Streamlining High-Volume Data Acquisition, Analysis and Tracking of Marine Mammals with Highly Configurable, Standards-based Software

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In April and May 2011, Mysticetus Observation Platform software, created by Entiat River Technologies, was Beta-tested during aerial surveys in southern California. During 2011, Mysticeus was used in over 12 flight hours spanning 2762.1 km of survey effort. Mysticetus provided real-time distance and bearing to a sighting by synthesizing real-time Global Positioning System (GPS) data with the declination angles (converted to distance) and times of sightings. This feature was critical in helping the pilots to relocate sightings quickly, even in higher Beaufort conditions when sightings are typically challenging to re-find. Relative location of the sighting to the aircraft was continuously displayed on the laptop screen, and adapted to changing distances and headings of the aircraft. The recorder communicated to the pilots how to adjust the flight pattern to relocate the sighting. Post-survey analysis tools, including automated on-effort survey reports, and Google Earth 3-D track display, greatly reduced data post-processing on the days Mysticetus was used as compared to previous processes. Mysticetus is being used for cetacean theodolite land based tracking. It is currently in use in winter 2012 aerial surveys being flown in southern California. Mysticetus is unique from other available similar software because it is user customizable.

A comparison of progesterone in the blubber of female delphinoids: *Delphinus capensis*, *Stenella attenuata*, *Stenella longirostris*, and *Phocoenoides dalli*

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Recent research has validated the use of biopsies as a minimally invasive way to study pregnancy in some species of wild cetaceans. Results of these studies have found that progesterone (P4) concentrations in the blubber of most biopsies is diagnostic of reproductive condition. However, available data is limited to four species: *Balaenaptera acutorostrata*, *Delphinus delphis*, *Lissodelphis borealis*, and *Lagenorhynchus obliquidens*. In the present study we measured P4 in the blubber of four additional cetacean species (three delphinids and one phocoenid) and examined the relationship between hormone levels and pregnancy state. P4 levels were compared between 40 females of known reproductive condition collected as fishery bycatch or beach strandings, including eighteen *Delphinus capensis*, eight *Stenella attenuata*, six *Stenella longirostris*, and eight *Phocoenoides dalli*. Significant differences in P4 levels between pregnant and non-pregnant animals were observed. Pregnant individuals had a mean blubber P4 concentration 168 times higher than non-pregnant females and no overlap in concentrations were found between these groups. No significant differences were found between mature non-pregnant and immature animals suggesting P4 level is not indicative of maturity state in female delphinoids. P4 concentrations in relation to reproductive state were remarkably similar across species, with the possible exception of immature Dall's porpoise, which contained significantly higher levels of P4 (2.30ng/g) when compared to *Stenella attenuata* (1.03ng/g, $p=0.049$) and S. longirostris (0.63ng/g, $p=0.025$). Both mature non-pregnant and pregnant Dall's porpoises appeared to have higher levels of P4 than other species but a full analysis of these data could not be conducted due to limited sample size. Nonetheless, blubber P4 was shown to be a reliable indicator of reproductive condition in multiple species and provides a useful tool to study reproduction in free-ranging cetaceans.

Habitat modeling of blue whales (*Balaenoptera musculus*) during two different calling behaviors

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Habitat modeling allows for predictions of cetacean distributions in response to various oceanographic processes. Past studies have used habitat models to understand and predict the occurrence of cetaceans based on their vocalizations. Blue whales (*Balaenoptera musculus*) in the Southern California Bight produce at least two types of vocalizations associated with different behavioral states. This study investigates the important oceanographic variables that are associated with these different behavioral states. We assessed the occurrence of blue whale feeding and reproductive calls from autonomous passive acoustic recordings collected off Point Conception, California during the summer months of 2010. The oceanographic data, including temperature, chlorophyll, nitrate, turbidity, and upwelling index, were available from a long-term continuous mooring deployed in the same location as the acoustic recordings. The occurrence of these different behavioral call types was related to current and time-lagged oceanographic predictor variables using a generalized additive modeling (GAM) framework. The most consistently selected variables for feeding calls and reproductive calls were determined among the trial models and cross-validation. This study presents results from temporal and spatial correspondence in long-term time-series data for both behavioral acoustic and environmental variables and provides a rare opportunity to explore the environmental contexts for the occurrence of different calls associated with different behaviors.

Southern California Marine Mammal Workshop

February 3–4, 2012 · Newport Beach, CA

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