Understanding multi-species interactions and movements in Lake Ontario through collaborative analysis of acoustic telemetry data

Project ID – 2022_FIS_740003

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December 2024

ABSTRACT:

Lake Ontario continues to support vibrant and diverse fisheries in the nearshore and offshore regions. Areas of ecological significance (i.e., biodiversity hotpots) are important for management as they provide information on where efforts should be allocated. Here, we used acoustic telemetry data for 2010-2021 and 19 fishes to define and provide a quantitative assessment of biodiversity patterns across space and time and understand their environmental characteristics. Distributions for each species were obtained using MaxEnt, combined based on near and offshore species characterization and overlapped to extract hotspots. Biodiversity hotspots were associated with the transition zone between nearshore and offshore areas (15-26 m), showed evidence of seasonal consistency and were strongly characterized by five covariates based on importance across study species: reefs, relative exposure index, depth, substrate, and direction of bottom hydrology. By combining acoustic telemetry from numerous studies and collaborators, this analysis has provided a comprehensive characterization of biodiversity hotspots and potential drivers of fish movement and occupancy. This synthesis study allowed for the creation of a dataset that includes 19 fish species with both static (e.g., bathymetric depth, mechanical energy) and dynamic (lake surface temperature and Chlorophyll a) environmental data linked to each fish position in time and space that is available for future use to explore how lake and environmental characteristics influence species' movements, habitat selection and general ecology. The novel insights from this study allow managers to better understand spatial utilization across multiple species thus informing survey efficacy and management plans that consider habitat attributes and seasonal variation in behaviour and movement.