Fisheries Models of Pelagic Species

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ABSTRACT

An optimal vessel allocation strategy aimed at maximizing the season's catch is developed for a K-vessel fleet operating on a region consisting of N adjacent cells over a M-period fishing season. The direction of pelagic fish movement and the "a priori" probability about the location of fish are assumed to be known from historical data; the model formulation relies on Bayesian updating and dynamic programming. Two examples of the model's performance are given for $K = 2$ and $K = 3$, with $N = 3$ and $M = 2$.

A new method for the determination of abundance of a pelagic stock is derived. The model refers to a multi-cell fishing region and applies search theory to the description of the detection process, since search effort represents a considerable fraction of the total fishing effort. The concept of random search for patches of schools and non-random search for schools within a patch is employed. An operational characterization of the search parameter, the pattern of fish movement and tagging data (number of detections and corresponding search times) provides the necessary fishery information. The abundance estimate is calculated through maximum likelihood estimation (MLE). Computer simulations for the special case of a two-cell

fishing area and a two-week fishing season confirm the method's good predictive ability.

The knowledge of the mechanisms which govern the movement of pelagic fish (e.g. tuna) is important for the study of fisheries interactions and the definition of fishing policy, both at the national and international levels. The basic model assumes that the spatiotemporal distribution of tuna can be described by a two-dimensional Brownian motion process with drift and is adjusted to account for: (a) instant catching and perfect catchability; (b) instant catching and imperfect catchability; (c) catch interval, stock depletion and operational catchability; and (d) catch interval, stock depletion, operational catchability and natural mortality. Bayesian and maximum likelihood estimation techniques are applied to determine the drift and diffusion parameters associated with tagged tuna movements. Using simulated tagging data sets, the method's performance is illustrated for different sampling conditions and parameter configurations.

occasion to participate in stimulating discussions on the various topics of the research project.

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