MARINE MAMMAL COMMISSION

8 July 2013

The Honorable Penny Pritzker
Chair, Gulf Coast Ecosystem Restoration Council
U.S. Department of Commerce
1401 Constitution Avenue N.W., Room 4077
Washington, D.C. 20230

Dear Secretary Pritzker:

The Gulf Coast Ecosystem Restoration Council has a key role in leading efforts to restore the Gulf coast ecosystem and economy under the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States (RESTORE) Act of 2012. One of the Council's initial charges was to develop a comprehensive plan outlining the framework that would be used to implement a coordinated, region-wide Gulf Coast restoration effort. On 29 May 2013, the Council published a notice of availability of its initial draft comprehensive plan and draft programmatic environmental assessment of the draft plan, and a preliminary list of ecosystem restoration projects under review by the Council (78 Fed. Reg. 32237).

The Marine Mammal Protection Act established the Marine Mammal Commission to oversee and advise federal officials regarding activities that may affect marine mammals and the ecosystems upon which they depend. The Commission is particularly concerned about potential adverse effects on Gulf of Mexico marine mammals from the Deepwater Horizon oil spill as well as other human activities and natural disasters that may be impeding the recovery of marine mammal stocks that may have been affected by the oil spill. In that capacity, the Commission, in consultation with its Committee of Scientific Advisors on Marine Mammals, offers the following recommendations and rationale regarding the Council's draft planning documents for restoration of the Gulf ecosystem.

RECOMMENDATIONS

The Marine Mammal Commission recommends that the Gulf Coast Ecosystem Restoration Council, in coordination with the Deepwater Horizon Natural Resource Damage Assessment Trustees and relevant federal, state, and local natural resource agencies, include in its restoration plan—

- Specific projects to assess and monitor the health and status of Gulf marine mammals, particularly those that are determined by the Trustees to have been injured by the Deepwater Horizon oil spill; recommended projects include—
  - marine mammal stock assessment surveys (including vessel and aerial surveys, tagging, photo identification, passive acoustic monitoring, and genetic sampling);
  - enhancement of the Gulf marine mammal stranding response program;
  - live capture/release health assessments of bottlenose dolphins; and
  - environmental studies (including prey studies);

- Specific projects to characterize and address high-priority risk factors that may be impeding the recovery and restoration of Gulf marine mammals, particularly those that are determined by the Trustees to have been injured by the oil spill; recommended projects include—
  - establishing or expanding observer coverage of commercial fisheries known to interact with marine mammals;
  - minimizing incidental takes of marine mammals in commercial and recreational fisheries;
  - minimizing the indirect effects of fishing on important prey species of marine mammals;
  - monitoring ambient sound levels and assessing the effects of human-caused sound on marine mammals in the Gulf;
  - minimizing effects of human-caused sound on marine mammals and their prey; and
  - reducing other human-caused environmental impacts that may be detrimental to marine mammals and their prey.

The Marine Mammal Commission further recommends that the Gulf Coast Ecosystem Restoration Council, in coordination with the Deepwater Horizon Natural Resource Damage Assessment Trustees and relevant federal, state, and local natural resource agencies, ensure that restoration projects include long-term monitoring to determine whether the projects are achieving their goals and injured resources are indeed being restored.

RATIONALE

The RESTORE Act of 2012 established the Gulf Coast Ecosystem Restoration Council, an independent entity within the federal government with responsibility for directing a portion of the Deepwater Horizon Clean Water Act penalties for ecosystem restoration, economic recovery, and tourism promotion in the Gulf coast region. The Council is charged with implementing that responsibility by first publishing a draft initial comprehensive plan. The purpose of the plan is to (1) establish the overarching restoration goals for the Gulf coast region, (2) describe how the Council will solicit, evaluate, and fund projects and programs for ecosystem restoration, (3) outline the process for the approval of individual state expenditure plans, (4) include a list of projects or programs authorized prior to enactment of the RESTORE Act, but not yet commenced, and (5) provide the Council's next steps.

The Council's draft initial comprehensive plan has five goals that provide the overarching framework for achieving an integrated and coordinated approach for region-wide Gulf Coast restoration and to help guide the collective actions at the local, state, tribal and federal levels. They are—

- Restore and conserve habitat;
- Restore water quality;
- Replenish and protect living coastal and marine resources;
- Enhance community resilience; and
- Restore and revitalize the Gulf economy.

The Commission supports these goals and believes that they represent an appropriate focus on restoration efforts that will enhance both the health of the Gulf Coast ecosystem and the resilience of the Gulf coast economy. In selecting specific projects for funding, the RESTORE Act directs the Council to use the best available science and give highest priority to ecosystem restoration projects that meet the Act's priority criteria, including projects that would make the greatest contribution to restoring and protecting the natural resources, ecosystems, fisheries, marine and wildlife habitats, beaches, and coastal wetlands of the Gulf Coast region, without regard to geographic location within the Gulf Coast region. Although restoration of marine ecosystems typically refers to activities intended to address loss of, or damage to, habitats (e.g., coastal marshes and wetlands), in this case Congress intended a much broader application of the term to include recovery of injured marine species.

The vast majority of projects identified by the Council in its preliminary list of projects designated as "authorized but not yet commenced" (Appendix A) appears to be focused on the restoration of nearshore habitats and nearshore species, with no projects identified for restoration of marine mammals and few projects identified for restoration of marine wildlife in offshore habitats. The Commission is concerned that this approach may be too limited given the broader focus of the Act's priority criteria on Gulf-wide ecosystem restoration. The Commission believes that Council should also include in its comprehensive restoration plan projects that restore and protect marine mammals, particularly those that are determined by the Natural Resource Damage Assessment Trustees to have been injured by the oil spill. Recognizing that the restoration and protection of Gulf marine mammals—especially those found in offshore habitats—presents a greater implementation challenge, the Commission provides the following information and recommendations to assist the Council in identifying and incorporating projects in its comprehensive plan that would enhance efforts to restore marine mammals injured by the oil spill.

Impact of the Deepwater Horizon oil spill on Gulf marine mammals

Twenty-two marine mammal species reside in or regularly visit the inshore, coastal, and offshore waters of the Gulf of Mexico (Waring et al. 2012, see Table 1 for a list of stocks and information on each). They comprise 57 stocks, 37 of which are bottlenose dolphin stocks. The scope and significance of injuries to Gulf marine mammals as a result of the Deepwater Horizon oil spill have yet to be fully determined. However, the following evidence suggests that the oil spill may have adversely affected certain marine mammal stocks—

- 155 bottlenose dolphins, two sperm whales, two unidentified *Kogia* species (dwarf and pygmy sperm whales), two melon-headed whales, and six spinner dolphins stranded in the northern Gulf during the response phase of the spill (30 April 2010 through 17 April 2011), which was in increase in the mean monthly stranding rate compared to that for 2002-2009 (www.nmfs.noaa.gov/pr/ health/oilspill/);
- some of the bottlenose dolphin strandings may have been part of an ongoing Unusual Mortality Event in the northern Gulf (Figure 1, adapted from www.nmfs.noaa.gov/pr/ health/mmume/cetacean_ gulfofmexico2010.htm);
- health assessments of coastal bottlenose dolphins in Barataria Bay, Louisiana, an area heavily affected by the spill, indicated high prevalence of poor health and suppressed metabolic and

immune function (www.gulfspillrestoration.noaa.gov/2012/03/study-shows-some-gulf-dolphins-severely-ill/); and

- movements of sperm whales with home ranges near the spill site indicate that although whales remained in the area after the oil spill, they avoided the most heavily surface-oiled areas (www.gulfspillrestoration.noaa.gov/wp-content/uploads/2012/05/2011_10_12_MAMMAL _Sperm_Whale_Tagging_LA-signature_Redacted3.pdf).

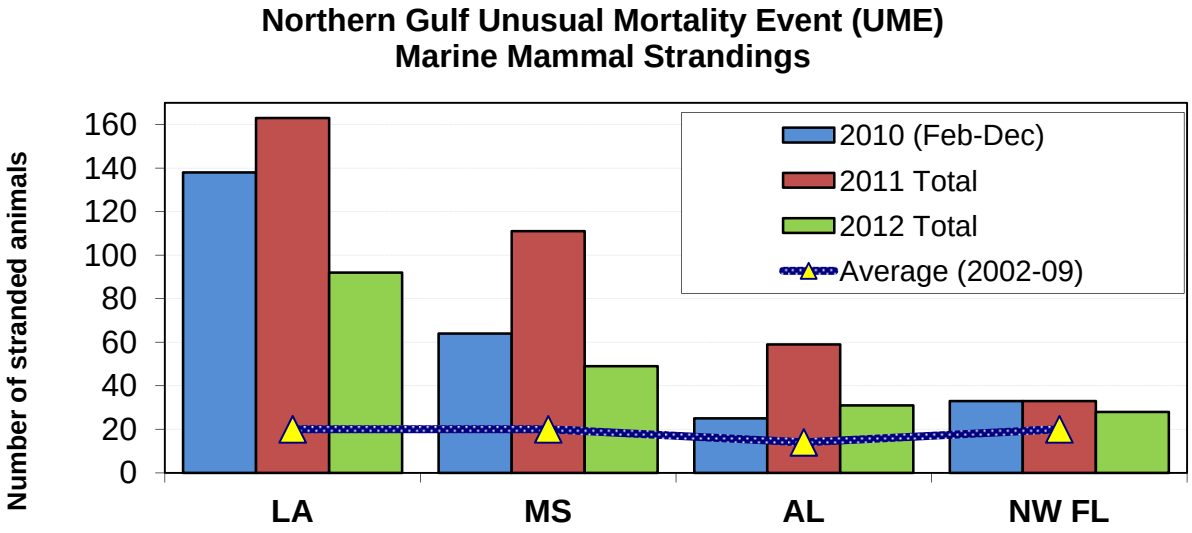

Figure 1. Number of marine mammals stranded in the northern Gulf of Mexico from Franklin County, Florida, to the Texas/Louisiana border, both before the Deepwater Horizon oil spill (based on average strandings per calendar year) and after (by year) (Source: www.nmfs.noaa.gov/pr/health/mmume/cetacean_gulfofmexico2010.htm)

In general, the numbers of injuries and deaths that are observed and reported represent only a fraction of the numbers that actually occur. For example, Williams et al. (2011) estimated that only two percent of the carcasses of animals that stranded in the Gulf immediately after the oil spill were likely recovered. Therefore, the reported damage does not tell the whole story. Besides the species and stocks represented in the stranding records, it is likely that other species and stocks of marine mammals that occur in the same habitats as those that showed up on shore were injured but their injuries were not detected. Therefore the reported marine mammal strandings should be considered only minimal estimates of actual injuries and deaths.

To ensure that restoration is guided by sufficient information, the Commission—with input from staff at the National Oceanic and Atmospheric Administration (NOAA), the U.S. Fish and Wildlife Service, the Bureau of Ocean Energy Management, and other federal agencies—prepared the enclosed report entitled "Assessing the Long-term Effects of the BP Deepwater Horizon Oil Spill on Marine Mammals in the Gulf of Mexico: A Statement of Research Needs." The report was intended to guide assessment of the spill's long-term effects on marine mammal populations and mitigation and restoration efforts, and to help track the changes in the Gulf ecosystem, including those resulting from recovery and restoration efforts. The report summarized potential effects of oil exposure and response activities on marine mammals and identified two primary areas of focus for

marine mammals that should be given high priority when developing long-term restoration plans for the Gulf, as noted below.

Restoration priority 1: Promoting recovery and restoration of marine mammals injured by the Deepwater Horizon oil spill

The Commission has recommended that NOAA and the Deepwater Horizon Natural Resource Damage Assessment Trustees include assessment and monitoring of marine mammals in its comprehensive restoration plan for the Gulf of Mexico (see the Commission's letter to NOAA dated 28 December 2012[1]). As the Trustees and other entities conducting research and monitoring on marine mammals in the Gulf of Mexico develop a better understanding of the effects of the oil spill on marine mammals, this information can be used by both the Trustees and the Council to adapt restoration projects to target marine mammal species and habitats that are most at risk. An adaptive approach that builds on information obtained from continued injury assessment is a critical component of effective restoration planning. As noted by the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling in its 2011 *Deep Water* report, "A sophisticated understanding of the full range of impacts from a large-scale oil spill is critical to effective recovery and restoration efforts" (Oil Spill Commission 2011).

Given the lack of baseline information on the abundance and habitat use of the majority of Gulf marine mammal stocks prior to the oil spill, a comprehensive assessment of marine mammal injuries resulting from the spill may not be possible. However, studies on other wildlife have revealed chronic, delayed, and indirect effects of the *Exxon Valdez* spill that lasted longer and were more severe than initially expected or assumed (Peterson et al. 2003). Exposure to oil from that spill was still impeding recovery of certain sea otter and killer whale populations 15 years later (Ballachey et al. 2007, Matkin et al. 2008). The Deepwater Horizon oil spill differs in some important respects from the *Exxon Valdez* spill, but long-term effects are a significant concern for Gulf marine mammals because of the vastly greater amount of oil spilled, the greater quantity of dispersant applied at the surface and wellhead, the low recovery rates of spilled oil, uncertainty regarding the eventual fate of both the oil and the dispersant, and uncertainty regarding the sub-lethal effects of the spill and spill response on marine mammals and on ecosystem elements important to marine mammals.

Despite the lack of baseline information for Gulf marine mammals and uncertainties regarding the extent of injuries caused by the spill, a cautionary approach to restoration in the Gulf should include monitoring of the health and status of marine mammal stocks, particularly those that were most likely to have been injured (i.e., coastal and estuarine bottlenose dolphins and sperm whales). The Marine Mammal Commission therefore recommends that the Gulf Coast Ecosystem Restoration Council, in coordination with the Deepwater Horizon Natural Resource Damage Assessment Trustees and relevant federal, state, and local natural resource agencies, include in its restoration plan specific projects to assess and monitor the health and status of Gulf marine mammals, particularly those that are determined by the Trustees to have been injured by the Deepwater Horizon oil spill. The plan should include a combination of projects targeted at studying both direct biological effects of the oil spill on individuals (such as displacement from preferred habitats, changes in foraging patterns, or physiological effects) as well as indirect effects on the

[1] Past Commission letters are available at www.mmc.gov/letters/welcome.shtml.

ecosystem as a whole (such as a decrease or displacement of key prey species or an increased incidence of harmful algal blooms or hypoxia/anoxia events). Studies to track population-level changes in abundance or vital rates over time also should be included to monitor recovery.

Recommended projects to monitor the health and status of Gulf marine mammals include—

- Marine mammal stock assessment surveys: Surveys to assess the abundance and distribution of marine mammal stocks are necessary to provide the basis against which changes in the status of a stock can be measured. Stock assessments require a basic understanding of stock structure, as stocks comprise the basic units of conservation within a species. The inadequacy of information on stock structure for many Gulf species, particularly coastal, bay, and estuarine bottlenose dolphins, is a significant impediment to current stock assessment efforts. Stock assessment methods differ depending on the stocks being assessed, but typically involve either a combination of vessel and aerial surveys or mark-recapture methods using tagging, photo-identification, passive acoustic monitoring, and/or genetic sampling. Stock assessment surveys should be conducted at least every other year for each stock, and should cover all portions of a stock's range and all seasons of the year.
- Enhancement of the Gulf marine mammal stranding program: Marine mammal stranding programs can provide information on the presence of marine mammals, movement patterns, reproduction, health status, toxin exposure, and causes of mortality. Stranding programs in the Gulf played a key role during the oil spill by monitoring coastal areas for stranded animals, collecting tissues for various types of analyses, and caring for live-stranded animals and moving them to facilities that could provide the necessary care. However, those programs operate primarily on a volunteer basis, often with limited or inconsistent institutional support. Existing support is not sufficient to sustain those programs and the kind of effort needed to assess the long-term effects of the spill. Particular focus should be on building capacity for stranding programs throughout the northern Gulf, including investments in training, equipment, supplies, data management, sample analyses, and rehabilitation facilities. Support should be provided to bring in experienced researchers and veterinarians from other regions to train local responders and to ensure that information collected from stranded animals is integrated with other assessment studies and contributes to a better understanding of the long-term effects of the oil spill and other human activities on Gulf marine mammals.[2]
- Live capture/release health assessments: The health of individual animals can be an important indicator of the adverse effects of risk factors, including exposure to oil, dispersant, and response activities. Coupled with information collected from dead stranded animals, in-depth assessments of live stranded or captured animals have provided important information on marine mammal health, disease, and causes of mortality. Live capture/release is a proactive means to evaluate risk factors and assess health conditions within populations, and it has been used in studies of coastal and estuarine bottlenose dolphin populations in the Gulf and elsewhere. Health assessments typically require collaboration among researchers

[2] The Marine Mammal Commission, in cooperation with Ocean Conservancy and marine mammal stranding network members in each of the Gulf coastal states, developed and submitted a project proposal to the Deepwater Horizon Natural Resource Damage Assessment Trustee Council (through the NOAA portal at http://www.gulfspillrestoration.noaa.gov/restoration/give-us-your-ideas/) for consideration in the Trustee's comprehensive restoration plan. The title of the proposal was "Expand and Improve Gulf of Mexico Marine Mammal Stranding Response and Science Capacity."

from federal agencies, private institutions, aquaria, and not-for-profit organizations to assemble the necessary expertise and logistic support.

- Environmental studies (including prey studies): Large-scale changes in community structure or prey abundance caused by the oil spill and response efforts can affect the carrying capacity and distribution of marine mammal populations. Quantifying those effects will require an integrated, multi-disciplinary approach. Tracking the movement and fate of oil and dispersant throughout the water column relative to the distribution of marine mammals and their prey species in the ecosystem seems essential for characterizing the ecological effects of these contaminants.

Restoration priority 2: Addressing other human-caused risk factors

The oil spill's effects on marine mammals were in addition to those from other ongoing human activities in the Gulf. Restoring marine mammal stocks to a healthy state will thus not only require addressing the direct effects of the oil spill, but also other risk factors from human activities in the Gulf. As noted previously, this broad approach to ecosystem restoration is consistent with the priority criteria identified in the RESTORE Act.

Several types of human activities may impede, directly or indirectly, the restoration of Gulf marine mammals. Seismic surveys used to locate oil and gas reserves or monitor their depletion generate high energy, low frequency sounds that can cause permanent or temporary hearing damage in marine mammals (Gordon et al. 2004), cause them to change their behavior, and cause them to change their habitat use patterns. Commercial fishing gear used in the Gulf can entangle and drown marine mammals (Garrison 2007). Dolphins frequently ingest and become entangled in recreational fishing gear (monofilament fishing lines and hooks), which generally leads to death (Powell and Wells 2011, Wells et al. 1998, Wells et al. 2008). Commercial and recreational vessel traffic and commercial tour operations directed at marine wildlife can disturb or displace marine mammals (Bejder et al. 2006, Nowacek et al. 2001). Commercial shipping also introduces a large amount of low-frequency sound energy into the Gulf (Snyder 2007). Military activities also can generate significant sound that can be injurious to certain marine mammals (Jepson et al. 2003). Agricultural runoff can cause excess nutrients to enter the Gulf, resulting in blooms of algae that die and degrade, depleting the oxygen in the water and creating hypoxic zones that cannot sustain marine life (Craig et al. 2001). Other blooms result in the production of toxic substances that effectively poison invertebrates, fish, and marine mammals (Magaña et al. 2003, Twiner et al. 2011). Table 2 provides a more complete list of human-caused and natural risk factors to marine mammals in the Gulf. Addressing the risk factors will help build resilience in Gulf marine mammal populations and accelerate recovery from the harmful effects of the spill.

The Marine Mammal Commission recommends that the Gulf Coast Ecosystem Restoration Council, in coordination with the Deepwater Horizon Natural Resource Damage Assessment Trustees and relevant federal, state, and local natural resource agencies, include in its restoration plan specific projects to characterize and address high-priority risk factors that may be impeding the recovery and restoration of Gulf marine mammals, particularly those that are determined by the Trustees to have been injured by the Deepwater Horizon oil spill. Recommended projects include—

- Establishing or expanding observer coverage of commercial fisheries known to interact with marine mammals: The establishment or expansion of observer coverage is necessary to document (and quantify) incidental takes of marine mammals in commercial fisheries identified by the National Marine Fisheries Service as having frequent or occasional interactions with marine mammals, including (but not limited to) the large pelagics longline fishery, the inshore gillnet fishery, the shrimp trawl fishery, the menhaden purse seine fishery, and the stone crab pot/trap fishery (76 Fed. Reg. 73912);
- Minimizing incidental takes of marine mammals in commercial and recreational fisheries: Conduct additional research and testing of alternative fishing gear, implement time-area restrictions on fishing activities, increase outreach efforts, and implement other measures as appropriate to reduce incidental takes of marine mammals in the above-mentioned commercial fisheries as well as recreational hook-and-line fisheries;
- Minimizing the indirect effects of fishing on important prey species of marine mammals: Investigate and implement measures to minimize the indirect effects of fishing activities (both directed catch and bycatch) on important prey species of marine mammals;
- Monitoring ambient sound levels and assessing the effects of human-caused sound on marine mammals in the Gulf: Establish a monitoring program to monitor sound levels and assess sound-related effects on marine mammals from a variety of human activities, including commercial shipping, oil and gas development (including seismic surveys, drilling, and the explosive removal of oil and gas platforms), and military operations and training;
- Minimizing effects of human-caused sound on marine mammals and their prey: Develop measures to minimize the direct, indirect, and cumulative effects of human-caused sound on marine mammals and their prey; and
- Reducing other human-caused environmental impacts that may be detrimental to marine mammals and their prey: Implement measures to reduce the occurrence and extent of other environmental impacts that may impede the restoration of marine mammals, such as hypoxic and anoxic events and harmful algal blooms.

The Marine Mammal Commission further recommends that the Gulf Coast Ecosystem Restoration Council, in coordination with the Deepwater Horizon Natural Resource Damage Assessment Trustees and relevant federal, state, and local natural resource agencies, ensure that restoration projects include long-term monitoring to determine whether the projects are achieving their goals and injured resources are indeed being restored. Long-term monitoring will provide critical information on the effectiveness of various projects and will help focus restoration efforts on activities and approaches that are having the greatest benefit. Monitoring also will help identify any projects that are having adverse impacts on targeted or other natural resources, and assist in minimizing those adverse impacts. Information on the effectiveness of restoration efforts is critical not just for ensuring the best use of restoration investments in the Gulf, but also to help guide future restoration planning efforts.

The Commission hopes the Commission's report and the recommendations provided herein will be helpful to the Council as it continues to work with the Deepwater Horizon Natural Resource Damage Assessment Trustees and other entities on developing a restoration plan for Gulf natural resources.

Sincerely,

Rebecca J. Lent, Ph.D.
Executive Director

Enclosure

cc: Donna Wieting, Director, National Marine Fisheries Service, Office of Protected Resources
Dr. Roy Crabtree, Regional Administrator, National Marine Fisheries Service, Southeast Regional Office
Dr. Bonnie Ponwith, Director, National Marine Fisheries Service, Southeast Fisheries Science Center
David Westerholm, Director, NOAA, Office of Response and Restoration

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Table 1. Information for marine mammal species in the Gulf of Mexico. The population information is from Waring et al. (2013) and the information regarding prey species is from Jefferson et al. (2008). For all stocks, the information is not sufficient to meet the requirements of the Marine Mammal Protection Act. CV=coefficient of variation, N_{best}=best estimate of abundance, N_{min}=minimum estimate of abundance, PBR=potential biological removal level, E=endangered under the Endangered Species Act, S=strategic under the Marine Mammal Protection Act). *As identified in Waring et al. (2013), although many sources of mortality and serious injury also may be applicable to other species.

Species/stock (E=endangered, S=strategic)	**Abundance N_{best} (CV) N_{min} PBR**	**Distribution and movement patterns**	**Stock structure**	**Social structure**	**Vital rates**	**Health status**	**Prey species**	**Total human-caused mortality/ serious injury**	**Possible sources of human-caused mortality/ serious injury***
Sperm whale (*Physeter macrocephalus*) (E/S)	N_{best} = 763 (CV = 0.38) N_{min} = 560 PBR = 1.1	Oceanic throughout the Gulf	Gulf stock distinct from other Atlantic Ocean stocks	Highly social, with adult females and juveniles of both sexes occurring together in mixed groups	Unknown	Unknown	Primarily deepwater cephalopods and fishes	Unknown	Oil and gas operations (seismic surveys), pollution
Bryde's whale (*Balaenoptera edeni*) (S)	N_{best} = 33 (CV = 1.04) N_{min} = 16 PBR = 0.1	Primarily along the shelf break (200 m) in the northeastern Gulf	Unknown	Generally found as singles or pairs, no calves observed	Unknown	Unknown	Small schooling fishes	Unknown	Ship strikes, other sources unknown
Cuvier's beaked whale (*Ziphius cavirostris*)	N_{best} = 74 (CV = 1.04) N_{min} = 36 PBR = 0.4	Oceanic throughout the Gulf	Unknown	Very cryptic, usually in groups of less than 5	Unknown	Unknown	Primarily squids, also deepwater fishes and crustaceans	Unknown	Unknown, possible military activities (sonar) in Atlantic Ocean
Blainville's beaked whale (*Mesoplodon densirostris*)	N_{best} = 149 (CV = 0.91) N_{min} = 77 (Estimate for all *Mesoplodon* sp.) PBR = 0.8	Oceanic throughout the Gulf	Unknown	Very cryptic, usually in groups of less than 5	Unknown	Unknown	Primarily squids, also deepwater fishes	Unknown	Unknown, possible military activities (SONAR) in Atlantic Ocean

Species/stock (E=endangered, S=strategic)	Abundance N_{best} (CV) N_{min} PBR	Distribution and movement patterns	Stock structure	Social structure	Vital rates	Health status	Prey species	Total human-caused mortality/ serious injury	Possible sources of human-caused mortality/ serious injury*
Gervais' beaked whale (*Mesoplodon europaeus*)	N_{best} = 149 (CV = 0.91) N_{min} = 77 (Estimate for all *Mesoplodon* sp.) PBR = 0.8	Oceanic throughout the Gulf	Unknown	Very cryptic, usually in groups of less than 5	Unknown	Unknown	Primarily squids, also deepwater fishes	Unknown	Unknown, possible military activities (sonar) in Atlantic Ocean and fisheries interactions
Bottlenose dolphin (*Tursiops truncatus*) continental shelf stock	Unknown, survey data more than 8 years old, PBR undetermined	Waters from 20 to 200 m throughout the Gulf	Uncertain but complex, stock is a mixture of genetically distinct coastal and offshore ecotypes	Highly social	Unknown	Unknown	Generalist, preference for sciaenids, scombrids, and mugilids, with squids more important in deeper waters	Unknown	Fisheries interactions, gunshot wounds, vessel strikes, oil rig removals, marine debris entanglement and ingestion
Bottlenose dolphin (*Tursiops truncatus*) eastern coastal stock	N_{best} = 7,702 (CV = 0.19) N_{min} = 6,551 PBR = 66	Mainland shore to waters 20 m deep east of 84° W	Uncertain but complex, coastal stocks divided for management purposes based on dissimilar habitat characteristics	Highly social	Unknown	Limited health assessment data from Sarasota Bay	Generalist, preference for sciaenids, scombrids, and mugilids, with squids more important in deeper waters	Unknown, minimum estimates from stranding data not distinguished by stock	Fisheries interactions, dredging, harmful algal blooms, disease, gunshot wounds, mutilations, vessel strikes, oil rig removals, marine debris entanglement and ingestion

Species/stock (E=endangered, S=strategic)	Abundance N_{best} (CV) N_{min} PBR	Distribution and movement patterns	Stock structure	Social structure	Vital rates	Health status	Prey species	Total human-caused mortality/ serious injury	Possible sources of human-caused mortality/ serious injury*
Bottlenose dolphin (*Tursiops truncatus*) northern coastal stock	N_{best} = 2,473 (CV = 0.25) N_{min} = 2,004 PBR = 20	Mainland shore to waters 20 m deep from the Mississippi River Delta east to 84°W	Coastal stocks divided for management purposes based on dissimilar habitat characteristics	Highly social	Unknown	Limited health assessment data from St. Joseph Bay	Generalist, preference for sciaenids, scombrids, and mugilids, with squids more important in deeper waters	Unknown, minimum estimates from stranding data not distinguished by stock	Fisheries interactions, dredging, red tide, disease, gunshot wounds, mutilations, vessel strikes, oil rig removals, marine debris entanglement and ingestion
Bottlenose dolphin (*Tursiops truncatus*) western coastal stock (S)	Unknown, survey data more than 8 years old, PBR undetermined	Mainland shore to waters 20 m deep west of the Mississippi River Delta	Uncertain but complex, coastal stocks divided for management purposes based on dissimilar habitat characteristics	Highly social	Unknown	Unknown	Generalist, preference for sciaenids, scombrids, and mugilids, with squids more important in deeper waters	Unknown, minimum estimates from stranding data not distinguished by stock	Fisheries interactions, dredging, red tide, disease, gunshot wounds, mutilations, vessel strikes, oil rig removals, marine debris entanglement and ingestion
Bottlenose dolphin (*Tursiops truncatus*) oceanic stock	N_{best} = 5,806 (CV = 0.39) N_{min} = 4,230 PBR = 42	Upper continental slope (200-1000 m) throughout the Gulf	Uncertain but assumed complex	Offshore morphotype, groups as big as 200 but typically around 20	Unknown	Unknown	Generalist, preference for sciaenids, scombrids, and mugilids, with squids more important in deeper waters	Unknown, minimum estimates from stranding data not distinguished by stock	Fisheries interactions, disease, gunshot wounds, mutilations, vessel strikes, oil rig removals, marine debris entanglement and ingestion

Species/stock (E=endangered, S=strategic)	Abundance N_{best} (CV) N_{min} PBR	Distribution and movement patterns	Stock structure	Social structure	Vital rates	Health status	Prey species	Total human-caused mortality/ serious injury	Possible sources of human-caused mortality/ serious injury*
Bottlenose dolphin (*Tursiops truncatus*) St. Joseph Bay stock (S)	N_{best} = 146 (CV = 0.18) N_{min} = 126 PBR=1.3	St. Joseph Bay	Stocks provisionally based on discrete communities, supported by genetics data	Community-based, some individuals exhibit extreme philopatry	Some data regarding individual reproductive rates, stock-wide rates unknown	Limited health assessment data	Preference for sciaenids, scombrids, and mugilids	Unknown, minimum estimates from stranding data not distinguished by stock	Fisheries interactions, ecotourism, red tide, marine debris entanglement and ingestion
Bottlenose dolphin (*Tursiops truncatus*) Choctawhatchee Bay (S)	N_{best} = 179 (CV = 0.04) N_{min} = 173 PBR = 1.7	Choctawhatchee Bay	Stocks provisionally based on discrete communities, supported by genetics data	Community-based, some individuals exhibit extreme philopatry	Some data regarding individual reproductive rates, stock-wide rates unknown	Unknown	Preference for sciaenids, scombrids, and mugilids	Unknown, minimum estimates from stranding data not distinguished by stock	Fisheries interactions, ecotourism, red tide, marine debris entanglement and ingestion
Bottlenose dolphin (*Tursiops truncatus*) Barataria Bay stock (S)	Unknown, survey data more than 8 years old, PBR undetermined	Barataria Bay	Stocks provisionally based on discrete communities, supported by genetics data	Community-based, some individuals exhibit extreme philopatry	Some data regarding individual reproductive rates, stock-wide rates unknown	Unknown	Preference for sciaenids, scombrids, and mugilids	Unknown, minimum estimates from stranding data not distinguished by stock	Fisheries interactions, ecotourism, red tide, marine debris entanglement and ingestion
Bottlenose dolphin (*Tursiops truncatus*) 29 remaining bay, sound, and estuarine stocks (S)	N_{min} unknown for all but 4 stocks, survey data more than 8 years old, PBR undetermined for all but 4 stocks	Bays, sounds, and estuaries throughout the Gulf	Stocks provisionally based on discrete communities, supported by genetics data	Community-based, some individuals exhibit extreme philopatry	Some data regarding individual reproductive rates, stock-wide rates unknown	Unknown	Preference for sciaenids, scombrids, and mugilids	Unknown, minimum estimates from stranding data not distinguished by stock	Fisheries interactions, ecotourism, red tide, marine debris entanglement and ingestion

Species/stock (E=endangered, S=strategic)	Abundance N_{best} (CV) N_{min} PBR	Distribution and movement patterns	Stock structure	Social structure	Vital rates	Health status	Prey species	Total human-caused mortality/ serious injury	Possible sources of human-caused mortality/ serious injury*
Atlantic spotted dolphin (*Stenella frontalis*)	Unknown, survey data more than 8 years old, PBR undetermined	Continental shelf throughout the Gulf, generally in waters 20-200 m	Unknown, separate from Atlantic stock for management purposes, supported by genetics data	Typical group sizes are less than 50, associate with smaller groups of bottlenose dolphins in some cases	Unknown	Unknown	Small epi- and mesopelagic fishes and squids, and benthic invertebrates	Unknown	Fisheries interactions, dredging, red tides
Pantropical spotted dolphin (*Stenella attenuata*)	N_{best} = 50,880 (CV = 0.27) N_{min} = 40,699 PBR = 407	Oceanic throughout the Gulf	Unknown, separate from Atlantic stock for management purposes	Typical groups are less than 100 dolphin but as many as 650 dolphins in a group have been observed	Unknown	Unknown	Small epi- and mesopelagic fishes, squids and crustaceans	Unknown	Unknown
Striped dolphin (*Stenella coeruleoalba*)	N_{best} = 1,849 (CV = 0.77) N_{min} = 1,041 PBR = 10	Oceanic throughout the Gulf	Unknown, separate from Atlantic stock for management purposes	Typical groups consist of about 50 dolphins	Unknown	Unknown	Small epi- and mesopelagic fishes and squids	Unknown	Vessel strike
Spinner dolphin (*Stenella longirostris*)	N_{best} = 11,441 (CV = 0.83) N_{min} = 6,221 PBR = 62	Continental slope (200-2000 m), primarily in the eastern Gulf	Unknown, separate from Atlantic stock for management purposes	Occur in very large cohesive groups of up to 800 dolphins	Unknown	Unknown	Small epi- and mesopelagic fishes and squids	Unknown	Fisheries interactions
Rough-toothed dolphin (*Steno bredanensis*)	N_{best} = 624 (CV = 0.99) N_{min} = 311 PBR = 3	Oceanic throughout the Gulf and, less commonly, the continental shelf	Unknown, separate from Atlantic stock for management purposes	Typically in groups of less than 25 dolphins, associated with Sargassum in many cases	Unknown	Limited info from rehab animals	Fish, including larger species (mahi mahi) and squids	Unknown	Unknown

Species/stock (E=endangered, S=strategic)	Abundance N_{best} (CV) N_{min} PBR	Distribution and movement patterns	Stock structure	Social structure	Vital rates	Health status	Prey species	Total human-caused mortality/ serious injury	Possible sources of human-caused mortality/ serious injury*
Clymene dolphin (*Stenella clymene*)	N_{best} = 129 (CV = 1.00) N_{min} = 64 PBR = 0.6	Oceanic throughout the Gulf but more common west of the Mississippi River	Unknown, separate from Atlantic stock for management purposes	Occur in large groups of up to 300 dolphins	Unknown	Unknown	Little known, small epi – and mesopelagic fishes and squids	Unknown	Unknown
Fraser's dolphin (*Lagenodelphis hosei*)	Unknown (no recent sightings) PBR undetermined	Oceanic throughout the Gulf	Unknown, separate from Atlantic stock for management purposes	Extremely rare, associated with melon-headed whales in some cases	Unknown	Unknown	Small midwater fishes, squids, and crustaceans	Unknown	Unknown
Killer whale (*Orcinus orca*)	N_{best} = 28 (CV = 1.02) N_{min} = 14 PBR = 0.1	Oceanic throughout the Gulf	Unknown, separate from Atlantic stock for management purposes	Groups typically of 6-10 whales. Photo-identification indicates wide ranging but with some habitat fidelity	Unknown	Unknown	Gulf prey largely unknown, one instance of predation on pantropical spotted dolphins	Unknown	Unknown
False killer whale (*Pseudorca crassidens*)	Unknown, survey data more than 8 years old, PBR undetermined	Oceanic throughout the Gulf	Unknown, separate from Atlantic stock for management purposes	Occur in cohesive groups that average 25 whales	Unknown	Unknown	Fish including larger species (dolphin fish) and squids	Unknown	Fisheries interaction
Pygmy killer whale (*Feresa attenuata*)	N_{best} = 152 (CV = 1.02) N_{min} = 75 PBR = 0.8	Oceanic throughout the Gulf	Unknown, separate from Atlantic stock for management purposes	Little known, occur in groups of less than 20 whales	Unknown	Unknown	Fishes and squids	Unknown	Unknown

Species/stock (E=endangered, S=strategic)	Abundance N_{best} (CV) N_{min} PBR	Distribution and movement patterns	Stock structure	Social structure	Vital rates	Health status	Prey species	Total human-caused mortality/ serious injury	Possible sources of human-caused mortality/ serious injury*
Dwarf sperm whale (*Kogia sima*)	N_{best} = 186 (CV = 1.04) N_{min} = 90 (Estimate for all *Kogia* spp.) PBR = 0.9	Oceanic throughout the Gulf	Unknown, separate from Atlantic stock for management purposes	Very cryptic, usually in groups of less than 5	Unknown	Unknown	Primarily deepwater cephalopods	Unknown, minimum estimates from stranding data	Fisheries interactions, ingestion of marine debris
Pygmy sperm whale (*Kogia breviceps*)	N_{best} = 186 (CV = 1.04) N_{min} = 90 (Estimate for all *Kogia* spp.) PBR = 0.9	Oceanic throughout the Gulf	Unknown, separate from Atlantic stock for management purposes	Very cryptic, usually in groups of less than 5	Unknown	Limited data from captive animals	Primarily deepwater cephalopods	Unknown, minimum estimates from stranding data	Fisheries interactions, ingestion of marine debris
Melon-headed whale (*Peponocephala electra*)	N_{best} = 2,235 (CV = 0.75) N_{min} = 1,274 PBR = 13	Oceanic throughout the Gulf but more common west of the Mississippi River	Unknown, separate from Atlantic stock for management purposes	Occur in large cohesive groups of up to 275 whales	Unknown	Unknown	Small fishes and squids	Unknown, minimum estimates from stranding data	Unknown
Risso's dolphin (*Grampus griseus*)	N_{best} = 2,442 (CV = 0.57) N_{min} = 1,563 PBR = 16	Shelf break area and oceanic throughout the Gulf	Unknown, separate from Atlantic stock for management purposes	Multiple groups of 5-10 dolphins typically occur over large areas	Unknown	Limited data from captive animals	Crustaceans, squids, and other cephalopods	Unknown, minimum estimates from stranding data	Fisheries interactions, red tide
Pilot whale, short finned (*Globicephala macrorhyncus*)	N_{best} = 2,415 (CV = 0.66) N_{min} = 1,456 PBR = 15	Oceanic throughout the Gulf but more common west of the Mississippi River	Unknown, separate from Atlantic stock for management purposes	Highly social, in groups of 20 or more	Unknown	Unknown	Primarily squids but also fishes	Unknown, minimum estimates from stranding data	Fisheries interactions

Species/stock (E=endangered, S=strategic)	**Abundance N_{best} (CV) N_{min} PBR**	**Distribution and movement patterns**	**Stock structure**	**Social structure**	**Vital rates**	**Health status**	**Prey species**	**Total human-caused mortality/ serious injury**	**Possible sources of human-caused mortality/ serious injury***
West Indian Manatee (*Trichechus manatus*) (E/S)	N_{best} (based on single synoptic survey of warm-water refuges in Jan 2009) = 3,802 PBR = 12	In freshwater, brackish and marine environments along the Gulf, from Florida to Louisiana	Florida manatees considered a single stock, but separated into management units	Disperse in the warmer months to feed, breed and socialize, aggregate in warm-water refuges during colder times of year, calves typically stay with their mothers for 2 years	Rmax= 6.2%	Limited studies provide data on contamin-ants, hormone levels, and nutrition	Herbivores, feed on an extensive range of aquatic vegetation	Minimum estimates from stranding data	Vessel strikes, cold water exposure, red tides, drowning in water control structures, fisheries interactions, marine debris entanglement and ingestion

Table 2. Human-caused and natural risk factors in the Gulf and potential consequences for marine mammals.

Activities	Specific risk factor	Potential consequences
Oil and gas development	Oil spills and leaks	Direct exposure: skin irritation/inflammation, necrosis, respiratory effects, organ damage Indirect: shifts in or loss of prey, habitat degradation
	Noise (seismic surveys, construction and decommissioning of platforms, and general operations)	Physical trauma to internal organs, permanent or temporary hearing loss, avoidance of preferred habitat
	Vessel operations	Vessel strikes (injury/mortality), avoidance of preferred habitat
	Production waste (drill fluids and cuttings, produced water, deck drainage, municipal wastes, and debris)	Organ damage and impaired immune system function from heavy metal contamination, habitat degradation (decreased water quality), loss of prey
Commercial and recreational fishing	Fishing with nets and lines	Entanglement in and ingestion of fishing gear
	Fishing for prey species	Reduced availability of prey species, habitat alteration
	Vessel operations	Vessel strikes (injury/mortality), avoidance of preferred habitat
Shipping and vessel traffic	Noise, vessel operations	Vessel strikes (injury/mortality), avoidance of preferred habitat
Military activities	Vessel operations	Vessel strikes (injury/mortality), avoidance of preferred habitat
	Noise (SONAR training and testing, explosives)	Acoustic and non-acoustic physical trauma, avoidance of preferred habitat, mortality in severe cases
Agriculture	Runoff of land-based pollutants (resulting in harmful algal blooms, anoxic or hypoxic "dead" zones)	Direct: injury/mortality Indirect: decreased water quality, shifts in or loss of prey species
Coastal development	Noise from pile driving and other activities associated with marina and bridge/causeway construction	Acoustic trauma (at short range), acoustic disturbance, avoidance of preferred habitat
	Dredging	Loss of sea grass beds, habitat degradation
	Loss of coastal wetlands and other coastal habitats	Loss of prey habitat, habitat degradation
Renewable energy	Pile driving for anchoring wind and wave turbines	Acoustic trauma (at short range), acoustic disturbance, avoidance of preferred habitat
	Turbine operations	Physical trauma, electromagnetic disturbance, avoidance of preferred habitat
Greenhouse gas emissions	Ocean acidification	Shifts in or reduction/loss of prey species
	Warming seas	Habitat degradation, shifts in or reduction/loss of prey
	Increased storm activity and increased severity of storms	Shifts in prey, avoidance of preferred habitat
	Sea level rise, leading to coastal habitat loss	Loss of prey habitat, habitat degradation
Natural events	Seepage of oil	Direct: organ damage Indirect: habitat degradation
	Harmful algal blooms (e.g., red tide)	Injury/mortality, shifts in prey
	Predation	Injury/mortality
	Large-scale ecosystem fluctuations	Shifts in or loss of prey
	Hurricanes	Shifts in prey, avoidance of preferred habitat, displacement of animals, habitat degradation or destruction
	Water temperature anomalies	Shifts in prey, avoidance of affected habitats, cold stress