Overfishing Definition for Anchovy—A Simulation Model Approach

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Summary

Management of northern anchovy, *Engraulis mordax*, including the definition of overfishing and annual quotas, is based on estimates of spawning biomass rather than fishing rates. The current definition of overfishing in the FMP for northern anchovy stops all fishing when the estimated spawning biomass falls below 50,000 tons two years in a row. Annual quotas for the U.S. reduction fishery are set to the difference (not to exceed 200,000 tons) between estimated spawning biomass and a 300,000 tons threshold level. The reduction quota is zero when estimated spawning biomass is less than the 300,000-ton threshold. Thus, the issue of an overfished stock is addressed by eliminating harvests at low biomass levels, while the issue of overfishing is addressed by reducing harvest as biomass declines. This approach illustrates how the definition of overfishing and procedures for specifying harvest levels can be used together to prevent overfishing or to rehabilitate an overfished stock.

Options for the definition of overfishing in the FMP for northern anchovy were evaluated using a simulation model that included population dynamics of the anchovy stock, reproductive success of brown pelicans (an endangered species that utilizes anchovy as forage), and economics of the fishery. Economic data were used in the model to determine when fishery segments would cease fishing as biomass declined and profits decreased. One version of the model was used to evaluate options in terms of anchovy biomass levels, harvest levels, fishery profits, and brown pelican reproductive success. Another version of the model was used to estimate recovery times (duration of intervals required to increase from low to high biomass levels).

Evaluation of overfishing definitions as carried out for anchovy requires a great deal of biological and economic data that may not be available in many cases. There were no biological data available for northern anchovy from periods of very low biomass, although such data would have been useful for evaluating a definition of overfishing. Simple surplus production models, such as the one used in the simulation for anchovy, may be too optimistic for evaluating the performance of management options at low biomass levels, particularly if autocorrelation in process errors affecting stock dynamics is not included. Explicit consideration of fishery economics was useful in the model for anchovy and may be for other fisheries as well. Potentially important issues not addressed in the model for northern anchovy include errors in spawning biomass estimates used to set quotas and to trigger the definition of overfishing, and the effects of fishing effort at low biomass levels (is it possible to catch the last fish?).

Defining Overfishing—Defining Stock Rebuilding

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