to disturbance by sound (i.e., acoustic harassment).

Description of Habitat and Marine Mammal Affected by the Activity

The Southern California Bight (SCB) including the Channel Islands, supports a diverse assemblage of marine mammals including cetaceans (whales, dolphins, and porpoises) and pinnipeds (seals and sea lions). A detailed description of the SCB and its associated marine mammals can be found in the **Federal Register** (56 FR 1606, January 16, 1991) and need not be repeated here.

Approximately 34 species of marine mammals inhabit the SCB. They include 6 species of pinnipeds and 27 species of cetaceans. The status of these species has been reviewed previously (NMFS, 1991 ¹). Recently, NMFS released draft revised stock assessment reports (59 FR 40527; August 9, 1994).² These reports include information on status and trends of marine mammals and an assessment of all human-caused mortality and serious injury of the various stocks of marine mammals.

It is possible that acoustic harassment by seismic survey operations could potentially occur for mysticete whales and possibly the sperm whale, since they represent the only species assumed to hear well the noise associated with airguns. Given the survey location and the time period within which the survey will be conducted, the species of whales that could be potentially affected are the following: (1) Blue whale (*Balaenoptera musculus*); (2) fin whale (*Balaenoptera physalus*); (3) humpback whale (*Megaptera novaeangliae*); (4) minke whale (*Balaenoptera acutorostrata*); (5)

sperm whale (*Physeter macrocephalus*; (6) pygmy sperm whale (*Kogia breviceps*); (7) sei whale (*Balaenoptera borealis*); and (8) Bryde's whale (*Balaenoptera edeni*). In addition, because this proposed authorization may extend into the period of time when gray whales (*Eschrichtius robustus*) may be present, that species may also be affected. Detailed descriptions of the distribution and abundance of these species in California waters can be found in Barlow (1994, 1995), Forney (1994) Forney et al. (1995) and NMFS (1993).

Potential Effects of Seismic Surveys on Marine Mammals

The airguns emit pulsed energy primarily at frequencies in the 10 to 300 Hz range. Dolphin, porpoise, seal, and sea lion hearing is believed to be poor at frequencies less than 1,000 Hz, and thus it is unlikely that the airgun noise would significantly affect them. Acoustic harassment takes, therefore, need to be assessed only for mysticete whales and the sperm whale, because they represent the only group that is believed to be able to hear or possibly react to the sound associated with seismic activities.

To determine the numbers of whales that could potentially be subject to acoustic harassment, marine mammal densities were applied over the anticipated zone of potential disturbance (ZPD). The densities utilized (Barlow, 1995) were obtained along the California coast during the summer and fall seasons of the year, which is consistent with the time period of the proposed survey.

The ZPD was conservatively assumed to be the entire survey area (303 km²) plus an additional area to account for the travel of sound outside the survey area perimeter. To determine the outer boundary of the affected area, it was concluded that the 160 dB level could be considered a conservative end point for potential marine mammal acoustic harassment. Tyack (1988) indicates that avoidance behavior occurs only at relatively close ranges at decibels greater than 160-170 dB for pulsed sounds such as those from airguns. It has been presumed that less than 10 percent of animals located beyond the 160 dB range would be subjected to acoustic harassment (Malme et al., 1984; LGL Assoc., 1991). Therefore, NMFS has adopted a level of 160 dB (re $1\mu Pa)$ as an acceptable level for impulsive noise based upon the best scientific evidence available.

For the proposed survey, the 160 dB isopleth occurs at a radius of approximately 5.2 km from the seismic source (Exxon, 1995). The ZPD was calculated by expanding the entire perimeter of the SYU survey area by 5.2 km. This area was calculated to be 470 km², and when added to the survey area 303 km², resulted in a total ZPD of 773 km². However, at any instant of time, harassment would be limited to an area approximately 84.9 km², with a radius of 5.2 km around the airgun array when the array is generating sound.

Using the above information and assumptions, the number of marine mammals that could potentially be subject to acoustic harassment is as follows:

Whale species	Density ³ (number/km ²)	Number of animals ⁴ acoustic harassment
Blue whale	0.033	26
Fin whale	0.013	10
Humpback whale	0.009	7
Minke whale	0.008	6
Sperm whale	0.011	9
Pygmy sperm whale	0.013	10
Sei whale	0.001	1
Bryde's whale	0.001	1
Gray whale	0.014	11
Total		81

³ From Barlow (1995).

⁴ Density X ZPD=No. Animals.

¹ A list of references used in this document can be obtained by writing to the address provided above (see ADDRESSES).

²NMFS has established a bulletin board for electronic retrieval of marine mammal stock

assessment reports. The reports are stored as Wordperfect 5.1 files and may be downloaded by a modem link to the following telephone number: (703) 218–2595. Within your communications software, specify 8 data bits, no parity, and 1 stop bit. Set up as an ANSI terminal and use your

appropriate baud rate up to 19,200. Instructions to download files are available on screen.