JIMAR – PFRP ANNUAL REPORT FOR FY 2005

P.I. John Sibert

Project Title: Integrative Modeling in Support of the Pelagic Fisheries Research Program: Spatially Disaggregated Population Dynamics Models for Pelagic Fisheries

Funding Agency: NOAA

NOAA Goal (Check those that apply):

☒ To protect, restore, and manage the use of coastal and ocean resources through ecosystem-base management

☒ To understand climate variability and change to enhance society's ability to plan and respond

☐ To serve society's needs for weather and water information

☐ To support the nation's commerce with information for safe, efficient, and environmentally sound transportation

1. Purpose of the Project (one paragraph)

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 2005 (One-two paragraphs, including a comparison of the actual accomplishments to the objectives established for the period, and the reasons for slippage if established objectives were not met):

Progress on goals from FY 2004:

- Augment the analysis of Coral Sea bigeye tracking data by comparison with sea-surface temperature.

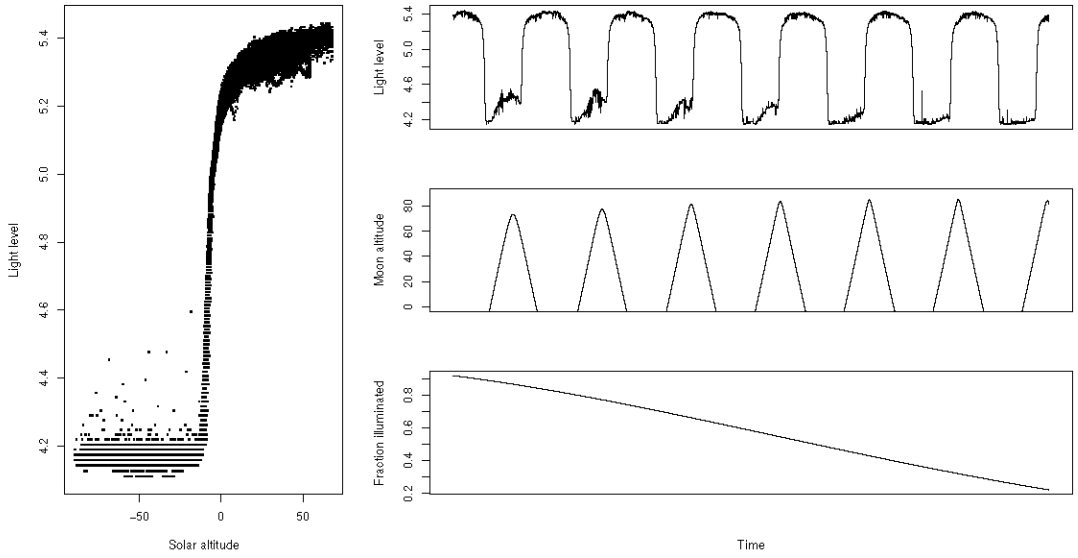
  An *ad hoc* polynomial latitude bias correction was included in the state-space Kalman filter mode. The estimated track agreed well with latitude estimation using SST data. The results were included in the report by Gunn *et al*. published by the Australian government.

- Analyze currently-used light-based geolocation algorithms to identify and correct the source of the autocorrelated latitude bias.

The astronomical computations used for latitude estimation by measurement of the position of the sun were examined. The latitude bias found in the light-base algorithms used in most archival tags appear to be due to misspecification of the elevation of the sun at arbitrary light thresholds. The conclusion is that light-based geolocation algorithms need revision.

Dr. Anders Nielsen has joined the project as a post-doctoral fellow to begin development of a joint model for geolocation and track reconstruction. This work will construct a statistical sound approach to geolocation and reconstruction of tracks from tagged individuals. It will include the formulation and implementation of a joint model for the geolocation from light measurements and prediction of the most probable track from these measurements.

The initial work re-analyzes the source of the geolocation, raw light measurements from the tags, and describes these measurements as functions of the position on the globe and time. For this purpose archived mooring studies have proven very valuable. Early findings (see figure 1) indicates that it is possible to estimate a strong relationship between the calculated solar altitude and the light intensity, and also that reflected light from the moon is detectable by the tags (at least when they are shallow).



This work involves close collaboration with other researchers in the PFRP, PIFSC and elsewhere to keep the focus of the developed methods on real practical problems.

- Refine the inclusion of temperature in the Kalman filter model.

  This work has been completed and a manuscript has been submitted to Fisheries Oceanography and accepted for publication after revisions. Nielsen, A., K. Bigelow, M. Musyl and J. Sibert. 2005. Improving light-based geolocation by including sea surface temperature.

- Complete re-analysis of HTTP data using the ADRM.

  This work was not completed because these data have already been thoroughly analyzed by other methods.

  Progress in other areas:

- Creation of electronic tagging data repository.

  Collaborators from within the PFRP, CSIRO Division of Marine Research, and Secretariat of the Pacific Community Oceanic Fisheries Programme requested that the PFRP act as an "honest broker" for the exchange of data from electronic tags. Considerable effort was expended to determine an appropriate format for inclusion of metadata. A preliminary web site has been established using the metadata tools provided by the Knowledge Network for Biocomplexity project. Several problems were encountered with the software provided by the KNB complicate creation of well-documented data objects. The "beta" version of the repository can be seen at http://shibi.soest.hawaii.edu:8080/knb

- Comparison of MULTIFAN-CL with other sock assessment methods.

  The results of the Secretariat of the Pacific Community, Oceanic Fishery Programme, simulation exercise to evaluate stock assessment models are reanalyzed. Standardized bias is used to evaluate the discrepancy between simulation and estimation and to provide a quantitative expression of estimation skill. Seven assessment models were applied to forty realizations of five fishery scenarios of increasing complexity. Production models performed well because of the exclusion of uninformative data in complex scenarios. MULTIFANCL performed well when data were informative and natural mortality correctly specified. Simulation exercises of this complexity do not definitively address the question of assessment model reliability. The results were presented at the Seventeenth Meeting Of The Standing Committee On Tuna And Billfish, Majuro, Republic of Marshall Islands, August 9-18, 2004. SCTB17/MWG-4.

- Collaboration on the "Mixed-resolution models for investigating individual to population spatial dynamics of large pelagics" project.

  The progress on implementing a variable resolution finite difference grid are reported in the report from the mixed resolution model project. Dr. Senina is currently implementing adjoint methods to carry out maximum likelihood parameter optimization in the SEAPODYM model.

3. Plans for the next fiscal year (one paragraph):

- Analyze currently-used light-based geolocation algorithms to identify and correct the source of the autocorrelated latitude bias.

  A state-space model statistical model will be applied to the problem of estimating geographic position from light intensity,

- Refine the inclusion of temperature in the Kalman filter model.

Automate the retrieval of SST data from the World Wide Web and improve the R wrapper for the kftrackSST software.

- Creation of electronic tagging data repository.

  In cooperation with the KNB the user interface to the data repository will be enhanced, data entry will be streamlined, and new users will be recruited.

- Collaboration on the "Mixed-resolution models for investigating individual to population spatial dynamics of large pelagics" project.

  Complete work on parameter optimzaion in SEAPODYM.

4. List of papers published in refereed journals during FY 2005.

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

Maunder, M. N., J. Sibert, A. Fonteneau, J. Hampton, P. Kleiber, and S. Harley. 2004. Problems with interpreting catch-per-unit-of-effort data to assess the status of individual stocks and communities: Is integrated stock assessment, ecosystem modeling, management strategy evaluation, or adaptive management the solution? Fourth World Fisheries Congress, Vancouver, BC, Canada May 2-6, 2004,

Sibert, K, J. Gunn, J. Hampton, N. Clear, K. Evans, and A. Nielsen. 2004. Movements Of Bigeye Tuna Off The East Coast Of Australia. 55th Annual Tuna Conference Lake Arrowhead, California, May 24-27, 2004.

Sibert, J. 2004. Comparison of stock assessment methods using an operational model. Seventeenth Meeting Of The Standing Committee On Tuna And Billfish, Majuro, Republic of Marshall Islands, August 9-18, 2004. SCTB17/MWG-4.

Sibert, J., M. Lutcavage, A. Nielsen, S. Wilson. 2004. Beyond pop-up: Where might it have gone? PFRP PI Meeting, Honolulu, November 29 –December 1, 2004.

Gunn, J. J. Hampton, K. Evans, N. Clear, T. Patterson, K. Bigelow, A. Langley, B. Leroy, P. Williams, N. Miyabe, J. Sibert, S. Bestley, K. Hartmann. 2004. Migration and habitat preferences of bigeye tuna, *Thunnus obesus*, on the east coast of Australia. FRDC Report 1999/109, Australia.

6. Graduates (Names of students graduating with MS or PhD degrees during FY 2005. Provide titles of their thesis or dissertation):

None

7. Awards (List awards given to JIMAR employees or to the project itself during the period):

None

8. Publication Count (Total count of publications for the reporting period and previous periods categorized by NOAA lead author and Institute (or subgrantee) lead author and whether it was peer-reviewed or non peer-reviewed (not including presentations):

	JL Lead Author			NOAA Lead Author			Other Lead Author		
	FY03	FY04	FY05	FY03	FY04	FY05	FY03	FY04	FY05
Peer-reviewed									
Non-peer reviewed			3						2

9. Students and Post-docs (Number of students and post-docs that were associated with NOAA funded research. Please indicate if they received any NOAA funding. For institutes that award subcontracts, please include information from your subgrantees):

Dr. Inna Senina and Dr. Anders Nielsen are employed on this project as JIMAR Visiting Scientists.

10. Personnel:

(i) Number of employees by job title and terminal degree that received more than 50% support from NOAA, including visiting scientists (this information is not required from subgrantees):

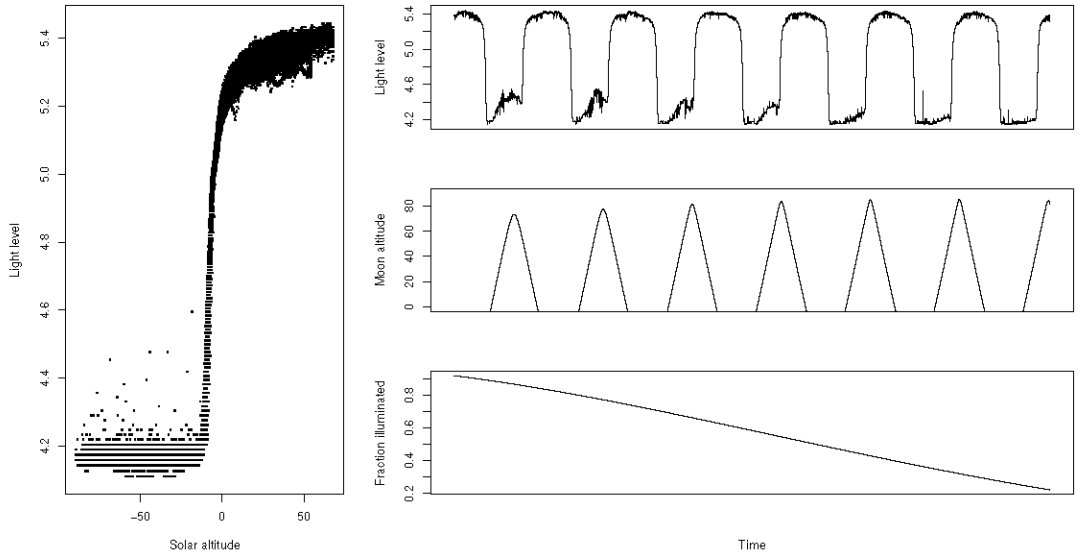
(ii) Number of employees/students that received 100% of their funding from an OAR laboratory and/or are located within that laboratory.

(iii) Number of employees/students that were hired by NOAA during the past year:

11. Images and Captions (JIMAR will be including images in the annual report. Please send two of your best high-resolution, color images (photo, graphic, schematic) as a JPEG of TIFF with a caption for each image. Hardcopies of images can be dropped off at the JIMAR office if no electronic versions are available.

Budget – see attached budget sheet

Caption 1: Relationship between calculated solar altitude and light intensity (left panel) and representative 7-day period from the raw light record from a tag (top right). The reflected light from the moon is detectable by the tags. Data from tags deployed on a mooring in the Pacific Ocean at 24ºN latitude.



Caption 2: Examples of mixed-resolution grid and generated mask (yellow dots – land, blue – ocean). On the upper graph two-dimensional transform of coordinates around Hawaiian islands is shown, below is the twice finer grid in the Kuroshio region, stretched along each direction separately.