

Species	"Best Estimate" of the Number of Exposures to Sound Levels ≥ 160 dB (≥ 170 dB)	% of North Atlantic Population	"Maximum Estimate" of the Number of Exposures to Sound Levels ≥ 160 dB (≥ 170 dB)
Fin whale	0	0	0
Blue whale	0	0	0
PINNIPED			
Hooded seal	0	0	0

^a% of Gulf of Mexico population. N.A. = not available.

Conclusions- Effects on Cetaceans

Strong avoidance reactions by several species of mysticetes to seismic vessels have been observed at ranges up to 8 km (4.3 nm) and occasionally as far as 30 km (16.2 nm) from the source vessel. In Arctic waters, 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 in the vicinity of seismic vessels. There are documented instances of dolphins approaching active seismic vessels. However, dolphins as well as some other types of odontocetes will 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.

The numbers of odontocetes that may be harassed by the proposed activities are small relative to the population sizes of the affected stocks. A maximum of 13660, 1481, and 654 bottlenose, Atlantic spotted, and pantropical spotted dolphins, respectively, (the most abundant delphinids in the proposed survey area) are expected to be exposed to seismic sounds greater than or equal to 160 dB. However, the best estimates for bottlenose, Atlantic spotted, and pantropical spotted dolphins are 9107, 988, and 436, respectively. This represents zero to 1.8 percent of the North Atlantic populations of these species based on population estimates. However, these dolphin species surveys have not been conducted for most of their range in the

North Atlantic Ocean and adjacent waters. Therefore the true percentages of the populations that might be exposed to seismic sounds greater than or equal to 160 dB are likely to be much less than 1.8 percent, as the population sizes and the zero to 1.8 percent are based on only a small fraction of their range and their actual population sizes are much larger.

In light of the type of take expected and the small percentages of affected stocks, the action is expected to have no more than a negligible impact on the affected species or stocks of marine mammals. In addition, mitigation measures such as controlled vessel speed, course alteration, look-outs, ramp-ups, and power-downs when marine mammals are seen within defined ranges (see Mitigation) should further reduce short-term reactions to disturbance, and minimize any effects on hearing sensitivity.

Conclusions- Effects on Pinnipeds

Pinnipeds are not expected to be encountered during the proposed seismic survey at the northern Yucatan Peninsula in the Gulf of Mexico. However, a conservative estimate of a maximum of 5 hooded seals may be affected by a portion of the proposed survey in the Gulf of Mexico if they are encountered. Responses of pinnipeds to acoustic disturbance are variable, but usually quite limited. If hooded seals were encountered, the proposed seismic survey would have, at most, a short-term effect on their behavior, falling within the definition of Level B harassment. The action would therefore have no more than a negligible impact on the affected species or stocks of pinnipeds.

Mitigation

The following mitigation measures are proposed for the subject seismic surveys, provided that they do not compromise operational safety requirements: (1) Speed and course alteration; (2) power-down and shut-down procedures; and (3) ramp-up procedures. Mitigation also includes marine mammal monitoring in the

vicinity of the arrays. These mitigation measures are further described here.

These mitigation measures will incorporate use of established safety radii which are equal to 1.5 times the distance from the arrays where sound levels ≥ 190 and 180 dB re 1 μ Pa rms (the criteria for onset of Level A harassment for pinnipeds and cetaceans respectively) are predicted to be received. LDEO has modeled the sound pressure fields for the 20-gun array in relation to distance and direction from the airguns and predicts that the 190-dB and 180-dB distance from the airgun array will be 275 ft (902 m) and 900 ft (2935 m) respectively.

The directional nature of the 20-airgun array to be used in this project is also an important mitigating factor. The airguns comprising these arrays will be spread out horizontally, so that the energy from the arrays will be directed mostly downward, resulting in lower sound levels at any given horizontal distance than would be expected at that distance if the source were omnidirectional with the stated nominal source level. Because the actual seismic source is a distributed sound source (20 guns) rather than a single point source, the highest sound levels measurable at any location in the water will be less than the nominal source level.

Speed and Course Alteration

If a marine mammal is detected outside the appropriate safety radius and, based on its position and the relative motion, is likely to enter the safety radius, the vessel's speed and/or direct course will be changed in a manner that also minimizes the effect to the planned science objectives. The marine mammal activities and movements relative to the seismic vessel will be closely monitored to ensure that the marine mammal does not approach within the safety radius. If the mammal appears likely to enter the safety radius, further mitigative actions will be taken, i.e., either further course alterations or shutdown of the airguns.