JIMAR, PFRP ANNUAL PROGRESS REPORT
FY 2002

P.I. Name: John Sibert

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

Funding Agency: NOAA

1. Purpose of the project and indicative results.
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. The work emphasizes collaboration with other PFRP projects.

2. Progress during FY 2002. Provide a thorough discussion of accomplishments and problems.
The analysis of the Hawaii Tuna Tagging Project using the bulk transport model has been completed. Estimates of size dependent natural and fishing mortality and exchange rates between fishing grounds are now available. Several papers have been submitted for publication. The analysis of the HTTP data using the advection-diffusion-reaction model (ADRM) has been postponed pending recapture of more tags and compilation of fishing effort data from NMFS and HDAR sources.

A state space Kalman filter model was developed to analyze horizontal movements of fish tracked with archival and applied to data from tags deployed in bigeye tuna with PFRP funding. The model appears to provide realistic estimates of *in situ* geolocation errors, movement parameters applicable to population movement, and resolve indeterminate position estimates produced by the tags during the equinox. A paper describing these results has been accepted for publication in Fisheries Oceanography. This model has been extended to longer tracks and has been applied to pop-up archival tags on bluefin tuna in the Atlantic. Methods to deduce changes in behavior by analysis of the estimated tracks are under development.

A new method of computing the movement parameters in the ADRM has been developed by Dr. Adam. This new method uses a neural network algorithm to relate tuna movement to features of the environment.

3. Plans for the next fiscal year.
1. Complete analysis of HTTP data using the ADRM.

2. Extend state space Kalman filter model to estimate a suite of common parameters from multiple tracks.

3. Further develop the neural network parameterization of the ADRM and attempt to identify critical environmental variables for tuna movement.

4. One of the new projects approved from the recent PFRP RFP, "Application of a Continuous Advection-Diffusion Equation to Spatial Mixed Resolution Dynamics Population Models", will involve a post-doctoral researcher to work in the PFRP modeling project. Dr. Adam is expected to leave the PFRP in early 2003 and a new post-doctoral researcher with expertise in numerical solution of partial differential equations will be recruited to assist with the mixed resolution model.

4. List of papers published in refereed journals during FY 2002.

Adam, M. S. and J. Sibert. 2002. Population dynamics and movements of skipjack tuna (*Katsuwonus pelamis*) in the Maldivian fishery: analysis of tagging data from anadvection-diffusion-reaction model. *Aquatic Living Resources*. 15: 13 – 23.

Sibert, J., M. Musyl, and R. Brill, 2002. Horizontal movements of bigeye tuna near Hawaii determined by Kalman filter analysis of archival tagging data. *Fish Oceanog. (in press)*.

Adam, M. S., J. R. Sibert, D. Itano, and K. Holland, 2002. Dynamics of bigeye and yellowfin tuna in Hawaii's pelagic fisheries: analysis of tagging data using a bulk transfer model incorporating size specific attrition. *Fish Bull (in revision)*.

Sibert, J. and J. Hampton, 2002(?). Mobility of tropical tunas and the implications for fisheries management. *Marine Policy (in review)*.

5. Other papers, technical reports, meeting presentations, etc.

Sibert, J., M. Lutcavage and R. Brill, 2002. Behavioral changes during tuna migration revealed by statistical analysis of tracks derived from pop-up archival tagging data. Presentation at the 53rd Annual Tuna Conference, Lake Arrowhead, California, May 20-23, 2002.

Sibert, J. and J. Hampton, 2002. Mobility of tropical tunas and the implications for fisheries management. Presentation at the 53rd Annual Tuna Conference, Lake Arrowhead, California, May 20-23, 2002.

Adam, M.S. and J. Sibert, 2002. An integrated approach to using a neural network in an advection diffusion reaction model for estimating large-scale movements of tunas: Preliminary investigation using Maldives tagging data. Presentation at the 53rd Annual Tuna Conference, Lake Arrowhead, California, May 20-23, 2002.

Sibert, J., 2002. Approaches to modeling large-scale distribution and abundance of tunas: Combining information from populations and individuals. Presentation at the Census of Marine Life, FMAP Workshop, Halifax, Canada, June 20 – 23, 2002.

Sibert, J., M. Lutcavage, and R. Brill. Behavioral changes during tuna migration revealed by statistical analysis of tracks derived from archival tagging data. Presentation at the 2002 Ocean Sciences Meeting, AGU, Honolulu, Hawaii, Feb. 11 – 15, 2002.

Sibert, J, 2002. Approaches to modeling large-scale movements of tunas: Estimation of movement (and mortality) from tagging data. Seminar presentation at the Virginia Institute of Marine Sciences, Gloucester Point, Virginia, Jan. 30, 2002.

6. Names of students graduating with MS or Ph.D. degrees during FY 2002. Include title of thesis or dissertation.
None

7. For multi-year projects, provide budget for the next year on a separate page.
See attached budget sheet.