

Hearing Impairment and Other Physical Effects

Given recent stranding events that have been associated with the operation of naval sonar, there is much concern that sonar noise can cause serious impacts to marine mammals (for discussion see Effects of Seismic Surveys). It is worth noting that the multi-beam sonar proposed for use by LDEO is quite different than sonars used for navy operations. Pulse duration of the multi-beam sonar is very short relative to the naval sonars. Also, at any given location, an individual marine mammal would be in the beam of the multi-beam sonar for much less time given the generally downward orientation of the beam and its narrow fore-aft beamwidth. (Navy sonars often use near-horizontally-directed sound.) These factors would all reduce the sound energy received from the multi-beam sonar rather drastically relative to that from the sonars used by the Navy.

Estimates of Take by Harassment for the Hess Deep Cruise

As described previously in this document and in the LDEO application, animals subjected to sound levels above 160 dB may alter their behavior or distribution, and therefore might be considered to be taken by Level B harassment. However, the 160 dB criterion is based on studies of baleen whales. Odontocete hearing at low frequencies is relatively insensitive, and the dolphins generally appear to be more tolerant of strong sounds than are most baleen whales. For that reason, it has been suggested that for purposes of estimating incidental harassment of odontocetes, a 170 dB criterion might be appropriate.

Based on summer marine mammal survey data collected by NMFS and density calculations by Ferguson and Barlow (2001), LDEO used their average marine mammal density to compute a "best estimate" of the number of marine mammals that may be exposed to seismic sounds ≥ 160 dB re 1 μ Pa (rms). The average densities were then multiplied by the proposed survey effort (912 and 189 km for the 10-gun and 12-gun array, respectively) and twice the 160 dB radius from the source vessel (the 160 dB radius was 6.5 and 7.25 km for the 10-gun and 12-gun array, respectively) to estimate the "best estimate" of the numbers of animals that might be exposed to sound levels ≥ 160 dB re 1 μ Pa (rms) during the proposed seismic survey program. Separate estimates were made for the 10-gun and 12-gun arrays because the 160 dB radius was different for the two arrays

(see Tables 5 and 6 in LDEO (2003)). Based on this method, the "best estimate" of the number of marine mammals that would be exposed to ≥ 160 dB (rms) and thus potentially taken by Level B harassment during the proposed survey is 8,901, including animals taken by both the 10-gun and 12-gun arrays. Of these, 12 animals would be endangered species, sperm whales (11) and a single blue whale. The species composition of cetaceans within the species groups shown in Tables 5 and 6 in LDEO (2003) is expected to be roughly in proportion to the densities shown for each species in Table 3 in LDEO (2003). Based on those densities, the numbers of each species that might be taken by Level B harassment are shown in Table 7 in LDEO (2003).

Dolphins would account for 96 percent of the overall estimate for potential taking by harassment (i.e., 8,532 of 8,901). While there is no agreement regarding any alternative "take" criterion for dolphins exposed to airgun pulses, if only those dolphins exposed to 170 dB re 1 μ Pa (rms) were affected sufficiently to be considered taken by Level B harassment, then the best estimate for dolphins would be 3,076 rather than 8,532. This is based on the predicted 170-dB radius around the 10- and 12-airgun arrays (2,330 and 2,680 m (7,644 and 7,742 ft), respectively), and is considered to be a more realistic estimate of the number of dolphins that may be disturbed. Therefore, the total number of animals likely to react behaviorally is considerably lower than the 8,901 that LDEO has estimated in Tables 5 and 6 (LDEO, 2003).

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 and occasionally as far as 20–30 km from the source vessel. Some bowhead whales avoided waters within 30 km 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 areas where seismic surveys are proposed. LDEO's "best estimate" is that 10 Bryde's whales, or 0.1 percent of the estimated Eastern Equatorial Bryde's whale population, will be exposed to sound levels ≤ 160 dB re 1 μ Pa (rms) and potentially affected, and 1 blue whale, or 0.1 percent of the "endangered" ETP blue whale population, would receive >160 dB. Therefore, these potential takings by Level B harassment will have a negligible impact on their populations.

Larger 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 (<0.1 percent) relative to the population sizes. The total number of odontocetes that might be exposed to ≥ 160 dB re 1 μ Pa (rms) in the Hess Deep area is estimated as 8,890. Of these, 8,532 are delphinids, and of these about 3,076 might be exposed to ≥ 170 dB. These figures are <0.1 percent of the Eastern Equatorial populations of these combined species, and the 3,076 value (based on the >170 dB criterion) is believed to be a more accurate estimate of the number that could potentially be harassed under Level B.

The many cases of apparent tolerance by cetaceans of seismic exploration, vessel traffic, and some other human activities show that co-existence is possible. Mitigation measures such as controlled speed, look-outs, non-pursuit, ramp-ups, avoidance of start-ups during periods of darkness when possible, and shut-down when within defined ranges (See Mitigation) should further reduce short-term reactions to disturbance, and minimize any effects on hearing sensitivity.

Conclusions—Effects on Pinnipeds

Very few if any pinnipeds are expected to be encountered in the Hess Deep area. Thus a maximum of 20 pinnipeds in the Hess Deep area may be affected by the proposed seismic surveys. If pinnipeds are encountered, the proposed seismic activities would have, at most, a short-termed effect on their behavior and no long-term impacts on individual seals or their populations.