

**Pro forma for funding requests other than workshops:****SHORT TITLE**

Using baleen whale tag data to inform ecosystem models

**RELEVANT AGENDA ITEM (NO. AND TITLE)**

2.1 Competition among baleen whales: how can we measure and model it

**BRIEF DESCRIPTION OF PROJECT AND WHY IT IS NECESSARY TO YOUR SUB-COMMITTEE**

A central focus of the IWC/SC/EM agenda at SC65b is discussing methods to model competition and competitive interactions between whales. For models to be accurate and valuable, detailed knowledge about the energetic demands and foraging behavior of individual species is paramount. However, critical information gaps exist in our understanding of the energetic costs of feeding and foraging bout duration and how these relate to measures of prey availability. In order to address this, both fine-scale suction cup and long-term satellite tag data and quantitative estimates of prey are required (Palacios et al. 2013).

Friedlaender has collected a substantial amount of fine-scale dive/kinematic data concurrent to prey estimates for minke, humpback, blue, and fin whales, and deployed a significant number of satellite tags. Recent work by Goldbogen et al. (2011) has modeled the energetic costs of feeding for a number of baleen whale species and the effect of prey availability on foraging behavior. With empirical data to now test this and other models, Friedlaender et al. (in prep) and Goldbogen et al. (in review) show how the kinematics of foraging behavior is affected by changes in prey density. Furthermore, foraging bout duration and feeding activity over long time periods can be gleaned from state-space models of satellite tag data to increase analytical power. This information is critical for models of competition both to show whether or not sympatry exists between species and whether changes in foraging bout duration occur over time.

We will conduct preliminary analysis on fine-scale and satellite tag data and provide information to Dr. De La Mare to develop individual-based models of cetacean foraging and generate specific hypotheses regarding competition between species from fine-scale foraging observations. This is a unique opportunity to achieve the analytical goals discussed within EM, provide new information to better understand competition between baleen whales, and stimulate further collaborative research.

Below are the research objectives:

1. Estimates of feeding costs for a range of baleen whales species.
2. Measures of how feeding costs change as a function of prey density.
3. Analysis of movement patterns, habitat use, and foraging bout duration from satellite-linked tags using state-space models.

**TIMETABLE**

Objectives 1 & 2, including reports to IWC SC and manuscript submission, will be completed in Year 1 (1 June 2015). Objective 3, including analysis of satellite-tag data for state-space and foraging models, reports to IWC SC and manuscript submission, will be completed in Year 2 (1 June 2016).

**RESEARCHERS NAMES**

Ari S. Friedlaender, William de la Mare, Jeremy Goldbogen

**ESTIMATED TOTAL COST (£16,600) WITH BREAKDOWN AS NEEDED**

<b>YEAR 1</b>	<b>Time</b>	<b>Work</b>	<b>Cost</b>
Student Salary	9 months	Data Analysis, manuscript writing (1&2)	£12,500
A. Friedlaender	3 months	Data analysis, writing (1&2)	£0**
W. De La Mare	3 months	Model development, writing (1&2)	£0**
<b>YEAR 2</b>			
Student Salary	3 months	Data Analysis, manuscript writing (3)	£4,100
A. Friedlaender	3 months	Data analysis, writing (3)	\$0**
W. De La Mare	3 months	Model development, writing (3)	\$0**

\*\* Drs. Friedlaender and De La Mare will contribute their time at no cost as in-kind support.