

**JIMAR, PFRP ANNUAL PROGRESS REPORT  
FY 2005**

**P.I. Name: Mark Maunder**

**(Main Collaborator: Simon Hoyle)**

**Inter-American Tropical Tuna Commission**

**Project Proposal Title: A general model for protected species**

**Funding Agency: NOAA.**

1. Purpose of the project and indicative results.

Managing wildlife-human interactions is increasingly important as human influence on natural habitats grows. Effective management requires defined objectives and reliable information about the likely consequences of management actions, or lack of such actions. These requirements are general across all taxonomic groups and management issues. Integrated Bayesian population modeling is a method for estimating population dynamics and decision analysis that is generally applicable, extremely flexible, uses data efficiently, and gives answers in a format that can be directly measured against management objectives.

The objective of the project is to generate a general Bayesian integrated modeling framework for protected species modeling that can be applied to multiple species and used to provide management advice. Models will be developed based on the general framework and used to estimate the effect of fisheries on the protected species populations. Methods will also be developed to estimate the effect of the management measures on both the protected species and the fisheries. We will apply the framework to several protected species populations.

2. Progress during FY 2005. Provide a thorough discussion of accomplishments and problems.

The present report reviews the activity under this contract from March 2004 to February 2005. The research was delayed due to staffing changes. The work to date has consisted of 4 main lines of activity:

- Development of an integrated model for dolphins
- Development of an integrated model for Albatross
- Development of general modeling framework for protected species
- Other applications

These topics are briefly reviewed below

a) Development of an integrated model for dolphins

- This project has been completed and a paper describing the research has been published

b) Albatross modeling

- The albatross mark-recapture database has been finalized by the Patuxent Environmental Research Centre, USGS, and received by the research team.
- Paul Doherty of the Department of Fishery and Wildlife Biology, Colorado State University, visited the IATTC to discuss the albatross mark-recapture data base and analysis of the data.
- Sophie Veran of the Centre d'Ecologie Fonctionnelle et Evolutive, visited the IATTC and collaborated on the analysis of adult survival rate from Tern Island mark-recapture data.
- SH continued the use of an individual-based model of albatross population dynamics and capture probability to investigating lack of fit in mark-recapture models and in particular the problems with the Tern Island population of black footed albatross data.
- Goodness of fit has been an ongoing problem for modeling the mark-recapture data. Sophie Veran visited Hawaii in late 2004 and updated the mark-recapture database. These more recent data were sampled differently from the earlier data that gave serious problems with goodness-of-fit. They considerably improve prospects for mark-recapture modeling. However, some problems remain with goodness of fit, and the integrated analysis will not be carried out until they are resolved – the goodness-of-fit work is being carried out in Montpellier.
- SH worked with Sophie Veran to continue the investigation of the effect of widowhood in albatross.
- Fishery effort time series and albatross bycatch rates for integration into a model of albatross interactions with fisheries were obtained from most of the available sources including Hawaiian, Californian, Alaskan, and non-US longline fisheries and Japanese, Taiwanese and Korean pelagic squid and large-mesh driftnet fisheries. There have also been difficulties obtaining Pacific-wide time series of detailed effort data and bycatch data for the numerous fisheries potentially taking black-footed albatross bycatch. We hope to obtain additional data within the next few weeks.
- SH visited Niall Broekhuizen of NIWA in New Zealand to discuss albatross modeling.

c) Development of a general modeling framework for protected species

A number of steps were taken towards developing and extending a general approach for modeling protected species.

- MM submitted a paper titled “A review and comparison of Bayesian and likelihood methods” to the journal Ecology that describes several aspects of the general framework.
- MM and SH developed a course titled “An introduction to ecological modeling and programming using AD Model Builder” and taught the course twice in the US and once in New Zealand. The course contains many aspects of the general framework and has been approved for 1.2 Continuing Education Units by the American Fisheries Society.
- MM collaborated with Panagiotis T. Besbeas of University of Kent to develop methods to approximate likelihoods and integrate the information into statistical models. This method can be used in the general framework to integrate prior information or reduce the computational demands of the analysis.
- MM gave several presentations on aspects of the general framework.

d) Other applications

- SH visited Milani Chaloupka at the University of Queensland and Col Limpus at the Queensland Environmental Protection Agency to discuss data and possible collaborations in preparation for applying the Bayesian integrated modeling approach to a turtle population.
- Jaume Forcada, Biological Sciences Division NERC, British Antarctic Survey, visited the IATTC and collaborated with MM and SH to develop an integrated model based on the general framework for Antarctic penguin populations.

3. Plans for the next fiscal year.

Albatross: We intend to continue our collaboration with Jean-Dominique Lebreton’s group on analyzing mark-recapture data for the Tern Island population of black footed albatross and development of integrated models. In a comparative analysis, we will also apply MULTIFAN-CL to the data for the Tern Island population of black footed albatross. Meetings will be held between our group, Jean-Dominique Lebreton’s, and other albatross researchers.

Turtles: We will further develop our links with sea turtle researchers and apply the general framework to a sea turtle population. We will meet with turtle researchers to form collaborative research projects.

General model: The general framework will be further developed and applied to the Tern Island population of black footed albatross and other species. Presentation of results at a modeling conference will be desirable.

Methodological development: We will carry out further investigation into appropriate methods to include information in models of protected species and to estimate uncertainty. We will continue collaborations with Panagiotis T. Besbeas to develop method to integrate data into models. MM and SH will attend the AFS Conference, teach

a course based on the general framework and give a presentation in the Bayesian section of the conference. MM will attend the objective Bayes conference in Missouri and give a poster based on an aspect of the general framework.

Collaborations: MM will collaborate with Tore Schweder at the Centre for Ecological and Evolutionary Synthesis, University of Oslo, who has been funded for the project “Integrated statistical analysis based on likelihood and confidence: applications to the hare-lynx population cycles and the status and structure of bowhead whales”.

PFRP: SH will attend the tuna conference and attend the PI meeting.

#### 4. List of papers published in refereed journals during FY 2004.

Hoyle, Simon D.; and Maunder, Mark N. (2004) ‘A Bayesian integrated population dynamics model to analyze data for protected species’. Animal Biology and Conservation, 27: 247-266.

McCarthy, M.A., Keith, D., Tietjen, J., Burgman, M.A., Maunder M.N., Master, L., Brook, B.W., Mace, G., Possingham, H.P., Medellin, R., Andelman, S., Regan, H., Regan, T., and Ruckelshaus, M. (2004) Comparing predictions of extinction risk using models and subjective judgment. *Acta Oecologica* 26: 67-74.

Maunder M.N. (2004) Population Viability Analysis, Based on Combining Integrated, Bayesian, and Hierarchical Analyses. *Acta Oecologica* 26: 85-94.

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

Hoyle, S. D. and Maunder M.N. (2004). Integrated modeling for protected species. PFRP [Pelagic Fisheries Research Program, Joint Institute for Marine and Atmospheric Research, University of Hawaii at Manoa], 9(4): 6-8.

Maunder M.N. and Hoyle, S. D. (presentation ) A general model for protected species: information and uncertainty. Tuna Conference.

Hoyle, S. D. and Maunder M.N. (presentation ) Integrated Population modeling for the northeastern offshore spotted dolphin (*Stenella attenuata*). Tuna Conference.

Maunder M.N. (presentation ) Computationally-intensive methods in natural resource management and software for parameter estimation. Invited presentation: Statistics for Natural Resources section, ICSA 2004 Applied Statistics Symposium, University of San Diego, June 6-9 2004.

Maunder M.N. (presentation ) Ecological modelling: information and uncertainty. University of Otago, Dunedin, March 30, 2004.

Maunder M.N. (presentation ) Ecological Modeling: Information and Uncertainty. IBC 2004 XXII<sup>nd</sup> International Biometric Conference in parallel with ASC 2004 Australian Statistical Conference, Cairns, Queensland, Australia, 11-16 July, 2004.

Maunder M.N. (presentation ) Ecological modelling: information and uncertainty. University of Auckland, Auckland, March 17, 2004.

Maunder M.N. (presentation ) Ecological modelling: information and uncertainty. Centre Halieutique Méditerranéen et Tropical, Institut de Recherche, Sete, March 11, 2004.

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Maunder M.N. (presentation ) A general framework for ecological modeling. Conference on New Developments of Statistical Analysis in Wildlife, Fisheries, and Ecological Research (The Fifth Winemiller Symposium), Columbia, Missouri, USA, 13-16 October, 2004.

6. Names of students graduating with MS or Ph.D. degrees during FY 2004. Include title of thesis or dissertation.

N/A