

Pelagic Fisheries Research Program

Integrative modeling in support of the Pelagic Fisheries Research Program: spatially disaggregated population dynamics models for pelagic fisheries

Progress Report

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Background

The general objective of this research is to integrate the results of different components of the Pelagic Fisheries Research Program into a consistent framework that integrates knowledge of fish movement and population dynamics, the fishing process, economics and oceanography. The primary focus of is the development of spatial models of pelagic fish population dynamics that explicitly include movement, mortality, and fisheries.

General Project Status

Lack of an associate researcher on this project and the preoccupation of the PI (Dr. Sibert) with PFRP program administration and related activities has slowed progress on project goals.

Collaborative work was begin in support of the PFRP project "A tag and release program for the Hawaiian seamount yellowfin and bigeye tuna handline and troll fisheries". A preliminary of yellowfin and bigeye movements between offshore fishing grounds analysis was completed using tag recaptures through mid 1997.

Progress on 1997-98 Goals:

- 1. Continue development of habitat-based movement models. If feasible, output from oceanographic models to simulate "real time" observations of temperature and oxygen fields. Explore possibilities of including stock structure.**

The existing tag movement and estimation software was completely revised to facilitate compatible development of habitat and regional based movement models. Availability of real time observations of habitat variables on a large scale depends on year and area. In the absence of observations predicted distributions of temperature, salinity and oxygen from GCMs have been used by collaborators at the SPC to generate fields of habitat variables from 1980 through 1995. Subsets of these variables will be used in the revised habitat model.

2. Complete analysis of SPC tuna tagging data and apply results to the analysis population exchanges within the WPRFMC area.

The analysis of the 1978-82 SSAP skipjack tagging data was finalized and a manuscript was submitted for publication. Data for the 1989-1992 RTTP skipjack and yellowfin tagging data have been updated through 1995 and is currently being analyzed. This analysis should be complete by the end of the calendar year.

3. Continue collaboration with TNFRI (Tohoku National Fisheries Research Institute, Japan) scientists on analysis of north Pacific skipjack migration.

The fishing effort data required to analyze the tagging data were extended back through 1988. Although estimation of movement patterns from this data set requires a great deal of computer time, progress is being made. Planned computer upgrades should decrease the computational time by a factor of two. This work should be complete during the next year.

4. Continue to improve numerical approximations to the partial differential equations used to model fish movement.

A one-step, fully implicit, numerical solution to the diffusion-advection-reaction equation was implemented using a conjugate gradient algorithm. Although this method is somewhat less accurate than the semi-implicit ADI method, it is more general and enables more complex finite difference approximations to the advective terms.

Goals for 1997-98:

The social science components of the PFRP have made progress in expressing fishing effort as functions of external variables (e.g. costs of fuel, prices of fish, distance to fishing grounds). A new goal for the next year will be to begin to use the results in a small scale model of pelagic the fishery around Hawaii. The two PFRP tagging projects have produced impressive results. A new goal for the next year is to collaborate with Dr. Holland in analysis of these data. Other project goals for the next year will be substantially unchanged from the previous year. A post-doctoral fellow will be recruited as a JIMAR visiting scientist.

1. Begin to incorporate models of effort distribution into models of the Hawaii pelagic fishery.
2. Continue development of habitat-based movement models. If feasible, output from oceanographic models to simulate "real time" observations of temperature and oxygen fields.
3. Complete analysis of SPC tuna tagging data and apply results to the analysis population exchanges within the WPRFMC area.

4. Conclude analysis of north Pacific skipjack migration in collaboration with scientists from TNFRI (Tohoku National Fisheries Research Institute, Japan) and NRIFSF (National Research Institute of Far Seas Fisheries, Shimizu, Japan).
5. Continue to improve numerical approximations to the partial differential equations used to model fish movement.
6. Complete collaboration on analysis of yellowfin and bigeye movements using data from the Cross Seamount tagging project.
7. Begin collaboration on the analysis of tag recaptures from Hawaii regional tuna tagging project using both bulk transfer and diffusion models.