Co-occurrence of functional groups in phytoplankton assemblages dominated by diatoms, chrysophytes and dinoflagellates

Marija Gligora Udovič, Petar Žutinić*, Koraljka Kralj Borojević and Andelka Plenković-Moraj

With 4 figures and 3 tables

Abstract: In four deep karstic lakes (Lake Vransko, Lake Visovačko, Kozjak and Prošće) several functionally well-adapted phytoplankton groups interchange in dominance during the seasonal cycle from April to September and likely tolerate the constraining conditions of nutrients deficiency more successfully as an aggregated group than as taxonomic units. This paper considers the functional approach by Reynolds et al. (2002), a method capturing much of the species ecology and which is successfully used for describing phytoplankton successions. Deep karstic lakes are attributed with the early spring (April) formation of stratification, low phytoplankton biomass, and with maximum biomass accumulating in July. The co-occurrence of functional groups in those lakes is evident but typically distinct according to different biomass proportions. The functional groups A, B, C, D, P, E and LO, represented by different Cyclotella, Ulnaria/Fragilaria, Dinobryon, Ceratium/Peridinium species, co-occurred in 50% and up to 90% of phytoplankton biomass in all investigated lakes. By observing the co-occurrence across the Croatian karstic region we: (i) demonstrate the regional distribution of phytoplankton assemblages in relation to low nutrient environment, and (ii) build a simple uniform pattern which successfully describes a variety of phytoplankton in deep karstic lakes and provides information of reliable indicators for those systems.

Key words: phytoplankton functional groups; succession; karstic lakes; regional distribution; indicators.

Introduction

The substantial amount of data and theory available on phytoplankton assemblages and succession (Bruggeman & Kooijman 2007) makes it plausible to study potential grouping of species according to environmental preferences (Reynolds et al. 2002). The exigency arose to reduce large numbers of species by pooling them into several descriptive groups containing mutual adaptations (Reynolds 2006), but without losing the information embedded in detailed species taxonomic lists (Kaiblinger 2008). In potential groups species are selected by hydrological and geological preferences of environment, together with light intensity and nutrients. During the last decades several functional approaches based on ecological criteria have been proposed (Salmaso et al. 2013) of which mostly functional, morphofunctional and morphologically based functional classifications of phytoplankton are being used (Reynolds et al. 2002; Salmaso & Padisák 2007; Kruk et al. 2010). General premise of the aforementioned classifications evolves from the combination of morphological, physiological or phenological characteristics of species measured at individual level which constitute a set of functional features affecting and determining the ecological efficiency and sustainability

Authors’ address:
1 University of Zagreb, Faculty of Science, Department of Biology, Rooseveltov trg 6, HR-10000 Zagreb
* Corresponding author; petar.zutinic@gmail.com