Historical and seasonal dynamics of phosphorus mobility in Sancha Lake of Southwest China's Sichuan Province

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Phosphorus (P) fractionations in the surface sediment of Sancha Lake in China's southwestern Sichuan Province were examined to assess the potential P release at the water-sediment interface and to understand its seasonal (2009–2010) and historical dynamics (1989–2010) in the surface water. Elevated P concentrations were detected in the sediment at main reservoir inflow, south canal of the Dujiangyan irrigation network, and intensive cage fish farming area, accounting for 32 and 40%of current total P discharges. The highest total P concentration (11,200 μg P g$-$1) was observed in the upper sediment below intensive fish farming area with a specific enrichment of HCl-P (51% of total P) mainly from fish feeds and feces. These sediments had larger MgCl2-P pools with higher diffusive P fluxes (0.43–0.47 mg m$-$2 d$-$1) from surface sediment than those from other areas (0.25–0.42 mg m$-$2 d$-$1). The general small proportion of MgCl2-P (5.7–10%) and low diffusive P fluxes from surface sediment (<0.02% of sediment P storage (0–1 cm)) indicate low mobility and slow release of P from sediments. The sediment as an internal P source led to a 3–4-year lag for P concentration decrease in the surface water after restriction of anthropogenic P discharges since 2005. Thus, the peak P concentration in April and September could be explained as a combined effect of supplementing internal loading via reductive processes in sediments and seasonal water vertical circulation in the early spring and fall. Policy played a crucial role in reducing P inputs to the lake.
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