Protected species monitoring in Onslow Bay, NC: January – December 2010

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A protected species monitoring program was initiated in 2007 when the US Navy identified Onslow Bay, NC as a potential site for an Undersea Warfare Training Range. To estimate marine mammal density, distribution and seasonality, traditional visual line transect surveys from both aerial and vessel platforms have been augmented with passive acoustic monitoring techniques. In 2010, 20 aerial (10,939 km of trackline) and 14 vessel (958 km of trackline) survey days were completed. In order of decreasing frequency Tursiops truncatus, Stenella frontalis, Grampus griseus, Globicephala macrorhynchus, Delphinus delphis, and Balaenoptera physalus were sighted. T. truncatus and S. frontalis comprised most sightings in both aerial (85%) and vessel (100%) surveys. Approximately 1,000 digital images were taken for species and individual identification during vessel-based surveys. To date, six T. truncatus and one S. frontalis have been re-sighted across seasons and years, suggesting some degree of residency in the study area. Passive acoustic monitoring techniques include towing a four-element hydrophone array during vessel surveys and deploying High-frequency Acoustic Recording Packages (HARPs) on the sea floor. Analysis of towed array recordings suggests that visual surveys detect approximately half of the dolphin groups that were acoustically detected. Hundreds of vocal detections are present in the HARP data, which will provide insights into of diel and seasonal patterns of marine mammal vocalization. This project, now in its fourth year, is providing a valuable long-term window into abundance and residency patterns of cetaceans in offshore waters of North Carolina.

The thermal properties of the integument of the pygmy sperm whale (*Kogia breviceps*)

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Blubber is the specialized hypodermis of the cetacean integument that contributes to buoyancy control, streamlining and insulation. Blubber's insulative properties are dependent on its lipid content and composition. The blubber of most cetaceans is composed predominantly of triacylglycerols (TAG). However, the blubber of kogiids, physterids, and ziphiids is formed predominantly of wax esters (WE). The thermal properties of waxy blubber have not yet been investigated. We examined the blubber of the pygmy sperm whale, Kogia breviceps, and discovered that their blubber is grossly stratified into two distinct layers. The superficial layer appeared more densely fibrous than the thicker deep layer. Therefore, we examined the thermal properties of the entire integument and each layer separately. Mid-thoracic blubber of adult, robust K. breviceps (n=8) was tested (using both standard material and heat flux disc methods) to determine its thermal conductivity (W m-1°C-1). The mean conductivity of K. breviceps integument was 0.14 ±0.01 Wm-1°C-1. The conductivity of the superficial blubber layer (0.21 ±0.03 Wm-1°C-1) was significantly higher than the deep layer (0.14 ±0.004) (t-test, P=0.04). The conductivity of the integument of K. breviceps was significantly lower than that of short-finned pilot whales, Globicephala macrorhynchus, (0.19 W m-1°C-1) (t-test, p= 0.0006) and lower than the listed values of bottlenose dolphins, Tursiops truncatus (0.18 W m-1°C-1) (Dunkin et al. 2005). Thus, WE blubber appears to be more insulative than blubber composed of TAG. We are currently investigating the blubber of juvenile and calf K. breviceps to determine how thermal properties change across development.