Phosphorus retention in a dammed reservoir in Ontario, Canada: Implications for nutrient management

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Harmful algal blooms in the western basin of Lake Erie (USA-Canada) have been increasing in frequency and severity since the late 1990s. Excess loads of phosphorus (P) from the lake's watershed are one of the primary drivers of this re-eutrophication. The Thames River, in southern Ontario, is the largest Canadian tributary source of P to Lake Erie's western basin. Yet, the role of dammed reservoirs on P loading and speciation in this river corridor remains poorly characterized. We estimated annual and seasonal retention efficiency (RE) of the following P pools: dissolved reactive P (DRP), dissolved unreactive P (DUP) and total P (TP) by the largest reservoir (Fanshawe) in the Thames River basin using a mass balance approach and two years of sampling data (2018-2019). Four load estimation models were used to quantify P loads into and out of the reservoir. Results show that, on an annual basis, the reservoir was a P sink (RE: 29 to 46%) with a slight increase of the outflow DRP:TP ratios. However, loads, RE and DRP:TP showed systematic seasonal variations. For TP, retention was highest in winter and fall (RE: 49 to 69%), while the reservoir acted as a net source during the summers and one spring season (RE: -25 to -110%). Furthermore, the reservoir's outflow DRP fraction increased during the summers, ostensibly driven by in-reservoir stratification and internal P loading. Our results show that Fanshawe Reservoir exerts a major influence on the flow and speciation of P on the Thames River and, thus, represents a potential point of intervention for P management.