Development of a bioenergetics model based on otoliths to estimate the impact of redfish populations in the Gulf of St. Lawrence

Collaborators: David Deslauriers (ISMER-UQAR)
Daniel Small & Caroline Senay & Joëlle Guitard (DFO)

It is anticipated that the sudden increase in the biomass of redfish (*Sebastes mentella* and *Sebastes fasciatus*) in the Gulf of St. Lawrence (GSL) will have impacts that could affect other commercially important species in the GSL ecosystem. In 2019, nearly 90% of the total demersal biomass recorded by Fisheries and Oceans Canada consisted of the two Sebastes species, a result attributed to strong recruitment periods from 2011 to 2013. Furthermore, the deep waters of the GSL where redfish are found are hypoxic, temperatures are rising, and pH is decreasing more rapidly than the overall average. A fundamental understanding of redfish physiology and biology is therefore necessary to integrate the interactions between various biotic and abiotic variables and thereby inform the management of this stock. Since 2019, DFO has captured a significant number of redfish that were used in several experiments in which environmental conditions, such as temperature, dissolved oxygen, pH, and diet, were manipulated, and from which the otoliths of some of these fish were extracted. As part of this doctoral project, an energy budget will be developed using these experimental data to validate the chemical signatures of the otoliths. This innovative approach will thus enable the estimation of the parameters necessary for developing the bioenergetics model. By doing so, it will be possible to estimate the fish's age, growth rates, and metabolic rates, as well as to estimate the environmental variables (temperature, oxygen, pH) to which the fish were exposed. The model parameters will be validated experimentally (in the laboratory or in the field) by exposing the fish to known environmental conditions and quantifying their metabolic and growth rates, as well as their food intake. This will make it possible to infer the environmental conditions experienced by redfish caught during scientific surveys. This project offers a unique opportunity to generate new fundamental knowledge that could impact redfish management in the GSL by collaborating with researchers from universities and government agencies, thereby providing access to high-quality wet labs at ISMER's station aquicole and at DFO's Maurice-Lamontagne Institute. Students with experience in ecological modeling and/or the ecophysiology of aquatic organisms are encouraged to apply. Please contact David Deslauriers david_deslauriers@uqar.ca before submitting your application.



Figure 1: Some of the 800 redfish in the wet lab at the Maurice-Lamontagne Institute, Fisheries and Oceans Canada, Mont-Joli, Quebec.

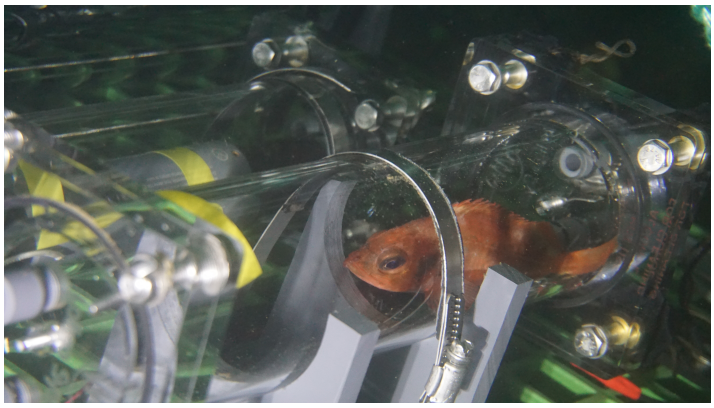

Figure 2: Redfish in Les Escoumins, Quebec, in a field respirometer. Picture: J.-D. Tourangeau-Larivière.