Quantitative Environmental DNA Metabarcoding for the Enumeration of Pacific Salmon (Oncorhynchus spp.)

Djajalie, Elizabeth (School: Thunder Mountain High School)

Understanding species distribution and abundance is critical to managing and conserving planetary biodiversity. Pacific salmon (Oncorhynchus spp.) are keystone species of cultural, economic, and ecological importance in Alaska. Traditional methods of enumerating salmon such as weirs and visual surveys are often costly, time-consuming, and reliant on taxonomic expertise. Environmental DNA (eDNA), which identifies and quantifies species based on DNA they shed in their habitats, is a potential cost- and time- saving alternative. The relative ease of collecting eDNA samples also enables citizen scientist involvement, expanding research coverage. Currently, more research is needed to define eDNA's potential and limits. This project investigated whether quantitative eDNA metabarcoding can accurately quantify the abundances of six fish species: the five Pacific salmon species plus rainbow trout. Water samples were collected from eight creeks in the Wood River watershed near Bristol Bay, Alaska. eDNA metabarcoding and subsequent bioinformatics processing produced a read count for each species. These were compared to visual survey counts, taken to be the true counts for the purposes of this study. Data analyses showed a positive, linear relationship between visual survey count and eDNA count for sockeye salmon. The results were significant for both the early ($p = 0.089$) and late ($p = 0.030$) sampling dates when alpha = 0.10. eDNA detections of non-sockeye species generally corresponded to visual survey observations of species presence or absence. Overall, the results of this study support eDNA's potential to be an alternative or supplement to standard methods for the enumeration of fish species.

Awards Won:

Fourth Award of $500

National Taiwan Science Education Center: Taiwan International Science Fair Special Award is a trip to participate in the Taiwan International Science Fair

Long Island University: Presidential Scholarships