

A new look at the Lake Superior biomass size-spectrum. Peder M. Yurista^{1*}, Daniel L. Yule², Matt Balge^{3,4}, Jon D. VanAlstine^{1,5}, Jo A. Thompson¹, Allison E. Gamble^{3,6}, Tom R. Hrabik³, John R. Kelly¹, Jason D. Stockwell^{2,7}, and Mark R. Vinson²

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Abstract

We combined data from multiple sampling programs to describe the Lake Superior pelagic biomass size structure. The data represented phytoplankton, zooplankton and prey-fish that spanned over 10 orders of magnitude in size and two time periods separated by five years. The biomass size-spectrum was stable over the 5-year time frame. The primary scaling or overall slope of the normalized biomass size-spectra (NBSS) for the combined years was -1.113. The slope was consistent with a previous estimate for Lake Superior (-1.10) that was based on phytoplankton and zooplankton (Sprules and Munawar 1986). Periodic dome structures within the overall biomass size-spectrum were fit to polynomial regressions. The regressions described observed sub-domes that occurred within the classical taxonomic positions (algae, zooplankton, and fish). This more restricted interpretation of periodic dome structure was aligned more closely with predator-prey size relationships that existed within the zooplankton (herbivorous, predacious) and fish (planktivorous, piscivorous) taxonomic positions. Domes were spaced approximately every 3.78 Log₁₀ units along the axis and with a decreasing peak magnitude of -4.1 Log₁₀ units. The relative position of the algal and herbivorous zooplankton domes predicted well the subsequent biomass domes for larger predatory zooplankton and planktivorous prey fish.

Keywords: biomass size-spectra, Lake Superior

Research task: Safe and Sustainable Water 1.1A.1 Tools and Indices. Development of an integrated assessment of large lakes using in situ sensor technologies: linking nearshore conditions with adjacent watersheds

Impact statement: This paper describes a synthesis of the pelagic biological community (algae through fish) in Lake Superior across a common theme of biomass. This work provides a common structure for evaluating the overall status of the biological community of Lake Superior and presents a bench mark in time as an indicator of the current state of condition. The methodology can be used in future trend analyses to assess the trajectory of the biological community. The work was a collaborative effort of multiple agencies and universities.

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