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Evaluation of iron-phosphate as a source of internal lake phosphorus loadings

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approximately 3–4 days following the date of sediment sampling. Water samples with duplicates and blanks were submitted to a federal government laboratory, Pacific Environmental Science Centre (PESC), for total and orthophosphate analysis using the molybdenum blue method (Eaton et al., 1995). Sediment was collected using an Eckman dredge. Water in the dredge was carefully decanted and measurements of pH and Eh were taken using a standardized Omega PHH-82 meter (accuracy ± 0.015 pH, ± 1 mV; 2 eo. 9 T D (7 k 7 T j 9 (E D (7 h) 4

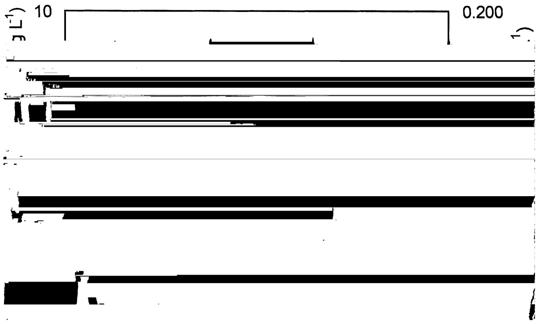

Fig. 1. Hypolimnetic conditions for the 1996 sampling period. Oxygen is measured at a depth of 8.5 m while total-P and

The signi®cant linear relationship observed between hypolimnetic TP and the model predictions is found only after removing the outlier (18 September) which represents conditions (high Eh) not conducive to strengite dissolution. The low P_{int} value predicted for 18 September is associated with a recent re-oxygenation of the bottom waters and an increase in sediment Eh (− 33 to 141 mV). Increases of oxygen in the bottom waters were noted on other dates as well (Fig. 1), but the degree of change in the Eh of the lower (4–8 cm) sediments was not as extreme, therefore reducing conditions were maintained. An evaluation of the daily wind speed records along with the oxygen and thermal pro®les of the water column indicates that the lake had been mixed on 16 September, 2 days previous to sediment sampling. The model was rerun with the 18 September sediment conditions but with Eh values of 100, 50 and 0 mV to evaluate the effect of the changing redox conditions. Predicted P_{int} values were 1.41, 3.89 and 11.13 $mg\ l^{-1}$, respectively. Tabor Lake sediment P is clearly sensitive to changes in Eh. The fact that the structural data from the water column show the re-establishment of anoxic conditions above the sediment–water interface by 23 September and that TP in the hypolimnion increased to 0.021 $mg\ l^{-1}$ indicates that the sediment Eh must have lowered. In Fig. 2 the measured 23 September TP_h of 0.021 $mg\ l^{-1}$ would be associated with a P_{int} of approximately 10 $mg\ l^{-1}$ which could have been released if the actual Eh conditions between 18 and 23 September had fallen between 0 and 50 mV, as is suggested by the structural pro®les.

Measured positive release rates are presented in Fig. 3 along with the results of Nürnberg (1988) who found a signi®cant linear relationship between BD-P and TP release rate ($r^2 = 0.90$, $n = 14$). The slopes of the two lines are nearly identical while their intercepts are quite different. The similar slopes suggest the process of anoxic driven release of iron phosphates is occurring in both data sets, while the different intercept likely re¯ects an overestimate of the actual amount of ni®cant relationships between iron-associated P in the sediment but not with the organic matter content of the sediment. While the speci®c role of the bacterial contribution to hypolimnetic water cannot be discerned in our data set, we concluded that remediation approaches that address the iron-bound phosphate would be most suitable for managing the internal P loading of Tabor Lake.

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