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Applications of Optimal Control for Ecosystem-Based Fishery Management.

In contrast to the traditional fishery management (TFM) focusing on one species, ecosystem based fishery management (EBFM) focusing on the whole ecosystem of the species by using the dynamics of food chain models is an useful trend in the commercial fishery to not only conserve and manage renewable food resources, but also to have optimal and healthy ecosystems. A food chain model coupled with optimal control theory can be used to investigate harvesting strategies for maximizing the discounted net value of a fish population. Since fish do not exist in a habitat by themselves, the presence of predators and/or competing species is an important feature in harvest and conservation in a food web. Therefore, we present a food chain model for harvesting of Black Sea anchovy on the southern part of the Black Sea. The anchovy stock coupled with a prey and a predator species is modeled using a system of nonlinear differential equations. The objective for the problem is to find the ecosystem- based optimal harvesting strategy that maximizes the discounted net value of the anchovy population with seasonal harvesting. Necessary conditions for the optimal harvesting policy are established. (Received September 19, 2018)