

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 is the development of spatial models of pelagic fish population dynamics that explicitly include movement, mortality, and fisheries.

General Project Status

The candidate selected as a post-doctoral fellow under the JIMAR visiting scientist program turned down the offer at the last minute. Lack of an associate researcher on this project continues to slow progress on project.

Progress on 1998-1999 Goals:

1. Begin to incorporate models of effort distribution into models of the Hawaii pelagic fishery.

No progress.

2. Continue development of habitat-based movement models. If feasible, output from oceanographic models to simulate "real time" observations of temperature and oxygen fields.

No progress.

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

An important improvement to the statistical model for analysis of the SPC skipjack and yellowfin tagging data was achieved in 1999. The new model provides

more realistic parameter estimates and the cost of a significant increase in computing time. Final analysis of the data should be complete within the next twelve months.

Estimates of skipjack movement parameters were used in a collaborative analysis with Dr. Pierre Kleiber of NMFS, Honolulu Laboratory, of the probable lifetime travel distance. This analysis was extended to compute the area required to regulate fisheries to reduce the impact of remote high-intensity fishing.

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).

Progress on this data set was limited by the same statistical problems as limited progress on the SPC data set. A final analysis should be completed next year.

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

No progress.

6. Complete collaboration on analysis of yellowfin and bigeye movements using data from the Cross Seamount tagging project.

Analysis of the Cross Seamount tagging data is nearly complete. Preliminary results were presented at seminars at PMEL and HIMB. A final analysis is in preparation and will be presented in October 1999 at the FAD Symposium in Martinique and published in the symposium proceedings. The results support the previous conclusions about the differences between use of Cross Seamount by bigeye and yellowfin tuna, indicate that fishing mortality on both populations is a small fraction of total mortality, and suggest low exchange rate between the offshore fishing grounds and the FADs around the Main Hawaiian Islands.

7. Begin collaboration on the analysis of tag recaptures from Hawaii regional tuna tagging project (HTTP) using both bulk transfer and diffusion models.

Preliminary work was done to analyze the data using the diffusion model at two spatial resolutions: one-degree geographic square for the entire Hawaiian Archipelago; and one third of a degree geographic square for the Main Hawaiian Islands. A more definitive stratification will be conducted as more tag recaptures accumulate. Recoveries from a single tag release cohort occur over a 24 month period from both surface and longline fishing gears. Substantial growth occurs over this period and the analytical models will require modifications to accommodate age dependent processes.

Goals for 1999-2000:

Goals for 1999-2000 will be essential the same as goals for 1998-1999. However work toward some goals (5-7 below) will depend on successful recruitment of an associate researcher under the JIMAR visiting scientist program.

1. Conclude analysis of SPC RTTP yellowfin and skipjack tagging data and apply results to the analysis population exchanges within the WPRFMC area.
2. Conclude analysis of north Pacific skipjack migration in collaboration with scientists from TNFRI (Tohoku National Fisheries Research Institute, Japan) and NRIFS (National Research Institute of Far Seas Fisheries, Shimizu, Japan).
3. Conclude analysis of yellowfin and bigeye movements using data from the Cross Seamount tagging project.
4. Continue analysis of tag recaptures from Hawaii regional tuna tagging project using both bulk transfer and diffusion models.
5. Continue to improve numerical approximations to the partial differential equations used to model fish movement.
6. Begin to incorporate models of effort distribution into models of the Hawaii pelagic fishery.
7. Continue development of habitat-based movement models. If feasible, output from oceanographic models to simulate "real time" observations of temperature and oxygen fields.