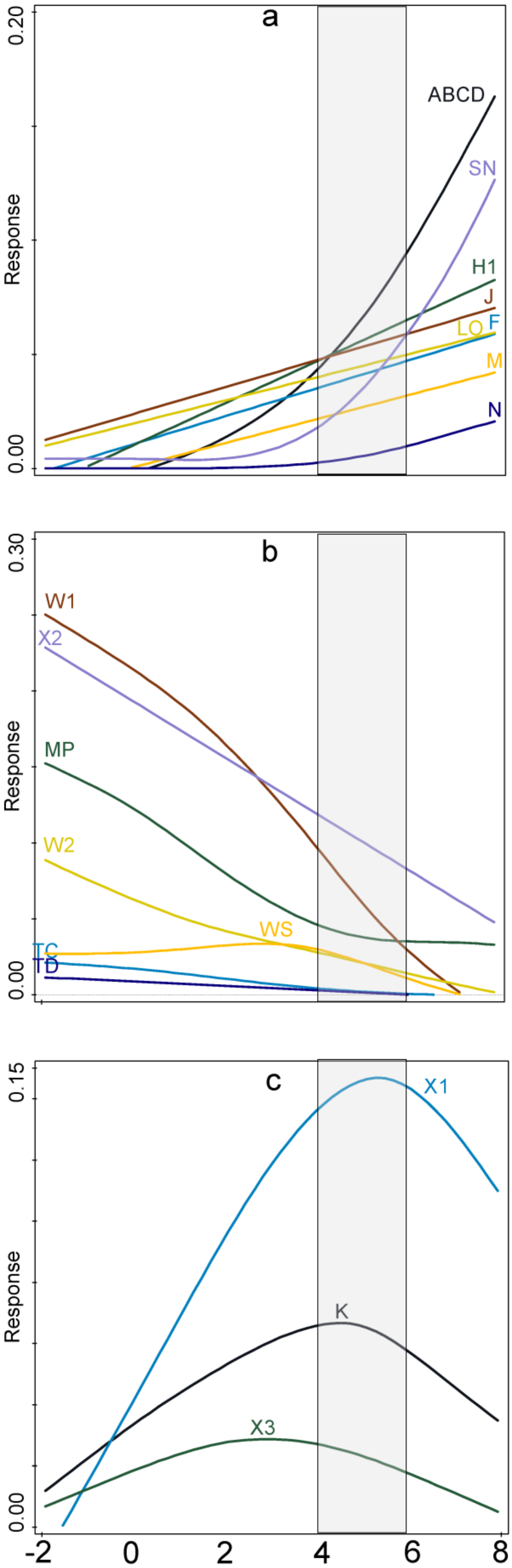


Fig. 3

Relationship between the water body area (m^2) and the relative abundance of those functional groups of algae which showed increasing (a), decreasing (b) tendency and (c) hump-shaped relationship with the area. Regression lines fitted by GAM.


a
0.20
0.00
Response
ABCD
SN
H1
J
F
LO
M
N
b
0.30
0.00
Response
W1
X2
MP
W2
WS
TC
TD
c
0.15
0.00
Response
X1
K
X3
-2
0
2
4
6
8

Legends for the electronic appendices

Appendix 1. List of observed taxa

Appendix 2. Summary of fitted Generalised Additive Models

List of taxa	Functional group	Number of water bodies in which the taxon was present	Area of the smallest waterbody in which the species occurred (log m^2)	Area of the largest waterbody in which the species occurred (log m^2)	The lowest abundance	The highest abundance
Acanthoceras zachariasii	A	10	4.92	6.29	0.002	0.025
Attheya zachariasii	A	1	8.77	8.77	0.026	0.026
Rhizosolenia eriensis	A	6	5.31	5.69	0.002	0.005
Rhizosolenia longiseta	A	2	8.77	8.77	0.014	0.026
Aulacoseira italica	B	1	6.24	6.24	0.018	0.018
Cyclotella bodanica	B	1	5.33	5.33	0.002	0.002
Cyclotella comta	B	15	3.93	8.77	0.005	0.837
Asterionella formosa	C	1	5.08	5.08	0.002	0.002
Asterionella gracillima	C	1	3.93	3.93	0.013	0.013
Aulacoseira distans	C	36	2.88	6.54	0.002	0.303
Aulacoseira muzzanensis	C	2	3.93	5.08	0.002	0.002
Aulacoseira sp.	C	1	5.31	5.31	0.002	0.002
Cyclotella meneghiniana	C	36	3.81	7.40	0.002	0.305
Cyclotella ocellata	C	4	4.54	8.77	0.002	0.105
Centrales sp.	C	36	0.67	6.29	0.002	0.451
Cyclotella sp.	C	18	2.95	6.00	0.002	0.097
Nitzschia acicularis	C	116	-1.15	8.77	0.002	0.263
Nitzschia fruticosa	C	5	3.93	6.24	0.003	0.072

Nitzschia reversa	C	18	0.50	8.77	0.002	0.122
Chaetoceros muelleri	D	7	7.40	7.40	0.010	0.761
Cyclotella pseudostelligera	D	9	4.92	6.48	0.005	0.283
Cyclotella stelligera	D	3	5.08	6.48	0.008	0.071
Fragilaria acus	D	33	3.81	8.77	0.002	0.153
Skeletonema potamos	D	14	5.31	8.77	0.002	0.088
Sphaerical component	D	1	5.31	5.31	0.002	0.002
Stephanodiscus hantzschii	D	7	3.93	6.48	0.002	0.050
Stephanodiscus minutulus	D	37	3.93	6.54	0.002	0.363
Stephanodiscus sp.	D	2	4.92	5.96	0.005	0.362
Fragilaria fasciculata	D	1	5.63	5.63	0.005	0.005
Ulnaria ulna	D	15	3.81	6.24	0.002	0.020
Thalassiosira weissflogii	D	1	5.69	5.69	0.012	0.012
Synedra nana	D	7	3.81	8.77	0.005	0.051
Ulothrix sp.	D	2	-1.15	0.67	0.011	0.023
Dinobryon bavaricum	E	5	4.92	5.51	0.003	0.030
Dinobryon divergens	E	14	3.93	6.24	0.002	0.925
Dinobryon korsikovii	E	1	5.33	5.33	0.002	0.002
Dinobryon sp.	E	5	4.54	6.24	0.003	0.220
Dinobryon sertularia	E	13	3.81	5.96	0.002	0.177
Dinobryon sociale	E	3	5.33	5.51	0.002	0.005
Dinobryon suecicum	E	1	4.92	4.92	0.003	0.003
Mallomonas caudata	E	1	5.51	5.51	0.135	0.135
Mallomonas sp.	E	18	0.37	6.48	0.002	0.031
Mallomonas tonsurata	E	2	5.08	5.33	0.009	0.020
Poteriodendron petiolatum	E	1	5.31	5.31	0.002	0.002
Ankistrodesmus acicularis	F	4	6.24	6.24	0.003	0.027
Ankistrodesmus bibraianus	F	2	4.67	5.17	0.002	0.003
Ankistrodesmus convolutus	F	2	7.40	7.40	0.037	0.042
Ankistrodesmus densus	F	3	3.93	5.17	0.002	0.002

Ankistrodesmus falcatus	F	4	3.81	5.69	0.002	0.014
Ankistrodesmus fusiformis	F	1	3.81	3.81	0.007	0.007
Ankistrodesmus gracilis	F	5	5.17	5.80	0.002	0.002
Ankistrodesmus minutissimus	F	2	6.03	6.24	0.005	0.023
Ankistrodesmus sp.	F	4	5.17	8.77	0.002	0.052
Botryococcus braunii	F	10	5.63	7.40	0.002	0.455
Coenochloris polycocca	F	3	5.17	6.48	0.002	0.009
Coenochloris pyrenoidosa	F	3	5.96	5.96	0.002	0.028
Coenocystis sp.	F	1	5.66	5.66	0.010	0.010
Dactylosphaerium jurisii	F	38	3.81	6.54	0.002	0.081
Dichotomococcus curvatus	F	1	6.00	6.00	0.009	0.009
Dictyosphaerium ehrenbergianum	F	3	4.67	7.40	0.002	0.012
Dictyosphaerium pulchellum	F	48	2.88	8.77	0.002	0.225
Dictyosphaerium simplex	F	1	6.03	6.03	0.005	0.005
Dictyosphaerium sp.	F	1	5.63	5.63	0.011	0.011
Dictyosphaerium tetrachotomum	F	10	4.54	6.48	0.002	0.054
Echinocoleum polymammilatum	F	1	6.48	6.48	0.003	0.003
Elakathotrix spirochroma	F	4	4.54	5.96	0.002	0.015
Elakatothrix gelatinosa	F	3	5.63	6.03	0.002	0.008
Elakatothrix genevensis	F	7	5.17	6.29	0.002	0.010
Elakatothrix lacustris	F	1	5.96	5.96	0.010	0.010
Eutetramorus planctonicus	F	13	3.81	6.29	0.002	0.048
Eutetramorus sp.	F	10	-2.11	6.29	0.002	0.033
Gloeococcus minor	F	3	4.04	4.04	0.019	0.019
Granulocystis verrucosa	F	16	4.75	6.54	0.002	0.100
Granulocystopsis sp.	F	3	2.88	3.08	0.003	0.020
Kirchneriella aperta	F	2	7.40	7.40	0.002	0.002
Kirchneriella contorta	F	14	3.93	7.40	0.002	0.064
Kirchneriella irregularis	F	5	5.17	5.89	0.002	0.038
Kirchneriella lunaris	F	6	4.67	7.40	0.002	0.047

Kirchneriella obesa	F	6	5.63	7.40	0.002	0.017
Kirchneriella roseana	F	1	4.92	4.92	0.059	0.059
Kirchneriella rotunda	F	17	4.54	6.48	0.002	0.222
Kirchneriella sp.	F	13	2.88	6.29	0.002	0.067
Oocystis borgei	F	6	5.08	7.40	0.007	0.033
Oocystis lacustris	F	60	3.08	7.40	0.002	0.168
Oocystis marssonii	F	15	5.31	7.40	0.002	0.025
Oocystis obesa	F	1	5.96	5.96	0.003	0.003
Oocystis parva	F	29	3.93	8.77	0.002	0.207
Oocystis solitaria	F	5	5.66	5.96	0.005	0.452
Oocystis sp.	F	10	-0.11	5.89	0.002	0.284
Planktosphaeria gelatinosa	F	3	5.66	6.29	0.005	0.008
Quadricoccus ellipticus	F	4	4.92	6.54	0.003	0.013
Raphidocelis sigmoidea	F	2	3.93	3.93	0.005	0.012
Sphaerocystis schroeteri	F	5	7.40	7.40	0.030	0.325
Tetrachlorella alternans	F	1	5.08	5.08	0.005	0.005
Tetrasporales sp.	F	2	1.45	2.02	0.010	0.066
Eudorina elegans	G	1	5.96	5.96	0.003	0.003
Pandorina charkoviensis	G	1	6.24	6.24	0.002	0.002
Pandorina morum	G	23	-2.11	6.48	0.002	0.451
Paradoxia multiseta	G	1	5.96	5.96	0.003	0.003
Anabaena aequalis	H1	1	5.69	5.69	0.010	0.010
Anabaena circinalis	H1	3	5.96	8.77	0.006	0.737
Anabaena compacta	H1	1	5.31	5.31	0.010	0.010
Anabaena elenkinii	H1	1	5.69	5.69	0.007	0.007
Anabaena flos-aquae	H1	2	6.03	6.24	0.011	0.356
Anabaena planctonica	H1	1	5.66	5.66	0.002	0.002
Anabaena solitaria	H1	2	5.08	5.96	0.003	0.005
Anabaena sp. 1	H1	34	3.81	8.77	0.002	0.463
Anabaena sp. 2	H1	4	-2.11	3.08	0.005	0.035

Anabaena sp. 3	H1	10	-0.11	1.89	0.003	0.070
Anabaena sp. 4	H1	13	-2.11	2.02	0.002	0.118
Anabaena sphaerica	H1	1	5.96	5.96	0.033	0.033
Anabaenopsis arnoldii	H1	2	5.69	5.96	0.002	0.017
Anabaenopsis circularis	H1	2	5.66	5.80	0.002	0.035
Anabaenopsis sp.	H1	9	0.85	5.96	0.002	0.185
Aphanizomenon aphanizomenoides	H1	16	4.92	8.77	0.002	0.213
Aphanizomenon flos-aquae	H1	21	5.63	8.77	0.002	0.938
Aphanizomenon gracile	H1	3	5.33	5.96	0.005	0.463
Aphanizomenon issatschenkoi	H1	31	3.81	8.77	0.002	0.295
Aphanizomenon ovalisporum	H1	8	5.08	5.96	0.002	0.102
Aphanizomenon sp.	H1	27	5.31	6.54	0.002	0.265
Actinastrum hantzschii	J	20	3.93	6.48	0.002	0.030
Amphikrikos minutissimus	J	8	3.08	5.51	0.002	0.151
Amphikrikos nanus	J	1	4.92	4.92	0.002	0.002
Chlorococcales sp.	J	2	2.88	5.63	0.002	0.060
Coelastrum astroideum	J	19	3.08	7.40	0.002	0.078
Coelastrum microporum	J	13	5.08	8.77	0.002	0.105
Coelastrum pseudomicroporum	J	32	3.81	6.48	0.002	0.281
Coelastrum reticulatum	J	8	5.33	8.77	0.002	0.023
Coelastrum sp.	J	1	5.80	5.80	0.002	0.002
Coelastrum sphaericum	J	10	5.33	5.96	0.002	0.022
Coronastrum lunatum	J	14	4.92	5.96	0.002	0.007
Desmatractum indutum	J	7	2.88	5.31	0.002	0.009
Diacanthos belenophorus	J	12	4.54	6.48	0.002	0.016
Dicellula planctonica	J	1	5.96	5.96	0.002	0.002
Dicloster arcuatus	J	4	3.93	6.24	0.002	0.365
Didymocystis inermis	J	31	4.54	6.54	0.002	0.031
Didymocystis planctonica	J	2	6.03	6.03	0.005	0.022
Didymogenes palatina	J	1	5.96	5.96	0.003	0.003

Diplochloris lunata	J	8	5.17	6.54	0.003	0.030
Neodesmus danubialis	J	1	6.54	6.54	0.003	0.003
Pediastrum biradiatum	J	1	5.63	5.63	0.002	0.002
Pediastrum boryanum	J	44	3.93	7.40	0.002	0.129
Pediastrum duplex	J	32	4.92	6.54	0.002	0.034
Pediastrum duplex var. *gracillimum*	J	2	6.24	6.24	0.003	0.006
Pediastrum simplex	J	31	5.08	8.77	0.002	0.087
Pediastrum tetras	J	37	3.81	6.48	0.002	0.042
Scenedesmus acuminatus	J	59	3.81	8.77	0.002	0.078
Scenedesmus acutiferum	J	10	3.93	5.96	0.002	0.021
Scenedesmus acutus	J	5	5.08	6.48	0.002	0.013
Scenedesmus arcuatus	J	12	0.50	5.96	0.002	0.013
Scenedesmus armatus	J	15	0.85	7.40	0.002	0.015
Scenedesmus bicaudatus	J	15	3.93	6.54	0.002	0.045
Scenedesmus carinatus	J	2	5.69	6.24	0.006	0.008
Scenedesmus communis	J	8	5.31	7.40	0.002	0.020
Scenedesmus costato-granulatus	J	2	7.40	7.40	0.002	0.002
Scenedesmus denticulatus	J	17	5.08	7.40	0.002	0.094
Scenedesmus dispar	J	1	3.93	3.93	0.002	0.002
Scenedesmus ecornis	J	48	0.50	8.77	0.002	0.100
Scenedesmus ecornis var. *disciformis*	J	2	5.17	5.17	0.003	0.058
Scenedesmus ellipsoideus	J	1	6.48	6.48	0.012	0.012
Scenedesmus ellipticus	J	2	5.66	5.69	0.002	0.015
Scenedesmus grahneisii	J	1	6.48	6.48	0.002	0.002
Scenedesmus granulatus	J	4	2.88	5.33	0.003	0.356
Scenedesmus gutwinski	J	1	3.08	3.08	0.003	0.003
Scenedesmus intermedeus	J	43	4.67	6.54	0.002	0.139
Scenedesmus juvenilis	J	15	2.88	5.96	0.002	0.124
Scenedesmus maximus	J	4	5.66	5.80	0.002	0.010
Scenedesmus obliquus	J	2	5.31	6.03	0.002	0.005

Scenedesmus obtusus	J	6	4.67	6.29	0.002	0.017
Scenedesmus opoliensis	J	14	4.67	7.40	0.002	0.035
Scenedesmus ovalternus	J	10	3.93	6.48	0.002	0.020
Scenedesmus protuberans	J	5	5.31	5.96	0.002	0.005
Scenedesmus quadricauda	J	71	3.93	8.77	0.002	0.156
Scenedesmus raciborskii	J	2	5.31	5.96	0.002	0.003
Scenedesmus regularis	J	9	3.93	6.48	0.002	0.042
Scenedesmus sp.	J	34	4.54	6.54	0.002	0.046
Scenedesmus spinosus	J	38	2.88	6.48	0.002	0.045
Scenedesmus subspicatus	J	15	5.31	6.54	0.002	0.024
Scenedesmus verrucosus	J	8	4.92	6.48	0.002	0.017
Selenastrum bibraianum	J	1	4.75	4.75	0.002	0.002
Selenastrum gracile	J	2	4.75	5.96	0.002	0.005
Selenastrum westii	J	1	5.69	5.69	0.002	0.002
Sorastrum spinulosum	J	2	5.17	5.17	0.002	0.002
Westella botryoides	J	2	5.08	5.63	0.002	0.045
Westella sp.	J	2	1.89	5.66	0.007	0.875
Xanthophyceae sp.	J	15	3.93	6.29	0.002	0.175
Aphanocapsa conferta	K	1	5.89	5.89	0.023	0.023
Aphanocapsa delicatissima	K	32	-0.11	6.48	0.002	0.359
Aphanocapsa elachista	K	3	5.63	5.69	0.002	0.056
Aphanocapsa holsatica	K	7	5.66	6.29	0.002	0.050
Aphanocapsa incerta	K	3	5.51	6.00	0.002	0.018
Aphanocapsa parasitica	K	1	4.92	4.92	0.003	0.003
Aphanocapsa planctonica	K	1	5.89	5.89	0.077	0.077
Aphanocapsa sp. 1	K	54	0.37	8.77	0.002	0.339
Aphanocapsa sp. 2	K	5	-2.11	1.75	0.002	0.045
Aphanocapsa sp. 3	K	3	1.10	1.75	0.003	0.013
Aphanothece sp. 1	K	8	0.37	6.29	0.002	0.059
Aphanothece sp. 2	K	1	0.37	0.37	0.007	0.007

Cyanocatena planctonica	K	11	5.33	6.54	0.002	0.205
Cyanocatenula calyptrata	K	2	4.92	4.92	0.310	0.760
Cyanodyction sp.	K	1	6.54	6.54	0.002	0.002
Cyanogranis basifixa	K	2	5.17	6.54	0.002	0.012
Cyanogranis ferruginea	K	46	0.37	6.54	0.002	0.350
Cyanogranis libera	K	22	3.93	6.54	0.002	0.718
Romeria elegans	K	3	5.08	5.17	0.008	0.040
Romeria gracilis	K	1	5.96	5.96	0.255	0.255
Romeria leopoliensis	K	4	5.63	6.48	0.002	0.022
Romeria simplex	K	1	5.33	5.33	0.485	0.485
Romeria sp.	K	12	3.08	6.29	0.002	0.122
Coelomoron pusillum	LM	19	3.93	6.29	0.002	0.293
Coelomoron sp.	LM	1	-0.11	-0.11	0.009	0.009
Ceratium cornutum	Lo	1	3.81	3.81	0.421	0.421
Ceratium furcoides	Lo	2	3.93	4.92	0.007	0.016
Ceratium hirundinella	Lo	10	3.81	8.77	0.002	0.039
Chroococcus limneticus	Lo	10	5.63	8.77	0.002	0.094
Chroococcus minutus	Lo	6	5.17	5.96	0.002	0.589
Chroococcus sp.	Lo	8	-0.11	5.96	0.002	0.078
Chroococcus turgidus	Lo	17	4.54	5.96	0.002	0.082
Cystodinium cornifax	LO	1	3.81	3.81	0.002	0.002
Dinophyta sp.	LO	18	-0.11	6.24	0.003	0.304
Gomphosphaeria aponina	LO	2	5.89	5.89	0.089	0.116
Gomphosphaeria lacustris	LO	7	5.96	5.96	0.003	0.138
Gomphosphaeria sp.	LO	4	5.51	8.77	0.002	0.014
Gymnodinium sp.	LO	17	0.50	8.77	0.002	0.027
Merismopedia elegans	LO	1	6.24	6.24	0.003	0.003
Merismopedia glauca	LO	20	4.54	6.24	0.002	0.426
Merismopedia punctata	LO	2	5.63	6.24	0.002	0.005
Merismopedia sp.	LO	3	5.31	5.63	0.002	0.033

Merismopedia tenuissima	LO	36	2.95	7.40	0.002	0.101
Peridiniopsis borgei	LO	5	7.40	7.40	0.238	0.713
Peridiniopsis cunningtoni	LO	1	3.93	3.93	0.005	0.005
Peridiniopsis elpatiewskyi	LO	3	3.93	5.89	0.002	0.003
Peridiniopsis oculatum	LO	1	6.24	6.24	0.144	0.144
Peridiniopsis sp.	LO	6	4.67	5.96	0.002	0.017
Peridinium aciculiferum	LO	4	5.66	5.96	0.002	0.010
Peridinium cinctum	LO	3	4.92	5.17	0.002	0.010
Peridinium cunningtonii	LO	1	5.33	5.33	0.003	0.003
Peridinium gatunense	LO	16	3.81	5.51	0.002	0.129
Peridinium inconspicum	LO	7	0.85	5.96	0.003	0.118
Peridinium palatinum	LO	2	5.33	5.63	0.003	0.003
Peridinium sp.	LO	15	-1.15	8.77	0.002	0.047
Peridinium umbonatum	LO	7	0.85	5.69	0.002	0.183
Peridinium voltzii	LO	2	3.81	5.33	0.009	0.011
Snowella lacustris	LO	12	4.67	5.96	0.002	0.271
Snowella litoralis	LO	2	5.63	5.63	0.002	0.002
Snowella sp.	LO	5	4.92	6.54	0.002	0.096
Woloszynskia sp.	LO	2	0.85	1.67	0.008	0.020
Woloszynskia tenuissima	LO	1	5.63	5.63	0.032	0.032
Woronichinia naegeliana	LO	4	5.17	5.89	0.002	0.381
Microcystis aeruginosa	M	21	3.93	7.40	0.002	0.746
Microcystis firma	M	1	5.96	5.96	0.002	0.002
Microcystis flos-aquae	M	10	5.63	8.77	0.002	0.667
Microcystis ichtyoblobae	M	1	6.48	6.48	0.009	0.009
Microcystis smithii	M	1	5.63	5.63	0.010	0.010
Microcystis sp.	M	12	4.54	8.77	0.002	0.948
Cosmarium bioculatum	N	7	5.63	5.96	0.002	0.025
Cosmarium depressum	N	3	5.63	5.96	0.003	0.010
Cosmarium humile	N	3	4.54	5.33	0.002	0.003

Cosmarium laeve	N	3	5.69	5.96	0.002	0.007
Cosmarium phaseolus	N	3	5.63	7.40	0.003	0.015
Cosmarium polygonum var. *depressum*	N	1	5.66	5.66	0.002	0.002
Cosmarium praecisum	N	1	5.63	5.63	0.007	0.007
Cosmarium regnellii var. *regnellii*	N	4	5.33	5.96	0.002	0.007
Cosmarium regnesii	N	3	6.54	7.40	0.005	0.007
Cosmarium sp. 1	N	23	-0.11	7.40	0.002	0.311
Cosmarium sp. 2	N	7	-0.11	2.02	0.003	0.030
Cosmarium subprotumidum	N	1	4.67	4.67	0.002	0.002
Cosmarium tenue	N	6	4.67	5.89	0.002	0.035
Cosmarium turpinii	N	1	5.17	5.17	0.002	0.002
Staurastrum chaetoceras	N	3	5.69	5.89	0.002	0.010
Staurastrum gracile	N	3	8.77	8.77	0.018	0.052
Staurastrum irregulare	N	1	5.96	5.96	0.002	0.002
Staurastrum manfeldtii var. *manfeldtii*	N	3	4.67	5.96	0.002	0.003
Staurastrum paradoxum	N	4	5.69	6.24	0.002	0.014
Staurastrum pingue	N	5	3.93	5.33	0.002	0.003
Staurastrum sp.	N	3	3.81	5.51	0.002	0.004
Staurastrum tetracerum	N	33	3.81	6.54	0.002	0.148
Aulacoseira granulata	P	18	3.93	8.77	0.002	0.098
Aulacoseira granulata var. *angustissima*	P	10	5.31	6.48	0.002	0.664
Aulacoseira granulata var. *muzzanensis*	P	3	5.08	5.96	0.003	0.006
Closterium aciculare	P	2	8.77	8.77	0.002	0.027
Closterium acutum	P	47	3.81	6.54	0.002	0.048
Closterium acutum var. *variabile*	P	10	3.93	8.77	0.005	0.046
Closterium dianae	P	1	3.81	3.81	0.002	0.002
Closterium exiguum	P	2	5.63	6.03	0.003	0.009
Closterium limneticum	P	6	3.81	5.63	0.002	0.007
Closterium lineatum	P	1	5.96	5.96	0.010	0.010
Closterium parvulum	P	1	0.37	0.37	0.030	0.030

Closterium sp.	P	10	2.95	6.48	0.002	0.015
Closterium strigosum	P	7	-1.15	6.24	0.003	0.011
Euastrum denticulatum	P	1	4.54	4.54	0.002	0.002
Euastrum insulare	P	1	5.96	5.96	0.002	0.002
Fragilaria construens	P	1	6.24	6.24	0.003	0.003
Fragilaria crotonensis	P	8	0.37	6.29	0.003	0.150
Fragilaria sp.	P	24	-0.11	6.54	0.002	0.068
Gonyostomum latum	Q	3	5.17	5.51	0.002	0.020
Gonyostomum semen	Q	4	3.93	5.31	0.003	0.680
Geitlerinema amphibia	S1	1	5.51	5.51	0.007	0.007
Geitlerinema splendidum	S1	2	5.31	5.69	0.002	0.096
Jaaginema metaphyticum	S1	2	1.45	2.02	0.005	0.335
Jaaginema sp.	S1	4	-1.15	-1.15	0.040	0.231
Limnothrix redekei	S1	14	5.33	6.48	0.002	0.463
Limnothrix sp.	S1	2	5.66	6.29	0.003	0.005
Planktolyngbya circumcreata	S1	4	8.77	8.77	0.010	0.183
Planktolyngbya contorta	S1	3	5.63	5.80	0.002	0.038
Planktolyngbya limnetica	S1	60	-1.15	8.77	0.002	0.433
Planktolyngbya sp.	S1	2	1.40	3.08	0.006	0.010
Planktothrix agardhii	S1	7	1.44	7.40	0.002	0.108
Planktothrix sp.	S1	3	-1.15	3.93	0.007	0.513
Pseudanabaena balatonica	S1	1	3.93	3.93	0.012	0.012
Pseudanabaena biceps	S1	2	-1.15	0.25	0.018	0.081
Pseudanabaena limnetica	S1	57	0.25	8.77	0.002	0.530
Pseudanabaena sp.	S1	8	-1.15	6.54	0.007	0.166
Pseudanabaena tenuis	S1	1	-2.11	-2.11	0.131	0.131
Spirulina jenneri	S2	1	5.17	5.17	0.009	0.009
Spirulina sp.	S2	4	-1.15	1.44	0.005	0.161
Cylindrospermopsis raciborskii	SN	48	5.33	8.77	0.002	0.911
Cylindrospermum sp.	SN	2	0.50	5.96	0.002	0.646

Gloeotila pelagica	T	2	5.96	5.96	0.002	0.003
Klebsormidium sp.	T	4	-2.11	5.31	0.002	0.015
Microspora sp.	T	1	-1.15	-1.15	0.023	0.023
Microsporopsis sp.	T	2	0.37	0.50	0.020	0.135
Mougeotia sp.	T	21	-0.11	6.29	0.002	0.112
Planctonema lauterbornii	T	41	3.93	7.40	0.002	0.067
Uroglena volvox	U	1	5.63	5.63	0.086	0.086
Chromatium sp.	V	1	1.10	4.54	0.181	0.181
Crenothrix fusca	V	2	4.54	4.54	0.031	0.493
Siderocapsa geminata	V	2	4.54	4.67	0.010	0.854
Siderocapsa sp.	V	2	4.54	5.17	0.408	0.633
Siderocelis sp.	V	3	2.88	3.08	0.005	0.015
Thiocystis sp.	V	1	4.67	4.67	0.002	0.002
Thiopedia rosea	V	3	4.92	5.17	0.003	0.012
Synura petersenii	WS	4	3.81	5.63	0.025	0.893
Synura sp.	WS	10	-2.11	6.00	0.007	0.943
Bumilleriopsis verrucosa	X1	1	4.54	4.54	0.002	0.002
Catena viridis	X1	9	5.17	6.48	0.002	0.014
Centritractus belenophorus	X1	11	1.67	5.80	0.002	0.051
Chlorella sp.	X1	57	-0.11	8.77	0.002	0.923
Chlorella vulgaris	X1	2	6.48	6.48	0.002	0.197
Chlorotetraedron incus	X1	12	5.31	6.54	0.002	0.012
Chodatella ciliata	X1	1	5.63	5.63	0.003	0.003
Closteriopsis acicularis	X1	2	5.69	5.96	0.002	0.002
Crucigenia apiculata	X1	8	5.08	6.03	0.003	0.046
Crucigenia quadrata	X1	4	5.08	8.77	0.023	0.052
Crucigenia tetrapedia	X1	84	2.95	8.77	0.002	0.418
Crucigeniella apiculata	X1	13	4.54	6.48	0.003	0.019
Crucigeniella crucifera	X1	41	3.93	6.54	0.002	0.088
Crucigeniella punctata	X1	2	5.63	5.96	0.003	0.003

Crucigeniella rectangularis	X1	1	4.54	4.54	0.010	0.010
Franceia elongata	X1	7	3.93	5.66	0.002	0.007
Franceia ovalis	X1	1	5.33	5.33	0.009	0.009
Golenkinia radiata	X1	12	5.08	6.24	0.002	0.067
Golenkinia sp.	X1	2	2.88	3.08	0.003	0.008
Hyaloraphidium arcuatum	X1	3	8.77	8.77	0.010	0.023
Hyaloraphidium contortum	X1	3	5.69	8.77	0.018	0.785
Korshikoviella limnetica	X1	1	6.24	6.24	0.005	0.005
Lagerheimia ciliata	X1	2	7.40	7.40	0.002	0.005
Lagerheimia genevensis	X1	8	2.88	6.03	0.002	0.020
Lagerheimia hindakii	X1	2	5.96	6.24	0.006	0.010
Lagerheimia minor	X1	2	5.31	5.69	0.005	0.028
Lagerheimia quadriseta	X1	6	5.66	7.40	0.002	0.003
Lagerheimia sp.	X1	1	2.88	2.88	0.005	0.005
Lagerheimia subsalsa	X1	10	5.08	6.54	0.002	0.012
Lagerheimia wratislaviensis	X1	10	3.81	6.00	0.002	0.020
Marvania geminata	X1	1	6.48	6.48	0.002	0.002
Micractinium pusillum	X1	16	3.81	6.54	0.002	0.040
Monoraphidium arcuatum	X1	31	2.88	6.48	0.002	0.054
Monoraphidium circinale	X1	8	4.92	5.89	0.005	0.250
Monoraphidium contortum	X1	114	0.50	6.54	0.002	0.264
Monoraphidium convolutum	X1	1	6.03	6.03	0.005	0.005
Monoraphidium dybowskii	X1	12	5.33	5.96	0.002	0.032
Monoraphidium griffithii	X1	42	3.81	6.54	0.002	0.028
Monoraphidium irregulare	X1	1	3.93	3.93	0.062	0.062
Monoraphidium komarkovae	X1	14	0.85	6.24	0.002	0.367
Monoraphidium minutum	X1	38	2.02	6.48	0.002	0.218
Monoraphidium pusillum	X1	2	5.31	6.03	0.002	0.015
Monoraphidium tortile	X1	54	1.89	6.54	0.002	0.179
Pseudodidymocystis inconspicua	X1	48	2.95	6.54	0.002	0.066

Pseudostaurastrum hastatum	X1	1	2.88	2.88	0.003	0.003
Pseudostaurastrum limneticum	X1	10	4.54	6.54	0.002	0.007
Pseudotetraedriella kamillae	X1	5	5.31	6.48	0.002	0.003
Schroederia robusta	X1	3	5.63	7.40	0.005	0.013
Schroederia setigera	X1	59	-0.11	8.77	0.002	0.079
Schroederia spiralis	X1	6	5.08	6.03	0.002	0.043
Siderocelis kolkwitzii	X1	7	3.93	5.33	0.002	0.039
Siderocelis minutissima	X1	1	5.17	5.17	0.002	0.002
Siderocelis ornata	X1	23	3.81	6.54	0.002	0.095
Siderocystopsis fusca	X1	2	5.63	5.69	0.002	0.003
Tetraedriella acuta	X1	1	5.96	5.96	0.003	0.003
Tetraedriella jovettii	X1	2	4.92	5.17	0.002	0.003
Tetraedriella limbata	X1	1	5.69	5.69	0.004	0.004
Tetraedriella sp.	X1	4	5.31	5.63	0.002	0.007
Tetraedriella spinigera	X1	1	5.17	5.17	0.005	0.005
Tetraedron arcus	X1	1	5.63	5.63	0.028	0.028
Tetraedron caudatum	X1	37	3.08	6.54	0.002	0.025
Tetraedron enorme	X1	1	5.63	5.63	0.003	0.003
Tetraedron hastatum v robostum	X1	1	5.96	5.96	0.002	0.002
Tetraedron incus	X1	1	5.96	5.96	0.002	0.002
Tetraedron minimum	X1	97	3.81	7.40	0.002	0.156
Tetraedron muticum	X1	4	5.69	6.03	0.002	0.005
Tetraedron proteiforme	X1	4	5.63	5.96	0.002	0.010
Tetraedron reticulatum	X1	1	5.96	5.96	0.008	0.008
Tetraedron sp.	X1	1	5.63	5.63	0.002	0.002
Tetraedron triangulare	X1	36	2.95	6.54	0.002	0.848
Tetraedron trilobatum	X1	1	5.63	5.63	0.002	0.002
Tetrastrum elegans	X1	2	6.24	6.24	0.002	0.003
Tetrastrum glabrum	X1	4	5.96	7.40	0.002	0.020
Tetrastrum hastiferum	X1	2	5.96	8.77	0.002	0.014

Tetrastrum heteracanthum	X1	4	3.93	5.31	0.002	0.007
Tetrastrum komarekii	X1	11	5.17	6.29	0.005	0.020
Tetrastrum punctatum	X1	5	5.31	6.54	0.002	0.005
Tetrastrum sp.	X1	1	-0.11	-0.11	0.012	0.012
Tetrastrum staurogeniaeforme	X1	29	2.95	7.40	0.002	0.015
Tetrastrum triangulare	X1	42	3.93	6.54	0.002	0.054
Treubaria euryacantha	X1	1	5.17	5.17	0.002	0.002
Treubaria planctonica	X1	2	5.17	5.89	0.003	0.003
Treubaria schmidlei	X1	2	6.24	6.48	0.002	0.003
Treubaria triappendiculata	X1	24	3.93	6.54	0.002	0.011
Carteria klebsii	X2	1	6.24	6.24	0.363	0.363
Carteria sp.	X2	1	6.24	6.24	0.008	0.008
Chlamydomonas ehrenbergii	X2	1	5.33	5.33	0.003	0.003
Chlamydomonas gelatinosa	X2	2	5.63	6.24	0.002	0.003
Chlamydomonas globosa	X2	5	5.66	7.40	0.002	0.022
Chlamydomonas incerta	X2	1	5.96	5.96	0.007	0.007
Chlamydomonas metastigma	X2	1	2.02	2.02	0.322	0.322
Chlamydomonas pertusa	X2	1	4.75	4.75	0.005	0.005
Chlamydomonas pseudopertusa	X2	2	5.17	6.24	0.002	0.002
Chlamydomonas reinhardtii	X2	7	4.04	7.40	0.002	0.019
Chlamydomonas simplex	X2	6	5.08	6.24	0.006	0.119
Chlamydomonas sp. 1	X2	48	-2.11	6.48	0.002	0.800
Chlamydomonas sp. 2	X2	4	0.37	6.54	0.005	0.043
Chlamydomonas umbonata	X2	1	6.24	6.24	0.042	0.042
Chlorogonium minimum	X2	1	6.24	6.24	0.003	0.003
Chlorogonium sp.	X2	3	2.95	5.66	0.002	0.010
Chromulina sp.	X2	7	3.93	6.48	0.008	0.265
Chrysochromulina parva	X2	15	5.33	7.40	0.002	0.247
Glenodiniopsis steinii	X2	1	3.81	3.81	0.172	0.172
Glenodinium sp. 1	X2	1	1.29	1.29	0.284	0.284

Glenodinium sp. 2	X2	1	1.29	1.29	0.526	0.526
Goniochloris fallax	X2	5	5.17	5.89	0.002	0.007
Goniochloris mutica	X2	52	3.81	6.54	0.002	0.105
Goniochloris sculpta	X2	1	5.63	5.63	0.002	0.002
Goniochloris smithii	X2	5	5.08	6.24	0.003	0.007
Goniochloris sp.	X2	7	5.31	6.48	0.002	0.014
Goniochloris spinosa	X2	3	5.17	5.66	0.002	0.005
Hymenomonas roseola	X2	2	5.63	5.63	0.002	0.003
Kephyrion cordatum	X2	2	3.93	4.92	0.002	0.010
Kephyrion crassum	X2	3	4.92	5.63	0.002	0.017
Kephyrion litorale	X2	3	5.31	5.63	0.002	0.005
Kephyrion moniliferum	X2	1	4.92	4.92	0.010	0.010
Kephyrion rubri-claustri	X2	13	3.93	6.48	0.002	0.092
Kephyrion sp.	X2	11	2.88	5.33	0.002	0.024
Nephrochlamys allanthoidea	X2	3	3.93	5.31	0.002	0.005
Nephrochlamys subsolitaria	X2	40	3.93	6.48	0.002	0.136
Nephrochlamys willeana	X2	2	5.63	5.96	0.002	0.005
Nephrocytium agardhianum	X2	2	5.63	5.69	0.003	0.009
Nephrocytium limneticum	X2	1	5.96	5.96	0.003	0.003
Nephroselmis olivacea	X2	13	5.17	6.54	0.002	0.706
Ophiocytium capitatum	X2	22	3.93	5.96	0.002	0.012
Petalomonas sp.	X2	1	-1.15	-1.15	0.154	0.154
Phytomonadina sp.	X2	1	-0.11	-0.11	0.009	0.009
Plagioselmis nannoplanctica	X2	3	5.31	5.69	0.005	0.044
Polyedriopsis spinulosa	X2	7	4.75	6.24	0.002	0.006
Pseudopedinella sp.	X2	3	5.17	5.51	0.002	0.097
Rhodomonas lacustris	X2	24	4.54	6.48	0.002	0.637
Rhodomonas minuta	X2	32	0.25	8.77	0.002	0.958
Rhodomonas sp.	X2	7	5.63	6.54	0.002	0.096
Stichococcus contortus	X2	23	3.93	6.54	0.002	0.570

Stichococcus pelagicus	X2	8	5.31	5.63	0.002	0.016
Stichococcus sp.	X2	10	-1.15	4.75	0.003	0.502
Trachidiscus lenticularis	X2	1	1.75	1.75	0.081	0.081
Trachidiscus sp. 1	X2	1	1.64	1.64	0.415	0.415
Trachidiscus sp. 2	X2	1	1.64	1.64	0.129	0.129
Trachidiscus sp. 3	X2	1	1.64	1.64	0.344	0.344
Trachidiscus sp. 4	X2	5	1.52	6.29	0.002	0.142
Trachydiscus ellipsoideus	X2	3	4.92	5.17	0.002	0.020
Trachydiscus lenticularis	X2	10	4.75	6.54	0.002	0.016
Trachydiscus sexangulatus	X2	1	5.08	5.08	0.019	0.019
Bicosoeca petiolata	X3	3	4.54	5.63	0.002	0.009
Bicosoeca planctonica	X3	6	4.04	6.48	0.002	0.010
Bicosoeca sp.	X3	12	4.54	5.63	0.002	0.026
Bicosoeca turrigera	X3	2	4.92	4.92	0.008	0.016
Chrysoamphitrema brunnea	X3	1	5.17	5.17	0.021	0.021
Chrysococcus biporus	X3	5	3.93	6.24	0.002	0.086
Chrysococcus rufescens	X3	58	-2.11	6.48	0.002	0.314
Chrysococcus sp.	X3	4	5.31	6.03	0.005	0.032
Chrysophyceae sp.	X3	3	5.31	5.89	0.009	0.212
Koliella longiseta	X3	32	4.75	7.40	0.002	0.025
Koliella tenuis	X3	47	3.81	6.48	0.002	0.169
Komarekia appendiculata	X3	3	4.75	6.48	0.002	0.005
Ochromonas sp.	X3	2	0.67	5.63	0.003	0.008
Ochromonas viridis	X3	1	1.75	1.75	0.682	0.682
Pseudokephyrion entzii	X3	3	3.93	5.33	0.002	0.015
Pseudokephyrion pseudospirale	X3	1	5.31	5.31	0.002	0.002
Pteromonas angulosa	X3	3	6.24	6.48	0.003	0.318
Pteromonas cf. *golenkiniana*	X3	1	2.88	2.88	0.005	0.005
Pteromonas cf. *limnetica*	X3	1	2.88	2.88	0.020	0.020
Pteromonas sp.	X3	4	3.08	5.31	0.002	0.010

Spermatozopsis exultans	X3	4	5.31	5.69	0.002	0.005
Sphaerellopsis sp.	X3	2	5.66	5.89	0.003	0.007
Tetraselmis cordiformis	X3	2	6.24	7.40	0.010	0.012
Chilomonas nordsdedtii	Y	2	6.24	6.24	0.031	0.050
Chroomonas acuta	Y	7	6.24	8.77	0.002	0.615
Chroomonas coerulea	Y	3	7.40	7.40	0.002	0.003
Cryptomonas curvata	Y	11	4.67	6.24	0.003	0.360
Cryptomonas erosa	Y	22	3.81	6.48	0.002	0.366
Cryptomonas marssonii	Y	38	3.81	6.48	0.003	0.523
Cryptomonas obovata	Y	6	4.67	6.24	0.002	0.102
Cryptomonas ovata	Y	16	3.81	7.40	0.002	0.065
Cryptomonas phaseolus	Y	2	7.40	7.40	0.002	0.012
Cryptomonas reflexa	Y	20	5.31	8.77	0.003	0.501
Cryptomonas rostrata	Y	4	3.81	5.17	0.007	0.121
Cryptomonas rostratiformis	Y	3	3.81	7.40	0.012	0.126
Cryptomonas sp. 1	Y	61	-0.11	6.54	0.002	0.509
Cryptomonas sp. 2	Y	7	-0.11	2.02	0.002	0.164
Cryptomonas sp. 3	Y	11	-2.11	0.37	0.007	0.359
Ochrobium sp.	Y	2	4.04	5.17	0.101	0.978
Phacotus lenticularis	YPh	31	3.93	6.54	0.002	0.209
Phacotus sp.	YPh	2	2.88	3.08	0.003	0.003
Synechococcus nidulans	Z	2	4.92	5.33	0.017	0.030
Synechococcus sp.	Z	6	5.33	7.40	0.002	0.235
Achnanthes hungarica	MP	1	4.54	4.54	0.002	0.002
Achnanthes lanceolata	MP	4	4.67	5.51	0.002	0.227
Achnanthes minutissima	MP	12	-0.11	7.40	0.002	0.329
Achnanthes sp.	MP	17	-2.11	6.48	0.003	0.209
Amphipleura pellucida	MP	2	4.54	4.75	0.003	0.004
Amphora inariensis	MP	2	0.67	1.44	0.003	0.026
Amphora ovalis	MP	3	5.63	6.03	0.003	0.007

Amphora pediculus	MP	2	4.67	6.03	0.002	0.007
Amphora sp.	MP	1	4.54	4.54	0.003	0.003
Amphora veneta	MP	2	1.75	1.78	0.005	0.020
Anthophysa vegetans	MP	5	6.24	6.24	0.006	0.039
Caloneis amphisbaena	MP	2	5.63	6.24	0.005	0.005
Campylodiscus noricus	MP	1	7.40	7.40	0.084	0.084
Cocconeis placentula	MP	6	5.69	7.40	0.003	0.601
Cymatopleura solea	MP	2	5.63	5.96	0.002	0.008
Cymbella cistula	MP	1	5.69	5.69	0.003	0.003
Cymbella lanceolata	MP	1	6.24	6.24	0.003	0.003
Cymbella ventricosa	MP	1	5.96	5.96	0.003	0.003
Cymbella sp.	MP	2	5.17	5.51	0.002	0.003
Cymbella tumida	MP	3	6.24	6.24	0.003	0.064
Diatoma elongatum	MP	2	5.63	8.77	0.012	0.013
Diatoma vulgare	MP	3	6.24	6.24	0.027	0.132
Didymosphaenia geminata	MP	1	5.31	5.31	0.005	0.005
Epithemia adnata	MP	2	3.81	4.54	0.003	0.005
Epithemia sorex	MP	3	4.67	5.69	0.002	0.002
Epithemia sp.	MP	2	0.50	5.17	0.002	0.048
Epithemia zebra	MP	1	6.24	6.24	0.003	0.003
Eunotia bilunaris	MP	2	0.37	3.81	0.014	0.066
Eunotia formica	MP	1	-0.11	-0.11	0.035	0.035
Eunotia sp.	MP	3	0.50	5.66	0.002	0.003
Fragilaria capucina	MP	1	4.92	4.92	0.010	0.010
Fragilaria fasciculata	MP	1	5.08	5.08	0.005	0.005
Gomphonema acuminatum	MP	2	0.85	6.24	0.003	0.008
Gomphonema minutum	MP	1	5.33	5.33	0.002	0.002
Gomphonema olivaceum	MP	1	5.63	5.63	0.003	0.003
Gomphonema sp. 1	MP	11	-2.11	5.69	0.003	0.115
Gomphonema sp. 2	MP	11	-2.11	0.85	0.002	0.112

Gomphonema truncatum	MP	1	6.24	6.24	0.021	0.021
Gyrosigma acuminatum	MP	1	6.24	6.24	0.005	0.005
Gyrosigma attenuatum	MP	1	2.88	2.88	0.003	0.003
Gyrosigma scalproides	MP	2	6.24	6.24	0.050	0.061
Gyrosigma sp.	MP	2	3.93	5.96	0.003	0.003
Melosira varians	MP	8	5.80	6.24	0.002	0.126
Navicula cryptocephala	MP	6	5.17	6.24	0.003	0.095
Navicula cryptotenella	MP	4	4.67	5.66	0.002	0.011
Navicula lanceolata	MP	3	4.54	4.67	0.003	0.023
Navicula pygmaea	MP	3	5.69	5.96	0.002	0.014
Navicula radiosa	MP	1	5.17	5.17	0.002	0.002
Navicula rynchocephala	MP	1	5.96	5.96	0.002	0.002
Navicula sp. 1	MP	29	-2.11	6.24	0.002	0.319
Navicula sp. 2	MP	14	-2.11	3.08	0.002	0.243
Navicula veneta	MP	2	6.03	6.03	0.002	0.005
Navicula viridula	MP	3	5.63	5.96	0.002	0.005
Nitzschia apiculata	MP	1	7.40	7.40	0.042	0.042
Nitzschia dissipata	MP	6	3.81	6.24	0.007	0.020
Nitzschia fonticola	MP	3	4.04	5.17	0.002	0.009
Nitzschia gracilis	MP	1	7.40	7.40	0.007	0.007
Nitzschia heufleriana	MP	1	4.67	4.67	0.002	0.002
Nitzschia intermedia	MP	7	4.75	8.77	0.002	0.042
Nitzschia linearis	MP	9	3.81	6.24	0.002	0.098
Nitzschia longissima v. reversa	MP	2	6.03	6.24	0.007	0.010
Nitzschia palea	MP	25	3.81	7.40	0.002	0.269
Nitzschia paleacea	MP	5	4.54	6.48	0.002	0.034
Nitzschia recta	MP	2	3.93	5.33	0.002	0.002
Nitzschia sigma	MP	1	4.54	4.54	0.005	0.005
Nitzschia sigmoidea	MP	1	6.24	6.24	0.003	0.003
Nitzschia sp. 1	MP	61	0.67	7.40	0.002	0.211

Nitzschia sp. 2	MP	6	-2.11	2.95	0.007	0.069
Nitzschia sp. 3	MP	7	-2.11	0.37	0.009	0.097
Nitzschia sp. 4	MP	9	-0.11	1.64	0.003	0.195
Nitzschia vermicularis	MP	1	6.24	6.24	0.019	0.019
Oedogoniales sp.	MP	3	-0.11	0.37	0.003	0.115
Pinnularia gibba	MP	2	4.54	5.17	0.002	0.002
Rhoicosphenia abbreviata	MP	2	1.44	1.75	0.008	0.008
Rhopalodia gibba	MP	4	-0.11	4.54	0.003	0.177
Stigeoclonium sp.	MP	1	6.29	6.29	0.003	0.003
Surirella angusta	MP	1	6.24	6.24	0.006	0.006
Surirella brebissonii	MP	1	0.25	0.25	0.027	0.027
Surirella elegans	MP	1	6.24	6.24	0.003	0.003
Astasia granulata	W1	4	-0.11	1.44	0.003	0.074
Astasia lageluna	W1	1	0.85	0.85	0.007	0.007
Astasia longa	W1	1	1.10	1.10	0.007	0.007
Colacium sp.	W1	3	0.50	6.48	0.005	0.282
Euglena sp. (palmelloid stage)	W1	13	-2.11	5.66	0.002	0.028
Euglena acus	W1	50	-0.11	8.77	0.002	0.165
Euglena adherens	W1	1	5.69	5.69	0.005	0.005
Euglena allorgei	W1	1	1.10	1.10	0.007	0.007
Euglena clavata	W1	9	0.50	6.24	0.002	0.041
Euglena deses	W1	2	5.69	5.69	0.002	0.003
Euglena ehrenbergii	W1	5	5.63	5.96	0.002	0.011
Euglena geniculata	W1	1	-1.15	-1.15	0.003	0.003
Euglena gracilis	W1	2	5.69	5.96	0.003	0.003
Euglena korshikovii	W1	4	0.85	3.08	0.005	0.066
Euglena limnophila	W1	17	-2.11	6.29	0.002	0.029
Euglena limnophila var. *minor*	W1	2	0.25	5.69	0.004	0.010
Euglena nayalis	W1	4	4.04	5.96	0.002	0.005
Euglena oblonga	W1	1	5.63	5.63	0.003	0.003

Euglena oxyuris	W1	15	-2.11	7.40	0.002	0.206
Euglena pisciformis	W1	12	-2.11	7.40	0.003	0.070
Euglena polymorpha	W1	16	0.50	5.96	0.002	0.115
Euglena proxima	W1	18	-2.11	7.40	0.002	0.066
Euglena pseduspiroides	W1	1	3.93	3.93	0.005	0.005
Euglena sanguinea	W1	9	-1.15	6.29	0.003	0.035
Euglena sociabilis	W1	5	-1.15	1.10	0.003	0.062
Euglena sp.	W1	46	-2.11	8.77	0.002	0.295
Euglena spathirhyncha	W1	1	5.96	5.96	0.002	0.002
Euglena spirogyra	W1	6	2.88	6.24	0.002	0.006
Euglena texta	W1	25	-0.11	6.48	0.002	0.763
Euglena tripteris	W1	4	4.92	5.96	0.002	0.005
Euglena variabilis	W1	28	-2.11	6.24	0.002	0.097
Euglena vermicularis	W1	1	7.40	7.40	0.018	0.018
Euglena viridis	W1	4	3.81	7.40	0.002	0.003
Gonium pectorale	W1	2	0.85	6.24	0.035	0.039
Lepocincilis globula	W1	7	-2.11	3.08	0.017	0.346
Lepocinclis conica	W1	1	-1.15	-1.15	0.026	0.026
Lepocinclis fusiformis	W1	15	-2.11	5.96	0.002	0.031
Lepocinclis lefevrei	W1	2	4.54	5.31	0.002	0.035
Lepocinclis ovum	W1	16	-1.15	6.48	0.002	0.325
Lepocinclis steinii	W1	4	3.93	5.17	0.002	0.005
Menodium tortuosum	W1	1	0.85	0.85	0.017	0.017
Menoidium pellucidum	W1	6	-0.11	1.37	0.005	0.917
Phacus acuminatus	W1	7	3.81	6.29	0.002	0.019
Phacus aenigmaticus	W1	1	5.96	5.96	0.003	0.003
Phacus agilis	W1	27	0.50	6.48	0.002	0.040
Phacus alatus	W1	4	-0.11	1.64	0.002	0.010
Phacus caudatus	W1	4	1.10	5.96	0.002	0.013
Phacus curvicauda	W1	8	0.85	5.96	0.002	0.132

Phacus glaber	W1	4	3.81	5.31	0.003	0.559
Phacus globosus	W1	2	1.44	1.52	0.003	0.015
Phacus granum	W1	1	6.29	6.29	0.010	0.010
Phacus hamatus	W1	2	5.08	5.96	0.002	0.003
Phacus lismorensis	W1	2	1.10	5.69	0.003	0.007
Phacus longicauda	W1	22	-0.11	6.29	0.002	0.272
Phacus longicauda var. *tortuosus*	W1	3	5.63	6.48	0.002	0.003
Phacus megapyrenoides	W1	1	3.81	3.81	0.005	0.005
Phacus orbicularis	W1	15	0.50	6.29	0.002	0.015
Phacus oscillans	W1	1	5.63	5.63	0.003	0.003
Phacus parvulus	W1	1	4.92	4.92	0.003	0.003
Phacus plataleus	W1	5	-0.11	3.08	0.003	0.030
Phacus pleuronectes	W1	3	3.81	5.63	0.002	0.003
Phacus polytrophos	W1	2	5.08	5.08	0.003	0.004
Phacus pyrum	W1	27	-1.15	6.29	0.002	0.021
Phacus raciborskii	W1	2	3.81	3.93	0.002	0.005
Phacus skujae	W1	2	4.54	6.48	0.002	0.014
Phacus sp.	W1	18	-2.11	6.48	0.002	0.023
Phacus suecicus	W1	14	-1.15	5.66	0.002	0.065
Phacus triquetrus	W1	5	4.92	6.24	0.002	0.005
Phacus undulatus	W1	5	3.93	5.96	0.002	0.005
Phacus wettsteinii	W1	4	-2.11	2.88	0.002	0.008
Pyrobotrys incurva	W1	3	4.04	4.04	0.764	0.772
Rhabdomonas sp.	W1	6	-2.11	1.44	0.005	0.072
Scherfellia ovata	W1	1	5.69	5.69	0.030	0.030
Scherffelia sp.	W1	4	0.67	3.08	0.043	0.299
Spondylomorum quaternarium	W1	3	4.04	4.04	0.038	0.039
Dysmorphococcus variabilis	W2	1	4.92	4.92	0.007	0.007
Gonium sociale	W2	1	0.85	0.85	0.098	0.098
Strombomonas acuminata	W2	1	4.54	4.54	0.007	0.007

Strombomonas deflandrei	W2	3	0.25	6.24	0.003	0.017
Strombomonas fluviatilis	W2	6	6.03	6.29	0.002	0.012
Strombomonas maxima	W2	3	3.81	4.75	0.002	0.013
Strombomonas praerialis	W2	1	3.93	3.93	0.007	0.007
Strombomonas sp.	W2	1	3.08	3.08	0.008	0.008
Trachelomonas armata	W2	4	2.88	4.04	0.002	0.003
Trachelomonas bernardiensis	W2	2	-2.11	2.88	0.003	0.047
Trachelomonas crebea	W2	2	4.04	4.04	0.002	0.002
Trachelomonas crebea var. *spinosa*	W2	3	4.04	5.33	0.002	0.002
Trachelomonas curta	W2	2	4.54	4.92	0.002	0.010
Trachelomonas erinaceus	W2	3	4.04	4.04	0.002	0.002
Trachelomonas globularis	W2	3	4.04	4.04	0.009	0.010
Trachelomonas granulosa	W2	5	2.88	6.24	0.007	0.042
Trachelomonas hispida	W2	4	4.92	6.03	0.002	0.021
Trachelomonas intermedia	W2	6	3.81	6.54	0.002	0.022
Trachelomonas lefévrei	W2	2	6.24	6.24	0.014	0.099
Trachelomonas lomnicki	W2	2	4.92	5.17	0.025	0.365
Trachelomonas oblonga	W2	7	3.93	6.24	0.002	0.187
Trachelomonas planctonica	W2	9	3.81	5.63	0.002	0.035
Trachelomonas similis	W2	1	5.31	5.31	0.002	0.002
Trachelomonas sp. 1	W2	36	-1.15	8.77	0.002	0.130
Trachelomonas sp. 2	W2	8	-0.11	3.08	0.003	0.103
Trachelomonas sp. 3	W2	5	-0.11	3.08	0.003	0.020
Trachelomonas sp. 4	W2	8	-0.11	2.88	0.005	0.132
Trachelomonas sp. 5	W2	4	-0.11	1.52	0.003	0.108
Trachelomonas sp. 6	W2	2	-1.15	-1.15	0.002	0.013
Trachelomonas sp. 8	W2	10	-2.11	-1.15	0.008	0.261
Trachelomonas sp. 9	W2	2	-0.11	0.37	0.020	0.071
Trachelomonas superba	W2	2	5.17	5.31	0.002	0.007
Trachelomonas verrucosa	W2	2	-2.11	6.03	0.005	0.007

Trachelomonas volvocina	W2	29	-2.11	7.40	0.002	0.136
Trachelomonas volvocinopsis	W2	36	-1.15	6.54	0.002	0.235
Trachelomonas wislouchii	W2	3	4.04	4.04	0.005	0.005
Trachelomonas woycickii	W2	2	5.17	5.31	0.002	0.002
Lyngbya sp.	TC	1	4.67	4.67	0.002	0.002
Nostocales sp.	TC	1	0.25	0.25	0.040	0.040
Oscillatoria amphibia	TC	3	5.96	8.77	0.020	0.352
Oscillatoria angusta	TC	6	5.63	5.96	0.003	0.486
Oscillatoria chalybea	TC	1	5.63	5.63	0.003	0.003
Oscillatoria limosa	TC	1	-2.11	-2.11	0.002	0.002
Oscillatoria pseudogeminata	TC	1	5.69	5.69	0.003	0.003
Oscillatoria putrida	TC	1	6.24	6.24	0.006	0.006
Oscillatoria sp.	TC	19	-1.15	7.40	0.002	0.398
Geitlerinema splendidum	TC	1	5.69	5.69	0.009	0.009
Oscillatoria tenuis	TC	2	5.63	5.96	0.002	0.004
Phormidium ambiguum	TC	1	4.67	4.67	0.002	0.002
Phormidium sp.	TC	7	5.31	6.54	0.002	0.117
Spirogyra sp.	TD	5	-0.11	1.64	0.003	0.358
Zygnema sp.	TD	3	0.25	1.40	0.003	0.010

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Appendix 2. Summary of fitted Generalized Additive Models.(Predictors: log Area, Distribution: normal)

The *Response* fields specify, respectively, the name of response (dependent) variable.

Type specifies (for one predictor or two predictor, separated by "**+**" character) its complexity within the model: *lin* means that a (generalized) linear term was chosen during stepwise selection, while *s2* describes a smooth term with complexity value 2 measured in degrees of freedom best model was selected by Akaike Information Criterion (AIC) values.

R2[%] provides a measure of explained variation, paralleling the coefficient of determination in classical regression, calculated here as the ratio of the deviance explained by the fitted model and the deviance of a null model (with no predictors), multiplied by 100

F test statistic and following **p** estimate of type I error rate correspond to an overall parametric test of the selected model against the null model.

Response	Type	R2[%]	F	p
K	s2	3.3	3.7	0.02649
X1	s2	8.7	10.3	0.00006
X3	s2	2.7	3	0.05159
ABCD	s2	15.7	20	<0.00001
F	lin	3.8	8.5	0.00379
H1	lin	2.6	5.7	0.01725
J	lin	2.2	4.8	0.02997
LO	lin	1.2	2.6	0.11127
M	lin	1	2.2	0.14047
N	s2	5.3	6.1	0.00274
SN	s2	8.2	9.6	0.0001
TC	s2	7.3	8.5	0.00027
MP	s2	10.4	12.4	<0.00001
W1	s2	20	26.8	<0.00001
W2	s2	11.2	13.6	<0.00001
WS	s2	2.8	3.1	0.04705
TD	lin	1.8	4	0.04739
X2	lin	5.9	13.4	0.0003