Optimizing Taxonomic Identification of Chironomidae (Diptera) for a Novel Method of Monitoring Our Global Fresh Water Supply Using DNA Barcoding (A Continuation)

Michaluk, Sonja (School: Hopewell Valley Central High School)

Using macroinvertebrates for freshwater bioassessment was popularized by Hilsenhoff in 1977. They show cumulative effects of habitat alteration and pollutants that chemical testing and field sensors do not. Currently there are hundreds of bioassessment protocol in use globally, however expert error rates as high as 65% have been observed at the genus and species levels. There is no standard freshwater bioassessment method, especially one that leverages the power of DNA Barcoding. The World Economic Forum lists water scarcity as one of the greatest global risks of the coming decade. It is forecast that 66% of our population will experience water scarcity within a decade, leaving us more dependent on surface water for drinking. This requires more filtration infrastructure, and more bioassessment of surface water sources. DNA Barcoding of Chironomidae, the most widespread macroinvertebrate family, may be a move toward a global bioassessment method. Bland Altman statistical analyses were conducted to validate this method as a more accurate and precise waterway measurement health data, adding significant value for monitoring scarce water resources. This project explored the optimal standard taxonomic level for waterway health assessment globally as well as the statistical power at each taxonomic level. Taxonomic levels of identification were compared through phylogenetic tree analyses and an optimal level was determined. Statistical analysis was used to compare taxonomic levels: family, subfamily, genus, and species. The validated method was used to assess pollutants on a waterway used for municipal drinking water. Learnings from these data were applied to build a genetics lab at a scientific institute, and demonstrate capability with samples gathered in the Arctic Circle.

Awards Won: