

action will have a negligible impact on the affected species or stocks.

Mitigation

For the proposed TAG seismic survey, LDEO will use a 20-gun array with a total volume of 8575 in³. Individual airguns will range in size from 80 to 850 in³. For the ADWBC cruise, LDEO will use 2 GI guns with a total volume of 210 in³. The airguns comprising these arrays will be spread out horizontally, so that the energy from the arrays will be directed mostly downward.

The sound pressure fields were modeled by LDEO in relation to distance and direction from the 2 GI guns and the 20-gun array, as shown in Figures 5 and 6 (LDEO Mid-Atlantic, 2003). The radii around the arrays where the received level would be 180-dB re 1 μ Pa (rms) (NMFS' threshold level for onset of Level A harassment applicable to cetaceans) were estimated as 54 m (177 ft) and 900 m (2953 ft), respectively, for the 2-GI and 20-gun array. The radii around the 2 GI guns and the 20-gun array where the received level would be 190 dB re 1 μ Pa (rms), (NMFS' threshold level for onset of Level A harassment applicable to pinnipeds), were estimated as 17 m (56 ft) and 275 m (902 ft), respectively. A calibration study was conducted prior to these surveys to determine the actual radii corresponding to each sound level. These actual radii will be used to define the safety radii to be used for this study. Until then, or if those measurements appear defective, LDEO will use a precautionary 1.5 times the modeled 180- (cetaceans) and 190- (pinnipeds) dB radii as the safety radii.

Vessel-based observers will monitor marine mammals in the vicinity of the arrays. LDEO proposes to power-down the airguns if marine mammals are observed within the proposed safety radii. Also, LDEO proposes to use a ramp-up procedure when commencing operations using the 20-gun array. Ramp-up will begin with the smallest gun in the array (80 in³), and guns will be added in a sequence such that the source level of the array will increase at a rate no greater than 6 dB per 5-minute period over a total duration of about 25 minutes. Ramp-up will not occur for the 2-GI gun array because the total air discharge volume is small (210 in³). Please refer to LDEO's application for more detailed information about the mitigation measures that are an integral part of the planned activity.

The directional nature of the 6-airgun array to be used in this project is an important mitigating factor, 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 (2 or 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.

Marine Mammal Monitoring

At least two vessel-based observers will be stationed aboard LDEO's seismic survey vessel during seismic operations in the Mid-Atlantic Ocean. It is proposed that one or two marine mammal observers aboard the seismic vessel will search for and observe marine mammals whenever seismic operations are in progress during daylight hours, and if feasible, during periods without seismic activity. Vessel-based observers will monitor for marine mammals near the seismic source vessel for at least 30 minutes prior to and during all daylight ramp-up and airgun operations, and during any nighttime startups of the airguns. Airgun operations will be suspended when marine mammals are observed within, or about to enter, the designated safety radii. Observers will not be on duty during ongoing seismic operations at night; bridge personnel will watch for marine mammals during this period and will call for the airguns to be powered down if marine mammals are observed in or about to enter the safety radii. At least one marine mammal observer will be on "standby" at night, in case bridge personnel see a marine mammal. An image-intensifier night-vision device (NVD) will be available for use at night. If the airguns are started up at night, two marine mammal observers will monitor for marine mammals near the source vessel for 30 minutes prior to start up using NVDs. The 30-minute observation period is only required prior to commencing seismic operations following an extended shut down period. After 30 minutes of observation, the ramp-up procedure will be followed.

The observers will watch for marine mammals from the highest practical vantage point on the vessel, which is either the flying bridge or the bridge. On the *R/V Maurice Ewing*, the observer's eye level will be approximately 11 m (36 ft) above sea level when stationed on the bridge, allowing for good visibility within a 210° arc. If observers are stationed on the flying bridge, the eye level will be 14.4 m (47.2 ft) above sea level. The proposed monitoring plan is summarized later in this document.

Mitigation During Operations

The following mitigation measures, as well as marine mammal monitoring, will be adopted during the proposed Mid-Atlantic seismic surveys, provided that doing so will not compromise operational safety requirements: (1) Speed or course alteration; (2) Power-down procedures; (3) Shut-down procedures; and (4) Ramp-up procedures.

Course Alteration

If a marine mammal is detected outside the 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.

Power-down and Shut-down Procedures

Received sound levels have been modeled for the 2-GI and 20-gun arrays. Based on the modeling, estimates of the 190-, 180-, 170-, and 160-dB re 1 μ Pa (rms) distances (safety radii) for these arrays have been provided previously in this document.

Airgun operations will be powered-down (or shut-down) immediately when cetaceans or pinnipeds are seen within or about to enter the appropriate 180-dB (rms) or 190-dB (rms) radius, respectively. These 180- and 190-dB criteria are consistent with guidelines listed for cetaceans and pinnipeds by NMFS (2000) and other guidance by NMFS. If a marine mammal is detected outside the safety radius but is likely to enter the safety radius, and if the vessel's course and/or speed cannot be changed to avoid having the marine mammal enter the safety radius, the airguns will be powered-down before the mammal is within the safety radius. Likewise, if a mammal is already within the safety radius when first detected, the airguns will be powered-down immediately. If a marine mammal is seen within the appropriate safety radius of the array while the guns are powered-down, airgun operations will be shut-down. For the power-down procedure for the 20-gun array, one 80 in³ airgun will be operated during the interruption of seismic survey. When the 2 GI guns are in use, a shut-down