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# Winter Climate Shapes Spring Phytoplankton Development in Non-Ice-Covered Lakes: Subtropical Lake Taihu as an Example

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Winter warming plays a vital role in spring phytoplankton community succession in temperate lakes due to variation of ice cover duration in winter. How winter conditions affect spring phytoplankton in subtropical lakes without winter ice cover is, however, largely unknown. In this study, covering 26 years, we elucidated the effects of both climate conditions and nutrient levels in winter on the phytoplankton community (expressed as Morpho-Functional Groups) in spring in Lake Taihu, a large shallow subtropical lake in China. During this period, wind speed declined significantly in both winter and spring from 1992 to 2017 and the sunshine hours increased slightly from 2000 to 2017. The biomass of eight dominant phytoplankton groups showed increasing trends from 1992 to 2017, while it declined for one group, which mainly included filamentous green algae such as *Ulothrix* sp. Nonmetric multidimensional scaling (NMDS) results indicated that wind speed and sunshine duration in winter and spring were the most important factors affecting the spring phytoplankton community in Lake Taihu. Also, partial least squares path modeling (PLS-PM) suggested that the spring phytoplankton community was strongly affected by winter conditions. Our study indicated that the "climate memory" effects on phytoplankton, resulting from winter and acting on the following spring, not only occur in north temperate winter ice-covered shallow lakes but also in subtropical lakes without ice-covered in winter.

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