

Invited Abstract

SOLAR RADIATION IN LAKE ERIE

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Recent analyses of trends in solar radiation failed to document a systematic clarification of the open waters of Lake Erie by dreissenids (zebra and quagga mussels) and/or nutrient controls, except for certain years in the west basin. It was apparent that tripton (i.e., inorganic suspended sediments), rather than phytoplankton or dissolved organic matter, was the dominant regulator of solar radiation in the lake. Decreased tripton concentrations and ongoing stratospheric ozone loss in the north temperate zone were shown to contribute to increased ultraviolet radiation (UVR) exposure of organisms in the lake. To predict future trends, it was suggested that research was needed to address the factors regulating the quantity and quality of tripton in the lake, and to provide a quantitative basis for estimating possible impacts of UVR. Continued, and if possible increased, lake-wide surveys of optical conditions were recommended as necessary means of accounting for the spatial and temporal variability in the lake.

Insufficient time has elapsed since the previous analysis to say whether the trends (or lack thereof) of solar radiation in the open lake have continued, and new survey results have not been published. However, additional evidence for the dominant influence of tripton on solar radiation has been produced, and tripton effects on UVR specifically have been better explained. Quantitative understanding of UVR impacts on the plankton has also increased. Some tools now exist to estimate both the gains and losses of planktonic primary and bacterial production that result from altered water clarity and stratospheric ozone depletion. Total UVR-dependent loss of areal primary production at present exposure levels in L. Erie appears to be on the order of 10% for typical sunny summer days, but can range from 5 to at least 25%. Dreissenids are apparently continuing to increase their areal coverage on all substrate types, and should exert continued or increased pressure on phytoplankton, but effects on solar radiation climate are still hard to predict. Comparisons of nearshore with offshore stations tend to indicate that dreissenids can produce spatial patterns in phytoplankton and nutrients within basins, but water clarity effects are obscured by other influences.

There remains a need to know more about the factors regulating tripton in Lake Erie, the role of tripton and other properties of the water column as water clarity increases, and the impact of "mature" dreissenid communities on optical conditions in the water column. The spatial, as well as temporal, component of variation needs explicit attention on the within-basin scale. Recent developments in remote sensing techniques for inferring water clarity and particle loads should be pursued in coordination with sampling programs in the lake itself. The possibility of adaptive responses of the biota (including benthic organisms) to variations in photosynthetically-useful and ultraviolet radiation exposure should be examined, so that accurate predictions of biotic responses to changing solar radiation climate in the lake can be developed.