Okanagan UBC

Internal Phosphorus Loading to Wood Lake From Rototilling

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INTRODUCTION

Eurasian watermilfoil (EWM) (*Myriophyllum spicatum*) first appeared in the Okanagan Valley in 1970, in the Vernon Arm of Okanagan Lake. It is an introduced aquatic plant that negatively affects property and recreational value and impacts the biodiversity of lakes [1,2]. Currently EWM is controlled in Okanagan lakes by rotovation. Resuspension of sediments may increase the concentration of nutrients in the water column [3]. High concentrations of phosphorus are a concern in Wood Lake; total phosphorus levels are consistently higher than target values of 0.020 mg/L to maintain a healthy aquatic habitat [4]. There is limited data on how rotovation impacts phosphorus loading in Wood Lake. In contrast to chemical and biological control methods, very little research has been done on the effects of mechanical control. This study was done to determine how much phosphorus is contributed to the annual internal loading of Wood Lake when sediments are disturbed by rotovation. As well loading was compared between chronically rotovated sediments and sediments that have never been rotovated.

Figure 1. Dense mats of Eurasian watermilfoil floating at waters surface.

Figure 2. Aquatic rototiller utilized by Okanagan Basin Water Board; used in removing Eurasian watermilfoil roots from Wood Lake, BC.

METHODS AND MATERIALS

A total of 20 cores were collected from Wood Lake, BC, half chronically rotovated and half never rotovated (Fig. 4)

Phosphorus analysis was done by standard methods (EPA method 365.3).

Total loading of phosphorus was calculated as the difference between samples and background phosphorus concentration.

Figure 3. Example of a sediment core taken from a milfoil infested area.

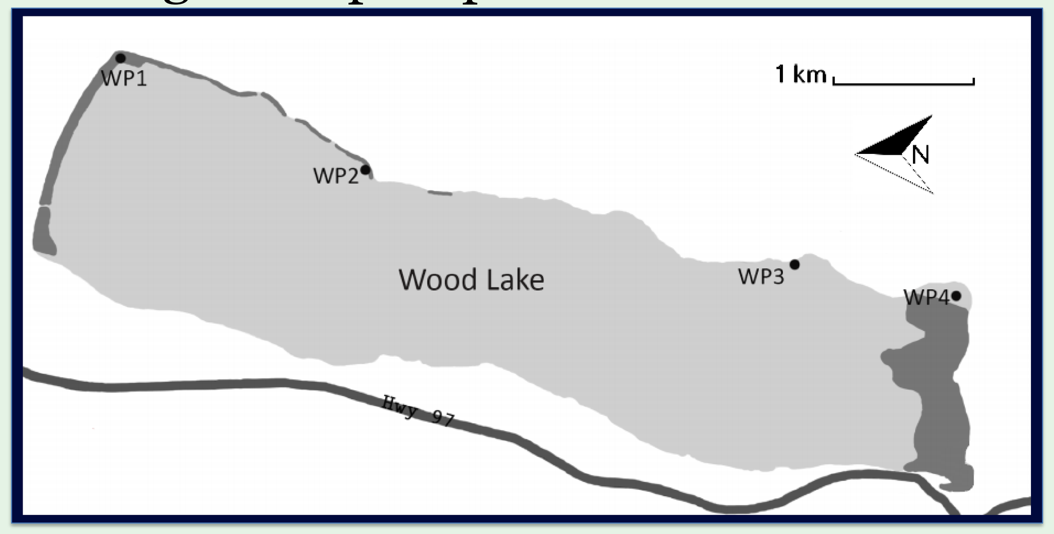

Figure 4. Map of Wood Lake with sample locations. Shaded areas are currently rotovated areas.

RESULTS

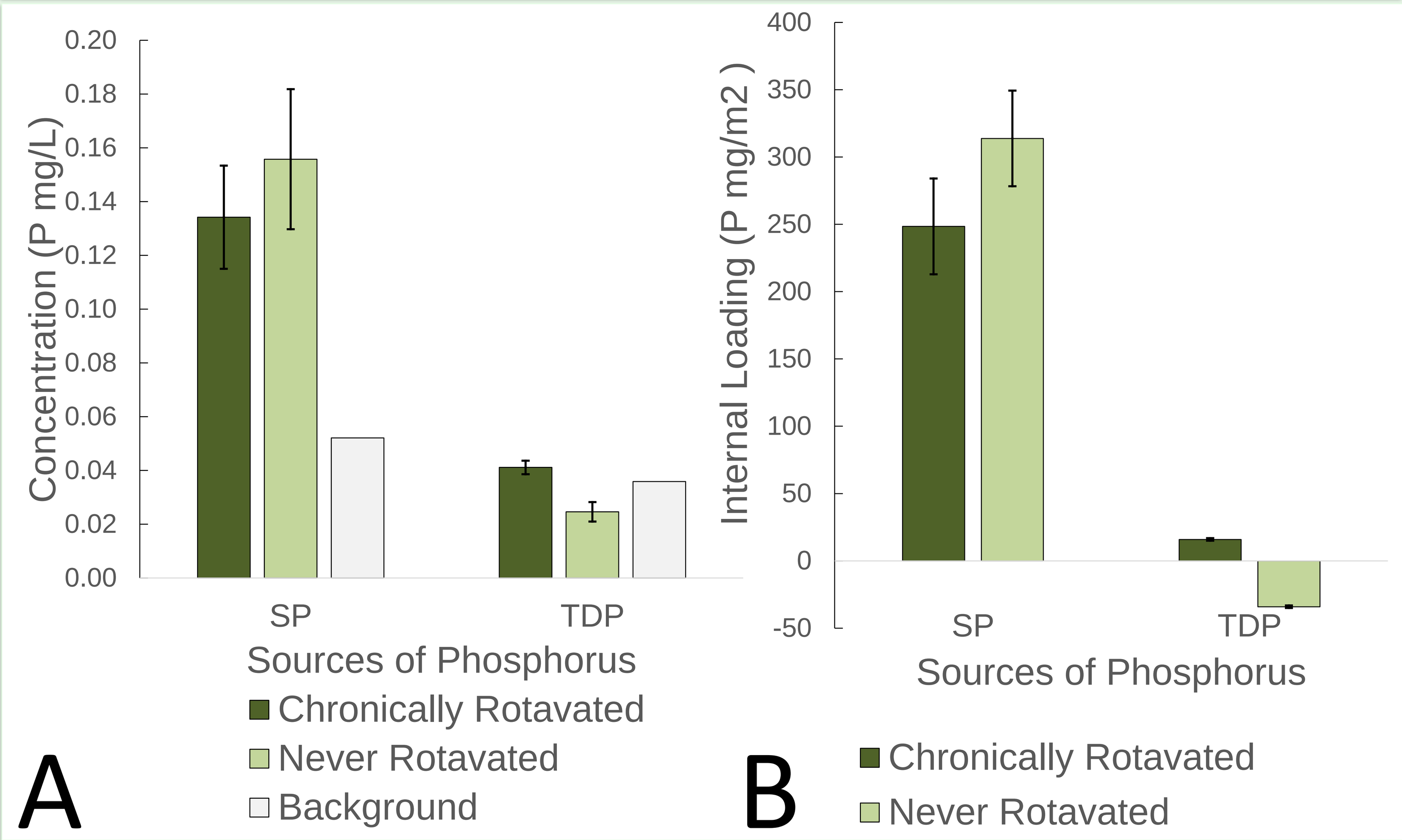

Figure 5.A) Mean phosphorus concentration as suspended phosphorus (SP) and total dissolved phosphorus (TDP) from chronically rotovated and never rotovated sediments compared to the background concentration of phosphorus in water. Error bars represent 2 standard errors. B) Internal loading of phosphorus in chronically rotovated and never rotovated sediments. Error bars represent standard error.

Chronically rotovated sediments differed significantly from never rotovated sediments in concentration of total dissolved phosphorus (TDP). There was no significant difference between the two sediments for suspended phosphorus (SP) ($p = 0.569$). Both chronically rotovated and never rotovated sediments raised SP concentrations significantly higher than background levels, by about 2.5 and 3 times respectively (Fig. 5A).

The rototilled sediments contribute 264 P mg/m2 in less than 24 hr, in contrast to a natural internal loading of 323 P mg/m2 annually[5]. Sediments that had never been rotovated had a slightly higher contribution of 280 P mg/m2.

By extrapolating our results to the total area treated in Wood Lake, total loading of phosphorus (combined SP and TDP) was estimated to be about 165 kg from annual rotovation treatment. Sediments that had never been rotovated had a slightly higher potential contribution of 174 kg of phosphorus.

The most recently published value for internal phosphorus loading in Wood Lake was reported by Nordin[5], who determined this value to be 3 tonnes; according to this value rotovation contributes about 5.5% of the internal loading observed in Wood Lake between October and January.

DISSCUSION AND CONCLUSION

Rotovation of sediments increased internal phosphorus loading for Wood Lake and will probably increase loading in all lakes subject to rotovation. There are two key variables to consider when assessing potential effects of rotovation on phosphorus and resulting water quality.

First, the proportion of treatment area should be considered because phosphorus loading increases necessarily as the percentage of area treated increases. Currently only 6.7% of Wood Lake is rotovated to control EWM. Since the lake is relatively large with a small area of treated shoreline, the contribution to internal loading from rotovation is not significant (5.5%). A significant portion (10%) of internal loading would come from rotovation if area treated was increased to 12.2% in Wood Lake (Fig. 6). In lakes with similar sediments, there would be a significant contribution if the percentage of treated area were to cross this threshold.

Second, understanding of the lake phosphorus budget enables estimation of the magnitude of increase relative to the undisturbed state. In the case of Wood Lake, the most recent measure of internal phosphorus loading to Wood Lake was done in 1987 and may not be representative of current internal phosphorus loading. Since then, external loading of phosphorus to Wood Lake has decreased and may cause internal loading of phosphorus to decrease as well[6].

Finally, from our results it seems likely that initial renovations will release more phosphorus in early years of mechanical milfoil control because sediments that had never been rotovated contributed greater amounts of phosphorus than those that had been chronically rotovated.

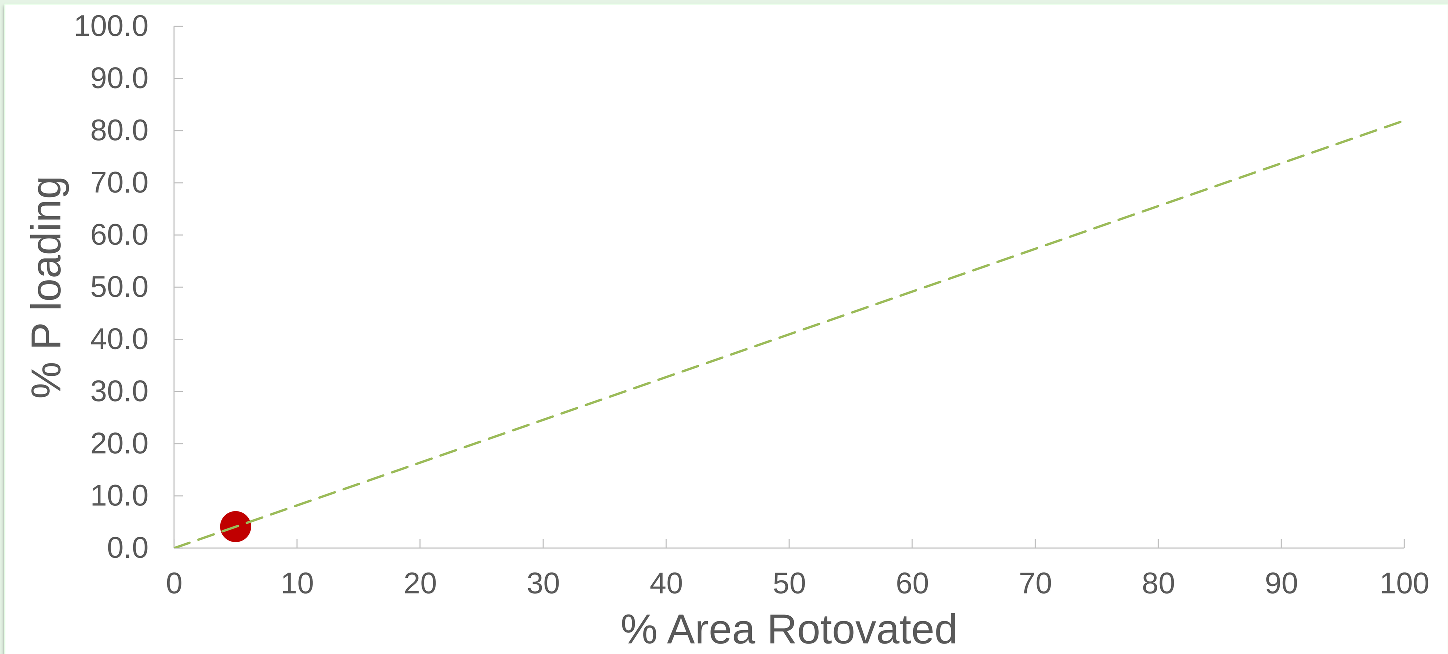

Figure 6. Extrapolation of percent internal phosphorus loading if the rotovated area were increased. Red dot represents current loading into Wood Lake.

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