NSERC HydroNet Component 2.1: Mesoscale Modeling of the Productive Capacity of Fish Habitats in Lakes and Reservoirs

Rationale: Assessment of the effects of the transformation of a river or a lake into a reservoir requires the estimation of the productive capacity of fish habitats in these ecosystems during the pre- and post-development phases. Numerous methods and protocols may be used to estimate the productive capacity of fish habitats in lakes and reservoirs but there is a need to adapt existing methods and to identify which survey designs may be most efficient.

Description*:* The overall objectives of the projects included in this component are to customize and to compare existing methods, and eventually to new survey protocols, to estimate the productive capacity of fish habitats in lakes and reservoirs. These objectives are achieved by conducting projects divided in two sub-components:

- ***Hydroacoustic mapping of physical and biological conditions in lakes and reservoirs*** *(Lead: George Rose, Memorial University of Newfoundland)*; The specific objectives of this project are to develop a hydroacoustic protocol adapted to map the bathymetry, bottom type, habitat (e.g. macrophytes) and fish and plankton densities in the pelagic zone (depth > 2 m) of lakes and reservoirs at the scale of habitat heterogeneity, and to investigate ways to use size- and frequency-based acoustic data to evaluate aquatic ecosystem structure, function, and productivity.
- ***Mesoscale modeling of fish habitat use in the littoral zone of lakes and reservoirs*** *(Lead: Daniel Boisclair, Université de Montréal)*; The purpose of this project is to conduct a comparative analysis of habitat use models (relationships between metrics of productive capacity and environmental conditions estimated at the scale of mesohabitats) developed for the littoral zone (depth < 3 m) of lakes and reservoirs using different sampling strategies (time of day and sampling gears).

List of Student Projects related to this component:

- *Applying fish length-frequency spectra as an indicator of habitat use and ecosystem status in an area impacted by hydropower*– Laura Wheeland (M.Sc. Memorial University of Newfoundland)
- *Aquatic community structure-productivity based on acoustic size and frequency* – Riley Pollom (M.Sc. Memorial University of Newfoundland)
- *Comparative analysis of the sampling methods to develop habitat use models to estimate and predict fish production in the littoral zone of lakes and reservoirs* –Nathan Satre (M Sc Université de Montréal)

Outcomes /Deliverables:

- Protocols adapted to map the bathymetry, bottom type, habitat (e.g. macrophytes) and fish and plankton densities in the pelagic zone (depth > 2 m) of lakes and reservoirs at the scale of habitat heterogeneity,
- Approaches to use size- and frequency-based acoustic data to evaluate aquatic ecosystem structure, function, and productivity.
- Sampling strategy that best estimate/predict metrics of productive capacity in the littoral zone of lakes and reservoirs ;
- The relative roles of local, lateral, and contextual variables on metrics of productive capacity ;
- Evaluation of the potential difference between estimates of metrics of productive capacity between the day and the night.

Benefits from this research: This component is expected to contribute to the development of standardized methods and survey designs to estimate the productive capacity of fish habitats in lakes and reservoirs, and hence, to streamline the process by which impact studies are conducted in these ecosystems.