Six-year compilation of cetacean sighting data collected during commercial seismic survey mitigation observations throughout the Gulf of Mexico, USA.

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ABSTRACT: Sightings data were collected as part of required mitigation from 2003-2008 during seismic surveys in the Gulf of Mexico, U.S.A. Mitigation measures include bi-weekly submission of sighting, survey, and observer effort reports. Nearly 3000 cetacean sightings, representing 19 species with over 35,000 individual animals recorded. The most common large cetacean encountered was the sperm whale, *Physeter macrocephalus*, (N=765 records). While all marine mammals are protected under the Marine Mammal Protection Act, sperm whales have additional protection under the Endangered Species Act and the presence of a sperm whale in the exclusion zone surrounding the airgun array requires a shut-down of all seismic activity. Airgun activity was recorded as full power, ramp-up, mitigation firing, or none. Sighting distances were recorded as the closest distance of the animals to the airgun array. Regardless of airgun activity, sperm whales were sighted at an average distance of 1807m. When airguns were at full-power (N=586), they were observed at an average of 1848m. When the mitigation gun was firing (N=86), the average was 1866m, and during ramp-up (N=18) the distance was 1936m. When the guns were silent, (n=169) the average was 1597m. There were 99 shut-downs due to sperm whales in the exclusion zone and 2 delays of a ramp-up. For all species, the average distance for all sightings regardless of airgun activity was 1070m. Of the sightings at full power (N=1762), the average distance was 1180m. When the mitigation gun was firing (N=275), the average sighting distance was 1015m, and during ramp-up (N=49) the sighting distance was 1124m. Observations made with the airguns off resulted in 597 sightings and an average distance of 816m. This dataset represents the largest volume of commercial seismic observer data in the United States and provides a useful tool for characterizing seismic activities in the Gulf of Mexico.

Figure 1. Gulf of Mexico Regional Map

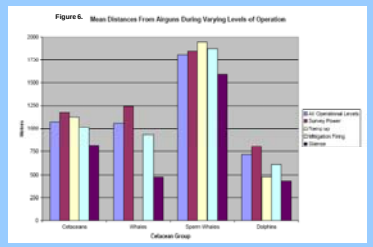
METHODS: For each protected species sighting the following data were collected: vessel name, survey type, MMS Permit Number, date, time, watch status, lat./long. of vessel, heading of vessel, bearing and estimated range to animal(s) at first sighting, water depth, species (identification to lowest possible taxonomic level), certainty of identification, total number of animals, number of juveniles, animal description, direction of animal's travel, behavior (note any observed changes in behavior), activity of vessel, airgun status, closest distance to animals from center of airgun or airgun array. If this sighting was of a whale(s) within the exclusion zone that resulted in a shut-down of the airguns, include in the sighting report the observed behavior of the whale(s) before shut-down, the observed behavior following shut-down (specifically noting any change in behavior), and the length of time between shut-down and subsequent ramp-up to resume the seismic survey (note if seismic survey was not resumed as soon as possible following shut-down).

INTRODUCTION: Mitigation is required for all geophysical operators working in water depths greater than 200m throughout the Gulf of Mexico and in all water depths in the Eastern Planning Area. (Figure 1). Between 2003 and 2008 there were approximately 16,380 vessel days in which protected species observations took place. The majority of surveys were performed in the Central Planning Area. The regulations follow NTL 2007-G02 (and previous versions) *Implementation of Seismic Survey Mitigation Measures and Protected Species Observer Program*. The mitigation measures require the following:

- •Use of 3 trained observers on board all source vessels
- •Observers must monitor an exclusion zone of 500m around the airguns and immediately around the vessel
- •Observers must maintain continuous watches during all gun operations during daylight hours
- •Operators must ramp up air gun array
- •Reports must be submitted to Minerals Management Service (MMS) on a biweekly basis
- •Cetaceans are grouped into the regulatory categories of Whales, which includes all Mysticete whales, sperm whales (Physeter), dwarf and pygmy sperm whales (Kogia), and all species of beaked whales (Ziphius, Mesoplodon); and Dolphins which includes all other Odontocetes.
- •Start of airguns must be delayed until exclusion zone is free of marine mammals and turtles for 30 minutes
- •Airguns must be shut off if a whale enters within 500m of the airgun source

Table 1. Summary data for cetacean sighting records

	All Cetacean Sightings	Whale Sightings (non-sperm whale)	Sperm Whale Sightings	Dolphin Sightings
Total Records	2808	31	765	1848
% Cetacean Sightings	100.00	1.10	29.42	65.81
Mean Group Size	10.6	2.05	2.46	15.56
Mean sighting frequency per 100 vessel days	17.161	0.189	4.67	11.294
Number of shutdowns or delays in gun operations	129	3	101	25.00
Mean mitigation actions per 100 vessel days	0.788	0.018	0.617	0.153
Mean Water Depth	1320.3	1605.9	1468.1	1245.5



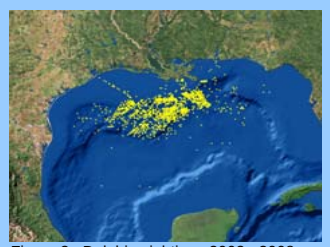


Figure 3. Dolphin sightings 2003 - 2008

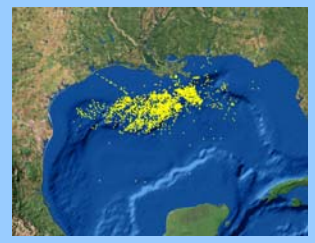


Figure 2. All cetacean sightings 2003-2008

Figure 4. Whale sightings excluding sperm whales

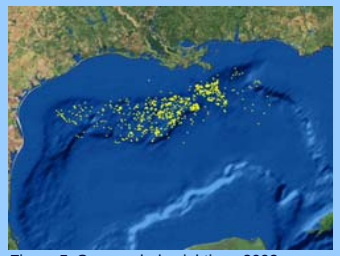
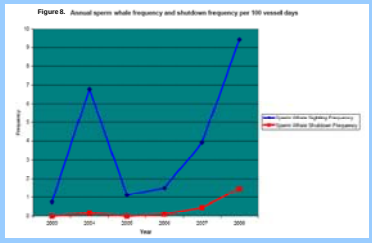


Figure 5. Sperm whale sightings 2003 - 2008

Results and Discussion: Species distribution was concentrated in slope areas of the GoM. Sperm whale sighting frequency was greatest during the months of May through September with annual peaks in 2004, 2007, and 2008. Sighting peaks in 2007 and 2008 may be due to the increase in Wide Azimuth Surveys (WaZ) becoming a choice survey methodology over that period. In a WaZ survey,3 to 6 seismic vessels work in conjunction with one another for geophysical data collection. All vessels typcially remain within 5km of one another thus increasing the overall survey area for observers. Overall sighting distances were closer for all species groups when guns were silent verses at times when there were any other gun operations ongoing. Mitigation measures remained low for all species with sperm whales having the highest shutdown frequency. Operational delays due to sperm whlaes resulting in only 95 hours of downtime over the six year period.



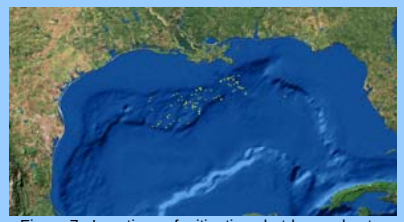


Figure 7. Locations of mitigation shutdowns due to sperm whales

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