

Analysis of Nutrient-Response Characteristics to Support Criteria Development for Constructed Reservoirs

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ABSTRACT

The form and variability of relationships between water-column nutrients (TP, TN) and response variables (chlorophyll *a*, secchi depth) will have direct application to nutrient criteria development. While the general form of nutrient-algal relationships observed in natural lakes can be expected to occur in artificial reservoirs, algal response models developed in natural lakes cannot be applied directly to impoundments because of differences in physical features of natural lakes and constructed reservoirs.

Canfield and Bachman (1981) in a study of data from 1,300+ artificial and natural lakes in the U.S. found chlorophyll *a* relationships with both TP and secchi depth to be far more variable in artificial lakes than in natural lakes. The variability in nutrient levels and response characteristics in reservoirs can be attributed to many factors. Kennedy (2002) noted that artificial reservoirs generally have larger watersheds than natural lakes, and therefore non-algal turbidity has greater influence on phytoplankton growth. Also, the location and mechanism of the water release in reservoirs can influence water temperature regimes (release of cooler waters from a lower depth will result in warmer in-reservoir temperatures, while a surface release will cause the opposite effect), creating a variability that is not present in natural lakes.

This research explores the validity of applying lake-based nutrient response models to constructed reservoir nutrient criteria development through two related questions. (1) Do constructed reservoirs demonstrate consistent relationships between water-column nutrient levels (TN and TP) and response variables (secchi depth, Chl-*a*)? (2) Do factors such as nonalgal turbidity, ecoregion, and morphological features exert a consistent and predictable influence on reservoir nutrient-response characteristics?

The analysis was completed using reservoir water quality and physical characteristic data from four USEPA Region 3 states, Maryland, Pennsylvania, Virginia and West Virginia. Data were screened and processed using USEPA guidance, resulting in 114 reservoirs suitable for the analysis. The analysis found strong relationships between TP and nutrient response variables in Region 3 reservoirs. The analysis also found TN and most reservoir physical characteristics are not significantly correlated with nutrient responses variables.

KEYWORDS

Nutrient criteria, constructed reservoirs, phosphorus, nitrogen, nutrient algal responses