

*The Effect of Copper and Manganese on Phytoplankton
in the Grand River (Southern Ontario), Lake Erie and Pacific Ocean
Ecosystems*

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With the increased use and loading of metals into the environment, the accumulation of toxic metals by phytoplankton has become a concern. Trace metal interactions with phytoplankton are of particular interest due to the influence of phytoplankton on the biogeochemical cycling of metals in aquatic systems. The study of the accumulation of metals and their toxicity in phytoplankton is also of interest since phytoplankton lie at the base of many aquatic food webs. Toxic metals therefore have the potential to disrupt food webs and may have important implications for aquatic ecosystems.

This study has chosen to focus on the response of phytoplankton to two trace metals in particular: copper (Cu) and manganese (Mn). Although both Cu and Mn are essential elements for phytoplankton, Cu is of particular interest as a toxicant. A number of laboratory studies have suggested that there exists a physiological interaction between Cu and Mn, and that Cu toxicity can be decreased in the presence of high concentrations of Mn. However, few studies have examined the effects of these metals on phytoplankton in their natural environments. The significance of this study is that it is one of the first to examine whether the importance of Cu toxicity and the interaction between Cu and Mn observed in the laboratory is also observable under natural conditions.

Short-term bioassays were conducted in order to observe the response of phytoplankton from the Grand River (Southern Ontario) and Lake Erie to additions of various concentrations of Cu and Mn under natural conditions. Similar long-term bioassay experiments were also conducted in the Pacific Ocean. Experiments in the Grand River and the Pacific Ocean revealed no significant decrease in phytoplankton biomass or in photosynthetic efficiency with the addition of various concentrations of Cu and Mn. In Lake Erie, phytoplankton biomass was only adversely affected following relatively high additions of Cu of 60 nM, and only under certain conditions. Therefore, based on these results and under the tested conditions, Cu toxicity may not be of particular concern to the phytoplankton of the Grand River, Lake Erie and Pacific Ocean ecosystems