

cloud cover, and sun glare. The data listed under (2) will also be recorded at the start and end of each observation watch and during a watch, whenever there is a change in one or more of the variables.

All mammal observations and airgun shutdowns will be recorded in a standardized format. Data will be entered into a custom database using a laptop computer when observers are off-duty. The accuracy of the data entry will be verified by computerized validity data checks as the data are entered and by subsequent manual checking of the database. These procedures will allow initial summaries of data to be prepared during and shortly after the field program, and will facilitate transfer of the data to statistical, graphical or other programs for further processing and archiving.

A draft report will be submitted to NMFS within 90 days after the end of the seismic program in the Storegga slide area. The end of the Storegga slide program is predicted to occur on or about September 25, 2003. The report will cover the seismic surveys in the Storegga slide area and will be submitted to NMFS, providing full documentation of methods, results, and interpretation pertaining to all monitoring tasks. The report will summarize the dates and locations of seismic operations, sound measurement data, marine mammal sightings (dates, times, locations, activities, associated seismic survey activities), and estimates of the amount and nature of potential "take" of marine mammals by harassment or in other ways. The draft report will be considered the final report unless comments and suggestions are provided by NMFS within 60 days of its receipt of the draft report.

#### **Estimates of Take by Harassment for the Norwegian Sea Cruise**

As described previously (see 68 FR 17909, April 14, 2003) and in the LDEO application, animals subjected to sound levels  $\geq 160$  dB may alter their behavior or distribution, and therefore might be considered to be taken by Level B harassment.

Based on summer marine mammal density survey data collected by Sigurjonsson and Gunnlaugsson (1989), LDEO used its best estimate of density to compute a best estimate of the number of marine mammals that may be exposed to seismic sounds  $\geq 160$  dB re 1  $\mu$ Pa (rms) (NMFS' current criterion for onset of Level B harassment), except for bottlenose whales. Northern bottlenose whales are migratory and most leave the proposed seismic survey area before the end of June (Benjaminsen 1972;

Sigurjonsson and Gunnlaugsson 1990). Therefore, only a few, if any, bottlenose whales may be seen during the seismic survey in the study area during late August to September. For bottlenose whales, LDEO used 0.10x the observed average or maximum density to calculate the numbers that might be exposed to seismic sounds, but even this reduced number is likely a high estimate. For all other species, the average densities were then multiplied by the proposed survey effort (3109 km or 1678 n.mi) and twice the 160-dB safety radius around the 6-gun array to estimate the "best estimate" of the numbers of animals that might be exposed to sound levels  $\geq 160$  dB re 1  $\mu$ Pa (rms) during the proposed seismic survey program.

The estimates of takes by harassment are based on the number of marine mammals that might be found within the 160 dB isopleth radius and potentially disturbed by operations with the 6-airgun array planned for the project. If the 2-GI gun array is used for all or part of the survey, the numbers of marine mammals that might be affected by the proposed seismic survey would be lower than the estimates described below. The 160-dB radius for the 2-GI gun array is 520 m (1706 ft) or 19 percent of that of the 6-gun array. If only the 2-GI gun array is used, the numbers of animals that would encounter airgun sounds  $\geq 160$  dB re 1 (rms) would be about one-fifth of the number if only the 6-gun array were used.

Based on this method, Table 3 in LDEO (2003) gives the best estimates of densities for each species or species group of marine mammal that might be exposed to received levels  $>160$  dB re 1  $\mu$ Pa (rms), and thus potentially taken by Level B harassment, during seismic surveys in the proposed study area of the Norwegian Sea. Of these, 86 animals would be endangered species, primarily fin (42), humpback (22), and sperm whales (18). Delphinidae would account for 75 percent of the overall estimate for potential taking by harassment, with white-beaked dolphins (298) believed to account for about 90 percent of all delphinids in the area of the proposed seismic survey, and with killer whales (137) and long-finned pilot whales (302) accounting for most of the remaining 10 percent.

#### **Conclusions**

##### *Effects on Cetaceans*

Strong avoidance reactions by several species of mysticetes to seismic vessels have been observed at ranges up to 6 to 8 km (3.2 to 4.3 nm) and occasionally

as far as 20–30 km (10.8–16.2 nm) from the source vessel. Some bowhead whales avoided waters within 30 km (16.2 nm) of the seismic operation. However, reactions at such long distances appear to be atypical of other species of mysticetes, and even for bowheads may only apply during migration.

Odontocete reactions to seismic pulses, or at least those of dolphins, are expected to extend to lesser distances than are those of mysticetes. Odontocete low-frequency hearing is less sensitive than that of mysticetes, and dolphins are often seen from seismic vessels. In fact, there are documented instances of dolphins approaching active seismic vessels. However, dolphins as well as some other types of odontocetes sometimes show avoidance responses and/or other changes in behavior when near operating seismic vessels.

Taking account of the mitigation measures that are planned, effects on cetaceans are generally expected to be limited to avoidance of the area around the seismic operation and short-term changes in behavior, falling within the MMPA definition of "Level B harassment." In the cases of mysticetes, these reactions are expected to involve small numbers of individual cetaceans because few mysticetes occur in the area where seismic surveys are proposed. LDEO's best estimate is that 42 fin whales, or 0.5 percent of the estimated fin whale population in and adjacent to the study area, will be exposed to sound levels  $\leq 160$  dB re 1  $\mu$ Pa (rms) and potentially affected. Similarly, 22 humpback whales, or 0.8 percent, and 18 sperm whales, or 0.2 percent of their populations that occur in and adjacent to the proposed survey area, would receive seismic sounds  $>160$  dB. Numbers and impact would be even smaller if the 2-GI gun array is used for a substantial fraction of the survey project.

Larger absolute numbers of odontocetes may be affected by the proposed activities, but the population sizes of the main species are large and the numbers potentially affected are small relative to the population sizes. The best estimate of the total number of odontocetes that might be exposed to  $\geq 160$  dB re 1  $\mu$ Pa (rms) in the proposed survey area in the Norwegian Sea is 878. Of these, 770 are Delphinidae, and of these about 200 might be exposed to  $\geq 170$  dB. These figures are  $<0.1$  percent of the populations of these combined species that occur in the Northeast Atlantic. These potential takings of small numbers of marine mammals by short-term Level B harassment will have