

# Phosphate solubilizing bacteria as an indicator of sediment phosphorus in freshwater lakes

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It has been well documented that phosphorus pollution is one of the most significant factors impeding the overall health of freshwater lakes. Various measures are being taken to reduce phosphorus input into the lakes by anthropogenic activities and thus to maintain a healthy ecosystem. However, it is well known that bioavailable phosphorus tends to bind with substances such as ferric iron and calcium present in the water, become insoluble, and settles into the sediments. The present study has been carried out to understand the relationship between the sediment phosphorus concentration and density of phosphate solubilizing bacteria (PSB) in two lakes in Ontario, Canada, namely, Lake Simcoe and Sparrow Lake. In September 2017, 20cm sediment cores were collected from the nearshore sites of these two lakes to determine the presence of PSB in relation to the sediment phosphorus concentration. PSB could potentially release phosphorus back into the water column through a process called internal phosphorus loading from the inorganic phosphates in the sediment when the right conditions are present. PSB were isolated from the sediment cores at 5 cm intervals by plating on to Pikovskaya's agar. Five grams of sediment was used to analyze total reactive phosphorus in the sediment. In Lake Simcoe, PSB ranged from  $3 \times 10^1$  to  $1.1 \times 10^1$  cfu/g, and the amount of total reactive phosphorus ranged from 0.19 to 0.46 mg/g. In Sparrow Lake, PSB ranged from  $4 \times 10^0$  to  $3 \times 10^1$  cfu/g and the amount of total reactive phosphorus ranged from 0.21 to 0.39 mg/g. A linear regression was completed to determine the relationship between total reactive phosphorus and PSB for each core. The results showed a negative relationship between these two tested parameters (Lake Simcoe:  $r^2=0.23$ ,  $y = -35.34x + 30.811$   $p=0.5206$ , and Sparrow Lake:  $r^2=0.87$ ,  $y = -155.9x + 62.322$ ,  $p=0.067$ ). While PSB density decreased with core depth, the concentration of reactive phosphorus increased. This indicates that the density of PSB in lake sediment may indicate the concentration of total reactive phosphorus and thus the internal phosphorus loading. More study is recommended to confirm the results.

Keywords: Phosphate Solubilizing Bacteria, Freshwater Lakes , Sediment Phosphorus , Canada