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The Role of Cannibalism in Cyclic Snow Crab Population Dynamics

The snow crab fishery is among Canada's most valuable fisheries and plays a critical role in the economy of coastal communities across Atlantic Canada and Quebec. As a cold-water stenothermic species, snow crab may be particularly vulnerable to environmental change associated with ocean warming. Understanding the mechanisms governing population variability is therefore essential for sustainable management.

In this talk, we present a discrete-time population dynamics model for snow crab in the southern Gulf of St. Lawrence that incorporates sex-specific developmental stages: immature, adolescent, and adult males, and immature, prepubescent, and adult females. The model includes density-dependent interactions through intercohort cannibalism, while excluding groundfish predation due to its limited influence in this ecosystem.

Using this framework, we analyze how biological interactions and demographic processes influence snow crab population dynamics. In particular, we investigate the effects of cannibalism, recruitment variability, natural mortality, fertility, and fishing mortality on long-term population behaviour. We also examine the conditions under which the model exhibits stable equilibria or cyclic dynamics through the use of dynamical systems tools such as bifurcation analysis and periodograms.

This work aims to improve understanding of the mechanisms driving variability in snow crab populations and to contribute to the development of stock assessment models that better account for nonlinear biological processes in a changing environment.