

**MS Thesis**  
**Department of Environmental Science and Policy**  
**College of Science**  
**George Mason University**

**Candidate:** Jessie Melton

**Defense Date and Time:** July 19, 2019, 10:00 am

**Defense Location:** Potomac Science Center, 3102

**Title:** An Evaluation of Non-Invasive Sampling Methods in Determining River Herring Abundance

**Thesis Director:** Dr. Kim de Mutsert

**Committee:** Dr. Chris Jones & Dr. Matt Ogburn

**ABSTRACT**

Alewife (*Alosa pseudoharengus*) and Blueback Herring (*Alosa aestivalis*), collectively known as river herring, are two anadromous species of fish that spend a majority of their life in marine waters, but migrate to freshwaters in order to spawn. The Potomac Environmental Research and Education Center (PEREC) has been conducting river herring run count studies for the last few decades in tributaries to the Potomac River, by using block nets to find adult river herring abundance, and plankton nets to examine ichthyoplankton abundance during the spawning season. The objective of this study is to compare the adult river herring abundance between block net abundance, video surveillance, and environmental DNA (eDNA) copy number, with the ultimate goal to determine if non-invasive collection methods can be effectively used to determine river herring run count. eDNA analysis allows for detection of shed DNA in a water sample from species present in the water. The study also examines the impact of abiotic factors such as salinity, pH, temperature, and flow rate on river herring eDNA, as it is expected that these factors will have an impact on DNA shedding rates and residence time, and will allow for predictive modeling. Ichthyoplankton abundance is compared with eDNA findings as well, as

ichthyoplankton may shed DNA that contribute to total eDNA found in water samples. Video counts and eDNA are both non-invasive methods, which will provide a way to determine river herring abundance without stress to the fish damage to the environment. Both video and eDNA as methods require less staff, and are not necessarily weather dependent, in comparison to block nets. While the study showed that video surveillance is not effective in this format for finding abundance of the target species, it was beneficial in showing the negative impacts that the block nets have. The use of eDNA does seem beneficial in a number of cases in not only showing correlation of presence, but also species-specific presence. The aim here is to explore the relationship between eDNA copy number and river herring abundance to determine whether abundance can be deduced from copy number alone, or in conjunction with abiotic factors in the system. This study showed that there is a significant correlation between copy number and river herring abundance, and that in this case abiotic factors do not significantly impact the abundance. However, further studies should be done to further explore abiotic factors in relation to eDNA longevity within the system, as well as what determines the DNA shedding rates of both adult and larval river herring.