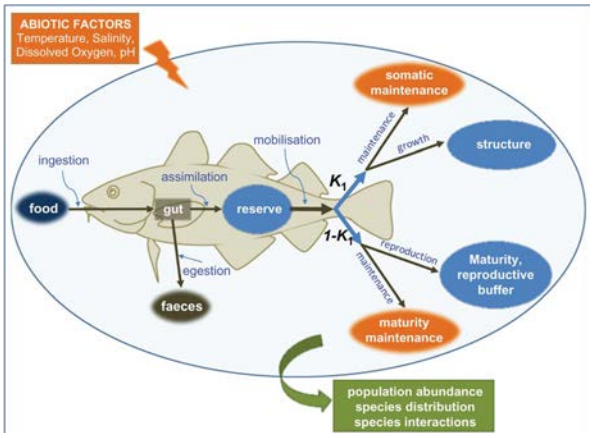
Development of an individual- and energetics-based model to estimate the imminent impact of Redfish populations in the Gulf of St. Lawrence

The recent increase in biomass of Redfish (*Sebastes mentella* and *Sebastes fasciatus*) in the Gulf of St. Lawrence (GSL) is predicted to have significant effects on other species of commercial importance in the GSL ecosystem. In 2019, it was estimated that 90% of the total demersal biomass surveyed by Fisheries and Oceans Canada (DFO) consisted of the two common Redfish species and that these resulted from the recruitment of three strong year classes between 2011 and 2013. In addition to this, the deep waters of the GSL where Redfish are found are hypoxic, temperature is increasing, and pH has been decreasing faster than the global average. To account for all these interacting biotic and abiotic effects, a fundamental understanding of the physiology and biology of Redfish is needed to better manage the stock. DFO recently captured a large number of Redfish to be used in experimental research, which offers a unique opportunity to study this fish. Within this project, a dynamic energy budget (DEB) will be developed using empirical and experimental approaches. An innovative method will consist of quantifying fish otolith microchemistry to derive the DEB parameters. By doing so, we will be able to estimate fish age, growth rates, and metabolic rates as well as quantify the environmental conditions individual fish were exposed to, such as temperature, oxygen, and salinity. The parameter estimates will be validated using experiments where fish will be exposed to known environmental conditions and where growth and metabolic rates will be quantified. Because we will be focusing our experimental designs on individual fish, an individual-based model will be created to test for the emergence of population-level impacts on the GSL ecosystem. This project offers a unique opportunity to tackle a pressing issue by working closely with academic and government researchers and gaining access to state-of-the-art experimental wet laboratory facilities at ISMER's aquaculture station and DFO's Maurice-Lamontagne Institute. Students with experience in ecological modeling and(or) eco-physiology of aquatic organisms are encouraged to apply.

A few of the 800 Redfish found at the Maurice-Lamontagne Institute, Fisheries and Oceans Canada, Mont-Joli, Quebec



Conceptual model for the Dynamic Energy Budget. Figure from McKenzie et al. (2016), Conservation Physiology.

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