

JIMAR – PFRP ANNUAL REPORT FOR FY 2006

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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 2006 (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 2005:

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

The bias in light-based geolocation estimates appears to be related to misspecification of the solar elevation that defines sunrise and sunset for an archival tag, misspecification of solar irradiance at that elevation, and errors in measuring irradiance.

Work was begun to construct a statistically sound approach to geolocation and reconstruction of tracks from animals tagged with light archiving tags. This includes the formulation and implementation of a joint model for the geolocation from light measurements and prediction of the most probable track from these measurements.

This project has developed and implemented a joint model for the geolocation from light measurements and prediction of the most probable track from these measurements. The model has been successfully tested on several tags attached to moorings. Depth correction is not included in the model yet, but the functional relationship between depth and light level is well understood, and this is expected to be a minor addition to the model. The model is promising, as it is able to provide accurate tracks for tags where the other methods have failed (see attached figure). The model is completely self contained, which means that it does not depend on code or pre-calculated geolocations from the tag manufacturers. In addition the developed model makes it possible to estimate confidence regions of the reconstructed track, without assuming some arbitrary seasonally varying latitude variance model.

In developing this model, there were two time demanding key issues. 1) Approximating the relationship between solar altitude angle and measured light intensity. 2) Selecting a computationally feasible estimating procedure to estimate model parameters and reconstruct the track. Both of these issues were resolved by comparing numerous solutions.

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

The kfSST statistical package was updated to include automatic retrieval of SST data from the World Wide Web. Graphics capabilities of the package were enhanced and the option to produce interactive track maps using Google Maps (<https://www.soest.hawaii.edu/tag-data/map/>) and Google Earth utilities were also included.

This project continues to maintain and develop the two software packages 'kfrack' and 'kfSST', which are used by many scientists to improve their tracks. Collaborations with numerous excellent scientists are ongoing, which benefit this project by providing inside information about real data challenges, and benefit them by improving their geolocation tools.

- Creation of electronic tagging data repository.

The Electronic Tagging Data Repository was redesigned and given a new URL:
<https://www.soest.hawaii.edu/tag-data/>

The repository now contains the following data

<i>Data</i>	<i>Owner</i>	<i>Number of Tags</i>	<i>Access</i>	<i>Type Of Data</i>
Hawaii Mooring	Musyl	5	Public	Raw data
Bigeye Acoustic	Holland	2	Public	Raw data
Horizontal Movement of Bigeye Near Hawaii	Sibert	11	Public	Processed position estimates
Vertical Movement of Bigeye Near Hawaii	Musyl	9	Public	Raw data
Coral Sea Bigeye	Gunn, Hampton	15	Restricted	Raw data
PSAT-Performance	Musyl	>650	Restricted	Data on shedding and data recovery
New Caledonia Mooring	Leroy	2	Restricted	Raw data
French Polynesia Acoustic	Dagorn, Josse, Bach	20	Public	Raw data
Indian Ocean Acoustic	Marsac, Cayré	10	Restricted	Raw data

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

Implementation of parameter optimization in SEAPODYM is nearly complete. Initial results indicate the parameters estimated by maximum likelihood methods greatly improve correlation between prediction and observation in both time and space domains. The estimated parameters will be of use in long-term simulations. A more complete description of progress on this topic can be found in the “Mixed-resolution models for investigating individual to population spatial dynamics of large pelagics” project progress report.

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.

This project will continue developing the geolocation model, and the first task will be adding the depth correction. Following that will be further testing with both real data from archival tagged individuals and artificial data. Once the model performance sufficiently validated it will be documented in a paper. Further, this project will continue

to maintain and develop the existing software packages, and to provide guidance to the scientists using them.

Complete theoretical analysis of geolocation errors and incorporate into state-space models.

- Continue develop and support kfSST and kftrack software..
 - Continue development of electronic tagging data repository.
Improve the user interface to the data repository, and new users will be recruited.
 - Collaboration on the “Mixed-resolution models for investigating individual to population spatial dynamics of large pelagics” project.
Continue work on parameter optimization in SEAPODYM.
4. List of papers published in refereed journals during FY 2005.

Nielsen, A., Bigelow, K. A., Musyl, M. K., and Sibert, J. R. (2006). Improving light-based geolocation by including sea surface temperature. *Fisheries Oceanography*, 15(4), 314-325.

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

Nielsen, A. and Sibert, J. R. (2005). From Light Measurements to Most Probable Track. Presented at PFRP Principal Investigators Workshop 15 Nov.

Nielsen, A. and Sibert, J. R. (2006). From Light Measurements to Most Probable Track. Presented at 57th Tuna Conference 24 May.

Sibert, J., Hampton, J., Kleiber, P., Maunder, M. 2006. Getting in touch with your inner elephants: Fishery induced changes in biomass, size and trophic level of large predatory fish in the Pacific Ocean. Presented at 57th Tuna Conference 24 May.

Sibert, J. CLIOTOP – Climate Impacts on Oceanic Top Predators. 2006. Poster presented at 57th Tuna Conference 24 May.

Sibert, J., Ancheta, J., Ajtai, P., Girard, C. 2006. Electronic tagging data repository. Poster presented at 57th Tuna Conference 24 May.

Sibert, J., Hampton, J., Kleiber, P., Maunder, M. 2006. We ate all the big tunas: Fishery induced changes in biomass, size and trophic level of large predatory fish in the Pacific Ocean. Seminar at IATTC, March 30, 2006.

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.

Mr. Peter Ajtai is a PFRP-supported Oceanography Department graduate student affiliated with this project.

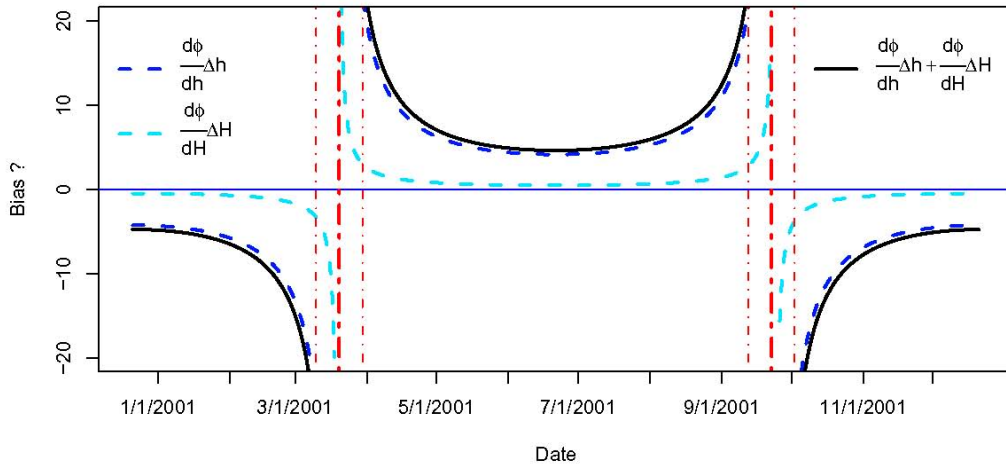
10. Personnel:

(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):

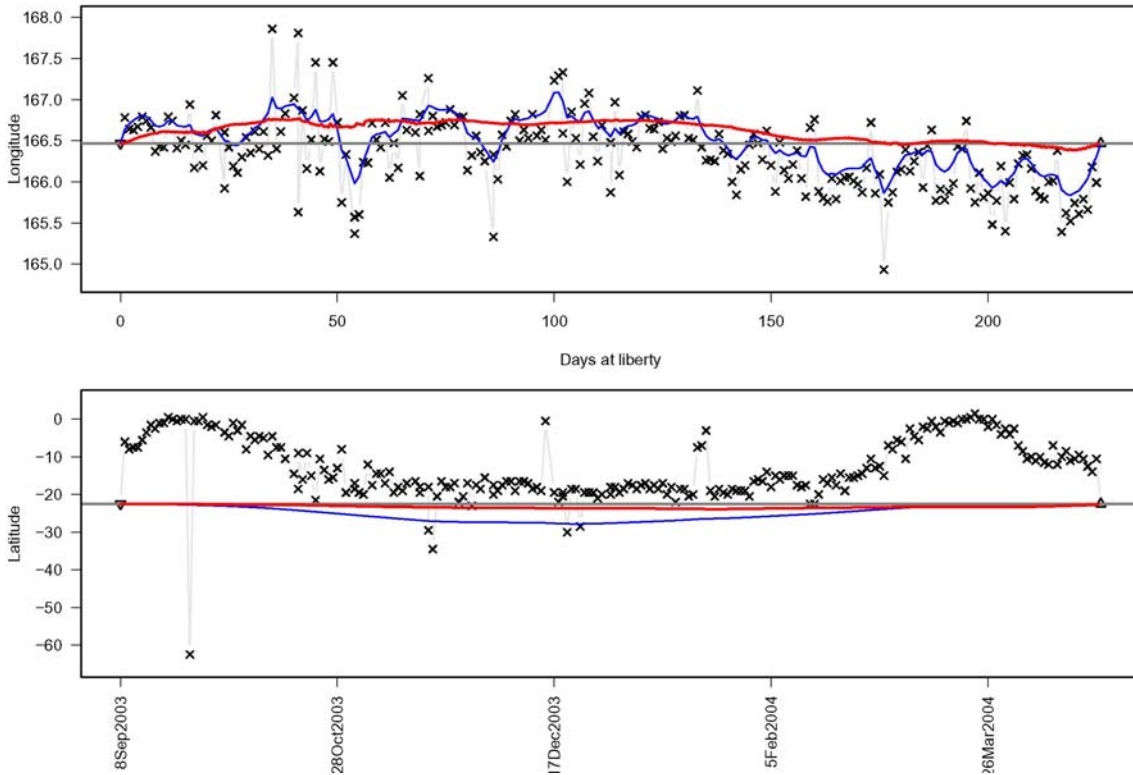
(ii) Number of employees/students that received 100% of their funding from an OAR laboratory and/or are located within that laboratory.

(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 or TIFF with a caption for each image. Hardcopies of images can be dropped off at the JIMAR office if no electronic versions are available.



Theoretical latitude estimation bias, solid black lines, at the latitude of Honolulu produced by a 2 minute sunset estimation error and a 2 degree misspecification in solar elevation at sunset. Vertical dashed lines indicate approximate dates of vernal and autumnal equinoxes and 10 day intervals before and after.



Reconstructed longitude and latitude of a tag attached to a mooring. The horizontal gray line is the known true position, the positions marked by 'x' are raw geolocations supplied by the tag manufactures, the thin blue line is the reconstruction from the two step approach, and the thick red line is the reconstruction from the joint model.