# United States Department of the Interior

MINERALS MANAGEMENT SERVICE
Gulf of Mexico OCS Region
1201 Elmwood Park Boulevard
New Orleans, Louisiana 70123-2394



In Reply Refer To: MS 5430

SEP 29 2004

Ms. Laurie Allen
Director, Office of Protected Resources
National Oceanic and Atmospheric Administration-Fisheries
1315 East West Highway, Room 13821
Silver Spring, Maryland 20910

Dear Ms. Allen:

The Minerals Management Service (MMS) hereby petitions, as a precautionary measure, for rulemaking under section 101(a)(5) of the Marine Mammal Protection Act (MMPA) to authorize any potential take of marine mammals incidental to seismic surveys ("specified activity") in the Gulf of Mexico ("specified geographic region"). This taking will involve only small numbers of marine mammals, have no more than a negligible impact on the species or stock, and have no unmitigable adverse impact on the availability of the species or stock for subsistence uses. The MMS includes the potential incidental take of the only commonly-occurring listed marine mammal in the Gulf of Mexico, the sperm whale, as well as the unlisted marine mammal species including dolphins, beaked whales and Bryde's whales, in this petition for rulemaking. This petition supplements the original petition submitted on December 26, 2002, that addressed only sperm whales.

The fourteen items of supporting information required at 50 CFR 216.104 for take authorizations are addressed in the enclosure to this letter. This package is based on the MMS Final Programmatic Environmental Assessment, "Geological and Geophysical Exploration for Mineral Resources on the Gulf of Mexico Outer Continental Shelf", copies of which have already been provided to your staff.

A copy is available at: http: //www.gomr.mms.gov/homepg/regulate/environ /nepa/2004-054.pdf. The final Programmatic Environmental Assessment (PEA) was prepared for the MMS by Continental Shelf Associates (CSA), a consulting firm. This document has undergone extensive review by MMS, other federal agencies, and interested parties. The final PEA was released to the public on July 30, 2004.

Your consideration of this petition for rulemaking is greatly appreciated. For purposes of coordination and further clarification, please contact Mr. Greg Gould, Chief, Environmental Division, at (703) 787-1616.

Sincerely,

Chris Oynes

Chris Oynes

Enclosure

cc: T. Readinger, w/encl (MS 4000)
J. Bennett, w/encl (MS 4042)
G. Gould, w/encl (MS 4023)
B. LaBelle, w/encl (MS 4040)

# Request to National Oceanic and Atmospheric Administration (NOAA) for Incidental Take regulations governing Seismic Surveys on the Outer Continental Shelf (OCS) of the Gulf of Mexico (GOM)
(A response to Subpart I — MMPA Petitioning Requirements at 50 CFR §216.104)

29 September 2004

## (1) A Detailed Description of the Specific Activity or Class of Activities That Can Be Expected To Result in Incidental Taking of Marine Mammals;

Geophysical surveys are performed to obtain information on surface and near-surface geology (high-resolution surveys) and on subsurface structures and formations (seismic surveys and vertical seismic profile (VSP) surveys). Geophysical surveys take place before and after a lease sale. High-resolution surveys done in support of lease operations are authorized under the terms of a lease agreement and are referred to as post-lease surveys. Seismic surveys are performed before and after lease sales, are primarily performed off-lease or on lands leased to a third party, and are authorized under Minerals Management Service's (MMS) permitting program as mandated under the OCS Lands Act.

Seismic surveys are generally deep penetrating and are used to obtain data about geologic formations greater than 300 m below the seafloor. Typical seismic surveying operations tow an array of airguns (the seismic sound source) and one or more streamers (cable(s) with hydrophone signal receivers) behind the vessel 5 to 10 m below the sea surface. An alternative to streamers is the deployment of seafloor geophones connected to ocean bottom cables (OBC). The airgun array produces underwater sound waves by releasing compressed air into the water column, creating an acoustical energy pulse. The intermittent release of compressed air creates a regular series of strong acoustic impulses separated by silent periods lasting up to 16 seconds, depending on survey type and depth to the target formations. The acoustic signals are reflected off subsurface structures and sediments and recorded back near the surface via the hydrophones in the streamer(s) or OBC geophones. Streamers are often 3 to 12 km in length and the speed at which the vessels tow them varies depending on the type of survey, but is typically 4.5 to 5 kt (about 5 to 6 mph) with gear deployed.

High-resolution surveys collect data on surface and near-surface geology used to identify archeological sites, potential shallow geologic and manmade hazards for engineering, and site planning for bottom-founded structures. Seismic surveys include both two-dimensional (2-D) and three-dimensional (3-D) surveys and data from these surveys are used to map the structural characteristics of stratigraphically important horizons in order to identify potential hydrocarbon traps.

*Deep Seismic*

For 2-D seismic surveys, a single streamer is towed behind the survey vessel, together with a single source or airgun array. Seismic vessels generally follow a systematic pattern during a survey, typically a simple grid pattern for 2-D work with lines no closer than half a kilometer. In simplistic terms, 3-D surveys collect a very large number of 2-D slices, with minimum line separations of only 25 to 30 m. A 3-D survey may take months to complete and involves a precise definition of the survey area and transects, including multiple passes to cover a given survey area. For seismic surveys, 3-D methods represent a

substantial improvement in resolution and useful information relative to 2-D methods. Most areas in the Gulf of Mexico previously surveyed using 2-D have been or will be surveyed using 3-D.

The 3-D seismic surveying provides the opportunity to create higher resolution subsurface images and to resolve imaging challenges, thereby enabling a more accurate assessment of potential hydrocarbon reservoirs. As a result the oil and gas industry is able to optimally locate exploration and development wells, thereby maximizing the success rate of exploration wells and minimizing the number of wells required to develop a field. State-of-the-art interactive computer mapping systems can handle much denser data coverage than the older 2-D seismic surveys. Multiple-source and multiple-streamer technologies are used for 3-D seismic surveys. A typical 3-D survey might employ a dual array of 18 guns per array. Each array might emit a 3,000-$in^3$ burst of compressed air at 2,000 pounds per square inch (psi). At 10 m from the source, the pressure experienced is approximately ambient pressure plus 1 atmosphere (atm). The streamer array might consist of 6 to 8 parallel cables, each 3,000 to 12,000 m long, spaced 25 to 100 m apart. An 8-streamer array used for deepwater surveys is typically 700 m wide. A series of 3-D surveys collected over time (commonly referred to as four-dimensional or 4-D seismic surveying) is used for reservoir monitoring and management (the movement of oil, gas, and water in reservoirs can be observed over time). Increasingly, the data collected in a 3-D seismic survey can be processed to provide near surface images adequate for many of the needs previously met by high-resolution surveys. Post-lease geophysical surveying may include high-resolution, 2-D, 3-D, or VSP surveying.

Seismic surveying is deeper penetration, high energy and low frequency (2-D, 3-D, or 4-D) and may also be done post-lease for more accurate identification of potential reservoirs, thereby aiding in the identification of additional reservoirs in "known" fields. This 3-D technology can be used in developed areas to identify bypassed hydrocarbon-bearing zones in currently producing formations and new productive horizons near or below currently producing formations. It can also be used in developed areas for reservoir monitoring and field management. The 4-D seismic surveying is used for reservoir monitoring and management, as well as in identifying bypassed "pay zones." Through time-lapsed surveys, the movement of oil, gas, and water in reservoirs can be observed over time, and that critical information used to adjust production techniques and decisions, leading to more efficient production of the reservoir and the ultimate recovery of a greater portion of the original oil and gas in place. Surveying may occur periodically throughout the productive life of a lease, as frequently as every six months.

*Vertical Seismic Profile (VSP) Surveys*

VSP surveys are surveys where seismic data are recorded from a vertical array of sensors placed in a borehole – usually a well bore (i.e., a hole vertical to the ocean surface or seafloor) with seismic sources deployed near the surface of the water in various geometries around the vertical array of sensors. When the seismic source is placed very close to vertically above the array of sensors, the survey is called a zero offset VSP, or check shot survey. These surveys are commonly used to correlate geologic data to seismic data. When the seismic source is placed in a series of positions along a radial line from the vertical array of sensors, the survey is called a walk-away survey. These surveys are used to obtain information about the nature of the seismic signal as well as more information about the geology surrounding the vertical array of sensors. Zero offset and walk-away VSP surveys are by far and away the most common VSP surveys conducted in the Gulf of Mexico. Less common are 3-D VSP surveys, where the source is deployed in an area surrounding the vertical array of sensors. 3-D VSP surveys provide more detailed information in the area surrounding the vertical array of sensors and are especially beneficial where salt layers stand between the geologic objective and the surface, as is the case in significant areas of the Gulf of Mexico. In some cases, where salt is present, 3-D VSP surveys are the only way to obtain geologic information below the salt layers.

The seismic sources used to in VSP surveys are the same as those used in conventional seismic surveys. Zero offset surveys are conducted using a small volume single airgun suspended by a crane located on the deck of the drilling rig. Walk-away surveys utilize a workboat equipped to operate airgun arrays of four to eight airguns. 3-D VSP surveys use the same airgun arrays as used for conventional 2-D and 3-D surveys. These airgun arrays can vary from 1,000 $in^3$ to 5,000 $in^3$, depending upon the depth of the objective. Two or three arrays are towed behind the source vessel. When two arrays are used, the centers of the arrays are from 60 to 80 m perpendicular to the centerline of the vessel axis. When a third array is added, it is placed between the outside two arrays (along the centerline of the vessel). Typical airgun array depths are 7 to 10 m below the surface.

Total time spent on VSP surveys depends upon the type of survey, the objectives of the survey, the cost of the drilling rig, and the equipment used. For a zero offset survey or a walk-away survey, the survey can take less than a day, in the absence of any serious equipment failures. For a zero offset survey, the airguns are fired four to eight times over 20 seconds, followed by a 5- to 20-minute quiet time during which the sensor string is raised; the airguns are fired again for four to eight times over 20 seconds and so on until the survey is completed. A 3-D VSP survey may require up to 10 days to complete; however, 30% of that time may be with the airguns in standby mode.

*High Resolution Surveys*

High-resolution site surveys are conducted to investigate the shallow subsurface for geohazards and soil conditions, as well as to identify potential benthic biological communities (or habitats) and archaeological resources in support of review and mitigation measures for OCS exploration and development plans. Information also can be recovered at much greater depths, so that some surveys are used for exploration purposes. A typical operation consists of a ship towing an airgun about 25 m behind the ship and a 600-m streamer cable with a tail buoy. The ship travels at 3 to 3.5 kn (5.6 to 6.5 km/h), and the airgun is fired every 7 to 8 s (or about every 12.5 m). Typical surveys cover one lease block, which is 4.8 km on a side. MMS regulations require information be gathered on a 300- by 900-m grid, which amounts to about 129 line km of data per lease block. If the MMS has identified a block as having a high probability for the presence of historic archaeological resources (i.e., shipwrecks), grid points must be on a 50 m spacing (i.e., pursuant to NTL No. 2002-G01). Including line turns, the time to survey one block is about 36 h; however, streamer and airgun deployment and other operations add to the total survey time.

High-resolution surveying is done on a site-specific or lease-specific basis or along a proposed pipeline route. These surveys are used to identify potential shallow, geologic hazards for engineering and site planning for bottom-founded structures. They are also used to identify environmental resources such as hard-bottom areas, topographic features, or historical archaeological resources. Post-lease, high-resolution seismic surveying is usually done at least once for each lease, except for leases where previous surveys preclude the requirement for new surveys.

Recently, 3D high resolution surveys using ships towing multiple streamer cables have become available. Since multiple streamers are towed, the ships tend to be slightly larger (47 m vs. 37 m). Up to six streamers 100 to 200 m long are used with a tri-cluster of airguns.

(Information is from the MMS Final Programmatic Environmental Assessment on Geological and Geophysical Exploration for Mineral Resources on the Gulf of Mexico Outer Continental Shelf (MMS, 2004). Also please refer to the 2004 G&G EA, Sections I and II, and Appendices C and D for a more thorough discussion of seismic operations.)

## (2) The Date(s) and Duration of Such Activity and the Specific Geographical Region Where It Will Occur;

Oil and gas exploration on parts of the continental shelf of the northern GOM (U.S. waters north of the Exclusive Economic Zone (EEZ) boundary) is in a mature state, although large discoveries are expected in deeper waters. The Eastern GOM remains largely under explored. From a seismic survey view, about 1,300 blocks in the Western and Central Planning Areas have not yet been surveyed with 3-D seismic techniques (R. Brinkman, MMS Gulf of Mexico Region, personal communication, 2004). A lower level of new seismic survey activity is expected to occur in the Eastern Planning Area compared to the Central and Western Planning Areas. Industry activity in the Eastern Gulf has historically been limited to the westernmost portions of the planning area due to lack of availability of acreage for lease and is usually defined by the 5-Year Leasing Program. Figure 2-1 defines MMS planning areas and protraction boundaries.

The different types of geophysical survey activity in the northern Gulf can occur on any day of a given year during the time period of the requested rule (5 years). Specific geophysical surveys may span one day, weeks, or months. Appendix D of the Final Programmatic Environmental Assessment for Geological and Geophysical Exploration for Mineral Resources on the Gulf of Mexico Outer Continental Shelf characterizes the different types of operations and equipment applicable to geophysical surveys employed in the region (MMS, 2004).

Geophysical surveys may be conducted in any Federal or state waters of the Gulf of Mexico. Tables 2.1, 2.2, and 2.3 project the anticipated activities for VSP, deep seismic, and high-resolution geophysical survey operations in the Gulf of Mexico OCS Region (GOMR) over the next five years. Estimated geophysical activity is further divided by MMS protraction areas. The upper portion of each of the three tables contains the values with which the MMS Gulf of Mexico Region's Office of Resource Evaluation (RE) regards as most reasonable for anticipated activity. The projected "most likely" (ML) surveys were obtained through calls to various companies active in the GOMR. The "minimum number" (MN) is the low estimate of their anticipated activity while the "maximum" (MX) reflects the highest number of surveys done in past years. The numbers in the lower portion of the tables provide a projected range of survey activities by year for various protraction areas in the GOM. Additionally:

- The projected locations for VSP surveys reflect the areas where new plays in deep water are developing and where deep gas incentives are available on the shelf.
- The location of the deep seismic surveys approximate past activities and the areas that may be due for replacement data based on past activity. The values provided reflect navigation miles, not line miles of data.
- The location of the high-resolution surveys generally reflects the scattered distribution of leases in the GOMR. The ultra-deepwater protraction areas have zero miles for the MN and ML reflecting the 10-year lease term for drilling, new technology (i.e. autonomous underwater vehicles—AUV's), and the sometimes allowed practice of using specially processed 3-D surveys in lieu of a high-resolution survey for shallow hazard detection. The MMS has projected the estimated miles to be surveyed by high-resolution surveys in the MX column to reflect changing technologies.

Figure 2-1. Mineral's Management Service's Gulf of Mexico Planning Areas and Protraction Boundaries

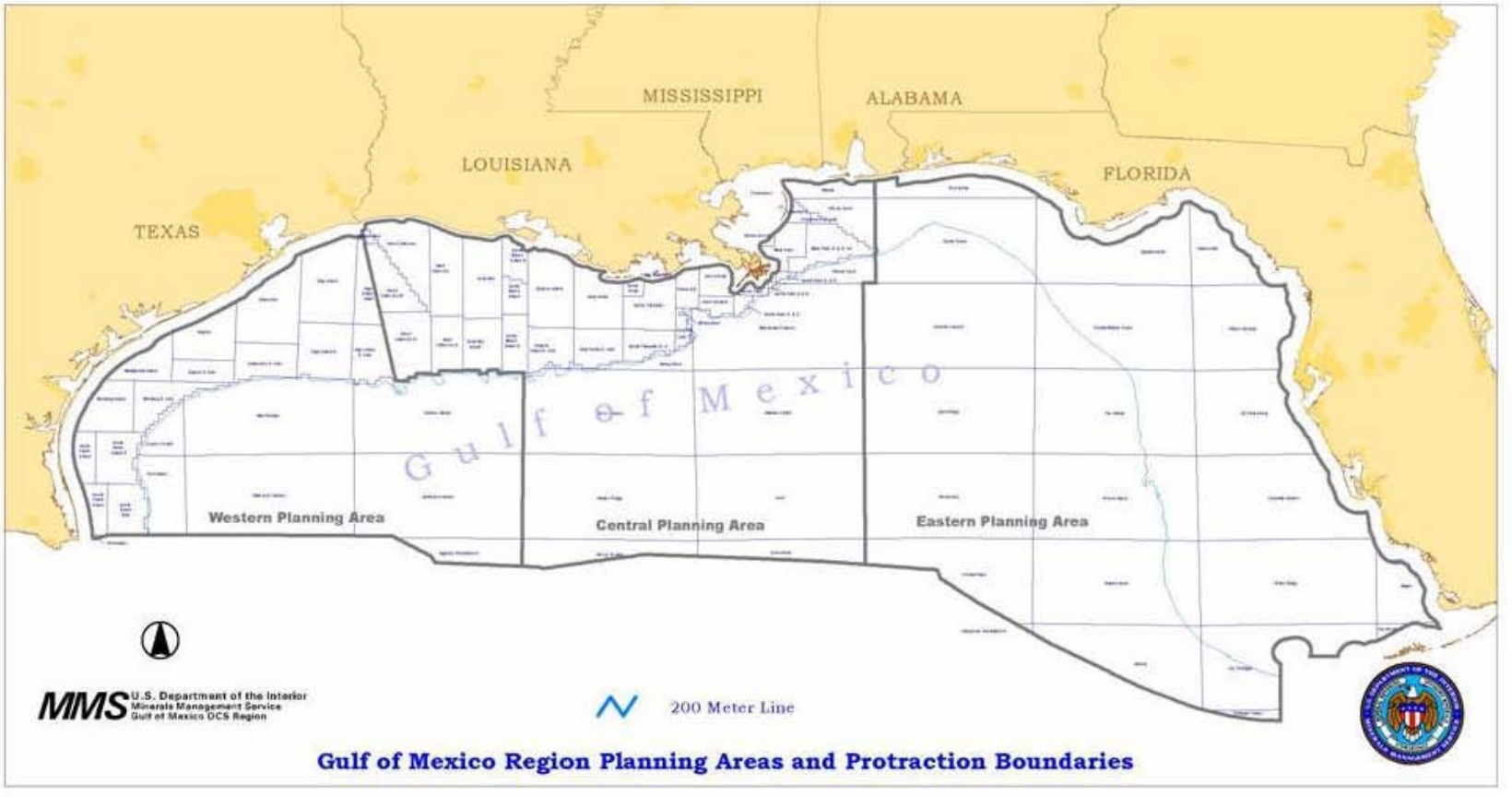

Table 2.1 Projected vertical Seismic Profiling (VSP) Operations in the GOM for 2004-2009

| (Number of Surveys) | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Annual Estimates** | | | **5 Year Estimates** | | | | | | | | | | | | | | |
| | ML | MN | MX | ML | MN | MX | | | | | | | | | | | | |
| Deep Water | 80 | 75 | 85 | 400 | 375 | 425 | | | | | | | | | | | | |
| Shallow Water | 135 | 125 | 140 | 675 | 625 | 700 | | | | | | | | | | | | |
| **Total** | **215** | **200** | **225** | **1,075** | **1,000** | **1,125** | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| **Possible Annual Scenarios** | | | | | | | | | | | | | | | | | | |
| | **YEAR 1** | | | **YEAR 2** | | | **YEAR 3** | | | **YEAR 4** | | | **YEAR 5** | | | **5 YEAR TOTALS** | | |
| | **ML** | **MN** | **MX** | **ML** | **MN** | **MX** | **ML** | **MN** | **MX** | **ML** | **MN** | **MX** | **ML** | **MN** | **MX** | **ML** | **MN** | **MX** |
| **SHALLOW WATER** | | | | | | | | | | | | | | | | | | |
| *East of river to AL/FL* | 20 | 19 | 21 | 20 | 19 | 21 | 20 | 19 | 21 | 20 | 19 | 21 | 20 | 19 | 21 | 100 | 95 | 105 |
| *West of river: West Delta – Eugene Island* | 45 | 43 | 46 | 45 | 43 | 46 | 45 | 43 | 46 | 45 | 43 | 46 | 45 | 43 | 46 | 225 | 215 | 230 |
| *West of river: South Marsh Island – West Cameron* | 45 | 43 | 46 | 45 | 43 | 46 | 45 | 43 | 46 | 45 | 43 | 46 | 45 | 43 | 46 | 225 | 215 | 230 |
| *Texas: High Island - Brazos* | 20 | 16 | 21 | 20 | 16 | 21 | 20 | 16 | 21 | 20 | 16 | 21 | 20 | 16 | 21 | 100 | 80 | 105 |
| *Texas: Matagorda – South Padre* | 5 | 4 | 6 | 5 | 4 | 6 | 5 | 4 | 6 | 5 | 4 | 6 | 5 | 4 | 6 | 25 | 20 | 30 |
| **TOTALS SHALLOW** | **135** | **125** | **140** | **135** | **55** | **140** | **135** | **55** | **140** | **135** | **125** | **140** | **135** | **125** | **140** | **675** | **625** | **700** |
| **DEEP WATER** | | | | | | | | | | | | | | | | | | |
| *East GOM off AL* | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 20 | 20 | 20 |
| *Viosca Knoll* | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 25 | 25 | 25 |
| *Mississippi Canyon* | 10 | 9 | 11 | 10 | 9 | 11 | 10 | 9 | 11 | 10 | 9 | 11 | 10 | 9 | 11 | 50 | 45 | 55 |
| *Atwater Valley -Lund* | 5 | 4 | 6 | 5 | 4 | 6 | 5 | 4 | 6 | 5 | 4 | 6 | 5 | 4 | 6 | 25 | 20 | 30 |
| *Ewing Bank* | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 30 | 30 | 30 |
| *Green Canyon* | 10 | 9 | 11 | 10 | 9 | 11 | 10 | 9 | 11 | 10 | 9 | 11 | 10 | 9 | 11 | 50 | 45 | 55 |
| *Walker Ridge* | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 30 | 30 | 30 |
| *Garden Banks* | 10 | 9 | 11 | 10 | 9 | 11 | 10 | 9 | 11 | 10 | 9 | 11 | 10 | 9 | 11 | 50 | 45 | 55 |
| *Keathley Canyon* | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 30 | 30 | 30 |
| *East Breaks* | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 25 | 25 | 25 |
| *Alaminos Canyon* | 10 | 9 | 11 | 10 | 9 | 11 | 10 | 9 | 11 | 10 | 9 | 11 | 10 | 9 | 11 | 50 | 45 | 55 |
| *Corpus Christi – Padre Island* | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 15 | 15 | 15 |
| **TOTALS DEEP** | **80** | **75** | **85** | **80** | **75** | **85** | **80** | **75** | **85** | **80** | **75** | **85** | **80** | **75** | **85** | **400** | **375** | **425** |
| **ANNUAL TOTALS** | **120** | **95** | **130** | **120** | **95** | **130** | **120** | **95** | **130** | **120** | **95** | **130** | **120** | **95** | **130** | **1,075** | **1,000** | **1,125** |

Table 2.2 Projected Deep Seismic Operations in the GOM for 2004-2009.

| | Annual Estimates (Blks) | | | 5 Year Estimates (Blks) | | | Annual Estimates (Line Miles) | | | 5 Year Estimates (Line Miles) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Deep Water | ML | MN | MX | ML | MN | MX | ML | MN | MX | ML | MN | MX | | | | | | |
| 3D | 1,800 | 1,350 | 2,500 | 9,000 | 6,750 | 12,500 | 90,000 | 67,500 | 125,000 | 450,000 | 337,500 | 625,000 | | | | | | |
| 2D | | | | | | | 20,000 | 15,000 | 25,000 | 100,000 | 75,000 | 125,000 | | | | | | |
| **TOTAL DEEP WATER** | **1,800** | **1,350** | **2,500** | **9,000** | **6,750** | **12,500** | **110,000** | **82,500** | **150,000** | **550,000** | **412,500** | **750,000** | | | | | | |
| Shallow Water | | | | | | | | | | | | | | | | | | |
| 3D | 200 | 150 | 500 | 1000 | 750 | 2,500 | 10,000 | 7,500 | 25,000 | 50,000 | 37,500 | 125,000 | | | | | | |
| 2D | | | | | | | 10,000 | 7,500 | 25,000 | 50,000 | 37,500 | 125,000 | | | | | | |
| **TOTAL SHALLOW WATER** | **200** | **150** | **500** | **1,000** | **750** | **2,500** | **20,000** | **15,000** | **50,000** | **100,000** | **75,000** | **250,000** | | | | | | |
| **TOTAL** | **2,000** | **1,500** | **3,000** | **10,000** | **7,500** | **15,000** | **130,000** | **97,500** | **200,000** | **650,000** | **487,500** | **1,000,000** | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |

**Possible Annual Scenarios**

| | YEAR 1 | | | YEAR 2 | | | YEAR 3 | | | YEAR 4 | | | YEAR 5 | | | 5 YEAR TOTALS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **ML** | **MN** | **MX** | **ML** | **MN** | **MX** | **ML** | **MN** | **MX** | **ML** | **MN** | **MX** | **ML** | **MN** | **MX** | **ML** | **MN** | **MX** |
| **SHALLOW WATER** | | | | | | | | | | | | | | | | 0 | 0 | 0 |
| *East of river to AL/FL* | 2,500 | 2,000 | 5,000 | 2,500 | 2,000 | 5,000 | 2,500 | 2,000 | 5,000 | 4,000 | 3,000 | 10,000 | 4,000 | 3,000 | 10,000 | 15,500 | 12,000 | 35,000 |
| *West of river: West Delta – Eugene Island* | 8,000 | 6,000 | 20,000 | 7,000 | 5,000 | 18,000 | 5,000 | 4,000 | 15,000 | 4,000 | 3,000 | 10,000 | 4,000 | 3,000 | 10,000 | 28,000 | 21,000 | 73,000 |
| *West of river: South Marsh Island – West Cameron* | 5,000 | 4,000 | 15,000 | 6,000 | 5,000 | 17,000 | 8,000 | 6,000 | 20,000 | 4,000 | 3,000 | 10,000 | 4,000 | 3,000 | 10,000 | 27,000 | 21,000 | 72,000 |
| *Texas: High Island - Brazos* | 3,500 | 2,500 | 8,000 | 3,500 | 2,500 | 8,000 | 3,500 | 2,500 | 8,000 | 6,000 | 5,000 | 15,000 | 5,000 | 4,000 | 12,000 | 21,500 | 16,500 | 51,000 |
| *Texas: Matagorda Island – South Padre* | 1,000 | 500 | 2,000 | 1,000 | 500 | 2,000 | 1,000 | 500 | 2,000 | 2,000 | 1,000 | 5,000 | 3,000 | 2,000 | 8,000 | 8,000 | 4,500 | 19,000 |
| **TOTALS SHALLOW** | **20,000** | **15,000** | **50,000** | **20,000** | **15,000** | **50,000** | **20,000** | **15,000** | **50,000** | **20,000** | **15,000** | **50,000** | **20,000** | **15,000** | **50,000** | **100,000** | **75,000** | **250,000** |

Table 2.2 Projected Deep Seismic Operations in the GOM for 2004-2009 (continued).

| | YEAR 1 | | | YEAR 2 | | | YEAR 3 | | | YEAR 4 | | | YEAR 5 | | | 5 YEAR TOTALS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **ML** | **MN** | **MX** | **ML** | **MN** | **MX** | **ML** | **MN** | **MX** | **ML** | **MN** | **MX** | **ML** | **MN** | **MX** | **ML** | **MN** | **MX** |
| **DEEP WATER** | | | | | | | | | | | | | | | | | | |
| *East GOM off AL* | 1,000 | 500 | 2,000 | 1,000 | 500 | 2,000 | 1,000 | 500 | 4,000 | 3,000 | 2,500 | 5,000 | 3,000 | 2,500 | 5,000 | 9,000 | 6,500 | 18,000 |
| *Viosca Knoll* | 3,000 | 1,500 | 5,000 | 3,000 | 1,500 | 5,000 | 4,000 | 3,000 | 6,000 | 5,000 | 3,000 | 8,000 | 5,000 | 3,000 | 8,000 | 20,000 | 12,000 | 32,000 |
| *Mississippi Canyon* | 5,000 | 3,000 | 7,500 | 5,000 | 3,000 | 7,500 | 6,000 | 3,000 | 10,000 | 16,000 | 12,000 | 20,000 | 16,000 | 12,000 | 20,000 | 48,000 | 33,000 | 65,000 |
| *Atwater Valley – Lund* | 7,000 | 5,000 | 12,500 | 7,000 | 5,000 | 12,500 | 7,000 | 5,000 | 14,000 | 14,000 | 12,000 | 17,500 | 14,000 | 12,000 | 17,500 | 49,000 | 39,000 | 74,000 |
| *Ewing Bank* | 4,000 | 3,000 | 6,000 | 4,000 | 3,000 | 6,000 | 4,000 | 3,000 | 6,000 | 5,000 | 3,000 | 8,000 | 5,000 | 3,000 | 8,000 | 22,000 | 15,000 | 34,000 |
| *Green Canyon* | 6,000 | 4,000 | 8,000 | 6,000 | 4,000 | 8,000 | 6,000 | 4,000 | 8,000 | 16,000 | 12,000 | 20,000 | 16,000 | 12,000 | 20,000 | 50,000 | 36,000 | 64,000 |
| *Walker Ridge* | 10,000 | 8,000 | 20,000 | 10,000 | 8,000 | 20,000 | 15,000 | 13,000 | 20,000 | 14,000 | 12,000 | 17,500 | 14,000 | 12,000 | 17,500 | 63,000 | 53,000 | 95,000 |
| *Garden Banks* | 20,000 | 15,000 | 22,000 | 20,000 | 15,000 | 22,000 | 6,000 | 4,000 | 8,000 | 8,000 | 6,000 | 12,000 | 8,000 | 6,000 | 12,000 | 62,000 | 46,000 | 76,000 |
| *Keathley Canyon* | 15,000 | 13,000 | 20,000 | 15,000 | 13,000 | 20,000 | 20,000 | 15,000 | 22,000 | 7,500 | 5,000 | 10,000 | 7,500 | 5,000 | 10,000 | 65,000 | 51,000 | 82,000 |
| *East Breaks* | 15,000 | 13,000 | 20,000 | 15,000 | 13,000 | 20,000 | 20,000 | 15,000 | 22,000 | 7,500 | 5,000 | 10,000 | 7,500 | 5,000 | 10,000 | 65,000 | 51,000 | 82,000 |
| *Alaminos Canyon* | 20,000 | 15,000 | 22,000 | 20,000 | 15,000 | 22,000 | 15,000 | 13,000 | 20,000 | 8,000 | 6,000 | 12,000 | 8,000 | 6,000 | 12,000 | 71,000 | 55,000 | 88,000 |
| *Corpus Christi – Padre Island* | 4,000 | 1,500 | 5,000 | 4,000 | 1,500 | 5,000 | 6,000 | 4,000 | 10,000 | 6,000 | 4,000 | 10,000 | 6,000 | 4,000 | 10,000 | 26,000 | 15,000 | 40,000 |
| **TOTALS DEEP** | **110,000** | **82,500** | **150,000** | **110,000** | **82,500** | **150,000** | **110,000** | **82,500** | **150,000** | **110,000** | **82,500** | **150,000** | **110,000** | **82,500** | **150,000** | **550,000** | **412,500** | **750,000** |
| **ANNUAL TOTALS** | **130,000** | **97,500** | **200,000** | **130,000** | **97,500** | **200,000** | **130,000** | **97,500** | **200,000** | **130,000** | **97,500** | **200,000** | **130,000** | **97,500** | **200,000** | **650,000** | **487,500** | **1,000,000** |

Table 2.3 Projected High-Resolution Seismic Operations in the GOM for 2004-2009

| | Annual Estimates (Line Miles) | | | 5 Year Estimates (Line Miles) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ML | MN | MX | ML | MN | MX | | | | | | | | | | | | |
| Deep Water | 2500 | 2000 | 4000 | 12500 | 10000 | 20000 | | | | | | | | | | | | |
| Shallow Water | 10000 | 7500 | 12500 | 50000 | 37500 | 62500 | | | | | | | | | | | | |
| **TOTALS** | **12500** | **9500** | **16500** | **62500** | **47500** | **82500** | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| **Possible Annual Scenarios** | | | | | | | | | | | | | | | | | | |
| | **YEAR 1** | | | **YEAR 2** | | | **YEAR 3** | | | **YEAR 4** | | | **YEAR 5** | | | **5 YEAR TOTALS** | | |
| | **ML** | **MN** | **MX** | **ML** | **MN** | **MX** | **ML** | **MN** | **MX** | **ML** | **MN** | **MX** | **ML** | **MN** | **MX** | **ML** | **MN** | **MX** |
| **SHALLOW WATER** | | | | | | | | | | | | | | | | | | |
| *East of river to AL/FL* | 1500 | 1000 | 1750 | 1500 | 1000 | 1750 | 1500 | 1000 | 1750 | 1500 | 1000 | 1750 | 1500 | 1000 | 1750 | 7500 | 5000 | 8750 |
| *West of river: West Delta – Eugene Island* | 2500 | 2000 | 3200 | 2500 | 2000 | 3200 | 2500 | 2000 | 3200 | 2500 | 2000 | 3200 | 2500 | 2000 | 3200 | 12500 | 10000 | 16000 |
| *West of river: South Marsh Island – West Cameron* | 2500 | 2000 | 3200 | 2500 | 2000 | 3200 | 2500 | 2000 | 3200 | 2500 | 2000 | 3200 | 2500 | 2000 | 3200 | 12500 | 10000 | 16000 |
| *Texas: High Island - Brazos* | 2500 | 2000 | 3200 | 2500 | 2000 | 3200 | 2500 | 2000 | 3200 | 2500 | 2000 | 3200 | 2500 | 2000 | 3200 | 12500 | 10000 | 16000 |
| *Texas: Matagorda Island – South Padre* | 1000 | 500 | 1150 | 1000 | 500 | 1150 | 1000 | 500 | 1150 | 1000 | 500 | 1150 | 1000 | 500 | 1150 | 5000 | 2500 | 5750 |
| **TOTALS SHALLOW** | 10000 | 7500 | 12500 | 10000 | 7500 | 12500 | 10000 | 7500 | 12500 | 10000 | 7500 | 12500 | 10000 | 7500 | 12500 | 50000 | 37500 | 62500 |
| **DEEP WATER** | | | | | | | | | | | | | | | | | | |
| *East GOM off AL* | 0 | 0 | 100 | 0 | 0 | 100 | 0 | 0 | 100 | 0 | 0 | 100 | 0 | 0 | 100 | 0 | 0 | 500 |
| *Viosca Knoll* | 200 | 100 | 300 | 200 | 100 | 300 | 200 | 100 | 300 | 200 | 100 | 300 | 200 | 100 | 300 | 1000 | 500 | 1500 |
| *Mississippi Canyon* | 500 | 450 | 650 | 500 | 450 | 650 | 500 | 450 | 650 | 500 | 450 | 650 | 500 | 450 | 650 | 2500 | 2250 | 3250 |
| *Atwater Valley – Lund* | 100 | 50 | 200 | 100 | 50 | 200 | 100 | 50 | 200 | 100 | 50 | 200 | 100 | 50 | 200 | 500 | 250 | 1000 |
| *Ewing Bank* | 200 | 100 | 300 | 200 | 100 | 300 | 200 | 100 | 300 | 200 | 100 | 300 | 200 | 100 | 300 | 1000 | 500 | 1500 |
| *Green Canyon* | 500 | 450 | 650 | 500 | 450 | 650 | 500 | 450 | 650 | 500 | 450 | 650 | 500 | 450 | 650 | 2500 | 2250 | 3250 |
| *Walker Ridge* | 0 | 0 | 100 | 0 | 0 | 100 | 0 | 0 | 100 | 0 | 0 | 100 | 0 | 0 | 100 | 0 | 0 | 500 |
| *Garden Banks* | 500 | 450 | 650 | 500 | 450 | 650 | 500 | 450 | 650 | 500 | 450 | 650 | 500 | 450 | 650 | 2500 | 2250 | 3250 |
| *Keathley Canyon* | 0 | 0 | 100 | 0 | 0 | 100 | 0 | 0 | 100 | 0 | 0 | 100 | 0 | 0 | 100 | 0 | 0 | 500 |
| *East Breaks* | 400 | 350 | 650 | 400 | 350 | 650 | 400 | 350 | 650 | 400 | 350 | 650 | 400 | 350 | 650 | 2000 | 1750 | 3250 |
| *Alaminos Canyon* | 0 | 0 | 100 | 0 | 0 | 100 | 0 | 0 | 100 | 0 | 0 | 100 | 0 | 0 | 100 | 0 | 0 | 500 |
| *Corpus Christi – Padre Island* | 100 | 50 | 200 | 100 | 50 | 200 | 100 | 50 | 200 | 100 | 50 | 200 | 100 | 50 | 200 | 500 | 250 | 1000 |
| **TOTALS DEEP** | 2500 | 2000 | 4000 | 2500 | 2000 | 4000 | 2500 | 2000 | 4000 | 2500 | 2000 | 4000 | 2500 | 2000 | 4000 | 12500 | 10000 | 20000 |
| **ANNUAL TOTALS** | 12500 | 9500 | 16500 | 12500 | 9500 | 16500 | 12500 | 9500 | 16500 | 12500 | 9500 | 16500 | 12500 | 9500 | 16500 | 62500 | 47500 | 82500 |

## (3) The Species and Numbers of Marine Mammals Likely To Be Found within the Activity Area;

See table below.

Table 3.1. Population Estimates for Marine Mammal Species in the Northern Gulf of Mexico

| Species | Population Estimate[1] | Population Estimate[2] |
|---|---|---|
| Killer Whale (*Orcinus orca*) | 180 | 122 |
| False Killer Whale (*Pseudorca crassidens*) | 1,515 | 1,014 |
| Pygmy Killer Whale (*Feresa attentuata*) | 443 | 342 |
| Dwarf Sperm Whale (*Kogia sima*) | 809[a] | 699[a] |
| Pygmy Sperm Whale (*Kogia breviceps*) | 809[a] | 699[a] |
| Melon-headed Whale (*Peponocephala electra*) | 3,320 | 3,308 |
| Risso's Dolphin (*Grampus griseus*) | 1,777 | 2,692 |
| Short-finned Pilot Whale (*Globicephala macrorhynchus*) | 3,252 | 2,289 |
| Sperm Whale (*Physeter macrocephalus*) | 1,315 | 1,256 |
| Bryde's Whale (*Balaenoptera edeni*) | 42 | 56 |
| Cuvier's Beaked Whale (*Ziphius cavirostris*) | 88 | 96 |
| Blainville's Beaked Whale (*Mesoplodon densirostris*) | 98[b] | 110[b] |
| Gervais' Beaked Whale (*Mesoplodon europaeus*) | 98[b] | 110[b] |
| Bottlenose Dolphin (*Turisops truncatus*) | 26,852 | 25,163 |
| Atlantic Spotted Dolphin (*Stenella frontalis*) | 39,545[c] | 29,519 |
| Pantropical Spotted Dolphin (*Stenella attenuatus*) | 93,174[c] | 87,097 |
| Striped Dolphin (*Stenella coeruleoalba*) | 6,258[c] | 6,746 |
| Spinner Dolphin (*Stenella longirostris*) | 11,550[c] | 16,293 |
| Rough-toothed Dolphin (*Steno bredanensis*) | 2,469[c] | 1,273 |
| Clymene's Dolphin (*Stenella clymene*) | 16,439 | 15,381 |
| Fraser's Dolphin (*Lagenodelphis hosei*) | 698[c] | 1,014 |
| | | |
| Absent from Stock Assessment: | | |
| Northern Right Whale (*Eubalaena glacialis*) | Extralimital | n/a[d] |
| Minke Whale (*Balaenoptera acutorostrata*) | Rare | n/a[d] |
| Sei Whale (*Balaenoptera edeni*) | Rare | n/a[d] |
| Blue Whale (*Balaenoptera musculus*) | Extralimital | n/a[d] |
| Fin Whale (*Balaenoptera physalus*) | Rare | n/a[d] |
| Humpback Whale (*Megaptera novaeangliae*) | Rare | n/a[d] |
| Sowerby's Beaked Whale (*Mesoplodon bidens*) | Extralimital | n/a[d] |

[1] Source: 2003 NOAA Stock Assessments for the Gulf of Mexico: http://www.nmfs.noaa.gov/prot_res/PR2/Stock_Assessment_Program/sars_draft.html

[2] Source: MMS, 2004

[a] This estimate of abundance is for pygmy and dwarf sperm whales combined.

[b] This estimate is based on the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.).

[c] This estimate is for oceanic waters, which is the best available for the Gulf of Mexico.

Extralimital: known on the basis of only a few records that probably resulted from unusual wanderings of animals into the region (Würsig et al., 2000).

Rare: present in such small numbers throughout the region that it is seldom seen (Würsig et al., 2000).

[d] n/a: no population estimate given

## (4) A Description of the Status, Distribution, and Seasonal Distribution (When Applicable) of the Affected Species or Stocks of Marine Mammals Likely To Be Affected by Such Activities;

The Gulf of Mexico is a semi-enclosed marginal sea of the Atlantic Ocean bounded by the United States, Mexico, and Cuba. Entry from the Atlantic Ocean into the Gulf of Mexico is gained through the Straits of Florida, and entry from the Caribbean Sea is gained through the Yucatan Channel. The Gulf is characterized by a very wide, gently sloping continental shelf around most of its margin. The only area of the U.S. Gulf (north of the Exclusive Economic Zone) where the water depth reaches 200 m within 50 km of the shore is off the Mississippi River delta. Continental shelf waters (< 200 m deep) comprise about 35 percent of the Gulf surface and continental slope waters (200-3,000 m) make up another 40 percent (Wursig et al., 2000). In contrast to the smooth, gentle slope of the continental shelf, the Gulf continental slope is steep and irregular with canyons and knolls. The remaining 25 percent of the Gulf waters are the abyssal depths, mainly of the Sigsbee Abyssal Plain.

The U.S. Gulf of Mexico marine mammal community is diverse and distributed throughout the northern Gulf waters. The only two species that are commonly found in continental shelf waters are bottlenose dolphins and Atlantic spotted dolphins (Fulling et al. 2003). Slope waters are routinely inhabited by 20 species, most of which have worldwide distribution in deep, warm-temperate to tropical waters. Two exceptions to worldwide distributions are Atlantic spotted dolphins (*Stenella frontalis*) and clymene dolphins (*Stenella clymene*). Common in the Gulf, these two species are found only in the Atlantic and its associated waters.

Listed below are the individual species that routinely inhabit the U.S. Gulf of Mexico and, thus, might be affected by the subject activities. Mullin and Fulling (in press) reported that many of these species were widely distributed but some had a more regional distribution and these are noted in species accounts. It was also reported that there was some evidence of seasonal changes in slope waters species abundance but that the Gulf marine mammal community remained diverse and abundant throughout the year and no commonly occurring species vacated the slope waters seasonally (Mullin and Fulling, 2004). Seasonal observations are also reported under individual species accounts. Unless otherwise cited, the information in the individual species accounts is from the 2003 Stock Assessment Report available on the NOAA Office of Protected Resources' website.

There are species that have been reported from Gulf waters, either by sighting or stranding, that are not included in the species accounts (Wursig et al. 2000; Mullin and Fulling, in press). These species include the blue whale (*Balaenoptera musculus*), the northern right whale (*Eubalaena glacialis*), and the Sowerby's beaked whale (*Mesoplodon bidens*), all considered extralimital in the Gulf of Mexico, and the humpback whale (*Megaptera novaeangliae*), the fin whale (*Balaenoptera physalus*), the sei whale (*Balaenoptera borealis*), and the minke whale (*Balaenoptera acutorostrata*), all considered rare occasional migrants in the Gulf. Because of the scarcity of these species in the Gulf, no potential effect from subject activities is expected.

### Killer Whale (*Orcinus orca*)

*Status*

The population of killer whales in the Gulf of Mexico is provisionally being considered a separate stock for management purposes by NOAA Fisheries. However, there is no current information to differentiate this stock from the Atlantic stock(s). Additional morphological, genetic, and/or behavioral data are required to confirm the Gulf stock delineation.

This species is not listed as endangered or threatened under the Endangered Species Act. The status of killer whales in the northern Gulf of Mexico, relative to the optimum sustainable population (OSP), is unknown. There are not sufficient data to assess population trends for this species. The Gulf of Mexico stock is not a strategic stock because the average annual fishery-related serious injury and mortality has not exceeded potential biological removal (PBR) for the last two years. The fishery-related serious injury and mortality for this stock is unknown, but NOAA Fisheries assumes it to be less than 10% of the calculated PBR and considers it to be insignificant.

*Distribution*

The killer whale is a cosmopolitan species that occurs in all oceans and seas and is considered the most widespread cetacean worldwide. These animals are not limited by such habitat features as water depth or temperature (Reeves et al., 2002). Killer whale sightings in the northern GOM have primarily been in deeper waters off the continental shelf (>200 m).

*Seasonal Distribution*

Killer whale sightings in the northern Gulf of Mexico have occurred primarily in summer months (May through September). There was one opportunistic sighting of a single killer whale in the northern Gulf of Mexico in November. Thirty-two individual killer whales have been photo-identified in the GOM with 6 resighted over a 5-year period and 1 resighted over 10 years. Three of the resightings involved individual whales that had moved over 1,100 km from the original sighting location (O'Sullivan and Mullin, 1997). It is not known whether killer whales in the northern GOM remain within the GOM or range more widely (Würsig et al., 2000). However, resighting individual whales in similar seasons in subsequent years would suggest that either the animals return seasonally to the northern Gulf after moving out of the area (particularly if surveys at other times of the year did not find killer whales) or that killer whales remain in the northern Gulf year.

## False Killer Whale (*Pseudorca crassidens*)

*Status*

The population of false killer whales in the Gulf of Mexico is provisionally being considered one stock for management purposes by NOAA Fisheries. Additional morphological, genetic, and/or behavioral data are required to confirm the Gulf stock delineation.

This species is not listed as endangered or threatened under the Endangered Species Act. The status of false killer whales in the northern Gulf of Mexico, relative to the OSP, is unknown. There are not sufficient data to assess population trends for this species. The Gulf of Mexico stock is not a strategic stock because the estimated 1997-2001 average annual fishery-related serious injury and mortality did not exceed PBR.

*Distribution*

The false killer whale occurs in oceanic depths (usually >1,000 m) of all tropical and warm temperate waters (Reeves et al., 2002). Species sightings in the northern GOM occurred primarily in the deep waters off the continental shelf.

*Seasonal Distribution*

False killer whales have only been sighted during the late spring and summer by extensive NOAA Fisheries aerial and shipboard surveys. Whether this indicates seasonal distribution or is an artifact of survey effort is not clear.

## Pygmy Killer Whale (*Feresa attentuata*)

*Status*

The population of pygmy killer whales in the Gulf of Mexico is provisionally being considered a separate stock for management purposes by NOAA Fisheries. However, there is no current information to differentiate this stock from the Atlantic stock(s). Additional morphological, genetic, and/or behavioral data are required to confirm the Gulf stock delineation.

Pygmy killer whales are not listed as threatened or endangered under the Endangered Species Act. The status of pygmy killer whales in the northern Gulf of Mexico, relative to the OSP, is unknown. There are not sufficient data to assess population trends for this species. The Gulf of Mexico stock is not a strategic stock because the average annual fishery-related serious injury and mortality has not exceeded PBR for the last two years. The fishery-related serious injury and mortality for this stock is unknown, but NOAA Fisheries assumes it to be less than 10% of the calculated PBR and considers it to be insignificant.

*Distribution*

The pygmy killer whale is an oceanic species with a worldwide, pantropical range (Reeves et al., 2002). Species sightings in the northern GOM occurred primarily in the deep waters off the continental shelf.

*Seasonal Distribution*

Sightings of pygmy killer whales have occurred in all seasons in the northern GOM during NOAA Fisheries surveys.

## Dwarf Sperm Whale (*Kogia sima*)

*Status*

The population of dwarf sperm whales in the Gulf of Mexico is provisionally being considered a separate stock for management purposes by NOAA Fisheries. However, there is no current information to differentiate this stock from the Atlantic stock(s). Additional morphological, genetic, and/or behavioral data are required to confirm the Gulf stock delineation.

The status of dwarf sperm whales in the northern Gulf of Mexico is unknown (relative to the OSP). This species is not listed under the Endangered Species Act as threatened or endangered and insufficient data prohibits determination of population trends. The total fishery-related mortality and serious injury for this stock in unknown but is assumed by NOAA Fisheries to be less than 10% of the calculated PBR and considered insignificant. This is not a strategic stock.

*Distribution*

The dwarf sperm whale is distributed worldwide in temperate to tropical waters. Reeves et al. (2002) reported that pygmy sperm whales are thought to inhabit waters primarily seaward of the continental shelf and that dwarf sperm whales are "somewhat more coastal," occurring in shelf-edge and slope waters. In the northern Gulf of Mexico, sightings of dwarf and pygmy sperm whales occur primarily along the continental shelf edge and over the deeper waters off the continental shelf. These two species are virtually impossible to differentiate in the field.

*Seasonal Distribution*

Dwarf sperm whales and their cogeners, pygmy sperm whales, are often combined into a *Kogia* category because of the inability to differentiate the two species at sea. Sightings of *Kogia* spp. have been documented in all seasons in the northern Gulf of Mexico.

## Pygmy Sperm Whale (*Kogia breviceps*)

*Status*

The population of pygmy sperm whales in the Gulf of Mexico is provisionally being considered a separate stock for management purposes by NOAA Fisheries. However, there is no current information to differentiate this stock from the Atlantic stock(s). Additional morphological, genetic, and/or behavioral data are required to confirm the Gulf stock delineation.

The status of pygmy sperm whales in the northern Gulf of Mexico is unknown (relative to the OSP). This species is not listed under the Endangered Species Act as threatened or endangered and insufficient data prohibits determination of population trends. The total fishery-related mortality and serious injury for this stock in unknown but is assumed by NOAA Fisheries to be less than 10% of the calculated PBR and considered insignificant. This is not a strategic stock.

*Distribution*

The pygmy sperm whale is distributed worldwide in temperate to tropical waters. Reeves et al. (2002) reported that pygmy sperm whales are thought to inhabit waters primarily seaward of the continental shelf and that dwarf sperm whales are "somewhat more coastal," occurring in shelf-edge and slope waters. In the northern Gulf of Mexico, sightings of dwarf and pygmy sperm whales occur primarily along the continental shelf edge and over the deeper waters off the continental shelf. These two species are virtually impossible to differentiate in the field.

*Seasonal Distribution*

Pygmy sperm whales and their cogeners, dwarf sperm whales, are often combined into a *Kogia* category because of the inability to differentiate the two species at sea. Sightings of *Kogia* spp. have been documented in all seasons in the northern Gulf of Mexico.

## Melon-headed Whale (*Peponocephala electra*)

*Status*

The population of melon-headed whales in the Gulf of Mexico is provisionally being considered a separate stock for management purposes by NOAA Fisheries. Additional morphological, genetic, and/or behavioral data are required to confirm the Gulf stock delineation.

The status of melon-headed whales in the northern Gulf of Mexico is unknown (relative to the OSP). This species is not listed under the Endangered Species Act as threatened or endangered and insufficient data prohibits determination of population trends. The total fishery-related mortality and serious injury for this stock in unknown but is assumed by NOAA Fisheries to be less than 10% of the calculated PBR and considered insignificant. This is not a strategic stock.

*Distribution*

Melon-headed whales are pantropical and oceanic, usually found between $20^0$N and $20^0$S (Reeves et al., 2002). In the northern Gulf of Mexico, sightings have occurred primarily in deeper waters off the continental shelf.

*Seasonal Distribution*

Sightings of melon-headed whales have occurred in all seasons in the northern GOM during NOAA Fisheries surveys.

## Risso's Dolphin (*Grampus griseus*)

*Status*

The population of Risso's dolphins in the Gulf of Mexico is provisionally being considered a separate stock for management purposes by NOAA Fisheries. However, there is no current information to differentiate this stock from the Atlantic stock(s). Additional morphological, genetic, and/or behavioral data are required to confirm the Gulf stock delineation.

The status of Risso's dolphins in the northern Gulf of Mexico is unknown (relative to the OSP). This species is not listed under the Endangered Species Act as threatened or endangered and insufficient data prohibits determination of population trends. The total fishery-related mortality and serious injury for this stock is unknown but is assumed by NOAA Fisheries to be less than 10% of the calculated PBR and considered insignificant. This is not a strategic stock.

*Distribution*

The Risso's dolphin is extensively distributed, occurring in tropical and warm temperate waters of all oceans and large seas, except the Black Sea (Reeves et al., 2002). Typically found in deep water (>1,000 m) on the upper continental slope, Risso's dolphins are known to move into more shallow water on the continental shelf, perhaps following prey. Sightings of this species in the northern GOM occurred primarily along the continental shelf and continental slope.

*Seasonal Distribution*

Sightings of Risso's dolphins have occurred in all seasons in the northern GOM during NOAA Fisheries surveys. Mullin and Fulling (in press) report that in the northeastern GOM, Risso's dolphins were three times more abundant in winter than in summer.

## Short-finned Pilot Whale (*Globicephala macrorhynchus*)

*Status*

The population of short-finned pilot whales in the Gulf of Mexico is provisionally being considered a separate stock for management purposes by NOAA Fisheries. However, there is no current information to differentiate this stock from the Atlantic stock(s). Additional morphological, genetic, and/or behavioral data are required to confirm the Gulf stock delineation.

The status of short-finned pilot whales in the northern Gulf of Mexico is unknown (relative to the OSP). This species is not listed under the Endangered Species Act as threatened or endangered and insufficient data prohibits determination of population trends. The total fishery-related mortality and serious injury for this stock in unknown but is assumed by NOAA Fisheries to be less than 10% of the calculated PBR and considered insignificant. This is not a strategic stock.

*Distribution*

The short-finned pilot whale is widespread and abundant in warm temperate to tropical marine waters of the world (Reeves et al., 2002). Sightings of this species in the northern GOM occurred primarily along the continental shelf and continental slope.

*Seasonal Distribution*

Sightings of short-finned pilot whales have occurred in all seasons in the northern GOM during NOAA Fisheries surveys.

## Sperm Whale (*Physeter macrocephalus*)

*Status*

The population of sperm whales in the Gulf of Mexico is provisionally being considered a separate stock for management purposes by NOAA Fisheries. However, there is no current information to delineate sperm whale stock structure within the Gulf of Mexico or to differentiate this stock from the Atlantic stock(s). Additional morphological, genetic, and/or behavioral data are required to confirm the Gulf stock delineation.

The status of sperm whales in the northern Gulf of Mexico is unknown (relative to the OSP). This species is listed under the Endangered Species Act and is the only commonly occurring marine mammal in the Gulf of Mexico with this status (The NOAA 2003 draft stock assessment report erroneously states that this species is not listed as threatened or endangered under the ESA.) Insufficient data prohibits determination of population trends. The total fishery-related mortality and serious injury for this stock in unknown but is assumed by NOAA Fisheries to be less than 10% of the calculated PBR and considered insignificant. Sperm whales are designated as strategic because of their endangered status.

*Distribution*

Sperm whales are found worldwide in ice-free waters from the equator to the edges of the polar ice pack (Reeves et al., 2002). In the northern Gulf of Mexico, sperm whales are widely distributed throughout oceanic waters (>200 m). The highest densities of sperm whales in the Gulf are in the slope waters between 200 and 2,000 m deep (Mullin and Fulling, in press). Mullin and Fulling (in press) report that there are increased sightings of sperm whales off the Mississippi River delta, and in the southeastern Gulf, west of the Dry Tortugas. They speculate that these whale concentrations may be due to the primary productivity associated with the Mississippi River plume and the productivity bolstered by nutrient upwelling along the Loop Current front and periodic formations of cyclonic gyres in the southeast Gulf, respectively.

*Seasonal Distribution*

Sperm whales have been sighted in all seasons in the Gulf of Mexico on NOAA surveys. However, sightings have been more common during the summer months.

## Bryde's Whale (*Balaenoptera edeni*)

*Status*

The population of Bryde's whales in the Gulf of Mexico is provisionally being considered a separate stock for management purposes by NOAA Fisheries. However, there is no current information to differentiate this stock from the Atlantic stock(s). Additional morphological, genetic, and/or behavioral data are required to confirm the Gulf stock delineation and/or residency.

The status of Bryde's whales in the northern Gulf of Mexico is unknown (relative to the OSP). This species is not listed under the Endangered Species Act as threatened or endangered and insufficient data prohibits determination of population trends. The total fishery-related mortality and serious injury for this stock in unknown but is assumed by NOAA Fisheries to be less than 10% of the calculated PBR and considered insignificant. This is not a strategic stock.

*Distribution*

The Bryde's whale occurs in tropical to temperate oceans of the world (Reeves, et al., 2002). Species sightings in the northern Gulf of Mexico are not common and have almost exclusively occurred in the eastern Gulf. Mullin and Fulling (in press) reported that all four Bryde's whale sightings made on NOAA surveys between 1996 and 2001 were in northeastern Gulf slope waters (200 – 1,000 m).

*Seasonal Distribution*
Sightings of Bryde's whales have occurred in the northern Gulf of Mexico mainly during the spring-summer months; however, Jefferson et al. (1992) reported that strandings have occurred throughout the year.

## Cuvier's Beaked Whale (*Ziphius cavirostris*)

*Status*
The population of Cuvier's beaked whales in the Gulf of Mexico is provisionally being considered a separate stock for management purposes by NOAA Fisheries. Inadequate biological information prohibits the determination of Cuvier's beaked whale stock structure in the Gulf of Mexico and Atlantic Ocean.

The status of Cuvier's beaked whales in the northern Gulf of Mexico is unknown (relative to the OSP). This species is not listed under the Endangered Species Act as threatened or endangered and insufficient data prohibits determination of population trends. The total fishery-related mortality and serious injury for this stock in unknown but is assumed by NOAA Fisheries to be less than 10% of the calculated PBR and considered insignificant. However, this is considered a strategic stock because of evidence of human induced mortality and serious injury that has been associated with several acoustic (primarily naval) events. None of these events have occurred in the Gulf of Mexico.

*Distribution*
The Cuvier's beaked whale is distributed worldwide in deep offshore, tropical to cool temperate marine waters (Reeves et al., 2002). Species sightings in the northern GOM occurred primarily in the deep waters off the continental shelf.

*Seasonal Distribution*
Strandings of Cuvier's beaked whales have been recorded throughout the year in the northern GOM. During NOAA Fisheries surveys, beaked whales were recorded in all seasons, but identifying the whales to the species level is difficult from aerial observations. Some of the aerial sightings may have been Cuvier's beaked whales.

## Blainville's Beaked Whale (*Mesoplodon densirostris*)

Three species of the genus *Mesoplodon* have been recorded in the Gulf of Mexico, based on sightings and strandings. These are Blainville's beaked whale (*M. densirostris*), Gervais' beaked whale (*M. europaeus*), and Sowerby's beaked whale (*M. bidens*). The latter of these, Sowerby's beaked whale, is known in the Gulf from only one stranding record and is considered extralimital because of its typical range in the northern temperate waters of the North Atlantic. Identification of *Mesoplodon* species in the field is very difficult so these species are combined as beaked whales. This species grouping may also include some Cuvier's beaked whales that were not identified to species.

*Status*
The population of Blainville's beaked whales in the Gulf of Mexico is provisionally being considered a separate stock for management purposes by NOAA Fisheries. However, there is no current information to differentiate this stock from the Atlantic stock(s). Additional morphological, genetic, and/or behavioral data are required to confirm the Gulf stock delineation and/or residency.

The status of Blainville's beaked whales in the northern Gulf of Mexico is unknown (relative to the OSP). This species is not listed under the Endangered Species Act as threatened or endangered and insufficient data prohibits determination of population trends. The total fishery-related mortality and serious injury for this stock in unknown but is assumed by NOAA Fisheries to be less than 10% of the calculated PBR and considered insignificant. However, this is considered a strategic stock because of evidence of human-induced mortality and serious injury that has been associated with several acoustic (primarily naval) events. None of these events have occurred in the Gulf of Mexico.

*Distribution*

The Blainville's beaked whale has widespread distribution in the tropical and warm temperate world oceans (Reeves et al., 2002). Sightings and stranding of this whale have rarely been identified to the species level in the northern Gulf of Mexico. Beaked whale sightings in the Gulf have occurred primarily in the deep waters off the continental shelf.

*Seasonal Distribution*

Sightings of beaked whales have occurred in all seasons in the northern Gulf of Mexico during NOAA Fisheries surveys.

## Gervais' Beaked Whale (*Mesoplodon europaeus*)

Three species of the genus *Mesoplodon* have been recorded in the Gulf of Mexico, based on sightings and strandings. These are Blainville's beaked whale (*M. densirostris*), Gervais' beaked whale (*M. europaeus*), and Sowerby's beaked whale (*M. bidens*). The latter of these, Sowerby's beaked whale, is known in the Gulf from only one stranding record and is considered extralimital because of its typical range in the northern temperate waters of the North Atlantic. Identification of *Mesoplodon* species in the field is very difficult so these species are combined as beaked whales. This species grouping may also include some Cuvier's beaked whales that were not identified to species.

*Status*

The population of Gervais' beaked whales in the Gulf of Mexico is provisionally being considered a separate stock for management purposes by NOAA Fisheries. However, there is no current information to differentiate this stock from the Atlantic stock(s). Additional morphological, genetic, and/or behavioral data are required to confirm the Gulf stock delineation and/or residency.

The status of Gervais' beaked whales in the northern Gulf of Mexico is unknown (relative to the OSP). This species is not listed under the Endangered Species Act as threatened or endangered and insufficient data prohibits determination of population trends. The total fishery-related mortality and serious injury for this stock in unknown but is assumed by NOAA Fisheries to be less than 10% of the calculated PBR and considered insignificant. However, this is considered a strategic stock because of evidence of human induced mortality and serious injury that has been associated with several acoustic (primarily naval) events. None of these events have occurred in the Gulf of Mexico.

*Distribution*

The Gervais' beaked whale appears to be distributed only in the tropical and warm temperate waters of the Atlantic Ocean (Reeves et al., 2002). Sightings and stranding of this whale have rarely been identified to the species level in the northern Gulf of Mexico. Beaked whale sightings in the Gulf have occurred primarily in the deep waters off the continental shelf.

*Seasonal Distribution*
Sightings of beaked whales have occurred in all seasons in the northern Gulf of Mexico during NOAA Fisheries surveys.

## Bottlenose Dolphin (*Turisops truncatus*)

*Status*
Thirty-eight stocks of bottlenose dolphins are recognized by NOAA Fisheries in the northern Gulf of Mexico for management purposes. These include 33 inshore stocks; 3 coastal stocks in the Eastern, Central and Western Gulf waters delineated as from the shore to 9 km seaward of the 10-fathom (18 m) contour; 1 outer continental shelf stock occurring from the coastal stock boundary to 9 km seaward of the 100-fathom (183 m) contour, and 1 continental shelf edge and slope stock occurring from the outer continental shelf boundary to the Exclusive Economic Zone (EEZ) boundary. These stocks may in fact overlap adjoining stocks in some areas and may be genetically indistinguishable from those stocks. The Gulf of Mexico bottlenose dolphin population consists of a coastal ecotype and an offshore ecotype.

The status of bottlenose dolphins in the northern Gulf of Mexico is unknown (relative to the OSP). This species is not listed under the Endangered Species Act as threatened or endangered and insufficient data prohibits determination of population trends. The total fishery-related mortality and serious injury for this stock in unknown but is assumed by NOAA Fisheries to be less than 10% of the calculated PBR and considered insignificant. This is not a strategic stock.

*Distribution*
Bottlenose dolphins are cosmopolitan marine mammals found in tropical and temperate oceans and peripheral seas. This species occupies a wide variety of habitats and is considered perhaps the most adaptable cetacean (Reeves et al., 2002). As shown by the numerous stocks mentioned above, this widespread species occurs throughout the Gulf of Mexico. Bottlenose dolphin habitat ranges from inshore bays and sounds to the deep waters of the continental slope. During NOAA Fisheries oceanic surveys, bottlenose dolphins were seen primarily in water depths less than 1,000 m, and the highest density of this species was in northeastern Gulf slope waters (Mullin and Fulling, in press). However, densities are similar between the eastern and western Gulf outer continental shelf waters. Bottlenose dolphins were also fairly evenly distributed between the coastal waters (< 20 m) and the outer continental shelf waters (20 to 200 m) (Fulling et al., 2003).

*Seasonal Distribution*
Sightings of bottlenose dolphins have occurred in all seasons in the northern GOM during NOAA Fisheries surveys.

## Atlantic Spotted Dolphin (*Stenella frontalis*)

*Status*
The population of Atlantic spotted dolphins in the Gulf of Mexico is provisionally being considered a separate stock for management purposes by NOAA Fisheries. However, there is no current information to differentiate this stock from the Atlantic stock(s). Additional morphological, genetic, and/or behavioral data are required to confirm the Gulf stock delineation.

The status of Atlantic spotted dolphins in the northern Gulf of Mexico is unknown (relative to the OSP). This species is not listed under the Endangered Species Act as threatened or endangered and insufficient data prohibits determination of population trends. The total fishery-related mortality and serious injury

for this stock in unknown but is assumed by NOAA Fisheries to be less than 10% of the calculated PBR and considered insignificant. This is not a strategic stock.

*Distribution*
Atlantic spotted dolphins are one of two Gulf of Mexico dolphin species that occur only in the Atlantic Ocean (along with clymene dolphins). Also, only this species and the bottlenose dolphin are commonly found in the shallower continental shelf waters (<200 m depth) of the Gulf (Mullin and Fulling, in press). Atlantic spotted dolphins are primarily distributed in waters between 10 and 500 m in the Gulf of Mexico and are not known to occur inshore. The density of Atlantic spotted dolphins is much greater in the eastern Gulf outer continental shelf waters that those of the western Gulf (Fulling et al., 2003).

*Seasonal Distribution*
Sightings of Atlantic spotted dolphins have occurred in all seasons in the northern GOM during NOAA Fisheries surveys.

## Pantropical Spotted Dolphin (*Stenella attenuatus*)

*Status*
The population of pantropical spotted dolphins in the Gulf of Mexico is provisionally being considered a separate stock for management purposes by NOAA Fisheries. However, there is currently no information to differentiate this stock from the Atlantic stock(s). Additional morphological, genetic, and/or behavioral data are required to confirm the Gulf stock delineation.

The status of pantropical spotted dolphins in the northern Gulf of Mexico is unknown (relative to the OSP). This species is not listed under the Endangered Species Act as threatened or endangered and insufficient data prohibits determination of population trends. The total fishery-related mortality and serious injury for this stock in unknown but is assumed by NOAA Fisheries to be less than 10% of the calculated PBR and considered insignificant. This is not a strategic stock.

*Distribution*
Pantropical spotted dolphins are found worldwide in all tropical to warm temperate waters between about $40^0$N and $40^0$S (Reeves et al., 2002). In the northern Gulf of Mexico, this species is widely distributed in deeper waters and is the most common cetacean in the oceanic northern GOM (Mullin et al., 2004;Wursig et al., 2000). The highest density for pantropical spotted dolphins is in the abyssal waters (> 2,000 m) but this species has been observed, though rarely, in the more shallow waters over the continental shelf (Mullin and Fulling, 2004).

*Seasonal Distribution*
Sightings of pantropical dolphins have occurred in all seasons in the northern GOM during NOAA Fisheries surveys. However, Mullin and Fulling (in press) report that this species is two times more abundant in summer in the northeastern Gulf than in winter.

## Striped Dolphin (*Stenella coeruleoalba*)

*Status*
The population of striped dolphins in the Gulf of Mexico is provisionally being considered a separate stock for management purposes by NOAA Fisheries. However, additional morphological, genetic, and/or behavioral data are required to confirm the Gulf stock delineation.

The status of striped dolphins in the northern Gulf of Mexico is unknown (relative to the OSP). This species is not listed under the Endangered Species Act as threatened or endangered and insufficient data prohibits determination of population trends. The total fishery-related mortality and serious injury for this stock in unknown but is assumed by NOAA Fisheries to be less than 10% of the calculated PBR and considered insignificant. This is not a strategic stock.

*Distribution*
The striped dolphin is cosmopolitan in distribution occurring in tropical and warm temperate waters (Reeves et al., 2002). In the northern Gulf of Mexico, sightings have occurred primarily in the deeper waters off the continental shelf (Mullin and Fulling, 2004).

*Seasonal Distribution*
Sightings of striped dolphins have occurred in all seasons except summer in the northern GOM during NOAA Fisheries surveys.

## Spinner Dolphin (*Stenella longirostris*)

*Status*
The population of spinner dolphins in the Gulf of Mexico is provisionally being considered a separate stock for management purposes by NOAA Fisheries. However, additional morphological, genetic, and/or behavioral data are required to confirm the Gulf stock delineation.

The status of spinner dolphins in the northern Gulf of Mexico is unknown (relative to the OSP). This species is not listed under the Endangered Species Act as threatened or endangered and insufficient data prohibits determination of population trends. The total fishery-related mortality and serious injury for this stock in unknown but is assumed by NOAA Fisheries to be less than 10% of the calculated PBR and considered insignificant. This is not a strategic stock.

*Distribution*
The spinner dolphin is generally a worldwide pantropical species including numerous regional populations and four subspecies (Reeves et al., 2002). Sightings of spinner dolphins in the northern Gulf of Mexico have primarily occurred on the continental slope east of Mobile Bay (Mullin and Fulling, 2004).

*Seasonal Distribution*
Sightings of spinner dolphins have occurred in all seasons in the northern GOM during NOAA Fisheries surveys.

## Rough-toothed Dolphin (*Steno bredanensis*)

*Status*
The population of rough-toothed dolphins in the Gulf of Mexico is provisionally being considered a separate stock for management purposes by NOAA Fisheries. However, additional morphological, genetic, and/or behavioral data are required to confirm the Gulf stock delineation.

The status of rough-toothed dolphins in the northern Gulf of Mexico is unknown (relative to the OSP). This species is not listed under the Endangered Species Act as threatened or endangered and insufficient data prohibits determination of population trends. The total fishery-related mortality and serious injury

for this stock in unknown but is assumed by NOAA Fisheries to be less than 10% of the calculated PBR and considered insignificant. This is not a strategic stock.

*Distribution*
The rough-toothed dolphin occurs in tropical and warm temperate waters globally (Reeves et al., 2002). In the northern Gulf of Mexico, sightings have occurred in both oceanic waters and in continental shelf waters (Fulling et al., 2003). This species may have a greater-than-expected presence in shelf waters (see Seasonal Distribution). Mullin and Fulling (in press) report that there may be similar numbers of rough-toothed dolphins in shelf waters as there are in oceanic waters.

*Seasonal Distribution*
Sightings of rough-toothed dolphins have occurred in all seasons in the northern GOM during NOAA Fisheries surveys. Higher densities of rough-toothed dolphins were found in the fall in northern Gulf shelf waters than were found in oceanic waters in the spring (Fulling et al., 2003).

## Clymene Dolphin (*Stenella clymene*)

*Status*
The population of clymene dolphins in the Gulf of Mexico is provisionally being considered a separate stock for management purposes by NOAA Fisheries. However, additional morphological, genetic, and/or behavioral data are required to confirm the Gulf stock delineation.

The status of clymene dolphins in the northern Gulf of Mexico is unknown (relative to the OSP). This species is not listed under the Endangered Species Act as threatened or endangered and insufficient data prohibits determination of population trends. The total fishery-related mortality and serious injury for this stock in unknown but is assumed by NOAA Fisheries to be less than 10% of the calculated PBR and considered insignificant. This is not a strategic stock.

*Distribution*
Clymene dolphins are found only in the deep tropical and subtropical waters of the Atlantic Ocean, including the Gulf of Mexico and the Caribbean Sea (Reeves et al., 2002). This is one of the two species commonly occurring in the Gulf that are limited to the Atlantic. In the northern Gulf of Mexico, sightings have occurred primarily over the deeper waters off the continental shelf and mostly west of Mobile Bay (Mullin and Fulling, in press).

*Seasonal Distribution*
Clymene dolphins were sighted in all seasons except fall in the northern Gulf of Mexico during NOAA Fisheries surveys.

## Fraser's Dolphin (*Lagenodelphis hosei*)

*Status*
The population of Fraser's dolphins in the Gulf of Mexico is provisionally being considered a separate stock for management purposes by NOAA Fisheries. However, additional morphological, genetic, and/or behavioral data are required to confirm the Gulf stock delineation.

The status of Fraser's dolphins in the northern Gulf of Mexico is unknown (relative to the OSP). This species is not listed under the Endangered Species Act as threatened or endangered and insufficient data prohibits determination of population trends. The total fishery-related mortality and serious injury for this

stock in unknown but is assumed by NOAA Fisheries to be less than 10% of the calculated PBR and considered insignificant. This is not a strategic stock.

*Distribution*
Fraser's dolphins are found worldwide in tropical waters, primarily in water depths greater than 1,000 m (Reeves et al., 2002). In the northern Gulf of Mexico, sightings have occurred primarily over the deeper waters off the continental shelf.

*Seasonal Distribution*
Sightings of Fraser's dolphins have occurred in all seasons in the northern GOM during NOAA Fisheries surveys.

## (5) The Type of Incidental Taking Authorization that Is Being Requested (I.E., Takes by Harassment Only; Takes by Harassment, Injury and/or Death) and the Method of Incidental Taking;

The MMS requests NMFS to promulgate regulations for any potential take (level B or level A) of 21 species of marine mammals, incidental to conducting seismic survey operations, regulated by the MMS, in the northern Gulf of Mexico OCS planning areas. The permitted operations, as described in Sections 1 and 2 of this petition, have the potential to take marine mammals by harassment as defined by NMFS. NMFS current criterion for the onset of level B harassment (disturbance) for cetaceans is exposure to 160 -179 dB re 1µ Pa rms. Current NMFS policy is that the potential for permanent hearing damage (level A harassment – injury or mortality) for cetaceans exists at sound levels beginning at 180 dB re 1µ Pa rms and greater.

The potential for incidental takes by level B harassment (probable risk of a behavioral response) during the use of airgun arrays is reasonably likely. The potential for acoustic injury exists, as typical airgun arrays will exceed 180 dB re 1µ Pa rms close to the source. Since it remains unclear that the pulsed, low-frequency sound source resulting from airguns has actually caused injury to marine mammals in open water (NRC, 2003) or that marine mammals would not deflect away from sound intensities that could result in injury (MMS, 2004), the potential for injury is considered unlikely, but exposure to 180 dB re 1µ Pa rms or greater is possible.

## (6) By Age, Sex, and Reproductive Condition (If Possible), the Number of Marine Mammals (by Species) that May Be Taken by Each Type of Taking Identified in Paragraph (a)(5) of this Section, and the Number of Times Such Takings by Each Type of Taking Are Likely to Occur;

Anticipated takes as a result of seismic operation in the northern Gulf of Mexico OCS planning areas would be "takes by harassment" mainly involving temporary changes in behavior. The National Marine Fisheries Service (NMFS) considers that take by harassment may occur at sound levels at or above 160 dB re 1 µPa (rms). This guideline does not consider the frequency component and nature of the sound source nor the hearing sensitivities of different cetacean species. Similarly, at sound levels at or above 180 dB re 1 µPa (rms), the potential for physical damage to hearing exists. NOAA Fisheries concluded in their August 30, 2003 Biological Opinion for Gulf of Mexico Outer Continental Shelf Oil and Gas Lease

Sales 189 and 197 that existing mitigation measures are "expected to significantly reduce the potential for injury to sperm whales and sea turtles." Since that opinion mitigation measures have been expanded to protect not only sperm whales, but shut-downs are now required for all whales entering the exclusion zone (NTL 2004-G01). While these measures reduce the potential for injury, they do not remove the possibility. Therefore, there exists a possibility of exposing some animals to sound levels exceeding 180 dB re 1 µPa (rms) and an undefined risk that some of these animals may have hearing permanently impaired. No lethal takes are anticipated.

As detailed in the Final Programmatic Environmental Assessment (PEA) for Geological and Geophysical Exploration for Mineral Resources on the Gulf of Mexico Outer Continental Shelf (MMS, 2004), the number of marine mammals, by species, estimated to be exposed to these "take thresholds" has been calculated for deep seismic activities using best available data and assumptions as outlined below and provided in detail in the PEA. Because of numerous data limitations and uncertainties in assessing acoustic effects on cetaceans, the best estimate of marine mammal density for a geographic location is used to predict a possible number of animals within a given distance of a sound source. Those animals within calculated isopleths of sound above 160 dB re 1 µPa (rms) are considered a take. This basic rationale (independent of uncertainties in numbers) probably overestimates takes (exposure is not necessarily equivalent to take). The take estimates calculated in the PEA attempt to refine this process; however, data limitations are significant.

The basic data elements used to estimate incidental take include: summary of seismic survey activity levels derived from recent MMS survey records; recent abundance and distribution estimates of Gulf of Mexico cetaceans provided by NMFS; and quantification of effects of detection (availability) bias for shipboard observers (visual monitoring), using a recent marine mammal mitigation program. Take estimates for each of the three types of seismic activity (deep, VSP, and high resolution) have been divided into six basic areas based on shallow (< 200 m depth) and deep water ( $\geq$ 200 m) portions of the three OCS planning areas of the Gulf of Mexico (western-WPS; central-CPA; eastern-EPA) (see Figure 2-1).

Because of the programmatic nature of the assessment, precise calculations associated with specific airgun arrays are impractical. Nor is it possible to develop a projection of exactly what distribution of possible arrays will be used in the future. Instead, a "typical deep seismic array" has been defined based on an analysis of airguns utilized in Gulf of Mexico operations (MMS, 2004). The defined array is a 4,550-in$^3$ airgun array with a 230 dB re 1 µPa (rms) real vertical source level. Actual array output varies by seismic survey type (e.g. VSP or high resolution) and can be considerably lower than this typical system or may on occasion be larger. This would result in an increase or decrease of the ensonification area. In non-commercial operations, array size can be considerably larger, such as the Lamont-Doherty Earth Observatory 20-gun array (MMS, 2004; LGL, 2003).

A point source level is assumed for estimating maximum radial distances to isopleths (160- and 180-dB) using spherical spreading in the far-field (Appendix C (MMS, 2004)). The extrapolation to a notional point source using the typical array produces a source level of about 260 dB re 1 µPa zero to peak. Using a -20 dB correction for array effect and -10 dB as an rms conversion factor, and 20log[R] attenuation, horizontal ranges to target isopleths are 300 m (180 dB) and 3,000 m (160 dB). Recent calibrations suggest that these ranges may not be appropriate, however take calculations in the Final Programmatic Environmental Assessment (PEA) for Geological and Geophysical Exploration for Mineral Resources on the Gulf of Mexico Outer Continental Shelf (MMS, 2004) used the best data available at the time and field data sufficient to unambiguously establish ranges to target isopleths in all water depths for the GOM do not presently exist.

It is known that a seismic signal is comprised primarily of low-frequency components with a peak of 50-60 Hz, but also has contributions from both mid- and high-frequency components. MMS (2004) concludes insufficient information is available to accurately estimate and integrate frequency components into the isopleth calculations. As a consequence, frequency spectra cannot readily be accounted for in the current analysis.

It is also known that the area of ensonification, when viewed from above is a somewhat irregular isopleth when actually measured but more closely approximates an elliptical shape rather than a circle (MMS, 2004). Assuming the model provides a realistic estimate of the greatest radial distance to a given isopleth, calculating the total area ensonified on the basis of a maximal radial distance produces an overestimation if the actual area is elliptical. Using elliptical geometry reduces the area ensonified by about 50%. MMS (2004) therefore adopts a 50% reduction in area ensonified to account for conversion from radial to an elliptical zone of ensonification.

Total area ensonified considers system start-up at a low output level (e.g., 160 dB [rms]), with incremental increases to full power within approximately 30 min. The area ensonified is equal to the length of a transect covered in 30 min (i.e., 4.17 km, using vessel speed of 4.5 kn (nmi/h) = 8.34 km/h), multiplied by twice the isopleth radius (i.e., r = 0.3 or 3.0 km, for 180 and 160 dB [rms], respectively). This product is subsequently multiplied by 0.50 to account for the gradual increase in airgun output to maximum power. Finally, the product is again multiplied by 0.50 to allow for conversion from a circular to elliptical area of ensonification. Over the course of this 30 min-start-up period, the survey vessel travels >4 km with an increasing number of airguns shooting every 12 to 16 sec (i.e., 112 to 150 shots total). In spite of the fact that the duration of each seismic pulse lasts only a few milliseconds, there remains considerable overlap between zones of ensonification created by the first shot and the next (i.e., sound fields overlap as the seismic vessel and array move forward 28 to 37 m between shots). Concurrently, zones of ensonification expand proportionally as more airguns come on line to reach full power.

Take estimates also factor in the detectability of Gulf marine mammal species. In shallow water, the proportion of animals expected to remain undetected is 100% for shallow water surveys because visual monitoring (and ramp-up) are not required, except in the Eastern Planning Area, where a detectability factor has been integrated into the first order take calculations. In deep water, where operations are uniformly conducted under NTL 2004-G01, the probabilities of detection and non-detection have been incorporated. Further, a factor has been added to account for the effectiveness of surface (shipboard) visual monitoring. No quantitative estimates are currently available to account for noise avoidance resulting from ramp-up effectiveness or species recognition of a sound source (at some low level, e.g., 160 dB or less) and subsequent avoidance of that sound source. These limitations are noteworthy, as is the potential overlap between vocalization characteristics (and, by inference, hearing capabilities) and the maximum output of seismic noise.

These estimates of incidental take consider current density estimates of marine mammal species found within shallow and deeper waters of the three GOM Planning Areas, as well as recent seismic survey activity by water depth and planning area. Measures of effective strip width (ESW) (from historic survey data) and availability bias have been integrated, as appropriate, into these estimates. Preliminary calculations of radial distance to isopleths of interest (i.e., 160 and 180 dB [rms]) are based on a typical GOM deep seismic array, as defined in MMS (2004). Limitations to isopleth calculations are explained in MMS (2004); appropriate adjustments also have been integrated, with proper justification, into the analysis (e.g., adjustment to radial calculations to account for the elliptical shape of the zones of ensonification). Additional data regarding susceptibility to seismic noise (i.e., potential for overlap between seismic noise and vocalization frequencies) and the potential for recognition and avoidance of

mobile sound sources are necessary to develop more complete estimates of incidental take, and to further identify those marine mammal species at greatest potential risk from seismic operations.

Takes were calculated for the three types of seismic activity (deep seismic, VSP, and high resolution) in the GOM OCS waters. Currently mitigation requirements are in place (NTL 2004-G01) and NMFS previously determined that these mitigation activities (ramp-up, visual monitoring, etc.) will more effectively minimize possible adverse effects, so take estimates were calculated using mitigation measures already in place.

Further details of limitations and assumptions are provided in Appendix L (MMS, 2004). The key elements integrated into the take analyses are as follows:

1) planning area and depth delineations for marine mammal abundance data;
2) planning area and depth delineations for seismic survey activity;
3) integration of total area ensonified for 160 and 180 dB calculated on a "typical array" and elliptical shaped zone;
4) visual monitoring effectiveness and species detection characteristics;
5) hearing capabilities of species present in the Gulf of Mexico

For all take calculations the following formulas were used:

Take = Mammal Density/100 * area ensonified * proportion detected

Annual Take = Take * (survey effort per year)

For all three types of seismic operations, a conservative approach was implemented when calculating takes. The assumed area ensonified remained the same for all calculations due to the variability in airgun number, volume, and configuration. For each of the surveys, exposure estimates are calculated on the basis of system ramp-up per existing mitigation requirements (NTL 2004-G01).

In both shallow and deep water, the estimated number of animals exposed to both 160 dB and 180 dB are summarized in Table 6.1.

*Deep Seismic*
Annual take was calculated for both deep and shallow water for a typical seismic array. It is estimated that 20 seismic surveys will occur per year and that for each survey ramp-up will occur 6 times. Take was calculated and then multiplied by a factor of 120, which estimates annual takes for cumulative deep seismic survey activity in the GOM

*VSP*
Due to the considerable variability in airgun number, placement and configuration for VSP surveys, a conservative approach was implemented for take calculations. Annual projected surveys in deep water (80 per year) and shallow water (135 per year) were multiplied by the same number of ramp-ups (6) as a standard deep seismic operation in order to adequately address variability. This may result in an overestimate of take.

*High Resolution*

There is less variability in the number of guns used and ramp-ups for high resolution surveys, however a conservative approach was also taken. The number of acquisition days was calculated based on the number of line miles a typical survey covers in a day (~50). Acquisition days for deep water (50) and shallow water (200) were multiplied by 2 ramp-ups per day to determine survey effort per year.

Table 6.1 Estimated annual takes for both shallow and deep water marine mammal species in the northern GOM.

| | Deep seismic | | VSP | | HR | | **TOTALS** | |
|---|---|---|---|---|---|---|---|---|
| DEEP WATER SPECIES[1] | 160 dB | 180 dB | 160 dB | 180 dB | 160 dB | 180 dB | **160 dB** | **180 dB** |
| Bryde's whale (*Balaenoptera edeni*) | 1 | 1 | 1 | 1 | 1 | 1 | **3** | **3** |
| Sperm whale (*Physeter macrocephalus*) | 5 | 3 | 27 | 4 | 4 | 3 | **36** | **10** |
| **Pygmy and dwarf sperm whales (*Kogia* spp.)** | 5 | 3 | 26 | 3 | 5 | 3 | **36** | **9** |
| Cuvier's beaked whale (*Ziphius cavirostris*) | 2 | 2 | 4 | 2 | 2 | 2 | **8** | **6** |
| Beaked whales (*Mesoplodon* spp.) | 3 | 3 | 6 | 3 | 3 | 3 | **12** | **9** |
| Pygmy killer whale (*Feresa attenuata*) | 2 | 2 | 6 | 2 | 2 | 2 | **10** | **6** |
| **False killer whale (*Pseudorca crassidens*)** | 2 | 1 | 11 | 1 | 2 | 1 | **15** | **3** |
| Killer whale (*Orcinus orca*) | 3 | 3 | 4 | 3 | 3 | 3 | **10** | **9** |
| Short-finned pilot whale (*Globicephala macrorhynchus*) | 7 | 2 | 39 | 2 | 5 | 2 | **51** | **6** |
| Melon-headed whale (*Peponcephala electra*) | 9 | 2 | 56 | 2 | 7 | 2 | **72** | **6** |
| Risso's dolphin (*Grampus griseus*) | 7 | 3 | 37 | 3 | 5 | 3 | **49** | **9** |
| Bottlenose dolphin (*Turisops truncatus*) | 8 | 3 | 51 | 3 | 8 | 3 | **67** | **9** |
| **Rough-toothed dolphin (*Steno bredanensis*)** | 3 | 3 | 12 | 3 | 3 | 3 | **18** | **9** |
| **Fraser's dolphin (*Lagenodelphis hosei*)** | 3 | 1 | 14 | 1 | 2 | 1 | **19** | **3** |
| Atlantic spotted dolphin (*Stenella frontalis*) | 1 | 1 | 3 | 1 | 1 | 1 | **5** | **3** |
| Spinner dolphin (*Stenella longirostris*) | 35 | 2 | 234 | 7 | 30 | 2 | **299** | **11** |
| **Pantropical spotted dolphin (*Stenella attenuata*)** | 208 | 6 | 1401 | 33 | 174 | 6 | **1783** | **45** |
| **Clymene dolphin (*Stenella clymene*)** | 45 | 2 | 297 | 8 | 37 | 2 | **379** | **12** |
| **Striped dolphin (*Stenella coeruleoalba*)** | 23 | 3 | 142 | 5 | 19 | 3 | **184** | **11** |
| | | | | | | | | |
| SHALLOW WATER SPECIES[1] | | | | | | | | |
| Bottlenose dolphin (*Turisops truncatus*) | 176 | 16 | 696 | 60 | 580 | 50 | **1452** | **125** |
| Atlantic spotted dolphin (*Stenella frontalis*) | 103 | 7 | 410 | 22 | 342 | 18 | **855** | **47** |
| **Rough-toothed dolphin (*Steno bredanensis*)** | 11 | 2 | 40 | 5 | 34 | 4 | **85** | **11** |

[1] Species represented in bold print exhibit vocalization characteristics that do not overlap with seismic output. While take was calculated for these species, none is expected.

## (7) The Anticipated Impact of the Activity Upon the Species or Stock;

The potential effects of noise on marine mammals can be divided into four categories: physical (including physiological), perceptual, behavioral, and indirect (for more information see Gordon et al., 2004, and references therein). Of the 21 species of cetaceans found regularly occurring in the Gulf, only one, the Bryde's whale (*Balaenoptera edeni*), makes low-frequency vocalizations, while all others vocalize in the mid-frequency range. The potential impacts of seismic surveys on mysticetes, odontocetes, and beaked whales are discussed below.

### *Mysticetes*

The only commonly occurring baleen whale in the northern Gulf of Mexico is the Bryde's whale (*Balaenoptera edeni*). The hearing of baleen whales has not been extensively studied, and there are no auditory data for Bryde's whale. However, baleen whales are more dependent on low-frequency sounds than other marine mammals. This puts them at greatest risk of auditory impacts from seismic sounds as many of their vocalizations overlap the maximum frequency range of energy output of a typical airgun array. Behavioral responses have not been observed in the Bryde's whale in response to airgun activity; however, other baleen whales species have exhibited behavioral avoidance of areas when received noise levels reached a threshold. Potential impacts include auditory impacts (hearing loss, injury, and discomfort), masking of important low-frequency sounds (communication, etc.) and changes in behavior are all possible as a result of seismic sounds.

### *Odontocetes*

Among the odontocetes, hearing thresholds are highly varied and species-specific. Many of these species are sensitive to high frequency sounds due to their use of high frequency sound pulses for echolocation and communication. Their sensitivity to low frequency sounds appears to be relatively poor, though low frequency hearing has not been extensively studied in odontocetes. Seismic sounds are predominately low frequency (<200 Hz), though airgun arrays also produce energy at higher frequencies that may negatively impact some delphinid species. Potential impacts include auditory impacts (hearing loss, injury, and discomfort) as well as modification of some behaviors (avoidance, vocalizations).

#### *Sperm Whales*

There is a reasonable potential that seismic surveys are exposing sperm whales to noise levels that may cause behavioral disturbance. The most probable disturbance is whales avoiding (moving away from) a seismic vessel. The degree of displacement, length of time involved, and types of normal activities interrupted would influence the significance of this disturbance. Less likely, but possible, are sperm whales remaining within acoustic exposure levels that will cause temporary hearing impairment or permanent hearing damage. This outcome would require whales to lack the ability to detect harmful sound intensities, "ignore" the signal in favor of other behavior such as feeding, or be in close proximity to a sudden start-up of airguns. The environment is deep, open waters. Short of a physically impaired whale, no physical constraints to "trap" a whale near a seismic sound source exist. Mitigation measures now in place remove sudden start-up as a possibility and observers with shut-down procedures substantially reduce the possibility of intense exposures. However, a deep-diving whale could be exposed to >180 dB signal intensities if the airgun array passes over the whale and the whale does not respond to (avoid) the increasing intensity.

There is an apparent concentration of whales located on the continental slope offshore of the Mississippi River mouth (and extending east to the DeSoto Canyon area in the Eastern Planning Area). Although sperm whales apparently are not being displaced from this area because of seismic surveys, it is unknown whether their site fidelity reflects low sensitivity to seismic noise or a high motivation to remain in the area in spite of this noise.

Because there is some evidence of sperm whale responses to low-frequency noise, including possibly leaving an area where seismic surveys are occurring, it is reasonable to presume that these animals are being exposed to potentially aversive noise levels (i.e., noise levels that would cause behavior modification, such as avoidance or displacement) in a preferred habitat. However, there are no consistent findings to date (Gordon et al., 2004) that lead to conclusions on either a directed response to seismic noise or a threshold level of response. For example, Mate et al. (1994) speculated that an absence of sperm whale sightings during a Gulf of Mexico cruise perhaps was correlated to seismic operations, yet Rankin and Evans (1998) and Rankin (1999) failed to detect any large-scale displacement of sperm whales or cetaceans relative to Gulf of Mexico seismic operations. Stone (2003) concluded that sperm whales showed no observed effects from visual observer data of seismic activity in UK waters, yet other UK cetacean species did exhibit avoidance behavior. Madsen et al. (2002) concluded that adult male sperm whales did not elicit observable avoidance to distant (>20 km) seismic operations over a period of 13 days nor were alterations in diving patterns and vocalization observed. In more recent ongoing studies correlating tagged sperm whale surfacing locations to seismic vessel location, data through 2002 were insufficient to conclude any smaller scale tolerance or flight from vessels; however, it is obvious that whales do not leave the general Mississippi Delta region during seismic surveys (Mate, 2003).

Minor behavioral changes typically do not adversely affect either the individual or the population. To date, there is no evidence that behavioral changes prompted by seismic noise are of sufficient magnitude to have meaningful effects on this population, in that no large-scale displacement or voids in sperm whale occurrence relative to seismic activities have been observed. The present state of knowledge indicates sperm whales may at times react to seismic activity, but results are not consistent. Studies are underway to precisely determine the behavioral responses of Gulf sperm whales to airguns. Current mitigation procedures include ramp-up, visual monitoring, and shut-down of seismic operations if sperm whales are within the 500-m exclusion zone (NTL 2004-G01). These measures are expected to significantly reduce the potential for noise impacts to sperm whales.

In the conclusions from the recent NOAA 2003 biological opinion on Lease Sales 189 and 197 for the Eastern Gulf of Mexico, it is their opinion that, with the current mitigations in place, seismic activities in the GOM are not likely to jeopardize the continued existence of this species. We find that while impacts are still somewhat speculative and the potential for harm to the species or stock is unlikely the potential effects are negligible. That is to say, the impacts to the species or stock are "negligible" in the sense described by MMPA regulations at 50 CFR 216.103.

### *Beaked Whales*

Recent international strandings and research have illuminated beaked whales as animals of particular concern regarding anthropogenic sound. The Navy acknowledges the link between their sonar and several of the stranding events. There is no direct evidence that seismic sounds have resulted in beaked whale strandings (NRC, 2003). In the one case where seismic research work was being done in the vicinity of the stranding, it is known that the vessel conducting the

research was also using various types of sonar devices. There may be a link to that sonar or there may be no link, and the stranding of those two beaked whales was because of some other cause. However, until more is known about beaked whale physiology and behavioral reactions to anthropogenic sounds, some potential impact from seismic activities must be considered.

Necropsies done on stranded beaked whales suggest that trauma was not a direct result of auditory system impact, but rather physical injury sustained from a behavioral reaction to the sound. One theory that has been suggested is that beaked whales, in contrast to other cetaceans, are saturation divers and do not decompress from deep dives during the long surface intervals that other deep-diving whales use. Preliminary indications are that beaked whales have unique dive profiles that do not include such surface rest periods. Under this scenario, any disturbance that resulted in beaked whales spending an extended period of time at or near the surface could result in gas bubble formation and associated trauma, as has been observed in stranded specimens. If anthropogenic sound events elicited a reaction in beaked whales that included surfacing and moving away from the source, bottom topography could become a key factor in survival. Should the animals, after moving away from the source, be unable to dive deep enough to remain saturated because of a rapid change in ocean bottom topography, a series of physiological events could begin that could ultimately result in death from trauma similar to what has been seen.

Although seismic exploration is common in the Gulf, and has in recent years moved into depths inhabited by beaked whales (three species occur in the Gulf), seismic work has not been considered a possible factor in any beaked whale stranding. Mass strandings of the type seen in other locales and associated with Navy sonar have not occurred in the Gulf region. This may be because of the lack of a beaked whale response to seismic or other anthropogenic stimuli that occur in the Gulf. Or, if there is a response to any sound in the Gulf, seismic or otherwise, the gently sloping bottom topography of the Gulf of Mexico may allow beaked whales to move well away from the source and still be in depths required to maintain saturation and, thus, avoid injury.

Seismic activity in the Gulf of Mexico 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 should further reduce short-term reactions to disturbance, and minimize any effects on hearing sensitivity.

(This information was largely taken from the Final Programmatic Environmental Assessment on Geological and Geophysical Exploration for Mineral Resources on the Gulf of Mexico Outer Continental Shelf, Chapter III-B (MMS, 2004). For a more thorough discussion of the impacts of G&G activities on marine mammals, see Section III.A.,B., and H., and Appendix G in the same document.)

## (8) The Anticipated Impact of the Activity on the Availability of the Species or Stocks of Marine Mammals for Subsistence Uses;

There are no subsistence uses of marine mammals in the northern Gulf of Mexico.

## (9) The Anticipated Impact of the Activity Upon the Habitat of the Marine Mammal Populations, and the Likelihood of Restoration of the Affected Habitat;

The majority of seismic operations anticipated will involve no more than a passing vessel introducing an elevated sound level into the water column. Adjacent areas may be exposed to pulsed sound over several days during the course of a survey; however, a continuous repetition of seismic operations in the same local habitat over months or years does not occur. No lasting modification or alteration of the habitat will occur. Immediate avoidance of the vessel (short-term, local displacement) may occur, but this situation does not represent loss of habitat.

There is no residual chemical or physical alteration of the habitat. The sonic intensity of seismic sound sources would most likely injure or kill small organisms within a meter or so of an airgun. Hearing damage to fish and, more so, behavioral alterations can occur in extended radii surrounding the sound source, likely on the same order as potential Level B takes at 160 dB re 1 µPa (rms) (LGL, 2003).

Habitat impacts, at most, will be some possible injurious effects on fish and planktonic organisms in close proximity to an airgun array and a greater area of possible behavioral responses. These are short-term impacts. Alteration of the habitat is minimal; restoration of the affected habitat to a pre-seismic state is rapid.

One exception to this type of operation would be proposed "4-D" or "seismic-on-demand" systems where a hydrophone cable or cable grid would be deployed on the ocean bottom and repeated seismic surveys would be conducted over months to years. Some local benthic disturbance resulting from laying of acoustic cables will occur. A negligible disturbance of sediments and benthic organisms will occur in these instances.

Even in this case, "repeated seismic operations" represent a geographically local area on the order of one lease block at most, and repetition is on the order of several days of firing airguns separated by several weeks to months of no activity.

## (10) The Anticipated Impact of the Loss or Modification of the Habitat on the Marine Mammal Populations Involved;

Beyond a possible immediate, local avoidance of seismic operation, no habitat loss or modification is anticipated. To date, there are no data that associate either decreases in abundance or increased strandings associated with seismic activity levels (MMS, 2004). There is no anticipated impact on marine mammal populations through loss or modification of habitat.

**(11) The Availability and Feasibility (Economic and Technological) of Equipment, Methods, and Manner of Conducting Such Activity or Other Means of Effecting the Least Practicable Adverse Impact Upon the Affected Species or Stocks, Their Habitat, and on Their Availability for Subsistence Uses, Paying Particular Attention to Rookeries, Mating Grounds, and Areas of Similar Significance;**

The current mitigation suite includes ramp-up, visual monitoring, establishment of an impact zone (currently 500 m around the sound source), and mandatory "shut-down" to avoid injury to whales in or about to enter the impact zone. Each of these helps ensure the least practicable adverse impact to marine mammals. Ramp-up, or soft start, requires seismic operators to start firing the acoustic array with one gun and gradually over time add more guns until the array is fully operational. This allows cetaceans in the area to move away from the sound source before discomfort or injury might result. Visual observers monitor the area around the sound source for 30 minutes prior to ramp-up and throughout seismic operations. Any time a whale enters or surfaces within 500 m of the sound source, seismic operations are immediately ceased in order to minimize as much as possible the exposure of the whales to potentially damaging levels of sound. An expanded seismic observer program is currently in place requiring trained observers on all seismic vessels. Enhanced monitoring and reporting is also required under the latest seismic NTL. For more detail on mitigations currently in effect, please see MMS Notice to Lessees NTL 2004-G01. These mitigations are discussed in detail as part of Alternative 1 in the G&G PEA (MMS, 2004).

Although not presently required, but encouraged under the NTL, the use of passive acoustic monitoring (PAM) is being tested and improved under the ongoing Sperm Whale Seismic Study (SWSS) with possible technology transfer to mitigation applications. The required use of PAM and also active acoustic detection are alternative actions evaluated in the PEA (MMS, 2004).

**(12) Where the proposed activity would take place in or near a traditional Arctic subsistence hunting area and/or may affect the availability of a species or stock of marine mammal for Arctic subsistence uses, the applicant must submit either a plan of cooperation or information that identifies what measures have been taken and/or will be taken to minimize any adverse affects on the availability of marine mammals for subsistence uses;**

Not applicable.

**(13) The Suggested Means of Accomplishing the Necessary Monitoring and Reporting that Will Result in Increased Knowledge of the Species, the Level of Taking or Impacts on Populations of Marine Mammals that Are Expected to Be Present while Conducting Activities and Suggested Means of Minimizing Burdens by Coordinating Such Reporting Requirements with Other Schemes Already Applicable to Persons Conducting Such Activity. Monitoring Plans Should Include a Description of the Survey Techniques that Would Be Used to Determine the Movement and Activity of Marine Mammals Near the Activity Site(S) Including Migration and Other Habitat Uses, Such as Feeding;**

Current monitoring and reporting requirements are set forth in MMS's Notice to Lessees and Operators of Federal Oil, Gas, and Sulphur Leases in the Outer Continental Shelf, Gulf of Mexico OCS Region (NTL 2004-G01): *Implementation of Seismic Survey Mitigation Measures and Protected Species Observer Program.* The NTL applies to seismic surveys in all water depths in the Eastern Planning Area of the GOM and in water depths greater than 200 m in the rest of the GOM.

An annual report summarizing all sperm whale and sea turtle sightings is submitted by MMS to the National Marine Fisheries Service (NOAA Fisheries), Southeast Regional Office. This reporting requirement was made as part of the conservation recommendations in NOAA Fisheries' Biological Opinion (August 30, 2003) for the Gulf of Mexico Outer Continental Shelf Oil and Gas Lease Sales 189 and 197.

Monitoring during seismic surveys requires visual observers. At least two protected species visual observers are required on watch aboard seismic vessels at all times during daylight hours (dawn to dusk) when seismic operations are being conducted, unless conditions (fog, rain, darkness) make sea surface observations impossible. If conditions deteriorate during daylight hours such that the sea surface observations are halted, visual observations must resume as soon as conditions permit. Operators may engage trained third party observers, may utilize crew members after training as observers, or may use a combination of both third party and crew observers. During these observations, the following guidelines shall be followed: (1) other than brief alerts to bridge personnel of maritime hazards, no additional duties may be assigned to the observer during his/her visual observation watch (if conditions warrant more vigilant look-outs when navigating around or near maritime hazards, additional personnel must be used to ensure that watching for protected species remains the primary focus of the on-watch observers), (2) no observer will be allowed more than 4 consecutive hours on watch as a visual observer, (3) a "break" time of no less than 2 hours must be allowed before an observer begins another visual monitoring watch rotation (break time means no assigned observational duties), and (4) no person (crew or third party) on watch as a visual observer will be assigned a combined watch schedule of more than 12 hours in a 24-hour period. Due to the concentration and diligence required during visual observation watches, operators who choose to use trained crew members in these positions are encouraged to select only those crew members who demonstrate willingness as well as ability to perform these duties.

All visual observers must have completed a protected species observer training course. The MMS does not sanction particular trainers or training programs. However, basic training criteria have been established and must be adhered to by any entity that offers observer training (NTL 2004-G01). Operators may utilize observers trained by third parties, may send crew for training conducted by third parties, or may develop their own training program.

### *Visual Monitoring Methods*

The observers on duty will look for whales, other marine mammals, and sea turtles using the naked eye and hand-held binoculars provided by the seismic vessel operator. The observers will stand watch in a suitable location that will not interfere with navigation or operation of the vessel and that affords the observers an optimal view of the sea surface. The observers will provide 360° coverage surrounding the seismic vessel and will adjust their positions appropriately to ensure adequate coverage of the entire area. These observations must be consistent, diligent, and free of distractions for the duration of the watch.

Visual monitoring will begin no less than 30 minutes prior to the beginning of ramp-up and continue until seismic operations cease or sighting conditions do not allow observation of the sea surface (e.g., fog, rain, darkness). If a marine mammal (whale or dolphin) or sea turtle is observed, the observer should note and monitor the position (including lat./long. of vessel and relative bearing and estimated distance to the animal) until the animal dives or moves out of visual range of the observer. Make sure to continue to observe for additional animals that may surface in the area, as often there are numerous animals that may surface at varying time intervals. At any time a whale is observed within an estimated 500 m of the sound source array ("exclusion zone"), whether because of the whale's movement, the vessel's movement, or because the whale surfaced inside the exclusion zone, the observer will call for the immediate shut-down of the seismic operation and airgun firing (the vessel may continue on its course but all airgun discharges must cease). The vessel operator must comply immediately with such a call by an on-watch visual observer. Any disagreement or discussion should occur only after shut-down. When no whales are sighted for at least a 30-minute period, ramp-up of the source array may begin. Ramp-up cannot begin unless conditions allow the sea surface to be visually inspected for whales for 30 minutes prior to commencement of ramp-up (unless the method described in the section entitled "Experimental Passive Acoustic Monitoring" is used). Thus, ramp-up cannot begin after dark or in conditions that prohibit visual inspection (fog, rain, etc.) of the exclusion zone. Any shut-down caused by a whale(s) sighting within the exclusion zone must be followed by a 30-minute all-clear period and then a standard, full ramp-up. Any shut-down for other reasons, including, but not limited to, mechanical or electronic failure, resulting in the cessation of the sound source for a period greater than 20 minutes, must also be followed by full ramp-up procedures. In recognition of occasional, short periods of the cessation of airgun firing for a variety of reasons, periods of airgun silence not exceeding 20 minutes in duration will not require ramp-up for the resumption of seismic operations if: (1) visual surveys are continued diligently throughout the silent period (requiring daylight and reasonable sighting conditions); and (2) no whales, other marine mammals, or sea turtles are observed in the exclusion zone. If whales, other marine mammals, or sea turtles are observed in the exclusion zone during the short silent period, resumption of seismic survey operations must be preceded by ramp-up.

### *Experimental Passive Acoustic Monitoring*

Whales, especially sperm whales, are very vocal marine mammals, and periods of silence are usually short and most often occur when these animals are at the surface and may be detected using visual observers. However, marine mammals may be at greatest risk of potential injury from seismic airguns when they are submerged and under the airgun array. Passive acoustic monitoring appears to be very effective at detecting submerged and diving sperm whales, and some other marine mammal species, when they are not detectable by visual observation. The MMS strongly encourages seismic operators to participate in an experimental program by including passive acoustic monitoring as part of the protected species observer program. Inclusion of passive acoustic monitoring does not relieve an operator of any of the mitigations (including visual observations) in the NTL with the following exception: Monitoring for whales with a passive acoustic array by an observer proficient in its use will allow ramp-up and the subsequent start of a seismic survey during times of reduced visibility (darkness, fog, rain, etc.) when such ramp-up otherwise would not be permitted using only visual observers. If passive acoustic monitoring is used you must include an assessment of the usefulness, effectiveness, and problems encountered with the use of the method of marine mammal detection in the reports described in the NTL.

*Reporting*

Only through diligent and careful reporting can MMS determine the need for and effectiveness of mitigation measures. Information on observer effort and seismic operations are as important as animal sighting and behavior data. Three reports are submitted on the 1st and the 15th of each month: observer effort, survey, and sighting reports. The observer effort report is prepared for each day during seismic operations and includes information about when visual surveys were conducted as well as the average environmental conditions during the surveys. Survey reports (also prepared daily) include information about ramp-up activities, marine mammal observations made during ramp-up activities, and the duration and intensity of airgun activity. Sighting reports are made only when a marine mammal or sea turtle is observed. Data include the species observed, number of individuals (including juveniles), the animal's behavior (noting any observed changes), closest distance of the animal(s) to the airguns, and whether or not the airguns were firing at the time of the observation. In the event that the sighting was of a whale(s) within the exclusion zone that resulted in a shut-down of the airguns, the report must include 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). The report should be sent to MMS within 24 hours of the shut-down.

Borehole seismic surveys (e.g. VSP) differ from surface seismic surveys in a number of ways, including the use of much smaller airgun arrays, having an average survey time of 12-24 hours, using a sound source that is not usually moving at 4-5 kt, and requiring the capability of moving the receiver in the borehole between shots. Because of these differences, the following altered mitigations apply only to borehole seismic surveys:

1. During daylight hours, when visual observations of the exclusion zone are being performed as required in NTL 2004-G01, borehole seismic operations will not be required to ramp-up for shutdowns of 30 minutes or less in duration, as long as no whales, other marine mammals, or sea turtles are observed in the exclusion zone during the shutdown. If a whale, other marine mammal, or sea turtle is sighted in the exclusion zone, ramp-up is required and may begin only after visual surveys confirm that the exclusion zone has been clear for 30 minutes.
2. During nighttime or when conditions prohibit visual observation of the exclusion zone, ramp-up will not be required for shutdowns of 20 minutes or less in duration. For borehole seismic surveys that use passive acoustics during nighttime and periods of poor visibility, ramp-up is not required for shutdowns of 30 minutes or less.
3. Nighttime or poor visibility ramp-up is allowed only when passive acoustics are used to ensure that no whales are present in the exclusion zone (as for all other seismic surveys). Operators are strongly encouraged to acquire the survey in daylight hours when possible.
4. Protected species observers must be used during daylight hours, as required in the NTL, and may be stationed either on the source boat or on the associated drilling rig or platform if a clear view of the sea surface in the exclusion zone and adjacent waters is available.
5. All other mitigations and provisions for seismic surveys as set forth in NTL 2004-G01 will apply to borehole seismic surveys.

Monitoring and reporting are also accomplished through NTL 2003-G10. Reports are required in the event of a vessel collision with a marine mammal, or sighting of an injured/dead marine mammal.

## (14) Suggested Means of Learning of, Encouraging, and Coordinating Research Opportunities, Plans, and Activities Relating to Reducing Such Incidental Taking and Evaluating Its Effects.

The MMS has long taken a lead in evaluating the potential effects of industry related noise on marine mammals. Beginning in the mid-1970's, MMS (then Bureau of Land Management) contracted for studies on the effects of noise on marine mammals in the Alaska and Pacific OCS Regions. In 1987, MMS awarded a contract to LGL Ltd to prepare a comprehensive review of all literature with emphasis on the effects of noise from oil industry activities. In 1992, the Office of Naval Research (ONR) agreed to provide core funding to convert the MMS report into an expanded manuscript suitable for commercial publication. *"Marine Mammals and Noise"* by Richardson et al., (1995) was published by Academic Press through ONR and MMS funding support.

In 1999, MMS funded a workshop on protected species issues in the Gulf of Mexico (McKay et al., 2001). Following presentations on issues, comments from a panel of eight experts, and public comment, a post-workshop meeting was held with the expert panel and other Federal representatives to discuss research priorities. One outcome, based on strong and clear recommendations for the workshop experts, was to modify an existing agreement with NMFS to conduct cetacean surveys to also explore methods to study acoustic impacts with the emphasis on effects of airguns on sperm whales. The Sperm Whale Acoustic Monitoring Program (SWAMP) began in June 2000 with joint support from MMS, ONR, and NMFS. The two-year pilot program effectively established new methods to study acoustic impacts and baseline whale behavior, including use of digital tags (D-tags), satellite tags (S-tags), passive acoustics, and team coordination to effectively track whales through visual and acoustic methods, and direct small boats to tag whales.

With success on developing tools and methods, a directed study to evaluate the effects of seismic operations on sperm whales was begun in 2002. The Sperm Whale Seismic Study (SWSS) includes support from MMS, ONR, National Science Foundation (NSF), and a coalition of seismic and oil industry funders. The SWSS further coordinates with related industry research initiatives and ongoing NMFS Gulf of Mexico cetacean surveys co-funded by the Navy (N-45). Further, MMS has supported acoustic research through the National Oceanographic Partnership Program (NOPP).

The MMS proposes to continue SWSS through FY 2006 with final reports completed by 2007. Partnership in NOPP will also continue. As SWSS nears completion, research recommendations from the Advisory Committee on Acoustic Impacts on Marine Mammals will be available to aid in planning future research.

A key debate being discussed in this Advisory Committee is the controlled exposure experiment (CEE) approach in which cetaceans are intentionally exposed to a sound source (airguns in this case) and animal response/exposure level measured by attached digital-tags. This approach would lead to relatively precise estimates of behavioral changes in swimming, diving, and vocalizations correlated to measured received sound level. A debate remains on if these data are "worth" some degree of risk with intentional exposures. Until a more definitive answer is reached, CEE's have been suspended under SWSS.

Another approach MMS and partners are pursuing is to actively monitor the existing situation in the GOM. All seismic vessels subject to MMS permitting now provide observer reports as part of mitigation and monitoring requirements. These data can be integrated into an overall research evaluation of seismic effects. The SWSS is developing improved passive acoustic monitoring techniques — ultimately to predict the bearing and range of submerged sperm whales. Methodology can be transferred to mitigation detection applications and/or a research vessel can provide enhanced observations of ongoing seismic

surveys. Improved satellite-tags are to be deployed in FY 05 and 06 which will provide diving depths and precise (GPS) surfacing locations over months to a year. A limited number of sperm whales may be tagged in advance of seismic operations and their movements correlated with vessel operations over extended times — in a sense, uncontrolled exposure experiments.

The MMS is engaged in a proactive research effort coordinated with NMFS, Navy, NSF, and industry for support. Research is conducted under academic management by recognized experts and results from SWSS are published through the scientific peer-review process as the end-product.

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