UNITED STATES DEPARTMENT OF THE INTERIOR
MINERALS MANAGEMENT SERVICE
Gulf of Mexico OCS Region
New Orleans, Louisiana

SITE-SPECIFIC ENVIRONMENTAL ASSESSMENT

OF

REVISED EXPLORATION PLAN NO. R-5038

FOR

BP EXPLORATION & PRODUCTION INC.

March 23, 2010

Related Environmental Documents

Programmatic Environmental Assessment for Geological and Geophysical Exploration
for Mineral Resources on the Gulf of Mexico Outer Continental Shelf
(OCS EIS/EA MMS 2004-054)

SITE-SPECIFIC ENVIRONMENTAL ASSESSMENT/
FONSI/EIS DETERMINATION

The Minerals Management Service (MMS) has reviewed BP Exploration & Production Inc.'s Revised Exploration Plan (EP) (Control No. R-5038) that proposes seismic activities for a hazards survey of Mississippi Canyon Area, Block 252, Lease OCS-G32306. Our Site-Specific Environmental Assessment, SEA No. R-5038 AA, on the subject action is complete and results in a Finding of No Significant Impact. Based on the conclusions of the SEA, there is no evidence to indicate that the proposed action will significantly (40 CFR 1508.27) affect the quality of the human environment. Preparation of an environmental impact statement is not required. Mitigation is imposed to ensure environmental protection, consistent environmental policy and safety as required by the National Environmental Policy Act (NEPA), as amended, Endangered Species Act (ESA), and Marine Mammal Protection Act (MMPA); or measures needed for compliance with 40 CFR 1500.2(f) regarding the requirement for Federal agencies to avoid or minimize any possible adverse effects of their actions upon the quality of the human environment.

This FONSI is valid only insofar as the following conditions are imposed:

Mitigations

1.04 RAMP-UP, PROTECTED SPECIES VISUAL MONITORING, TRAINING, REPORTING, AND EXPERIMENTAL PASSIVE ACOUSTIC MONITORING REQUIREMENTS FOR SEISMIC SURVEY OPERATIONS: You will comply with NTL 2007-G02 Implementation of Seismic Survey Mitigation Measures and Protected Species Observer Program. It can be accessed on the web at http://www.gomr.mms.gov/homepg/regulate/regs/ntls/2007NTLs/07-g02.pdf.

1.05 VESSEL-STRIKE AVOIDANCE/REPORTING: The You will comply with NTL 2007-G04. It can be accessed on the web at http://www.gomr.mms.gov/homepg/regulate/regs/ntls/2007NTLs/07-g04.pdf.

0.00 PROTECTED SPECIES OBSERVER (PSO) MANNING: Due to the emergency nature of the proposed survey work and other logistic/timing issues, the operator will be allowed to use available crew members as Protected Species Observers (PSO) for conducting the requisite visual monitoring. The PSOs will make every effort to follow the monitoring and reporting guidelines outlined in NTL No. 2007-G02, which will be complied with in all other regards.

4/23/2010

Chief, Environmental Compliance Section
Leasing and Environment, GOM OCS Region

Date

Table of Contents

SITE-SPECIFIC ENVIRONMENTAL ASSESSMENT (SEA) PREPARED FOR
BP EXPLORATION & PRODUCTION INC.
REVISED EXPLORATION PLAN No. R-5038

1. INTRODUCTION

1.1. BACKGROUND

The purpose of this Site-Specific Environmental Assessment (SEA) is to assess the specific impacts associated with BP Exploration & Production Inc.'s seismic activities for a proposed on-lease hazards survey. The SEA is based on a Programmatic Environmental Assessment (PEA) for G&G Exploration for Mineral Resources on the Gulf of Mexico Outer Continental Shelf (USDOI, MMS, 2004) which evaluates a broader spectrum of potential impacts resulting from G&G activities across the Eastern, Central, and Western planning areas of the Gulf of Mexico (GOM) Outer Continental Shelf (OCS). The PEA/SEA process is called a "tiering" process and it is detailed in the National Environmental Policy Act's (NEPA's) implementing regulations (40 CFR §1502.20 and §1508.28). The PEA/SEA process is designed to reduce and simplify the size of environmental assessment documents by eliminating repetitive discussions of the same issues. The subsequent SEAs allow the analyses to focus on specific concerns and effects related to the proposed action.

This SEA conforms to the Minerals Management Service (MMS) and other appropriate guidelines for preparing environmental assessments by using data presented in the PEA to complete the assessment. It presents site-specific data regarding the proposed seismic survey and evaluates the potential impacts. This document identifies mitigation measures that should reduce the potential impacts. Preparation of this SEA has allowed the determination of whether a Finding of No Significant Impact (FONSI) is appropriate or whether further assessment of the proposal is necessary.

The G&G surveys provide information used by industry and government to evaluate the potential for offshore oil and gas resources below the surface of the land and seafloor. These operations direct high-intensity, low-frequency sound waves through layers of subsurface rock, which are reflected at boundaries between geological layers with different physical and chemical properties. The reflected sound waves are recorded and processed to provide information about the structure and composition of subsurface geological formations (McCauley, 1994). In an offshore seismic survey, a high-energy sound source is towed at slow speed behind a survey vessel. The sound source typically used is an airgun, a pneumatic device that produces acoustic output through the rapid release of a volume of compressed air.

The description of the air gun is found in Appendix B, Glossary of MMS Terminology and the PEA. The airgun is designed to direct the high-energy bursts of low-frequency sound (termed a "shot") downward towards the seafloor. Airguns are usually used in sets, or arrays, rather than singly (McCauley, 1994). Reflected sounds from below the seafloor are received by an array of sensitive hydrophones on cables (collectively termed "streamers") that are either towed behind a survey vessel or attached to cables placed on or anchored to the seafloor. A summary of G&G activities being conducted in the Gulf of Mexico is provided in Appendix C of the PEA (USDOI, MMS, 2004). Table II-2 from the PEA lists the typical G&G activities in the GOM. For this proposal, the operator will conduct a hazards survey using airgun arrays with streamers.

A detailed description of seismic sources is found in Appendix C of the PEA (USDOI, MMS, 2004). For the purpose of this analysis, G&G activities include seismic surveys (including high-resolution site surveys and various types of seismic exploration and development surveys), deep tow side-scan sonar surveys, electromagnetic surveys, and remote sensing. Most G&G activities aimed at OCS mineral exploration are considered a major Federal action under NEPA.

A glossary of MMS terminology relating to this G&G SEA is found in Appendix B. For abbreviations and acronyms, see page xxv of the PEA (USDOI, MMS, 2004).

1.2. PURPOSE, NEED, AND REGULATORY FRAMEWORK, AND DESCRIPTION

The MMS is mandated to manage the development of OCS oil, gas, and mineral resources, while also ensuring safe operations and protection of the human, marine, and coastal environments. The purpose of the MMS regulatory program is to ensure that the G&G data needed by industry and government are obtained in a technically safe and environmentally sound manner. The MMS performs assessment, leasing, exploration, development, production, and royalty management. The G&G activities aimed at mineral exploration are subject to a complex series of permits and notices. The MMS Resource Evaluation (RE) Program oversees G&G data acquisition and permitting activities, pursuant to regulations in 30 CFR (Dellagiarino et al., 1997 and 1998). Specifically, these include (1) Part 251, which regulates prelease G&G exploratory operations for oil, gas, and sulfur resources; and (2) Part 280, which regulates prelease prospecting activities (Fulton, 1998). The MMS Field Operations (FO) Program oversees on lease G&G activities pursuant to regulations in 30 CFR Part 250 which regulates ancillary activities, including hazards surveys, on-lease G&G exploration, and development G&G activities. Other regulations also pertain to one or more of the issues considered in this analysis (e.g., the President's Council on Environmental Quality [CEQ] guidelines for implementation of NEPA and pertinent regulations.

The G&G surveys provide information used by industry and government to evaluate the potential for offshore oil and gas resources and geologic hazards. The oil and gas industry needs accurate data on the location, extent, and properties of hydrocarbon resources, as well as information on shallow geologic hazards and seafloor geotechnical properties, in order to explore, develop, produce, and transport hydrocarbons safely and economically. The survey proposed under R-5038, is for a shallow hazards assessment of seafloor conditions in Mississippi Canyon Area, Block 252.

The MMS uses high-resolution geophysical data in each of its primary mission areas. The MMS Regulatory staff uses these data to ensure that the proposed site of bottom-founded structures is safe (i.e., via geohazards review) and that the foundations are properly designed (i.e., based on engineering parameters determined from cores), thus ensuring safe operations. The MMS Resource Evaluation staff uses deep seismic data for resources estimation and bid evaluation to ensure that the government receives a fair-market value for tracts offered for lease. The MMS Production and Development staff uses 3D data to map reserves and develop conservation evaluations for conservation of resources.

The MMS Leasing and Environment staff performs analyses to determine whether G&G activity (i.e., seismic survey noise, coastal vessel and aircraft traffic, space-use conflicts with seismic arrays, and seafloor disturbance) have significant impacts on the marine, coastal, or human environments of the GOM (i.e., marine mammals, sea turtles, fishes, commercial and recreational fisheries, coastal and marine birds, benthic communities, and cultural resources). The impacts are determined by an impact analysis that is used (1) to determine whether G&G activities have significant impacts on the marine, coastal, or human environments of the Gulf of Mexico; and (2) to identify significant impacts, if any, for further NEPA analysis. For the impact analysis, resource-specific significance criteria were developed for each category of the affected environment. The criteria reflect consideration of both the context and intensity of impact (40 CFR 1508.27). Criteria for marine mammals and sea turtles reflect the Federal protected status of all species occurring in the Gulf of Mexico. Adverse impacts are classified into one of three levels:

- significant adverse impact (including those that could be mitigated to nonsignificance);
- adverse but not significant impact; or
- negligible impact.

Significance criteria presented in this analysis, reflecting accepted threshold levels for significance (i.e., thresholds are resource-specific), are based on a recent EIS (USDOI, MMS, 2001b) for proposed floating production, storage, and offloading (FPSO) systems being considered in the deepwater regions of the Gulf of Mexico. Impacts are also categorized as direct or indirect. No beneficial impacts (either significant or nonsignificant) have been identified.

A preliminary screening was conducted to focus the impact analysis on those G&G activities and resources with potential for non-negligible impacts. First, a matrix was prepared to identify impact agents associated with each type of G&G activity (Table III-1 of the PEA; USDOI, MMS, 2004). The impact agents are (1) airgun noise; (2) sonar noise; (3) seafloor disturbance; (4) vessel traffic; (5) towed streamers; and (6) aircraft traffic. A second matrix was prepared to identify resources potentially affected by each type of G&G activity (Table III-2 of the PEA; USDOI, MMS, 2004). In this preliminary analysis, the level of impact associated with each interaction was categorized as *no impact* (i.e., no measurable impact to a resource evident), *negligible impact* (i.e., measurable but relatively minor impact to a resource predicted), or *potentially adverse impact* (i.e., measurable impact to a resource predicted).

Seismic surveys are the main focus because they have historically covered a large area of the Gulf each year and have the greatest potential for "significant" impacts on the environment. Further, there are increasing concerns in the regulatory and scientific communities regarding acoustic impacts on marine life, including marine mammals, turtles, and fishes. Of particular concern are those species whose hearing capabilities (based on vocalization characteristics) fall within the low frequencies introduced into the marine environment by seismic and geophysical activities. The PEA provides a comprehensive characterization of those biological resources that may be adversely affected by G&G activities. Based on a review of the Gulf's diverse biological resources, several species of marine mammals (sperm, Bryde's, and beaked whales) are deemed to be at greater risk of acoustic impact from seismic surveys. Therefore, seismic surveys are described in the most detail. However, all remaining G&G activities are also described.

In this SEA, MMS evaluates the potential impacts resulting from BP Exploration & Production Inc.'s proposed hazards survey, whereas the PEA provides a comprehensive characterization of those biological resources that may be adversely affected by G&G activities in general. Common G&G activities are found on page I-1 of the PEA (USDOI, MMS, 2004).

This SEA will focus on the affected environment from BP Exploration & Production Inc.'s proposed seismic activities for a hazards survey in Mississippi Canyon Area, Block 252, Lease OCS-G32306, in the Central Planning Area in water depths greater than 200 m.

2. PROPOSED ACTION AND ALTERNATIVES

BP Exploration & Production Inc. proposes to conduct a hazards survey with vessel deployment of the seismic source (airgun array) and towed receivers in Mississippi Canyon Area, Block 252, OCS-G32306. The proposed survey is a requisite emergency action that will be used to determine siting of two relief wells on the lease to assist in well control and reduction of ongoing pollution event/oil spill. The emergency actions are in response to a catastrophic accident on a mobile offshore drilling unit (MODU) and its subsequent sinking while conducting well operations on the block. The survey will provide BP with information related to seafloor conditions and the nature/orientation of the submerged MODU. Due to timing, the nature of the operations, and other logistical issues, the operator will not be able to transport third-party protected species observers (PSOs) to the survey vessel being rerouted to the area to conduct the proposed action. Coordination with MMS's protected species leads has verified that members of the vessel crew will be allowed to function as PSOs and comply with any/all monitoring requirements.

The area of the proposed action is in the Central Planning Area of the Gulf of Mexico, approximately 48 miles offshore, south of Plaquemines Parish, Louisiana. The proposed action is scheduled to begin in April 24, 2010 and last for approximately three-days. The proposed action in R-5038 would normally be categorically excluded (516 DM Chapter 6, Appendix 10, C. (9)). However, the proposed action represents exceptions to the categorical exclusions 516 DM Chapter 2, Appendix 2, 2.3 and 2.8, because activities proposed under this plan may have highly controversial environmental effects, may have adverse effects on species listed or proposed to be listed on the List of Endangered or Threatened Species, or have adverse effects on designated Critical Habitat for these species. Therefore, a SEA was prepared by MMS.

2.1. RANGE OF ALTERNATIVES

The Coordinator of the SEA evaluated the following range of alternatives:

Alternative 1 – Proposed Action, or a continuation of the status quo, consisting of the various G&G activities currently occurring and estimated to occur in the foreseeable future (i.e., over the next several decades) in the Western, Central, and Eastern Planning Areas of the GOM, operating under current MMS regulations and requirements (e.g., applicable NTLs). Specifically, G&G operators must adhere to the requirements of NTL Nos. 2007-G02 and 2007-G04 when operating in waters >200 m deep in the GOM (and all Federal waters of the Eastern Planning Area) by utilizing ramp-up, employing visual monitoring using trained observers, completing reporting requirements, and having the option of initiating seismic operations during nighttime and periods of limited visibility using passive acoustic monitoring techniques.

Alternative 2 – Addition of Vessel-based Passive Acoustic Monitoring as a Requirement. Specifically, G&G operators working in water depths >200 m throughout the GOM and all OCS waters of the Eastern Planning Area must adhere to the status quo (i.e., compliance with the requirements of NTL Nos. 2007-G02 and 2007-G04: ramp-up, visual monitoring using trained observers, reporting requirements) and must utilize passive acoustic monitoring techniques prior to rampup in conjunction with visual monitoring.

Alternative 3 – Addition of Both Passive and Active Acoustic Monitoring as a Requirement., specifically, G&G operators working in water depths >200 m throughout the GOM and all OCS waters of the Eastern Planning Area must adhere to the status quo (i.e., compliance with the requirements of NTL Nos. 2007-G02 and 2007-G04) and must utilize both passive acoustic monitoring and active acoustic monitoring techniques prior to ramp-up in conjunction with visual monitoring.

Alternative 4 – Restrict G&G Seismic Surveying Operations. Under this alternative, the existing suite of G&G activities would continue but with the implementation of additional restrictions on G&G seismic operations. Specifically, G&G operators would be precluded from conducting simultaneous seismic operations (i.e., within 4 km of one another; within an adjacent OCS lease block) in those portions of the GOM most frequented by sperm whales and Bryde's whales (i.e., water depths >200 m). The purpose of this measure is to remove the potential for simultaneous exposure to seismic noise from concurrent surveys in the same general area.

The preferred alternative for this seismic survey is approval with mitigation measures (modified Alternative 1). Alternative 1 requirements are found on page II-3 (44 of 487) of the PEA. Impacts are found on page III-29 (102 of 487) in the PEA but the modified Alternative 1 mitigations are found on Page II-22 (63 of 487) of the PEA. Modified Alternative 1 was selected because the operator proposes G&G operations in the Central planning area and needs the additional mitigations to protect the sperm, Bryde's, Beaked whales and other cetaceans.

Selected Alternative Description:

Modified Alternative 1 meets the underlying need. The current suite of G&G activities provides the oil and gas industry with sufficiently accurate data on the location, extent, and properties of hydrocarbon resources, as well as information on shallow geologic hazards and seafloor geotechnical properties, in order to explore, develop, produce, and transport hydrocarbons safely and economically.

Mitigations

Approval with Mitigation Measures (Modified Alternative 1)

1.04 RAMP-UP, PROTECTED SPECIES VISUAL MONITORING, TRAINING, REPORTING, AND EXPERIMENTAL PASSIVE ACOUSTIC MONITORING REQUIREMENTS FOR SEISMIC SURVEY OPERATIONS: You will comply with NTL 2007-G02 Implementation of Seismic Survey Mitigation Measures and Protected Species Observer Program. It can be accessed on the web at http://www.gomr.mms.gov/homepg/regulate/regs/ntls/2007NTLs/07-g02.pdf.

1.05 VESSEL-STRIKE AVOIDANCE/REPORTING: The You will comply with NTL 2007-G04. It can be accessed on the web at http://www.gomr.mms.gov/homepg/regulate/regs/ntls/2007NTLs/07-g04.pdf.

0.00 PROTECTED SPECIES OBSERVER (PSO) MANNING: Due to the emergency nature of the proposed survey work and other logistic/timing issues, the operator will be allowed to use available crew members as Protected Species Observers (PSO) for conducting the requisite visual monitoring. The PSOs will make every effort to follow the monitoring and reporting guidelines outlined in NTL No. 2007-G02, which will be complied with in all other regards.

These mitigations would involve additional costs and delays to operators in obtaining seismic data and would slow OCS exploration and development in a similar fashion to those noted under Alternative 2, but these mitigations as well as vessel strike avoidance and injured/dead protected species reporting, marine trash and debris awareness and elimination will help determine the presence and location of marine mammals and protect them. See also Appendix A, *Proposed Mitigation Measures*.

2.2. SUMMARY AND COMPARISON OF ALTERNATIVES

A detailed summary and comparison of alternatives is provided in the PEA Section III (Tables III-4 and S-2) and in Appendix C of this SEA as part of a summary evaluation of potential impacts by resource. Alternatives Considered but Not Analyzed, Existing and Proposed Mitigation Measures, and Potential Operational Restrictions are found in Appendix E of the PEA.

Table S-2 compares the environmental consequences of each alternative on a resource by resource basis for seismic operations using air guns. Comparisons of alternatives are based on their perceived advantages relative to Alternative 1-Proposed Action. Limitations evident in each alternative are also noted in this appendix.

Reduced potential impacts are noted for each of the alternatives (Alternatives 2, 3, and 4). The use of passive acoustic monitoring (Alternative 2) offers to reduce further the potential exposure to seismic survey noise for those whales that vocalize. The combined use of passive and active acoustic monitoring (Alternative 3) also provides potential impact reductions for whales; however, there are notable limitations for employing active acoustic monitoring systems. Under Alternatives 2 and 3, potential impacts to fishes, commercial and recreational fisheries, sea turtles, coastal and marine birds, and benthic resources remain unchanged relative to Alternative 1. Restricting concurrent seismic operations (Alternative 4) is intended to preclude the potential for simultaneous exposure. Industry practice may already effectively implement this restriction. Limitations identified for alternatives, including potential cost ramifications, are also noted. As evident in Table S-2, Alternatives 2 and 3 do not result in a reduction in impact (due to operational restrictions) to most of the resources listed. Impacts to those resources remain unchanged relative to Alternative 1.

Among sea turtles, visual monitoring (under Alternative 1) offers limited mitigation against vessel strikes under those conditions where individual turtles may be sighted. Alternatives 2, 3, and 4 offer no reduction in impact level relative to Alternative 1.

Among the marine mammals, there are expected decreases in impacts to all vocalizing marine mammals (with the exception of manatees) under Alternative 2 (passive acoustic monitoring) and Alternative 3 (passive and active acoustic monitoring), in spite of the limitations noted for each mitigation measure. Alternative 2 offers the greatest potential for reduced impacts to vocalizing species (e.g., sperm whales); impacts to non-vocalizing marine mammals remain unchanged. A combination of existing NTL requirements and passive acoustic monitoring, while not completely eliminating the limitations inherent in each individual measure, is expected to provide the greatest degree of assurance that no marine mammals (with the exception of manatees) have ventured into the exclusion zone of an operational seismic array. Under Alternative 3, some marine mammals (i.e., those that vocalize) may realize benefit from passive acoustic monitoring, and some species may be detectable using active acoustic monitoring techniques. However, there are limitations and potential impacts associated with active acoustic monitoring that may outweigh its potential benefits (e.g., increased anthropogenic noise in the environment, use of sound sources whose sound pressure levels may exceed acceptable exposure levels, etc.). Alternative 4 offers an indeterminate reduction in the potential for impact to sperm and Bryde's whales; however, current industry practice may already address the need to avoid concurrent seismic survey activity.

In all cases where impacts are expected to decrease, there has been no reduction in impact designation level as initially determined under Alternative 1, due in part to the limitations inherent in each mitigation. Only the potential for impact has been reduced as a result of the mitigation measure. For accidents, all of the Gulf resources evaluated could be affected by a spill caused by an accident involving a G&G vessel. Based on the historical occurrence of vessel accidents (e.g., three incidents reported in the GOM during 1996 and 1997 involving "research vessels," inclusive of G&G vessels), the probability of such incidents occurring is quite low, with the potential for a pollution incident even lower. Records of the volumes of released lubricating oil or diesel fuel in documented G&G vessel accidents has generally been low (i.e., two to five minor releases per year in the GOM). An event involving a survey vessel could result in release of diesel fuel, but such an event has an extremely remote probability of occurring. Thus, incidents involving survey vessels are not expected to result in significant impacts on any of the Gulf resources considered in this analysis. In all cases, impacts are negligible.

A cumulative activity scenario was developed that identified major activities occurring in the GOM. Similarly, the noise environment of the Gulf also was described. Major impact producing factors (i.e., coincident with other similar activities) under the cumulative activity scenario include vessel traffic (i.e., cargo, tanker, military, commercial fishing, recreational boating) and its associated noise and shipstrike potential. Analysis of the cumulative scenario (exclusive of the Proposed Action) produced predicted impact levels, by resource, which ranged from negligible to potentially adverse but not significant (i.e., no significant impacts were evident). The incremental impact of the Proposed Action was then compared to the cumulative scenario impact determinations to predict incremental impacts. In terms of vessel activity levels, seismic survey vessel activity represents a very small component of total vessel activity in Gulf waters. For example, oil and gas support vessels account for approximately 250,000 transits per year in Gulf waters, with commercial vessels >10,000 dead weight tons (DWT) contributing another 36,000 trips. By comparison, approximately 20 seismic surveys may occur (USDOI, MMS, 2004).

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS

INTRODUCTION

The objectives of this impact analysis are (1) to determine whether G&G activities have significant impacts on the marine, coastal, or human environments of the Gulf of Mexico; and (2) to identify significant impacts, if any, for further NEPA analysis.

After a review of previous EAs and EISs (e.g., USDOI, MMS, 1996, 1997, 1998, 1999, 2001a,b, 2002a,b) and relevant literature pertinent to historic and projected OCS activities (e.g., Baud et al, 2002), the following resources were initially considered for impact analysis:

- marine mammals (including ESA listed species and strategic stocks);
- sea turtles (all are ESA listed species);
- fishes (including listed species and ichthyoplankton);
- commercial and recreational fisheries;
- coastal and marine birds (including ESA listed species);
- benthic communities;
- cultural resources;
- recreational and commercial diving;
- marine transportation;
- geology/sediments; and
- air and water quality.

A preliminary screening of the PEA indicates that seismic surveys have potentially adverse impacts on marine mammals, sea turtles, fishes, and commercial and recreational fisheries. Negligible impacts are on coastal and marine birds, cultural resources, air quality, and benthic communities (chemosynthetic communities). This analysis will focus on these categories (Page S-6, 30 of 487 of the PEA). For the impact analysis, resource-specific significance criteria were developed for each category of the affected environment. The criteria reflect consideration of both the context and intensity of impact (40 CFR 1508.27). Criteria for marine mammals and sea turtles reflect the Federal protected status of all species occurring in the Gulf of Mexico. Adverse impacts are classified into one of three levels:

- significant adverse impact (including those that could be mitigated to nonsignificance);
- adverse but not significant impact; or
- negligible impact.

For the purpose of tiering, this section will concentrate on the affected environment and potentially adverse but not significant impacts (whales and other cetaceans), sea turtles, fishes [Gulf Sturgeon], and negligible to no impacts cultural resources [shipwreck/prehistoric discovery], air quality, and benthic communities [chemosynthetic communities]) from G&G operations in the GOM. A detailed description of other environmental resources are not addressed in this SEA but are assessed in the PEA. A Summary and Comparison of Impact Determinations is found in the Section III. H. and Table III-4 of the PEA (USDOI, MMS, 2004).

3.1. Marine Mammals

Twenty-nine species of marine mammals occur in the GOM (Davis et al., 2000). The GOM's marine mammals are represented by members of the taxonomic order Cetacea, which is divided into the suborders Mysticeti (i.e., baleen whales) and Odontoceti (i.e., toothed whales), as well as the order Sirenia, which includes the manatee and dugong. Within the GOM, there are 28 species of cetaceans (7 mysticete and 21 odontocete species) and one sirenian species, the manatee (See Appendix D, Table 3.1).

Baleen whale hearing has not been extensively studied. An analysis of marine mammal hearing compiled by Ketten in 1998 showed that mysticetes (baleen whales) exhibited inferred hearing thresholds of 10 to 31,000 Hz, with dominant frequencies of 16 to 25,000 Hz. There are no specific data regarding sensitivity, frequency or intensity discrimination, or localization abilities in baleen whales. Baleen whales apparently are more dependent on low frequency sounds than other marine mammals. The lack of specific data on baleen whale hearing abilities remains a major limitation in evaluating the effects of manmade noise on this group (USDOI, MMS, 2004).

Toothed whales are most sensitive to high-frequency sounds, e.g., frequencies above approximately 10 kHz. Below that level, sensitivity deteriorates with decreasing frequency; with the possible exception of the sperm whale (Carder and Ridgway, 1990). The sensitivity of many toothed whale species to high frequency sounds is attributed to their use of high frequency sound pulses in echolocation and moderately high frequency calls for communication. Low frequency hearing has not been studied extensively in toothed whales; however some species may be able to detect sound frequencies as low as 60-105 Hz. Below 1 kHz, where most industrial noise energy is concentrated, odontocete hearing sensitivity appears to be relatively poor. Toothed whales possess good intensity and frequency discrimination abilities, as well as good localization capabilities (USDOI, MMS, 2004).

The hearing sensitivity of the West Indian manatee ranges from 15 Hz to 46 kHz, with best sensitivity between 6 kHz and 20 kHz (Gerstein et al., 1999). The USDOI, FWS (1996), indicates that the West Indian manatee is sensitive to low frequency noise.

Several environmental factors must be considered when conducting hearing studies or assessing the impacts of manmade noise on free-ranging cetaceans (Dalheim and Ljungblad, 1990), including determinations of 1) ambient noise levels and the potential for masking; 2) sound propagation characteristics of the medium (e.g., water depth, substrate, temperature, salinity, seasonal fluctuation in characteristics such as stratification); 3) absolute sound levels and frequencies reaching the cetacean; and 4) orientation of the cetacean relative to the sound source. Predicting sound propagation has proven to be a complex issue. For example, hydrophones moored in a remote area of the mid-Atlantic Ocean picked up seismic airgun sounds frequently over a two-year period. Estimates of sound source location indicated that seismic survey vessels were often located 3000 km or more from the hydrophone array (Nieukirk et al., 2004). Tolstoy et al (2004) compared broadband calibration measurements of the seismic sources on the R/V *Ewing* to modeled values and safety radii. They found the modeled values in deep water overestimated the safety radii (measured values for the 160-190 dB radii were not as large as those modeled). However the opposite was true for shallow water. They found that modeled estimates of the 180, 170 and 160 dB radii were underestimates of the actual distances where such levels occur. The results indicated that, in shallow water, reverberations played a significant role and previous modeling had not accounted for bottom reverberations.

Biological factors should also be considered when evaluating the results of hearing studies conducted on marine mammals. Hearing may vary among individuals according to age or sex (Awbrey et al., 1988). Indeed, age related hearing loss has been shown in the structure of cetacean ears, which with a restricted sample size of animals for testing and behavioral observation could be misinterpreted as a hearing injury. The behavioral state of test animals may also influence the responses evoked (Ljungblad et al., 1988). Habituation may also occur under those conditions where a cetacean is repeatedly exposed to a manmade sound (Dalheim and Ljungblad, 1990). However, with regard to habituation, it is difficult to determine if habituation is behavioral (i.e., the animal is voluntarily tolerating a noise level) or whether the animal has

become de-sensitized to repeated noise exposure through either temporary or permanent threshold shift (USDOI, MMS, 2004).

3.1.1. Threatened or Endangered Marine Mammal Species

One toothed whale (the sperm whale), five baleen whales (the northern right, blue, fin, sei, and humpback), and one sirenian (the West Indian manatee) occur in the GOM and are listed as endangered. However, only the sperm whale frequently occurs in oceanic waters of the northern GOM and may be a resident species. All five of the endangered baleen whale species are considered rare or extralimital in the GOM (Würsig et al., 2000, see Appendix D, Table 3.1). None of the five endangered baleen whales known to occur in the GOM are included in the NOAA stock assessments for the Gulf and they will not be further analyzed here. The West Indian manatee *(Trichechus manatu*s) inhabits only coastal marine, brackish, and freshwater areas.

Sperm Whale (Physeter macrocephalus)

The sperm whale (*Physeter macrocephalus*) is found worldwide in deep waters between approximately 60°N and 60°S latitudes, although generally only large males venture to the extreme northern and southern portions of their range (Jefferson et al., 1993). As deep divers, sperm whales generally inhabit oceanic waters, but they do come close to shore where submarine canyons or other geophysical features bring deep water near the coast (Jefferson et al., 1993). Sperm whales prey on cephalopods, demersal fishes, and benthic invertebrates (Rice, 1989; Jefferson et al., 1993).

The sperm whale is the only great whale that is considered common in the northern GOM (Fritts et al., 1983; Mullin et al., 1994; Davis and Fargion, 1996; Jefferson and Schiro, 1997). Aggregations of sperm whales are commonly found in waters over the shelf edge in the vicinity of the Mississippi River delta in waters that are 500-2,000 m (1,641-6,562 ft) in depth (Mullin et al., 1994; Davis and Fargion, 1996; Davis et al., 2000). They are often concentrated along the continental slope in or near cyclones (Davis et al., 2000). Consistent sightings in the region indicate that sperm whales occupy the northern GOM throughout all seasons (Mullin et al., 1994; Davis and Fargion, 1996; Sparks et al., 1996; Jefferson and Schiro, 1997; Davis et al., 2000). For management purposes, sperm whales in the GOM are provisionally considered a separate stock from those in the Atlantic and Caribbean (Waring et al., 1997). Estimated abundance for the northern GOM is 1,349 individuals (NOAA, 2004).

West Indian Manatee (Trichechus manatus)

The West Indian manatee (*Trichechus manatus*) is the only sirenian occurring in tropical and subtropical coastal waters of the southeastern U.S., GOM, and Caribbean Sea (Reeves et al., 1992; Jefferson et al., 1993; O'Shea et al., 1995). There are two subspecies of the West Indian manatee: the Florida manatee *(T. m. latirostri*s), which ranges from the northern GOM to Virginia; and the Antillean manatee *(T. m. manatu*s), which ranges from northern Mexico to eastern Brazil, including the islands of the Caribbean Sea. Manatees primarily use open coastal (shallow nearshore) areas, estuaries, and they are also found far up freshwater tributaries. Manatees often use secluded canals, creeks, embayments, and lagoons, particularly near the mouths of coastal rivers and sloughs, for feeding, resting, mating, and calving (USDOI, FWS, 2001). During warmer months, manatees are common along the Gulf Coast of Florida from Everglades National Park northward to the Suwannee River in northwestern Florida and less common farther westward. In winter, the GOM subpopulations move southward to warmer waters. The winter range is restricted to waters at the southern tip of Florida and to waters near localized warm-water sources, such as power plant outfalls and natural springs in west-central Florida. Crystal River in Citrus County, is typically the northern limit of the manatee's winter range on the Gulf Coast. Manatees are uncommon west of the Suwannee River in Florida and are infrequently found as far west as Texas. Manatees are not expected to be impacted by seismic operations due to their coastal and near shore habitat preference.

Conclusion (Endangered Species)

Richardson et al. (1995) defined four zones of potential noise effects on marine mammals. In order of increasing severity, the zones are:

- audibility;
- responsiveness;
- masking; and
- hearing loss, discomfort, or injury (physical effects).

Potential impacts in the Gulf of Mexico are likely to include behavioral effects, which could have extensive radii (kilometers) from airgun sources, and possibly physical effects extending from behavioral modification and acoustically induced decompression sickness (DCS). Perceived wisdom from other studies suggests that audibility in itself is not likely to cause adverse impacts and that masking is not likely to pose a major problem due to the low duty cycle of seismic pulses. Temporary Threshold Shift (TTS) and Permanent Threshold Shift (PTS) are only likely to occur at close ranges (tens or perhaps hundred of meters from an airgun source). Therefore, physical damage to auditory structures is only likely in extreme proximity to airgun sources. Recent debate has introduced the possibility of DCS as a physical effect that could be acoustically induced to some deep diving marine mammals. Those effects might occur in response to sound levels considerably lower than those required to produce TTS and PTS in auditory structures. Sperm whales are the only endangered species in the Gulf of Mexico potentially impacted by industry seismic operations. Behavioral disturbance, such as cessation of vocalizations and startle reactions, have been reported for sperm whales. However, research in the Gulf reported no alteration in vocalizations or observed behavior modification. Also in the Gulf, areas such as the Mississippi Delta that were historically populated with sperm whales are still areas of sperm concentration in spite of oil and gas industry development and seismic activity. There are, as yet, insufficient data to assign thresholds for acoustic disturbance to sperm whales. There are few documented data on physical effects of high levels of sound on sperm whales. The deep diving habit of sperm whales may create a greater vulnerability to being in regions of increased ensonification, relative to more near-surface species. Seismic airgun arrays are generally configured to produce a maximum, low frequency energy lobe directly downwards towards the seabed and a deep dive could take a whale down to a depth where they could be passed over directly by an operating seismic vessel without their being visually detected. However, studies in the Gulf of Mexico showed that the marine mammal sighting rate did not change significantly due to seismic exploration signals and the analysis of the results was unable to detect small-scale (<100 km) changes in marine mammal distribution.

Mitigations currently in effect for seismic operations include ramp up of the airgun array and visual monitoring during all daylight hours, as well as observer training, reporting, vessel strike avoidance and marine trash and debris awareness and elimination. Seismic airguns cease firing when any whale comes within 500m of the sound source and visual observers monitor the movements of surfaced marine mammals. Ramping up the airguns is a mitigation to "warn" animals in the area of the increasing sound source and give animals the opportunity to move away or avoid ensonified regions. This may be effective for both surfaced and submerged marine mammals. The transitory nature of seismic surveys results in only the temporary acoustic disturbance of any given region.

3.1.2. Nonendangered Species

The remaining 22 marine mammal species that occur in the Gulf of Mexico are nonendangered. However, all marine mammals are protected by the Marine Mammal Protection Act. There are two species of baleen whales that occur in the GOM, the minke whale and the Bryde's whale. The minke whale is considered rare and is not included in the NOAA Stock Assessment for the Gulf of Mexico. The Bryde's whale is considered uncommon but is the most frequently sighted baleen whale in the Gulf.

Nonendangered toothed whales include all of the dolphin and small whale/"blackfish" species in the Gulf comprising 20 species. Several of the member species of this group are known to approach and bow ride

seismic vessels, even when surveying with active airguns. Two species groups may warrant particular concern regarding seismic activities. The *Kogia* species (pygmy and dwarf sperm whales) are small and cryptic whales that inhabit offshore waters. Very little is known of their life history. The beaked whales have been highly publicized in the last several years due to strandings and deaths attributed to military sonar. Beaked whales are not as small as *Kogia* but they are just as cryptic and difficult to survey. As with *Kogia*, very little is known about beaked whales.

Bryde's Whale (Balaenoptera edeni)

The Bryde's whale (*Balaenoptera edeni*) is found in tropical and subtropical waters throughout the world. The Bryde's whale feeds on small pelagic fishes and invertebrates (Leatherwood and Reeves, 1983; Jefferson et al., 1993). Bryde's whale in the northern GOM, with few exceptions, has been sighted along a narrow corridor near the 100-m (328-ft) isobath (Davis and Fargion, 1996; Davis et al., 2000). Most sightings have been made in the DeSoto Canyon region and off western Florida, though there have been some in the west-central portion of the northeastern GOM. The best estimate of abundance for the northern GOM is 40 individuals (NOAA, 2004).

Pygmy and Dwarf Sperm Whales (Family Kogiidae)

Pygmy Sperm Whales (Kogia breviceps)

The pygmy sperm whale *(Kogia breviceps*) has a worldwide distribution in temperate to tropical waters. They feed mainly on squid, but will also eat crab, shrimp, and smaller fishes (Würsig et al., 2000). In the GOM, they occur primarily along the continental shelf edge and in deeper waters off the continental shelf (Mullin et al. 1991). At sea, it is difficult to differentiate pygmy from dwarf sperm whales (*Kogia sima*) and sightings are often grouped together as "*Kogia* spp." The best estimate of abundance for pygmy and dwarf sperm whales combined, in the northern GOM, is 742 individuals (NOAA, 2004).

Dwarf Sperm Whales (Kogia sima)

The dwarf sperm whale *(Kogia sima*) has a worldwide distribution in temperate to tropical waters (Caldwell and Caldwell 1989). It is believed that they feed on squid, fishes, and crustaceans (Würsig et al., 2000). In the GOM they are found primarily along the continental shelf edge and over deeper waters off the continental shelf (Mullin et al. 1991). At sea, it is difficult to differentiate dwarf from pygmy sperm whales (*Kogia breviceps*) and sightings are often grouped together as "*Kogia* spp." The best estimate of abundance for dwarf and pygmy sperm whales combined, in the northern GOM, is 742 individuals (NOAA, 2004).

Beaked Whales (Family Ziphiidae)

Cuvier's Beaked Whale (Ziphius cavirorostris)

Cuvier's beaked whale (*Ziphius cavirorostris*) is widely (but sparsely) distributed throughout temperate and tropical waters worldwide (Würsig et al. 2000). Their diet consists of squid, fishes, crabs, and starfish. In the northern GOM, they are broadly distributed in waters greater than 1,000 m over lower slope and abyssal landscapes (Davis et al., 1998 and 2000). Sightings data indicate that Cuvier's beaked whale is probably the most common beaked whale in the GOM (Jefferson and Schiro, 1997; Davis et al., 1998 and 2000). Abundance estimates for Cuvier's beaked whale in the northern GOM is 95 individuals (NOAA, 2004).

Gervais' Beaked Whale(Mesoplodon europaeus)

Gervais' beaked whale (*Mesoplodon europaeus*) appears to be widely but sparsely distributed worldwide in temperate to tropical waters (Leatherwood and Reeves, 1983). Little is known about their life history, but it is believed that they feed on squid (Würsig et al., 2000). Beaked whales in the GOM are grouped

into an undifferentiated complex (*Mesoplodon* spp. and *Ziphius* sp.) due to the difficulty of at sea identification. In the northern GOM, they are broadly distributed in waters greater than 1,000 m over lower slope and abyssal landscapes (Davis et al., 1998 and 2000). Stranding records suggest that this is probably the most common mesoplodon in the northern GOM (Jefferson and Schiro, 1997). Abundance estimates for the undifferentiated beaked whale complex in the northern GOM is 106 individuals (NOAA, 2004).

Blainville's Beaked Whale (Mesoplodon densirostris)

Blainville's beaked whale (*Mesoplodon densirostris*) is distributed throughout temperate and tropical waters worldwide, but is not considered common (Würsig et al., 2000). Little life history is known about this secretive whale, but it is known to feed on squid and fish. Beaked whales in the GOM are grouped into an undifferentiated complex (*Mesoplodon* spp. and *Ziphius* sp.) due to the difficulty of at sea identification. In the northern GOM, they are broadly distributed in waters greater than 1,000 m over lower slope and abyssal landscapes (Davis et al., 1998 and 2000). Abundance estimates for the undifferentiated beaked whale complex in the northern GOM is 106 individuals (NOAA, 2004).

Sowerby's Beaked Whale (Mesoplodon bidens)

Sowerby's beaked whale (*Mesoplodon bidens*) occurs in cold temperate to subarctic waters of the North Atlantic and feeds on squid and small fishes (Würsig et al., 2000). It is represented in the GOM by only a single record, a stranding in Florida; this record is considered extralimital since this species normally occurs much farther north in the North Atlantic (Jefferson and Schiro, 1997). There are no abundance estimates for the GOM.

Conclusion (Nonendangered Species)

Potential noise effects and impacts are listed in the Conclusion section under Endangered Species above. As toothed whales, *Kogia sp.* and beaked whales share similarities with the sperm whale, including deep diving and the almost certain use of echolocation clicks for navigation and prey location. Little, if anything, is known of detailed behavior responses of these animals to anthropogenic sound. However, their behavior may be linked to observed physical effects, and can only be extrapolated at this time.

There are now several examples of possible acoustically induced stranding events by beaked whales, including those that are strongly correlated to the use of military sonar. It must be emphasized that sonar and seismic acoustic events are vastly different both in frequency range and pulse duration. However, it is now generally accepted that at least in some instances, beaked whale stranding events were acoustically induced, and that they occurred in response to received sound levels much lower than would be expected to give rise to "normal" physical trauma in marine mammals. The deep diving habit of beaked whales, and *Kogia* may, like sperm whales, increase their risk of being exposed to higher energy levels from downward-directed seismic pulses. There is evidence that beaked whales may be vulnerable to acoustically and/or behaviorally induced decompression sickness from rapid surfacing or inability to repeat a deep dive.

Baleen whales have probably been the most studied group of marine mammals in the open ocean in terms of observations of behavioral changes in response to seismic operations and other high level sound sources. The Bryde's whale is the only baleen whale regularly occurring in the Gulf of Mexico. Although there have been no studies of Bryde's whale reactions to seismic surveys, it is generally considered on the basis of vocalization frequencies and ear anatomy (Ketten, 1998) that the auditory abilities of all baleen whale species are broadly similar. In terms of overall sensitivity to seismic activities, baleen whales are probably a relatively "high risk" category amongst the marine mammals. There is clearly a possible overlap between the expected frequencies of good hearing sensitivity in baleen whales and maximal airgun output at source. Avoidance reactions by baleen whales to seismic and seismic-type sounds have been reported. Pressure pulses from airguns have the potential for damaging the hearing of all marine mammals, including baleen whales. However, there are no data for TTS, PTS, or even hearing thresholds in baleen whales. Since baleen whales are not typically deep divers, it is less

likely they would suffer from acoustically and\or behaviorally induced decompression sickness than might be the case for some of the toothed whales.

The mitigations noted in the conclusions for endangered species (above) are in place for Bryde's whales, beaked whales, and *Kogia sp.* as well. In the eastern Gulf, where Bryde's whales are almost exclusively found, the observer mitigations are for all federal waters, not just those greater than 200m as in the central and western Gulf. With an estimated abundance of 40 individuals in the Gulf of Mexico (NOAA, 2004), the probability of a Bryde's whale being in the proximity of a seismic operation is very low. The cryptic behavior and the apparent avoidance of ships in general by *Kogia* and beaked whales, as well as ramp-up requirements for seismic operations to warn animals out of the ensonified area, should reduce the probability of exposure to high levels of sound by those species groups.

3.2. TURTLES

Description

Five species of sea turtles are known to inhabit the Gulf of Mexico (Pritchard, 1997). These species are the loggerhead, leatherback, Kemp's ridley, green, and hawksbill turtles. All five species are listed as either endangered or threatened species under the ESA (Pritchard, 1997). Additional information on sea turtle species of the Gulf of Mexico is provided in Appendix E of the PEA (USDOI, MMS, 2004).

There are no designated critical habitats for sea turtles in the northern Gulf of Mexico. The NMFS recognizes many coastal areas of the Gulf as preferred habitat (important, sensitive habitats that are essential for the species within a specific geographic area); e.g., seagrass beds in Texas lagoons and other nearshore or inshore areas (including jetties) for green turtles; and bays and lakes, especially in Louisiana and Texas for Kemps ridley turtles. Sargassum mats also are recognized as preferred habitat for hatchlings. There are no designated migratory routes for turtles in the Gulf.

Conclusion

The main concern from an impact perspective is noise from seismic surveys. Impacts of seismic surveys on sea turtles may include auditory trauma (impact) and/or behavioral disturbance. Acoustic impacts to sea turtle hearing capabilities and the summary serving as the basis for assessing the environmental impact of G&G activities upon sea turtles are reviewed in Appendix G of the PEA (USDOI, MMS, 2004). Seismic survey noise may disturb sea turtles and may produce temporary or permanent hearing impairment in some individuals, but it is unlikely to cause death or life-threatening injury. Seismic surveys and other G&G activities are not expected to cause long-term or permanent displacement of sea turtles from critical or other preferred habitat, nor will they result in the destruction or adverse modification of critical habitat.

G&G seismic activities involve vessel traffic, which carries some risk of collisions with turtles. Because sea turtles are submerged most of the time and may avoid seismic arrays, the risk of death or life-threatening injury is low. Therefore, impacts of G&G seismic activities on sea turtles will be negligible most of the time, with occasional impacts being adverse but not significant (e.g., when a sea turtle cannot avoid and is subsequently exposed to seismic survey noise). Mitigation for ramp-up, visual monitoring, reporting, protective species identification training, borehole seismic surveys, experimental passive acoustic monitoring, marine trash and debris awareness and elimination, and injured/dead protected species reporting apply. See Appendix A, *Proposed Mitigation Measures.*

3.3. FISHES

Description

The Gulf of Mexico's marine habitats, ranging from coastal marshes to the deep-sea abyssal plain, support a varied and abundant fish population. Distinctive fish assemblages can be recognized within broad habitat classes for the continental shelf and oceanic waters as follows: softbottom, hardbottom, and coastal pelagic fishes on the continental shelf; and epipelagic, midwater, and demersal fishes in oceanic

waters (>200-m water depths). Appendix E in the PEA presents detailed information on fish populations in the Gulf of Mexico (USDOI, MMS, 2004).

Only one threatened fish species occurs in the Gulf of Mexico: the Gulf sturgeon. This species occurs primarily off Florida and Alabama, where it spends winter months in estuaries and inner shelf waters (over soft bottoms). The biology and status of this species are discussed in detail by USDOI, MMS (1999).

The main concern from an impact perspective is noise from seismic surveys, as well as the high-pressure pulse realized in the near field. The general physiology of sound detection by fishes is relatively well understood (Fay and Simmons, 1999; Popper and Fay, 1999). In contrast, the usual acoustic behavior and uses of sound by fishes are less well documented. Finally, the effects of intense and potentially damaging sound on fish hearing and behavior are only poorly understood, with only a small number of studies published in the peer-reviewed literature. Appendix H in the PEA presents a review of literature on fish hearing and acoustic impacts (USDOI, MMS, 2004).

Impact criteria noted above were derived from USDOI, MMS (2001). The main concern from an impact perspective is noise from seismic surveys. Such noise may disturb fishes and may produce temporary or permanent hearing impairment in some individuals, but it is unlikely to cause death or life-threatening injury. Neither seismic surveys nor other G&G activities are expected to cause long-term or permanent displacement of any listed species (i.e., Gulf sturgeon) from critical habitat or other preferred habitat, nor to result in destruction or adverse modification of critical habitat or essential fish habitat. Therefore, potential impacts to fish resources will be negligible most of the time, with occasional impacts being adverse but not significant (e.g., when fish in very close proximity to an airgun array cannot avoid exposure to seismic survey noise).

There are two main ways in which G&G surveys could affect commercial fishing: (1) seismic surveys could cause behavioral changes in target species that could make them more difficult to catch and (2) survey vessels and towed cables could temporarily preclude fishers from productive fishing grounds.

The cumulative activity scenario is presented in Appendix I in the PEA (USDOI, MMS, 2004). The major impact-producing factors under the cumulative activity scenario are space-use conflicts and noise. In terms of vessel activity levels (for space-use conflicts and as a noise source), seismic survey vessel activity represents a very small component of total vessel activity in Gulf waters. For example, oil and gas support vessels account for approximately one quarter of a million transits per year in Gulf waters, with commercial vessels >10,000 Dead Weight Tons contributing another 36,000 trips (Appendix E in the PEA). By comparison, approximately 100 seismic surveys may occur annually in the Gulf, or 0.03 percent of the activity from these three sources (i.e., oil and gas support operations, commercial cargo and tanker activity, and seismic surveys). Commercial fishing and recreational boating, military operations, and ocean study activities also contribute to the cumulative vessel activity level, further reducing the relative contribution from seismic surveys. Impacts from vessel operations (and associated areal preclusion) under the cumulative scenario are negligible. Because G&G operations contribute an extremely minor amount of additional vessel activity in the Gulf of Mexico, incremental impacts are deemed negligible.

Measurements of ambient noise levels in the Gulf of Mexico are lacking. Based on the predominant noise sources identified in Appendix E in the PEA for the Gulf of Mexico and their relative contributions to total noise levels, seismic surveys represent a potentially significant but transient component of the overall noise environment. Seismic surveys produce repetitive, transitory, and short-term increases in ambient noise levels, with the period between potential exposure ranging from hours to days (i.e., time between separate passes of a seismic survey vessel). In the near field, within approximately 295 m or so of an array, received sound levels may reach or exceed 180 dB re 1 µPa (rms). This is based on the 15-log CR Sound Attenuation Model in which the 180 dB re1 µPa (rms) isopleth in surface and nonsurface waters occurs at 295 m from the array (USDOI, MMS, 2004; pages II-22 and II-23). At greater distances, sound from a seismic survey is of a similar nature to other commercial vessel activity. Given the current level of vessel activity and its associated infrastructure, future seismic survey activity is not expected to

produce a significant incremental increase in ambient noise levels. Analysis of cumulative noise impacts on Gulf of Mexico commercial and recreational fisheries (provided in Appendix I in the PEA) suggests that cumulative impacts are negligible. The cumulative incremental impact attributed to G&G vessel noise is negligible.

Conclusion

In summary, cumulative impacts to commercial and recreational fisheries from space-use conflicts and noise will remain negligible.

3.4. CULTURAL RESOURCES

Description

Prehistoric

Geographic features that have a high probability for associated prehistoric sites in the northwestern and north central Gulf (from Texas to Alabama) include barrier islands and back barrier embayments, river channels and associated floodplains and terraces, and salt dome features. Also, a high probability for prehistoric resources may be found landward of a line which roughly follows the 45 m bathymetric contour.

Historic

Historic archaeological resources on the OCS include shipwrecks and light houses. Investigation identified over 4,000 potential shipwreck locations in the Gulf, nearly 1,500 of which occur on the OCS (Garrison et al., 1989). A number of OCS –related factors may cause adverse impacts to archaeological resources. Damage caused by anchoring could destroy artifacts or disrupt the provenance and stratigraphic context of artifacts, sediments, and paleoindicators from which scientific value of the archaeological resource is derived.

Conclusion

The proposed hazard survey will not impact the seafloor and there are no known archaeological resources in the vicinity of the proposed action. No impacts are expected.

3.5. AIR QUALITY

Description

Air quality of the coastal areas bordering the Gulf of Mexico is measured against the National Ambient Air Quality Standards (NAAQS) resulting from the Clean Air Act, as amended, or restrictive standards adopted by a state. The NAAQS have been adopted by all of the five Gulf of Mexico states coastal to the Gulf of Mexico (USDOI, MMS, 2002a,b).

Ships and aircraft involved in G&G activities emit pollutants into the air and could impact air quality. These adverse impacts are temporary and localized.

Conclusion

Air emissions from the proposed activities are not expected to significantly affect the air quality of any onshore area.

3.6. DEEPWATER BENTHIC COMMUNITIES

Description

Chemosynthetic Communities rely on sea floor surface hydrocarbon gas for nutrition and a contiguous sea floor fault to bring the gas to the sea floor. These deepwater (water depths greater than 400 meters) chemosynthetic communities include assemblages of tubeworms, clams, mussels, bacterial mats, and a

variety of associated organisms. While most communities are represented by low densities, there are examples of very high densities of organisms in small isolated areas. Features or areas that could support high-density chemosynthetic communities include hydrocarbon-charged sediments associated with surface faulting, acoustic void zones associated with surface faulting, anomalous mounds or knolls, and gas or oil seeps.

Deepwater coral communities occur almost exclusively on authigenic carbonates created by chemosynthetic communities. Deep coral colonization can be on scattered small solitary features or spread over larger areas. These complex communities form three-dimensional structure that create habitat for hot-spots of biodiversity.

Damage to deepwater benthic communities could result from oil and gas activities that disturb the seafloor in the immediate vicinity of these communities. To assist in avoiding potential damage, MMS has released NTL 2009-G40, Deepwater Benthic Communities, to provide a consistent and comprehensive approach to protecting high-density deepwater benthic communities. More information on the NTL can be found at http://www.gomr.mms.gov/homepg/regulate/regs/ntls/2009NTLs/09-G40.pdf.

Conclusion

The proposed seismic activities will employ towed receivers; therefore, the proposed action will not impact the seafloor where there may be possible Deepwater Benthic Communities.

3.7. OTHER CONSIDERATIONS

A discussion of coastal and marine birds and benthic communities can be found in Section III. of the PEA (USDOI, MMS, 2004).

4. PUBLIC OPINION

A discussion of public concerns regarding general G&G activities In the Gulf of Mexico Region can be found in appendix IV of the PEA. The PEA addresses public comments and outreach conducted for the programmatic document; however, no public commenting/reviews will be conducted at the site-specific level.

5. CONSULTATION AND COORDINATION

The information in this SEA was obtained from MMS personnel listed on pages VI-1 and VI-2 and from other Federal agencies, private sector, and academia personnel found on pages IV-1 and IV-2 of the PEA (USDOI, MMS, 2004).

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8. APPENDICES

Appendix A Proposed Mitigation Measures

Appendix B Glossary of MMS Terminology

Appendix A

Proposed Mitigation Measures

Mitigations

1.04 RAMP-UP, PROTECTED SPECIES VISUAL MONITORING, TRAINING, REPORTING, AND EXPERIMENTAL PASSIVE ACOUSTIC MONITORING REQUIREMENTS FOR SEISMIC SURVEY OPERATIONS: You will comply with NTL 2007-G02 Implementation of Seismic Survey Mitigation Measures and Protected Species Observer Program. It can be accessed on the web at http://www.gomr.mms.gov/homepg/regulate/regs/ntls/2007NTLs/07-g02.pdf.

1.05 VESSEL-STRIKE AVOIDANCE/REPORTING: The You will comply with NTL 2007-G04. It can be accessed on the web at http://www.gomr.mms.gov/homepg/regulate/regs/ntls/2007NTLs/07-g04.pdf.

0.00 PROTECTED SPECIES OBSERVER (PSO) MANNING: Due to the emergency nature of the proposed survey work and other logistic/timing issues, the operator will be allowed to use available crew members as Protected Species Observers (PSO) for conducting the requisite visual monitoring. The PSOs will make every effort to follow the monitoring and reporting guidelines outlined in NTL No. 2007-G02, which will be complied with in all other regards.

Appendix B

Glossary of MMS Terminology

Airgun — A device that releases compressed air into the water column, creating an acoustical energy pulse with the purpose of penetrating the seafloor.

Dolphins — means all marine mammal species in the Family *Delphinidae*. In the Gulf of Mexico, this includes, among others, killer whales, pilot whales, and all of the "dolphin" species.

Exclusion zone — The area at and below the sea surface within a radius of 500 m surrounding the center of an airgun array and the area within the immediate vicinity of the survey vessel.

Passive Acoustic Monitoring — Acoustic monitoring is passive (i.e., no acoustic sources are used, only listening devices) and can occur either from a vessel-based system or from a hydrophone or sonobuoy array placed on the seafloor, or both.

PTS — Permanent threshold shift is a raising of the hearing threshold from overexposure to high- level sound; but, in this case, permanent damage occurs to the inner ear sensory mechanisms and hence the shift is nonreversible.

Ramp-up — Ramp-up is also known as "soft start", "slow start", or "slow build up". The gradual increase in emitted sound levels from an airgun array by systematically turning on the full complement of an array's airguns over a defined period of time (i.e., at a rate of 6 dB re 1 μPa per 5 minute interval).

TTS — Temporary threshold shift is the temporary raising of hearing threshold resulting from exposure to high-level sounds. This is the lowest end of the physical effects scale which is a temporary, reversible form of hearing impairment. In TTS, the lower threshold of hearing in the relevant frequency band is increased (i.e., hearing becomes less sensitive) when exposed to a critical combination of sound intensity and duration.

Visual monitoring — Means the use of trained observers to scan the ocean surface visually for the presence of marine mammals and sea turtles. These observers must have successfully completed a visual observer training program as described in NTL 2007-G02. The area to be scanned visually includes, but is not limited to, the exclusion zone. Visual monitoring of an exclusion zone and adjacent waters is intended to establish and, when visual conditions allow, maintain a zone around the sound source and seismic vessel that is clear of marine mammals and sea turtles, thereby reducing or eliminating the potential for injury.

VSP – vertical seismic profile. A type of wellbore seismic.

Wellbore Seismic – Seismic measurements made in the wellbore using geophones inside the wellbore and a seismic source (airgun) at the surface near the well.

Whales — Means all marine mammals in the Gulf of Mexico except dolphins (see definition) and manatees. This includes all species of baleen whales (Suborder Mysticeti), all species of beaked whales (Ziphius cavirostris and Mesoplodon sp.), sperm whales (Physeter macrocepahalus), and pygmy and dwarf sperm whales (Kogia sp.). Of the baleen whales, only the Bryde's whale (Balaenoptera edeni) is expected to be present in the northern Gulf of Mexico and is considered common. This species has primarily been sighted in water depths less than 200 m in the eastern Gulf of Mexico. Sightings of other baleen species are highly unlikely.

Appendix C

Summary and Comparison of Environmental Impacts from Each Alternative on a Resource-by-Resource Basis

Table S-2
Summary and Comparison of Environmental Impacts from Each Alternative on a Resource by Resource Basis

Resource	Alternative 1 – Proposed Action[1]	Alternative 2 – Addition of Vessel-based Passive Acoustic Monitoring as a Requirement	Alternative 3 – Addition of Both Passive and Active Acoustic Monitoring as Requirements	Alternative 4 – Restrict G&G Seismic Survey Operations
Marine Mammals				
Sperm whales	Potentially ***adverse but not significant*** impact from potential exposure to elevated, repetitive, intermittent, and localized noise levels, resulting in possible hearing impairment. No mortality or serious injury (i.e., no exceedance of the Potential Biological Removal [PBR] level); no displacement from key habitat; no long-term or permanent displacement from preferred feeding, breeding, or nursery habitats; no substantial or chronic disruption of behavioral patterns that may adversely affect sperm whales through effects on annual rates of recruitment or survival. In water depths ≥200 m throughout the GOM and Federal waters <200 m in the Eastern Planning Area, under requirements of Notice to Lessees (NTL) No. 2004-G01, visual monitoring of the 500-m exclusion zone reduces the likelihood that whales will be present in close proximity to an array. When coupled with ramp-up, these measures may reduce the potential for hearing impairment or other injury to sperm whales from instantaneous start-up of an airgun array. Potential for acoustic impact to sperm whales remains, as undetected individuals may enter the zone of maximum ensonification below an array during a dive. Limitations: 1) visual monitoring effective during daylight, good visibility/sightability conditions; 2) ramp-up remains unproven as a mitigation measure, although recognized as a common sense measure; 3) species/group specific limitations (detectability); and 4) minor cost ramifications.	Potentially ***adverse but not significant***. Passive acoustic monitoring relies on passive sensing and location of whale vocalizations. Potential for impact may be reduced if whales vocalize and are detected. Assumed to be effective for sperm whales, as they frequently vocalize. Potential for impact to sperm whales is not completely eliminated, impact level remains potentially ***adverse but not significant***. Limitations: Passive acoustic monitoring 1) only works for vocalizing whales; many animals are quiet much of the time, especially when disturbed; 2) difficult to determine the range to the vocalizing animals when using a towed array; 3) cannot readily determine depth to vocalizing animals; 4) for fixed hydrophones (ship or bottom mounted recorders, sonobuoys, ocean bottom cables), area of coverage/detection range may be limited by noise, requiring more sensors to cover a seismic survey area; 5) requires hydrophone arrays be towed behind the survey vessel (or from an additional chase boat); 6) hydrophone performance may be affected by tow speed and the ship's acoustic characteristics, limiting detection range; and 7) cost ramifications.	Potentially ***adverse but not significant***. Passive acoustic monitoring relies on passive sensing and location of whale vocalizations. Active acoustic monitoring relies on an active (e.g., sonar) search for whales. Potential for impact may be reduced. Passive acoustic monitoring may be effective for sperm whales, as they frequently vocalize. Potential for impact to sperm whales may be reduced if whales vocalize and are detected. Advantages of passive acoustic monitoring relative to active acoustic monitoring include: 1) longer ranges can be achieved; 2) omnidirectional; 3) species can be potentially identified by their vocalization signature; 4) no acoustic footprint that could affect the target animals; and 5) more mature and affordable technology. Advantages of active acoustic monitoring compared with passive acoustic are as follows: 1) works with non-vocalizing or cryptic whales and those species that exhibit only limited vocalization; 2) can in some cases determine 3D range and bearing, including depth of vocalizing animals; 3) avoids having to stream behind survey vessel if sound source and hydrophone/receiver are hull-mounted; and 4) may involve less bulky equipment, minimizing personnel required for handling and operation. Limitations: Active acoustic monitoring has the following disadvantages: 1) active source may be more harmful than the sound source it is being used to mitigate; 2) limited detection ranges depending on power and frequency; 3) inability to identify species based purely on size; 4) limited beam width and associated problems seeing deep-diving whales at close range; 5) active systems could potentially affect the behavior of the animals themselves; 6) towfish would be required, possibly larger than passive acoustic monitoring array; and 7) current costs for development and deployment are higher.	Potentially ***adverse but not significant***. Restrictions on concurrent seismic operations will prevent the potential for simultaneous exposure. Acoustic impacts to sperm whales would be slightly reduced; however, the potential for acoustic impacts to sperm whales remains. Industry practice may already effectively implement this restriction. Limitations: None.

Table S-2
Summary and Comparison of Environmental Impacts from Each Alternative on a Resource by Resource Basis
(Continued)

Resource	Alternative 1 – Proposed Action[1]	Alternative 2 – Addition of Vessel-based Passive Acoustic Monitoring as a Requirement	Alternative 3 – Addition of Both Passive and Active Acoustic Monitoring as Requirements	Alternative 4 – Restrict G&G Seismic Survey Operations
Bryde's whales	Potentially ***adverse but not significant*** impact from potential exposure to injurious noise levels (repetitive, intermittent, and localized); same effects as sperm whales, above (e.g., no PBR exceedances, etc.). Effective visual monitoring when coupled with ramp-up may reduce the potential for hearing impairment or other injury to Bryde's whales from instantaneous start-up of an airgun array. Visual monitoring of a pre-determined impact zone reduces the potential for hearing impairment. The potential for acoustic impact is reduced. Potential for acoustic impacts to Bryde's whales remains. Limitations: Ramp-up unproven as a mitigation measure. Visual monitoring effective only during daylight, during periods of good visibility; cost ramifications.	Potentially ***adverse but not significant.*** Same as sperm whales above – potential for impact remains. Bryde's whales are known to vocalize, but the frequency of their vocalizations may be problematic; passive acoustic effective only when whales vocalize; geographic and depth limits of this species may further limit mitigation effectiveness. Limitations: Same as above.	Potentially ***adverse but not significant.*** Bryde's whales are known to vocalize; frequency of vocalization may be problematic; passive acoustic effective only when whales vocalize; geographic and depth limits of this species may further limit mitigation effectiveness. Active acoustic may be problematic. Potential for impact remains. Limitations: Same as above.	Potentially ***adverse but not significant.*** Same as sperm whales above – potential for impact remains the same. Limitations: Same as above.
Beaked whales	Potentially ***adverse but not significant*** impact from potential exposure to injurious noise levels (repetitive, intermittent, and localized); same effects as sperm whales, above (e.g., no PBR exceedances, etc.).	Potentially ***adverse but not significant.*** Beaked whales same as Bryde's whales above – potential for impact remains. Limitations: Same as above.	Potentially ***adverse but not significant.*** Beaked whales same as Bryde's whales above – potential for impact remains. Limitations: Same as above.	Potentially ***adverse but not significant.*** Same as sperm whales above – potential for impact remains. Limitations: Same as above.
Other cetaceans	Potentially ***adverse but not significant*** impact from potential exposure to injurious noise levels (repetitive, intermittent, and localized).	Potentially ***adverse but not significant.*** Same as sperm whales above – potential for impact remains. Limitations: Same as above.	Potentially ***adverse but not significant.*** Same as sperm whales above – potential for impact remains. Limitations: Same as above.	Potentially ***adverse but not significant.*** Same as sperm whales above – potential for impact remains. Limitations: Same as above.
Manatees	**Negligible** impact due to unlikely exposure.	***Negligible.*** No effect of mitigation; potential for impact remains the same. Limitations: Same as above.	***Negligible.*** No effect of mitigation; potential for impact remains the same. Limitations: Same as above.	***Negligible.*** No effect of mitigation; potential for impact remains the same. Limitations: Same as above.
Sea Turtles	Impacts primarily ***negligible***, but may elevate to potentially ***adverse but not significant*** from potential exposure to injurious noise levels (repetitive, intermittent, and localized) and vessel traffic; seismic noise may disturb sea turtles and may produce temporary or permanent hearing impairment in some individuals, but is unlikely to cause death or life-threatening injury. Seismic surveys and other G&G activities are not expected to cause long-term or permanent displacement from critical habitat/preferred habitat, nor result in destruction or adverse modification of critical habitat.	***Negligible*** to potentially ***adverse but not significant.*** No effect of mitigation due to lack of vocalization; potential for impact remains the same. Limitations: Same as above. No effect of mitigation due to lack of vocalization	***Negligible*** to potentially ***adverse but not significant.*** Potential for impact remains the same. Limitations: Same as above.	***Negligible*** to potentially ***adverse but not significant.*** No effect of mitigation; potential for impact remains the same. Limitations: Same as above.

Table S-2
Summary and Comparison of Environmental Impacts from Each Alternative on a Resource by Resource Basis
(Continued)

Resource	Alternative 1 – Proposed Action[1]	Alternative 2 – Addition of Vessel-based Passive Acoustic Monitoring as a Requirement	Alternative 3 – Addition of Both Passive and Active Acoustic Monitoring as Requirements	Alternative 4 – Restrict G&G Seismic Survey Operations
Fishes	***Negligible*** to potentially ***adverse but not significant*** impact from seismic survey noise (repetitive, intermittent, and localized); noise may disturb fish and may produce temporary or permanent hearing impairment in some individuals, but is unlikely to cause death or life-threatening injury. Seismic surveys are not expected to cause long-term or permanent displacement of any listed species from critical habitat/preferred habitat, nor to result in destruction or adverse modification of critical habitat or essential fish habitat.	***Negligible*** to potentially ***adverse but not significant.*** No effect of mitigation; potential for impact remains the same. Limitations: Same as above.	***Negligible*** to potentially ***adverse but not significant.*** No effect of mitigation; potential for impact remains the same. Limitations: Same as above.	***Negligible*** to potentially ***adverse but not significant.*** No effect of mitigation; potential for impact remains the same. Limitations: Same as above.
Commercial and Recreational Fisheries	Potentially ***adverse but not significant*** impact from space-use conflicts (between seismic surveys and longline fisheries) and seismic survey noise (short-term and localized decreases in catchability, not to an extent that would be expected to result in economic losses).	Potentially ***adverse but not significant.*** No effect of mitigation; potential for impact remains the same. Limitations: Same as above.	Potentially ***adverse but not significant.*** No effect of mitigation; potential for impact remains the same. Limitations: Same as above.	Potentially ***adverse but not significant.*** No effect of mitigation; potential for impact remains the same. Limitations: Same as above.
Coastal and Marine Birds	***Negligible*** impact from seismic surveys (repetitive, intermittent, and localized noise) and aircraft and vessel traffic (noise, disturbance).	***Negligible.*** No effect of mitigation; potential for impact remains the same. Limitations: Same as above.	***Negligible.*** No effect of mitigation; potential for impact remains the same. Limitations: Same as above.	***Negligible.*** No effect of mitigation; potential for impact remains the same. Limitations: Same as above.
Benthic Communities	***Negligible*** impact from geological and geochemical sampling, anchors, and bottom cables (placement, retrieval) on soft bottom communities, with ***negligible*** to potentially ***adverse but not significant*** impacts to sensitive benthic communities (if unidentified prior to bottom-related activities). No seismic related impacts.[2]	***Negligible*** (see footnote 2). No effect of mitigation; potential for impact remains the same. Limitations: Same as above.	***Negligible*** (see footnote 2). No effect of mitigation; potential for impact remains the same. Limitations: Same as above.	***Negligible*** (see footnote 2). No effect of mitigation; potential for impact remains the same. Limitations: Same as above.

[1] In water depths ≥200 m throughout the GOM and Federal waters <200 m in the Eastern Planning Area, includes ramp-up and visual monitoring per NTL No. 2004-G01; in water depths <200 m elsewhere, no visual monitoring or ramp-up required.

[2] Negligible impacts to sensitive benthic resources are expected from bottom-related (i.e., seafloor) activities due to existing protective measures and operational restrictions, coupled with proper identification of known sensitive resources; increased impact levels might be realized if sensitive resources remain unidentified (see **PEA Section III.G - Benthic Communities**).

Appendix D

Marine Mammals of the Gulf of Mexico

Table III-3
Marine Mammals of the Gulf of Mexico

Scientific Name	Common Name	Management Status[1]	Population Status[2]
ORDER CETACEA	**WHALES AND DOLPHINS**		
SUBORDER MYSTICETI	BALEEN WHALES		
Family Balaenidae	Right whales		
Eubalaena glacialis	Northern right whale	E, S	1
Family Balaenopteridae	Rorquals		
Balaenoptera musculus	Blue whale	E, S	1
Balaenoptera edeni	Bryde's whale	none	3
Balaenoptera physalus	Fin whale	E, S	2
Megaptera novaeangliae	Humpback whale	E, S	2
Balaenoptera acutorostrata	Minke whale	none	2
Balaenoptera borealis	Sei whale	E, S	2
SUBORDER ODONTOCETI	TOOTHED WHALES/DOLPHINS		
Family Physeteridae	Sperm whales		
Physeter macrocephalus	Sperm whale	E, S	4
Family Kogiidae	Pygmy and dwarf sperm whales		
Kogia breviceps	Pygmy sperm whale	none	4[3]
Kogia simus	Dwarf sperm whale	none	4[3]
Family Ziphiidae	Beaked whales		
Mesoplodon densirostris	Blainville's beaked whale	S	2-4[3]
Ziphius cavirostris	Cuvier's beaked whale	S	2-4[3]
Mesoplodon europaeus	Gervais' beaked whale	S	3
Mesoplodon bidens	Sowerby's beaked whale	S	1
Family Delphinidae	Dolphins (Delphinids)		
Stenella frontalis	Atlantic spotted dolphin	none	4
Tursiops truncatus	Bottlenose dolphin	none	4
Stenella clymene	Clymene dolphin	none	4
Pseudorca crassidens	False killer whale	none	3
Lagenodelphis hosei	Fraser's dolphin	none	4
Orcinus orca	Killer whale	none	3
Peponocephala electra	Melon-headed whale	none	4
Stenella attenuata	Pantropical spotted dolphin	none	4
Feresa attenuata	Pygmy killer whale	none	3
Globicephala macrorhynchus	Short-finned pilot whale	S	4
Grampus griseus	Risso's dolphin	none	4
Steno bredanensis	Rough-toothed dolphin	none	4
Stenella longirostris	Spinner dolphin	none	4
Stenella coeruleoalba	Striped dolphin	none	4
ORDER SIRENIA	**DUGONGS AND MANATEES**		
Family Trichechidae	Manatees		
Trichechus manatus latirostris	Florida manatee	E	2[4]
Trichechus manatus manatus	Antillean manatee	E	2

[1] Management status: E = endangered under the Endangered Species Act of 1973; S = strategic stock under the Marine Mammal Protection Act of 1972, as indicated by Waring et al. (1999).

[2] Population status: 1 = extralimital; 2 = rare; 3 = uncommon; 4 = common (adapted from Würsig et al., 2000).

[3] Determining the population status of Blainville's and Cuvier's beaked whales and dwarf and pygmy sperm whales (*Kogia*), which occur in the Gulf of Mexico, is problematic. Würsig et al. (2000) classify the presence of Blainville's and Cuvier's beaked whales in the Gulf as rare. The National Marine Fisheries Service (NMFS) notes that beaked whales are difficult to identify to species, they are hard to see, and they occur in small groups. In general, only Cuvier's beaked whales and adult male Blainville's beaked whales can be identified in the field. Nevertheless, NMFS suggests that sightings of beaked whales and *Kogia* in the Gulf are not rare or that uncommon. During all NMFS aerial and ship surveys combined, there have been sightings of about 75 beaked whale groups (15 as Cuvier's beaked whale, 36 as *Mesoplodon* spp., 2 as Blainville's beaked whale, and 22 as unidentified ziphiids). While these sightings are widely distributed in the deep waters of the northern Gulf, because they occur in small groups (usually <4 to 6), the abundance of each beaked whale category is low compared with species with a similar number of sightings that occur in much larger groups. Another factor to consider is the sightability of beaked whales and *Kogia*; they rarely leap out of the water or splash at the surface and are difficult to see unless seas are very calm (Beaufort sea state 0, 1). While a quantitative analysis has not been performed, in general, as the sea state decreases, the number of beaked whale sightings increases. The majority of NMFS surveys have been conducted in sea states that are not optimal for sighting beaked whales. Therefore, NMFS suggests that Blainville's and Cuvier's beaked whales are at least uncommon, and depending on how abundance is viewed (group sightings or number of individuals), may in fact, along with Gervais' beaked whale, be common. Because of the difficulties distinguishing Gervais' and Blainville's beaked whale, it may be that if one species is truly rare, the other is without doubt common or uncommon. On the basis of the frequency of their sightings, the Marine Mammal Commission considers *Kogia* as common in the northern Gulf.

[4] Excluding the Florida coast, the Florida manatee is considered rare in the northern Gulf of Mexico.

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

Species	Population Estimate[1]
Killer Whale (*Orcinus orca*)	133
False Killer Whale (*Pseudorca crassidens*)	1,038
Pygmy Killer Whale (*Feresa attentuata*)	408
Dwarf Sperm Whale (*Kogia sima*)	742a
Pygmy Sperm Whale (*Kogia breviceps*)	742a
Melon-headed Whale (*Peponocephala electra*)	3,451
Risso's Dolphin (*Grampus griseus*)	2,169
Short-finned Pilot Whale (*Globicephala macrorhynchus*)	2,388
Sperm Whale (*Physeter macrocephalus*)	1,349
Bryde's Whale (*Balaenoptera edeni*)	40
Cuvier's Beaked Whale (*Ziphius cavirostris*)	95
Blainville's Beaked Whale (*Mesoplodon densirostris*)	106b
Gervais' Beaked Whale (*Mesoplodon europaeus*)	106b
Bottlenose Dolphin (*Turisops truncatus*)	27,559[c]
Atlantic Spotted Dolphin (*Stenella frontalis*)	30,947
Pantropical Spotted Dolphin (*Stenella attenuatus*)	91,321
Striped Dolphin (*Stenella coeruleoalba*)	6,505
Spinner Dolphin (*Stenella longirostris*)	11,971
Rough-toothed Dolphin (*Steno bredanensis*)	2,223
Clymene's Dolphin (*Stenella clymene*)	17,355
Fraser's Dolphin (*Lagenodelphis hosei*)	726
Absent from Stock Assessment:	
Northern Right Whale (*Eubalaena glacialis*)	Extralimital
Minke Whale (*Balaenoptera acutorostrata*)	Rare
Sei Whale (*Balaenoptera edeni*)	Rare
Blue Whale (*Balaenoptera musculus*)	Extralimital
Fin Whale (*Balaenoptera physalus*)	Rare
Humpback Whale (*Megaptera novaeangliae*)	Rare
Sowerby's Beaked Whale (*Mesoplodon bidens*)	Extralimital

[1] Source: U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments -- 2003 (NOAA, 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 combines abundance estimates from the Northern Gulf of Mexico Oceanic Stock (2, 239) and Continental Shelf Stock (25,320).

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).