Título del seminario: Equilibrio, colapso y extinción en modelos estructurados por edades: el caso del Northern cod stock.

Abstract
Equilibrium-based methods are widely used in the literature on population ecology to analyze the sustainability of the management strategy. This approach fails to account for many factors such as age-specific natural mortality rates, the cohort survival rates, the possibility of extinction, the characterization of the equilibriums, their stability properties, and transient dynamics. We propose here a method, based on the theory of non-linear dynamic systems, that determines necessary and sufficient conditions for the stability of the equilibrium in age-structured models, using time-independent survival rates (autonomous) and age-specific natural mortality rates. In the case of a hockey stick stock-recruitment function, the method characterizes the equilibriums, their stability properties, and transient dynamics. Depending on the cohort survival rates, we find that there are two opposite scenarios: extinction or positive equilibrium. In the latter case, we also find the possibility of collapse with slow recovery. We demonstrate that the stock tends to equilibrium at an exponential rate in both scenarios. Considering the Northern cod (*Gadus morhua*) stock by way of illustration, we find that slow recovery of the stock could be expected at sufficiently low cohort survival rates, despite the fact that the condition for the stability of the equilibrium was met during the moratorium period (positive equilibrium). This result is consistent with the species' lack of expected recovery. In contrast to equilibrium-based methods under constant natural mortality rates and the precautionary approach framework, we also find the possibility of extinction at sufficiently low cohort survival rates, even in the absence of harvesting.