

WASHINGTON SEA GRANT PROGRESS REPORT

for the period 03/01/2007 - 02/29/2008

Project Number: **E/I-10**

Project Title: **NMFS - Sea Grant Graduate Fellowship in Population Dynamics:
Incorporating Environmental Time Series into Marine Mammal Stock
Assessment Models**

Principal Investigator(s) and Affiliation:

André Punt, University of Washington
in support of **John Brandon**

1. OBJECTIVES

The underlying objective of this project is to expand upon and advance existing stock assessment methods for marine mammals, by providing a framework to synthesize information relating environmental variables and population processes. These methods could possibly allow for improved estimation and evaluation of management quantities and strategies, given natural variability in ecosystem conditions and the potential for future global climate change.

The objectives as listed in the original proposal are:

- identify candidate data sets that show a relationship between a demographic parameter and the environment;
- develop and test methods for synthesizing environmental time series with existing stock assessment models for marine mammals;
- apply the modeling framework to conduct a stock assessment of a marine mammal species;
- evaluate alternative management schemes (including those used by the International Whaling Commission (IWC)) to assess their robustness to environmental variation;
- develop user-friendly software that will allow other assessment scientists to apply these methods; and
- identify future research needs with respect to natural environmental variability and predicted climate change.

2. RATIONALE

Currently, the assessments used to determine management-related reference points for marine mammals are conducted using custom-built software rather than a standardized framework. It is difficult for scientists to apply these models without a thorough understanding of the underlying mathematical details and computer code on which they are based. Future stock assessments for marine mammals would be conducted more efficiently if generic and well-tested software with a high-quality user-interface were available. User-friendly software, with an option for incorporating environmental time series, to fit population dynamics models to data on marine mammals, could also be used for assessments of other long-lived species.

3. ACCOMPLISHMENTS

JB's research during this period has been focused on developing and implementing methodology for incorporating environmental data when fitting a population dynamics model to multiple sources of data, as applied to an assessment of the eastern Pacific stock of gray whales.

JB co-organized, attended and presented preliminary research at the annual meeting of the Society of Marine Mammalogy Northwest Student Chapter. Additionally, he attended the 2007 PICES meeting and presented a more revised version of this work there as well.

JB was an Invited Participant at the 2007 annual meeting of the International Whaling Commission (IWC) Scientific Committee meeting, where he presented his research as primary author (Brandon *et al.*, 2007b) and also served as a rapporteur, assisting in the drafting and compilation of a sub-committee report.

During the reporting period, JB had published two peer-reviewed journal articles, including one as primary author (Brandon *et al.*, 2007a; Turvey *et al.*, 2007), with a third article in press (Li *et al.*, *In Press*).

JB worked with several collaborators (and co-authors) at the NMFS on these projects (including JB's NMFS mentor, Paul Wade).

Finally, JB successfully passed his General Exam and has been promoted to PhD candidate status.

5. PERFORMANCE MEASURES

Measure 2: Cumulative number of coastal, marine, and Great Lakes issue-based forecast capabilities developed and used for management.

Actual (reporting period covered by this report):

New forecast capability developed - preliminary forecasting of Eastern North Pacific gray whale calf production. This forecasting capability will form part of the basis to test the robustness of current aboriginal whaling management procedures.

Anticipated (12-month period following this reporting period):

During the next 12 month period, the forecasting methods will be refined and then applied to a risk assessment, during which the robustness of current management procedures will be tested via computer simulation.

6. PUBLICATIONS

Please refer to instructions for reprint requirements.

A. Journal articles:

Li, S., Akamatsu, T., Wang, D., Wang, K., Dong, S., Zhao, X., Wei, Z., Zhang, X., Taylor, B., Barrett, L.A., Turvey, S.T., Reeves, R.R., Stewart, B.S., Richlen, M. & **Brandon, J.R.** *In Press*. Indirect evidence of boat avoidance behaviour of Yangtze finless porpoise. *Bioacoustics*. 17: XX-XXX.

Brandon, J.R., Breiwick, J.M., **Punt, A.E.**, and Wade, P.R. 2007a. Constructing a coherent joint prior while respecting biological realism: application to marine mammal stock assessments. *ICES J. Mar. Sci.* 64: 1085-1100.

Turvey, S.T., Pitman, R.L., Taylor, B.L., Barlow, J., Tomonari, A., Barret, L.A., Zhao, X., Reeves, R.R., Stewart, B.S., Wang, K., Wei, Z., Zhang, X., Pusser, L.T., Richlen, M.R., **Brandon, J.R.** and Wang, D. 2007. First human-caused extinction of a cetacean species? *Biology Letters*. 3: 537-540.

E. Technical reports:

Brandon, J.R., **Punt, A.E.**, Wade, P.R., Perryman, W.L., Methot, R.D. and Maunder, M.N. 2007b. Incorporating environmental time series into a population dynamics model for eastern North Pacific gray whales. Paper SC/59/BRG26 presented to the International Whaling Commission (IWC) Scientific Committee, May 2007, Anchorage, AK. 16pp. (unpublished)

7. POSTERS AND PRESENTATIONS

Akamatsu, T.; Wang, D.; Wang, K.; Li, S.; Dong, S.; Zhao, X.; Wei, Z.; Zhang, X.; Barlow, J.; Pitman, R.L.; Taylor, B.L.; Barrett, L.A.; Turvey, S.T.; Reeves, R.R.; Stewart, B.S.; Richlen, M.; **Brandon, J.R.** Acoustic survey of baiji and finless porpoises in their historic habitats in the Yangtze River. 17th Biennial Conference on the Biology of Marine Mammals, Cape Town, South Africa, 29 November - 3 December, 2007

Samuel T. Turvey, Robert L. Pitman, Barbara L. Taylor, Jay Barlow, Tomonari Akamatsu, Leigh A. Barrett, Xiujiang Zhao, Randall R. Reeves, Brent S. Stewart, Kexiong Wang, Zhuo Wei, Xianfeng Zhang, Michael Richlen, **John Brandon** and Ding Wang. Probable Extinction of the Baiji, *Lipotes vexillifer*. 17th Biennial Conference on the Biology of Marine Mammals, Cape Town, South Africa, 29 November - 3 December, 2007

Zhao, X.1; Wang, D.; Barlow, J.; Pitman, R.L.; Taylor, B.L.; Wang, K.; Wei, Z.; Zhang, X.; Li, S.; Barrett, L.A.; Akamatsu, T.; Turvey, S.T.; Reeves, R.R.; Stewart, B.S.; Richlen, M.; **Brandon, J.R.** Abundance of finless porpoises in the middle and lower reaches of the Yangtze River. 17th Biennial Conference on the Biology of Marine Mammals, Cape Town, South Africa, 29 November - 3 December, 2007

Brandon, J.R. 2007. Integrating environmental data into the stock assessment of eastern North Pacific gray whales. PICES 16th Annual Meeting, Victoria, BC, Canada. 26th October. –5th, November, 2007.

Li, S., Akamatsu, T., Wang, D., Wang, K., Dong, S., Zhao, X., Wei, Z., Zhang, X., Taylor, B., Barrett, L.A., Turvey, S.T., Reeves, R.R., Stewart, B.S., Richlen, M. & **Brandon, J.R.** Indirect evidence of boat avoidance behaviour of Yangtze finless porpoise. International Conference on the Effects of Noise on Aquatic Life, Nyborg, Denmark, August 13-17, 2007

Brandon, J.R. 2007. Sea ice and a stock assessment of the eastern North Pacific gray whale. Annual meeting of the Society of Marine Mammology Northwest Student Chapter, Seattle, WA. 14 – 15th, April, 2007.

Brandon, J.R. 2007. Constructing a coherent joint prior while respecting biological realism: constraint or copula? Annual National Marine Fisheries Service (NMFS) Fellowships in Population Dynamics and Marine Resource Economics Meeting, Miami, FL. 3 – 5th, April, 2007.

10. LIST ALL STUDENTS SUPPORTED BY OR AFFILIATED WITH THIS PROJECT

Student Name: John R. Brandon

Department: School of Aquatic and Fishery Sciences

Major/Degree field: Quantitative methods in fisheries science

Major Professor: André E. Punt

Degree: Ph.D.

Dissertation title: Incorporating Environmental Time Series into Marine Mammal Stock Assessment Models

Date of graduation (actual or anticipated): 2008

Approximate support or affiliation period: June 2005-May 2008

Type of support (RA, research costs, conferences – list all that apply): RA

Current employment if applicable: N/A

11. INTERACTIONS

Collaboration with scientists at NMML/NMFS (see ‘Accomplishments’ and ‘Publications’ above, and ‘Future activities’ below).

12. OUTREACH AND INFORMATION/TECHNOLOGY TRANSFER

During the reporting year, the results of this project were made available to the scientific community through oral presentations at various meetings and conferences, including the 59th annual Scientific Committee meeting of the International Whaling Commission. The resulting interactions and informal peer critiques were subsequently incorporated and translated into the peer-reviewed publications noted above. During the final year of this project, these outreach activities will continue, especially with regards to the management procedures of the IWC to ensure that the results of this project are applied to the fullest extent possible.

13. FUTURE ACTIVITIES

No changes are proposed to this project during the next year. Currently, JB is working on incorporating the suggestions of the Scientific Committee of the IWC (2007 meeting) into the mathematical framework and software for integrating environmental time series into marine mammal stock assessments. The eastern North Pacific gray whale has been chosen as the first case study on which to apply this assessment framework, and the Bering-Chukchi-Beaufort Seas stock of bowhead whales has been chosen as a second case study. It is anticipated that these methods will be applied to an assessment of the bowhead stock during the end of 2008. The results of the current research applied to gray whales, will be presented at the next meeting of the IWC (June 08), with submittal for peer-reviewed publication to follow. Following the application of the assessment framework, the population dynamics model will be used as an operating model to test the robustness of aboriginal whaling management procedures for the gray whale. During the course of applying the modeling framework and testing management procedures, we anticipate the final objectives of this project will be addressed as well (i.e., user friendly software and identifying future research needs). Collaboration with scientists at NMML/NMFS will continue as the research progresses during the next year.