

Diel Vertical Migration and Distribution Patterns of Phytoplankton in Spring Bloom of Pengxi River

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Abstract

Since the impoundment of the Three Gorges Reservoir, Pengxi River has shown significant spring algal succession characteristics, often manifested as periodic outbreaks of Cyanophyta and Pyrrophyta blooms. In order to explore the diel vertical distribution pattern of phytoplankton community in Pengxi River, carrying out the diel stratified sampling in the typical monitoring section PX7 in April 2024 (25-26 and 17-18), to analyze the dynamic changes of the diurnal vertical distribution of dominant phytoplankton and its environmental driving mechanism. Based on the depth contour map, the diel vertical distribution pattern of phytoplankton in water was simulated, and the principal component analysis (PCA) was used to quantify the ecological association between environmental factors and algae communities. The results showed that the order of phytoplankton dominance was cyanobacteria > dinoflagellates > cryptophytes > green algae > diatoms. The dominant species included *Chroococcus minor* (52.67%), *Ceratium hirundinella* (17.07%), *Anabaena circinalis* (10.78%), *Aphanizomenon flos-aquae* (9.52%). Especially, cyanobacteria has showed no significant difference in the vertical distribution between day and night, mainly concentrated in the surface layer of 0-2m and the upper part of 4 ± 1 m to show phototaxis. At noon, with the increase of photosynthetically active radiation (PAR), water temperature (W) and dissolved oxygen (DO), the average density of surface/middle/bottom layer increased by 7.14%, 8.68% and 24.84%, respectively. In contrast, dinoflagellates have significant diel migration behavior. The density of each water layer at noon decreases compared with that in the morning, then partially recovers in the evening. It is speculated that it adjusts its position through the swing of tail flagella to escape from strong light and live in a more suitable environment. The results of PCA showed that W, DO, nitrogen and phosphorus nutrition and PAR were the key factors affecting phytoplankton's dynamic distribution in Pengxi River. The water depth was negatively correlated with the density of cyanobacteria, which was attributed that its gas vesicles are difficult to regulate structure to break through the thermocline. Diatoms prefer low-oxygen, low-light deep-water layers, and other dominant algae prefer oxygen-rich and warm waters. At the same time, phosphorus nutrition is a more important nutrient factor affecting the photosynthesis and community structure of phytoplankton in water, or a nutrient driving force for the diurnal migration of dinoflagellates.

Keywords

Algal Bloom, Phytoplankton Succession, Day and Night Migration, Three Gorges Reservoir