

gun array and the other will be a 20-gun array (with varying numbers of those 20 guns active at any one time). While towing each of the arrays and firing the guns at 20-sec intervals, the *Ewing* will approach the spar buoy from 10 km (5.4 nm) away, pass the spar buoy about 100 m (54 nm) to the side of it, and continue until it is 10 km (5.4 nm) past the spar buoy. Sounds will be recorded at the spar buoy and telemetered to the *Ewing*. The *Ewing* will be self-contained, and the crew of the vessel will live aboard.

During the GOM cruise, water depths in the study area will range from <100 to >2000 m (<330 >6500 ft). Airgun operations will be conducted along a total of about 132 km (71.3 nm) of trackline. This includes 66 km (35.6 nm) of trackline for each of the 2-Generator-Injector (GI) guns and the 20-gun array. About one third of the survey effort will be in water <100 m (328.1 ft), one third will be in water 100–2,000 m (328.1–6,561.7 ft), and one third will be in water >2,000 m (>6,561.7 ft). These linear figures represent the planned surveys. There may be additional operations associated with equipment testing and repeat coverage of any calibration run where initial data quality is sub-standard. To allow for these possible additional operations, the estimates of marine mammals that may be taken includes an allowance for an additional 44 km (23.7 nm) of airgun operations or 110 km (59.4 nm) for each of the 2-GI and 20-gun configurations (220 km (118.8 nm) of total trackline).

About one-half of the airgun operations in each water depth category will be conducted with the 2-gun array and the other half will be with varying proportions of the 20-airgun array. During operations with the larger array, the number of airguns active will vary from 6 to 20. The five configurations to be tested (2, 6, 10, 12 and 20 airguns) will include all of the airgun configurations that are anticipated to be used during LDEO's subsequent 2003 cruises.

The procedures to be used during the airgun calibration surveys will be similar to those used during previous seismic surveys by LDEO, e.g., in the equatorial Pacific Ocean (Carbotte *et al.*, 1998, 2000). The proposed program will use conventional seismic methodology with a towed airgun array as the energy source and a LDEO spar buoy as the receiver system. At one of the locations, a moored US Navy/University of New Orleans EARS (Environmental Acoustic Recording System) buoy will also record received sound levels as an independent calibration of the data that are received by the LDEO spar buoy.

The energy for the airgun array is compressed air supplied by compressors on board the source vessel. The specific configuration of the airgun array will be varied to represent all of the different arrays that will be used during 2003 and the most common arrays that will be used in future years. In addition, a multi-beam bathymetric sonar will be operated from the source vessel for part of the calibration survey. A lower-energy sub-bottom profiler will also be operated for part of this cruise. Detailed specifications on the acoustic instrumentation planned for this calibration study can be found in LDEO's application.

#### **Description of Habitat and Marine Mammals Affected by the Activity**

A total of 28 cetacean species and one species of sirenian (West Indian manatee) are known to occur in the GOM. These species are the sperm whale (*Physeter macrocephalus*), pygmy sperm whale (*Kogia breviceps*), dwarf sperm whale (*Kogia sima*), Cuvier's beaked whale (*Ziphius cavirostris*), Sowerby's beaked whale (*Mesoplodon bidens*), Gervais' beaked whale (*Mesoplodon europaeus*), Blainville's beaked whale (*Mesoplodon densirostris*), rough-toothed dolphin (*Steno bredanensis*), bottlenose dolphin (*Tursiops truncatus*), pantropical spotted dolphin (*Stenella attenuata*), Atlantic spotted dolphin (*Stenella frontalis*), spinner dolphin (*Stenella longirostris*), Clymene dolphin (*Stenella clymene*), striped dolphin (*Stenella coeruleoalba*), Fraser's dolphin (*Lagenodelphis hosei*), Risso's dolphin (*Grampus griseus*), melon-headed whale (*Peponocephala electra*), pygmy killer whale (*Feresa attenuata*), false killer whale (*Pseudorca crassidens*), killer whale (*Orcinus orca*), short-finned pilot whale (*Globicephala macrorhynchus*), North Atlantic right whale (*Eubalaena glacialis*), humpback whale (*Megaptera novaeangliae*), minke whale (*Balaenoptera acutorostrata*), Bryde's whale (*Balaenoptera edeni*), sei whale (*Balaenoptera borealis*), fin whale (*Balaenoptera physalus*), and the blue whale (*Balaenoptera musculus*). Another 3 species (long-beaked common dolphin (*Delphinus capensis*), short-beaked common dolphin (*Delphinus delphis*), and long-finned pilot whale (*Globicephala melas*)) could potentially occur in the GOM.

In the northern GOM, cetaceans are concentrated along the continental slope near cyclonic eddy and confluence areas of cyclonic-anticyclonic eddy pairs, due to nutrient-rich water which is thought to increase zooplankton stocks and thus prey abundance in those areas (Davis *et*

*al.*, 2002). The narrow continental shelf south of the Mississippi River delta appears to be an important habitat for some cetacean species (Baumgartner *et al.*, 2001; Davis *et al.*, 2002). Low salinity, nutrient-rich waters may occur over the continental slope near the mouth of the Mississippi River or be entrained within the confluence areas and transported beyond the continental slope, creating a deep-water environment with increased productivity (Davis *et al.*, 2002). The rate of primary productivity and the standing stocks of chlorophyll and plankton are higher in this area as compared with other regions in the oceanic Gulf (Dagg *et al.*, 1988; Ortnier *et al.*, 1989; Muller-Karger *et al.*, 1991). This increased productivity may explain the presence of a breeding population of endangered sperm whales within 100 km (54 nm) of the Mississippi River delta (Davis *et al.*, 2002). The southwestern Florida continental shelf may be another region of high productivity, and an important habitat for several cetacean species (Baumgartner *et al.*, 2001).

Several species of cetaceans are also widespread outside the previously described areas, on the continental shelf and/or along the shelf break. These include bottlenose dolphins, Atlantic spotted dolphins, and Bryde's whales (Davis *et al.*, 2002). Thus, cetaceans in the GOM seem to be partitioned by their habitat preferences, which are likely based on prey distribution (Baumgartner *et al.*, 2001).

Detailed descriptions of the marine mammal species are provided in the LDEO application and EA (both documents are available upon request (see ADDRESSES)). Please refer to those documents for additional information. Additional information on these species can also be found in Waring *et al.* (2001, 2002). These latter reports are available at the following location: [http://www.nmfs.noaa.gov/prot\\_res/PR2/Stock\\_Assessment\\_Program/sars.html](http://www.nmfs.noaa.gov/prot_res/PR2/Stock_Assessment_Program/sars.html)

#### **Potential Effects on Marine Mammals**

As outlined in several previous NMFS documents, the effects of noise on marine mammals are highly variable and can be categorized as follows (based on Richardson *et al.*, 1995):

- (1) The noise may be too weak to be heard at the location of the animal (i.e., lower than the prevailing ambient noise level, the hearing threshold of the animal at relevant frequencies, or both);
- (2) The noise may be audible but not strong enough to elicit any overt behavioral response;
- (3) The noise may elicit reactions of variable conspicuousness and variable