A Novel Method of Monitoring the Health of Our Global Fresh Water Supply Using DNA Barcoding of Chironomidae (Diptera)

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Less than 1% of the world's water is accessible as a public water source. Approximately 40% of our population experiences water scarcity. This is expected to grow to 66% within a decade, leaving us more dependent on surface water for drinking, which requires more filtration infrastructure, and more monitoring of surface water sources. Current water monitoring methods are expensive and technically challenging, relying on manual identification of biological macroinvertebrate samples. Macroinvertebrates are important indicators as they spend their larval lives within a small area of water, showing the cumulative effects of habitat alteration and pollutants in a way that chemical testing and field sensors do not. Detailed identification is time consuming and subject to human error. Molecular methods, such as DNA Barcoding from a region of the mitochondrial gene COI (cytochrome c oxidase subunit 1), have begun to enhance biomonitoring programs. This project explores DNA Barcoding to measure waterway health with larval Chironomidae (Diptera). Chironomidae are the most widespread macroinvertebrate family, extant even in Antarctica, however their complex taxonomy makes manual morphological identification difficult. A statistical sampling plan was designed that represents variation in geological, ecological, and land use factors. Two methods of PCR amplification were compared. A statistical data analysis shows that DNA Barcoding of Chironomidae results in more accurate and precise waterway health data, and therefore add significant value for monitoring our increasingly scarce water resource. The learnings from these data are being offered and applied to build a microbiology capability at a non-profit water study institute.

Awards Won:

Fourth Award of $500