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Genetic analysis of migratory and resident walleye (*Sander vitreus*) from Saginaw Bay,
the origins of two behaviors

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ABSTRACT:

One of the most basic behaviors animals have at their disposal to adapt to a changing environment is movement. Movement allows animals to seek out new foraging and reproductive habitats that can increase lifetime fitness. In the Great Lakes, fish have the space to travel long distances and disperse to new landscapes to forage. However, in many species of fish, some individuals maintain small home ranges while others travel long distances. This dichotomy is pronounced in Walleye (*Sander vitreus*) spawning in Saginaw Bay, Lake Huron. Some Walleyes remain within Saginaw Bay year-round, while others out-migrate into Lake Huron after spawning, traveling to northern Lake Huron annually, and others move to southern Lake Huron annually. All contingents displayed high fidelity to their spawning river, where tagged (Tittabawassee River) and generally repeated off-spawning season migratory patterns. Here we use a combination of acoustic telemetry and whole-genome sequencing to investigate the role, if any, of ancestry in migratory behavior. By conducting outlier analysis between migrating and non-migrating individuals, we found little evidence that migration behavior is closely linked to any genetic variants. However, we think this trait could be partially quantitative based on the observation that many of the genes that differed more strongly in allele frequency between migrating and non-migrating individuals were associated with genes that may regulate metabolism and diet based on gene ontology analysis. Our project was a pilot project and due to small sample sizes, there may be additional variation not detected within our samples. By exhibiting diverse behavioral adaptations, the local walleye population in Saginaw Bay may enhance resilience to present and future environmental change. For example, as climate change shifts habitat suitability and restoration efforts throughout the Great Lakes create new spawning and foraging habitats, understanding the role and potential heritability of exploratory behavior becomes increasingly important to help predict how fish will adapt in years to come.