

**Comment on: "Bachmann, R. W., M. V. Hoyer, and D. E. Canfield. 2013. The extent that natural lakes in the United States of America have been changed by cultural eutrophication. *Limnology and Oceanography* 58:945-950."**

**John Stoddard, Alan Herlihy, Steve Paulsen, Amina Pollard, R. Jan Stevenson, Lester Yuan**

In a recent paper, Bachmann et al. (2013) conclude, based on paleolimnological reconstructions, that lakes in the conterminous U.S. have undergone very little cultural eutrophication. They go on to suggest that their results invalidate the efforts of the U.S. EPA to establish numeric nutrient criteria to protect and restore lake water quality. We find both the data analyses and conclusions of Bachman et al. to be fatally flawed.

The data on which these conclusions are based come from the U.S. EPA's National Lake Assessment (NLA; U.S. Environmental Protection Agency 2009), a probability survey of ca. 1000 lakes conducted in 2007. As the originators of those data, we are delighted to have outside researchers using them; we also think it is important to point out some of the consequences of how those data were handled and interpreted, as they have a strong influence on the conclusions. We have three major concerns with the way the data were presented:

1. The data analyses in Bachmann et al. are unweighted; correct interpretation of probability data, like the NLA, require the use of weights (or inclusion probabilities);
2. The set of lakes reported in Bachmann et al. includes 39 non-probability lakes (candidate reference sites) that should not be considered representative of the population of U.S. lakes—these lakes were hand selected because they had a high likelihood of being in least-disturbed condition (Stoddard et al. 2006). In addition, 33 probability lakes with valid data were excluded from the Bachmann et al. analysis.
3. The process by which the full NLA dataset of 1028 probability lakes was pared down to the 240 reported by Bachmann et al. (or the 234 that should have been reported) introduced a profound bias toward low nutrient lakes. Only a small subset of the probability sites included in NLA had useable sediment cores, and therefore inferences of historical nutrient concentrations are unavailable for most of the lakes in regions likely to have undergone cultural eutrophication.