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PHYTOPLANKTON INTERACTIONS AS MAIN FOCUS OF THE 18TH WORKSHOP OF THE INTERNATIONAL ASSOCIATION OF PHYTOPLANKTON TAXONOMY AND ECOLOGY (IAP): AN OVERVIEW

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Abstract. This paper aims to summarize the work, topics and contributions of the 18th Workshop of the International Association of Phytoplankton Taxonomy and Ecology (IAP), which took place in Natal, Rio Grande do Norte - Brazil, from August 27 to September 3, 2017. The Organizing committee was chaired by professors from two Brazilian universities at Natal and Sao Carlos and comprised scientists from Brazil and Argentina. In total, 39 scientific reports (5 plenary lectures, 20 oral presentations and 13 posters), prepared by 152 contributors from 20 countries were presented. The phytoplankton interactions were the main focus of the workshop, introduced in five plenary lectures. Most other presentations also dealt with this topic: they considered interactions among phytoplankters and phytoplankton-zooplankton interactions, but there was also an interest for processes involving mixotrophic organisms, phytoplankton-bacteria interactions, phytoplankton macrophytes interactions, parasitism and trophic webs. The factors influencing the phytoplankton development and diversity in different environments, as a background for phytoplankton interactions and drivers of phytoplankton diversity, were also discussed. Different aspects of the phytoplankton diversity were also presented with special emphasis on biodiversity conservation. Traditionally, methodological support for microscopic plankton counts and size measurements and trait-based approaches were among the side-topics of the workshop. Several future lines of research were suggested on the basis of the meeting summary.

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INTRODUCTION

The 18th Workshop of the International Association of Phytoplankton Taxonomy and Ecology (IAP) took place in Natal, Rio Grande do Norte - Brazil, from August 27 to September 3, 2017. The Organizing committee was chaired by professors from two Brazilian universities at Natal and Sao Carlos and comprised scientists from Brazil and Argentina: Hugo Sarmiento, Vanessa Becker, Vera Huszar, Irina Izaguirre, Carolina Davila Domingues, Luciane Oliveira Crossetti, Ines O'Farrell and Fernando Unrein.

Fourty-two scientists from fourteen countries participated in the meeting but the number of contributors was higher: 152 from 20 countries. In total, 39 presentations were discussed (5 plenary lectures, 20 oral presentations and 13 posters). The phytoplankton interactions were the main focus of the workshop.

Each day sessions were introduced by a plenary lecture. The first speaker was Antonio Calado, Department of Biology, University of Aveiro, Portugal. He spoke about the phylogeny of dinoflagellates, illustrating the feeding mechanisms associated with particular cell features in heterotrophic species, and showed that similar features exist in phototrophic taxa, suggesting they are mixotrophic. However, food uptake in phototrophic species was demonstrated for very few freshwater dinoflagellates (Calado 2017).

On the second day, Hugo Sarmiento, Department of Hydrobiology, Universidade Federal de Sao Carlos, Brazil, reviewed theoretical concepts on biotic interactions, methods to quantify interaction strength and specialization in interaction networks. In this talk, he stressed that a number of studies had shown that tropical lakes are different from temperate ones in some fundamental ways: constantly high temperature affecting stratification patterns and biological processes; food web structure influenced by zooplankton small body size, etc. He suggested that a great amount of work is still needed to understand biotic interactions along latitudinal gradients (Sarmiento 2017).

On the third day, the mid-workshop field trip took place and was focused on the visit of a reservoir in the *Caatinga*. Brazil has six biomes: Amazon, Brazilian savannah (*cerrado*), Atlantic forest, Pampa, Pantanal and Caatinga. In this trip, participants had a unique opportunity to experience the semi-arid conditions of Caatinga, a region where climate change has already influenced ecosystems and people's lives. The reservoir usually has high phytoplankton biomass - permanent blooms of *Cylindrospermopsis* are not rare when water level is decreasing, or dominated by mixotrophs (mainly cryptophytes and euglenoids) when water level reaches a critical depth. On this trip, the participants saw a critical state of the system, which has been affected by severe drought lasting for several years, leading

Fig. 1. Illustrations of the status of the eutrophic reservoir visited in the Caatinga, North East Brazil.

to an extremely low water level, dominance of phytoplankton by small coccoid cyanoprokaryotes/cyanobacteria, and fish kills related to the extreme eutrophication resulting in dissolved oxygen depletion (**Fig. 1**).

On the fourth day, the session was introduced by a talk given by Mariangela Menezes, Department of Botany, Universidade Federal do Rio de Janeiro, Brazil. The contribution focused on the taxonomical updates on phytoflagellates, summarizing the current taxonomic treatment of mixotrophic phytoflagellates in freshwater systems, focusing on the reassessment of genera and species of cryptophytes and euglenophytes (Menezes 2017).

The last plenary, by Carla Kruk, Universidad de la Republica, Uruguay, focused on a trait-based approach of phytoplankton-zooplankton interactions. She developed classifications based on literature review of specific ingestion rates and selectivity in Rotifers and Cladocerans and applied them to a study of grazing pressure along a latitudinal gradient in South America (Kruk et al. 2017).

Most other presentations also dealt with the main workshop topic: they considered interactions among phytoplankters (Ali Ger et al. 2017; Crossetti et al. 2017; Muhl et al. 2017; Pires et al. 2017; Rangel et al. 2017; Song et al. 2017; Znachor et al. 2017; Zohary et al. 2017) and phytoplankton-zooplankton interactions (de Souza Cardoso et al. 2017; O'Farrell et al. 2017; Olrik 2017; Quesado et al. 2017; Selmeczy et al. 2017), but there was also an interest for processes involving mixotrophic organisms (Cagle et al. 2017; Costa et al. 2017; Naselli-Flores & Barone 2017; Unrein & Gereá 2017), phytoplankton bacteria interaction (Devercelli et al. 2017; Piccini et al. 2017; Zutinic et al. 2017), phytoplankton-macrophytes interactions (Barbosa & de Araujo Alves 2017), parasitism (Rychtecky et al. 2017) and trophic webs (Domingues et al. 2017; Feitosa et al. 2017; Izaguirre et al. 2017; Wilk-Wozniak et al. 2017). The factors influencing the phytoplankton development and diversity in different environments, as a background for phytoplankton interactions and drivers of

phytoplankton diversity, were also discussed (Abonyi et al. 2017; Becker et al. 2017; Colina et al. 2017; Descy et al. 2017; Di Pasquale et al. 2017). Different aspects of the phytoplankton diversity were also presented (Huber & Unrein 2017; Metz et al. 2017) with special emphasis on biodiversity conservation (Porcel et al. 2017). Traditionally, methodological support for microscopic plankton counts and size measurements (Zohary 2017) and trait-based approaches (Borics et al. 2017) were among the side-topics of the workshop. All the above-mentioned works were multi-aspected and revealed also the need for more efforts in observations of living organisms for outlining the potentially mixotrophic organisms, the difficulties in determining coexistence, competition and cooperation, the influence of invasive species on size phytoplankton structure, the existence of different interaction patterns among the lakes or between free-flowing and impounded river stretches, the possibilities for phytoplankton development in the main river bed, some intriguing similarities between terrestrial and planktonic systems, the effects of different disturbances and species traits on phytoplankton development, *etc.*

Several future lines of research were suggested on the basis of the meeting summary. At the end, it was decided that the next IAP meeting will be held in Hungary and chaired by Gabor Borics, Department of Tisza River Research, MTA Centre for Ecological Research, Hungary. The main topic of this future workshop remains to be decided on.

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