Alternative Technologies for Assessing Fish Populations Using Environmental DNA

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The Narragansett Bay forms New England's largest estuary and is home to thousands of species of fish, plants, and other wildlife. Human activity including climate change, industrial waste, commerce, and fisheries all impact the Bay in various ways. In order to determine how fish communities change in response to human activity, we focused on a new way to survey fish based on environmental DNA (eDNA) - the DNA found in water that comes from shed cells or tissues. Our pilot work aimed to establish a protocol that would estimate fish populations using a quantitative polymerase chain reaction (qPCR) from water samples where our target species resided. These species and their target gene region include: Tautogs *Tautoga onitis*, mtD-loop; Winter Flounder *Pseudopleuronectes americanus*, mtD-loop; and Bluefish *Pomatomus saltatrix*, COI. Our project used manual fish surveys conducted in collaboration with Dr. David Taylor's team from Roger Williams University to see whether environmental DNA concentrations reflect the number of fish counted. A total of 65 500 mL water samples were collected near the shore of three Rhode Island locations: Festival Pier in Pawtucket, Goddard State Park and Conimicut Point Park in Warwick. Throughout the course of the project, we have developed protocols for filtering our water samples, created primers and probes for the qPCR machine, and optimized the conditions for the qPCR runs. Our initial analysis of qPCR data using the Tautog and Winter Flounder probes suggests eDNA quantities roughly correlate with census counts for target species within habitats across time. However, differences in baseline signal between habitats suggest that the tool must be calibrated differently for each habitat surveyed. Developing these alternative technologies for assessing fish populations may ultimately be cost-effective, efficient, less labor intensive, and less invasive. Our data will hopefully create a baseline for surveys to detect changes in fish populations as the environment continues to change.

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