

Why Filamentous Green Algae Dominated Benthic Habitats After the Zebra Mussel Invasion in Saginaw Bay, Lake Huron

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Abstract

We conducted a series of nutrient manipulation experiments over the first 5 years of zebra mussel colonization in Saginaw Bay, Lake Huron, to evaluate benthic algal nutrient limitation and community composition. We placed nutrient-diffusing substrata in the littoral zone of the Bay during 1991 (early *Dreissena* colonization) and from 1992 to 1995 (post-*Dreissena* colonization). The treatments consisted of P, N, and P+N additions, and a control. Benthic chlorophyll *a* and benthic algal biomass decreased through time from 1992-1995. Phosphorus limited biovolume only in 1994. Treatments with P additions had significantly ($p < 0.05$) more chlorophyll *a* than the controls each year after 1992. This result was consistent with an observed decrease in dissolved P throughout the study. Nitrogen additions had no significant effect throughout the 5 year period. Major shifts in species composition did not result from nutrient additions but rather seemed consistent with changes in light penetration and *Dreissena* herbivory. Our data demonstrated that the pre-*Dreissena* benthic algal community was dominated by tychoplanktonic diatoms (i.e., *Aulacoseira granulata* and *Tabellaria fenestrata*), which would be susceptible to filter-feeding *Dreissena*. Early post-invasion conditions were marked by an increase in light penetration (probably due to a decrease in phytoplankton by *Dreissena* grazing), and benthic algae were dominated by filamentous green algae (mostly *Spirogyra* sp. and *Cladophora* sp.). This type of algae typically responds well to

increases in light. Late post-invasion conditions were marked by a reduction of light caused by planktonic blooms of the blue-green alga *Microcystis* sp., which were resistant to zebra mussel herbivory. The benthic algal dominance shifted to periphytic diatoms (i.e. *Gomphonema clevei*), which were also resistant to zebra mussel filter-feeding since they were attached to the substrata and thus not part of the plankton. A new equilibrium may have developed where *Dreissena* herbivory limits tycho planktonic diatoms, which promotes *Microcystis* blooms (through lack of competing algal taxa), which in turn limits *Dreissena* filtering rates.

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