Visual and acoustic surveys for beaked whales in the Great Bahama Canyon: determining their distribution, abundance and population structure

Mass strandings of beaked whales in several areas, including the northern Bahamas, have correlated with naval operations, raising concern that beaked whales are particularly vulnerable to military sonars. As such, information on the basic population ecology of beaked whales is necessary to understand and mitigate the effects of such activities. The deep waters around the Bahama Islands are one of the few areas where beaked whales are known to regularly occur close to shore. The Bahamas Marine Mammal Research Organisation (BMMRO) has been conducting field studies of beaked whales around Abaco Island since 1991, resulting in more than 320 encounters with beaked whales, comprising both Cuvier's beaked whales (*Ziphius cavirostris*) and Blainville's beaked whales *(Mesoplodon densirostris*). Using randomized boat transects and established photographic identification methods, individual whales have been re-identified and followed over multiple years. This unique dataset has provided unprecedented individual-based information on the ecology of beaked whales, including residency patterns, long-term site fidelity, social organisation and habitat use.

In 2006, the Office of Naval Research funded BMMRO to begin a three-year study to extend our on-going study in scope and geographic extent, to fill critical data gaps on the distribution, abundance and population structuring of beaked whales in the northern Bahamas. The need to fill these gaps exists for several reasons. The first of these is that naval operating areas in the Bahamas lie outside BMMRO's current study areas, and secondly, although the March 15th 2000 mass stranding event encompassed the study area, the geographic extent was much greater, including both Northeast and Northwest Providence Channels. Another reason to extend our survey area to assess the wider distribution, abundance and population structuring of beaked whales is to provide a context for interpreting BMMRO's long term datasets from around Abaco Island. The objectives of the three-year study are to determine beaked whale distribution and abundance in the Great Bahama Canyon (Northeast and Northwest Providence Channels and Tongue of the Ocean) from visual and acoustic surveys and to examine population structuring of beaked whales in the Great Bahama Canyon through the analysis of photo-identification data and genetic samples currently archived by BMMRO and from photographs and biopsy samples obtained during the proposed surveys.

The first two of three planned research cruises were conducted in the Great Bahama Canyon during May and October 2007. During 40 days at sea, a total of 1771 nautical miles (3277 km) of visual and acoustic survey effort were conducted resulting in 91 marine mammal sightings. Eleven different cetacean species were sighted, with beaked whales being the most frequently sighted species. There were a total of 30 sightings of beaked whales, including 16 Blainville's beaked whale sightings, 6 Cuvier's beaked whale sightings and 3 Gervais' beaked whale (*M. europaeus*) sightings and the rest were unidentified Ziphiids. Over 2500 photo-identification photographs were taken during encounters and preliminary analysis shows matches of some individuals to those previously archived in BMMRO's existing photographic catalogues from south Abaco Island. During encounters, skin and blubber samples were collected using remote biopsy

techniques from five beaked whales and four sperm whales which will contribute to study of beaked whale diet (through fatty acid, stable isotope and contaminant analyses) and stock structure (using molecular genetic approaches).