

Modeling Size Dependent Harvesting of North Atlantic Swordfish (Xiphias Gladius)

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Abstract:

Swordfish are a commercially important species, for which harvesting greatly depends on the size structure of the population. The classical model for size dependent harvesting uses either size as an independent variable or a structured population both of which can become computationally unfeasible. We derived a system of nonlinear partial differential equations to model a structured population of North Atlantic swordfish by treating the average size of the population as a dependent variable. With average size as a dependent variable the number of independent variables is decreased which leads to a less computationally intensive model. Assuming spacial homogeneity, we found an approximation of maximum sustainable yield for different profiles of average size harvested and compared these yields to find suggestions for which sizes should be commercially targeted. We then examined the behavior of the swordfish population under non-homogeneous spacial conditions, in order to judge the effects of limiting harvesting to a portion of the North Atlantic. This is important to study since many areas off the United States coast have been closed to commercial harvesting of swordfish since 1998, and the effect of the closures is still not well understood.