

ZOOPLANKTON ASSEMBLAGES IN FISHLESS BOG LAKES: INFLUENCE OF BIOTIC AND ABIOTIC FACTORS¹

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Abstract. Some bog lakes in northern Wisconsin and Michigan lack fish because of low pH and low winter oxygen concentrations. The lakes are characterized by a dominance of large zooplankton species. Small zooplankton species are scarce, whereas in nearby lakes with fish they are common. The importance of biotic and abiotic factors in preventing the successful invasion of small zooplankton species into these fishless lakes was determined using a series of field manipulations. The relative importance of competition with large herbivores (the cladoceran *Daphnia pulex*), predation by large invertebrates (the dipteran *Chaoborus americanus* and the copepod *Diaptomus leptopus*), and abiotic conditions including pH were examined experimentally. Abiotic and/or resource conditions suppressed the population growth rate of 70% of the small zooplankton species introduced into enclosures in the fishless lakes relative to those introduced into enclosures in their resident lake (a lake with fish). Fewer small zooplankton species were suppressed in a similar experiment when pH was experimentally raised to 7, suggesting that pH is one factor that inhibits the successful invasion of small zooplankton into these lakes. Manipulations of large herbivores and invertebrate predators showed that predation was more important than competition in restricting the distribution of small species. Predation by *Chaoborus* primarily reduced the densities of crustaceans while predation by *Diaptomus* reduced the densities of rotifers. Competitive suppression of small zooplankton by *Daphnia* was not detected. The results suggest that both predation by *Chaoborus* and *Diaptomus* and abiotic conditions, including pH, are important factors determining zooplankton community structure in these fishless bog lakes.

Key words: *abiotic factors; Chaoborus; community structure; competition; Daphnia; Diaptomus; pH; predation; zooplankton.*