SPATIAL AND TEMPORAL VARIATION OF WATER COLUMN MEASUREMENTS IN AQUACULTURE PONDS

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ABSTRACT

Horizontal, vertical, and diel variations of soluble reactive phosphorus, total dissolved phosphorus, particulate carbon, particulate nitrogen, and particulate nitrogen:carbon ratios were examined in 0.4 ha, 1-m deep freshwater aquaculture ponds. Day-to-day variability of both concentrations of soluble reactive phosphorus and rates of uptake of soluble reactive phosphorus were examined in 163 m^2 seawater ponds. Levels of sampling of the 0.4 ha ponds included horizontal locations, buckets from the same location, samples from buckets, and subsamples of samples.

The variability associated with each level of sampling was estimated by a nested analysis of variance (ANOVA). The greatest sources of variability of all measurements were the highest (locations) and lowest (samples for particulate measurements and subsamples for dissolved measurements) levels of sampling. Locations within ponds were responsible for 7 to 96 % of the total variance of the means of measurements. A statistical analysis indicated that sampling at three locations, with only one sample at all lower levels of sampling, would be adequate to reduce the coefficient of variation to 10 % at least 50 % of the time for all dissolved and particulate measurements examined in this study. During conditions when the ponds were vertically well-mixed, this number of locations may have

sufficed most of the time. Consequently, determination of the temperature difference between surface and bottom water of the pond prior to sampling is recommended as an index of mixing conditions.

The contributions of depth and time of day to the variability of measurements were analyzed according to a nested random model factorial ANOVA based on the data previously analyzed for horizontal variability. During well mixed conditions, depth never contributed more than about 12 % to the total variance of any measurement. Although the time of day contributed more than 50 % to the total variance of a few measurements during well mixed conditions, the magnitude of the temporal variations was small except for particulate carbon, which increased by approximately 25 % from morning to afternoon in surface water.

Variability of both concentrations of soluble reactive phosphorus and rates of uptake of soluble reactive phosphorus was found between small treatment ponds. A significant difference was found between soluble reactive phosphorus measurements made in a single pond on separate sampling days. Day-to-day variability may exceed inter-pond variability in ponds treated similarly. Treatment ponds should therefore be compared only if measurements are made simultaneously or if a control is set up to account for temporal effects.