Muskegon Lake's historical industrial development, past environmental degradation, and designation as a Great Lakes Area of Concern prompted shoreline restoration and subsequent socio-economic and environmental monitoring. Macrophyte surveys were conducted in August during pre- (2009-2010) and post- (2011-2012) restoration at six restored habitats and two reference habitats (unrestored). For my thesis research, I continued macrophyte monitoring in July 2018 at two of the restored habitats and one reference habitat. Monitoring included measurement of: macrophyte biological variables (e.g., density, biomass, and richness); shoreline habitat characteristics (slope and exposure to wind and wave action); and other environmental variables (e.g., water level, precipitation, and air temperature). Surveys of epiphytic algae growing on the macrophyte species *Vallisneria americana* also were conducted in 2018 to examine epiphytic algal interactions with their host plant. To further evaluate *V. americana*-epiphyton interactions, I conducted a one-month controlled mesocosm experiment where two nitrogen and phosphorus sources were manipulated (10× ambient concentrations) in four different treatments: nutrient enriched water column, nutrient enriched sediment porewater, both sources enriched, and no nutrient enrichment.

For the macrophyte survey, fluctuations in hydrologic and meteorological conditions among all survey years, largely due to changes in water level, obscured restoration-induced macrophyte changes and slowed ecosystem improvement. However, habitat quality improvement at the restored habitats from 2012 to 2018, based on Michigan's Coefficient of Conservatism values, suggested restoration has positively influenced shoreline macrophyte communities. Results from my epiphytic algal survey and mesocosm experiment indicated epiphytic algal density and biomass negatively impacted *V. americana*, even when phytoplankton-induced light reduction mitigated epiphytic algae pressures over their host macrophyte. Water column and porewater enrichment were positively associated with macrophyte and epiphytic algal biomass in the mesocosm experiment and porewater nutrients increased in importance for the *V. americana*-epiphyton complex when in competition with phytoplankton for water column

nutrients. Both studies displayed the importance of environmental variation and biological interactions for understanding macrophyte community structure. Therefore, in order to recover shoreline ecosystem services, restoration designs should optimize macrophyte community success (protected areas; shallow slopes), mitigate epiphytic algal pressures (intermediate light and hydrologic exposure), and increase habitat resiliency to climatic-scale environmental shifts (shallow water habitats).