Phosphorus supply pathways and mechanisms in shallow lakes with different regime

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In order to better understand the pathways and mechanisms of phosphorus (P) supply under different regimes, 12 sampling sites from 4 basins of 2 lakes were studied seasonally from October 2017 to July 2018 in Wuhan City, China. Concentrations of different forms of P and nitrogen (N) in surface and interstitial water, contents of carbon (C), N, P and iron (Fe) compounds as well as related extracellular enzymatic activities, phosphorus sorption,

abundance of phosphorus-solubilizing bacteria (PSB), total and specific (containing phosphatase gene) microbial community composition in sediments were analyzed. In lakes with macrophyte dominance, P supply pathway from sediment to water column was blocked. In lakes being early period of regime shifting from macrophyte to algae, exogenous P input was the main P supply mode. In lakes being later period of regime shifting from macrophyte to algae, organic P hydrolysis and calcium-bound P dissociation driven by PSB contributed greatly to P regeneration, which was continuous and trickling. In this process, rapid C and N cycles fueled P regeneration. In lakes with algal dominance, given the significantly higher iron-bound P (Fe(OOH)~P), equilibriums phosphorus concentration and dehydrogenase activity, the main P regeneration pathway might be the desorption of Fe(OOH)~P driven by anoxia, showing the seasonal and pulsed characteristics. In addition, during the process of regime shift from macrophyte to algae, the dominant algal species switched from cyanobacteria to Chlorophyta. P-solubilizing microorganisms correlated with environmental factors, suggesting the coupling of multiple nutrient cycles, especially C, N, P, oxygen (O) and Fe, could effectively increase the pathways diversification and the strength of P regeneration.

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