

Lake Erie Phytoplankton at the Millennium: Nutrients, Zebra Mussels, and the Future.

David A. Culver, (culver.3@osu.edu), Li Hui, and Lisa Babcock-Jackson. Dept. Evolution, Ecology, and Organismal Biology, The Ohio State University, 1735 Neil Ave., Columbus, OH 43210

Trends: Since 1970, decreased phosphorus and increased nitrogen input have affected the functioning of the Lake Erie pelagic ecosystem (including algal, zooplankton, and fish abundances), even before the introduction of dreissenids further altered biological balances in the lake. May-August mean algal biomass (mg wet weight/l) in the western basin declined from 5.3 (1970) to 2.0 (1985) to 0.9 (1995-97). Comparable data for the central and eastern basins were (3.1, 1.0, 0.7) and (2.3, 0.4, 0.4), respectively. **Current Status:** The cyanophyte blooms that were so common in the 1970s have abated, with Chrysophyta and Cryptophyta dominating in 1996-97 in the western basin (67% and 21%, respectively). Central basin algae were dominated by Chrysophyta (55%), Cryptophyta (24%), and Pyrrhophyta (10%). Nevertheless, major blooms of toxic strains of *Microcystis* occurred in the western basin in 1995 and 1998, suggesting that phosphorus availability may be increasing. Various lines of evidence suggest that zebra mussel excretion of phosphorus and nitrogen has increased nutrient content of the lake, at least in the western and west central basins. Nevertheless, the highest algal concentrations occur at the mouths of the Maumee and Sandusky Rivers, around the Bass Islands, near Cleveland, and east of Long Point (frequent upwelling events) all of which provide ample nutrients. **Relevance:** The algae not only form the base of the pelagic foodweb, but contribute in major ways to toxin (e.g. microcystin), taste and odor (e.g., geosmin), and low oxygen (central basin) components of water quality. **Trajectory:** If zebra mussels are responsible for the recent cyanophyte blooms, their expansion over soft sediments suggests that Lake Erie algal blooms may continue to increase. In effect, increased internal loading of nutrients will undo progress made in limiting external loading. **Future Needs:** Better understanding of the role of turbulent mixing on the impact benthic zebra mussels on pelagic algae is required. We also need much more information on spatial distribution and size distribution of zebra mussels, particularly as they expand to low turbulent energy, soft substrates. Most of our data on phytoplankton distribution are from surface samples, whereas it is clear that highest concentrations may be far below the surface. Even so, remote sensing of chlorophyll distribution will enable us to better model variation in surface algal abundance under the influences of rivers, cities, and upwelling events. Seasonal variation in phosphorus, nitrogen, and silica loadings are needed desperately for modeling efforts, at a time when information is becoming increasingly scarce, particularly for the Detroit River.