Small Pelagic Fishes and Fishery Management in the California Current: Or, What to Do After the Collapse

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Summary

A review of the population dynamics of small pelagic fishes that dominate the California Current fisheries characterizes these stocks as extremely variable. The observed population collapses of sardine, mackerel, and anchovy were extremely precipitous, and the population recovery of mackerel, which occurred under a moratorium on landings and after a decade of extremely low biomass levels, also was very rapid once it began. Annual recruitment rates in these species are highly variable and autocorrelated. In addition, recent studies suggest that natural mortality and fecundity rates are highly variable; however, annual measurement of these rates has, to date, received little attention.

In response to the historical failures of California's traditional pelagic fisheries, a management regime based on catch quotas, in which the fishing mortality rate is a function of stock biomass, is currently in place. Under existing regulations, fishing mortality rates are intended to increase (decrease) gradually as the stock biomass increases (decreases); at low biomass levels (in some cases at very low levels) moratoria on directed fishing are automatically triggered. Management thus depends on assessments (predictions) of current biomass. These assessments (i.e., look ahead VPA analyses and stock synthesis models) have resulted in stable fisheries when biomass levels were relatively stable. However, to date they have greatly overestimated biomass levels during periods of population collapse and greatly underestimated biomass levels during recoveries. The failure (bias) of these types of predictive models is not restricted to fisheries in the California Current, and it has recently been recognized as a worldwide fisheries management problem.

It has been the general consensus that the relatively robust California management regime should prevent recruitment overfishing by reducing the exploitation rate at lower biomass levels. Four factors suggest that what is thought to be a robust management regime may in fact not prevent severe economic and biological disruptions. First, the California Current sardine, anchovy, and mackerel fisheries have each experienced changes in catches of close to an order of magnitude within two seasons. Second, to date, fisheries scientists have not been successful in developing the ability to predict, or even measure on a real time basis, shifts in population size. Third, annual recruitment rates appear to be highly autocorrelated. Fourth, although transitions occur quite quickly, stocks remain at high or low levels for periods of 1-3 decades.

Two lines of research appear to be the most likely to produce significant results. The first is to decrease the level of uncertainty by ascertaining the environmental processes that alter the population dynamics of these stocks. The second is to utilize new modeling techniques to develop a better understanding of the economic and biological risks associated with harvesting these fishes under different exploitation regimes.

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