Supporting Information - Török et al. Functional diversity supports the biomass-diversity humped-back relationship in phytoplankton assemblages

Functional classifications of phytoplankton

Appendix S2A Functional groups (FG, based on Reynolds, (2002) and Padisák et al. (2009)

	Habitat	Specific sensitivity	Some abundant taxa of the study
A	Clear, deep, base poor lakes	Increase in pH	*Urosolenia longiseta, Urosolenia eriensis, Acanthoceras zachariasii*
B	Mesotrophic small- and medium- sized lakes	The onset of stratification	*Stephanodiscus minutulus, Discostella pseudostelligera*, *Discostella stelligera*
C	Eutrophic small- and medium-sized lakes	The onset of stratification	*Aulacoseira distans*, *Cyclotella meneghiniana, Asterionella formosa*
D	Shallow turbid waters	Nutrient depletion with criterion	*Nitzschia acicularis*, *Stephanodiscus hantzschii*, *Fragilaria acus*
P	Continuous or semi-continuous mixing shallow lakes with higher trophic states	stratification	*Aulacoseira granulata*, *Staurastrum paradoxum*, *Closterium acutum*
MP	frequently stirred up, inorganically turbid shallow lakes		*Surirella robusta*, *Oscillatoria limosa*, *Fragilaria fasciculata*
T	mixed environments with clear epilimnia of deep lakes		*Mougeotia* sp., *Stichococcus contortus*, *Planctonema lauterbornii*
S1	turbid mixed environments	N-deficiency	*Limnothrix redekei*, *Planktothrix agardhii*, *Geitlerinema splendidum*
S2	warm, shallow and often highly alkaline waters	N-deficiency	*Spirulina jenneri*, *Spirulina major*, *Spirulina meneghiniana*
S_N	warm mixed environments		*Cylindrospermopsis raciborskii*
X3	shallow, well mixed oligotrophic environments	grazing pressure	*Koliella spiculiformis*, *Chrysococcus rufescens*, *Chromulina* sp.
X2	shallow, meso-eutrophic environments	grazing pressure	*Chlamydomonas incerta*, *Plagioselmis nannoplanctica*, *Nephroselmis olivacea*
X1	shallow, eu-hypertrophic environments	grazing pressure	*Monoraphidium contortum*, *Chlorella vulgaris, Monoraphidium tortile*
X_{Ph}	small, even temporary, calcium rich, well illuminated, alkaline lakes	grazing pressure	*Phacotus lenticularis*
E	small, shallow, base poor lakes or heterotrophic ponds		*Dinobryon sertularia*, *Dinobryon divergens*, *Mallomonas akrokomos*
Y	almost all lentic ecosystems	High grazing pressure	*Cryptomonas marsonii*, *Cryptomonas obovata*, *Cryptomonas erosa*
F	clear, deeply mixed meso-eutrophic lakes	Light deficiency	*Eutetramorus planctonicus*, *Oocystis solitaria*, *Micractinium pusillum*
G	nutrient-rich conditions in stagnating water columns; small eutrophic lakes and very stable phases in larger river-fed basins and storage reservoirs	Nutrient deficiency	*Pandorina morum, Eudorina elegans*, *Pandorina charkowiensis*
J	shallow, mixed, highly enriched systems	sedimentation	*Pediastrum boryanum*, *Pediastrum duplex*, *Pediastrum simplex*
K	shallow, nutrient-rich water columns		*Aphanocapsa delicatissima*, *Lemmermanniella* sp., *Cyanogranis libera*
H1	eutrophic, stratified and shallow lakes with low nitrogen content	Strong mixing criteria	*Aphanizomenon flos-aquae*, *Aphanizomenon ovalisporum*, *Anabaenopsis* sp.

U	stratifying oligotrophic and mesotrophic lakes		*Uroglena* sp.
L_O	deep and shallow, oligo to eutrophic, medium to large lakes	Strong mixing criteria	*Peridinium gatunense*, *Peridinium umbonatum*,
L_M	eutrophic to hypertrophic, small- to medium-sized lakes	Strong mixing criteria	*Gomphosphaeria lacustris*, *Gomphosphaeria compacta*, *Gomphosphaeria aponina*
M	eutrophic to hypertrophic, small- to medium-sized water bodies	Light deficiency	*Microcystis aeruginosa*, *Microcystis flos-aquae*, *Microcystis viridis*
V	metalimnia of eutrophic stratified lakes or monimolimnia of meromictic lakes		*Beggiatoa alba*, *Ochrobium tectum*, *Siderocapsa* sp.
W1	ponds, even temporary, rich in organic matter from husbandry or sewages	grazing pressure	*Euglena polymorpha*, *Euglena deses*, *Euglena proxima*
W2	meso-eutrophic ponds, even temporary, shallow lakes		*Trachelomonas volvocinopsis*, *Trachelomonas volvocina*, *Trachelomonas planctonica*
W_S	ponds, even temporary, rich in organic matter from decomposition of vegetal matter (humic environments), but not acidic	rising pH	*Synura petersenii*, *Synura uvella*, *Synura* sp.
Q	small acidic, humic lakes		*Gonyostomum latum*, *Gonyostomum semen*

Appendix S2B Summary of the main morphological features of the Morpho-Functional Groups (MFG) (based on Salmaso & Padisák 2007).

	Description		Cell habit	Taxonomic group	Some abundant taxa of the study
1	Large flagellates – potential mixotrophs	1a	colonial or unicellular	Chrysophytes/Haptophytes	*Synura petersenii*, *Gonyostomum semen*, *Uroglena* sp.
		1b		Dinophytes	*Peridinium gatunense, Peridinium palatinum*, *Ceratium hirundinella*
		1c		Euglenophytes	*Euglena polymorpha*, *Euglena deses*, *Euglena texta*
2	Small flagellates – potential mixotrophs	2a	unicellular	Chrysophytes/Haptophytes	*Phacotus lenticularis*, *Chrysococcus rufescens*, *Mallomonas* sp.
		2b		Dinophytes	*Peridinium umbonatum*, *Peridinium aciculiferum*, *Peridiniopsis elpatiewskyi*
		2c		Euglenophytes	*Trachelomonas volvocinopsis*, *Trachelomonas volvocina*, *Phacus pyrum*
		2d		Cryptophytes	*Cryptomonas marssonii*, *Cryptomonas obovata*, *Cryptomonas erosa*
3	Flagellates – mostly autotrophs	3a	unicellular	Phytomonadina	*Chlamydomonas incerta*, *Nephroselmis olivacea*, *Carteria* sp.
		3b	colonial	Phytomonadina	*Pandorina morum*, *Eudorina elegans*, *Pyrobotrys incurva*
4	Cyanobacteria	4	unicellular	Cyanobacteria	*Synechococcus nidulans*, *Synechococcus* sp., *Synechocystis* sp.
5		5a	colonial	Thin filaments (Oscillatoria)	*Oscillatoria* sp., *Limnothrix redekei*, *Planktothrix* sp.
		5b		Large vacuolated Chroococcales	*Microcystis aeruginosa, Microcystis flos-aquae*, *Microcystis viridis*
		5c		Other large colonies, mostly non-vacuolated Chroococcales	*Chroococcus limneticus*, *Aphanocapsa delicatissima*, *Coelomoron pusillum*
		5d		Small Chroococcales	*Aphanocapsa* sp., *Merismopedia glauca*, *Chroococcus turgidus*
		5e		Nostocales	*Cylindrospermopsis raciborskii*, *Aphanizomenon flos-aquae*, *Anabaena* sp.,
6	Diatoms - Large	6a		Centrics	*Aulacoseira granulata*, *Melosira varians*, *Acanthoceras zachariasii*
		6b		Pennates	*Surirella robusta*, *Nitzschia acicularis*, *Fragilaria* sp.
7	Diatoms -Small	7a		Centrics	*Aulacoseira distans*, *Stephanodiscus minutulus*, *Cyclotella meneghiniana*
		7b		Pennates	*Achnanthes lanceolata*, *Achnanthes minutissima*, *Navicula confervacea*
8	Large other groups	8a	unicellular	Conjugatophytes/Chlorophytes	*Koliella spiculiformis*, *Monoraphidium contortum*, *Closterium lineatum*
		8b		Other groups	*Ophiocytium capitatum*, *Tetraedron minimum*, *Tetraedron caudatum*
9	Small other groups	9a	unicellular	Conjugatophytes	*Cosmarium margaritiferum*, *Franceia elongata*, *Franceia ovalis*
		9b		Chlorococcales	*Chlorella vulgaris*, *Crucigenia tetrapedia*, *Monoraphidium tortile*
		9c		Chrysophytes	-
		9d		Other groups	*Trachydiscus ellipticus*, *Trachydiscus ellipsoideus*, *Goniochloris mutica*
10		10a	Filaments	Chlorophytes	*Mougeotia* sp., *Stichococcus contortus, Planctonema lauterbornii*
		10b		Conjugatophytes	*Teilingia granulata*, *Spondylosium planum*, *Gonatozygon brebissonii*

	10c		Xanthophytes		-
11	**11a**	Non filament colonies	Chlorococcales	Naked colonies	*Pediastrum boryanum*, *Pediastrum duplex*, *Hyaloraphidium contortum*
	11b		Chlorococcales – gelatinous colonies		*Eutetramorus planctonicus*, *Oocystis solitaria*, *Micractinium pusillum*
	11c		Other colonies		*Dichotomococcus curvatus*, *Cosmocladium saxonicum*, *Gloeococcus minor*

Appendix S2C Morphologically based functional groups (MBFG) (based on Kruk et al. 2010)

	Description	Taxonomic group	Some abundant taxa of the study
I	Small organisms with high S/V ratio	Chlorococcales, Chroococcales, Oscillatoriales, Xanthophyceae, Ulotrichales	*Chlorella vulgaris*, *Tetraedron minimum*, *Aphanocapsa* sp.
II	Small flagellates with siliceous exoskeletons	Chrysophyceae	*Synura petersenii*, *Uroglena* sp., *Synura* sp.
III	Large filaments with aerotropes	Nostocales, Oscillatoriales	*Cylindrospermopsis raciborskii*, *Aphanizomenon flos-aquae*, *Anabaena* sp.
IV	Medium sized organisms without specialised traits	Chlorococcales, Oscillatoriales, Xanthophyceae, Zygnematophyceae	*Pediastrum boryanum*, *Mougeotia* sp., *Pediastrum duplex*
V	Unicellular flagellates with medium to large size	Cryptophyceae, Dinophyceae, Euglenophyceae, Volvocales, Chlorococcales	*Peridinium gatunense*, *Peridinium umbonatum*, *Euglena polymorpha*
VI	Non-flagellated organisms with siliceous exoskeletons	Diatoms	*Surirella robusta*, *Aulacoseira distans*, *Stephanodiscus minutulus*
VII	Large mucilaginous colonies	Chlorococcales, Chroococcales, Oscillatoriales	*Microcystis aeruginosa*, *Microcystis flos-aquae*, *Eutetramorus planctonicus*

Appendix S2D Summary of the main morphometric and behavioural characteristics of CSR-strategy (based on Reynolds 1988, 2006)

	Name	Dispersal	Cell habit	Cell size	Some abundant taxa of the study
Main strategies					
C	Competitors / Invasive opportunists	Highly effective, cosmopolitan	Mostly unicellular	$10^{-1} – 10^{3}$ μm^3	*Desmodesmus communis*, *Stephanodiscus minutulus*, *Koliella spiculiformis*
R	Ruderals / Attuning or acclimating	Widely distributed	Some unicellular, many coenobial	$10^{3} – 10^{5}$ μm^3	*Mougeotia* sp., *Surirella robusta*, *Aulacoseira distans*
S	Stress-tolerators / Acquisitive	Tendency to discontinuous distribution	Some unicellular, many coenobial	$10^{4} – 10^{7}$ μm^3	*Cylindrospermopsis raciborskii*, *Peridinium gatunense*, *Aphanizomenon flos-aquae*
SS	Chronic-stress tolerant	Cosmopolitan	Exclusively unicellular	≤ 4 μm^3	-
Intermediate strategies	**Characteristics**				
CS	max. growth rates, low-temperature tolerance, exploit nutrient resources				*Pediastrum boryanum*, *Pediastrum duplex*, *Pediastrum simplex*
CR	varying tolerance of turbidity				-
RS	slow-growing, long-surviving				-
CSR	unicellular with moderate size				*Peridinium umbonatum*, *Peridinium aciculiferum*, *Synura petersenii*